



8674  
DIESEL ENGINE  
FUNDAMENTALS AND  
SERVICE (11A)

30S/30E/30M

A Heavy Duty Equipment Technician Course



# 8674 DIESEL ENGINE FUNDAMENTALS AND SERVICE (11A) 30S/30E/30M

## Course Description

Students learn the basic principles of diesel engines, the inner workings and relations of the engine components, and how those relate to vehicle operation. They also learn the procedures to service, repair, and replace engines and their components.

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**Goal 1:** Describe and apply appropriate **safety** practices for heavy duty equipment technicians.

**GLO 1.1:** Describe and apply appropriate **safety** practices for heavy duty equipment technicians.

- SLO 11A.1.1.1 Demonstrate the ability to describe and apply appropriate health and safety practices.
- SLO 11A.1.1.2 Demonstrate the ability to create and maintain a safe and organized working environment.
- SLO 11A.1.1.3 Apply safety procedures associated with hydraulic hydrostatic system servicing.
- SLO 11A.1.1.4 Apply safety procedures associated with HVAC system servicing.

### A2 Trade Safety Awareness (7 hours)

- SLO 11A.1.1.5 Identify safety and health requirements. (A2.1)
  - overview of *The Workplace Safety and Health Act* (the Act)
    - rights and responsibilities of employees under the Act
    - rights and responsibilities of employers under the Act
    - rights and responsibilities of supervisors under the Act
  - fourteen (14) regulations
  - codes of practice
  - guidelines
  - right to refuse
    - explanation of right to refuse process
    - rights and responsibilities of employees
    - rights and responsibilities of employers
    - rights and responsibilities of supervisors under the Act

- SLO 11A.1.1.6 Identify personal protective equipment (PPE) and procedures. (A2.2)
- employer and employee responsibilities as related to personal protective equipment
  - standards: Canadian Standards Association (CSA), American National Standards Institute (ANSI), and guidelines
  - work protective clothing and danger if it fits poorly
  - gloves—importance of proper glove selection (when handling chemicals, cold items, slivers, etc.)
  - headwear—appropriate protective headwear when required and the approved type of headwear
  - eye protection—comparison and distinction of everyday eyeglasses, industrial safety glasses, and safety goggles
  - foot protection—when required according to safety standards
  - hearing protection
    - hazards of various noise levels (hearing protection must be worn)
    - laws
    - types of hearing protection
  - respiratory protection—types, overview of proper selection
  - fall protection—Manitoba requirements, standards, guidelines
    - ANSI (U.S.A. standards), etc.
  - ladders and scaffolding
  - safety principles for working with or around industrial trucks site-specific (forklifts, pallet trucks, etc.)
- SLO 11A.1.1.7 Identify electrical safety. (A2.3)
- effects of electric current on the human body
  - three factors that affect the severity of an electric shock
  - the effects of arc and blast on the human body and equipment
  - work with energized equipment

- SLO 11A.1.1.8 Identify fire safety. (A2.4)
- types of fires
  - types of firefighting equipment
  - classifications of fire extinguishers (A, B, and C)
  - location of fire extinguishers and fire exits
  - fire alarms and drills
- SLO 11A.1.1.9 Identify ergonomics. (A2.5)
- definition of ergonomics and conditions that may affect the body
    - working postures
    - repetition
    - force
    - lifting (simple safety procedures and precautions related to material handling procedures on how to lift, carry, and put down a load)
    - tools
    - identify tool and safety equipment
    - causes of hand tool accidents
    - equipment
- SLO 11A.1.1.10 Hazard recognition and control. (A2.6)
- safe work practices
  - basic risk assessment
  - injury prevention and control measures
  - identification of hazards involved in pneumatic tool use and explanation of how to guard against them
- SLO 11A.1.1.11 Hazard of confined space entry. (A2.7)
- identification of a confined space
  - hazards of a confined space
    - physical
    - biological
  - working in a confined space
  - emergency response plan
  - self-contained breathing apparatus (SCBA)

- SLO 11A.1.1.12 Identify First Aid/CPR. (A2.8)
- overview of First Aid Regulation
  - obligations of employers regarding First Aid
    - Who is certified to provide First Aid?
    - What to do while waiting for help?
    - Where is First Aid kit?
  - describe basic First Aid requirements and techniques
    - scope and limits of First Aid intervention
    - specific interventions (cuts, burns, abrasions, fractures, suffocation, shock, electrical shock, etc.)
    - What is it?
    - interface with other services and agencies (e.g., Workers Compensation claims)
  - describe basic Cardiopulmonary Resuscitation (CPR) requirements and techniques
    - How do you get certified?
    - scope and limits of CPR intervention (include varieties of CPR certification)
- SLO 11A.1.1.13 Identify the safety requirements as they apply to WHMIS with emphasis on (A2.9)
- WHMIS is a system
  - provincial regulation under *The Workplace Safety and Health Act*
    - each province has a WHMIS regulation
  - federal *Hazardous Products Act*
  - WHMIS generic training:
    - WHMIS defined and the format used to convey information about hazardous materials in the workplace
    - information found on supplier and workplace labelling using WHMIS
    - hazardous materials in accordance with WHMIS
    - compliance with government safety standards and regulations
  - description of WHMIS (include varieties of WHMIS certification)
    - typology of WHMIS labels, symbols, and classifications
    - scope and use of Materials Safety Data Sheets (MSDS)

- SLO 11A.1.1.14 Identifying and controlling hazards. (A2.10)
- basic control measures (injury prevention)
  - safe work procedures
  - explanation on the importance of industrial housekeeping
  - employer responsibilities
  - how and where to store materials
  - safety measures related to walkways, stairs, and floor openings
  - explanation of how to protect the worker and others when working in traffic paths
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**Goal 2: Identify, select, use, and maintain tools, equipment, materials, and consumables.**

**GLO 2.1: Identify, select, use, and maintain tools, equipment, materials, and consumables.**

- SLO 11A.2.1.1 Demonstrate the knowledge and skills required to identify, select, use, and maintain tools, equipment, materials, and consumables used in the maintenance and repair of diesel engines.

**A3 Tools and Equipment (28 hours)**

- SLO 11A.2.1.2 Define terminology associated with workshop practices and materials. (A3.1)
- tools and equipment
  - hoisting and lifting
  - moving machinery
  - materials
    - aluminum
    - steel
    - cast iron
    - brass
    - copper
    - plastics/composites

- fasteners and sealants
    - gaskets
    - seals
    - sealing compounds
    - nuts/bolts/screws
    - tubes/hoses/fittings/clamps
  - bearings
    - friction-type
    - non-friction-type
- SLO 11A.2.1.3 Describe and identify tools and equipment. (A3.2)
  - hand tools
  - measuring tools
  - power tools
  - shop equipment
- SLO 11A.2.1.4 Explain and demonstrate the principles of use of workshop tools and equipment. (A3.3)
  - tools and equipment
    - hand tools
    - measuring tools
    - cleaning tools
  - materials
    - aluminum
    - steel
    - cast iron
    - brass
    - copper
    - plastics/composites
  - fasteners and sealants
    - gaskets
    - seals
    - sealing compounds
    - nuts/bolts/screws
    - tubes/hoses/fittings/clamps
- SLO 11A.2.1.5 Describe the procedures used to start, move, and shut down machinery. (A3.4)
  - lock out/tag out
  - situational awareness

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**Goal 3: Maintain, diagnose, and repair HDE systems.****GLO 3.1:** Perform **maintenance** on HDE systems.

- SLO 11A.3.1.1 Demonstrate the knowledge and skills required to perform maintenance on diesel engines.
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**GLO 3.2: Diagnose** issues with HDE systems.

- SLO 11A.3.2.1 Demonstrate the knowledge and skills required to diagnose issues related to diesel engines.

## A8 Hoisting and Lighting (7 hours)

- SLO 11A.3.2.2 Define terminology associated with hoisting and lifting. (A8.1)

- SLO 11A.3.2.3 Describe towing, lifting, and hoisting equipment and their procedures. (A8.2)

- hoisting and lifting equipment, including their limitations
  - safety practices, hand signals communications, and maintenance of hoisting and lifting equipment
  - towing, transporting, and coasting precautions
  - hoisting and lifting equipment construction, grading, sizing, and limits
  - selection and inspection of correct equipment for rigging typical loads
  - hoisting and lifting equipment including slings, ropes, and chains
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**GLO 3.3: Repair** HDE systems.

## A5 Engine Principles (35 hours)

- SLO 11A.3.3.1 Define terminology associated with engine principles. (A5.1)

- SLO 11A.3.3.2 Explain the principles and theories of engine operation. (A5.2)

- basic combustion principles
- two-stroke cycle
- four-stroke cycle
- compression ignition
- spark ignition

- SLO 11A.3.3.3 Identify types and classifications of engines and describe their applications. (A5.3)
- diesel
  - gasoline
  - liquid-cooled
  - air-cooled
- SLO 11A.3.3.4 Identify major engine components and describe their purpose and operation. (A5.4)
- cooling
  - lubrication
  - diesel fuel supply systems
  - intake and exhaust
  - starting aids
  - base engine components
    - cylinder block and head
    - valve train
    - pistons and connecting rods
    - crankshaft
    - emission components
- SLO 11A.3.3.5 Demonstrate the knowledge and skills required to repair diesel engine systems.
- SLO 11A.3.3.6 Demonstrate the knowledge and skills required to describe sealing devices, to install them, and to perform seal service.
- SLO 11A.3.3.7 Demonstrate an awareness of engine performance.
- SLO 11A.3.3.8 Demonstrate an awareness of engine construction.
- SLO 11A.3.3.9 Demonstrate the knowledge and skills required to perform the removal, installation, disassembly/assembly inspection, and reconditioning of engine systems.
- SLO 11A.3.3.10 Demonstrate the knowledge and skills required to describe and perform procedures to diagnose, service, and repair engine lubrication systems.
- SLO 11A.3.3.11 Demonstrate an awareness of the servicing of engine oil and filters.
- SLO 11A.3.3.12 Demonstrate an awareness of cooling system types, operation, and service.
- SLO 11A.3.3.13 Demonstrate an awareness of HDE starting aids.
- SLO 11A.3.3.14 Demonstrate an awareness of air intake and exhaust system design and operation.
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**Goal 4:** Describe and demonstrate the transferable **cross-curricular** knowledge and skills pertaining to HDE technology.

**GLO 4.1: Read, interpret, and communicate** information relevant to HDE technology.

SLO 11A.4.1.1 Demonstrate the ability to read, interpret, and communicate information found on components, equipment, manuals, and service records.

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**GLO 4.2:** Apply knowledge and skills from **mathematics** to HDE technology.

SLO 11A.4.2.1 Demonstrate the mathematical skills required for working on diesel engines.

SLO 11A.4.2.2 Demonstrate proficiency in the use of fractions, decimals, ratios, and percentages, and in converting between different units of measure (i.e., metric and imperial [standard]).

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**GLO 4.3:** Apply knowledge and skills from the **sciences** to HDE technology.

SLO 11A.4.3.1 Demonstrate an understanding of the viscosity of liquids.

SLO 11A.4.3.2 Demonstrate an understanding of pressure in diesel engine systems.

SLO 11A.4.3.3 Demonstrate an understanding of the chemicals used in diesel engine systems.

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**GLO 4.4:** Apply knowledge and skills from **information and communication technology** to HDE technology.

SLO 11A.4.4.1 Describe general organization and basic retrieval strategies for trade-related documents. (A4.5)

- service bulletins
- tech bulletins
- service manuals
- other publications
- online resources, including Learning Management Systems (LMSs)

- SLO 11A.4.4.2 Demonstrate trade-related computer skills. (A4.6)
- basic computer skills
    - application programs
    - common computer commands
    - file management tasks (create and organize)
  - Internet searching skills for trade-related research
    - search engines via Universal Resource Locator (URL) addresses
    - key word search
    - filtering results
- SLO 11A.4.4.3 Demonstrate an awareness of shop management software (e.g., electronic work order software).
- SLO 11A.4.4.4 Demonstrate an understanding of the use of electronic diagnostic tools.

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**Goal 5:** Demonstrate an awareness of **sustainability** as it pertains to HDE technology.

**GLO 5.1:** Describe the HDE industry's **sustainability practices** and its impact on the environment.

- SLO 11A.5.1.1 Demonstrate an awareness of the impact of chemical hazards on the environment.
- SLO 11A.5.1.2 Demonstrate an awareness of efficient material usage to reduce waste and its impact on the environment.
- SLO 11A.5.1.3 Demonstrate environmentally responsible disposal practices.

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**GLO 5.2:** Describe the impact of the HDE industry on **human health and well-being**.

- SLO 11A.5.2.1 Demonstrate an awareness of the long-term health hazards related to the servicing and maintenance of diesel engines.

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**GLO 5.3:** Describe **sustainable business practices** within the HDE service and repair industry.

- SLO 11A.5.3.1 Demonstrate an awareness of the relationship between the state of the economy and the nature of repairs and servicing requested by customers.
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**Goal 6:** Demonstrate an awareness of **ethics** and **legal standards** as they pertain to the HDE industry.

**GLO 6.1:** Demonstrate an awareness of **ethics** as they pertain to the HDE industry.

SLO 11A.6.1.1 Demonstrate an awareness of own ethics, and how they might have been acquired.

SLO 11A.6.1.2 Demonstrate an awareness of some of the ways in which own ethics benefit self and others.

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**GLO 6.2:** Demonstrate an awareness of **legal standards** as they pertain to the HDE industry.

SLO 11A.6.2.1 Demonstrate an awareness of liability concerns related to HDE systems and service.

SLO 11A.6.2.2 Demonstrate an awareness of the motor vehicle licences required to operate heavy duty equipment.

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**Goal 7:** Demonstrate **employability skills** related to the HDE industry.

**GLO 7.1:** Demonstrate fundamental **employability skills**.

SLO 11A.7.1.1 Demonstrate regular attendance and punctuality.

SLO 11A.7.1.2 Demonstrate the ability to take responsibility for own actions.

SLO 11A.7.1.3 Demonstrate adaptability, initiative, and effort.

SLO 11A.7.1.4 Demonstrate the ability to accept and follow direction and feedback.

SLO 11A.7.1.5 Demonstrate the ability to work as a member of a team.

SLO 11A.7.1.6 Demonstrate the ability to stay on task and to make effective use of time.

SLO 11A.7.1.7 Describe the importance of effective communication. (A4.1)

- customers
- co-workers
- related professionals
- journeyperson/apprentice

- SLO 11A.7.1.8 Describe and demonstrate the methods of professional communication. (A4.2)
- phone
  - email
  - instant messaging/texting
  - fax
  - other methods of communication
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**GLO 7.2:** Demonstrate an understanding of the **business operation** of an HDE service and repair facility.

- SLO 11A.7.2.1 Demonstrate an awareness of the importance of documentation and service reporting.
- SLO 11A.7.2.2 Demonstrate an awareness of the use of flat rate guidelines in the HDE service and repair industry.
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**GLO 7.3:** Demonstrate the knowledge, skills, and attitudes required to **think critically** in order to **solve complex problems**.

- SLO 11A.7.3.1 Demonstrate an awareness of some of the steps required to solve problems.
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**GLO 7.4:** Demonstrate an awareness of **cultural competence**, and its importance in the workplace.

- SLO 11A.7.4.1 Demonstrate an awareness of cultural competence.
- SLO 11A.7.4.2 Demonstrate an awareness of at least one of one's own cultures.
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**Goal 8:** Demonstrate an understanding of the **scope** of the HDET trades (along with associated occupations), including **working conditions**, and **training** and **career opportunities**.

**GLO 8.1:** Demonstrate an understanding of the **scope** of the HDET trades and associated occupations, including **working conditions**.

- SLO 11A.8.1.1 Demonstrate an awareness of the scope of HDET trades and associated occupations.
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**GLO 8.2:** Demonstrate an understanding of **career** and **training opportunities** in HDE technology and associated professions.

- SLO 11A.8.2.1 Demonstrate an awareness of career and training opportunities related to servicing diesel engines.
- SLO 11A.8.2.2 Demonstrate an awareness of apprenticeship and the High School Apprenticeship Program (HSAP).
- SLO 11A.8.2.3 Demonstrate an awareness of apprenticeship, including how to become an apprentice and how to earn journeyman certification.

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**Goal 9:** Demonstrate an awareness of the **evolution** of HDE technology, including its **technological progression and emerging trends**.

**GLO 9.1:** Describe the evolution of HDE service and repair, including its **technological progression and emerging trends**.

No applicable SLOs.

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