

# TECHNICAL DESCRIPTION

## AUTOMOBILE TECHNOLOGY



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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:

<b>1.</b>	<b>INTRODUCTION .....</b>	<b>2</b>
<b>2.</b>	<b>COMPETENCY AND SCOPE OF WORK .....</b>	<b>2</b>
<b>3.</b>	<b>THE TEST PROJECT .....</b>	<b>4</b>
<b>4.</b>	<b>SKILL MANAGEMENT AND COMMUNICATION.....</b>	<b>8</b>
<b>5.</b>	<b>ASSESSMENT .....</b>	<b>9</b>
<b>6.</b>	<b>SKILL-SPECIFIC SAFETY REQUIREMENTS .....</b>	<b>10</b>
<b>7.</b>	<b>MATERIALS &amp; EQUIPMENT .....</b>	<b>11</b>
<b>8.</b>	<b>MARKETING THE SKILL TO VISITORS AND MEDIA.....</b>	<b>12</b>

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John Shiel  
Chair Technical Committee



Stefan Praschl  
Vice Chair Technical Committee

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## 1. **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:

- Engine Management Systems (Compression ignition / Spark Ignition)
- Braking and Stability systems
- Electrical and electronic systems
- 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 workshops specialised in car diagnostic, repair and 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 - 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 shall have the following knowledge:

- 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 shall be able to:

- Read, interpret and extract technical data and instructions from automotive workshop/manuals, (including wiring diagrams) in paper based form or electronic.
- Use and maintenance of measuring equipment (mechanical and electrical) used in the service and repair of automotive light vehicles.
- Select and use of workplace tools and equipment which includes safety and maintenance, used in the service and repair of automotive light vehicles.
- Communicate in the workplace by oral, written and electronic means.
- Write routine texts ensuring correct grammar and punctuation are used and to be able to complete standard automotive forms.
- Operate basic computers (including scan tools) which are used in the service and repair of automotive light vehicles.

### Electrical Systems Construction and Testing

Competitors shall be able to:

- Carry out inspection, testing and repair to vehicle electrical systems, electrical circuits, including all body electrics.
- Construct basic electrical circuits using a variety of automotive electrical components.
- Carry out inspection, testing and repair of charging and starting systems appropriate to light vehicle.

### Brake and stability control Systems

Competitors shall be able 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.
- Carry out inspection, testing and repair to electronically controlled antilock brakes in accordance with manufacturer/component supplier specifications.

### Suspension & Steering Systems

Competitors shall be able 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.
- Inspect, test 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
- Inspect, test and repair of all suspension system and associated components, and assess their condition used in the service and repair of automotive light vehicles.
- Carry out steering wheel alignment operations to vehicles used in the service and repair of automotive light vehicles.

### Engine Mechanical Repair

Competitors shall be able to:

- Carry out inspection and repairs to light vehicle four stroke engines and associated engine components.

### Transmissions manual and automatic

Competitors shall be able to:

- Inspect, test 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 shall be able to:

- Inspect, test 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 shall be able to:

- Inspect, test 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 shall be able 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.

2.2.2 Knowledge of rules and regulations is not examined.

## **2.3 Practical work**

The Competitor has to carry out, independently, the modules selected. Each 3-hour modules can be made up of one or more areas within the specific module 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 six 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 shall 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 shall 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).

Remark: All Modules must concentrate their projects on the core system of the module

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

Module	May include	Excluding
<b>Engine Management System</b> <b>The Competition Organiser will decide on availability to choose compression ignition or spark ignition engines</b>	<p><b>Spark Ignition</b></p> <p>Pressure and flow testing Use Diagnostic tools</p> <p>Exhaust gas recirculation systems Catalytic converters Ignition Systems Engine Actuators and Sensors Electronic fuel Injection Engine analyzers Exhaust gas analyzers Multiplex systems Starting system</p> <p><b>Compression Ignition</b></p> <p>Filtration systems Use Diagnostic tools Glow plug system Electronic pump control systems Engine Actuators and Sensors Particulate filters Common rail systems Forced induction systems Multiplex systems Starting System</p>	<p>Fuel tanks Injector servicing</p> <p>Bench testing injector pumps In-line fuel pump</p>
<b>Body Electrical and Electronical Systems</b>	<p>Charging systems</p> <p>Lighting systems Accessory circuits Dashboard gauges and warning devices</p> <p>Multiplexing systems</p> <p>Climate control systems Multiplex systems</p>	<p>Air bag and S.R.S. systems Alarm systems and immobilisers Work involving refrigerant Work involving coolant Smart Power charging system</p>

Module	May include	Excluding
<b>Braking and Stability control Systems</b>	Anti-skid braking systems 4 wheel disc systems Disc/drum systems Parking brake systems Brake assistance and stability control Multiplex systems	Air brake systems
<b>Suspension and Steering Systems</b>	Hydraulic systems Wheel balancing 4 wheel alignments 4 wheel steering systems Electronic suspension systems Electric / computer-controlled Power assisted steering  Multiplex systems	Shock absorber testing Air suspension
<b>Drive line</b>	Electronic systems Hydraulic systems Mechanical systems Constant variable transmission Conventional or transaxle Final drives Transfer case  Multiplex systems	Remove & refit transmission Flushing and changing oil
<b>Engine Repair</b>	Cylinder head Engine block and internal mechanical components	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:

All Experts

### 3.3.2 How and where is the Test Project / modules developed

The Test Project / modules are developed by:

- Six (6) 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 Competition Organiser. The Competition Organiser 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 Project developed

The Test Project is developed according to the below timeline.

Time	Activity
At the Competition	The Test Project modules are developed during the preparation days by a team of Experts assigned to each module.

## 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

The Test Project is selected as follows:

*Refer 3.3.2 How and where is the Test Projects / modules are developed.*

## 3.7 Test Project circulation

The Test Project is circulated via WorldSkills International website as follows:

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 18-22 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 / modules are developed.*

### **3.10 Material or manufacturer specifications**

Six months prior to the Competition the Competition Organiser 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 by agreement of the Experts. The Skill Management Plan can be viewed in the Expert Centre (<http://www.worldskills.org/expertcentre>).

## 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	Engine Management Systems		16.7	16.7
B	Steering and Suspensions systems		16.5	16.5
C	Electrical Systems		16.7	16.7
D	Engine Mechanical		16.7	16.7
E	Braking Systems		16.7	16.7
G	Drive Train		16.7	16.7
<b>Total =</b>			<b>100</b>	<b>100</b>

### 5.2 **Subjective marking**

Not applicable

### 5.3 **Skill assessment specification**

#### Engine Management System

- 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 and Electronical 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

#### 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 marks 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 module due to shortfalls of the workstation itself, the marks of these elements of the module 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 module, 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 WorldSkills 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 ISO 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 Competition Organiser will progressively update the Infrastructure List specifying the actual quantity, type, brand/model of the items. Items supplied by the Competition Organiser are shown in a separate column.

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**

**Note:** The Competition Organiser may supply the toolbox as part of the Infrastructure List. Where this is the case registered Members will be notified 12 months prior to the Competition. The description and contents must be put on the Infrastructure List at least 3 months prior to the Competition.

In the case where the Competition Organiser cannot supply the 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 scribe
- 1 measuring tape 2 m
- 1 torch lamp (flashlight)
- 1 feeler gauge set (0.01mm / 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

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

Not applicable

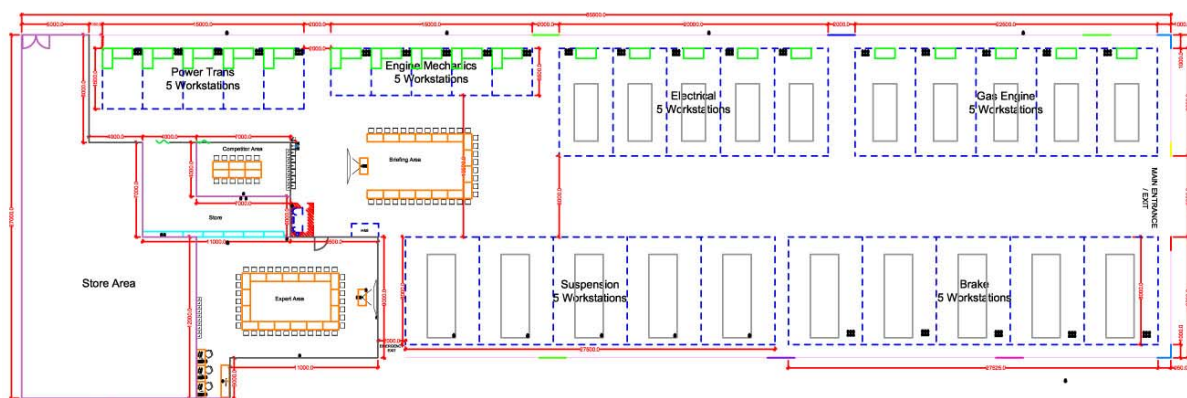
### 7.4 Materials & equipment prohibited in the skill area

Pneumatic tools are not to be used electric tools (electric ratchet screwdrivers etc) can be used if supplied by the Competition Organiser.

### 7.5 Proposed workshop and workstation layouts

Workshop layouts from London are available at:  
[http://www.worldskills.org/index.php?option=com\\_halls&Itemid=540](http://www.worldskills.org/index.php?option=com_halls&Itemid=540)

Workshop layout:



## 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 after Competition