Saskatchewan Apprenticeship and Trade Certification Commission

Automotive Service Technician

Guide to Course Content

2018

Online: www.saskapprenticeship.ca

Recognition:
To promote transparency and consistency, this document has been adapted from the 2016 Automotive Service Technician Red Seal Occupational Standard (Employment and Social Development Canada).

A complete version of the Occupational Standard can be found at www.red-seal.ca

STRUCTURE OF THE GUIDE TO COURSE CONTENT

To facilitate understanding of the occupation, this guide to course content contains the following sections:

Description of the Automotive Service Technician trade: an overview of the trade's duties and training requirements.

Essential Skills Summary: an overview of how each of the nine essential skills is applied in this trade.

Elements of harmonization of apprenticeship training: includes adoption of Red Seal trade name, number of levels of apprenticeship, total training hours (on-the-job and in-school) and consistent sequencing of technical training content. Implementation for harmonization will take place progressively. Level one to be implemented in 2017/2018, level two 2018/2019, level three 2019/2020, and level four in 2020/2021.

Task Matrix: a chart which outlines graphically the major work activities, tasks and sub-tasks of this standard detailing the essential skills and the level of training where the content is covered.

Major Work Activity (MWA): the largest division within the standard that is comprised of a distinct set of trade activities.

Task: distinct actions that describe the activities within a major work activity.

Sub-task: distinct actions that describe the activities within a task.

Training Profile Chart: a chart which outlines the model for Saskatchewan Apprenticeship and Trade Certification Commission (SATCC) technical training.

Technical Training Course Content for the Automotive Service Technician trade: a chart which outlines the model for SATCC technical training sequencing. For the harmonized level of training, a cross reference to the Harmonized apprenticeship technical training sequencing, at the learning outcome level, is provided.

Appendix A: Post Harmonization Training Profile Chart: a chart which outlines the finalized model for SATCC technical training sequencing with a cross reference to the Harmonized apprenticeship technical training sequencing, at the topic level.

The Red Seal Automotive Service Technician Curriculum Outline, which provides additional detail of the Harmonized technical training, can be found at www.red-seal.ca

DESCRIPTION OF THE AUTOMOTIVE SERVICE TECHNICIAN TRADE

Automotive Service Technicians perform inspecting, diagnosing, servicing, repairing, replacing and overhauling of all components of an automobile, light truck or light bus, except body sheet metal repairing and painting.

Automotive service technicians possess the full range of knowledge and abilities required to perform preventative maintenance, diagnose problems and repair vehicle systems including engines, vehicle management, hybrids, steering, braking, tires, wheels, drivetrains, suspension, electrical, electronics, heating, ventilation and air conditioning (HVAC), restraints, trim and accessories of automotive vehicles and light trucks.

Automotive service technicians may be employed by automotive repair shops, dealerships, automotive specialty repair shops, large organizations that may own a fleet of vehicles and motor vehicle body repair companies.

While the scope of the automotive service technician trade includes many aspects of vehicle service and repair, an increasing number of technicians specialize in specific areas of automotive vehicle repair due to the complexity of today's motor vehicle systems.

Technicians usually work indoors and can expect a work environment that includes noise, fumes, odours, hazardous compounds, drafts, vibrations, and confined spaces. The work often requires considerable standing, bending, crawling, lifting, pulling and reaching.

Some important attributes of automotive service technicians are: good hand-eye coordination, mechanical aptitude, time management skills, logical thinking and decision making skills, excellent communication skills, computer skills and the ability to continue learning as technology advances. It is also imperative to have a valid driver's license.

With additional training, experienced automotive service technicians may advance to shop supervisor or service manager positions. Also technicians can transfer their skills and knowledge to related occupations such as automotive instructor, truck and transport mechanic, agricultural equipment technician or heavy duty equipment technician. Some technicians may open their own garage or automotive specialty shop.

Training Requirements: To graduate from each level of the apprenticeship program, an apprentice must successfully complete the required technical training and compile enough on-the-job experience to total at least 1800 hours each year. Total trade time required is 7200 hours and at least 4 years in the trade.

There are four levels of technical training delivered by Saskatchewan Polytechnic in Saskatoon and Moose Jaw. The General Motors Automotive Service Educational Program (ASEP) training is delivered at Saskatchewan Polytechnic in Saskatoon and Regina.

Level One: 8 weeks
Level Two: 8 weeks
Level Three: 8 weeks
Level Four: 8 weeks

The information contained in this pamphlet serves as a guide for employers and apprentices. The pamphlet briefly summarizes the training delivered at each level of apprenticeship training. An apprentice spends approximately 15% of the apprenticeship term in a technical training institute learning the technical and theoretical aspects of the trade. The hours and percentages of technical and practical training may vary according to class needs and progress.

The content of the technical training components is subject to change without notice.

Entrance Requirements for Apprenticeship Training

Your grade twelve transcripts (with no modified classes) or GED 12 is your guarantee that you meet the educational entrance requirements for apprenticeship in Saskatchewan. In fact, employers prefer and recommend apprentices who have completed high school. This ensures the individual has all of the necessary skills required to successfully complete the apprenticeship program, and receive journeyperson certification.

Individuals with “modified” or “general” classes in math or science do not meet our entry requirements. These individuals are required to take an entrance assessment prescribed by the SATCC.

English is the language of instruction in all apprenticeship programs and is the common language for business in Saskatchewan. Before admission, all apprentices and/or “upgraders” must be able to understand and communicate in the English language. Applicants whose first language is not English must have a minimum Canadian Language Benchmark Assessment of six (CLB6).

Note: A CLB assessment is valid for a one-year period from date of issue.

Designated Trade Name	**Math Credit** at the Indicated Grade Level❶	**Science Credit** at Grade Level
Automotive Service Technician	Grade 10	Grade 10

❶ - (One of the following) WA – Workplace and Apprenticeship; or F – Foundations; or P – Pre-calculus, or a Math at the indicated grade level (Modified and General Math credits are not acceptable.).

*Applicants who have graduated in advance of 2015-2016, or who do not have access to the revised Science curricula will require a Science at the minimum grade level indicated by trade.

For information about high school curriculum, including Math and Science course names, please see: http://www.curriculum.gov.sk.ca/#

Individuals not meeting the entrance requirements will be subject to an assessment and any required training.

ESSENTIAL SKILLS SUMMARY

Essential skills are needed for work, learning and life. They provide the foundation for learning all other skills and enable people to evolve with their jobs and adapt to workplace change.

Through extensive research, the Government of Canada and other national and international agencies have identified and validated nine essential skills. These skills are used in nearly every occupation and throughout daily life in different ways.

A series of CCDA-endorsed tools have been developed to support apprentices in their training and to be better prepared for a career in the trades. The tools can be used independently or with the assistance of a tradesperson, trainer, employer, teacher or mentor to:

- understand how essential skills are used in the trades;
- learn about individual essential skills strengths and areas for improvement; and
- improve essential skills and increase success in an apprenticeship program.

The tools are available online or for order at: www.esdc.gc.ca/eng/jobs/les/profiles/index.shtml

The application of these skills may be described throughout this document within the skills and knowledge which support each sub-task of the trade. The most important essential skills for each sub-task have also been identified. The following are summaries of the requirements in each of the essential skills, taken from the essential skills profile. A link to the complete essential skills profile can be found at www.red-seal.ca.

READING

Automotive service technicians must read and comprehend a variety of materials including repair manuals, manufacturers' bulletins and safety documents. They refer to government regulations, vehicle inspection procedures, hazardous material handling and disposal and safety requirements of vehicles.

DOCUMENT USE

Automotive service technicians interpret technical drawings and flowcharts. They locate data such as classifications, product and material specifications, identification numbers, quantities and costs. Automotive service technicians often use specification tables. They scan a variety of manufacturers' labels for part numbers, serial numbers, sizes, colours and other information and adhere to hazard and safety icons.

WRITING

Automotive service technicians complete workplace documents such as written explanations to the client, work orders, inspection reports and incident reports.

ORAL COMMUNICATION

Automotive service technicians gather information from different sources about vehicle faults and needed repairs, explain the results of inspections and repairs, and discuss maintenance procedures. They exchange technical repair and troubleshooting information with others such as service managers, apprentices, co-workers, colleagues and suppliers.

NUMERACY

Automotive service technicians take a variety of measurements using digital and analog equipment. They estimate the amount of time required to complete repairs. Automotive service technicians compare measurements of energy, dimension, speed, horsepower, temperature and torque to specifications. They analyze pressure, power, torque, compression and electrical readings to assess vehicle performance and troubleshoot faults.

THINKING

Automotive service technicians use thinking skills and visual analysis to diagnose and repair problems. They evaluate the severity of vehicle defects and deficiencies and the quality of repairs. Automotive service technicians decide the most efficient course of action to complete a job.

WORKING WITH OTHERS

Most automotive service technicians work independently on jobs outlined in work orders. They may assist others with jobs that require two people or are within their specific area of expertise. They collaborate effectively with colleagues including salespersons, Partspersons and management to resolve concerns, situations and problems.

DIGITAL TECHNOLOGY

Automotive service technicians use computerized scanning equipment, onboard vehicle diagnostics and hand-held diagnostic tools to gain operational information about vehicles. They access the Internet and databases to retrieve repair information. Automotive service technicians use digital technology to exchange information with other technicians, service managers, colleagues in other locations and manufacturer support specialists. Keyboarding and basic computer skills are an asset.

CONTINUOUS LEARNING

Constant change in the industry makes it vital for automotive service technicians to stay current with the latest technology. They learn on the job, in organized information activities and in work discussion groups. Their training is provided by vehicle manufacturers, parts suppliers, employers and associations. They also advance skills by reading work-related magazines, periodicals and automotive websites.

ELEMENTS OF HARMONIZATION FOR APPRENTICESHIP TRAINING

At the request of industry, the Harmonization Initiative was launched in 2013 to *substantively align* apprenticeship systems across Canada by making training requirements more consistent in the Red Seal trades. Harmonization aims to improve the mobility of apprentices, support an increase in their completion rates and enable employers to access a larger pool of apprentices.

As part of this work, the Canadian Council of the Directors of Apprenticeship (CCDA) identified four main harmonization priorities in consultation with industry and training stakeholders:

1. Trade name

The official Red Seal name for this trade is Automotive Service Technician.

2. Number of Levels of Apprenticeship

The number of levels of technical training recommended for the Automotive Service Technician trade is four.

3. Total Training Hours during Apprenticeship Training

The total hours of training, including both on-the-job and in-school training for the Automotive Service Technician trade is 7200.

4. Consistent sequencing of training content (at each level) using the most recent Occupational Standard

Implementation for harmonization will take place progressively. Level one to be implemented in 2017/2018, level two 2018/2019, level three 2019/2020, and level four in 2020/2021. See Appendix A for the finalized curriculum comparisons.

White boxes are “Topics,” grey boxes are “In Context”. In context means learning that has already taken place and is being applied to the applicable task. Learning outcomes for in context topics are accomplished in other topics in that level.

Level 1 (2017/2018 implementation)	Level 2 (2018/2019 implementation)	Level 3 (2019/2020 implementation)	Level 4 (2020/2021 implementation)
Tools, Equipment, Materials and Documentation	Tools, Equipment, Materials and Documentation	Tools, Equipment, Materials and Documentation	Tools, Equipment, Materials and Documentation
Maintenance Inspection	Maintenance Inspection	Maintenance Inspection	Maintenance Inspection
Vehicle Networking Systems	Vehicle Networking Systems	Vehicle Networking Systems	Vehicle Networking Systems

Level 1 (2017/2018 implementation)	Level 2 (2018/2019 implementation)	Level 3 (2019/2020 implementation)	Level 4 (2020/2021 implementation)
Safety-Related Functions			
Fundamentals of Tools, Equipment, Materials and Documentation			
Communication Techniques			Mentoring Techniques
Tires, Wheels, Hubs and Wheel Bearings			
Body Components, Accessories and Trim			
Steering, Suspension and Control Systems	Steering, Suspension and Control Systems		
Braking and Control Systems	Braking and Control Systems		
Electrical Systems and Components	Electrical Systems and Components	Electrical Systems and Components	Electrical Systems and Components
		Vehicle Networking Systems	
Driveline Systems	Driveline Systems	Driveline Systems	Driveline Systems
	Engine Systems		
		Gasoline Engine Support Systems	Diesel Engine Support Systems
			HVAC and Comfort Control Systems
			Hybrid and Electrical Vehicle (EV)
			Restraint Systems

AUTOMOTIVE SERVICE TECHNICIAN TASK MATRIX CHART

This chart outlines the major work activities, tasks and sub-tasks from the 2016 Automotive Service Technician Red Seal Occupational Standard. Each sub-task details the corresponding essential skill and level of training where the content is covered. *

* Sub Tasks with numbers in the boxes is where the content will be delivered in training. The Task Matrix Chart will be updated every year until Harmonization implementation is complete. Implementation for harmonization will take place progressively. Level one to be implemented in 2017/2018, level two 2018/2019, level three 2019/2020, and level four in 2020/2021.

A - PERFORMS COMMON OCCUPATIONAL SKILLS

A-1 Performs safety-related functions	**1.01 Maintains safe work environment**  **1**	**1.02 Uses personal protective equipment (PPE) and safety equipment**  **1**			
A-2 Uses and maintains tools, equipment and documentation	**2.01 Uses tools and equipment**  **1** **2 In Context**	**2.02 Uses fasteners, tubing, hoses and fittings**  **1** **2 In Context**	**2.03 Uses hoisting and lifting equipment**  **1** **2 In Context**	**2.04 Uses technical information**  **1** **2 In Context**	
A-3 Uses communication techniques	**3.01 Uses communication techniques**  **1** **2 In Context**	**3.02 Uses mentoring techniques** 			

B – DIAGNOSES AND REPAIRS ENGINE AND ENGINE SUPPORT SYSTEMS

B-4 Diagnoses engine systems	**4.01 Diagnoses cooling systems**  **2**	**4.02 Diagnoses lubricating systems**  **2**	**4.03 Diagnoses engine assembly**  **2**	**4.04 Diagnoses accessory drive systems**  **2**
B-5 Repairs engine systems	**5.01 Repairs cooling systems**  **2**	**5.02 Repairs lubricating systems**  **2**	**5.03 Repairs engine assembly**  **2**	**5.04 Repairs accessory drive systems**  **2**
B-6 Diagnoses gasoline engine support systems	**6.01 Diagnoses gasoline fuel delivery and injection systems** 	**6.02 Diagnoses gasoline ignition systems** 	**6.03 Diagnoses gasoline intake / exhaust systems** 	**6.04 Diagnoses gasoline emission control systems** 
B-7 Repairs gasoline engine support systems	**7.01 Repairs gasoline fuel delivery and injection systems** 	**7.02 Repairs gasoline ignition systems** 	**7.03 Repairs gasoline intake / exhaust systems** 	**7.04 Repairs gasoline emission control systems** 
B-8 Diagnoses diesel engine support systems	**8.01 Diagnoses diesel fuel delivery and injection systems** 	**8.02 Diagnoses diesel intake/exhaust systems** 	**8.03 Diagnoses diesel emission control systems** 	
B-9 Repairs diesel engine support systems	**9.01 Repairs diesel fuel delivery and injection systems** 	**9.02 Repairs diesel intake/exhaust systems** 	**9.03 Repairs diesel emission control systems** 	

C – DIAGNOSES AND REPAIRS VEHICLE MODULE COMMUNICATION SYSTEMS

C-10 Diagnoses vehicle networking systems	**10.01 Reads diagnostic trouble codes (DTCs)** 	**10.02 Monitors data** 	**10.03 Interprets tests results** 	**10.04 Tests system circuitry and components** 
C-11 Repairs vehicle networking systems	**11.01 Updates components software** 	**11.02 Replaces components** 	**11.03 Verifies vehicle module communications system repair** 	

D – DIAGNOSES AND REPAIRS DRIVELINE SYSTEMS

D-12 Diagnoses driveline systems	**12.01 Diagnoses drive shafts and axles**  1	**12.02 Diagnoses manual transmissions / transaxles**  2	**12.03 Diagnoses automatic transmissions / transaxles** 	**12.04 Diagnoses clutches**  2	**12.05 Diagnoses transfer cases** 
	12.06 Diagnoses final drive assemblies  2				

D-13 Repairs driveline systems	**13.01 Repairs drive shafts and axles**  **1**	**13.02 Repairs manual transmissions / transaxles**  **2**	**13.03 Repairs automatic transmissions / transaxles** 	**13.04 Repairs clutches**  **2**	**13.05 Repairs transfer cases** 
	13.06 Repairs final drive assemblies  **2**				

E – DIAGNOSES AND REPAIRS ELECTRICAL AND COMFORT CONTROL SYSTEMS

E-14 Diagnoses electrical systems and components	**14.01 Diagnoses basic wiring and electrical systems**  **1**	**14.02 Diagnoses starting/charging systems and batteries**  **1, 2**	**14.03 Diagnoses lighting and wiper systems**  **2**	**14.04 Diagnoses entertainment systems** 	**14.05 Diagnoses electrical options** 
	14.06 Diagnoses instrumentation and information displays 	**14.07 Diagnoses electrical accessories** 			
E-15 Repairs electrical systems and components	**15.01 Repairs basic wiring and electrical systems**  **1**	**15.02 Repairs starting/charging systems and batteries**  **1, 2**	**15.03 Repairs lighting and wiper systems**  **2**	**15.04 Repairs entertainment systems** 	**15.05 Repairs electrical options** 

	15.06 Repairs instrumentation and information displays 	15.07 Installs electrical accessories 	15.08 Repairs electrical accessories  2
E-16 Diagnoses heating, ventilation and air conditioning (HVAC) and comfort control systems	16.01 Diagnoses air flow control systems 	16.02 Diagnoses refrigerant systems 	16.03 Diagnoses heating systems 
E-17 Repairs heating, ventilation and air conditioning (HVAC) and comfort control systems	17.01 Repairs air flow control systems 	17.02 Repairs refrigerant systems  1	17.03 Diagnoses heating systems 

F – DIAGNOSES AND REPAIRS STEERING AND SUSPENSION, BRAKING, CONTROL SYSTEMS, TIRES, HUBS AND WHEEL BEARINGS

F-18 Diagnoses steering and suspension, braking, control systems, tires, wheels, hubs and wheel bearings	18.01 Diagnoses steering, suspension and control systems  1, 2	18.02 Diagnoses braking and control systems  1, 2	18.03 Diagnoses tires, wheels, hubs and wheel bearings  1
F-19 Repairs steering and suspension, braking, control systems, tires, wheels, hubs and wheel bearings	19.01 Repairs steering, suspension and control systems  1, 2	19.02 Repairs braking and control systems  1, 2	19.03 Repairs tires, wheels, hubs and wheel bearings  1

G – DIAGNOSES AND REPAIRS RESTRAINT SYSTEMS, BODY COMPONENTS, ACCESSORIES AND TRIM SYSTEMS

G-20 Diagnoses restraint systems, body components, accessories and trim	**20.01 Diagnoses restraint systems** 	**20.02 Diagnoses wind noises, rattles and water leaks**  1	**20.03 Diagnoses interior and exterior components, accessories and trim**  1	**20.04 Diagnoses latches, locks and movable glass**  1
G-21 Repairs restraint systems, body components, accessories and trim	**21.01 Repairs restraint systems** 	**21.02 Repairs wind noises, rattles and water leaks**  1	**21.03 Repairs interior and exterior components, accessories and trim**  1	**21.04 Repairs latches, locks and movable glass**  1

H – DIAGNOSES AND REPAIRS HYBRID AND ELECTRIC VEHICLES (EV)

H-22 Diagnoses hybrid and electric vehicles (EV)	**22.01 Implements specific safety protocols for hybrid and electric vehicles (EV)** 	**22.02 Diagnoses hybrid and electric vehicle (EV) systems** 
H-23 Repairs hybrid and electric vehicles (EV)	**23.01 Repairs hybrid vehicle systems** 	**23.02 Repairs electric vehicle (EV) systems** 

TRAINING PROFILE CHART

This Training Profile Chart represents Saskatchewan Apprenticeship and Trade Certification Commission (SATCC) technical training at the topic level.

Level One	Transcript Code	Hours
Automotive Shop Fundamentals	SHOP 123	30
Body Components and Service Inspection	ATBD 120	12
Braking Systems	BRAK 122 – Theory	30
	BRAK 123 - Shop	30
Driveline Systems	DRTR 122	30
Electrical System and Components	ELCT 120 – Theory	30
	ELCT 121 - Shop	18
Engine Systems	ENGN 124	30
Steering, Suspension and Control Systems	STER 120	30
		240

Level Two	Transcript Code	Hours
Braking and Stability Control Systems	???? 2XX	18
Engine Systems	???? 2XX - Theory	30
	???? 2XX - Shop	48
Steering, Suspension and Control Systems	???? 2XX - Theory	18
	???? 2XX - Shop	24
Starting, Charging, Lighting and Wipers	ELEC 2XX – Theory	20
	ELEC 2XX - Shop	22
Transmission and Final Drive Systems	???? 2XX - Theory	30
	???? 2XX - Shop	30
		240

Level Three	Transcript Code	Hours
Anti-lock Brake Systems (ABS)	BRAK 300	22
Chassis Systems	ATMC 302 – Theory	26
	ATMC 303 – Shop	30
Differentials	DRTR 300 – Theory	14
	DRTR 301 – Shop	16
Heating, Ventilation and Air Conditioning (HVAC) Systems	ATMC 300 – Theory	24
	ATMC 301 – Shop	30
Manual Transmissions	TRNM302 – Theory	24
	TRNM 303 – Shop	30
Vehicle Communication Systems	ATMC 304	24
		240

Level Four	Transcript Code	Hours
Special Piping Systems	PIPE 471	25
Pump and Private Water Supply	PLMB 470	25

Automatic transmissions	TRNM 400 – Theory	30
	TRNM 401 – Shop	45
Diesel Fuel Injection Systems	FUEL 402 – Theory	28
	FUEL 403 – Shop	23
Gasoline Engine Management Systems	FUEL 400 – Theory	30
	FUEL 401 – Shop	30
Restraint Systems	TECH 400	54
		240

TECHNICAL TRAINING COURSE CONTENT

This chart outlines the model for Saskatchewan Apprenticeship and Trade Certification Commission (SATCC) technical training sequencing. For the harmonized level of training, a cross reference to the Red Seal Occupational Standard (RSOS) apprenticeship technical training sequencing, at the learning outcome level, is provided.

Implementation for harmonization will take place progressively. Level one to be implemented in 2017/2018, level two 2018/2019, level three 2019/2020, and level four in 2020/2021.

The Red Seal Automotive Service Technician Curriculum Outline, which provides additional detail of the Harmonized technical training, can be found at www.red-seal.ca

Level One 8 weeks 240 hours

Automotive Shop Fundamentals 30 hours

- describe occupation related safety procedures
  - **Safety Related Functions (refrigerant, restraints, hybrid and electric vehicles):**
    - describe safe handling of refrigerants
    - describe restraint systems safety precautions
    - describe hybrid and electric vehicle safety
- describe occupation related tools and equipment
- describe road test procedures
- demonstrate knowledge of trade documents
  - **Communication Techniques:**
    - demonstrate knowledge of trade documents
    - apply trade documents to vehicle repair
- prepare trade documents

RSOS topics covered in this section of training:

A-1 Safety-related functions

A-1.01 Maintains safe work environment

- safe work practices
- regulatory requirements pertaining to safety

A-1.02 Uses personal protective equipment (PPE) and safety equipment

- PPE, their applications, limitations and procedures for use
- safety equipment their applications and procedures for use

A-2 Fundamentals of Tools, Equipment, Materials and Documentation

2.01 Uses tools and equipment

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

2.02 Uses fasteners, tubing, hoses and fittings

- fasteners, tubing, hoses, and fittings, their applications and procedures for use

2.03 Uses hoisting and lifting equipment

- vehicle hoisting and lifting equipment, their applications and procedures for use
- shop lifting equipment, their applications and procedures for use

2.04 Uses technical information

- trade documents and their use

- preparing and interpreting trade documents

A-3 Communication Techniques
3.01 Uses communication techniques
- trade terminology
- effective communication practices
- technical resources available
- various learning styles
- benefits of a productive team environment
- policies and procedures regarding harassment and discrimination

E-17 heating, ventilation and air conditioning (HVAC) and comfort control systems
E-17.02 Repairs refrigerant systems
- refrigerant systems, their components and operation
- procedures used to repair refrigerant systems

G-20 restraint systems, body components, accessories and trim
G-20.01 Diagnoses restraint systems
- restraint systems, their components and operation
- procedures used to diagnose restraint systems

H-22 hybrid and electric vehicles (EV)
H-22.01 Implements specific safety protocols for hybrid and electric vehicles (EV)
- operations of hybrid and EV systems
- diagnosing hybrid and EV systems

Brake Systems – Theory — 30 hours

- describe the operation, diagnosis and repair procedures for brake system operation
- describe brake system hydraulic component evaluation and replacement
- describe the evaluation and repair of drum brake, disc brake and park brake assemblies
- describe power assist brake system operation and evaluation

Brake Systems – Shop — 30 hours

- demonstrate brake system hydraulic component evaluation and replacement
- demonstrate brake system flushing and bleeding procedures
- demonstrate the evaluation and repair of drum brake, disc brake and park brake assemblies
    - (oxy-fuel safety, setup and shutdown)
- diagnose power assist brake system operation
    - (hybrid brake safety)
- diagnose brake system operation
    - **Communication Techniques:**
        - apply trade documents to vehicle repair
        - prepare trade documents

RSOS topics covered in this section of training:

A-3 Communication Techniques
A-3.01 Uses communication techniques
- trade terminology
- effective communication practices
- technical resources available

- various learning styles
- benefits of a productive team environment
- policies and procedures regarding harassment and discrimination

F-18 Braking and Control Systems
F-18.02 Diagnoses braking and control systems
- braking systems, their components and operation
- procedures used to diagnose braking systems
- procedures used to diagnose control systems

F-19 Braking and Control Systems
F-19.02 Repairs braking and control systems
- braking systems, their components and operation
- procedures used to repair braking systems
- procedures used to repair control systems

Body Components and Service Inspection — 12 hours

- describe adjustment of doors, lids and moveable glass
- describe diagnosis and repair of body leaks and noises
- describe basic service inspections

RSOS topics covered in this section of training:

G-20 Body Components, Accessories and Trim
G-20.02 Diagnoses wind noises, rattles and water leaks
- wind noises, rattles and water leaks and their causes
- procedures used to diagnose wind noises, rattles and water leaks

G-20.03 Diagnoses interior and exterior components, accessories and trim
- interior and exterior components, accessories and trim and their applications
- procedures used to diagnose interior and exterior components, accessories and trim

G-20.04 Diagnoses latches, locks and movable glass
- latches, locks and movable glass and their application
- procedures used to diagnose latches, locks and movable glass

G-21 Body Components, Accessories and Trim
G-21.02 Repairs wind noises, rattles and water leaks
- wind noises, rattles and water leaks
- procedures used to repair wind noises, rattles and water leaks

G-21.03 Repairs interior and exterior components, accessories and trim
- interior and exterior components, accessories and trim and their applications
- procedures used to repair interior and exterior components, trim and accessories

G-21.04 Repairs latches, locks and movable glass
- latches, locks and movable glass and their applications
- procedures used to repair latches, locks and movable glass

Driveline Systems — 30 hours

- Describe operation, diagnosis and repair of driveshafts and axles
- Repair drive shafts and axles
- Describe operation, diagnosis and repair procedures for wheels and tires
- Describe operation, diagnosis and repair of wheel bearings and seals
  - **Tires, Wheels, Hubs and Wheel Bearings:**
    - repair wheels and tires
    - service wheel bearings and seals
    - perform the evaluation and repair of tire pressure monitor systems

RSOS topics covered in this section of training:

F-18 Tires, Wheels, Hubs and Wheel Bearings
F-18.03 Diagnoses tires, wheels, hubs and wheel bearings
- tires, wheels, hubs, bearings, their components and operation
- procedures used to diagnose tires, wheels, bearings and hubs

F-19 Tires, Wheels, Hubs and Wheel Bearings
F-19.03 Repairs tires, wheels, hubs and wheel bearings
- tires, wheels, hubs, wheel bearings, their components and operation
- procedures used to repair tires, wheels, hubs and wheel bearings

G-20 Body Components, Accessories and Trim
G-20.02 Diagnoses wind noises, rattles and water leaks
- wind noises, rattles and water leaks and their causes
- procedures used to diagnose wind noises, rattles and water leaks

G-20.03 Diagnoses interior and exterior components, accessories and trim
- interior and exterior components, accessories and trim and their applications
- procedures used to diagnose interior and exterior components, accessories and trim

G-20.04 Diagnoses latches, locks and movable glass
- latches, locks and movable glass and their application
- procedures used to diagnose latches, locks and movable glass

G-21 Body Components, Accessories and Trim
G-21.02 Repairs wind noises, rattles and water leaks
- wind noises, rattles and water leaks
- procedures used to repair wind noises, rattles and water leaks

G-21.03 Repairs interior and exterior components, accessories and trim
- interior and exterior components, accessories and trim and their applications
- procedures used to repair interior and exterior components, trim and accessories

G-21.04 Repairs latches, locks and movable glass
- latches, locks and movable glass and their applications
- procedures used to repair latches, locks and movable glass

Electrical Systems and Components – Theory — 30 hours

- describe types of electrical circuits
- construct electrical circuits
- use electrical test equipment
- describe battery operation, diagnosis and repair
- describe schematics and flowcharts
- describe conductors and insulators
- describe solid state components
- describe the operation, diagnosis and repair of computer control systems

Electrical Systems and Components – Shop — 18 hours

- repair conductors and connectors
- construct electrical circuits
- use electrical test equipment
- diagnose batteries

RSOS topics covered in this section of training:

E-14 Electrical Systems and Components
E-14.01 Diagnoses basic wiring and electrical systems
- basic electrical and electronic principles
- electrical circuits, their components and operation
- procedures used to diagnose electrical circuits and components

E-14.02 Diagnoses starting/charging systems and batteries
- starting/charging systems, and batteries, their components and operation
- procedures used to diagnose starting/charging systems and batteries

E-15 Electrical Systems and Components
E-15.01 Repairs basic wiring and electrical systems
- basic electrical and electronic principles
- electrical circuits, their components and operation
- procedures used to repair electrical circuits and components

E-15.02 Repairs starting/charging systems and batteries
- starting/charging systems and batteries, their components and operation
- procedures to repair starting/charging system components and batteries

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Engine Systems — 30 hours

- describe the operation of engine types
- describe the operation and diagnosis of engine cooling and lubrication systems
- describe the operation and diagnosis of engine induction and exhaust systems
- test engine cooling and lubrication system
- inspect induction and exhaust systems

This section of training exceeds RSOS scope of work in Level One and exceeds the minimum sequencing as set out in the Automotive Service Technician RSOS. Its purpose is mainly to assist in the understanding of the topic Body Components and Service Inspection

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Steering, Suspension and Control Systems — 30 hours

- describe the operation and diagnosis of suspension systems
- describe the operation and diagnosis of steering systems
- perform the evaluation of suspension systems
- perform the evaluation of steering systems

RSOS topics covered in this section of training:

F-18 Steering, Suspension and Control Systems
F-18.01 Diagnoses steering, suspension and control systems
- suspension systems, their components and operation
- procedures used to diagnose suspension systems
- steering systems, their components and operation

F-19 Steering, Suspension and Control Systems
F-19. 01 Repairs steering, suspension and control systems
- suspension systems, their components and operation
- procedures used to repair suspension systems
- procedures used to repair steering systems

Level One topics from the RSOS that are taught in context:

Tools, Equipment, Materials and Documentation
Maintenance Inspection
Vehicle Networking Systems

For details regarding the In Context Topic, see page 28

Level Two — 8 weeks — 240 hours

Braking and Stability Control Systems — 18 hours

- describe the operation, diagnoses and repair of anti-lock, traction and stability control systems
- perform the evaluation and repair of anti-lock brake, traction and stability control systems

RSOS topics covered in this section of training:

F-18 Braking and Control Systems
F-18.02 Diagnoses braking and control systems
- braking systems, their components and operation
- procedures used to diagnose braking systems
- procedures used to diagnose control systems

F-19 Braking and Control Systems
F-19.02 Repairs braking and control systems
- braking systems, their components and operation
- procedures used to repair braking systems
- procedures used to repair control systems

Engine Systems – Theory — 30 hours

- describe the operation, diagnosis and construction of cylinder head and block assembly
- describe the types and use of automotive engine measuring tools
- describe the engine assembly procedures
- describe the diagnosis and repair of an engine
- describe engine replacement procedures
- describe the diagnoses and repair of induction and exhaust systems
- describe the diagnoses and repair of lubrication and cooling systems

Engine Systems – Shop — 48 hours

- perform the evaluation and repair of cylinder head and block assemblies
- use precision measuring tools
- assemble engine
- diagnose engine faults
- replace engine
- perform the evaluation and repair of induction and exhaust systems
- perform the evaluation and repair of engine lubrication and cooling systems

RSOS topics covered in this section of training:

B-4 Engine Systems
B-4.01 Diagnoses cooling systems

- cooling systems, their components and operation
- procedures used to diagnose cooling systems

B-4.02 Diagnoses lubricating systems
- engine lubricating systems, their components and operation
- procedures used to diagnose engine lubricating systems

B-4.03 Diagnoses engine assembly
- engine theory
- engine assemblies, their components and operation
- procedures used to diagnose engine assemblies

B-4.04 Diagnoses accessory drive systems
- accessory drive systems, their components and operation
- procedures used to diagnose accessory drive systems

B-5 Engine Systems

B-5.01 Repairs cooling systems
- cooling systems, their components and operation
- procedures used to repair cooling systems

B-5.02 Repairs lubricating systems
- engine lubricating systems, their components and operation
- procedures used to repair engine lubricating systems

B-5.03 Repairs engine assembly
- engine theory
- engines, their components and operation
- procedures used to repair engine assembly

B-5.04 Repairs accessory drive systems
- accessory drive systems, their components and operation
- procedures used to repair accessory drive systems

Starting, Charging, Lighting and Wipers – Theory — 20 hours

- describe the operation, diagnoses and repair of starting systems
- describe the operation, diagnoses and repair of charging systems
- describe the operation, diagnoses and repair of wiper systems
- describe the operation, diagnoses and repair of lighting systems

Starting, Charging, Lighting and Wipers – Shop — 22 hours

- perform the evaluation and repair of a starting system
- replace a starter
- perform the evaluation and repair of a charging system
- replace a generator
- perform the evaluation and repair of lighting systems
- perform the evaluation and repair of wiper systems

RSOS topics covered in this section of training:

E-14 Electrical Systems and Components

E-14.02 Diagnoses starting/charging systems and batteries
- starting/charging systems, and batteries, their components and operation
- procedures used to diagnose starting/charging systems and batteries

E-14.03 Diagnoses lighting and wiper systems
- lighting and wiper systems, their components and operation
- procedures to diagnose lighting and wiper systems

E-14.07 Diagnoses electrical accessories

E-15 Electrical Systems and Components

E-15.02 Repairs starting/charging systems and batteries

- starting/charging systems and batteries, their components and operation
- procedures to repair starting/charging system components and batteries

E-15.03 Repairs lighting and wiper systems

- lighting and wiper systems, their components and operation
- procedures to repair lighting and wiper systems

E-15.08 Repairs electrical accessories

- electrical accessories, their components and operation
- procedures used to repair electrical accessories

Steering, Suspension and Control Systems – Theory **18 hours**

- describe the diagnoses and repair of steering systems
- describe the diagnoses and repair of suspension systems
- describe the principles of wheel alignment

Steering, Suspension and Control Systems – Shop **24 hours**

- perform the diagnoses and repair of steering systems
- perform the diagnoses and repair of suspension systems
- perform wheel alignment procedures

RSOS topics covered in this section of training:

F-18 Steering, Suspension and Control Systems

F-18.01 Diagnoses steering, suspension and control systems

- suspension systems, their components and operation
- procedures used to diagnose suspension systems
- steering systems, their components and operation
- procedures used to diagnose steering systems
- electronically controlled suspension systems, their components and operation
- procedures used to diagnose and perform wheel alignments

F-19 Steering, Suspension and Control Systems

F-19.01 Repairs steering, suspension and control systems

- suspension systems, their components and operation
- procedures used to repair suspension systems
- procedures used to repair steering systems
- procedures used to repair wheel alignment and electronically-controlled suspension systems

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Transmission and Final Drive Systems – Theory **30 Hours**

- describe the operation, diagnoses and repair of differential assemblies
- describe the evaluation and repair of clutch assemblies
- describe transmission, transaxle, transfer case removal and installation procedures
- describe maintenance procedure for transmission, transaxle, transfer case, differential and engine

Transmission and Final Drive Systems – Shop **30 Hours**

- perform the evaluation and repair of differential systems
- perform the evaluation and repair of clutch assemblies
- replace manual transmission and automatic transmissions
- perform maintenance procedures on differential assemblies, transfer case, automatic transmission and engine

RSOS topics covered in this section of training:

D-12 Driveline Systems

D-12.02 Diagnoses manual transmissions/transaxles

- manual transmissions/transaxles, their components and operation
- procedures used to diagnose manual transmissions/transaxles

D-12.04 Diagnoses clutches
- clutches, their components and operation
- procedures used to diagnose clutches

D-12.06 Diagnoses final drive assemblies
- final drive assemblies, their components and applications
- procedures to diagnose final drive assembly

D-13 Driveline Systems

D-13.02 Repairs manual transmissions/transaxles
- manual transmissions and transaxles, their components and operation
- procedures used to repair manual transmissions and transaxles

D-13.04 Repairs clutches
- clutches, their components and operation
- procedures used to repair clutches

D-13.06 Repairs final drive assemblies
- final drive assemblies, their components and applications
- procedures to repair final drive assemblies

Level One topics from the RSOS that are taught in context:

Tools, Equipment, Materials and Documentation
Maintenance Inspection
Vehicle Networking Systems

For details regarding the In Context Topic, see page 28

Level Three — 8 weeks — 240 hours

Anti-lock Brake Systems (ABS) — **22 hours**
- Describe operation, diagnosis and repair of anti-lock brake, traction and stability control systems
- Perform evaluation and repair of anti-lock brake, traction and stability control systems
- Perform evaluation and repair of tire pressure monitor systems

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Chassis Systems – Theory — **26 hours**
- Describe operation, diagnosis and repair of suspension designs
- Describe operation, diagnosis and repair of steering systems
- Describe operation, diagnosis and repair of steering columns
- Describe operation, diagnosis and repair of steering gears
- Describe operation, diagnosis and repair of steering linkages
- Describe principles of wheel a alignment

Chassis Systems – Shop — **30 hours**
- Perform the evaluation and repair of suspension systems
- Perform the evaluation and repair of steering columns
- Perform the evaluation and repair on steering systems
- Perform the evaluation and repair on steering linkages
- Perform wheel alignment procedures

Differentials – Theory **14 hours**

- Describe the operation, diagnosis and repair of differential assemblies

Differentials – Shop **16 hours**

- Perform the evaluation and repair of differential assemblies

Heating, Ventilation and Air Conditioning (HVAC) Systems – Theory **24 hours**

- Explain physical properties of gases, liquids and solids
- Describe operation, diagnosis and repair of heating system
- Describe safe handling of refrigerants
- Describe operation, diagnosis and repair of air conditioning compressors
- Describe operation diagnosis and repair of air conditioning systems
- Describe operation, diagnosis and repair of air conditioning control systems

Heating, Ventilation and Air Conditioning (HVAC) Systems – Shop **30 hours**

- Perform the evaluation and repair of the heating systems
- Perform the evaluation and repair of the compressor components
- Perform the evaluation and repair of the air conditioning systems
- Perform the evaluation and repair of the air conditioning control systems

Manual Transmissions – Theory **24 hours**

- Describe operation, diagnosis and repair of transfer cases, manual transmissions, and transaxles
- Describe All Wheel Drive (AWD) and Four Wheel Drive (4WD) systems

Manual Transmissions – Shop **30 hours**

- Perform the evaluation and repair of transfer cases, manual transmissions and transaxles

Vehicle Communication Systems **24 hours**

- Describe the diagnostic code types and formats
- Describe the various types of networks
- Utilize diagnostic code protocols and actions to identify open, shorts, and ground faults
- Describe the various types, operation and interrelationship of modules
- Perform computer programming procedures

Level Four 8 weeks 240 hours

Automatic Transmissions – Theory **30 hours**

- Describe operation diagnosis and repair of automatic transmissions
- Describe alternate types of automatic transmissions

Automatic Transmissions – Shop **45 hours**

- Perform the evaluation and repair of automatic transmissions

Diesel Fuel Injection Systems – Theory **28 hours**

- Describe operation, diagnosis and repair of diesel fuel injection systems
- Describe operation, diagnosis and repair of turbo charged systems
- Describe operation, diagnosis and repair of supercharged systems

Diesel Fuel Injection Systems – Shop **23 hours**

- Perform the evaluation and repair of diesel fuel injection systems
- Perform the evaluation and repair of turbo charged systems
- Perform the evaluation and repair of supercharged systems

Gasoline Engine Management Systems – Theory **30 hours**

- Describe vehicle emission legislation
- Describe operation, diagnosis and repair of emission systems
- Describe operation, diagnosis and repair of electronic fuel injection (EFI) systems
- Describe types of engine management systems
- Describe diagnostic tools for on-board diagnostic (OBD) systems
- Describe operation, diagnosis and repair of OBD engine management systems
- Describe operation, diagnosis and repair of alternative fuel systems

Gasoline Engine Management Systems – Shop **30 hours**

- Perform the evaluation and repair of engine management systems
- Perform the evaluation and repair of alternative fuel systems
- Perform the evaluation and repair of emission systems

New Technology **54 hours**

- Research trends and innovations in the automotive industry
- Present research findings
- Describe the hybrid electric vehicle safety
- Describe hybrid vehicles
- Describe electric vehicles
- Explain hybrid electric vehicle operation
- Describe hybrid electric vehicle service procedures
- Describe electric brakes
- Describe hybrid electric vehicle brake systems

In Context Topics

In context means learning that has already taken place and is being applied to the applicable task. Learning outcomes for in context topics are accomplished in other topics in that level.

A-2 Tools, Equipment, Materials and Documentation

A-2.01 Uses tools and equipment
- hand and power tools, their applications, maintenance and procedures for use
- measuring and testing devices, their applications, maintenance and procedures for use
- shop tools and equipment, their applications, maintenance and procedures for use
- welding, cutting and heating equipment and their applications

A-2.02 Uses fasteners, tubing, hoses and fittings
- fasteners, tubing, hoses, and fittings, their applications and procedures for use

A-2.03 Uses hoisting and lifting equipment
- vehicle hoisting and lifting equipment, their applications and procedures for use
- shop lifting equipment, their applications and procedures for use

A-2.04 Uses technical information
- trade documents and their use
- preparing and interpreting trade documents

G-20 Maintenance Inspection

G-20.02 Diagnoses wind noises, rattles and water leaks
- wind noises, rattles and water leaks and their causes
- procedures used to diagnose wind noises, rattles and water leaks

G-20.03 Diagnoses interior and exterior components, accessories and trim
- interior and exterior components, accessories and trim and their applications
- procedures used to diagnose interior and exterior components, accessories and trim

G-20.04 Diagnoses latches, locks and movable glass
- latches, locks and movable glass and their application
- procedures used to diagnose latches, locks and movable glass

G--21 Maintenance Inspection

G-21.02 Repairs wind noises, rattles and water leaks
- wind noises, rattles and water leaks
- procedures used to repair wind noises, rattles and water leaks

G-21.03 Repairs interior and exterior components, accessories and trim
- interior and exterior components, accessories and trim and their applications
- procedures used to repair interior and exterior components, trim and accessories

G-21.04 Repairs latches, locks and movable glass
- latches, locks and movable glass and their applications
- procedures used to repair latches, locks and movable glass

C-10 Vehicle Networking Systems

C-10.01 Reads diagnostic trouble codes (DTCs)
- vehicle networking systems, their components and operation

C-10.02 Monitors data
- vehicle networking systems, their components and operation

C-10.03 Interprets test results
- vehicle networking systems, their components and operation

C-10.04 Tests system circuitry and components
- vehicle networking systems, their components and operation
- procedures used to diagnose vehicle networking system components

- circuits, their components and operation
- procedures used to diagnose circuits and components

C-11 Vehicle Networking Systems

C-11.01 Updates component software

- vehicle networking systems, their components and operation
- procedures used to repair vehicle networking system components
- reprogramming software

C-11.02 Replaces components

- vehicle networking systems, their components and operation
- procedures used to repair vehicle networking system components
- reprogramming software

C-11.03 Verifies vehicle module communications system repair

- vehicle networking systems, their components and operation
- procedures used to repair vehicle networking system components
- reprogramming software

APPENDIX A: POST HARMONIZATION TRAINING PROFILE CHART

This chart which outlines the finalized model for SATCC technical training sequencing with a cross reference to the Harmonized apprenticeship technical training sequencing, at the topic level.

Implementation for harmonization will take place progressively. Level one to be implemented in 2017/2018, level two 2018/2019, level three 2019/2020, and level four in 2020/2021.

SATCC Level One	Transcript Code	Hours	Pan-Canadian Harmonized Level One
			*Tools, Equipment, Materials and Documentation (In-Context)
			* Maintenance Inspection (In-Context)
			* Vehicle Networking Systems (In-Context)
Automotive Shop Fundamentals	SHOP 123 - Theory/Shop	30	Safety-Related Functions • refrigerant • restraints • hybrid and electric vehicles (EV)
			Fundamentals of Tools, Equipment, Materials and Documentation
			Communication Techniques
Steering, Suspension and Control Systems	STER 120 - Theory/Shop	30	Steering, Suspension and Control Systems • conventional steering and suspension systems
Braking Systems	BRAK 122 – Theory	30	Braking and Control Systems • non-ABS
	BRAK 123 - Shop	30	
Body Components and Service Inspection	ATBD 120 - Theory/Shop	12	Body Components, Accessories and Trim
Electrical System and Components	ELCT 120 – Theory	30	Electrical Systems and Components • batteries
	ELCT 121 - Shop	18	
Driveline Systems	DRTR 122 - Theory/Shop	30	Driveline Systems • Introduction to drive shafts and axles
			Tires, Wheels, Hubs and Wheel Bearings
Engine Systems	ENGN 124 - Theory/Shop	30	Engine Systems (introduction)
		240	

SATCC Level Two	Transcript Code	Hours	Pan-Canadian Harmonized Level Two
			*Tools, Equipment, Materials and Documentation (In-Context)
			* Maintenance Inspection (In-Context)
			* Vehicle Networking Systems (In-Context)
Steering, Suspension and Control Systems	???? 999 - Theory	18	Steering, Suspension and Control Systems • electronically controlled steering and suspension systems
	???? 999 - Shop	24	

Braking and Stability Control Systems	???? 999	18	Braking and Control Systems • ABS
Starting, Charging, Lighting and Wipers	???? 999	20	Electrical Systems and Components • starting/charging • lighting and wipers
	???? 999	22	
Transmission and Final Drive Systems	???? 999	30	Driveline Systems • clutches and manual transmissions • final drive assemblies
	???? 999	30	
Engine Systems	???? 999	30	Engine Systems
	???? 999	48	
		240	

SATCC Level Three	Transcript Code	Hours	Pan-Canadian Harmonized Level Three
			*Tools, Equipment, Materials and Documentation (In-Context)
			* Maintenance Inspection (In-Context)
			* Vehicle Networking Systems (See topic below)
Electrical Options and Accessories	*TBD*	30	Electrical Systems and Components • electrical accessories • electrical options
Vehicle Networking Systems	*TBD*	30	Vehicle Networking Systems
Transfer Cases and Manual Transmissions	*TBD*	30	Driveline Systems transfer cases
	TBD	30	
Gasfitting (Exceed)	*TBD*	45	Gasoline Engine Support Systems
	TBD	45	
Electric Controls (Exceed)	*TBD*	30	
		240	

SATCC Level Four	Transcript Code	Hours	Pan-Canadian Harmonized Level Three
			*Tools, Equipment, Materials and Documentation (In-Context)
			* Maintenance Inspection (In-Context)
			* Vehicle Networking Systems (In-Context)
Mentoring Techniques	*TBD*	30	Mentoring Techniques
Entertainment Systems, Instrumentation and Information Displays	*TBD*	24	Electrical Systems and Components • entertainment systems • instrumentation and information displays
Automatic transmissions and Automated AWD/4WD Systems	*TBD*	30	Driveline Systems • automatic transmissions • intelligent/computer controlled AWD/FWD systems
	TBD	42	
Diesel Engine Support Systems	*TBD*	18	Diesel Engine Support Systems
	TBD	30	
HVAC and Comfort Control Systems	*TBD*	30	HVAC and Comfort Control Systems
Hybrid and Electric Vehicles (EV)	*TBD*	18	Hybrid and Electric Vehicles (EV)
Restraint Systems	*TBD*	18	Restraint Systems
		240	

Exceed Topics

Throughout this guide to course content there are topics which exceed the minimum scope of work as set out in the Automotive Service Technician RSOS. Industry in Saskatchewan has deemed certain topics to fall within the scope of work of the Automotive Service Technician trade in Saskatchewan and therefore require technical training to cover these topics.