



Automotive Technology Primary Learning Outcomes Resource

Strand A: Trade Safety (A2)

AUT-GR-A1 Define Manitoba safety and health requirements.

AUT-GR-A1-1 Define Manitoba safety and health requirements under The Workplace Safety and Health Act and Regulations for **workers' rights**, including

- the right to know
- the right to participate
- the right to refuse
- the right to protection from reprisal

AUT-GR-A1-2 Define Manitoba safety and health requirements under The Workplace Safety and Health Act and Regulations for **workers' responsibilities**, including

- taking reasonable care to protect themselves and others
- using safety equipment properly
- following safety rules and procedures
- cooperating with safety representatives and supervisors

AUT-GR-A1-3 Define and describe Manitoba safety and health requirements under The Workplace Safety and Health Act and Regulations for

- the rights and responsibilities of **supervisors**
- the rights and responsibilities of **employers**

AUT-GR-A1-4 Define and describe workplace **safety and health programs** and the roles of workers, including

- safety and health committee
- participation in investigation and inspection process



AUT-GR-A1-5 Define and describe the Manitoba safety and health requirements for various **public agencies**, including

- Workplace Safety and Health (Enforcement)
- SAFE Work Manitoba (Prevention)

AUT-GR-A2 Identify, describe, and demonstrate personal protective equipment (PPE) requirements and standards in the workplace.

AUT-GR-A2-1 Identify various **personal protective equipment** (PPE), including

- eye protection
- face protection
- hearing protection
- foot protection
- head protection
- hand protection
- skin protection
- respiratory protection
- protective clothing
- fall protection (trade-specific)

AUT-GR-A2-2 Describe various **personal protective equipment** (PPE), including

- selection of the appropriate PPE
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance

AUT-GR-A2-3 Demonstrate how to use the required **personal protective equipment** (PPE), ensuring

- a proper fit
- a proper seal
- it is worn properly
- an understanding of the procedures for reporting any damage or malfunctions

AUT-GR-A2-4 Identify **hierarchy of control measures** and describe the requirements and standards, including

- elimination
- substitution
- engineering controls
- administrative controls
- personal protective equipment (PPE)



- AUT-GR-A2-5** Describe each individual's responsibilities when using and managing **personal protective equipment** (PPE) at work or in training for **various roles**, including the
 - employer
 - supervisor
 - worker
 - teacher
 - student
- AUT-GR-A2-6** Describe requirements for **personal protective equipment** (PPE), including
 - the name of the provider
 - its proper maintenance
 - required training
 - the different types of gear
 - procedures in place to guarantee regulations are upheld

AUT-GR-A3 Identify and describe the Workplace Hazardous Material Information System (WHMIS) and procedures.

- AUT-GR-A3-1** Describe how various hazardous materials are **identified**, including
 - classification
 - safety data sheets (SDS)
 - labelling
 - training
 - access to information
- AUT-GR-A3-2** Describe what **suppliers and workplaces** must do when labelling hazardous products, including
 - using safety symbols
 - classifying chemicals
- AUT-GR-A3-3** Identify various **safety data sheets** (SDS).
- AUT-GR-A3-4** Identify various **chemical and biological hazards**.
- AUT-GR-A3-5** Describe how to deal with **chemical and biological hazards** safely, including
 - how to wash off spills
 - moving dangerous materials
 - storing them properly



AUT-GR-A4 Identify and describe safe work procedures (SWP).

AUT-GR-A4-1 Identify a **safe work procedure** (SWP) that outlines specific steps to safely perform a task, including

- hazard identification
- risk assessment
- control measures

AUT-GR-A4-2 Describe a **safe work procedure** (SWP), including

- purpose
- scope
- procedure
- training

AUT-GR-A4-3 Identify a hazard and describe the procedures to follow for **managing various uncontrolled risks**, including

- unsecured tools or equipment
- improper use of machinery
- electrical hazards
- chemical exposure
- lack of personal protective equipment (PPE)

AUT-GR-A4-4 Describe the **process of developing** a safe work procedure (SWP), including

- gathering information
- identifying hazards
- implementing controls
- documenting steps
- training workers

AUT-GR-A5 Identify and describe injury prevention.

AUT-GR-A5-1 Identify, describe, and demonstrate the **SAFE acronym**.

- **S**pot the hazard
- **A**ssess the risk
- **F**ind a safer way
- **E**very day

AUT-GR-A5-2 Identify various **mental health risks** at work and school, such as

- stress
- bullying
- violence



AUT-GR-A5-3 Describe how to prevent various **mental health risks**, including

- respectful communication
- implementation of clear policies
- access to support systems

AUT-GR-A5-4 Demonstrate how to reduce various **mental health risks** at work and school, such as by

- promoting respect
- offering support
- proactively identifying and managing issues such as stress or bullying

AUT-GR-A5-5 Identify various methods to prevent injuries among **young workers**, such as through

- completion of the Young Worker Readiness Certificate Course
- mandatory safety orientation and training
- supervision by experienced workers
- implementation of the SAFE Work Manitoba's Young Worker Injury Prevention Strategy
- use of personal protective equipment (PPE)
- encouraging reporting of unsafe conditions
- promoting awareness of workers' rights

AUT-GR-A5-6 Describe various methods to prevent injuries among **young workers**, including

- selection of the appropriate method
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance

AUT-GR-A5-7 Identify various **chemical and biological hazards**, including

- dust
- fumes
- gases

AUT-GR-A5-8 Describe how to prevent various **chemical and biological hazards**, such as by

- using proper ventilation
- using safety gear
- using personal protective equipment (PPE)
- implementing safe handling procedures



AUT-GR-A5-9 Describe how to prevent various injuries related to **electrical safety**, including

- using proper tools
- turning off power before repairs
- following lockout/tagout steps to make sure machines cannot be turned on accidentally

AUT-GR-A5-10 Demonstrate how to safely shut off and lock electrical equipment using a **lockout/tagout** procedure.

AUT-GR-A5-11 Identify how to prevent various types of **fires and injuries from fire**, including

- identifying different types of fires
- identifying different kinds of fire extinguishers
- describing how to use fire extinguishers safely

AUT-GR-A5-12 Demonstrate knowledge of the **locations of various fire emergency safety equipment** and evacuation safety measures, including

- fire extinguisher
- alarm pull stations
- emergency exits
- muster points

AUT-GR-A5-13 Identify various work-related **diseases and illness** and describe how to prevent them, such as

- asbestos
- hearing loss
- carpal tunnel syndrome
- tendonitis
- lead poisoning

AUT-GR-A5-14 Identify various **muscle and joint injuries** and describe how to prevent them by using ergonomics prevention methods, including

- good posture
- proper workplace setup

AUT-GR-A5-15 Identify various **confined spaces**.

AUT-GR-A5-16 Describe methods to prevent injuries during **confined space** entry.



AUT-GR-A6 Identify and describe injury response.

AUT-GR-A6-1 Describe how to **manage a scene** when responding to an injury, such as by

- staying calm
- keeping the area safe
- providing support until trained help arrives

AUT-GR-A6-2 Describe how to **report an injury**, including reporting the injury to

- a teacher or supervisor
- Workers Compensation Board of Manitoba (WCB)

AUT-GR-A6-3 Demonstrate knowledge of the **locations of emergency safety equipment**, including

- first aid kit
- eyewash station
- automated external defibrillator (AED)

AUT-GR-A7 Demonstrate navigation of SAFE Work Manitoba website.

AUT-GR-A7-1 Demonstrate how to navigate SAFE Work Manitoba's website, and retrieve and apply resources from key content, including

- legislation
- bulletins
- templates
- shop talk
- other resources

Strand B: Career Education (A1)

AUT-GR-B1 Describe the structure and scope of the automotive service technician trade.

AUT-GR-B1-1 Describe opportunities and future **career paths** in the trade, including

- becoming a specialist
- moving into leadership
- working in different locations
- growing with new technology

AUT-GR-B1-2 Describe **The Apprenticeship and Certification Act**, including

- support training
- the board



- trade committees
- rules for each trade
- policies about attendance
- continuing training

AUT-GR-B1-3 Describe the **Red Seal Occupational Standard (RSOS)**, including

- how it helps with training
- tracking work hours
- preparing for tests in a trade

AUT-GR-B2 Describe levels of workplace competency.

AUT-GR-B2-1 Describe **job competencies** workers and learners need to know related to **workplace culture**, including

- understanding tools and materials
- using the right skills to do the job well

AUT-GR-B2-2 Describe the **social competencies** workers and learners need to know related to **workplace culture**, including

- working well with others
- using appropriate language
- respecting different beliefs
- understanding workplace rules
- supporting fairness and inclusion

AUT-GR-B3 Describe accommodation for apprentices with accessibility requirements.

AUT-GR-B3-1 Describe **The Accessibility for Manitobans Act** and how it supports apprentices with accessibility, including

- customer service
- communication
- buildings
- transportation
- training at work



Strand C: Trade-Related Communications (A4)

AUT-GR-C1 Describe and demonstrate techniques for effective verbal and non-verbal communication.

AUT-GR-C1-1 Describe how to communicate clearly and respectfully with various people at school and/or work, using both **words and body language**.

AUT-GR-C1-2 Demonstrate how to communicate clearly and respectfully with various people at school and/or work, using both **words and body language**.

AUT-GR-C2 Identify workplace behaviours and communication that constitute bullying as defined by the Canadian Human Rights Act and jurisdictional human rights laws.

AUT-GR-C2-1 Identify what **respectful workplace** values look like and what kinds of behaviour are considered bullying, harassment, or discrimination under Canadian law.

AUT-GR-C3 Demonstrate effective communication skills, and practise active listening and response.

AUT-GR-C3-1 Demonstrate **effective communication and active listening**, including

- listening carefully
- responding clearly
- using appropriate body language
- asking questions
- being open to feedback

AUT-GR-C4 Identify types of communication devices, and describe their purpose and operation.

AUT-GR-C4-1 Identify various types of **communication devices**, including

- telephones
- two-way radios
- computers
- smartphones
- tablets



AUT-GR-C4-2

Describe various purposes and operation of **communication devices**, such as their use for

- speaking
- sending messages
- sharing information

AUT-GR-C5 Demonstrate communication techniques using various communication devices.

AUT-GR-C5-1

Demonstrate good **communication skills** when using various communication devices to speak, send messages, or share information, including

- keeping the message concise
- articulating ideas precisely to avoid confusion
- remaining polite and professional

AUT-GR-C6 Identify types of trade-related documents and describe their applications.

AUT-GR-C6-1

Identify various **documents** used in trade, including

- codes and standards
- company policies
- vehicle identification number (VIN)
- schematics, service information, and manufacturers' specifications
- technical service bulletins (TSB)
- industry standard labour guides

AUT-GR-C6-2

Describe various **documents** used in trade, including

- selection of the appropriate documents
- characteristics and key features
- application (i.e., its role or utility in specific scenarios)
- limitations in scope or performance

AUT-GR-C7 Describe the procedures used to prepare and/or complete trade-related documents.

AUT-GR-C7-1

Describe the procedures used to prepare and/or complete trade-related documents, such as

- work and repair orders
- pre-delivery inspection
- preventative maintenance
- estimates



AUT-GR-C8 Describe the importance of communicating job requirements.

AUT-GR-C8-1 Describe the importance of clearly defining what a job entails so that each team member understands exactly what is expected of them.

Strand D: Trade-Related Mathematics (A5)

AUT-GR-D1 Use mathematical properties to solve problems involving whole, fractional, decimal, and percentage numbers, with an emphasis on trade-related problems.

AUT-GR-D1-1 Demonstrate how to solve math problems with both **positive and negative numbers**, indicating how the signs (+ or -) affect the answer, when

- adding
- subtracting
- multiplying
- dividing

AUT-GR-D1-2 Identify various **types of fractions**, including

- proper fractions
- improper fractions
- mixed fractions

AUT-GR-D1-3 Explain various **types of fractions**, including

- a proper fraction has a smaller number on top (like $\frac{3}{4}$)
- an improper fraction has a bigger number on top (like $\frac{5}{3}$)
- a mixed fraction combines a whole number and a fraction (like $1\frac{2}{3}$)

AUT-GR-D1-4 Demonstrate how to add and subtract **fractions**.

AUT-GR-D1-5 Demonstrate how to multiply, divide, simplify (reduce), and expand **fractions**.

AUT-GR-D1-6 Demonstrate how to change a fraction into a **decimal** and a decimal into a fraction.

AUT-GR-D1-7 Demonstrate how to calculate **percentages** in trade situations, such as

- when material costs increase by 10%
- when applying a 15% discount



AUT-GR-D2 Demonstrate how to communicate measurements.

AUT-GR-D2-1 Demonstrate how to **measure**.

AUT-GR-D2-2 Demonstrate how to **measure** using both **metric and customary** (imperial) measurement systems, such as by

- measuring length
- measuring materials

AUT-GR-D2-3 Demonstrate how to provide **measurements**, including how much the measurements can vary (e.g., torque specs).

AUT-GR-D3 Calculate the perimeter, area, and volume of simple and complex shapes, using both metric and customary units of measurement.

AUT-GR-D3-1 Demonstrate how to calculate various **circumferences**, including

- circles
- arc lengths
- sectors
- segments

AUT-GR-D3-2 Demonstrate how to calculate various **areas**, including

- circles
- arc lengths
- sectors
- segments

AUT-GR-D3-3 Demonstrate how to calculate various **volumes**, including

- prisms
- spheres
- cylinders

AUT-GR-D4 Solve problems using ratio and proportion.

AUT-GR-D4-1 Demonstrate how to use **ratios and proportions** to solve problems, including

- direct proportion (as one value increases, the other also increases)
 - If a car uses seven litres of fuel to travel 110 km, how much fuel will it use to travel 250 km?
- indirect (inverse) proportion (as one value increases, the other decreases)
 - If a car takes four hours to travel a certain distance at 60 km/h, how long will it take at 70 km/h?
- example: Pascal's law



Strand E: Tools and Equipment (A3)

AUT-GR-E1 Identify, describe, and demonstrate an understanding of terminology associated with tools and equipment.

AUT-GR-E1-1 Identify **key terms** and **names** of various tools and equipment.

AUT-GR-E1-2 Describe the **names and purposes** of various tools and equipment.

AUT-GR-E1-3 Demonstrate an understanding of the **names** and **purposes** of various tools and equipment.

AUT-GR-E2 Identify the various hazards associated with tools and equipment, and describe and demonstrate the related safe work practices.

AUT-GR-E2-1 Identify various **hazards of tools and equipment**, including

- harmful noise levels
- lacerations caused by sharp tools or materials
- crush injury hazards
- moving parts on machines that can catch and trap hands or garments
- flying debris hazards

AUT-GR-E2-2 Describe **safe work practices** for various tools and equipment, including

- wearing appropriate personal protective equipment (PPE)
- inspecting tools and equipment before use
- using the correct tool for the job
- keeping the work area clean and organized
- following manufacturer instructions and safety guidelines
- disconnecting power tools when not in use or during maintenance
- reporting and removing damaged tools from service
- staying alert and avoiding distractions while working
- using guards and safety devices as intended
- storing tools properly after use

AUT-GR-E2-3 Demonstrate **safe work practices** related to tools and equipment.

AUT-GR-E3 Identify, describe, and demonstrate tools and equipment, including their selection, characteristics, applications, and limitations.

AUT-GR-E3-1 Identify various **hand tools**.

AUT-GR-E3-2 Describe various **hand tools**, including

- selection of the appropriate tool
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance
- guidelines for proper storage

AUT-GR-E3-3 Demonstrate how to safely and properly use various **hand tools**.

AUT-GR-E3-4 Identify various **portable power tools**, including

- electric power tools
- hydraulic power tools
- pneumatic power tools

AUT-GR-E3-5 Describe various **portable power tools**, including

- selection of the appropriate tool
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance
- guidelines for proper storage

AUT-GR-E3-6 Demonstrate how to safely and properly use various **portable power tools**.

AUT-GR-E3-7 Identify various **measuring tools**, including

- micrometers
- vernier caliper

AUT-GR-E3-8 Describe various **measuring tools**, including

- selection of the appropriate tool
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection



- procedures for regular maintenance
- guidelines for proper storage

AUT-GR-E3-9 Demonstrate how to safely and properly use various **measuring tools**.

AUT-GR-E3-10 Identify various **stationary power tools**.

AUT-GR-E3-11 Describe various **stationary power tools**, including

- selection of the appropriate tool
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance
- guidelines for proper storage

AUT-GR-E3-12 Demonstrate how to safely and properly use various **stationary power tools**.

AUT-GR-E3-13 Identify various types of **facility equipment**.

AUT-GR-E3-14 Describe various types of **facility equipment**, including

- selection of the appropriate equipment
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance
- guidelines for proper storage

AUT-GR-E3-15 Demonstrate how to safely and properly use various types of **facility equipment**.

AUT-GR-E3-16 Identify various types of **hoisting and lifting equipment**.

AUT-GR-E3-17 Describe various types of **hoisting and lifting equipment**, including

- selection of the appropriate equipment
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance
- guidelines for proper storage

AUT-GR-E3-18

Demonstrate how to safely and properly use various types of **hoisting and lifting equipment**.

AUT-GR-E3-19

Identify, describe, and demonstrate **service information** from drawings and specifications associated with hoisting and lifting equipment.

Strand F: Materials and Consumables

AUT-GR-F1 Share and discuss Indigenous perspectives and environmental impacts.

AUT-GR-F1-1

Share and discuss an **Indigenous perspective** on material selection, emphasizing sustainability, respect for natural resources, and cultural significance, such as

- principles of the honourable harvest
- four sacred elements (earth, wind, water, fire)
- inviting an Elder to teach sustainability

AUT-GR-F1-2

Share and discuss the **environmental impact** of selecting and disposing of various materials.

AUT-GR-F2 Identify the various hazards associated with consumables and materials, and describe and demonstrate the related safe work practices.

AUT-GR-F2-1

Identify various hazards of **consumables and materials**, including

- harmful noise levels
- lacerations caused by sharp tools or materials
- crush injury hazards
- moving parts on machines that can catch and trap hands or garments
- flying debris hazards

AUT-GR-F2-2

Describe **safe work practices** for various consumables and materials, including

- wearing appropriate personal protective equipment (PPE)
- inspecting consumables and materials before use
- using the correct consumables and materials for the job
- keeping the work area clean and organized
- following manufacturer instructions and safety guidelines
- reporting and removing damaged consumables and materials from service
- staying alert and avoiding distractions while working
- storing consumables and materials properly after use



AUT-GR-F2-3 Demonstrate safe work practices related to **materials and consumables**.

AUT-GR-F3 Identify and describe organizing materials, including their characteristics, applications, and procedures.

AUT-GR-F3-1 Identify various **materials and consumables**, including

- adhesives
- cleaners
- fasteners
- fittings
- flaring
- fluids
- gaskets
- hoses
- lubricants
- seals
- sealants
- tubing

AUT-GR-F3-2 Describe various **materials and consumables**, including

- selection of the appropriate materials or consumables
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance
- guidelines for proper storage

AUT-GR-F3-3 Demonstrate how to safely and properly use various types of **materials and consumables**.

Strand G: Driveline Systems (A6)

AUT-GR-G1 Identify, describe, and demonstrate an understanding of terminology associated with driveshafts and axles.

AUT-GR-G1-1 Identify **key terms** and **names** of various driveshafts and axles.

AUT-GR-G1-2 Describe the **names** and **purposes** of various driveshafts and axles.

AUT-GR-G1-3 Demonstrate an understanding of the **names** and **purposes** of various driveshafts and axles.

AUT-GR-G2 Identify the various hazards associated with driveshafts and axles, and describe and demonstrate the related safe work practices.

AUT-GR-G2-1 Identify various driveshaft and axle **hazards**, and describe the **safe work practices** for each of the following:

- personal (e.g., use proper lifting techniques and wear PPE)
- facility (e.g., ensure the vehicle is securely lifted)
- vehicle (e.g., follow manufacturer guidelines)
- environmental (e.g., dispose of old parts and fluids properly)

AUT-GR-G2-2 Demonstrate **safe work practices** related to driveshaft and axle systems.

AUT-GR-G3 Identify tools and equipment relating to driveshafts and axles, and describe their applications and procedures for use.

AUT-GR-G3-1 Identify various **tools and equipment** used for driveshafts and axles, including

- dial indicator
- inclinometer
- vibration analyzer

AUT-GR-G3-2 Describe various **tools and equipment** used for driveshafts and axles, including

- selection of the appropriate tool
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance
- guidelines for proper storage

AUT-GR-G3-3 Demonstrate how to safely and properly use various **tools and equipment** for driveshaft and axle systems.

AUT-GR-G4 Identify types of driveshafts and their components, and describe their purpose and operation.

AUT-GR-G4-1 Identify various **driveshafts**, including

- front-wheel drive (CV shafts)
- rear-wheel drive

AUT-GR-G4-2 Describe various **driveshafts**, including

- selection of the appropriate driveshaft



- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance
- guidelines for proper storage

AUT-GR-G4-3

Identify various driveshaft **components**, including

- slip yokes and flanges
- flex joints
- single cardan joints
- double cardan joints
- support bearing
- viscous coupling

AUT-GR-G4-4

Describe various driveshaft **components**, including

- selection of the appropriate driveshaft component
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance
- guidelines for proper storage

AUT-GR-G4-5

Demonstrate how to safely and properly use procedures for **repairing or replacing** various driveshaft systems.

AUT-GR-G5 Identify types of axles, and describe their components and operation.

AUT-GR-G5-1

Identify various **axles**, including

- half shafts (independent suspension)
- floating
- semi-floating

AUT-GR-G5-2

Describe various **axles**, including

- selection of the appropriate axles
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection



- procedures for regular maintenance
- guidelines for proper storage

AUT-GR-G5-3 Identify various axle **components**, including

- axle shaft
- differential
- axle housing
- wheel hub
- bearings
- CV joints
- u-joints
- seals
- gaskets
- brake components
- axle flange

AUT-GR-G5-4 Describe various axles **components**, including

- selection of the appropriate axle components
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance
- guidelines for proper storage

AUT-GR-G5-5 Demonstrate how to safely and properly use procedures for **repairing or replacing** various axle systems.

AUT-GR-G6 Identify types of lubricants, fasteners, gaskets, seals, and sealants, and describe their applications in relation to driveshafts and axles.

AUT-GR-G6-1 Identify various axle **lubricants, fasteners, gaskets, seals, and sealants**, such as

- lubricants: gear oil, grease
- fasteners: bolts, studs, snap rings
- gaskets: cover, flange
- seals: oil, dust, o-rings
- sealants: RTV, threadlocker



- AUT-GR-G6-2** Describe various axle **lubricants, fasteners, gaskets, seals, and sealants**, including
 - selection of the appropriate lubricants, fasteners, gaskets, seals, and sealants
 - characteristics and key features
 - application (i.e., role or utility in specific scenarios)
 - limitations in scope or performance
 - procedures for conducting a thorough inspection
 - procedures for regular maintenance
 - guidelines for proper storage.
- AUT-GR-G6-3** Demonstrate how to safely and properly use procedures for various **lubricants, fasteners, gaskets, seals, and sealants**.

AUT-GR-G7 Demonstrate how to safely and properly use procedures to test, diagnose, and repair driveshaft and axle systems.

- AUT-GR-G7-1** Demonstrate how to safely and properly use procedures to test, diagnose, and repair various **driveshaft and axle systems**, including
 - driveshaft angle/runout measurements
 - universal joint/constant velocity (CV) joint replacement
 - multiple piece driveshaft phasing and indexing

Strand H: Engine Fundamentals (A7)

AUT-GR-H1 Identify, define, and demonstrate an understanding of terminology associated with engine fundamentals.

- AUT-GR-H1-1** Identify **key terms** and **names** of various engine fundamentals.
- AUT-GR-H1-2** Describe the **names** and **purposes** of various engine fundamentals.
- AUT-GR-H1-3** Demonstrate an understanding of the **names** and **purposes** of various engine fundamentals.

AUT-GR-H2 Identify the various hazards associated with engine systems, and describe and demonstrate the related safe work practices.

- AUT-GR-H2-1** Identify various engine system **hazards** and describe the **safe work practices** for each of the following:
 - personal (e.g., use proper lifting techniques and wear PPE)
 - facility (e.g., ensure the vehicle is securely lifted)



- vehicle (e.g., follow manufacturer guidelines)
- environmental (e.g., dispose of old parts and fluids properly)

AUT-GR-H2-2 Demonstrate **safe work practices** related to engine systems.

AUT-GR-H3 Identify tools and equipment related to engine fundamentals, and describe their applications and procedures for use.

AUT-GR-H3-1 Identify various **tools and equipment** used for engine fundamentals.

AUT-GR-H3-2 Describe various **tools and equipment** used for engine fundamentals, including

- selection of the appropriate tool or equipment
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance
- guidelines for proper storage

AUT-GR-H3-3 Demonstrate how to safely and properly use various **tools and equipment** for engine fundamentals.

AUT-GR-H4 Identify, describe, and demonstrate the use of various mechanical and electrical parts and systems.

AUT-GR-H4-1 Identify various **mechanical parts**.

AUT-GR-H4-2 Describe various **mechanical parts** and their operation.

AUT-GR-H4-4 Identify various **mechanical systems**.

AUT-GR-H4-5 Describe various **mechanical systems** and their operation.

AUT-GR-H4-6 Demonstrate how to safely and properly use procedures for **repairing** various engine systems.

AUT-GR-H5 Identify and describe various electrical and hybrid parts and systems.

AUT-GR-H5-1 Identify various electrical and hybrid **parts**.

AUT-GR-H5-2 Describe various electrical and hybrid parts and their operation.

AUT-GR-H5-3 Identify various electrical and hybrid **systems**.

AUT-GR-H5-4 Describe various electrical and hybrid systems and their operation.



AUT-GR-H6 Describe internal combustion principles.

AUT-GR-H6-1 Describe various principles of **internal combustion** for different engines, including

- two-stroke
- four-stroke
- rotary

AUT-GR-H7 Identify and describe types of engine classifications, configurations, and their construction.

AUT-GR-H7-1 Identify the various types of **classification** and construction of different engines, including

- diesel
- gasoline
- alternate fuels

AUT-GR-H7-2 Describe the various types of **classification** and construction of different engines, including

- selection of the appropriate engine
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance
- guidelines for proper storage

AUT-GR-H7-3 Identify the various types of **configuration** and construction of different engines, including

- inline
- rotary
- opposed
- v-type
- w-type

AUT-GR-H7-4 Describe the various types of **configuration** and construction of different engines, including

- selection of the appropriate configuration and construction
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection



- procedures for regular maintenance
- guidelines for proper storage

AUT-GR-H8 Identify and describe types of valvetrain configurations and their construction.

AUT-GR-H8-1

Identify the various configurations and construction of different **valvetrains**, including

- push rod
- overhead cam
- multi-valve
- solenoid-operated valve

AUT-GR-H8-2

Describe the various configurations and construction of different **valvetrains**, including

- selection of the appropriate valvetrain configuration
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance
- guidelines for proper storage

AUT-GR-H9 Identify engine components, and describe their design, purpose, and operation.

AUT-GR-H9-1

Identify various engine **components**, including

- block assembly
- cylinder head assembly
- timing gear
- timing belt
- timing chain
- variable valve timing

AUT-GR-H9-2

Describe various engine **components**, including

- selection of the appropriate component
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection



- procedures for regular maintenance
- guidelines for proper storage

AUT-GR-H9-3

Demonstrate how to safely and properly use procedures for **repairing or replacing** various engine components.

AUT-GR-H10 Identify types of fasteners, gaskets, seals, and sealants, and describe their applications and procedures in relation to engine fundamentals.

AUT-GR-H10-1

Identify various engine **fasteners, gaskets, seals, and sealants**, such as

- fasteners: head bolts, main bearing bolt
- gaskets: head gasket, oil pan gasket
- seals: crankshaft seal, valve stem seal
- sealants: RTV silicone, thread sealant

AUT-GR-H10-2

Describe various engine **fasteners, gaskets, seals, and sealants**, including

- selection of the appropriate fasteners, gaskets, seals, and sealants
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance
- guidelines for proper storage

AUT-GR-H10-3

Demonstrate how to safely and properly use procedures for **repairing or replacing** various fasteners, gaskets, seals, and sealants.

AUT-GR-H11 Calculate engine displacement, compression ratios, horsepower, area, and volume.

AUT-GR-H11-1

Demonstrate the calculations of various engine parameters, including

- engine displacement
- compression ratio
- horsepower
- area
- volume



AUT-GR-H12 Demonstrate how to safely and properly use procedures for repairing various engine systems.

AUT-GR-H12-1 Demonstrate how to safely and properly use procedures for **repairing** various engine systems.

AUT-GR-H13 Demonstrate how to safely and properly use procedures to test, diagnose, and repair engine systems.

AUT-GR-H13-1 Demonstrate how to safely and properly use procedures to test, diagnose, and repair various **engine systems**, such as

- visual inspection
- OBD-II scan
- compression test
- leak-down test
- fuel system test
- vacuum test
- cooling system test
- exhaust/emissions test

Strand I: Electrical Systems (A8)

AUT-GR-I1 Identify, describe, and demonstrate an understanding of terminology associated with wiring, electrical, and electronic systems and principles.

AUT-GR-I1-1 Identify **key terms** and **names** of various wiring, electrical, and electronic systems and principles.

AUT-GR-I1-2 Describe the **names** and **purposes** of various wiring, electrical, and electronic systems and principles.

AUT-GR-I1-3 Demonstrate an understanding of the **names** and **purposes** of various wiring, electrical, and electronic systems and principles.

AUT-GR-I2 Identify the various hazards associated with wiring, electrical, and electronic systems, and describe and demonstrate the related safe work practices.

AUT-GR-I2-1 Identify various electrical and electronic **hazards** and describe the **safe work practices** for each of the following:

- personal (e.g., burns from over-heated components)
- facility (e.g., tripping from wire and cable)
- vehicle (e.g., follow manufacturer guidelines)
- environmental (e.g., dispose of old parts and e-waste)



AUT-GR-I2-2 Demonstrate **safe work practices** related to electrical and electronic systems.

AUT-GR-I3 Identify tools and equipment related to electrical and electronic systems, and describe their applications and procedures for use.

AUT-GR-I3-1 Identify various **tools and equipment** used for electrical and electronic systems.

AUT-GR-I3-2 Describe various **tools and equipment** used for electrical and electronic systems, including

- selection of the appropriate tool or equipment
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance
- guidelines for proper storage

AUT-GR-I3-3 Demonstrate how to safely and properly use various **tools and equipment** for electrical and electronic systems.

AUT-GR-I4 Identify and describe information pertaining to wiring, electrical, and electronic components found on drawings and specifications.

AUT-GR-I4-1 Identify **diagnostic flowcharts** pertaining to wiring, electrical, and electronics components and systems.

AUT-GR-I4-2 Describe **diagnostic flowcharts** pertaining to wiring, electrical, and electronics components and systems.

AUT-GR-I4-3 Demonstrate how to interpret **diagnostic flowcharts** for wiring, electrical, and electronic components and systems, including

- recognizing the specific components and circuits involved
- analyzing the flowchart to determine the sequence of diagnostic steps
- performing tests and inspections as indicated in the flowchart
- using appropriate diagnostic tools
- interpreting the results to diagnose and repair faults in the system

AUT-GR-I4-3 Identify **schematics** for wiring, electrical, and electronic components and systems.

AUT-GR-I4-4 Describe **schematics** for wiring, electrical, and electronic components and systems.

**AUT-GR-I4-5**

Demonstrate an understanding of a **schematic** for wiring, electrical, and electronic components and systems, including

- recognizing the symbols
- analyzing the connections between components
- tracing the paths of electrical current
- using the schematic to troubleshoot and diagnose

AUT-GR-I5 Identify and describe basic electrical theory and demonstrate its applications to electrical circuits.

AUT-GR-I5-1

Identify the following **electrical theories**, including

- conventional theory
- electron theory
- Ohm's law
- Kirchoff's law
- Watt's law
- series circuit
- parallel circuit
- series-parallel circuits

AUT-GR-I5-2

Describe the following **electrical theories** and their applications to electrical circuits, including

- conventional theory
- electron theory
- Ohm's law
- Kirchoff's law
- Watt's law
- series circuit
- parallel circuit
- series-parallel circuits

AUT-GR-I5-3

Demonstrate how to apply the following **electrical theories** to electrical circuits:

- conventional theory
- electron theory
- Ohm's law
- Kirchoff's law
- Watt's law
- series circuit



- parallel circuit
- series-parallel circuits

AUT-GR-I6 Identify and describe types of tools and equipment used to test wiring, electrical, and electronic systems and their components, and demonstrate their use.

AUT-GR-I6-1 Identify various types of **tools and equipment** used to test wiring, electrical, and electronic systems and their components.

AUT-GR-I6-2 Describe various types of **tools and equipment** used to test wiring, electrical, and electronic systems and their components, including

- selection of the appropriate tools or equipment
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance
- guidelines for proper storage

AUT-GR-I6-3 Demonstrate how to safely and properly use various types of **tools and equipment** to test wiring, electrical, and electronic systems and their components.

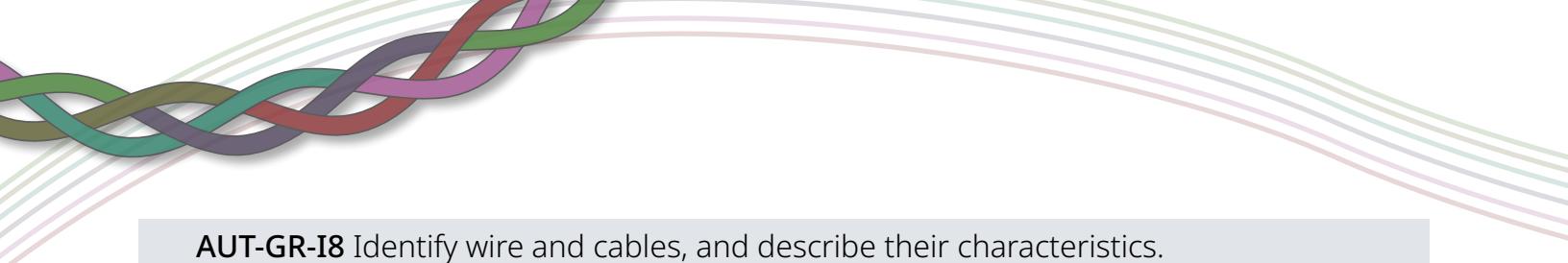
AUT-GR-I7 Identify, describe, and demonstrate the use of tools and equipment related to wire and cables.

AUT-GR-I7-1 Identify various **tools and equipment** related to wire and cables.

AUT-GR-I7-2 Describe various **tools and equipment** related to wire and cables, including

- selection of the appropriate tools or equipment
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance
- guidelines for proper storage

AUT-GR-I7-3 Demonstrate how to safely and properly use various **tools and equipment** related to wire and cables.



AUT-GR-I8 Identify wire and cables, and describe their characteristics.

AUT-GR-I8-1 Identify various types of **wires**, including type and size.

AUT-GR-I8-2 Describe various types of **wires**, including

- selection of the appropriate type of wire
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance
- guidelines for proper storage

AUT-GR-I8-3 Identify various types of **cable**, including type and size.

AUT-GR-I8-4 Describe various types of **cable**, including

- selection of the appropriate type of cable
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance
- guidelines for proper storage

AUT-GR-I8-5 Demonstrate how to safely and properly replace various **electrical wires or cables**.

AUT-GR-I9 Identify and describe types of electrical components and their purpose and operation.

AUT-GR-I9-1 Identify various types of **electrical components**, including

- circuit protection
- control device
- load device

AUT-GR-I9-2 Describe various types of **electrical components**, including

- selection of the appropriate electrical components
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance
- guidelines for proper storage



AUT-GR-I9-3 Demonstrate how to safely and properly repair or replace various **electrical components**.

AUT-GR-I10 Identify, describe, and demonstrate the procedures to repair wiring, electrical, and electronic systems.

AUT-GR-I10-1 Identify various **wire and cable repairs**.

AUT-GR-I10-2 Describe various **wire and cable repairs**, including

- selection of the appropriate wire or cable repair
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection

AUT-GR-I10-3 Demonstrate how to safely and properly complete various **wire and cable repairs**, including

- splicing
- terminal replacement
- soldering
- crimping

AUT-GR-I11 Identify, describe, and demonstrate the procedures to safely and properly test and diagnose electrical and electronic systems.

AUT-GR-I11-1 Identify various procedures to **test and diagnose** electrical and electronic systems, including

- resistance measurements
- current measurements
- voltage measurements
- voltage drops

AUT-GR-I11-2 Describe various procedures to **test and diagnose** electrical and electronic systems, including

- selection of the appropriate test
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection



AUT-GR-I11-3

Demonstrate how to safely and properly **test and diagnose** various electrical and electronic systems, including

- resistance measurements
- current measurements
- voltage measurements
- voltage drops

AUT-GR-I12 Demonstrate how to safely and properly use procedures to test, diagnose, and repair electrical and electronic systems.

AUT-GR-I12-1

Demonstrate how to safely and properly use procedures to test, diagnose, and repair various **electrical and electronic** systems, including

- resistance measurements
- current measurements
- voltage measurements
- voltage drops

Strand J: Starting and Charging Systems, and Low Voltage Batteries (A9)

AUT-GR-J1 Identify, describe, and demonstrate an understanding of terminology associated with starting and charging systems, and low voltage batteries.

AUT-GR-J1-1

Identify **key terms** and **names** of various starting and charging systems, and low voltage batteries.

AUT-GR-J1-2

Describe the **names** and **purposes** of various starting and charging systems, and low voltage batteries.

AUT-GR-J1-3

Demonstrate an understanding of the **names** and **purposes** of various starting and charging systems, and low voltage batteries.

AUT-GR-J2 Identify the various hazards associated with starting and charging systems, and low voltage batteries, and describe and demonstrate the related safe work practices.

AUT-GR-J2-1

Identify various starting and charging systems, and low voltage battery systems **hazards**, and describe the **safe work practices** for each of the following:

- personal (e.g., shock from exposed terminals)
- facility (e.g., corrosive damage from battery acid spills)
- vehicle (e.g., follow manufacturer guidelines)
- environmental (e.g., dispose of old parts and fluids properly)

AUT-GR-J2-2

Demonstrate **safe work practices** related to starting and charging systems, and low voltage battery systems.



AUT-GR-J3 Identify, describe, and demonstrate the use of various types of tools and equipment relating to starting and charging systems, and low voltage (12-volt) batteries.

AUT-GR-J3-1 Identify various **testing tools and equipment** used to test starting and charging systems, and low voltage (12-volt) battery systems, including

- starting system
- charging system
- low voltage battery

AUT-GR-J3-2 Describe various **testing tools and equipment** used to test starting and charging systems, and low voltage (12-volt) battery systems, including

- selection of the appropriate tool
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance
- guidelines for proper storage

AUT-GR-J3-3 Demonstrate how to safely and properly use various **testing tools and equipment** for starting and charging systems, and low voltage (12-volt) battery systems.

AUT-GR-J4 Identify various types of starting and charging systems, and describe their components and operation.

AUT-GR-J4-1 Identify various types of **starting systems**.

AUT-GR-J4-2 Describe various types of **starting systems**, including

- selection of the appropriate starting system
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance
- guidelines for proper storage

AUT-GR-J4-3 Identify various types of **charging systems**.

AUT-GR-J4-4 Describe various types of **charging systems**, including

- selection of the appropriate charging system
- characteristics and key features

- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance
- guidelines for proper storage

AUT-GR-J4-5 Identify various types of starting and charging system **components**.

AUT-GR-J4-6 Describe various types of starting and charging system **components**, including

- selection of the appropriate components
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance
- guidelines for proper storage

AUT-GR-J4-7 Identify various types of starting and charging system **operations**.

AUT-GR-J4-8 Describe various types of starting and charging system **operations**, including

- selection of the appropriate starting and charging system operations
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance

AUT-GR-J4-9 Demonstrate how to safely and properly use procedures for repairing various **starting systems**.

AUT-GR-J4-10 Demonstrate how to safely and properly use procedures for repairing various **charging systems**.

AUT-GR-J5 Identify and describe low voltage (12-volt) batteries and their characteristics.

AUT-GR-J5-1 Identify various low voltage (12-volt) batteries.

AUT-GR-J5-2 Describe various low voltage (12-volt) batteries, including

- selection of the appropriate battery
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance



- procedures for conducting a thorough inspection
- procedures for regular maintenance
- guidelines for proper storage

AUT-GR-J5-3

Demonstrate how to safely and properly use procedures for **repairing or replacing** various low voltage (12-volt) battery systems.

AUT-GR-J6 Demonstrate how to safely and properly use procedures to test, diagnose, and repair starting and charging systems, and low voltage batteries.

AUT-GR-J6-1

Demonstrate how to safely and properly use procedures to test, diagnose, and repair various starting and charging systems, and low voltage batteries, including

- resistance measurements
- current measurements
- voltage measurements
- voltage drops

Strand K: Steering and Suspension (A10)

AUT-GR-K1 Identify, describe, and demonstrate an understanding of terminology associated with steering and suspension systems.

AUT-GR-K1-1

Identify **key terms** and **names** of various steering and suspension systems.

AUT-GR-K1-2

Describe the **names** and **purposes** of various steering and suspension systems.

AUT-GR-K1-3

Demonstrate an understanding of the **names** and **purposes** of various steering and suspension systems.

AUT-GR-K2 Identify the various hazards associated with steering and suspension systems, and describe and demonstrate the related safe work practices.

AUT-GR-K2-1

Identify steering and suspension **hazards** and describe **safe work practices** for each of the following:

- personal (e.g., crush injuries from coil springs)
- facility (e.g., leaking shocks or steering system)
- vehicle (e.g., follow manufacturer guidelines)
- environmental (e.g., dispose of old parts and fluids properly)

AUT-GR-K2-2

Demonstrate **safe work practices** related to steering and suspension systems.



AUT-GR-K3 Identify tools and equipment related to steering and suspension systems, and describe their applications and procedures for use.

AUT-GR-K3-1 Identify various **tools and equipment** used for steering and suspension systems.

AUT-GR-K3-2 Describe various **tools and equipment** used for steering and suspension systems, including

- selection of the appropriate tool
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance
- guidelines for proper storage

AUT-GR-K3-3 Demonstrate how to safely and properly use various **tools and equipment** for engine fundamentals.

AUT-GR-K4 Identify types of frames and body construction.

AUT-GR-K4-1 Identify various types of **frames and body** construction, including

- unibody construction
- body-on frame construction

AUT-GR-K4-2 Describe various types of **frames and body** construction, including

- selection of the appropriate frame and body
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance

AUT-GR-K5 Identify types of steering systems, and describe their components and operation.

AUT-GR-K5-1 Identify various **steering systems**, including

- electric
- hydraulic
- variable



- AUT-GR-K5-2** Describe various **steering systems**, including
 - selection of the appropriate steering system
 - characteristics and key features
 - application (i.e., role or utility in specific scenarios)
 - limitations in scope or performance
 - procedures for conducting a thorough inspection
 - procedures for regular maintenance
- AUT-GR-K5-3** Identify various **steering systems components**, such as
 - linkage
 - recirculating ball
 - steering wheel
 - steering column
 - rack and pinion or steering box
 - tie rods
 - steering knuckle
 - power steering pump or electric motor
- AUT-GR-K5-4** Describe various **steering systems components**, including
 - selection of the appropriate components
 - characteristics and key features
 - application (i.e., role or utility in specific scenarios)
 - limitations in scope or performance
 - procedures for conducting a thorough inspection
 - procedures for regular maintenance
 - guidelines for proper storage
- AUT-GR-K5-5** Demonstrate how to safely and properly use procedures for **repairing or replacing** various steering systems.

AUT-GR-K6 Identify types of suspension systems, and describe their components and operation.

- AUT-GR-K6-1** Identify various **suspension systems**, such as
 - MacPherson strut
 - double wishbone (a-arm)
 - multi-link suspension
 - torsion beam
 - leaf spring suspension
 - air suspension

- coil spring suspension
- hydraulic suspension

AUT-GR-K6-2 Describe various **suspension systems**, including

- selection of the appropriate suspension system
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance

AUT-GR-K6-3 Identify various **suspension systems components**, including

- coil springs
- leaf springs
- torsion bar springs
- air springs
- struts
- shocks
- independent
- solid axle

AUT-GR-K6-4 Describe various **suspension systems components**, including

- selection of the appropriate suspension system component
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance
- guidelines for proper storage

AUT-GR-K6-5 Demonstrate how to safely and properly use procedures for **repairing or replacing** various suspension systems.

AUT-GR-K7 Identify types of fluids and lubricants, fasteners, tubing, hoses, gaskets, and seals, and describe their applications in relation to steering and suspension systems.

AUT-GR-K7-1 Identify various steering and suspension system **lubricants, fasteners, gaskets, seals, and sealants**, such as

- lubricants: power steering fluid, grease, hydraulic fluid
- fasteners: bolts, nuts, cotter pins

- tubing: power steering hoses, suspension lines
- gaskets: pump gaskets, reservoir gaskets
- seals: rack seals, strut seals, dust boots

AUT-GR-K7-2

Describe various steering and suspension system **lubricants, fasteners, gaskets, seals, and sealants**, including

- selection of the appropriate lubricants, fasteners, gaskets, seals, and sealants
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance
- guidelines for proper storage

AUT-GR-K7-3

Demonstrate how to safely and properly use procedures for various **lubricants, fasteners, gaskets, seals, and sealants**.

AUT-GR-K8 Demonstrate how to safely and properly use procedures to test, diagnose, and repair steering and suspension systems.

AUT-GR-K8-1

Demonstrate how to safely and properly use procedures to test, diagnose, and repair various **steering and suspension** systems, including

- maintenance
- inspection
- adjustment procedures
- component repair and/or replacement, such as
 - ball joint
 - bushing
 - tie rods/steering linkage
 - sway bar linkages

Strand L: Braking (A11)

AUT-GR-L1 Identify, describe, and demonstrate an understanding of terminology associated with braking systems.

AUT-GR-L1-1

Identify **key terms** and **names** of various braking systems.

AUT-GR-L1-2

Describe the **names** and **purposes** of various braking systems.



AUT-GR-L1-3 Demonstrate an understanding of the **names** and **purposes** of various braking systems.

AUT-GR-L2 Identify the various hazards associated with braking systems, and describe and demonstrate the related safe work practices.

AUT-GR-L2-1 Identify braking system **hazards** and describe the **safe work practices** for each of the following:

- personal (e.g., hot brakes)
- facility (e.g., fluid spills)
- vehicle (e.g., improper maintenance)
- environmental (e.g., dispose of old parts and fluids properly)

AUT-GR-L2-2 Demonstrate **safe work practices** related to braking systems.

AUT-GR-L3 Identify tools and equipment related to braking systems, and describe their applications and procedures for use.

AUT-GR-L3-1 Identify various **tools and equipment** used for braking systems.

AUT-GR-L3-2 Describe various **tools and equipment** used for braking systems, including

- selection of the appropriate tool
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance
- guidelines for proper storage

AUT-GR-L3-3 Demonstrate how to safely and properly use various **tools and equipment** for braking systems.

AUT-GR-L4 Describe principles related to braking systems.

AUT-GR-L4-1 Describe braking systems **principles**, including

- Pascal's law
- coefficients of friction
- kinetic energy

AUT-GR-L5 Identify types of braking systems, and describe their components and operation.

AUT-GR-L5-1 Identify various **braking systems**, including

- disc
- drum
- parking

AUT-GR-L5-2 Describe various **braking systems**, including

- selection of the appropriate braking system
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance

AUT-GR-L5-3 Identify various braking system **components**, such as

- brake pedal
- master cylinder
- brake lines
- calipers
- brake pads
- rotors
- drums
- brake shoes

AUT-GR-L5-4 Describe various braking system **components**, including

- selection of the appropriate braking system component
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance
- guidelines for proper storage

AUT-GR-L5-5 Identify various **power assists**, including

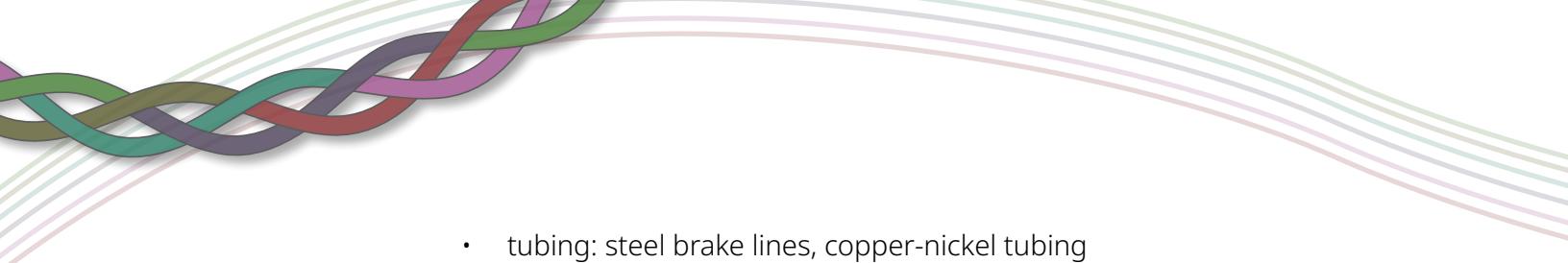
- vacuum
- hydraulic
- electric



- AUT-GR-L5-6** Describe various **power assists**, including
 - selection of the appropriate power assist
 - characteristics and key features
 - application (i.e., role or utility in specific scenarios)
 - limitations in scope or performance
 - procedures for conducting a thorough inspection
 - procedures for regular maintenance
- AUT-GR-L5-7** Identify various **power assist components**, including
 - brake booster
 - power steering pump
 - electric power steering motor
 - hydraulic control unit (HCU)
 - vacuum pump
 - electric vacuum pump
 - hydro-boost unit
 - electronic brake control module (EBCM)
 - steering angle sensor
 - active suspension compressor
- AUT-GR-L5-8** Describe various **power assist components**, including
 - selection of the appropriate power assist component
 - characteristics and key features
 - application (i.e., role or utility in specific scenarios)
 - limitations in scope or performance
 - procedures for conducting a thorough inspection
 - procedures for regular maintenance
 - guidelines for proper storage
- AUT-GR-L5-9** Demonstrate how to safely and properly use procedures for **repairing or replacing** various braking systems.

AUT-GR-L6 Identify types of fluids, fittings, flaring, tubing, and hoses, and describe their applications and procedures for use related to braking systems.

- AUT-GR-L6-1** Identify various braking system **fluids, fittings, flaring, tubing, and hoses**, such as
 - fluids: brake fluid
 - fittings: banjo bolt, inverted flare
 - flares: double flare, ISO bubble flare



- tubing: steel brake lines, copper-nickel tubing
- hoses: rubber brake, braided stainless steel

AUT-GR-L6-2

Describe various braking system **fluids, fittings, flaring, tubing, and hoses**, including

- selection of the appropriate fluids, fittings, flaring, tubing, and hoses
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance
- guidelines for proper storage

AUT-GR-L6-3

Demonstrate how to safely and properly use procedures for **repairing or replacing fluids, fittings, flaring, tubing, and hoses**.

AUT-GR-L7 Demonstrate how to safely and properly use procedures to test, diagnose, and repair braking systems.

AUT-GR-L7-1

Demonstrate how to safely and properly use procedures to test, diagnose, and repair various braking systems, including

- maintenance and inspection, such as
 - measuring components
- adjusting procedures
- component repair and or replacement, such as
 - flushing and bleeding hydraulic brakes
 - flaring and bending metal lines
 - repairing or replacing machine components

Strand M: Tires, Wheels, Hubs, and Wheel Bearings (A12)

AUT-GR-M1 Identify, define, and demonstrate an understanding of terminology associated with tires, wheels, hubs, and wheel bearings.

AUT-GR-M1-1

Identify **key terms** and **names** of various tires, wheels, hubs, and wheel bearings.

AUT-GR-M1-2

Describe the **names** and **purposes** of various tires, wheels, hubs, and wheel bearings.

AUT-GR-M1-3

Demonstrate an understanding of the **names** and **purposes** of various tires, wheels, hubs, and wheel bearings.



AUT-GR-M2 Identify the various hazards associated with tires, wheels, hubs, and wheel bearings, and describe and demonstrate the related safe work practices.

AUT-GR-M2-1 Identify various tire, wheel, hub, and wheel bearing **hazards**, and describe the **safe work practices** for each of the following:

- personal (e.g., pinch points using tire machine)
- facility (e.g., noise from pneumatic tools)
- vehicle (e.g., improperly torqued lug nuts)
- environmental (e.g., dispose of old parts and fluids properly)

AUT-GR-M2-2 Demonstrate **safe work practices** related to tires, wheels, hubs, and wheel bearings.

AUT-GR-M3 Identify tools and equipment related to tires, wheels, hubs, and wheel bearings, and describe their applications and procedures for use.

AUT-GR-M3-1 Identify various **tools and equipment** used for tires, wheels, hubs, and wheel bearings.

AUT-GR-M3-2 Describe various **tools and equipment** used for tires, wheels, hubs, and wheel bearings, including

- selection of the appropriate tools and equipment
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance
- guidelines for proper storage

AUT-GR-M3-3 Demonstrate how to safely and properly use various **tools and equipment** for tires, wheels, hubs, and wheel bearings.

AUT-GR-M4 Identify types of tires, and describe their components and operation.

AUT-GR-M4-1 Identify various types of **tires**, such as

- all-season
- winter
- summer
- all-terrain (A/T)
- mud-terrain (M/T)
- performance
- run-flat
- spare (doughnut)



- AUT-GR-M4-2** Describe various types of **tires**, including
 - selection of the appropriate types of tires
 - characteristics and key features
 - application (i.e., role or utility in specific scenarios)
 - limitations in scope or performance
 - procedures for conducting a thorough inspection
 - procedures for regular maintenance
 - guidelines for proper storage
- AUT-GR-M4-3** Identify various **tire components**, including
 - tread
 - sidewall
 - bead
 - shoulder
 - inner liner
 - belts
 - plies
 - sipes
 - grooves
 - ribs
- AUT-GR-M4-4** Describe various **tire components**, including
 - selection of the appropriate tire components
 - characteristics and key features
 - application (i.e., role or utility in specific scenarios)
 - limitations in scope or performance
 - procedures for conducting a thorough inspection
 - procedures for regular maintenance
 - guidelines for proper storage
- AUT-GR-M4-5** Demonstrate how to safely and properly use procedures for **repairing and replacing** various tires.

AUT-GR-M5 Identify types of wheels, and describe their characteristics and operation.

- AUT-GR-M5-1** Identify various types of **wheels**, including
 - construction
 - sizing
 - offset
 - backspace



- AUT-GR-M5-2** Describe various types of **wheels**, including
 - selection of the appropriate types of wheels
 - characteristics and key features
 - application (i.e., role or utility in specific scenarios)
 - limitations in scope or performance
 - procedures for conducting a thorough inspection
 - procedures for regular maintenance
 - guidelines for proper storage
- AUT-GR-M5-3** Demonstrate how to safely and properly use procedures for **repairing and replacing** various wheels.

AUT-GR-M6 Identify types of hubs and wheel bearings, and describe their characteristics and operation.

- AUT-GR-M6-1** Identify various types of **hubs and wheel bearings**, including
 - adjustable
 - non-adjustable
- AUT-GR-M6-2** Describe various types of **hubs and wheel bearings**, including
 - selection of the appropriate hub and wheel bearings
 - characteristics and key features
 - application (i.e., role or utility in specific scenarios)
 - limitations in scope or performance
 - procedures for conducting a thorough inspection
 - procedures for regular maintenance
 - guidelines for proper storage
- AUT-GR-M6-3** Demonstrate how to safely and properly use procedures for **repairing or replacing** various hubs and wheel bearings.

AUT-GR-M7 Identify types of tire pressure monitoring systems (TPMS), and describe their applications and procedures for use.

- AUT-GR-M7-1** Identify various types of **tire pressure monitoring systems** (TPMS), including
 - direct
 - indirect
- AUT-GR-M7-2** Describe various types of **tire pressure monitoring systems** (TPMS), including
 - selection of the appropriate tire pressure monitoring system
 - characteristics and key features
 - application (i.e., role or utility in specific scenarios)

- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance
- guidelines for proper storage

AUT-GR-M7-3

Identify various **tools and equipment** used for tire pressure monitoring systems (TPMS).

AUT-GR-M7-4

Describe various **tools and equipment** used for tire pressure monitoring systems (TPMS), including

- selection of the appropriate tools and equipment
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance
- guidelines for proper storage

AUT-GR-M7-5

Identify various tire pressure monitoring systems (TPMS) **servicing and diagnosing** applications and procedures.

AUT-GR-M7-6

Describe various tire pressure monitoring systems (TPMS) **servicing and diagnosing** applications and procedures.

AUT-GR-M7-7

Demonstrate how to safely and properly use procedures for servicing, diagnosing, and repairing various **tire pressure monitoring systems (TPMS)**.

AUT-GR-M8 Demonstrate how to safely and properly use procedures to test, diagnose, and repair various tires, wheels, hubs, and wheel bearing systems.

AUT-GR-M8-1

Demonstrate how to safely and properly use procedures to test, diagnose, and repair various tires, wheels, hubs, and wheel bearing systems, including

- tires
 - remove and install
 - index and balance
 - tire rotation
 - measure radial and lateral runout
 - tire pressure monitoring systems (TPMS) servicing, diagnosing, and resetting/programming procedures
- wheels
 - measure radial and lateral runout



- hubs and wheel bearings
 - service and inspection of bearing assembly

Strand N: Body Components, Accessories, and Trim (A13)

AUT-GR-N1 Identify, describe, and demonstrate an understanding of terminology associated with body components, accessories, and trim.

AUT-GR-N1-1 Identify **key terms** and **names** of various body components, accessories, and types of trim.

AUT-GR-N1-2 Describe the **names** and **purposes** of various body components, accessories, and types of trim.

AUT-GR-N1-3 Demonstrate an understanding of the **names** and **purposes** of various body components, accessories, and types of trim.

AUT-GR-N2 Identify the various hazards associated with body components, accessories, and trim, and describe and demonstrate the related safe work practices.

AUT-GR-N2-1 Identify body components, accessories, and trim **hazards**, and describe the **safe work practices** for each of the following:

- personal (e.g., eye injury from clips snapping loose)
- facility (e.g., ventilation for paints or solvents)
- vehicle (e.g., follow manufacturer guidelines)
- environmental (e.g., dispose of old parts and fluids properly)

AUT-GR-N2-2 Demonstrate **safe work practices** related to body components, accessories, and trim.

AUT-GR-N3 Identify and describe tools and equipment related to body components, accessories, and trim, and demonstrate their applications and procedures for use.

AUT-GR-N3-1 Identify various **tools and equipment** used for body components, accessories, and trim.

AUT-GR-N3-2 Describe various **tools and equipment** used for body components, accessories, and trim, including

- selection of the appropriate tool
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance
- guidelines for proper storage



AUT-GR-N3-3 Demonstrate how to safely and properly use various **tools and equipment** for body components, accessories, and trim

AUT-GR-N4 Identify various body components, accessories, and types of trim, and describe their applications and procedures for use.

AUT-GR-N4-1 Identify various interior and exterior body components, including

- locks
- latches
- windows

AUT-GR-N4-2 Describe various interior and exterior body components, including

- selection of the appropriate body components
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance
- guidelines for proper storage

AUT-GR-N4-3 Identify various interior and exterior body accessories.

AUT-GR-N4-4 Describe various interior and exterior body accessories, including

- selection of the appropriate body accessories
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance
- guidelines for proper storage

AUT-GR-N4-5 Identify various interior and exterior types of body trim.

AUT-GR-N4-6 Describe various interior and exterior types of body trim, including

- selection of the appropriate body trim
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance
- guidelines for proper storage



AUT-GR-N4-7

Demonstrate how to safely and properly use procedures for **repairing or replacing** interior and exterior body components, accessories, and trim.

AUT-GR-N5 Demonstrate how to safely and properly use procedures for repairing various body components, accessories, and trim systems.

AUT-GR-N5-1

Demonstrate how to safely and properly use procedures for repairing, replacing, and adjusting various body components, accessories, and trim systems, including

- adjusting
 - doors
 - windows
 - trunk lids
 - hoods
 - interior trim panel removal and installation

Strand O: Hybrid and Electric Vehicle Systems (A14)

AUT-GR-O1 Identify, describe, and demonstrate an understanding of terminology associated with hybrid and electric vehicle (EV) systems.

AUT-GR-O1-1

Identify **key terms** and **names** of various hybrid and electric vehicle (EV) systems.

AUT-GR-O1-2

Describe the **names** and **purposes** of various hybrid and electric vehicle (EV) systems.

AUT-GR-O1-3

Demonstrate an understanding of the **names** and **purposes** of various hybrid and electric vehicle (EV) systems.

AUT-GR-O2 Identify the various hazards associated with hybrid and electric vehicle (EV) systems, and describe the related safe work practices.

AUT-GR-O2-1

Identify **hazards** in hybrid and electric vehicle (EV) systems, and describe **safe work practices** for each of the following:

- personal
 - personal protective equipment (PPE)
 - electrocution hazards
 - one hand rule
 - shop/facility

- vehicle
 - properly tagging out the vehicle
 - hybrid vehicle and electric vehicle (EV) identification markers
 - safety precautions for working on high voltage batteries
 - various disconnect procedures
 - verification of voltage
- environmental
- hazards
 - fire
 - shocks
 - arc flash
 - sparks
 - high temperature
 - heavy components
 - sharp edges

AUT-GR-03 Identify tools and equipment related to hybrid and electric vehicle (EV) safety, and describe their applications and procedures for use.

AUT-GR-03-1 Identify various safety **tools and equipment** for hybrid and electric vehicle (EV) safety, including

- personal protective equipment (PPE)
 - high voltage gloves
 - testing high voltage gloves
 - safety glasses
 - insulated steel-toed boots
- high voltage multimeters and leads (Cat III)
- warning pylons
- insulated tools
- platform lift for battery removal
- hook or gaff for electrocution

AUT-GR-03-2 Describe various safety **tools and equipment** for hybrid and electric vehicles (EVs), including

- selection of the appropriate tools
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance



- procedures for conducting a thorough inspection
- procedures for regular maintenance
- guidelines for proper storage

AUT-GR-04 Identify and describe the fundamentals of hybrid vehicle and electric vehicle (EV) technology.

AUT-GR-04-1 Identify various types of **hybrid** vehicle **powertrain** designs, including

- series
- parallel
- series-parallel

AUT-GR-04-2 Describe various types of **hybrid** vehicle **powertrain** designs, including

- selection of the appropriate powertrain design
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance

AUT-GR-04-3 Identify various **levels of hybrid** vehicles, including

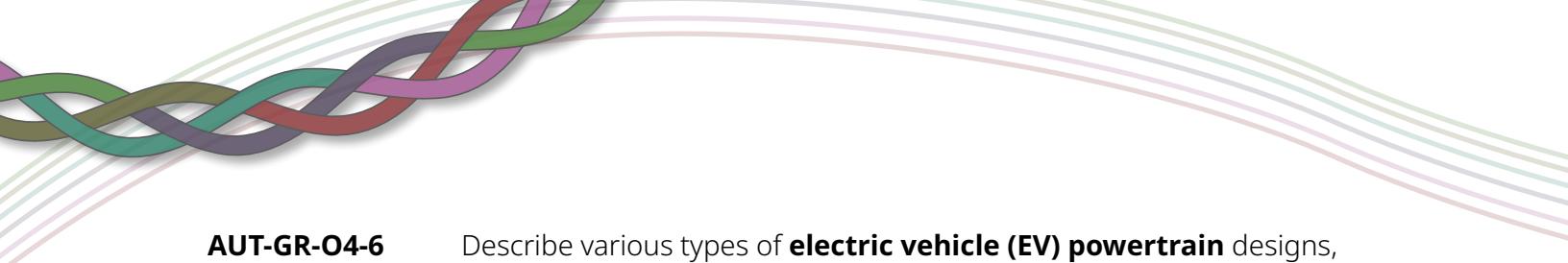
- mild hybrid
- medium hybrid
- full hybrid

AUT-GR-04-4 Describe various **levels of hybrid** vehicles, including

- their development
- selection of the appropriate battery
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance

AUT-GR-04-5 Identify various types of **electric vehicle (EV) powertrain** designs, such as

- BEV: battery electric vehicle
- PHEV: plug-in hybrid electric vehicle
- HEV: hybrid electric vehicle
- FCEV: fuel cell electric vehicle
- EREV: extended-range electric vehicle
- in-wheel motor EV: motor in each wheel



AUT-GR-04-6 Describe various types of **electric vehicle (EV) powertrain** designs, including

- selection of the appropriate electric vehicle powertrain design
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance

AUT-GR-04-7 Identify the various types of hybrid vehicle and electric vehicle (EV) **high voltage batteries**, including

- lead-acid batteries in series
- nickel-metal hydride
- lithium-ion
- other emerging technologies

AUT-GR-04-8 Describe the various types of hybrid vehicle and electric vehicle (EV) **high voltage batteries**, including

- selection of the appropriate high voltage battery
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance
- guidelines for proper storage

Strand P: Advanced Technology

AUT-GR-P1 Identify and describe advanced technology and automotive systems, and demonstrate how to safely and properly use procedures for repairing.

AUT-GR-P1-1 Identify various **advanced** technology and automotive systems, such as

- anti-lock braking systems (ABS)
- fuel management
- ignition systems
- supplementary restraint systems (SRS)
- advanced driver assistance systems (ADAS)

AUT-GR-P1-2 Describe various **advanced** technology and automotive systems, such as

- anti-lock braking systems (ABS)
- fuel management



- ignition systems
- supplementary restraint systems (SRS)
- advanced driver assistance systems (ADAS)

AUT-GR-P1-3

Demonstrate how to safely and properly use procedures for repairing various **advanced** technology and automotive systems, such as

- anti-lock braking systems (ABS)
- fuel management
- ignition systems
- supplementary restraint systems (SRS)
- advanced driver assistance systems (ADAS)