

# *Wallenpaupack Area School District*

## **COURSE: Power Mechanics III**

**GRADE LEVEL:** 12

**LENGTH OF COURSE:** 90 Days

**TEXT:** Automotive Technology – A Systems Approach, 3<sup>rd</sup> edition

**PUBLISHER:** Jack Erjavec

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### **COURSE DESCRIPTION:**

A specific technical course designed to teach the principles of automotive hydraulic brake systems. This course builds on the essential laws of physics, motion, forces, hydraulics, thermodynamics, and chemical reactions and how these principles apply to the operation and diagnosis of automotive brake systems. This course will cover the energy conversion of motion changed to heat energy (when you apply brakes), the effects of weight and speed on braking and stopping distance, thermal expansion, friction, force, and coefficient of friction as they apply to braking systems. Courseware covers the fundamentals and service of disc/drum brakes including how they operate, brake-fluid properties, diagnosis, component replacement/repair/adjustment, disc/drum machining, and power-assist units; and the fabrication (ISO or double flaring) of brake lines. The course will also cover computer-controlled antilocking brake system (ABS) operation and diagnosis. The student will learn strategy-based diagnostic routines for interpreting and verifying customer concerns and proper operation. The student will perform tests and inspection using special tools and scan tools to determine the causes of problems and make corrections related to hydraulic brakes and will communicate electronically with antilock brake systems (ABS). Through the inspection, testing, or measurement of components process, the student will learn to apply this knowledge to determine needed repairs and repair vehicle. A specific technical course designed to teach the principles of automotive suspension/steering systems and 4-wheel suspension alignment. This course builds on the essential concepts of geometry, gear reduction, hydraulics laws, and characteristics of liquids and how they apply to the operation and diagnosis of power steering and suspension systems. Steering column operation and diagnosis including supplemental restraint system service will be included. The course will cover the fundamentals of short/long-arm, and strut suspensions, including: caster, camber, thrust angle, toe-in, steering axis inclination (SAI), included angle, toe-out on turns (turning angle/radius), and how they apply to steering, suspension, and 4-wheel alignment. The following wheel balance terms will be specifically explained: static balance, dynamic balance, tramping, and radial force variation. Students will learn strategy-based diagnostic routines, in order to interpret and verify customer concerns and proper operation, and to perform tests and inspection to determine the causes and make corrections related to suspension/steering/wheel systems and alignment. These areas include steering columns, power steering, wheels/tires, short/long-arm/strut suspensions, and 4-wheel alignment. Through the inspection, testing, or measurement of component processes, students will learn to apply this knowledge to determine needed repairs and correctly repair a vehicle.

### **CURRICULUM WRITING TEAM:**

Mark C. Watson, Ph.D.

### **DATE OF REVISION:**

2007

# Wallenpaupack Area School District

**Course:** Power Mechanics III

**Grade Level:** Grade 12

**Unit:** Safety

**PA Standards:** 13.1.11  
13.2.11  
13.3.11  
13.4.11

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| <b>Topics:</b><br>Safety <ul style="list-style-type: none"><li>• Personal Safety</li><li>• Tool and Equipment Safety</li><li>• Work Area Safety</li><li>• Manufacturer's Warnings and Government Regulations</li></ul> | <b>Skills:</b><br>Cognitive and Manipulative Development<br>Active listening strategies<br>Drawing inferences<br>Following directions<br>Demonstrate knowledge of safety practices in the use of hand tools, power equipment, and in performing job tasks and procedures |
| <b>Activities:</b><br>Lecture <ul style="list-style-type: none"><li>• Power Point</li><li>• Smart board interaction</li><li>• Student presentations</li></ul> Shop demonstration                                       | <b>Performance Assessments:</b><br>Quizzes<br>Oral questioning<br>Written test<br>Shop assessment through observation <ul style="list-style-type: none"><li>• weekly grade</li></ul>   |

# Wallenpaupack Area School District

**Course:** Power Mechanics III

**Grade Level:** Grade 12

**Unit:** Brakes

**PA Standards:** 13.1.11  
13.2.11  
13.3.11  
13.4.11

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|---|--|
| <p><b>Topics:</b></p> <p>Brake Systems</p> <ul style="list-style-type: none"> <li>• Principles of Hydraulic Brake Systems</li> <li>• Components</li> <li>• Master Cylinder Operation</li> <li>• Hydraulic Tubes and Hoses</li> <li>• Hydraulic System Safety Switches and Valves</li> <li>• Drum and Disc Brakes Assemblies</li> <li>• Hydraulic System Service</li> <li>• Hydraulic and Vacuum Boosters</li> </ul> | <p><b>Skills:</b></p> <p>Identify the principles of friction, hydraulic circuits, and basic braking system operation</p> <p>State the name and operation of all braking system components</p> <p>Analyze the purpose and purpose and operation of power brakes</p> <p>State the principles of ABS</p> <p>Identify various problems, diagnosis and services tips and procedures</p> |
| <p><b>Activities:</b></p> <p>Shop demonstration<br/>Lecture<br/>View Smart board presentation<br/>Board demonstrations<br/>Open discussion<br/>Class debate<br/>Guided practice<br/>Shop demonstration<br/>Supervised shop work<br/>Group projects and individual projects<br/>Cooperative learning groups<br/>Homework</p>   | <p><b>Performance Assessments:</b></p> <p>Quizzes<br/>Oral questioning<br/>Written test<br/>Shop assessment through observation</p> <ul style="list-style-type: none"> <li>• weekly grade</li> </ul>   |

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|--|--|
| <p><b>Topics:</b></p> <p>Drum Brakes</p> <ul style="list-style-type: none"> <li>• Drum Brake Operation</li> <li>• Drum Brake Components</li> <li>• Drum Brake Designs</li> <li>• Road Testing Brakes</li> <li>• Drum Brake Inspections</li> <li>• Brake Shoes and Linings</li> <li>• Wheel Cylinders             <ul style="list-style-type: none"> <li>○ Inspection</li> <li>○ Servicing</li> </ul> </li> </ul> | <p><b>Skills:</b></p> <p>Explain how drum brakes operate<br/>Identify the major components of a typical drum brake and describe their functions<br/>Explain the difference between duo-servo and Nonservo drum brakes<br/>Perform a cleaning and inspection of a drum brake assembly<br/>Recognize conditions that adversely affect the performance of drums, shoes, linings, and related hardware<br/>Reassemble a drum brake after servicing<br/>Explain how typical drum parking brakes operate<br/>Adjust a typical drum parking brake</p> |
| <p><b>Activities:</b></p> <p>Shop demonstration<br/>Lecture<br/>View Smart board presentation<br/>Board demonstrations<br/>Open discussion<br/>Class debate<br/>Guided practice<br/>Shop demonstration<br/>Supervised shop work<br/>Group projects and individual projects<br/>Cooperative learning groups<br/>Homework</p>  | <p><b>Performance Assessments:</b></p> <p>Quizzes<br/>Oral questioning<br/>Written test<br/>Shop assessment through observation             <ul style="list-style-type: none"> <li>• weekly grade</li> </ul> </p>  |

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| <p><b>Topics:</b></p> <p>Disc Brakes</p> <ul style="list-style-type: none"> <li>• Disc Brake Components and their Function</li> <li>• Disc Brake Diagnosis</li> <li>• Service Precautions</li> <li>• General Caliper Inspecting and Services</li> <li>• Rotor Inspecting and Servicing</li> </ul>  | <p><b>Skills:</b></p> <p>List the advantages of disc brakes</p> <p>List disc brake components and describe their functions</p> <p>Explain the difference between the three types of calipers commonly used on disc brakes</p> <p>Describe the two types of parking brake systems used with disc brakes</p> <p>Describe the general procedure involved in replacing disc brake pads</p> <p>List and describe five typical disc brake rotor problems</p> |
| <p><b>Activities:</b></p> <p>Shop demonstration</p> <p>Lecture</p> <p>View Smart board presentation</p> <p>Board demonstrations</p> <p>Open discussion</p> <p>Class debate</p> <p>Guided practice</p> <p>Shop demonstration</p> <p>Supervised shop work</p> <p>Group projects and individual projects</p> <p>Cooperative learning groups</p> <p>Homework</p> | <p><b>Performance Assessments:</b></p> <p>Quizzes</p> <p>Oral questioning</p> <p>Written test</p> <p>Shop assessment through observation</p> <ul style="list-style-type: none"> <li>• weekly grade</li> </ul>  |

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**PA Standards:** 13.1.11  
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| <b>Topics:</b>  | <b>Skills:</b>   |
|---|--|
| <p>Antilock Brake System</p> <ul style="list-style-type: none"> <li>• Antilock Brakes</li> <li>• ABS Components</li> <li>• Types of Antilock Brake Systems</li> <li>• ABS Operation</li> <li>• Automatic Traction Control</li> <li>• Automatic Stability Control</li> <li>• Antilock Brake System Service</li> <li>• Diagnosis and Testing</li> </ul> | <p>Antilock brake systems work to bring a vehicle to a controlled stop</p> <p>Describe the differences between a integrated and a nonintegrated antilock brake system</p> <p>Briefly describe the major components of a four-wheel antilock brake system</p> <p>Describe the operation of the major components of an antilock brake system</p> <p>Describe the operation of the major components of automatic traction and stability control systems</p> <p>Explain the best procedure for finding ABS faults</p> <p>List the precautions that should be followed whenever working on an antilock brake system</p> |
| <b>Activities:</b>  | <b>Performance Assessments:</b>  |
| <p>Shop demonstration</p> <p>Lecture</p> <p>View Smart board presentation</p> <p>Board demonstrations</p> <p>Open discussion</p> <p>Class debate</p> <p>Guided practice</p> <p>Shop demonstration</p> <p>Supervised shop work</p> <p>Group projects and individual projects</p> <p>Cooperative learning groups</p> <p>Homework</p>                    | <p>Quizzes</p> <p>Oral questioning</p> <p>Written test</p> <p>Shop assessment through observation</p> <ul style="list-style-type: none"> <li>• weekly grade</li> </ul>   |

# Wallenpaupack Area School District

**Course:** Power Mechanics III

**Grade Level:** Grade 12

**Unit:** Suspension and Steering

**PA Standards:** 13.1.11  
13.2.11  
13.3.11  
13.4.11

|  |   |
|--|---|
| <p><b>Topics:</b></p> <p>Safety</p> <ul style="list-style-type: none"> <li>• Personal Safety</li> <li>• Tool and Equipment Safety</li> <li>• Work Area Safety</li> <li>• Manufacturer's Warnings and Government Regulations</li> </ul>   | <p><b>Skills:</b></p> <p>Cognitive and Manipulative Development</p> <p>Active listening strategies</p> <p>Drawing inferences</p> <p>Following directions</p> <p>Demonstrate knowledge of safety practices in the use of hand tools, power equipment, and in performing job tasks and procedures</p> |
| <p><b>Activities:</b></p> <p>Shop demonstration</p> <p>Lecture</p> <p>View Smart board presentation</p> <p>Board demonstrations</p> <p>Open discussion</p> <p>Class debate</p> <p>Guided practice</p> <p>Shop demonstration</p> <p>Supervised shop work</p> <p>Group projects and individual projects</p> <p>Cooperative learning groups</p> <p>Homework</p> | <p><b>Performance Assessments:</b></p> <p>Quizzes</p> <p>Oral questioning</p> <p>Written test</p> <p>Shop assessment through observation</p> <ul style="list-style-type: none"> <li>• weekly grade</li> </ul>   |

# Wallenpaupack Area School District

**Course:** Power Mechanics III

**Grade Level:** Grade 12

**Unit:** Suspension and Steering

**PA Standards:** 13.1.11  
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13.4.11

|   |  |
|---|--|
| <p><b>Topics:</b></p> <p>Tires and Wheels</p> <ul style="list-style-type: none"> <li>• Safety</li> <li>• Wheels</li> <li>• Tires</li> <li>• Tire Repair</li> <li>• Tire/Wheel Run out</li> <li>• Tire/Wheel Assembly Service</li> <li>• Wheel Bearing</li> </ul>  | <p><b>Skills:</b></p> <p>Use tire terminology to define how tires are constructed</p> <p>Identify different characteristics of tires</p> <p>Compare different types of tires, including ply, radial, and spare tire</p> <p>Identify how tires are sized</p> <p>Analyze the purpose and operation of wheels and rims</p> <p>Identify various problems, diagnosis and services tips and procedures</p> |
| <p><b>Activities:</b></p> <p>Shop demonstration</p> <p>Lecture</p> <p>View Smart board presentation</p> <p>Board demonstrations</p> <p>Open discussion</p> <p>Class debate</p> <p>Guided practice</p> <p>Shop demonstration</p> <p>Supervised shop work</p> <p>Group projects and individual projects Cooperative learning groups</p> <p>Homework</p> | <p><b>Performance Assessments:</b></p> <p>Quizzes</p> <p>Oral questioning</p> <p>Written test</p> <p>Shop assessment through observation</p> <ul style="list-style-type: none"> <li>• weekly grade</li> </ul>  |

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| <b>Topics:</b>  | <b>Skills:</b>  |
|---|---|
| <p>Suspension Systems</p> <ul style="list-style-type: none"> <li>• Safety</li> <li>• Frames</li> <li>• Suspension System Components</li> <li>• MacPherson Strut Suspension Components</li> <li>• Independent Front Suspension</li> <li>• General Front-Suspension Inspection</li> <li>• Front-Suspension Component Servicing</li> <li>• Rear-Suspension Systems</li> <li>• Live-Axle Rear-Suspension System</li> <li>• Semi-Independent Suspension</li> <li>• Independent Suspension</li> <li>• Electronically Controlled Suspensions</li> <li>• Servicing Electronic Suspension Components</li> <li>• Active Suspension</li> </ul> | <p>Define the parts and operation of the front suspension system</p> <p>Define the parts and operation of the rear suspension system</p> <p>Analyze the purpose, parts, and operation of different types of shock absorbers</p> <p>Compare struts suspension with other suspension systems, including parts and operation</p> <p>Define the operation of computer-controlled suspension systems</p> <p>Identify the purpose and operation of level controls and air suspension</p> <p>Identify various problems, diagnosis and services tips and procedures</p> |
| <b>Activities:</b>  | <b>Performance Assessments:</b>   |
| <p>Shop demonstration</p> <p>Lecture</p> <p>View Smart board presentation</p> <p>Board demonstrations</p> <p>Open discussion</p> <p>Class debate</p> <p>Guided practice</p> <p>Shop demonstration</p> <p>Supervised shop work</p> <p>Group projects and individual projects</p> <p>Cooperative learning groups</p> <p>Homework</p>  | <p>Quizzes</p> <p>Oral questioning</p> <p>Written test</p> <p>Shop assessment through observation</p> <ul style="list-style-type: none"> <li>• weekly grade</li> </ul>  |

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**Unit:** Suspension Systems

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| <p><b>Topics:</b></p> <p>Steering Systems</p> <ul style="list-style-type: none"> <li>• Safety</li> <li>• Manual-Steering Systems</li> <li>• Power-Steering Systems</li> <li>• Electronically Controlled Power-Steering Systems</li> <li>• Steering System Diagnosis</li> <li>• Visual Inspection</li> <li>• Four-Wheel Steering Systems</li> </ul>           | <p><b>Skills:</b></p> <p>Define the parts and operation of standard steering system</p> <p>Examine the operation of the steering gear</p> <p>Define front end geometry including caster, camber, toe, steering axis, turning radius, and four wheel alignment</p> <p>Identify the operation of power steering units and pumps</p> <p>Identify various problems, diagnosis and services tips and procedures</p> |
| <p><b>Activities:</b></p> <p>Shop demonstration</p> <p>Lecture</p> <p>View Smart board presentation</p> <p>Board demonstrations</p> <p>Open discussion</p> <p>Class debate</p> <p>Guided practice</p> <p>Shop demonstration</p> <p>Supervised shop work</p> <p>Group projects and individual projects</p> <p>Cooperative learning groups</p> <p>Homework</p> | <p><b>Performance Assessments:</b></p> <p>Quizzes</p> <p>Oral questioning</p> <p>Written test</p> <p>Shop assessment through observation</p> <ul style="list-style-type: none"> <li>• weekly grade</li> </ul>  |

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| <b>Topics:</b>   | <b>Skills:</b>   |
|--|--|
| <p>Wheel Alignment</p> <ul style="list-style-type: none"> <li>• Safety</li> <li>• Alignment Geometry</li> <li>• Prealignment Inspection</li> <li>• Wheel Alignment Equipment</li> <li>• Alignment Machines</li> <li>• Adjusting Wheel Alignment</li> <li>• Four-Wheel-Drive Vehicle Alignment</li> </ul>                           | <p>Explain the benefits of accurate wheel alignment</p> <p>Explain correct wheel angles</p> <p>Describe the different functions of camber and caster</p> <p>Explain why toe is the most critical tire wear factor</p> <p>Identify the purposes of turning radius or toe-out</p> <p>Explain the condition known as tracking</p> <p>Perform a pre-alignment inspection</p> <p>Describe how alignment angles can be changed on a vehicle</p> <p>Understand the importance of rear-alignment</p> <p>Know the difference between two and four wheel alignments</p> <p>Cognitive and Manipulative Development</p> <p>Active listening strategies</p> <p>Drawing inferences</p> <p>Following directions</p> |
| <b>Activities:</b>   | <b>Performance Assessments:</b>  |
| <p>Shop demonstration</p> <p>Lecture</p> <p>View Smart board presentation</p> <p>Board demonstrations</p> <p>Open discussion</p> <p>Class debate</p> <p>Guided practice</p> <p>Shop demonstration</p> <p>Supervised shop work</p> <p>Group projects and individual projects</p> <p>Cooperative learning groups</p> <p>Homework</p> | <p>Oral questioning</p> <p>Written test</p> <p>Shop assessment through observation</p> <ul style="list-style-type: none"> <li>• weekly grade</li> </ul>  |