



Agricultural Technology and Mechanical Systems Handbook

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 5 hp OHV
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.
 - e. 5pt deduction per event may be applied for not applying proper PPE

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.

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.

A. V-Butt weld for tensile pull (25 points)

	<u>Possible points</u>
1. The V filled as to height and ends	5
2. Strength (pounds of pull)	<u>20</u>
<small>Improper Assembly -5, Improper PPE -5, Out of position score a zero</small>	
Total Points	25

B. Fillets (Overhead, Pipe to Plate, Vertical, Horizontal and/or GMAW Horizontal / Vertical (25 points each)

	<u>Possible points</u>
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>
<small>Improper Assembly -5, Improper PPE -5, Out of position score a zero</small>	
Total Possible	25

C. Flat Lap (25 points)

	<u>Possible points</u>
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>
<small>Improper Assembly -5, Improper PPE -5, Out of position score a zero</small>	
Total Possible	25

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 seriated 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

A.	<u>Pattern cut</u>	<u>Possible Points</u>
	1. Fit to pattern	12
	2. Angle of cut	5
	3. Top corner square	7
	4. Underside free of slag	<u>10</u>
	Improper Assembly -5, Improper PPE -5, Out of position score a zero	
	Total Possible	34
B.	<u>Lap fusion weld</u>	<u>Possible Points</u>
	1. Penetration	12
	2. Edges feathered	6
	3. Surface appearance	10
	4. Start and stop	<u>5</u>
	Improper Assembly -5, Improper PPE -5, Out of position score a zero	
	Total Possible	33
C.	<u>Fillet fusion weld/GTAW fillet weld</u>	<u>Possible Points</u>
	1. Absence of undercutting	11
	2. Edges feathered	5
	3. Concave bead	5
	4. Legs equal	7
	5. Start and stop	<u>5</u>
	Improper Assembly -5, Improper PPE -5, Out of position score a zero	
	Total Possible	33
D.	<u>Lap braze weld</u>	<u>Possible Points</u>
	1. Surface appearance	10
	2. Concave bead	5
	3. Absence of overheating	5
	4. Absence of excess materials	6
	5. Adhesion	<u>7</u>
	Improper Assembly -5, Improper PPE -5, Out of position score a zero	
	Total Possible	33
E.	<u>Fillet braze weld</u>	<u>Possible Points</u>
	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>
	Improper Assembly -5, Improper PPE -5, Out of position score a zero	
	Total Possible	33
F.	<u>GTAW Flat Butt weld</u>	<u>Possible Points</u>
	1. Penetration	12
	2. Edges feathered	6
	3. Surface appearance	10
	4. Start and stop	<u>5</u>
	Improper Assembly -5, Improper PPE -5, Out of position score a zero	
	Total Possible	33

Tools 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 list* use the internet as a reference.
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 use internet as reference

Tool ID List

	Bar, crow		Drill, star
	Bar, wrecking		Drill, twist, straight
	Bevel, sliding T		Drill, twist, taper shank
	Bit, auger, solid center		Driver, bushing
	Bit, holder, extension		Driver, nut
	Bit, masonry		Edger, concrete
	Bit, screwdriver		Expander, piston ring
	Bit, self-feed, plumbers		Extractor, screw
	Bit, spade		Extractor, tap
	Blade, metal, abrasive cut-off		File, chain saw
	Brush, paint		File, double cut, flat
	Brush, steel wire		File, mill
	Calipers, inside		File, round
	Calipers, outside		File, slim taper
	Calipers, Vernier		File, square
	Carrier, battery		Flaring tool, copper tubing
	Chain, chain saw, chipper		Float, concrete
	Chain, chain saw, chisel		Gauge, depth
	Chain or tape, surveyor's		Gauge, dial indicator
	Chisel, cape		Gauge, screw pitch
	Chisel, cold		Gauge, small hole
	Chisel, diamond point		Gauge, tap and drill
	Chisel, round nose		Gauge, telescoping
	Chisel, wood		Gauge, thickness
	Clamp, "C"		Gauge, wire (Am. Std.)
	Clamp, fixtures, pipe		Grinder, electric disc
	Cleaner, battery post		Grinder, valve
	Cleaner, ring groove		Gun, chalking
	Cleaner, oxyacetylene tip		Gun, grease
	Compressor, piston ring		Gun, soldering
	Compressor, valve spring		Hammer, ball peen
	Countersink		Hammer, bell faced, curved claw
	Creeper, auto		Hammer, bell faced, straight claw
	Cutter, bolt		Hammer, blacksmith's cross peen
	Cutter, PEX		Hammer, chipping or slag
	Cutter, pipe		Hammer, tinner's riveting
	Cutter, tubing		Handle, axe
	Cutter, valve seat		Handle, file
	Die, pipe threading		Handle, machinist's hammer
	Die stock		Handle, nail hammer
	Die, thread cutting		Handle, speeder
	Dresser, emery wheel		Holder, flywheel
	Drill, electric		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	Welder, plastic
Snip's Tinner's aviation	Wheel, emery grinding
Snips, Tinner's combination	Wrench, adjustable
Socket, 6 pt., 1/4", 3/8", 1/2" drive	Wrench, distributor
Socket, 8 pt., 1/4", 3/8", 1/2" drive	Wrench, double offset, box pattern
Socket, 12 pt., 1/4", 3/8", 1/2" drive	Wrench, hex
Socket, deep well 1/4", 3/8", 1/2" drive (regular or impact)	Wrench, ignition
Socket, Impact regular or deep	Wrench, impact, hand
Socket, reducer	Wrench, impact, electric or air
Socket, universal	Wrench, internal pipe
Splitter, nut	Wrench, oil filter
Splitter or separator, Bearing	Wrench, pipe chain
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	

Hardware ID List

Anchor, concrete		
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 Iron, channel
Box, electrical, outlet or junction		Iron, deck plate
Box, electrical, receptacle or switch		Iron, expanded metal
Bracket, shelf		Iron, galvanized
Brad, wire		Iron, I Bar
Bushing, plastic or meta		Iron, round
Cable, "Romex", non-metallic		Iron, square
Cable, "Romex" underground feeder		Iron, square tubing
Cap, electrical cord		Key, woodruff
Caster, roller 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, square hook
Pipe, PEX fittings, brass compression, coupling or union	Screw, thumb
Pipe, PEX fittings, brass compression, male adapter	Screw, wood, flat head
Pipe, PEX fittings, brass compression, female adapter	Screw, wood, round head
Pipe, PEX fittings, plastic compression, tee	Sealer, sill
Pipe, PEX fittings, plastic compression, 90 degree elbow	Sheetrock (gypsum board)
Pipe, PEX fittings, plastic compression, coupling or union	Shield, expansion
Pipe, plastic PVC – white	Shim stock
Pipe, PVC fitting, 90° elbow	Slide, drawer
Pipe, PVC fitting, 45° elbow	Soapstone
Pipe, PVC fitting, tee	Solder, bar
Pipe, PVC fitting, coupling	Solder, flux core
Pipe, PVC fitting, female adapter	Solder, solid core
Pipe, PVC fitting, male adapter	Spring, compression coil
Pipe, PVC fitting, cap	Spring, extension coil
Pipe, PVC fitting, union	Staple, poultry netting
Plate, strike	Staple, Romex
Receptacle, duplex	Steel, tool, octagonal
Ring, retaining E-clip	Switch, single pole
Ring, snap	Switch- 3-way
Ring, snap, external	Tack, carpet
Ring, snap, internal	Tack, double pointed
Rivet, blind	Tape, electrical, plastic
Rivet, copper and burr	Tape, duct
Rivet, countersunk head	Tape, masking
Rivet, flat head, soft iron	Tape, Teflon
Rivet, round head, soft iron	Terminal, wire
Roofing, composition shingles	Thimble, wire rope
Roofing, roll	Tie, cable
Screw, dry wall	Tubing, heat shrink
Screw, eye	Turnbuckle
Screw, lag	Wall plate, receptacle, duplex
Screw, machine, flat head	Wall plate, switch
Screw, machine, round head	Washer, flat
Screw, molly	Washer, lock
Screw, self-drilling	Wire, baling (tie)
Screw, sheet metal	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

A. Cold Chisel

	Points Possible
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

Failure to apply proper PPE -5 pts deduction

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 |
|---|----|

Failure to apply proper PPE -5 pts deduction

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°)

	Points Possible
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

Failure to apply proper PPE -5 pts deduction

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. The common terminal will be marked on the drawing of the 3-way switch.
 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 5 hp OHV 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 5hp OHV 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
- C. Copper
- D. Grey Cast Iron
- E. High Carbon/Tool Steel
- F. High Speed Steel
- G. Lead
- H. Low Carbon/Mild Steel
- I. Magnesium
- J. Malleable Cast Iron
- K. Medium Carbon Steel
- L. Nickel
- M. Stainless Steel
- N. White Cast Iron
- O. Titanium
- P. Tungsten
- Q. Zinc Die Cast/Pot Metal

- 1. _____
- 2. _____
- 3. _____
- 4. _____
- 5. _____
- 6. _____
- 7. _____
- 8. _____

(Correct identification 4 points each.)

(5pt deduction for not applying proper PPE)

TOTAL SCORE ON METAL ID _____