

INDIANA FFA ORGANIZATION

SMALL ENGINES

CAREER DEVELOPMENT EVENT

I. PURPOSE

As the small engine industry keeps pace with the space age, it becomes increasingly important that accuracy in workmanship be maintained at the highest degree of perfection. The more complex mechanisms of today's automobiles and the increased awareness of safe operation of small engine equipment requires a degree of accuracy in workmanship that was unheard of a few short years ago.

Since the main goal of the Indiana FFA Small Engine CDE is to interest and prepare high school students for rewarding careers in the mechanic's service field, we feel that all involved with the event should continue to place emphasis on the importance of high quality workmanship.

II. OBJECTIVES

1. Student will develop their communication skills.
2. Students will develop teamwork skills.
3. Students will develop problem-solving skills.
4. Students will enhance research and analytical skills.
5. Students will use the event practicums to enhance their English, Math and Science Skills.
6. Students will interact with industry professionals.

III. EVENT RULES

The rules and regulations stated herein are presented for the purpose of establishing basis rules and guidelines to follow in conducting a small engines event. These rules will not cover every situation that may be encountered during an event. One of the responsibilities of the local event manager will be to make local rulings that are not covered herein.

1. Participation will consist of one team per school for the district, section, and state events. The top three teams from each District will advance to the Section Event with the top three teams from the Section event advancing to State.
2. Any FFA member in good standing will be eligible to participate.
3. High school students that have not won as team members in the state level will be eligible to compete in the event again. Any infraction of this rule will result in immediate disqualification of the team and will not be allowed to compete in the state event.
4. Parental consent forms must be submitted by all participants. The team will not be allowed to compete, regardless of circumstances, if forms are not submitted.
5. Team members are not allowed to leave the area during the event.
6. Last year of eligibility will be the summer after graduation from a secondary school.
7. Teams may be disqualified for the following reasons:
 - failure to follow rules and regulations or the team judge's instruction
 - violation of common safety rules and/or endangering team mates thorough carelessness
 - misconduct on the part of the instructor, the student, the school they represent, of behavior not in the spirit of the contest

IV. EVENT FORMAT

A. DESCRIPTION OF EVENTS

Students will participate in seven practicums throughout the event in either individual or team formats. The practicums include:

- Written Exam
- Tool and Parts Identification
- Skills
- Assembly and Disassembly
- Service and Repair Manual Research
- Skills
- Customer Service (State Event)

B. WRITTEN EXAM PRACTICUM – 50 POINTS

- Exam will test team knowledge concerning small engine principles, basics, theory of operation, maintenance, and troubleshooting.
- Exam will be completed as a team.
- Twenty minutes will be allowed to complete the exam
- Use of multiple choice, true/false, matching and fill-in-the blank can be used.
- Exam guidelines should be considered the same at all levels, district, section, and state.

C. TOOL AND PARTS IDENTIFICATION – 50 POINTS

- Tool and parts identification will consist of 25 tool or parts to be identified.
- The tool and parts identification will be an individual practicum with the team's scored averaged together.
- Tool and parts ID will come from the 2000 Briggs and Stratton Tool and Parts Manual (complete list is included in the resources section of these guidelines)

D. ASSEMBLY AND DISASSEMBLY – 100 POINTS

- Contestants will correctly assemble a small engine, using safe and industry accepted procedures within a given time limit. The engine will also be adjusted to run properly at given high and low speeds.
- Teams are composed of 2 people.
- Teams provide their own tools and safety equipment.
- Team members must wear safety equipment during competition.
- Team members must wear safe clothing during competition.
- Event judge decisions are final.
- All parts used in the assembly must be from the engine provided. Teams may not substitute their own parts such as sparkplugs, flywheel keys, gaskets, etc.
- Each team must provide a qualified engine judge for the event. This person may be the team coach if necessary.
- No books or manuals other than those provided by the event officials may be used.

Engine

The engine used for the state small engines event will be a Briggs & Stratton 5 horsepower, single-cylinder, "L" head, horizontal shaft, Industrial Plus engine.

Model 133412
Type 0059 01
Code 95101807

Other engines may be substituted for district and section events. It is strongly recommended that these engines be horizontal shaft in design for ease in anchoring the engine to tables for starting and adjusting purposes. Attempts should be made to have all engines in the event be of the same model and type.

E. SERVICE AND REPAIR MANUAL RESEARCH – 50 POINTS

- This practicum will test the individual student's ability to find information needed to correctly trouble-shoot, repair and adjust specific engines.
- Team members will work individually and their scores will be averaged to obtain the team score.
- Contestants will be given specific engine model, type and code numbers to use in answering the test questions.
- The test should include a minimum of 20 questions and should have a total value of 30 points.
- Contestants will use a Briggs and Stratton Repair Manual to find the answers.
- Contestants will have 20 minutes to complete the practicum.
- They will provide their own writing utensil.
- The repair manual to be used for this practicum will be B & S repair manual # 270962 for single cylinder L-head engines built after 1981.

F. SKILLS – 50 POINTS

- Team members will work together to demonstrate their measurement skills on the engine.

G. CUSTOMER SERVICE – 50 POINTS (ONLY AT STATE EVENT)

- Team members will work together to solve a customer service scenario.
- Team members will be asked to use either their written and oral skills in solving the problem.

H. TIE BREAKER (IN THE CASE OF A TIE THE FOLLOWING SCRITERIA WILL BE USED)

- Step 1 - Total added scores form specification sheet plus written exam plus tool and parts ID plus the skills stations.
- Step 2 – Score form the skill stations
- Step 3 – Score from the tool and part ID
- Step 4 – Score from specification sheet
- Step 5 – Score from engine assembly
- Step 6 – Score from customer complaint (STATE ONLY)
- Step 7 – Score form exam

V. EQUIPMENT STANDARDS

Assembly/Dissassembly

<u>Coordinator Requirments</u>	<u>Contestant Requirmenets</u>
<ul style="list-style-type: none"> • One engine per team entered • One table or bench per team entered • One table for gasoline, funnels, papers, etc. • Two C-clamps per engine • One engine manual per team • One quart of oil per team (sae 30 recommended) • Good ventilation for exhaust fumes • At least 1 Safety gas can per every 2 teams filled with gas • Funnels for oil and gas • Copies of the scorecard for each team/judge 	<p>General Tools</p> <ul style="list-style-type: none"> • ¼ inch drive socket set with sockets down to ¼ inch in size and extensions • 3/8 inch drive socket set with extension • Combination end wrenches from 3/16 inch to 9/16 inch • Spark plug socket • Screwdrivers – flat head, phillips, and torx • Pliers – slip-joint, long-nose, needle-nose • Hammers and Mallets – ball-pein, brass, rubber, rawhide • Alignment punches • Safety glasses or goggles • Fire Extinguisher • Hand towels/rags <p>Small Engine Specialty Tools</p> <ul style="list-style-type: none"> • 3/8” drive inch-pounds torque wrench • ¼” to 3/8” drive adapter • 3/8” or ½” drive foot-pounds torque wrench • Piston ring compressor • Piston ring expander • Feeler gauges – wire and flat • Flywheel holder or flywheel strap wrench • Spark tester • Tachometer • Valve spring compressor • Valve spring keeper tools • Re-coil clutch wrench • Carb. Adjustment tools

VI. EVENT COORDINATION STANDARDS

Written Exam Standards

- All exams must be developed from official resources. Terminology, techniques, diagrams, illustrations, etc. must be consistent with resource material.
- The exam will be administered by the exam supervisor. All instructions or special instructions must be announced prior to administering the exam.
- The exam will begin by the announcement of the exam supervisor, at this time the official start time will be recorded and will conclude in 20 minutes.
- Exam supervisor will collect exams as they are finished and at the end of the exam session. All answers are final when the contestants turn the exam into the exam supervisor.
- Exams will be graded and scored. Each exam should be scored twice by the exam supervisor and an additional official to avoid inadvertent mistakes.
- At the District level, exams will be organized and implemented by the contest manager. The answer key will be developed by the contest manager but subject to the analysis of at least but not limited to one other contest official or qualified individual.

- At the state level, exams will be organized and distributed by the Indiana FFA organization to the designated section sites and state contest. The exam will be implemented by the exam supervisor.

Engine Assembly/Dissassembly Standards

Engine Preparation

An engine model to be used must be determined and enough obtained to provide one per team.

The engines must be checked to be sure they run and operate correctly before being torn down.

The engines are then disassembled exactly the same.

All parts and bolts, etc. should be placed in containers to keep them from getting lost.

Equipment and supplies listed above must be secured.

Judges should be assigned to teams and briefed on proper scoring, what to look for, and told how to get questions answered during the contest.

An engine manual should be placed on each table/bench for team use.

Conducting the engine assembly practicum

1. Place engine parts and bolts on tables/benches
2. Assign teams to a table/bench
3. Allow teams to set up and organize tools
4. No parts should be touched or moved until the contest begins
5. Give final instructions for engine assembly
6. Start the practicum – Time limit is 75 minutes
7. Stop the practicum at 75 minutes
8. Team judge and event judge determine team score (contest judge's decision is final)
9. Team ranking is determined

VII. RESOURCES

Briggs and Stratton Repair Manual for Single Cylinder 4-cycle Engines;
Number: 270962

Briggs and Stratton Tool and Part Identification
Copyright @ 2000 by Briggs and Stratton

AgriScience Mechanics;

Lloyd J. Phillips, Glen M. Miller, Interstate Publishers, Inc. Copyright @ 1998 ISBN 0-8134-3088-7

Briggs and Stratton Manuals

Text CE8020

Workbook CE8021

Instructor guide CE8022

Engines, Compact Equipment; Fundamentals of Service; John Deere Service
Publications, Copyright @ 1992/ Deere and Company, Moline IL ISBN 0-86691-146-4

briggsandstratton.com;

home page for Briggs and Stratton, engine support and maintenance.

Customer Assistance Scorecard

Contestant Name: _____

Chapter: _____

Category	Points Possible	Points Scored
Approach	5	
Effective Greeting and Offer to help		
Positive, Enthusiastic, not hesitant		
Personality	10	
Pleasant, Friendly manner		
Not pushy in selling		
Voice	10	
Easy to hear and understand		
Proper grammar		
Information Requested from Customer	10	
Determines assistance needs		
Effectively asks details/preferences		
Salesmanship	10	
Effective, tries to expand sale		
Develops customer confidence in product		
Closing	5	
Repeats order, handles payment		
Asks if instructions are understood		
Closes		
Grand Total	50	

SMALL ENGINE ASSEMBLY SCORE SHEET

Chapter Name: _____

Engine Model Number : _____

Procedures	Points Possible	Points Scored
Oil plug installed and tightened.	2	_____
Rings installed correctly on piston.	3	_____
Rings oiled when installed in piston ring compressor.	2	_____
Piston & rings properly installed into engine cylinder.	2	_____
Rod cap installed with both bosses visible and matched.	2	_____
Oil dipper installed correctly.	1	_____
Rod cap oiled and torqued properly.	3	_____
Valve lifters installed and oiled.	2	_____
Timing marks aligned correctly.	2	_____
Governor installed correctly.	2	_____
Torque sideplate or sump cover in at least 2 sequences.	2	_____
Torque sidecover/sump to correct setting.	1	_____
Valve springs and keepers installed correctly.	3	_____
Head bolts in correct position - 3 longer ones.	2	_____
Head bolt threads oiled properly - very lightly.	1	_____
Head bolts torqued in correct sequence every time.	2	_____
Head bolts torque split into 2 or 3 sequences.	2	_____
Head bolts torqued to correct setting.	2	_____
Flywheel and key installed correctly.	1	_____
Flywheel washer and nut or clutch installed.	2	_____
Flywheel torqued to correct setting.	1	_____
Coil & armature or magnetron installed/adjusted correctly.	3	_____
Carb linkages installed correctly without bending/forcing.	2	_____
Intake tube installed with gasket.	2	_____
Carb. installed with gasket or o-ring.	2	_____
Fuel lines installed and tightened properly.	2	_____
Fuel tank installed and tightened properly.	1	_____
Governor spring installed properly without damage.	1	_____
Air cleaner housing installed properly.	1	_____
Air cleaner properly installed.	1	_____
On/off switch properly installed and functioning.	1	_____
Choke control installed and adjusted correctly.	1	_____
Sparkplug adjusted and installed properly.	1	_____
Proper amount of oil added.	1	_____
Oil cap or dipstick properly mounted and tightened	1	_____
Correct Tool Usage - LOOK FOR - pliers on nuts and bolts, other tools used as a hammer, adjustable wrenches used, appropriate use of small engine specialty tools, etc.	5	_____
Safety - LOOK FOR - safety glasses off, dropped items, slippage of hands and tools, spills, excessive speed, etc.	5	_____
Engine runs for 2 minutes and for the judge.	15	_____
Engine runs smoothly at low RPM. (1700 rpm)	5	_____
Engine runs smoothly at high RPM. (3200rpm)	5	_____
Engine accelerates and decelerates smoothly.	5	_____
Grand Total	100	_____

SUMMARY SCORE SHEET

School _____		Team's placing in event _____	
Part 1	Written Exam	50 points	_____
Part 2	Tool and Parts ID	50 points	_____
Part 3	Assembly and Disassembly	100 points	_____
Part 4	Service Manual Research	50 points	_____
Part 5	Engine runs unassisted for 2 minutes or starts and runs for judges	25 points	_____
Part 6	Skills	50 points	_____
Part 7	Customer Service(state)	50 points	_____
Total possible(District and Section)		325 points	_____
Total possible(State)		375 points	_____

**OFFICIAL INDIANA FFA STATE SMALL ENGINES CDE
PART ID LIST**

Air cleaner (Oil foam, dual element or Cartridge)	Governor control bracket
Air deflector shield	Governor spring
Armature	Intake manifold
Band brake control bracket	Link (type not important)
Belleville washer	Magnetron module
Blower housing	Muffler
Brake shoe \ band brake	Needle valve
Breather tube	Oil slinger
Breather assembly	Oil drain plug
Camshaft	Oil seal
Carburetor	Piston
Connecting rod	Piston Pin
Connecting rod cap	Piston pin retainer
Connecting rod screw	Points
Crankcase cover	Push rod
Crankshaft	Rewind spring
Crankshaft timing gear	Rewind starter
Cylinder head	Rings (oil control, scraper, compression)
Cylinder head bolt	Rocker arm
Dipper (oil)	Rod lock / Lock plate
Dipstick	Flywheel screen
Float	Spark Plug
Flywheel	Starter clutch
Flywheel key	Starter motor
Flywheel nut	Stop switch (toggle, stationary, rotary & key)
Fuel bowl	Stop switch wire
Fuel pick-up tube	Tappets
Fuel Tank	Valve
Gasket (crankcase, sump, cylinder head)	Valve cover
Governor (pneumatic or Mechanical)	Valve rotator
Governor arm	Valve Seat
Valve Spring	
Valve spring retainer (pin, collar, self lock)	

**The words in parenthesis are needed to specifically identify the part!
“/” = either term can be used!**

References

Small Engines, Briggs and Stratton, American Technical Publishers, Inc., 1997
Single Cylinder “L” Head Repair Manual 1999, Briggs & Stratton

Official Indiana State FFA Small Engine CDE Tool Identification List

General Tools:

- Sockets: (size, regular or deep well, points and drive size) Ex.: *5/8" regular, 12 points, 3/8" drive socket*
- Ratchet or Break over Bar: (drive size)
Ex.: *3/8" Drive ratchet*
- List the following as to size and kind:
 1. -OPEN END WRENCH
 2. -Box end wrench
 3. -Combination wrench (both open-box)
EX.: 7/16" Box end wrench
- Pliers: (needle nose, duckbill, curved long nose, snap ring) Ex.: *Duckbill pliers*
- Hammers & Mallets (brass, ball peen, rawhide & rubber) Ex.: *Brass hammer*
- Screwdrivers (flat head or Phillips & Torx) Ex.: *Phillips screwdriver*
- Tap or Die (size) Ex.: *3/8"- 24 Tap*
- Torque wrench (inch/# or foot/# and drive size) Ex.: *1/2" Drive Ft/# Torque Wrench*

Briggs & Stratton Specialty Tools

Band Brake Adjustment Gauge
Bushing Driver
Carburetor Adjustment Screwdriver
Carburetor Screwdriver
Carburetor Nozzle Screwdriver
Counter bore Cutter
Cutter Shank
Cylinder Hone
Cylinder Ridge Reamer
Cylinder Support
Dial Caliper
Digital Multi-meter
Expansion Pilot
Feeler Gauge (wire, flat)
Flywheel Holder
Flywheel puller
Flywheel Strap Wrench
Ignition Tester
Compression Tester
Micrometer (inside or outside)
Pilot Guide Brushing
Piston Ring Compressor
Piston Ring Expander
Piston Ring Groove Cleaner
Plug Gauge
Punch
Reamer (Counter bore, Finish)
Rewind Tool
Shunt (AC, DC)
Starter Clutch Wrench

Spark Plug Gap Gauge
Spark Plug Wrench
Tang Bender
Tachometer
Telescoping gauge
Test light
T-Handle
Valve Guide Bushing Driver
Valve Guide Puller Set
Valve Guide Tool Guide
Valve Lapping Tool
Valve Seat Cutter Kit
Valve Seat Driver
Valve Seat Puller
Valve Spring Compressor

The words in parenthesis are needed to specifically identify the tool!!!

References

- *Single Cylinder "L" Head Repair Manual 1999, Briggs & Stratton*
- *Broadhead Garrett 2002 catalog*