Apprenticeship Manitoba

Manitoba

Diesel Engine Mechanic (DEM)
Level 1

Rev. June 2011

Apprenticeship Manitoba

Diesel Engine Mechanic (DEM)

Unit: A1 Orientation I: The Structure and Scope of DEM Trade Learning

Level: One

Duration: 7 hours

Theory: 7 hours

Practical: 0 hours

Overview:

Jobsite learning and teaching have long been fundamental to DEM trade-practice, including its safety, health, and environmental implications. The chance to gain maximum benefit from workplace trade learning can be shaped by such complex factors as production schedules and jobsite politics. As adult trade-learners, DEM apprentices at all levels of skill-development are encouraged to use their eyes, ears, prior knowledge, and interpersonal skills to encourage journeypersons to teach as well as to supervise them. This requires understanding the trade's dynamics, including the roles and responsibilities that order jobsite activity. Unit content outlines the trade's skill-requirements and long-term career possibilities. It includes suggestions about trade-related learning styles/strategies. It also introduces the concept of skills stewardship, stressing the obligations that apprentices incur in learning from journeypersons to 'pay it forward' by assisting other newcomers who will follow them into the trade. The unit's purpose is to provide this essential information about learning to learn as a Manitoba Diesel Engine Mechanic apprentice. Elsewhere in Technical Training, senior apprentices explore the importance of learning to teach in trade workplaces – a central function of Diesel engine mechanic journeywork.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Describe the structure and scope of the trade.	**20%**
a. Historical background, including apprentice experiences	
b. Structure/scope of the trade	
• International and national characteristics	
• Important features of practicing the trade in Manitoba	
• Trade and construction industry organizations	
• Generalists and specialists	
• Lead hands and other immediate supervisors	
• Geographic mobility	
• Job hierarchies and innovations	
2. Describe the Manitoba Diesel Engine Mechanic (DEM) Apprenticeship Program.	**40%**
a. Concept and significance of skills stewardship	
• To the trade	
• To apprentices	
• To journeypersons	
• To employers	

b. Practical Training: on-site component of program
   - Roles/responsibilities of employer and journeyperson(s)
   - Roles/responsibilities of Training Coordinator
   - Roles/responsibilities of apprentice, including record-keeping re: job experience

c. Technical Training: off-site component of program
   - Roles/responsibilities of instructors (including Related'-area faculty)
   - Roles/responsibilities of apprentices

d. Attendance requirements

e. Progression requirements

f. Reporting of grades

g. Other (as may be specified by instructor)

3. Describe special opportunities and challenges re: Diesel engine mechanic training. 40%

a. Adapting personal learning goals to program contexts
   - Principles of adult learning (including importance of self-direction)
   - Description/recognition of learning and teaching styles
   - Significance of work culture and interpersonal skills re: trade-learning
   - Integrating Technical Training and Practical Training content
   - Possibilities and perils of peer learning
   - Budgeting and other necessary personal arrangements
   - Identifying sources of support (e.g. upgrading trade-related math skills)

b. On-site learning challenges and opportunities
   - Significance of jobsite supervision roles and teaching styles (e.g. journey-level skills-coach vs. mentor)
   - Communication with journeypersons and employers
   - Coverage of prescribed tasks/subtasks that define the scope of trade, and the content of the certification exam administered to apprentices who are completing their program
   - Getting help and fixing mistakes
   - Maintaining personal record of trade-learning challenges/achievements (e.g. a learning journal, and/or a personal training plan, if possible, discussed with employers and others supporting the apprenticeship journey to certification)

c. In-school opportunities/challenges
   - Personal arrangements that support progress in technical training
   - "Baggage-handling" – self-assessing potential impacts of previous experiences (favourable/unfavourable) on current learning; availability of supports
   - Techniques for note-taking, record-keeping, and review
   - Relations with instructors (including 'Related'-area faculty)
   - College resources (library, support services, etc.)

****

Apprenticeship Manitoba

Diesel Engine Mechanic (DEM)

Unit: A2 Trade Safety Awareness

Level: One

Duration: 7 hours

Theory: 7 hours

Practical: 0 hours

Overview:

Safe working procedures and conditions, injury prevention, and the preservation of health are of primary importance to industry in Canada. These responsibilities are shared and require the joint efforts of government, employers, and employees. It is imperative that all parties become aware of circumstances that may lead to injury or harm. Safe learning experiences and environments can be created by controlling the variables and behaviours that may contribute to incidents or injury. It is generally recognized that safety-conscious attitudes and work practices contribute to a healthy, safe, and accident-free working environment. It is imperative to apply and be familiar with the Workplace Safety and Health Act and Regulations. As well, it's essential to determine workplace hazards and take measures to protect oneself, co-workers, the public, and the environment. Safety education is an integral part of Diesel Engine Mechanic apprenticeship training both in school and on-the-job. Unit content is supplemented throughout Technical Training by trade-specific information about Diesel Engine Mechanic safety hazards and precautions presented in the appropriate contexts of discussion and study. ***Note*: No percentage-weightings for test purposes are prescribed for this unit's objectives. Instead, a 'Pass/Fail" grade will be recorded for the unit in its entirety.**

Objectives and Content:	**Percent of Unit Mark (%)**
1. Identify safety and health requirements.	n/a
a. Overview of The Workplace Safety and Health 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 b. Fourteen (14) regulations c. Codes of practice d. Guidelines e. 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	
2. Identify personal protective equipment (PPE) and procedures. a. Employer and employee responsibilities as related to personal protective equipment. b. Standards: ANSI (U.S.A. standards), etc. c. Work protective clothing and danger if it fits poorly.	

d. Gloves – Importance of proper glove selection (when handling chemicals, cold items, slivers, etc.)
e. Headwear – appropriate protective headwear when required and the approved type of headwear.
f. Eye protection – comparison and distinction of everyday eyeglasses, industrial safety glasses and safety goggles
g. Foot protection – when required according to safety standards
h. Hearing protection
   - Hazards of various noise levels (hearing protection must be worn)
   - Laws
   - Types of hearing protection
i. Respiratory protection – types, overview of proper selection
j. Fall protection – Manitoba requirements standards guidelines
   - ANSI (U.S.A. standards), etc.
k. Ladders and scaffolding
l. Safety principles for working with or around industrial trucks site-specific (forklifts, pallet trucks, etc.)

3. Identify regulations pertinent to care and cleanliness in the working area.

4. Identify the regulations relevant to the safe use of chemicals.

5. Identify regulations governing the use of scaffolding.

6. Identify regulations governing the use of ladders and related equipment.

7. Identify ergonomics.

a. Definition of ergonomics and conditions that may affect the body
   - Working postures
   - Repetition
   - Force
   - Lifting
   - Tools
   - Identify tool and safety equipment
   - Causes of hand tool accidents
   - equipment

8. Hazard recognition and control.

a. Safe work practices
b. Basic risk assessment
c. Injury prevention and control measures
d. Identification of hazards involved in pneumatic tool use and explanation of how to guard against them
e. Refrigerants
f. Toxic chemical (non-refrigerant)
g. High pressure fluids

9. Hazard of confined space entry.

a. Identification of a confined space
b. Hazards of a confined space (including physical and biological hazards)
c. Working in a confined space

d. Emergency response plan
e. Self-contained breathing apparatus (SCBA)

10. Identify first aid/CPR.

a. Overview of first aid regulation
b. 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?
c. 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)
d. Describe basic CPR requirements and techniques
   - How do you get certified?
   - Scope and limits of CPR intervention (include varieties of CPR certification)

11. Identify the safety requirements as they apply to WHMIS with emphasis on:

a. WHMIS is a system
b. Provincial regulation under the Safety and Health Act
   - Each province has a WHMIS regulation
c. Federal Hazardous Products Act
d. WHMIS generic training:
   - WHMIS defined and the format used to convey information about hazardous materials in the workplace
   - Information found on supplier and workplace labeling using WHMIS
   - Hazardous materials in accordance with WHMIS
   - Compliance with government safety standards and regulations
e. Description of WHMIS (include varieties of WHMIS Certification)
   - Typology of WHMIS labels, symbols, and classifications
   - Scope and use of Materials Safety Data Sheets (MSDS)

12. Identifying and controlling hazards.

a. Basic control measures (injury prevention)
b. Safe work procedures
c. Explanation on the importance of industrial housekeeping
d. Employer responsibilities
e. How and where to store materials
f. Safety measures related to walkways, stairs and floor openings
g. Explanation of how to protect the worker and others when working in traffic paths

13. Describe the safe storage of stock equipment in service vehicles.

14. Discuss transportation of dangerous goods.

****

Apprenticeship Manitoba

Diesel Engine Mechanic (DEM)

Unit: A4 Tools and Equipment

Level: One

Duration: 35 hours

Theory: 15 hours

Practical: 20 hours

Overview:

This unit of instruction is designed to provide the Diesel Engine Mechanic apprentice with the knowledge to describe and to use basic hand tools, shop tools, safety equipment, rigging, hosting and securing equipment, cleaning equipment, and measuring tools, gauges and equipment.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Describe/demonstrate the use of basic hand tools.	**10%**
2. Describe/demonstrate the use of shop tools.	**10%**
3. Describe/demonstrate the use of safety equipment.	**25%**
4. Describe/demonstrate the use of rigging, hoisting and securing equipment.	**20%**
5. Describe/demonstrate the use of cleaning equipment.	**5%**
6. Describe/demonstrate the use of measuring tools, gauges and equipment.	**30%**

***

Apprenticeship Manitoba

Diesel Engine Mechanic (DEM)

Unit: A5 Planning and Communication Skills

Level: One

Duration: 7 hours

Theory: 7 hours

Practical: 0 hours

Overview:

This unit of instruction is designed to help the Diesel Engine Mechanic apprentice develop planning and communication skills, including time management skills that facilitate effective work objectives and positive interaction with customers and industry peers.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Describe government policies, procedures, guidelines and standards. a. Work-related accident reporting procedure of the Workers Compensation Board (WCB) b. Legislation and regulations that govern workplace safety and health	**30%**
2. Describe aspects of public relations/customer service and interactions with suppliers.	**10%**
3. Describe basic communications principles and practices.	**15%**
4. Describe and perform key on-the-job written communications duties, including work orders.	**25%**
5. Describe task and time management skills, including sequencing of jobs and estimating repair times.	**20%**

***

Apprenticeship Manitoba

Diesel Engine Mechanic (DEM)

Unit: A6 DEM Trade-Related Mathematics

Level: One

Duration: 14 hours

Theory: 10 hours

Practical: 4 hours

Overview:

This unit of instruction is intended to help make the world of numbers and shapes work for, rather than against, the DEM apprentice. Content includes a brief review of basic math concepts and operations, but its major focus concerns applications in actual trade practice. Apprentices will extend their trade-math skills elsewhere in technical training – for example, in preparing project estimates and layouts. The unit also includes up-to-date information about 'math anxiety,' and how it can be overcome. ***Note**: Although this unit includes a review of math basics, and provides some tools for building skill and confidence in applying them, it is not a remedial math course. Unit content assumes a prior familiarity with math basics. Apprentices who might require upgrading in this area are strongly encouraged to consult with their Apprenticeship Training Coordinator and/or their Instructor early in the program to identify suitable options and resources for math-skills upgrading where appropriate.*

Objectives and Content: **Percent of Unit Mark (%)**

1. **Describe the practical importance and application of math disciplines to the DEM trade.** **30%**
   a. Definition and scope of relevant math disciplines
   b. Detailed examples
      - Plane geometry and calculating rates of coverage by materials (e.g. railway car paint)
      - Ratio/proportion and technical drawing to scale
      - Other (specified by instructor)
   c. Time-sheets, wages, and personal budgeting
   d. Engineering of tools and equipment
   e. Manufacture and packaging of materials and products
   f. Trade documents
   g. Standards, codes, tolerances, and other specifications
   h. Computer technology/applications
   i. Design/technical drawing
   j. Estimation and bidding
   k. Project planning and monitoring
   l. Materials procurement, inventory, and optimization
   m Machinery and equipment set-up
   n. Measurement and lay-out
   o. Temperatures, pressures, and other measured: properties of materials and tools

p. Customer relations/perceptions (e.g. schedules, timetables, etc.)
q. Business management

2. Describe "math anxiety" and its remedies. 5%

a. Definition
b. Recognition
c. Options, resources, and techniques for overcoming math anxiety
d. Other common problems
   - Importance of personal awareness of math strengths/learning needs
   - Importance of early resolution during term of apprenticeship
   - Options/resources for remedial math instruction and other assistance

3. Review general math concepts and use of electronic calculator. 25%

a. Basic operations
b. Ratio and proportion
c. Percentage calculations
d. Constructing/solving simple equations
e. Units of measure
   - Imperial
   - Metric (SI)
   - Conversion factors
f. Calculator use
   - Basic operation keys/functions
   - Percentage keys/functions
   - Keys/functions re: memory and constants

4. Perform trade-related calculations as specified by instructor. 40%

a. Linear measurement
   - Rectangular/triangular dimensions
   - Radius/diameter/circumference
b. Area and volume
   - Squares/rectangles
   - Triangles
   - Circles/cylinders
   - Irregular shapes
c. Ratio/proportion
   - Ratios
   - Percentages
   - Rates
   - SI/Metric Units (including conversions)

****

Apprenticeship Manitoba

Diesel Engine Mechanic (DEM)

Unit: A7 Access, Hoisting, Lifting, and Rigging

Level: One

Duration: 7 hours

Theory: 7 hours

Practical: 0 hours

Overview:

This unit of instruction is designed to provide the Diesel Engine Mechanic apprentice with the working knowledge required to effectively and safely use proper lifting techniques and equipment as defined by broad occupational health and safety standards.

Objectives and Content:		Percent of Unit Mark (%)
1.	**Describe access and lifting equipment, including their limitations.**	**15%**
2.	**Describe safety practices and maintenance of access and lifting equipment.**	**20%**
3.	**Describe towing, transporting and coasting precautions.**	**5%**
4.	**Describe lifting equipment construction, grading, sizing and limits.**	**15%**
5.	**Describe the selection of correct equipment for rigging typical loads.**	**15%**
6.	**Describe lifting equipment including slings, ropes, chains, etc.**	**20%**
7.	**Describe winch design, operation and troubleshooting procedures.**	**10%**

***

Apprenticeship Manitoba

Diesel Engine Mechanic (DEM)

Unit: A8 Computer Applications

Level: One

Duration: 7 hours

Theory: 5 hours

Practical: 2 hours

Overview:

This unit of instruction is designed to provide the Diesel Engine Mechanic apprentice with the working knowledge required to use proprietary software and to access service-related information from various retrieval systems and to describe trade-related computer applications.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Describe basic computer components and operations, including Internet searches and functions, and proprietary software.	**30%**
2. Access and interpret service-related information from various retrieval systems. a. Automated and other information retrieval systems	**30%**
3. Describe trade-related computer applications, including diagnostic platforms.	**40%**

***

Apprenticeship Manitoba

Diesel Engine Mechanic (DEM)

Unit: A9 Trade Related Documents

Level: One

Duration: 7 hours

Theory: 2 hours

Practical: 5 hours

Overview:

This unit is designed to provide the Diesel Engine Mechanic apprentice with the knowledge about trade related documents used in today's diesel engine industry. Beginning with the uses of the service and parts manuals, this unit covers the use of service manuals, parts manuals, the parts ordering procedure and the information required to prepare a work order. There is a trend towards more access to trade information through new information technologies such as CD-ROMs and the Internet. With these developments, future diesel engine mechanics must be readily able to use service and parts manuals to find service procedures and parts numbers, and be able to take and complete work orders for the repair and service of diesel engine equipment.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Describe/demonstrate the selection and use of the correct service manual and parts manual for diesel engine and related equipment.	**60%**
2. Describe parts ordering procedures for diesel engine equipment.	**30%**
3. Describe information required in a typical work order.	**10%**

***

Apprenticeship Manitoba

Diesel Engine Mechanic (DEM)

Unit: A10 Fasteners, Adhesives and other Consumables

Level: One
Duration: 7 hours
Theory: 6 hours
Practical: 1 hour

Overview:

This unit introduces Diesel engine mechanic apprentices to the wide array of fasteners, adhesives and other consumables. The unit covers both metric and U.S. standard and other considerations when working with adhesives, fasteners and other consumables.

Objectives and Content:	Percent of Unit Mark (%)
1. Describe special safety hazards and precautions as they relate to fasteners, adhesives and other consumables such as: fumes, tensile strength and toxic substances.	**10%**
2. Describe the properties of metric and U.S. standard threaded fasteners.	**35%**
3. Describe the operating characteristics and types of adhesives.	**30%**
4. Describe the selection and use of consumables.	**10%**
5. Demonstrate the installation and use of fasteners.	**15%**

***

Apprenticeship Manitoba

Diesel Engine Mechanic (DEM)

Unit: A11 Standards and Regulations (General and Industry Specific)

Level: One

Duration: 14 hours

Theory: 14 hours

Practical: 0 hours

Overview:

This unit of instruction is designed to provide the Diesel Engine Mechanic apprentice with the working knowledge of the regulatory environment and its significance for trade practices. A major focus of the unit is exposure to the regulatory requirements for each of the hydro, mining and railway sectors.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Describe regulatory environment and its general significance and implications for Diesel Engine Mechanic trade practice.	**55%**
2. Describe regulatory requirements, such as the Manitoba Hydro Act and the Hydro Safety Book, and their operational significance to the hydro-sector Diesel Engine Mechanic trade practice.	**15%**
3. Describe regulatory requirements, such as the Mines Act, MOPIA and related environmental protection standards, and their operational significance to the mining resource sector Diesel Engine Mechanic trade practice.	**15%**
4. Describe regulatory requirements, such as the Federal Railroad Administration (FRA) requirements, Transport Canada regulations, American Association of Railways (AAR) rules and other employer-specific procedures, and their operational significance to the railway sector Diesel Engine Mechanic trade practice.	**15%**

***

Apprenticeship Manitoba

Diesel Engine Mechanic (DEM)

Unit: B1 Fundamentals of Diesel Engines

Level: One

Duration: 28 hours

Theory:	28	hours
Practical:	0	hours

Overview:

This unit of instruction is designed to provide the Diesel Engine Mechanic apprentice with the working knowledge required to describe and work with diesel engine terminology and principles.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Describe special safety hazards and precautions as they relate to diesel engine fundamentals such as: rotating parts, high temperatures, confined spaces and toxic/flammable substances.	**20%**
2. Describe diesel engine related terminology.	**30%**
3. Describe diesel engine operating principles and classifications.	**50%**

***

Apprenticeship Manitoba

Diesel Engine Mechanic (DEM)

Unit: B2 Diesel Engine Internal Components

Level: One
Duration: 70 hours
Theory: 15 hours
Practical: 55 hours

Overview:

This unit of instruction is designed to provide the Diesel Engine Mechanic apprentice with the working knowledge required to effectively and safely diagnose, service and repair diesel engine internal components.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Describe special safety hazards and precautions as they relate to diesel engine internal components, such as: massive and moving objects, pinch points, chemicals and corrosive/toxic substances.	**10%**
2. Describe/demonstrate diesel engine construction; diesel engine component removal, installation, assembly/disassembly, and inspection/reconditioning procedures.	**60%**
3. Describe and perform procedures to diagnose, service and repair engine lubrication systems.	**30%**

***

Apprenticeship Manitoba

Diesel Engine Mechanic (DEM)

Unit: B3 Diesel Engine Support Systems

Level: One

Duration: 21 hours

Theory: 15 hours

Practical: 6 hours

Overview:

This unit of instruction is designed to provide the Diesel Engine Mechanic apprentice with the working knowledge required to diagnose, service and repair diesel engine support systems. The unit also covers cooling systems, air intake/exhaust systems, and engine protection devices (EPDs).

Objectives and Content:	**Percent of Unit Mark (%)**
1. Describe special hazards and precautions as they relate to diesel engine support systems, such as: heat (high temperature), combustibles and massive rotating equipment.	**10%**
2. Describe/demonstrate the servicing of engine oil, filters and startup.	**25%**
3. Describe/demonstrate cooling system operation and service, including cooling system construction.	**25%**
4. Describe/demonstrate starting aids such as block heaters and other warm-up devices, cooling heaters (e.g., ProHeat or Espar), ether kits and glow plugs.	**10%**
5. Describe/demonstrate design and operation of air intake and exhaust system.	**20%**
6. Describe/demonstrate functions, operation, diagnosis and repair of engine protection devices (EPDs).	**10%**

***

Apprenticeship Manitoba

Diesel Engine Mechanic (DEM)

Unit: E1 Basic Electrical Principles and Testing

Level: One

Duration: 42 hours

Theory: 35 Hours

Practical: 7 Hours

Overview:

This unit of instruction is designed to provide the Diesel Engine Mechanic apprentice with the working knowledge required to effectively and safely apply electrical principles and testing concepts as they relate to circuits, wiring and components, batteries and charging systems, and diesel engine alternators and charging/starting systems.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Describe special hazards and precautions as they relate to electrical principles and testing, such as shocks, burns, explosions, toxic substances, etc.	**5%**
2. Describe basic AC/DC theory and electrical fundamentals, including AC/DC, series and parallel circuits, and circuit components.	**40%**
3. Describe/demonstrate the use of test equipment to diagnose basic electrical wiring and components.	**25%**
4. Describe trade practices re: batteries and charging systems, including ratings, diagnoses/servicing, connections, testing, and safety hazards specific to batteries.	**10%**
5. Describe the function and operation of diesel engine alternators and charging and starting systems.	**20%**

***

Apprenticeship Manitoba

Diesel Engine Mechanic (DEM)

Unit: A13 Welding

Level: One

Duration: 42 hours

Theory: 7 hours

Practical: 35 hours

Overview:

This unit of instruction is designed to provide the Diesel Engine Mechanic apprentice with the working knowledge required to weld effectively and safely using oxy-acetylene and electric arc welding equipment, and related consumables.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Describe special hazards and precautions as they relate to welding, such as: shock, burns, welding flash, flammable and combustible gas and fire hazards.	**10%**
2. Describe the fundamentals of the welding process.	**20%**
3. Describe and identify the components of oxy-acetylene equipment.	**35%**
4. Describe/demonstrate the components and applications of electric arc welding equipment and consumables.	**35%**

***