Diesel Engine Mechanic

Provincial Occupational Analysis
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ACKNOWLEDGEMENTS

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OTHER RELATED OCCUPATIONAL TITLES

In developing this analysis, the Industry Working Group (IWG) consulted National Occupational Analyses prepared by Human Resources Skills Development Canada from the following:

Heavy Duty Equipment Technician National Occupational Analysis 2009

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GUIDE TO ANALYSIS

DEVELOPMENT OF ANALYSIS

A draft analysis is developed by a knowledgeable consultant who, with the assistance of a committee of experts in the field, identifies all the tasks performed in the occupation.

STRUCTURE OF ANALYSIS

To facilitate the understanding of the nature of the occupation, the work performed is divided into the following divisions:

A. BLOCK - is the largest division within the analysis and reflects a distinct operation relevant to the occupation.

B. TASK - is the distinct activity that, combined with others, makes up the logical and necessary steps the worker is required to perform to complete a specific assignment within a "BLOCK."

C. SUB-TASK - is the smallest division into which it is practical to subdivide any work activity and, combined with others, fully describes all duties constituting a "TASK."

Supporting Knowledge and Abilities

The element of skill and knowledge that an individual must acquire to adequately perform the task is identified under this heading.

Trends

Any shifts or changes in technology or the working environment which affect the block are identified under this heading.

VALIDATION METHOD

Several Diesel Engine Mechanics validated the sub-tasks and applied percentage ratings to blocks and tasks. This method for the validation assisted in the completion of the time weighting section of the position description.

DEFINITIONS

YES: You perform this sub-task.

NO: You do **not** perform this sub-task.

BLOCK %: the percentage of time you spend on a monthly basis performing this component.

TASK %: the percentage of time you spend on a monthly basis performing this task.

TOOLS AND EQUIPMENT (APPENDIX "A")

ACRONYMS (APPENDIX "B")

PIE CHART (APPENDIX "C")

The graph depicts the percentages the Committee assigned to blocks in the analysis during validation.

DACUM CHART (APPENDIX “D”)

The listing of all the blocks, tasks and sub-tasks as established by the Industry Working Group and validated by several Diesel Engine Mechanics.

SCOPE OF THE OCCUPATION

This occupational analysis identifies tasks performed by qualified Diesel Engine Mechanics across Manitoba. Diesel Engine Mechanics diagnose, service, adjust, overhaul, maintain, and test diesel engines and related equipment and components.

Diesel Engine Mechanics are employed by a variety of employers in both public and private sectors. Employers include transportation companies, mining companies, public utilities, companies that own and operate diesel equipment, diesel equipment dealerships, rental and service companies, construction contractors, forestry companies, and government departments that service and repair their own equipment. Mechanics can work in the following industries: transportation, mining, construction, forestry, oil and gas, material handling, landscaping and land clearing. Many Diesel Engine Mechanics have experience on a wide variety of equipment types and manufacturers.

In general, Diesel Engine Mechanics perform the following main duties:

- Review and interpret work orders and technical manuals
- Maintain and troubleshoot engine and engine support systems and their components using test devices to diagnose and isolate faults as part of a qualification process
- Adjust, repair or replace mechanical, fuel, or electrical system parts and components using trade tools and equipment
- Test and adjust repaired equipment for proper performance
- Perform scheduled maintenance and unscheduled service on equipment
- Estimate cost of repairs

To be successful in the trade, some important attributes of the Diesel Engine Mechanic are: mechanical, electrical and mathematical aptitude, an ability to work with computers, an ability to communicate effectively, the ability to work alone or as part of a team, the ability to plan and work sequentially, the ability to think logically and keep up with changes in technology; and the ability to work in awkward, tight or confined spaces in all types of weather conditions.

This analysis recognizes similarities or overlaps in the work of other tradespersons such as automotive service technicians, agricultural equipment technicians, heavy duty equipment technicians, ironworkers, machinists, CNC operators, and truck and transport mechanics.

OCCUPATIONAL OBSERVATIONS

Some significant observations and trends emerged from the provincial occupational analysis of the Diesel Engine Mechanic occupation. These observations and trends are briefly outlined in this section.

The computer is increasingly being used for diagnostics, function calibration, programming, service and parts information. The use of computerized equipment has raised the level of troubleshooting ability required by mechanics. Onboard computer systems are being used to increase efficiency, reliability and performance. This in turn requires a higher level of training for mechanics.

Satellite monitoring and diagnosing of machinery has been introduced and is becoming more widespread. The use of Global Positioning System (GPS) and wireless technology has been introduced to improve equipment operation and repair. Human/machine interface has allowed for the use of remote access to operation and diagnosis of equipment in the transportation, mining and public utility sectors.

Regular scheduled and unscheduled maintenance is being emphasized to reduce downtime and costs related to major failures. Improved oils and filtering are being used to extend oil life to reduce the amount of environmental waste.

Increasingly stringent environmental regulations have led to work practices such as safe handling, disposal, storage and recycling of toxic or environmentally-hazardous materials that reduce the impact on the environment. There is concern regarding diesel engine emissions produced. Changes to regulations and emission standards will have an impact on the way diesel engines are constructed and on the duties of mechanics. Different issues and vehicle faults may arise because of the new designs of these engines and components.

ANALYSIS

BLOCK A

Occupational Skills

Trends: *There are more efficient tools, methods of repair and more sophisticated diagnostic techniques. Workplaces have become safer and safety requirements have become more stringent. There is more access to trade information through new information technologies such as CD-ROMs and the Internet.*

Task 1 **Uses, selects and maintains tools and equipment.**

Sub-task

1.01	**Operates access equipment.**	**Supporting Knowledge and Abilities**
	1.01.01	knowledge of types of access equipment
	1.01.02	knowledge of safe use of the equipment , including fall restraints and equipment limits
	1.01.03	ability to work in confined spaces
	1.01.04	ability to operate scissor lifts and aerial platforms

Sub-task

1.02	**Maintains and inspects tools.**	**Supporting Knowledge and Abilities**
	1.02.01	knowledge of tools and equipment, including standards/specifications re: assessing optimal vs. actual condition of tool
	1.02.02	knowledge of tool-care procedures, including monitoring/inspecting, lubricating, sharpening, cleaning, alignment, calibrating, repair/replacement protocols, etc.
	1.02.03	knowledge of imperial and metric tool sizes
	1.02.04	ability to select/inspect. and identify worn, damaged or defective tools.

1.02.05	ability to follow tool-maintenance procedures to maintain tools, e.g. clean, sharpen, lubricate, etc. per manufacturer specifications and other requirements (e.g. AAR rules re: gauges)
1.02.08	ability to store tools in accordance with manufacturer, employer and industry expectations

Sub-task

1.03 Calibrates tools.

Supporting Knowledge and Abilities

1.03.01	knowledge of purpose of tool
1.03.02	knowledge conditions for tool use
1.03.03	ability to select tools
1.03.04	ability to understand the need, tool calibration and timelines for calibration

Sub-task

1.04 Uses hoisting, lifting and rigging equipment.

Supporting Knowledge and Abilities

1.04.01	knowledge of types of lifting equipment such as jacks, hoists, stands and drop tables
1.04.02	knowledge of limitations of hoisting, lifting and securing equipment
1.04.03	knowledge of types of moving equipment such as front end loaders, forklifts and dollies
1.04.04	knowledge of purposes, styles and operation of lifting and moving equipment
1.04.05	ability to follow manufacturers' instructions for use, maintenance and storage
1.04.06	ability to select lifting points
1.04.07	ability to select lifting and moving equipment

Sub-task

1.05	**Uses welding and cutting equipment.**	**Supporting Knowledge and Abilities**
	1.05.01	knowledge of types of cutting and heating tools and equipment such as gas and electric
	1.05.02	knowledge of materials to be cut or heated
	1.05.03	knowledge of cutting and heating consumable materials such as propane, oxygen and acetylene
	1.05.04	knowledge of cutting and heating tools and equipment operating procedures
	1.05.05	knowledge of ventilation requirements
	1.05.06	ability to select cutting and heating tools and equipment
	1.05.07	ability to perform cutting and heating procedures
	1.05.08	ability to maintain cutting and heating tools and equipment
	1.05.09	ability to recognize flammable materials
	1.05.10	ability to identify unsafe cutting and heating equipment
	1.05.11	ability to store cutting and heating equipment

Sub-task

1.06	**Uses computers.**	**Supporting Knowledge and Abilities**
	1.06.01	knowledge of basic computer skills
	1.06.02	ability to perform basic operations on computer

1.06.03	ability to perform operations on computer to perform searches on the Internet, parts databases, parts catalogues, and WHMIS/MSDS information sheets
1.06.04	ability to perform time entries
1.06.05	ability to access work orders and schematics

Sub-task

1.07 Uses Personal Protective Equipment (PPE).

Supporting Knowledge and Abilities

1.07.01	knowledge of types of PPE such as masks, glasses, coveralls and hearing protection
1.07.02	knowledge of types of safety equipment such as fire extinguisher, eye wash station and workplace mats
1.07.03	knowledge of PPE and safety equipment operations
1.07.04	knowledge of location of PPE and safety equipment
1.07.05	knowledge of workplace safety and health regulations
1.07.06	ability to select PPE and safety equipment
1.07.07	ability to inspect and maintain PPE and safety equipment
1.07.08	ability to store PPE and safety equipment

Task 2 Organizes work.

Sub-task

2.01 Interprets technical documents and qualification protocols.

Supporting Knowledge and Abilities

2.01.01	knowledge of types of documentation such as service manuals, parts manuals, service bulletins and work orders
2.01.02	knowledge of formats of documentation and reference tools such as print, Internet, microfiche and CD-ROM
2.01.03	knowledge of Workplace Hazardous Materials Information System (WHMIS) documentation and symbols
2.01.04	ability to interpret and extract specific information
2.01.05	ability to interpret technical sketches such as the routing of hoses, wires and cables
2.01.06	ability to complete work-related records such as work orders and service reports
2.01.07	ability to record technical information such as warranty claims and failure service analysis

Sub-task

2.02 Communicates with others.

Supporting Knowledge and Abilities

2.02.01	knowledge of trade terminology
2.02.02	knowledge of verbal and written communication
2.02.03	ability to explain technical information in layperson's terms
2.02.04	ability to acquire information through questioning
2.02.05	ability to use communication equipment
2.02.06	ability to communicate with customers, manufacturers, suppliers and supervisors
2.02.07	ability to consult with colleagues

2.02.08	ability to communicate with other tradespeople such as welders, machinists and motor vehicle body repairers
2.02.09	ability to consult with authorities such as insurance appraisers and safety inspectors
2.02.10	ability to resolve customer complaints
2.02.11	ability to coach and mentor apprentices

Sub-task

2.03 Plans daily/project tasks.

Supporting Knowledge and Abilities

2.03.01	knowledge of time management
2.03.02	knowledge of sequencing of jobs
2.03.03	ability to assign priorities to tasks
2.03.04	ability to estimate repair times and finish dates
2.03.05	ability to plan required materials and tools for diagnostics and repair for service calls
2.03.06	ability to organize schedule

Sub-task

2.04 Interprets general standards and regulations.

Supporting Knowledge and Abilities

2.04.01	knowledge of the regulatory environment in general
2.04.02	knowledge of mining-resource sector regulatory environment, e.g. the *Mines Act*
2.04.03	knowledge of the hydro-electric power generation/transmission (PGT) regulatory environment, e.g. the *Manitoba Hydro Act*

	2.04.04	knowledge of the rail transport regulatory environment, e.g. Transport Canada regulations and American Association of Railways (AAR) Rules and protocols
	2.04.05	ability to interpret/sectoral regulations and standards in general the specific circumstances and requirements of diesel engine repair/maintenance trade-work assignments

Sub-task

2.05	**Complies with mining resource sector-specific standards and regulations.**	**Supporting Knowledge and Abilities**
	2.05.01	knowledge of sector-specific regulations and their operational significance, e.g. *Mines Act*, MOPIA, emissions-control and environmental protection standards, etc.
	2.05.02	knowledge of specific procedures and practices (including employer policies) associated with the mining-sector regulatory environment
	2.05.03	ability to retrieve and maintain current information regarding the mining-sector regulatory environment and its operational requirements.
	2.05.04	ability to interpret and apply all protocols and technical procedures arising from the mining-sector regulatory environment

Sub-task

2.06	**Complies with railway-sector specific standards and regulations.**	**Supporting Knowledge and Abilities**
	2.06.01	knowledge of sector-specific regulations and their operational significance, e.g. Federal Railway Association (FRA) requirements, Transport Canada regulations, American Association of Railways (AAR) rules, etc.

	2.06.02	knowledge of specific procedures and practices (including employer policies) associated with the rail-transport sector regulatory environment
	2.06.03	ability to retrieve and maintain current information regarding the rail-transport sector regulatory environment and its operational requirements.
	2.06.04	ability to interpret and apply all protocols and technical procedures arising from the rail-transport sector regulatory environment

Sub-task

2.07	**Complies with hydro-sector specific standards and regulations.**	**<u>Supporting Knowledge and Abilities</u>**
	2.07.01	knowledge of hydro-sector specific regulations and their operational significance, e.g. *Manitoba Hydro Act*
	2.07.02	knowledge of specific procedures and practices (including employer policies) associated with the hydro sector regulatory environment, e.g. Hydro *Safety Book*
	2.07.03	ability to retrieve and maintain current information regarding the hydro-sector regulatory environment and its operational requirements.
	2.07.04	ability to interpret and apply all protocols and technical procedures arising from the rail-transport sector regulatory environment, e.g. Electrical Code, lock-out/tag-out procedure, etc.

Task 3 Performs routine trade activities.

Sub-task

3.01	**Uses fasteners, adhesives and other consumables.**	**<u>Supporting Knowledge and Abilities</u>**

3.01.01	knowledge of types and applications of fasteners such as locking washers, lock nuts and split washers
3.01.02	knowledge of types and applications of sealing devices, adhesives and gaskets
3.01.03	knowledge of torque specification of fasteners
3.01.04	knowledge of taps, dies and thread repair kits
3.01.05	ability to select the appropriate sealing or gasket material for the job
3.01.06	ability to install fasteners, sealing devices, adhesives and gaskets
3.01.07	ability to identify grade, thread pitch and size of fasteners
3.01.08	ability to make gaskets
3.01.09	ability to repair threads using tools such as taps, dies, chasers and thread inserts
3.01.10	ability to apply specialty sealants ability to select the appropriate sealing or gasket material for the job

Sub-task

3.02 Cleans and prepares parts and components.

Supporting Knowledge and Abilities

3.02.01	knowledge of cleaning agents and their preferred uses, including manufacturer specifications
3.02.02	knowledge special hazards and precautions, e.g. ventilation requirements
3.02.03	knowledge of handling, storage and disposal requirements for cleaning agents
3.02.04	ability to select cleaning agent required for specific application
3.02.05	ability to apply cleaning procedures

	3.02.06	ability to use cleaning equipment such as parts washers and pressure washers

Sub-task

3.03	**Maintains safe work environment.**	**Supporting Knowledge and Abilities**
	3.03.01	knowledge of WHMIS
	3.03.02	knowledge of workers' rights and responsibilities
	3.03.03	knowledge of company safety policies and procedures
	3.03.04	knowledge of safety training requirements
	3.03.05	knowledge of jurisdictional health and safety acts and regulations
	3.03.06	knowledge of emergency procedures
	3.03.07	knowledge of on-site first aid stations
	3.03.08	knowledge of disposal and recycling procedures
	3.03.09	knowledge of company, federal, provincial and employer safety requirements
	3.03.10	ability to apply WHMIS procedures
	3.03.11	ability to interpret safety and environmental regulations, e.g. lockout an tag-out requirements disposal/recycling protocols, etc.
	3.03.12	ability to recognize and prevent personal injury hazards

Sub-task

3.04	**Commissions/ decommissions equipment.**	**Supporting Knowledge and Abilities**
	3.04.01	knowledge of equipment structure and function

3.04.02	knowledge of rules/regulations and procedures re: commissioning/ decommissioning of equipment (e.g. documentation)
3.04.03	knowledge of employer and industry requirements re: equipment commissioning/decommissioning practices
3.04.04	ability to follow required procedures (e.g. pressure testing)
3.04.05	ability to distinguish between salvageable and disposable equipment/materials
3.04.06	ability to document performance of commissioning/decommissioning activities

BLOCK B

Engines

Trends: *There is a trend towards larger displacement, higher output and lighter components. Manufacturers' tolerances are tighter and engines have benefited from better engineering and design, better lubricants and new materials and technologies. More stringent emission controls are in place.*

Task 4 Overhauls engine blocks.

Sub-task

4.01 Removes/installs engine.

Supporting Knowledge and Abilities

4.01.01	knowledge of removal/installation procedures, including tools and equipment, e.g. for rigging/hoisting
4.01.02	knowledge of relevant documentation re: shimming, placement, , disposal of engine oil, etc.: shims, placement, cleaning/preparation cleaning/preparation requirements, tools and equipment required for
4.01.03	knowledge of hand signals
4.01.04	ability to interpret, perform and document disassembly process per requirements, e.g., recording of serial number(s)
4.01.05	ability to select and use removal/installation tools and materials
4.01.06	ability to use/interpret hand signals, e.g. during hoists

Sub-task

4.02 Disassembles/ reassembles engine.

Supporting Knowledge and Abilities

4.02.01	knowledge manufacturer specifications and prescribed procedures

	4.02.02	knowledge of required sequence for assembly/disassembly of specific engine components
	4.02.03	knowledge of types of valve systems such as reed valve, rotary valve and piston port
	4.02.04	ability to follow and document procedure(s)
	4.02.05	ability to coordinate with crane/hoisting equipment operators
	4.02.06	ability to operate crane in federally-regulated workplaces per certification and associated requirements

Sub-task

4.03	**Tests, repairs and requalifies mechanical engine-block components.**	**Supporting Knowledge and Abilities**
	4.03.01	knowledge of engine block structure and function, including manufacturer specifications
	4.03.02	knowledge of diesel engine-block faults such as deterioration, wear, cavitation, misalignments, and overheating, including their significance
	4.03.03	knowledge of diagnostic criteria, testing procedures, and instruments for identifying/assessing faults
	4.03.04	ability to evaluate the mechanical condition of engine components to detect faults
	4.03.05	ability to visually read such measuring devises as calipers, micrometers, dial indicators, torque wrenches, feeler gauges
	4.03.06	ability to assess the significance of visual and other data re: mechanical condition of diesel engine-block components

Sub-task

4.04	**Welds engine block.**	**Supporting Knowledge and Abilities**
	4.04.01	knowledge of engine block structure and function, including manufacturer specifications
	4.04.02	knowledge of engine block-specific welding procedures including superheating, blanketing, etc.
	4.04.03	knowledge of cleaning/preparation procedure for welding operations
	4.04.04	knowledge of engine block fasteners, fastening equipment, and fastening standards
	4.04.05	ability to interpret welding procedures and use welders, grinders, torches, peening hammers, chemical-welding products, etc.
	4.04.06	ability to weld per prescribed standards and requirements of engine-block welding assignment

Sub-task

4.05	**Tests water and fuel systems of block.**	**Supporting Knowledge and Abilities**
	4.05.01	knowledge of testing procedures and inspection criteria
	4.05.02	knowledge of manufacturer specifications
	4.05.03	ability to select and use tools per prescribed testing procedures and standards, e.g. pressure testing, blanking plates, etc.

Task 5 Qualifies internal engine components.

Sub-task

5.01	**Removes, washes and measures camshaft and crankshaft.**	**Supporting Knowledge and Abilities**

	5.01.01	knowledge of crankshaft components, including manufacturer specifications re: procedures and standards for disassembly and cleaning
	5.01.02	knowledge of required tools and equipment, including lifting/hoisting accessories and measuring tools
	5.01.03	ability to select and use tools per prescribed procedures and inspection criteria/standards, e.g. jib crane, sling, etc.

Sub-task

5.02	**Removes, washes and inspects gears.**	**<u>Supporting Knowledge and Abilities</u>**
	5.02.01	knowledge of gear components, including manufacturer specifications re: procedures and standards for disassembly and cleaning
	5.02.02	knowledge of required tools and equipment, including lifting/hoisting accessories and measuring tools
	5.02.03	ability to select and use tools per prescribed procedures and inspection criteria/standards, e.g. jib crane, sling, etc.

Sub-task

5.03	**Removes and measures power assemblies (cylinder packs).**	**<u>Supporting Knowledge and Abilities</u>**
	5.03.01	knowledge of cylinder-pack components, including manufacturer specifications re: procedures and standards for disassembly and cleaning
	5.03.02	knowledge of required tools and equipment, including lifting/hoisting accessories and measuring tools

	5.03.03	ability to select and use tools per prescribed procedures and inspection criteria/standards, e.g. C-hook, liner pullers, piston pullers/installers, hydraulic detensioner, etc.

Sub-task

5.04	**Rebuilds cylinder heads.**	**Supporting Knowledge and Abilities**
	5.04.01	knowledge of types of cylinder heads, including preferred uses and manufacturer specifications
	5.04.02	ability to perform inspection per procedures and prescribed criteria
	5.04.03	ability to evaluate history of use
	5.04.04	ability to select and use required tools and equipment including valve-spring compressors, lapping tools, valve-grinding/guiding tools, etc.

Sub-task

5.05	**Rebuilds injectors/injector pumps.**	**Supporting Knowledge and Abilities**
	5.05.01	knowledge of types of injectors and injector-pumps, including preferred uses and manufacturer specifications
	5.05.02	ability to perform inspection per procedures and prescribed criteria
	5.05.03	ability to evaluate history of use
	5.05.04	ability to select and use required tools and equipment including pressure-break tool, fuel-pump timing tool, etc.

Task 6 Aligns crankshaft.

Sub-task

6.01	**Assesses crankshaft bore.**	**Supporting Knowledge and Abilities**

	6.01.01	knowledge of crankshaft assembly and components, including manufacturer specifications
	6.01.02	ability to perform checks and measurements
	6.01.03	ability to evaluate structural integrity of specified materials and components

Sub-task

6.02	**Welds crankshaft bore and/or cap.**	**<u>Supporting Knowledge and Abilities</u>**
	6.02.01	knowledge of bore- and cap- metallurgy
	6.02.02	knowledge of block-associated welding procedures such as cleaning/preparation, superheating, blanketing , etc.
	6.02.03	knowledge of fastening equipment and standards
	6.02.04	knowledge of manufacturers' specifications
	6.02.05	knowledge of fastening equipment and standards
	6.02.06	knowledge of manufacturers' specifications
	6.02.07	knowledge of welding technology and techniques
	6.02.08	ability to perform welding procedures using welders, torches grinders, peening hammers, chemical-welding products, etc.
	6.02.09	ability to perform checks and measurements

Sub-task

6.03	**Machines crankshaft bore and/or cap.**	**<u>Supporting Knowledge and Abilities</u>**
	6.03.01	knowledge of crank-shaft-bore, caps, and block, including manufacturer specifications

6.03.02 knowledge of procedure to set up and use line-bore machine and associated equipment

6.03.03 ability to perform checks and measurement per specifications

6.03.04 ability to document specified dimensions before/after completion of machining assignment

Task 7 Measures and qualifies counterbore.

Sub-task

7.01 Assesses counterbore. **Supporting Knowledge and Abilities**

7.01.01 knowledge of counterbore and associated components, including manufacturer specifications

7.01.02 ability to perform checks and measurements

7.01.03 ability to evaluate structural integrity of specified materials and components

Sub-task

7.02 Welds counterbore. **Supporting Knowledge and Abilities**

7.02.01 knowledge of bore- and cap- metallurgy

7.02.02 knowledge of block-associated welding procedures such as cleaning/preparation, superheating, blanketing , etc.

7.02.03 knowledge of fastening equipment and standards

7.02.04 knowledge of manufacturers' specifications

7.02.05 knowledge of fastening equipment and standards

7.02.06 knowledge of manufacturers' specifications

7.02.07	knowledge of welding technology and techniques
7.02.08	ability to perform welding procedures using welders, torches grinders, peening hammers, chemical-welding products, etc.
7.02.09	ability to perform checks and measurements

Sub-task

7.03 Machines counterbore.

Supporting Knowledge and Abilities

7.03.01	knowledge of crank-shaft-bore, caps, and block, including manufacturer specifications
7.03.02	knowledge of procedure to set up and use line-bore machine and associated equipment
7.03.03	ability to set up and operate counterbore-machining equipment
7.03.04	ability to perform checks and measurement per specifications

Task 8 Machines intake/exhaust manifold.

Sub-task

8.01 Assesses intake/exhaust manifold.

Supporting Knowledge and Abilities

8.01.01	knowledge of manifolds and associated components, including manufacturer specifications
8.01.02	knowledge of relevant inspection criteria
8.01.03	ability to perform checks and measurements
8.01.04	ability to evaluate structural integrity of specified materials and components

Sub-task

8.02	**Welds intake/exhaust manifold.**	**Supporting Knowledge and Abilities**
	8.02.01	knowledge of manifold metallurgy
	8.02.02	knowledge of manufacturers' specifications
	8.02.03	knowledge of fastening equipment and standards
	8.02.04	knowledge of welding technology and techniques
	8.02.05	ability to perform welding procedures using welders, torches grinders, peening hammers, chemical-welding products, etc.
	8.02.06	ability to perform checks and measurements

Sub-task

8.03	**Machines intake/exhaust manifold base.**	**Supporting Knowledge and Abilities**
	8.03.01	knowledge of manifolds and associated components, including manufacturer specifications
	8.03.02	knowledge of relevant inspection criteria
	8.02.03	knowledge of milling machine set-up/operation
	8.03.04	ability to follow machining procedure, including cleaning/preparation, verification of hole-layout, tapping of holes, installation of inserts, etc
	8.03.05	ability to evaluate component conditions
	8.03.06	ability to document measurements before and after performance of task.

Sub-task

8.04	**Removes/installs intake/exhaust manifold.**	**Supporting Knowledge and Abilities**
	8.04.01	knowledge of manifolds and associated components, including manufacturer specifications
	8.04.02	knowledge of torque sequence
	8.04.03	ability to evaluate component conditions
	8.04.04	ability to remove and replace parts and components

Task 9 Measures and qualifies head-pot seat.

Sub-task

9.01	**Assesses head-pot seat.**	**Supporting Knowledge and Abilities**
	9.01.01	knowledge of manufacturer specifications
	9.01.02	knowledge of criteria re: required measurements
	9.01.03	knowledge of procedure to set-up and operate cylinder-head seat-cutting machine
	9.01.04	ability to perform checks and measurements
	9.01.05	ability to evaluate structural integrity

Sub-task

9.02	**Welds head-pot seat.**	**Supporting Knowledge and Abilities**
	9.02.01	knowledge of manufacturer specifications
	9.02.02	knowledge of criteria re: required measurements
	9.02.03	knowledge of procedure to set-up and operate cylinder-head seat-cutting machine

9.02.04	knowledge of required welding procedures, equipment, and standards
9.02.05	ability to perform checks and measurements
9.02.06	ability to weld
9.02.07	ability to perform checks and measurements
9.02.08	ability to evaluate structural integrity

Sub-task

9.03 Machines head-pot seat.

Supporting Knowledge and Abilities

9.03.01	knowledge of manufacturers' specifications
9.03.02	knowledge of procedure to set-up and operate cylinder-head seat-cutting machine
9.03.03	ability to follow procedure, including cleaning/preparation, installation of inserts, etc
9.03.04	ability to operate head-seat cutting machine
9.03.05	ability to document measurements before and after performance of task.

BLOCK C

Engine Support Systems

Trends: *Engine support systems on diesel engines have benefited from engineering enhancements, newer technology such as electronic sensors and advanced, higher-efficiency cooling and lube systems. There is increasing use of new lighter-weight components as well.*

Task 10 Maintains/troubleshoots lube systems.

Sub-task

10.01 Diagnoses lube system.

Supporting Knowledge and Abilities

10.01.01	knowledge of manufacturer specifications
10.01.02	knowledge of criteria defining functional condition of system
10.01.03	knowledge of interplay between lube-system and other engine support-systems.
10.01.04	ability to follow schematic diagrams
10.01.05	ability to perform checks and measurements
10.01.06	ability to evaluate condition of components

Sub-task

10.02 Services lube system.

Supporting Knowledge and Abilities

10.02.01	knowledge of manufacturer specifications
10.02.02	knowledge of criteria defining functional condition of system
10.02.03	knowledge of interplay between lube-system and other engine support-systems
10.02.04	ability to follow schematic diagrams
10.02.05	ability to perform checks and measurements

10.02.06	ability to evaluate condition of components
10.02.07	ability to repair, recondition, and replace components

Task 11 Maintains/troubleshoots cooling systems.

Sub-task

11.01 Maintains/troubleshoots cooling systems.

Supporting Knowledge and Abilities

11.01.01	knowledge of manufacturer specifications
11.01.02	knowledge of criteria defining functional condition of system
11.01.03	knowledge of interplay between cooling system and other engine support-systems
11.01.04	ability to follow schematic diagrams
11.01.05	ability to perform checks and measurements
11.01.06	ability to understand coolant test and results
11.01.07	ability to evaluate condition of components

Sub-task

11.02 Services cooling system.

Supporting Knowledge and Abilities

11.02.01	knowledge of manufacturer specifications
11.02.02	knowledge of criteria defining functional condition of system
11.02.03	knowledge of interplay between cooling-system and other engine support-systems
11.02.04	ability to follow schematic diagrams
11.02.05	ability to perform checks and measurements

11.02.06 ability to evaluate condition of components

11.02.07 ability to repair, recondition, and replace components

Task 12 Maintains/troubleshoots fuel systems.

Sub-task

12.01 Diagnoses fuel systems. **Supporting Knowledge and Abilities**

12.01.01 knowledge of manufacturer specifications

12.01.02 knowledge of criteria defining functional condition of system

12.01.03 knowledge of interplay between fuel system and other engine support-systems

12.01.04 ability to follow schematic diagrams

12.01.05 ability to perform checks and measurements

12.01.06 ability to evaluate condition of components

Sub-task

12.02 Services fuel system. **Supporting Knowledge and Abilities**

12.02.01 knowledge of manufacturer specifications

12.02.02 knowledge of criteria defining functional condition of system

12.02.03 knowledge of interplay between fuel-system and other engine support-systems

12.02.04 knowledge of techniques for detecting and neutralizing explosive gases and residues

12.02.05 knowledge of special hazards and precautions when servicing fuel systems such as welding the fuel tank

12.02.06 ability to follow schematic diagrams

	12.02.07	ability to perform checks and measurements
	12.02.08	ability to evaluate condition of fuel tank components
	12.02.09	ability to repair, recondition, and replace fuel tank components
	12.02.10	ability to follow the procedure in using a sniffer and other specialized tools to detect explosive gases and residues

Sub-task

12.03	**Conducts emission testing.**	**<u>Supporting Knowledge and Abilities</u>**
	12.03.01	knowledge of applicable regulations, including Mines Act, environmental protection legislation, etc.
	12.03.02	knowledge of emissions-testing procedures and instruments
	12.03.03	ability to select, calibrate, and use emissions testing equipment per prescribed procedures and standards
	12.03.04	ability to document test activity/results

Task 13 Maintains/troubleshoots air systems.

Sub-task

13.01	**Diagnoses air system.**	**<u>Supporting Knowledge and Abilities</u>**
	13.01.01	knowledge of manufacturer specifications
	13.01.02	knowledge of criteria defining functional condition of system
	13.01.03	knowledge of interplay between air-system and other engine support-systems
	13.01.04	ability to follow schematic diagrams

	13.01.05	ability to perform checks and measurements
	13.01.06	ability to evaluate condition of components

Sub-task

13.02 Services air system.	**Supporting Knowledge and Abilities**	
	13.02.01	knowledge of manufacturer specifications
	13.02.02	knowledge of criteria defining functional condition of system
	13.02.03	knowledge of interplay between air-system and other engine support-systems
	13.02.04	ability to follow schematic diagrams
	13.02.05	ability to perform checks and measurements
	13.02.06	ability to evaluate condition of components
	13.02.07	ability to repair, recondition, and replace components

Task 14 Qualifies supercharger/turbocharger systems.

Sub-task

14.01 Diagnoses supercharger/ turbocharger system.	**Supporting Knowledge and Abilities**	
	14.01.01	knowledge of manufacturer specifications
	14.01.02	knowledge of criteria defining functional condition of system
	14.01.03	knowledge of interplay between supercharger/turbocharger system and other engine support-systems
	14.01.04	ability to follow schematic diagrams

14.01.05	ability to perform checks and measurements
14.01.06	ability to evaluate condition of components

Sub-task

14.02 Services supercharger/ turbocharger system.

Supporting Knowledge and Abilities

14.02.01	knowledge of manufacturer specifications
14.02.02	knowledge of criteria defining functional condition of system
14.02.03	knowledge of interplay between supercharger/turbocharger system and other engine support-systems
14.02.04	ability to follow schematic diagrams
14.01.05	ability to perform checks and measurements
14.01.06	ability to evaluate condition of components
14.01.07	ability to repair, recondition, and replace components

Task 15 Maintains/troubleshoots exhaust system components.

Sub-task

15.01 Diagnoses exhaust system.

Supporting Knowledge and Abilities

15.01.01	knowledge of manufacturer specifications
15.01.02	knowledge of criteria defining functional condition of system
15.01.03	knowledge of interplay between exhaust system and other engine support-systems
15.01.04	ability to follow schematic diagrams

15.01.05	ability to perform checks and measurements
15.01.06	ability to evaluate condition of components

Sub-task

15.02 Services exhaust system. **Supporting Knowledge and Abilities**

15.02.01	knowledge of manufacturer specifications
15.02.02	knowledge of criteria defining functional condition of system
15.02.03	knowledge of interplay between exhaust system and other engine support-systems.
15.02.04	ability to follow schematic diagrams
15.02.05	ability to perform checks and measurements
15.02.06	ability to evaluate condition of components
15.02.07	ability to repair, recondition, and replace components

Task 16 Maintains/troubleshoots engine protection devices.

Sub-task

16.01 Diagnoses engine protection devices. **Supporting Knowledge and Abilities**

16.01.01	knowledge of manufacturer specifications, including water, lubricant type and crankcase pressure
16.01.02	knowledge of criteria defining functional condition of system
16.01.03	knowledge of safety hazards and precautions
16.01.04	knowledge of computer systems for engine protection devices

	16.01.05	ability to follow schematic diagrams
	16.01.06	ability to select and use engine protection device-specific diagnostic tools
	16.01.07	ability to perform checks and measurements
	16.01.08	ability to evaluate condition of components

Sub-task

16.02	**Services engine protection devices.**	**<u>Supporting Knowledge and Abilities</u>**
	16.02.01	knowledge of manufacturer specifications
	16.02.02	knowledge of criteria defining functional condition of system
	16.02.03	knowledge of various types of engine protection devices, and the interplay between mechanical and electronic control engine-protection devices
	16.02.04	ability to check/set overspeed dump valve
	16.02.05	ability to perform checks and measurements
	16.02.06	ability to evaluate condition of components
	16.02.07	ability to repair, recondition, and replace components
	16.02.08	ability to consult and interact with other tradespeople/crafts such as electrician

BLOCK D

Suspension Systems, Undercarriage & Wheel Assemblies

Trends: *Radial, self-steering trucks are increasingly prevalent. The use of suspension distributed tractive effort has resulted in improved weight distribution and increased adhesion to the track.*

Task 17 Inspects and qualifies wheel assemblies (draft systems).

Sub-task

17.01 Performs non-destructive testing of wheel axle assembly.

Supporting Knowledge and Abilities

17.01.01	knowledge of applicable procedures and standards re: non-destructive testing requirements, e.g. AAR Rules; serial number and coding-conventions, record-keeping, etc.
17.01.02	knowledge of the physical, chemical and mechanical characteristics of the objects/materials to be tested
17.01.03	knowledge of special hazards and precautions re: testing
17.01.04	ability to select, set-up, and use equipment and materials required to perform non-destructive testing
17.01.05	ability to follow test protocols, including re: required documentation/reporting of test results

Sub-task

17.02 Disassembles/ reassembles traction-motor and wheel assembly.

Supporting Knowledge and Abilities

17.02.01	knowledge of components
17.02.02	knowledge of procedure and specifications re: connection/ disconnection of traction-motor cable

17.02.03 knowledge of special equipment-requirements such as drop-table, overhead crane, rigging accessories, etc.

17.02.04 knowledge of classification and coding system conventions, e.g. serial numbers

17.02.05 ability to interpret manufacturer-specified procedures specifications, e.g. assembly-sequencing

17.02.06 ability to document serial numbers, position numbers, and other pertinent information

Sub-task

17.03 Diagnoses and qualifies wheel sets and traction motor.

Supporting Knowledge and Abilities

17.03.01 knowledge of components, including manufacturer specifications

17.03.02 knowledge of regulatory environment including FRA requirements

17.03.03 knowledge of diagnostic criteria and inspection procedure

17.03.04 ability to interpret and satisfy FRA requirements

17.03.05 ability to document and report required measurements

Sub-task

17.04 Services wheel sets and traction motor.

Supporting Knowledge and Abilities

17.04.01 knowledge of components, including manufacturer specifications

17.04.02 knowledge of regulatory environment including FRA requirements

17.04.03 knowledge of diagnostic criteria and inspection procedure

17.04.04	ability to interpret and satisfy FRA requirements
17.04.05	ability to document/ report required measurements
17.04.06	ability to select and use required tools including lathe, burnishing machine, CNC lathe, boring mills, etc.
17.04.07	ability to follow interpret schematic diagrams
17.04.08	ability to repair, recondition, and replace components

Sub-task

17.05 Diagnoses and qualifies draft-gear system and components.

Supporting Knowledge and Abilities

17.05.01	knowledge of components, including manufacturer specifications
17.05.02	knowledge of regulatory environment including FRA requirements
17.05.03	knowledge of diagnostic criteria and inspection procedure
17.05.04	ability to interpret and satisfy FRA requirements
17.05.05	ability to document and report required measurements

Task 18 Maintains trucks/suspension and their components.

Sub-task

18.01 Diagnose shocks, springs, stabilizers and trucks.

Supporting Knowledge and Abilities

18.01.01	knowledge of components, including manufacturer specifications
18.01.02	knowledge of FRA rules

	18.01.03	knowledge of regulatory environment.
	18.01.04	ability to interpret FRA rules.
	18.01.05	ability to document/ report required measurements
	18.01.06	ability to evaluate condition of components

Sub-task

18.02	**Services shocks, spring, stabilizers and trucks.**	**Supporting Knowledge and Abilities**
	18.02.01	knowledge of components, including manufacturer specifications
	18.02.02	knowledge of FRA rules
	18.02.03	knowledge of regulatory environment.
	18.02.04	ability to interpret FRA rules.
	18.02.05	ability to document/ report required measurements
	18.02.06	ability to evaluate condition of components
	18.02.07	ability to perform sensory inspection
	18.02.08	ability to interpret schematic diagrams
	18.02.09	ability to repair, recondition, and replace components

BLOCK E

BRAKE SYSTEMS

Trends: *Brake Systems have benefitted from higher performance materials, including lightweight composite materials for brake shoes. There is increasing use of electronic air brakes, which has decreased maintenance requirements.*

Task 19 Troubleshoots braking systems.

Sub-task

19.01 Diagnoses hydraulic braking systems.

Supporting Knowledge and Abilities

19.01.01	knowledge of hydraulic principles
19.01.02	knowledge of types of hydraulic braking systems such as disc and drum
19.01.03	knowledge of components
19.01.04	knowledge of materials
19.01.05	knowledge of types of brake fluids
19.01.06	knowledge of system operation
19.01.07	knowledge of manufacturers' specifications
19.01.08	knowledge of diagnostic procedures
19.01.09	ability to perform sensory inspection
19.01.10	ability to evaluate component conditions such as fluid pressure, leakage, wear of brake pad and fluid quality
19.01.11	ability to perform checks and measurements such as run out, thickness and diameter
19.01.12	ability to determine causes of failure such as contaminants, abuse and inactivity
19.01.13	ability to test ride unit

Sub-task

19.02 Diagnoses mechanical braking systems.

Supporting Knowledge and Abilities

19.02.01	knowledge of types of mechanical braking systems such as disc and drum
19.02.02	knowledge of components such as levers, cables, linkages, pivots and springs
19.02.03	knowledge of materials
19.02.04	knowledge of system operation
19.02.05	knowledge of applicable standards including manufacturer specifications and FRA Rules
19.02.06	knowledge of diagnostic procedures
19.02.07	ability to perform sensory inspection
19.02.08	ability to evaluate component conditions such as seizure and corrosion
19.02.09	ability to perform checks and measurements such as thickness, diameter and free play
19.02.10	ability to determine causes of failure such as contaminants and abuse
19.02.11	ability to test unit

Sub-task

19.03 Diagnoses electric braking systems.

Supporting Knowledge and Abilities

19.03.01	knowledge of types of electric brake systems
19.03.02	knowledge of operation of electric brake systems
19.03.03	knowledge of applicable standards including manufacturer specifications and FRA Rules

19.03.04	knowledge of component functions
19.03.05	ability to select and use tools and equipment such as measuring and diagnostic equipment
19.03.06	ability to identify electric brake system problems
19.03.07	ability to recognize worn, damaged or defective components

Sub-task

19.04 Diagnoses pneumatic braking systems.

Supporting Knowledge and Abilities

19.04.01	knowledge of types of pneumatic braking systems
19.04.02	knowledge of components
19.04.03	knowledge of materials
19.04.04	knowledge of types of brake fluids
19.04.05	knowledge of system operation
19.04.06	knowledge of applicable standards including manufacturer specifications and FRA Rules
19.04.07	knowledge of diagnostic procedures
19.04.08	ability to perform checks and measurements such as run out, thickness and diameter
19.04.09	ability to determine causes of failure such as contaminants, abuse and inactivity
19.04.10	ability to test unit

Task 20 Maintains braking systems.

Sub-task

20.01 Services hydraulic braking systems.

Supporting Knowledge and Abilities

20.01.01	knowledge of hydraulic principles
20.01.02	knowledge of types of hydraulic braking systems such as disc and drum
20.01.03	knowledge of components
20.01.04	knowledge of materials
20.01.05	knowledge of types of brake fluids
20.01.06	knowledge of system operation
20.01.07	knowledge of applicable standards including manufacturer specifications and FRA Rules
20.01.08	ability to remove and replace components such as friction materials, rotors, drums and springs
20.01.09	ability to recondition components such as master cylinder and slave cylinder
20.01.10	ability to set tolerances to specifications
20.01.11	ability to test unit

Sub-task

20.02 Services mechanical braking systems.

Supporting Knowledge and Abilities

20.02.01	knowledge of types of mechanical braking systems such as disc and drum
20.02.02	knowledge of components such as levers, cables, linkages, pivots and springs
20.02.03	knowledge of materials
20.02.04	knowledge of system operation

	20.02.05	knowledge of applicable standards including manufacturer specifications and FRA Rules.
	20.02.06	ability to remove and replace components such as pads, cables, pivots and drums
	20.02.07	ability to set tolerances
	20.02.08	ability to test unit

Sub-task

20.03	**Services electric braking systems.**	**<u>Supporting Knowledge and Abilities</u>**
	20.03.01	knowledge of electric brake system components such as controllers and magnets
	20.03.02	knowledge of component functions
	20.03.03	knowledge of applicable standards including manufacturer specifications and FRA Rules.
	20.03.04	knowledge of component replacement procedures
	20.03.05	knowledge of electric brake components that can be repaired, replaced or adjusted
	20.03.06	ability to remove components
	20.03.07	ability to replace or reinstall electric brake components
	20.03.08	ability to repair electric brake components to specifications
	20.03.09	ability to adjust electric brakes

Sub-task

20.04	**Services pneumatic braking systems.**	**<u>Supporting Knowledge and Abilities</u>**
	20.04.01	knowledge of pneumatic principles

20.04.02	knowledge of types of pneumatic braking systems
20.04.03	knowledge of components
20.04.04	knowledge of materials
20.04.05	knowledge of types of brake fluids
20.04.06	knowledge of system operation
20.04.07	knowledge of applicable standards including manufacturer specifications and FRA Rules.
20.04.08	ability to remove and replace components such as friction materials, etc.
20.04.09	ability to recondition components such as master cylinder, actuation cylinder and hose.
20.04.10	ability to set tolerances to specifications
20.04.11	ability to test unit

BLOCK F

DRIVEN (AUXILIARY) SYSTEMS

Trends: *Driven (Auxiliary) Systems are increasingly run by computer control, static control, and with other power sources. Driven by motors, current driven (auxiliary) systems are more efficient.*

Task 21 Maintains/troubleshoots air compressors.

Sub-task

21.01 Inspects air-compressor system components.

Supporting Knowledge and Abilities

21.01.01	knowledge of types of air compressor systems
21.01.02	knowledge of air compressor system components
21.01.03	knowledge of air compressor system operation
21.01.04	knowledge of manufacturers' specifications
21.01.05	ability to evaluate component conditions
21.01.06	ability to test unit

Sub-task

21.02 Performs scheduled maintenance of air compressor.

Supporting Knowledge and Abilities

21.02.01	knowledge of air compressor
21.02.02	knowledge of air compressor system components
21.02.03	knowledge of air compressor system operation
21.02.04	knowledge of manufacturers' specifications
21.02.05	ability to remove and replace components

	21.02.06	ability to recondition components
	21.02.07	ability to evaluate component conditions
	21.02.08	ability to test unit

Sub-task

21.03	**Assembles/disassembles air compressor system components.**	**Supporting Knowledge and Abilities**
	21.03.01	knowledge of air compressor
	21.03.02	knowledge of air compressor system components
	21.03.03	knowledge of air compressor system operation
	21.03.04	knowledge of manufacturers' specifications
	21.03.05	ability to remove and replace components

Sub-task

21.04	**Qualifies air compressor system components.**	**Supporting Knowledge and Abilities**
	21.04.01	knowledge of air compressor system components
	21.04.02	knowledge of qualification process for air compressor system components
	21.04.03	knowledge of air compressor system operation
	21.04.04	ability to evaluate component conditions

Sub-task

21.05	**Aligns air compressor to engine.**	**Supporting Knowledge and Abilities**
	21.05.01	knowledge of air compressor and system operation
	21.05.02	knowledge of engine operation

21.05.03 knowledge of manufacturers' specifications

21.05.04 ability to set tolerances

Sub-task

21.06 Removes/installs air compressor.

Supporting Knowledge and Abilities

21.06.01 knowledge of air compressor system

21.06.02 knowledge of air compressor system components

21.06.03 knowledge of manufacturers' specifications

21.06.04 ability to remove and replace components

21.06.05 ability to align drive couplers/drive shafts

Sub-task

21.07 Tests air compressor operation.

Supporting Knowledge and Abilities

21.07.01 knowledge of air compressor system

21.07.02 knowledge of air compressor system components

21.07.03 knowledge of manufacturers' specifications

21.07.04 ability to evaluate component conditions

21.07.05 ability to test unit

Task 22 Maintains/troubleshoots main generator/ alternator.

Sub-task

22.01 Inspects main generator/ alternator components

Supporting Knowledge and Abilities

22.01.01 knowledge of main generator and types of alternator components

22.01.02 knowledge of main generator system operation

22.01.03 knowledge of manufacturers' specifications

22.01.04 ability to evaluate component conditions

22.01.05 ability to perform functional testing of unit

Sub-task

22.02 Performs scheduled maintenance of main generator/alternator.

Supporting Knowledge and Abilities

22.02.01 knowledge of main generator and types of alternator components

22.02.02 knowledge of main generator system operation

22.02.03 knowledge of manufacturers' specifications

22.02.04 ability to remove and replace components

22.02.05 ability to recondition components

22.02.06 ability to qualify component condition

22.02.07 ability to test unit

Sub-task

22.03 Assembles/disassembles main generator/alternator components.

Supporting Knowledge and Abilities

22.03.01 knowledge of main generator and alternator components

22.03.02 knowledge of manufacturers' specifications

22.03.03 ability to remove and replace components

Sub-task

22.04 Qualifies main generator/ alternator components.

Supporting Knowledge and Abilities

22.04.01 knowledge of main generator and alternator components

22.04.02 knowledge of manufacturers' specifications

22.04.03 knowledge of main generator/ alternator component operation

22.04.04 ability to evaluate component conditions

Sub-task

22.05 Aligns main generator/ alternator to engine.

Supporting Knowledge and Abilities

22.05.01 knowledge of main generator operation

22.05.02 knowledge of alternator operation

22.05.03 knowledge of manufacturers' specifications

22.05.04 ability to work within tolerances

Sub-task

22.06 Removes/installs main generator/alternator.

Supporting Knowledge and Abilities

22.06.01 knowledge of main generator and types of alternator components

22.06.02 knowledge of manufacturers' specifications

22.06.03 ability to remove and replace components

Sub-task

22.07 Tests main generator/ alternator operation.

Supporting Knowledge and Abilities

22.07.01 knowledge of main generator and types of alternator components

	22.07.02	knowledge of manufacturers' specifications
	22.07.03	ability to evaluate component conditions
	22.07.04	ability to test unit

Sub-task

22.08	**Verifies voltage regulator (VR) function.**	**Supporting Knowledge and Abilities**
	22.08.01	knowledge of types of voltage regulators
	22.08.02	knowledge of voltage regulator function
	22.08.03	ability to set voltage regulator

Sub-task

22.09	**Balances rotor.**	**Supporting Knowledge and Abilities**
	22.09.01	knowledge of types of rotors
	22.09.02	knowledge of rotor operation
	22.09.03	ability to work within tolerances

Task 23 Maintains/troubleshoots electric drive motors.

Sub-task

23.01	**Inspects electric drive motor components.**	**Supporting Knowledge and Abilities**
	23.01.01	knowledge of electric drive motor components
	23.01.02	knowledge of electric drive motor system operation
	23.01.03	knowledge of manufacturers' specifications
	23.01.04	ability to evaluate component conditions
	23.01.05	ability to test unit

Sub-task

23.02 Performs scheduled maintenance of electric drive motor.

Supporting Knowledge and Abilities

23.02.01	knowledge of electric drive motor components
23.02.02	knowledge of electric drive motor system operation
23.02.03	knowledge of manufacturers' specifications
23.02.04	ability to remove and replace components
23.02.05	ability to recondition components
23.02.06	ability to evaluate component conditions
23.02.07	ability to test unit

Sub-task

23.03 Assembles/disassembles electric drive motor components.

Supporting Knowledge and Abilities

23.03.01	knowledge of electric drive motor components
23.03.02	knowledge of manufacturers' specifications
23.03.03	ability to remove and replace components

Sub-task

23.04 Qualifies electric drive motor components.

Supporting Knowledge and Abilities

23.04.01	knowledge of electric drive motor components
23.04.02	knowledge of electric drive motor system operation

	23.04.03	knowledge of manufacturers' specifications
	23.04.04	ability to evaluate component conditions

Sub-task

23.05	**Removes/installs electric drive motor.**	**Supporting Knowledge and Abilities**
	23.05.01	knowledge of electric drive motor components such as traction motors
	23.05.02	knowledge of manufacturers' specifications
	23.05.03	ability to remove and replace components

Sub-task

23.06	**Tests electric drive motor.**	**Supporting Knowledge and Abilities**
	23.06.01	knowledge of electric drive motor components
	23.06.02	knowledge of manufacturers' specifications
	23.06.03	ability to evaluate component conditions
	23.06.04	ability to test unit

Sub-task

23.07	**Renews shaft using hydraulic press.**	**Supporting Knowledge and Abilities**
	23.07.01	knowledge of types shafts
	23.07.02	knowledge of hydraulic press function and operation
	23.07.03	ability to verify tolerances per manufacturers' specifications

Sub-task

23.08	**Qualifies stator frame.**	**Supporting Knowledge and Abilities**
	23.08.01	knowledge of types of stator frames

23.08.02	knowledge of manufacturers' specifications
23.08.03	ability to evaluate component conditions
23.08.04	ability to verify tolerances per manufacturers' specifications

Sub-task

23.09 Machines commutator. **Supporting Knowledge and Abilities**

23.09.01	knowledge of types of commutators.
23.09.02	knowledge manufacturers' specifications
23.09.03	knowledge of components of charging systems such as rotors, stators and regulator/rectifiers
23.09.04	ability to verify tolerances per manufacturers' specifications

Sub-task

23.10 Assemble armature and frame. **Supporting Knowledge and Abilities**

23.10.01	knowledge of armature and frame assembly
23.10.02	knowledge of electric drive motor operation
23.10.03	knowledge of manufacturers' specifications
23.10.04	ability to remove and replace components

Task 24 Maintains/ troubleshoots hydraulic motors and pumps.

Sub-task

24.01 Inspects hydraulic motors and pump components. **Supporting Knowledge and Abilities**

24.01.01	knowledge of types of hydraulic motors and pumps

	24.01.02	knowledge of hydraulic motors and pump operation
	24.01.03	knowledge of manufacturers' specifications
	24.01.04	ability to evaluate component conditions
	24.01.05	ability to test unit

Sub-task

24.02	**Performs scheduled maintenance of hydraulic motors and pumps.**	**Supporting Knowledge and Abilities**
	24.02.01	knowledge of hydraulic motors and pumps and their related components
	24.02.02	knowledge of hydraulic motor and pump operation
	24.02.03	knowledge of manufacturers' specifications
	24.02.04	ability to remove and replace components
	24.02.05	ability to recondition components
	24.02.06	ability to evaluate component conditions
	24.02.07	ability to test unit

Sub-task

24.03	**Assembles/disassembles hydraulic motors/ pump components.**	**Supporting Knowledge and Abilities**
	24.03.01	knowledge of hydraulic motor and pump components
	24.03.02	knowledge of manufacturers' specifications
	24.03.03	ability to remove and replace components

Sub-task

24.04 Qualifies hydraulic motors and pump components.

Supporting Knowledge and Abilities

24.04.01 knowledge of hydraulic motor and pump components

24.04.02 knowledge of operation of hydraulic motors and pumps

24.04.03 knowledge of manufacturers' specifications

24.04.04 ability to perform sensory inspection

Sub-task

24.05 Removes/installs hydraulic motors and pump.

Supporting Knowledge and Abilities

24.05.01 knowledge of hydraulic motor and pump components

24.05.02 knowledge of manufacturers' specifications

24.05.03 ability to remove and replace components

Sub-task

24.06 Tests hydraulic motors and pump.

Supporting Knowledge and Abilities

24.06.01 knowledge of hydraulic motor and pump components

24.06.02 knowledge of manufacturers' specifications

24.06.03 ability to evaluate components

24.06.04 ability to test unit

Task 25 Maintains/ troubleshoots drivetrains.

Sub-task

25.01 Inspects drivetrain components.

Supporting Knowledge and Abilities

25.01.01 knowledge of types of drivetrains and related components

25.01.02 knowledge of drivetrain and system operation

25.01.03 knowledge of manufacturers' specifications

25.01.04 ability to evaluate component conditions

25.01.05 ability to test unit

Sub-task

25.02 Performs scheduled maintenance of drivetrains.

Supporting Knowledge and Abilities

25.02.01 knowledge of drivetrains and related components

25.02.02 knowledge of drivetrain and system operation

25.02.03 knowledge of manufacturers' specifications

25.02.04 ability to remove and replace components

25.02.05 ability to recondition components

25.02.06 ability to evaluate component conditions

25.02.07 ability to test unit

Sub-task

25.03 Assembles/disassembles drivetrain components.

Supporting Knowledge and Abilities

25.03.01 knowledge of drivetrains and related components

25.03.02 knowledge of drivetrain and system operation

25.03.03 knowledge of manufacturers' specifications

25.03.04 ability to remove and replace components

Sub-task

25.04 Qualifies drivetrain components.

Supporting Knowledge and Abilities

25.04.01 knowledge of drivetrain components

25.04.02 knowledge of operation of drivetrain components

25.04.03 knowledge of manufacturers' specifications

25.04.04 ability to perform sensory inspection

Sub-task

25.05 Aligns drivetrain to engine.

Supporting Knowledge and Abilities

25.05.01 knowledge of drivetrain components

25.05.02 knowledge of drivetrain and engine system function

25.05.03 knowledge of manufacturers' specifications

25.05.04 ability to set tolerances

25.05.05 ability to remove and replace components

Sub-task

25.06 Removes/installs drivetrain.

Supporting Knowledge and Abilities

25.06.01 knowledge of drivetrain components

25.06.02 knowledge of manufacturers' specifications

25.06.03 ability to remove and replace components

Sub-task

25.07 Tests drivetrain operation. **Supporting Knowledge and Abilities**

25.07.01 knowledge of drivetrain components

25.07.02 knowledge of manufacturers' specifications

25.07.03 ability to evaluate components

25.07.04 ability to test unit

Task 26 Maintains/troubleshoots engine-mounted cooling fans.

Sub-task

26.01 Inspects engine-mounted cooling fan components. **Supporting Knowledge and Abilities**

26.01.01 knowledge of types of engine-mounted cooling fan components

26.01.02 knowledge of operation of engine-mounted cooling fan components

26.01.03 knowledge of manufacturers' specifications

26.01.04 ability to evaluate components

26.01.05 ability to test unit

Sub-task

26.02 Performs scheduled maintenance of engine-mounted cooling fans. **Supporting Knowledge and Abilities**

26.02.01 knowledge of engine-mounted cooling fan components

26.02.02 knowledge of operation of engine-mounted cooling fan components

26.02.03 knowledge of manufacturers' specifications

26.02.04 ability to remove and replace components

26.02.05 ability to recondition components

26.02.06 ability to evaluate component conditions

26.02.07 ability to test unit

Sub-task

26.03 Assembles/disassembles engine-mounted cooling fan components.

Supporting Knowledge and Abilities

26.03.01 knowledge of engine-mounted cooling fan components

26.03.02 knowledge of operation of engine-mounted cooling fan

26.03.03 knowledge of manufacturers' specifications

26.03.04 ability to remove and replace components

Sub-task

26.04 Qualifies engine-mounted cooling fan components.

Supporting Knowledge and Abilities

26.04.01 knowledge of engine-mounted cooling fan components

26.04.02 knowledge of operation of engine-mounted cooling fan

26.04.03 knowledge of manufacturers' specifications

26.04.04 ability to perform sensory inspection

Sub-task

26.05 Aligns engine-mounted cooling fans to engine.

Supporting Knowledge and Abilities

26.05.01 knowledge of engine-mounted cooling fan components

26.05.02 knowledge of engine-mounted cooling fan and engine system function

26.05.03 knowledge of manufacturers' specifications

26.05.04 ability to set tolerances

26.05.05 ability to remove and replace components

Sub-task

26.06 Removes/installs engine-mounted cooling fans.

Supporting Knowledge and Abilities

26.06.01 knowledge of engine-mounted cooling fan components

26.06.02 knowledge of manufacturers' specifications

26.06.03 ability to remove and replace components

Sub-task

26.07 Tests engine-mounted cooling fan operation.

Supporting Knowledge and Abilities

26.07.01 knowledge of engine-mounted cooling fan components

26.07.02 knowledge of manufacturers' specifications

26.07.03 ability to evaluate components

26.07.04 ability to test unit

Task 27 Overhaul, clean and qualify governor drive.

Sub-task

27.01 Inspects governor drive components.

Supporting Knowledge and Abilities

27.01.01 knowledge of types of governor drive components

27.01.02 knowledge of operation of governor drive components

27.01.03 knowledge of manufacturers' specifications

27.01.04 ability to evaluate components

27.01.05 ability to test unit

Sub-task

27.02 Performs scheduled maintenance of governor drive.

Supporting Knowledge and Abilities

27.02.01 knowledge of governor drive components

27.02.02 knowledge of operation of governor drive components

27.02.03 knowledge of manufacturers' specifications

27.02.04 ability to remove and replace components

27.02.05 ability to recondition components

27.02.06 ability to evaluate component conditions

27.02.07 ability to test unit

Sub-task

27.03 Assembles/disassembles governor drive components.

Supporting Knowledge and Abilities

27.03.01 knowledge of governor drive components

27.03.02 knowledge of operation of governor drive

27.03.03 knowledge of manufacturers' specifications

27.03.04 ability to remove and replace components

Sub-task

27.04 Qualifies governor drive components.

Supporting Knowledge and Abilities

27.04.01 knowledge of governor drive components

27.04.02 knowledge of operation of governor drive

27.04.03 knowledge of manufacturers' specifications

27.04.04 ability to perform sensory inspection

Sub-task

27.05 Aligns governor drive to engine.

Supporting Knowledge and Abilities

27.05.01 knowledge of governor drive components

27.05.02 knowledge of governor drive and engine system function

27.05.03 knowledge of manufacturers' specifications

27.05.04 ability to set tolerances

27.05.05 ability to remove and replace components

Sub-task

27.06 Removes and installs governor drive.

Supporting Knowledge and Abilities

27.06.01 knowledge of types of governor drives

27.06.02 knowledge of operation of governor drive

27.06.03 knowledge of governor drive components

27.06.04 ability to remove and replace components

BLOCK G

Electrical and Control Systems

Trends: *Electrical and Control Systems are used for computer-assisted diagnostics and operation. There is increasing use of automatic engine start stop (AESS) that helps to save fuel and by keeping the engine on to warm up the engine in a cooler environment and shutting the engine down when it is no longer needed.*

Task 28 Troubleshoots electrical control systems.

Sub-task

28.01 Diagnoses electrical starting systems.

Supporting Knowledge and Abilities

28.01.01	knowledge of electrical starting system components
28.01.02	knowledge of electrical starting system operation
28.01.03	knowledge of manufacturer`s specifications
28.01.04	knowledge of diagnostic procedures
28.01.05	ability to perform sensory inspection
28.01.06	ability to evaluate component conditions
28.01.07	ability to determine causes of failure

Sub-task

28.02 Diagnoses electrical charging systems.

Supporting Knowledge and Abilities

28.02.01	knowledge of electrical charging system components
28.02.02	knowledge of electrical charging system operation
28.02.03	knowledge of manufacturer`s specifications
28.02.04	knowledge of diagnostic procedures

28.02.05 ability to perform sensory inspection

28.02.06 ability to evaluate component conditions

28.02.07 ability to determine causes of failure

Sub-task

28.03 Diagnoses electrical accessory systems.

Supporting Knowledge and Abilities

28.03.01 knowledge of electrical accessory system components

28.03.02 knowledge of electrical accessory system operation

28.03.03 knowledge of manufacturer`s specifications

28.03.04 knowledge of diagnostic procedures

28.03.05 ability to perform sensory inspection

28.03.06 ability to evaluate component conditions

28.03.07 ability to determine causes of failure

Sub-task

28.04 Diagnoses electrical power generator systems.

Supporting Knowledge and Abilities

28.04.01 knowledge of electrical power generator system components

28.04.02 knowledge of electrical power generator system operation

28.04.03 knowledge of manufacturer`s specifications

28.04.04 knowledge of diagnostic procedures

28.04.05 ability to perform sensory inspection

28.04.06 ability to evaluate component conditions

28.04.07 ability to determine causes of failure

Task 29 Maintains electrical control systems.

Sub-task

29.01 Services electrical starting systems.

Supporting Knowledge and Abilities

29.01.01	knowledge of electrical starting system components
29.01.02	knowledge of electrical starting system operation
29.01.03	knowledge of manufacturer`s specifications
29.01.04	ability to remove and replace components
29.01.05	ability to perform adjustments
29.01.06	ability to correct causes of failure

Sub-task

29.02 Services electrical charging systems.

Supporting Knowledge and Abilities

29.02.01	knowledge of electrical charging system components
29.02.02	knowledge of electrical charging system operation
29.02.03	knowledge of manufacturer`s specifications
29.02.04	ability to remove and replace components
29.02.05	ability to perform adjustments
29.02.06	ability to correct causes of failure

Sub-task

29.03 Services electrical accessory systems.

Supporting Knowledge and Abilities

29.03.01	knowledge of electrical accessory system components

29.03.02	knowledge of electrical accessory system operation
29.03.03	knowledge of manufacturer`s specifications
29.03.04	ability to remove and replace components
29.03.05	ability to perform adjustments
29.03.06	ability to correct causes of failure

Sub-task

29.04 Services electrical power generator systems.

Supporting Knowledge and Abilities

29.04.01	knowledge of electrical power generator system components
29.04.02	knowledge of electrical power generator system operation
29.04.03	knowledge of manufacturer`s specifications
29.04.04	ability to remove and replace components
29.04.05	ability to perform adjustments
29.04.06	ability to correct causes of failure

Task 30 Troubleshoots pneumatic control systems.

Sub-task

30.01 Diagnoses pneumatic starting systems.

Supporting Knowledge and Abilities

30.01.01	knowledge of pneumatic starting system components
30.01.02	knowledge of pneumatic starting system operation
30.01.03	knowledge of manufacturer`s specifications
30.01.04	knowledge of diagnostic procedures

30.01.05 ability to perform sensory inspection

30.01.06 ability to evaluate component conditions

30.01.07 ability to determine causes of failure

Sub-task

30.02 Diagnoses pneumatic accessory systems.

Supporting Knowledge and Abilities

30.02.01 knowledge of pneumatic accessory system components

30.02.02 knowledge of pneumatic accessory system operation

30.02.03 knowledge of manufacturer`s specifications

30.02.04 knowledge of diagnostic procedures

30.02.05 ability to perform sensory inspection

30.02.06 ability to evaluate component conditions

30.02.07 ability to determine causes of failure

Task 31 Maintains pneumatic control systems.

Sub-task

31.01 Services pneumatic starting systems.

Supporting Knowledge and Abilities

31.01.01 knowledge of pneumatic starting system components

31.01.02 knowledge of pneumatic starting system operation

31.01.03 knowledge of manufacturer`s specifications

31.01.04 ability to remove and replace components

31.01.05	ability to perform adjustments
31.01.06	ability to correct causes of failure

Sub-task

31.02 Services pneumatic accessory systems.

Supporting Knowledge and Abilities

31.02.01	knowledge of pneumatic accessory system components
31.02.02	knowledge of pneumatic accessory system operation
31.02.03	knowledge of manufacturer`s specifications
31.02.04	ability to remove and replace components
31.02.05	ability to perform adjustments
31.02.06	ability to correct causes of failure

Task 32 Troubleshoots mechanical control systems.

Sub-task

32.01 Diagnoses mechanical starting systems.

Supporting Knowledge and Abilities

32.01.01	knowledge of mechanical starting system components
32.01.02	knowledge of mechanical starting system operation
32.01.03	knowledge of manufacturer`s specifications
32.01.04	knowledge of diagnostic procedures
32.01.05	ability to perform sensory inspection
32.01.06	ability to evaluate component conditions
32.01.07	ability to determine causes of failure

Sub-task

32.02 Diagnoses mechanical charging systems.

Supporting Knowledge and Abilities

32.02.01	knowledge of mechanical charging system components
32.02.02	knowledge of mechanical charging system operation
32.02.03	knowledge of manufacturer`s specifications
32.02.04	knowledge of diagnostic procedures
32.02.05	ability to perform sensory inspection
32.02.06	ability to evaluate component conditions
32.02.07	ability to determine causes of failure

Sub-task

32.03 Diagnoses mechanical accessory systems.

Supporting Knowledge and Abilities

32.03.01	knowledge of mechanical accessory system components
32.03.02	knowledge of mechanical accessory system operation
32.03.03	knowledge of manufacturer`s specifications
32.03.04	knowledge of diagnostic procedures
32.03.05	ability to perform sensory inspection
32.03.06	ability to evaluate component conditions
32.03.07	ability to determine causes of failure

Sub-task

32.04	**Diagnoses mechanical power generator systems.**	**Supporting Knowledge and Abilities**
	32.04.01	knowledge of mechanical power generator system components
	32.04.02	knowledge of mechanical power generator system operation
	32.04.03	knowledge of manufacturer`s specifications
	32.04.04	knowledge of diagnostic procedures
	32.04.05	ability to perform sensory inspection
	32.04.06	ability to evaluate component conditions
	32.04.07	ability to determine causes of failure

Task 33 Maintains mechanical control systems.

Sub-task

33.01	**Services mechanical starting systems.**	**Supporting Knowledge and Abilities**
	33.01.01	knowledge of mechanical starting system components
	33.01.02	knowledge of mechanical starting system operation
	33.01.03	knowledge of manufacturer`s specifications
	33.01.04	ability to remove and replace components
	33.01.05	ability to perform adjustments
	33.01.06	ability to correct causes of failure

Sub-task

33.02	**Services mechanical charging systems.**	**Supporting Knowledge and Abilities**
	33.02.01	knowledge of mechanical charging system components
	33.02.02	knowledge of mechanical charging system operation
	33.02.03	knowledge of manufacturer`s specifications
	33.02.04	ability to remove and replace components
	33.02.05	ability to perform adjustments
	33.02.06	ability to correct causes of failure

Sub-task

33.03	**Services mechanical accessory systems.**	**Supporting Knowledge and Abilities**
	33.03.01	knowledge of mechanical accessory system components
	33.03.02	knowledge of mechanical accessory system operation
	33.03.03	knowledge of manufacturer`s specifications
	33.03.04	ability to remove and replace components
	33.03.05	ability to perform adjustments
	33.03.06	ability to correct causes of failure

Sub-task

33.04	**Services mechanical power generator systems.**	**Supporting Knowledge and Abilities**
	33.04.01	knowledge of mechanical power generator system components

33.04.02	knowledge of mechanical power generator system operation
33.04.03	knowledge of manufacturer`s specifications
33.04.04	ability to remove and replace components
33.04.05	ability to perform adjustments
33.04.06	ability to correct causes of failure

BLOCK H

Diesel-Engine Structural and Cabin Components

Trends: *New developments include an increasing use of high-precision tools used in the steel fabrication process; air ride seats; improved cabin design. Expanded use of sound-deadening materials has resulted in quieter cabins.*

Task 34 Assesses damage and extent of repair required.

Sub-task

34.01 Removes components to provide access.

Supporting Knowledge and Abilities

34.01.01	knowledge of components such as frame, engine, car body, etc., including interrelationships between components and diesel system
34.01.02	knowledge of special hazards and precautions including combustion sources, hazardous wastes, confined space, etc.
34.01.03	knowledge of detailed procedure for assembly/disassembly and removal/replacement of parts per manufacturer specifications, employer policy, and other requirements re: diesel-engine repair
34.01.04	ability to specify and implement applicable risk-assessment protocols re: confined space, blocking, hoisting, etc.
34.01.05	ability to select and use required repair tools, equipment, and materials
34.01.06	ability to establish , organize, and maintain work-area for repair operations
34.01.07	ability to follow detailed procedure for assembly/disassembly and removal/replacement of parts per manufacturer specifications, employer policy, and other requirements re: diesel-engine repair
34.01.08	ability to comply with requirements re: disposal of contaminated/damaged components and material

Sub-task

34.02 Applies/installs components.

Supporting Knowledge and Abilities

34.02.01 knowledge of components such as frame, engine, car body, etc., including interrelationships between components and diesel system

34.02.02 knowledge of special hazards and precautions including combustion sources, hazardous wastes, confined space, etc.

34.02.03 knowledge of detailed procedure for assembly/disassembly and removal/replacement of parts per manufacturer specifications, employer policy, and other requirements re: diesel-engine repair

34.02.04 ability to specify and implement applicable risk-assessment protocols re: confined space, blocking, hoisting, etc.

34.02.05 ability to select and use required repair tools, equipment, and materials

34.02.06 ability to establish , organize, and maintain work-area for repair operations.

34.02.07 ability to follow detailed procedure for assembly/disassembly and removal/replacement of parts per manufacturer specifications, employer policy, and other requirements re: diesel-engine repair

34.02.08 ability to comply with requirements re: disposal of contaminated/damaged components and material

Sub-task

34.03 Verifies integrity and functionality of repair.

Supporting Knowledge and Abilities

34.03.01 knowledge of inspection and documentation techniques

34.03.02	knowledge of manufacturer, employer, and regulatory requirements
34.03.03	ability to use inspection tools and instruments including micrometers, gauges, levels, etc.
34.03.04	ability to follow detailed procedure for verifying assembly/disassembly and repair/replacement of parts per manufacturer specifications, employer policy, and other requirements re: diesel-engine repair
34.03.04	ability to test repaired/replaced components in place

Task 35 Performs steel fabrication.

Sub-task

35.01 Lays out workpiece on replacement material.

Supporting Knowledge and Abilities

35.01.01	knowledge of diesel engine parts, materials, and their use in fabrication
35.01.02	knowledge of fabrication layout/design tools and procedures
35.01.03	knowledge procedures and metallurgical properties re: fabricating with such materials as cast iron, mild steel, High Speed Steel (HSS), High Tensile Steel (HST) , aluminum , etc.
35.01.04	ability to estimate materials and other resources required for fabrication assignment
35.01.05	ability to predict and allow for dimensional and other changes due to working properties and physical characteristics of metal workpieces
35.01.06	ability to anneal, cut ,grind, heat-treat, weld , solder, braze, plasma cut, etc.

Sub-task

35.02 Estimates and specifies required repair materials.

Supporting Knowledge and Abilities

35.02.01 knowledge of diesel engine parts, materials, and their use in fabrication

35.02.02 knowledge of fabrication layout/design tools and procedures

35.02.03 knowledge procedures and metallurgical properties re: fabricating with such materials as cast iron, mild steel, High Speed Steel (HSS), High Tensile Steel (HST) , aluminum , etc.

35.02.04 ability to estimate materials and other resources required for fabrication assignment

35.02.05 ability to predict and allow for dimensional and other changes due to working properties and physical characteristics of metal workpieces

35.02.06 ability to anneal, cut , grind, heat-treat, weld , solder, braze, plasma cut, etc.

Sub-task

35.03 Sets up required tooling and equipment.

Supporting Knowledge and Abilities

35.03.01 knowledge of diesel engine parts, materials, and their use in fabrication

35.03.02 knowledge of fabrication layout/design tools and procedures

35.03.03 knowledge procedures and metallurgical properties re: fabricating with such materials as cast iron, mild steel, High Speed Steel (HSS), High Tensile Steel (HST) , aluminum , etc.

35.03.04 ability to estimate materials and other resources required for fabrication assignment

35.03.05	ability to predict and allow for dimensional and other changes due to working properties and physical characteristics of metal workpieces
35.03.06	ability to anneal, cut , grind, heat-treat, weld , solder, braze, plasma cut, etc.

Task 36 Changes out components.

Sub-task

36.01 Installs replacement components.

Supporting Knowledge and Abilities

36.01.01	knowledge of manufacturer's specifications
36.01.02	ability to remove and replace components
36.01.03	ability to set tolerances within manufacturers' specifications

Sub-task

36.02 Verifies integrity and function of replacement components.

Supporting Knowledge and Abilities

36.02.01	knowledge of diesel engine structural components
36.02.02	knowledge of cabin components
36.02.03	knowledge of manufacturers` specifications
36.02.04	ability to remove and disassemble components to determine failure
36.02.05	ability to evaluate component conditions

Task 37 Maintains cab/building accessories.

Sub-task

37.01 Inspects cab/building components and related equipment.

Supporting Knowledge and Abilities

37.01.01 knowledge of manufacturers' specifications

37.01.02 knowledge of cab, building and related components

37.01.03 ability to check for shipping damage

37.01.04 ability to evaluate component conditions

Sub-task

37.02 Changes out cab/building components and related equipment.

Supporting Knowledge and Abilities

37.02.01 knowledge of manufacturers' specifications

37.02.02 knowledge of cab, building and related components

37.02.03 ability to remove and replace components

Sub-task

37.03 Fabricates floor and ceiling materials

Supporting Knowledge and Abilities

37.03.01 knowledge of manufacturers' specifications

37.03.02 knowledge of types of flooring and ceiling materials

37.03.03 ability to perform checks and measurements

37.03.04 ability to cut and bend flooring or ceiling materials to required dimensions

Sub-task

37.04 Inspects/services air conditioning and heating components.

Supporting Knowledge and Abilities

37.04.01 knowledge of manufacturers' specifications

37.04.02	knowledge of climate control unit components
37.04.03	ability to remove and replace components
37.04.04	ability to test unit

APPENDICES

Appendix “A”
Tools and Equipment

Basic Hand Tools

1/4, 3/8, 1/2, and 3/4 -inch drive socket sets
3/4- and 1-inch impact gun
adjustable wrench
bar (pry, aligning, heel)
battery post and clamp cleaner, battery terminal nut
brass drift
center punch
chisel
convertible 2/3 jaw puller
cutting equipment: side cutter, tube cutter, wire cutter, plier cutters, shears
digital multimeter
feeler gauge set
file
H puller
hacksaw and blade
hammer: impact, rubber, sledge, air, slide, soft blow
hex key set, metric and imperial
impact wrench (up to 1/2-inch)
jumper wire
magnetic pick-up tool (telescopic, flex)
metric and imperial steel rule
micrometer
pick (o-ring, seal)
pin punch
pipe wrench
pliers: insulated, snap ring, torque, multipliers
punch
scraper
screwdriver
tape measure
test light
tool chest
torque wrench
torx bit
universal joint
utility knife
vernier caliper
wire brush
wire crimper and stripper
wrench set, combination (metric & imperial)
wrench set, flare nut (metric & imperial)

Shop Tools

3/4 – 1 inch power bar/torque wrench
air compressor
air line adapter
alignment tool
analyzer: gas, infrared, vibration meter
battery charger
battery load/starting system tester
bearing heater
black light
bleeding equipment
booster cable
butane torch
caliper: outside, inside
carbon arc
chisel: air, electric, hand
clutch alignment tool
component heating or cooling equipment
compressors: air, mechanical spring, piston ring, pneumatic spring, spring, valve spring
computer equipment: terminal, on-board computer, portable diagnostic computer, printer
container
continuity tester
coolant recycling unit
cooling system pressure tester
crack detecting equipment
crimping tool
cutting and welding torch set
cylinder cart and tank
diagnostic equipment
drift
drill: bench, hand drivers, twist, air
exhaust expander
extension cord/trouble light
fast charger
file
flame cutter
flaring tool
flushing kit
fuel recovery and storage system

Shop Tools (continued)

funnel
grease gun
grinder: bench, hand, valve
hand pump
honing equipment
hot air gun
ironworker
labeling kit
laser scope
leak detection equipment
leakdown tester
level protractor
metal break
nitrogen charging equipment
overhaul tools
plasma cutter
press: arbor, spring, hydraulic, bushing, shop, mechanical, hand
pry bar
puller: bearing, gear, heavy duty, mechanical
reamer
recycling unit
refractometer
ridge reamer
sandblaster
sander
saw: jigsaw, hacksaw, hole saw
scanning tool
seal driver
shear
shop vacuum
soldering iron/gun
spacer
spark lighter
straight edge
strobe light
stud extractor
suction cups
tachometer
tap and die set
temperature gauge
thread file
tire bar
torque angle tool, torque wrench
torque multiplier
transit
Transport Canada-approved gauges
tube bender
vacuum pump
valve spring tester
vice
welding equipment

Safety Equipment

apron
communication device
CPR accessories (disposable)
ear protection
emergency backup lighting
eye wash station
face shield
fall arrest equipment
fall prevention equipment
fire extinguisher
fireproof blanket
first aid station
gas mask
gloves
goggles
ladder
leather gloves
leggings
lock-out tag
manlift
respirator
safety boots
safety cage
safety glasses
safety hat
sniffer
splash suit
sprinkler system
stretcher

Rigging, Hoisting and Securing Equipment

axle stand
bottle/axle jack
cable hoist
chain hoist
clamp
clevis
dolly
engine crane
engine repair stand
floor hoist
forklift
ground strap
hydraulic floor jack
hydraulic hand jack
mobile crane
repair stand
shim/blocking
shop crane
sling/cable/chain
spreader bar
support stand
vice

Cleaning Equipment

air blowgun
cleaning cloth
cleaning gloves
crocus cloth
glass bead machine
hot tank degreaser
parts cleaning solvent
pressure washer
soft brush
solvent washer
steam cleaner
wire brush

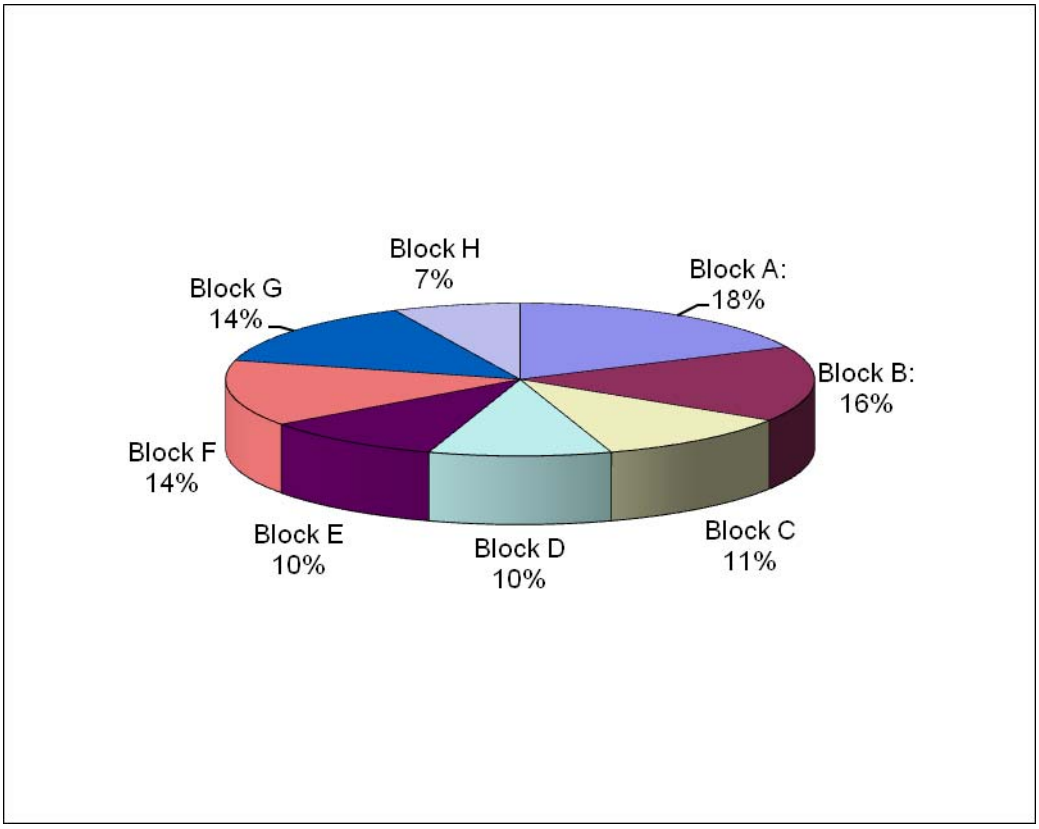
Measuring Tools, Gauges and Equipment

air pressure gauge
ammeter
boost gauge
borescope
compression gauge
cylinder bore gauge
depth micrometer
dial gauge
electric pressure gauge
flowmeter
fuel pressure gauge
holding gauge
hydraulic pressure testing gauge/fittings
hydrometer
inside micrometer
laser level
level
mechanical pressure gauge
non-magnetic feeler gauge
oil temperature gauge
phototachometer
pinion angle gauge
plasti-gauge
pressure gauge
pull-type scale
pyrometer
small hole gauge
spring scale
steel ruler
stethoscope
straight edge
tachometer
telescoping gauge
test lead
test light
thermometer
timing gauge
timing light
tire gauge
torquemeter
vacuum gauge

Appendix “B”
Pie Chart*
Titles of Blocks

Block A	Occupational Skills	18%
Block B	Engines	16%
Block C	Engine Support Systems	11%
Block D	Suspension Systems, Undercarriage and Wheel Assemblies	10%
Block E	Brake Systems	10%
Block F	Driven Systems	14%
Block G	Electrical and Control Systems	14%
Block H	Diesel Engine Structural and Cabin Components	7%

* The percentages reflect the average amount of time workers within the occupation spend performing these tasks on a yearly basis.



Appendix “C”
DACUM Chart – Task Profile Chart

Diesel Engine Mechanic

BLOCKS	TASKS	SUB-TASKS				
A OCCUPATIONAL SKILLS	1. Uses, selects and maintains tools and equipment.	1.01 Operates access equipment.	1.02 Maintains and inspects tools.	1.03 Calibrates tools.	1.04 Uses hoisting, lifting and rigging equipment.	1.05 Uses welding and cutting equipment.
		1.06 Uses computers.	1.07 Uses Personal Protective Equipment (PPE).			
	2. Organizes work.	2.01 Interprets technical documents and qualification protocols.	2.02 Communicates with others.	2.03 Plans daily project tasks.	2.04 Interprets general standards and regulations.	2.05 Complies with mining resource sector-specific standards and regulations.
		2.06 Complies with railway-sector specific standards and regulations.	2.07 Complies with hydro-sector specific standards and regulations.			
	3. Performs routine trade activities.	3.01 Uses fasteners, adhesives and other consumables.	3.02 Cleans and prepares parts and components.	3.03 Maintains safe work environment.	3.04 Commissions/ decommissions equipment.	
B ENGINES	4. Overhauls engine blocks.	4.01 Removes/ installs engine.	4.02 Disassembles/ reassembles engine.	4.03 Tests, repairs and requalifies mechanical engine components.	4.04 Welds engine block.	4.05 Tests water and fuel systems of block.
	5. Qualifies internal engine components.	5.01 Removes, washes and measures camshaft and crankshaft.	5.02 Removes, washes and inspects gears.	5.03 Removes and measures power assemblies (cylinder packs).	5.04 Rebuilds cylinder heads.	5.05 Rebuilds injectors/ injector pumps.
	6. Aligns crankshaft.	6.01 Assesses crankshaft bore.	6.02 Welds crankshaft bore and/or cap.	6.03 Machines crankshaft bore and/or cap.		

BLOCKS	TASKS	SUB-TASKS			
	7. Measures and qualifies counterbore.	7.01 Assesses counterbore.	7.02 Welds counterbore.	7.03 Machines counterbore.	
	8. Machines intake/exhaust manifold.	8.01 Assesses intake/exhaust manifold.	8.02 Welds intake/exhaust manifold.	8.03 Machines intake/exhaust manifold base.	8.04 Removes/ installs intake/exhaust manifold.
	9. Measures and qualifies head-pot seat.	9.01 Assesses head-pot seat.	9.02 Welds head-pot seat.	9.03 Machines head-pot seat.	
C ENGINE SUPPORT SYSTEMS	10. Maintains/ troubleshoots lube systems.	10.01 Diagnoses lube system.	10.02 Services lube system.		
	11. Maintains/ troubleshoots cooling systems.	11.01 Diagnoses cooling system.	11.02 Services cooling system.		
	12. Maintains/ troubleshoots fuel systems.	12.01 Diagnoses fuel systems.	12.02 Services fuel system.	12.03 Conducts emission testing.	
	13. Maintains/ troubleshoots air systems.	13.01 Diagnoses air system.	13.02 Services air system.		
	14. Qualifies supercharger/ turbocharger systems.	14.01 Diagnoses supercharger/ turbocharger system.	14.02 Services supercharger/ turbocharger system.		
	15. Maintains/ troubleshoots exhaust system components.	15.01 Diagnoses exhaust system.	15.02 Services exhaust system.		

BLOCKS	TASKS	SUB-TASKS				
	16. Maintains/ troubleshoots engine protection devices.	16.01 Diagnose engine protection devices.	16.02 Services engine protection devices.			
D SUSPENSION SYSTEMS, UNDERCAR-RIAGE, & WHEEL ASSEMBLIES	17. Inspects and qualifies wheel assemblies (draft systems).	17.01 Performs non-destructive testing of wheel axle assembly.	17.02 Disassembles/ reassembles traction-motor and wheel assembly.	17.03 Diagnoses and qualifies wheel sets and traction motor.	17.04 Services wheel sets and traction motor.	17.05 Diagnoses and qualifies draft-gear and system components.
	18. Maintains trucks/ suspension and their components.	18.01 Diagnose shocks, springs, stabilizers and trucks.	18.02 Services shocks, spring, stabilizers and trucks.			
E BRAKE SYSTEMS	19. Troubleshoots braking systems.	19.01 Diagnoses hydraulic braking systems.	19.02 Diagnoses mechanical braking systems.	19.03 Diagnoses electric braking systems.	19.04 Diagnoses pneumatic braking systems.	
	20. Maintains braking systems.	20.01 Services hydraulic braking systems.	20.02 Services mechanical braking systems.	20.03 Services electric braking systems.	20.04 Services pneumatic braking systems.	
F DRIVEN (AUXILIARY) SYSTEMS	21. Maintains/ troubleshoots air compressors.	21.01 Inspects air compressor system components.	21.02 Performs scheduled maintenance of air compressor.	21.03 Assembles/ disassembles air compressor system components.	21.04 Qualifies air compressor system components.	21.05 Aligns air compressor to engine.
		21.06 Removes/ installs air compressor.	21.07 Tests air compressor operation.			
	22. Maintains/ troubleshoots main generator/ alternator.	22.01 Inspects main generator/ alternator components.	22.02 Performs scheduled maintenance of main generator/ alternator.	22.03 Assembles/ disassembles main generator/ alternator components.	22.04 Qualifies main generator/ alternator components.	22.05 Aligns main generator/ alternator to engine.
		22.06 Removes/ installs main generator/ alternator.	22.07 Tests main generator/ alternator operation.	22.08 Verifies voltage regulator (VR) function.	22.09 Balances rotor.	

BLOCKS	TASKS	SUB-TASKS				
	23. Maintains/ troubleshoots electric drive motors.	23.01 Inspects electric drive motor components.	23.02 Performs scheduled maintenance of electric drive motor.	23.03 Assembles/ disassembles electric drive motor components.	23.04 Qualifies electric drive motor components.	23.05 Removes/ installs electric drive motor.
		23.06 Tests electric drive motor.	23.07 Renews shaft using hydraulic press.	23.08 Qualifies stator frame.	23.09 Machines commutator.	23.10 Assemble armature and frame.
	24. Maintains/ troubleshoots hydraulic motors and pumps.	24.01 Inspects hydraulic motors and pump components.	24.02 Performs scheduled maintenance of hydraulic motors and pumps.	24.03 Assembles/ disassembles hydraulic motors/ pump components.	24.04 Qualifies hydraulic motors and pump components.	24.05 Removes/ installs hydraulic motors and pump.
		24.06 Tests hydraulic motors and pump.				
	25. Maintains/ troubleshoots drivetrains.	25.01 Inspects drivetrain components.	25.02 Performs scheduled maintenance of drivetrains.	25.03 Assembles/ disassembles drivetrain components.	25.04 Qualifies drivetrain components.	25.05 Aligns drivetrain to engine.
		25.06 Removes/ installs drivetrain.	25.07 Tests drivetrain operation.			
	26. Maintains/ troubleshoots engine-mounted cooling fans.	26.01 Inspects engine-mounted cooling fan components.	26.02 Performs scheduled maintenance of engine-mounted cooling fans.	26.03 Assembles/ disassembles engine-mounted cooling fan components.	26.04 Qualifies engine-mounted cooling fan components.	26.05 Aligns engine-mounted cooling fans to engine.
		26.06 Removes/ installs engine-mounted cooling fans.	26.07 Tests engine-mounted cooling fan operation.			
	27. Overhaul, clean and qualify governor drive.	27.01 Inspects governor drive components.	27.02 Performs scheduled maintenance of governor drive.	27.03 Assembles/ disassembles governor drive components.	27.04 Qualifies governor drive components.	27.05 Aligns governor drive to engine.

BLOCKS	TASKS	SUB-TASKS			
		27.06 Removes and installs governor drive.			
G ELECTRICAL AND CONTROL SYSTEMS	28. Troubleshoots electrical control systems.	28.01 Diagnoses electrical starting systems.	28.02 Diagnoses electrical charging systems.	28.03 Diagnoses electrical accessory systems.	28.04 Diagnoses electrical power generator systems.
	29. Maintains electrical control systems.	29.01 Services electrical starting systems.	29.02 Services electrical charging systems.	29.03 Services electrical accessory systems.	29.04 Services electrical power generator systems.
	30. Troubleshoots pneumatic control systems.	30.01 Diagnoses pneumatic starting systems.	30.02 Diagnoses pneumatic accessory systems.		
	31. Maintains pneumatic control systems.	31.01 Services pneumatic starting systems.	31.02 Services pneumatic accessory systems.		
	32. Troubleshoots mechanical control systems.	32.01 Diagnoses mechanical starting systems.	32.02 Diagnoses mechanical charging systems.	32.03 Diagnoses mechanical accessory systems.	32.04 Diagnoses mechanical power generator systems.
	33. Maintains mechanical control systems.	33.01 Services mechanical starting systems.	33.02 Services mechanical charging systems.	33.03 Services mechanical accessory systems.	33.04 Services mechanical power generator systems.
H DIESEL ENGINE STRUCTURAL AND CABIN COMPONENTS	34. Assesses damage and extent of repair required.	34.01 Removes components to provide access.	34.02 Applies/ installs components.	34.03 Verifies integrity and functionality of repair.	
	35. Performs steel fabrication.	35.01 Lays out workpiece on replacement material.	35.02 Estimates and specifies required repair materials.	35.03 Sets up required tooling and equipment.	

BLOCKS	TASKS	SUB-TASKS			
	36. Changes out components.	36.01 Installs replacement components.	36.02 Verifies integrity and function of replacement components.		
	37. Maintains cab accessories.	37.01 Inspects cab components and related equipment.	37.02 Changes out cab components and related equipment.	37.03 Fabricates floor and ceiling materials.	37.04 Inspects/ services air conditioning and heating components.