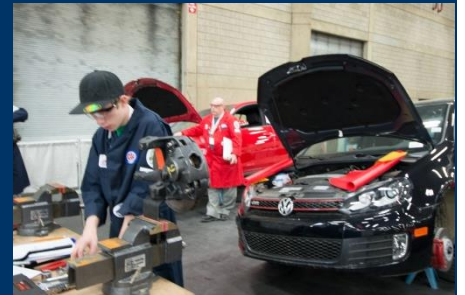


AUTOMOBILE TECHNOLOGY PREPARATION MANUAL

[SkillsAlberta.com](https://www.skillsalberta.com)



SCORING

When the participant arrives at each station they will receive information on the tasks to be completed at that station and the points awarded for each task. The participant should review the document to identify areas they are comfortable with and those that are most difficult. They should review the points allocated for each section to best manage their time. Do not get stuck on an item that is worth a few points.

SAFETY REQUIREMENTS

Safety is the first priority at all SCA events. At the event you will participate in a safety orientation lead by the technical judges. **Steel toe boots and safety glasses must be worn at all times.** Judges will be monitoring the competition floor for the safe use of tools at all times.

Please note that students who do not comply with the safety requirements outlined in the Contest Description will not be eligible to compete. Please carefully review the safety equipment and tools required to avoid disqualification.

TOOLS & EQUIPMENT

The Competitor is responsible for the safe use of basic automotive hand tools. It is expected that the competitor is knowledgeable on the use and safety of the following tools (metric and imperial):

- Wrenches
- ¼", 3/8" and 1/2" ratchets, sockets and extensions
- Screwdrivers (Flat, Phillips, Robertson, Torx, Allen head)
- Hammers (ball peen, dead blow)
- Pry bars
- Pliers (combination, side cutters, needle nose, electrical, channel lock)
- Trouble lights
- Fender covers and seat protection
- Creepers
- Tape measures
- Battery Charger
- Battery/Starter/Charging System Tester
- Bearing Packer
- Belt Tension Gauge
- Coolant Tester (Bulb and Refraction)
- Cooling System Pressure Tester and Adapters
- Cylinder Leakage Tester
- Dial Indicator (Magnetic Base, Clamp-on, Imperial, Metric)
- Digital Multimeter (DVOM)
- Electric Heat Gun
- Engine Coolant Recovery Equipment or Recycler or Coolant Disposal Contract Service
- Electronic Service Information (ie All-Data, Mitchell on Demand, ShopKey)
- Feeler Gauges (Imperial, Metric)
- Hand Held Vacuum Pump
- Hydraulic Press with adapters
- Puller Set
- Remote Starter Switch
- Scan Tool (eg Snapon, Verus, Solus OTC)
- Serpentine Belt Tensioner Tools

- Snap Ring Pliers Set (External, Internal)
- Soldering Gun
- Spark Plug Boot Puller
- Tap and Die Set (Standard, Metric)
- Telescopic Gauges
- Temperature Gun (Infrared)
- Thread Repair Insert Kit
- Tire Inflator Chuck
- Tube Quick Disconnect Tool Set
- Tubing Bender
- Tubing Cutter/Flaring Set (Imperial, ISO)
- Valve Core Removing Tool
- Vernier Calipers (Imperial, Metric)

COMPETITION DESCRIPTION

The student will rotate through seven stations each with a focus on a specific area. Review the Contest Description for information on the time allotted to complete each station. Contest Descriptions are located at <https://skillsalberta.com/competition/events/>

1. MEASURING TOOLS AND FASTENERS

Students may be required to:

- Use imperial and metric measuring tools (including micrometers, dial calipers, dial indicators, telescopic gauges, small hole gauges, feeler gauges.)
- Calculate dimensions based on the measurements taken from supplied project jig
- Identify and classify fasteners that are provided
- Using supplied information (directions, tap drill charts and torque chart) perform correct drilling, correct tapping and installation of fasteners to project piece.
- Correctly set and use a torque wrench

2. BRAKES AND STABILITY CONTROL SYSTEMS

Students will remove, inspect, measure, and replace brake components. The following tasks may be part of a competition:

- Remove, inspect, and measure brake drum diameter; determine necessary action
- Remove, and inspect brake shoes, springs, pins, clips, levers, adjusters/self-adjusters, other related brake hardware, and backing support plates; lubricate and reassemble
- Pre-adjust brake shoes; install brake drums or drum/hub assemblies and wheel bearings; make final checks and adjustments
- Remove caliper assembly
- Inspect rotor, measure rotor thickness, thickness variation, and lateral runout; determine necessary action
- Install wheel and torque lug nuts
- Inspect caliper mounting and slides/pins for proper operation, wear, and damage; determine necessary action
- Remove, inspect, and replace pads and retaining hardware
- Lubricate and reinstall caliper, pads, and related hardware; seat pads and inspect for leaks
- Measure final rotor thickness and compare with specifications
- Measure final rotor thickness and compare with specifications

- Retract and re-adjust caliper piston on an integral parking brake system
- Check brake pad wear indicator; determine necessary action
- Remove and reinstall rotor
- Be able to flare and bend brake tubing
- Determine if a wheel speed sensor needs replacing

Brake Tools

- Dial Indicator
- Brake Drum and Rotor Micrometer
- Brake Spring Removal Tool
- Digital or Dial Calliper
- Brake Clearance Transfer Gauge
- Flaring Tools
- Tubing Cutter and Pipe Bender
- Steel Rule
- Digital Micrometer

3. SUSPENSION AND STEERING SYSTEMS

Students will inspect a suspension and steering system, and perform adjustment and service procedures. Key components may include:

- Identify the type of suspension and steering systems used in a vehicle
- Dismount, inspect, and remount tire on wheel (may have Tire Pressure Monitoring System); balance wheel and tire assembly (static and dynamic). Check the assembly for road force variation
- Inspect, remove and install strut cartridge or assembly, strut coil spring, insulators (silencers), and upper strut bearing mount
- Inspect tire condition; identify tire wear patterns; measure and understand tread depth; check for correct tire size and application (load and speed ratings) and adjust air pressure; determine necessary action
- Understand function of the anti-bar system, coil springs, steering rack and constant velocity shaft
- Perform a pre-alignment inspection and measure vehicle ride height
- Flare and bend brake tubing
- Analyze alignment data

Steering and Suspension Tools

- Tire Pressure Monitoring Tools
- Air Pressure Gauge
- Coil Spring Compressor
- Tire Balancer and Changer
- Ball Joint Dial Indicator
- Ball Joint Press
- Brake Pedal Depressor
- Pitman Arm Puller
- Power Steering Pump Pulley Removing and Installing Tools
- Shock Absorber Tools
- Strut Spring Compressor Tool
- Tie Rod Puller

- Wheel Alignment Equipment-4 wheel (including alignment tools)
- Wheel Weight Pliers

4. DRIVELINE

Students will identify paths of power through the clutch, to manual transmission and to the differential.

Clutch

- Identify the components in a clutch assembly (release bearing, pilot bearing, clutch disc, pressure plate and flywheel)

Manual Transmission

- Describe the operational characteristics of a manual transmission/transaxle
- Calculate gear ratios in a manual transmission/transaxle
- Identify which gear is selected in a manual transmission/transaxle
- Identify the input shaft, mainshaft, countershaft and reverse idler shaft in a manual transmission/transaxle
- Measure the endplay of an input shaft or a countershaft

Driveshaft

- Remove and install a universal joint in a driveshaft
- Properly phase a two piece driveshaft
- Inspect, service, and replace CV joints
- Measure shaft runout; measure and adjust driveline angles

Differential Assemblies

- Check the fluid level of a differential assembly
- Measure pinion bearing pre-load
- Pre-load differential side bearings
- Roll a gear tooth pattern and interpret the pattern. Identify the changes required to correct a poor gear tooth pattern
- Measure drive axle flange runout and shaft end play; determine necessary action.

Driveline Tools

- Dial Indicator
- Feeler Gauges
- Clutch Aligning Tool
- Straight Edge
- Universal Joint Press

5. BODY ELECTRICAL

Students will diagnose basic electrical circuits and components. These could include parallel circuits and series-parallel circuits. Relay operations may be incorporated into the circuits.

General: Electrical System Diagnosis

- Demonstrate knowledge of electrical/electronic series, parallel, and series-parallel circuits using principles of electricity (Ohm's Law)

- Demonstrate knowledge of Common Electrical Symbols
- Demonstrate proper use of a digital multimeter (DVOM) when measuring source voltage, voltage drop (including grounds), current flow and resistance.
- Demonstrate knowledge of the causes and effects from shorts, grounds, opens, and resistance problems in electrical/electronic circuits
- Check operation of electrical circuits with a test light
- Check operation of electrical circuits with fused jumper wires P-1
- Perform solder repair of electrical wiring
- Inspect and test switches, connectors, relays, solenoid solid state devices, and wires of electrical/electronic circuits; determine necessary action
- Use wiring diagrams during the diagnosis (troubleshooting) of electrical/electronic circuit problems
- Perform battery state-of-charge test (Open Circuit Voltage); determine necessary action

Vehicle Electrical Systems

- Diagnose faults in the following vehicle systems:
- Horn system
- Back-up light system
- Rear defogger grid system
- Brake light system
- Power door lock system
- Headlight system

Electrical Tools

- DVOM and Amp Clamp Attachment
- Test Light (12v circuit tester)
- LED Test Light
- Electrical Pin Out Kit
- Jumper Wire
- Amp Clamp for the DVOM

6. ENGINE MECHANICAL

Students may be required to measure crankshaft, connecting rod bore, camshaft, piston and valve train. Students may also be tested on basic engine timing concepts.

Testing

- Perform a compression test
- Perform a cylinder leakage test

Engine Block and Heads

- Measure cylinder for diameter, taper and out of round
- Measure crankshaft journals for diameter, taper and out of round
- Measure crankshaft to main bearing clearance using plastigage
- Measure a piston for diameter, taper and out of round
- Remove and install a piston into a cylinder
- Remove and install rings on a piston
- Install and torque a main bearing cap and/or a connecting rod cap

- Measure gasket surfaces for warpage
- Install a timing chain/belt on an engine
- Calculate engine displacement based on bore and stroke measurements
- Verify correct camshaft timing.
- Measure crankshaft end play and identify how and where endplay is controlled
- Remove cylinder head; inspect gasket condition; install cylinder head and gasket; tighten according to manufacturer's specifications and procedures
- Visually inspect a cylinder head for cracks; check gasket surface areas for warpage and surface finish; check passage condition
- Inspect pushrods, rocker arms, rocker arm pivots and shafts for wear, bending, cracks, looseness, and blocked oil passages (orifices); determine necessary action
- Adjust valves (mechanical or hydraulic lifters)
- Inspect and replace camshaft. Measure camshaft lobe lift
- Remove and install a valve in a cylinder head
- Measure a valve spring for free height, straightness and tension
- Establish camshaft position sensor indexing

Engine Tools

- Dial Indicators
- Feeler Gauges
- Piston Ring Compressor
- Piston Ring Pliers
- Piston Installation Hammer
- Straight Edge
- Plastigage
- Telescoping Gauges
- Small Hole Gauges
- Torque Wrenches
- Micrometers
- Digital or Dial Caliper
- Compression Tester
- Cylinder Leakdown Tester
- Precision Straight Edge
- Piston Ring Compressor
- Piston Ring Pliers
- Connecting Rod Vice
- Torque to Angle Gauge
- V-blocks
- Valve Spring Compressor
- Valve Spring Compressor for Overhead Cam Engines

7. DRIVABILITY

Students will be given one realistic problem to identify and resolve. Evaluation will be based on:

- Proper use of safety equipment
- Proper use of diagnostic literature
- Proper use of diagnostic equipment
- Logical order of repair, proper repair and verification of repair

Tasks in the competition may include:

- Research applicable vehicle and service information, service precautions, and technical service bulletins
- Retrieve and record diagnostic trouble codes and clear codes when applicable
- Access and use service information to perform step-by-step (troubleshooting) diagnosis
- Perform active tests of actuators using a scan tool; determine necessary action
- Use a scan tool to monitor engine data
- Use a DVOM to diagnose circuit faults (opens, shorts to ground, shorts to voltage and high resistance)
- Use a scanner and perform an injector kill test (injector drop test)
- Remove and inspect spark plugs. Install and torque spark plugs
- Measure spark plug wire resistance to determine if a plug wire is open, has high resistance or can be put back into service

Drivability Tools

- Scan Tool
- Test Lights (12v Circuit Tester)
- Electrical Pin-out Kits
- Jumper Wires
- DVOM
- Battery Chargers
- Injector Pulse Tester
- Spark Tester

HIGH SCHOOL CTS COURSES

The following high school Career and Technology Studies (CTS) courses include related material useful in preparing for the competition. Not all elements of the courses will be tested at the competition and students do not need to have completed the courses to participate.

MEC1015: Mechanics Tools & Materials

MEC1040: Engine Fundamentals

MEC1090: Electrical Fundamentals

MEC2030: Lubrication & Cooling

MEC2040: Fuel & Exhaust Systems

MEC2060: Ignition Systems

MEC2070: Emission Controls

MEC2090: Electrical Components

MEC2110: Braking Systems

MEC2130: Drive Line

MEC2140: Transmissions/Transaxles

MEC2150: Suspension Systems

MEC2160: Steering Systems

MEC3030: Engine Diagnosis

MEC3040: Engine Tune-up

MEC3060: Engine Reconditioning – Head

MEC3070: Engine Reconditioning – Block

MEC3090: Computer Systems

MEC3130: Automatic Transmissions

MEC3150: Wheel Alignment