



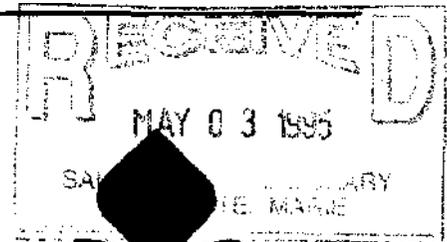
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**Course Title:** Heavy Equipment I Shop  
**Code No.:** HED 100  
**Program:** Heavy Equipment Diesel  
**Senester:** Fall  
**Date:** May 1993  
**Author:** M. Hartin/B. Tucker

**Hew:**            **Revision:**

**Approved:**

**Date:**



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## Heavy Equipment X Shop

## I PHILOSOPHY/GOALS:

The purpose of this program is to provide the student with hands on experience on crawler and rubber tired heavy equipment encountered in construction, forestry, mining and on-highway vehicles. The emphasis is put on the diesel engine, fuel injection, powertrains, hydraulic and electrical systems.

## II STUDENT PERFORMANCE OBJECTIVES:

Upon successful completion of this course the student may enter the forestry, mining, construction or equipment dealer industries as a heavy equipment apprentice and in a few years become a qualified journeyman. Graduates of this program may also entered truck and coach or automotive apprenticeships.

## III TOPICS TO BE COVERED:

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IV LEARNING ACTIVITIES:

Topic 1 Shop Safety

Learning Activities

- 1.1 Identify potential health and safety hazards.
- 1.2 Locate and identify emergency safety equipment and safe handling procedures.
- 1.3 Demonstrate desirable shop housekeeping practices.

Topic 2 Hand Tools And Shop Equipment

Learning Activities

- 2.1 Demonstrate the correct use of hand tools and shop equipment.

Topic 3 What Is Heavy Equipment

Learning Activities

- 3.1 Identify different types of heavy equipment.
- 3.2 Demonstrate pre-operative and daily inspection and maintenance procedures.
- 3.3 Locate and identify operator controls and instruments.

Topic 4 Fork Trucks

Learning Activities

- 4.1 Demonstrate pre-operative and daily inspection.
- 4.2 Locate and identify fork truck controls and instruments.
- 4.3 Apply safe operating & slinging procedures.

Topic 5 Cleaning Methods

Learning Activities

- 5.1 Demonstrate safe and correct cleaning procedures.

Topic 6 Torque Wrenches

Learning Activities

- 6.1 Demonstrate how to tighten fasteners with different torque wrenches.
- 6.2 Student will practice in torquing cylinder heads utilising different types of torque wrenches.

IV LEARNING ACTIVITIES:

- 6.3 Demonstrate how to use a degree torque wrench for the torque turn method.

Topic 7 Taps. Dies ap.4 Drill Bits

Learning Activities

- 7.1.0 Drill Bits
- 7.1.1 Demonstrate how to inspect a bench grinder before sharpening drill bits.
- 7.1.2 Student will inspect and adjust bench grinder.
- 7.1.3 Demonstrate how to sharpen drill bits.
- 7.1.4 Student will practice sharpening drill bits.
- 7.1.5 Student will practice drilling holes using a drill press.
- 7.2.0 Taps and dies
- 7.2.1 Student will practice tapping holes using taps\*
- 7.1.2 Student will practice filing and cutting steel using files and hack saws.
- 7.3.0 Helicoil and Keen sert
- 7.3.1 Student will practice repairing threads using helicoils and loctite.

Topic 8 Measuring Instruments

Learning Activities

- 8.1 Student will learn how to use different feeler gauges in different applications.
- 8.2 Demonstrate how to measure components with different micrometers.
  - Inside micrometers
  - Outside micrometers
  - Depth micrometers
- 8.3 Student will practice measuring components using different micrometers.
  - Inside micrometers
  - Outside micrometers
  - Depth micrometers
- 8.4 Demonstrate how to use dial indicator for different applications.

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IV LEARNING ACTIVITIES:

- 8.5 Student will practice measuring components with dial indicators.
- 8.6 Demonstrate how to use vernier calipers for different measurements.
- 8.7 Student will practice measuring component with vernier calipers.

Topic 9 Fire Safety

Learning Activities

- 9.1 Student will scan the heavy equipment shop and classroom area and locate all fire fighting equipment.
- 9.2 Student will write a report on all fire fighting equipment locations.

Topic 10 Starting Aids and Starting Methods

Learning Activities

- 10.1.0 Starting Aids
  - 10.1.1 Identify different types of starting aids.
  - 10.1.2 Demonstrate the safe and correct use of starting aids.
- 10.2.0 Starting Methods
  - 10.2.1 Identify various starting methods.
  - 10.2.2 Perform the safe and correct methods of starting engines.

Topic 11 Engine Fundamentals

Learning Activities

- 11.1 The student will set their work environment for a diesel engine overhaul.
- 11.1 The students (in group of 4 or 5) will perform a complete diesel engine overhaul.

NOTE: The complete overhaul will be performed during the fall and the winter semester.

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IV LEARNING ACTIVITIES:

Topic 12 g^giwo Crankshaft and Camshaft

Learning Activities

- 12.1 During the engine overhaul, the students will remove, clean, inspect, measure and analyze the crankshaft of their assigned engine.
- 12.2 Demonstrate how to polish a crankshaft using a lathe and the proper polisher.
- 12.3 During the engine overhaul, the students will remove, clean, inspect, measure and analyze the camshaft of their assigned engine.

Topic 13 Engine Bearing

Learning Activities

- 13.1 During the engine overhaul, the students will clean, remove, inspect, measure and analyze the crankshaft bearings of their assigned engine.
- 13.2 During the engine overhaul, the students will clean, remove, inspect, measure and analyze the camshaft bearings of their assigned engine.

Topic 14 r<sub>T</sub> ^ M<sup>h</sup>a ft Balancing Force and Flywheel

Learning Activities

- 14.1 During the engine overhaul, the students will clean, remove, inspect, measure and analyze the vibration damper of their assigned engine.
- 14.2 During the engine overhaul, the students will clean, remove, inspect, measure and analyze the flywheel of their assigned engine.

Topic 15 Engine Liners and Cylinders Bores

Learning Activities

- 15.1 During the engine overhaul, the students will clean, remove, inspect, measure and analyze the cylinders of their assigned engine.
- 15.2 Demonstrate how to deglaze engine cylinders on different type of cylinders.
- 15.3 During the engine overhaul, the students will deglaze the cylinders their assigned engine.

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IV LEARNING ACTIVITIES:

Topic 16 Engine Pistons and Piston rings

Learning Activities

- 16.1 During the engine overhaul, the students will clean, remove, inspect, measure and analyze the pistons of their assigned engine.
- 16.2 During the engine overhaul, the students will clean, remove, inspect, measure and analyze the piston rings of their assigned engine.

Topic 17 Engine Cylinder heads and valves

Learning Activities

- 17.1 During the engine overhaul, the students will clean, remove, inspect, measure and analyze the cylinder head of their assigned engine.
- 17.2 Demonstrate how to service the engine valves, how to knurl valve guides and how to service valve seats using the proper valve service tools.
- 17.3 During the engine overhaul, the students will service the engine valves, knurl valve guides and service valve seats of their assigned engine

Topic 18 Engine Lubrication System

Learning Activities

- 18.1 During the engine overhaul, the students will clean, remove, inspect, measure and analyze the lubricating pump and valves of their assigned engine.
- 18.2 During the engine overhaul, the students will clean, remove, inspect, measure and analyze the oil cooler and the bypass valve of their assigned engine.
- 18.3 Demonstrate how to inspect and measure different types of engine lubrication pumps.

Topic 19 Engine Cooling System

Learning Activities

- 19.1 Demonstrate how to inspect, test and service a liquid cooling pump, a radiator and a radiator cap.
- 19.2 Demonstrate how to inspect and test a thermostat in a diesel engine.

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IV LEARNING ACTIVITIES:

- 19.3 During the engine overhaul, the students will .clean, remove, inspect, measure and analyze the liquid'cooling system pump of their assigned engine..
- 19.2 During the engine overhaul, the students will clean, remove, inspect, measure and analyze the thermostat of their assigned engine.

Topic 20 Bearings And Seals

Learning Activities

- 20.1 Identify different types of bearings and seals.
- 20.2 Perform correct and safe bearing adjustment procedures.
- 20.3 Perform safe and correct bearing removal, inspection and assembly procedures.
- 20.4 Demonstrate safe and correct oil & grease seal removal and installation.
- 20.5 Demonstrate proper troubleshooting procedures.

Topic 21 Gears

Learning Activities

- 21.1 Identify and examine different types of gears.

Topic 22 Clutches

Learning Activities

- 21.1 Identify and examine different classifications and types of clutches.
- 21.2 Remove, examine, install and adjust different clutch assemblies.
- 21.3 Demonstrate a safe and correct troubleshooting procedure.

Topic 23 Manual Transmissions

Learning Activities

- 23.1 Identify different types and classifications of transmissions and control mechanisms.
- 23.2 Dismantle, examine and reassemble manual shift transmission and control mechanisms.

IV LEARNING ACTIVITIES:

Topic 24 Drivelines

Learning Activities

- 24.1 Identify different types and classifications of drivelines and universal joints.
- 24.2 Demonstrate the safe and correct method on the removal, service and installation procedures.
- 24.3 Perform driveline angularity checks.

Topic 25 Differentials

Learning Activities

- 25.1 Identify the different types and classifications of differentials, axles and control systems.
- 25.2 Demonstrate the safe and correct removal, disassembly, inspection, service, adjustment and installation procedures required of axles, differentials and their control systems.
- 25.3 Perform safe and correct troubleshooting methods.

Topic 26 Traction Controls

Learning Activities

- 26.1 Identify different types of traction controls.
- 26.2 Perform safe & correct removal, inspection and installation procedures.

Topic 27 Inter-Axle Differential

Learning Activities

- 27.1 Identify and demonstrate a working knowledge of the fundamental principles of inter-axle differentials.

Topic 28 Wheel Planetary Drives

Learning Activities

- 28.1 Identify, disassemble, inspect and reassemble wheel planetary drives.

**V. EVALUATION METHODS:**

HED 100 shop assessment is based on two criteria.

1. 70% on project or shop assignments and on the students ability as measured subjectively by performance on a variety of shop jobs. Such assignments or projects not received on time will be degraded accordingly.
2. 30% on related (Theory and Shop) attendance. 1% deduction per unexcused period absence.

The following grades will be assigned.

A+	(>90%)	(Numerical Equivalent 4.0)	- Consistently Outstanding
A	(85-90%)	(Numerical Equivalent 3.75)	- Outstanding Achievement
B	(75-84%)	(Numerical Equivalent 3.00)	- Consistently Above Average Achievement
C	(65-74%)	(Numerical Equivalent 2.00)	- Satisfactory or Acceptable Achievement
R	(<65%)	(Numerical Equivalent 0.00)	- Repeat - Objectives of course not achieved and course must be repeated

CR - Credit exemption

X - A temporary grade, limited to situations with extenuating circumstances, giving a student additional time to complete course requirements.

Your Semester Shop Letter Grade will be comprised of:

- 70% of Semester shop performance
- 30% of Semester attendance

A 65% Average of the total semester shop evaluation and attendance must be achieved to receive a passing grade in Heavy Equipment Diesel Shop.

**VI. REQUIRED STUDENT RESOURCES:**

Textbooks:

Diesel Fundamentals (Second Edition) - Thiessen/Dales  
Diesel Equipment I - Schulz

VII. ADDITIONAL RESOURCE MATERIALS AVAILABLE IN THE COLLEGE LIBRARY:

Periodical Section

Suggested list of periodicals in the Library which are of interest to Heavy Duty Equipment Students:

Heavy Construction News  
Engineering & Contract Record  
Northern Logger  
Construction Methods & Equipment  
Diesel Equipment Superintendent  
Hydraulics and Pneumatics  
Power  
Bus and Truck Transport  
Motor  
E.M. (Heavy Duty "Equipment Maintenance")  
Motor Truck  
Diesel and Gas Turbine Progress  
Audiovisual Section (Library Film Strip/Cassette Modules)  
TJ 02a The crawler Tractor Operator Familiarization  
TJ 02b Working The Crawler  
TJ 03 Cummins Aneroids  
TJ 04 Cummins Dial Indicator Tune-up  
TJ 05 Cummins Piston Rings  
TJ 06 Cummins PTD Fuel Injection  
TJ 07 PTG AFC Theory and Operation  
TJ 08 Diesel Truck History  
TJ 09 Cummins Professional Driver Techniques  
TJ 010 Drive Line Alignment  
TJ 011 Driving With "Skid-Trol"  
TJ 012 Introduction To Diesel  
TJ 013 High Energy Ignition  
TJ 014 Stopmaster Brake Troubleshooting  
TJ 015 Oils For The 70's  
TJ 016 Theory and Operation of Fluid Drive  
TJ 017 VE Pump Operation

VII. **SPECIAL NOTES:**

High Top Safety Boots (CSA Approved)  
Safety Glasses (CSA Approved), Impact on Prescription Lenses  
Coloured Pencils (red, blue, green, yellow)

Students with special needs (eg. physical limitations, visual impairments, hearing impairments, learning disabilities) are encouraged to discuss required accommodations confidentially with the instructor.

Your instructor reserves the right to modify the course as he/she deems necessary to meet the need of the students.