

# Atlantic Workforce Partnership

Curriculum Standard

## AUTOMOTIVE SERVICE TECHNICIAN

Version: 2026

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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

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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 trade.

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

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

Level	Implementation Effective
Level 1	2026-2027
Level 2	2027-2028
Level 3	2028-2029
Level 4	2029-2030

**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.

## **Acknowledgements**

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The development of the Atlantic Apprenticeship Curriculum Standard (AACS) is an initiative of the Atlantic Apprenticeship Council's Atlantic Apprenticeship Harmonization Partnership (AAHP) through the Atlantic Workforce Partnership.

The AAHP was created in 2014 and funded through contributions from Employment and Social Development Canada (ESDC) and the four Atlantic Provinces. In 2023, Phase III of the AAHP concluded and the AAHP transitioned to a maintenance office supported by the four Atlantic Provinces. The Atlantic Apprenticeship Council would like to thank ESDC for the financial support provided to harmonize the 23 trades in Phase I, II and III of the AAHP.

Advisory committees, industry representatives, instructors and apprenticeship staff provided valuable input to the development of the trade Atlantic Apprenticeship Curriculum Standard (AACS) in 2015 and updating of the trade AACS in 2024. Without their dedication to quality apprenticeship training, this document could not have been produced. The Atlantic Apprenticeship Council wishes to acknowledge the contributions of the industry and instructional representatives who participated in the development of this document.

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## **User Guide**

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Atlantic Apprenticeship Curriculum Standards (AACCS) are developed based on trade specific national occupational standards, such as the Red Seal Occupational Standard (RSOS), and 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 AACCSs are deliberately constructed for ease of use and flexibility of structure 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 AACCS 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 AACCS 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 exam administered through the jurisdictional Apprenticeship Authority.

## User Guide (continued)

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The Red Seal Occupational Standard (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. The AACS should be used in conjunction with the national standard for the trade – the Red Seal Occupational Standard (RSOS).

## **Glossary of Terms**

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

<b>Adjust</b>	To put in good working order; regulate; bring to a proper state or position.
<b>Application</b>	The use to which something is put and/or the circumstance in which an individual would use it.
<b>Characteristic</b>	A feature that helps to identify, tell apart or describe recognizably; a distinguishing mark or trait.
<b>Component</b>	A part that can be separated from or attached to a system; a segment or unit.
<b>Define</b>	To state the meaning of (a word, phrase, etc.).
<b>Describe</b>	To give a verbal account of; tell about in detail.
<b>Explain</b>	To make plain or clear; illustrate; rationalize.
<b>Identify</b>	To point out or name objectives or types.
<b>Interpret</b>	To translate information from observation, charts, tables, graphs and written material.
<b>Maintain</b>	To keep in a condition of good repair or efficiency.
<b>Method</b>	A means or manner of doing something that has procedures attached to it.
<b>Operate</b>	How an object works; to control or direct the functioning of.
<b>Procedure</b>	A prescribed series of steps taken to accomplish an end.
<b>Purpose</b>	The reason for which something exists or is done, made or used.

## **Glossary of Terms (continued)**

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**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/ Skills for Success

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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. In response to the evolving labour market and changing skill needs, in 2021 the Government of Canada launched a new **Skills for Success** model: QR code #1 or web link below.

<https://www.canada.ca/en/services/jobs/training/initiatives/skills-success/new-model.html>

The Employment and Social Development Canada (ESDC) website provides information about the Skills for Success, including:

- a brief description of the skill;
- why the skill is important;
- tools to help you improve on each of the skills, and
- Videos to help you improve on each of the skills.

This information can be found at: QR code #2 or web link below.

<https://www.jobbank.gc.ca/essentialskills>

Skills for Success training tools can be found at: QR code #3 or web link below.

<https://www.canada.ca/en/services/jobs/training/initiatives/skills-success/tools.html>

The development and improvement of these Skills for Success is inherent throughout the apprenticeship training program as apprentices work towards achieving journey person status.



#1 The new Skills for Success model – Canada.ca



#2 Explore careers by essential skills – Job Bank



#3 Assessment and training tools – Canada.ca

## Level Structure

### Level 1 – 8 Weeks

Unit Code	Unit Title	Sugg Hrs*	Pg #	Practical Objectives*
AST-100	Safety	12	20	N/A
AST-105	Tools and Equipment	9	23	N/A
AST-115	Hoisting and Lifting Equipment	6	26	N/A
MENT-700	Mentoring I	6	28	N/A
AST-125	Technical Information	6	30	N/A
AST-130	Tires, Wheels, Hubs & Wheel Bearings	12	32	N/A
AST-135	Oxy-Acetylene Heating and Cutting	12	35	1. Set up, adjust, use and shut down oxy-acetylene equipment.
AST-140	Gas Metal Arc Welding (GMAW)	9	36	1. Set up, adjust, use and shut down GMAW equipment.
AST-145	Suspension Systems I	12	37	1. Inspect a non-electronic suspension system to ensure it meets manufacturing specs.
AST-150	Steering Systems I	18	40	1. Inspect non-electronic steering system to ensure it meets manufacturing specs.
AST-155	Drive Shafts and Axles	9	43	N/A
AST-160	Braking Systems I (Non-ABS)	36	46	1. Flare a line.
AST-165	Electrical and Electronic Principles	57	49	1. Test battery. 2. Perform a wire/connector repair.
AST-170	Body Components and Trim	9	52	N/A
AST-175	Engine Principles	27	55	N/A

### Level 2 – 8 Weeks

Unit Code	Unit Title	Sugg Hrs*	Pg #	Practical Objectives*
AST-200	Cooling Systems	12	60	1. Perform a coolant system pressure test.
AST-205	Engine Lubricating Systems	12	63	1. Perform an oil pressure test.
AST 215	Engine Repair	42	66	1. Perform a leak down test. 2. Perform a precision engine component measurement. 3. Perform a compression test.
AST-220	Starting Systems	15	68	1. Perform a voltage drop test.
AST-225	Charging Systems	15	70	1. Perform a charging system test.
AST-230	Lighting and Wiper Systems	18	73	1. Locate a connector on a vehicle using a diagram.
AST-235	Steering Systems II	12	75	1. Perform a steering sensor reset & relearn.
AST-240	Suspension Systems II	24	77	N/A
AST-245	Braking Systems II (ABS)	24	79	1. Test wheel speed sensors.
AST-250	Manual Transmissions & Transaxles	36	82	N/A
AST-255	Clutches	6	84	N/A
AST-260	Final Drive Assemblies	24	86	1. Disassemble final drive. 2. Measure pre-load and backlash.

## Level Structure (continued)

### Level 3 – 7 Weeks

Unit Code	Unit Title	Sugg Hrs*	Pg #	Practical Objectives*
AST-305	Gasoline Fuel Delivery and Injection Systems	24	90	1. Perform fuel pressure check.
AST-310	Gasoline Ignition Systems	24	93	N/A
AST-315	Vehicle Networking Systems	60	96	1. Check the integrity of a CAN bus system. 2. Connect scan tools and monitor live data.
AST-320	Gasoline Emission Control Systems	30	99	1. Perform a smoke check of the EVAP system.
AST-325	Gasoline Intake & Exhaust Systems	18	102	1. Perform an engine vacuum test.
AST-330	Electrical Options and Accessories	30	105	1. Perform parasitic draw test.
AST-332	Advanced Driver Assistance Systems (ADAS)	21	108	N/A
AST-355	Motor Vehicle Inspection	3	110	N/A

### Level 4 – 9 Weeks

Unit Code	Unit Title	Sugg Hrs*	Pg #	Practical Objectives*
AST-400	Transfer Cases	18	112	1. Disassemble and reassemble a transfer case.
MENT-701	Mentoring II	6	115	N/A
AST-405	Diesel Fuel Delivery and Injection Systems	18	116	N/A
AST-410	Diesel Emission Control Systems	18	119	N/A
AST-415	Diesel Intake and Exhaust Systems	6	122	1. Perform a smoke test on an intake.
AST-420	Entertainment Systems	12	125	N/A
AST-425	Instrumentation and Information Displays	12	127	N/A
AST-430	Restraint Systems	18	129	1. Remove and reinstall an air bag.
AST-435	Automatic Transmissions and Transaxles	48	132	1. Disassemble and reassemble an automatic transmission. 2. Perform a line pressure test.
AST-440	Heating, Ventilation and Air Conditioning Systems	30	135	1. Conduct a performance test on an air conditioning (A/C) system. 2. Perform a leak test.
AST-445	Hybrid and Electric Vehicle Systems	30	139	N/A
AST-446	High Voltage Batteries	12	142	N/A
AST-447	Hybrid and EV HVAC Systems	12	144	N/A
AST-450	Program Review	30	146	N/A

## 2023 RSOS Sub-Task to AACS Unit Comparison

RSOS Sub-Task		AACS Unit	
<b>Task 1 – Performs safety-related functions.</b>			
1.01	Maintains safe work environment.	AST-100	Safety
1.02	Uses personal protective equipment (PPE) and safety equipment.	AST-100	Safety
1.03	Implements specific safety protocols for hybrid and electric vehicles (EV).	AST-100	Safety
<b>Task 2 – Uses tools, equipment and documentation.</b>			
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)
2.02	Uses fasteners, tubing, hoses and fittings.	AST-105	Tools and Equipment
		AST-160	Braking Systems I (Non-ABS)
2.03	Uses hoisting and lifting equipment.	AST-115	Hoisting and Lifting Equipment
2.04	Uses electronic service tools and systems for diagnostics and programming.	AST-105	Tools and Equipment
2.05	Uses documentation and technical information.	AST-125	Technical Information
<b>Task 3 – Uses communication and mentoring techniques.</b>			
3.01	Uses communication techniques.	MENT-700	Mentoring I
		MENT-701	Mentoring II
3.02	Uses mentoring techniques.	MENT-700	Mentoring I
		MENT-701	Mentoring II
<b>Task 4 – Diagnoses engine systems.</b>			
4.01	Diagnoses cooling systems.	AST-200	Cooling Systems
4.02	Diagnoses lubricating systems.	AST-205	Engine Lubricating Systems
4.03	Diagnoses engine assembly.	AST-175	Engine Principles
		AST-215	Engine Repair
4.04	Diagnoses accessory drive systems.	AST-225	Charging Systems
<b>Task 5 – Repairs engine systems.</b>			
5.01	Repairs cooling systems.	AST-200	Cooling Systems
5.02	Repairs lubricating systems.	AST-205	Engine Lubricating Systems
5.03	Repairs engine assembly.	AST-175	Engine Principles

RSOS Sub-Task		AACS Unit	
		AST-215	Engine Repair
5.04	Repairs accessory drive systems.	AST-225	Charging Systems
<b>Task 6 – Diagnoses gasoline engine support systems.</b>			
6.01	Diagnoses gasoline fuel delivery and injection systems.	AST-305	Gasoline Fuel Delivery and Injection Systems
6.02	Diagnoses gasoline electronic ignition systems.	AST-310	Gasoline Ignition Systems
6.03	Diagnoses gasoline intake and exhaust systems.	AST-325	Gasoline Intake and Exhaust Systems
6.04	Diagnoses gasoline emission control systems.	AST-320	Gasoline Emission Control Systems
<b>Task 7 – Repairs gasoline engine support systems.</b>			
7.01	Repairs gasoline fuel delivery and injection systems.	AST-305	Gasoline Fuel Delivery and Injection Systems
7.02	Repairs gasoline electronic ignition systems.	AST-310	Gasoline Ignition Systems
7.03	Repairs gasoline intake and exhaust systems.	AST-325	Gasoline Intake and Exhaust Systems
7.04	Repairs gasoline emission control systems.	AST-320	Gasoline Emission Control Systems
<b>Task 8 – Diagnoses diesel engine support systems.</b>			
8.01	Diagnoses diesel fuel delivery and injection systems.	AST-405	Diesel Fuel Delivery and Injection Systems
8.02	Diagnoses diesel intake and exhaust systems.	AST-415	Diesel Intake and Exhaust Systems
8.03	Diagnoses diesel emission control systems.	AST-410	Diesel emission control systems.
<b>Task 9 – Repairs diesel engine support systems.</b>			
9.01	Repairs diesel fuel delivery and injection systems.	AST-405	Diesel Fuel Delivery and Injection Systems
9.02	Repairs diesel intake and exhaust systems.	AST-415	Diesel Intake and Exhaust Systems
9.03	Repairs diesel emission control systems.	AST-410	Diesel emission control systems
<b>Task 10 – Diagnoses vehicle networking systems.</b>			
10.01	Reads diagnostic trouble codes (DTCs).	AST-315	Vehicle Networking Systems
10.02	Monitors data.	AST-315	Vehicle Networking Systems
10.03	Tests system circuitry and components.	AST-315	Vehicle Networking Systems
10.04	Interprets test results.	AST-315	Vehicle Networking Systems
<b>Task 11 – Repairs vehicle networking systems.</b>			
11.01	Updates component software.	AST-315	Vehicle Networking Systems

RSOS Sub-Task		AACS Unit	
11.02	Replaces components.	AST-315	Vehicle Networking Systems
11.02	Repairs system circuitry and components.	AST-315	Vehicle Networking Systems
11.04	Verifies vehicle module communications system repair.	AST-315	Vehicle Networking Systems
<b>Task 12 – Diagnoses driveline systems.</b>			
12.01	Diagnoses drive shafts and axles.	AST-155	Drive Shafts and Axles
12.02	Diagnoses manual transmissions and transaxles.	AST-250	Manual Transmissions and Transaxles
12.03	Diagnoses automatic transmissions and transaxles.	AST-435	Automatic Transmissions and Transaxles
12.04	Diagnoses clutches.	AST-255	Clutches
12.05	Diagnoses transfer cases.	AST-400	Transfer Cases
12.06	Diagnoses final drive assemblies.	AST-260	Final Drive Assemblies
<b>Task 13 – Repairs driveline systems.</b>			
13.01	Repairs drive shafts and axles.	AST-155	Drive Shafts and Axles
13.02	Repairs manual transmissions and transaxles.	AST-250	Manual Transmissions and Transaxles
13.03	Repairs automatic transmissions and transaxles.	AST-435	Automatic Transmissions and Transaxles
13.04	Repairs clutches.	AST-255	Clutches
13.05	Repairs transfer cases.	AST-400	Transfer Cases
13.06	Repairs final drive assemblies.	AST-260	Final Drive Assemblies
<b>Task 14 – Diagnoses electrical systems and components.</b>			
14.01	Diagnoses wiring and electrical systems.	AST-165	Electrical and Electronic Principles
14.02	Diagnoses starting/charging systems and low voltage (12 volt) batteries.	AST-165	Electrical and Electronic Principles
		AST-220	Starting Systems
		AST-225	Charging Systems
14.03	Diagnoses lighting and wiper systems.	AST-230	Lighting and Wiper Systems
14.04	Diagnoses entertainment systems.	AST-420	Entertainment Systems
14.05	Diagnoses electrical options and accessories.	AST-330	Electrical Options and Accessories
14.06	Diagnoses instrumentation and information displays.	AST-425	Instrumentation and Information Displays
14.07	Diagnoses advanced driver assistance system (ADAS) components.	AST 332	Advanced Driver Assistance Systems (ADAS)
<b>Task 15 – Repairs electrical systems and components.</b>			
15.01	Repairs wiring and electrical systems.	AST-165	Electrical and Electronic Principles

RSOS Sub-Task		AACS Unit	
15.02	Repairs starting/charging systems and low voltage (12 volt) batteries.	AST-165	Electrical and Electronic Principles
		AST-220	Starting Systems
		AST-225	Charging Systems
15.03	Repairs lighting and wiper systems.	AST-230	Lighting and Wiper Systems
15.04	Repairs entertainment systems.	AST-420	Entertainment Systems
15.05	Repairs electrical options and accessories.	AST-330	Electrical Options and Accessories
15.06	Repairs instrumentation and information displays.	AST-425	Instrumentation and Information Displays
15.07	Repairs advanced driver assistance system (ADAS) components.	AST 332	Advanced Driver Assistance Systems (ADAS)
<b>Task 16 – Diagnoses heating, ventilation and air conditioning (HVAC) and comfort control systems.</b>			
16.01	Diagnoses air flow control systems.	AST-440	Heating, Ventilation and Air Conditioning Systems
16.02	Diagnoses refrigerant systems.	AST-440	Heating, Ventilation and Air Conditioning Systems
16.03	Diagnoses heating systems.	AST-440	Heating, Ventilation and Air Conditioning Systems
<b>Task 17 – Repairs heating, ventilation and air conditioning (HVAC) and comfort control systems.</b>			
17.01	Repairs air flow control systems.	AST-440	Heating, Ventilation and Air Conditioning Systems
17.02	Repairs refrigerant systems.	AST-440	Heating, Ventilation and Air Conditioning Systems
17.03	Repairs heating systems.	AST-440	Heating, Ventilation and Air Conditioning Systems
<b>Task 18 – Diagnoses steering, suspension, braking and control systems, tires, wheels, hubs and wheel bearings.</b>			
18.01	Diagnoses steering, suspension and control systems.	AST-145	Suspension Systems I
		AST-150	Steering Systems I
		AST-235	Steering Systems II
		AST-240	Suspension Systems II
18.02	Diagnoses braking and control systems.	AST-160	Braking Systems I (Non-ABS)
		AST-245	Braking Systems II (ABS)
18.03	Diagnoses tires, wheels, hubs and wheel bearings.	AST-130	Tires, Wheels, Hubs and Wheel Bearings
18.04	Diagnoses advanced driver assistance system (ADAS) components related to steering, suspension and braking systems.	AST-332	Advanced Driver Assistance Systems (ADAS)

RSOS Sub-Task		AACS Unit	
<b>Task 19 – Repairs steering, suspension, braking and control systems, tires, wheels, hubs and wheel bearings.</b>			
19.01	Repairs steering, suspension and control systems.	AST-145	Suspension Systems I
		AST-150	Steering Systems I
		AST-235	Steering Systems II
		AST-240	Suspension Systems II
19.02	Repairs braking and control systems.	AST-160	Braking Systems I (Non-ABS)
		AST-245	Braking Systems II (ABS)
19.03	Repairs tires, wheels, hubs and wheel bearings.	AST-130	Tires, Wheels, Hubs and Wheel Bearings
19.04	Repairs advanced driver assistance system (ADAS) components related to steering, suspension and braking systems.	AST 332	Advanced Driver Assistance Systems (ADAS)
<b>Task 20 – Diagnoses restraint systems, body components, accessories and trim.</b>			
20.01	Diagnoses restraint systems.	AST-430	Restraint Systems
20.02	Diagnoses wind noises, rattles and water leaks.	AST-170	Body Components and Trim
20.03	Diagnoses interior and exterior components, accessories and trim.	AST-170	Body Components and Trim
20.04	Diagnoses latches, locks and movable glass.	AST-170	Body Components and Trim
<b>Task 21 – Repairs restraint systems, body components, accessories and trim.</b>			
21.01	Repairs restraint systems.	AST-430	Restraint Systems
21.02	Repairs wind noises, rattles and water leaks.	AST-170	Body Components and Trim
21.03	Repairs interior and exterior components, accessories and trim.	AST-170	Body Components and Trim
21.04	Repairs latches, locks and movable glass.	AST-170	Body Components and Trim
<b>Task 22 – Diagnoses hybrid and electric vehicle (EV) systems.</b>			
22.01	Diagnoses hybrid vehicle systems.	AST-445	Hybrid and Electric Vehicle Systems
22.02	Diagnoses electric vehicle (EV) systems.	AST-445	Hybrid and Electric Vehicle Systems
22.03	Diagnoses high voltage batteries.	AST-446	High Voltage Batteries
22.04	Diagnoses hybrid and electric vehicle (EV) HVAC systems.	AST-447	Hybrid and EV HVAC Systems
<b>Task 23 – Repairs hybrid and electric vehicle (EV) systems.</b>			
23.01	Repairs hybrid vehicle systems.	AST-445	Hybrid and Electric Vehicle Systems
23.02	Repairs electric vehicle (EV) systems.	AST-445	Hybrid and Electric Vehicle Systems

<b>RSOS Sub-Task</b>		<b>AACS Unit</b>	
23.03	Services high voltage batteries.	AST-446	High Voltage Batteries
23.04	Repairs hybrid and electric vehicle (EV) HVAC systems.	AST-447	Hybrid and EV HVAC Systems



# Level 1

Unit Code	Unit Title	Suggested Hours	Page Number
AST-100	Safety	12	20
AST-105	Tools and Equipment	9	23
AST-115	Hoisting and Lifting Equipment	6	26
MENT-700	Mentoring I	6	28
AST-125	Technical Information	6	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)	9	36
AST-145	Suspension Systems I	12	37
AST-150	Steering Systems I	18	40
AST-155	Drive Shafts and Axles	9	43
AST-160	Braking Systems I (Non-ABS)	36	46
AST-165	Electrical and Electronic Principles	57	49
AST-170	Body Components and Trim	9	52
AST-175	Engine Principles	27	55

## **AST-100**

## **Safety**

### **Learning Outcomes:**

- Demonstrate knowledge of safe work practices.
- Demonstrate knowledge of PPE and safety equipment, their characteristics, applications, limitations, and procedures for use.
- Demonstrate knowledge of training and certification requirements related to workplace safety, PPE, and safety equipment.
- Demonstrate knowledge of regulatory requirements related to safety and maintaining a safe work environment.
- Demonstrate knowledge of PPE and safety equipment specific to hybrid and EV systems, their characteristics, applications and procedures for use.
- Demonstrate knowledge of safety protocols for hybrid and EV systems.
- Demonstrate knowledge of regulatory requirements related to hybrid and EV systems.

### **2023 Red Seal Occupational Standard Reference:**

- 1.01 Maintains safe work environment.
- 1.02 Uses personal protective equipment (PPE) and safety equipment.
- 1.03 Implements specific safety protocols for hybrid and electric vehicles (EV).

### **Suggested Hours:**

12 Hours

### **Theoretical Objectives:**

1. Describe safe work practices to maintain a safe work environment.
2. Identify training and certification requirements related to workplace safety.
  - i) Workplace Hazardous Material Information System (WHMIS)/ Globally Harmonized System (GHS)
  - ii) first aid
  - iii) refrigerant-handling training
3. Identify and describe jurisdictional safety regulations to maintain a safe work environment.
  - i) Occupational Health and Safety (OHS)
  - ii) Workplace Hazardous Material Information System (WHMIS)
  - iii) Globally Harmonized System (GHS)

4. Identify components of Workplace Hazardous Materials Information System (WHMIS)/Globally Harmonized System (GHS).
  - i) safety data sheets
  - ii) labels
  - iii) training
  
5. Describe procedures to handle, store, recycle and dispose of hazardous materials.
  - i) supplemental restraint system components
  - ii) batteries
  - iii) automotive fluids and chemicals
  - iv) cleaning fluids and chemicals
  
6. Identify and describe jurisdictional requirements for handling, recycling and disposing of hazardous materials.
  
7. Identify types of PPE and safety equipment and describe their characteristics, applications, limitations, and procedures for use.
  - i) PPE
    - work boots
    - ear protection
    - eye protection
    - face shields
    - insulating clothing
    - fire resistant clothing
    - respirators
  - ii) safety equipment
    - jack stands
    - exhaust ventilation fans
    - fire extinguishers
    - lock-out devices
    - insulated equipment
  - iii) PPE and safety equipment (specific to hybrid and EV systems)
    - insulated clothing (e.g. gloves, arc flash suit, helmets, aprons)
    - pylons
    - high voltage specific tools
    - safety hook
  
8. Describe handling, storage and maintenance of PPE and safety equipment.
  
9. Identify safety manuals, standards and jurisdictional regulations related to PPE and safety equipment.
  
10. Identify training and certification requirements related to PPE and safety equipment.

11. Identify safety hazards specific to working on hybrid vehicles and EVs and safe work practices.
12. Identify safety protocols related to hybrid and EV systems.
13. Identify and interpret standards and regulations related to hybrid and EV systems.
  - i) CSA (e.g., z462)
  - ii) jurisdictional regulations

**Practical Objectives:**

N/A

## **AST-105**

## **Tools and Equipment**

### **Learning Outcomes:**

- Demonstrate knowledge of hand and power tools, their characteristics, applications, maintenance and procedures for use.
- Demonstrate knowledge of measuring and testing devices, their characteristics, applications, maintenance and procedures for use.
- Demonstrate knowledge of fasteners, tubing, hoses and fittings, their characteristics, applications and procedures for use.
- Demonstrate knowledge of shop tools and equipment, their characteristics, applications, maintenance and procedures for use.
- Demonstrate knowledge of welding, cutting and heating equipment, their characteristics, applications, maintenance and procedures for use.
- Demonstrate knowledge of using electronic service tools for diagnostics and programming.

### **2023 Red Seal Occupational Standard Reference:**

- 2.01 Uses tools and equipment.
- 2.02 Uses fasteners, tubing, hoses and fittings.
- 2.04 Uses electronic service tools and systems for diagnostics and programming.

### **Suggested Hours:**

9 Hours

### **Theoretical Objectives:**

1. Identify types of hand tools and describe their characteristics, applications and procedures for use.
2. Identify types of power tools and describe their characteristics, applications and procedures for use.
  - i) electric
  - ii) pneumatic
  - iii) hydraulic
3. Describe procedures used to store and maintain hand and power tools.
4. Describe safe operating procedures for hand and power tools.
5. Identify types of measuring and testing devices, and describe their characteristics, applications and procedures for use.
  - i) micrometers

- ii) vernier calipers
  - iii) pressure gauges
  - iv) torque wrenches
6. Identify types of fasteners, and describe their characteristics, applications and procedures for use.
- i) grades/classes
  - ii) threads
  - iii) dimensions
7. Describe procedures used to store and maintain measuring and testing devices.
8. Identify types of shop tools and equipment and describe their characteristics, applications and procedures for use.
- i) brake lathe
  - ii) tire changing machine
  - iii) wheel balancer
  - iv) battery chargers
  - v) vices
  - vi) presses
  - vii) part washers
  - viii) oil bins
  - ix) inductive heating equipment
  - x) bench grinder
  - xi) drill press
9. Describe procedures used to store and maintain shop tools and equipment.
10. Identify types of electronic service tools used in diagnostics and programming and describe their characteristics, applications and procedures for use.
- i) laptops
  - ii) smart phones
  - iii) tablets
  - iv) on-board diagnostic II (OBDII) adaptors
  - v) scanners
  - vi) digital multimeters (DMM)
11. Describe software applications used in diagnostics and programming.
- i) original equipment manufacturer (OEM) diagnostic and operating software
  - ii) online technical support
  - iii) remote monitoring systems
12. Describe manufacturers' programming and monitoring procedures.

13. Identify types of data and parameters of diagnostic results and reports.

i) data

- temperatures
- speeds
- pressures
- switch states
- state of charge
- fuel trims
- altitude changes
- rotational speeds
- system status
- positions
- voltages

ii) parameters

- speeds
- temperatures
- pressures
- volumes

**Practical Objectives:**

N/A

## AST-115

## Hoisting and Lifting Equipment

### Learning Outcomes:

- Demonstrate knowledge of vehicle hoists, their components, characteristics, applications and maintenance.
- Demonstrate knowledge of procedures used to operate vehicle hoists and accessories.
- Demonstrate knowledge of shop lifting equipment, their characteristics, applications and procedures for use.
- Demonstrate knowledge of procedures used to operate shop lifting equipment.

### 2023 Red Seal Occupational Standard Reference:

2.03 Uses hoisting and lifting equipment.

### Suggested Hours:

6 hours

### Theoretical Objectives:

1. Identify hazards and describe safe work practices related to vehicle hoists and accessories and shop lifting equipment.
  - i) hazards
    - ceiling heights
    - overhead wires
    - uneven surfaces
    - uneven weight distribution
    - vehicle roof accessories
  - ii) safe work practices
    - supervision of lifts
    - securing work area
    - communication
  
2. Identify types of vehicle hoists and accessories and shop lifting equipment and describe their characteristics and applications.
  - i) lifting equipment
    - chain falls
    - overhead cranes
    - hydraulic jacks/transmission jacks
    - engine hoists
    - lift tables
  - ii) vehicle hoists
    - car hoist (2 post or 4 post)
    - scissor lift/mid-rise lift

- alignment rack

3. Describe procedures used to operate vehicle hoists and accessories and shop lifting equipment.
4. Describe procedures used to inspect, store and maintain vehicle hoists and accessories and shop 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.

### **2023 Red Seal Occupational Standard Reference:**

- 3.01 Uses communication techniques.
- 3.02 Uses mentoring techniques.

### **Suggested Hours:**

6 Hours

### **Theoretical 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

**Practical Objectives:**

N/A

## AST-125

## Technical Information

### Learning Outcomes:

- Demonstrate knowledge of trade-related documents, their characteristics and applications.
- Demonstrate knowledge of preparing, completing and using trade-related documents.

### 2023 Red Seal Occupational Standard Reference:

2.05 Uses documentation and technical information.

### Suggested Hours:

6 Hours

### Theoretical Objectives:

1. Identify and interpret types of trade-related documents and describe their characteristics and applications.
  - i) repair work orders
  - ii) estimates
  - iii) history
  - iv) preventative maintenance reports and schedules
  - v) schematics and service information
  - vi) technical service bulletins (TSB)
  - vii) industry standard labour guides
  - viii) pre-delivery inspection reports
  - ix) safety recalls
2. Identify trade-related identification codes and technical information.
  - i) identification codes
    - vehicle identification number (VIN)
    - component identification codes
    - diagnostic indicators
    - safety placards and decals
    - information labels
    - part numbers
    - serial numbers
  - ii) technical information
    - online service and parts information
    - troubleshooting trees
    - flow charts
    - schematics

- technical drawings
  - specifications
  - test results
  - parameters
  - technical service bulletins (TSB)
  - warranty bulletins
  - service records
  - preventative maintenance records
3. Identify work-related information to be recorded.
    - i) technician hours worked
    - ii) odometer reading
    - iii) Vehicle Identification Number (VIN)
    - iv) parts used
    - v) service descriptions
    - vi) scan data
  4. Describe procedures used to prepare, complete and use trade-related documents.
    - i) work orders
    - ii) estimates
    - iii) pre-delivery inspection reports
    - iv) preventative maintenance reports
  5. Document vehicle service history.
    - i) motor vehicle inspections
    - ii) warranty records
    - iii) preventative maintenance documents
    - iv) failure analysis using photographs
  6. Describe procedures used to prepare safety-related documents.
    - i) accident reports
    - ii) injury reports
    - iii) safety inspection reports
    - iv) safety warning labels and symbols
    - v) workplace hazard reports including hazard analysis

**Practical Objectives:**

N/A

## AST-130

## Tires, Wheels, Hubs and Wheel Bearings

### Learning Outcomes:

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

### 2023 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

### Theoretical Objectives:

1. Identify hazards and describe safe work practices related to tires, wheels, hubs and wheel bearing and their components.
  - i) tire inflation
  - ii) mounting
  - iii) pinch points
  - iv) lifting and support procedures
  - v) noise levels
2. Identify types of tires and describe their construction.
  - i) snow
  - ii) run flats
  - iii) radials
  - iv) bias
  - v) passenger
  - vi) light truck
  - vii) low rolling resistance (LRR)
3. Interpret tire codes and sidewall markings.
  - i) uniform tire grade quality (UTGQ)
  - ii) speed and load ratings
  - iii) size and aspect ratio
  - iv) Department of Transport (DOT) markings

4. Describe the importance of tire pressure, balance and rotation.
5. Identify types of wheels and describe their components and construction.
  - i) wheels
    - steel
    - alloy
  - ii) components
    - wheel fasteners
    - bearings
    - seals
    - gaskets
    - sensors
    - switches
    - modules
  - iii) construction
    - offset
    - drop zone
    - deep flange
    - 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 (TPMS) and describe their applications.
  - i) passive
  - ii) active
8. Identify types of lubricants and describe their characteristics, applications and procedures for use.
9. Describe the relationship between steering, suspension and wheel assemblies.
10. Identify tools and equipment used to diagnose and repair tires, wheels, hubs, wheel bearings and their components, and describe their characteristics, applications and procedures for use.
  - i) measuring tools
  - ii) pressure gauges
  - iii) chassis ears
  - iv) stethoscopes
  - v) vibration analyzers
  - vi) TPMS equipment

- vii) hand tools
  - viii) air tools
  - ix) scan tools
  - x) wheel balancers
  - xi) tire changing machines
  - xii) tire pressure monitoring tools
  - xiii) presses
  - xiv) pullers
  - xv) tire inflation cage
11. Describe procedures used to diagnose tires, wheels, hubs and wheel bearings.
- i) verify concern
  - ii) perform sensory inspection
  - iii) retrieve diagnostic trouble codes (DTCs)
  - iv) access service information
  - v) conduct tests and measurements
  - vi) isolate problem and identify root cause
12. Describe procedures used to remove and reinstall tires, wheels, hubs and wheel bearings.
13. Describe procedures to repair and replace tires, wheels, hubs and wheel bearings.
14. Describe procedures used to verify repair.
15. Describe maintenance procedures.
- i) torque fasteners to specifications
  - ii) rotations
  - iii) set tire pressure

**Practical Objectives:**

N/A

## **AST-135**

## **Oxy-Acetylene Heating and Cutting**

### **Learning Outcomes:**

- Demonstrate knowledge of oxy-acetylene heating and cutting equipment, their characteristics, applications and procedures for use.
- Demonstrate knowledge of procedures to heat and cut using oxy-acetylene.

### **2023 Red Seal Occupational Standard Reference:**

2.01 Uses tools and equipment.

### **Suggested Hours:**

12 Hours

### **Theoretical Objectives:**

1. Identify hazards and describe safe work practices related to oxy-acetylene heating and cutting.
2. Identify oxy-acetylene heating and cutting equipment and accessories and describe their characteristics, applications and procedures for use.
3. Describe procedures used to set up, adjust and shut down oxy-acetylene equipment.
4. Describe procedures used to heat and cut using oxy-acetylene.
5. Describe procedures used to inspect, store and maintain oxy-acetylene equipment.

### **Practical Objectives:**

1. Set up, adjust, use and shut down oxy-acetylene equipment.

## **AST-140**

## **Gas Metal Arc Welding (GMAW)**

### **Learning Outcomes:**

- Demonstrate knowledge of gas metal arc welding (GMAW) equipment, their characteristics, applications and procedures for use.
- Demonstrate knowledge of procedures used to weld using GMAW equipment.

### **2023 Red Seal Occupational Standard Reference:**

2.01 Uses tools and equipment.

### **Suggested Hours:**

9 Hours

### **Theoretical Objectives:**

1. Identify hazards and describe safe work practices related to gas metal arc welding (GMAW).
2. Identify welding equipment and accessories and describe their characteristics, applications and procedures for use.
  - i) gas metal arc welding (GMAW)
  - ii) metal inert gas welding (MIG)
  - iii) shielded metal arc welding (SMAW)
3. Identify types of GMAW processes and describe their applications.
4. Describe procedures used to set up, adjust and shut down GMAW equipment.
5. Describe procedures used to weld using GMAW equipment.
6. Describe procedures used to inspect, maintain and store GMAW equipment.
7. Describe weld defects, their causes and procedures used to prevent and correct them.

### **Practical Objectives:**

1. Set up, adjust, use and shut down GMAW equipment.

## AST-145

## Suspension Systems I

### Learning Outcomes:

- Demonstrate knowledge of non-electronic suspension systems, their components, characteristics, applications and operation.
- Demonstrate knowledge of procedures used to diagnose and repair non-electronic suspension systems and their components.

### 2023 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

### Theoretical Objectives:

1. Identify hazards and describe safe work practices related to non-electronic suspension systems and their components.
  - i) loaded components
    - ball joints
    - struts/springs
  - ii) pinch/crush points
  - iii) hoisting
  
2. Identify types of non-electronic suspension systems and their components and describe their characteristics and applications.
  - i) non-electronic suspension systems
    - MacPherson strut
    - leaf spring
    - independent
    - monobeam
  - ii) components
    - springs
    - dampers
    - control arms
    - ball joints
    - sway bars, links and bushings
  
3. Describe operating principles of non-electronic suspension systems and their components.

4. Identify types of springs and describe their purpose and operation.
  - i) coil
  - ii) leaf
  - iii) torsion bar
  - iv) air
  
5. Identify types of dampers and their components and describe their purpose and operation.
  - i) struts
  - ii) shocks
  
6. Describe suspension geometry.
  
7. Identify tools and equipment used to diagnose and repair non-electronic suspension systems and their components and describe their characteristics, applications and procedures for use.
  - i) pressure gauges
  - ii) dial indicators
  - iii) alignment machine
  - iv) hand tools
  - v) air tools
  - vi) power tools
  - vii) pullers
  - viii) presses
  - ix) vibration analysis equipment
  - x) chassis ears
  
8. Describe procedures used to diagnose non-electronic suspension systems and their components.
  - i) verify concern
  - ii) perform sensory inspection
  - iii) access service information
  - iv) conduct tests and measurements
  - v) isolate problem and identify root cause
  
9. Describe procedures used to repair non-electronic suspension systems.
  
10. Describe procedures used to remove and reinstall non-electronic suspension system components.
  
11. Describe procedures used to adjust, repair and replace non-electronic suspension system components.

12. Describe procedures used to verify repair.
13. Describe maintenance procedures.
  - i) service chassis
  - ii) grease fittings

**Practical Objectives:**

1. Inspect a non-electronic suspension system to ensure it meets manufacturing specifications.

## AST-150

## Steering Systems I

### Learning Outcomes:

- Demonstrate knowledge of non-electronic steering systems, their components, characteristics, applications and operation.
- Demonstrate knowledge of procedures used to diagnose and repair non-electronic steering systems and their components.

### 2023 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

### Theoretical Objectives:

1. Identify hazards and describe safe work practices related to non-electronic steering systems and their components.
  - i) accidental deployment of passive restraints
  - ii) clock springs
  - iii) telescopic columns
2. Identify types of non-electronic steering systems and their components and describe their characteristics and applications.
  - i) non-electronic steering systems
    - rack-and-pinion
    - recirculating ball (steering box)
  - ii) components
    - tie rods
    - idler arms
    - pitman arms
    - center links
    - steering stabilizer
3. Describe operating principles of non-electronic steering systems and their components.
4. Identify types of steering columns and their components and describe their characteristics and applications.
  - i) tilt
  - ii) telescopic

5. Identify types of steering assist systems and their components and describe their characteristics, applications and operation.
  - i) electric
  - ii) hydraulic
  - iii) variable
  
6. Identify types of power steering pumps and their components and describe their characteristics, applications and operation.
  - i) hydraulic
    - gear
    - vane
    - roller
    - electric-hydraulic pump
  
7. Identify types of fluids, lubricants, fasteners, tubing, hoses, gaskets and seals, and describe their applications.
  
8. Describe procedures used to disarm passive restraints.
  
9. Describe steering geometry.
  
10. Identify related systems and describe their relationship to non-electronic steering systems.
  
11. Identify tools and equipment used to diagnose and repair non-electronic steering systems and their components, and describe their characteristics, applications and procedures for use.
  - i) pressure gauges
  - ii) dial indicators
  - iii) alignment machine
  - iv) hand tools
  - v) air tools
  - vi) power tools
  - vii) pullers
  - viii) presses
  - ix) vibration analysis equipment
  - x) chassis ears
  - xi) belt tension gauges
  - xii) belt installers
  
12. Describe procedures used to diagnose non-electronic steering systems and their components.
  - i) verify concern
  - ii) perform sensory inspection
  - iii) access service information

- iv) conduct tests and measurements
  - v) isolate problem and identify root cause
13. Describe procedures used to remove and reinstall non-electronic steering system components.
  14. Describe procedures used to adjust, repair and replace non-electronic steering system components.
  15. Describe procedures used to verify repair.
  16. Describe maintenance procedures.
    - i) greaseable parts
    - ii) fluid levels
    - iii) belt and pulley inspection

**Practical Objectives:**

1. Inspect non-electronic 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, characteristics, applications and operation.
- Demonstrate knowledge of procedures used to diagnose and repair drive shafts and axles and their components.

### 2023 Red Seal Occupational Standard Reference:

12.01 Diagnoses drive shafts and axles.

13.01 Repairs drive shafts and axles.

### Suggested Hours:

9 Hours

### Theoretical Objectives:

1. Identify hazards and describe safe work practices related to drive shafts and axles and their components.
  - i) exposed rotating parts
  - ii) pinch points
  - iii) lifting and support procedures
2. Identify types of drive shaft and axle systems and their components and describe their characteristics and applications.
  - i) 2WD
  - ii) 4WD/AWD
  - iii) solid axle
  - iv) independent
  - v) full-floating and semi-floating axle engagement mechanisms
3. Identify types of drive shafts and their components and describe their composition, characteristics and applications.
  - i) drive shafts
    - 1-piece
    - multi-piece
  - ii) components
    - drive shafts
    - cardan joints
    - bearings
    - CV axles
    - CV joints

- slip yokes and flanges
  - flex joints
  - iii) composition
    - steel
    - aluminum
    - composites
4. Identify types of axles and their components and describe their characteristics and applications.
    - i) half shafts
    - ii) full-floating
    - iii) semi-floating
    - iv) three quarter-floating
  5. Describe operating principles of drive shafts and axles and their components.
  6. Describe axle disconnects, locking hubs and their purpose.
  7. Describe the importance of multiple piece drive shaft phasing, indexing and angles.
  8. Identify types of lubricants, fasteners, gaskets, seals and sealants, and describe their applications.
  9. Identify tools and equipment used to diagnose and repair drive shafts and axles and their components and describe their characteristics, applications and procedures for use.
    - i) electronic vibration analyzers
    - ii) inclinometers
    - iii) dial indicators
    - iv) hand tools
    - v) air tools
    - vi) power tools
    - vii) pullers
    - viii) presses
  10. Describe procedures used to diagnose drive shafts and axles and their components.
    - i) verify concern
    - ii) perform sensory inspection
    - iii) access service information
    - iv) conduct tests and measurements
    - v) measure drive line angles
    - vi) isolate problem and identify root cause
  11. Describe procedures used to adjust, repair and replace drive shafts and axles and their components.

12. Describe procedures used to verify repair.
13. Describe maintenance procedures.
14. Identify materials that can be reconditioned, reused or recycled.

**Practical Objectives:**

N/A

## AST-160

## Braking Systems I (Non-ABS)

### Learning Outcomes:

- Demonstrate knowledge of braking systems, their components characteristics, applications and operation.
- Demonstrate knowledge of procedures used to diagnose and repair braking systems and their components.
- Demonstrate knowledge of fasteners, tubing, hoses and fittings, their characteristics, applications and procedures for use.

### 2023 Red Seal Occupational Standard Reference:

- 2.02 Uses fasteners, tubing, hoses and fittings.
- 18.02 Diagnoses braking and control systems.
- 19.02 Repairs braking and control systems.

### Suggested Hours:

36 Hours

### Theoretical Objectives:

1. Identify hazards and describe safe work practices related to braking systems and their components.
  - i) hydraulic pressure
  - ii) airborne contaminants
  - iii) hoisting
  
2. Identify types of braking systems and their components and describe their characteristics and applications.
  - i) braking systems
    - hydraulic
    - park brake
  - ii) components
    - discs
    - drums
    - pads
    - calipers
    - shoes
    - lines
    - cylinders
    - switches
    - valves (metering, proportioning, pressure differential switch)

3. Describe the operating principles of braking systems and their components.
4. Explain hydraulic principles related to braking systems.
  - i) Pascal's law
5. Identify types of power assists and their components and describe their characteristics, applications and operation.
  - i) vacuum
  - ii) hydraulic
6. Identify types of brake fluids and describe their characteristics, applications and procedures for use.
7. Identify types of fittings, flaring, tubing and hoses, and describe their characteristics, applications and procedures for use.
  - i) single, double (imperial)
  - ii) International Standards Organization (ISO) (metric)
8. Identify tools and equipment used to diagnose and repair braking systems and their components and describe their characteristics, applications and procedures for use.
  - i) pressure gauges
  - ii) measuring tools
  - iii) hand tools
  - iv) air tools
  - v) power tools
  - vi) digital multimeters (DMMs)
9. Describe procedures used to diagnose braking systems and their components.
  - i) verify concern
  - ii) perform sensory inspections
  - iii) access service information
  - iv) conduct tests and measurements
  - v) isolate fault and identify root cause
10. Describe procedures used to flush and bleed hydraulic brakes.
11. Describe procedures used to measure and machine components.
12. Describe procedures used to adjust, repair and replace braking systems and their components.
13. Describe procedures used to verify repair.
14. Describe maintenance procedures.
  - i) brake fluid flush

ii) brake service

**Practical Objectives:**

1. Flare a line.

**Learning Outcomes:**

- Demonstrate knowledge of electrical and electronic principles.
- Demonstrate knowledge of low voltage (12 volt) batteries, their components, characteristics, applications and operation.
- Demonstrate knowledge of procedures used to diagnose and repair low voltage (12 volt) batteries and their components.
- Demonstrate knowledge of electrical circuits, their components and operation.
- Demonstrate knowledge of procedures used to diagnose and repair electrical circuits and components.

**2023 Red Seal Occupational Standard Reference:**

- 14.01 Diagnoses wiring and electrical systems.
- 14.02 Diagnoses starting/charging systems and low voltage (12 volt) batteries (batteries only).
- 15.01 Repairs wiring and electrical systems.
- 15.02 Repairs starting/charging systems and low voltage (12 volt) batteries (batteries only).

**Suggested Hours:**

57 Hours

**Theoretical Objectives:**

1. Identify hazards and describe safe work practices related to electrical circuits, low voltage (12 volt) batteries and their components.
  - i) damaging electrical components
  - ii) fire
  - iii) burns
  - iv) battery explosions
  - v) corrosive materials
  - vi) soldering fumes
2. Interpret diagnostic flow charts and schematics.
3. Explain electrical theory.
  - i) conventional theory
  - ii) electron theory
  - iii) hole theory
  - iv) Ohm's Law
  - v) Watt's Law
  - vi) magnetism
  - vii) induced voltages

4. Explain electrical and electronic principles.
5. Explain module operation.
  - i) inputs
  - ii) outputs
  - iii) process
6. Describe the application of Ohm's Law to electrical circuits.
  - i) series circuit
  - ii) parallel circuit
  - iii) series-parallel circuits
7. Identify types of electrical components and describe their purpose and operation.
  - i) circuit protection
  - ii) control devices
  - iii) load devices
8. Identify types of low voltage (12 volt) batteries and their components and describe their characteristics and applications.
9. Describe operating principles of low voltage (12 volt) batteries and their components.
10. Identify types of wire and describe their characteristics, composition and applications.
11. Describe relationship of wiring and electronic systems to vehicle networking system.
12. Identify tools and equipment used to diagnose and repair low voltage (12 volt) batteries, electrical circuits and their components and describe their characteristics, applications and procedures for use.
  - i) digital multimeters (DMM)
  - ii) hand tools
  - iii) scan tools
  - iv) circuit testers
  - v) battery testers
  - vi) oscilloscopes
  - vii) soldering equipment
13. Describe procedures used to test and charge batteries.
14. Identify types of electronic components and describe their purpose.
  - i) diodes
  - ii) transistors
  - iii) resistors
  - iv) integrated circuits

15. Describe procedures used to diagnose low voltage (12 volt) batteries and electrical circuits 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
  
16. Identify electrical circuit problems.
  - i) open
  - ii) shorts to voltage
  - iii) shorts to ground
  - iv) high resistance
  
17. Identify methods of wire repair and describe their associated procedures.
  - i) splicing
  - ii) terminal replacement
  - iii) soldering
  - iv) crimping
  
18. Describe procedures used to repair and replace electrical circuits and their components.
  
19. Describe procedures used to verify repair.
  
20. Identify materials that can be reconditioned, reused or recycled.
  
21. Identify practices that reduce material waste.
  
22. Identify training requirements to repair electrical systems.

**Practical Objectives:**

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

## AST-170

## Body Components and Trim

### Learning Outcomes:

- Demonstrate knowledge of wind noises, rattles and water leaks and their causes.
- Demonstrate knowledge of procedures used to diagnose and repair wind noises, rattles and water leaks.
- Demonstrate knowledge of interior and exterior components, accessories and trim, their characteristics, applications and operation.
- Demonstrate knowledge of procedures used to diagnose and repair interior and exterior components, accessories and trim.
- Demonstrate knowledge of latches, locks and glass, their components, characteristics, applications and operation.
- Demonstrate knowledge of procedures used to diagnose and repair latches, locks and glass, and their components.

### 2023 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

### Theoretical Objectives:

1. Identify hazards and describe safe work practices related to body components and trim.
  - i) handling
  - ii) disposal
  - iii) storage
  - iv) air bag placement
  - v) rotating parts
  - vi) sharp edges
  - vii) slippery floors
  - viii) restraint components
    - seatbelts
    - Occupant Classification System (OCS)
    - various airbags
    - pre-tensioner systems
    - crash sensors

- control modules
  - ix) pinch points
2. Identify types of interior and exterior components, accessories and trim and describe their characteristics and applications.
- i) body components
    - doors
    - seats
    - seat covers
    - dashes
    - bumpers
    - mirrors
    - mounts
  - ii) accessories
    - bug shields
    - visors
    - spoilers
    - roof racks
    - bike racks
    - running boards
3. Identify types of latches, locks and glass and their components and describe their characteristics and applications.
- i) components
    - sensors
    - switches
    - rods
    - fasteners
    - latches
    - hinges
    - modules
    - actuators
    - motors
4. Explain the principles of basic aerodynamics related to body design.
5. Identify types and sources of wind noises, rattles and water leaks and their causes.
- i) missing sealant and adhesive
  - ii) loose fasteners
  - iii) panel misalignment
  - iv) incorrect clearances
  - v) exterior accessories
6. Identify types of repair materials and describe their characteristics, applications and procedures for use.

- i) tapes
  - ii) adhesives
  - iii) gaskets
  - iv) insulators
  - v) lubricants
  - vi) seals
  - vii) sealants
  - viii) fastening devices
  - ix) cleaners
7. Identify warning indicators and describe their characteristics, applications and operation.
- i) warning messages
  - ii) warning lights
  - iii) audible signals
8. Identify tools and equipment used to diagnose and repair body components and trim and describe their characteristics, applications and procedures for use.
- i) chassis ears
  - ii) water hose
  - iii) stethoscope
  - iv) trim tools
  - v) hinge tools
  - vi) scan tools
  - vii) hand tools
  - viii) air tools
  - ix) power tools
  - x) digital multimeters (DMM)
9. Identify flaws in interior and exterior components, accessories and trim.
- i) fit
  - ii) finish
  - iii) form
  - iv) function
10. Describe 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
11. Describe procedures used to repair body components and trim.
- i) wind noises, rattles and water leaks

- ii) interior and exterior components, accessories and trim
  - iii) latches, locks and glass
12. Describe procedures used to adjust, repair and replace interior and exterior components, accessories and trim.
13. Describe procedures used to verify repair.
14. Describe maintenance procedures.
- i) lubricating
  - ii) cleaning
  - iii) adjusting
  - iv) calibrating

**Practical Objectives:**

N/A

## AST-175

## Engine Principles

### Learning Outcomes:

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

### 2023 Red Seal Occupational Standard Reference:

- 4.03 Diagnose engine assembly (engine theory).
- 5.03 Repairs engine assembly (engine theory).

### Suggested Hours:

27 Hours

### Theoretical Objectives:

1. Define and explain terminology associated with engines.
2. Explain internal combustion principles.
3. Identify types of engine classifications.
  - i) fuel
    - diesel
    - gasoline
    - alternate fuels
  - ii) two-stroke and four-stroke
  - iii) cooling systems
    - air
    - liquid
4. Describe operating principles of engine assemblies and their components.
5. Identify types of engine configurations and describe their construction.
  - i) inline
  - ii) rotary
  - iii) opposed
  - iv) V
6. Identify engine assemblies and their components and describe their characteristics and applications.
  - i) components
    - crankshafts

- camshafts
- bearings
- pistons and rings
- engine block
- cylinder head assemblies
- gaskets
- seals
- sealants
- timing belt and pulley
- timing chain and gears
- tensioners
- variable valve actuators

7. Identify types of valve train configurations and describe their construction.
  - i) cam in block
  - ii) overhead cam
  - iii) multi-valve
  - iv) solenoid operated valve
8. Describe variable valve timing control systems.
9. Describe engine displacement, compression ratios, horsepower and torque.
10. Identify related components and describe their relationship to engine assembly.
  - i) engine oil coolers
  - ii) lines
  - iii) hoses
  - iv) pulleys

**Practical Objectives:**

N/A



# Level 2

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## AST-200

## Cooling Systems

### Learning Outcomes:

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

### 2023 Red Seal Occupational Standard Reference:

4.01 Diagnoses cooling systems.

5.01 Repairs cooling systems.

### Suggested Hours:

12 Hours

### Theoretical Objectives:

1. Identify hazards and describe safe work practices related to cooling systems and their components.
  - i) high temperature
  - ii) high pressure
  - iii) toxicity
2. Identify types of cooling systems and their components and describe their characteristics and applications.
  - i) cooling systems
    - liquid
    - air cooled
  - ii) components
    - water pumps
    - radiators
    - thermostats
    - tubes
    - hoses
    - belts
    - tensioners
    - shrouds
    - seals
    - sealants
    - gaskets
    - fans

- active grille shutters
3. Describe operating principles of cooling systems and their components.
  4. Identify types of coolants and chemical additives and describe their characteristics and applications.
  5. Identify types of fan systems and their components and describe their characteristics, applications and operation.
    - i) mechanical
    - ii) electric
    - iii) hydraulic
  6. Identify warning indicators and describe their characteristics, applications, and operation.
    - i) warning messages
    - ii) warning lights
    - iii) audible signals
  7. 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
  8. Identify tools and equipment used to diagnose and repair cooling systems and their components and describe their applications and procedures for use.
    - i) pressure testers
    - ii) coolant testers
    - iii) infrared temperature guns
    - iv) scan tools
    - v) automated refill devices
    - vi) tension gauges
    - vii) hand tools
    - viii) air tools
    - ix) power tools
    - x) belt installers
  9. Describe procedures used to diagnose cooling 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

10. Describe procedures used to repair cooling systems.
11. Describe procedures used to remove, reinstall and bleed cooling system components.
12. Describe procedures to remove, flush, replace, recycle and dispose of coolant.
13. Describe service intervals according to type of coolant.
14. Describe procedures used to verify repair.
15. Identify materials that can be reconditioned, reused or recycled.
16. Identify and interpret jurisdictional standards and regulations related to cooling systems.

**Practical Objectives:**

1. Perform a coolant system pressure test.

## AST-205

## Engine Lubricating Systems

### Learning Outcomes:

- Demonstrate knowledge of engine lubricating systems, their components, characteristics, applications and operation.
- Demonstrate knowledge of procedures used to diagnose and repair engine lubricating systems and their components.

### 2023 Red Seal Occupational Standard Reference:

- 4.02 Diagnoses lubricating systems.
- 5.02 Repairs lubricating systems.

### Suggested Hours:

12 Hours

### Theoretical Objectives:

1. Identify hazards and describe safe work practices related to engine lubricating systems and their components.
  - i) slip and fall
  - ii) toxicity
  - iii) high temperature
2. Identify types of engine lubricating systems and their components and describe their characteristics and applications.
  - i) components
    - pumps and drives
    - coolers
    - lines
    - hoses
    - filters
    - chains
    - tensioners
    - seals
    - sealants
    - gaskets
    - fastening devices
3. Describe operating principles of engine lubricating systems and their components.
4. Identify types of engine lubricants and describe their characteristics and applications.
  - i) grades and classifications
  - ii) synthetics

- iii) additives
5. Identify types of oil pumps and describe their characteristics, applications and operation.
    - i) rotor
    - ii) vane
    - iii) gear
  6. Identify types of oil coolers and describe their characteristics and applications.
    - i) oil-to-air
    - ii) oil-to-coolant
  7. Describe oil flow, filtration and pressure regulation.
  8. Identify types of warning indicators and describe their characteristics, applications and operation.
    - i) warning messages
    - ii) warning lights
    - iii) audible signals
  9. Identify testing procedures for checking oil contaminants.
  10. Identify lubricating requirements related to superchargers and turbochargers.
  11. Identify related systems and describe the relationship to engine lubricating systems.
    - i) engine assembly
    - ii) galleries and clearances
  12. Identify tools and equipment used to diagnose and repair engine lubricating systems and their components and describe their applications and procedures for use.
    - i) pressure gauges
    - ii) scan tools
    - iii) black light
    - iv) dye
  13. Describe procedures used to diagnose engine lubricating 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 procedures used to repair engine lubricating systems.

15. Describe procedures used to verify repair.
16. Describe maintenance procedures.
  - i) changing oil and filter
  - ii) resetting maintenance reminder
17. Identify materials that can be reconditioned, reused or recycled.
18. Identify standards and regulations related to engine lubricating systems and materials.

**Practical Objectives:**

1. Perform an oil pressure test.

## AST-215

## Engine Repair

### Learning Outcomes:

- Demonstrate knowledge of procedures to diagnose and repair engine assemblies and their components.

### 2023 Red Seal Occupational Standard Reference:

4.03 Diagnoses engine assembly.

5.03 Repairs engine assembly.

### Suggested Hours:

42 Hours

### Theoretical Objectives:

1. Identify hazards and describe safe work practices related to engine assemblies and their components.
  - i) slips and falls
  - ii) high temperature
  - iii) toxicity
  - iv) sharp edges
  - v) rotating parts
  - vi) pinch points
2. Identify symptoms of engine assembly faults and describe their cause.
  - i) reduced power
  - ii) smoke
  - iii) oil consumption
  - iv) fluid contamination
  - v) rough running
  - vi) internal/external leaks
  - vii) noises
  - viii) coolant consumption
3. Identify types of engine mounts and describe their characteristics and applications.
4. Identify types of fasteners, gaskets, seals and sealants, and describe their applications and procedures for use.
5. Identify tools and equipment used to diagnose and repair engine assemblies and their components and describe their applications and procedures for use.
  - i) scan tools
  - ii) compression testers

- iii) measuring tools
  - iv) stethoscopes
  - v) electronic vibration analyzers
  - vi) pyrometer
  - vii) laser tools
  - viii) straight edges
  - ix) leak down testers
  - x) hand tools
  - xi) air tools
  - xii) power tools
  - xiii) oil pressure gauge
6. Describe procedures used to diagnose engine assemblies 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 procedures used to remove, repair and reassemble engine assemblies and their components.
8. Describe procedures used to adjust, repair and replace engine assembly components.
9. Describe procedures used to verify repair.
10. Identify materials that can be reconditioned, reused or recycled.

**Practical Objectives:**

- 1. Perform a leak down test.
- 2. Perform a precision engine component measurement.
- 3. Perform a compression test.

## AST-220

## Starting Systems

### Learning Outcomes:

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

### 2023 Red Seal Occupational Standard Reference:

14.02 Diagnoses starting/charging systems and low voltage (12 volt) batteries.

15.02 Repairs starting/charging systems and low voltage (12 volt) batteries.

### Suggested Hours:

15 Hours

### Theoretical Objectives:

1. Identify hazards and describe safe work practices related to starting systems and their components.
  - i) fire
  - ii) battery explosions
  - iii) corrosive materials
  - iv) exposed rotating parts
  - v) electric arc
2. Identify types of starting systems, their components and describe their characteristics and applications.
  - i) components
    - generator (alternator)
    - starter motor
    - low voltage (12 volt) batteries
    - circuit protection devices
    - cables
    - sensors
    - modules
3. Describe operating principles of starting systems and their components.
4. Identify control systems and their components and describe their characteristics, applications and operation.
  - i) anti-theft/immobilizer
  - ii) safety interlock devices
  - iii) stop-start system

5. Identify warning indicators.
  - i) warning messages
  - ii) warning lights
  - iii) audible signals
6. Describe the relationship of the starting system to the vehicle networking system.
7. Identify tools and equipment used to diagnose and repair starting systems and their components and describe their characteristics, applications and procedures for use.
  - i) battery testers
  - ii) digital multimeters (DMM)
  - iii) circuit testers
  - iv) scan tools
  - v) oscilloscopes
  - vi) hand tools
  - vii) specialized tools
  - viii) power tools
8. Describe procedures used to diagnose starting 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 procedures used to adjust, repair and replace starting system components.
10. Describe procedures used to verify repair.
11. Identify materials that can be reconditioned, reused or recycled.
12. Identify practices that reduce material waste.

**Practical Objectives:**

1. Perform a voltage drop test.

## AST-225

## Charging Systems

### Learning Outcomes:

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

### 2023 Red Seal Occupational Standard Reference:

- 4.04 Diagnoses accessory drive systems.
- 5.04 Repairs accessory drive systems.
- 14.02 Diagnoses starting/charging systems and low voltage (12 volt) batteries.
- 15.02 Repairs starting/charging systems and low voltage (12 volt) batteries.

### Suggested Hours:

15 Hours

### Theoretical Objectives:

1. Identify hazards and describe safe work practices related to charging systems and their components.
  - i) fire
  - ii) battery explosions
  - iii) corrosive materials
  - iv) high voltage
  - v) exposed rotating parts
  - vi) pinch points
  
2. Identify types of charging systems, their components and describe their characteristics and applications.
  - i) components
    - generator (alternator)
    - low voltage (12 volt) batteries
    - circuit protection devices
    - cables
    - sensors
    - modules

3. Identify types of accessory drive systems and their components and describe their characteristics and applications.
  - i) components
    - tensioners
    - pulleys
    - belts
    - brackets
    - gaskets
    - sealants
    - fastening devices
4. Describe operating principles of accessory drive systems and their components.
5. Describe procedures used to reinstall and adjust accessory drive systems and their components.
6. Identify warning indicators.
  - i) warning messages
  - ii) warning lights
  - iii) audible signals
7. Identify types of charging system faults.
  - i) undercharge
  - ii) overcharge
8. Describe the relationship of charging system to the vehicle networking system.
9. Identify tools and equipment used to diagnose and repair charging systems and their components and describe their characteristics, applications and procedures for use.
  - i) battery testers
  - ii) digital multimeters (DMM)
  - iii) circuit testers
  - iv) scan tools
  - v) oscilloscopes
  - vi) hand tools
  - vii) specialized tools
  - viii) power tools
  - ix) belt tension gauges
  - x) belt installers
  - xi) stethoscopes
10. Describe procedures used to diagnose charging 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
11. Describe procedures used to adjust, repair and replace charging system components.
  12. Describe procedures used to repair accessory drive systems and their components.
  13. Describe procedures used to reinstall and adjust accessory drive systems and their components.
  14. Describe procedures used to verify repair.
  15. Describe maintenance procedures.
    - i) belt inspection
    - ii) tensioner inspection
  16. Identify materials that can be reconditioned, reused or recycled.
  17. Identify practices that reduce material waste.

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

### 2023 Red Seal Occupational Standard Reference:

14.03 Diagnoses lighting and wiper systems.

15.03 Repairs lighting and wiper systems.

### Suggested Hours:

18 Hours

### Theoretical Objectives:

1. Identify hazards and describe safe work practices related to lighting and wiper systems and their components.
  - i) lamps (high intensity discharge (HID))
  - ii) high voltage lighting
  - iii) pinch points
  - iv) high temperature
  - v) sharp edges
2. Identify types of lighting and wiper systems and their components and describe their characteristics and applications.
  - i) lighting and wiper systems
    - electrically controlled
    - electronically-controlled
      - steering responsive headlights
      - automatic high beams
  - ii) lighting components
    - light bulbs
    - light emitting diodes (LED)
    - switches
    - modules
  - iii) wiper components
    - switches
    - linkages/ transmissions
    - controls
    - wiper motors
    - modules

- sensors

3. Describe operating principles of lighting and wiper systems and their components.
4. Describe the relationship of lighting and wiper systems to the vehicle networking system.
5. Identify tools and equipment used to diagnose and repair lighting and wiper systems and their components and describe their characteristics, applications and procedures for use.
  - i) digital multimeters (DMM)
  - ii) scan tools
  - iii) circuit testers
  - iv) reprogramming equipment
  - v) oscilloscopes
  - vi) hand tools
  - vii) specialized tools
6. Describe procedures used to diagnose lighting and wiper 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. Interpret wiring diagrams and schematics.
8. Describe procedures used to adjust, repair and replace lighting and wiper system components.
9. Describe procedures used to verify repair.
10. Identify jurisdictional requirements related to lighting and wiper systems.

**Practical Objectives:**

1. Locate a connector on a vehicle using a diagram.

## AST-235

## Steering Systems II

### Learning Outcomes:

- Demonstrate knowledge of electronic steering systems, their characteristics, applications and operation.
- Demonstrate knowledge of procedures used to diagnose and repair electronic steering systems and their components.
- Demonstrate knowledge of steering geometry.

### 2023 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

### Theoretical Objectives:

1. Identify hazards and describe safe work practices related to electronic steering systems.
  - i) accidental deployment of passive restraints
    - air bags
    - clock springs
  - ii) telescopic columns
  - iii) loaded components
  - iv) high temperature
  - v) high pressure
  - vi) pinch/crush points
  - vii) hoisting
2. Identify types of electronic steering systems and describe their components and operation.
  - i) electric
  - ii) variable
3. Describe steering geometry.
4. Identify related systems and describe their relationship to electronic steering systems.
  - i) lane departure warning
  - ii) active park assist
  - iii) lane keep assist

5. Identify tools and equipment used to diagnose and repair electronic steering systems and their components and describe their characteristics, applications and procedures for use.
  - i) scan tools
  - ii) pressure gauges
  - iii) dial indicators
  - iv) alignment machine
6. Describe procedures used to diagnose electronic 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
7. Describe procedures used to remove and reinstall electronic steering system components.
8. Describe procedures used to adjust, repair and replace electronic steering system components.
9. Describe procedures to calibrate steering sensors.
10. Describe procedures used to verify repair.

**Practical Objectives:**

1. Perform a steering sensor reset and relearn.

## AST-240

## Suspension Systems II

### Learning Outcomes:

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

### 2023 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

### Theoretical Objectives:

1. Identify hazards and describe safe work practices related to electronically-controlled suspension systems and their components.
  - i) loaded components
    - ball joints
    - struts
    - springs
  - ii) high temperature
  - iii) high pressure
  - iv) pinch/crush points
  - v) hoisting
2. Identify types of electronically-controlled suspension systems and their components and describe their characteristics and applications.
  - i) ride control
  - ii) height control
3. Describe the operating principles of electronically-controlled suspension systems and their components.
4. Describe suspension geometry.

5. Identify tools and equipment used to diagnose and repair electronically-controlled suspension systems and their components, and describe their characteristics, applications and procedures for use.
  - i) hand tools
  - ii) air tools
  - iii) power tools
  - iv) scan tools
  - v) pullers
  - vi) presses
  - vii) reprogramming equipment
  - viii) alignment machine
  - ix) digital multimeters (DMM)
  - x) oscilloscopes
6. Describe procedures used to diagnose electronically-controlled suspension 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 procedures used to remove and reinstall electronically-controlled suspension systems components.
8. Describe procedures used to adjust, repair and replace electronically-controlled suspension systems components.
9. Describe procedures used to diagnose and perform wheel alignments.
10. Describe procedures used to verify repair.

**Practical Objectives:**

N/A

## AST-245

## Braking Systems II (ABS)

### Learning Outcomes:

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

### 2023 Red Seal Occupational Standard Reference:

18.02 Diagnoses braking and control systems.

19.02 Repairs braking and control systems.

### Suggested Hours:

24 Hours

### Theoretical Objectives:

1. Identify hazards and describe safe work practices related to anti-lock braking systems (ABS), control systems and their components.
  - i) hydraulic pressure
  - ii) airborne contaminants
  - iii) high voltage systems
  - iv) hoisting
2. Identify types of anti-lock braking systems (ABS) and their components and describe their characteristics, applications and operation.
  - i) components
    - proportioning valves
    - pressure limiting systems
    - actuators
    - modules
    - switches
    - sensors
      - positions
      - pressure
      - speed
        - active
        - passive
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 their components and describe their characteristics, applications and procedures for use.
  - i) traction control system (TCS)
  - ii) anti-lock brake system (ABS)
  - iii) stability control
  - iv) adaptive cruise control
  
6. Identify tools and equipment used to diagnose and repair anti-lock braking systems (ABS), control systems and their components and describe their applications and procedures for use.
  - i) scan tools
  - ii) pressure gauges
  - iii) measuring tools
  - iv) hand tools
  - v) air tools
  - vi) power tools
  - vii) digital multimeters (DMM)
  - viii) oscilloscopes
  
7. Describe procedures used to diagnose anti-lock braking systems (ABS), control 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
  
8. Describe procedures used to flush and bleed anti-lock brakes.
  
9. Describe procedures used to adjust, repair and replace anti-lock braking system (ABS) components.
  
10. Describe procedures used to repair control systems.
  
11. Describe procedures used to verify repair.
  
12. Describe relationship between ABS and vehicle network systems.

**Practical Objectives:**

1. Test wheel speed sensors.

## AST-250

## Manual Transmissions and Transaxles

### Learning Outcomes:

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

### 2023 Red Seal Occupational Standard Reference:

12.02 Diagnoses manual transmissions and transaxles.

13.02 Repairs manual transmissions and transaxles.

### Suggested Hours:

36 Hours

### Theoretical Objectives:

1. Identify hazards and describe safe work practices related to manual transmissions and transaxles and their components.
  - i) exposed rotating parts
  - ii) pinch points
  - iii) lifting and support procedures
2. Identify types of manual transmissions and transaxles and their components and describe their characteristics and applications.
3. Describe operating principles of manual transmissions and transaxles and their components.
4. Explain manual transmissions and transaxles power flow.
5. Describe gear ratios, their purpose and calculation.
6. Identify types of lubricants, fasteners, gaskets, seals and sealants, and describe their applications.
7. Identify types of engine and driveline mounts, their construction and application.
8. Identify tools and equipment used to diagnose and repair manual transmissions and transaxles and their components and describe their characteristics, applications and procedures for use.
  - i) chassis ears
  - ii) stethoscopes

- iii) hand tools
  - iv) scan tools
  - v) measuring tools
  - vi) presses
  - vii) pullers
  - viii) air tools
  - ix) power tools
  - x) lifting and support equipment
9. Describe procedures used to diagnose manual transmissions and transaxles 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
10. Describe procedures used to remove and reinstall manual transmissions and transaxles.
11. Describe procedures used to adjust, repair and replace manual transmissions and transaxles and their components.
12. Describe procedures used to replace engine and driveline mounts.
13. Describe procedures used to verify repair.
14. Describe maintenance procedures.
15. Identify materials that can be reconditioned, reused or recycled.

**Practical Objectives:**

N/A

**Learning Outcomes:**

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

**2023 Red Seal Occupational Standard Reference:**

12.04 Diagnoses clutches.

13.04 Repairs clutches.

**Suggested Hours:**

6 Hours

**Theoretical Objectives:**

1. Identify hazards and describe safe work practices related to clutches and their components.
  - i) airborne contaminants
  - ii) pinch points
  - iii) exposed rotating parts
  - iv) lifting and support procedures
  - v) fluid
2. Identify types of clutches and their components and describe their characteristics, and applications.
  - i) clutches
    - single disc
    - multi-disc
  - ii) components
    - clutch disc
    - pressure plate
    - flywheel
    - release bearing
    - primary cylinder
    - secondary cylinder
3. Describe operating principles of clutches and their components.
4. Identify types of flywheels and their components and describe their characteristics, application and operation.
  - i) single mass
  - ii) dual mass

5. Identify hydraulic and electric clutch actuating systems and their components and describe their characteristics, applications and operating principles.
6. Identify types of fluids, fasteners, tubing, hoses and seals, and describe their applications.
7. Describe clutch system power flow.
8. Identify related systems and describe their relationship to clutch systems.
  - i) engine
  - ii) manual transmission
  - iii) drive shaft and axles
9. Identify tools and equipment used to diagnose and repair clutches and their components and describe their characteristics, applications and procedures for use.
  - i) measuring tools
  - ii) alignment tools
  - iii) pullers
  - iv) hand tools
  - v) air tools
  - vi) power tools
  - vii) lifting and support equipment
10. Describe procedures used to diagnose clutches 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
11. Describe procedures used to remove and reinstall clutches.
12. Describe procedures used to adjust, repair and replace clutches and flywheels and their components.
13. Describe procedures used to verify repair.
14. Identify materials that can be reconditioned, reused or recycled.

**Practical Objectives:**

N/A

## AST-260

## Final Drive Assemblies

### Learning Outcomes:

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

### 2023 Red Seal Occupational Standard Reference:

12.06 Diagnoses final drive assemblies.

13.06 Repairs final drive assemblies.

### Suggested Hours:

24 Hours

### Theoretical Objectives:

1. Identify hazards and describe safe work practices related to final drive assemblies and their components.
  - i) exposed rotating parts
  - ii) pinch points
  - iii) lifting and supporting procedures
2. Identify types of final drive assemblies, and their components and describe their characteristics and applications.
  - i) types of assemblies
    - integral
    - removable
  - ii) types of differential assemblies
    - locking
    - limited slip
    - torque distribution
    - standard (open)
3. Describe operating principles of final drive assemblies and their components.
4. Describe final drive assembly power flow.
5. Identify related systems and describe their relationship to final drive assembly.
  - i) transmissions
  - ii) drivelines
  - iii) mounts

6. Identify types of lubricants, fasteners, gaskets, seals and sealants, and describe their applications.
7. Describe gear ratios, their purpose and calculations.
8. Identify tools and equipment used to diagnose and repair final drive assemblies and their components and describe their applications and procedures for use.
  - i) hand tools
  - ii) air tools
  - iii) power tools
  - iv) scan tools
  - v) measuring tools
  - vi) presses
  - vii) pullers
  - viii) lifting and support equipment
  - ix) tooth contact pattern
9. Describe procedures used to diagnose final drive assembly 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
10. Describe procedures used to adjust, repair and replace final drive assemblies and their components.
11. Describe procedures used to verify repair.
12. Describe maintenance procedures.
13. Identify materials that can be reconditioned, reused or recycled.

**Practical Objectives:**

1. Disassemble final drive.
2. Measure pre-load and backlash.



# Level 3

Unit Code	Title	Suggested Hours	Page
AST-305	Gasoline Fuel Delivery and Injection Systems	24	90
AST-310	Gasoline Ignition Systems	24	93
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AST-320	Gasoline Emission Control Systems	30	99
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## **AST-305**

## **Gasoline Fuel Delivery and Injection Systems**

### **Learning Outcomes:**

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

### **2023 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

### **Theoretical Objectives:**

1. Identify hazards and describe safe work practices related to gasoline fuel delivery and injection systems.
  - i) high pressure
  - ii) flammability
  
2. Identify types of gasoline fuel delivery and injection systems and their components and describe their characteristics and applications.
  - i) fuel delivery and injection systems
    - fuel pumps and supply systems
    - gasoline direct injection
    - port injection systems
  - ii) components
    - injectors
    - pumps
    - tanks
    - lines
    - hoses
    - tubing
    - filters
    - control systems
    - regulators
    - gaskets

3. Describe operating principles of gasoline fuel delivery and injection systems and their components.
4. Identify tools and equipment used to diagnose and repair gasoline fuel delivery and injection systems and describe their characteristics, applications and procedures for use.
  - i) fuel pressure gauges
  - ii) scan tools
  - iii) vacuum gauges
  - iv) digital multimeters (DMMs)
  - v) oscilloscopes
  - vi) fuel pressure relief devices
  - vii) fuel transfer and storage equipment
  - viii) fuel injector cleaning equipment
  - ix) hand tools
  - x) air tools
  - xi) power tools
  - xii) smoke generator
5. Describe procedures used to diagnose 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 procedures used to remove and reinstall gasoline fuel delivery and injection systems and their components.
7. Describe procedures used to adjust, calibrate, repair and replace gasoline fuel delivery and injection system components.
8. Describe procedures used to verify repair.
9. Describe maintenance procedures.
  - i) fuel injector flushes
  - ii) contaminants removal
  - iii) filter replacement
10. Identify materials that can be recycled.
11. Identify codes, standards and regulations related to gasoline fuel delivery and injection systems.

**Practical Objectives:**

1. Perform fuel pressure check.

## **AST-310                      Gasoline Ignition Systems**

### **Learning Outcomes:**

- Demonstrate knowledge of gasoline electronic ignition systems, their components, characteristics, applications and operation.
- Demonstrate knowledge of procedures used to diagnose and repair gasoline electronic ignition systems and their components.

### **2023 Red Seal Occupational Standard Reference:**

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

### **Suggested Hours:**

24 Hours

### **Theoretical Objectives:**

1. Identify hazards and describe safe work practices related to gasoline electronic ignition systems.
  - i) high voltage
  - ii) high temperature
  
2. Identify types of gasoline electronic ignition systems and their components and describe their characteristics and applications.
  - i) ignition systems
    - coil-on-plug
    - coil-near-plug
    - waste spark
  - ii) components
    - spark plugs
    - coils
    - plug wires
    - modules
    - sensors
  
3. Describe operating principles of gasoline electronic ignition systems and their components.
  
4. Identify the types of ignition circuits and describe their purpose and operation.
  - i) primary
  - ii) secondary

- i) control
5. Identify warning indicators and describe their characteristics, applications and operation.
- i) warning messages
  - ii) warning lights
  - iii) audible signals
6. Identify gasoline electronic ignition concerns.
- i) hesitation
  - ii) misfire
  - iii) lag
  - iv) no start
  - v) detonation
  - vi) pre-ignition
7. Identify related systems and describe their relationship to gasoline electronic ignition systems.
- i) fuel
  - ii) exhaust
  - iii) air intake
8. Identify tools and equipment used to diagnose and repair gasoline electronic ignition systems and their components and describe their characteristics, applications and procedures for use.
- i) scan tools
  - ii) hand tools
  - iii) air tools
  - iv) power tools
  - v) digital multimeters (DMMs)
  - vi) oscilloscopes
  - vii) gauges
  - viii) spark testers
9. Describe procedures used to diagnose gasoline electronic ignition 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
10. Describe procedures used to repair gasoline ignition systems.

11. Describe procedures used to remove and reinstall ignition system components.
12. Describe procedures used to adjust, calibrate, repair and replace gasoline electronic ignition system components.
13. Describe procedures used to verify repair.
14. Describe maintenance procedures.
  - i) spark plug change intervals
  - ii) ignition cable replacement

**Practical Objectives:**

N/A

## **AST-315**

## **Vehicle Networking Systems**

### **Learning Outcomes:**

- Demonstrate knowledge of vehicle networking systems, their components and operation.
- Demonstrate knowledge of procedures to read diagnostic trouble codes (DTCs) and monitor data.
- Demonstrate knowledge of procedures used to diagnose and replace vehicle networking system components.
- Demonstrate knowledge of circuits, their components and operation.
- Demonstrate knowledge of procedures used to diagnose and repair circuits and components.
- Demonstrate knowledge of procedures used to update component software and reprogram software.

### **2023 Red Seal Occupational Standard Reference:**

- 10.01 Reads diagnostic trouble codes (DTCs).
- 10.02 Monitors data.
- 10.03 Tests system circuitry and components.
- 10.04 Interprets test results.
- 11.01 Updates component software.
- 11.02 Replaces components.
- 11.03 Repairs system circuitry and components.
- 11.04 Verifies vehicle module communications system repair.

### **Suggested Hours:**

60 Hours

### **Theoretical Objectives:**

1. Identify and describe safe work practices related to vehicle networking systems.
2. Identify types of network protocols and describe their purpose.
  - i) International Standards Organization (ISO)
  - ii) local interface network (LIN)
  - iii) speed
  - iv) controller area network (CAN)
3. Describe the networking of modules and multiplexing.
  - i) wiring designs
  - ii) star and loop
  - iii) wireless

4. Identify and interpret data.
  - i) inputs
  - ii) outputs
  - iii) module
  - iv) network status
  
5. Identify on-board diagnostic (OBD) systems and describe their components and operation.
  - i) diagnostic trouble codes (DTCs)
  - ii) freeze frame data
  - iii) readiness monitors
    - continuous
    - non-continuous
  - iv) global OBDII systems
    - operational modes
  
6. Identify parameters of inputs and outputs and describe their relationships.
  
7. Identify type of network wiring and describe their characteristics, composition and applications.
  
8. Identify methods used to access, transfer and reprogram software, and describe their associated procedures.
  - i) USB
  - ii) internet
  - iii) scan tool
  - iv) over the air (OTA) updates
  
9. Identify tools and equipment used to diagnose and repair network and electronic circuitry and describe their characteristics, applications and procedures for use.
  - i) digital multimeters (DMM)
  - ii) scopes
  - iii) probes
  - iv) break out boxes
  - v) scan tools
  - vi) LED circuit testers
  - vii) manufacturer-compliant programming tools
  - viii) laptops / computers
  - ix) voltage maintainer
  
10. Describe procedures used to diagnose vehicle networking systems, circuits 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 read diagnostic trouble codes (DTCs).
  12. Describe procedures used to monitor data.
  13. Interpret diagnostic flowcharts and schematics.
  14. Describe the procedures used to interpret test results.
  15. Describe procedures used to repair and replace vehicle networking system components.
  16. Describe procedures used to verify repair.

**Practical Objectives:**

1. Check the integrity of a CAN bus system.
2. Connect scan tools and monitor live data.

## AST-320

## Gasoline Emission Control Systems

### Learning Outcomes:

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

### 2023 Red Seal Occupational Standard Reference:

6.04 Diagnoses gasoline emission control systems.

7.04 Repairs gasoline emission control systems.

### Suggested Hours:

30 Hours

### Theoretical Objectives:

1. Identify hazards and safe work practices related to gasoline emission control systems and their components.
  - i) high temperature
  - ii) noxious gas
2. Identify types of gasoline emission control systems and their components and describe their characteristics and applications.
  - i) emission control systems
    - exhaust gas recirculation (EGR)
    - evaporative emission control systems (EVAP)
    - secondary air injection
    - exhaust system
    - positive crankcase ventilation (PCV)
    - induction system
    - variable cam-timing (VCT)
  - ii) components
    - solenoids
    - EGR valves
    - catalytic converters
    - PCV valves
    - canisters
    - air pumps
    - fasteners
    - tubing

- hoses
  - gaskets
  - seals
  - sealants
  - sensors
  - particulate filter
3. Describe operating principles of gasoline emission control systems and their components.
  4. Identify types of emission gases and how they are formed.
    - i) carbon monoxide (CO)
    - ii) carbon dioxide (CO<sub>2</sub>)
    - iii) oxides of nitrogen (NO<sub>x</sub>)
    - iv) hydrocarbon (HC)
    - v) oxygen (O<sub>2</sub>)
  5. Identify warning indicators and describe their characteristics, applications and operation.
    - i) warning messages
    - ii) warning lights
    - iii) audible signals
  6. Identify related systems and describe their relationship to gasoline emission control systems.
    - i) exhaust
    - ii) intake
    - iii) fuel
    - iv) ignition
  7. Identify tools and equipment used to diagnose and repair gasoline emission control systems and their components and describe their characteristics, applications and procedures for use.
    - i) hand tools
    - ii) air tools
    - iii) power tools
    - iv) scan tools
    - v) smoke generators
    - vi) evaporative emission control system (EVAP) leak detectors
    - vii) gas analyzers
    - viii) digital multimeters (DMM)
    - ix) cleaning and service tools
    - x) reprogramming equipment
    - xi) pressure gauges

- xii) vacuum gauges
  - xiii) infrared thermometer
8. Describe procedures used to diagnose gasoline emission control 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 procedures used to remove and reinstall gasoline emission control system components.
  10. Describe procedures used to adjust, repair and replace gasoline emission control system components.
  11. Describe procedures used to verify repair.
  12. Describe maintenance procedures.
    - i) cleaning EGR valves/passages
    - ii) replacing PCV valves
  13. Identify materials that can be recycled.
  14. Identify standards and regulations related to gasoline emission control systems.

**Practical Objectives:**

1. Perform a smoke check of the EVAP system.

## AST-325

## Gasoline Intake and Exhaust Systems

### Learning Outcomes:

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

### 2023 Red Seal Occupational Standard Reference:

6.03 Diagnoses gasoline intake and exhaust systems.

7.03 Repairs gasoline intake and exhaust systems.

### Suggested Hours:

18 Hours

### Theoretical Objectives:

1. Identify hazards and describe safe work practices related to gasoline intake and exhaust systems and their components.
  - i) high temperature
  - ii) noxious emissions
  - iii) fuel pressure
  - iv) flammability
  
2. Identify types of gasoline intake and exhaust systems and their components and describe their characteristics and applications.
  - i) intake and exhaust systems
    - forced air (turbocharged, supercharged)
    - naturally aspirated (NA)
    - single or dual exhaust
    - variable intake manifold
  - ii) components
    - intake manifolds and associated piping
    - exhaust manifolds and associated piping
    - mufflers
    - catalytic converters
    - turbocharger systems
    - supercharger systems
    - charge air coolers (CAC)
    - waste gates
    - fasteners

- tubing
  - hoses
  - gaskets
  - seals
  - sealants
  - recirculating valves
3. Describe operating principles of gasoline intake and exhaust systems and their components.
  4. Identify symptoms of gasoline intake and exhaust system faults and describe their causes.
    - i) leaks
    - ii) blockages/restrictions
    - iii) noise
    - iv) vibration
    - v) reduced power
    - vi) smoke
  5. Identify related systems and describe their relationship to gasoline intake and exhaust systems.
    - i) emissions
    - ii) lubricating
    - iii) fuel delivery
  6. Identify tools and equipment used to diagnose and repair gasoline intake and exhaust systems and their components and describe their characteristics, applications and procedures for use.
    - i) scan tools
    - ii) vacuum gauges
    - iii) exhaust back pressure gauges
    - iv) smoke generators
    - v) gas analyzers
    - vi) torches
    - vii) welders
  7. Describe procedures used to diagnose gasoline 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

8. Describe procedures used to remove, adjust, calibrate, repair and reinstall gasoline intake and exhaust system components.
9. Describe procedures used to verify repair.
10. Describe maintenance procedures.
  - i) cleaning throttle body
  - ii) replacing air filters
  - iii) changing supercharger oil
  - iv) priming, lubricating and servicing turbocharger and supercharger systems
  - v) carbon cleaning
11. Identify materials that can be recycled.

**Practical Objectives:**

1. Perform an engine vacuum test.

## **AST-330**

## **Electrical Options and Accessories**

### **Learning Outcomes:**

- Demonstrate knowledge of electrical and electronic principles.
- Demonstrate knowledge of circuits, their components and operation.
- Demonstrate knowledge of electrical options and accessories, their components, characteristics, applications and operation.
- Demonstrate knowledge of procedures used to diagnose and repair electrical options and accessories.

### **2023 Red Seal Occupational Standard Reference:**

14.05 Diagnoses electrical options and accessories.

15.05 Repairs electrical options and accessories.

### **Suggested Hours:**

30 Hours

### **Theoretical Objectives:**

1. Identify hazards and describe safe work practices related to electrical options and accessories and their components.
  - i) fire
  - ii) accidental restraint system deployment
  - iii) pinch points
  - iv) sharp edges
  
2. Identify types of electrical options and accessories and their components and describe their characteristics, applications and operation.
  - i) power options
    - windows
    - mirrors
    - seats
    - door locks
    - sunroofs
  - ii) theft deterrents
  - iii) remote starter
  - iv) heated and cooled seats
  - v) heated steering wheel
  - vi) keyless entry
  - vii) cruise control
  - viii) components

- switches
  - modules
  - actuators
  - antennae
  - cabling
3. Describe operating principles of electrical options and accessories and their components.
  4. Describe application of Ohm's law to electrical circuits.
  5. Interpret diagnostic flowcharts and schematics.
  6. Describe the relationship of electrical options and accessories to vehicle networking system.
  7. Identify tools and equipment used to diagnose and repair electrical options and accessories and their components and describe their characteristics, applications and procedures for use.
    - i) digital multimeters (DMM)
    - ii) scan tools
    - iii) circuit testers
    - iv) oscilloscopes
    - v) infrared thermometer
  8. Describe procedures used to diagnose electrical options and accessories 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 the root cause
  9. Describe procedures used to repair and replace electrical options and accessories and their components.
  10. Describe procedures used to verify repair.
  11. Describe maintenance procedures.
    - i) replace key fob battery

**Practical Objectives:**

1. Perform parasitic draw test.

## **AST-332**

## **Advanced Driver Assistance Systems (ADAS)**

### **Learning Outcomes:**

- Demonstrate knowledge of ADAS components, characteristics, applications and operation.
- Demonstrate knowledge of procedures used to diagnose and repair ADAS components.

### **2023 Red Seal Occupational Standard Reference:**

- 14.07 Diagnoses advanced driver assistance system (ADAS) components.
- 15.07 Repairs advanced driver assistance system (ADAS) components.
- 18.04 Diagnoses advanced driver assistance system (ADAS) components related to steering, suspension and braking systems.
- 19.04 Repairs advanced driver assistance system (ADAS) components related to steering, suspension and braking systems.

### **Suggested Hours:**

21 Hours

### **Theoretical Objectives:**

1. Identify hazards and describe safe work practices related to ADAS components.
  - i) road testing defective components
2. Identify types of ADAS systems and describe their characteristics and applications.
  - i) lane keep assist
  - ii) lane departure warning
  - iii) forward collision warning
  - iv) adaptive cruise control
  - v) autonomous driving
  - vi) driver drowsiness detection
  - vii) active park assist
  - viii) pedestrian detection
  - ix) blind-spot monitoring
3. Identify types of ADAS components and describe their characteristics and applications.
  - i) around-view cameras
  - ii) back up cameras
  - iii) parking-aid sensors
  - iv) modules
  - v) night vision sensors
  - vi) rain sensors

- vii) navigation unit
  - viii) UV sensors
  - ix) haptic and audible alarms
  - x) warning lights
4. Describe operating principles of ADAS components.
  5. Describe relationship of ADAS to steering, suspension, braking and vehicle networking systems.
    - i) windshield cameras
    - ii) forward radar sensors
    - iii) blind spot radar sensors
    - iv) switches
    - v) modules
  6. Identify tools and equipment used to diagnose and repair ADAS components, and describe their characteristics, applications and procedures for use.
    - i) digital multimeters (DMM)
    - ii) hand tools
    - iii) scan tools
    - iv) manufacturer-specific tools and equipment
    - v) reprogramming equipment
    - vi) alignment machine
    - vii) oscilloscope
  7. Describe procedures used to diagnose ADAS components.
  8. Describe procedures used to adjust, calibrate, repair and replace ADAS components.
  9. Describe procedures used to verify repair.
  10. Describe procedures and obligations to document calibration and repairs.
  11. Identify training and certification requirements to diagnose and repair ADAS components.
  12. Identify regulations related to ADAS components.

**Practical Objectives:**

N/A

## **AST-335                      Motor Vehicle Inspection**

### **Learning Outcomes:**

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

### **2023 Red Seal Occupational Standard Reference:**

N/A

### **Suggested Hours:**

3 Hours

### **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) journey person
  - iii) shop owner
  - iv) government
3. Identify jurisdictional requirements related to motor vehicle inspections.
  - i) inspection instructions
  - ii) specifications and tolerances
  - iii) documentation
    - inspection forms
    - rejection stickers
    - inspection stickers
4. Describe procedures used to perform a provincial motor vehicle inspection.
  - i) vehicles
  - ii) trailers

### **Practical Objectives:**

N/A

# Level 4

Unit Code	Title	Suggested Hours	Page
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AST-415	Diesel Intake and Exhaust Systems	6	122
AST-420	Entertainment Systems	12	125
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AST-430	Restraint Systems	18	129
AST-435	Automatic Transmissions and Transaxles	48	132
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## **AST-400                      Transfer Cases**

### **Learning Outcomes:**

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

### **2023 Red Seal Occupational Standard Reference:**

12.05 Diagnoses transfer cases.

13.05 Repairs transfer cases.

### **Suggested Hours:**

18 Hours

### **Theoretical Objectives:**

1. Identify hazards and describe safe work practices related to transfer cases and their components.
  - i) pinch points
  - ii) exposed rotating components
  - iii) lifting and support procedures
2. Identify types of transfer cases and their components and describe their characteristics and applications.
  - i) part-time
  - ii) full-time
  - iii) automatic
  - iv) all-wheel drive (AWD)
  - v) power transfer unit (PTU)
3. Describe operating principles of transfer cases and their components.
4. Identify types of AWD systems, their components and operation.
5. Identify types of four-wheel drive systems, their components and operation.
  - i) manual selection
  - ii) automatic selection
6. Identify types of controls and electrical components and describe their operation.
  - i) controls

- vacuum
  - mechanical
  - shifters
  - linkage
  - ii) electrical components
    - actuators
    - solenoids
    - sensors
    - switches
    - viscous coupling
    - clutches (multi-disc and Haldex)
7. Describe transfer case power flow.
  8. Describe gear ratios, their purpose and calculations.
  9. Identify types of lubricants, fasteners, gaskets, seals and sealants, and describe their applications.
  10. Identify related systems and describe their relationship to transfer cases.
    - i) transmissions
    - ii) drivelines
    - iii) mounts
  11. Identify tools and equipment used to diagnose and repair transfer cases and their components and describe their applications and procedures for use.
    - i) scan tools
    - ii) reprogramming equipment
    - iii) measuring tools
    - iv) presses
    - v) pullers
    - vi) hand tools
    - vii) air tools
    - viii) power tools
    - ix) lifting and support equipment
  12. Describe procedures used to diagnose transfer cases 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

13. Describe procedures used to remove and reinstall transfer cases.
14. Describe procedures used to adjust, repair and replace transfer cases and their components.
15. Describe procedures used to verify repair.
16. Describe maintenance procedures.
17. Identify materials that can be reconditioned, reused or recycled.

**Practical Objectives:**

1. Disassemble and reassemble a transfer case.

## **MENT-701            Mentoring II**

### **Learning Outcomes:**

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

### **2023 Red Seal Occupational Standard Reference:**

- 3.01 Uses communication techniques
- 3.02 Uses mentoring techniques.

### **Suggested Hours:**

6 Hours

### **Theoretical 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.

### **Practical Objectives:**

N/A

## AST-405

## Diesel Fuel Delivery and Injection Systems

### Learning Outcomes:

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

### 2023 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

### Theoretical Objectives:

1. Identify hazards and describe safe work practices related to diesel fuel delivery and injection systems and their components.
  - i) high pressure fuel
  - ii) high injector voltage
  - iii) diesel fuel contamination (bacteria)
2. Identify types of diesel fuel delivery and injection systems and their components and describe their characteristics and application.
  - i) diesel fuel delivery and injection systems
    - direct injection
    - Indirect injection
    - mechanical
    - hydraulic
    - electronic
    - common rail systems
  - ii) components
    - lift pumps
    - transfer pumps
    - high pressure pumps
    - fuel filters
    - tanks
    - fuel heater
    - fuel coolers
    - lines

- gaskets
  - seals
  - injectors
  - fuel water separators
3. Describe operating principles of diesel fuel delivery and injection systems and their components.
  4. Identify types of pre-heat systems and describe their purpose and operation.
    - i) glow plugs
    - ii) intake heaters
    - iii) timers
  5. Identify methods to test fuel quality and describe their associated procedures.
  6. Identify types and sources of diesel fuel delivery and injection system faults.
    - i) reduced (lack of) power
    - ii) smoke
    - iii) hard start
  7. Identify related systems and describe their relationship to diesel fuel delivery and injection systems.
    - i) intake and exhaust
    - ii) emission control
  8. Identify tools and equipment used to diagnose and repair diesel fuel delivery and injection systems and their components and describe their characteristics, applications and procedures for use.
    - i) fuel pressure gauges
    - ii) fuel pressure relief devices
    - iii) scan tools
    - iv) digital multimeters (DMM)
    - v) oscilloscopes
    - vi) graduated cylinders
    - vii) hydrometer
    - viii) hand tools
    - ix) air tools
    - x) power tools
    - xi) fuel transfer
    - xii) storage equipment
    - xiii) reprogramming equipment
  9. Describe procedures used to diagnose diesel 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
10. Describe procedures used to remove, adjust, repair and replace diesel fuel delivery and injection system components.
11. Describe procedures used to verify repair.
12. Describe maintenance procedures.
- i) fuel filter replacement
  - ii) prime
13. Identify materials that can be reconditioned, reused or recycled.
14. Identify codes, standards and regulations related to diesel fuel injection systems.

**Practical Objectives:**

N/A

## AST-410

## Diesel Emission Control Systems

### Learning Outcomes:

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

### 2023 Red Seal Occupational Standard Reference:

8.03 Diagnoses diesel emission control systems.

9.03 Repairs diesel emission control systems.

### Suggested Hours:

18 Hours

### Theoretical Objectives:

1. Identify hazards and describe safe work practices related to diesel emission control systems.
  - i) corrosive diesel exhaust fluid
  - ii) high temperature
  - iii) noxious fumes
2. Identify diesel emission control systems and their components and describe their characteristics and applications.
  - i) emission control systems
    - exhaust gas recirculation (EGR)
    - positive crankcase ventilation (PCV)
    - variable cam-timing (VCT)
  - ii) exhaust emissions
    - selective catalyst reduction (SCR)
    - diesel emission fluid (DEF)
    - diesel oxidation catalyst (DOC)
    - diesel particulate filter (DPF)
    - diesel regeneration process
  - iii) components
    - EGR valve
    - particulate filter
    - EGR cooler
    - DEF tank
    - heater

- injector
  - gaskets
  - seals
  - sensors
  - fastening devices
3. Describe the operating principles of diesel emission control systems and their components.
  4. Identify diesel emissions and how they are formed.
    - i) carbon monoxide (CO)
    - ii) carbon dioxide (CO<sub>2</sub>)
    - iii) oxides of nitrogen (NO<sub>x</sub>)
    - iv) hydrocarbon (HC)
    - v) oxygen (O<sub>2</sub>)
    - vi) sulfur dioxide (SO<sub>2</sub>)
    - vii) particulates
  5. Identify warning indicators and describe their characteristics, applications and operation.
    - i) warning messages
    - ii) warning lights
    - iii) audible signals
  6. Identify tools and equipment used to diagnose diesel emission control systems and their components and describe their characteristics, applications and procedures for use.
    - i) scan tools
    - ii) hand tools
    - iii) air tools
    - iv) power tools
    - v) vacuum gauges
    - vi) smoke generators
    - vii) leak detectors
    - viii) digital multimeters (DMM)
    - ix) oscilloscopes
    - x) reprogramming equipment
    - xi) opacity meter
    - xii) refractometer
  7. Describe 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 procedures used to service, repair and replace diesel emission control systems and components.
  9. Describe procedures used to verify repair.
  10. Describe maintenance procedures.
    - i) cleaning EGR system and restricted passages
    - ii) replacing filters
    - iii) performing regeneration procedures
  11. Identify materials that can be reconditioned, reused or recycled.
  12. Identify codes, standards and regulations related to diesel emission control systems.

**Practical Objectives:**

N/A

## AST-415

## Diesel Intake and Exhaust Systems

### Learning Outcomes:

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

### 2023 Red Seal Occupational Standard Reference:

8.02 Diagnoses diesel intake/exhaust systems.

9.02 Repairs diesel intake/exhaust systems.

### Suggested Hours:

6 Hours

### Theoretical Objectives:

1. Identify hazards and describe safe work practices related to diesel intake and exhaust systems and their components.
  - i) high temperature
  - ii) noxious fumes
  - iii) run away condition
  - iv) engine overspeed
  
2. Identify types of diesel intake and exhaust systems and their components and describe their characteristics and applications.
  - i) components
    - air filter
    - mufflers
    - turbochargers
    - piping
    - manifolds
    - charge air coolers (CAC)
    - gaskets
    - seals
    - sealants
    - fastening devices
    - clamps
    - variable geometry turbo (VGT)

3. Describe operating principles of diesel intake and exhaust systems, and their components.
4. Identify symptoms of intake and exhaust system faults and their causes.
  - i) leaks
  - ii) restrictions/blockages
  - iii) noise
  - iv) vibration
5. Identify tools and equipment used to diagnose and repair diesel intake and exhaust systems and their components and describe their characteristics, applications and procedures for use.
  - i) scan tools
  - ii) hand tools
  - iii) air tools
  - iv) power tools
  - v) manometers
  - vi) pressure gauges
  - vii) smoke generators
  - viii) pyrometers
  - ix) reprogramming equipment
6. Describe procedures used to diagnose 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 procedures used to adjust, repair and replace diesel intake and exhaust systems and their components.
8. Describe procedures used to perform decarbonization of turbocharger systems.
9. Describe procedures used to verify repair.
10. Describe maintenance procedures.
  - i) cleaning passages
  - ii) priming, lubricating, and servicing turbocharger
11. Identify materials that can be reconditioned, reused or recycled.

12. Identify codes, standards and regulations related to diesel intake and exhaust systems.

**Practical Objectives:**

1. Perform a smoke test on an intake.

## AST-420

## Entertainment Systems

### Learning Outcomes:

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

### 2023 Red Seal Occupational Standard Reference:

14.04 Diagnoses entertainment systems.

15.04 Repairs entertainment systems.

### Suggested Hours:

12 Hours

### Theoretical Objectives:

1. Identify hazards and describe safe work practices related to entertainment systems.
  - i) fire
  - ii) accidental restraint system deployment
2. Identify types of entertainment systems and their components and describe their characteristics and applications.
  - i) entertainment systems
    - audio
    - video
    - wireless/handsfree
  - ii) components
    - switches
    - modules
    - actuators
    - antennae
    - cabling
3. Describe operating principles of entertainment systems and their components.
4. Describe relationship of the entertainment system to the vehicle networking system.
5. Identify tools and equipment used to diagnose and repair entertainment systems and their components and describe their characteristics, applications and procedures for use.

- i) digital multimeters (DMM)
  - ii) scan tools
  - iii) hand tools
  - iv) circuit testers
  - v) oscilloscopes
  - vi) specialized tools
6. Describe procedures used to diagnose entertainment 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 procedures used to adjust, repair and replace entertainment systems and their components.
8. Describe procedures used to verify repair.
9. Describe maintenance procedures.
- i) checking for updates

**Practical Objectives:**

N/A

## AST-425

## Instrumentation and Information Displays

### Learning Outcomes:

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

### 2023 Red Seal Occupational Standard Reference:

14.06 Diagnoses instrumentation and information displays.

15.06 Repairs instrumentation and information displays.

### Suggested Hours:

12 Hours

### Theoretical Objectives:

1. Identify hazards and describe safe work practices related to instrumentation and information displays and their components.
  - i) fire
  - ii) accidental restraint deployment
2. Identify types of instrumentation and information displays and their components and describe their characteristics and applications.
  - i) instrumentation and information displays
    - gauges
    - warning indicators
    - audible indicators
    - heads-up display (HUD)
    - driver information centre (DIC)
  - ii) components
    - switches
    - modules
    - actuators
    - sensors
3. Describe operating principles of instrumentation and information displays and their components.
4. Describe the relationship of instrumentation and information displays to the vehicle networking system.

5. Identify tools and equipment used to diagnose and repair instrumentation and information displays and their components and describe their characteristics, applications and procedures for use.
  - i) digital multimeters (DMM)
  - ii) oscilloscopes
  - iii) hand tools
  - iv) scan tools
  - v) circuit testers
  - vi) reprogramming equipment
6. Describe procedures used to diagnose instrumentation and information displays 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 procedures used to adjust, calibrate, repair and replace instrumentation and information displays and their components.
8. Describe procedures used to perform maintenance light or message reset.
9. Describe procedures used to verify repair.
10. Identify jurisdictional regulations related to instrumentation and information displays.
  - i) odometer servicing

**Practical Objectives:**

N/A

## AST-430

## Restraint Systems

### Learning Outcomes:

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

### 2023 Red Seal Occupational Standard Reference:

20.01 Diagnoses restraint systems.

21.01 Repairs restraint systems.

### Suggested Hours:

18 Hours

### Theoretical Objectives:

1. Identify hazards and describe safe work practices related to restraint systems.
  - i) handling
  - ii) storage
  - iii) disposal
  - iv) servicing
  - v) manufacturers' protocols
  
2. Identify types of restraint systems and their components and describe their characteristics and applications.
  - i) restraint systems
    - active
    - passive
  - ii) components
    - seatbelts
    - steering column
    - occupant classification system (OCS)
    - various airbags
    - pre-tensioner systems
    - crash sensor
    - control modules
    - clock spring
    - buckles
    - retractors
    - seat belt track

- seat track frame

3. Describe operating principles of restraint systems and their components.
4. Identify types of restraint system monitoring and warning indicators and describe their purpose.
  - i) warning messages
  - ii) warning lights
  - iii) audible signals
5. Identify tools and equipment used to diagnose and repair restraint systems and their components and describe their characteristics, applications and procedures for use.
  - i) scan tools
  - ii) hand tools
  - iii) air tools
  - iv) power tools
  - v) repair kit
  - vi) simulators
  - vii) test leads
  - viii) digital multimeters (DMM)
6. Describe procedures used to diagnose restraint 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 procedures to remove, repair, replace, adjust, and reinstall electrical and mechanical restraint systems and their components.
8. Describe care, handling and storage procedures of restraint system components.
9. Describe procedures used to verify repair.
10. Identify jurisdictional requirements and procedures used to recycle or dispose of restraint systems components.
  - i) disposal
  - ii) repair
  - iii) motor vehicle inspection

**Practical Objectives:**

1. Remove and reinstall an air bag.

## **AST-435**

## **Automatic Transmissions and Transaxles**

### **Learning Outcomes:**

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

### **2023 Red Seal Occupational Standard Reference:**

12.03 Diagnoses automatic transmissions/transaxles.

13.03 Repairs automatic transmissions/transaxles.

### **Suggested Hours:**

48 Hours

### **Theoretical Objectives:**

1. Identify hazards and describe safe work practices related to automatic transmissions and transaxles and their components.
  - i) exposed rotating parts
  - ii) pinch points
  - iii) lifting and support procedures
  - iv) high temperature
  - v) pressurized fluids
2. Identify types of automatic transmissions and transaxles and components and describe their characteristics and operation.
  - i) conventional planetary
  - ii) continually/constantly variable transmission (CVT)
  - iii) dual clutch transmission (DCT)
3. Describe operating principles of automatic transmissions and transaxles and their components.
4. Explain hydraulic principles related to automatic transmissions and transaxles.
  - i) Pascal's law
  - ii) fluid dynamics
5. Explain automatic transmissions and transaxles power flow.
6. Interpret electric and hydraulic schematics.

7. Describe gear ratios, their purpose and calculation.
8. Identify types of lubricants, fasteners, tubing, hoses, gaskets, seals and sealants and describe their applications.
9. Identify warning indicators and describe their characteristics, applications and operation.
  - i) warning messages
  - ii) warning lights
  - iii) audible signals
10. Identify tools and equipment used to diagnose and repair automatic transmissions and transaxles and their components and describe their characteristics, applications and procedures for use.
  - i) hand tools
  - ii) air tools
  - iii) power tools
  - iv) pressure gauges
  - v) scan tools
  - vi) reprogramming equipment
  - vii) measuring tools
  - viii) presses
  - ix) pullers
  - x) lifting and support equipment
  - xi) clutch compression tools
11. Describe procedures used to diagnose automatic transmissions and transaxles 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
12. Describe procedures used to remove, adjust, repair and replace automatic transmissions and transaxles and their related components.
13. Describe procedures used to replace engine and driveline mounts.
14. Describe procedures used to verify repair.
15. Describe maintenance procedures.

16. Identify materials that can be reconditioned, reused or recycled.

**Practical Objectives:**

1. Disassemble and reassemble an automatic transmission.
2. Perform a line pressure test.

## **AST-440**

## **Heating, Ventilation and Air Conditioning Systems**

### **Learning Outcomes:**

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

### **2023 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 control systems.
- 17.02 Repairs refrigerant systems.
- 17.03 Repairs heating systems.

### **Suggested Hours:**

30 Hours

### **Theoretical Objectives:**

1. Identify hazards and describe safe work practices related to air flow control, refrigerant and heating systems.
  - i) airborne contaminants
  - ii) mould spores
  - iii) handling of refrigerants
  - iv) high pressure gases
  - v) pinch points
  - vi) rotating components
  - vii) burns
2. Identify air flow control systems and their components and describe their characteristics and applications.
  - i) components
    - cabin filter
    - blower motors
    - actuators

- ventilation systems
  - duct work
  - control units
  - connectors
  - blend door motors
  - resistors
  - HVAC controls
  - modules
  - switches
  - sensors
3. Describe operating principles of air flow control systems and their components.
  4. Identify refrigerant systems and their components and describe their characteristics and applications.
    - i) components
      - orifice tube
      - thermal expansion valve
      - hoses
      - tubing
      - wiring
      - compressors
      - evaporators
      - condensers
      - accumulators
      - receiver/dryers
      - lines and seals
  5. Describe operating principles of refrigerant systems and their components.
  6. Identify types of refrigerants and lubricants and describe their applications and procedures for use.
  7. Identify types of heating systems and their components and describe their characteristics and applications.
    - i) components
      - heater core
      - thermostats
      - fans
      - electric circulating coolant pumps
      - bypass valves
      - cabin heater
  8. Describe operating principles of heating systems and their components.

9. Identify types of fasteners, tubing, hoses, gaskets, seals and sealants, and describe their applications.
10. Identify related systems, and describe their relationship to air flow control, refrigerant and heating systems.
  - i) engine cooling system
  - ii) accessory drives
  - iii) vehicle management system
11. Identify tools and equipment used to diagnose and repair air flow control, refrigerant and heating systems, and describe their characteristics, applications and procedures for use.
  - i) digital multimeters (DMM)
  - ii) oscilloscopes
  - iii) scan tool
  - iv) hand tools
  - v) air tools
  - vi) power tools
  - vii) circuit testers
  - viii) vacuum pumps
  - ix) inspection cameras
  - x) temperature probes
  - xi) refrigerant leak detectors
  - xii) refrigerant identifiers
  - xiii) infrared thermometers
  - xiv) black lights
  - xv) gas analyzers
  - xvi) manifold gauge set
  - xvii) charging station
12. Describe procedures used to diagnose air flow control, refrigerant and heating 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
13. Describe procedures used to repair air flow control, refrigerant and heating systems.
14. Describe procedures used to remove and reinstall air flow control, refrigerant and heating system components.

15. Describe procedures used to identify, recover, recycle, evacuate and recharge refrigerant systems.
16. Describe procedures used to fill and bleed heating systems.
17. Describe procedures used to verify repair.
18. Identify HVAC materials that can be reconditioned, reused or recycled.
19. Identify practices that reduce HVAC material waste.
20. Identify certification requirements according to jurisdictional regulations.
21. Identify jurisdictional requirements related to refrigerants and lubricants.
  - i) handling and disposal
  - ii) storing and recycling
  - iii) heating
  - iv) Refrigeration and Air Conditioning Institute of Canada (HRAI) licensing and certification

**Practical Objectives:**

1. Conduct a performance test on an air conditioning (A/C) system.
2. Perform a leak test.

## AST-445

## Hybrid and Electric Vehicle Systems

### Learning Outcomes:

- Demonstrate knowledge of hybrid and electric vehicle (EV) systems, their components, characteristics, applications and operation.
- Demonstrate knowledge of procedures to diagnose and repair hybrid and EV systems and their components.

### 2023 Red Seal Occupational Standard Reference:

- 22.01 Diagnoses hybrid vehicle systems.
- 22.02 Diagnoses electric vehicle (EV) systems.
- 23.01 Repairs hybrid vehicle systems.
- 23.02 Repairs electric vehicle (EV) systems.

### Suggested Hours:

30 Hours

### Theoretical Objectives:

1. Identify hazards and describe safe work practices related to hybrid and EV systems and their components.
  - i) fire
  - ii) shocks
  - iii) arc flash
  - iv) sparks
  - v) high temperatures
  - vi) heavy components
  - vii) sharp edges
  - viii) hoisting
  - ix) high voltage
2. Identify hybrid and electric vehicle systems and their components and describe their characteristics and applications.
  - i) hybrid and electric vehicle systems
    - hybrid electric vehicles (HEV)
      - series
      - parallel
      - series/parallel
    - battery electric vehicles (BEV)
    - plug-in hybrid electric vehicles (PHEV)
  - ii) components

- modules
  - inverters
  - high voltage batteries
  - drive motors
  - converters
  - wiring
  - onboard chargers
  - sensors
  - coolers
3. Describe operating principles of hybrid and EV systems and their components.
  4. Identify types of Electric Vehicle Supply Equipment (EVSE), charging plugs, and levels and describe their characteristics and applications.
  5. Identify types of motors and describe their characteristics, applications and operation.
    - i) 3 phase AC permanent magnet
    - ii) 3 phase AC induction
    - iii) axial flux
  6. Identify tools and equipment used to diagnose and repair hybrid and EV systems and their components and describe their applications and procedures for use.
    - i) specialized PPE
    - ii) safety devices
    - iii) scan tools
    - iv) specialized digital multimeters (DMM)
      - insulation testers
      - megohmmeter
      - milliohmmeter
    - v) oscilloscopes
    - vi) electronic service tools
    - vii) specialized hand tools (insulated tools)
    - viii) manufacturer-specific tools and equipment
  7. Describe procedures used to diagnose hybrid and EV systems and their components.
    - i) verify concern
    - ii) perform sensory inspections
    - iii) retrieve diagnostic codes
    - iv) access service information
    - v) conduct tests and measurements
    - vi) isolate fault and identify root cause

8. Describe procedures used to remove, repair and replace hybrid and EV system components.
9. Describe procedures used to verify repair.
10. Describe maintenance procedures.
  - i) changing fluids
  - ii) servicing cooling system
  - iii) deenergize high voltage system
11. Identify materials that can be reconditioned, reused or recycled.
12. Identify practices that reduce material waste.
13. Identify codes, standards, and regulations according to jurisdictional regulations.

**Practical Objectives:**

N/A

## AST-446

## High Voltage Batteries

### Learning Outcomes:

- Demonstrate knowledge of high voltage batteries, their components, characteristics, applications and operation.
- Demonstrate knowledge of procedures to diagnose and service high voltage batteries and their components.

### 2023 Red Seal Occupational Standard Reference:

22.03 Diagnoses high voltage batteries.

23.03 Services high voltage batteries.

### Suggested Hours:

12 Hours

### Theoretical Objectives:

1. Identify hazards and describe safe work practices related to high voltage batteries and their components.
  - i) fire
  - ii) shocks
  - iii) arc flash
  - iv) sparks
  - v) high temperatures
  - vi) heavy components
  - vii) sharp edges
  - viii) high voltage
  - ix) hoisting
  
2. Identify types of high voltage batteries and describe their characteristics and applications.
  - i) high voltage batteries
    - nickel metal hydride
    - lithium ion
  - ii) components
    - contactors
    - control modules
    - cooling
    - heating
    - bus bars
    - high voltage connections
    - high voltage interlocks

- sensors

3. Describe operating principles of high voltage batteries and their components.
4. Identify tools and equipment used to diagnose and service high voltage batteries and their components and describe their applications and procedures for use.
  - i) specialized PPE
  - ii) safety devices
  - iii) scan tools
  - iv) specialized digital multimeters (DMMs)
  - v) oscilloscopes
  - vi) electronic service tools
  - vii) specialized hand tools (insulated tools)
  - viii) manufacturer-specific tools and equipment
  - ix) insulation testers
  - x) battery lift
  - xi) vacuum bleeding tool
5. Describe procedures used to diagnose high voltage batteries and their components.
  - i) verify concern
  - ii) perform sensory inspections
  - iii) retrieve diagnostic codes
  - iv) access service information
  - v) conduct tests and measurements
  - vi) isolate fault and identify root cause
6. Describe procedures used to service high voltage batteries and their components.
7. Describe procedures used to verify repair.
8. Describe maintenance procedures for high voltage batteries.
  - i) re-conditioning of high voltage battery
  - ii) performing high voltage battery health check
9. Identify materials that can be reconditioned, reused or recycled.
10. Identify practices that reduce material waste.

**Practical Objectives:**

N/A

## AST-447

## Hybrid and EV HVAC Systems

### Learning Outcomes:

- Demonstrate knowledge of hybrid and EV HVAC systems, their components, characteristics, applications and operation.
- Demonstrate knowledge of procedures used to diagnose and repair hybrid and EV HVAC systems and their components.

### 2023 Red Seal Occupational Standard Reference:

22.04 Diagnoses hybrid and electric vehicle (EV) HVAC systems.

23.04 Repairs hybrid and electric vehicle (EV) HVAC systems.

### Suggested Hours:

12 Hours

### Theoretical Objectives:

1. Identify hazards and describe safe work practices related to hybrid and EV HVAC systems and their components.
  - i) shocks
  - ii) arc flash
  - iii) sparks
  - iv) high temperatures
  - v) pressurized gas
  - vi) burns
  - vii) high voltage
  
2. Identify types of hybrid and EV HVAC systems and their components and describe their characteristics and applications.
  - i) hybrid and EV HVAC systems
    - heat pump
    - carbon dioxide (CO<sub>2</sub>)
  - ii) components
    - electric cooling pumps
    - high voltage compressors
    - PTC heater (positive temperature coefficient)
    - refrigerant control valves
    - sensors
    - switches
    - modules

3. Describe operating principles of hybrid and EV HVAC systems.
4. Identify tools and equipment used to diagnose and repair hybrid and EV HVAC systems and their components and describe their applications and procedures for use.
  - i) specialized PPE
  - ii) safety devices
  - iii) scan tools
  - iv) specialized digital multimeters (DMMs)
  - v) oscilloscopes
  - vi) electronic service tools
  - vii) specialized hand tools (insulated tools)
  - viii) manufacturer-specific tools and equipment
  - ix) insulation testers
  - x) HVAC-specific tools and equipment
  - xi) belt tension gauges
  - xii) belt installers
5. Describe procedures used to diagnose hybrid and EV HVAC systems and their components.
  - i) verify concern
  - ii) perform sensory inspections
  - iii) retrieve diagnostic codes
  - iv) access service information
  - v) conduct tests and measurements
  - vi) isolate fault and identify root cause
6. Describe procedures used to replace hybrid and EV HVAC system components.
7. Describe procedures used to verify repair.
8. Identify materials that can be reconditioned, reused or recycled.
9. Identify practices that reduce material waste.
10. Identify and interpret jurisdictional regulations related to hybrid and EV HVAC 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 Red Seal Examination.
- Demonstrate knowledge of overall comprehension of the trade in preparation for the Interprovincial Red Seal Examination.

### **2023 Red Seal Occupational Standard Reference:**

Entire Red Seal Occupational Standard

### **Suggested Hours:**

30 Hours

### **Theoretical Objectives:**

1. Define and explain terminology associated with an RSOS.
  - i) major work activities (MWA)
  - 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 electronic 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

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

**New Brunswick:**

Skilled Trades NB  
Post-Secondary Education, Training and  
Labour  
470 York St. PO Box 6000  
Fredericton, NB E3B 5H1  
Tel: 506-453-2260  
Toll Free in NB: 1-855-453-2260  
[www.gnb.ca/skilledtrades](http://www.gnb.ca/skilledtrades)

**Prince Edward Island:**

Apprenticeship, Training and Certification  
Workforce, Advanced Learning and  
Population  
176 Great George St., PO Box 2000  
Charlottetown, PE C1A 7N8  
Tel: 902-368-4460  
[www.apprenticeship.pe.ca](http://www.apprenticeship.pe.ca)

**Newfoundland and Labrador:**

Apprenticeship and Trades Certification  
Confederation Bldg., West Block  
Prince Philip Dr., PO Box 8700  
St. John's, NL A1B 4J6  
Toll Free: 1-877-771-3737  
[www.gov.nl.ca/atcd](http://www.gov.nl.ca/atcd)

**Nova Scotia:**

Nova Scotia Apprenticeship Agency  
7071 Bayers Road, Suite 2007  
Halifax, NS B3L 2C2  
Tel: 902-424-5651  
Toll Free in NS: 1-800-494-5651  
[www.nsapprenticeship.ca](http://www.nsapprenticeship.ca)

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
2024	All sections	Update to align with national occupational standard