

Marine and Outdoor Power Equipment Technician Level 3

Marine and Outdoor Power Equipment Technician

Unit: D2 Transmission Systems

Level: Three

Duration: 85 hours

Theory: 40 hours

Practical: 45 hours

Overview:

This unit is designed to provide the apprentice with the knowledge about the principles of transmission systems found in today's marine and outdoor power equipment. Beginning with an overview of primary drive systems terminology, the unit covers the major parts and principles of operation of various types of transmission systems. The unit ends with coverage of diagnostic and repair procedures for the various types of transmission systems. Drivetrains on both marine and outdoor power equipment have benefited from engineering enhancements, from improved piston design to the use of new lighter-weight components using carbon fiber. Increasingly, units come standard with digital operator controls and digital throttle and shift (DTS).

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Define terminology associated with transmission systems.	10%
2. Identify the major parts of various types of transmission systems.	10%
a. Constant Mesh	
b. Variable-ratio Belt	
c. Automatic	
d. Fluid-drive	
3. Describe the principles of operation of various types of transmission systems.	10%
a. Constant Mesh	
b. Variable-ratio Belt	
c. Automatic	
d. Fluid-drive	
4. Describe the diagnostic procedures for various types of transmission systems.	10%
a. Manufacturers' specifications	
b. Common causes of failure	
5. Describe repair procedures for transmission systems.	10%
6. Perform inspection and evaluation of various types of transmission systems and related components.	25%
a. Measurements	
• Constant mesh: shaft end play, gear shimming and fork clearance	

- Variable-ratio belt: belt width and spring free length
 - Automatic and fluid-drive: oil pressure and flow
- b. Determine causes of component failure

7. Perform repair procedures on various types of transmission systems.

25%

- a. Measurements
- b. Correct causes of component failure

Marine and Outdoor Power Equipment Technician

Unit: D3 Final Drive Systems

Level: Three

Duration: 90 hours

Theory: 40 hours

Practical: 50 hours

Overview:

This unit is designed to provide the apprentice with the knowledge about the principles of final drives found in today's marine and outdoor power equipment. Beginning with an overview of final drive systems terminology, the unit covers the major components and principles of operation of final drive systems. The unit ends with coverage of diagnostic and repair procedures (including inspection and evaluation) of final drive systems. Drivetrains on both marine and outdoor power equipment have benefited from engineering enhancements, from improved piston design to the use of new lighter-weight components using carbon fiber. Increasingly, units come standard with digital operator controls and digital throttle and shift (DTS).

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Define terminology associated with final drive systems.	10%
2. Identify the major components of final drive systems.	10%
a. Shaft and gear	
b. Chains	
c. Sprockets	
d. Belts	
e. Pulleys	
3. Describe the principles of operation of final drive systems and their major components.	10%
a. Shaft and gear	
b. Chains	
c. Sprockets	
d. Belts	
e. Pulleys	
4. Describe the diagnostic procedures for final drive systems.	10%
a. Manufacturers' specifications	
b. Common causes of failure	
5. Describe repair procedures for final drive systems.	10%
6. Perform inspection and evaluation of final drive systems and related components.	25%

- a. Sensory Inspection
- b. Evaluation of component conditions
- c. Measurements
 - Backlash of gear
- d. Determine causes of component failure

7. Perform repair procedures on various types of transmission systems.

25%

- a. Removal and replacement of components
- b. Adjustments
 - Chain adjustment
 - Belt tension adjustment
 - Sprocket/pulley alignment
- c. Correct causes of component failure

Marine and Outdoor Power Equipment Technician

Unit: E2 Fuel Systems II

Level: Three

Duration: 37 hours

Theory: 20 hours

Practical: 17 hours

Overview:

This unit is designed to provide the apprentice with the knowledge about the fundamentals of fuel systems and components found in today's marine and outdoor power equipment. This unit, which builds on the course Fuel Systems I, is intended to provide the apprenticeship with ample opportunity to build on fuel systems terminology and concepts. Beginning with the principles of operation of fuel systems and associated components, this unit covers the diagnostic, repair, inspection and evaluation procedures for these systems. Fuel systems on both marine and outdoor power equipment have benefited from engineering enhancements such as the use of advanced fuel management systems. These computer-controlled fuel management systems provide better fuel economy and quieter operation. Consumer demand for ATVs and similar multi-wheeled vehicles with higher performance have resulted in the availability of superchargers on select units.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Describe the principles of operation of fuel systems and associated components.	15%
a. Fuel injection systems and subcomponents	
b. Superchargers	
2. Describe the diagnostic procedures for fuel systems.	15%
a. Sensory inspection	
b. Manufacturers' specifications	
c. Common causes of failure	
3. Describe the repair procedures for fuel systems.	15%
4. Describe advanced carburetion.	15%
5. Perform inspection and evaluation of fuel systems and related components.	20%
a. Measurements	
• Fuel injection systems: pressure test	
• Superchargers: impeller clearance	
b. Evaluation of component conditions	
c. Determine causes of component failure	
6. Perform repair procedures for frames and structural components.	20%
a. Measurements	

- b. Removal and replacement of components
- c. Correct causes of component failure

Marine and Outdoor Power Equipment Technician

Unit: E4 Exhaust Systems II

Level: Three

Duration: 37 hours

Theory: 20 hours

Practical: 17 hours

Overview:

This unit is designed to provide the apprentice with the knowledge about the fundamentals of exhaust systems and components found in today's marine and outdoor power equipment. This unit, which builds on the course Exhaust Systems I, is intended to provide the apprenticeship with ample opportunity to build on exhaust systems terminology and concepts. Beginning with the principles of operation of exhaust systems and associated components, this unit covers the diagnostic, repair, inspection and evaluation procedures for these systems. Exhaust systems on both marine and outdoor power equipment have benefited from engineering enhancements such as the use of advanced exhaust management systems. These computer-controlled exhaust management systems provide better fuel economy and quieter operation. Consumer demand for ATVs and similar multi-wheeled vehicles with higher performance have resulted in the availability of turbochargers on select units.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Describe the principles of operation of exhaust systems and associated components.	5%
a. Emission systems operation	
b. Turbocharger operation	
2. Describe the diagnostic procedures for exhaust systems.	5%
a. Sensory inspection	
b. Manufacturers' specifications	
c. Common causes of failure	
3. Describe the repair procedures for exhaust systems.	10%
4. Describe exhaust gases.	10%
5. Describe catalytic converters.	10%
6. Describe feedback concepts.	10%
7. Describe advanced two-stroke exhaust systems.	10%
8. Describe advanced four-stroke exhaust systems.	10%
9. Perform inspection and evaluation of exhaust systems and related components.	15%

- a. Measurements
 - Exhaust gas analysis
 - Exhaust control valve check
 - Impeller clearance
 - Pressure test
 - Vacuum test
- b. Evaluation of component conditions
- c. Determine causes of component failure

10. Perform repair procedures on exhaust systems and related components.

15%

- a. Measurements
- b. Removal and replacement of components
- c. Correct causes of component failure

Marine and Outdoor Power Equipment Technician

Unit: G6 Ignition Systems II

Level: Three

Duration: 37 hours

Theory: 20 hours

Practical: 17 hours

Overview:

This unit is designed to provide the apprentice with the relevant electrical systems knowledge (starting and ignition systems) for working with today's marine and outdoor power equipment. This unit, which builds on the course Ignition Systems I, is intended to provide the apprenticeship with ample opportunity to build on ignition systems terminology. The unit covers the types of ignition systems, switching devices, and various diagnostic concepts. Electrical and electronic components on both marine and outdoor power equipment have benefited from engineering enhancements, from electronic shifting to digital ignitions and electronic operator controls. Consumer demand for higher levels of amenities and performance has resulted in availability of such features as command start, heated seats and block heaters.

Objectives and Content:

**Percent of
Unit Mark (%)**

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|--|-----|
| 1. Describe AC capacitor discharge ignition systems. | 10% |
| 2. Describe DC capacitor discharge ignition systems. | 10% |
| 3. Describe DC transistor controlled ignition systems. | 10% |
| 4. Describe switching devices. | 10% |
| 5. Describe timing advance. | 10% |
| 6. Describe knock control. | 10% |
| 7. Demonstrate diagnostic concepts. | 10% |
| 8. Demonstrate secondary diagnostics concepts. | 15% |
| 9. Perform repair procedures on ignition systems. | 15% |
| a. Measurements | |
| b. Manufacturers' specifications | |
| c. Adjustments | |
| • Spark plug cap, dwell and pulse coil air gap | |
| d. Removal and replacement of components | |

- e. Correct causes of component failure (improper installation of battery, short circuit of wiring)

Marine and Outdoor Power Equipment Technician

Unit: G8 Computer Management Systems

Level: Three

Duration: 14 hours

Theory: 7 hours

Practical: 7 hours

Overview:

This unit is designed to provide the apprentice with the knowledge required to work on the electrical systems (computer management systems) used in today's marine and outdoor power equipment. Beginning with a descriptive overview of computer management systems and their role, this unit covers the operation of modules and components, diagnostic codes, information resources, and the inspection, evaluation and repair procedures for computer management systems. Electrical and electronic components on both marine and outdoor power equipment have benefited from engineering enhancements, from electronic shifting to digital ignitions and electronic operator controls. Consumer demand for higher levels of amenities and performance

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Describe computer management systems and their role in marine and outdoor power equipment.	10%
2. Describe the operation and interrelationship of modules and components.	10%
3. Identify the types of diagnostic codes and their meanings and parameters.	10%
4. Identify information resources for codes and service information.	10%
5. Describe inspection and evaluation procedures for computer management systems.	5%
a. Manufacturers' specifications.	
b. Methods of software transfer.	
c. Determine causes of component failure	
6. Describe repair procedures on computer management systems.	5%
a. Reconfiguration of modules	
b. Manufacturers' specifications (calibrations)	
c. Removal, rewiring and replacement of components	
d. Correct causes of component failure	
7. Demonstrate interpretation of diagnostic codes and their meanings and parameters.	10%
8. Perform inspection and evaluation of computer management systems.	20%

- a. Manufacturers' specifications
- b. Methods of software transfer
- c. Determine causes of component failure

9. Perform repair procedures on computer management systems.

20%

- a. Reconfiguration of modules
- b. Manufacturers' specifications (calibrations)
- c. Removal, rewiring and replacement of components
- d. Correct causes of component failure

Marine and Outdoor Power Equipment Technician

Unit: A3 Orientation II: The Job of Journeywork

Level: Three

Duration: 7 hours

Theory: 7 hours

Practical: 0 hours

Overview:

Marine and Outdoor Power Equipment Technician Technical Training offers an entry-level orientation to the challenges of apprenticeship learning. The present unit introduces senior apprentices to the responsibilities of workplace *teaching* that they will assume as supervising journeypersons. Tradeworkers have a particularly rich tradition of refreshing and sharing their skills from one generation of practitioners to the next. This unit orients senior apprentices to some of the practical and conceptual tools that can enable them to contribute to this trade heritage when they themselves become certified journeypersons. The journeyperson's obligation to assist trade learners to develop skills and knowledge is complex and challenging. It involves safety considerations, employer expectations, provincial regulations, as well as the tradition of skills stewardship that links modern practice with the long history of workplace teaching and learning that defines the apprenticeable trades. The ability to offer timely, appropriate support to apprentices is itself an important area of trade learning. This unit presents material intended to help refine this ability through reflection and discussion by senior apprentices, and dialogue with their instructor. The detailed descriptors under each unit objective reflect Manitoba and Canadian standards prescribed for journey-level supervisory capabilities, as well as key topics in current research on the importance of workplace teaching and learning in trades-apprenticeship systems. Thus, descriptors represent suggested focal points or guidelines for potentially-worthy exploration. Delivery of this content will vary with the discretion of individual instructors, and with the experiences senior apprentices bring forward for group/individual reflection on the skills-stewardship dimension of their own future practice as journeypersons.

Objectives and Content:	Percent of Unit Mark (%)
1. Describe the scope, substance, and significance of journey-level status.	20%
<ul style="list-style-type: none"> a. Historical background, including trainee experiences <ul style="list-style-type: none"> • Origin, definition, and examples of journey-level status • Obligations to employers, trade clients, and apprentices • Concept of skills stewardship, and its rationale • Customary responsibilities of journeyperson as workplace trainer/supervisor • Overview development of formal systems for regulating/recognizing journey-level competence in designated apprenticeable trades • Contributions of 'unticketed journeymen' and other informally-qualified Ironworkers to workplace trade-learning • Achievements/limitations of informal systems for workplace training • Trends (e.g. succession planning in the trades; recognition of credentials and prior learning; defined standards for on-the-job trades education and training) b. Regulatory/legal dimensions of journey-level status in designated trades 	

- Rights and obligations re: Canada's Interprovincial 'Red Seal' program (Red Seal rationale, scope, and products, including the National Occupational Analysis [NOA], and Interprovincial examinations)
 - Manitoba provincial requirements [e.g. *Apprenticeship and Trades Qualifications Act; General Regulation; the Marine and Outdoor Power Equipment Technician Trade Regulation*; relevant policies of the Apprenticeship and Trades Qualifications Board of Manitoba]
 - Trade-specific requirements re: Practical Training supervision and documentation; importance of quality assurance and broad-scope coverage of prescribed task-content; ratios, etc.
- c. Other (as may be specified by instructor)

2. Compare/contrast role-options and responsibilities of the supervising journeyperson.

20%

- a. Recognizing the variability of supervision assignments, situations, and roles
- b. Source and specification of the supervision assignment
- c. Formal vs. informal roles (e.g. mandated by an employer's succession plan)
- d. Implicit vs. explicit standards and content: training goals are/are not codified; assessment measures are/are not used,
- e. Accountability for results: subject/not subject to third-party notification; completion of supervision assignment itself is/is not assessed by third party; journeyperson is/is not required to prepare performance evaluation that could affect apprentice's employability or wage-rate, etc.
- f. General vs. task- or job-specific supervision assignments: e.g. scope of expectations re: content of supervisory task(s)
- g. Long-term vs. short-run supervision assignments – e.g., considerable latitude/little latitude for apprentice to learn from mistakes
- h. Formally vs. informally structured – e.g. supervision assignment is part of a prescribed cycle of assignments involving coordination among multiple journeypersons; apprentice is trained according to an individual Training Plan negotiated with employer
- i. Typology of common supervisory role-options and what is implied by each:
 - Coach role: is often initiated by someone other than apprentice, and limited to a particular skill set, task, or production requirement
 - Mentor role : often initiated by apprentice, and relatively open-ended regarding content, duration, etc.
 - Peer role: typically involves individual upgrading or cross-training of one journeyperson by another; can include senior apprentice assisting less-experienced trade learner
 - Managerial role(s): can shade over into hire/fire issues as lead-hand or site-boss
 - Coordinator role: often a senior-level journeyperson appointed by an organization to assume responsibilities for monitoring progression of groups of apprentices
 - Other roles: may be improvised by journeyperson
- j. Possibilities, perils, and likelihood of role-overlap in 'real-life' trade practice
- k. Importance of clarifying all roles, expectations, and implications involved in accepting a supervision assignment
- l. Role of Apprenticeship Training Coordinator (ATC), Manitoba Apprenticeship Branch
- m. Resources for developing skills and knowledge re: providing journey-level supervision
 - Books and journals (not always trade-specific)
 - Websites
 - Conversation with trade instructors, journeypersons, and peers
 - Workshops
- n. Other (as may be specified by instructor)

3. Describe/demonstrate common requirements re: providing journey-level supervision. 20%

- a. Review Unit A1 content re: challenges/opportunities opportunities of Apprenticeship learning adapted to journey-level supervision assignments and a journey-level standpoint
 - Application of adult education concepts to trades teaching/learning (e.g. responsibilities and expectations of adult learners)
 - Practical significance of 'styles' of adult learning and teaching
 - Helping apprentices to integrate Technical Training (in school) and Practical Training (on-the-job) learning experiences
 - Providing help and guidance re: new tasks and skills
 - Providing help and guidance re: fixing mistakes
 - Learning/teaching "the ropes" – socialization of learner within a community of trade practice (e.g. how to borrow a tool, interrupt a journeyperson, 'recruit' an advisor)
 - Coverage/documentation of prescribed tasks and subtasks (Landscape Horticulturist NOA), including responsibility re: logbook sign-off (where applicable)
 - Consultation with Apprenticeship Training Coordinator (ATC), Manitoba Apprenticeship Branch
 - Communicating with apprentices and employers about supervision assignments and assignment specifications, including the limits of the trainers' own responsibilities and competence (e.g. substance-abuse intervention)
 - Benefits of maintaining a personal record of achievements, ideas, and needs as a workplace trainer
- b. Individual reflection and guided group discussion re: personal experiences of workplace learning as an apprentice
 - Identification of best and worst practices of supervising journeypersons
 - Assessment of personal experiences (if any) to date in supervising, coaching, or guiding other people to learn or improve their skills (e.g. entry-level apprentices, members of athletic team, younger family members, etc.), and how this might compare/contrast with the journey-level support of apprenticeship learning
 - Identification of workplace and other factors that can contribute to good and bad trades teaching/learning experiences
 - Development of personal standards re: responsibility to share one's knowledge and skill with others in the workplace (e.g., use/misuse of humour, rigour, discretion, craft-pride, etc.)
- c. Comparison/contrast of discussion results with current knowledge/resources re: workplace skills coaching methods as applicable to journey-level supervision assignments
 - Qualities of a good workplace coach
 - Components of workplace skills coaching
 - Processes and recommended practices re: workplace coaching
 - Troubleshooting problems re: supervision assignments
- d. Other (as may be specified by instructor)

4. Complete Modules 1 to 3, *Workplace Coaching Skills* (or equivalent). 20%

- a. Identifying purpose of the lesson
 - Explaining the point of the lesson
 - Role of the coach in specific coaching situation
 - Other (specified by instructor)
- b. Linking the lesson
 - Learner needs
 - Lesson sequence
 - Focus on learner
 - Selection/timing of coaching opportunities
- c. Demonstration of skill/task to be learned

- Starting the coaching session
- Demonstration
- Hands-on trial
- Recap for learner

5. Complete Modules 4 to 6, *Workplace Coaching Skills* (or equivalent).

20%

- a. Practice of skill/task to be learned
 - Nature and importance of practice
 - Setting up for learner practice
 - Types of practice
 - Recycling and reinforcing skill/task learning
- b. Providing feedback to the learner
 - Value of feedback
 - Kinds of feedback
 - Guidelines and tips
- c. Assessment
 - Value of assessing learner progress
 - Assessing level of skill
 - Planning further steps toward skill/task mastery

Marine and Outdoor Power Equipment Technician

Unit: A10 Pre-Provincial Review

Level: Three

Duration: 8 hours

Theory: 8 hours

Practical: 0 hours

Overview:

This unit offers senior apprentices a systematic review of skills and knowledge required to pass the Provincial Examination. It promotes a purposeful personal synthesis between on-the-job learning and the content of in-school technical training. The unit includes information about the significance of Provincial certification and the features of the Provincial Examination. **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:	<u>Percent of Unit Mark (%)</u>
<p>1. Describe the significance, format and general content of Provincial Examinations for the trade of Marine and Outdoor Power Equipment Technician.</p> <ul style="list-style-type: none"> a. Scope and aims of Provincial certification; value of certifications b. Obligations of candidates for Provincial certification <ul style="list-style-type: none"> • Relevance of Provincial Examinations to current, accepted trade practices; industry-based provincial validation of test items • Supplemental Policy (retesting) • Confidentiality of examination content c. Multiple-choice format (four-option) item format, Apprenticeship Manitoba standards for acceptable test items d. Government materials relevant to the Provincial Examinations for apprentice Marine and Outdoor Power Equipment Technicians <ul style="list-style-type: none"> • Provincial Occupational Analysis (POA); prescribed scope of the skills and knowledge which comprise the trade • POA "Pie-chart" and its relationship to content distribution of Provincial Examination items • Apprenticeship Manitoba Technical Training package. 	n/a
<p>2. Identify resources, strategies and other considerations for maximizing successful completion of written examinations.</p> <ul style="list-style-type: none"> a. Personal preparedness <ul style="list-style-type: none"> • Rest • Nutrition • Personal study regimen • Prior experience in test situations (e.g., Unit Tests) c. Self-assessment, consultation and personal study plan <ul style="list-style-type: none"> • Self-assessment of individual strengths/weaknesses in trade related skills and knowledge 	n/a

- Approved textbooks
- Study groups

- | | |
|---|------------|
| 3. Review program content regarding occupational skills. | n/a |
| 4. Review program content regarding engine and engine support systems. | n/a |
| 5. Review program content regarding drivetrains. | n/a |
| 6. Review program content regarding chassis, steering, suspension, brakes and tires. | n/a |
| 7. Review program content regarding fuel and exhaust systems. | n/a |
| 8. Review program content regarding electrical and electronic components. | n/a |
| 9. Review program content regarding plumbing. | n/a |
| 10. Review program content regarding assembly and pre-delivery. | n/a |
| 11. Review program content regarding marine and outdoor power equipment components. | n/a |
