AIR FORCE
QUALIFICATION TRAINING PACKAGE (AFQTP)

FOR

ELECTRICAL POWER PRODUCTION
(3E0X2)

MODULE 17
ENGINE MAINTENANCE FUNDAMENTALS

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MODULE 17

ENGINE MAINTENANCE FUNDAMENTALS

Career Field Education and Training Plan (CFETP) references from 1 Aug 02 version.

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AIR FORCE QUALIFICATION TRAINING PACKAGES
FOR
ELECTRICAL POWER PRODUCTION

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INTRODUCTION

Before starting this AFQTP, refer to and read the "AFQTP Trainer/Trainee Guide."

AFQTPs are mandatory and must be completed to fulfill task knowledge requirements on core and diamond tasks for upgrade training. ***It is important for the trainer and trainee to understand*** that an AFQTP ***does not*** replace hands-on training, nor will completion of an AFQTP meet the requirement for core task certification. AFQTPs will be used in conjunction with applicable technical references and hands-on training.

AFQTPs and Certification and Testing (CerTest) must be used as minimum upgrade requirements for Diamond tasks*.*

MANDATORY minimum upgrade requirements:

Core task:
AFQTP completion
Hands-on certification

Diamond task:
AFQTP completion
CerTest completion (80% minimum to pass)

Note*: Trainees will receive hands-on certification training for Diamond Tasks when equipment becomes available either at home station or at a TDY location*.

Put this package to use. Subject matter experts under the direction and guidance of HQ AFCESA/CEOF revised this AFQTP. If you have any recommendations for improving this document, please contact the Career Field Manager at the address below.

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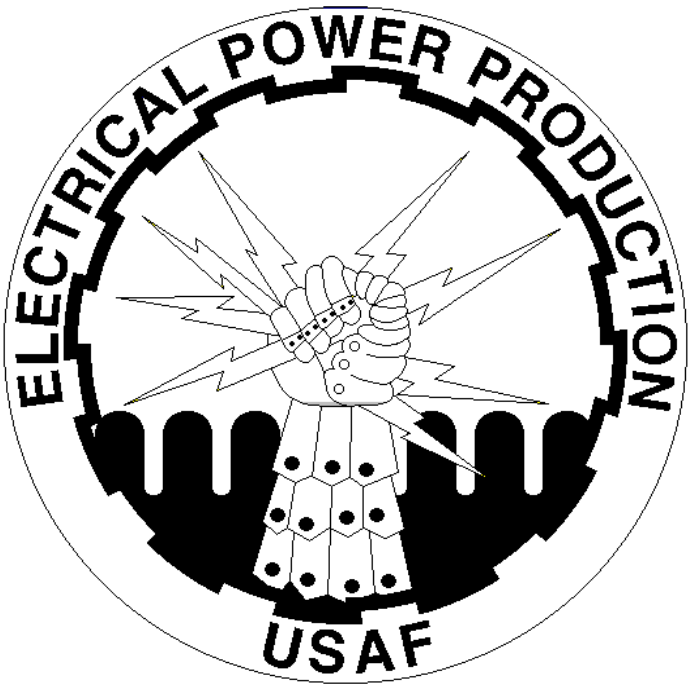
Notice. This AFQTP is *NOT* intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.



ENGINE MAINTENANCE FUNDAMENTALS

GASOLINE ENGINES

MODULE 17 **AFQTP UNIT 1**

TROUBLESHOOT ENGINE MALFUNCTIONS (17.1.2.)

Notice. This AFQTP is *NOT* intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

TROUBLESHOOT ENGINE MALFUNCTIONS

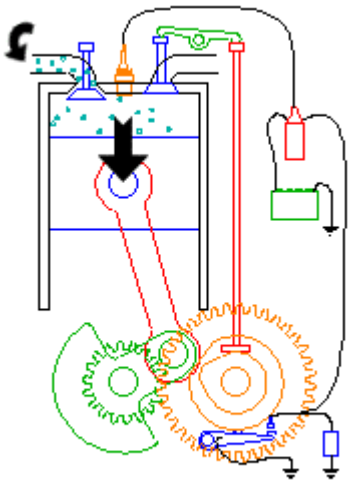
Task Training Guide

STS Reference Number/Title:	17.1.2., Troubleshoot engine malfunctions.
Training References:	1. Career Development Course (CDC) 3E052B, Vol. 1, Unit 1: *Engine Fundamentals and Protective Devices*. 2. Applicable Technical Orders (TOs). 3. Manufacturer's Manuals. 4. Local Procedures.
Prerequisites:	1. **Possess, as a minimum, 3E052 AFSC.** 2. **Review the following references:** 2.1. Applicable TOs and manufacturer's manuals. 2.2. CDC 3E052B, Vol. 1, Unit 1.
Equipment/Tools Required:	1. Gasoline engine. 2. Personal safety equipment. 3. Training references. 4. Hand tools. 5. Test equipment (I.E. multimeter, battery load tester).
Learning Objective:	Troubleshoot engine malfunctions.
Samples of Behavior:	Trainee will be able to successfully troubleshoot engine malfunctions.
Notes:	
1. To successfully complete this element follow the steps outlined in the applicable technical manual exactly--no exceptions. 2. Any safety violation is an automatic failure.	

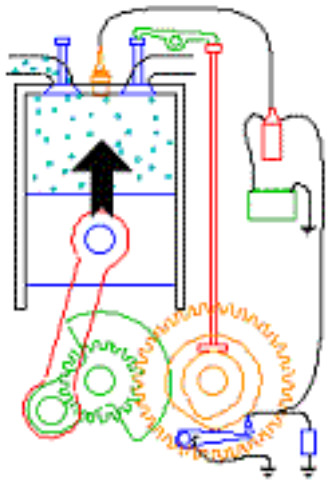
TROUBLESHOOT ENGINE MALFUNCTIONS

1. Background: A gasoline-fueled engine is a mechanism designed to transform the chemical energy of burning fuel into mechanical energy. Gasoline engines control and apply this energy to mow lawns, cut trees, propel tractors, and perform many other jobs.

2. There are three items needed in order for a gasoline engine to operate: air, spark, and fuel. When the engine is cranked, gasoline is atomized and mixed with air. The mixture is forced through an intake port and into the cylinder, where it is compressed by the piston on the upstroke and ignited by an electrical spark. Burning rapidly, the heated gases trapped within the cylinder expand and apply pressure to the walls of the cylinder and to the top of the piston. This pressure drives the piston downward on the power stroke, causing the crankshaft to turn.
A stroke of the piston is its movement in the cylinder from one end of its travel to the other. Each stroke is identified by the job it performs, i.e. intake, compression, power, or exhaust.

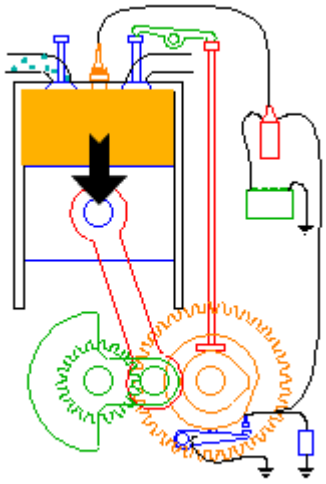


2.1. <u>Intake stroke</u>: The piston is moving downward with the intake valve open. This action draws air (air/fuel mixture in the gasoline engine) into the cylinder. Most engines can be broken into two intake style categories. They are naturally aspirated and supercharged. Naturally aspirated engines draw in air without any outside assistance much like your lungs do for your body. Supercharged engines have pressurized air forced into the cylinder by a turbocharger, blower, or both. There are advantages and disadvantages to both styles of intake systems.

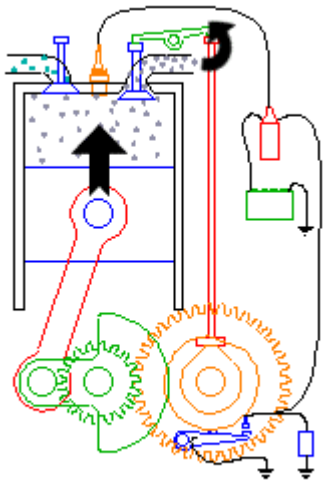


2.2. Compression stroke. On this stroke the piston is moving in the upward direction. The intake and exhaust valves are both closed causing the air inside to be squeezed or compressed. The typical gasoline engine has a compression ratio of 9:1. The compression ratio is a comparison of the total volume of the cylinder and combustion chamber with the piston at BDC and the piston at TDC. The higher the compression ratio the more pressure being generated in the cylinder resulting in a more intense explosion when the spark is introduced in the ignition event. There are limits to the amount of compression practical and one common downfall of higher compression engines includes the need for high-octane fuel.

2.2.1. Ignition Event. Once the piston is near TDC (Top Dead Center) on the compression stroke the spark is introduced into the highly pressurized air/fuel mixture. When the spark ignites the fuel it causes an explosion forcing the piston to begin downward travel. This event must happen at a precise time to allow the engine to function properly. If it happens too soon the explosion will cause the piston to work against the upward force being applied from the crankshaft effectively attempting to reverse the rotation of the engine and wasting the power gain from the explosion. If it happens too late the piston is already moving down and much of the power gain from the explosion is wasted. (The pressure value of the air/fuel mixture in the cylinder is lower thus less power gain.) The importance of this event is validated by the need to time the engine. You may have heard someone say they had to advance or retard the timing on their engine to get better performance. In today's modern engines computers automatically adjust for changes in altitude and the fuel octane level. Before the computer it was necessary (or at least highly recommended) to have your timing adjusted when moving from Denver Colorado to Miami Florida. The difference in altitude would greatly change the amount of air introduced into the cylinder. In the same respect it was imperative to run the appropriate octane level fuel in your automobile (87, 89, or 92). Most of today's vehicles are designed to run effectively on 87 Octane fuel. Buying the more expensive high-octane fuel is unnecessary and gains you little in the end. (It should be noted this is not a concrete rule.)



2.3. Power stroke. During the power stroke both valves are closed and the piston is moving downward. The force generated from the ignition event is transferred from the head of the piston through the connecting rod down to the crankshaft. This action powers your car down the road.



2.4. Exhaust stroke. After the piston reaches its full downward movement in the power stroke and begins to travel upward the exhaust valve opens. The upward travel of the piston along with the open exhaust valve pushes all of the dirty air out of the cylinder into the exhaust system. Once the piston reaches TDC on the exhaust stroke it starts all over again with the intake stroke. This process happens at speeds in excess of 3600 strokes per minute in an engine running 1800 RPM. (Revolutions Per Minute)

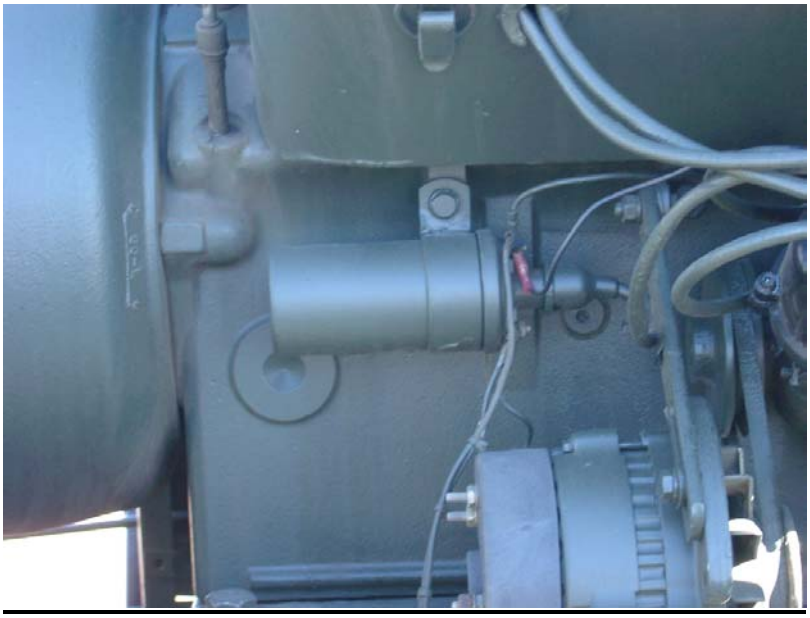
3. Carburetors and Fuel Injection Systems. Another important item in the gasoline engine is the carburetor. A carburetor's primary purpose is to produce a mixture of fuel and air to operate the engine. Basically air enters the top of the carburetor and is mixed with liquid fuel, which is fed through carburetor passages and sprayed into the air stream. This air-fuel mixture is forced into the intake manifold by atmospheric pressure and burned in the combustion chamber of the engine.

3.1. In a fuel injected gasoline engine the right amount of fuel is injected individually into each cylinder. This happens either right above the intake valve (port fuel injection) or directly into the cylinder (direct fuel injection). Most gasoline engines used in the automobiles of today have fuel injectors. Most small gasoline engines used in lawn mowers and small generators still use the carburetion principle.

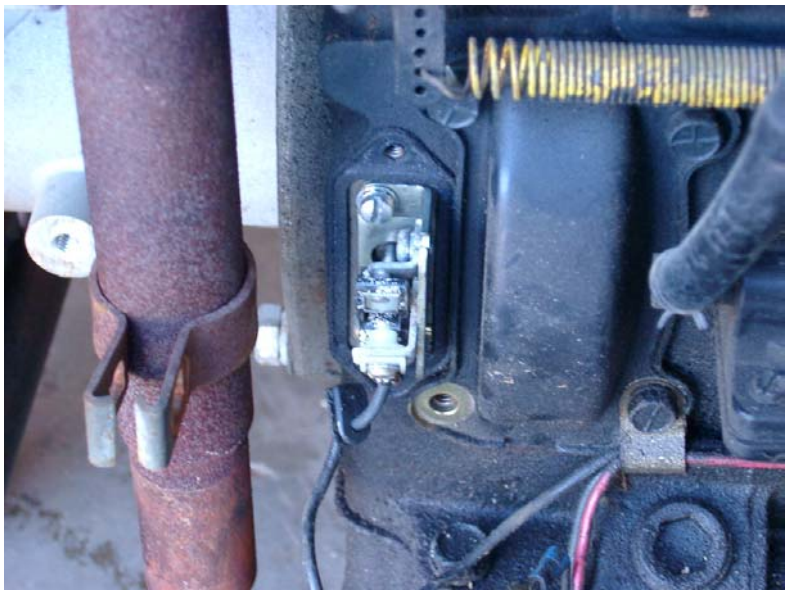
4. Ignition System. The ignition system produces a high-voltage electrical charge and transmits it to the spark via the ignition wires. They're several different styles of ignition systems used in gasoline engines. They include: the magneto style, distributor, and solid-state individual cylinder ignition (one coil per cylinder). The magneto style is most common on older engines and small lawnmower engines. The basic principle is a permanent magnet provides the spark needed to run the engine. There is no need for a to battery augment the ignition system. The basic distributor design has one coil and a distributor allowing the spark to be controlled and sent to only one cylinder at a time. These designs come either with breaker points or solid-state components. The solid-state type typically means there are no breaker points in the distributor. This is typical of most engines today along with the BAK-12 Rewind engine. The individual cylinder style ignition is becoming more and more popular in automotive engines. This allows for precise computer controlled ignition.

BAK-13 Magneto Ignition System

BAK-12 Rewind Engine- Distributor Breaker Points



BAK-12 Rewind Engine- Ignition Coil



Wacker MAAS HPU- Ignition Breaker Points

2000 Ford Ranger- Solid-State Coil/Distributor System

5. Troubleshooting. Since troubleshooting is a step-by-step procedure, the effectiveness depends on how much you know about the equipment and how much you think while working. The ability to troubleshoot depends on your capability to think and apply knowledge. To troubleshoot effectively, you must follow a systematic procedure. First, study the symptoms of the trouble thoroughly and ask yourself these questions:

5.1. What was the warning signs preceding the trouble?

5.2. What recent repair has been done?

5.3. Has a similar trouble occurred before?

5.4. Next, follow the basic troubleshooting procedures:

5.4.1. The first step is to **perform an operational check** of the engine to determine if an actual problem really exists. Follow step-by-step procedures in the technical manual for your particular item of equipment. Perform a visual inspection of the electrical components, check wiring harness for breaks, and check relays for loose connections, evidence of over heating, cracks or any signs of damage.

5.4.2. The second step in troubleshooting is to **analyze the malfunction**. Once you are aware of a malfunction, consult the proper technical manual for normal engine operation. This gives one a clearer understanding of how the engine should be working. One can also use the troubleshooting chart located in the proper technical manual.

5.4.2.1. It is in this step that one determines the type of trouble in order to determine the type of test equipment to use.

5.4.3. The third step is **locating the malfunction**; this is perhaps the most difficult task. In this step, one will need to stay focused on the problem and not allow frustration to set in. This can cause one to resort back to the remove and replace technique. Perform the previous steps. Understanding engine operation and knowing the “how, what, when and where” in engine operation is key to locating the malfunction.

5.4.4. The fourth step is to **perform corrective action**, once you have located the problem; a neat and permanent repair is a necessity. If possible, use original replacement parts to make repairs.

5.4.5. The last step is to **perform an operational check**, This is the most rewarding step in the troubleshooting process. If you do not prove your work, you will not know if the problem is solved. Remember, one malfunction can produce more than one problem.

NOTE TO TRAINER:

1. This task requires a gasoline engine in need of maintenance. There is no feasible way to identify what specific type of engine. The troubleshooting chart given in this AFQTP is a general-purpose guide for small gasoline engines. It should not replace Technical Orders and Manufacturer’s manuals. Common examples of engines to be used for training purposes may include:
   1.1. BAK-12 rewind engine.
   1.2. MAAS Hydraulic Power Unit (HPU).
   1.3. BAK-13 rewind engine.
   1.4. Small commercial generator.
2. If no malfunctioning equipment is available you must provide a training scenario to the trainee on the problem you want him/her to solve.

SAFETY:
FAILURE TO ADHERE TO APPLICABLE TECHNICAL ORDERS AND /OR MANUFACTURER'S MANUALS COULD RESULT IN SERIOUS INJURY AND EQUIPMENT DAMAGE.

6. ***To perform the task, follow these steps:***

Step 1. Provide the trainee with equipment and scenario in which to perform task.

Step 2. Use the five-step process in troubleshooting.

2.1. Perform an operational check.
2.2. Analyze the malfunction.
2.3. Locate the malfunction.
2.4. Perform corrective action.
2.5. Perform an operational check.

ENGINE TROUBLESHOOTING CHART	
CAUSE	**REMEDY**
ENGINE FAILS TO START OR STARTS WITH DIFFICULTY.	
No fuel in tank.	Fill tank with clean, fresh fuel.
Shut-off valve closed.	Open valve.
Obstructed fuel line.	Clean fuel screen and line. If necessary, remove and clean carburetor.
Tank cap vent obstructed.	Open vent in the fuel tank cap
Water in fuel.	Drain tank. Clean carburetor and fuel lines. Dry spark plugs and points. Fill tank with clean, fresh fuel.
Engine over-choked.	Close fuel shut-off and pull starter until engine starts. Reopen fuel shut-off for normal fuel flow.
Improper carburetor adjustment.	Adjust carburetor.
Loose or defective distributor wiring.	Check distributor wiring for shorts and grounds; repair if necessary.
Faulty distributor.	Check timing, point gap; if necessary overhaul distributor.
Spark plug fouled.	Clean and regap spark plug.
ENGINE KNOCKS.	
CAUSE	**REMEDY**
Carbon in the combustion chamber.	Remove cylinder head and clean carbon from head and piston.
Loose or worn connecting rod.	Replace connecting rod.
Loose flywheel.	Check flywheel key and keyway; replace parts if necessary. Tighten flywheel nut to proper torque.
Worn cylinder.	Replace cylinder.
Improper distributor timing.	Time distributor.
ENGINE MISSES UNDER LOAD.	
Spark plug fouled.	Clean and re-gap spark plug.
Spark plug porcelain cracked.	Replace spark plug.
Improper spark plug gap.	Re-gap spark plug.
Pitted distributor breaker points.	Replace pitted breaker points.
Distributor breaker arm sluggish.	Clean and lubricate breaker point arm.
Faulty condenser.	Check condenser on a tester; replace if defective.
Improper carburetor adjustment.	Adjust carburetor.
Improper valve clearance.	Adjust valve clearance to the recommended specifications.
Weak valve spring.	Replace valve spring.
Reed fouled or sluggish (two cycle only).	Clean or replace reed.
Crankcase seals leak (two cycle only).	Replace worn crankcase seals.

ENGINE TROUBLESHOOTING CHART (Cont.)	
CAUSE	**REMEDY**
ENGINE LACKS POWER.	
CAUSE	**REMEDY**
Choke partially closed.	Open choke.
Improper carburetor adjustment.	Adjust carburetor.
Distributor improperly timed.	Time distributor.
Worn rings or piston.	Replace rings or piston.
Air cleaner fouled.	Replace air cleaner.
Lack of lubrication.	Fill crankcase to the proper level.
Valves leaking.	Grind valves and set to recommended specifications.
Reed fouled or sluggish (two cycle only).	Clean or replace reed.
Improper amount oil in fuel mixture (two cycle only).	Drain tank; fill with correct mixture.
Crankcase seals leak (two cycle only).	Replace worn crankcase seals.
ENGINE OVERHEATS.	
CAUSE	**REMEDY**
Engine improperly timed.	Time engine.
Carburetor improperly adjusted.	Adjust carburetor.
Air-flow obstructed.	Remove any obstructions from air passages.
Cooling fins clogged.	Clean cooling fins.
Excessive load on the engine.	Check operation of associated equipment, reduce excessive load.
Carbon in the combustion chamber.	Remove the cylinder head and clean carbon from the head and piston.
Lack of lubrication.	Fill crankcase to proper level.
Improper amount of oil in fuel mixture (two cycle only).	Drain tank; fill with correct mixture.
Crankcase seals leak (two cycle only).	Replace worn crankcase seals.

REVIEW QUESTIONS
FOR
TROUBLESHOOT ENGINE MALFUNCTIONS

QUESTION	ANSWER
1. Air, spark, and fuel are three main items needed for ignition.	a. True. b. False.
2. In what strokes of the engine will you find both valves closed?	a. Intake. b. Compression and Power. c. Power. d. Exhaust.
3. What fundamental step in the troubleshooting process is required to prove your work and ensure the equipment is in the proper working order?	a. Locate the malfunction. b. Analyze the malfunction. c. Perform the corrective action. d. Perform an operational check.
4. How many steps are there in the fundamental troubleshooting process?	a. 3. b. 4. c. 5. d. 6.

TROUBLESHOOT ENGINE MALFUNCTIONS

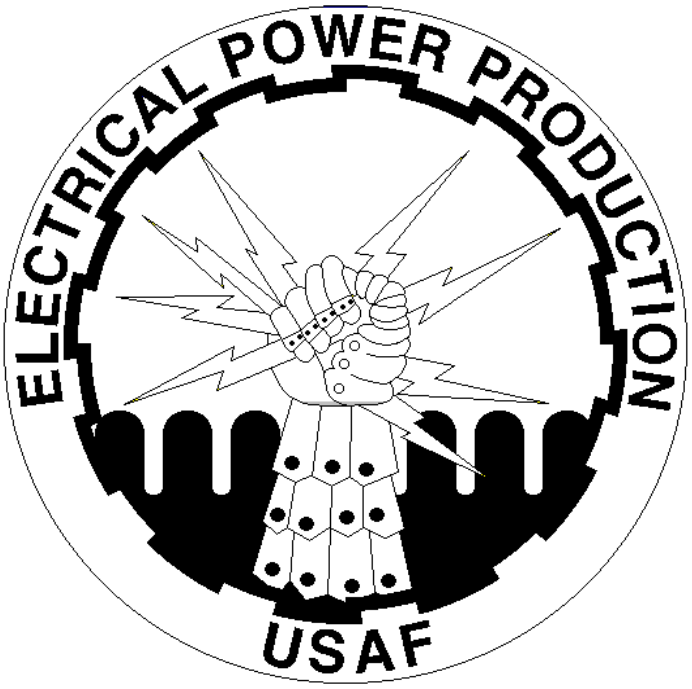
PERFORMANCE CHECKLIST

INSTRUCTIONS:

The trainee must satisfactorily perform all parts of the task without assistance. Evaluate the trainee's performance using this checklist.

DID THE TRAINEE….?	YES	NO
1. Have the equipment and scenario provided to perform task		
2. Perform an operational check		
3. Analyze the malfunction		
4. Locate the malfunction		
5. Perform corrective action		
6. Perform an operational check		
7. Comply with all safety requirements		

FEEDBACK: Trainer should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer.



ENGINE MAINTENANCE FUNDAMENTALS

GASOLINE ENGINES

MODULE 17 **AFQTP UNIT 1**

PERFORM GASOLINE ENGINE TUNE-UP (17.1.3.)

Notice. This AFQTP is *NOT* intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

PERFORM GASOLINE ENGINE TUNE-UP

Task Training Guide

STS Reference Number/Title:	17.1.3., Perform gasoline engine tune-up.
Training References:	1. 35E8 and 38G2 Series Technical Orders (TOs). 2. Manufacturer's Manuals. 3. Career Development Course (CDC) 3E052B, Vol. 1, Section 003: *Gasoline Components and Tune-up*. 4. Local Procedures.
Prerequisites:	1. **Possess, as a minimum, 3E032 AFSC.** 2. **Review the following references:** 2.1. Applicable TOs and Manufacturer's Manuals. 2.2. CDC 3E052B, Vol. 1, Section 003.
Equipment/Tools Required:	1. Gasoline engine. 2. Personal safety equipment. 3. Training references. 4. Low pressure gauge. 5. Neon timing light.
Learning Objective:	Perform Gasoline Engine Tune-up.
Samples of Behavior:	Trainee will be able to tune-up gasoline engine systems.
Notes:	
1. To successfully complete this element follow the steps outlined in the applicable technical manual exactly--no exceptions. 2. Any safety violation is an automatic failure.	

TUNE-UP GASOLINE ENGINE SYSTEMS

1. Background: The gasoline engine selected for the development of this AFQTP is the V-465D Wisconsin engine (covered in TO 38G2-117-3 and shown in Figure 1). This Engine is used as the rewind source for the BAK-12 and MAAS aircraft arresting systems. This engine is a four-cylinder, four-cycle, air-cooled engine. The V-465D systems we will tune-up or discuss are the carburetor, ignition, lubrication, cooling, and governor. We will provide a brief overview of these systems before beginning our tune-up.

1.1. The V-465D Wisconsin engine uses a horizontal carburetor with a concentric fuel bowl. Proper gasoline to air mixture is furnished to the combustion chamber for all loads and speeds.

1.2. The electrical system consists of a distributor ignition system, 12-volt battery, battery-charging alternator, a starter motor, high temperature safety switch, spark plugs, anti-diesel solenoid, ignition start switch, and start solenoid. The cylinder firing order is 1-3-4-2 with cylinder number 1 being the one closest to the flywheel in the left bank *(odd numbered bank)* when viewed from the flywheel end. The distributor system uses an ignition coil to step up the voltage potential from the 12 volt DC system. From the coil the high potential signal *(typically in excess of 10,000 volts)* moves onto the distributor. The distributor then sends out the high voltage signal to each of the spark plugs in firing order sequence. The timing of the spark signal is determined from breaker points, or solid-state circuitry, located inside the distributor. (*Many of the V-465 engines now have solid-state ignition systems deleting any references made to breaker points.)*

1.3. Centrifugal fly-ball governor controls the engine speed by varying the throttle opening to suit the load imposed on the engine. The governor rotates on a stationary pin pressed into the upper part of the timing gear cover. The governor is driven off the camshaft gear and turns 1/8 faster than the crankshaft speed.

1.4. The air-cooled system relies heavily on the flywheel cooling vanes and shroud assembly to operate effectively. The engine should never be operated with any of the engine shrouding removed.

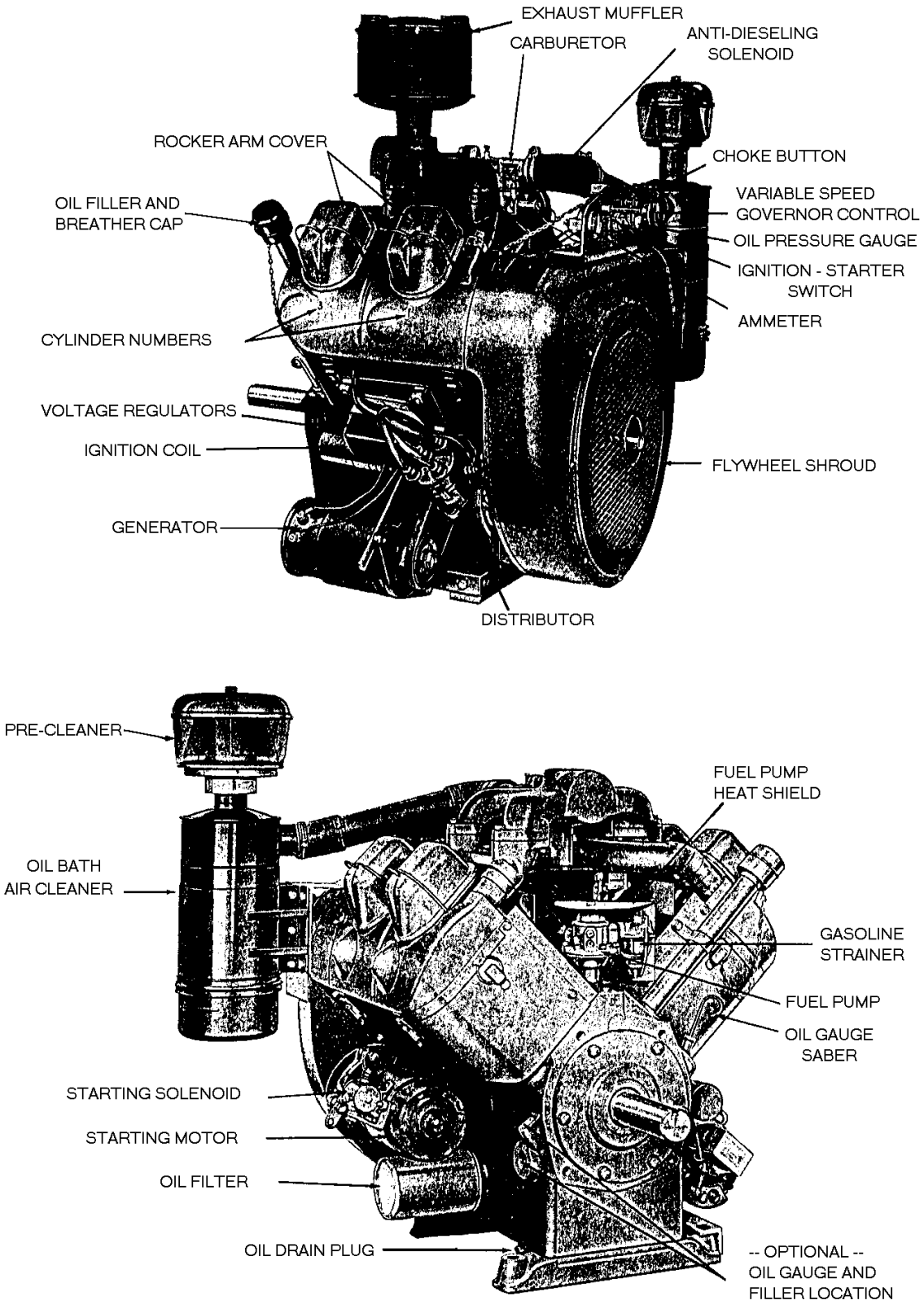


Figure 1. V-465D Wisconsin Gasoline Engine.

Notice. This AFQTP is *NOT* intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

2. ***To perform the task, follow these steps:***

Step 1: Start-up engine.

1.1. Perform a pre-operational check. Crankcase oil level, fuel level and battery condition.

1.2. Pull the over center clutch handle clockwise to disengage the clutch.

1.3. Pull the manual throttle control out about one inch.

1.4. Turn ignition-starting switch to the start position and at the same time pull out the choke control handle to the full out position.

1.5. Release the choke control handle to the open position after the engine starts.

1.6. If flooding should occur, continue cranking with the starting motor, but with choke open (choke handle in).

1.7. After the engine starts, push in choke control as required for smooth running. Choke must be completely in when the engine is warmed up.

1.8. After warm-up, place the manual throttle control in a position, which operates the engine at 1,000 +/- 100 rpm on engine tachometer.

Step 2: Stop engine.

2.1. Remove load from the engine and reduce speed to approximately 1000 RPM.

2.2. Allow engine to operate for three the five minutes, for cool down.

2.3. Turn ignition-starting switch to the off position, push throttle in.

2.4. Perform a post-operational check.

Step 3: Adjust engine carburetor. The main metering jet in the carburetor is of the fixed type, that is, it requires no adjustment. The idle needle should be adjusted for best low speed operation, while the carburetor throttle is closed by hand.

3.1. Adjust the throttle stop screw to obtain the desired idling speed. The idle adjusting needle should be in proper adjustment at about ¾ to 1 turn open.

3.2. Adjust the idle adjusting needle to obtain smooth idling of the engine (turn the needle out, counter-clockwise, to make the mixture richer; turn the needle in, clockwise, to make the mixture leaner).

Step 4: Time distributor to the engine.

4.1. The distributor requires no maintenance unless all the above items have been tested and the problem persists, or if during maintenance it was removed. If it was removed for service the operator must follow the engine manufacturer's instructions for timing the distributor to the engine. ***(See Step 5)***

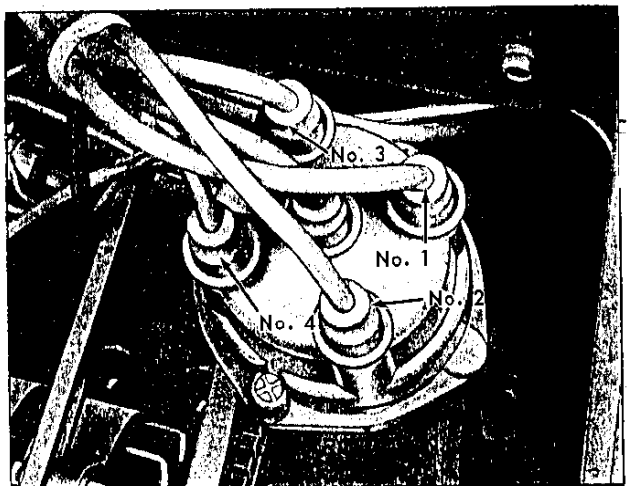


Figure 2a. Distributor Cap and Cylinder Tower Numbers.

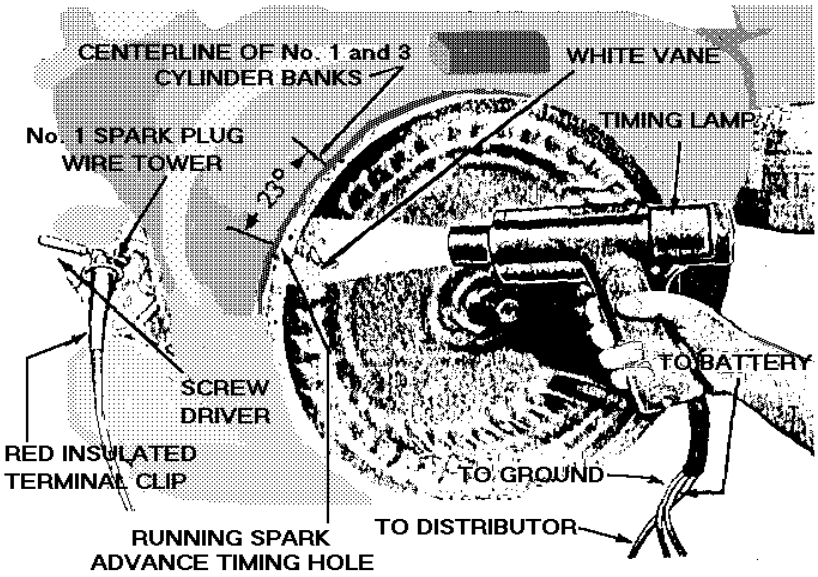


Figure 2b. Timing Engine With A Neon Light

Step 5: Check the timing with a neon timing light (Figure 2a & b). The engine should be timed to the 23-degree advance position at not less than 2000 RPM.

5.1. Insert a small screwdriver into the number 1 terminal tower on the distributor cap, making contact with the sparkplug wire terminal.

5.2. Connect the red terminal clip, of the timing light, to the metal portion of the screwdriver.

5.3. Connect one of the other timing light leads to the battery, and the other to ground.

5.4. With white chalk or paint highlight the end of the “X”-marked vane on the flywheel.

5.5. Operate the engine at 2000 RPM or higher and allow the flash from the neon lamp to illuminate the whitened vane.

5.6. At the time of flash, the leading edge of the vane should line up with the running advance-timing hole on the flywheel shroud. (See Figure 2b).

5.7. If the leading edge of the vane shroud and the running advance timing hole do not line up, loosen the distributor clamp screw and rotate the body slightly clockwise or counterclockwise until the white flywheel vane matches up with the advance timing hole. Carefully tighten the distributor clamp screw.

5.8. Shut down the engine and secure all shrouding, covers, plug wires and equipment.

NOTE:

1. The running spark advance is 23-degrees before the centerline of the number 1 and 3 cylinders.

2. The distributor breaker point gap is 0.015-inch at full separation. If the ignition spark is weak after continued operation, the breaker points may have to be readjusted or replaced.

Step 6: Gap spark plugs.

6.1. Remove old spark plugs, if serviceable you may clean, re-gap, and reuse.

6.2. Using wire gauge, check plug gap and set to 0.030-inch.

6.3. Install new gasket on spark plug.

6.4. Clean threads in cylinder head.

6.5. Install spark plug in cylinder and torque to 22 foot-pounds repeat as required.

Step 7: Service air intake system.

7.1. The oil bath cleaner must be serviced frequently, depending on the dust conditions. Service daily if required or operated under very dusty conditions.

7.2. Remove the oil cup from the bottom of air cleaner and clean thoroughly with clean diesel fuel

7.3. Add the same grade of oil as used in crankcase to the level line indicated on the oil cup.

7.4. Reinstall the oil cup.

7.5. Remove and clean the air cleaner element once every year as a minimum. Soak and clean the element with an approved solvent.

Step 8: Service gasoline supply system.

8.1. The gasoline strainer prevents sediment, dirt, and water from entering the carburetor and causing engine problems. The strainer has a glass bowl and should be inspected frequently, and cleaned if dirt or water is present.

8.2. To clean, loosen the nut below the bowl and swing the wire bail to one side to remove the bowl.

8.3. Next clean the bowl and screen and reinstall the bowl replacing the gasket.

Step 9: Perform post-operational checks.

9.1. Clean exterior of engine using engine degreaser, brushes, rags, and low-pressure air as needed.

9.2. Ensure documentation of maintenance is complete.

REVIEW QUESTIONS
FOR
PERFORM GASOLINE ENGINE TUNE-UP

QUESTION	ANSWER
1. The carburetor provides the proper gasoline to air mixture for the combustion chamber for all loads and speeds.	a. True. b. False.
2. What component produces the high potential electrical charge for the ignition system?	a. Battery-charging Alternator. b. The distributor. c. The ignition coil. d. The spark plug.
3. The air is divided and directed by ducts and baffle plates to insure what type of cooling?	a. Evaporative cooling caused by condensing vapors. b. Uniform cooling of all parts. c. Refrigerated. d. None of the above.
4. Why should an air-cooled engine never operate with any part of the shrouding removed?	a. Will have no effect on engine operation. b. Cause low engine operating temperature. c. Retard the air-cooling capabilities of the engine. d. All of the above.
5. How can you verify that the number 1 cylinder is on the compression stroke?	a. Remove rocker arm cover from number 1 cylinder and rotate engine with hand crank until inlet valve opens and closes. b. Observe that the leading edge of the “X” marked flywheel vane is in line with the vertical centerline mark of the No. 1 and 3 cylinder bank. c. The flywheel keyway is on top. d. All of the above.
6. What is the minimum rpm that the engine must operate when checking the timing with a neon light?	a. 1000. b. 1200. c. 1800. d. 2000.
7. Under what conditions should the oil bath air cleaner be serviced daily?	a. Normal. b. Dry. c. Wet. d. Dusty.
8. The gasoline strainer prevents sediment, dirt, and water from entering the carburetor and causing engine problems.	a. True. b. False.

PERFORM GASOLINE ENGINE TUNE-UP

PERFORMANCE CHECKLIST

INSTRUCTIONS:

The trainee must satisfactorily perform all parts of the task without assistance. Evaluate the trainee's performance using this checklist.

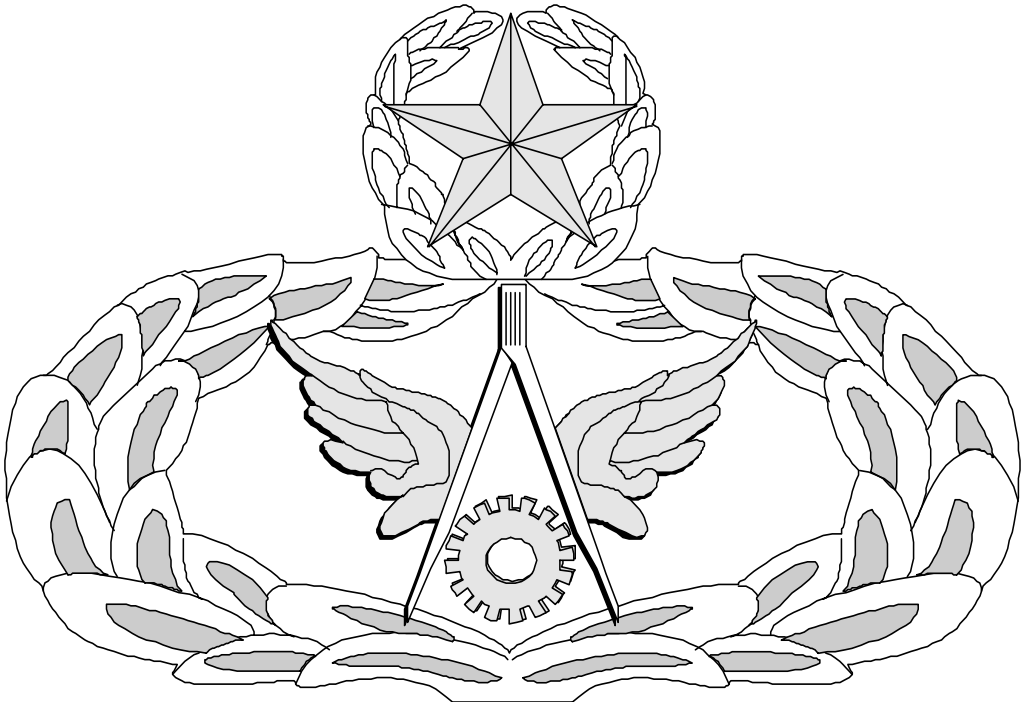
DID THE TRAINEE….?	YES	NO
1. Start the engine		
2. Stop the engine		
3. Adjusted engine carburetor		
4. Checked the timing with a neon timing light		
5. Re-gapped spark plugs		
6. Serviced air intake system		
7. Serviced gasoline supply system		
8. Cleaned exterior of engine		
9. Document maintenance		
10. Comply with all safety requirements		

FEEDBACK: Trainer should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer.

Air Force Civil Engineer

QUALIFICATION TRAINING PACKAGE (QTP)

REVIEW ANSWER KEY



FOR

ELECTRICAL POWER PRODUCTION

(3E0X2)

MODULE 17

ENGINE MAINTENANCE FUNDAMENTALS

Notice. This AFQTP is *NOT* intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

TROUBLESHOOT ENGINE MALFUNCTIONS
(3E0X2-17.1.2)

QUESTION	ANSWER
1. Air, spark, and fuel are three main items needed for ignition.	b. False.
2. In what stroke of the engine will you find both valves closed?	b. Compression and Power.
3. What fundamental step in the troubleshooting process is required to prove your work and ensure the equipment is in the proper working order?	d. Perform an operational check.
4. How many steps are there in the fundamental troubleshooting process?	c. 5.

PERFORM GASOLINE ENGINE TUNE-UP
(3E0X2-17.1.3.)

QUESTION	ANSWER
1. The carburetor provides the proper gasoline to air mixture for the combustion chamber for all loads and speeds.	a. True.
2. What component produces the high potential electrical charge for the ignition system?	c. The ignition coil.
3. The air is divided and directed by ducts and baffle plates to insure what type of cooling?	b. Uniform cooling of all parts.
4. Why should an air-cooled engine never operate with any part of the shrouding removed?	c. Retard the air-cooling capabilities of the engine.
5. How can you verify that the number 1 cylinder is on the compression stroke?	d. All of the above.
6. What is the minimum rpm that the engine must operate when checking the timing with a neon light?	d. 2000.
7. Under what conditions should the oil bath air cleaner be serviced daily?	d. Dusty.
8. The gasoline strainer prevents sediment, dirt, and water from entering the carburetor and causing engine problems.	a. True.

MEMORANDUM FOR HQ AFCESA/CEOF
139 Barnes Drive Suite 1
Tyndall AFB, FL 32403-5319

FROM:

SUBJECT: Qualification Training Package Improvement

1. Identify module.

   Module # and title_____

2. Identify improvement/correction section(s):

   _____ STS Task Reference
   _____ Training Reference
   _____ Evaluation Instructions
   _____ Performance Resources
   _____ Steps in Task Performance
   _____ Performance Checklist
   _____ Feedback
   _____ Format
   _____ Other

3. Recommended changes--use a continuation sheet if necessary.

   _____
   _____
   _____
   _____
   _____
   _____
   _____
   _____

4. You may choose to call in your recommendations to DSN 523-6392 or FAX DSN/Commercial 523-6488 or (850) 283-6488 or email ceof.helpdesk@tyndall.af.mil.

5. Thank you for your time and interest.

YOUR NAME, RANK, USAF
Title/Position