OPERATING ENGINEER (HEAVY DUTY REPAIRER)
(Time-Based)

APPENDIX A

O*NET CODE 49-3042.00

This training outline is a minimum standard for Work Processes and Related Instruction. Changes in technology and regulations may result in the need for additional on-the-job or classroom training.

WORK PROCESSES

Approximate Hours

A. Workplace Knowledge **150**

1. Understand and adhere to general shop safety practices.
2. Knowledge of shop equipment, tools, and terminology.
3. Understand parts and service manuals, including electronic and hard copy manuals of the equipment or vehicle, and written notes.
4. Read reports and memos describing equipment and vehicular malfunction.

B. Cleaning and Inspecting the Parts of all Types of Equipment **250**

1. Demonstrate understanding of general repair and inspection methods.
2. Inspect and maintain the various types of equipment and components used by the industry.
3. Understand the application of proper oils, greases, lubricants, and solvents used by the industry (in accordance with manufacture specifications), along with safe handling, use, and disposal.

C. Knowledge of Engine Functions and Components **550**

1. Identify and describe the purpose, function, properties, and characteristics of basic engine function, and their components (such as: cylinder heads, blocks, and liners; pistons; crankshaft; valvetrain).
2. Understand the operation, maintenance, and repair of internal combustion engines (diesel and gasoline) with attached driven units, including: compressors; water pumps; ac/dc generators; and electric motors.

3. Describe the operating principals of electronic controls and sensors used in the electrical system to control engine functions.
4. Identify and describe the types, styles, and applications of mechanical and electronic governors.
5. Understand how to troubleshoot and test engine systems to resolve issues, using diagnostic tools, and non-destructive testing and magnetic particle testing (i.e.) Magnaflux.

D. Fuel Systems **550**

1. Perform troubleshooting procedures on fuel and diesel fuel systems.
2. Identify and describe the purpose, functions, properties, and characteristics of fuel and diesel fuel injection systems.
3. Identify and explain procedures for inspection, servicing, testing, and diagnosing problems associated with low-pressure and high-pressure fuel systems.
4. Check and adjust injection and carburetion systems.
5. Repair fuel pumps and carburetors.
6. Check and service fuel filtering systems.

E. Alternate Energy and Fuel Systems (Optional)* **400**

1. Inspect natural gas (compressed and liquified) and other alternate fuel systems by performing inspections of fuel system components such as filters, pumps, injections, lines, and pressure safety devices.
2. Understand the operation, maintenance, and repair of alternate systems, such as: hybrid; electric; renewable fuel (i.e., renewable diesel); natural gas; etc.

F. Electrical Systems **500**

1. Understand general principles of electrical theory, as applied to the trade.
2. Troubleshoot, repair, and adjust components of electrical systems (such as voltage regulators, generators, alternators, starters, etc.).
3. Use proper equipment to check and troubleshoot electrical systems, such as a digital volt-ohm meter (DVOM), ammeter (AMP meter), test light, and power probe.
4. Utilize and reference proper electrical schematics.

5. Understand the difference between 12-volt and 24-volt battery systems.
6. Check timing of electrical systems.
7. Troubleshoot wiring circuits, including series, parallel, and combination circuits.
8. Identify and describe the operating principles of electronic signal processing systems used in electrical system control on modern diesel engines.

G. Heating and Cooling Systems **300**

1. Understand the process for troubleshooting and identifying issues with heating and cooling systems (such as: checking pressures, and adjusting fan belts and friction-driven fan drives).
2. Identify and describe heating and air conditioning systems on heavy equipment (as applicable to the trade), and check for proper operation.
3. Learn the process to drain, recover, recycle, and properly refill cooling systems, in accordance with safety procedures and regulations.
4. Understand how to safely and properly perform recoveries and recharges on air conditioning systems.

H. Clutches and Brakes **450**

1. Troubleshoot issues with clutch and brake systems.
2. Check, adjust, and repair clutches, including steering clutches.
3. Adjust and maintain air, electric, and hydraulic-operated brake systems.
4. Repair brake and air system components, including but not limited to: S-cam brakes, disc brakes, brake lining and brake applicators, air dryers, air compressors, air governors, and air reservoirs.

I. Transmissions and Differentials **600**

1. Troubleshoot transmissions, torque converters, differentials, and gearboxes, using proper tools and equipment, and computer-based diagnostic software (if available).
2. Maintain, repair, and replace transmissions, torque converters, differentials, steering clutches, linkages, gear boxes, and drive boxes.

3. Inspect and replace ball bearings, precision (e.g., Timken) bearings, and oil seals.
4. Inspect, repair, and replace differential gears, bearings, and oil seals.

J. Undercarriage, Drive Components, and Final Drive **600**

1. Perform troubleshooting procedures on final drives used in heavy equipment.
2. Troubleshoot issues with undercarriages and drive components.
3. Inspect and repair drive chains, drive sprockets, and segments, idlers, rollers, and track guides.
4. Remove, adjust, and repair final drives, axles, gears, bearings, oil seals, and duo-cone seals.
5. Adjust tracks, track rollers, and wheel bearings.
6. Repair, service, and adjust boosters, valves, and regulators.
7. Use proper hydraulic press equipment.

K. Hydraulic Systems **600**

1. Describe the principles of hydraulics.
2. Utilize and reference proper hydraulic schematics for repair and servicing.
3. Identify and describe the function of the components that make up a typical hydraulic system, such as: closed center; open center; negative control; and resolver networks.
4. Understand the use and operation of hydraulic pumps and motors, such as: load sensing variable displacement pumps; gear pumps; pump push photocurrent (PPPc) pumps; and variable displacement motors, and gear motors.
5. Perform troubleshooting procedures on hydraulic systems:
    a. Repair and service cylinders, valves, power control units, solenoids, switches, and hydraulic circuits.
    b. Learn proper release of hydraulic pressure in a circuit and accumulators.
    c. Identify and understand hose and coupling sizes, ratings, and dimensions.
    d. Adhere to environmental requirements/regulations for oil spills and learn to properly mitigate risks.

L. Intake, Exhaust, and Emissions **600**

1. Describe the function and applications of intake systems, crankcase ventilation systems, exhaust systems, and emission systems.

1. Understand exhaust gas recirculation system components for diesel engines, such as: the particulate filter; selective catalytic reduction catalyst; and diesel oxidation catalyst.
2. Inspect intake and exhaust systems, particulate filter devices, and emission control components, and adhere to methods for performing inspections and diagnostic procedures.
3. Identify and describe the types, styles, and application of turbochargers.

M. Welding **200**

1. Demonstrate knowledge of welding, such as grinding, joint fitment, bevels, thickness, and preheating, as applied to the trade.
2. Perform welding in support of service and maintenance (as applied to the trade), following all safety procedures and policies:
   a. Acetylene: Cutting, brazing, and welding.
   b. Electric: Cutting and welding.

N. Repair and Maintenance of Self-Propelled and Stationary Equipment (Exclusive of Engines) **250**

1. Maintain and repair the various types of equipment used by the industry.
2. Perform troubleshooting and repair of associated systems and subsystems.
3. Use proper oils, greases, tools, and shop equipment used by the industry.

Approximate Total Hours (Over a four-year period) **6000**

***If optional work processes are not selected, the hours should be devoted to further mastery of the other required work processes.**

Apprenticeship work processes are applicable only to training curricula for apprentices in approved programs. Apprenticeship work processes have no impact on classification determinations under Article 8 or 9 of the Labor Law. For guidance regarding

classification for purposes of Article 8 or 9 of the Labor Law, please refer to https://dol.ny.gov/public-work-and-prevailing-wage.

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APPENDIX B

RELATED INSTRUCTION

Safety and Health

1. Trade Safety
2. General Workplace Safety
3. Right-to-Know/Material Safety Data Sheets (MSDS)
4. First Aid & CPR (minimum 6.5 hours every 3 years)
5. Personal Protective Equipment (PPE)/Personal Fall Protective Equipment
6. Height Safety and Awareness
7. Sexual Harassment Prevention Training – must comply with Section 201-g of the Labor Law
8. OSHA 10-Hour Construction Course – if required for Public Work
9. HAZMAT (Hazardous Materials) Training
10. Proper Disposal of Waste (oil, filters, fluids, etc.)
11. Environmental Protection Agency (EPA) Technician Training (Section 609)
12. Asbestos Safety:

    If apprentice will do <u>any</u> handling of asbestos:

    Successfully complete a course approved by the New York State Department of Health for “Asbestos Handler” and obtain, and keep current, an “Asbestos Handler (Worker): certificate from the New York State Department of Labor.

    If apprentice will do <u>no</u> handling of asbestos:

    Asbestos Awareness – minimum 4 hours (see attachment)

Diagrams, Components, and Schematics

1. Hydraulic Components and Schematics
2. Electrical Circuits and Diagrams

Mathematics

1. Fundamentals
2. Electrical Mathematics, Formulas, etc.
3. Shop Mathematics
4. Use of Handbooks, Tables, Charts, etc.

Trade Theory

1. Tools and Equipment
2. Equipment and Technical Training
3. Terminology
4. Materials
5. Operation, Care, and Maintenance
6. Theory of Job Processes

Trade Science

1. Heavy Duty Systems (Repair and Operations)
2. Preventative Maintenance and Inspections
3. Confined Space Entry
4. Rigging and Material Handling
5. Frame Holding and Pulling (Anchoring, Blocking, Mounting, Stress Relief)
6. Power and Energy Systems
7. Fuel Systems
8. Alternate Energy and Fuel Systems (if optional work process selected)
9. Cylinder Heads, Blocks, and Liners
10. Air Intake and Exhaust Systems
11. Cooling Systems
12. Principles of Heat Exchange, Air Conditioning, and Refrigeration
13. Electrical Systems
14. Transmission and Differentials
15. Suspension and Undercarriage
16. Final Drive and Air Brakes
17. Hydraulic Systems
18. Welding
19. Metallurgy
20. Strength of Materials
21. Machine Design
22. Water Treatment
23. Lubricants

24. Fundamentals of D.C.
25. Fundamentals of A.C.
26. Principles of Gauges, Measuring, and Testing Devices

Other Workplace Skills

1. CDL “B” license from New York State Department of Motor Vehicles
2. Overhead Crane Operator Training (as applicable to trade)
3. Employer Specific Skills

Additional Topics as Required

A minimum of 144 hours of Related Instruction is required for each Apprentice, each year.

Appendix B topics are approved by New York State Education Department.

ATTACHMENT TO APPENDIX B

Asbestos Awareness

This course must be delivered by one of the following:

1. A provider currently approved by the New York State Department of Health to deliver asbestos safety training.
2. A person holding a current Asbestos Handler certificate from the New York State Department of Labor in the title of: Inspector, Supervisor, Project Monitor, Management Planner, or Project Designer.
3. Anyone otherwise approved by the New York State Education Department.

Minimum course contents must include the following:

1. Definition of asbestos
2. Types and physical characteristics
3. Uses and applications
4. Health effects:
    a. Asbestos-related diseases
    b. Risks to families
    c. Cigarette smoking
    d. Lack of safe exposure level
5. Employer-specific procedures to follow in case of potential exposure, including making a supervisor or building owner immediately aware of any suspected incidental asbestos disturbance so that proper containment and abatement procedures can be initiated promptly.

Notwithstanding the above course requirement, employers are advised that they must also be in compliance with New York State Department of Labor Industrial Code Rule 56 at all times.

Employers are further advised, and must advise all apprentices, that completion of the above course requirement does not authorize any person to remove, encapsulate, enclose, repair, disturb, or abate in any manner, any friable or non-friable asbestos, asbestos containing material, presumed asbestos containing material, or suspect miscellaneous asbestos containing material.