

Automotive Heavy Vehicle Technology

Technical Handbook



Richard Hutchins

IMI Skills Competitions Manager

RichardH@theimi.org.uk



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We would like to thank all of our industry leading sponsors that are passionate about finding the top talented apprentices and make this competition possible:

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This WorldSkills UK competition is managed by the Institute of the Motor Industry

Overview:

Heavy Vehicle Engineering is a significant sector within the automotive engineering industry, Heavy Vehicle Engineering covers the maintenance/inspection and repair of trucks, buses, vans etc.

Heavy Vehicle Engineering includes a wide range of skills, high standards and critical thinking and process applications and problem solving.

This guide will provide you with a clear path to follow, from the initial registration to the National finals and beyond.

Career Pathway:

What is the job role?

Heavy vehicle service technicians service and repair large vehicles such as trucks, lorries and buses. Technicians are trained in all areas of heavy vehicle mechanics and electronics, from engine and exhaust systems to air conditioning and security features.

As a heavy vehicle service technician you will need to demonstrate excellent practical skills, the ability to work quickly with attention to detail, the ability to work without supervision, good communication skills, the ability to follow written and verbal instructions and a reasonable level of fitness and normal colour vision.

Qualifications

You will need to be trained in heavy vehicle maintenance and repair level 2 at this stage of your career and then progress to heavy vehicle maintenance and repair Level 3.

Level 2 Heavy Vehicle Maintenance and Repair

<http://awarding.theimi.org.uk/Qualifications/Course-Details?courseID=11>

Apprenticeship Standard

Heavy Vehicle Service and Maintenance Technician

<https://awarding.theimi.org.uk/Qualifications/Automotive-Retail-Motor-Vehicle-Service-and-Maintenance-HV>

IMI Accreditation

Working hours and salary

Most service technicians work 40 hours a week, from Monday to Saturday. This may include some shift and overtime work. Some tasks may be physically demanding although you will

use lifting equipment to move heavy parts. As an apprentice or a trainee heavy vehicle technician you may expect to earn between £7,000 – £13,000 depending on your age and stage of training.

Once you are qualified the average Heavy Vehicle Technician salary in United Kingdom is £28,674 per year or £14.70 per hour. Entry level positions start at £10,000 per year while most experienced workers make up to £41,113 per year.

(Average salaries taken from <https://neuvoo.co.uk/salary/?job=heavy+vehicle+technician>)

You may also be eligible for holiday entitlement, company pension and private healthcare schemes.

Progression to:

Heavy Vehicle Diagnostic Technician, Refrigeration Technician earning.

For more Automotive career pathway information:

<https://www.autocity.org.uk/>

Resources and Registration:

For information and resources, including how to register, competition rules, and the steps to competing,

Visit:

<https://worldskillsuk.org/champions/national-skills-competitions/tools-and-resources>

Pre-competition Activity:

Pre-competition competitors should try to familiarise themselves with competition style activities even if you have a fellow student to judge a completed work task during a practical session at college/training provider.

Also familiarise yourself with current industry processes and procedures for completing a range of tasks you may need to complete.

For information and resources, including a detailed Pre-Competition activity pack please find it on the WorldSkills webpage for Heavy Vehicle Technology.

Competition Structure:

Registration:

Once you have completed your registration (and accepted All terms and conditions) you will be emailed a link to complete a Passive online test.

Passive Stage:

When the passive online test has been completed you will be notified to let you know if you have scored high enough to go through to the National Qualifiers (the practical competition rounds).

National Qualifiers Stage one:

The National Qualifier will be an online competition, all details would be emailed to you well in advance of any of the competitions.

Ensure you're ready to compete in your National Qualifiers by looking at both the physical and online qualifier project briefs below.

These outline the type of tasks you will be expected to carry out. Ask your lecturer/employer for help in any areas where you feel you could improve and try to gain practical experience in all the task areas of the competition.

The Online National Qualifier consists of similar tasks to the practical competition that ran in previous years however the online task will be broken down into a series of online questions for you to answer.

The tasks outline the type of questions you will be expected to answer. Ask your lecturer/employer for help in any areas where you feel you could improve and try to use your practical experience in all the task areas to think about the different processes etc. that you could be questioned on for competition.

National Qualifier Stage two:

Compete in your online National Qualifier. Details on how to join will be sent to you once you have passed the passive stage.

WorldSkills UK Live Final Stage one:

The 6 highest scoring competitors across each National Qualifiers will be invited to compete at the finals - WorldSkills UK Live in November 2021.

WorldSkills UK Live Final Stage two:

Ensure you're ready to compete in your WorldSkills UK Live Final by looking at the project brief below. This outlines the type of tasks you will be expected to carry out. Ask your lecturer/employer for help in any areas where you feel you could improve and try to gain practical experience in all the task areas of the competition.

Attend Pre final training arranged by IMI Skills Competitions (budget depending) and virtual online training.

WorldSkills UK Live Final Stage three:

Attend and compete in your allocated WorldSkills UK Live Final.

Specification of the Practical Tasks:

Tasks will be designed to test the competitors technical ability to:

- Set up and use diagnostic equipment
- Follow correct procedures
- Work efficiently
- Inspect vehicles ready for use
- Efficiently complete systems repairs
- Follow technical procedures
- Following manufacturer's procedures to repair the faults
- Carry out a diagnostic procedure
- Accurately use scan tools, multimeters, DTI gauges
- Accurately assess vehicle systems

Specification of the Online Tasks:

Tasks will be designed to test the competitors technical ability to:

- How to set up and use diagnostic equipment
- The importance of following correct procedures
- How to work efficiently
- Correct procedure for inspecting vehicles ready for use
- How to efficiently complete systems repairs
- How to follow technical procedures
- The process of following manufacturer's procedures to repair the faults
- Methods of how to carry out a diagnostic procedure

- How to use scan tools, multimeters, DTI gauges
- Correct methods and procedures of assessing vehicle systems

Task Overview:

National Qualifiers - Heavy Vehicle Technology

Task A – Vehicle Inspection:

This task requires competitors to use a methodical approach carry out an inspection on the selected areas of the vehicle and record your findings on the Vehicle Inspection Sheet, once the faults have been identified the competitor will need to complete a number of additional inspection related questions on a separate question paper. The competitor is not required to rectify any of the defects/faults found during the inspection.

Task B – Engine Mechanical:

Competitors will be required to check and correctly set up and use a vernier caliper to measure the dimensions indicated for each of the bushes, to check and correctly set up and use the micrometer to measure the dimensions indicated for each of the castings and to check and correctly set up and use the dial test indicator to measure each of the camshaft lobes identified.

The competitor will then be required to record all of the results found on a sheet provided.

Task C – Braking System:

The competitors will need to diagnose a reported electrical fault in the braking system, they will need to complete the relevant diagnostic tests to the braking system and complete any repairs needed to the system and then recheck the system to ensure the correct operation.

Task D – Transmission:

The competitors are required to carry out mechanical shifting of all gears, remove gearbox shifting control unit accurately, take measurements and record results, set up, refit gearbox control unit testing for air leaks etc. and report if gearbox is serviceable.

Task E – Body Electrical:

The competitors are required to use a multimeter to test each circuit and diagnose the faults to see why it is not functioning correctly. The competitor will be required to test a number of circuits in the correct order to enable them to complete the task. All findings will need to be

recorded on the report sheet provided. Include any readings taken and recommended action to correct the fault.

Task F – Engine Electrical:

The competitor will be required to confirm a fault in a vehicle engine electrical system, check vehicle display and diagnose the cause of the fault and complete the appropriate repairs needed.

Marking and Assessment (Practical National Qualifier):

The WorldSkills UK/IMI Skills competitions provide an opportunity for automotive technicians to demonstrate the technical skills required to be a successful modern-day heavy vehicle technician.

Competitors were required to work on a selection of trucks and components carrying out various tasks, which test the skills and abilities of a modern heavy vehicle technician.

The competition consisted of 6 tasks lasting approximately 45 minutes each, designed to reflect the knowledge of technicians working towards, or at, a level 3 heavy vehicle qualification.

The competition consisted mainly of carrying out a practical activity as well as an element of reporting diagnosed faults; tasks were from (but not limited to) any of the following: Engine mechanical, engine electrical, steering & suspension, transmissions, vehicle inspections, vehicle electrics, braking systems.

Competitors were expected to demonstrate competence using hand tools, power tools, workshop equipment, measuring devices, specialist tools and diagnostic equipment such as multi-meters, scan tools, code readers, oscilloscopes and wheel alignment systems as well as referencing technical manuals, wiring diagrams and electronic data retrieval systems.

Judges would have been looking for other skills expected of a successful technician such as time management, planning and problem-solving skills, working under pressure, communication skills, attitude and behaviour.

All IMI Skills Competitions are judged by a panel of experts drawn from industry, colleges and training providers. The judges' decisions will be independently moderated and quality assured before results are confirmed. The judges will be briefed on assessment procedures prior to the competition.

Judges are looking for technical competency but are also briefed to look for excellence amongst competitors. Judges will therefore take into account skills such as:

- Collect, analyse and organise information
- Communicate ideas and information
- Plan and organise work activities
- Use mathematical ideas and techniques
- Solve problems
- Use current technology
- Comply with H&S legislation

All task marking is objective and based on agreed criteria.

National Qualifiers

Vehicle Inspection	16%
Engine Mechanical	15%
Braking Systems	16%
Transmission	18%
Body Electrical	18%
Engine Electrical	17%

Marking and Assessment (Online National Qualifier):

The WorldSkills UK/IMI Skills competitions provide an opportunity for automotive technicians to demonstrate the technical skills knowledge required to be a successful modern day heavy vehicle technician.

Competitors are required to answer questions on a selection of virtual trucks and components carrying out various tasks, which will test the knowledge and abilities of a modern heavy vehicle technician.

The competition consists of 6 tasks lasting approximately 45 minutes each, designed to reflect the knowledge of technicians working towards, or at, a level 3 heavy vehicle qualification.

The competition consists mainly of answering questions on practical activities as well as an element of reporting diagnosed faults; tasks may be from (but are not limited to) any of the following: Engine mechanical, engine electrical, steering & suspension, transmissions, vehicle inspections, vehicle electrics, braking systems.

Competitors will be expected to demonstrate competent knowledge using hand tools, power tools, workshop equipment, measuring devices, specialist tools and diagnostic equipment such as multi-meters, scan tools, code readers, oscilloscopes and wheel alignment systems as well as referencing technical manuals, wiring diagrams and electronic data retrieval systems.

All task marking is objective and based on agreed criteria.

National Qualifiers

Vehicle Inspection	16%
Engine Mechanical	15%
Braking Systems	16%
Transmission	18%
Body Electrical	18%
Engine Electrical	17%

National Qualifiers (Practical) What to expect:

In the past, the Heavy Vehicle Engineering National Qualifiers took place at the prestigious IVECO Academy in Basildon.

The competitors would rotate around the six tasks over a full day of competition.

The competition consisted of 6 tasks lasting approximately 45 minutes each, designed to reflect the knowledge of technicians working towards, or at, a level 3 heavy vehicle qualification.

The competitors would have needed to show knowledge of the processes and equipment used for these operations.

National Qualifiers (Online) What to expect:

The Heavy Vehicle Engineering Online National Qualifiers takes place remotely in the form of online/virtual tests.

You will be emailed a link and given a specific time to complete your online/virtual competition.

Task duration may vary according to the complexity of the task and the number of areas to be completed.

The competition will need to be accessed via laptop or P.C the digital competition maybe invigilated remotely by IMI staff and technical support will be available during the competition.

The competitors will need to show knowledge of the processes and equipment used for these operations.

Task Overview:

National Final - Heavy Vehicle Technology

Task A – Engine Diagnostics:

This task requires competitors to diagnose and repair a two stage fault in a vehicle that has been towed in as it will not start. The competitor will need to log all related fault codes, diagnose the non-start fault, rectify the system fault and clear any fault codes on the vehicle.

Task B – Vehicle Inspection/Assessment:

This task requires competitors to use a methodical approach carry out an inspection on the selected areas of the vehicle and record your findings on the Vehicle Inspection Sheet. Once the faults have been identified the competitor will need to complete a number of additional inspection related questions on a separate question paper. The competitor is not required to rectify any of the defects/faults found during the inspection.

Task C – Transmission:

The competitors will need to diagnose a transmission fault in a vehicle that has been recovered to the workshop with transmission warning displayed on the vehicle dash display.

The competitor will need to follow manufactures instructions to confirm and diagnose the fault, and appropriately rectify the problem. Any/All findings should be recorded on the sheet provided and any codes etc. cleared.

Task D – Vehicle Electrical Systems:

This task requires the competitor to carry out a diagnostic procedure on a vehicle that has failed to start on the key.

The fault/faults will need to be correctly identified, rectified and all code etc. cleared.

Task E – Steering & Suspension Systems:

The competitors are required to carry out a full check to the steering and suspension systems to ensure that they are fit for purpose, and if it is not then the system should be rectified using the correct parts following all manufactures guidelines, leaving the vehicle in a safe usable condition.

Task F – Braking Systems:

This task requires competitors to diagnose and repair a fault in a trailer braking system that has been previously repaired and now has a warning light on in the tractor unit and has harsh braking when unloaded.

The competitor will need to log all related fault codes, diagnose both faults and rectify them. Once the faults are correctly rectified all fault codes should be cleared on the vehicle.

Marking and Assessment:

The marking scheme is designed to fairly compare every competitor's work.

The marking is split between specific judgement aspects throughout the task, including efficiency, health and safety and technical performance.

The IMI Skills competitions are judged by a panel of industry specialists.

The judges' decisions will be independently moderated and quality assured before being confirmed at the closing ceremony where the results are announced. The judges are briefed on assessment procedures prior to the competition.

Judges are looking for technical competency but are also briefed to look for excellence amongst competitors. Judges will therefore take into account skills such as time management, working under pressure and communication skills. All marking is objective and based on agreed criteria.

Competitors are required to carry out practical activities and follow diagnostic procedures on vehicles and/or training rigs to identify reported faults. The tasks will be selected from the following vehicle systems: engine mechanical, engine electrical, steering & suspension, transmissions, brakes, body electrical and vehicle inspections.

The tasks at the final are in the final stages of development but will follow a similar format to those at the qualifiers but are of a more complex nature, requiring an in depth knowledge of diagnostic procedures and higher understanding of the operation and function of vehicle components and systems. You will be required to reference data specifications and workshop procedures and be competent using multi-meters, scan tools, diagnostic equipment (including oscilloscopes), pressure gauges, wheel alignment systems and various measuring devices such as micrometers, DTI's and Vernier gauges.

The tasks at the UK LIVE final follow a similar format to those at the qualifiers but are of a more complex nature requiring an in depth knowledge of repair procedures, techniques, etc.

Judges will also be looking for other skills expected of a successful technician, such as:-

- Efficiency
- Time Management
- Performance when working under pressure
- Communication skills
- Effective Planning
- Collect, analyse and organise information
- Communicate ideas and information
- Plan and organise work activities
- Use mathematical ideas and techniques
- Solve problems
- Use current technology

All competitors will receive feedback after the competition on their performance.

The allocation of marks is dependent on the tasks chosen and their complexity.

Below is a broad outline of how marks may be distributed:

National final:

Braking systems	15%
Body electrical	18%
Engine mechanical	15%
Engine diagnostics	20%
Inspections	18%
Steering / suspension	14%

Judges Top Tips:

- **Preparation and Practice**
A successful competitor you need to be confident, calm and self-assured when competing.
Prepare by practicing your skills and techniques to ensure you get the required standard/results you want without any surprises.
- **Time Management**
Learn to manage your time effectively when completing tasks by working smart not fast!
The tasks have allocated times, so practice working to time and under pressure to perfect your timing.
If you run out of time in the competition you will lose marks.
- **Planning**
Make your own plans for how to complete each task, work methodically and even write it down to help you prepare.
- **Organised**
Make sure you are organised, make sure all stages of a task are completed.
Organise all of your equipment and materials for the task.
- **Health & Safety**
In any automotive refinishing environment Health & Safety is very important, make sure you use the appropriate PPE for the task and work safely.
- **Clean and Tidy**
Keep your working area tidy as you can be more efficient in a tidy work area. Make sure that when you present your work to the judges it is clean and ready for final judging.
- **Understanding**
Read the task brief thoroughly and make sure you understand what you need to do. Do not be afraid to ask questions, remember there is only one silly question.....the one you don't ask!
- **Don't Worry**
If a part of a task hasn't gone as well as you might have wanted don't worry or dwell on it, just draw a line under that and get on with the next task. Always focus on the marks you can gain not what you might have lost.
- **Enjoy**
To get to the WorldSkills UK National Qualifiers or the WorldSkills UK Live National Finals is in its self a massive achievement that you should be extremely proud of!
Make the most of the whole WorldSkills UK/IMI Skills Competitions process and enjoy it!

National Final - Heavy Vehicle Engineering What to expect:

The competitors rotate around the six tasks above over the two days (usually a Thursday and Friday) of the competition.

Task duration varies according to the complexity of the task, during which time they will be required to apply industry recognised techniques and procedures for inspection, diagnosis and repair of complex faults on heavy vehicle systems.

The competitors will need to show knowledge of the equipment used in these processes and be able to follow the correct industry recognised process for each task. The tasks are designed to assess the knowledge and skills of technicians working towards, or at, a level 3 Heavy Vehicle Engineering vocational qualification as a minimum.

A period of familiarisation and training is scheduled (Wednesday) to allow you to become acquainted with the tools, materials and equipment you will use during the competition and the tasks to be completed.

Use this time to ensure you are confident in the use of application of all the equipment you will use.

Saturday activity: Heavy Vehicle Engineering

The Saturday showcase activity gives you a chance to become the trainer and to show your skills to the public and visitors without the pressure of the competition.

On the Saturday each heavy vehicle finalist will each be the trainer/judge and man the "Have a Go" on the competition stand to provide the visitors with a hands on experience of the heavy vehicle engineering industry.

Training for the National Finals:

IMI Skills Competitions will invite the finalists to a training event at Volvo UK training centre in Stephenson College* and virtual training from Electude. This is an excellent opportunity for all competitors to boost their confidence using the equipment in a safe environment, while replicating the competition tasks and expectations.

The Training will cover:

- Updates on out come from Heats including training needs analysis
- Back to Basics
- Advanced sensors
- Advanced multimeter use
- C.A.N networks
- Inspection techniques
- Open forum

Live training events at Volvo's training centre are dependent on funding/budget

Digital Resources:

Useful product information and “How to” guides can be gained at our sponsor suppliers websites.

<https://tmdfriction.com/>

<https://www.youtube.com/channel/UCKxrC7xNUbKbBpviQX5vZhA>

<https://www.youtube.com/channel/UCKxrC7xNUbKbBpviQX5vZhA/videos>

<https://www.youtube.com/c/Wabco-auto/videos>

https://totalcare.co.uk/?gclid=EAlaIQobChMIueei66ST6wIVxrHtCh3FUQ4uEAAYASAAEgIU9PD_BwE

<https://www.forteuk.co.uk/>

<https://www.electude.com/heavy-vehicles/>

<https://www.youtube.com/channel/UCffgvTwnLInjPOD1EUQ-Mhg>

<https://www.youtube.com/watch?v=TdUK6RPdlrA>

<https://www.youtube.com/c/PicoScopeAutomotive/videos>

<https://www.youtube.com/watch?v=c9KNAIjoEYs>

<https://www.youtube.com/watch?v=UikBNF-3uOw>

<https://www.youtube.com/watch?v=O8vMFFYNifo>

<https://www.youtube.com/watch?v=1Nq2PI7q6Hk>

<https://www.youtube.com/watch?v=vkPlzmalvN4>

<https://www.youtube.com/watch?v=LEzkoF-gAn4>

<https://www.youtube.com/channel/UC0j4RPLcdNCVJPdEL-Q7m9A>

<https://www.theimi.org.uk/landing/skillauto/>

<https://tide.theimi.org.uk/>

<https://student.theimi.org.uk/competitions>

Competition Rules:

Conduct for competitors during live competitions:

- It is the competitor's responsibility to arrive on time at the event each day, late arrivals may be excluded from the competition.
- The IMI will provide accommodation for you from the Wednesday to the Sunday.
- Competitors will start and finish tasks as instructed by the judges or Competition team.
- Equipment, tools and specific safety equipment will be supplied; however competitors are required to wear the Skill Auto uniforms supplied. Please bring own safety shoes. (Without your safety shoes you may not be able to take part in the competition due to health and safety regulations).
- Any competitor who wishes to leave the area during the competition must seek the permission of the competition organisers or lead judge.
- If there is a power stoppage, breakdown of machinery or accident, the competitors must act according to the instructions of the competition organisers.
- Competitors are expected to comply with the host venue rules and regulations.
- Between tasks competitors will wait in the designated area until directed to their next task by a judge.

Beyond the National Finals:

Please note, the 2021 competition is not a selection year for the EuroSkills or International Competitions.

The IMI Skills Competitions national finals sometimes forms part of the selection process for WorldSkills International competitions. The Heavy Vehicle competition unfortunately doesn't progress to WorldSkills International however it does progress to EuroSkills. Training managers will be onsite during the competition, monitoring the performance of those who are age eligible and who show the highest skills, passion, and drive to compete could be invited to train for the EuroSkills competitions.

Further details of the international competitions including eligibility criteria can be found on the WorldSkills International website www.worldskills.org You will be notified if you are age eligible.

Those who are not eligible for EuroSkills competitions may join the Champions programme, which allows continued involvement, including the opportunity to work with WorldSkills UK and visit schools, colleges, and events to inspire the next generations.

Alternatively, if training is of interest to you, you could consider supporting WorldSkills UK with organising and training, and even helping to run the National finals.

Get inspired and you could become a part of Team UK!



