



**VIRGINIA**  
FFA ASSOCIATION



Virginia FFA Association  
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# Small Engines Troubleshooting Event – Sponsored by James River Equipment

*Superintendents: Stuart Byrd; Jeff Wilt; Andy Seibel, Virginia  
Cooperative Extension*

## REGISTRATION

**DEADLINE: SEPTEMBER 21ST** - Participants must register through the online registration system on vaffa.org. For State Fair entry system go to [www.vaffa.org](http://www.vaffa.org). **Teams** will need to be entered under team/club or school name. **Individuals** will also need to be entered separately to be eligible for premiums and scholarships.

**Location:** Best of Show Pavilion located in Harvest Landing

**Date:** Friday, September 27<sup>th</sup>, 2019

**Time:** Contest meeting at 10:30 AM, contest begins at 10:45 AM, awards presentation at the conclusion of the event.

Participants must have a \$5.00 Student Competition Ticket to enter the Fairgrounds. 4-H Agent/FFA Coach is responsible for ordering tickets directly from the following website:

<https://2017statefairstudentcompetitions.eventbrite.com>

## RULES

- Information can be found on the Virginia FFA website:**  
<https://www.vaffa.org>
- The six individuals who have won their respective local, Federation, and Area Small Engines Troubleshooting contests are eligible to compete.
- Event rules are below.

## PREMIUMS

The Virginia FFA Association will provide medals for the top three individuals and sponsored plaques to area and state winners. Ribbons will be presented at the event and plaques will be presented at the Virginia FFA State Convention. The State Fair of Virginia will provide premiums and ribbons for the high scoring individuals according to the following schedule:

	<b>1<sup>st</sup></b>	<b>2<sup>nd</sup></b>	<b>3<sup>rd</sup></b>	<b>4<sup>th</sup></b>	<b>5<sup>th</sup></b>
<b>6<sup>th</sup></b>	<b>\$50</b>	<b>\$30</b>	<b>\$20</b>	<b>\$10</b>	<b>\$5</b>
<b>\$5</b>					

## SCHOLARSHIPS

Contestants will be eligible to participate in the State Fair Scholarship Program. Please see the **State Fair website, [www.statefairva.org](http://www.statefairva.org) for more information regarding the State Fair of Virginia Scholarship Program and eligibility requirements for other available**

**scholarships.** The following scholarships will be awarded to the top four individuals:

1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>		
		\$600	\$400	\$300	\$200

### DESCRIPTION:

This event provides FFA members an opportunity to demonstrate their knowledge of small engines by completing a written test and to display their practical skills by troubleshooting an engine malfunction.

### PROCEDURES:

1. The state event is held during the State Fair of Virginia.
2. One participant from each area competes in the state event.
3. The event consists of two parts: Part 1 is a written test, and Part 2 is a practical test.

### PART 1: WRITTEN TEST

1. The written test contains 20 true-false and/or multiple-choice questions, one measurement, five tools to identify, and one part for which to determine the replacement part number.
2. The time limit is 40 minutes.
3. The test has a maximum of 100 points.

### PART 2: PRACTICAL TEST

#### A. *Preparation for the Practical Test* *Event Manager*

1. Secures six engines of the same make and model.
2. Secures parts, oil, fuel, rags, fires extinguishers, and two containers per participant (one container is used to exchange parts; the other is used for storing parts while troubleshooting).
3. Designates a spare-parts area.
4. Acts as parts manager and event timekeeper.
5. Appoints judges.
6. Determines and supervises the installation of the malfunctions.
7. Discusses the malfunctions with the judges before the event.
8. Furnishes a malfunction check-off sheet to each participant.
9. Conducts a drawing (1-6) among the participants to determine engine assignments.
10. Records the starting and completion time of each participant.
11. Has each replacement part readily available? Records the parts requested by each participant.
12. Assumes responsibility for the overall operation of the event.

#### *Judges*

1. Ensure that participants do not inspect the engines before the event.
  2. Observe one participant.
  3. Keep a copy of the malfunction check-off sheet and a score sheet for one participant (use these to determine whether the malfunctions are corrected properly).
  4. Observe the progress of repairs but do not interfere with the participant unless his or her repairs are damaging the engine or endangering the participant.
  5. Do not assist any participant in any manner by locating or correcting malfunctions.
  6. Ensure that the participant signals the event manager when finished.

## *B. Procedures for the Practical Test*

1. The practical test involves having the participant troubleshoot an engine to determine specific malfunctions and to adjust the engine so that it operates properly.
2. The maximum time limit is two hours. A shorter time limit may be set if appropriate. If an unplanned malfunction occurs, time required to correct the malfunction is deducted from the participant's total time.
3. If possible, all engines are of the same make and model and have the same malfunctions. Participants bring their own safety glasses, tools, and repair manuals.
4. Oil, fuel, rags, fire extinguishers, and parts containers are provided.
5. No work is to be done outside the designated troubleshooting area.
6. If a mechanical failure over which no one has any control should occur, it is considered an act of nature, and participants are expected to accept this without claim or recourse.
7. Adjustments must be within tolerances specified in repair manuals.
8. Participants should consult with the event manager when in doubt.
9. Participants are not penalized for requesting parts if they can justify their requests to the events manager.
10. Participants may be disqualified for any of the following reasons:
  - failure to follow rules and regulations of the event or the judges' instructions
  - conduct on the part of an instructor or participant unbecoming a gentleman or lady or inappropriate to the spirit of the event and of the school represented
  - smoking in the event area
  - conversing with anyone other than the judges and the event manager
  - employing an unapproved practice (such as using a starter fluid).
11. The event manager is allowed to request a participant's aid and to use participant's tools to determine if malfunctions have been corrected.
12. The point-addition system is used to score the event. The participant with the lowest total score is the winner. Each participant is scored on safety throughout the event. Each participant receives a Malfunction Check-off Sheet to complete as he or she corrects a malfunction. This sheet is also used for scoring. (The Malfunction Check-off Sheet and the Small Engines Troubleshooting Event Score Sheet follow this section).
13. Participants must notify the event manager when they have completed the event. At that point, no further adjustments to the engines are allowed.
14. Only members of the event committee and participants are allowed in the immediate troubleshooting area. Spectators are allowed to observe from a distance but may not converse with participants.
15. The event manager and judges' rule on any condition not covered herein. Their decision is final.

# Small Engines Troubleshooting

## MALFUNCTION CHECK-OFF SHEET

Participants Name \_\_\_\_\_

School \_\_\_\_\_

Engine Model \_\_\_\_\_

Type \_\_\_\_\_

Engine

	GOOD	NEEDS WORK	DESCRIBE WORK DONE
<b>1. Ignition System</b>			
a. Spark Plug			
b. Breaker points			
c. Condenser			
d. Armature air gap			
e. Ignition wires			
f. Other			
<b>2. Fuel System</b>			
a. Air Cleaner			
b. Carburetor			
c. Fuel			
d. Idle adjustment			
e. Main Load adjustment			
f. Choke			
g. Stop Switch			
h. Governor			
i. Other			
<b>3. Cranking System</b>			
a. Compression			

b. Tappet clearance			
c. Rings			
d. Timing			
e. Gaskets			
f. Other			
<b>4. Lubrication</b>			
a. Oil Level			
b. Drain plug			
c. Breather			
d. Other			

NOTE: Notify event manager when you have completed the event.

## Small Engines Troubleshooting

### SCORE SHEET

Participants Name \_\_\_\_\_  
 School \_\_\_\_\_

Engine Model \_\_\_\_\_  
 Type \_\_\_\_\_

Engine

	<b>SCORING AREA</b>	<b>POINTS</b>
1.	Failure to start engine (+200 points)	
2.	Failure to correct present defects ( _____ defects not corrected X 50 points)	
3.	Number of parts requested but not needed: _____ X 20	
4.	Carburetor idle mixture improperly adjusted (+20 points) (Engine must have a distinct high and low end idle)	
5.	Number of minutes or major fractions thereof (over 30 seconds) of troubleshooting: _____ Minutes X 2 points	
6.	Safety violations (ex. Goggles, carelessness): _____ safety violations X 20 points	
7.	Improper use and care of tools: _____ incidents X 20 points	
8.	Failure to reassemble the engine to factory/original condition + 100	
9.	Written Examination: _____ wrong X 5 points	
10.	Parts and Tool ID: _____ wrong X 10 points	
11.	Measurement: +5 points if incorrect	
12.	Part Lookup: +20 points if incorrect	
	<b>TOTAL POINTS</b>	

## Small Engines Troubleshooting

### SCORE SHEET

*Measurement, Identification, Part Number*

Participant \_\_\_\_\_  
 School \_\_\_\_\_

## MEASUREMENT EXERCISE

1. \_\_\_\_\_

## PARTS AND TOOL ID

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_

## DETERMINING PART NUMBER

1. \_\_\_\_\_

## Small Engines Event Tool List

Adapter—"to 3/8"  
Adjustable wrench  
Allen or hex wrench (SAE & metric) Ball peen hammer  
Box-end wrench  
Brass hammer  
Breaker bar\*  
Center punch  
Clutch type screwdriver  
Cold chisel  
Combination wrench  
Compression tester or gauge Crankshaft holder wrench  
Cylinder gauge  
Cylinder hone  
Cylinder ridge remover  
Deep socket or deep well socket\*# diagonal cutters  
Diagonal cutting pliers or  
Dial caliper  
Die  
Die stock  
Drift punch  
Extension\*  
Feeler gauge (SAE & metric)  
Flat file  
Flywheel holder  
Flywheel knocker  
Flywheel puller  
Gear or wheel puller  
Groove joint or channel lock pliers Half-round file  
Ignition or spark tester  
Impact socket\*  
Lever wrench pliers or vise grip pliers  
Metric socket  
Micrometer  
Needle nose or long nose pliers  
Nut driver \*  
Offset screwdriver  
Open-end wrench  
Phillips screwdriver  
Pin punch or prick punch  
Piston groove cleaner  
Piston ring expander  
Plastic hammer  
Ratchet or ratchet handle\*  
Ratchet starter remover  
Ring compressor or piston ring compressor Round file  
Rubber mallet  
Screw extractor

Sliding "T" handle  
Slip-joint or combination pliers Snap ring pliers  
Spark plug gauge and adjusting tool Spark plug socket  
Speed handle\*  
Standard or regular socket\*# Standard screwdriver  
Starter clutch wrench Tap  
Tap wrench  
Telescoping gauge Torque wrench\* (in lbs.) Torx screwdriver  
Valve grinder (hand) Valve lapper (hand) Valve refacer  
Valve spring compressor Vernier caliper Vibration tachometer  
\* size drive—3/8  
# point

# ENGINE MALFUNCTIONS

The following list contains example of engine and hydraulic system malfunctions for both diesel and gasoline tractors.

## **Diesel Tractor**

Failure of Engine To Crank

- dual-range shift lever not in neutral position
- loose, grounded, shorted, or broken wiring
- discharged or weak battery
- inoperative starting motor

## **Engine Cranks but Fails To Start**

### **Fuel System**

- lack of fuel in tank
- excessive air
- fuel shut-off control rod in the “off” position
- fuel tank sediment bowl shut-off valve in the “off” position
- fuel filters clogged
- injection pump idle speed set too slow

### **Air System**

- air cleaner inlet tube restricted
- plugged or clogged air cleaner

### **Rough Engine Operation**

- injection pump incorrectly timed
- faulty injectors
- faulty injection pump

### **Excessive Engine Exhaust Smoke**

- faulty injectors
- incorrect injection pump timing
- clogged air cleaner
- improper valve adjustment
- burned, worn, or sticking valves
- excessive operation at low idle speed or loads

### **Loss of Power**

- plugged fuel filter
- worn rings, pistons, or sleeves, burned or sticking valves
- faulty injection pump governor action
- faulty throttle or governor linkage
- blown head gasket
- brakes dragging
- improper valve adjustment
- connecting rod or main bearings too tight
- clogged air cleaner
- fuel shut-off rod linkage incorrect
- faulty pump timing

### **Excessive Fuel Consumption**

- faulty injectors
- pump timing incorrect
- excessive fuel pressure line leakage
- throttle linkage incorrect
- burned, worn, or sticking valves
- worn pistons, rings, or sleeves
- improper valve adjustment, worn or bent push rods
- engine overheating
- clutch slippage
- brakes dragging
- excessive exhaust back pressure
- faulty cooling system thermostat

- clogged air cleaner or air pipe

### **Erratic Misfire**

- faulty injectors
- weak or broken valve springs
- sticky valves
- excessive air in the system
- plugged fuel filters
- water in fuel

## **Gasoline Tractor**

### **Failure of Engine To Crank**

- dual-range shift lever not in neutral position
- loose, grounded, shorted, or broken wiring
- discharged battery
- inoperative starting motor

### **Engine Cranks but Fails To Start**

(Ignition Spark Failure)

- loose, grounded, shorted, or broken ignition wiring
- mechanical failure of spark plugs-cracked or broken porcelain, incorrect gap setting, electrodes fouled
- distributor failure
- faulty coil

### **Engine Cranks but Fails To Start**

(Carburetion Failure)

- choke not pulled out when engine is cold
- throttle closed
- fuel shut-off valve not open
- fuel tank empty
- clogged vent in fuel cap
- clogged fuel filter or screens
- restricted fuel line
- restricted carburetor passages
- maladjustment of needle valves
- water deposits in carburetor
- air cleaner inlet tube restricted
- clogged air cleaner
- throttle and/or governor linkage inoperative or incorrectly adjusted
- air leak in fuel line
- cracked or broken intake manifold
- valves sticking

### **Engine Cranks Slowly**

- weak battery
- crankcase oil too heavy for temperature
- defective starter or connections

### **Excessive Fuel Consumption**

- fuel leak
- fouled air cleaner
- idle adjustment incorrect
- main jet adjustment incorrect
- timing incorrect
- automatic spark advances not working properly
- distributor points need replacing
- spark plugs need torquing or replacing
- faulty wiring
- improper valve timing
- burned, worn, or sticking valves

- worn pistons, rings, or sleeves
- improper valve adjustment, worn or bent push rods
- engine overheating
- clutch slipping
- brakes dragging
- excessive exhaust back pressure

#### **Excessive Oil Consumption**

- oil leak
- plugged breather pipe
- worn valve guides
- worn, broken, or ill-fitted rings
- worn, scored, or out-of-round cylinders or pistons
- worn ring grooves
- inverted rings
- stuck piston rings
- worn neoprene oil guard gaskets on the intake valves

#### **Loss of Power**

- dirty or improperly adjusted carburetor
- faulty ignition
- worn rings, pistons, or sleeves; burned or sticking valves
- faulty governor operation
- faulty throttle, governor, or choke linkage
- crank in intake manifold or leaky gasket
- blown head gasket
- brakes dragging
- improper valve adjustment, worn or bent push rods
- connecting rods or main bearings too tight
- excessive exhaust back pressure
- clogged air cleaner

#### **Erratic Misfire**

- dirty carburetor
- weak or broken valve springs
- sticking valves
- faulty ignition

#### **Pre-ignition**

- poor grade of fuel
- ignition timing too far advanced
- engine overheating
- heavy carbon deposits in the combustion chamber
- spark plugs of improper heat range
- insufficient tappet clearance
- burned or worn valves
- improper distributor advance

#### **Continuous Misfire**

- stuck or burned valves
- blown head gasket
- faulty ignition
- improper timing

#### **Engine Overheating**

- thermostat stuck closed
- water leakage
- fan belt slippage
- clogged radiator core
- carburetor mixture too lean
- improper ignition timing
- fouled cooling system
- engine too tight
- improper valve timing

#### **Hydraulic System Problems**

##### **Low Oil Pressure (Power Shift Transmission)**

- clogged transmission oil filter element
- clogged hydraulic oil filter element
- low oil supply

##### **Transmission Oil Overheats**

(Power Shift Transmission)

- low oil supply
- oil cooler air passages clogged
- excessive shifting under heavy load

##### **Hydraulic Oil Overheats**

- low oil supply
- oil cooler air passage clogged

#### **Insufficient Hitch Transport Clearance**

- center link too long
- lift links too long
- implement not level
- implement improperly adjusted

#### **Hitch Fails To Lift**

- excessive load on hitch
- Hitch Drops Slowly
- speed-of-drop valve set improperly

#### **Hitch Too Active**

- selector lever in wrong position
- No Hitch Response To Draft Load
- selector level in wrong position
- speed-of-drop too slow

#### **Remote Cylinder Will Not Lift Load**

- excessive load
- breakaway coupler not completely engaged

#### **Remote Cylinder Rate of Travel Incorrect**

- incorrect flow control valve setting

#### **No Remote Cylinder Float Position**

- control rod in lower hole on control lever

#### **Direction of Remote Cylinder Travel Reversed**

- improper hose connections

#### **Brake Pedal Bottoms When Engine Stops**

- bleed screws left open
- air in system