THEORY AND MAINTENANCE

RECIPROCATING ENGINES ORAL

1. How are conventional reciprocating engines classified?

   They are classified according to cylinder arrangement with respect to the crankshaft (in-line, V-type, radial and opposed), or according to method of cooling (liquid cooled or air cooled).

2. What are the different types of piston rings?

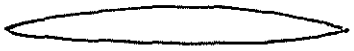
   Compression rings, oil control rings, and scraper rings.

3. What is the purpose of the oil control rings?

   They are used to control the thickness of the oil film on the cylinder walls.

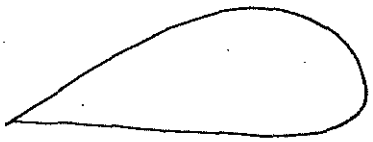
4. What may be the result of installing piston rings incorrectly?

   Excessive oil consumption.



5. What type of piston rods are commonly found in radial engines?

   A master and articulating rod assembly.



6. What type bearings are in general use in reciprocating engines?

   Plain bearings, which are generally used for crankshaft, cam ring, camshaft, connecting rods, and accessory drive shaft bearings. Roller bearings, which are used primarily as crankshaft main bearings, but have other applications as well. Ball bearings, which are used for supercharger impeller shaft bearings, rocker arm bearings in some engines, and as propeller thrust bearings.

7. What is the indication of valve blowby?

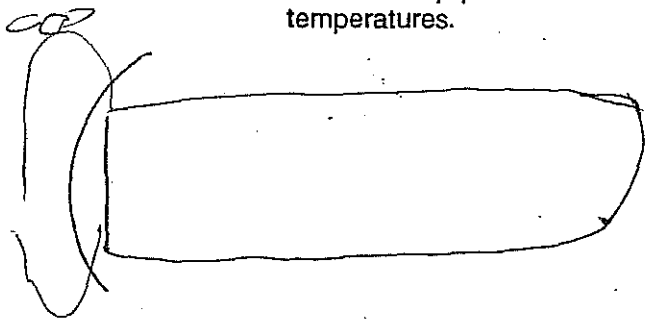
   Valve blowby is indicated by a hissing or whistle when pulling the propeller through prior to starting the engine. A cylinder compression check should be made to identify the faulty cylinder.

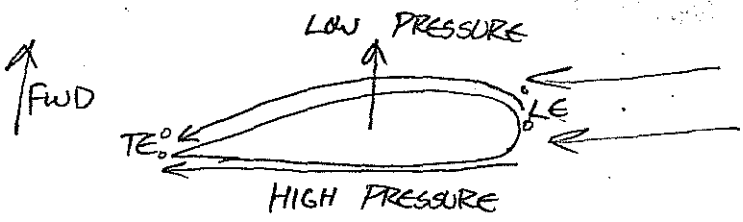
8. What is the purpose of using more than one spring for valve closing?

   If only one spring is used to close the valve, it will vibrate or surge at certain speeds. To eliminate this difficulty, two or more springs, one inside the other are installed on each valve. Each spring will vibrate at a different engine speed, and the spring surge vibrations will be dampened. Two or more springs also reduce the danger of weakness and possible failure by breakage due to heat and metal fatigue.

9. What is the purpose of valve overlap?

   Valve overlap permits better volumetric efficiency and lowers the cylinder operating temperatures.





10. Describe the inspection you would give the valve springs during engine overhaul.

They should be cleaned thoroughly, and then visually inspected for evidence of overheating, cracks, broken ends, and for compression strength.

11. What is the purpose of using valves with sodium filled stems?

Some intake and exhaust valve stems are hollow and partially filled with metallic sodium. Sodium is used because it is an excellent heat conductor. The sodium melts at about 208°F., and the movement of the valves circulates the liquid sodium which enables it to carry the heat from the valve head to the stem, where it is dissipated through the valve guide to the cylinder head and cooling fins.

12. What causes engine sudden stoppage?

Striking an object or engine seizure due to internal damage.

13. What type inspection must be made after sudden stoppage of an engine due to striking and object?

The propeller drive shaft must be checked for misalignment, and the propeller checked for track.

14. What is the purpose of crankshaft dynamic dampers used in aircraft engines?

Dampers are used to overcome forces which cause deflection of the crankshaft and torsional vibration. These forces are generated by the power impulses of the pistons. Crankshaft vibrations are reduced by placing floating dampers (weights) in the counterweight assembly, particularly in a single throw type crankshaft.

15. How would you make a "runout" check on a crankshaft that is still installed in the engine?

Remove the propeller from the shaft and attach a dial indicator gage to the front of the crankcase. Adjust the position of the gage needle so that it is touching the shaft. Turn the engine through with the starter and note any changes in the gage reading.

16. What is detonation?

Normal combustion is when the fuel-air mixture burns at a uniform rate across the combustion chamber. The temperature and pressure within the cylinder rises at a normal rate as the mixture burns. All fuels have critical limits of temperature and compression and beyond this limit they will ignite spontaneously and burn with explosive violence. This instantaneous explosive burning of the last portion of the charge is called detonation.

17. During valve clearance adjustment on an R-2800 engine, why must you depress certain valves other than the ones being adjusted?

The valves must be depressed (unloaded) in order to remove the spring tension from the side positions on the cam and thus permit the cam to slide away from the valves to be adjusted until it contacts the cam bearing. This prevents cam shift from introducing errors in the clearance settings.

18. What can be learned about the condition of an engine by studying the results of a compression check?

From the cylinder compression check you can determine if the valves, piston rings, and pistons are adequately sealing the combustion chamber.

19. How can a cold cylinder be located on a double row radial engine?

    A cold cylinder check can be made with a cold cylinder indicator, sometimes called a "magic wand", to locate any cylinder that has a temperature lower than the normal operating temperature of the other cylinders.

20. What instrument can be used to check a cylinder bore for out of roundness?

    A cylinder bore can be checked with dial indicator, a telescopic gage and micrometer, or an inside micrometer.

RECIPROCATING ENGINES PROJECTS

1. Check piston rings for correct end and side clearance.
2. Check valve stems for stretch using a contour gage or micrometer.
3. Repair a scored aluminum piston.
4. Locate and inspect engine mounts in accordance with reference material.
5. Adjust engine oil pressure in accordance with reference material.
6. Demonstrate correct engine starting procedures.
7. Operate an engine throughout the normal operating range and check for proper operation in accordance with the operating instructions.
8. Use a cold cylinder indicator and locate a cold cylinder after an engine runup.
9. Using reference material, correctly remove and reinstall a propeller.
10. Correctly identify all the parts of an air cooled cylinder.
11. Correctly identify all the parts of a crankshaft.
12. Using reference material, inspect a crankshaft, record the dimensions, and determine if the crankshaft is within tolerance to meet return to service quality.
13. Correctly identify various types of bearings and determine if they are return to service quality.
14. Measure the inside diameter, taper, and out-of-round of a cylinder bore and determine if it is return to service quality.
15. Using reference material, check and adjust valve clearances within the given limits.
16. Correctly disassemble an articulating rod from a master rod assembly, and reassemble according to manufacturer's instructions.
17. Adjust a mechanical push-pull control system in accordance with reference material.
18. Install a piston pin, a knuckle pin, and the retainer without damage to the components.

TURBINE ENGINES ORAL

1. What are the major components of a typical gas turbine engine?

   A typical gas turbine engine consists of an air inlet, a compression section, a combustion section, a turbine section, an exhaust section, and the accessory section.

2. What are the two principal types of compressors used in turbojet aircraft?

   The two most common compressors in use today are the centrifugal flow and the axial flow types.

3. What are three types of combustion chamber systems?

   They are the can type, the can-annular type, and the annular type.

4. What is the purpose of the interconnector tubes between can type combustion chambers?

   To spread the flame to the combustion chambers that are not equipped with igniter plugs during engine starting.

5. What prevents burning of the liner walls in can type combustion chambers?

   Louvers are provided along the axial length of the liners to direct a cooling layer of air along the inside wall of the liner.

6. What types of damage may be found when inspecting compressor blades?

   Dents, scratches, gouges, galling, burns, burrs, pitting and cracks.

7. What is the location and function of the diffuser section in a turbine engine?

   The diffuser is the divergent section of the engine located between the compressor section and the burner cans. Its function is to change the high velocity compressor discharge air to static pressure.

8. Where are stress rupture cracks most likely to occur on turbine blades?

   They usually appear as small hairline cracks on or across the leading or trailing edge of the blades. The cracks appear at right angles to the edge length.

9. How are compressor blades attached to a disk-type rotor?

   The compressor blades are fitted into the disks by either bulb-type or fir-tree type roots. The blades are then locked by means of screws, peening, locking wires, pins, or keys.

10. What is the purpose of the nozzle diaphragm or turbine nozzle?

    First, the turbine nozzle must prepare the mass airflow for driving the turbine rotor. The stationary vanes are shaped and set at such an angle that they form a number of small nozzles that discharge the gases at extremely high speed. That is, they convert a portion of the heat and pressure energy to velocity energy to drive the turbine. The second purpose of the turbine nozzle is to deflect the gases to a specific angle in the direction of turbine rotation.

11. What is the major difference between a turboprop and a turbojet engine?

    A turboprop engine usually has more turbine stages than the turbojet engine. In addition to operating the compressor and accessories, the turboprop turbine must also drive a propeller.

12. What is a turbofan engine?

    A turbofan engine is, in principle, the same as a turboprop, except that the propeller is replaced by a duct-enclosed axial flow fan.

13. What is the effect of air density on the thrust of a turbine engine?

    Air density determines the mass of air that is used by a jet engine. The factors that affect density are the temperature and pressure of the air. If density increases, thrust increases, and vice versa. An increase in air temperature entering an engine will cause a decrease in density and thrust. An increase in air pressure entering the engine will cause an increase in density and thrust. With a given throttle setting, engine thrust will vary if the temperature or pressure of the air entering the engine changes.

14. What are the two most common types of thrust reversers?

    The mechanical blockage type and the aerodynamic blockage type.

15. What is a split compressor system in a turbine engine?

    The split compressor system requires two concentric shafts joining the turbine stages to their respective compressors.

16. What is one method of relieving thermal stress on a turbine disk.?

    One means is to bleed cooling air back onto the face of the disk.

17. What may be the indications if a turbojet engine is out of trim?

    The engine has high exhaust gas temperature (EGT) at target engine pressure ratio (EPR) for takeoff.

TURBINE ENGINES PROJECTS

1. Remove and install a combustion chamber case and liner.
2. Adjust turbine engine fuel control.
3. Properly start, operate, and shutdown a turbine engine.
4. Identify turbine blades.
5. Identify the major components of a turbine engine.
6. Identify different types of compressors.
7. Correctly remove and reinstall a fuel nozzle in a turbine engine.
8. Inspect combustion liners and determine their return to service quality.
9. Check the axial and radial clearance of turbine blades and determine if clearance is within limits.

10. Inspect inlet guide vanes and compressor blades for damage and determine if engine is return to service quality.

11. Identify and list different types of damage on turbine blades.

12. Remove and reinstall compressor or turbine blades.

13. Identify damage to nozzle guide vanes.

14. Adjust turbine idle rpm to within limits required by reference material.

15. Using reference material, perform a hot start inspection.

16. Using reference material, perform an overspeed inspection.

17. Match a list of turbine indication malfunctions with the possible cause of each malfunction.

18. Label the direction of airflow on a drawing of a turbine engine, and indicate the changes in air pressure between engine sections.

ENGINE INSPECTION ORAL

1. What steps must be taken in order to prepare an aircraft for a 100 hour or annual inspection?

   Remove or open all necessary inspection plates, access doors, fairing and cowling. Then thoroughly clean the aircraft and the engine.

2. What may be used as a guide for a 100 hour inspection on an aircraft engine?

   FAR Part 43, Appendix D.

3. What additional inspection must be performed if the cylinder compression is weak?

   You must make an internal cylinder inspection for improper internal tolerances.

4. Where are the engine operating limitations found?

   In the Aircraft Specifications or Type Certificate Data Sheet.

5. Where can a mechanic look to identify an aircraft engine?

   On the engine identification plate that is affixed to the engine at an accessible location.

6. What publication is needed to inspect an engine for conformity with specifications?

   The Engine Specifications or Engine Type Certificate Data Sheet.

7. What type of FAA approval is required when a change to an engine type design is not enough to require a new Type Certificate?

   A Supplemental Type Certificate is required.

8. What type of FAA approval is required when a change is made to the engine principle of operation?

   A new Type Certificate must be obtained.

ENGINE INSPECTION PROJECTS

1. Inspect an engine and determine conformity with the Engine Specifications or Engine Type Certificate Data Sheet.
2. Make a check list for a 100 hour inspection that includes the scope and detail of the requirements set for the in FAR Part 43, Appendix D.
3. Perform a 100 hour inspection and list any discrepancies found.
4. Inspect an aircraft engine and determine if it is in compliance with a specific Airworthiness Directive.
5. Inspect aircraft engine accessories for conformity.
6. Check engine controls for freedom of operation.
7. Review aircraft maintenance records and determine compliance with the required Airworthiness Directives by inspection of the engine.
8. Find and list all the information from an engine data plate.
9. Check an engine for fluid leaks after engine operation and determine return to service quality.
10. Inspect an aircraft engine for compliance with a service bulletin.

SYSTEMS AND COMPONENTS

ENGINE INSTRUMENT SYSTEMS ORAL

1. What are the units in an engine fuel flow system?

   The system consists of a transmitter and an indicator for each engine.

2. Where is the fuel flow transmitter located?

   It is mounted in the fuel line between the engine driven pump and the carburetor.

3. What type of readout is indicated on a fuel flow system?

   The indicator is calibrated to record the fuel flow in pounds of fuel per hour.

4. What is the reason for monitoring the fuel flow?

   In addition to fuel consumption, the operator can determine from the fuel flow indication whether the engine is operating at the correct fuel-air mixture for a given power setting.

5. What does a manifold pressure gage indicate?

   It measures absolute pressure in the intake manifold.

6. What would be the effect of a broken manifold pressure gage line?

   A broken line will cause the gage to indicate atmospheric pressure.

7. What does the engine tachometer indicate?

   It indicates crankshaft speed (rpm).

8. What are turbine engine tachometers designed to indicate?

   They are designed to indicate percent of rotor rpm.

9. What is turbojet EPR?

   It is a ratio between total turbine discharge pressure to total inlet pressure, and is an indication of thrust being developed by the engine.

10. What is the electric source for a cylinder head temperature gage?

    The gage is connected to a thermocouple attached to the cylinder which tests show to be the hottest on the engine.

11. Where is a carburetor air temperature bulb located?

    It is located in the air intake passage to the engine.

12. How can a turbine engine EGT be checked without operating the engine?

    By checking resistance to thermocouples and circuits.

ENGINE INSTRUMENT SYSTEMS PROJECTS

1. Measure the resistance of thermocouple leads.
2. Check a manifold pressure gage for proper operation.
3. Repair a leaking manifold pressure system.
4. Locate and repair a loose line on a turbine engine EPR system.
5. Inspect EGT probes and determine their return to service quality.
6. Locate and inspect fuel warning low pressure system components.
7. Remove and reinstall a carburetor air temperature thermocouple.
8. Replace a cylinder head temperature thermocouple assembly and check for proper operation.
9. Inspect an rpm gage for proper markings by reviewing the engine operating limitations.
10. Locate and inspect fuel flow system components.
11. Remove and reinstall a fuel flow gage.
12. Remove and reinstall a fuel flow transmitter.
13. Measure the electrical power supply to a fuel flow transmitter.
14. Remove and reinstall turbine engine EGT harness.

ENGINE FIRE PROTECTION SYSTEMS ORAL

1. What types of fire detectors are used for engine fire protection systems?

They are overheat detectors, rate-of-temperature-rise detectors, and flame detectors.

2. When using a thermocouple type fire-detector system, what happens if the engine overheats slowly?

A thermocouple depends on the rate of temperature rise and will not give a warning if the engine slowly overheats or a short circuit develops.

3. Describe the operation of a Kidde continuous loop fire detector system?

The Kidde continuous loop system has two wires imbedded in a special ceramic core within an Inconel tube. One wire acts as an internal ground and the other wire is a hot lead that provides a current when the ceramic core material changes its resistance with a rise in temperature.

4. Where does a thermocouple fire detector system get its electrical power to operate?

The thermocouple produces power to close a relay, and power from the aircraft electrical system flows through the relay to the warning light.

5. Describe a thermal switch fire detector system?

Thermal switch systems have one or more lights that are energized by the aircraft electrical system when a heat sensitive thermal switch closes the circuit at a specific temperature.

6. How are thermal switches electrically connected in the circuit?

The thermal switches are connected in parallel with each other but in series with the warning light. A temperature rise in any one section of the circuit will cause a thermal switch to close and complete the circuit to indicate a fire or overheat condition.

7. What is the most common cause of a false fire warning in a continuous loop detector system?

The most common cause of false warnings is dents, kinks, or crushed sensing element causing an internal wire to short to the ground wire or outer tubing.

8. What two methods are used to discharge fire extinguishing agents?

Mechanical and electrical.

9. What method is used to release the fire extinguishing agent in a typical turbine engine fire protection system?

One common method is to equip the fire extinguishing containers with discharge valves that are operated by electrically discharged cartridges. The discharge plug is sealed with a breakable disk that is ruptured by the explosive cartridge, and the contents of the bottle is discharged into the engine area.

10. What method is used to determine proper fire extinguisher container pressure?

Check the container gage to determine if the pressure is between the prescribed minimum and maximum limits.

11. What method other than the pressure gage is used to indicate low agent pressure in a container?

    Some aircraft are equipped with a low pressure warning light in the cockpit.

12. What is the purpose of the yellow and the red discharge plugs in a turbine engine fire extinguishing system?

    The yellow plug indicates normal discharge, and the red plug indicates thermal discharge.

13. What are two methods commonly used to distribute the fire extinguishing agent to the engine?

    Many systems use perforated tubing or discharge nozzles to distribute the agent.

14. How does the fire extinguishing agent put out the fire?

    It dilutes the atmosphere so that it will not support combustion.

15. What is a HRD fire extinguishing system?

    High Rate of Discharge.

16. How is the fire extinguishing agent distributed from a HRD system?

    It is delivered from open-end tubes.

17. How long does it take to discharge the extinguishing agent in a HRD system?

    It takes only 1 to 2 seconds.

ENGINE FIRE PROTECTION SYSTEMS PROJECTS

1. Identify the different types of fire detection sensing units.
2. Inspect a continuous loop fire detection system and point out any damaged areas.
3. Make a continuity check of a fire detection system, locate a fault, and repair the system.
4. Inspect a fire extinguishing system blowout plugs and determine if the pressure is within the allowable limits.
5. Check the pressure in a fire extinguisher container and determine if the pressure is within the allowable limits.
6. Inspect a fire extinguisher container discharge cartridge for service life and determine return to service quality.
7. Check a fire extinguisher cartridge discharge circuit for continuity with a voltmeter by removing the electrical connection to the cartridge.
8. Service a CO2 fire extinguisher bottle.
9. Check a manually operated fire extinguishing agent discharge handle for proper operation without discharging the agent.
10. Use a fire detector test unit and verify the proper operation of a fire detector.

ENGINE ELECTRICAL SYSTEMS ORAL

1. How would you seat newly installed generator brushes to the commutator?

   When new brushes are installed in a generator the face of the brushes must be shaped to provide an area of maximum contact with the commutator. To seat the brushes use number 000 sandpaper placed around the commutator with the sanding surface facing outward. Turn the armature in the normal direction of rotation until the face of the brushes is properly contoured. Remove the sandpaper and blow out any residue with compressed air.

2. Where is the generator rating and performance data located?

   It is stamped on the name plate attached to the generator.

3. What units make up a DC generator three unit regulator?

   The voltage regulator, the current limiter, and the reverse current cutout.

4. What method is used to control the voltage of an aircraft alternator?

   The frequency depends upon the speed of rotation of the rotor and the number of poles.

5. What determines the frequency of the voltage of an alternator?

   The frequency depends upon the speed of rotation of the rotor and the number of poles.

6. How is alternator frequency maintained?

   By installing a constant speed drive (CSD) unit between the engine and the alternator.

7. What are the three basic types of DC motors?

   Series motors, shunt motors, and compound motors.

8. Name the parts of a DC motor?

   The armature, the field, the brushes, and the frame.

9. What is a starter-generator system used on many turbine engines?

   The system uses a starter-generator which operates as a starter motor to drive the engine during starting, and after the engine has reached a self-sustaining speed it operates as a generator to supply the electrical system power.

10. What is the American Wire Gage (AWG) system of designating electrical wire size?

    A gage number is assigned the wire according to its cross-sectional area. The smaller the gage number, the larger the wire.

11. What is open wiring?

    Open wiring is any wire, wire group, or wire bundle not enclosed in conduit.

12. What method is used to control the voltage of DC aircraft generators?

    The only practical means of regulating generator voltage is to control the strength of the magnetic field. Field strength is determined by the amount of current flowing through the field coils, and the current is controlled by placing some form of variable or intermittent resistance in the external field circuit of the generator.

13. What are the causes of excessive arcing at the generator brushes?

    Arcing can be caused by a commutator that is dirty, rough, or out of round. A more common cause of arcing is worn or binding brushes or the brush spring tension too low.

14. When installing single wires or wire bundles, how much slack is normally allowed between supports?

    Slack between supports should normally not exceed one-half inch.

15. What precaution should be taken when running wires close to heating ducts or exhaust stacks?

    The wires should be insulated with a high temperature material.

ENGINE ELECTRICAL SYSTEMS PROJECTS

1. Use the engine electrical system service manual and locate required reference material to repair five different electrical components.
2. Use an electrical system parts catalog and locate the part number for five different components that are to be replaced.
3. Remove and reinstall an engine driven generator in accordance with reference material.
4. Check an engine driven generator by running the engine and determining whether generator operation is within limits.
5. Remove old brushes from a DC generator and install and seat new brushes.
6. Locate and replace the reverse current cutout relay in the generator electrical system.
7. Using reference material, parallel a dual generator system to the limits prescribed in given reference material.
8. Remove and reinstall a direct drive electric starter motor.
9. Remove and reinstall a new starter solenoid.
10. Fabricate an alternator electric cable by selecting the proper cable size and installing the proper size lug for the alternating rating.
11. Correctly flash the field of a DC generator.
12. Repair the lacing cord on a wire bundle using single cord lacing.
13. Fabricate and install an electrical bonding jumper.
14. Solder splice three different sizes of wire.
15. Fabricate a solderless electrical terminal.
16. Using reference material, determine if a starter-generator is authorized for installation on a specific engine.
17. Using reference material, select the proper size wire for several electrical system components.
18. Use a voltmeter to locate an open in a generator field circuit.

LUBRICATION SYSTEMS ORAL

1. What is the primary purpose of lubricant in an aircraft engine?

   To reduce friction between moving parts.

2. What is the most important property that aircraft reciprocating engine oil must possess?

   Viscosity.

3. What factors must be considered in determining the proper grade of oil to use in a specific engine?

   The operating load, rotational speeds, and operating temperatures are the most important factors to be considered.

4. What is the purpose of the oil flow control valve?

   The oil flow control valve, located on the oil cooler, regulates the flow of oil either into or around the oil cooler.

5. What are the main oil contaminants?

   They are gasoline, moisture, acids, dirt, carbon, and metallic particles.

6. From what location on a reciprocating engine is the oil temperature usually taken?

   In a dry sump lubrication system the oil temperature bulb is located anywhere in the oil inlet line between the oil tank and the engine. Wet sump systems have the temperature bulb located where it senses the temperature after the oil passes through the oil cooler. In either system the bulb is located where it measures oil temperature before it enters the hot sections of the engine.

7. What do metallic particles on an oil screen indicate?

   Metallic particles may be an indication of internal failure of the engine.

8. What could cause oil foaming?

   Foaming can be caused by diluted oil, contaminated oil, or the oil level too high.

9. What would be an indication of blocked oil cooler passages?

   High oil temperature.

10. What would be an indication of an inadequate oil supply?

    Low oil pressure and high oil temperature.

11. What type of oil is used in turbine engine lubrication systems?

    Specially developed synthetic oils.

12. What are two types of oil coolers used in turbine engine lubrication systems?

    The air-cooled oil cooler and the fuel-cooled oil cooler are the two basic types in general use.

13. What is the meaning of oil flash point? Fire point?

    Oil flash point is that temperature at which the oil will begin to give off ignitable vapors. The fire point is that temperature at which there are sufficient vapors to support a flame.

14. What are the functions of engine oil in a reciprocating engine?

    In addition to lubrication, oil cools various parts of the engine, helps to seal the combustion chamber by providing a film between the cylinder walls and the rings, and aids in cleaning the engine by carrying engine residues to the oil filter.

15. What is the weight of aircraft engine oil?

    Approximately 7.5 pounds per U.S. gallon.

16. What is the purpose of an oil dilution system?

    The oil dilution system thins the oil by introducing fuel into the lubrication system which makes cold weather starting easier.

LUBRICATION SYSTEMS PROJECTS

1. Operate the aircraft engine and check the oil cooler for proper operation.
2. Inspect an oil cooler for leaks after engine runup.
3. Perform an engine oil pressure adjustment.
4. Drain an oil tank.
5. Service an oil tank.
6. Locate an identify each of the oil system components.
7. Inspect oil lines for leaks.
8. Using reference material, pre-oil an engine.
9. Using reference material, list possible causes of low and high oil temperature malfunctions.
10. Indicate the direction of oil flow on a drawing of an oil system.
11. Examine an oil filter or screen and identify any foreign material.
12. Determine the proper oil for three different climatic temperature conditions.
13. Using aircraft reference data, select the approved oil for three engines.
14. Remove, clean, and reinstall a scavenger pump.
15. Explain the operation of a Cuno oil filter.
16. Using reference material and a list of oils, match oils that may be mixed for two specific engines.

IGNITION SYSTEMS ORAL

1. What is a magneto?

   A magneto is a special type of engine driven AC generator that uses a permanent magnet source of energy. The magneto develops a high voltage which is used to fire the spark plu

2. What is the purpose of the condenser in a high tension magneto electrical system?

   To prevent arcing at the points and to hasten the collapse of the magnetic field around the primary coil.

3. Where is the E-gap position in a magneto?

   The E-gap position is when the rotating magnet is a few degrees past the neutral position.

4. What are the three major circuits of a high tension magneto system?

   The magnetic circuit, the primary electrical circuit, and the secondary electrical circuit.

5. What are the components of a high tension magnetic circuit?

   The magnetic circuit consists of a permanent multipole rotating magnet, a soft iron core, and pole shoes.

6. What happens when the primary breaker points open in a magneto?

   Opening the breaker points stops the flow of current in the primary circuit, and allows the magnetic rotor to quickly reverse the field through the coil core. This sudden flux reversal produces a high rate of flux change in the core, which cuts across the secondary coil of the magneto, inducing the pulse of high voltage current in the secondary needed to fire the spark plugs.

7. What is the piston position when the spark occurs in a cylinder?

   The piston is a specified number of crankshaft degrees before top dead center of the compression stroke.

8. What is a dual magneto ignition system?

   The dual magneto system incorporates two magnetos in one housing, and one rotating magne and a cam are common to two sets of breaker points and coils. On radial engines, the right magneto fires all the front plugs and the left magneto fires all the rear plugs.

9. What is the difference between a low tension and a high tension ignition system?

   In the high tension system high voltage is generated in the magneto and flows to the plugs through high tension leads. In the low tension system, low voltage is generated in the magneto and flows through low tension leads to the primary winding of a transformer coil located near each spark plug. There the voltage is increased to high voltage by transformer action and is conducted to the plugs by very short high tension leads.

10. When the ignition switch is in the OFF position, what is the condition of the primary circuit?

    It is completed through the ignition switch to ground.

11. What three conditions are required to fire the plugs in a cylinder when the piston is in the prescribed position?

    The magneto rotor must be in the E-gap position, the breaker points must open, and the distributors must be aligned with that cylinder.

12. In a dual magneto ignition system, what part of the system is grounded when the ignition switch is placed in the RIGHT position?

    The left magneto circuit will be grounded.

13. What is internal timing of a magneto?

    It is adjusting the breaker points to open when the rotating magnet is at the E-gap position.

14. What is the purpose of an impulse coupling used with a magneto?

    The purpose of an impulse coupling is to spin the magneto rapidly to produce a hot spark for starting the engine, and at the same time retard the timing of the spark.

15. What is staggered ignition timing?

    It is the firing of one sparkplug before the other one instead of firing them simultaneously.

16. What is the proper spark plug reach?

    The proper spark plug reach is when the electrode end of the plug inside the cylinder is in the best position to achieve ignition.

17. What type ignition system is used in most turbine engines?

    A typical turbine engine is equipped with an electronic capacitor type ignition system.

18. What is the function of the igniter plugs in a turbine engine?

    The function of the igniter plug is to provide a discharge gap for the current which is stored in the capacitor. The discharge results in a high intensity spark which ignites the fuel-air mixture.

19. When are turbine engine ignition systems normally in use?

    The ignition system is normally required only for starting or restarting an engine.

IGNITION SYSTEMS PROJECTS

1. Remove and reinstall an engine ignition harness.
2. Check the serviceability of high tension ignition leads.
3. Locate an open or a ground in an ignition switch circuits.
4. Test several condensers and determine if each is serviceable.
5. Test a set of spark plugs for one engine and determine return to service quality.
6. Select the proper spark plugs and install them in an engine.
7. Using reference material and instructions, fabricate an ignition lead to specifications.

8. Inspect magneto breaker points and determine serviceability.

9. Check the internal timing of a magneto.

10. Disassemble a magneto, identify all the major parts, and reassemble the magneto.

11. Install a magneto on an engine, time the magneto to the engine, and determine return to service quality by engine operation.

12. Time a distributor to the engine.

13. Check the strength of a rotating magnet installed in a magneto and determine return to service quality.

14. Install turbine engine igniter plugs and check for proper operation.

15. Using reference material, inspect a turbine engine ignition system.

FUEL METERING SYSTEMS ORAL

1. Where are the fuel spray nozzles located in a turbine engine?

   They are located either externally or internally on the combustion chamber in such a way that the fuel can be sprayed into the combustion area.

2. Name two heat sources for the operation of fuel heaters used in turbine engines.

   Turbine engine fuel heaters operate as heat exchangers. Fuel lines are routed through the fuel heater, which uses as a heat source either bleed air or engine lubricating oil. If bleed air is used as a heat source it is called an air-to-liquid heat exchanger, and when oil is used it is called a liquid-to-liquid heat exchanger.

3. What engine variables are sensed by a hydromechanical fuel control?

   The fuel control senses power lever position, engine rpm, either compressor inlet pressure or temperature, burner pressure or compressor discharge pressure, and either EGT or TIT.

4. What are the two most commonly used carburetors in small reciprocating engines?

   They are the float-type carburetor and the pressure-type carburetor.

5. What type fuel control unit is used in a turbine engine?

   Both hydromechanical and electronic fuel control units are in use today. However, the most commonly used fuel control unit is the completely hydromechanical type.

6. What is the purpose of a mixture control in a float type carburetor?

   It is to control the fuel-air mixture as air density changes with changes in altitude.

7. What is the purpose of an accelerating system on a float-type carburetor?

   When the throttle is opened rapidly, the fuel-air mixture will lean out momentarily. To overcome this tendency, a charge of fuel from the accelerating pump will temporarily enrich the mixture in the venturi.

8. Describe the purpose and operation of a venturi.

   The venturi performs three functions. It proportions the fuel-air mixture, lowers the pressure at the discharge nozzle, and limits the airflow at full throttle.

9. What is the function of a metering jet?

   The main metering jet is placed in the fuel passage between the float chamber and the discharge nozzle. Its purpose is to limit the fuel flow when the throttle valve is wide open.

10. What is the fuel metering force in a float-type carburetor?

    It is the differential pressure between the pressure in the float chamber and that at the nozzle.

11. What will be the result of using excessively rich idle mixtures?

    Excessively rich idle mixtures will cause spark plug fouling.

12. What is the purpose of the economizer system in a float carburetor?

    The economizer is essentially a valve which is closed at throttle settings below 60% to 70% of rated power, but provide additional fuel for cooling the engine to prevent detonation at higher throttle settings.

13. Where does a pressure injection carburetor obtain fuel pressure?

    It obtains fuel pressure from the boost pump for starting and from the engine driven fuel pump for normal operation of the engine.

14. What operates an automatic mixture control (AMC) on a pressure carburetor?

    The AMC contains a sealed bellows that expands or contracts with changes in atmospheric pressure. The movement of the bellow operates a tapered needle that controls the impact air pressure into the "A" chamber of the carburetor.

15. In what position do you place the mixture control of a pressure injection carburetor to stop the engine?

    In the idle cutoff position.

16. What rpm indication should result when the mixture control is placed in the idle cutoff position when the idle mixture is set correctly?

    There should be a slight increase in rpm, followed by a rapid drop of rpm to zero.

17. What is the purpose of filling a pressure injection carburetor full of fuel and allowing it to soak for a period of about eight hours prior to installation?

    This is done is order to soften the diaphragms and make them as pliable as they were when the carburetor was originally calibrated.

FUEL METERING SYSTEMS PROJECTS

1. Inspect a turbine engine fuel control unit for fuel leaks, security, and missing safety wire.

2. Trim a turbine engine fuel control as prescribed by reference material.

3. Check and adjust the float level of a float-type carburetor to within prescribed limits.

4. Repair a leaking float.

5. Using reference material, adjust the idle speed on a float-type carburetor.

6. Using reference material, adjust the idle mixture on a float-type carburetor.

7. Using reference material, remove and reinstall a float carburetor without error.

8. Using reference material, remove and reinstall a needle-type mixture control valve in a float-type carburetor.

9. Inspect a float needle and seat in a float carburetor by removing the needle, examining the needle and seat, determining their serviceability, and reinstalling the needle.

10. Identify major carburetor components.

11. Using reference material, locate inspection procedures for a water injection systems components.

12. Remove, clean, and reinstall a fuel inlet screen as prescribed by reference material.

13. Locate and point out the main discharge nozzle in a pressure carburetor.

14. Identify the parts of an accelerating pump for a float carburetor.

15. Disassemble a float carburetor and point out the air bleed system.

16. Inspect an AMC and determine if the unit is serviceable.

17. Remove, list the size, and reinstall a main metering jet in a carburetor.

18. Remove, inspect, and reinstall a direct injection fuel nozzle.

ENGINE FUEL SYSTEMS ORAL

1. What is the purpose of strainers in a fuel system?

   They are used to prevent foreign matter from entering the carburetor.

2. What is the purpose of fuel selector valves?

   They provide a means of shutting off fuel flow, for tank and engine selection, for crossfeed, and for fuel transfer.

3. What should be looked for when inspecting an engine driven fuel pump?

   Look for fuel leaks and security of mounting.

4. What is the purpose of an engine driven fuel pump?

   The engine driven fuel pump must deliver a continuous supply of fuel at the proper pressure at all times during engine operation.

5. What type fuel pump is generally used with large reciprocating engines?

   A positive-displacement rotary-vane-type pump.

6. What happens to the excess fuel not required by the engine in a constant displacement pump?

   The pressure relief valve opens and the fuel is routed back to the inlet side of the pump.

7. What is the most common type of fuel boost pump?

   The electrically driven centrifugal type pump.

8. What is the purpose of the bypass valve in the engine driven fuel pump?

   The bypass valve provides a path around the pump vanes for starting the engine, and to allow fuel to bypass the pump in case of pump failure.

9. What is the purpose of using boost pumps in a fuel system?

   Electric boost pumps are used to supply fuel to a pressure carburetor during engine starting and in case of engine driven pump failure. However, a main function of a boost pump is to keep the pressure on the suction side of the engine driven pump from becoming low enough to permit the fuel to boil when operating at high altitudes.

10. What are the three general causes of vapor lock?

    They are low fuel pressure, high fuel temperatures, and excessive fuel turbulence.

11. Turbine engine fuel pumps may be divided into what two distinct system categories?

    Constant displacement and variable displacement.

12. What category is a turbine engine driven gear-type pump?

    Constant displacement.

13. What type fuel pump can be made to vary the fuel flow at any speed?

    A variable displacement pump.

14. What part of a gas turbine engine fuel system is very susceptible to the formation of ice?

    The fuel filter.

15. How is the engine fuel system protected from ice formation?

    By the use of fuel heaters.

16. Why is a micron fuel filter provided with a bypass valve as a necessary safety factor?

    Because the small openings in this type filter make it very susceptible to clogging.

ENGINE FUEL SYSTEMS PROJECTS

1. Using reference material, adjust the output pressure on an engine driven fuel pump to within limits.
2. Using reference material, remove, clean, and replace an engine fuel strainer.
3. Inspect a main fuel filter assembly by pressurizing the fuel system and observing for fuel leaks in the filter area.
4. Remove and reinstall an engine driven fuel pump using reference material as a guide.

5. Identify the components of an engine driven fuel pump.
6. Remove and reinstall an electrically driven boost pump.
7. Identify the components of an electrically driven boost pump.
8. Correctly adjust fuel pump pressure to the limits prescribed in reference material.
9. Inspect fuel lines for fuel leaks and security.
10. Determine if a fuel pressure warning light operates within prescribed limits.
11. Check a fuel selector valve for proper operation.
12. Locate a turbine engine fuel heater and identify all the connections.

ENGINE INDUCTION SYSTEMS ORAL

1. What are the three major parts of a reciprocating engine induction system?

   The airscoop and ducting, the carburetor, and the intake manifold.

2. What effect does induction system icing have on engine performance?

   Induction system icing can cause an engine to act erratically and lose power.

3. What method is used to prevent or remove induction system ice in a reciprocating engine?

   The most common method of preventing or removing ice formation in the induction system is by the use of heated air.

4. How is ice cleared in some aircraft induction systems if the carburetor heat is too low to clear the ice?

   A fluid such as alcohol, anilol, or mersol is sprayed into the induction system ahead of the carburetor. The fluid will dislodge the ice which is ingested by the engine.

5. What engine indication can be the result of a dirty air filter?

   Low power.

6. What is the danger of using carburetor heat when operating at high power settings?

   The higher air temperatures could cause detonation and possible engine failure.

7. Carburetor throttle ice is most likely to form when the throttle is in which position?

   During part throttle operation when the throttle is near the closed position.

8. What are the two general classifications of superchargers used in reciprocating engine induction systems?

   They are classified as internally driven or externally driven (turbocharger) supercharger systems.

9. What is the purpose of a distribution impeller in a supercharger?

   It is designed to break up the fuel globules into finer particles for better distribution to the cylinders.

10. How does an internally driven supercharger boost air pressure?

    A high speed impeller is driven through a gear train from the crankshaft at a gear ratio that varies from 6:1 to 12:1.

11. Where does an externally driven supercharger get its power?

    The exhaust gases are directed against a turbine. For this reason they are commonly called turbochargers.

12. What unit regulates the amount of exhaust gases to the turbine of a turbocharger?

    The waste gate.

13. What type of power is used to control the position of the turbocharger waste gate on some engines?

    Oil pressure to an actuating piston.

ENGINE INDUCTION SYSTEMS PROJECTS

1. On a drawing of a reciprocating engine induction system, point out the areas where icing is most likely to form.
2. On a drawing of a turbine engine air intake system, point out the two areas that are provided with ice protection.
3. Inspect a carburetor air heating system and determine if it is return to service quality.
4. Check the operation of a carburetor air heat system for proper operation.
5. Remove, clean, and reinstall an induction air filter.
6. Inspect an induction system for obstructions.
7. Install new seals in an air intake pipe.
8. Inspect an air intake manifold and list any area found to be leaking.
9. Identify all the components of a turbocharger.
10. Using reference material, remove, inspect, and reinstall a turbocharger.
11. Operate a turbocharger and determine if it is functioning properly.
12. Inspect a turbocharger, exhaust pipes, and all connections for leaks.
13. From a list of air induction problems, point out the items that might cause improper engine idling.
14. From a drawing of a turbine engine air inlet ice protection system, determine the probable cause of a malfunction.
15. From a list of turbocharger malfunctions, determine which items might prevent an aircraft from reaching critical altitude.

ENGINE COOLING SYSTEMS ORAL

1. What is the most common means of regulating the cooling air flow through a radial engine?

   By the use of cowl flaps.

2. What is the purpose of the fins on engine cylinders?

   To increase the effective size of the cylinder for cooling.

3. What other engine characteristics are designed to aid in engine cooling besides cooling fins?

   The engine cowling and baffles are designed to force air over the cylinder cooling fins.

4. Why is the "open and close" adjustment during installation of cowl flaps important?

   For each engine installation the cowl flaps are set for tolerances that will permit them to open and close the correct amount to keep the cylinder head temperature within allowable limits.

5. What should be done to cylinders when too much of the cooling fin area is broken off?

   The cylinder should be replaced because it cannot cool properly and a hotspot will develop.

6. When should cowl flaps be kept in the fully open position?

   Normally during all ground operations.

7. What publication should be referred to before reprofiling cylinder cooling fins?

   The manufacturer's service or overhaul manual should be used to obtain the allowable limits.

8. What power sources are used to operate the cowl flaps?

   Cowl flaps may be operated by electrical power, hydraulic power, or manually.

9. What is the purpose of blast tubes that are built into the baffles on a reciprocating engine?

   To direct jets of cooling air onto the rear spark plug elbows of each cylinder to prevent overheating of the ignition leads.

10. What are the main reasons that excessive heat in reciprocating engine is undesirable?

    Excessive heat shortens the life of the engine parts, impairs lubrication and affects combustion.

11. Describe an augmentor system.

    Augmentors consist of two pairs of tubes running from the engine compartment to the rear of the nacelle. The exhaust gas collector feeds exhaust gases into the inner augmentor tubes. Air that has passed over the engine is fed into the outer tubes where it is heated, by the exhaust tubes, and then expelled to mix with the exhaust gases. The heating of the air causes it to form a high temperature, low pressure, jet-like exhaust which draws additional cooling air over the engine. The heated air is sometimes used for cabin heating, defrosting, and anti-icing.

12. What is the source of air that is directed to turbine engine bearings for cooling?

    It is bleed air from the compressor section of the engine.

13. What is the purpose of insulation blankets on the exhaust duct of a turbine engine?

    To reduce the temperature of the structure in the vicinity of the exhaust duct or afterburner, and to eliminate the possibility of fuel or oil coming into contact with the hot parts of the engine.

14. What types of material are used to make insulation blankets for turbine engines?

    They are made of stainless steel, with layers of aluminum foil, fiber glass, and silver foil.

15. What areas of a turbine engine are cooled by the secondary air passing through the engine?

    The combustion chambers and the turbines.

ENGINE COOLING SYSTEMS PROJECTS

1. Install cylinder head baffles.
2. Reprofile a damaged cylinder cooling fin.
3. Repair damaged cylinder head baffles.
4. Troubleshoot a cowl flap system to determine the cause of a malfunction.
5. Check cowl flap travel and determine if the open and closed positions are within limits.
6. Inspect cylinder cooling fins for damage and determine if the damage is repairable.
7. Locate and point out all the parts of an augmenter cooling system.
8. Inspect an augmenter cooling system and determine if it is return to service quality.
9. Inspect a rotorcraft engine cooling fan for damage.
10. Identify a rotorcraft engine cooling fan and associated components.
11. Using reference material, repair a turbine engine insulation blanket.
12. On a drawing of a turbine engine, draw in the cooling air flow path and list the units being cooled.
13. On a drawing of a turbine engine, point out the areas where an insulation blanket is required.

ENGINE EXHAUST SYSTEMS ORAL

1. What are two types of reciprocating engine exhaust systems?

    The short stack system and the collector system.

2. What are the possible hazards of exhaust system failure?

    Depending on the location and type of exhaust system failure, it can result in carbon monoxide poisoning of the crew and passengers, partial or complete loss of engine power, and an aircraft fire.

3. What type of exhaust system is generally used on low powered non-supercharged engines?

   The short (open) stack system.

4. What type of exhaust system is used on turbocharged engines?

   The exhaust collector system.

5. Which type of exhaust system creates a higher exhaust back pressure?

   The collector system.

6. What is the purpose of a reciprocating engine exhaust system?

   To dispose of the high temperature, noxious gases that are discharged by the engine.

7. What happens when lead, zinc, or galvanized marks are made on an exhaust system?

   The mark is absorbed by the metal when it is heated and causes a change in the molecular structure of the metal.

8. What type of visual indication can usually be seen in the area of an exhaust leak?

   Exhaust leaks usually leave flat gray or sooty black streaks on the pipes in the area of the leak.

9. How are ceramic coated exhaust stacks cleaned?

   By degreasing only.

10. What is the usual cause of muffler and heat exchanger failures?

    They are usually caused by thermal and vibration cracking or ruptures in areas of stress concentration.

11. Where are exhaust manifold and stack failures most likely to occur?

    These failures usually occur at welded or clamped points in the system.

12. What is a common cause of the waste gate unit malfunctioning in a turbocharger system?

    The most common cause of waste gate malfunctioning is carbon buildup, causing the waste gate valve to stick in the "closed" position.

13. What factors are affected if the area of the exhaust nozzle of a turbine engine is changed?

    The size of the exhaust nozzle affects both the engine performance and the exhaust gas temperature.

14. What are the probes in a turbine exhaust tail pipe used for?

    They are used to measure exhaust gas temperature (EGT).

ENGINE EXHAUST SYSTEMS PROJECTS

1. Detect and repair an exhaust system leak.
2. Perform a heat exchanger collector tube leak test.
3. Inspect an exhaust heat exchanger and list any cracks or damage.
4. Remove and reinstall an exhaust manifold heat exchanger collector tube.
5. Remove and reinstall exhaust ducts.
6. Clean ceramic coated exhaust pipes.
7. Identify exhaust system components.
8. Check a turbine engine thrust reverser system for proper operation.
9. Inspect a turbine engine exhaust nozzle.
10. Determine if three exhaust system components with damage are repairable.
11. Inspect an exhaust system internal baffles or diffusers and list any damage found.
12. Determine the cause of a malfunction in a thrust reverser system.

PROPELLERS ORAL

1. What is the purpose of a propeller?

   To create thrust and either pull or push the airplane through the air.

2. What are the two classifications of propellers?

   The tractor type and the pusher type.

3. What type of propeller has the blade angle built into the propeller and cannot be changed?

   A fixed pitch propeller.

4. What is the purpose of the metal tipping on the leading edge of a wooden propeller?

   It is to protect the propeller from damage caused by flying particles in the air during landing, taxiing, and takeoff.

5. What is the process of determining the positions of the tips of the propeller blades relative to each other. BLADE TRACKING

6. What tool is used to determine propeller blade angle?

   A universal propeller protractor.

7. What are the aerodynamic forces and loads acting on a rotating propeller blade?

   A rotating propeller is acted upon by centrifugal, twisting, and bending forces.

8. What is the meaning of propeller blade "back" and "face"?

   The cambered or curved side of the propeller blade is called the blade back. This is the side of the blade that faces away from the engine. The flat side of the propeller blade is known as the blade face. This side of the blade faces the engine.

9. What should be used to clean aluminum and steel propeller blades and hubs?

   They should be washed with a suitable cleaning solvent using a brush or cloth.

10. What positions are used on a balance stand to check a two bladed propeller for static balance?

    First the vertical position and then a horizontal position.

11. When centrifugal force acts on the counterweights of a hydraulic counterweight propeller it tends to rotate the blades in which direction?

    Centrifugal force tends to increase the blade pitch.

12. Why do you put the blades of a counterweight propeller into high pitch before stopping the engine?

    This type propeller has a movable cylinder that slides over the propeller piston. In the low pitch position, the cylinder is outboard and the piston is exposed to the open air, but in the high pitch position, the cylinder moves inboard and covers the propeller piston. In this position the piston is protected from dirt and moisture in the air. This is particularly important if the airplane engine will not be operated for several days.

13. Why are cones installed on splined shafts with the propeller?

    The cones center the propeller on the shaft as they are forced toward each other by the tightening of the retaining nut.

14. How is feathering accomplished on a constant speed counterweight propeller?

    Releasing governor oil pressure allows the counterweights and feathering spring to move the blades to the feathered position.

15. What type ice control systems are used for propellers?

    Either fluid or electrical deicing systems are used for deicing propellers.

16. What is the purpose of a slinger ring on some propeller installations?

    Propeller deicing fluid is ejected from a stationary nozzle on the engine into a scoop attached to the rear of the propeller assembly. This U-shaped channel is called the slinger ring. The fluid under pressure of centrifugal force is transferred through a nozzle to the propeller blades.

PROPELLER PROJECTS

1. Using reference material, check vertical and horizontal unbalance on a two blade propeller and determine if the propeller is within balance limits as prescribed.

2. Install oil control plugs in a governor.

3. Determine the direction of rotation for which a governor is set.

4. Measure propeller blade pitch angle.

5. Clean and protect aluminum propeller blades.
6. Detect and correct front cone bottoming of a propeller installed on a splined shaft.
7. Adjust a propeller governor so that the propeller will operate within the correct range.
8. Remove, inspect, and reinstall a propeller governor.
9. Lubricate a propeller as prescribed by reference material.
10. Using reference material, locate the inspection procedures for propeller ice control systems.
11. Using reference material, find and list the critical range of operation for a specific propeller/engine combination.
12. Check a propeller blade feather angle and determine if it is correct for that installation.
13. Inspect a wooden propeller metal tipping and list any defects.
14. Using reference material, repair a metal propeller with slight nicks and scratches.
15. Remove, desludge, and reinstall a propeller dome on a hydromatic propeller.
16. Remove a fixed pitch propeller, inspect the shaft, and reinstall the propeller as prescribed in reference material.
17. Check the track of a propeller and determine if it is within limits.
18. Identify the components of a turboprop propeller system.
19. On a drawing of a constant speed propeller, indicate the path of the oil flow for an on speed, an overspeed, and an underspeed condition of the propeller.
20. Operate an engine and check a reversing type propeller for proper operation.