

# **TRUCK AND TRANSPORT (On-Road)**

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## **NATIONAL OCCUPATIONAL ANALYSIS (2007) Integrated With INDIVIDUAL LEARNING MODULES**

Revised May 7, 2009



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# DOCUMENT DESCRIPTION

Tasks that are performed by skilled workers in this trade across Canada.

Block: A group of related tasks.

This number indicates the percentage of exam questions on the topic.

**A → OCCUPATIONAL SKILLS → 17%**

**I → USES TOOLS, EQUIPMENT AND MATERIAL →**

	Subtask	Enabling Objective	ILM Module Number	ILM Module Name
1.01	Uses hand tools	<ul style="list-style-type: none"> <li>•→ ability to use measuring and layout tools (tapes, rules, squares, dividers, sliding T bevel, protractor, trammel points, callipers)</li> <li>•→ ability to sharpen and maintain tools</li> <li>•→ ability to use cutting tools (saws, files, rasps)</li> <li>•→ ability to use fastening tools (hammers, wrenches, screwdrivers, staplers)</li> <li>•→ ability to use hand chisels and planes</li> <li>•→ ability to use hand drills</li> <li>•→ ability to use abrading tools (sandpaper)</li> <li>•→ ability to use dismantling tools (nail pullers, wrecking bars)</li> </ul>	020103a	Hand Tools

Subtask Number

Small divisions, when combined, describe the duties constituting a task.

The essential skills and knowledge required to perform the task and subtask.

Module name and number where information is available on the subtask/enabling objective.

## A OCCUPATIONAL SKILLS

5%

### 1 MAINTAINS TOOLS AND EQUIPMENT

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
1.01	Maintains hand tools	<ul style="list-style-type: none"><li>• knowledge of types of hand tools</li><li>• knowledge of operating procedures</li><li>• knowledge of imperial system and international metric system (SI)</li><li>• knowledge of types of specialty tools such as pullers, presses and tamperproof tools</li><li>• ability to organize hand tools</li><li>• ability to store hand tools</li><li>• ability to recognize worn, damaged or defective hand tools</li></ul>	190101a 190101b 190101c 190101d 190101e	Safety and Communications Lifting Procedures & Wire Ropes Materials and Fastening Devices Hand, Shop and Power Tools Measuring Tools
1.02	Maintains power tools	<ul style="list-style-type: none"><li>• knowledge of types of power tools such as impact guns, drills and grinders</li><li>• knowledge of operating procedures</li><li>• knowledge of basic repairs of power</li></ul>	190101d	Hand, Shop and Power Tools

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<p>tools</p> <ul style="list-style-type: none"> <li>• knowledge of manufacturers' maintenance specifications such as lubrication and calibration schedules</li> <li>• knowledge of provincial regulations in regards to shop equipment maintenance</li> <li>• ability to organize power tools</li> <li>• ability to store power tools</li> <li>• ability to recognize worn, damaged or defective power tools</li> </ul>		
1.03	Maintains measuring, testing and diagnostic tools	<ul style="list-style-type: none"> <li>• knowledge of measuring devices such as micrometers, calipers and tape measures</li> <li>• knowledge of testing devices such as pressure gauges, flowmeters and temperature gauges</li> <li>• knowledge of diagnostic tools such as computer and handheld diagnostic tools</li> <li>• knowledge of operating procedures</li> <li>• knowledge of manufacturers'</li> </ul>	190101e	Measuring Tools

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<p data-bbox="636 289 982 318">maintenance specifications</p> <ul data-bbox="590 362 1121 699" style="list-style-type: none"> <li data-bbox="590 362 1121 472">• ability to recognize worn, damaged or defective measuring, testing and diagnostic tools</li> <li data-bbox="590 516 1121 586">• ability to reset measuring, testing and diagnostic tools</li> <li data-bbox="590 630 1121 699">• ability to store measuring, testing and diagnostic tools</li> </ul>		
1.04	Maintains hoisting and lifting equipment	<ul data-bbox="590 743 1121 1464" style="list-style-type: none"> <li data-bbox="590 743 1121 854">• knowledge of types of hoisting and lifting equipment such as jacks, chain hoists and vehicle hoists</li> <li data-bbox="590 898 1121 927">• knowledge of operating procedures</li> <li data-bbox="590 971 1121 1040">• knowledge of applications of hoisting and lifting equipment</li> <li data-bbox="590 1084 1121 1154">• knowledge of limitations of hoisting and lifting equipment</li> <li data-bbox="590 1198 1121 1268">• ability to recognize and interpret tags on equipment identifying load limits</li> <li data-bbox="590 1312 1121 1382">• ability to recognize safe lifting locations or points</li> <li data-bbox="590 1425 1121 1464">• ability to recognize worn, damaged or</li> </ul>	190101b	Lifting Procedures and Wire Ropes

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<p>defective hoisting and lifting equipment</p> <ul style="list-style-type: none"> <li>• ability to recognize potential hazards such as ceiling heights, overhead wires and uneven surfaces</li> </ul>		
1.05	Maintains personal protective equipment (PPE) and safety equipment	<ul style="list-style-type: none"> <li>• knowledge of types of PPE such as respiratory, hearing, eye and body protection</li> <li>• knowledge of types of safety equipment such as caging devices, shop ventilation, eye wash station and first aid kit</li> <li>• knowledge of PPE and safety equipment operations</li> <li>• knowledge of workplace safety and health regulations such as fall protection and Workplace Hazardous Materials Information System (WHMIS)</li> <li>• knowledge of location of safety equipment</li> <li>• ability to recognize worksite hazards</li> </ul>	<p>190101a</p> <p>190101b</p>	<p>Safety and Communications</p> <p>Lifting Procedures &amp; Wire Ropes</p>

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<ul style="list-style-type: none"> <li>• ability to store PPE and safety equipment</li> <li>• ability to recognize worn, damaged or defective PPE and safety equipment</li> </ul>		
1.06	Maintains staging equipment	<ul style="list-style-type: none"> <li>• knowledge of types of staging equipment such as axle stands, blocking and scaffolds</li> <li>• knowledge of load limitations of staging equipment and supporting devices</li> <li>• ability to recognize and interpret tags on staging equipment identifying load limits</li> <li>• ability to recognize worn, damaged or defective staging equipment</li> <li>• ability to store staging equipment</li> </ul>	190101b	Lifting Procedures and Wire Ropes
1.07	Maintains solvent washers and biological parts washers	<ul style="list-style-type: none"> <li>• knowledge of operating procedures</li> <li>• knowledge of particle counts</li> <li>• knowledge of WHMIS</li> <li>• knowledge of recycling and disposal</li> </ul>	190101a	Safety and Communications

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		procedures <ul style="list-style-type: none"> <li>• ability to change solvents</li> </ul>		

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## 2 ORGANIZES WORK

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	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
2.01	Uses documentation and reference materials	<ul style="list-style-type: none"> <li>• knowledge of different types of documents and reference tools materials such as service manuals, Material Safety Data Sheets (MSDS) and check lists</li> <li>• knowledge of documentation and reference material formats (paper and digital)</li> <li>• knowledge of jurisdictional/industry regulations</li> <li>• knowledge of preventative maintenance schedules</li> <li>• ability to locate vehicle identification numbers</li> <li>• ability to locate and update manuals,</li> </ul>		Considered on the job training

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<p>service bulletins and support documentation (paper or digital)</p> <ul style="list-style-type: none"> <li>• ability to interpret shop service manuals</li> <li>• ability to interpret schematics and drawings</li> <li>• ability to document service records</li> <li>• ability to draw up parts lists</li> <li>• ability to match replacement part to original part</li> <li>• ability to refer to original equipment manufacturer (OEM) specifications, and diagnostic and servicing procedures</li> </ul>		
2.02	Communicates with others	<ul style="list-style-type: none"> <li>• knowledge of technical terminology</li> <li>• knowledge of industry policies and procedures, guidelines and standards</li> <li>• knowledge of verbal and written communication</li> <li>• ability to use communication equipment and media such as Internet,</li> </ul>	190101a	Safety and Communications

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		email and fax <ul style="list-style-type: none"> <li>• ability to translate technical information into layperson's terms</li> <li>• ability to acquire information through questioning</li> <li>• ability to communicate with industry professionals such as partspersons, supervisors and other mechanics</li> <li>• ability to communicate with customers</li> <li>• ability to communicate with manufacturer representatives and salespeople</li> </ul>		
2.03	Maintains safe work environment	<ul style="list-style-type: none"> <li>• knowledge of WHMIS</li> <li>• knowledge of types and operation of fire extinguishing equipment</li> <li>• knowledge of safety equipment such as first aid stations, eye wash stations and stretchers</li> <li>• knowledge of emergency phone numbers</li> <li>• knowledge of industry-related safety</li> </ul>	190101a	Safety and Communications

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<p>acts and regulations</p> <ul style="list-style-type: none"> <li>• knowledge of company policies and procedures such as evacuation routes, location of safety equipment and safety training</li> <li>• knowledge of disposal and recycling procedures</li> <li>• ability to recognize potential hazards such as fluids and gases under high pressure in hydraulic, pneumatic and air conditioning systems</li> <li>• ability to handle and store hazardous materials</li> <li>• ability to perform walk-around inspection of vehicles</li> </ul>		

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### **3 PERFORMS ROUTINE TRADE ACTIVITIES**

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	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
3.01	Uses computer for diagnostics	<ul style="list-style-type: none"> <li>• knowledge of operation of specialized diagnostic tools such as computer and</li> </ul>	190204a	Electronic Fuel System Fundamentals

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		handheld devices <ul style="list-style-type: none"> <li>• knowledge of components such as data connectors, receptacles and adapters</li> <li>• ability to use operating software</li> <li>• ability to use specialized diagnostic software</li> <li>• ability to check for and install software updates</li> <li>• ability to interpret diagnostic results and reports</li> <li>• ability to record diagnostic information</li> <li>• ability to download and print reports from electronic control modules (ECMs)</li> </ul>	190204b 190204c 190205a 190205b 190205c 190205d 190205e 190301a	Electronic Controlled Fuel Injection Systems Performance Analysis & Tune-up Charging System & Control Circuit Fundamentals Charging System Testing & Service Cranking System Fundamentals and Motor Drives Cranking system Control Circuits Cranking system Testing & Service Hydraulic Principles
3.02	Maintains fluids, lubricants and coolants	<ul style="list-style-type: none"> <li>• knowledge of types of lubricants such as synthetic, semi-synthetic and nonsynthetic</li> <li>• knowledge of the limitation of mixing types of fluids, lubricants and coolants</li> <li>• knowledge of the disposal and recycling of fluids, lubricants and</li> </ul>	190102h 190405d	Preventative Maintenance Orientation to Vehicle Inspection

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		coolants <ul style="list-style-type: none"> <li>• ability to verify fluid levels such as transmission levels, differential levels and hydraulic levels</li> <li>• ability to select types and grades of fluids and lubricants appropriate for the application</li> <li>• ability to select types of coolants appropriate for the application</li> <li>• ability to identify when fluids have been mixed improperly</li> <li>• ability to store fluids, lubricants and coolants according to regulations</li> <li>• ability to take fluid samples</li> <li>• ability to interpret fluid sample results</li> </ul>		
3.03	Uses fasteners, sealing devices, adhesives and gaskets	<ul style="list-style-type: none"> <li>• knowledge of types of fasteners, sealing devices, adhesives and gaskets</li> <li>• knowledge of chemical reaction of sealants</li> <li>• knowledge of torque specification of</li> </ul>	190101c	Materials and Fastening Devices

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<p>fasteners</p> <ul style="list-style-type: none"> <li>• knowledge of taps, dies and thread repair kits</li> <li>• ability to select the appropriate sealing or gasket material for the job</li> <li>• ability to install fasteners, sealing devices, adhesives and gaskets</li> <li>• ability to identify grade, thread pitch and size of fasteners</li> <li>• ability to make gaskets</li> <li>• ability to repair threads using tools such as taps, dies, chasers and thread inserts</li> <li>• ability to apply specialty sealants such as aerobic and anaerobic</li> <li>• ability to remove broken fasteners</li> </ul>		
3.04	Services hoses, tubing and fittings	<ul style="list-style-type: none"> <li>• knowledge of different types of hoses, tubing and fittings such as plastic, rubber, neoprene and steel</li> <li>• knowledge of regulations regarding</li> </ul>	190105b	Hydraulic System Components: Reservoir, Filters, Hoses and Coolers

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		hoses, tubing and fittings <ul style="list-style-type: none"> <li>• ability to relieve pressure from air and fluid systems before disconnecting hoses, tubing and fittings</li> <li>• ability to remove and replace hoses, tubing and fittings</li> <li>• ability to match hoses, tubing and fittings to fluid being used</li> <li>• ability to identify pressure limits of hoses, tubing, fittings and clamps</li> <li>• ability to construct hose/tube assemblies</li> <li>• ability to flare tubing</li> </ul>		
3.05	Services bearings, bushings and seals	<ul style="list-style-type: none"> <li>• knowledge of types of bearings</li> <li>• knowledge of types of bushings</li> <li>• knowledge of types of seals such as static and dynamic</li> <li>• knowledge of the application of bearings, bushings and seals</li> <li>• knowledge of types of shaft repairs</li> </ul>	190102c	Bearings and Seals

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<p>such as installing wear sleeves and machining shaft</p> <ul style="list-style-type: none"> <li>• ability to identify symptoms of failing bearings, bushings and seals</li> <li>• ability to recognize worn, damaged or defective bearings, bushings and seals</li> <li>• ability to lubricate bearings, bushings and seals</li> <li>• ability to install bearings, bushings and seals</li> <li>• ability to identify the allowable tolerance of bearings and bushings</li> <li>• ability to adjust bearings and bushings</li> </ul>		
3.06	Services filters	<ul style="list-style-type: none"> <li>• knowledge of different types of filters such as wash-out and pre-cleaners</li> <li>• knowledge of the application of filters such as air, fuel and oil</li> <li>• knowledge of the disposal and recycling of filters</li> <li>• knowledge of location of filters such as</li> </ul>	190102h 190405d	Preventative Maintenance  Orientation to Vehicle Inspection

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<p>transmission, cab and differentials</p> <ul style="list-style-type: none"> <li>• ability to select tools used to remove and install filters</li> <li>• ability to relieve pressure from air and fluids before removing filters</li> <li>• ability to remove filters</li> <li>• ability to recognize plugged filters</li> <li>• ability to install filters</li> </ul>		
3.07	Uses welding equipment	<ul style="list-style-type: none"> <li>• knowledge of types of welding equipment such as oxy-acetylene (OAW) and MIG gas metal arc welding (GMAW)</li> <li>• knowledge of welding materials such as electrodes, wires and shielding gases</li> <li>• knowledge of jurisdictional regulations for welding procedures</li> <li>• knowledge of welding principles and considerations</li> <li>• knowledge of basic welding procedures</li> <li>• ability to organize welding equipment</li> </ul>		Usually contracted out to a welding shop

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<ul style="list-style-type: none"> <li>• ability to store welding equipment</li> <li>• ability to transport welding equipment according to standards such as federal, provincial and territorial regulations and Transport of Dangerous Goods (TDG)</li> <li>• ability to recognize worn, damaged or defective welding equipment and potential hazards</li> <li>• ability to determine when structural welding must be done by welders</li> <li>• ability to maintain welding equipment such as cleaning welding tips</li> </ul>		
3.08	Uses cutting equipment	<ul style="list-style-type: none"> <li>• knowledge of types of cutting equipment such as OAW and plasma</li> <li>• knowledge of cutting principles and considerations</li> <li>• knowledge of basic cutting procedures</li> <li>• ability to organize cutting equipment</li> <li>• ability to store cutting equipment</li> </ul>	190101f	Oxy-Fuel Equipment, Heating and Cutting

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<ul style="list-style-type: none"> <li>• ability to transport cutting equipment according to standards such as federal, provincial and territorial regulations and TDG</li> <li>• ability to recognize worn, damaged or defective cutting equipment and potential hazards</li> <li>• ability to maintain cutting equipment such as cleaning cutting tips</li> </ul>		
3.09	Verifies vehicle repairs	<ul style="list-style-type: none"> <li>• knowledge of industry regulations respecting vehicle repair and compliance</li> <li>• knowledge of company policies and procedures such as work orders and checklists</li> <li>• knowledge of repair procedures</li> <li>• ability to bench test rebuilt components such starters, switches and electrical components</li> <li>• ability to perform a walk-around ability to advise operator of required follow-up procedures such as retorques and</li> </ul>		Considered on the job training

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		fluid top-ups <ul style="list-style-type: none"> <li>• inspection</li> <li>• ability to verify that dimensions/pressures are correct according to OEM specifications</li> </ul>		
3.10	Conducts road tests	<ul style="list-style-type: none"> <li>• knowledge of jurisdictional licensing regulations</li> <li>• knowledge of proper performance of vehicle</li> <li>• knowledge of operation of vehicle</li> <li>• ability to drive the vehicle</li> <li>• ability to perform sensory inspection</li> <li>• ability interpret the results of a road test</li> </ul>	190204c 190302b 190303f 190401f 190401I	Performance Analysis & Tune-up Suspension System Fundamentals & Service Powershift & Automatic Transmission Testing & Service Transmission Service Drive Axle Assembly Service (On Road)

**B ENGINE AND SUPPORTING SYSTEMS****16%****4 DIAGNOSES ENGINE AND SUPPORTING SYSTEMS**

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
4.01	Diagnoses base engine	<ul style="list-style-type: none"><li>• knowledge of components of base engine</li><li>• knowledge of operating principles of two-stroke and four-stroke engines</li><li>• knowledge of troubleshooting trees</li><li>• ability to perform specialized testing procedures such as dye testing, pressure testing and engine oil analysis</li><li>• ability to perform sensory inspection</li><li>• ability to interpret diagnostic readings</li><li>• ability to compare diagnostic results to industry norms</li><li>• ability to perform failure analysis</li></ul>	190201a 190201b 190201c 190201d 190201e 190201f 190201g 190201h 190201I	Engine Fundamentals Engine Block & Cylinder Liner Fundamentals Engine Block & Cylinder Liner Service Piston, Piston Rings & Connecting Rod Fundamentals Piston, Piston Rings & Connecting Rod Service Crankshaft, Bearings & Related Component Fundamentals Crankshaft, Bearings & Related Component Service Camshaft & Follower Fundamentals Camshaft & Follower Service

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
			190201j	Cylinder Head Fundamentals
			190201kA	Cylinder Head Service – Part A
			190201kB	Cylinder Head Service – Part B
			190201L	Engine Braking System Fundamentals & Service
4.02	Diagnoses cooling system	<ul style="list-style-type: none"> <li>• knowledge of cooling system principles</li> <li>• knowledge of cooling system components such as fans, shutters, block heaters and belts</li> <li>• knowledge of auxiliary heaters</li> <li>• knowledge of OEM auxiliary heating components</li> <li>• knowledge of radiator cap relief pressure</li> <li>• knowledge of types of coolants</li> <li>• knowledge of coolant additives</li> <li>• knowledge of hazards of pressurized cooling systems</li> <li>• ability to recognize failed, worn,</li> </ul>	190202dA  190202dB	Cooling Systems (Liquid & Air) – Part A  Cooling Systems (Liquid & Air) – Part B

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<p>damaged and defective components</p> <ul style="list-style-type: none"> <li>• ability to recognize contamination of coolant</li> <li>• ability to interpret coolant flow schematics</li> <li>• ability to perform specialized testing procedures such as dye testing, pressure testing and coolant analysis</li> <li>• ability to perform pressure test for systems and separate components</li> <li>• ability to perform coolant strength test and supplemental coolant additives (SCA) test</li> </ul>		
4.03	Diagnoses lubrication system	<ul style="list-style-type: none"> <li>• knowledge of lubrication system operation</li> <li>• knowledge of lubrication system components such as oil pumps, filters and coolers</li> <li>• knowledge of inspection and testing procedures</li> <li>• ability to identify oil contamination</li> </ul>	190202c	Lubrication systems & Crankcase Ventilation

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<ul style="list-style-type: none"> <li>• ability to perform sensory inspection</li> <li>• ability to interpret lubricant flow schematics</li> <li>• ability to perform pressure test of systems and separate components</li> <li>• ability to interpret test results</li> <li>• ability to identify failed, worn, damaged and defective components</li> </ul>		
4.04	Diagnoses fuel delivery system	<ul style="list-style-type: none"> <li>• knowledge of types of fuel delivery systems such as mechanical and electronic</li> <li>• knowledge of fuel delivery system components such as pumps, injectors, tanks, check valves and lines</li> <li>• knowledge of fuel system operation</li> <li>• knowledge of winter and summer fuels</li> <li>• ability to recognize hazards of fuel delivery systems such as high voltage and high pressures</li> <li>• ability to interpret fuel system flow</li> </ul>	<p>190203a</p> <p>190203b</p> <p>190203c</p> <p>190203d</p> <p>190203e</p> <p>190203f</p> <p>190203g</p>	<p>Diesel Fuel &amp; Storage Tanks (Machine &amp; Bulk Storage)</p> <p>Combustion Process &amp; Starting Aids</p> <p>Basic Fuel Injection System</p> <p>Fuel system Service</p> <p>Port/Helix Metering Fuel System</p> <p>Opposed Plunger Inlet Fuel Metering System</p> <p>Diesel Fuel Injector Fundamentals &amp; Service</p>

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		schematics <ul style="list-style-type: none"> <li>• ability to perform sensory inspection</li> <li>• ability to identify fuel contamination</li> <li>• ability to use diagnostic tools such as pressure testing equipment, flowmeters and handheld devices</li> <li>• ability to perform pressure tests on fuel system components</li> <li>• ability to interpret test results</li> <li>• ability to recognize failed, worn, damaged and defective components</li> </ul>	190203h  190203i	Engine Governor Fundamentals & Service  Emergency Shut-down Systems
4.05	Diagnoses intake and exhaust systems	<ul style="list-style-type: none"> <li>• knowledge of intake system components such as CACs, turbochargers and superchargers</li> <li>• knowledge of emergency shutdown devices such as air dams (cable and switch operated)</li> <li>• knowledge of exhaust system components such as manifolds, piping and mufflers</li> <li>• knowledge of starting aids such as pre-</li> </ul>	190202a  190202b	Air Induction & Exhaust Systems  Turbo Charged air Systems

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		heaters, ether injectors and glow plugs <ul style="list-style-type: none"> <li>• ability to recognize hazards of intake and exhaust systems such as running engine in confined spaces and dangers surrounding air inlets</li> <li>• ability to identify intake system contamination such as dust, oil and antifreeze</li> <li>• ability to perform sensory inspection</li> <li>• ability to detect leaks in intake and exhaust systems</li> <li>• ability to inspect intake and exhaust components</li> <li>• ability to perform specialized intake testing procedures</li> <li>• ability to identify starting aid malfunction</li> <li>• ability to interpret test results</li> </ul>		
4.06	Diagnoses emission systems for diesel engines	<ul style="list-style-type: none"> <li>• knowledge of jurisdictional regulations</li> <li>• knowledge of emission system components such as catalytic</li> </ul>	190202a  190202b	Air Induction & Exhaust Systems  Turbo Charged air Systems

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		converters, EGR systems and particulate traps <ul style="list-style-type: none"> <li>• knowledge of emission system functions and operations</li> <li>• ability to perform sensory inspection</li> <li>• ability to perform specialized testing procedures using equipment such as back pressure tester and opacity meter</li> <li>• ability to interpret test results</li> </ul>		
4.07	Diagnoses engine management system	<ul style="list-style-type: none"> <li>• knowledge of engine management system components such as ECM, sensors, solenoids and harnesses</li> <li>• knowledge of the operation, design and function of engine management systems</li> <li>• ability to perform specialized testing to determine electronic/electrical faults using equipment such as computers, handheld devices, break-out harnesses and multimeters</li> <li>• ability to perform sensory inspection</li> </ul>	190202a 190202b	Air Induction & Exhaust Systems Turbo Charged air Systems

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<ul style="list-style-type: none"> <li>• ability to interpret test results</li> </ul>		

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## 5 SERVICES ENGINE AND SUPPORTING SYSTEMS

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	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
5.01	Services base engine	<ul style="list-style-type: none"> <li>• knowledge of components of base engine such as blocks, crankshaft, camshafts, cylinder head, pistons and bushings</li> <li>• knowledge of operating principles of two-stroke and four-stroke engines</li> <li>• knowledge of component compatibility with solvents and cleaning agents</li> <li>• ability to recognize related effect of component failure such as consequences of turbo failure</li> <li>• ability to use specialized tools</li> <li>• ability to clean components</li> </ul>	<p>190201a</p> <p>190201b</p> <p>190201c</p> <p>190201d</p> <p>190201e</p> <p>190201f</p> <p>190201g</p>	<p>Engine Fundamentals</p> <p>Engine Block &amp; Cylinder Liner Fundamentals</p> <p>Engine Block &amp; Cylinder Liner Service</p> <p>Piston, Piston Rings &amp; Connecting Rod Fundamentals</p> <p>Piston, Piston Rings &amp; Connecting Rod Service</p> <p>Crankshaft, Bearings &amp; Related Component Fundamentals</p> <p>Crankshaft, Bearings &amp; Related Component Service</p>

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<ul style="list-style-type: none"> <li>• ability to identify necessary replacement parts</li> <li>• ability to replace components such as cylinder heads, gaskets, water pumps and oil coolers</li> <li>• ability to perform update modification as per OEM specifications</li> <li>• ability to repair and rebuild all engine components such as cylinder heads and water pumps</li> <li>• ability to recognize worn, damaged or defective components</li> <li>• ability to measure tolerances, clearances and backlash such as shim, liner protrusions and gear clearance</li> </ul>	<p>190201h</p> <p>190201I</p> <p>190201j</p> <p>190201kA</p> <p>190201kB</p> <p>190201L</p>	<p>Camshaft &amp; Follower Fundamentals</p> <p>Camshaft &amp; Follower Service</p> <p>Cylinder Head Fundamentals</p> <p>Cylinder Head Service – Part A</p> <p>Cylinder Head Service – Part B</p> <p>Engine Braking System Fundamentals &amp; Service</p>
5.02	Services cooling system	<ul style="list-style-type: none"> <li>• knowledge of cooling system principles</li> <li>• knowledge of cooling system components such as fans, shutters and belts</li> <li>• knowledge of auxiliary heaters</li> <li>• knowledge of OEM auxiliary heating</li> </ul>	<p>190202dA</p> <p>190202dB</p>	<p>Cooling Systems (Liquid &amp; Air) – Part A</p> <p>Cooling Systems (Liquid &amp; Air) – Part B</p>

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<p>components</p> <ul style="list-style-type: none"> <li>• knowledge of types of coolants</li> <li>• knowledge of coolant additives</li> <li>• knowledge of controls such as ECMs and manual switches</li> <li>• knowledge of radiator cap relief pressure</li> <li>• knowledge of hazards of cooling systems under pressure such as steam and extreme heat</li> <li>• ability to release pressure from system</li> <li>• ability to use specialized tools such as coolant recycle machine, seal drivers and belt tension gauge</li> <li>• ability to remove cooling system components</li> <li>• ability to identify necessary replacement components</li> <li>• ability to rebuild cooling system components</li> </ul>		

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<ul style="list-style-type: none"> <li>• ability to replace cooling system components</li> <li>• ability to adjust belt tension</li> <li>• ability to perform recycle procedure on cooling system</li> </ul>		
5.03	Services lubrication system	<ul style="list-style-type: none"> <li>• knowledge of lubrication system operation</li> <li>• knowledge of lubrication system components such as oil pumps, filters and coolers</li> <li>• knowledge of inspection and testing procedures</li> <li>• knowledge of controls such as ECMs and manual switches</li> <li>• ability to use specialized tools such as pullers, presses and feeler gauges</li> <li>• ability to remove lubrication system components</li> <li>• ability to identify necessary replacement components</li> </ul>	190202c	Lubrication systems & Crankcase Ventilation

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<ul style="list-style-type: none"> <li>• ability to recognize worn, damaged and defective components</li> <li>• ability to rebuild lubrication system components</li> <li>• ability to replace lubrication system components</li> </ul>		
5.04	Services fuel delivery system	<ul style="list-style-type: none"> <li>• knowledge of types of fuel delivery systems such as mechanical and electronic</li> <li>• knowledge of fuel delivery system components such as pumps, injectors, tanks, check valves and lines</li> <li>• knowledge of fuel system operation</li> <li>• knowledge of controls such as ECMs and manual switches</li> <li>• ability to recognize hazards of fuel delivery systems such as high voltage and high pressures</li> <li>• ability to recognize winter and summer fuels</li> <li>• ability to interpret flow schematics</li> </ul>	<p>190203a</p> <p>190203b</p> <p>190203c</p> <p>190203d</p> <p>190203e</p> <p>190203f</p> <p>190203g</p> <p>190203h</p> <p>190203i</p>	<p>Diesel Fuel &amp; Storage Tanks (Machine &amp; Bulk Storage)</p> <p>Combustion Process &amp; Starting Aids</p> <p>Basic Fuel Injection System</p> <p>Fuel system Service</p> <p>Port/Helix Metering Fuel System</p> <p>Opposed Plunger Inlet Fuel Metering System</p> <p>Diesel Fuel Injector Fundamentals &amp; Service</p> <p>Engine Governor Fundamentals &amp; Service</p> <p>Emergency Shut-down Systems</p>

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<ul style="list-style-type: none"> <li>• ability to determine component specifications</li> <li>• ability to use specialized tools such as pullers, specialized wrenches and gauges</li> <li>• ability to remove fuel delivery system components</li> <li>• ability to recognize worn, damaged and defective components</li> <li>• ability to identify necessary replacement components</li> <li>• ability to replace fuel delivery system components</li> <li>• ability to calibrate electronic injectors</li> </ul>		
5.05	Services intake and exhaust systems	<ul style="list-style-type: none"> <li>• knowledge of intake system components such as CACs, turbochargers and superchargers</li> <li>• knowledge of controls such as ECMs and manual switches</li> <li>• knowledge of emergency shutdown devices such as air dams (cable and</li> </ul>	190202a 190202b	Air Induction & Exhaust Systems Turbo Charged air Systems

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<p>switch operated)</p> <ul style="list-style-type: none"> <li>• knowledge of exhaust system components such as manifolds, piping and mufflers</li> <li>• knowledge of starting aids such as pre-heaters, ether injectors and glow plugs</li> <li>• knowledge of hazards of intake and exhaust systems such as running engine in confined spaces and dangers surrounding air inlets</li> <li>• ability to repair intake system components</li> <li>• ability to replace intake system components</li> <li>• ability to repair exhaust system components</li> <li>• ability to replace exhaust system components</li> <li>• ability to repair starting aid components</li> <li>• ability to replace starting aid components</li> </ul>		

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<ul style="list-style-type: none"> <li>• ability to use welding equipment to repair piping, remove broken fasteners and cutting exhaust pipe</li> <li>• ability to install starting aid components</li> <li>• ability to identify worn, damaged and defective components for intake and exhaust systems</li> </ul>		
5.06	Services emission systems for diesel engines	<ul style="list-style-type: none"> <li>• knowledge of jurisdictional regulations</li> <li>• knowledge of emission system components such as catalytic converters, EGRs and particulate traps</li> <li>• knowledge of servicing procedures for emission systems</li> <li>• knowledge of emission system functions and operations</li> <li>• knowledge of controls such as ECMs and manual switches</li> <li>• ability to replace emission system components</li> <li>• ability to identify worn, damaged and</li> </ul>	<p>190202a</p> <p>190202b</p>	<p>Air Induction &amp; Exhaust Systems</p> <p>Turbo Charged air Systems</p>

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		defective components <ul style="list-style-type: none"> <li>• ability to perform maintenance on particulate traps</li> </ul>		
5.07	Services engine management system	<ul style="list-style-type: none"> <li>• knowledge of the operation, design and function of engine management systems</li> <li>• knowledge of controls such as ECMs and manual switches</li> <li>• knowledge of hazards when servicing engine management systems such as high voltage and voltage spiking</li> <li>• knowledge of specialized tools such as computers, handheld devices and multimeters</li> <li>• knowledge of specialized connectors and harnesses such as sensor connections, injector harnesses and ECM connectors</li> <li>• ability to identify engine management system components such as sensors, actuators and ECMs</li> <li>• ability to repair engine management</li> </ul>	190202a 190202b	Air Induction & Exhaust Systems Turbo Charged air Systems

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<p>systems components such as harnesses and connectors</p> <ul style="list-style-type: none"> <li>• ability to replace engine management components such as actuators, sensors, potentiometer and solenoids</li> <li>• ability to calibrate engine management components such as injectors, turbochargers and speed control sensors</li> <li>• ability to reprogram parameters such as shut downs, cruise controls and fan controls</li> <li>• ability to update engine management system software</li> </ul>		

## C AIR SYSTEMS AND BRAKES

16%

### 6 DIAGNOSES AIR SYSTEMS AND BRAKES

	Subtask	Enabling Objective	ILM Module Number	ILM Module Name
6.01	Diagnoses air systems	<ul style="list-style-type: none"><li>• knowledge of air system design and function</li><li>• knowledge of air system components such as compressors, valves and brake chambers</li><li>• knowledge of air starting systems</li><li>• knowledge of common faults such as ruptured and chafed hoses, sticking valves and compressor not building air pressure</li><li>• knowledge of air system specifications</li><li>• ability to perform sensory inspection</li><li>• ability to recognize hazards of diagnosing air systems</li><li>• ability to use diagnostic tools such as soap and water, gauges and hand tools</li></ul>	190106a 190106b 190106cA 190106cB 190106d 190106e 190106f 190404a 190404b	Air Brake System Fundamentals Air Brake System Mechanical Components Truck/Tractor Air Brake System Components – Part A Truck/Tractor Air Brake System Components – Part B Trailer Air Brake system Components Air Brake Testing & Service Air Antilock Brake System Fundamentals Air Antilock Brake Systems Air Antilock Brake System Diagnosis

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<ul style="list-style-type: none"> <li>ability to perform tests such as pressure tests, timed tests and leakdown tests</li> </ul>		
6.02	Diagnoses brake systems	<ul style="list-style-type: none"> <li>knowledge of types of brake systems such as air, hydraulic and emergency (parking) brake</li> <li>knowledge of air brake components such as brake chambers, slack adjusters (automatic and manual), rotors, calipers, S cams, pins and bushings</li> <li>knowledge of hydraulic brake components such as master cylinders, wheel cylinders and brake proportioning valves</li> <li>knowledge of common faults such as broken brake chamber springs, leaking diaphragms and loose calipers</li> <li>knowledge of types of brake shoes and linings</li> <li>knowledge of brake system operation</li> <li>knowledge of traction control and braking systems</li> <li>knowledge of warning systems</li> </ul>	<p>190103a</p> <p>190103b</p> <p>190103c</p> <p>190103d</p> <p>190103e</p> <p>190103f</p> <p>190106a</p> <p>190106b</p> <p>190106cA</p> <p>190106cA</p> <p>190106d</p>	<p>Hydraulic Brake System Fundamentals</p> <p>Hydraulic Brake System (Drum and Disc)</p> <p>Hydraulic Brake System Diagnosis and Service</p> <p>Hydraulic Brake Booster System Fundamentals and Service</p> <p>Parking Brake System Fundamentals and Service</p> <p>Electric Brake Fundamentals and Service</p> <p>Air Brake System Fundamentals</p> <p>Air Brake System Mechanical Components</p> <p>Truck/Tractor Air Brake System Components – Part A</p> <p>Truck/Tractor Air Brake System Components – Part B</p> <p>Trailer Air Brake system</p>

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<ul style="list-style-type: none"> <li>• ability to perform sensory inspection</li> <li>• ability to measure brake drums and rotors</li> <li>• ability to check for wear on components such as brake shoes, S cams and bushings</li> <li>• ability to interpret flash/fault codes for ABS</li> <li>• ability to interpret schematics</li> <li>• ability to use ABS diagnostic equipment such as readers, computers, handheld devices and multimeters</li> </ul>	 190106e  190106f   190404a  190404b	Components  Air Brake Testing & Service  Air Antilock Brake System Fundamentals  Air Antilock Brake Systems  Air Antilock Brake System Diagnosis
6.03	Diagnoses auxiliary braking systems	<ul style="list-style-type: none"> <li>• knowledge of types and operation of auxiliary/retarder braking systems such as engine, driveline and exhaust</li> <li>• knowledge of braking system components such as solenoids, valves and switches</li> <li>• knowledge of common faults such as corroded wiring, intermittent operation and weak performance</li> </ul>	190106a  190106b  190106cA  190106cB  190106d	Air Brake System Fundamentals  Air Brake System Mechanical Components  Truck/Tractor Air Brake System Components – Part A  Truck/Tractor Air Brake System Components – Part B  Trailer Air Brake system

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<ul style="list-style-type: none"> <li>• ability to perform sensory inspection</li> <li>• ability to use diagnostic equipment such as computer, handheld devices, multimeter and pressure gauges</li> <li>• ability to interpret test results</li> </ul>	190106e 190106f 190404a 190404b	Components Air Brake Testing & Service Air Antilock Brake System Fundamentals Air Antilock Brake Systems Air Antilock Brake System Diagnosis

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## 7 SERVICES AIR SYSTEMS AND BRAKES

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	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
7.01	Services air systems	<ul style="list-style-type: none"> <li>• knowledge of air system design and function</li> <li>• knowledge of air system components such as compressors, valves and brake chambers</li> <li>• knowledge of air starting systems</li> <li>• ability to recognize hazards of servicing air systems</li> </ul>	190106a 190106b 190106cA 190106cB 190106d	Air Brake System Fundamentals Air Brake System Mechanical Components Truck/Tractor Air Brake System Components – Part A Truck/Tractor Air Brake System Components – Part B Trailer Air Brake system

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<ul style="list-style-type: none"> <li>• ability to replace components such as air lines, relay valves, modulating valves and compressors</li> <li>• ability to repair components such as air starters, compressors, air dryers and driver warning systems</li> <li>• ability to perform general maintenance on air dryers and compressors</li> </ul>	<p>190106e</p> <p>190106f</p> <p>190404a</p> <p>190404b</p>	<p>Components</p> <p>Air Brake Testing &amp; Service</p> <p>Air Antilock Brake System Fundamentals</p> <p>Air Antilock Brake Systems</p> <p>Air Antilock Brake System Diagnosis</p>
7.02	Services brake systems	<ul style="list-style-type: none"> <li>• knowledge of types of brake systems such as air, hydraulic and emergency (parking) brake</li> <li>• knowledge of operating principles of ABS and traction control</li> <li>• knowledge of components of air brakes such as brake chambers, slack adjusters (automatic and manual), rotors, calipers, S cams, pins and bushings</li> <li>• knowledge of hydraulic brake components such as master cylinders, wheel cylinders and brake proportioning valves</li> <li>• knowledge of ABS components such as wiring, ECMs, modulating valves and</li> </ul>	<p>190103a</p> <p>190103b</p> <p>190103c</p> <p>190103d</p> <p>190103e</p> <p>190103f</p> <p>190106a</p> <p>190106b</p>	<p>Hydraulic Brake System Fundamentals</p> <p>Hydraulic Brake System (Drum and Disc)</p> <p>Hydraulic Brake System Diagnosis and Service</p> <p>Hydraulic Brake Booster System Fundamentals and Service</p> <p>Parking Brake System Fundamentals and Service</p> <p>Electric Brake Fundamentals and Service</p> <p>Air Brake System Fundamentals</p> <p>Air Brake System Mechanical</p>

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<ul style="list-style-type: none"> <li>sensors</li> <li>• knowledge of types of brake shoes, pads and linings</li> <li>• knowledge of brake system operation</li> <li>• ability to bleed hydraulic brakes following OEM procedures</li> <li>• ability to identify types of power assisted hydraulic brakes</li> <li>• ability to adjust brakes as per OEM specifications</li> <li>• ability to adjust and replace sensors for ABS</li> <li>• ability to service ABS components such as wiring, connectors and terminals</li> </ul>	<p>190106cA</p> <p>190106cB</p> <p>190106d</p> <p>190106e</p> <p>190106f</p> <p>190404a</p> <p>190404b</p>	<p>Components</p> <p>Truck/Tractor Air Brake System Components – Part A</p> <p>Truck/Tractor Air Brake System Components – Part B</p> <p>Trailer Air Brake system Components</p> <p>Air Brake Testing &amp; Service</p> <p>Air Antilock Brake System Fundamentals</p> <p>Air Antilock Brake Systems</p> <p>Air Antilock Brake System Diagnosis</p>
7.03	Services auxiliary braking systems	<ul style="list-style-type: none"> <li>• knowledge of types and operation of engine compression brakes</li> <li>• knowledge of types and operation of engine exhaust brakes</li> <li>• knowledge of types and operation of</li> </ul>	<p>190106a</p> <p>190106b</p> <p>190106cA</p>	<p>Air Brake System Fundamentals</p> <p>Air Brake System Mechanical Components</p> <p>Truck/Tractor Air Brake System Components – Part A</p>

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		driveline retarders <ul style="list-style-type: none"> <li>• knowledge of auxiliary braking system components such as solenoids, valves and switches</li> <li>• knowledge of the function of electronic controls used with auxiliary braking systems</li> <li>• ability to adjust compression brake clearances as per OEM specifications</li> <li>• ability to replace components such as solenoids, seals and o-rings</li> <li>• ability to repair components such as retarders, wiring and connectors</li> </ul>	190106cB  190106d  190106e  190106f  190404a  190404b	Truck/Tractor Air Brake System Components – Part B  Trailer Air Brake system Components  Air Brake Testing & Service  Air Antilock Brake System Fundamentals  Air Antilock Brake Systems  Air Antilock Brake System Diagnosis

## D ELECTRICAL AND ELECTRONIC SYSTEMS

16%

### 8 DIAGNOSES ELECTRICAL SYSTEMS

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
8.01	Diagnoses batteries	<ul style="list-style-type: none"><li>• knowledge of types of batteries such as sealed, vented and gel cell</li><li>• knowledge of common faults such as low voltage, cracked casing and corroded terminals</li><li>• knowledge of battery ratings such as cold cranking amps (CCA), reserve capacity (RC) and amp-hour rating</li><li>• ability to recognize hazards related to working with and handling batteries</li><li>• ability to perform visual inspections</li><li>• ability to perform a battery load test</li><li>• ability to use hydrometer and refractometer to perform specific gravity tests</li><li>• ability to interpret test results</li></ul>	190104e	Battery Fundamentals & Service

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
8.02	Diagnoses charging systems	<ul style="list-style-type: none"> <li>• knowledge of types of charging systems such as externally excited, internally excited, and 12- and 24-volt</li> <li>• knowledge of charging system components such as alternators, internal and external regulators, wiring and relays</li> <li>• knowledge of types of alternators such as air/oil cooled, belt driven and gear driven</li> <li>• knowledge of ratings of alternators</li> <li>• knowledge of alternator components</li> <li>• ability to perform sensory inspection</li> <li>• ability to use diagnostic equipment to perform tests such as full-field, amperage and voltage</li> </ul>	<p>190205a</p> <p>190205b</p>	<p>Charging System &amp; Control Circuit Fundamentals</p> <p>Charging System Testing &amp; Service</p>
8.03	Diagnoses starting systems	<ul style="list-style-type: none"> <li>• knowledge of types of starting systems such as 12- and 24-volt</li> <li>• knowledge of starting system components such as starter, cables, relays, switches and solenoids</li> </ul>	<p>190205d</p> <p>190205e</p> <p>190205f</p>	<p>Cranking System Control Circuits</p> <p>Cranking system Testing &amp; Service</p> <p>Non-electric Cranking Systems</p>

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<ul style="list-style-type: none"> <li>• knowledge of starting system conditions requiring servicing such as no start, slow cranking and intermittent operation</li> <li>• knowledge of common faults such as dead battery, frayed cables and high resistance in cables and connections</li> <li>• ability to perform starter draw tests as per OEM specifications</li> <li>• ability to use multimeter to perform voltage drop test</li> <li>• ability to perform solenoid hold-in and pull-in test</li> <li>• ability to interpret test results</li> </ul>		
8.04	Diagnoses electrical components and accessories	<ul style="list-style-type: none"> <li>• knowledge of electrical components such as lights, switches, wiring, relays, fuses and breakers</li> <li>• knowledge of electrical accessories such as driving lights, rotary beacons, block heaters, auxiliary power units and seat heaters</li> <li>• knowledge of common faults such as</li> </ul>	190104a 190104b 190104d 19104fA 190104fB	Electrical Theory Electrical Circuits Test Equipment Electrical Wiring, Lighting Circuits and Circuit Protection – Part A Electrical Wiring, Lighting Circuits

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		blown fuses, broken wires and corroded connections	190405a	and Circuit Protection – Part B
		<ul style="list-style-type: none"> <li>• ability to interpret wiring schematics</li> <li>• ability to perform sensory inspection</li> <li>• ability to use multimeter to identify faults</li> <li>• ability to interpret test results</li> </ul>	190405b	Truck Electrical Circuit Fundamentals Truck Electrical Circuit Service

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## 9 SERVICES ELECTRICAL SYSTEMS

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	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
9.01	Services batteries	<ul style="list-style-type: none"> <li>• knowledge of types of batteries such as sealed, vented and gel cell</li> <li>• knowledge of common faults such as low voltage, cracked casing and corroded terminals</li> <li>• knowledge of battery ratings such as CCA, RC and amp-hour rating</li> <li>• knowledge of battery maintenance</li> </ul>	190104e	Battery Fundamentals & Service

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<p>schedule</p> <ul style="list-style-type: none"> <li>• ability to recognize hazards related to working with, handling and disposal of batteries</li> <li>• ability to clean, refill, recharge and replace battery</li> <li>• ability to disconnect and connect batteries in proper sequence</li> <li>• ability to perform boosting procedures as per OEM specifications</li> <li>• ability to apply anti-corrosion compounds</li> </ul>		
9.02	Services charging systems	<ul style="list-style-type: none"> <li>• knowledge of types of charging systems such as externally excited, internally excited, and 12- and 24-volt</li> <li>• knowledge of charging system components such as alternators, internal and external regulators, wiring and relays</li> <li>• knowledge of types of alternators such as air/oil cooled, belt driven and gear driven</li> </ul>	<p>190205a</p> <p>190205b</p>	<p>Charging System &amp; Control Circuit Fundamentals</p> <p>Charging System Testing &amp; Service</p>

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<ul style="list-style-type: none"> <li>• knowledge of ratings of alternators</li> <li>• knowledge of alternator components</li> <li>• knowledge of rebuilding alternators and regulators</li> <li>• ability to replace components such as belts, pulleys, alternators and regulators</li> <li>• ability to repair and replace alternator mounting brackets</li> <li>• ability to adjust belt tension to OEM specifications</li> <li>• ability to repair connections by crimping and soldering</li> <li>• ability to clean connections</li> </ul>		
9.03	Services starting systems	<ul style="list-style-type: none"> <li>• knowledge of types of starting systems such as 12- and 24-volt</li> <li>• knowledge of starting system components such as starter, cables, relays, switches and solenoids</li> <li>• knowledge of starting system schematics</li> </ul>	190205d 190205e 190205f	Cranking System Control Circuits Cranking system Testing & Service Non-electric Cranking Systems

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<ul style="list-style-type: none"> <li>• knowledge of starter rebuilding procedures</li> <li>• ability to remove and replace starter</li> <li>• ability to replace components such as solenoid, relays, cables, connections and ignition switches</li> <li>• ability to clean components such as connections and terminals</li> </ul>		
9.04	Services electrical components and accessories	<ul style="list-style-type: none"> <li>• knowledge of electrical components such as lights, switches, wiring, relays, fuses and breakers</li> <li>• knowledge of electrical accessories such as driving lights, rotary beacons, block heaters, auxiliary power units and seat heaters</li> <li>• knowledge of common faults such as blown fuses, broken wires and corroded connections</li> <li>• ability to interpret wiring schematics</li> <li>• ability to replace components such as light bulbs, fuses, harnesses and plugin connectors</li> </ul>	190104a 190104b 190104d 19104fA 190104fB 190405a 190405b	Electrical Theory Electrical Circuits Test Equipment Electrical Wiring, Lighting Circuits and Circuit Protection – Part A Electrical Wiring, Lighting Circuits and Circuit Protection – Part B Truck Electrical Circuit Fundamentals Truck Electrical Circuit Service

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<ul style="list-style-type: none"> <li>• ability to repair components such as faulty wiring, corroded terminals and sockets</li> <li>• ability to identify and tighten loose connections</li> <li>• ability to apply anti-corrosion compound</li> <li>• ability to clean components such as corroded terminals, sockets and junction boxes</li> <li>• ability to select and match components such as wire, fuses, relays and switches to electrical load</li> <li>• ability to install electrical accessories</li> </ul>		

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## 10 DIAGNOSES ELECTRONIC SYSTEMS

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	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
10.01	Diagnoses spark ignition systems	<ul style="list-style-type: none"> <li>• knowledge of spark ignition components such as distributor, spark plugs, modules, ignition coils, rotor,</li> </ul>	<u>Automotive Service</u> 090303a	<u>Technician Modules Available</u> Ignition System Fundamentals

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<p>pick up coils, distributor cap and coil packs</p> <ul style="list-style-type: none"> <li>• knowledge of conditions requiring servicing such as intermittent problems, no start, hard starting and misfiring</li> <li>• knowledge of common faults such as faulty wiring, low voltage, faulty modules and bad ground</li> <li>• knowledge of electrical fundamentals</li> <li>• knowledge of engine operating principles such as firing order, ignition timing and combustion cycle</li> <li>• ability to perform sensory inspection</li> <li>• ability to identify primary and secondary sides of system</li> <li>• ability to use diagnostic equipment such as multimeter, timing lights, code readers, scopes and spark testers</li> <li>• ability to interpret test results</li> </ul>	<p>090303b</p> <p>090303c</p> <p>A090305a</p>	<p>Distributor Ignition Systems</p> <p>Electronic Ignition Systems</p> <p>Ignition system Fundamentals</p>
10.02	Diagnoses electronic components and	<ul style="list-style-type: none"> <li>• knowledge of types of electronic systems such as day time running lights (DRL), driver communication, cruise</li> </ul>	190104g	Basic Electronics

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
	accessories	<p>control and supplemental restraint system (SRS)</p> <ul style="list-style-type: none"> <li>• knowledge of electronic system components such as actuators, circuit boards, multi-function controls, wiring and connectors</li> <li>• knowledge of conditions requiring servicing such as electronic malfunction indicators, intermittent operation and component failure</li> <li>• knowledge of common faults such as faulty modules, blown fuses and poor connections</li> <li>• knowledge of wiring schematics</li> <li>• ability to perform sensory inspection</li> <li>• ability to use diagnostic equipment such as multimeter and diagnostic software</li> <li>• ability to understand flash codes for various OEMs</li> <li>• ability to interpret test results</li> </ul>	<p>190104h</p> <p>190405b</p> <p>190405a</p>	<p>Electronic Control Systems</p> <p>Truck Electrical Circuit Service</p> <p>Truck Electrical Circuit Fundamentals</p>

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
10.03	Diagnoses vehicle management systems	<ul style="list-style-type: none"> <li>• knowledge of multiplex systems</li> <li>• knowledge of communication protocols</li> <li>• knowledge of vehicle management components such as data links, communication plugs, connectors and terminating resistors</li> <li>• knowledge of conditions requiring servicing such as gauges not sweeping and failure of lighting circuits</li> <li>• knowledge of common faults such as miscommunication over data link and loss of signal</li> <li>• ability to locate vehicle management system modules and communication cables</li> <li>• ability to perform sensory inspection</li> <li>• ability to interpret wiring schematics</li> <li>• ability to check for software updates</li> <li>• ability to use computer and diagnostic software</li> </ul>	<p>190201a</p> <p>190201b</p> <p>190201c</p> <p>190201d</p> <p>190201e</p> <p>190201f</p> <p>190201g</p> <p>190201h</p> <p>190201I</p> <p>190201j</p> <p>190201kA</p> <p>190201kB</p>	<p>Engine Fundamentals</p> <p>Engine Block &amp; Cylinder Liner Fundamentals</p> <p>Engine Block &amp; Cylinder Liner Service</p> <p>Piston, Piston Rings &amp; Connecting Rod Fundamentals</p> <p>Piston, Piston Rings &amp; Connecting Rod Service</p> <p>Crankshaft, Bearings &amp; Related Component Fundamentals</p> <p>Crankshaft, Bearings &amp; Related Component Service</p> <p>Camshaft &amp; Follower Fundamentals</p> <p>Camshaft &amp; Follower Service</p> <p>Cylinder Head Fundamentals</p> <p>Cylinder Head Service – Part A</p> <p>Cylinder Head Service – Part B</p>

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<ul style="list-style-type: none"> <li>ability to interpret test results</li> </ul>	190201L	Engine Braking System Fundamentals & Service

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## 11 SERVICES ELECTRONIC COMPONENTS

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	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
11.01	Services spark ignition systems	<ul style="list-style-type: none"> <li>knowledge of spark ignition system components such as distributor, spark plugs, modules, ignition coils, rotor, pick up coils, distributor cap and coil packs</li> <li>knowledge of electrical fundamentals</li> <li>knowledge of engine operating principles such as firing order, ignition timing and combustion cycle</li> <li>ability to replace components such as spark plugs, coils, high tension wires and distributor caps</li> <li>ability to repair components such as loose and corroded connections</li> <li>ability to adjust engine timing and</li> </ul>	<u>Automotive Service</u>  090303a 090303b 090303c A090305a	<u>Technician Modules Available</u>  Ignition System Fundamentals Distributor Ignition Systems Electronic Ignition Systems Ignition system Fundamentals

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		spark plug gap		
11.02	Services electronic components and accessories	<ul style="list-style-type: none"> <li>• knowledge of types of electronic systems such as DRL, driver communication, cruise control and SRS</li> <li>• knowledge of electronic components such as actuators, circuit boards, multifunction controls, wiring and connectors</li> <li>• knowledge of repair procedures such as soldering, heat shrinking, terminal installation and insulation protection</li> <li>• knowledge of wiring schematics</li> <li>• knowledge of damage caused by static electricity</li> <li>• ability to understand flash codes for various OEMs</li> <li>• ability to replace components such as modules, connectors, switches and solenoids</li> <li>• ability to repair components such as wiring, connectors and terminals</li> <li>• ability to adjust components such as</li> </ul>	<p>190104g</p> <p>190104h</p> <p>190405b</p> <p>190405a</p>	<p>Basic Electronics</p> <p>Electronic Control Systems</p> <p>Truck Electrical Circuit Service</p> <p>Truck Electrical Circuit Fundamentals</p>

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<p>automatic engine shutdowns and sensors</p> <ul style="list-style-type: none"> <li>ability to install accessories such as inverters, auxiliary coolant heaters and air heaters with electronic controls</li> </ul>		
11.03	Services vehicle management systems	<ul style="list-style-type: none"> <li>knowledge of multiplex systems</li> <li>knowledge of communication protocols</li> <li>knowledge of wiring types such as twisted pairs</li> <li>knowledge of hazards such as static electricity</li> <li>knowledge of tools and repair procedures required for various OEM connectors</li> <li>ability to repair components such as wiring, sensors, gauges and connectors</li> <li>ability to replace faulty cards/circuit boards and ECMs</li> <li>ability to interpret wiring schematics</li> <li>ability to use computer to reprogram ECMs to update software and to</li> </ul>	<p>190201a</p> <p>190201b</p> <p>190201c</p> <p>190201d</p> <p>190201e</p> <p>190201f</p> <p>190201g</p> <p>190201h</p>	<p>Engine Fundamentals</p> <p>Engine Block &amp; Cylinder Liner Fundamentals</p> <p>Engine Block &amp; Cylinder Liner Service</p> <p>Piston, Piston Rings &amp; Connecting Rod Fundamentals</p> <p>Piston, Piston Rings &amp; Connecting Rod Service</p> <p>Crankshaft, Bearings &amp; Related Component Fundamentals</p> <p>Crankshaft, Bearings &amp; Related Component Service</p> <p>Camshaft &amp; Follower Fundamentals</p> <p>Camshaft &amp; Follower Service</p>

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		accommodate new vehicle accessories  <ul style="list-style-type: none"> <li>• ability to locate and access vehicle management system modules and communication cables</li> </ul>	190201I  190201j  190201kA  190201kB  190201L	Cylinder Head Fundamentals  Cylinder Head Service – Part A  Cylinder Head Service – Part B  Engine Braking System Fundamentals & Service

**E DRIVE TRAIN****12%****12 DIAGNOSES DRIVE TRAIN**

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
12.01	Diagnoses clutches	<ul style="list-style-type: none"><li>• knowledge of types of clutches such as pull, push, self-adjusting and manual adjusting</li><li>• knowledge of clutch components such as discs, center plate, release springs and release bearings</li><li>• knowledge of clutch operation and adjustment</li><li>• knowledge of conditions that indicate that clutch needs servicing such as hard shifting, loss of pedal free play and excessive pedal free play</li><li>• knowledge of clutch faults such as shock loads, worn parts, seized release bearings and broken clutch springs</li><li>• ability to perform sensory inspection</li><li>• ability to perform failure analysis</li></ul>	190303k 190401a	Clutch Fundamentals & Service Clutch Fundamentals & Service

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<ul style="list-style-type: none"> <li>ability to use diagnostic tools such as clutch adjustment tool, feeler gauge, tape measure and spring gauge</li> </ul>		
12.02	Diagnoses standard transmissions and transfer cases	<ul style="list-style-type: none"> <li>knowledge of types of standard transmissions such as 13 speed, 15 speed, double countershaft and triple countershaft</li> <li>knowledge of standard transmission components such as seals, gaskets, gears and bearings</li> <li>knowledge of types of transfer case and transfer case shift controls such as air, electrical and mechanical</li> <li>knowledge of common component faults such as missing teeth in gears, lack of lubrication and worn synchronizers</li> <li>knowledge of auxiliary shift components such as slave cylinder, air lines, regulators and shift knobs</li> <li>ability to perform sensory inspection</li> <li>ability to perform failure analysis</li> </ul>	<p>190401c</p> <p>190401dA</p> <p>190401dB</p> <p>190401e</p> <p>190401f</p> <p>190401g</p> <p>190401h</p> <p>190401i</p>	<p>Gearing Principles</p> <p>Transmission Fundamentals – Part A</p> <p>Transmission Fundamentals – Part B</p> <p>Transmission Shifting</p> <p>Transmission Service</p> <p>Transfer Case &amp; Auxiliary Drives</p> <p>Drive Axle Fundamentals (On Road)</p> <p>Drive Axle Assembly Service (On Road)</p>

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
12.03	Diagnoses automatic transmissions	<ul style="list-style-type: none"> <li>• knowledge of automatic transmission components such as torque converters, valve bodies, pumps and clutches</li> <li>• knowledge of component failures such as burnt clutch packs, deteriorating clutch lining and sticking valves</li> <li>• ability to perform visual inspection</li> <li>• ability to perform failure analysis</li> <li>• ability to perform diagnostic tests such as pressure checks, stall test and test for proper shift point</li> <li>• ability to use diagnostic tools such as pressure gauges, computers and handheld devices</li> <li>• ability to interpret test results</li> </ul>	<p>190303a</p> <p>190303b</p> <p>190303c</p> <p>190303d</p> <p>190303e</p> <p>190303f</p>	<p>Gearing Principles</p> <p>Torque Converter Fundamentals &amp; Service</p> <p>Powershift &amp; Automatic Transmission Mechanical/ Electronic Components</p> <p>Powershift &amp; Automatic Transmission Control &amp; Shifting</p> <p>Hydraulic Retarder Fundamentals</p> <p>Powershift &amp; Automatic Transmission Testing &amp; Service</p>
12.04	Diagnoses automated transmissions	<ul style="list-style-type: none"> <li>• knowledge of manual transmissions and failures that can occur with them</li> <li>• knowledge of automated transmission components such as wiring, solenoids and ECMs</li> <li>• knowledge of data links and</li> </ul>	<p>190303a</p> <p>190303b</p> <p>190303c</p>	<p>Gearing Principles</p> <p>Torque Converter Fundamentals &amp; Service</p> <p>Powershift &amp; Automatic Transmission Mechanical/ Electronic Components</p>

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<p>communication with engine ECM</p> <ul style="list-style-type: none"> <li>• ability to use diagnostic equipment such as computers, handheld devices, multimeters, test leads and break-out harnesses</li> <li>• ability to check for proper operation of shift solenoids using test equipment</li> <li>• ability to interpret test results</li> </ul>	<p>190303d</p> <p>190303e</p> <p>190303f</p>	<p>Powershift &amp; Automatic Transmission Control &amp; Shifting</p> <p>Hydraulic Retarder Fundamentals</p> <p>Powershift &amp; Automatic Transmission Testing &amp; Service</p>
12.05	Diagnoses driveline systems	<ul style="list-style-type: none"> <li>• knowledge of types of driveline systems such as standard and extended life</li> <li>• knowledge of methods of mounting and phasing of driveline systems</li> <li>• knowledge of u-joint installation and removal</li> <li>• knowledge of conditions requiring servicing such as vibration, noise and other reported problems</li> <li>• knowledge of wear limits and driveline angles as per OEM specifications</li> <li>• ability to perform sensory inspection</li> </ul>	190401b	Driveline Fundamentals & Service

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<ul style="list-style-type: none"> <li>• ability to perform diagnostic tests such as air ride height and driveline angles</li> <li>• ability to use diagnostic equipment such as vibration analyzer, angle gauges and computers</li> <li>• ability to interpret test results</li> <li>• ability to perform failure analysis</li> </ul>		
12.06	Diagnoses differentials	<ul style="list-style-type: none"> <li>• knowledge of types of differentials such as locking, two-speed, limited slip and outboard planetary</li> <li>• knowledge of differential components such as seals, axles, gaskets, hubs, gears and bearings</li> <li>• knowledge of weight ratings and gear ratios such as 4.11:1</li> <li>• knowledge of differential lock activating methods such as air and electric</li> <li>• knowledge of methods of securing hubs to spindles such as preset and conventional</li> </ul>	<p>190401g</p> <p>190401h</p> <p>190401i</p>	<p>Transfer Case &amp; Auxiliary Drives</p> <p>Drive Axle Fundamentals (On Road)</p> <p>Drive Axle Assembly Service (On Road)</p>

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<ul style="list-style-type: none"> <li>• knowledge of conditions that indicate that differential needs servicing such as noise and interaxle differential lock not working</li> <li>• knowledge of common faults such as missing teeth in crown and pinion gears, broken shift fork in power dividers, lack of lubrication and broken axles</li> <li>• ability to perform sensory inspection</li> <li>• ability to perform failure analysis</li> </ul>		

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## 13 SERVICES DRIVE TRAIN

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	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
13.01	Services clutches	<ul style="list-style-type: none"> <li>• knowledge of types of clutches such as pull, push, self-adjusting and manual adjusting</li> <li>• knowledge of clutch components such as discs, center plate, release springs and release bearings</li> </ul>	190303k 190401a	Clutch Fundamentals & Service Clutch Fundamentals & Service

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<ul style="list-style-type: none"> <li>• knowledge of clutch operation and adjustment</li> <li>• knowledge of clutch operation components such as hydraulic assisted and air assisted</li> <li>• ability to measure flywheel and flywheel housing run-out and concentricity</li> <li>• ability to remove and replace flywheel for resurfacing and inspection of ring gear for wear</li> <li>• ability to remove and replace components such as bushings, shafts, forks and clutches</li> <li>• ability to bleed air from master and slave cylinders</li> <li>• ability to align discs and pressure plates</li> <li>• ability to adjust clutch according to OEM specifications</li> </ul>		
13.02	Services standard transmissions and transfer cases	<ul style="list-style-type: none"> <li>• knowledge of types of standard transmissions such as 13 speed, 15 speed, double countershaft and triple</li> </ul>	190401c 190401dA	Gearing Principles Transmission Fundamentals – Part

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<p>countershaft</p> <ul style="list-style-type: none"> <li>• knowledge of standard transmission components such as seals, gaskets, gears and bearings</li> <li>• knowledge of auxiliary shift components such as slave cylinder, air lines, regulators and shift knobs</li> <li>• knowledge of types of transfer case and transfer case shift controls such as air, electrical and mechanical</li> <li>• ability to perform a major overhaul using tools such as feeler gauges, shims and dial indicator</li> <li>• ability to replace components such as gears, bearings, oil coolers, oil pumps and seals</li> <li>• ability to perform routine maintenance</li> <li>• ability to repair air lines and cylinders</li> <li>• ability to install power takeoffs (PTOs)</li> </ul>	<p>190401dB</p> <p>190401e</p> <p>190401f</p> <p>190401g</p> <p>190401h</p> <p>190401i</p>	<p>A</p> <p>Transmission Fundamentals – Part B</p> <p>Transmission Shifting</p> <p>Transmission Service</p> <p>Transfer Case &amp; Auxiliary Drives</p> <p>Drive Axle Fundamentals (On Road)</p> <p>Drive Axle Assembly Service (On Road)</p>
13.03	Services automatic transmissions	<ul style="list-style-type: none"> <li>• knowledge of automatic transmission components such as torque converters,</li> </ul>	190303a	<p>Gearing Principles</p> <p>Torque Converter Fundamentals &amp;</p>

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		valve bodies, pumps and clutches	190303b	Service
		<ul style="list-style-type: none"> <li>• knowledge of types and locations of coolers</li> </ul>	190303c	Powershift & Automatic Transmission Mechanical/ Electronic Components
		<ul style="list-style-type: none"> <li>• knowledge of servicing procedures for components such as clutch packs, bearings, seals, torque converters and planetaries</li> </ul>	190303d	Powershift & Automatic Transmission Control & Shifting
		<ul style="list-style-type: none"> <li>• ability to perform routine maintenance</li> </ul>	190303e	Hydraulic Retarder Fundamentals
		<ul style="list-style-type: none"> <li>• ability to install PTOs</li> </ul>	190303f	Powershift & Automatic Transmission Testing & Service
13.04	Services automated transmissions	<ul style="list-style-type: none"> <li>• knowledge of manual transmissions and failures that can occur with them</li> <li>• knowledge of automated transmission components such as wiring, solenoids and ECMs</li> <li>• knowledge of data links and communication with engine ECM</li> <li>• ability to replace components such as solenoids, ECMs, wiring harnesses and gaskets</li> <li>• ability to repair components such as wiring harnesses and connectors</li> </ul>	190303a	Gearing Principles
			190303b	Torque Converter Fundamentals & Service
			190303c	Powershift & Automatic Transmission Mechanical/ Electronic Components
			190303d	Powershift & Automatic Transmission Control & Shifting
			190303e	Hydraulic Retarder Fundamentals
			190303f	Powershift & Automatic Transmission Testing & Service

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
13.05	Services driveline systems	<ul style="list-style-type: none"> <li>• knowledge of types of driveline systems such as standard and extended life</li> <li>• knowledge of methods of mounting and phasing of driveline systems</li> <li>• knowledge of wear limits and driveline angles as per OEM specifications</li> <li>• ability to identify components that affect driveline angle</li> <li>• ability to identify worn and loose yokes</li> <li>• ability to replace components such as u-joints, yokes and steady bearings</li> <li>• ability to repair failed components such as loose saddles, faulty engine mounts and broken springs</li> <li>• ability to lubricate u-joints and slip yokes as per OEM specifications</li> </ul>	190401b	Driveline Fundamentals & Service
13.06	Services differentials	<ul style="list-style-type: none"> <li>• knowledge of types of differentials such as locking, two-speed, limited slip and outboard planetary</li> <li>• knowledge of weight ratings and gear</li> </ul>	190401g 190401h	Transfer Case & Auxiliary Drives Drive Axle Fundamentals (On Road)

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<p>ratios such as 4.11:1</p> <ul style="list-style-type: none"> <li>• knowledge of methods of securing hubs to spindles such as preset and conventional</li> <li>• knowledge of components such as seals, axles, gaskets, hubs, gears and bearings</li> <li>• ability to perform overhaul procedures such as setting and adjusting preload and backlash, and checking and adjusting crown and pinion gear tooth pattern</li> <li>• ability to replace components such as gears, bearings, shafts and thrust washers</li> <li>• ability to repair components such as housings and spindle threads</li> <li>• ability to clean components such as housings, gears and hubs</li> <li>• ability to adjust wheel bearings as per OEM specifications</li> </ul>	190401i	Drive Axle Assembly Service (On Road)

**F STEERING, CHASSIS/FRAMES, SUSPENSION, WHEELS, HUBS AND TIRES 14%**

**14 DIAGNOSES STEERING SYSTEM, CHASSIS/FRAMES, SUSPENSION, WHEELS, HUBS AND TIRES**

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
14.01	Diagnoses steering system	<ul style="list-style-type: none"> <li>• knowledge of operating principles of steering systems</li> <li>• knowledge of types of steering systems such as integral, linkage, rack and pinion, and air assisted</li> <li>• knowledge of steering system components such as steering boxes, pitman arms, tie rods, king pins, connecting rods, drag links and power steering components</li> <li>• knowledge of master and slave steering systems</li> <li>• knowledge of common faults such as tire wear, bent tie rods and loose drag link</li> <li>• knowledge of steering geometry and</li> </ul>	<p>190402a</p> <p>190402b</p> <p>190402c</p>	<p>Steering Fundamentals</p> <p>Steering Service</p> <p>Steering Angles &amp; Alignment</p>

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<p>alignment such as caster, camber, toe-in and toe-out</p> <ul style="list-style-type: none"> <li>• ability to perform tests such as pressure, volume and mechanical tests</li> <li>• ability to perform sensory inspection</li> <li>• ability to interpret tire wear</li> <li>• ability to use diagnostic tools</li> <li>• ability to inspect for leaks</li> </ul>		
14.02	Diagnoses chassis/frames	<ul style="list-style-type: none"> <li>• knowledge of chassis/frame components such as frame rails, cross members, mounts, hangers and gussets</li> <li>• knowledge of unibody (monocoque) chassis design</li> <li>• knowledge of chassis/frame fastening systems</li> <li>• knowledge of common chassis/frame faults such as bending, cracking, corrosion and missing fasteners</li> <li>• ability to use diagnostic equipment such as laser alignment tools, calipers</li> </ul>	<p>190102a</p> <p>190102b</p>	<p>Frame &amp; Suspension Fundamentals</p> <p>Frame &amp; Suspension Service</p>

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<p>and straight edge</p> <ul style="list-style-type: none"> <li>• ability to perform visual inspection</li> </ul>		
14.03	Diagnoses suspension	<ul style="list-style-type: none"> <li>• knowledge of types of suspensions such as air ride, spring, solid block and combination</li> <li>• knowledge of suspension components such as spring hangers, shackles, saddles, shocks, torsion bars, walking beam and u-bolts</li> <li>• knowledge of axle applications such as steering, drive and auxiliary</li> <li>• knowledge of common suspension faults such as broken springs, air springs, u-bolts, leaking shocks and worn bushings</li> <li>• ability to use diagnostic equipment such as dial indicators, tape measure and angle gauges</li> <li>• ability to perform sensory inspection</li> <li>• ability to interpret test results</li> </ul>	<p>190102a</p> <p>190102b</p> <p>190102e</p>	<p>Frame &amp; Suspension Fundamentals</p> <p>Frame &amp; Suspension Service</p> <p>Trailer Systems &amp; Components</p>
14.04	Diagnoses hitches	<ul style="list-style-type: none"> <li>• knowledge of types of hitches and couplers such as pintle hitch, 5th wheel</li> </ul>	190102e	Trailer Systems & Components

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
	and couplers	hitch and ball hitch <ul style="list-style-type: none"> <li>• knowledge of hitch and coupler applications</li> <li>• knowledge of common faults such as out of adjustment and twisted, bent and worn components</li> <li>• ability to use specialized diagnostic tools such as go/no-go gauge and king pin tool</li> <li>• ability to perform visual inspection</li> <li>• ability to test hitch and coupler operation</li> </ul>	190102fA  190102fB  190102g	Coupling Units and Landing Gear Fundamentals and Service – Part A  Coupling Units and Landing Gear Fundamentals and Service – Part B  Orientation to Trailer Inspection
14.05	Diagnoses tires, wheels and hubs	<ul style="list-style-type: none"> <li>• knowledge of types of tires such as radial and bias</li> <li>• knowledge of tire load ranges, pressures, profiles and sizes</li> <li>• knowledge of steering and drive tires</li> <li>• knowledge of types of wheels such as aluminum, steel and dual</li> <li>• knowledge of types of hubs such as</li> </ul>	190402a  190402b  190402c	Steering Fundamentals  Steering Service  Steering Angles & Alignment

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		spoked, hub pilot and stud pilot <ul style="list-style-type: none"> <li>• knowledge of tire components such as belts, tread, tubes and sidewall</li> <li>• knowledge of wheel components such as rims, spacers, wedges and valve stems</li> <li>• knowledge of hub components such as studs, nuts and spacers</li> <li>• knowledge of common faults such as cracked rims, holes in tires, broken studs and worn locks</li> <li>• ability to use diagnostic equipment such as dial indicator, torque wrench, air gauge and tread depth gauge</li> <li>• ability to perform sensory inspection</li> </ul>		

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## 15 SERVICES STEERING SYSTEM, CHASSIS/FRAMES, SUSPENSION, WHEELS, HUBS AND TIRES

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	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
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	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
15.01	Services steering system	<ul style="list-style-type: none"> <li>• knowledge of operating principles of steering systems</li> <li>• knowledge of types of steering systems such as integral, linkage, rack and pinion, and air assisted</li> <li>• knowledge of steering system components such as steering boxes, pitman arms, tie rods, king pins, connecting rods, drag links and power steering components</li> <li>• knowledge of master and slave steering systems</li> <li>• knowledge of steering geometry and alignment such as caster, camber, toe-in and toe-out</li> <li>• ability to replace worn and damaged components such as pins, bushings, hoses and seals</li> <li>• ability to adjust components such as pitman arms, steering box, drag link and steering wheel</li> <li>• ability to repair components such as leaking hoses, reservoirs and steering</li> </ul>	<p>190402a</p> <p>190402b</p> <p>190402c</p>	<p>Steering Fundamentals</p> <p>Steering Service</p> <p>Steering Angles &amp; Alignment</p>

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		box <ul style="list-style-type: none"> <li>• ability to perform alignment</li> <li>• ability to grease components such as tie rods, king pins and u-joints</li> <li>• ability to change steering system oil and filters</li> </ul>		
15.02	Services chassis/frames	<ul style="list-style-type: none"> <li>• knowledge of chassis/frame components such as frame rails, cross members, mounts, hangers and gussets</li> <li>• knowledge of unibody (monocoque) chassis design</li> <li>• knowledge of chassis/frame fastening systems</li> <li>• knowledge of frame straightening procedures</li> <li>• ability to modify chassis/frame such as adding inserts, drilling frames and adjusting length</li> <li>• ability to repair and replace components and fasteners</li> </ul>	190102a 190102b	Frame & Suspension Fundamentals Frame & Suspension Service

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<ul style="list-style-type: none"> <li>• ability to install new components</li> <li>• ability to relocate existing components</li> </ul>		
15.03	Services suspension	<ul style="list-style-type: none"> <li>• knowledge of types of suspension such as air ride, spring, solid block and combination</li> <li>• knowledge of suspension components such as spring hangers, shackles, saddles, shocks, torsion bars, walking beam and u-bolts</li> <li>• knowledge of axle applications such as steering, drive and auxiliary</li> <li>• ability to repair components such as torsion bars and spring guides</li> <li>• ability to use welding and cutting equipment to repair axle stops, shackle assemblies and hanger assemblies</li> <li>• ability to replace components such as bushings, air springs and spring assemblies</li> <li>• ability to make suspension adjustments such as ride height and axle angle</li> </ul>	<p>190102a</p> <p>190102b</p> <p>190102e</p>	<p>Frame &amp; Suspension Fundamentals</p> <p>Frame &amp; Suspension Service</p> <p>Trailer Systems &amp; Components</p>

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<ul style="list-style-type: none"> <li>• ability to lubricate suspension components</li> </ul>		
15.04	Services hitches and couplers	<ul style="list-style-type: none"> <li>• knowledge of types of hitches and couplers such as pintle hitch, 5th wheel hitch and ball hitch</li> <li>• knowledge of OEM specifications such as wear limits and load capacity</li> <li>• knowledge of hitch and coupler applications</li> <li>• ability to repair and replace faulty components</li> <li>• ability to use welding and cutting equipment to repair and relocate hitch and coupler components</li> <li>• ability to perform adjustments to components such as 5th wheel jaws, sliders and slide rails</li> <li>• ability to lubricate components</li> <li>• ability to install hitches and couplers</li> <li>• ability to rebuild hitches and couplers</li> </ul>	<p>190102e</p> <p>190102fA</p> <p>190102fB</p> <p>190102g</p>	<p>Trailer Systems &amp; Components</p> <p>Coupling Units and Landing Gear Fundamentals and Service – Part A</p> <p>Coupling Units and Landing Gear Fundamentals and Service – Part B</p> <p>Orientation to Trailer Inspection</p>

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
15.05	Services tires, wheels and hubs	<ul style="list-style-type: none"> <li>• knowledge of types of tires such as radial and bias</li> <li>• knowledge of tire load ranges, pressures, profiles and sizes</li> <li>• knowledge of jurisdictional requirements</li> <li>• knowledge of steering and drive tires</li> <li>• knowledge of types of wheels such as aluminum, steel and dual</li> <li>• knowledge of types of hubs such as spoked, hub pilot and stud pilot</li> <li>• knowledge of tire components such as belts, tread, tubes and sidewall</li> <li>• knowledge of wheel components such as rims, spacers, wedges and valve stems</li> <li>• knowledge of hub components such as studs, nuts and spacers</li> <li>• knowledge of wheel balancing procedures</li> </ul>	<p>190402a</p> <p>190402b</p> <p>190402c</p>	<p>Steering Fundamentals</p> <p>Steering Service</p> <p>Steering Angles &amp; Alignment</p>

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<ul style="list-style-type: none"> <li>• ability to recognize hazards associated with tire inflation such as split rims and damaged tires</li> <li>• ability to identify mismatched tires by casing and tread depth</li> <li>• ability to repair and replace components</li> <li>• ability to mount tire to rim</li> <li>• ability to remove tire from rim</li> <li>• ability to use tools to mount and remove tires</li> <li>• ability to align wheel on hub</li> <li>• ability to adjust air pressure and run-out and torque on wheels</li> </ul>		

**16 DIAGNOSES CAB COMPONENTS**

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
16.01	Diagnoses interior components	<ul style="list-style-type: none"> <li>• knowledge of interior components such as pedals, air ride seats, seat belts, wheelchair accessories and side windows</li> <li>• knowledge of OEM specifications on interior component operations</li> <li>• knowledge of common faults such as sticking pedals, air leak on seat and malfunctioning window controls</li> <li>• ability to perform sensory inspection</li> </ul>	<u>Auto Body</u> 100102d  100101a 102302a 102302g	<u>Technician Modules</u>  Component Assembly, Removal and Installation  Safety in the Workplace Body Damage Analysis Glass Replacement
16.02	Diagnoses exterior components	<ul style="list-style-type: none"> <li>• knowledge of exterior components such as windshields, wipers, mirrors, door handles, steps, wind deflectors, engine bonnet/hood cables, lock-down straps, mouldings and fenders</li> <li>• knowledge of OEM specifications on exterior component operations</li> </ul>	<u>Auto Body</u> 100102d  100101a 102302a 102302g	<u>Technician Modules</u>  Component Assembly, Removal and Installation  Safety in the Workplace Body Damage Analysis Glass Replacement

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<ul style="list-style-type: none"> <li>• knowledge of common faults such as crooked door handles, broken mirrors, cracked windshields and faulty wipers</li> <li>• ability to perform sensory inspection</li> <li>• ability to inspect cab mounts and cab suspension</li> </ul>		

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## 17 SERVICES CAB COMPONENTS

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	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
17.01	Services interior components	<ul style="list-style-type: none"> <li>• knowledge of interior components such as pedals, air ride seats, seat belts and side windows</li> <li>• knowledge of OEM specifications on interior component operations</li> <li>• ability to remove and repair faulty components</li> <li>• ability to replace components such as door panels, seat belts, and window regulators and motors</li> </ul>	<u>Auto Body</u> 100102d 100101a 102302a 102302g	<u>Technician Modules</u> Component Assembly, Removal and Installation Safety in the Workplace Body Damage Analysis Glass Replacement

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<ul style="list-style-type: none"> <li>ability to perform adjustments such as brake pedal travel, fuel pedal sensor and seat placement</li> </ul>		
17.02	Services exterior components	<ul style="list-style-type: none"> <li>knowledge of exterior components such as windshields, wipers, mirrors, door handles, steps, wind deflectors, engine bonnet/hood cables, lock-down straps, mouldings and fenders</li> <li>knowledge of OEM specifications on exterior component operations</li> <li>ability to use welding and cutting equipment to repair components</li> <li>ability to replace exterior components</li> <li>ability to repair faulty exterior components</li> <li>ability to perform door and cab adjustments</li> </ul>	<u>Auto Body</u> 100102d 100101a 102302a 102302g	<u>Technician Modules</u> Component Assembly, Removal and Installation Safety in the Workplace Body Damage Analysis Glass Replacement

## H TRAILERS

4%

### 18 DIAGNOSES TRAILER COMPONENTS

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
18.01	Diagnoses landing gear	<ul style="list-style-type: none"><li>• knowledge of landing gear components such as legs, feet, gearing, handle, cross tubes, brackets and bracing</li><li>• knowledge of common faults such as seized gear boxes, stripped gears, broken handles, bent legs and pads, and bent and broken cross tubes</li><li>• knowledge of capacity of landing gear components</li><li>• ability to perform inspections such as measuring for the length of legs, and checking for bent and broken components</li><li>• ability to determine causes of faults such as disconnecting from vehicle, manufacturers' defects and lack of lubrication</li></ul>	190102e 190102fA 190102fB 190102g	Trailer Systems & Components Coupling Units and Landing Gear Fundamentals and Service – Part A Coupling Units and Landing Gear Fundamentals and Service – Part B Orientation to Trailer Inspection
18.02	Diagnoses trailer	<ul style="list-style-type: none"><li>• knowledge of trailer body components</li></ul>		Considered On The Job Training

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
	body accessories and components	<p>such as doors, handles, cross members, refrigeration panels, body panels, flooring, roof, wall studs and kick plate</p> <ul style="list-style-type: none"> <li>• knowledge of trailer body accessories such as canvas air chute and bogie rails</li> <li>• ability to perform visual inspections</li> <li>• ability to determine causes of faults such as corrosion, overloading and abuse</li> </ul>		

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## 19 SERVICES TRAILER COMPONENTS

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	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
19.01	Services landing gear	<ul style="list-style-type: none"> <li>• knowledge of landing gear components such as legs, feet, gearing, handles, cross tubes, brackets and bracing</li> <li>• ability to lubricate and test movement of landing gear</li> <li>• ability to replace worn or damaged components</li> </ul>	<p>190102e</p> <p>190102fA</p> <p>190102fB</p> <p>190102g</p>	<p>Trailer Systems &amp; Components</p> <p>Coupling Units and Landing Gear Fundamentals and Service – Part A</p> <p>Coupling Units and Landing Gear Fundamentals and Service – Part B</p> <p>Orientation to Trailer Inspection</p>

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<ul style="list-style-type: none"> <li>• ability to repair landing gear</li> <li>• ability to perform adjustments</li> <li>• ability to use welding and cutting equipment to repair cross members, brackets and legs</li> </ul>		
19.02	Services trailer body accessories and components	<ul style="list-style-type: none"> <li>• knowledge of trailer body components such as doors, handles, cross members, refrigeration panels, body panels, flooring, roof, wall studs and kick plate</li> <li>• knowledge of trailer body accessories such as canvas air chute and bogie rails</li> <li>• knowledge of required signage, lighting and reflective material for safety</li> <li>• knowledge of jurisdictional regulations on reflective material, lighting and signage</li> <li>• ability to repair accessories and components</li> <li>• ability to replace accessories and components</li> <li>• ability to perform adjustments to</li> </ul>		Considered On The Job Training

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		components such as locks and doors		

# I CLIMATE CONTROL

6%

## 20 DIAGNOSES CLIMATE CONTROL SYSTEMS

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
20.01	Diagnoses heating and ventilation systems	<ul style="list-style-type: none"><li>• knowledge of heating system components such as blowers, pumps, resistors, controls and modules</li><li>• knowledge of heater operating principles such as water flow and heat exchange</li><li>• knowledge of common heating system faults such as burnt resistors, worn motors and malfunctioning heat controls</li><li>• knowledge of ductwork components and routing</li><li>• ability to disassemble and reassemble dashboard and firewall components for access</li><li>• ability to use specialized diagnostic tools</li></ul>	190403a 190403b 190403cA 190403cB	Air Conditioning Fundamentals HVAC Control Systems Air Conditioning Testing & Service – Part A Air Conditioning Testing & Service – Part B

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<ul style="list-style-type: none"> <li>• ability to test system and component operation to isolate problem</li> <li>• ability to interpret test results</li> </ul>		
20.02	Diagnoses air conditioning systems	<ul style="list-style-type: none"> <li>• knowledge of air conditioning system components such as evaporator, condenser, compressor, receiver dryer, expansion valves, sensors and controls</li> <li>• knowledge of air conditioning operating principles and theory (compression and expansion)</li> <li>• knowledge of types of refrigerant oils and refrigerants such as R134A, R22 and R12</li> <li>• knowledge of hazards of materials</li> <li>• knowledge of air conditioning electrical components</li> <li>• knowledge of regulations and standards relating to air conditioning material handling</li> <li>• ability to disassemble and reassemble dashboard and firewall components for access</li> </ul>	<p>190403a</p> <p>190403b</p> <p>190403cA</p> <p>190403cB</p>	<p>Air Conditioning Fundamentals</p> <p>HVAC Control Systems</p> <p>Air Conditioning Testing &amp; Service – Part A</p> <p>Air Conditioning Testing &amp; Service – Part B</p>

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<ul style="list-style-type: none"> <li>• ability to use specialized diagnostic tools</li> <li>• ability to run system to isolate problem</li> <li>• ability to perform specialized testing such as nitrogen pressure testing and electrical testing</li> <li>• ability to perform sensory inspection</li> <li>• ability to interpret test results</li> </ul>		

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## 21 SERVICES CLIMATE CONTROL SYSTEMS

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	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
21.01	Services heating and ventilation systems	<ul style="list-style-type: none"> <li>• knowledge of heating system components such as blowers, pumps, resistors, controls and modules</li> <li>• knowledge of heater operating principles such as water flow and heat exchange</li> <li>• knowledge of ductwork components and routing</li> </ul>	190403a 190403b 190403cA 190403cB	Air Conditioning Fundamentals HVAC Control Systems Air Conditioning Testing & Service – Part A Air Conditioning Testing & Service – Part B

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<ul style="list-style-type: none"> <li>• ability to clean and replace filters</li> <li>• ability to disassemble and reassemble dashboard and firewall components for access</li> <li>• ability to repair or replace faulty components</li> <li>• ability to reset monitors</li> </ul>		
21.02	Services air conditioning systems	<ul style="list-style-type: none"> <li>• knowledge of air conditioning system components such as evaporator, condenser, compressor, receiver dryer, expansion valves, sensors and controls</li> <li>• knowledge of air conditioning operating principles and theory (compression and expansion)</li> <li>• knowledge of types of refrigerant oils and refrigerants such as R134A, R22 and R12</li> <li>• knowledge of hazards of materials</li> <li>• knowledge of air conditioning electrical components</li> <li>• knowledge of regulations and standards</li> </ul>	<p>190403a</p> <p>190403b</p> <p>190403cA</p> <p>190403cB</p>	<p>Air Conditioning Fundamentals</p> <p>HVAC Control Systems</p> <p>Air Conditioning Testing &amp; Service – Part A</p> <p>Air Conditioning Testing &amp; Service – Part B</p>

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<p>related to air conditioning material handling</p> <ul style="list-style-type: none"> <li>• ability to disassemble and reassemble dashboard and firewall components for access</li> <li>• ability to evacuate, clean and recharge system refrigerant according to OEM specifications</li> <li>• ability to use welding equipment to braze or solder lines</li> <li>• ability to repair and replace air conditioning system components</li> <li>• ability to install and assemble new air conditioning system</li> </ul>		

## J HYDRAULIC SYSTEMS

6%

### 22 DIAGNOSES HYDRAULIC SYSTEMS

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
22.01	Diagnoses hydrodynamic systems	<ul style="list-style-type: none"><li>• knowledge of hydrodynamic systems theory and operating principles</li><li>• knowledge of torque converters</li><li>• knowledge of fluid couplers</li><li>• knowledge of types of hydraulic oils</li><li>• knowledge of common faults such as leaks, deterioration and worn components</li><li>• ability to perform tests of hydrodynamic systems such as stall tests and oil condition verification</li><li>• ability to perform sensory inspection</li><li>• ability to use specialized diagnostic equipment</li><li>• ability to interpret test results</li></ul>	190301a 190301b 190301c 190301d 190301e 190301fA 190301fB 190301g 190301h 190301I	Hydraulic Principles Hydraulic Pump Fundamentals Hydraulic Pump Service Hydraulic Actuator Fundamentals Hydraulic Actuator Service Hydraulic Valves – Part A Hydraulic Valves – Part B Hydraulic System Types Hydraulic System Testing & Service Electro-Hydraulics

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
22.02	Diagnoses hydrostatic systems	<ul style="list-style-type: none"> <li>• knowledge of hydrostatic systems theory and operating principles</li> <li>• knowledge of hydrostatic system components such as cylinders, motors, reservoirs, accumulators, controls, sensors and gauges</li> <li>• knowledge of types of pumps such as constant supply pumps and demand pumps</li> <li>• knowledge of types of hydraulic oils</li> <li>• knowledge of hydrostatic system controls</li> <li>• knowledge of system driving the hydrostatic system such as transmission, PTO shaft and engine</li> <li>• knowledge of common faults such as stuck valves, seized motors, chafed or broken hoses and leaks</li> <li>• ability to interpret flow schematics</li> <li>• ability to perform tests of hydrostatic system such as pressure and volume tests</li> </ul>	<p>190301a</p> <p>190301b</p> <p>190301c</p> <p>190301d</p> <p>190301e</p> <p>190301fA</p> <p>190301fB</p> <p>190301g</p> <p>190301h</p> <p>190301I</p>	<p>Hydraulic Principles</p> <p>Hydraulic Pump Fundamentals</p> <p>Hydraulic Pump Service</p> <p>Hydraulic Actuator Fundamentals</p> <p>Hydraulic Actuator Service</p> <p>Hydraulic Valves – Part A</p> <p>Hydraulic Valves – Part B</p> <p>Hydraulic System Types</p> <p>Hydraulic System Testing &amp; Service</p> <p>Electro-Hydraulics</p>

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		<ul style="list-style-type: none"> <li>• ability to perform sensory inspection</li> <li>• ability to use specialized diagnostic equipment</li> <li>• ability to interpret test results</li> </ul>		

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## 23 SERVICES HYDRAULIC SYSTEMS

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	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
23.01	Services hydrodynamic systems	<ul style="list-style-type: none"> <li>• knowledge of hydrodynamic systems theory and operating principles</li> <li>• knowledge of torque converters</li> <li>• knowledge of fluid couplers</li> <li>• knowledge of types of hydraulic oils</li> <li>• ability to replace worn torque converters and fluid couplers</li> <li>• ability to drain and replace fluids</li> <li>• ability to clean and flush transmission and oil cooling systems</li> </ul>	190301a 190301b 190301c 190301d 190301e 190301fA 190301fB 190301g 190301h	Hydraulic Principles Hydraulic Pump Fundamentals Hydraulic Pump Service Hydraulic Actuator Fundamentals Hydraulic Actuator Service Hydraulic Valves – Part A Hydraulic Valves – Part B Hydraulic System Types Hydraulic System Testing &

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
			190301I	Service Electro-Hydraulics
23.02	Services hydrostatic systems	<ul style="list-style-type: none"> <li>• knowledge of hydrostatic systems theory and operating principles</li> <li>• knowledge of hydrostatic system components such as cylinders, motors, reservoirs, accumulators, controls, sensors and gauges</li> <li>• knowledge of types of pumps such as constant supply pumps and demand pumps</li> <li>• knowledge of types of hydraulic oils</li> <li>• knowledge of hydrostatic system controls</li> <li>• ability to repair components such as pumps, motors and cylinders</li> <li>• ability to replace components such as hoses, valves, motors, cylinders and pumps</li> <li>• ability to install new components</li> <li>• ability to adjust components such as</li> </ul>	190301a 190301b 190301c 190301d 190301e 190301fA 190301fB 190301g 190301h 190301I	Hydraulic Principles Hydraulic Pump Fundamentals Hydraulic Pump Service Hydraulic Actuator Fundamentals Hydraulic Actuator Service Hydraulic Valves – Part A Hydraulic Valves – Part B Hydraulic System Types Hydraulic System Testing & Service Electro-Hydraulics

	<b>Subtask</b>	<b>Enabling Objective</b>	<b>ILM Module Number</b>	<b>ILM Module Name</b>
		relief valves, flow control valves and splitter valves  <ul style="list-style-type: none"> <li>• ability to change fluid and filters</li> </ul>		