



TECHNICAL DESCRIPTION
Automobile Technology



world **skills**
international

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WorldSkills International, by a resolution of the Technical Committee and in accordance with the Constitution, the Standing Orders and the Competition Rules, has adopted the following minimum requirements for this skill for the WorldSkills Competition.

The Technical Description consists of the following:

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Technical Committee Chair

INTRODUCTION

1.1 Name and description of skill

1.1.1 The name of the skill is [Automobile Technology](#).

1.1.2 Description of skill

[There are seven important car systems:](#)

- [Compression ignition fuel systems](#)
- [Braking systems](#)
- [Electrical systems](#)
- [Spark ignitions engine management](#)
- [Drive Train systems](#)
- [Engine repair](#)
- [Steering and suspension Systems](#)

[Technicians must be able to understand the functioning of these systems, and carry out troubleshooting, maintenance and repair work. They must be to work logically and systematically, adhering to the health and safety regulations.](#)

[The Automotive Technician is identified as someone who works mainly in garages and work shops specialised in car maintenance.](#)

1.2 Scope of application

1.2.1 Every Expert and Competitor must know this Technical Description.

1.2.2 In the event of any conflict within the different languages of the Technical Descriptions, the English version takes precedence.

1.3 Associated documents

1.3.1 As this Technical Description contains only skill-specific information it must be used in association with the following:

- WSI - Competition Rules
- WSI - Competition Manual
- WSI - Online resources as indicated in this document
- Host Country - Health and Safety regulations

2. COMPETENCY AND SCOPE OF WORK

The Competition is a demonstration and assessment of the competencies associated with this skill. The Test Project consists of practical work only.

2.1 Competency specification

[Competitors should be competent in the following areas related to the automotives and repair of light vehicles \(up to 3 tonne including 4WD vehicles\).](#)

General Competency

- Competitors should have the knowledge in current Worksafe Guidelines and practices which encompasses competencies necessary to apply basic safety and emergency procedures to maintain a safe workplace environment for themselves and others.
- Competitors should be competent to be able read automotive workshop/manuals, (including wiring diagrams) in paper based form or electronic.
- Competitors should be competent in the use and maintenance of measuring equipment (mechanical and electrical) used in the service and repair of automotive light vehicles.
- Competitors should be competent in the selection and use of workplace tools and equipment which includes safety and maintenance, used in the service and repair of automotive light vehicles.
- Competitors should be competent to communicate in the workplace by oral, written and electronic means.
- Competitors should be competent to write routine texts ensuring correct grammar and punctuation are used and to be able to complete standard automotive forms.
- Competitors should be competent in the operation of basic computers (including scan tools) which are used in the service and repair of automotive light vehicles

Electrical Systems Construction and Testing

- Competitors should be competent to carry out inspection, testing and repair to vehicle electrical systems, electrical circuits, including all body electrics.
- Competitors should be competent to construct basic electrical circuits using a variety of automotive electrical components.
- Competitors should be competent to carry out inspection, testing and repair of charging and starting systems appropriate to light vehicle.

Brake and stability control Systems

- Competitors should be competent to carry out inspection, testing and repairs to hydraulic braking systems (disc and drum) and/or associated components, including air over hydraulic systems and hand or parking brake systems.
- Competitors should be competent to carry out inspection, testing and repair to electronically controlled antilock brakes in accordance with manufacturer/component supplier specifications.

Suspension & Steering Systems

- Competitors should be competent to remove and refit driveline components during rectification of faults in steering and suspension systems used in the service and repair of automotive light vehicles.
- Competitors should be competent to carry out inspection, testing and repair of steering systems/components and assess their condition (including mechanical and power assisted steering systems) used in the service and repair of automotive light vehicles
- Competitors should be competent to carry out inspection, testing and repair of all suspension system and associated components, and assess their condition used in the service and repair of automotive light vehicles.
- Competitors should be competent to carry out steering wheel alignment operations to vehicles used in the service and repair of automotive light vehicles.

Engine Mechanical Repair

- Competitors should be competent to carry out inspection and repairs to light vehicle four stroke engines and associated engine components.

Transmissions manual and automatic

- Competitors should be competent to carry out inspection, testing and repair of manual/automatic transaxles/ transmissions and components and assess their condition used in the service and repair of automotive light vehicles

Diesel systems

- Competitors should be competent to carry out inspection, testing and repair of diesel fuel systems which includes electronic compression ignition engine management systems and associated components. Engine management systems are systems where the ECU incorporates control over both fuel injection and timing control systems.

Engine management

- Competitors should be competent to carry out inspection, testing and repair of four stroke spark ignition engine management systems which includes electric/electronic petrol fuel systems/ emission control systems/ ignition systems for light vehicles.

Diagnostics

- Competitors should be sufficiently competent to determine the precise location of component faults within various light vehicle systems using advanced diagnostic procedures and specialist diagnostic tooling and equipment.

2.2 Theoretical knowledge

2.2.1 Theoretical knowledge is required but not tested explicitly.

- Interpretation of workshop manuals to ISO standards
- Read, follow and extract technical data and instructions from workshop manuals
- Knowledge of equipment, consumables and processes

2.2.2 Knowledge of rules and regulations is not examined.

2.3 Practical work

The Competitor has to carry out, independently, the tasks selected. Each 3-hour test can be made up of one or more areas within the specific task area (Task A – G).

3. THE TEST PROJECT

3.1 Format / structure of the Test Project

The format of the Test Project is a series of seven standalone modules to be completed in rotation. All Competitors will do all modules selected at the Competition.

3.2 Test Project design requirements

The total working time for the Test Project modules will be between 18 and 22 hours.

- The Competitor has to carry out, independently, the modules that will be selected from Subsection 2.3.2 “Automobile Technology Tests”. Each nominally 3 hour module can be made up of one or more areas contained in this section.
- Each module has to include:
 - Description of tests.
 - Competitor Instructions for completing test.
 - Competitor Report sheets (if necessary).
 - Instructions to the Workshop Supervisor.
- All modules have to be based on a minimum of 4 different world-known manufacturers’ cars taking into consideration the Competitors’ origin.

Modules for Automobile Technology competitions

This description has two main functions.

1. It will be the basis on which Experts will select modules for their submission to the Host country.
2. It will act as a guideline to countries that do not have an Expert with Competitor preparation.

The number and specification of the modules on the list must not be taken as complete or final as it is intended that regular amendments and additions will follow:

- In the light of its use over a period of time
- In the interest of arriving at a more complete list
- In regard to technological change and subsequent updating with respect for the regulations of the host country

Any instructions to Competitors should be provided in the format as per the Instruction Sheet. Each nominally 3 hour module can be made up of one area or a number of areas from the following (2.3.5 – 2.3.21).

The modules may involve the diagnosis, service and repair of the following:

	May include	Excluding
Spark Ignition engine management	<ul style="list-style-type: none"> • Pressure and flow testing • Use of scan tools • Distributor less systems • Multiple coil systems • Exhaust gas recirculation systems • Catalytic converters • Air pumps • Electronic fuel Injection • Engine analyzers • Exhaust gas analyzers • Multiplex systems 	<ul style="list-style-type: none"> • Fuel tanks • Injector servicing
Compression ignition Fuel Systems	<ul style="list-style-type: none"> • Filtration systems • Pre-Start systems • Electronic pump control systems • Particulate filters • Common rail systems • Forced induction systems • Multiplex systems 	<ul style="list-style-type: none"> • Bench testing injector pumps • In-line fuel pump
Electrical Systems	<ul style="list-style-type: none"> • Charging systems • Starting systems • Lighting systems • Accessory circuits • Dashboard gauges and warning devices • Design, construct and test electrical / electronic circuit board • Multiplexing systems • In car entertainment systems • Climate control systems • Multiplex systems 	<ul style="list-style-type: none"> • Air bag and S.R.S. systems • Alarm systems and immobilisers • Work involving refrigerant • Work involving coolant

Braking Systems	<ul style="list-style-type: none"> • Anti-skid braking systems • 4 wheel disc systems • Disc/drum systems • Parking brake systems • Brake assistance and stability control • Multiplex systems 	<ul style="list-style-type: none"> • Air brake systems
Suspension and Steering Systems	<ul style="list-style-type: none"> • Hydraulic systems • Wheel balancing • 4 wheel alignments • 4 wheel steering systems • Electronic suspension systems • Electric / computer-controlled Power assisted steering • Air suspension • Multiplex systems 	<ul style="list-style-type: none"> • Shock absorber testing • Air suspension
Drive line	<ul style="list-style-type: none"> • Electronic systems • Hydraulic systems • Mechanical systems • Constant variable transmission • Conventional or transaxle • Final drives • Transfer case • Changing universal joints • Assessing and repacking constant velocity joints • Multiplex systems 	<ul style="list-style-type: none"> • Remove & refit transmission • Flushing and changing oil
Engine Repair	<ul style="list-style-type: none"> • Cylinder head • Engine block • Crankshaft • Balance shafts 	<ul style="list-style-type: none"> • Boring and honing cylinder • Piston to connecting rod fitting by heating

3.3 Test Project development

The Test Project MUST be submitted using the templates provided by WorldSkills International (<http://www.worldskills.org/Competitionpreparation>). Use the Word template for text documents and DWG template for drawings.

3.3.1 Who develops the Test Project / modules

The Test Project / modules are developed **by the Experts**.

3.3.2 How and where is the Test Project / modules developed

The Test Project / modules are developed by:

- Seven (7) nominally three-hour test modules will be designed using the guidelines set out in 3.2 Test Project design requirements
- The Test Project proposals or actual Test Project modules will be prepared on the Competition site by a team of Experts according to the equipment provided by the Host country. The Host country is required to provide a sufficient choice of materials and spare parts in order to enable the Experts to set up a variety of projects.

3.3.3 When is the Test Projects developed

The Test Project/Modules are developed at the Competition site during the days preceding the Competition.

3.4 Test Project marking scheme

Each Test Project must be accompanied by a marking scheme proposal based on the assessment criteria defined in Section 5.

3.4.1 The marking scheme proposal is developed by the person(s) developing the Test Project. The detailed and final marking scheme is developed and agreed by all Experts at the Competition.

3.4.2 Marking schemes should be entered into the CIS prior to the Competition.

3.5 Test Project validation

Validation will be demonstrated by the Expert groups designing the Test Project/modules so each can be completed with the equipment, knowledge and time constraints.

The Chief Expert will ensure that the individual modules are endorsed by the Expert group which has designed the module.

3.6 Test Project selection

Refer 3.3.2 *How and where is the test projects are developed.*

3.7 Test Project circulation

The Test Project modules are not circulated.

3.8 Test Project coordination (preparation for Competition)

Coordination of the Test Project will be undertaken by the Chief Expert.

The Chief Expert will be responsible for ensuring that:

- The modules can be completed in the prescribed time of 22 hours
- The material/equipment list is accurate
- Competitor instructions are kept to a minimum of text, and that they do not exceed the available space permitted on the approved instruction sheet for any one module automobile technology Tests (refer 2.3.3 – 2.3.19)

The Chief Expert shall set up deadlines for all Test Project preparation work, detailing when modules and the corresponding documentation must be completed as well as translated.

The CE and DCE are responsible for the quality assurance of each module in co-operation with the QA team of experts.

3.9 Test Project change at the Competition

Refer to 3.3.2 *How and where is the test projects are developed.*

3.10 Material or manufacturer specifications

Six months prior to the Competition the Host Country is requested to supply a finalised Infrastructure List of vehicles, test equipment and general equipment. Information is to include:

- Make, model and year and option level of vehicles – brochures to be included (also include CD-ROM workshop manuals and proprietary vehicle scan tool if available for selected vehicles)
- Reference numbers and details of test equipment – brochures to be included
- List of vehicle and equipment manufactures/suppliers contact

4. SKILL MANAGEMENT AND COMMUNICATION

4.1 Discussion Forum

Prior to the Competition, all discussion, communication, collaboration and decision making regarding the skill must take place on the skill-specific Discussion Forum

(<http://www.worldskills.org/forums>). All skill-related decisions and communication are only valid if

they take place on the forum. The Chief Expert (or an Expert nominated by the Chief Expert) will be moderator for this forum. Refer to Competition Rules for the timeline of communication and Competition development requirements.

4.2 Competitor information

All information for registered Competitors is available from the Competitor Centre (<http://www.worldskills.org/competitorcentre>).

This information includes:

- Competition Rules
- Technical Descriptions
- Test Projects
- Other Competition-related information

4.3 Test Projects

Circulated Test Projects will be available from [worldskills.org](http://www.worldskills.org) (<http://www.worldskills.org/testprojects>) and the Competitor Centre (<http://www.worldskills.org/competitorcentre>).

4.4 Day-to-day management

The day-to-day management is defined in the Skill Management Plan that is created by the Skill Management Team led by the Chief Expert. The Skill Management Team comprises the Jury President, Chief Expert and Deputy Chief Expert. The Skill Management Plan is progressively developed in the six months prior to the Competition and finalised at the Competition (agreed by Experts and submitted to the Chair/Vice Chair of the Technical Committee). The Chief Expert is to regularly share updates of the Skill Management Plan via the Forum.

5. ASSESSMENT

This section describes how the Experts will assess the Test Project / modules. It also specifies the assessment specifications and procedures and requirements for marking.

5.1 Assessment criteria

This section defines the assessment criteria and the number of marks (subjective and objective) awarded. The total number of marks for all assessment criteria must be 100.

Section	Criterion	Marks		
		Subjective (if applicable)	Objective	Total
A	Spark ignition Engine Management		14.3	14.3
B	Steering and Suspension systems		14.2	14.2
C	Electrical Systems		14.3	14.3
D	Engine Mechanical		14.3	14.3
E	Braking Systems		14.3	14.3
F	Compression ignition Fuel Systems		14.3	14.3
G	Drive Train		14.3	14.3
Total =			100	100

5.2 Subjective marking

Not applicable

5.3 Skill assessment specification

[Spark ignition Engine Management](#)

- Health, Safety and Preparation

- Testing and diagnosis
- Repair and measurement
- Housekeeping and conclusion

Steering and Suspension systems

- Health, Safety and Preparation
- Testing and diagnosis
- Repair and measurement
- Housekeeping and conclusion

Electrical Systems

- Health, Safety and Preparation
- Testing and diagnosis
- Repair and measurement
- Housekeeping and conclusion

Engine Mechanical

- Health, Safety and Preparation
- Testing and diagnosis
- Repair and measurement
- Housekeeping and conclusion

Braking Systems

- Health, Safety and Preparation
- Testing and diagnosis
- Repair and measurement
- Housekeeping and conclusion

Compression ignition Fuel Systems

- Health, Safety and Preparation
- Testing and diagnosis
- Repair and measurement
- Housekeeping and conclusion

Drive Train

- Health, Safety and Preparation
- Testing and diagnosis
- Repair and measurement
- Housekeeping and conclusion

5.4 Skill assessment procedures

- Competitors shall not be awarded points for an item within a task they are unable to complete because of tool shortage in their own tool kit.
- If some or all Competitors are unable to complete one or more elements of a task due to shortfalls of the workstation itself, the points of these elements of the task shall be awarded to all Competitors so as not to distort the scoring scheme.
- When an equipment failure occurs preventing a Competitor from completing one or more elements of a task, then all points for all elements affected will be awarded to all Competitors.
- Experts are to complete an Objective Marking Form for each module for each Competitor.
- Marks will vary according to the marking scale defined for the Competition, but will align to the ranges defined in paragraph 5.1 above.
- Expert marking teams are devised to include a mixture of WS experience, Language and culture.
- Experts will assess the same aspects for each Competitor.
- Experts will assess the same percentage of the overall marks.

Results

- Daily results may be displayed in the Competition and to the media in line with the WSI and host media engagement strategy. This may display progressive marking for all sections of the Competition and will display the current total aggregate result. Ranking of the top 5 Competitors will be shown in Country Code alphabetical order with no scores displayed.
- The Chief Expert will nominate Experts with Special Responsibilities according to the Competition Rules.

6. **SKILL-SPECIFIC SAFETY REQUIREMENTS**

Refer to Host Country Health & Safety documentation for Host Country regulations.

- Work clothes must comply with relevant codes. If the host country has any specific codes that are to be in place during the Competition, then these must be made known to the Competitors at least 6 months prior.
- All machinery and/or equipment must comply with the safety requirements of the host country.
- Competitors must keep their work area clear of obstacles and their floor area clear of any material, equipment or items likely to cause someone to trip, slip or fall.
- All Competitors must wear PPE at all times in the workshop area.
- Experts will use the appropriate personal protective equipment when inspecting, checking or working with a Competitor's project
- Experts are required to bring their own white warehouse coat and should be worn at all times when in the workshop.

7. **MATERIALS & EQUIPMENT**

7.1 **Infrastructure List**

The Infrastructure List details all equipment, materials and facilities provided by the Host Country.

The Infrastructure List is online (<http://www.worldskills.org/infrastructure/>).

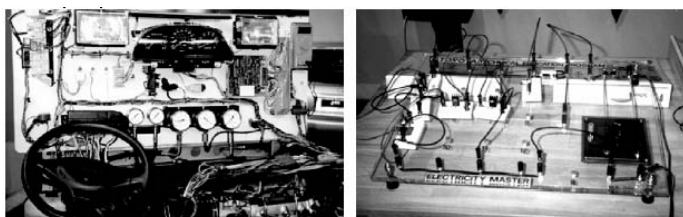
The Infrastructure List specifies the items & quantities requested by the Experts for the next Competition. The Host Country will progressively update the Infrastructure List specifying the actual quantity, type, brand/model of the items. Host Country supplied items are shown in a separate column.

The Host Country is required to supply a balanced choice of a minimum of 4 different world-known manufacturers' cars taking into consideration the Competitors' origin.

The Host Country will determine what make and model of vehicle/component will be used for each of the modules and if the vehicle/components are suitable for the selected module.

The Host Country will supply adequate spare parts to allow for a range of faults and work procedures to be set.

Standalone vehicle simulators and electrical circuit boards can be used in tasks. See pictures.



At each Competition, the Experts must review and update the Infrastructure List in preparation for the next Competition. Experts must advise the Technical Director of any increases in space and/or equipment.

At each Competition, the Technical Observer must audit the Infrastructure List that was used at that Competition.

The Infrastructure List does not include items that Competitors and/or Experts are required to bring and items that Competitors are not allowed to bring – they are specified below.

7.2 **Materials, equipment and tools supplied by Competitors in their toolbox**

The Competitor must bring with him the tools contained in the Competitors minimum tool requirements list. Extra tools may be brought if the Competitor wishes. The use of instructions and checklists has to be explicitly permitted by the Experts.

Competitor's minimum tool requirements include:

- 1 set of flat bladed screwdrivers
- 1 set of pozi-drive screwdrivers (4 pieces min.)
- 1 set of Allen (hex, inbus) key 1.5 to 10 mm
- 1 set of torx drivers internal ranging from size 8 to 55
- 1 set of torx drivers external ranging from 8 to 55
- 1 open ended spanners 6 to 32 mm
- 1 set of ring spanners (bos) 6 to 32 mm
- 1 set of torx ring spanners 8 - 55
- 1 water pump (pipe) pliers
- 1 side cutter
- 1 long nosed pliers
- 1 combination pliers
- 1 vice grip
- 1 scribe
- 1 measuring tape 2 m
- 1 metal ruler (300 mm)
- 1 torch lamp (flashlight)
- 1 vernier calliper gauge, internal, external and depth gauge (accuracy 0.02 mm)
- 1 micrometer (palmer) 0 – 25 mm (0 - 1 inch)
- 1 digital multimeter, V, A (10 A), Ohms
- 1 feeler gauge set (0.05 mm / 0.002 inch increments up to 2.00 mm / 0.080 inch)
- 1 test lamp 12 V
- 1 test lamp (LED type)
- 1 socket set ranging from 6 to 32 mm
- Torque wrench(s) ranging from 0 to 200 Nm
- 1 torque angle adapter
- 1 hammer 300g
- 1 soft headed hammer (mallet)
- 1 parallel drift punch set (diameter 2 to 8 mm)
- 1 magnetic pick up tool
- 1 set metric deep/long wall sockets
- Digital callipers, micrometers and verniers are permitted

7.3 **Materials, equipment and tools supplied by Experts**

Not applicable

7.4 **Materials & equipment prohibited in the skill area**

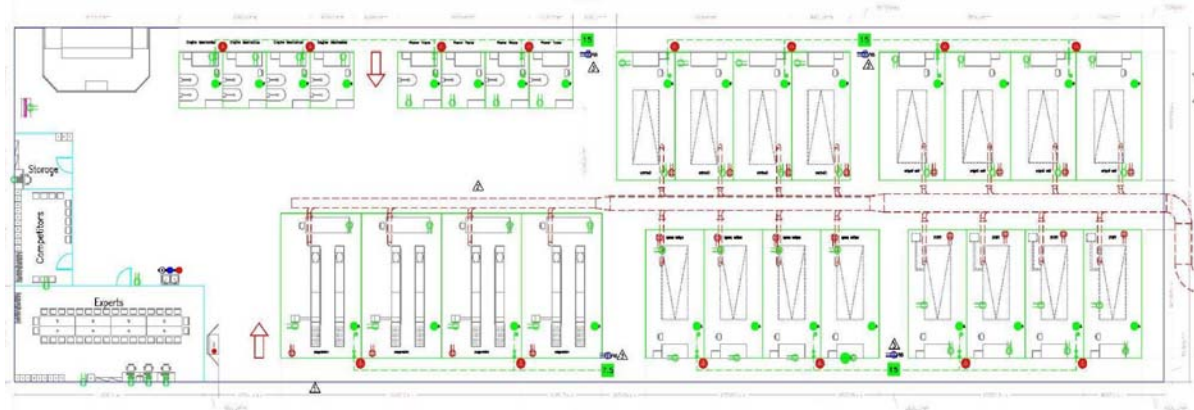
Pneumatic tools electric tools (electric ratchet screwdrivers etc)

7.5 Sample workshop layouts

Workshop layouts from Calgary are available at:

http://www.worldskills.org/index.php?option=com_halls&Itemid=540

Workshop layout from previous Competition:



8. MARKETING THE SKILL TO VISITORS AND MEDIA

8.1 Maximising visitor and media engagement

Following is a list of possible ideas to maximise visitor and media engagement.

- Try a trade
- Display screens
- Test Project descriptions
- Enhanced understanding of Competitor activity
- Competitor profiles
- Career opportunities
- Daily reporting of Competition status

8.2 Sustainability

- Recycling
- Use of 'green' materials
- Use of completed Test Projects or equipment used for the Test Projects after Competition