



NATIONAL
FFA ORGANIZATION

Agricultural Mechanics Handbook

2017-2021

Purpose:

To provide an opportunity for participants to demonstrate their knowledge, skill, technical competence, and problem solving ability in the areas of agricultural systems and mechanics.

Objectives:

1. Demonstrate competence and skill in the areas of arc and acetylene welding.
2. Demonstrate competence and skill in the areas of tool and metal identification and tool reconditioning.
3. Demonstrate competence and skill in the areas of small engine trouble shooting and problem solving.
4. Demonstrate competence and skill electrical problem solving and wiring.
5. Demonstrate competence and skill in the areas of copper and PVC pipefitting, soldering and gluing.

General Rules:

1. A team shall consist of three or four members. Each team member shall participate in either one or two of the subject matter areas and the team is encouraged to compete in all six areas. Teams that, for whatever reason, have fewer than three members are not eligible for team awards, but participants may receive individual awards. The team advisor shall assign the members of the team to the subject matter areas.
2. The event shall be developed from the following subject matter areas:
 - a. Arc Welding (SMAW), MIG Welding (GMAW)
 - b. Oxyacetylene and TIG Welding (GTAW)
 - c. Tool and Hardware Identification
 - d. Tool Reconditioning / Metal Identification or Pipe Fitting
 - e. Electricity (Residential Wiring)
 - f. Small Gasoline Engines
3. Each participant shall be responsible for:
 - a. Industrial Quality Eye Protection - No participant shall be allowed to participate in the performance skills of the event without wearing industrial quality eye protection. Those participants wearing prescription eyewear of non-industrial quality shall also wear goggles to obtain adequate protection.
 - b. Clothing - Each participant shall furnish and wear appropriate coveralls, shop coats or shop work suits. Clothing must be in good repair and fit properly. Long sleeved clothing must be worn when welding. Leather high top shoes are required--high top leather tennis shoes are acceptable.
 - c. Gloves - Gloves to be used in arc and oxyacetylene welding shall be furnished by the participant.
 - d. Clipboard and Pencil - Each participant shall provide a clipboard and pencil to use in Tool and Hardware Identification and the Small Gasoline Engines.

4. The event chairman shall furnish all tools and materials for the event unless specified under the specific rules for each subject matter area.
5. Participants shall be responsible for reporting to the event at the time and place announced.
6. Participants shall not in any way reveal identity to judges except by the number assigned.
7. When participants begin lining up for the event, no more conferring shall take place between participants and outsiders. Access to the building or area of the event shall be restricted to the participants and the judges. Individuals other than participants or judges wishing access to the event site must receive permission from the event chairman.
8. Maximum time allowed for the activities of each subject matter area shall be 45 minutes. The 45 minutes shall include any warm-ups and/or adjustments.
9. Participants in need of special accommodations (disability or other health issues) must submit the Idaho State FFA Career Development Events Request for Special Accommodation Application found at the end of the General Rules and Regulations at least one month prior to the event.

Format and scoring:

1. Judges shall be responsible for marking by number each participant's work before the event begins.
2. At the close of the event a grade or score shall be given by the judge on all participants in the subject matter area assigned to that judge. Grades or scores shall not be revealed until after the awards assembly.
3. At approximately mid-morning of the day following the event, participants and advisors may go over the work if they wish. Again, no results shall be revealed until the awards assembly.
4. Each of the subject matter areas shall be scored on the basis of 100 possible points.
5. Tie Breakers- The placings of members from all six areas will be tabulated with the low score breaking the tie.

Awards:

Plaques will be awarded to the top five (5) teams. FFA Award Pins will be presented to the top three (3) individuals in each of the six (6) event areas. During the presentation of awards, the top ten (10) teams and the top five (5) individuals in each event area will be announced.

Arc Welding

1. After brief directions from an event supervisor, each participant shall be given 45 minutes to become familiar with, adjust the welder and complete the skills.
2. Participants shall be allowed to choose between an AC or DC welder, if possible. The judge may assign participants to a particular machine within those two types. Each advisor should have received an inventory of the arc welders available for the event.
3. Practice material shall be provided for participants to use in setting the machine.
4. The electrodes used in the arc welding skill shall be 1/8" diameter. The electrodes will be E6010, E6011, E6013 and E7018. Electrodes will be provided. Participants are not to bring their own electrodes.
5. All electrode types will be specified in the spring mailing.
6. All materials used in the arc welding skill shall be 1/4 inch. GMAW Vertical Down 1/8 inch.
7. Helmets and leathers for the arc welding skill shall be provided, however participants may bring their own helmets and leathers.
8. The participants shall perform four of the following skills, selected by the event chairman:
 - a. V-Butt weld for tensile pull - 6011
 - b. Overhead fillet - 7018
 - c. Vertical up fillet - 6011
 - d. Horizontal fillet - 7018
 - e. GMAW horizontal fillet (Amperage and voltage set by chairman but may be changed by participant)
 - f. GMAW vertical down fillet, single pass, welded on 1/8 plate (Amperage and voltage set by chairman but may be changed by participant)
 - g. Flat Lap – 6013
 - h. Pipe (1 1/2 schedule 40) to Plate (1/4") single pass – E6010

ARC WELDING SCORECARD

Four out of the seven skills listed below shall have equal weight; 25 points each for a total of 100 points.

	<u>Possible pnts</u>
A. V-Butt weld for tensile pull (25 pts)	
1. The V filled as to height and ends	5
2. Strength (pounds of pull)	<u>20</u>
	25
B. Fillets (Overhead, Pipe to Plate, Vertical, Horizontal and/or MIG Horizontal / Vertical (25 pts each)	
1. Absence of overlap or undercut	7
2. Equal legs	3
3. Throat equal to metal thickness	3
4. Absence of slag inclusion	5
5. Smoothness and shape of bead	<u>7</u>
	25
C. Flat Lap (25 pnts)	
1. Absence of overlap or undercut	7
2. Appropriate leg length	3
3. Throat equal to metal thickness	3
4. Absence of slag inclusion	5
5. Smoothness and shape of bead	<u>7</u>
	<u>25</u>

Total Possible Points = 75

Oxyacetylene and GTAW Welding

1. After brief directions by an event supervisor, each participant shall be given 45 minutes to become familiar with, regulate the welder, and complete the skill.
2. The gas regulator pressures shall be pre-set for the tip size indicated. However, the pressure and tip may be changed by the participant. If the participant is not certain of the changes he/she wishes to make, that participant shall ask the supervisor for help. The operational information on the system that is being used for the event has been mailed to each instructor at least 5 consecutive years and therefore it is assumed each department has a copy.
3. For fusion welding, copper-clad mild steel welding rods in the sizes of 1/16, 3/32, and 1/8 shall be provided.

For braze welding, a flux-coated rod in the sizes of 3/32 and 1/8 shall be provided. Additional flux shall be provided as needed.

NOTE: Participants may provide their own fusion and braze welding rod.

4. The metal for the welds shall be mild steel of a thickness of 1/16 to 1/8 inches. The metal for cutting shall be mild steel and of a thickness of 1/4 to 5/8 inches. The metal for GTAW welding shall be 1/8".
5. Participants shall bring their own sharpened ceriated tungsten 3/32 size for GTAW welding. Size to be designated annually by the CDE superintendent.
6. The following welds will be required in the Oxyacetylene Welding section. One GTAW (A or B), one fusion or braze (C, D, E, F) and one pattern cut (G)
 - a. GTAW flat butt weld (1/8" metal)
 - b. GTAW horizontal fillet weld (1/8" metal)
 - c. Lap fusion weld
 - d. Fillet fusion weld
 - e. Lap braze weld
 - f. Fillet braze weld
 - g. Pattern cut (Participants may cut in any position with or without a rest. The total length of all cuts in the pattern may not be more than eight (8) inches.)
7. GTAW weld will be flat butt or horizontal fillet on 1/8" metal.
8. All torches will be Victor Super Range with tip sizes from 00 to 3 for welding and sizes 00, 0, and 1 for cutting.

OXYACETYLENE AND GTAW WELDING SCORECARD

Possible
Points

A.	Pattern cut	
	1. Fit to pattern	12
	2. Angle of cut	5
	3. Top corner square	7
	4. Underside free of slag	<u>10</u>
		34
B.	Lap fusion weld	
	1. Penetration	12
	2. Edges feathered	6
	3. Surface appearance	10
	4. Start and stop	<u>5</u>
		33
C.	Fillet fusion weld/GTAW fillet weld	
	1. Absence of undercutting	11
	2. Edges feathered	5
	3. Concave bead	5
	4. Legs equal	7
	5. Start and stop	<u>5</u>
		33
D.	Lap braze weld	
	1. Surface appearance	10
	2. Concave bead	5
	3. Absence of overheating	5
	4. Absence of excess materials	6
	5. Adhesion	<u>7</u>
		33
E.	Fillet braze weld	
	1. Surface appearance	8
	2. Concave bead	5
	3. Absence of overheating	5
	4. Absence of excess material	5
	5. Equal legs	5
	6. Adhesion	<u>5</u>
		33
F.	GTAW Flat Butt weld	
	1. Penetration	12
	2. Edges feathered	6
	3. Surface appearance	10
	4. Start and stop	<u>5</u>
		33

Tool and Hardware Identification

1. After brief directions from an event supervisor responsible for this area, participants shall have 45 minutes to complete the skill. After the supervisor has passed out the blanks, given instructions and placed the participants around the identification area, the judge shall announce the beginning of the event. Participants may proceed at their own pace and may go back to recheck items.
2. There shall be 100 items selected from the *Tools and Hardware Identification Manual* by Jack McHargue and Dan Hood for the participants to identify.
3. Blanks shall be provided listing 110 items on which each participant shall insert the correct number of the item as it is displayed. Tools/Equipment and Hardware/Supplies shall be listed separately. Participants will not receive credit if there is more than one number per blank.
4. Sixty-six (66) of the items shall be from the Tools and Equipment List and thirty-four (34) shall be from the Hardware and Supplies List.
5. Each participant in this area shall be graded by the judge on the percentage of correct answers.
6. *Tools and Hardware Identification Manual* by Jack McHargue and Dan Hood will be used as the official reference.

Tool ID List

	Bar, crow		Drill, hand
	Bar, wrecking		Drill, star
	Bevel, sliding T		Drill, twist, straight
	Bit, auger, solid center		Drill, twist, taper shank
	Bit, holder, extension		Driver, bushing
	Bit, masonry		Driver, nut
	Bit, screwdriver		Edger, concrete
	Bit, self feed, plumbers		Expander, piston ring
	Bit, spade		Extractor, screw
	Blade, metal, abrasive cut-off		Extractor, tap
	Brush, paint		File, chain saw
	Brush, steel wire		File, double cut, flat
	Calipers, inside		File, mill
	Calipers, outside		File, round
	Calipers, Vernier		File, slim taper
	Carrier, battery		File, square
	Chain, chain saw, chipper		Flaring tool, copper tubing
	Chain, chain saw, chisel		Float, concrete
	Chain or tape, surveyor's		Gauge, depth
	Chisel, cape		Gauge, dial indicator
	Chisel, cold		Gauge, screw pitch
	Chisel, diamond point		Gauge, small hole
	Chisel, round nose		Gauge, tap and drill
	Chisel, wood		Gauge, telescoping
	Clamp, "C"		Gauge, thickness
	Clamp, fixtures, pipe		Gauge, wire (Am. Std.)
	Cleaner, battery post		Grinder, electric disc
	Cleaner, ring groove		Grinder, valve
	Cleaner, oxyacetylene tip		Gun, chalking
	Compressor, piston ring		Gun, grease
	Compressor, valve spring		Gun, soldering
	Countersink		Hammer, ball peen
	Creeper, auto		Hammer, bell faced, curved claw
	Cutter, bolt		Hammer, bell faced, straight claw
	Cutter, PEX		Hammer, blacksmith's cross peen
	Cutter, pipe		Hammer, chipping or slag
	Cutter, tubing		Hammer, tinner's riveting
	Cutter, valve seat		Handle, axe
	Die, pipe threading		Handle, file
	Die stock		Handle, machinist's hammer
	Die, thread cutting		Handle, nail hammer
	Dresser, emery wheel		Handle, speeder
	Drill, electric		Holder, flywheel
			Hone, brake cylinder

Hone, cylinder	Punch, roll pin or pilot
Indicator, speed	Punch, sheet metal
Iron, soldering, electric	Punch, starter
Jack, hydraulic	Rasp, wood, flat
Jack, screw	Rasp, wood, half round
Knife, draw	Reamer, cylinder ridge
Knife, linoleum	Reamer, expansion
Knife, putty	Reamer, pipe
Knife, utility	Regulator, oxygen or acetylene
Level, carpenter's	Remover, Stud
Level, transit	Ripper, cable
Level, transit, laser	Riveter, pop
Lifter, valve	Router, electric
Light, timing	Rule, machinist
Light, trouble	Sander, belt
Lighter, spark	Sander, palm, oscillating
Line, chalk	Saw, back
Mallet, rubber	Saw, circular
Mallet, wood	Saw, circular combination
Micrometer, outside	Saw, circular, plywood
Micrometer, inside	Saw, compass
Micrometer, depth	Saw, coping
Oil can, pump type	Saw, hand crosscut
PEX, tool, crimper	Saw, hand hack
PEX, tool, expansion	Saw, hand rip
Plane, hand, electric	Saw, hole
Pliers, battery or gripping	Saw, keyhole
Pliers, Tongue and Groove	Saw, meat
Pliers, diagonal cutting	Saw, miter, electric
Pliers, fencing	Saw, pruning
Pliers, hose clamp	Scraper, cabinet
Pliers, lineman's	Scraper, carbon
Pliers, locking	Screwdriver, common
Pliers, needle nose	Screwdriver, offset
Pliers, round nose	Screwdriver, Phillips
Pliers, snap ring	Screwdriver, stubby
Pliers, universal slip joint	Screwdriver, Torx
Plumb bob	Scriber
Puller, flywheel	Set, nail
Puller, gear	Shear, bench
Puller, nail	Shear, Pruning
Punch, center	Shear, Squaring
Punch, long taper (aligning)	Shield, face
Punch, pin	Sink, Heat

Sledge, blacksmith, double face	Wheel, emery grinding
Snip's Tinner's aviation	Wrench, adjustable
Snips, Tinner's combination	Wrench, distributor
Socket, 6 pt., 1/4", 3/8", 1/2" drive	Wrench, double offset, box pattern
Socket, 8 pt., 1/4", 3/8", 1/2" drive	Wrench, hex
Socket, 12 pt., 1/4", 3/8", 1/2" drive	Wrench, ignition
Socket, deep well 1/4", 3/8", 1/2" drive (regular or impact)	Wrench, impact, hand
Socket, Impact regular or deep	Wrench, impact, electric or air
Socket, reducer	Wrench, internal pipe
Socket, universal	Wrench, oil filter
Splitter, nut	Wrench, pipe chain
Splitter or separator, bearing spoon, brake adjusting	Wrench, pipe, stillson type
Square, combination	Wrench, ratchet 1/4", 3/8", 1/2" drive
Square, Protractor Head	Wrench, starter clutch
Square, steel framing	Wrench, tap T-handle
Square, T	Wrench, (torque)
Square, try	
Stone, Bench, sharpening	
Stripper and crimper, wire	
Stud Finder	
Tachometer, vibration	
Tap, machinist's hand	
Tap, pipe	
Tape, flexible steel	
Tester, compression	
Tester, spark	
Torch, cutting	
Torch, propane	
Torch, welding	
Trowel, masonry brick	
Trowel, masonry pointing	
Trowel, concrete	
Trowel, plasterer's	
Vise, carpenter's	
Vise, drill press	
Vise, machinist's	
Vise, pipe, chain type	
Vise, pipe, hinged type	
Wedge, falling	
Wedge, splitting	
Welder, spot	
Welder, plastic	

Hardware ID List

Anchor, concrete	Hasp, safety
Anchor, sheetrock	
Block, snatch	Hinge, butt
Bolt, carriage	Hinge, continuous
Bolt, door, barrel type	Hinge, strap
Bolt, eye	Hinge, tee
Bolt, foundation	Hook, gate
Bolt, machine (cap screw)	Insert, threaded
Bolt, plow	Insulation, batt type
Bolt, shoulder	Insulation, foil type
Bolt, stud	Insulation, granulated type
Bolt, toggle	Insulation, pipe
Bolt, u	Iron, angle
Box, electrical, outlet or junction	Iron, channel
Box, electrical, receptacle or switch	Iron, deck plate
Bracket, shelf	Iron, expanded metal
Brad, wire	Iron, galvanized
Bushing, plastic or meta	Iron, I Bar
Cable, "Romex", non-metallic	Iron, round
Cable, "Romex" underground feeder	Iron, square
Cap, electrical cord	Iron, square tubing
Caster, roller	Key, woodruff
Caster, caulking	Key, stock
Chain, roller	Latch, door
Clamp, hose	Link, chain repair
Clevis, common	Lock, door
Clevis, screw pin	Lock, drawer
Clip, alligator	Lock, pad
Clip, hair pin	Material, gasket
Clip, wire rope	Metal, sheet, corrugated, alum.
Cloth, emery	Metal, sheet, corrugated, galv.
Cloth, wire	Nail, box
Conduit, thin walled	Nail, cement coated
Connector, electrical cord	Nail, common
Connectors, solderless	Nail, duplex (double headed)
Coupler, air and nipple	Nail, finish
Fiber glass, corrugated	Nail, galvanized box
Fitting, grease	Nail, joist hanger
Fuse, Automotive	Nail, masonry
Fuse, cartridge	Nail, roofing, neoprene washer
Fuse, plug	Nail, ring shank
Glide, furniture	Nail, roofing, large head
Grommet, rubber or metal	Nut, castellated
Hanger, joist	Nut, machine, NF

	Nut, self-locking		Pipe, ABS fitting, coupling
	Nut, standard, NC		Pipe, copper, flexible
	Nut, thumb (Wing)		Pipe, copper, rigid
	Paper, emery		Pipe (copper, rigid), fittings, 90° elbow
	Paper, sand		Pipe, (copper, rigid), fittings, male adapter
	Pin, common cotter		Pipe, (copper, rigid), fittings, cap
	Pin, lynch		Pipe, (copper, rigid), fittings, tee
	Pin, roll or tension		Pipe, (copper, rigid), fittings, drop leaf elbow
	Pipe, black iron		Pipe, (copper, rigid), fittings, 45° elbow
	Pipe, galvanized iron		Pipe, (copper, rigid), fittings, female adapter
	Pipe, iron fitting, bushing		Pipe, (copper, rigid), fittings, union
	Pipe, iron fitting, cap		Pipe, (copper, rigid), fittings, tee, copper by female pipe
	Pipe, iron fitting, coupling		Pipe, PEX
	Pipe, iron fitting, elbow, standard 45°		Pipe, PEX fittings, crimp, metal bands
	Pipe, iron fitting, elbow, standard 90°		Pipe, PEX fittings, brass crimp, tee
	Pipe, iron fitting, nipple, standard		Pipe, PEX fittings, brass crimp, 90 degree elbow
	Pipe, iron fitting, plug		Pipe, PEX fittings, brass crimp, coupling
	Pipe, iron fitting, street elbow		Pipe, PEX fittings, brass crimp, male adapter
	Pipe, iron fitting, tee		Pipe, PEX fittings, brass crimp, female adapter
	Pipe, iron fitting, union		Pipe, PEX fittings, brass crimp, drop leaf elbow
	Pipe, iron fitting, union Dielectric		Pipe, PEX fittings, brass crimp, plug
	Pipe, plastic ABS DWV – black		Pipe, PEX fittings, plastic crimp, tee
	Pipe, ABS fitting, 90° elbow		Pipe, PEX fittings, crimp, 90 degree elbow
	Pipe, ABS fitting, 45° street elbow		Pipe, PEX fittings, plastic crimp, coupling
	Pipe, ABS fitting, 90° street elbow		Pipe, PEX fittings, plastic crimp, male adapter
	Pipe, ABS fitting, female adapter		Pipe, PEX fittings, plastic crimp, female adapter
	Pipe, ABS fitting, male adapter		Pipe, PEX fittings, plastic crimp, plug
	Pipe, ABS fitting, plug		Pipe, PEX fittings, brass compression, tee
	Pipe, ABS fitting, closet flange		

Pipe, PEX fittings, brass compression, 90 degree elbow		Screw, self drilling
Pipe, PEX fittings, brass compression, coupling or union		Screw, sheet metal
Pipe, PEX fittings, brass compression, male adapter		Screw, square hook
Pipe, PEX fittings, brass compression, female adapter		Screw, thumb
Pipe, PEX fittings, plastic compression, tee		Screw, wood, flat head
Pipe, PEX fittings, plastic compression, 90 degree elbow		Screw, wood, round head
Pipe, PEX fittings, plastic compression, coupling or union		Sealer, sill
Pipe, plastic PVC – white		Sheetrock (gypsum board)
Pipe, PVC fitting, 90° elbow		Shield, expansion
Pipe, PVC fitting, 45° elbow		Shim stock
Pipe, PVC fitting, tee		Slide, drawer
Pipe, PVC fitting, coupling		Soapstone
Pipe, PVC fitting, female adapter		Solder, bar
Pipe, PVC fitting, male adapter		Solder, flux core
Pipe, PVC fitting, cap		Solder, solid core
Pipe, PVC fitting, union		Spring, compression coil
Plate, strike		Spring, extension coil
Receptacle, duplex		Staple, poultry netting
Ring, retaining Eclip		Staple, romex
Ring, snap		Steel, tool, octagonal
Ring, snap, external		Switch, single pole
Ring, snap, internal		Switch- 3-way
Rivet, blind		Tack, carpet
Rivet, copper and burr		Tack, double pointed
Rivet, countersunk head		Tape, electrical, plastic
Rivet, flat head, soft iron		Tape, duct
Rivet, round head, soft iron		Tape, masking
Roofing, composition shingles		Tape, teflon
Roofing, roll		Terminal, wire
Screw, dry wall		Thimble, wire rope
Screw, eye		Tie, cable
Screw, lag		Tubing, heat shrink
Screw, machine, flat head		Turnbuckle
Screw, machine, round head		Wall plate, receptacle, duplex
Screw, molly		Wall plate, switch

	Washer, flat		
	Washer, lock		
	Wire, baling (tie)		
	Wire, barbed		

Tool Reconditioning and Pipe Fitting

1. After brief directions by an event supervisor, participants shall have a total of 45 minutes to complete the skill in this area.
2. The skill for this area of the event shall be one of the following three:
 - a. Tool Reconditioning
 - b. Copper Pipe Fitting
 - c. Plastic Pipe Fitting:

The skills will rotate as follows:

2018- Tool Reconditioning / Metal Identification
 2019- Plastic Pipe Fitting
 2020- Copper Pipe Fitting
 2021- Tool Reconditioning / Metal Identification
 2022- Plastic Pipe Fitting
 2023- Copper Pipe Fitting

3. Each participant shall be required to provide the following at the beginning of the tool reconditioning phase of the event:
 - a. One-half inch twist drill bit
 - b. One-half inch common cold chisel

NOTE: In case the tool reconditioning skill has not been chosen, the participant shall not be asked to provide these tools.

4. All other materials and tools shall be provided for this part of the event.
5. Tool Reconditioning / Metal Identification
 - a. The twist drill bit and common cold chisel shall be numbered and blunted by the judge before sharpening begins.
 - b. The tools shall be sharpened according to the specifications given on the scorecard.
 - c. The tools shall be sharpened on the face of the grinding stone.
 - d. Gauges and files shall be furnished, and only those shall be used.
 - e. Grinders shall be provided and only those shall be used.
 - f. Participants shall not grind on sides of grinding wheel.
 - g. Participants will identify metals using the following methods: visual, spark test, weight, magnetism, hardness and chemical.

6. Copper Pipe Fitting
 - a. Examples of the project shall be provided for the participant to follow.
 - b. All ends of the pipe shall be properly reamed.
 - c. The pipe used in this exercise shall be Type L, 1/2 inch and will not exceed 5 fittings.
 - d. All tools will be provided, however participants may bring their own tubing cutter and/or reamer.
7. Plastic Pipe Fitting
 - a. Examples shall be provided for the participant to follow in cutting, fitting, and cementing of plastic pipe.
 - b. The plastic pipe used in this exercise shall be a PVC or Pex type and one inch or less in size.
 - c. All tools will be provided and only those shall be used.

**TOOL
RECONDITIONING
SCORECARD**

Possible
Points

A. Cold Chisel		
1.	Included angle (70°)	8
2.	Side lengths equal	5
3.	Squareness	5
4.	Single faces	4
5.	Sharpness	5
6.	Absence of burning	<u>5</u>
		32
B. Metal Identification		
1.	Eight metals will be identified from the sixteen possible with a point value of four points for each correct answer.	32
2.	Metals to be identified by:	
	a. Color	
	b. Weight	
	c. Spark	
	d. Chemical	
	e. Magnetism	
	f. Hardness/File test	
C. Twist Drill (Total Cutting Angle 118°) (Rake 8-12°)		
1.	Lip angle (59°) (5 pts. each)	10
2.	Lip length	5
3.	Faces	5
4.	Lip clearance	13
5.	Chisel point	<u>3</u>
		36

Total Possible Points = 100

COPPER PIPE FITTING SCORECARD

	<u>Points</u>
A. Proper heat (copper and wood if applicable)	20
B. Absence of leaks	25
C. Absence of excess solder	10
D. Inside of pipe reamed	5
E. Proper lengths of pipe	20
F. Proper angle of joints	10
G. Safety Glasses	5
H. Clean up of station	5
a. Deduct 20% for Improper assembly	

PLASTIC PIPE FITTING SCORECARD

	<u>Points</u>
A. Absence of leaks	25
B. Absence of excess primer/cement	5
C. Proper length of pipe	20
D. Proper angle of joints	20
E. Joints properly seated	10
F. Pipe chamfered	10
G. Safety Glasses	5
H. Clean up of Station	5
a. Deduct 20% for Improper assembly	

Electricity

1. After brief directions from an event supervisor, each participant shall be given 45 minutes to complete the skill.
2. Residential Electricity - There will be two sections including a wiring exercise (30 minutes) and a problem-solving section (15 minutes).
 - a. Wiring Exercise:
 1. The electrical wiring shall conform to wiring diagram provided to the participant.
 2. All tools and supplies required for this area shall be provided except for a pocket knife suitable for wire stripping, which shall be provided by the participant. All tools provided by the participant shall be approved by the area judge before use. Multimeter specifications will be supplied at spring mailing; however, students are encouraged to supply their own.
 3. The participant will demonstrate wiring skills which may include:
 - a. reading simple wiring diagrams.
 - b. wiring single pole switches.
 - c. wiring three-way switches.
 - d. wiring duplex receptacle.
 - e. wiring split-wired switched receptacles.
 - f. wiring light fixtures (porcelain type).
 - g. reading a multimeter (resistance and voltage).
 - h. installing cord caps on power cords.
 4. All wires shall be stripped to specification neatly without wire nicking.
 5. All wire-to-wire connections will be made with solderless connectors provided.
 6. Assembly of circuits will be done on wiring board provided.
 7. All circuits shall provide proper grounding (bare or green conductor) as specified by the National Electrical Code.
 8. Maximum of three boxes in electricity skills.
 - b. Problem-Solving Section (will included the following):
 1. Determining resistance of a portion of a circuit.
 2. Determining voltage and/or voltage drop for a circuit or portion of a circuit.
 3. Determining continuity of a circuit.
 4. Conductor size and labeling.
 5. Voltage drop due to total length of conductor.
 6. Overcurrent devices and protection.
 7. Grounding for safety.
3. References:
 - a. *Step-By-Step Guide Book on Home Wiring*, available at many hardware stores or from: Step-By-Step Guide Book Co., PO Box 70865, Salt Lake City, UT 84170.
 - b. Pamphlet prepared by Ed Dowding, University of Idaho Agricultural Engineering Department.

ELECTRICAL WIRING SCORECARD

	Possible Points
A. Wiring exercise (assembled according to example)	35
B. Workmanship	15
C. Problem solving	40
D. Tool handling/safety	<u>10</u>
TOTAL	100

Small Gasoline Engines

1. After brief directions from an event supervisor, participants shall have a total of 45 minutes to complete this area of the event.
2. The small gasoline engines subject matter area shall be divided into problem-solving and mechanical skills. The problem-solving exercise shall take approximately 15 minutes. The mechanical skills portion shall take approximately 30 minutes.
3. The problem solving and mechanical skills shall deal with the Briggs and Stratton small gasoline engine. Participants should be familiar with Briggs and Stratton repair manuals, illustrated parts lists, and the specialty tools utilized for Briggs and Stratton engine repair and overhaul.
4. Problem Solving
 - a. Participants shall be required to solve approximately 8-10 problems dealing with Briggs and Stratton small gasoline engines.
 - b. Problem solving shall include such things as parts identification, looking up specifications, ordering parts, making decisions about reject sizes and making decisions about repair procedures.
5. Mechanical Skills
 - a. Participants shall be working on identical engines.
 - b. Participants shall be responsible for finding faults or performing common repairs or service on Briggs and Stratton engines.
 - c. Participants shall not be required to open the crankcase of the engine.
 - d. Participants shall not be required to disassemble the carburetor.
 - e. Proper use of tools and safe procedure throughout the event.

SMALL GASOLINE ENGINES SCORECARD

	Possible Points
A. 8-10 Problems (equally weighted)	40
B. Mechanical Skills	40
C. Use of Proper Procedures and Tools	<u>20</u>
TOTAL	100

METAL IDENTIFICATION SCORECARD

Participant No. _____

Instructions: Place the letter of the METAL NAME for each sample in the blank for the appropriate sample number.

METAL NAMES

- A. Aluminum
- B. Brass & Bronze 1.
- C. Copper 2.
- D. Grey Cast Iron 3.
- E. High Carbon/Tool Steel 4.
- F. High Speed Steel 5.
- G. Lead 6.
- H. Low Carbon/Mild Steel 7.
- I. Magnesium 8.
- J. Malleable Cast Iron (Correct identification 4 points each.)
- K. Medium Carbon Steel
- L. Nickel
- M. Stainless Steel
- N. White Cast Iron
- O. Titanium
- P. Tungsten
- Q. Zinc Die Cast/Pot Metal

TOTAL SCORE ON METAL ID