

Cape Cod Community College AMTS

Practical Project Guide for AMT 251 Powerplant Curriculum, Subject Items

Part 147, Appendix D, Part 1 - Subject A – Reciprocating Engines

Item 2. **Overhaul reciprocating engine.** (Level 2)

Item 3. **Inspect**, check, service, and repair reciprocating engines and reciprocating engine installations.
(Level 3)

Item 4. Install, troubleshoot, and remove reciprocating engines. (Level 3)

Project 1

Purpose: To learn to properly classify and describe various Reciprocating Engines as specified in the Type Certificate Data Sheets, and Manufacturer's Overhaul Manual. To familiarize the student with the nomenclature related to Reciprocating Engines

References:

- (1) 14 CFR, Federal Aviation Regulations for Aviation Maintenance Technicians (Current Edition), Aviation Maintenance Technician Handbook Powerplant, Volume 1 (FAA-H-8083-32) Chapter 1
- (2) Lycoming Overhaul Manual Direct Drive Engine
- (3) faa.gov

Equipment and Tools Needed:

- (1) faa.gov Type Certificate Data Sheets

Supplies and Materials Needed:

- (1) Computer with internet access

Procedure:

Complete following procedure

1. Describe the various Reciprocating Engines listed below by the model number
2. Describe the engines as per the T C D S and indicate the T C D S number and the latest revision number.
3. Answer the questions below. The first letters in the identification model number indicates the
 - a. The center number in the identification model number indicates the
 - b. The last letters and or numbers indicate the
 - c. List the description the following engines using the Engine Identification:
 - i. Model Code Lycoming O-320-H2AD T C D S Number
blank _____ Rev. blank _____ Description:
 - ii. Continental GT S I O-520- F T C D S Number blank
_____ Rev. blank _____ Description:
 - iii. Continental O-200-A T C D S Number blank _____ Rev.
blank _____ Description:
 - iv. Pratt & Whitney R-2800-31 T C D S Number blank _____
Rev. blank _____ Description:
4. Describe what the letters (H) and (L) indicate in the Engine Model Code
5. Locate and Identify No. 1 cylinder on the Pratt and Whitney R-2800 engine.
6. Draw a block diagram of Continental and Lycoming 4 and 6 cylinder engines. Then label each cylinder with the cylinder number.

Cape Cod Community College AMTS

Practical Project Guide for AMT 251 Powerplant Curriculum, Subject Items

Part 147, Appendix D, Part 1 - Subject A – Reciprocating Engines

- Item 2. **Overhaul reciprocating engine.** (Level 2)
- Item 3. **Inspect**, check, service, and repair reciprocating engines and reciprocating engine installations. (Level 3)
- Item 4. Install, troubleshoot, and remove reciprocating engines. (Level 3)

Project 2

Purpose: To learn to locate and identify various reciprocating engine components as specified Manufactures Overhaul Manuals, Illustrated Parts Catalog. To familiarize the student with the nomenclature related to Reciprocating Engines

References:

- (1) Aviation Maintenance Technician Handbook Powerplant, Volume 1 (FAA-H-8083-32) Chapter 1
- (2) Lycoming Overhaul Manual Direct Drive Engines
- (3) Lycoming O-320 series Illustrated Parts Catalog.

Equipment and Tools Needed:

- (1) Lycoming O-320 engine with the rocker box covers removed and all parts labeled with letters, including some detractors' letters.

Supplies and Materials Needed:

- (1) Computer with internet access to the manuals and IPC
- (2) Labels with letters, including some detractors' letters.

Procedure:

Complete the following procedure

1. Using the Manufacturer's Overhaul Manual and or Parts manual as a reference, identify the following components and be prepared for an oral check out:
 - a. Cylinder exhaust side blank _____ How do you know it's the exhaust side?
 - b. Cylinder intake side blank _____ How do you know it's the intake side?
 - c. Cylinder base flange blank _____
 - d. Cylinder head blank _____ Material type blank _____
 - e. Cylinder barrel blank _____ Material type blank _____
 - f. Intake Rocker Arm blank _____
 - g. Rocker Arm shaft blank _____
 - h. Exhaust valve spring blank _____
 - i. Right Magneto blank _____
 - j. # 3 cylinder Intake tube blank _____
 - k. Oil screen housing blank _____
 - l. # 4 cylinder rocker box oil drain tube elbow fitting blank _____
 - m. # 2 cylinder barrel fins blank _____
 - n. Propeller Attachment blank _____ Describe the type blank _____
 - o. # 1 cylinder intake valve spring stem key (valve keeper) blank _____

Cape Cod Community College AMTS

Practical Project Guide for AMT 251 Powerplant Curriculum, Subject Items

Part 147, Appendix D, Part 1 - Subject A – Reciprocating Engines

Item 2. **Overhaul reciprocating engine.** (Level 2)

Item 3. **Inspect,** check, service, and repair reciprocating engines and reciprocating engine installations.
(Level 3)

Project 3

Purpose: To learn to read and interpret information and follow the Lycoming Direct Drive Engine Overhaul Manual procedures for Engine Overhaul. This Project covers the removal of the Oil Sump, Accessory Housing and the engine cylinders.

References:

- (1) Aviation Maintenance Technician Handbook Powerplant, Volume 1 (FAA-H-8083-32) Chapter 1
- (2) Lycoming Direct Drive Engine Overhaul Manual
- (3) Lycoming O-320 series Illustrated Parts Catalog.

Equipment and Tools Needed:

- (1) Lycoming O-320 tear down engine
- (2) Student hand tools
- (3) Lycoming Engine Cylinder Base Wrenches

Supplies and Materials Needed:

- (1) Storage area for the components
- (2) Hardware storage for each cylinder
- (3) Lint Free rags

Procedure:

Complete following procedure

- (1) Pre-Inspection for Engine disassembly
 - a) Prepare the area and inspect the engine stand for security
 - b) Prepare an area for the oil sump , accessory case, and engine cylinder storage
 - c) Prepare a supply of various Fluid Line caps and plugs
 - d) Prepare an area for hardware storage for each cylinder
 - e) Insure an adequate supply of hand tools
 - f) Prepare the necessary special tools for cylinder removal
- (2) Perform a pre-disassembly inspection for condition, damage, cracks, leaks, etc.

- (3) Proceed to the Lycoming Direct Drive Engine Overhaul Manual and review Section 2 on the engine General Description.
- (4) Proceed to the Lycoming Direct Drive Engine Overhaul Manual and Section 8. Follow the procedures to remove the Engine Oil Sump. Secure the hardware and place the Sump in the assigned storage area.
- (5) Proceed to the Lycoming Direct Drive Engine Overhaul Manual and Section 5. Follow the procedures to remove the Accessory Housing. Secure the hardware and place them in the assigned storage area.
- (6) Proceed to the Lycoming Direct Drive Engine Overhaul Manual and Section 6. Follow the procedures to remove all cylinders. Secure the hardware and place them in the assigned storage area.
- (7) List any discrepancies or missing parts.

Cape Cod Community College AMTS

Practical Project Guide for AMT 251 Powerplant Curriculum, Subject Items

Part 147, Appendix D, Part 1 - Subject A – Reciprocating Engines

- Item 2. **Overhaul reciprocating engine.** (Level 2)
- Item 3. **Inspect**, check, service, and repair reciprocating engines and reciprocating engine installations. (Level 3)
- Item 4. Install, troubleshoot, and remove reciprocating engines. (Level 3)

Project 4

Purpose: To learn to read and interpret information and follow the Lycoming Direct Drive Engine Overhaul Manual procedures for Engine Overhaul. This Project covers the Disassembly and Inspection of the Cylinder Assemblies.

References:

- (1) Aviation Maintenance Technician Handbook Powerplant, Volume 1 (FAA-H-8083-32) Chapter 1
- (2) Lycoming Direct Drive Engine Overhaul Manual
- (3) Lycoming O-320 series Illustrated Parts Catalog.

Equipment and Tools Needed:

- (1) Lycoming O-320 tear down engine
- (2) Student hand tools
- (3) Lycoming Engine Special Tools
- (4) Percussion Instruments
- (5) Valve Seat Grinding Equipment
- (6) Valve Grinder

Supplies and Materials Needed:

- (1) Storage area for each cylinder
- (2) Hardware storage for each cylinder
- (3) Lint Free rags

Procedure:

Complete following procedure

1. Pre-Inspection for Engine disassembly:
 - a. Insure an adequate supply of hand tools
 - b. Prepare the necessary special tools for cylinder inspection
 - c. Lint Free rags
2. Perform a pre-disassembly inspection for condition, damage, cracks, leaks, etc.
3. Proceed to the Lycoming Direct Drive Engine Overhaul Manual and review Section 6-1 – 6-7 on the general cylinder information.
4. Proceed to the Lycoming Direct Drive Engine Overhaul Manual and Section 6-18. Follow the Disassembly procedures of each Cylinder Assembly. Secure the hardware and component parts and place them in the assigned storage area. Insure that the components stay with the correct cylinder.
5. Proceed to the Lycoming Direct Drive Engine Overhaul Manual and Section 6-18. Follow the Inspection procedures for each cylinder. Construct a chart and record all dimensional inspection information.
6. Proceed to the Lycoming Direct Drive Engine Overhaul Manual and Section 6-67. Follow the Valve Seat Grinding Procedures. Complete at least one valve seat.
7. Proceed to the Lycoming Direct Drive Engine Overhaul Manual and Section 6-80. Follow the Valve refacing procedures. Reface at least one valve.
8. List any discrepancies or missing parts.

Cape Cod Community College AMTS

Practical Project Guide for AMT 251 Powerplant Curriculum, Subject Items

Part 147, Appendix D, Part 1 - Subject A – Reciprocating Engines

Item 3. **Inspect**, check, service, and **repair reciprocating engines** and reciprocating engine installations.
(Level 3)

Project 5

Purpose: To practice the inspection and repair of damaged Cylinder Cooling Fins.

References:

- (1) Aviation Maintenance Technician Handbook Powerplant, Volume 1 (FAA-H-8083-32) Chapter 1
- (2) Lycoming Direct Drive Engine Overhaul Manual
- (3) Lycoming O-320 series Illustrated Parts Catalog.

Equipment and Tools Needed:

- (1) Lycoming O-320 tear down engine
- (2) Student hand tools

Supplies and Materials Needed:

- (1) cylinder with damaged cooling fin(s)
- (2) 3/16 –Inch drill bit
- (3) Fluorescent penetrant inspection kit

Procedure:

Complete following procedure

- (1) Inspect the assigned cylinder's cooling fins for damage and repair the damage found as per the Lycoming Direct Drive Overhaul Manual instructions.
- (2) Perform Fluorescent Penetrant Inspection as per the Lycoming Direct Drive Overhaul Manual procedures.

Cape Cod Community College AMTS

Practical Project Guide for AMT 251 Powerplant Curriculum, Subject Items

Part 147, Appendix D, Part 1 - Subject A – Reciprocating Engines

- Item 2. **Overhaul reciprocating engine.** (Level 2)
- Item 3. **Inspect**, check, service, and repair reciprocating engines and reciprocating engine installations. (Level 3)
- Item 4. Install, troubleshoot, and remove reciprocating engines. (Level 3)

Project 6

Purpose: To learn to read and interpret information and follow the Lycoming Direct Drive Engine Overhaul Manual procedures for Engine Overhaul. This Project covers the Disassembly and Inspection of the Crankcase, Crankshaft and Reciprocating Parts.

References:

- (1) Aviation Maintenance Technician Handbook Powerplant, Volume 1 (FAA-H-8083-32) Chapter 1
- (2) Lycoming Direct Drive Engine Overhaul Manual
- (3) Lycoming O-320 series Illustrated Parts Catalog.

Equipment and Tools Needed:

- (1) Lycoming O-320 tear down engine
- (2) Student hand tools
- (3) Lycoming Engine Special Tools
- (4) Percussion Instruments
- (5) Torque Wrenches

Supplies and Materials Needed:

- (1) Storage area for each cylinder
- (2) Hardware storage for each cylinder
- (3) Lint Free rags

Procedure:

Complete following procedure

1. Pre-Inspection for Engine disassembly
 - a. Prepare an area for the engine crankcase, crankshaft and reciprocating parts storage
 - b. Prepare an area for associated hardware and component storage
 - c. Insure an adequate supply of hand tools
 - d. Prepare the necessary special tools for disassembly and inspection of the Crankcase, Crankshaft and Reciprocating Parts.
2. Perform a pre-disassembly inspection for condition, damage, cracks, leaks, etc.
3. Proceed to the Lycoming Direct Drive Engine Overhaul Manual and review Section 7-1 information.
4. Proceed to the Lycoming Direct Drive Engine Overhaul Manual and Section 7-2. Follow the procedures for Crankcase Disassembly. Secure the hardware and place the crankcase in the assigned storage area.
5. Proceed to the Lycoming Direct Drive Engine Overhaul Manual and Section 7-22. Follow the Inspection procedures for the Crankcase, Crankshaft and Reciprocating Parts. Construct a chart and record all dimensional inspection information.
6. Proceed to the Lycoming Direct Drive Engine Overhaul Manual and Section 7-67. Follow the assembly procedures of the Crankcase, Crankshaft and Reciprocating Parts
7. List any discrepancies or missing parts.

Cape Cod Community College AMTS

Practical Project Guide for AMT 251 Powerplant Curriculum, Subject Items

Part 147, Appendix D, Part 1 - Subject A – Reciprocating Engines

Item 2. **Overhaul reciprocating engine.** (Level 2)

Item 3. **Inspect**, check, service, and repair reciprocating engines and reciprocating engine installations.
(Level 3)

Item 4. Install, troubleshoot, and remove reciprocating engines. (Level 3)

Project 7

Purpose: To learn to read and interpret information and follow the Lycoming Direct Drive Engine Overhaul Manual procedures for Engine Overhaul. This Project covers the Reassembly of the Engine.

References:

- (1) Aviation Maintenance Technician Handbook Powerplant, Volume 1 (FAA-H-8083-32) Chapter 1
- (2) Lycoming Direct Drive Engine Overhaul Manual
- (3) Lycoming O-320 series Illustrated Parts Catalog.

Equipment and Tools Needed:

- (1) Lycoming O-320 tear down engine
- (2) Student hand tools
- (3) Lycoming Engine Special Tools
- (4) Torque Wrenches

Supplies and Materials Needed:

- (1) Hardware for each section
- (2) Lubricating oil as recommended
- (3) Lint Free rags

Procedure:

Complete following procedure

1. Proceed to the Lycoming Direct Drive Engine Overhaul Manual and Section 6-11. Follow the procedures for Reassembly of the Cylinder Assemblies
2. Proceed to the Lycoming Direct Drive Engine Overhaul Manual and Section 5-25. Follow the procedures for Reassembly of the Accessory Housing.
3. Proceed to the Lycoming Direct Drive Engine Overhaul Manual and Section 8-30. Follow the assembly procedures of the Engine Oil Sump.

4. Proceed to the Lycoming Direct Drive Engine Overhaul Manual and Section 9-1. Review the Test Procedure requirements. Then construct an Engine Test Run Checklist.
5. Proceed to the Lycoming O320 Test Cell and perform the engine test run, recording all the data required by your checklist.
6. Complete a Log Book entry concerning the engine test run.
7. List any discrepancies or missing parts.

Cape Cod Community College AMTS

Practical Project Guide for AMT 251 Powerplant Curriculum, Subject Items

Part 147, Appendix D, Part 1 - Subject A – Reciprocating Engines

- Item 3. **Inspect, check, service**, and repair reciprocating engines and reciprocating engine installations. (Level 3)
- Item 4. **Install, troubleshoot, and remove reciprocating engines**. (Level 3)

Project 8

Purpose: To learn to properly remove, install, check, service and inspect reciprocating engines. To familiarize the student with the proper Log Book entry procedures.

References:

- (1) 14 CFR, Federal Aviation Regulations for Aviation Maintenance Technicians (Current Edition), Aviation Maintenance Technician Handbook Powerplant, Volume 1 (FAA-H-8083-32) Chapter 1
- (2) AeroTrain AE-25-520 Engine Removal and Replacement Trainer Procedure Manual
- (3) faa.gov (TCDS) Type Certificate Data Sheets

Equipment and Tools Needed:

- (1) AeroTrain AE-25-520 Engine Removal and Replacement Trainer
- (2) Engine Hoist (height and capacity)
- (3) Tool Cabinet equipped with all hand tools
- (4) Engine oil drain container
- (5) Cowling Rack or suitable cowling storage area
- (6) Propeller stand or suitable storage area
- (7) Component storage area as necessary
- (8) Tool Cabinet with full set of hand tools
- (9) Torque Wrenches - Snap-On Torque wrench cabinet

Supplies and Materials Needed:

- (1) Lint Free rags
- (2) Various Fluid Line caps and plugs
- (3) Component and Hardware tags and/or storage bags
- (4) Oil dry as necessary
- (5) Computer with internet access

Procedure:

Complete following procedure

1. Pre-Inspection for Engine Removal
 - a) The Engine Nacelle is from a 1977 Cessna 421 Golden Eagle S/N 421C-416. TCDS # A7CE. Is the engine installed approved to be in this airframe? Yes
No Explain briefly
 - b) Prepare the area and secure the Trainer
 - c) Inspect the engine hoist for height and capacity
 - d) Prepare an area for the Cowling and Propeller storage
 - e) Prepare a supply of various Fluid Line caps and plugs
 - f) Prepare component, electrical tags and hardware storage.
 - g) Insure an adequate supply of hand tools
 - h) Secure an engine oil drain container
 - i) Aircraft Power disconnected
2. Perform a pre-removal inspection for condition, damage, cracks, leaks, etc.
3. Proceed to the Engine Removal and Replacement Trainer Manual and follow the removal instructions (71-00-01)
4. Once the engine is removed and secured, Inspect the nacelle engine mounts for condition, cracks, wear, etc. List and discrepancies and discuss with the Instructor
5. Clean the Engine nacelle area.
6. Install the engine in accordance with the Engine Removal and Replacement Trainer Manual and follow the engine Installation instructions (71-00-02)
7. Following the Installation,
 - a) Check all fluid and electrical connections
 - b) Service the engine oil
 - c) Inspect all engine components for security
8. Install the cowling
9. Clean the area and return all tools and supplies to their storage area
10. Complete a log book entry describing your task. Total time on the engine is 3553.7 hours

Cape Cod Community College AMTS

Practical Project Guide for AMT 251 Powerplant Curriculum, Subject Items

Part 147, Appendix D, Part 1 - Subject A – Reciprocating Engines

Item 4. Install, **troubleshoot**, and remove reciprocating engines. (Level 3)

Project 9

Purpose: To practice troubleshooting by reading and interpreting information found in manufacturer's manuals and the FAA-H-8083-32 Powerplant handbook.

References:

- (1) Aviation Maintenance Technician Handbook Powerplant, Volume 1 (FAA-H-8083-32) Chapter 1
- (2) Lycoming O-235, O-320, and O-540 Engine Service & Parts Manuals
- (3) Lycoming Direct Drive Overhaul Manual
- (4) Lycoming O-320 Parts Manual
- (5) Continental T S I O-520 Engine Service Manual
- (6) Piper Comanche 250 (PA-24) Service Manual
- (7) Piper Colt Flight Manual
- (8) Cessna 402C Service Manual

Equipment and Tools Needed:

- (1) None

Supplies and Materials Needed:

- (1) None

Procedure:

Complete following procedure

1. The Instructor will assign 2 of the below scenarios to the student. The Instructor will act as the flight crew/pilot for the aircraft indicated.
2. The student must:
 - a) Gather whatever information they need to solve the problem.
 - b) Prepare a plan to solve the problem. This plan must include whatever Tests they wish to run, where the Tests would be run, and what the results would be if there was no problem with the engine.
3. When the Plan is complete, present it to the Instructor who will indicate results of the Tests the student wishes to run.
4. Based on #3 above, the student will determine what's wrong with the engine and what needs to be done to repair it.
5. When 1-4 are completed, hand in the Project Sheet along with the Plan and repair recommendations.

INSTRUCTOR NOTE: Below are possible causes of the indicated Scenarios. Choose one when you assign the Scenarios. Based on that choice, answer any questions they may have for the "flight crew/pilot" accordingly and study their tests and give them results according to the cause you chose. Don't forget to write down your choice somewhere. NOTE: you may get or know of more causes than listed below. Use them, too.

Scenarios:

- | | |
|---|-------------------------|
| 1) Engine quits at idle. | Scenario #: blank _____ |
| 2) Low Static R P M. | Aircraft: blank _____ |
| 3) No R P M drop on Left Magneto. | Engine: blank _____ |
| 4) High Fuel Flow indicated. | Scenario #: blank _____ |
| 5) Engine stumbles during acceleration. | Aircraft: blank _____ |
| 6) High Oil consumption. | Engine: blank _____ |
| 7) Won't start. | |
| 8) Oil Pressure excessively high. | |
| 9) R P M drops right off to zero when going from Full Rich to Idle Cut Off at Idle R P M. | |
| 10) Engine does not want to quit when Mixture Control is in Idle Cutoff. | |
| 11) Black smoke coming from exhaust. | |
| 12) Engine won't turn over when the starter is turned on. | |
| 13) EGT is excessive at full power. | |
| 14) Fuel leaking from Carb Heat Box after engine shut down. | |
| 15) Low alternator voltage. | |
| 16) Engine runs OK when the Fuel Boost Pump is on but dies when it's turned off. | |

This workforce product was funded by a grant awarded by the U.S. Department of Labor's Employment and Training Administration. The product was created by the grantee and does not necessarily reflect the official position of the U.S. Department of Labor. The U.S. Department of Labor makes no guarantees, warranties, or assurances of any kind, express or implied, with respect to such information, including any information on linked sites and including, but not limited to, accuracy of the information or its completeness, timeliness, usefulness, adequacy, continued availability, or ownership.

This work is licensed under a Creative Commons Attribution 4.0 International License.

