Virginia FFA: Tractor Troubleshooting

State Fair of Virginia

2026 Contest Letter

State Fair Address: Meadow Event Park 13111 Dawn Blvd Doswell, VA 23047 Caroline County	**Contest Registration and Tickets:** Participants must have a $6 Student Competition Ticket to enter the Fairgrounds unless they are already at the Fair for another competition. Agricultural Education instructors are responsible for ordering tickets: https://www.vaffa.org/state-fair-of-virginia	**Event Location:** Best of Show Tent	**Date:** September 25, 2026 **Times:** *Contest Meeting:* 10:00 AM *Contest Begins:* 10:15 AM *Awards:* Following the Event
Contest Superintendents: Andy Seibel RJ Nobblitt	**Entry Deadline:** September 15, 2026 by 5:00 PM.	**Questions? Contact us!** *Virginia FFA Association* Andy Seibel - gseibel@vt.edu Sarah Jo Jones - shelms07@vt.edu 540-231-3823	

Purpose:

Three components constitute this event: a written test, a diagnostic component, and a repair component. These three are designed to allow participants to demonstrate their knowledge of the theory of tractor operation, their ability to diagnose tractor malfunctions, and their skills in making repairs.

Rules and Guidelines:

1. Each team consists of two members.
2. Local FFA advisors must use a competitive basis for determining participants to represent their schools.

3. Area events are subject to the same rules and regulations as the state event and must be held before June 1st of each year.
4. The winning area team competes in the state event.
5. FFA members who have competed in but have not won the state event are eligible to compete.
6. Safety glasses must be worn during the diagnostic component and the repair component. The school advisor is responsible for having the team suitably attired.
7. Smoking is not permitted in the event area.
8. Teams may be disqualified for any of the following reasons:
    a. failing to follow rules and regulations
    b. failing to obey judges' instructions
    c. operating tractors recklessly or violating common safety rules
    d. leaving tractors in an unsatisfactory condition e. behaving in a manner unbecoming a gentleman or lady or not in the spirit of the event or the school represented.
9. Each team must furnish its own equipment as follows:
    a. One set of tools consisting of sockets, wrenches, feeler gauge, screwdriver, and hammer.
    b. Test equipment is limited to the following:
        i. 1 hydrometer
        ii. 1 volt-ampere meter
        iii. 1 vacuum gauge
        iv. 1 compression gauge
        v. 1 test light
        vi. 1 jumper wire set 36" long
        vii. 1 torque wrench
        viii. 1 OHM kilovolt meter.
10. The winning team receives a plaque for their school and a medal for each member. Second and third place teams receive medals for each team member.

Events:

Procedures for the Written Test:

- Each participant must take the written test.
- The test is composed of 50 true/false and multiple-choice questions.
- The time limit for the test is 25 minutes.
- Each question is worth one point.
- The highest score per team member is 50 points; the highest team score is 100 points.
- All questions will be taken from the following references:
    - Tractor Maintenance—Principles and Procedures (AAVIM)
    - Fundamentals of Service: Tractors (John Deere)
    - Farm and Ranch Safety Management (John Deere)
    - Fuels, Lubricants, Coolants, and Filters (John Deere)
    - Fundamentals of Maintenance Service (John Deere)
    - Fundamentals of Machine Operation:Preventive Maintenance (John Deere).

- Fundamentals of Service: Engines (John Deere).

Procedures for the Diagnostic Event:

1. The number of tractors used in the event is equal to the number available.
2. Each event has two malfunctions. A short description of the problem to be diagnosed appears on each tractor.
3. Each team has 15 minutes per tractor to identify the two malfunctions. No repair work is done in this phase of the event.
4. Teams rotate to each tractor in the event.
5. Different tractor models, including both gasoline and diesel engines, are used in the event.
6. Malfunctions relate to air; fuel; power train; and electrical, braking, and hydraulic systems.
7. A list of possible malfunctions is provided at the end of the event rules.
8. Teams receive 10 points for each malfunction that is diagnosed correctly.

Procedures for the Repair Event:

1. After the diagnostic event, teams draw for tractors.
2. Each team has 20 minutes to correct the two malfunctions.
3. Road testing of tractors is not allowed.
4. New parts are not provided. If a part is broken by the team, no credit is given for repairing the malfunction. If a defective part is found, the original part is made available for replacement.
5. All work must be performed within the designated repair area. Only judges and team members are allowed in this area.
6. Stall testing is not allowed.
7. Test equipment used by the teams in making repairs is left by the tractor for use by the judges in checking the completed work.
8. Once repairs are completed, the tractor should operate according to standards provided by the event coordinator prior to the event.
9. Teams earn 50 points per corrected malfunction. The following standards apply:
    a. Engine speed is within 50 rpm of specification.
    b. Bolts are torqued within 10 lbs. of specification.
    c. Clutch free travel is within 1/2” of specification.
    d. Brake pedal travel is within 1” of specification.
    e. Other standards are announced before the event.
10. If a mechanical failure over which no one has any control should occur, the event is deemed an act of nature without claim or recourse on behalf of the participant.
11. The event committee rules on any condition not covered herein. Their decision is final.

Judging/Scoring Criteria:

- Written Exam (50 points per team member) - 100 points
- Diagnosis (10 points per malfunction) - 100 points
- Repair (50 points per correction) - 100 points
- 10 point deduction for safety infractions

Tie Breaker: Teams completing repair work before 20 minutes have elapsed receive additional credit of two points for each minute or major fraction thereof left in the 20-minute time period as the tie breaker.

Awards:

Cash Awards:

Place:	Award:
1st	$100
2nd	$75
3rd	$50
4th	$25
5th	$25

Ribbons:
1st-6th Place - Rosette Ribbons

State Fair Scholarship Program:
Contestants will be eligible to participate in the State Fair Scholarship Program. Please see the State Fair website, 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:

1st Place - $600
2nd Place - $400
3rd Place - $300
4th Place - $200

Event Sponsor:

JAMES RIVER

Supplementary Materials:

- Event Scoresheet
- List of Malfunctions

Tractor Troubleshooting Score Sheet

EVENT

TOTAL _____

Written Test

1 point per question answered correctly
(50 questions x 2 students = 100 total possible points)

Diagnosis

10 points per correctly diagnosed malfunction
(100 possible points)
Tractor A ___
Tractor B ___
Tractor C ___
Tractor D ___
Tractor E ___

_____

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

- duel-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
- 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

•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 advance 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