# Diesel Equipment Technology II

8614 36 weeks / 280 hours

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Acknowledgments

This 2017 edition of the task list for Diesel Equipment Technology was validated by a panel of industry representatives and educators:

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Virginia Department of Education

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Course Description

**Suggested Grade Level:** 11 or 12  
**Prerequisites:** 8613

Students receive instruction in diagnosis and adjustment of medium- and heavy-duty diesel trucks and equipment. They apply theory and maintain operation of diesel engines, brakes, suspension and steering systems, and electrical/electronic systems.

*Legislation enacted in the 2011 Virginia General Assembly (HB 1493) and amended in 2012 (HB 1108) requires where there is a national industry certification for career and technical*
education instructional personnel or programs for automotive technology, the Board of Education must make such certification mandatory. The provisions of this act shall become effective July 1, 2013. To comply with the requirements, all Career and Technical Education (CTE) automotive programs must be NATEF accredited and the instructors must be certified by the National Institute for Automotive Service Excellence (ASE).

As noted in Superintendent's Memo #058-17 (2-28-2017), this Career and Technical Education (CTE) course must maintain a maximum pupil-to-teacher ratio of 20 students to one teacher, due to safety regulations. The 2016-2018 biennial budget waiver of the teacher-to-pupil ratio staffing requirement does not apply.

**Task Essentials List**

- Tasks/competencies designated by plus icons (⊕) in the left-hand column(s) are essential
- Tasks/competencies designated by empty-circle icons (○) are optional
- Tasks/competencies designated by minus icons (⊖) are omitted
- Tasks marked with an asterisk (*) are sensitive.

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<th>Task Number</th>
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<td><strong>REQUIRED SUPPLEMENTAL TASKS</strong></td>
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<tr>
<td>Practicing Lab/Shop and Personal Safety</td>
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<tr>
<td>39 ⊕</td>
<td>Identify general lab/shop safety rules and procedures.</td>
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<td>40 ⊕</td>
<td>Utilize safe procedures for handling of tools and equipment.</td>
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<tr>
<td>41 ⊕</td>
<td>Identify and use proper placement of floor jacks and jack stands.</td>
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<tr>
<td>42 ⊕</td>
<td>Identify and use proper procedures for safe lift operation.</td>
<td></td>
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<tr>
<td>43 ⊕</td>
<td>Utilize proper ventilation procedures for working within the lab/shop area.</td>
<td></td>
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<tr>
<td>44 ⊕</td>
<td>Identify marked safety areas.</td>
<td></td>
</tr>
<tr>
<td>45 ⊕</td>
<td>Identify the location and the types of fire extinguishers and other fire safety equipment; demonstrate knowledge of the procedures for using fire extinguishers and other fire safety equipment.</td>
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<tr>
<td>46 ⊕</td>
<td>Identify the location and use of eye wash stations.</td>
<td></td>
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<td>47 ⊕</td>
<td>Identify the location of the posted evacuation routes.</td>
<td></td>
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<tr>
<td>48 ⊕</td>
<td>Comply with the required use of safety glasses, ear protection, gloves, and shoes during lab/shop activities.</td>
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<tr>
<td>49 ⊕</td>
<td>Identify and wear appropriate clothing for lab/shop activities.</td>
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<tr>
<td>50 ⊕</td>
<td>Secure hair and jewelry for lab/shop activities.</td>
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<tr>
<td>51 ⊕</td>
<td>Demonstrate awareness of the safety aspects of supplemental restraint systems (SRS), electronic brake control systems, and hybrid vehicle high voltage circuits.</td>
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<tr>
<td>Task Number</td>
<td>Tasks/Competencies</td>
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<tr>
<td>52</td>
<td>Demonstrate awareness of the safety aspects of high voltage circuits (such as high intensity discharge [HID] lamps, ignition systems, injection systems, etc.).</td>
<td></td>
</tr>
<tr>
<td>53</td>
<td>Demonstrate knowledge of safety data sheets' (SDS) location and content.</td>
<td></td>
</tr>
</tbody>
</table>

**DIESEL ENGINES**

**Diesel Engines: General**

<table>
<thead>
<tr>
<th>Task Number</th>
<th>Tasks/Competencies</th>
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<tbody>
<tr>
<td>54</td>
<td>Diagnose cranking and starting problems.</td>
</tr>
<tr>
<td>55</td>
<td>Identify engine surging, rough operation, misfiring, low power, slow deceleration, slow acceleration, and shutdown problems.</td>
</tr>
<tr>
<td>56</td>
<td>Identify engine vibration problems.</td>
</tr>
<tr>
<td>57</td>
<td>Record electronic diagnostic codes.</td>
</tr>
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</table>

**Diesel Engines: Servicing Air Induction and Exhaust Systems**

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<th>Tasks/Competencies</th>
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</thead>
<tbody>
<tr>
<td>58</td>
<td>Inspect exhaust gas recirculation (EGR) system.</td>
</tr>
</tbody>
</table>

**Diesel Engines: Servicing Fuel Supply System**

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<th>Task Number</th>
<th>Tasks/Competencies</th>
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</thead>
<tbody>
<tr>
<td>59</td>
<td>Check fuel level and condition.</td>
</tr>
<tr>
<td>60</td>
<td>Perform fuel supply and return system tests.</td>
</tr>
<tr>
<td>61</td>
<td>Inspect fuel tanks, vents, caps, mounts, valves, screens, crossover system, supply and return lines and fittings.</td>
</tr>
</tbody>
</table>

**BRAKES**

**Brakes: Servicing Air Brakes**

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<tr>
<th>Task Number</th>
<th>Tasks/Competencies</th>
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<tr>
<td>62</td>
<td>Identify poor stopping, air leaks, premature wear, pulling, grabbing, dragging, or balance problems caused by supply and service system malfunctions.</td>
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<td>63</td>
<td>Check air system build-up time.</td>
</tr>
<tr>
<td>64</td>
<td>Drain air reservoir/tanks.</td>
</tr>
<tr>
<td>65</td>
<td>Inspect air compressor drive gear, belts and coupling.</td>
</tr>
<tr>
<td>66</td>
<td>Inspect air compressor inlet; oil supply and coolant lines, fittings, and mounting brackets.</td>
</tr>
<tr>
<td>67</td>
<td>Inspect air system pressure controls.</td>
</tr>
<tr>
<td>68</td>
<td>Inspect air system lines, hoses, fittings, and couplings.</td>
</tr>
<tr>
<td>69</td>
<td>Inspect air tank relief (safety) valves, one-way (single) check valves, two-way (double) check valves, manual and automatic drain valves.</td>
</tr>
<tr>
<td>70</td>
<td>Inspect air drier systems, filters, valves, heaters, wiring, and connectors.</td>
</tr>
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<td>71</td>
<td>Inspect brake application.</td>
</tr>
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<td>72</td>
<td>Inspect stop light circuit switches, wiring, and connectors.</td>
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<td>73</td>
<td>Inspect hand brake (trailer) control valve, lines, fittings, and mountings.</td>
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<td>74</td>
<td>Inspect brake relay valves.</td>
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<td>99</td>
<td>Service power steering reservoir including filter, seals, and gaskets.</td>
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<tr>
<td>100</td>
<td>Inspect power steering pump drive gear and coupling device.</td>
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<tr>
<td>101</td>
<td>Replace power steering pump, mountings, and brackets.</td>
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<tr>
<td>102</td>
<td>Replace power steering system cooler, lines, hoses, clamps/mountings, hose routings, and fittings.</td>
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<tr>
<td>103</td>
<td>Replace integral type power steering gear(s) (single and/or dual) and mountings.</td>
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**Suspension and Steering: Servicing Steering Linkage**

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<td>Adjust steering (wheel) stops.</td>
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**Suspension and Steering: Servicing Suspension Systems**

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<td>Inspect front axles and attaching hardware.</td>
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<td>Service kingpins, steering knuckle bushings, locks bearings, seals, and covers.</td>
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<td>109</td>
<td>Inspect shock absorbers, bushings, brackets, and mounts.</td>
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<td>110</td>
<td>Inspect leaf springs, center bolts, clips, pins and bushings, shackles, U-bolts, insulators, brackets, and mounts.</td>
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<tr>
<td>111</td>
<td>Inspect axle aligning devices.</td>
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<td>112</td>
<td>Inspect tandem suspension equalizer components.</td>
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<tr>
<td>113</td>
<td>Test air suspension pressure regulator and height control valves, lines, hoses, dump valves, and fittings.</td>
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<tr>
<td>114</td>
<td>Inspect air springs, mounting plates, springs, suspension arms, and bushings.</td>
</tr>
<tr>
<td>115</td>
<td>Adjust ride height.</td>
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<td>116</td>
<td>Identify rough ride problems.</td>
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**Suspension and Steering: Wheel Alignment Diagnosis, Adjustment, and Repair**

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<td>117</td>
<td>Identify causes of vehicle wandering, pulling, shimmy, hard steering, and off-center steering wheel problems.</td>
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<td>118</td>
<td>Check camber.</td>
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<td>119</td>
<td>Check caster.</td>
</tr>
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<td>120</td>
<td>Adjust toe settings.</td>
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<td>121</td>
<td>Check rear axle(s) alignment (thrustline/centerline) and tracking.</td>
</tr>
<tr>
<td>122</td>
<td>Identify turning/Ackerman angle (toe-out-on-turns) problems.</td>
</tr>
<tr>
<td>123</td>
<td>Check front axle alignment (centerline).</td>
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</tbody>
</table>

**ELECTRICAL/ELECTRONIC SYSTEMS**
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<td><strong>Electrical/Electronic Systems: Servicing Starting System</strong></td>
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<tr>
<td>124</td>
<td>✅</td>
<td>Perform starter circuit cranking voltage and voltage drop tests.</td>
</tr>
<tr>
<td>125</td>
<td>✅</td>
<td>Test components (key switch, push button and/or magnetic switch) and wires and harnesses in the starter control circuit.</td>
</tr>
<tr>
<td>126</td>
<td>✅</td>
<td>Test starter relays and solenoids/switches.</td>
</tr>
<tr>
<td>127</td>
<td>✅</td>
<td>Replace starter.</td>
</tr>
<tr>
<td><strong>Electrical/Electronic Systems: Servicing Charging System</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>128</td>
<td>✅</td>
<td>Test instrument panel, mounted volt meters, and/or indicator lamps.</td>
</tr>
<tr>
<td>129</td>
<td>✅</td>
<td>Identify causes of a no charge, low charge, or overcharge problems.</td>
</tr>
<tr>
<td>130</td>
<td>✅</td>
<td>Replace alternator drive belts, pulleys, fans, tensioners, and mounting brackets.</td>
</tr>
<tr>
<td>131</td>
<td>✅</td>
<td>Perform charging system voltage and amperage output tests, and alternating current (AC) ripple test.</td>
</tr>
<tr>
<td>132</td>
<td>✅</td>
<td>Perform charging circuit voltage drop tests.</td>
</tr>
<tr>
<td>133</td>
<td>✅</td>
<td>Replace alternator.</td>
</tr>
<tr>
<td>134</td>
<td>✅</td>
<td>Replace cables, wires, and connectors in the charging circuit.</td>
</tr>
<tr>
<td><strong>Electrical/Electronic Systems: Servicing Lighting Systems</strong></td>
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</tr>
<tr>
<td>135</td>
<td>✅</td>
<td>Perform diagnostic procedures using recommended electronic service tool(s).</td>
</tr>
<tr>
<td>136</td>
<td>✅</td>
<td>Identify causes of brighter than normal, intermittent, dim, or no headlight and daytime running light (DRL) operations.</td>
</tr>
<tr>
<td>137</td>
<td>✅</td>
<td>Replace headlights.</td>
</tr>
<tr>
<td>138</td>
<td>✅</td>
<td>Test headlight and dimmer circuit switches, relays, wires, terminals, connectors, sockets, and control components/modules.</td>
</tr>
<tr>
<td>139</td>
<td>✅</td>
<td>Test switchers, bulbs/LEDs, sockets, connectors, terminals, relays, wires, and control components/models of parking, clearance, and taillight circuits.</td>
</tr>
<tr>
<td>140</td>
<td>✅</td>
<td>Test instrument panel light circuit switches, relays, bulbs/LEDs, sockets, connectors, terminals, wires, and control components/modules.</td>
</tr>
<tr>
<td>141</td>
<td>✅</td>
<td>Test interior cab light circuit switches, bulbs/LEDs, sockets, low voltage disconnect (LVD), connectors, terminals, wire, and control modules.</td>
</tr>
<tr>
<td>142</td>
<td>✅</td>
<td>Test tractor-to-trailer multi-wire connectors.</td>
</tr>
<tr>
<td>143</td>
<td>✅</td>
<td>Adjust stoplight circuit switches, bulbs/LEDs, sockets, connectors, terminals, wires and control components/modules.</td>
</tr>
<tr>
<td>144</td>
<td>✅</td>
<td>Test turn signal and hazard circuit flasher(s), switches, relays, bulbs/LEDs, sockets, connectors, terminals, wires and control components/modules.</td>
</tr>
<tr>
<td>145</td>
<td>✅</td>
<td>Test reverse lights and warning device circuit switches, bulbs/LEDs, sockets, horns, buzzers, connectors, terminals, wires and control components/modules.</td>
</tr>
<tr>
<td><strong>Electrical/Electronic Systems: Servicing Gauges and Warning Devices</strong></td>
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<tr>
<td>Task Number</td>
<td>8614</td>
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</tr>
<tr>
<td>146</td>
<td>☑️</td>
<td>Test warning devices (lights and audible) circuit sensor/sending units, bulbs/LEDs, sockets, connectors, wires, and control components/modules.</td>
</tr>
<tr>
<td>147</td>
<td>☑️</td>
<td>Replace electronic speedometer, odometer, and tachometer systems.</td>
</tr>
<tr>
<td>148</td>
<td>☑️</td>
<td>Identify causes of constant, intermittent, or no horn operation.</td>
</tr>
<tr>
<td>149</td>
<td>☑️</td>
<td>Test horn circuit relays, horns, switches, connectors, wires, clock springs, and control components/modules.</td>
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<tr>
<td>150</td>
<td>☑️</td>
<td>Identify causes of constant, intermittent, or no wiper operation.</td>
</tr>
<tr>
<td>151</td>
<td>☑️</td>
<td>Test wiper motor, resistors, park switch, relays, switches, connectors, wires, and control components/modules.</td>
</tr>
<tr>
<td>152</td>
<td>☑️</td>
<td>Inspect wiper motor transmission linkage, arms, and blades.</td>
</tr>
<tr>
<td>153</td>
<td>☑️</td>
<td>Test windshield washer motor or pump/relay assembly, switches, connectors, terminals, wires, and control components/modules.</td>
</tr>
<tr>
<td>154</td>
<td>☑️</td>
<td>Test side-view mirror motors, heater circuit grids, relays, switches, connectors, terminals, wires, and control components/modules.</td>
</tr>
<tr>
<td>155</td>
<td>☑️</td>
<td>Test heater and air-conditioning electrical components.</td>
</tr>
<tr>
<td>156</td>
<td>☑️</td>
<td>Test auxiliary power outlet, integral fuse, connectors, terminals, wires, and control components/modules.</td>
</tr>
<tr>
<td>157</td>
<td>☑️</td>
<td>Identify causes of slow, intermittent, or no power window operation.</td>
</tr>
<tr>
<td>158</td>
<td>☑️</td>
<td>Test motors, switches, relays, connectors, terminals, wires, and control components/modules of power window circuits.</td>
</tr>
<tr>
<td>159</td>
<td>☑️</td>
<td>Test block heaters.</td>
</tr>
<tr>
<td>160</td>
<td>☑️</td>
<td>Test cruise control electrical components.</td>
</tr>
<tr>
<td>161</td>
<td>☑️</td>
<td>Test switches, relays, controllers, actuator/solenoids, connectors, terminals, and wires of electric door lock circuits.</td>
</tr>
<tr>
<td>162</td>
<td>☑️</td>
<td>Test engine cooling fan electrical control components/modules.</td>
</tr>
</tbody>
</table>

Legend: ☑️Essential ☐Non-essential ☐Omitted

Curriculum Framework

REQUIRED SUPPLEMENTAL TASKS

Practicing Lab/Shop and Personal Safety
Task Number 39

Identify general lab/shop safety rules and procedures.

Definition

Identification should include

- wearing correct protective eyewear and clothing
- following all Occupational Safety and Health Administration (OSHA) standards for the task performed
- following the lab/shop rules set by the local school board.

Process/Skill Questions

- Why is eye protection important in the diesel lab/shop?
- Why should you follow OSHA guidelines when performing service on a diesel vehicle?

Task Number 40

Utilize safe procedures for handling of tools and equipment.

Definition

Utilization should include always reading the manufacturer procedures for the safe use of hand tools, power tools, and equipment.

Process/Skill Questions

Why should you always read manufacturer procedures for the proper use of the tool?

Task Number 41

Identify and use proper placement of floor jacks and jack stands.

Definition

Identification should include
following manufacturer recommendations for jack placement
ensuring the vehicle is on level ground before jacking
using jacks and jack stands that are rated for the capacity for the vehicle on which the
service is to be performed.

Process/Skill Questions

- Why should you check for proper jack placement?
- Why should you use jack stands to support a vehicle?

Task Number 42

Identify and use proper procedures for safe lift operation.

Definition

Procedure should include

- reviewing all lift-safety information
- identifying the correct placement of lift arms on vehicle
- lowering vehicle on safety locks before performing under-carriage service.

Process/Skill Questions

- Why is it important to read all lift-safety material supplied by the lift manufacturer?
- Why is it important to lower the vehicle onto the safety locks?

Task Number 43

Utilize proper ventilation procedures for working within the
lab/shop area.

Definition

Utilization should include

- keeping bay doors open when possible
- operating lab/shop exhaust fans
- using an exhaust ventilation hose on running vehicles.
Process/Skill Questions

- What are the gases emitted by a running vehicle?
- Why is proper ventilation so important?
- What are the dangers of a running vehicle in a confined space?

Task Number 44

Identify marked safety areas.

Definition

Identification should include describing and translating signage and special markings (e.g., floor paint) that identify work and caution areas.

Process/Skill Questions

- What are the different types of work zones?
- How do you know if additional safety equipment or clothing is needed to enter a safety area?
- How are walkways identified in the lab/shop area?

Task Number 45

Identify the location and the types of fire extinguishers and other fire safety equipment; demonstrate knowledge of the procedures for using fire extinguishers and other fire safety equipment.

Definition

Identification should include

- the different types of fires encountered in the diesel technology field (Classes A, B, C, D, and E) and the hazards and the precautions associated with each type of fire
- the locations and types fire safety equipment including the appropriate type of extinguishers and their use and identification of relevant signage and labels
• fire emergency procedures in accordance with government regulations, building specifications, and instructor's guidelines.

Process/Skill Questions

• How are fire extinguishers locations marked?
• What types of extinguishers are used in the diesel lab/shop?
• What other fire safety equipment might be found in a diesel lab/shop?

Task Number 46

Identify the location and use of eye wash stations.

Definition

Identification should include describing the signage and operating procedures for the unit.

Process/Skill Questions

• What is the color of the sign that signifies an eye wash station?
• When should you use an eye wash station?
• What safety equipment provides additional eye protection?

Task Number 47

Identify the location of the posted evacuation routes.

Definition

Identification should include

• events that could trigger an evacuation
• the location and interpretation of the posted evacuation route
• the destination and procedures for evacuation.

Process/Skill Questions

• What route should be followed in the event of an evacuation?
• Where is the evacuation route posted?
• Why is it important to establish a meeting place in the case of an evacuation?
Task Number 48

Comply with the required use of safety glasses, ear protection, gloves, and shoes during lab/shop activities.

Definition

Compliance should include

- wearing safety glasses at all times in the diesel lab/shop area
- wearing additional personal safety equipment, when necessary
- adhering to governmental and classroom safety policies.

Process/Skill Questions

- Why are safety glasses in the diesel lab/shop required at all times?
- What kinds of shoes are appropriate in the lab/shop area?
- Why might you need to wear ear protection in the diesel lab/shop?

Task Number 49

Identify and wear appropriate clothing for lab/shop activities.

Definition

Identification should include

- clothing that will not hinder operations or be a danger to self or others
- school or lab/shop policy
- professional dress requirements and professional expectations.

Process/Skill Questions

- What can result from wearing loose clothing around moving objects in the lab/shop?
- What is the school dress code?
- What are the benefits of following standard workplace policies for apparel in the lab/shop?
Task Number 50

Secure hair and jewelry for lab/shop activities.

Definition

Compliance should include

- restraining hair to keep it from inadvertently getting caught in moving parts
- restraining or not wearing jewelry that can short circuit electrical components, cause electrical burns, or get caught in moving parts
- adhering to lab/shop safety policies.

Process/Skill Questions

- What is your lab/shop’s policy concerning hair safety?
- Why should long hair be tied up?
- What is the best way to secure your hair so that it does not cause serious injury?

Task Number 51

Demonstrate awareness of the safety aspects of supplemental restraint systems (SRS), electronic brake control systems, and hybrid vehicle high voltage circuits.

Definition

Demonstration should include following manufacturer guidelines when working with supplemental restraint systems (SRS), electronic brake control systems, and hybrid vehicle high voltage circuits. When working with hybrid vehicles, workers should be able to identify

- location of the battery
- physical appearance of the disconnects (small, plastic pieces that fit into the side of a hybrid battery)
- location of high voltage circuits, according to service materials and manufacturer guidelines
- specific protective gear and clothing that technicians should wear when working with the service plug (i.e., type 00 insulating/voltage gloves).
Process/Skill Questions

- Why is it important to follow manufacturer guidelines when disabling an SRS?
- What could happen if the airbag deploys at the wrong time?
- What precautions should be taken when handling removed airbags?
- What are the components of electronic brake control systems?
- What are the types of electronic brake control systems?
- How does the wheel speed sensor operate?
- What color are the high voltage circuits?
- What are the shock dangers involving electric/hybrid vehicles?
- What is the electrocution threshold for humans?

Task Number 52

Demonstrate awareness of the safety aspects of high voltage circuits (such as high intensity discharge [HID] lamps, ignition systems, injection systems, etc.).

Definition

Demonstration should include identifying the manufacturer’s warning and guidelines regarding shock hazard.

Process/Skill Questions

- What is the typical system voltage of an HID headlight?
- What gas is used in most HID bulbs?
- What do HID bulbs use in place of filaments?

Task Number 53

Demonstrate knowledge of safety data sheets' (SDS) location and content.

Definition

Demonstration should include identifying
• the location of the sheets within the lab/shop and the purpose they serve
• the administration’s (ownership’s) responsibility for workers’ health and safety
• laws/regulations and practices affecting workers’ health and safety
• health and safety hazards
• health and safety programs
• the responsibility for environmental stewardship
• environmental laws, regulations, and practices
• sustainability initiatives.

Process/Skill Questions

• What environmental concerns should an industry address?
• What environmentally-friendly practices and resources are available to an industry?
• What methods can be used to motivate employees to become involved in effective health, safety, and environmental practices?

DIESEL ENGINES

Diesel Engines: General

Task Number 54

Diagnose cranking and starting problems.

Definition

Diagnosis should include

• performing a visual inspection of electrical, air induction, and fuel systems
• performing an electrical system performance test with a digital multimeter (DMM)
• testing and repairing fuel system components
• determining additional needed action.

Process/Skill Questions

• What visual inspections should be performed before any diagnostic equipment is used?
• What tools other than a DMM could be used in troubleshooting the electrical system?
• How would you check fuel pressure?
• How is an air filter restriction measured?
Task Number 55

Identify engine surging, rough operation, misfiring, low power, slow deceleration, slow acceleration, and shutdown problems.

Definition

Identification should include

- verifying actual problem and condition
- verifying engine diagnostic codes with Electronic Technician (ET) software
- using appropriate electrical and mechanical diagnostic equipment
- determining needed action.

Process/Skill Questions

- Where do you locate the diagnostic code interpretation?
- In what order would you perform the various engine tests?

Task Number 56

Identify engine vibration problems.

Definition

Identification should include

- verifying severity of vibration and condition that it is most apparent
- determining vibration specification (if applicable)
- performing a visual inspection for missing, loose, or failed components
- demonstrating use of a vibration meter
- isolating problem to revolutions per minute (RPM) range, if possible.

Process/Skill Questions

- What is the maximum vibration specification?
- What is the difference between amplitude, frequency, and resonance?
Task Number 57

Record electronic diagnostic codes.

Definition

Recording includes downloading fault codes with a scan tool or computer.

Process/Skill Questions

- Where is the fault code identification located?
- How are fault codes cleared in the engine control module (ECM)?

Diesel Engines: Servicing Air Induction and Exhaust Systems

Task Number 58

Inspect exhaust gas recirculation (EGR) system.

Definition

Inspection should include following all inspection guidelines for all the EGR components.

Process/Skill Questions

- What is the purpose of the EGR system?
- What issues will a failed EGR systems cause?

Diesel Engines: Servicing Fuel Supply System

Task Number 59

Check fuel level and condition.

Definition

Checking should include

- viewing fuel level via a gauge, sight glass, or dip stick
• taking a fuel sample
• sending the fuel sample to laboratory for analysis
• determining needed action.

Process/Skill Questions

• What will water and contaminants do to a fuel system?
• Why should an operator fill his fuel tank each night?

Task Number 60

Perform fuel supply and return system tests.

Definition

Performance should include

• following manufacturer’s guide to checking and measuring fuel pressure and return flow
• comparing findings to engine specifications
• determining needed action.

Process/Skill Questions

• What problems can air in the fuel system cause?
• What are three reasons for low return fuel flow to the tank?

Task Number 61

Inspect fuel tanks, vents, caps, mounts, valves, screens, crossover system, supply and return lines and fittings.

Definition

Inspection should include

• cleaning cap, screens and vents
• inspecting fuel lines for leaks, kinks, and chafing
• inspecting all rubber components for deterioration
• determining needed action.
Process/Skill Questions

- Why are fuel tanks vented?

**BRAKES**

**Brakes: Servicing Air Brakes**

**Task Number 62**

**Identify poor stopping, air leaks, premature wear, pulling, grabbing, dragging, or balance problems caused by supply and service system malfunctions.**

**Definition**

Identification should include

- listing causes of poor stopping (e.g., long stopping distances, pulling, grabbing, dragging, or balance problems)
- confirming that the vehicle has at least 90 pounds per square inch (psi) of air pressure before beginning the test drive
- confirming that the brake pedal has the proper amount of resistance when pressed
- driving the vehicle through a variety of braking scenarios to check for even and smooth braking
- confirming that there is no excessive stopping distance, pulling, grabbing, dragging, or balance problems under normal braking conditions.

**Process/Skill Questions**

- What would cause a spongy, weak, or no-brake pedal?
- What might cause a very hard brake pedal with very little effort applied to the brakes?
- What might a driver experience if air pressure is low?

**Task Number 63**

**Check air system build-up time.**

**Definition**
Checking air system build-up time should include consideration of the following specifications:

- In single air systems (built before 1975), pressure typically builds from 50 to 90 psi within 3 minutes with the engine at an idle speed of 600-900 RPM.
- When the engine is at operating RPM (check the manufacturer’s specifications to determine the correct operating RPM), the pressure should build from 85 to 100 psi within 45 seconds in dual air systems.

Process/Skill Questions

- How much pressure should a system have in vehicles built before 1975?
- How many minutes does a system require to build pressure in a single air system?
- What are the requirements for building a dual air system?

Task Number 64

Drain air reservoir/tanks.

Definition

Draining reservoir/tanks should include checking for the presence of oil, water, or foreign material.

Task Number 65

Inspect air compressor drive gear, belts and coupling.

Definition

Inspection should include visually inspecting the components for damage or wear.

Process/Skill Questions

- Where do you find air hoses on a vehicle?
- What are the typical failures of a compressor?
- Why is it important to route brake lines properly?

Task Number 66
Inspect air compressor inlet; oil supply and coolant lines, fittings, and mounting brackets.

Definition

Inspection should include visually inspecting the air compressor inlet for signs of oil/coolant residue.

Process/Skill Questions

- If you find oil residue in the compressor inlet, what procedure would you perform next?
- What conditions may cause the compressor to leak oil/coolant?

Task Number 67

Inspect air system pressure controls.

Definition

Inspection should include the governor cut-in and cut-out tests as per manufacturer specifications to ensure proper operation.

Process/Skill Questions

- Is the governor within specifications? Why, or why not?
- How can you tell whether the air lines are properly routed?

Task Number 68

Inspect air system lines, hoses, fittings, and couplings.

Definition

Inspection should include visually inspecting the components for damage or wear.

Process/Skill Questions

- Where do you find flexible hoses on a vehicle?
• What are the typical failures of brake hoses?
• Why is it important to route brake lines properly?

Task Number 69

Inspect air tank relief (safety) valves, one-way (single) check valves, two-way (double) check valves, manual and automatic drain valves.

Definition

Inspection should include visually inspecting the air tank and relief valves.

Process/Skill Questions

• What types of contaminants might be found in the air dryer exhaust valve?

Task Number 70

Inspect air drier systems, filters, valves, heaters, wiring, and connectors.

Definition

Inspection should include

• identifying leaks or problems that require necessary repairs
• visually inspecting components for evidence of leaks and poor connections
• replacing desiccant or filter, depending on manufacturer requirements.

Process/Skill Questions

• Why should you bleed the system air pressure before performing repairs?

Task Number 71
Inspect brake application.

Definition

Inspection should include operating the brake pedal to determine functionality of the system.

Process/Skill Questions

• What steps should be taken if the brake pedal is low?

Task Number 72

Inspect stop light circuit switches, wiring, and connectors.

Definition

Inspection should include using a DMM or a test light to indicate relevant components that may fail.

Process/Skill Questions

• What is the purpose of the brake warning light?
• How is a brake warning light tested?
• What will activate the brake warning light?

Task Number 73

Inspect hand brake (trailer) control valve, lines, fittings, and mountings.

Definition

Inspection should include operating the hand brake and checking for air loss when the hand brake is applied.

Process/Skill Questions

• What are some possible causes of air loss?
Task Number 74

Inspect brake relay valves.

Definition

Inspection should include

- operating the treadle valve and checking the brake chambers for even application
- checking the hoses from the brake relay valve to the brake chambers for blockage or leakage.

Process/Skill Questions

- How might the brakes operate if the relay valve is not functioning properly
- What types of evidence indicate a defective relay valve?

Task Number 75

Inspect quick release valves.

Definition

Inspection should include operating the treadle valve and visually observing the brake chambers to determine if the brakes release evenly.

Process/Skill Questions

- What might cause brake chambers to stop releasing evenly?

Task Number 76

Inspect tractor protection valve.

Definition

Inspection should include
• chocking wheels before beginning
• starting engine to build air pressure to 120 psi
• turning engine off and listening for air leaks
• applying brakes until air pressure reaches 60 psi.

Process/Skill Questions
• What might cause a valve to leak when released?

Task Number 77

Inspect emergency (spring) brake control/modulator valve(s).

Definition
Inspection should include operating the yellow parking brake switch and determining if the parking brakes release properly.

Process/Skill Questions
• What would happen to the parking brakes if there was a leak at the primary brake control system?
• How many brake applications does the valve allow if there is a problem in the system?

Task Number 78

Inspect low pressure warning devices, wiring, and connectors.

Definition
Inspection should include

• starting the engine to build air pressure in the system
• inspecting the low air light for proper operation
• inspecting the audible low air pressure warning system.

Process/Skill Questions
• What is the repair procedure when there is a low air pressure warning alert?

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Task Number 79

Inspect air pressure gauges, lines, and fittings.

Definition

Inspection should include

• starting the engine to build air pressure in the system
• visually inspecting gauges to determine whether manufacturer specifications are met.

Process/Skill Questions

• What is the diagnosis process when pressure is below manufacturer specifications?

Brakes: Servicing Mechanical/Foundation Brakes

Task Number 80

Identify poor stopping, brake noise, premature wear, pulling, grabbing, or dragging problems.

Definition

Inspection should include

• checking for out-of-round, scored, hot spots, heat checks, cracks, and damaged brake hardware
• visually inspecting the brake slack adjuster for proper braking application.

Process/Skill Questions

• What is pedal pulsation?
• What are possible causes of pulling while braking?
• What are possible causes of dragging brakes?
Task Number 81

Inspect service brake chambers, diaphragm, clamp, spring, pushrod, clevis, and mounting brackets.

Definition

Inspection should include the condition of the brake chambers and associated hardware.

Process/Skill Questions

- What are possible causes if the brake chambers do not operate as per manufacturer specifications?
- What is the repair procedure for replacing a brake chamber?

Task Number 82

Service slack adjusters.

Definition

Service should include

- inspecting slack adjusters for proper operation when brakes are applied and released
- using manufacturer specifications to identify the type of slack adjuster used.

Process/Skill Questions

- What is the repair procedure for replacing the slack adjuster?
- How will brakes operate if the slack adjusters are inoperable?

Task Number 83

Inspect camshafts, tubes, rollers, bushings, seals, spacers, retainers, brake spiders, shields, anchor pins, and springs.
Definition

Inspection should include

- removing brake drums and visually inspecting hardware for damage
- locating the camshaft and checking for up-down or side-to-side movement.

Process/Skill Questions

- What might happen if the brake hardware does not meet manufacturer specifications?

Task Number 84

Inspect air disc brake caliper assemblies.

Definition

Inspection should include

- removing caliper assembly
- replacing pads, according to manufacturer guidelines.

Process/Skill Questions

- What are the procedures to remove pads?
- How often should the pads be checked and replaced?
- How do you determine pad composition? Why is this information important?

Task Number 85

Inspect brake shoes or pads.

Definition

Inspection should include

- removing drum
- inspecting all brake hardware
- adjusting per manufacturer guidelines.
Process/Skill Questions

- What are the procedures to remove brake shoes?
- What are two types of brake drum systems?
- What are some possible problems concerning brake hardware?

Task Number 86

Inspect brake drums or rotors.

Definition

Inspection should include

- using proper tools to remove brake drums and diagnose repair procedures
- using proper measuring tools to determine the condition of the rotor.

Process/Skill Questions

- How do you use a brake drum micrometer?
- What are the safety measures for cleaning brake drums?
- What should you look for when inspecting brake drums?
- What tool is used to check lateral run-out? Thickness variation?
- What evidence should require you to discard rather than try to repair the rotor?
- At how many points do you measure rotor for thickness variation?

Brakes: Servicing Parking Brakes

Task Number 87

Replace parking (spring) brake chamber.

Definition

Replacement should include

- inspecting parking (spring) brake chamber diaphragm and seals
- checking for air leaks
- replacing parking (spring) brake chamber
- disposing of removed chambers in accordance with local regulations.
Process/Skill Questions

- What are some possible failures of a parking brake system?
- What are the local regulations for disposing of a brake chamber?
- What are the replacement procedures for the air brake chamber?

Task Number 88

Inspect parking (spring) brake check valves, lines, hoses, and fittings.

Definition

Inspect parking (spring) brake check valves, lines, hoses, and fittings.

Process/Skill Questions

- What might happen if the parking brake does not work properly?

Task Number 89

Inspect parking (spring) brake application and release valve.

Definition

Inspection should include

- visually inspecting components for signs of damage and proper routing
- checking air lines for leaks.

Task Number 90

Manually release (cage) and reset (uncage) parking (spring) brakes.

Definition
Releasing and resetting should include

- removing the parking brake cage bolt from the chamber
- inserting into the back of chamber and turning it 90 degrees
- installing a flat washer and nut to compress the brake chamber.

**Process/Skill Questions**

- What safety procedure must be followed when releasing and resetting parking (spring) brakes?

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**Task Number 91**

**Test anti compounding brake function.**

**Definition**

Testing should ensure that simultaneous applications of the service brake and the parking (spring) brake forces to the slack adjuster do not occur.

**Process/Skill Questions**

- When the treadle valve is applied, does it continue to exert force? Why, or why not?

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**SUSPENSION AND STEERING**

**Suspension and Steering: Servicing Steering Column**

**Task Number 92**

**Identify causes of fixed and driver adjustable steering column and shaft noise, looseness, and binding problems.**

**Definition**

Identification should include
• listing conditions that may cause such problems, such as constant movement of the 
  steering shaft or corrosion on the shaft or attached couplings
• describing the process for diagnosing issues
• determining needed action.

**Process/Skill Questions**

• How can binding problems be solved?
• Why would it be important to have an assistant turn the steering wheel?

---

**Task Number 93**

**Service steering shaft U-joints (s), slip joints, bearings, bushings, and seals.**

**Definition**

Service should include

• placing vehicle on a stationary ramp that allows access underneath
• having someone inside the cab wiggle the steering wheel
• visually inspecting the steering shaft and components
• phasing the shaft.

**Process/Skill Questions**

• Why is it important that the shaft be in phase?
• Why should manufacturer's specifications be followed?

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**Task Number 94**

**Adjust ride height.**

**Definition**

Adjustment should include

• checking cab mounting
• inspecting mounts and mounting brackets for worn, cracked, or missing components
Process/Skill Questions

- Why is ride height important to alignment?
- How does tire pressure relate to ride height?
- Do the manufacturer's specifications only cover removing and replacing? Explain.

Suspension and Steering: Servicing Steering Units

Task Number 95

Identify causes of power steering system noise, steering binding, darting/oversteer, reduced wheel cut, steering wheel kick, pulling, non-recovery, turning effort, looseness, hard steering, overheating, fluid leakage, and fluid aeration problems.

Definition

Identification should include

- listing causes of problems
- conducting a visual inspection
- determining needed action.

Process/Skill Questions

- How can collision damage cause looseness in the steering column?
- How might you distinguish between steering column binding and steering gear binding?
- How might you distinguish between steering column noises and steering gear noises?
- How might you distinguish between steering gear problems and steering knuckle problems?
- What is the difference between flexible coupling looseness and sector shaft misadjustment?
Task Number 96

Determine recommended type of power steering fluid level and condition.

Definition

Determination should include

- following state inspection standards and manufacturer's specifications
- performing a visual check of the level and condition of the fluid
- determining needed action.

Process/Skill Questions

- What are the consequences of using the wrong type of fluid? Too much fluid?
- How is fluid condition assessed?
- What are the characteristics of power steering fluid?
- What are some indications that the condition of the steering fluid is not acceptable?

Task Number 97

Refill power steering system.

Definition

Refilling should include

- flushing the power steering system
- purging air from the system
- refilling fluid according to specifications.

Process/Skill Questions

- What can happen if flushing the system runs the system dry?
- What are the consequences of not bleeding the power steering system?
- Why is it important to flush the system after installing a new power steering pump?
- Would it ever be appropriate to add a steering fluid filter? Why, or why not?
Task Number 98

Perform power steering system pressure, temperature, and flow tests.

Definition

Performance should include

- testing pressure, temperature, and flow
- determining needed action.

Process/Skill Questions

- Why is it important to pressure test?
- What tools or instruments are used to conduct a pressure test?
- How might you determine the needed action after finding a problem with power steering fluid flow?
- Why is it important to do a flow test?
- What effect does temperature have on fluids?

Task Number 99

Service power steering reservoir including filter, seals, and gaskets.

Definition

Service should include

- visually inspecting power steering reservoir components
- flushing the system
- replacing fluid according to original equipment manufacturer (OEM) specifications
- replacing components as needed.

Process/Skill Questions

- How would you know that a gasket needs replacing?
- Why is it important to check if the vehicle equipped with a power steering filter?
- What is the OEM required maintenance schedule for filter replacement?
Task Number 100

Inspect power steering pump drive gear and coupling device.

Definition

If the steering pump is mounted on the engine it should be inspected while the engine is running for wear. In some instances, the pump may require removal to inspect the coupling device.

Process/Skill Questions

- What is considered excessive wear?
- If wear is found, what should be done?

Task Number 101

Replace power steering pump, mountings, and brackets.

Definition

Procedure should include conducting a visual inspection according to state inspection standards and following manufacturer guidelines and specifications.

Process/Skill Questions

- What would happen if mounting bushings failed?
- Why is an alignment needed after replacing the steering gear?
- Why would the power steering system need flushing after the replacement of the steering gear?

Task Number 102

Replace power steering system cooler, lines, hoses, clamps/mountings, hose routings, and fittings.

Definition
Procedure should include the use of hand tools and a pulley remover/installer.

**Process/Skill Questions**

- What is the function of the power steering cooler?
- Why would a power steering pump need to be replaced?
- Should power steering lines always be replaced when the pump is replaced? Why, or why not?
- Why are routing power steering lines important?
- Should sealant be used when fittings are reinstalled? Why, or why not?

**Task Number 103**

**Replace integral type power steering gear(s) (single and/or dual) and mountings.**

**Definition**

Replace integral type power steering gear(s) (single and/or dual) and mountings.

**Process/Skill Questions**

- Are all bolts present and securely attached?
- Is there visible play in the unit?
- If a seal shows signs of leaking should the seal be replaced or the entire unit be removed and rebuilt?

**Suspension and Steering: Servicing Steering Linkage**

**Task Number 104**

**Align pitman arm.**

**Definition**

Procedure should include

- inspecting the pitman arm
• using specially designed puller set impact wrench with impact socket set
  • replacing as needed.

Process/Skill Questions

• Why should a specially designed puller set be used?
• What is the disadvantage of using a pickle fork?
• What is the proper way to install a cotter pin?

Task Number 105

Adjust steering (wheel) stops.

Definition

Limiting stops on the front axle are used to stop the tire from rubbing on the frame. This must occur after the steering gear pressure relief poppets have relieved pressure (otherwise you run the risk of having hydraulic pressure from the steering system acting against the steering levers when they cannot move, resulting in broken and bent steering parts.

Process/Skill Questions

• What is the minimum space normally set between the tire and any fixed chassis component?

Task Number 106

Lubricate steering components.

Definition

Many new vehicles have component without lubrication points. Inspect for excessive wear in all the motion points by having someone assist in turning the steering wheel while the engine is off. Any excessive movement should be compared to manufacturers specifications.

Process/Skill Questions

• How do you identify lubrication points?
• What do shiny mounting points indicate?
Suspension and Steering: Servicing Suspension Systems

Task Number 107

Inspect front axles and attaching hardware.

Definition

Axle attachment must allow up and down movement between wheel and frame without binding. Any damage found such as cracks, bends, twist indicate the axle needs replacing. Component attachment locations and hardware must be inspected for cracks, missing or lose bolts, and wear.

Process/Skill Questions

- Should the axle and components be cleaned prior to inspection? Why?

Task Number 108

Service kingpins, steering knuckle bushings, locks bearings, seals, and covers.

Definition

Each front-end component assists in horizontal and vertical movement of the vehicle. Each of the components is under constant stress and must be inspected for wear and damage often. Lift the front of the vehicle by using a jack under the axle to remove tension from all components.

Process/Skill Questions

- How do you determine if a component has excessive wear?
- If any noises are heard when examining the front end, what should be done?
- Is there any noticeable binding between components what should be done to correct this problem?

Task Number 109
Inspect shock absorbers, bushings, brackets, and mounts.

Definition

Procedures should include a visual inspection, according to state inspection criteria, and removing and replacing, using specialized tools according to manufacturer guidelines.

Process/Skill Questions

- What does oil leaking from a shock absorber indicate?
- What is the difference between a low-pressure and high-pressure absorber?
- How do you bleed a shock absorber?
- What effect does a worn shock absorber have on front-end tire wear?

Task Number 110

Inspect leaf springs, center bolts, clips, pins and bushings, shackles, U-bolts, insulators, brackets, and mounts.

Definition

Inspection should be conducted visually, using specialized tools, according to state inspection criteria and manufacturer guidelines.

Process/Skill Questions

- What safety precautions should be taken when handling leaf springs?
- What is the purpose of the center bolt? How does it affect alignment?
- What is the purpose of the spring shackle?
- If a vehicle from the factory only has one large spring on the rear axle, is it acceptable to replace the single spring with a spring pack rated at the same strength?

Task Number 111

Inspect axle aligning devices.

Definition
Inspection should be conducted visually, using specialized tools, according to state inspection criteria and manufacturer's guidelines. Devices to be inspected may include:

- radius rods
- track bars
- stabilizer bars
- torque arms
- bushings
- mounts
- shims
- cams.

Determine needed action after inspection.

**Process/Skill Questions**

- When inspecting rods, bars, and arms, should bushings be part of the inspection? Explain.
- Does tire wear indicate a problem in the alignment of the rear axle(s)? Explain.
- If bushings are worn badly on one side, should both sides be replaced?

**Task Number 112**

**Inspect tandem suspension equalizer components.**

**Definition**

Double eye equalizers are only found on spring suspension. Sometimes they are referred to as center hangers. The equalizer bracket is bolted to the frame and allows the springs to move up and down creating a suspension pivot point. The tips of the springs often encounter excessive wear.

Inspect and determine needed action.

**Process/Skill Questions**

- What should be done if the equalizer shows signs of wear?
- What are the most common wear points?

**Task Number 113**
Test air suspension pressure regulator and height control valves, lines, hoses, dump valves, and fittings.

Definition

Inspection should include a thorough inspection of all parts related to the suspension including the valve in the cab. After the parts inspection, refer to the manufacturer's specification for height adjustment.

Process/Skill Questions

- Why is suspension height important?
- If no air were present in the system, what damage could occur?

Task Number 114

Inspect air springs, mounting plates, springs, suspension arms, and bushings.

Definition

Inspect the air springs (air bags) for any damage or contact with vehicle. Mounting plates, springs, and bushings should be replaced if wear is evident.

Process/Skill Questions

- Would a small amount of wear among several components add up to problems with tire wear?

Task Number 115

Adjust ride height.

Definition

Instructions for adjusting ride height is very important to the wear and tear associated to the vehicle. Follow manufacturer instructions when making the initial settings. Some modifications may be required based on the desired ride and the load being hauled.
Process/Skill Questions

- Why would adjusting the ride height be so important?
- Can small adjustments be made to make the ride more comfortable?
- What would happen if the air suspension were adjusted so the bags extend to maximum height, and the driver tried to hook to a trailer?

Task Number 116

Identify rough ride problems.

Definition

Air ride systems are tuned to make the ride as enjoyable as possible. After checking the air suspension to make sure that the setting match those of the manufacturer check the cab air ride system and components. A cab air ride system improperly setup can feel as if the vehicle air suspension system is faulty.

Process/Skill Questions

- Would low air in the suspension have an effect on drive line configuration?
- Could low air cause damage to the differential?

Suspension and Steering: Wheel Alignment Diagnosis, Adjustment, and Repair

Task Number 117

Identify causes of vehicle wandering, pulling, shimmy, hard steering, and off-center steering wheel problems.

Definition

Procedure should include conducting a visual inspection according to state inspection procedures. Use specialized tools designed specifically to do alignment, toe, etc. according to manufacturer guidelines.

Process/Skill Questions
• What is memory steer? Torque steer?
• How would you differentiate among drift, pull, and wander?
• What are three causes of poor steering wheel return?

Task Number 118

Check camber.

Definition
Checking should include the inward and outward tilt of the tire and determining needed action.

Process/Skill Questions
• What wear pattern would you expect from negative camber?
• What wear pattern would you expect from positive camber?

Task Number 119

Check caster.

Definition
Caster is determined by the tilt of the steering axle kingpin on a large truck. Using vehicle specifications determines needed action on the alignment machine.

Process/Skill Questions
• What is the desired caster angle?
• Why is the right side caster angle sometimes slightly higher than the left?
• How can be caster be changed?

Task Number 120

Adjust toe settings.
Definition

Use tools available to determine toe settings for a specific vehicle.

Process/Skill Questions

- How do you adjust toe on a given vehicle?
- Is the steering wheel level and toe correct?

Task Number 121

Check rear axle(s) alignment (thrustline/centerline) and tracking.

Definition

The rear axle(s) need to follow straight and true behind the front axle. Using alignment tool(s) check and adjust rear axle centerline (thrust angle).

Process/Skill Questions

- What can cause the rear axle to be out of alignment?

Task Number 122

Identify turning/Ackerman angle (toe-out-on-turns) problems.

Definition

Steering geometry is designed as such that the front wheels don’t slip or scoot on tight turns. By using proper tools, the Akerman angle of the front wheels can be determined.

Process/Skill Questions

- What tools are used to find the Akerman angle?
Task Number 123

Check front axle alignment (centerline).

Definition

Use alignment tool(s) to check and adjust front axle centerline (thrust angle).

Process/Skill Questions

- What are consequences of the front axle not being aligned?

ELECTRICAL/ELECTRONIC SYSTEMS

Electrical/Electronic Systems: Servicing Starting System

Task Number 124

Perform starter circuit cranking voltage and voltage drop tests.

Definition

Performance should include performing positive- and negative-side voltage drop tests.

Process/Skill Questions

- What is the typical voltage drop range in a starter circuit?
- At what connection points are voltage drop tests performed?
- What are the effects of using a gauge wire that is too small in a starter circuit?

Task Number 125

Test components (key switch, push button and/or magnetic switch) and wires and harnesses in the starter control circuit.
Definition

Testing should include

- checking the ignition switch, push button, and/or magnetic switch
- checking the neutral safety switch
- checking the clutch safety switch
- checking the starter relay
- conducting a visual inspection of the wiring harness
- testing components, according to service materials and manufacturer guidelines.

Process/Skill Questions

- What components are in a starter control circuit?
- How much voltage drop is allowed across the connector?

Task Number 126
Test starter relays and solenoids switches.

Definition

Testing should include using voltage drop testing for power source (available voltage) and checking the ground.

Process/Skill Questions

- What is the function of a relay?
- What is (are) the function(s) of a solenoid?
- How would you test a relay?

Task Number 127
Replace starter.

Definition

Procedure should include

- disconnecting the battery/negative cable
- conducting a visual inspection of the flywheel/ring gear
- removing the starter, according to service materials and manufacturer guidelines.
Process/Skill Questions

- What should be inspected when removing a starter motor?
- What is the first step in removing a starter motor?
- How many wires are on a typical starter motor?

**Electrical/Electronic Systems: Servicing Charging System**

**Task Number 128**

**Test instrument panel, mounted volt meters, and/or indicator lamps.**

**Definition**

Testing should include inspecting and testing, based on

- manufacturer guidelines
- description of normal operation
- interpretation of appropriate wiring diagrams.

**Process/Skill Questions**

- What information does the volt meter or indicator lamp provide?
- If the voltmeter reads lower than normal, what is the diagnosis procedure?

**Task Number 129**

**Identify causes of a no charge, low charge, or overcharge problems.**

**Definition**

Identification should include referring to service materials and manufacturer guidelines, and using recommended testing equipment.

**Process/Skill Questions**
- What might be the effect of a loose belt?
- What does a wet battery indicate?
- What is the effect of RPM/idle speed being too low?

**Task Number 130**

**Replace alternator drive belts, pulleys, fans, tensioners, and mounting brackets.**

**Definition**

Replacement should include

- differentiating between procedures for V-belts and serpentine belts
- conducting a visual inspection of all belt surfaces
- aligning belts, using a straight-edge, visual inspection, or specialized tools
- inspecting tensioners by conducting a visual inspection of wear indicators and ensuring freedom of motion
- following service materials and manufacturer guidelines.

**Process/Skill Questions**

- How is correct belt alignment determined?
- How is the drive belt tension adjusted?
- How should a drive belt be removed?

**Task Number 131**

**Perform charging system voltage and amperage output tests, and alternating current (AC) ripple test.**

**Definition**

Performance should include

- using appropriate testing equipment
- using appropriate service information
- determining if additional diagnosis is needed (when vehicle is not performing correctly).
Process/Skill Questions

- What is the proper charging voltage with the vehicle running?
- Where should you place the inductive pickup during an output test?
- What procedures could be used to full field test an alternator?
- Where would you find the amperage specification for an alternator?
- What alternator component is defective if the AC ripple test indicates too much AC voltage?

Task Number 132

Perform charging circuit voltage drop tests.

Definition

Performance should include

- conducting a visual inspection of terminals, alternator, junction block, or battery
- performing positive- and negative-side voltage drop tests.

Process/Skill Questions

- How should a voltage drop test on an alternator be performed?
- What is maximum voltage drop across the cable?
- What is the result of excessive voltage drop?

Task Number 133

Replace alternator.

Definition

Replacement should be completed according to service materials and manufacturer guidelines.

Process/Skill Questions

- What function do diodes have in an alternator?
- What is the first step in removing an alternator?
- What affect would pulley size have on alternator output?
Task Number 134

Replace cables, wires, and connectors in the charging circuit.

Definition

Replacement should include attention to routing and should be based on using specialized tools and referring to service materials and manufacturer guidelines.

Process/Skill Questions

• Why would you use heat shrink instead of tape insulation?
• Why is soldering typically the preferred repair method?

Electrical/Electronic Systems: Servicing Lighting Systems

Task Number 135

Perform diagnostic procedures using recommended electronic service tool(s).

Definition

Performance should include

• determining the connector location
• entering the correct vehicle data
• using the scan tool
• acquiring diagnostic trouble codes (DTCs), on-board diagnostic (OBD) monitor status, freeze frame data, and clear DTCs, when applicable.

Process/Skill Questions

• What does the DTC prefix indicate about the system?
• What functions can the scan tool perform to aid in diagnosis?

Task Number 136
Identify causes of brighter than normal, intermittent, dim, or no headlight and daytime running light (DRL) operations.

Definition

Diagnosis should include testing the bulb for

- continuity and correct wattage
- proper voltage source
- proper ground
- proper terminal fit/connection
- resistance in the wiring (voltage drop test).

Process/Skill Questions

- What would cause a brighter than normal light?
- How would a loose connection affect the light?
- How would high resistance affect the light?

Task Number 137

Replace headlights.

Definition

Procedure should include

- checking for proper function of headlights and bulbs including cracked, broken, or hazy lenses, lights that will not hold adjustment, and dull reflectors
- aiming lights according to state inspection guidelines.

Process/Skill Questions

- What tool is typically used to aim the headlights?
- Why should you avoid touching halogen bulbs?
- How can a glazed headlight be repaired?

Task Number 138
Test headlight and dimmer circuit switches, relays, wires, terminals, connectors, sockets, and control components/modules.

Definition

Procedure should include inspecting and testing, based on

- manufacturer guidelines
- description of normal operation
- interpretation of appropriate wiring diagrams.

Process/Skill Questions

- What are some common reasons for headlight or dimmer switch failure?
- What is the difference between a normally-opened and a normally-closed switch?
- How do you test a relay?

Task Number 139

Test switchers, bulbs/LEDs, sockets, connectors, terminals, relays, wires, and control components/models of parking, clearance, and taillight circuits.

Definition

Procedure should include inspecting and testing, based on

- manufacturer guidelines
- description of normal operation
- interpretation of appropriate wiring diagrams.

Process/Skill Questions

- What are some common reasons for switch failure?
- What is the difference between a normally-opened and a normally-closed switch?
- What inputs are necessary for the parking, clearance, and taillights to work properly?

Task Number 140
Test instrument panel light circuit switches, relays, bulbs/LEDs, sockets, connectors, terminals, wires, and control components/modules.

Definition

Procedure should include inspecting and testing, based on
- manufacturer guidelines
- description of normal operation
- interpretation of appropriate wiring diagrams.

Process/Skill Questions

- What are some common reasons for switch failure?
- What is the difference between a normally-opened and a normally-closed switch?
- What is the typical maximum voltage drop across any switch?

Task Number 141

Test interior cab light circuit switches, bulbs/LEDs, sockets, low voltage disconnect (LVD), connectors, terminals, wire, and control modules.

Definition

Procedure should include inspecting and testing, based on
- manufacturer guidelines
- description of normal operation
- interpretation of appropriate wiring diagrams.

Process/Skill Questions

- What are the advantages of LED lights over other light bulb types?
- What is the difference between a normally-opened and a normally-closed switch?
- What is the proper repair procedure for circuits located in the interior of the vehicle?

Task Number 142

Test tractor-to-trailer multi-wire connectors.
Definition

Procedure should include inspecting and testing, based on

- manufacturer guidelines
- description of normal operation
- interpretation of appropriate wiring diagrams.

Process/Skill Questions

- What is the inspection process of the tractor-to-trailer multi-wire connector?
- What can happen if there is a problem with the connector?

Task Number 143

Adjust stoplight circuit switches, bulbs/LEDs, sockets, connectors, terminals, wires and control components/modules.

Definition

Adjustment should include

- checking for proper function of stoplights and bulbs including cracked, broken, or hazy lenses, lights that will not hold adjustment, and dull reflectors
- checking for proper function of bulbs, flashers, turn signals, and hazard switches
- testing related components
- referring to service materials and manufacturer guidelines.

Process/Skill Questions

- What is the function of the flasher?
- What condition might cause a stop light to go out when a signal light flashes?

Task Number 144

Test turn signal and hazard circuit flasher(s), switches, relays, bulbs/LEDs, sockets, connectors, terminals, wires and control components/modules.
Definition

Testing should include

- checking for proper function of bulbs including cracked, broken, or hazy lenses, lights that will not hold adjustment, and dull reflectors
- checking for proper function of bulbs, flashers, turn signals, and hazard switches
- testing related components
- referring to service materials and manufacturer guidelines.

Process/Skill Questions

- What is the function of the flasher?
- What condition might cause a tail light to go out when a signal light flashes?
- What could cause flashing that is too rapid or too slow?

Task Number 145

Test reverse lights and warning device circuit switches, bulbs/LEDs, sockets, horns, buzzers, connectors, terminals, wires and control components/modules.

Definition

Inspection should include

- checking for proper function of reverse light bulbs including cracked, broken, or hazy lenses, lights that will not hold adjustment, and dull reflectors
- checking for proper function of bulbs and warning devices
- testing related components
- referring to service materials and manufacturer guidelines.

Process/Skill Questions

- What is the purpose of a warning device horn or buzzer when in reverse?
- What condition might cause a reverse light to not come on?

Electrical/Electronic Systems: Servicing Gauges and Warning Devices

Task Number 146
Test warning devices (lights and audible) circuit sensor/sending units, bulbs/LEDs, sockets, connectors, wires, and control components/modules.

Definition

Testing should include

- checking coolant temperature, fuel, vehicle speed, odometer, oil pressure, tachometer
- following procedures for each individual circuit.

Note: Typically, digital and fiber optic gauges and warning circuits are not serviceable by the automotive service technician but are sent to special repair centers when servicing is required.

Process/Skill Questions

- What tool might be used to test sensors?
- What is a common fault of connectors?
- What is the difference between a weather pack connector and a standard connector?

Task Number 147

Replace electronic speedometer, odometer, and tachometer systems.

Definition

Replacement should include inspecting and testing, based on

- manufacturer guidelines
- description of normal operation
- interpretation of appropriate wiring diagrams.

Process/Skill Questions

- What is the procedure for testing and calibrating the electronic speedometer, odometer or tachometer?
- What components provide the input signal to the electronic speedometer, odometer or tachometer?
Electrical/Electronic Systems: Servicing Related Electrical Systems

Task Number 148

Identify causes of constant, intermittent, or no horn operation.

Definition

Diagnosis should include

- determining the number of horns on the vehicle
- demonstrating proper horn function
- referring to service materials and following manufacturer guidelines.

Process/Skill Questions

- How does a horn work?
- Where is a horn typically located?
- Why would a horn operate only with certain steering wheel positions?
- What mechanical or electrical issue would cause the horn to sound continuously?

Task Number 149

Test horn circuit relays, horns, switches, connectors, wires, clock springs, and control components/modules.

Definition

Testing should include

- demonstrating proper horn function
- testing horn switch, relay, wiring, clock spring, power, and ground
- referring to service materials and following manufacturer guidelines.

Process/Skill Questions

- Why would a horn operate only with certain steering wheel positions?
- What mechanical or electrical issue would cause the horn to sound continuously?
Task Number 150

Identify causes of constant, intermittent, or no wiper operation.

Definition

Identification should include

- demonstrating proper wiper function
- referring to service materials and following manufacturer guidelines.

Process/Skill Questions

- What would cause a phantom wipe?
- What condition would prevent wipers from parking?
- How do intermittent wipers work?

Task Number 151

Test wiper motor, resistors, park switch, relays, switches, connectors, wires, and control components/modules.

Definition

Testing should include

- testing wiper motor and park switch, wiper switch, control module, wiring, and related components
- referring to service materials and following manufacturer guidelines.

Process/Skill Questions

- How can you test a wiper motor for proper operation?
- What does the park switch do in a wiper circuit?
- What condition would prevent wipers from parking?
- How do intermittent wipers work?

Task Number 152

Inspect wiper motor transmission linkage, arms, and blades.
Definition

Inspection should include

- testing wiper motor and blades
- referring to service materials and following manufacturer guidelines.

Process/Skill Questions

- How can you test a wiper motor for proper operation?
- What can occur if the wiper linkage is bent or in a bind?

Task Number 153

Test windshield washer motor or pump/relay assembly, switches, connectors, terminals, wires, and control components/modules.

Definition

Testing should include

- inspecting wiper washer pump motor, wiper switch, control module, wiring, and related components
- referring to service materials and following manufacturer guidelines.

Process/Skill Questions

- How can you test a wiper washer pump motor for proper operation?
- Why is it important to only use washer fluid designed for vehicles?

Task Number 154

Test side-view mirror motors, heater circuit grids, relays, switches, connectors, terminals, wires, and control components/modules.

Definition

Testing should include

- demonstrating proper side-view mirror operation, including the heated circuit grids
• checking for proper voltage source, grounds, switches, modules, wiring, and related components
• referring to service materials and following manufacturer guidelines.

Process/Skill Questions

• What tool can be used to quickly diagnose side-view mirror operation?
• What would cause a side-view mirror to only move up and down and not side to side?

Task Number 155

Test heater and air-conditioning electrical components.

Definition

Testing should include

• performing a visual inspection of components
• testing individual components
• following service materials and manufacturer guidelines.

Process/Skill Questions

• What procedures should be followed to check blower controls and protection devices?
• Where can you find information to diagnose electrical components?
• What are the causes of noises and abnormal smells related to the blower motor components?

Task Number 156

Test auxiliary power outlet, integral fuse, connectors, terminals, wires, and control components/modules.

Definition

Procedure should include inspecting and testing, based on

• manufacturer guidelines
• description of normal operation
• interpretation of appropriate wiring diagrams.

Process/Skill Questions
• What are some common reasons for an auxiliary power outlet to fail?
• What is the difference between a normally-opened and a normally-closed switch?

Task Number 157

Identify causes of slow, intermittent, or no power window operation.

Definition

Diagnosis should include

• demonstrating proper power windows
• checking for proper voltage source, grounds, switches, modules, wiring, and related components
• referring to service materials and following manufacturer guidelines.

Process/Skill Questions

• How do you test a motor-driven circuit?
• What would cause an electric window to operate only when the door is in the closed position?
• What causes most motors to reverse direction?

Task Number 158

Test motors, switches, relays, connectors, terminals, wires, and control components/modules of power window circuits.

Definition

Procedure should include inspecting and testing, based on

• manufacturer guidelines
• description of normal operation
• interpretation of appropriate wiring diagrams.

Process/Skill Questions

• What are some common reasons for switch failure?
• What is the difference between a normally-opened and a normally-closed switch?
• What is the typical maximum voltage drop across any switch?
Task Number 159

Test block heaters.

Definition

Diagnosis should include

- checking for proper voltage source, grounds, switches, modules, wiring, and related components
- referring to service materials and following manufacturer guidelines.

Process/Skill Questions

- What might cause a block heater not to work properly?
- What conditions require a block heater?

Task Number 160

Test cruise control electrical components.

Definition

Diagnosis should include

- demonstrating proper cruise control systems
- checking for proper voltage source, grounds, switches, modules, wiring, and related components
- referring to service materials and following manufacturer guidelines.

Process/Skill Questions

- What might cause unintended deactivation of cruise control?
- What are multiplex switches?
- How would you explain the operation of multiplex switches and cruise control?

Task Number 161

Test switches, relays, controllers, actuator/solenoids, connectors, terminals, and wires of electric door lock circuits.
Definition

Diagnosis should include

- demonstrating proper electric lock operation, including remote keyless entry
- checking for proper voltage source, grounds, switches, modules, wiring, and related components
- referring to service materials and following manufacturer guidelines.

Process/Skill Questions

- What tool can be used to quickly diagnose lock operation?

Task Number 162

Test engine cooling fan electrical control components/modules.

Definition

Testing should include

- using an infrared thermometer and scan tool
- following manufacturer guidelines.

Process/Skill Questions

- How should you inspect and test fans?
- What can happen if a fan fails?
- What tools are needed to check electrical fans? To check mechanical fans?

SOL Correlation by Task

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<td>Identify general lab/shop safety rules and procedures.</td>
<td>11.5, 12.5</td>
<td>GOVT.9, GOVT.15, GOVT.16</td>
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<td>Utilize safe procedures for handling of tools and equipment.</td>
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<td>History and Social Science: GOVT.9, GOVT.15, GOVT.16 Science: CH.1b English: 11.5, 12.5</td>
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<td>Demonstrate awareness of the safety aspects of high voltage circuits (such as high intensity discharge [HID] lamps, ignition systems, injection systems, etc.).</td>
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<td>History and Social Science: GOVT.9</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Science: PH.11c</td>
<td></td>
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<tr>
<td>53</td>
<td>Demonstrate knowledge of safety data sheets' (SDS) location and content.</td>
<td>English: 11.5, 12.5</td>
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<td></td>
<td></td>
<td>History and Social Science: GOVT.9, GOVT.15, GOVT.16</td>
<td></td>
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<tr>
<td>54</td>
<td>Diagnose cranking and starting problems.</td>
<td></td>
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<tr>
<td>55</td>
<td>Identify engine surging, rough operation, misfiring, low power, slow deceleration, slow acceleration, and shutdown problems.</td>
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<tr>
<td>56</td>
<td>Identify engine vibration problems.</td>
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<tr>
<td>57</td>
<td>Record electronic diagnostic codes.</td>
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<tr>
<td>58</td>
<td>Inspect exhaust gas recirculation (EGR) system.</td>
<td>English: 11.5, 12.5</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>History and Social Science: GOVT.15</td>
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<tr>
<td>59</td>
<td>Check fuel level and condition.</td>
<td></td>
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<tr>
<td>60</td>
<td>Perform fuel supply and return system tests.</td>
<td>English: 11.5, 12.5</td>
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<tr>
<td>61</td>
<td>Inspect fuel tanks, vents, caps, mounts, valves, screens, crossover system, supply and return lines and fittings.</td>
<td>English: 11.5, 12.5</td>
<td></td>
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</tr>
<tr>
<td>62</td>
<td>Identify poor stopping, air leaks, premature wear, pulling, grabbing, dragging, or balance problems caused by supply and service system malfunctions.</td>
<td>English: 11.5, 12.5</td>
<td></td>
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<tr>
<td>63</td>
<td>Check air system build-up time.</td>
<td>English: 11.5, 12.5</td>
<td></td>
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<tr>
<td>64</td>
<td>Drain air reservoir/tanks.</td>
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<tr>
<td>65</td>
<td>Inspect air compressor drive gear, belts and coupling.</td>
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<tr>
<td>66</td>
<td>Inspect air compressor inlet; oil supply and coolant lines, fittings, and mounting brackets.</td>
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<tr>
<td>67</td>
<td>Inspect air system pressure controls.</td>
<td></td>
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<tr>
<td>68</td>
<td>Inspect air system lines, hoses, fittings, and couplings.</td>
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<tr>
<td>69</td>
<td>Inspect air tank relief (safety) valves, one-way (single) check valves, two-way (double) check valves, manual and automatic drain valves.</td>
<td></td>
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<tr>
<td>70</td>
<td>Inspect air drier systems, filters, valves, heaters, wiring, and connectors.</td>
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<tr>
<td>71</td>
<td>Inspect brake application.</td>
<td></td>
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<tr>
<td>72</td>
<td>Inspect stop light circuit switches, wiring, and connectors.</td>
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<tr>
<td>73</td>
<td>Inspect hand brake (trailer) control valve, lines, fittings, and mountings.</td>
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<tr>
<td>74</td>
<td>Inspect brake relay valves.</td>
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<tr>
<td>75</td>
<td>Inspect quick release valves.</td>
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<tr>
<td>76</td>
<td>Inspect tractor protection valve.</td>
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<tr>
<td>77</td>
<td>Inspect emergency (spring) brake control/modulator valve(s).</td>
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<tr>
<td>78</td>
<td>Inspect low pressure warning devices, wiring, and connectors.</td>
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<tr>
<td>79</td>
<td>Inspect air pressure gauges, lines, and fittings.</td>
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<tr>
<td>80</td>
<td>Identify poor stopping, brake noise, premature wear, pulling, grabbing, or dragging problems.</td>
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<tr>
<td>81</td>
<td>Inspect service brake chambers, diaphragm, clamp, spring, pushrod, clevis, and mounting brackets.</td>
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<tr>
<td>82</td>
<td>Service slack adjusters.</td>
<td></td>
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<tr>
<td>83</td>
<td>Inspect camshafts, tubes, rollers, bushings, seals, spacers, retainers, brake spiders, shields, anchor pins, and springs.</td>
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<tr>
<td>84</td>
<td>Inspect air disc brake caliper assemblies.</td>
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<tr>
<td>85</td>
<td>Inspect brake shoes or pads.</td>
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<tr>
<td>86</td>
<td>Inspect brake drums or rotors.</td>
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<tr>
<td>87</td>
<td>Replace parking (spring) brake chamber.</td>
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<tr>
<td>88</td>
<td>Inspect parking (spring) brake check valves, lines, hoses, and fittings.</td>
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<tr>
<td>89</td>
<td>Inspect parking (spring) brake application and release valve.</td>
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<tr>
<td>90</td>
<td>Manually release (cage) and reset (uncage) parking (spring) brakes.</td>
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<tr>
<td>91</td>
<td>Test anti compounding brake function.</td>
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<tr>
<td>92</td>
<td>Identify causes of fixed and driver adjustable steering column and shaft noise, looseness, and binding problems.</td>
<td>English: 11.5, 12.5</td>
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<tr>
<td>93</td>
<td>Service steering shaft U-joints (s), slip joints, bearings, bushings, and seals.</td>
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<tr>
<td>94</td>
<td>Adjust ride height.</td>
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<tr>
<td>95</td>
<td>Identify causes of power steering system noise, steering binding, darting/oversteer, reduced wheel cut, steering wheel kick, pulling, non-recovery, turning effort, looseness, hard steering, overheating, fluid leakage, and fluid aeration problems.</td>
<td></td>
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<tr>
<td>96</td>
<td>Determine recommended type of power steering fluid level and condition.</td>
<td>History and Social Science: GOVT.15</td>
<td></td>
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<tr>
<td>97</td>
<td>Refill power steering system.</td>
<td>English: 11.5, 12.5</td>
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<tr>
<td>98</td>
<td>Perform power steering system pressure, temperature, and flow tests.</td>
<td></td>
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<tr>
<td>99</td>
<td>Service power steering reservoir including filter, seals, and gaskets.</td>
<td>English: 11.5, 12.5</td>
<td></td>
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<tr>
<td>100</td>
<td>Inspect power steering pump drive gear and coupling device.</td>
<td>History and Social Science: GOVT.15</td>
<td></td>
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<tr>
<td>101</td>
<td>Replace power steering pump, mountings, and brackets.</td>
<td>English: 11.5, 12.5</td>
<td></td>
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<tr>
<td>102</td>
<td>Replace power steering system cooler, lines, hoses, clamps/mountings, hose routings, and fittings.</td>
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<tr>
<td>103</td>
<td>Replace integral type power steering gear(s) (single and/or dual) and mountings.</td>
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<tr>
<td>104</td>
<td>Align pitman arm.</td>
<td></td>
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<tr>
<td>105</td>
<td>Adjust steering (wheel) stops.</td>
<td></td>
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<tr>
<td>106</td>
<td>Lubricate steering components.</td>
<td>English: 11.5, 12.5</td>
<td></td>
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<tr>
<td>107</td>
<td>Inspect front axles and attaching hardware.</td>
<td></td>
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<tr>
<td>108</td>
<td>Service kingpins, steering knuckle bushings, locks bearings, seals, and covers.</td>
<td></td>
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<tr>
<td>109</td>
<td>Inspect shock absorbers, bushings, brackets, and mounts.</td>
<td>English: 11.5, 12.5</td>
<td></td>
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</tr>
<tr>
<td>110</td>
<td>Inspect leaf springs, center bolts, clips, pins and bushings, shackles, U-bolts, insulators, brackets, and mounts.</td>
<td>English: 11.5, 12.5</td>
<td></td>
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<tr>
<td>111</td>
<td>Inspect axle aligning devices.</td>
<td>English: 11.5, 12.5</td>
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<tr>
<td>112</td>
<td>Inspect tandem suspension equalizer components.</td>
<td></td>
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<tr>
<td>113</td>
<td>Test air suspension pressure regulator and height control valves, lines, hoses, dump valves, and fittings.</td>
<td>English: 11.5, 12.5</td>
<td></td>
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</tr>
<tr>
<td>114</td>
<td>Inspect air springs, mounting plates, springs, suspension arms, and bushings.</td>
<td></td>
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</tr>
</tbody>
</table>
| 115 | Adjust ride height. | English: 11.5, 12.5  
| 116 | Identify rough ride problems. | English: 11.5, 12.5  
| 117 | Identify causes of vehicle wandering, pulling, shimmy, hard steering, and off-center steering wheel problems. | English: 11.5, 12.5  
|  | History and Social Science: GOVT.15  
| 118 | Check camber. | Mathematics: G.5  
| 119 | Check caster. | English: 11.5, 12.5  
|  | Mathematics: G.2, G.3  
| 120 | Adjust toe settings. |  
| 121 | Check rear axle(s) alignment (thrustline/centerline) and tracking. | Mathematics: G.2, G.3  
| 122 | Identify turning/Ackerman angle (toe-out-on-turns) problems. | Mathematics: A.4, G.5  
| 123 | Check front axle alignment (centerline). |  
| 124 | Perform starter circuit cranking voltage and voltage drop tests. | Science: PH.11c  
| 125 | Test components (key switch, push button and/or magnetic switch) and wires and harnesses in the starter control circuit. | English: 11.5, 12.5  
|  | Science: PH.11c  
| 126 | Test starter relays and solenoids/switches. | Science: PH.11c  
| 127 | Replace starter. | English: 11.5, 12.5  
|  | Science: PH.11c  
| 128 | Test instrument panel, mounted volt meters, and/or indicator lamps. | English: 11.5, 12.5  
|  | Science: PH.11c  
| 129 | Identify causes of a no charge, low charge, or overcharge problems. | English: 11.5, 12.5  
|  | Science: PH.11c  
| 130 | Replace alternator drive belts, pulleys, fans, tensioners, and mounting brackets. | English: 11.5, 12.5  
| 131 | Perform charging system voltage and amperage output tests, and alternating current (AC) ripple test. | Science: PH.11c  
| 132 | Perform charging circuit voltage drop tests. | Science: PH.11c  
| 133 | Replace alternator. | English: 11.5, 12.5  
| 134 | Replace cables, wires, and connectors in the charging circuit. | English: 11.5, 12.5  
| 135 | Perform diagnostic procedures using recommended electronic service tool(s). | Science: PH.11c  


<table>
<thead>
<tr>
<th>136</th>
<th>Identify causes of brighter than normal, intermittent, dim, or no headlight and daytime running light (DRL) operations.</th>
</tr>
</thead>
<tbody>
<tr>
<td>137</td>
<td>Replace headlights.</td>
</tr>
<tr>
<td>138</td>
<td>Test headlight and dimmer circuit switches, relays, wires, terminals, connectors, sockets, and control components/modules.</td>
</tr>
<tr>
<td>139</td>
<td>Test switchers, bulbs/LEDs, sockets, connectors, terminals, relays, wires, and control components/models of parking, clearance, and taillight circuits.</td>
</tr>
<tr>
<td>140</td>
<td>Test instrument panel light circuit switches, relays, bulbs/LEDs, sockets, connectors, terminals, wires, and control components/modules.</td>
</tr>
<tr>
<td>141</td>
<td>Test interior cab light circuit switches, bulbs/LEDs, sockets, low voltage disconnect (LVD), connectors, terminals, wire, and control modules.</td>
</tr>
<tr>
<td>142</td>
<td>Test tractor-to-trailer multi-wire connectors.</td>
</tr>
<tr>
<td>143</td>
<td>Adjust stoplight circuit switches, bulbs/LEDs, sockets, connectors, terminals, wires and control components/modules.</td>
</tr>
<tr>
<td>144</td>
<td>Test turn signal and hazard circuit flasher(s), switches, relays, bulbs/LEDs, sockets, connectors, terminals, wires and control components/modules.</td>
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<tr>
<td>145</td>
<td>Test reverse lights and warning device circuit switches, bulbs/LEDs, sockets, horns, buzzers, connectors, terminals, wires and control components/modules.</td>
</tr>
<tr>
<td>146</td>
<td>Test warning devices (lights and audible) circuit sensor/sending units, bulbs/LEDs, sockets, connectors, wires, and control components/modules.</td>
</tr>
<tr>
<td>147</td>
<td>Replace electronic speedometer, odometer, and tachometer systems.</td>
</tr>
<tr>
<td>148</td>
<td>Identify causes of constant, intermittent, or no horn operation.</td>
</tr>
<tr>
<td>149</td>
<td>Test horn circuit relays, horns, switches, connectors, wires, clock springs, and control components/modules.</td>
</tr>
<tr>
<td>150</td>
<td>Identify causes of constant, intermittent, or no wiper operation.</td>
</tr>
<tr>
<td>151</td>
<td>Test wiper motor, resistors, park switch, relays, switches, connectors, wires, and control components/modules.</td>
</tr>
<tr>
<td>152</td>
<td>Inspect wiper motor transmission linkage, arms, and blades.</td>
</tr>
<tr>
<td>153</td>
<td>Test windshield washer motor or pump/relay assembly, switches, connectors, terminals, wires, and control components/modules.</td>
</tr>
<tr>
<td>154</td>
<td>Test side-view mirror motors, heater circuit grids, relays, switches, connectors, terminals, wires, and control components/modules.</td>
</tr>
<tr>
<td>155</td>
<td>Test heater and air-conditioning electrical components.</td>
</tr>
<tr>
<td>156</td>
<td>Test auxiliary power outlet, integral fuse, connectors, terminals, wires, and control components/modules.</td>
</tr>
<tr>
<td>157</td>
<td>Identify causes of slow, intermittent, or no power window operation.</td>
</tr>
<tr>
<td>158</td>
<td>Test motors, switches, relays, connectors, terminals, wires, and control components/modules of power window circuits.</td>
</tr>
<tr>
<td>159</td>
<td>Test block heaters.</td>
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</tbody>
</table>
Entrepreneurship Infusion Units

Entrepreneurship Infusion Units may be used to help students achieve additional, focused competencies and enhance the validated tasks/competencies related to identifying and starting a new business venture. Because the unit is a complement to certain designated courses and is not mandatory, all tasks/competencies are marked “optional.” Teachers can find the infusion/unit in the course listing.
Appendix: Credentials, Course Sequences, and Career Cluster Information

Industry Credentials: Only apply to 36-week courses

- ASE Certification Examinations
- ASE Entry-Level Certification Examinations
- College and Work Readiness Assessment (CWRA+)
- Customer Service Examination
- Customer Service Specialist (CSS) Examination
- Diesel Technology Assessment
- Mobile Communications and Electronics Installer (MCEI) Examination
- National Career Readiness Certificate Assessment
- Professional Communications Certification Examination
- Workplace Readiness Skills for the Commonwealth Examination

Concentration sequences: A combination of this course and those below, equivalent to two 36-week courses, is a concentration sequence. Students wishing to complete a specialization may take additional courses based on their career pathways. A program completer is a student who has met the requirements for a CTE concentration sequence and all other requirements for high school graduation or an approved alternative education program.

- Diesel Equipment Technology I (8613/36 weeks, 280 hours)

Career Cluster: Transportation, Distribution and Logistics

<table>
<thead>
<tr>
<th>Pathway</th>
<th>Occupations</th>
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<tbody>
<tr>
<td>Facility and Mobile Equipment Maintenance</td>
<td>Automotive Service Technician, Mechanic</td>
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<tr>
<td></td>
<td>Diesel Service Technician</td>
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<td></td>
<td>Electrical and Electronic Installer</td>
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<td></td>
<td>Electrical and Electronic Repairer</td>
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<td></td>
<td>Service Technician</td>
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