Document aimed at advanced heavy vehicle candidate qualification

This document is intended to reflect the skills of the trade that are being assessed on the provincial Advanced Heavy Vehicle Mechanical Qualification Examination.

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This document has been validated by the Technical Committee of Experts on Heavy Vehicule Mechanical Trade.

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INTRODUCTION

This document reflects the elements and skills that are assessed in the Advanced Heavy Vehicle Mechanical trade Qualification Examination in Quebec.

These requirements have been withdrawn from the documentation below;

- The occupational analysis of the heavy vehicle mechanic trade;
- DEP training program of the specialization;
- The national standard red seal for the transport truck mechanic trade.

FEATURES OF THE EXAMINATION

This is an entirely theoretical exam on a computer medium.

The Advanced Heavy Vehicle Mechanics exam is an assessment tool that aims to certify that the required knowledge and standards are met within a qualifying high-level technician. The exam is identical throughout the province of Quebec.

Obtaining a higher certificate of qualification confirms that you have the acquired knowledge and skills necessary to work in accordance with the rules governing the profession of heavy truck technician.

The advanced heavy vehicle qualification exam was developed based on taxonomy. Exam items are based on 3 levels of difficulty: Novice, intermediate, difficult.

The exam consists of 70 multiple choice questions, randomly selected from a question bank.

The questions help assess the level of understanding of different systems and the ability to diagnose and repair heavy-duty road vehicles.

The questions were written by high-level truck technicians. A technical committee approved each question.

All comments, suggestions and remarks of the candidates are gathered in a report which is periodically submitted to the technical committee to overlook.

CONDUCT

The duration of the examination is 150 minutes.

Arrive 30 minutes before the scheduled time.

A supervisor will greet you and explain the exam.

A computer will be assigned to you by the exam supervisor.

The exam software allows you to answer questions in the order you choose and return to review your answers.

If you have issues using the software or the computer, the supervisor will assist you.

EXPECTED SKILLS FOR ADVANCED HEAVY VEHICLE QUALIFICATION EXAMINATION

Engine and pollution control

Knowledge of engine and pollution control systems; the candidate must understand the following sub-elements; identifying and understanding the functions of all engine / pollution control components and understanding the interrelationship between them.

Understanding the operation of diesel engines is essential. The skills required to troubleshoot, maintain, adjust, and replace parts according to the manufacturer's recommendations and with the appropriate specialized tools must be mastered.

Your knowledge and skills will be assessed at a level of analysis and diagnosis related to the advanced mechanical issue (s) using the recommended methods.

The required knowledge reflects the following components;

- Electronic control modules (ECM);
- Sensors (sensor);
- Actuators (actuator);
- Wiring harnesses (harness).

Candidates require knowledge of all of the above mentioned components with use of a multimeter and/or required equipment (diagnostic software) to diagnose their states by interpreting and comparing results obtained by manufacturers' specifications. Trouble code reading and interpretation is also required.

Also necessary is the understanding of the different existing communication protocols (J1939, J1587, J1708) and multiplexing knowledge.

Advanced diagnostics, use of an oscilloscope, or engine performance, are a higher level of skill and must be mastered for advanced heavy vehicle examination qualification.

The candidate must be able to fully interpretate the lubrication system operation and its components including the distinction of lubricating products according to the manufacturer's recommendations.

The knowledge of the lubrication circuit diagrams and the inspection and replacement of its components must be thoroughly understood as well as the diagnosis of frequent issues.

The candidate must have the ability to evaluate oil sampling as part of a preventative maintenance program and have the ability to detect and interpret contaminated oil results.

Understanding the operation of the fuel supply systems and its components, on both conventional diesel engines and on electronically controlled diesel engines, is essential.

The interpretation of the various diesel fuels and their characteristics, in addition to the ability to detect contamination of them, must be acquired.

The applicant must interpret pressure, vacuum and restriction readings on supply circuits with manometers, flow meters or other such tools according to manufacturer's specifications. The candidate must be able to perform the interpretation as well as the diagnosis of defective parts.

Understanding of intake and exhaust systems must consist of all basic components such as air filters, manifolds, heat exchangers (Air to Air), etc., start-assist systems must be acquired. Personal knowledge must include the understanding of the system's leak detection diagnostics, contamination testing and more. Systems such as EGR, variable geometry turbocharger's, particulate filter's must be skills acquired by the aspirant.

The applicant must be able to recognize worn, damaged or defective components and make a diagnosis according to the manufacturers' recommendations.

The correct interpretation of the aftertreatment system's lamps and the associated effects are essential;

- The EGR (Exhaust Gas Recirculation) (EGR) system;
- Variable geometry (VGT) turbochargers or wastegate;
- The particulate filter and the regeneration process (DPF);
- Selective Catalytic Reduction, Urea (SCR);
- Crankcase ventilation.

In summary, it is expected that your skills and knowledge are mastered in relation to these specifics in engine and pollution control: Mechanical system, lubrication system, intake system, exhaust system, fuel system, antipollution system, and cooling system.

Braking system and hydraulic system

Different types of mechanical, pneumatic and hydraulic auxiliary braking system's existing on the market, must be acknowledged such as:

- Engine compression brake's;

- Engine brake at the exhaust's;

- Electric retarder brake's;

- Hydraulic retarding brake's;

- ABS, ATC and RSC brake's;

- In addition to the physical principles that apply to pneumatics and hydraulics, knowledge of pneumatic circuits and diagrams, hydraulic circuits and diagrams, friction principles and both disc and drum brake operation of both pneumatic and hydraulic systems fitted to heavy vehicles are crucial for troubleshooting purposes.

- Knowledge of all existing regulations and standards on braking systems must also be studied in detail in order to accomplish the advanced heavy vehicle examination. The candidates will be in measure to certify the safety and security and conformity of their repairs to heavy road vehicle's braking systems.

- Knowledge and skills in extracting and interpreting ABS and TCS Traction Control fault codes must be grasped.

- The skills expected in hydraulics begin with the theory of pressure and flow and their relation. Certain types of electrohydraulic control found on heavy vehicles such as (Snow plow's, tippers, etc.) must be understood.

- The candidates must have the ability to take pressure and flow measurements with the appropriate tooling, and this in complete safety in order to carry out the verification and conformity of hydraulic systems according to manufacturer specifications.

- This field of application consists in mastering the skills related to the hydraulic pump, cylinder and simple distributor while ensuring their safety and that of others.

- Hydraulic control pump's.

Transmission

The main element of this module concerns all types of clutch's. In addition to the acknowledgement and understanding of their operation, the applicant must be able to perform inspection's, make a diagnosis of their components and make the necessary adjustment to comply with the manufacturer's specifications, and this using the appropriate tooling. This includes clutch assist and linkage mechanisms.

In relation to other components of the power transmission system, the knowledge of their operation, their maintenance as well as the installation of power take-offs (PTO) and / or defective components such as a cooler, a gasket, brace (universal joint), etc. repair and replacement are required.

Regarding other components, referencing to the manual transmission, the automated transmission, the automatic transmission, the transfer case, the driveshaft, the differential and the driving axles is necessary.

The candidate must master the following elements:

- The data links between components;
- The connection or repair of the wiring harness';
- Clutches;
- Manual transmission's;
- Automatic transmission's;
- Automatic transmission's oil change and maintenance;
- Transmission organs;
- The correct phasing and analysis of transmission shaft angles (vibration issues);
- Differential's;
- The means for activating differential lock's.

Suspension and direction

The candidate must master the skills concerning the components related to heavy road vehicle handling, specifically a perfect understanding of the operation, inspection, maintenance, assembly and disassembly, the diagnosis of adjustment as well as repairs to the following components:

- Tires and rims;
- Bearings and wheel hubs;
  Leaf spring suspension;
- Pneumatic suspension;
- Other models of suspension found on trucks;
- Pneumatic suspension system components;
- Axles and their rod-ends;
- Spindles;
- Power steering system;
- Steering system.

Knowledge and understanding of current regulations is also crucial.

Notions of wheel angles and geometry must be known.

Testing and adjustment of hydraulically assisted steering systems with specialized equipment such as a flow meter must also be understood.

Electrical control system and comfort

The candidates mastering and expected knowledge of these systems must be of highest level. In addition to notions and knowledge in electricity and electronics, the use of a multimeter and all its functions ** in problem and / or verification troubleshooting of all electrical and electronic circuits part of a vehicle must be fully understood.

Battery connecting and verification of cables, relays, solenoids, starters, alternators, protective devices, switches and wiring harnesses with specialized tools is an integral part of the expected acknowledgments, as is the reading and interpretation of electrical diagrams per manufacturers' specifications.

Understanding of components and operation of the heating and cooling systems is required as is that of the auxiliary heating system.

The candidate must master the following skills:

- Electrical systems;
- Starting and charging systems;
- Electronic management systems;
- Multiplexed systems;
- Air conditioning systems;
- Heating systems;
- Auxiliary climate units;
- Internal and external elements;
- Driver assistance systems (Radar, and roll-over protection).

** Meter functions:
- Voltmeter
- Ammeter
- Ohmmeter
- Work cycle (duty cycle %)
- Frequency meter HZ
- Diode check
- Capacitor check
- MS or PW signal checks
- Temperature check with probe
- Min / Max
- Hold
- AC and DC voltage
- Manual or auto range

In addition to troubleshooting and servicing the cooling system and components such as the cooling fan, thermostat, radiator, block heater and auxiliary heating systems, the mastered skills of the technician must be able to interpret physical actions directly related to its operation.

The candidate must have knowledge on different products used and their characteristics as well coolant testing methods.

In conclusion, an attentive lecture of this document will enable the candidate to confirm their skills foundation required to attain the advanced qualification of truck technician certification.