DOCUMENT RESUME

ED 139 941 CE 010 959

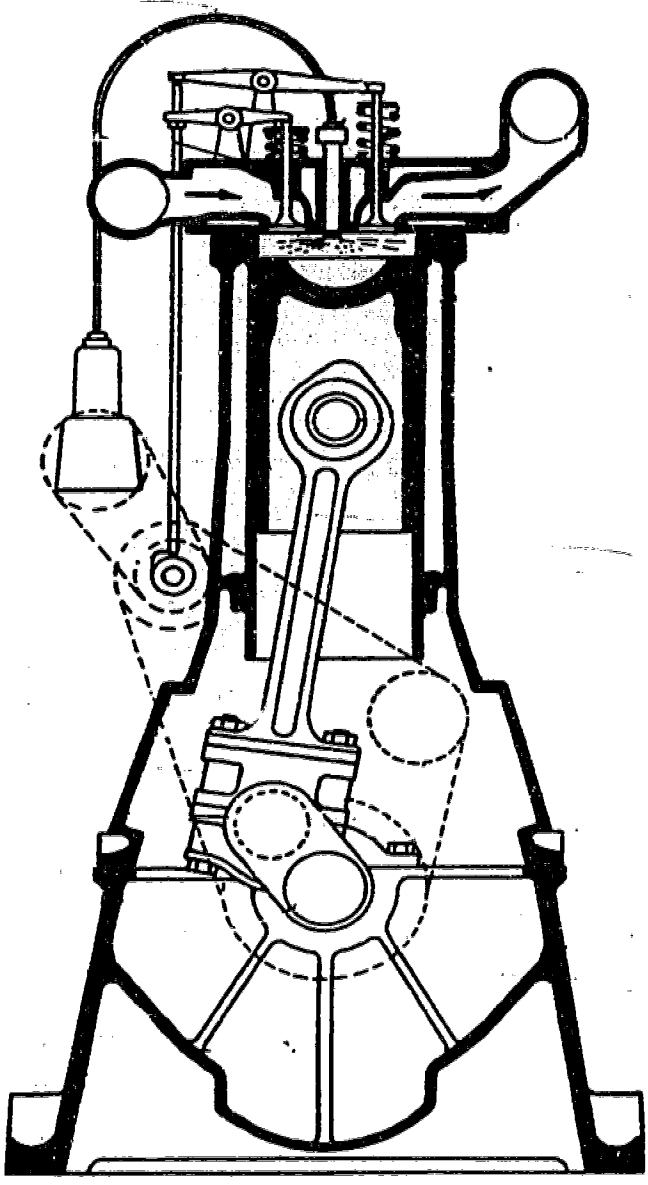
AUTHOR Tidwell, Joseph
TITLE Diesel Mechanics. Performance Objectives. Basic Course.
INSTITUTION Duval County School Board, Jacksonville, Fla.
PUB DATE Aug 74
NOTE 48p.; For a related document see CE 010 960

EDRS PRICE MF-$0.83 HC-$2.06 Plus Postage.
DESCRIPTORS *Auto Mechanics; *Behavioral Objectives; *Criterion Referenced Tests; Curriculum Guides; *Diesel Engines; Grade 10; Maintenance; Mechanical Skills; Repair; Senior High Schools; *Shop Curriculum; Skill Development; Vocational Education

ABSTRACT

Several intermediate performance objectives and corresponding criterion measures are listed for each of 12 terminal objectives for a basic diesel mechanics course. The course is designed as a two-semester (2 hour daily) course for 10th graders interested in being diesel service and repair mechanics; it would serve as the first year of a 3-year secondary school program. Based on shop manipulative practices in addition to related classroom instruction, the focus of instruction is on use of tools and safety, engine theory, terminology, main stationary parts, major moving parts, valve gear and scavenging systems, fuel injection systems, burning the fuel, lubrication system, cooling system, and governing. The titles of the 12 terminal objectives are Orientation, Theory of Internal Combustion Engines, Operating Principles, Design Variation, Main Stationary Parts, Major Moving Parts, Value Gear, Intake and Exhaust, Lubrication System, Cooling System, Fuel Injection System, Burning the Fuel, and Governing. (This manual and 54 others were developed for various secondary level vocational courses using the System Approach for Education (SAFE) guidelines.) (HD)

diesel mechanics



PERFORMANCE OBJECTIVES

BASIC COURSE

2

DUVAL COUNTY SCHOOL BOARD

Dr. John T. Gunning

Superintendent of Schools

DUVAL COUNTY SCHOOL BOARD

Mr. William E. Carter, Chairman
Mr. Wendell P. Holmes, Jr., Vice Chairman
Mr. Joseph Cullen
Mr. James S. Hornsby
Mr. William S. Mathias, Jr.
Mrs. Gene W. Miller
Mr. Hugh Schulman

Dr. Donald W. Johnson

Associate Superintendent, Curriculum

Mr. David A. Rigsby

Director of Vocational-Technical Education

Mr. Charles L. Downing

Supervisor of Vocational-Technical Education

Mr. David A. Brown

Supervisor of Industrial Education

Duval County Public Schools
August, 1974

ACKNOWLEDGEMENTS

This manual was developed using System Approach For Education (SAFE) guidelines.

Appreciation and recognition are extended to the following educators who have assisted in the preparation of this manual:

Mr. Tom Carter, Coordinator
School Industry Education

Mr. Joseph Killough, Coordinator
School Industry Education

Mr. Charles Downing, Supervisor
Vocational-Technical Education

The following educator participated as the writer of this manual:

Mr. Joseph Tidwell, Instructor

Cover design and printing by Mr. Chester Seivert

Typist: Sharon Pratt

9343

DIESEL MECHANICS - BASIC

Syllabus of Terminal Performance Objectives

1.0 - Orientation

2.0 - Theory of Internal Combustion Engines

3.0 - Operating Principles

4.0 - Design Variations

5.0 - Main Stationary Parts

6.0 - Major Moving Parts

7.0 - Value Gear, Intake and Exhaust

8.0 - Lubrication System

9.0 - Cooling System

10.0 - Fuel Injection System

11.0 - Burning the Fuel

12.0 - Governing

DIESEL MECHANICS-BASIC
Accreditation No.: 9243
Length of Course: 2 Semesters
Time Block: 2 Hours Daily

COURSE DESCRIPTION

This course is prepared to train students who are interested in being diesel service and repair mechanics. The course consists of shop manipulative practices in addition to related classroom instruction. Basic instruction includes: use of tools and safety, engine theory, terminology, main stationary parts, major moving parts, valve gear and scavenging systems, fuel injection systems, burning the fuel, lubrication system, cooling system and governoring. This prepares the student in necessary skills, attitudes, technical knowledge, plus ability to get along with other people.

360 Hours

COURSE DIESEL MECHANICS-BASIC

TERMINAL PERFORMANCE OBJECTIVE NO. 1.0 — Orientation

Upon completion of this unit on orientation 90% of the students will demonstrate through 80% correct responses to a criterion test, objective knowledge of the career opportunities for diesel mechanics, basic internal combustion engine principles, course education activities, safety, hand and power tools and school policy handbook.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
		1.0	Test attached.
1.1	By researching the classified advertisements in telephone book, city directory and occupational information handbook the student will list twenty job opportunities for diesel mechanics in this area.	1.1	Submit written report covering outline of training for diesel mechanics and list of twenty places of employment.
1.2	The student will demonstrate his comprehension of the fuel air mixture ignition in gasoline and diesel engines by reading pages 11 through 14 of text and answering test questions correctly.	1.2	State air and fuel mixture is ignited by spark in gasoline engines. State air only is compressed high enough to ignite the fuel when injected into diesel engine.
1.3	The student will distinguish two important advantages of diesel engines when compared to gasoline engines. By listing two advantages with 100% accuracy.	1.3	List two advantages of the diesel engine over the gasoline engine.
1.4	The student will distinguish two important disadvantages of diesel engine when compared to gasoline engines. By listing two disavantages with 100% accuracy.	1.4	List two disadvantages of the diesel engine that gasoline engines do not have.

COURSE DIESEL MECHANICS-BASIC

TERMINAL PERFORMANCE OBJECTIVE NO. 1.0 (cont'd) Orientation

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
1.5	The student given a sample progress chart to examine will demonstrate his understanding of the educational activities of related instruction, shop work activities and human relations. He will preform the required activities with at least 80% accuracy.	1.5	With the assistance of the instructor he will help maintain records and information required by course product standards and progress chart. The student will be shown typical product standard forms and have the required activities and human relations explained to him.
1.6	The student will demonstrate his knowledge of shop fire safety by marking fire extinguisher locations and exit route on shop floor plan with 100% accuracy.	1.6	Mark fire exit route and mark location of 7 or 8 fire extinguishers correctly.
1.7	The student will demonstrate his understanding of the importance of shop safety by orally or in writing give at least ten shop regulations.	1.7	Write or state ten safety regulations appliable to the diesel mechanics shop.
1.8	Given a list of ten hand and power tools the student will identify and state the function of 8 of 10.	1.8	Identify and write the function of the following hand and power tools. 1. Ratchet & socket 2. Valve refacing machine 3. Combination wrench 4. Impact wrench 5. Drill & grinder 6. Micrometer 7. Valve sert grinder 8. Spaner wrench 9. Hinge pull handle 10. Vise grips

COURSE DIESEL MECHANICS-BASIC

TERMINAL PERFORMANCE OBJECTIVE NO. 1.0 (cont'd) — Orientation

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
1.9	After being read the school policy handbook, the student will demonstrate his understanding of school policies by listing actions that will cause expulsion from the school system with 80% accuracy.	1.9	Student will state or list three actions that will cause expulsion.

DIESEL MECHANICS - BASIC

1.0

1. The first diesel engine patented in 1892 was designed to burn:
   A. Kerosene
   B. Heavy oil
   C. Powderd coal
   D. Gasoline

2. An Englishman Herbert Ackroyd Stuart patented an oil engine in 1888 ignition of the fuel and air mixture was by:
   A. Electrical spark
   B. Heated glow plug
   C. Heat of compression
   D. Hot surface of chamber

Directions: Circle the letter "A" if you agree with the following statements. Circle the letter "D" if you disagree.

3. A D Diesel engines require no ignition systems.

4. A D Diesel engines draw into the cylinder only air and then compresses it.

5. Which of the following type hammers would be used when driving out a rivet or pin with a punch.
   A. Ball peen
   B. Claw
   C. Rubber face mallet
   D. Lead face mallet

6. Box end wrenches used for heavy duty work have how many points?
   A. 6 only
   B. 12 only
   C. 8 only
   D. 16 only

7. The type chisel which would be used to split a seized nut is?
   A. Cold chisel
   B. Diamond point chisel
   C. Cape chisel
   D. Round nose

8. Which of the following types of gauge is used for measuring gaps or clearances?
   A. Radius gauge
   B. Ring and plug gauge
   C. Surface gauge
   D. Feeler gauge

9. When using a bench grinder, you should always:
   A. Wear a face shield or goggles
   B. Wear gloves to protect hands
   C. Keep tool rest adjusted above the center line of the wheel
   D. Do all of the above

10. The master switch which controls all power in the maintenance shop normally is located:
   A. In the center of the shop
   B. In the tool room
   C. At the rear of the shop
   D. Just inside the shop entrance

COURSE DIESEL MECHANICS-BASIC

TERMINAL PERFORMANCE OBJECTIVE NO. 2.0

Theory of Internal Combustion

Upon completion of this unit 90% of the students will demonstrate through 80% correct responses to a criterion test, objective knowledge of theory of internal combustion.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
		2.0	Test attached
2.1	The student will list in the order they occur the strokes of a four cycle and a two cycle diesel engine with 80% accuracy	2.1	List correctly in the order they occur the strokes of four cycle and two cycle diesel engine.
2.2	The student will demonstrate his understanding of two and four stroke cycle diesel engines by making a line drawing of a four and two stroke cycle engine cylinder unit with 80% accuracy.	2.2	Make a line drawing of a cylinder unit of a two stroke cycle and a four stroke diesel engine.
2.3	The student will explain the difference between internal and external combustion. Process orally or in writing with 80% accuracy.	2.3	Explain the difference between internal and external combustion process.

DIESEL MECHANICS - BASIC

2.0

1. Combustion in the true diesel cycle occurs at constant _____.

2. Combustion in the otto cycle o-curs at constant _____.

3. The stroke of a diesel engine piston:
   A. Is always the same as the cylinder bore measurement.
   B. Is the distance the top of the piston travels when moving from top center downward to the bottom center position.
   C. Is the length of the connecting rod.
   D. Is the distance the piston travels in one complete engine cycle.

4. In what order do the strokes of a four stroke cycle engine oc occur?
   A. Compression, Power, exhaust, intake
   B. Compression, power, intake, exhaust
   C. Intake, compression, power, exhaust
   D. Intake, compression, exhaust, power

5. Two stroke cycle diesel engines produce a power stroke in each cylinder:
   A. Once in every two revolutions of the crankshaft.
   B. Once for every four strokes of the piston
   C. Once for every two strokes of the piston
   D. Directly after the exhaust stroke.

6. On two stroke cycle engines using exhaust ports, the inlet ports are uncovered first as the piston moves downward on the power stroke.
   True or False

7. The compression ration is the ratio of the whole cylinder volume to the least cylinder volume.
   True or False

8. Fuel oil is injected into the diesel engine cylinder at the end of the _____stroke with the piston at or nearly at top dead center.

9. Gasoline engines usually depend upon a_____for supplying the proper fuel-air mixture.

10. During which stroke in the operating cycle of a four stroke cycle engine is the greatest force exerted on the piston head?

2.0

Continued

A. Intake

B. Compression

C. Power

D. Exhaust

COURSE DIESEL MECHANICS-BASIC

TERMINAL PERFORMANCE OBJECTIVE NO. 3.0 Operating Principles

Upon completion of the unit on operating principles of reciprocating internal combustion engines eighty five percent of the students will achieve seventy five percent or better on a criterion examination.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
		3.0	Test attached.
3.1	The student will demonstrate his understanding of the ignition process of fuel air mixture in a gasoline engine by correctly identifying spark plugs, distributor, ignition wires and carburator on an illustration of a gasoline engine 80% accuracy.	3.1	Correctly identify the spark plugs, distributor, ignition wires and carburator of a gasoline engine.
3.2	The student will demonstrate his understanding of the compression ignition principle of diesel engines by explaining how the higher compression ratio drives the temperature of the compressed air high enough to ignite fuel when injected into the cylinder with 80% accuracy.	3.2	Correctly explain the pressure and temperature relation of the air during compression stroke, approximately 20F rise for each pound of pressure.
3.3	The student will explain the power loss of two cycle engines due to scavenging inefficency and power consumption of the blower using wall charts or cut away engine assembly with 80% accuracy.	3.3	Correctly explain incomplete air exchange in cylinder of two cycle engines and power required to drive the blower for air pressure.

COURSE DIESEL MECHANIC -BASIC

TERMINAL PERFORMANCE OBJECTIVE NO. 3.0 (cont'd) Operating Principles

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
3.4	Using wall charts or projection device of engine timing gears. The student will explain why valve timing of four cycle engine requires the camshaft to revolve at one half crankshaft speed with 80% accuracy.	3.4	Correctly explain how piston has to make four strokes or two revolutions for each cycle.
3.5	Using wall charts or projection device of engine timing gears. The student will explain why the crankshaft and camshaft of two cycle engines revolve at the same speed with 80% accuracy.	3.5	Correctly explain how intake and exhaust strokes are eliminated by pumping action of scavenging air pressure.
3.6	Using wall charts, projection device or cutaway engine the student will describe how the flywheel mass absorbes energy on power strokes and gives up energy on compression strokes with 80% accuracy.	3.6	Correctly explain how mass of the flywheel speeds up on power strokes and slows down on compression strokes due to kinetic energy.
3.7	Using wall charts, projection device or cutaway engine the student will demonstrate his understanding of how a supercharger increases the power output of an engine with 100% accuracy.	3.7	Correctly demonstrate understanding that air pressure in the cylinder is increased before the compression stroke begins in a super charged engine.

DIESEL MECHANICS - BASIC

3.0

1. Two reasons for compressing air to a high pressure in the diesel engine cylinder - (Circle two choices)
   A. This permits the use of a smaller flywheel
   B. The temperature of the air is raised to a point where it will ignite fuel oil
   C. The engine will run more smoothly between power strokes
   D. Formation of carbon is prevented
   E. More power can be obtained from a combustible mixture which has been highly compressed before burning.

2. The purpose of the flywheel is to
   A. Counterbalance the cranic throws on the crankshaft
   B. Keep the engine running smoothly between power strokes
   C. Provide a belt driving surface
   D. Prevent the engine from overspeeding

3. The supercharger - (Circle two answers)
   A. Provides scavenging air for two - stroke-cycle diesel engines
   B. Must be on all four stroke cycle diesel engines
   C. Makes it possible to obtain more power from a given engine
   D. Simply provides a greater volume of air at normal atmospheric pressure.
   E. Makes it possible to restore most of the power lost when an engine is operated at high altitudes above sea level.

4. A supercharger forces compressed air into the cylinders of the engine.
   True or False

5. Flywheels are necessary on all diesel engines
   True or False

6. The brake horsepower of a diesel engine is:
   A. The amount of horsepower developed within the engine
   B. The amount of horsepower developed by the friction of the engine
   C. The amount of horsepower developed by the heating valve of the fuel
   D. The net amount of horsepower available at the crankshaft of the engine.

7. The volumetric efficiency of an unsupercharged diesel engine of the four stroke cycle type:
   A. Is very low at slower engine speeds
   B. Is the ratio of the actual volume of air entering the engine cylinder during the intake stroke to the volume of air equal to the piston displacement.
   C. Is not affected by the temperature of the engine parts which the intake air contacts while entering the engine cylinder
   D. Is not affected by the value timing

8. Pistons with small diameters and short strokes have lower rubbing speeds and inertia forces than those with larger diameters and longer strokes.
   True or False

9. An air pump must be used on a two cycle diesel engine.
   True or False

10. Both the intake and the exhaust valves of a four stroke cycle diesel engine are closed during the _____ stroke and the _____ stroke.

COURSE DIESEL MECHANICS-BASIC

TERMINAL PERFORMANCE OBJECTIVE NO. 4.0

Diesel Design Variations

Upon completion of the unit on diesel design varations 90% of the students will demonstrate through 80% correct responses to a criterion test, objective knowledge of diesel engine design variations.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
		4.0	Test attached.
4.1	Following instruction on engine design varations the student will demonstrate his understanding of single action, double acting and opposed piston engines by making a line sketch of each type cylinder unit with 80% accuracy.		Make an accurate line sketch of the three type cylinder units.
4.2	The student will explain why engines are difficult to classify by listing two examples of how groupings overlap with 80% accuracy.	4.2	Correctly demonstrate that classification is difficult by listing two groups that overlap.
4.3	Using wall charts and shop engine assemblies the student will explain why small four stroke cycle diesel engines differ from automotive gasoline engines with 80% accuracy.	4.3	Correctly point out diesels have more main bearings and have heavier construction to withstand high pressure.
4.4	Given an illustration of four basic diesel engine cylinder arrangements the student will identify each with 80% accuracy.	4.4	Correctly identify in line, V type, flat and radial diesel engine cylinder arrangements.

COURSE DIESEL MECHANICS-BASIC

TERMINAL PERFORMANCE OBJECTIVE NO. 4.0 (cont'd) — Diesel Design Variations

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
4.5	Using black board and chalk the student will demonstrate his understanding of variations in piston action of diesel engines with 80% accurracy.	4.5	Correctly illustrate a single acting and a double piston design using black board and chalk.
4.6	Using wall charts or cutaway engine assembly, the student will explain the difference in oil spray and oil circulation methods of piston cooling with 80% accuracy.	4.6	Correctly explain the oil spray and oil circulation methods of piston cooling.
4.7	Given an illustration of three basic engine cylinder designs the student will identify each with 80% accuracy.	4.7	Correctly identify dry, wet and integral type diesel cylinder liners.

DIESEL MECHANICS - BASIC

T.P.O. 4.0 - Design Variations

4.0 - Criterion Test

Directions: Circle the letter "A" if you agree with the following statements. Circle the letter "D" if you disagree.

1. A D - Diesel Engines may be classified in several ways; operating cycle, piston action, piston connection, cylinder arrangement, method of fuel injection and engine speed.

2. A D - Diesel Engines may be grouped into the following categories because they differ in size, speed and use, small four-cycle, small two-cycle, medium-size four-cycle, medium-size two-cycle and large size.

3. A D - Diesel and High Compression Gas Engines have four basic cylinder arrangements, they are; cylinders in line, V-arrangements, flat, and radial.

4. A D - Cylinders are generally cast in blocks containing several cylinders, but in few designs they are cast individually.

5. Small Diesel Engines which have an automotive design frame
   A. Always have each cylinder cast seperately.
   B. Have crankshaft supported by the main bearings caps.
   C. Use welded centerframes for light weight.
   D. Cannot use through bolts as they interfere with the cooling water jacket arrangement.

6. In opposed piston engines
   A. Both faces of the piston are used.
   B. The crosshead principle must be employed.
   C. Two crankshafts are used.
   D. Two injection systems must be employed.

7. On a Radial Engine of four cylinders, there are,
   A. Four connecting rods and four crankpins
   B. Four connecting rods and two crankpins.
   C. Four connecting rods and one crankpin.
   D. Two connecting rods and two crankpins.

8. In engines which use A-frame construction, through bolts tie the cylinder heads and A-frames to the bedplate and take the stretching forces due to combustion. T F

9. In most cases a diesel engine "model" represents a specific design in a specific cylinder size. T F

10. Speed, as a means of classifying engines, is
   A. Satisfactory, as it indicates the type of use an

T.P.O. 4.0 - Design Variations

4.0 - Criterion Test (con't)

engine will be put to.

B. Satisfactory, as it indicates the amount of inertia forces developed within an engine.

C. Unsatisfactory, as it does not indicate the amount of inertia forces developed within an engine.

D. Unsatisfactory, as it does not indicate the type of duty for which an engine is suited.

COURSE DIESEL MECHANICS-BASIC

TERMINAL PERFORMANCE OBJECTIVE NO. 5.0 — Main Stationary Parts

Upon completion of this unit on main stationary parts consisting of main frames, cylinder liners and cylinder heads. 90% of students will demonstrate through 80% correct responses to a criterion test, objective knowledge of main stationary parts, the students will also demonstrate his ability through job assignments to disassemble, clean, inspect for wear and reassemble components during laboratory assignments using manufacturers service manuals, tools and materials. Clearance measurements must be ± .002 and no abnormal times.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
		5.0	Test attached.
5.1	Given an illustration of the two methods of engine frame construction the student will identify each method with 80% accuracy.	5.1	Correctly identify cast and welded methods of frame construction.
5.2	Given a list of four types of engine frame design the student will describe each type frame with 80% accuracy.	5.2	Correctly describe the four types of engine frame design one piece, two piece, three piece and "A" frame construction.
5.3	The student will demonstrate his understanding of the function of the main frame by listing three jobs preformed by the main stationary frame with 80% accuracy.	5.3	Correctly list the function of engine frames; 1. Support and align engine parts 2. Resist forces of engine operations 3. Supports auxiliaries, provides oil sump and cooling passages.
5.4	Using wall chart or cutaway engine the student will explain the three basic functions of the cylinder liner with 80% accuracy.	5.4	Correctly explain how cylinder liner seals compression and combustion, takes side thrust of pistons and transfers heat from the piston.
5.5	Given an illustration of three types of cylinder liners the student will identify each with 80% accuracy.	5.5	Correctly identify dry, wet and integral type cylinder liners.

COURSE DIESEL MECHANICS-BASIC

TERMINAL PERFORMANCE OBJECTIVE NO. 5.0 (cont'd) Main Stationary Parts

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
5.6	Using a wall chart the student will explain the function of the cylinder head with 80% accuracy.	5.6	Correctly explain function of the cylinder head is to seal compression and combustion.
5.7	Using wall charts and cut-away engine the student will locate the engine water jackets and cooling passages in the cylinder head with 80% accuracy.	5.7	Correctly identify cooling passages in engine block and cylinder head.
5.8	Following instruction on main stationary parts the student given a shop laboratory engine will disassemble clean, inspect parts for wear. Reassemble engine using manufacturers shop manuals, tools and material. Student will measure clearances to .002. Reassemble engine and test run.	5.8	Disassemble, clean, inspect parts for wear. Measure clearances to ±.002 using shop manual reassemble engine and test run.

9243

DIESEL MECHANICS - BASIC

T.P.O. 5.0 - Main Stationary Parts

5.0 - Criterion Test

1. The two basic methods of engine frame construction are casting and fabrication. T F

2. When a diesel engine uses a bedplate in its construction, the main bearing caps bolt downward upon the crankshaft. T F

3. Large engines use individual cylinder heads, small engines use groups of heads cast together. T F

4. The cooling water jackets on most diesel engines are arranged
   - A. So that the water circulates all of the cylinder liners before it can flow to the heads.
   - B. For circulation of water downward through the heads into the top of the liners to bring cool water to the hottest area first.
   - C. With seperate circulation of water through the cylinder heads only and through the liners only to maintain more even tempatures.
   - D. So that tempature strains are reduced by having the water enter at the lower end of the liners and flow upward into the cylinder heads.

5. Cylinder liners are generally used on diesel engines because
   - A. Liners may be easy replaced after the cylinder walls show wear.
   - B. Liners provide a more efficient cooling system.
   - C. Rubbing speeds are reduced through the use of liners.
   - D. Liners provide a better lubrication surface.

6. Cylinder liners are
   - A. Usually bolted to the cylinder head.
   - B. Pressed into the engine frame or block from the lower end of the cylinder.
   - C. Sealed against water leakage at the bottom end by rubber rings.
   - D. Head in place in the engine frame or block by screw thraeds at the upper end of the liner.

7. The function of an engine's stationary part is to
   - A. Add power to the engine.
   - B. Keep the engine firmly attached to its supporting base.
   - C. Furnish a framework on which to attach or enclose movable parts.
   - D. Regulate crankshaft speed.

DIESEL MECHANICS - BASIC

T.P.O. 5.0 - Main Stationary Parts

5.0 - Criterion Test (con't)

Directions: Circle the letter "A" if you agree with the following statements. Circle the letter "D" if you disagree.

8. A D - The structural parts of a diesel engine are subjected to the firing pressures which tend to push the cylinder heads and crankshaft bearings apart and also to the inertia forces of the pistons, connecting rods and crankshaft which try to twist and bend the engine frame.

9. A D - Engine frame designs fall into two classes vertical frames and horizontal frames and may be one, two or three piece construction.

10. A D - Cylinder heads for four-stroke-cycle engines have only to provide openings for the valves and the injector nozzle, thus making them very simple castings.

COURSE DIESEL MECHANICS-BASIC

TERMINAL PERFORMANCE OBJECTIVE NO. 6.0 — Major Moving Parts

Upon completion of this unit on major moving parts consisting of; pistons, piston rings, connecting rods, wrist pins, crankshafts, bearings and flywheels, 90% of the students will demonstrate through 80% correct responses, to a criterion test, objective knowledge of major moving parts. The student will demonstrate his ability to disassemble, clean, inspect, for wear and reassemble components during laboratory assignments using manufacturers service manuals tools and materials. Clearance measurements must be .002 and no abnormal times.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
		6.0	Test attached.
6.1	Given an illustration of a piston the student will identify the various parts of a piston and the method of cooling used with 80% accuracy.	6.1	Correctly identify parts of a piston and method of cooling on illustration.
6.2	Given an illustration of a trunk and crosshead type piston the student will identify each type and state application of each with 80% accuracy.	6.2	Correctly identify piston types and state application of each.
6.3	The student will demonstrate his understanding of piston rings by stating orally or in writing the two types and four functions of piston rings with 80% accuracy.	6.3	Correctly identify piston ring types and state four functions of rings.
6.4	Given an illustration of four types of piston ring joints the student will identify the joints with 80% accuracy.	6.4	Correctly identify piston ring joints on illustration.

COURSE DIESEL MECHANICS-BASIC

TERMINAL PERFORMANCE OBJECTIVE NO. 6.0 (cont'd) Major Moving Parts

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
6.5	The student will demonstrate his understanding of the function of connecting rods by stating orally or in writing the purpose of the connecting rod with 80% accuracy.	6.5 o	Correctly state the function of the connecting rod.
6.6	Given an illustration of four types of crankpin end designs of connecting rods the student will identify the various types with 80% accuracy.	6.6	Correctly identify four types of crankpin end designs of connecting rods.
6.7	Given an illustration of four types of wrist pin arrangements the student will identify each type and state the function of wrist pins with 80% accuracy.	6.7	Correctly identify four types of wrist pins and state the function of wrist pins.
6.8	The student will demonstrate his understanding of crankshafts orally or in writing by stating the function and forces the crankshaft withstands with 80% accuracy	6.8	Correctly state the crankshaft function and the forces acting on it.
6.9	Given a list of four functions bearings must preform the student will demonstrate his knowledge orally or in writing by stating how each function is accomplished with 80% accuracy.	6.9	Correctly state four functions of bearings and how functions are accomplished

COURSE DIESEL MECHANICS-BASIC

TERMINAL PERFORMANCE OBJECTIVE NO. 6.0 (cont'd) Major Moving Parts

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
6.10	The student will demonstrate his understanding of flywheels orally or in writing by stating the function of flywheels and two factors that determine its' size with 80% accuracy.	6.10	Correctly state the function of flywheels and two factors that determine its size.
6.11	Following instruction on major moving parts the student given a shop laboratory engine or customers engine, will disassemble, clean, inspect parts for wear. Reassemble engine using manufacturers shop manuals, tools, parts and material. Student must be able to measure clearances to within ± .002 and work at an acceptable rate, engine must be test run after repair.	6.11	Disassemble, clean, inspect parts for wear. Measure clearances to ± .002 using shop manual reassemble engine and test run.

DIESEL MECHANICS - BASIC

T.P.O. 6.0 - Major Moving Parts

6.0 - Criterion Test

1. Pistons of the trunk type are tapered from the top of the skirt to the top of the crown to provide slightly more clearance in the high-tempature zone. T F

2. Aluminum pistons will expand more than cast iron pistons under the same operations conditions and are therefore often designed with
   A. Split Skirts
   B. Slipper Skirts
   C. Full Trunk Skirts
   D. Full Trunk and Slipper Skirts

3. Compression rings are forced against the wall of the cylinder by the
   A. Spring action of the ring only.
   B. Spring action of the ring and the force of the gas pressure.
   C. Pressure of the lubricating oils.
   D. Tapered construction of the ring face.

4. Oil control rings are designed to scrape excess oil from the cylinder walls on both the upstroke and downstroke of the piston. T F

5. Connecting rod bolts are snugly fitted in their holes in the connecting rod and cap to offer resistance to inertia forces which act sidewise against the rod bearing. T F

6. There are three methods commonly used for fastening the piston pin to the piston and connecting rod, they are;
   A. _____
   B. _____
   C. _____

7. Crankshafts must withstand torsional forces as well as forces tending to bend them. T F

8. The vibration damper is a device designed to
   A. Balance camshaft speed with crankshaft speed.
   B. Reduce twisting strain on the crankshaft.
   C. Brake the flywheel during engine speed reduction.
   D. Reduce flywheel vibration.

9. Two important factors that help make a good installation of bearing shells are
   A. Bearing spread and bearing crush.
   B. Bearing width and bearing crush.
   C. Bearing spread and bearing thickness.
   D. Bearing width and thickness.

DIESEL MECHANICS - BASIC

T.P.O. 6.0 - Major Moving Parts

6.0 - Criterion Test (con't)

10. In addition to reducing engine speed fluctuations, the flywheel often serves as a
    A. Power take off for the camshaft and a pressure surface for the clutch.
    B. Pressure surface for the clutch and starting system gear.
    C. Starting system gear and a power take off for the fuel pump.
    D. Power take off for the fuel pump and a timing reference for the injection system.

COURSE DIESEL MECHANICS-BASIC

TERMINAL PERFORMANCE OBJECTIVE NO. 7.0 Valve Gear, Intake and Exhaust Systems

Upon completion of this unit on valve gear, intake and exhaust systems 90% of the students will demonstrate through 80% correct responses to a criterion test, objective knowledge of valves, intake and exhaust systems. The student will demonstrate his ability to disassemble, clean, inspect for wear and reassemble components during laboratory assignments. Using manufacturers service manuals, tools, parts and material clearance measurements must be ± .002 and no abnormal times.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
		7.0	Test attached.
7.1	Given illustration of a valve assembly the student will identify the various parts of the assembly with 80% accuracy.	7.1	Correctly identify various parts of the valve assembly.
7.2	Using a wall chart of a fourstroke cycle engine the student will demonstrate his knowledge of valve actuating gear orally, by tracing the power flow from the crankshaft to the valve with 80% accuracy.	7.2	Correctly state the power flow in the valve train from the crankshaft to the valve.
7.3	The student will demonstrate his understanding of valve timing by stating orally or in writing why valves must be timed and three types of drives employed with 80% accuracy.	7.3	Correctly state why valves must be timed and three types of drives used in valve timing.
7.4	Using a wall chart the student will demonstrate his knowledge of the air intake system by tracing the flow through the intake filter into the cylinder and naming three types of air filters employed with 80% accuracy.	7.4	Correctly describe the flow of intake air through the filter into the cylinder and name three types of air filters.

COURSE DIESEL MECHANICS-BASIC

TERMINAL PERFORMANCE OBJECTIVE NO. 7.0 (cont'd) Valve Gear, Intake and Exhaust Systems

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
7.5	Given an illustration of the basic methods of scavenging air flow in two stroke cycle engines the student will identify each method and describe the events and air flow through the cylinder with 80% accuracy.	7.5	Correctly identify the three basic methods of scavenging two cycle engines and describe the air flow through the cylinder.
7.6	Using wall charts or cut-away components the student will demonstrate his understanding of engine superchargers by naming the two basic types and stating the power input, air flow and exhaust flow with 80% accuracy.	7.6	Correctly name two types of superchargers and state the power input, air and exhaust flow.
7.7	The student will demonstrate his understanding of exhaust systems orally or in writing by stating the three basic requirements of the exhaust system with 80% accuracy.	7.7	Orally or in writing, correctly state the three basic requirements of the exhaust system.
7.8	Following instruction on valve gear, intake and exhaust systems the student given a shop laboratory engine or a customer engine will preform the required service operations on intake and exhaust valves, intake air and exhaust systems. The student will disassemble the engine or com-	7.8	Disassemble, clean, inspect parts for wear. Measure clearances to± .002 using shop manual reassemble engine and test run.

COURSE DIESEL MECHANICS-BASIC

TERMINAL PERFORMANCE OBJECTIVE NO. 7.0 (cont'd) Valve Gear, Intake and Exhaust Systems

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
7.8	ponents as required, clean and inspect for wear. Reassemble engine using manufacturers shop manual, tools, parts and material. Student must be able to reject faulty parts and measure clearance to within ± .002 and work at an acceptable rate. Engine must be test run after repair.		

COURSE DIESEL MECHANICS (BASIC)

TERMINAL PERFORMANCE OBJECTIVE NO. - 8.0 Lubrication System

Upon completion of this unit on lubrication system 90% of the students will demonstrate through 80% correct responses to a criterian test, objective knowledge of lubrication systems. The student will demonstrate his ability to perform required service operations on components during laboratory assignments. Using manufacturers service manuals, tools, parts, and material. Clearance measurements must be ±.002 and no abnormal times used.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
		8.0	Test Attached
8.1	The student will define friction orally or in writing.	8.1	Correctly explain what friction is.
8.2	The student will demonstrate his knowledge of the laboratory of the lubrication system using a wall chart show the four jobs the lubricating system must perform with 80% accuracy.	8.2	Correctly show the four jobs performed by the lubricating system.
8.3	Given an illustration two types of lubricating systems the student will identify and describe each system with 80% accuracy.	8.3	Correctly identify and describe the two types of lubrication systems.
8.4	The student will demonstrate his knowledge of wet and dry sump engine and auxiliary equipment used in lubrication systems, using wall charts or a cutaway engine identify system & explain the function of auxiliary equipment with 80% accuracy.	8.4	Correctly identify wet and dry sump lubricating systems and explain the function of auxiliary equipment.

COURSE DIESEL MECHANICS (BASIC)

TERMINAL PERFORMANCE OBJECTIVE NO. 8.0 (cont'd) Lubrication System

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
8.5	The student will demonstrate his knowledge of lubricating oil deterioration by stating orally or in writing the two primary sources of deterioration and the factors that cause deterioration with 80% accuracy.	8.5	Correctly state the two primary sources of lubricating oil deterioration and the factors that cause deterioration.
8.6	The student will demonstrate his understanding of lubricating oil additives and treatment by stating orally or in writing two additives & three types of oil treatment used with 80% accuracy.	8.6	Correctly state two oil additives and three types of lubricating oil treatment.
8.7	Same objective.	8.7	Correctly define the properties of lubricating oil listed: A. Viscosity B. Carbon Residue C. Pour Point D. Flash Point E. Water and Sediment F. Acidity or Neutralization Number G. Precipitation Number H. Gravity I. Color

COURSE DIESEL MECHANICS (BASIC)

TERMINAL PERFORMANCE OBJECTIVE NO. 8.0 (cont'd) Lubrication System

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
8.9	The student given a shop laboratory or customer engine will remove, clean and inspect for wear on oil pressure pump, using engine shop manuals, necessary tools and materials. Reassemble and test pump on engine, pump must deliver 45 pounds pressure with no leaks.	8.9	Remove, disassemble, clean, and inspect for wear on oil pump. Reassemble and test on engine. Pump must deliver 45 pounds pressure with no leaks.
8.10	The student given a shop laboratory or customer engine will perform the required service operations to remove, clean, and replace the lubricating oil filter element. Using shop manuals, necessary tools, and materials. Reassemble filter and test engine. Filter must show no evidence of oil leaks at maximum engine R.P.M.	8.10	Remove,clean, and Replace engine oil filter elements. Reassemble filter and test on engine, filter, must show no evidence of leaks at maximum engine R.P.M.

COURSE DIESEL MECHANICS (BASIC)

TERMINAL PERFORMANCE OBJECTIVE NO. 9.0 — Cooling System

Upon completion of this unit on Cooling Systems 90% of the students will demonstrate through 80% correct responses to a criterian test, objective knowledge of cooling systems. The student will demonstrate his ability to perform required service operations on components during laboratory assignments. Using manufacturers service manuals, tools, parts, and material. Clearance measurements must be ±.002 and no abnormal times used.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
		9.0	Test Attached
9.1	The student will state the purpose of the cooling system orally or in writing with 80% accuracy.	9.1	Correctly state the purpose of the cooling system.
9.2	The student will state two methods and two types of engine cooling systems and do it orally or written using wall charts or cutaway engine with 80% accuracy.	9.2	Correctly state two methods and two types of engine cooling systems.
9.3	Same Objective Write Up.	9.3	Correctly explain the function of the following seven units in the engine cooling system: A. Water Jackets B. Water Pump C. Fan and Shroud D. Radiator and Pressure cap E. Thermostat F. Temperature Gauge G. Oil Cooler
9.4	The student will explain the two types of engine cooler construction orally or in writing using wall charts or cutaway engine with 80% accuracy.	9.4	Correctly explain the two types of engine cooler construction.
9.5	The student will explain the operation of cooling system thermostats and state why engines must be operated near the permissable limits in writing or orally with wall charts & 80% accuracy.	9.5	Correctly explain the operation of engine thermostats and state why engines must be operated near the permissable limits.

COURSE DIESEL MECHANICS (BASIC)

TERMINAL PERFORMANCE OBJECTIVE NO. 9.0 (cont'd) Cooling Systems

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
9.6	The student given a shop laboratory engine or customer engine will perform the required service operations to drain, fill, flush with system cleaner, drain and flush with water and fill system with anti-freeze or coolant. Using shop manuals, necessary tools, and materials adjust anti-freeze protection for-20°F.	9.6	Service cooling system as follows: Drain fill, flush with cleaner, drain, flush with water and fill system with anti-freeze or coolant. Adjust anti-freeze protection to-20°F.
9.7	The student given a shop laboratory engine or a customer engine will perform the required service operations to replace a faulty water pump. Using manufactirers shop manuals, necessary tools and materials. All pump gasket joints must not leak, pump seal must not leak and all hose connections and drive belts in good condition and properly tightened. Test system at operating temperature and maximum R.P.M.	9.7	Service cooling system as follows: Drain system, replace faulty water pump, replace all gaskets, faulty hose and drive belts. Fill system and test for leaks at engine operating temperature and maximum engine R.P.M.

COURSE DIESEL MECHANICS (BASIC)

TERMINAL PERFORMANCE OBJECTIVE NO. 10.0 — Fuel Injection Systems

Upon completion of this unit on fuel injection systems 90% of the students will demonstrate through 80% correct responses to a criterian test, objective knowledge of fuel injection systems. The student will demonstrate his ability to perform required service operations on components during laboratory assignments. Using manufacturers service manuals, tools, parts, and materials. Clearance measurements must be ±.002 and no abnormal times used.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
		10.0	Test Attached.
10.1	Given a list of five function the fuel injection system must perform the student will demonstrate his knowledge of fuel injections systems orally or in writing by explaining each function with 80% accuracy.	10.1	Correctly explain the following five functions the fuel system must perform: A. Meter the fuel B. Time the fuel C. Control rate of injection D. Atomize the fuel E. Distribute the fuel
10.2	Given an illustration of a typical fuel injection system the student will demonstrate his understanding of the fuel system by tracing the flow of fuel and explaining the function of the various components with 80% accuracy.	10.2	Correctly trace the flow of fuel and explain the function of system components in a typical fuel system on the illustration assigned you.
10.3	The student will demonstrate his knowledge of fuel system design variations by listing five fuel injection design types with 80% accuracy.	10.3	List five fuel injection design types correctly.
10.4	Given an illustration of a typical cam-operated spray valve and a self-actuated spray valve, the student will state the two functions performed by injector spray valves and identify the various components of each type assembly with 80% accuracy.	10.4	Correctly state the two functions performed by fuel spray valves and identify the various components of both cam-operated and self-operated spray valves, on the illustration assigned you.

COURSE DIESEL MECHANICS (BASIC)

TERMINAL PERFORMANCE OBJECTIVE NO. 10.0 (cont'd) Fuel Injection System

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
10.5	Using wall charts and cutaway assembly of a unit injector the student will demonstrate his knowledge of this type injector by stating how the quantity and timing of fuel is accomplished and identify the various components of the assembly with 80% accuracy.	10.5	Correctly state how fuel quantity and timing is accomplished in unit injector type design and correctly identify the various components.
10.6	Using wall charts and cutaway assemblies of a Cummins PT fuel pump and unit injector. The student will demonstrate his knowledge of the PT injection system by stating orally or in writing the function of the units and identify the various components of the assembly with 80% accuracy.	10.6	Correctly state the function of Cummins PT Pump and unit injector and correctly identify the various components of the assemblies.
10.7	Given an illustration of the four basic design variations of fuel injections systems supply pumps, the student will demonstrate his knowledge of each type orally or in writing by correctly identifying each type and stating the operating principle of each type with 80% accuracy.	10.7	Correctly identify the four basic design variations of fuel injection system supply pumps and correctly state the operating principle of each type on the assignment.
10.8	The student given a shop laboratory or customer engine will remove, disassemble, clean, inspect for wear a Bosch fuel injection pump and injection nozzle. Using fuel injection pump maintenance manual, necessary tools and materials. Reassemble pump, run pump on test stand and calibrate pump units, disassemble clean and reassemble	10.8	Remove, clean, disassemble, inspect, and reassemble Bosch fuel injection pump and nozzle,. Time and reinstall pump and injection nozzle on engine. Test run engine-pump must be calibrated to 3cc per 1000R.P.M. and deliver 1600 Ps: with no leaks. Injection nozzle must hold 1600 Ps: with no leaks.

COURSE DIESEL MECHANICS (BASIC)

TERMINAL PERFORMANCE OBJECTIVE NO. 10.0 (cont'd) Fuel Injection System

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
10.8 (con.)	fuel injection nozzle. Time and assemble pump and nozzle on engine. Test run engine, pump units must be calibrated to 3cc per 1000 RPM with no leaks at 1600 PS: fuel injector must hold 1600 PS: with no leaks.		
10.9	The student given a shop laboratory or customer engine will remove, disassemble, clean, inspect for wear a General Motor unit injector. Using fuel injection maintenance manual, necessary tools and materials. Reassemble G.M. unit injector, test run unit injector in calibration stand and check injector for, rack freeness, plunger binding, fuel delivery, pressure holding, spray pattern and valve opening pressure. Calibration must be within 3cc of rated delivery for 1000 strokes, have no leaks and spray valve must hold 600 P.S.1. Install injector in engine time engine injector using injector highth guage and set valve clearance to .012 cold. Test run engine to maximum RPM after repairs.	10.9	Remove, clean, disassemble, inspect and reassemble G.M. unit injector. Test injector in calibration stand for capacity, rack freeness, plunger binding, spray pattern, pressure holding and spray valve opening pressure. Capacity calibration must be within 3cc for 1000 strokes and injector spray valve must hold 600 P.S.1. with no leaks.
10.10	The student given a shop	10.10	Remove, clean and replace engine

COURSE DIESEL MECHANICS (BASIC)

TERMINAL PERFORMANCE OBJECTIVE NO. 10.0 (cont'd) Fuel Injection System

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
10.10 (con)	laboratory or customer engine will perform the required service operations to remove, clean and replace the fuel oil strainer and filter the elements. Using shop manuals, necessary tools and materials. Reassemble strainer and filter elements and test on engine. Filters must be able to show no evidence of leaks at maximum engine RPM.	10.10	fuel filter and strainer elements. Reassemble filter and test on engine. Filter must show no evidence of leaks at maximum engine RPM.
10.11	The student given a shop laboratory or customer engine will perform the required service operations to remove, clean, inspect for wear a fuel oil supply pump. Using engine shop manuals, necessary tools and materials. Reassemble and test pump on engine, pump must deliver 50 PSI with no leaks.	10.11	Remove, disassemble, clean, inspect, for wear fuel oil supply pump. Reassemble and test on engine. Pump must deliver 50 P.S.I. with no leaks.

COURSE DIESEL MECHANICS-BASIC

TERMINAL PERFORMANCE OBJECTIVE NO. 11.0 Burning the Fuel

Upon completion of this unit on burning the fuel 90% of the students will demonstrate through 80% correct responses to a criterion test, objective knowledge of burning the fuel. The student will demonstrate his ability to perform required service operations on components during laboratory assignments, using manufacturers service manuals, tools, parts and materials. Clearance measurements must be ± .002 and no abnormal times used.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
		11.0	Test attached.
11.1	The student will demonstrate his knowledge of diesel combustion process orally or in writing by explaining the following factors: 1. Fine atomization 2. High temperature for prompt ignitions 3. High relative velocity between fuel and air particles 4 Good mixing of fuel and air particles that good combustion depends upon with 80% accuracy.		Correctly explain the four factors on which good diesel combustion depends.
11.2	The student will demonstrate his knowledge of the solid-injection principle orally or in writing by explaining the two requirements: 1. Atomization 2. Penetration, essential to burning the fuel efficently with 80% accuracy.	11.2	Correctly explain how atomization and penetration effect the efficiency of burning the fuel.
11.3	Using wall charts, cut away engine assembly and pistons of various crown designs the student will	11.3	Correctly explain the factors of single combustion space and air motion that are related to open combustion chambers.

COURSE DIESEL MECHANICS-BASIC

TERMINAL PERFORMANCE OBJECTIVE NO. 11.0 (cont'd) Burning The Fuel

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
11.3	Demonstrate his knowledge of open combustion chambers by explaining the factors of single space and air motion with 80% accuracy.		
11.4	Given an illustration four special design combustion chambers the student will identify each type design, and explain orally or in writing why engines operating on wide speed ranges use combustion chambers of special design, with 80% accuracy.	11.4	Correctly identify illustration of four special design combustion chambers and explain why engines operating on wide speed ranges use these chambers.
11.5	The student given a shop laboratory engine will perform the required service operations to remove a precombustion chamber cup and inspect for cracks and excessive nozzle wear, using manufacturer's shop manuals, necessary tools and materials. Useable chamber must show no evidence of cracks and nozzle opening show no more than .025 wear, reinstall and test engine at maximum R.P.M. Cup must show no evidence of leaks at injector area.	11.5	Remove, inspect and replace injector precombustion cup. Cup must have no cracks and wear must not exceed .025 at nozzle. Cup must show no evidence of leaks at injector area at maximum R.P.M.

COURSE DIESEL MECHANICS - BASIC

TERMINAL PERFORMANCE OBJECTIVE NO. 12.0

GOVERNING

Upon completion of this unit on engine governing 90% of the students will demonstrate through 80% correct responses to a criterion test, objective knowledge of engine governing. The student will demonstrate his ability to preform required service operations on components during laboratory assignments, using manufacturers service manuals, tools, parts and materials. Clearance measurements must be ± .002 and no abnormal times used.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
		12.0	Test attached
12.1	The student will demonstrate his knowledge of a engine governor orally or in writing by explaining what an engine governor does, with 80% accuracy.	12.1	Correctly explain what an engine governor does.
12.2	Using wall charts and cutaway engine assemblies the student will orally or in writing demonstrate his knowledge of how the governor controls engine speed, with 80% accuracy.	12.2	Correctly explain how the governor controls engine speed.
12.3	Given an illustration of a mechanical engine governor the student will demonstrate his knowledge of mechanical governors by identifying the components and stating how the regulating force is transmitted to the engine, with 80% accuracy.	12.3	Correctly identify the coponents in a mechanical governor and state how the regulating force is transmitted to the engine.

COURSE DIESEL MECHANICS-BASIC

TERMINAL PERFORMANCE OBJECTIVE NO. 12.0 (cont'd) of Governing

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
12.4	governors by identifying the components and stating how the regulating force is transmitted to the engine, with 80% accuracy.		
12.5	Given a list of seven governor modifications the student will demonstrate his knowledge of governor modifications by stating orally or in writing the function of each type application with 80% accuracy. 1. Isochronous governor 2. Permanent speed droop governor 3. Variable speed droop governor 4. Two speed mechanical governor 5. Overspeed governor and trips 6. Pressure regulating governor 7. Load-limiting governor	12.5	Correctly identify the following seven governor modifications by stating the function of each type application: a. Isochronous governor b. Permanent speed droop governor c. Variable speed droop governor d. Two speed mechanical governor e. Overspeed governor and trips f. Pressure regulating governor g. Load-limiting governor
12.6	The student given a shop laboratory or customer engine will remove, disassemble, clean, inspect for wear a two speed mechanical governor. Using manufacturers shop manual necessary tools and materials. Reassemble governor, install on engine, test run engine and set low and high speed ad-	12.6	Preform service operations on a two speed mechanical governor as follows: Remove, clean, disassemble, inspect for wear. Reassemble, installed engine and test run engine. Set low speed at 450 RPM and high speed at 2100 RPM with ± 10 RPM tolerance.

COURSE DIESEL MECHANICS-BASIC

TERMINAL PERFORMANCE OBJECTIVE NO. 12.0 (cont'd) Governing

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
12.6	justments as follows: Low speed: 450 RPM High speed: 2100 RPM with ± 10 RPM tolerance		
12.7	The student given a shop laboratory engine or customer engine will remove, disassemble, clean, inspect for wear a model: SG hydraulic governor. Using manufacturers shop manual, necessary tools and materials, reassemble governor, install on engine, test run engine and set low and high speed adjustments as follows: Low speed: 450 RPM High speed: 2100 RPM with ± 10 RPM tolerance.	12.7	Preform service operations on a model; SG hydraulic as follows: Remove, clean, disassemble, inspect forwear. Reassemble, install on engine and test run engine. Set low speed at 450 RPM; high speed at 2100 RPM with ± 10 RPM tolerance.