Montana Big Sky Pathways (Programs of Study)
Agreement Valid for 2012-2013 Academic Year

The Carl D. Perkins Career and Technical Education Act of 2006 (Perkins IV) calls for states to offer "career and technical programs of study," known as Big Sky Pathways in Montana, as an option to students and their parents when planning for and completing future coursework. These programs, at a minimum, must:

- Incorporate and align secondary and postsecondary education elements,
- Include academic and CTE content in a coordinated, non-duplicative progression of courses,
- Offer the opportunity, where appropriate, for secondary students to acquire postsecondary credits, and
- Lead to an industry-recognized credential or certificate at the postsecondary level, or an associate or baccalaureate degree.

By my signature on this form, I verify each of the eight (8) requirements listed below are demonstrated within the Big Sky Pathways Proposal and Gap Analysis. For approval, all eight (8) requirements must be checked.

| Name of Big Sky Pathway (Cluster Level): | Manufacturing |
| Name of High School: | Stevensville |
| Names of High School Lead Teacher & Counselor: | Josh Perkins, Teacher Karen Rebel |
| The Lead High School Teacher will be contacted if OPI has questions about this request. | |
| Lead Teacher’s email address: | perkinsj@stevensville.k12.mt.us |
| Lead Teacher’s phone number: | 406-727-9481 Q. 40 |
| Name of College: | U of M COT |
| Name of College Lead Faculty Member: | Mark Raymond |

### REQUIREMENTS FOR APPROVAL

<table>
<thead>
<tr>
<th>Requirement</th>
<th>YES</th>
<th>IP</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Includes all state and local graduation requirements preparing students for entry into a postsecondary program or apprenticeship.</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>2. Identifies the appropriate secondary CTE, academic, and recommended elective courses offered by this high school which will prepare the student for college-level courses without remediation.</td>
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<td>X</td>
<td></td>
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<tr>
<td>3. Outlines a non-duplicative sequence of courses from grades 9-12 and from secondary to postsecondary education.</td>
<td></td>
<td>X</td>
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<tr>
<td>4. Leads to an industry-recognized postsecondary credential, degree or employment</td>
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<td>X</td>
<td></td>
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<tr>
<td>5. Completed &quot;Gap Analysis&quot; with a program offered by a Montana postsecondary institution.</td>
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<td>X</td>
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<tr>
<td>6. When applicable, dual enrollment, Advanced Placement, International Baccalaureate courses and CTE START (Statewide Articulations) opportunities have been identified.</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>7. Pathway curriculum includes appropriate state/national standards and/or industry skills standards. Identify standards used: Agriculture, Food &amp; Natural Resource - AWS</td>
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<tr>
<td>8. Links with a web-based guidance delivery system such as Montana Career Information System (MCIS). If using something other than MCIS, please indicate:</td>
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</tbody>
</table>

High School Principal’s Signature: [Signature] Date: 2/15/12
High School CTE Teacher’s Signature: [Signature] Date: 2/15/12
High School Counselor’s Signature: [Signature] Date: 2/15/12

College Chief Academic Officer’s Signature: [Signature] Date: 4/13/2012
College Lead Faculty Member’s Signature: [Signature] Date: 5/30/2012

Please submit this Approval Form with the Big Sky Pathway Proposal to the Big Sky Pathway Coordinator at the College identified above.

OPI Approval: [Signature] Date of Approval: 4/1/2012
OCHE Approval: [Signature] Date of Approval: 4/1/2012

October 2011
Big Sky Pathways 2011 - Page 74
October 11, 2011

TO: College Chief Academic Officers  
   College Lead Faculty Members  
   High School Principals  
   High School CTE Teacher  
   High School Counselor

RE: Big Sky Pathways Approval Process

The attached Big Sky Pathways Agreement form must be reviewed with all signatures must be submitted with approval signatures by the following dates:

Friday, February 3, 2012: Submit to Postsecondary Partner with High School CTE Teacher, Counselor, and Principal Review Signatures.

Friday, March 2, 2012: Postsecondary Partner submits to the Office of Public Instruction Specialist with College Lead Faculty and Chief Academic Officer Review Signatures.

Friday, April 6, 2012: Office of Public Instruction Specialist submits to OCHE for review and approval.

Friday, May 4, 2012: Agreement form returned to Secondary and Postsecondary schools with OCHE Deputy Commissioner Review and Approval.

Approval forms must be accompanied with the following materials:
- Completed Pathway Template
- Completed Gap Analysis
- 2012-2013 Completed Agreement Form

A member of the Big Sky Pathways team will follow up with each Big Sky Pathways participant by December 15, 2011 to check on the status of each pathway development and approval process.

If you have questions, feel free to email Dr. Arlene Parisot who is the Big Sky Pathways representative for the Office of the Commissioner of Higher Education at aparisot@bigskyweb.com.

Sincerely,

[Signature]

John E. Cech, Ph.D.
Deputy Commissioner for Two-Year and Community College Education
Montana University System
Phone: 406-444-0316
Email: jceech@montana.edu
**BIG SKY PATHWAY PROPOSAL**

**Manufacturing**

**Occupation Examples:**
Assembler, MIG Welder, TIG Welder, Machine Operator, Sheet Metal Worker, Mechanical Engineer, Industrial Engineer, Quality Control Technician, Safety Technician, Safety Engineer, Dispatcher, Production Manager, Purchasing Agent, Logician

For a complete listing, go to: http://online.onetcenter.org/find/career?c=13&g=Go

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### SUGGESTED HIGH SCHOOL COURSES

<table>
<thead>
<tr>
<th>Grade</th>
<th>Graduation Requirements</th>
<th>CTE and/or Electives</th>
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</thead>
<tbody>
<tr>
<td>9th</td>
<td>Workforce/2-Year College Prep (Rigorous Core)</td>
<td>English 9, Science</td>
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<tr>
<td></td>
<td>Workforce/2-Year College Prep (Rigorous Core)</td>
<td>Math</td>
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<tr>
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<td>Workforce/2-Year College Prep (Rigorous Core)</td>
<td>Algebra I</td>
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<tr>
<td></td>
<td>Workforce/2-Year College Prep (Rigorous Core)</td>
<td>Computer App’s, AG I, Tech I</td>
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<tr>
<td>10th</td>
<td>Workforce/2-Year College Prep (Rigorous Core)</td>
<td>English 10, World History</td>
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<td>Workforce/2-Year College Prep (Rigorous Core)</td>
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<td>Workforce/2-Year College Prep (Rigorous Core)</td>
<td>Geometry</td>
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<td>AG II, Tech II, AG Mech, Adv. Mech</td>
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<td>11th</td>
<td>Workforce/2-Year College Prep (Rigorous Core)</td>
<td>English 11, US History</td>
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<td></td>
<td>Workforce/2-Year College Prep (Rigorous Core)</td>
<td>Math</td>
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<td>English Consumer Ed., Business Apps</td>
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<td>English 12, Math, Gov't.</td>
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<td>Workforce/2-Year College Prep (Rigorous Core)</td>
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<td></td>
<td>Workforce/2-Year College Prep (Rigorous Core)</td>
<td>English</td>
</tr>
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### ADVANCED LEARNING OPPORTUNITIES
High School to College/Career Linkages

- **CTE START courses:**
- **Advanced Placement or IB courses:**
- **Dual Enrollment courses:**
- **Online courses:**

Other:
MT Digital Academy, College Prep MT University System

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### POSTSECONDARY PROGRAM OF STUDY

<table>
<thead>
<tr>
<th>Semester</th>
<th>Math</th>
<th>English</th>
<th>Major</th>
<th>Other</th>
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<tbody>
<tr>
<td>13—Semester 1</td>
<td>M 111</td>
<td></td>
<td>WLDG 150, WLDG 180, WLDG 205, MPR 114T</td>
<td>CAPP 120</td>
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<tr>
<td>14—Semester 1</td>
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<td>WLDG 117, WLDG 145, WLDG 184, WLDG 187, WLDG 191</td>
<td>PSYX 163</td>
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<tr>
<td>15—Semester 1</td>
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<td></td>
<td>WLDG 210, WLDG 215, MPR 214T</td>
<td>CADX 110</td>
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</tbody>
</table>

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*September 2011*
### MONTANA POSTSECONDARY OPPORTUNITIES

**Montana University System Degree and Program Inventory:** [http://www homepage.montana.edu/~mus/dirginv/](http://www homepage.montana.edu/~mus/dirginv/)

**Your Guide to Montana’s Certificate and Associate Degree Programs:** [http://mus.edu/twoyear/YourGuide.html](http://mus.edu/twoyear/YourGuide.html)

| MILITARY | Requires diploma or GED  
|          | 17 with parental consent; 18 without  
|          | Air Force, Air Guard, Army, Coast Guard, Marines, and Navy  
|          | For more information: [http://todaysmilitary.com](http://todaysmilitary.com)  

| PROFESSIONAL CERTIFICATE | Requires diploma or GED  
|                          | Less than 30 credits; little/no general ed credits  
|                          | Complete in one year or less  
|                          | Welding Technology — FVCC  
|                          | Electricians  
|                          | Sheet Metal Workers  

| APPRENTICESHIP | Requires diploma or GED  
|               | Must be at least 18  
|               | Minimum 2,000 hours of supervised experience  
|               | See the MT Dept of Labor website for more information: [http://gsd.dli. state.mt.us/apprenticeship/default.asp](http://gsd.dli.state.mt.us/apprenticeship/default.asp)  

| CERTIFICATE OF APPLIED SCIENCE | Requires diploma or GED  
|                                | 30-45 credits; limited general education credits  
|                                | Complete in one year or less  
|                                | Industrial Machine Technology/CNC — FVCC  
|                                | Metals (Fabrication) Technology — BLCOT  
|                                | Machine Tool Technology — HCOT, UMW  
|                                | Sustainable Energy Technician — BLCOT, TECHCOT, GFCOT, MSUN  
|                                | Water Quality Technology — HCOT, MSUN  
|                                | Welding Technology — HCOT, UMCOT, GFCOT, BLCOT, GCP, MSUN, DCC, FVCC, FPCC  

| ASSOCIATE’S OF APPLIED SCIENCE DEGREE | Requires diploma or GED  
|                                       | 60-72 credits; includes 15-25 general ed credits  
|                                       | Complete in two years (if prepared academically in math and English)  
|                                       | Biofuel Energy — MCC  
|                                       | Electronics Technology — UMCOT  
|                                       | Energy Technology — UMCOT  
|                                       | Metals (Fabrication) Technology — HCOT, TECHCOT, BLCOT  
|                                       | Machine Tool Technology — HCOT  
|                                       | Power Plant Technology — BLCOT  
|                                       | Process Plant Technology — BLCOT  
|                                       | Sustainable Energy Technician — BLCOT, TECHCOT, GFCOT, MSUN  
|                                       | Water Quality Technology — FPCC  
|                                       | Welding Technology — HCOT, UMCOT, BLCOT, FVCC  

| BACCALAUREATE DEGREE | Requires 4-year college prep for admission  
|                      | 128 credits (approximately)  
|                      | Complete in four years  
|                      | Bioengineering — MSU  
|                      | Electrical Engineering — TECH, MSU  
|                      | Civil Engineering — TECH, MSU  
|                      | Industrial Engineering — MSU  
|                      | Mechanical Engineering — TECH, MSU  
|                      | Mining Engineering — TECH  
|                      | Occupational Safety & Health — TECH  
|                      | Welding Engineering — TECH  
|                      | Metallurgical & Materials Engineering — TECH  
|                      | Petroleum Engineering — TECH  

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Degree and Program Inventory above may not be all inclusive.
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</table>

- Employ the concept of a combination square set.
- Use visual measuring tools to accuracy of 1/64".
- Identify basic metalworking tools used in measuring.
- At least 75 percent demonstrate an understanding of practical measurement with a test score of X.
- Understand precautions involving labeling.
- Demonstrate work in confined spaces properly.
- Demonstrate hot work operation.
- Demonstrate proper use and inspection of equipment used for ventilation.
- Demonstrate proper use of equipment used for protection of personnel.

**Materials Catalog**

- Demonstrate safety and through www.skillsusa.org/Shop > Educational Identity safety standards on a test with a score of at least 75 percent and

**Standards and Competencies**

www.skillsusa.org/Shop > Educational Materials Catalog

and download the relevant "Compete Singles" both are available through Championship Technical Standards CD-ROM for the current year or purchase.

Any questions for a SkillsUSA Championships contest please refer to the SkillsUSA Assessment. This blueprint does NOT contain the information one would need to assess the blueprint contains the subject matter content of this skill connect.
**WELDING Knowledge & Skills Statements**

- Use layout and marking tools as required

- Determine wire feed speed

**Read and interpret blueprints with a test score of at least 75 percent**

- Apply information found in the information block of the drawing

- Identify the basic views used in blueprints including assembly, detail and fit-up drawings

- Identify common types of lines, abbreviations and symbols in accordance with national drawing standards (ANSI)

- Identify basic welding symbols and components of a symbol (such as arrow, reference line, tail, size or length) in accordance with the current national welding symbol standard AWS A 2.4 current edition

**Produce welds using a Shielded Metal Arc Welding (SMAW) process to AWS QC10 standards**

- Demonstrate safety procedures for SMAW

- Demonstrate ability to correctly set up SMAW power sources, related welding equipment and do
**WELDING Knowledge & Skills Statements**

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</table>

- **Select correct type of electrode based on carbon steel and/or stainless steel plate (" to " thickness)**

- **Prepare carbon steel and/or stainless steel for welding**

**Produce welds using a Gas Metal Arc Welding (GMAW) process to AWS QC10 standards**

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</table>

- **Demonstrate correct safety procedures for GMAW**

- **Demonstrate ability to correctly set up GMAW power sources, related welding equipment and do basic process and equipment troubleshooting**

- **Identify short circuiting, globular, spray and pulsed transfer welding of carbon steel, stainless steel and/or aluminum**

- **Select correct type of filler metal, type of shielding gas, amperage and voltage based on carbon steel, stainless steel and/or aluminum sheet and/or plate (1/16" to 3/8" thickness)**

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- **Prepare the carbon steel, stainless steel and/or aluminum for welding**

**Produce welds using a Fluxed Cored Arc Welding (FCAW) process to AWS QC10 standards**

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</table>

- **Demonstrate correct safety procedures for FCAW**
### WELDING Knowledge & Skills Statements

- Demonstrate ability to correctly set up FCAW power sources, related welding equipment and do basic process and equipment troubleshooting

- Select correct type of filler metal, type of shielding gas, amperage and voltage based upon carbon steel and/or stainless steel sheet and/or plate (1/16" to 3/8" thickness)

- Prepare stainless steel and/or carbon steel for welding

**PRODUCE WELDS using a Gas Tungsten Arc Welding (GTAW) process to AWS QC10 standards**

- Demonstrate safety procedures for GTAW

- Demonstrate ability to correctly set up GTAW power sources, related welding equipment and do basic process and equipment troubleshooting for regular and pulsed welding of aluminum, stainless steel and/or carbon steel

- Select the correct type of tungsten and/or filler metal based on aluminum, stainless steel or carbon steel sheet and/or plate (1/16" to 1/4" thickness)

- Prepare aluminum, stainless steel and/or carbon steel for welding

**PRODUCE CUT MATERIALS USING AN OXYGEN FUEL CUTTING (OFC) process to AWS QC10 standards**

- Demonstrate safety procedures for OFC

- Demonstrate ability to correctly set up the OFC equipment for cutting and do basic process troubleshooting
Produce cut materials using a Plasma Arc Cutting (PAC) process to AWS QC10 standards

- Demonstrate safety procedures for PAC

- Demonstrate ability to correctly set up the PAC power sources, related cutting equipment and do basic process and equipment troubleshooting

- Set up and shut down equipment for cutting carbon steel, stainless steel and/or aluminum

Demonstrate knowledge of visual inspection with a test score of at least 75 percent

- Examine and measure undercut

- Examine and measure porosity

- Measure fillet size

- Examine and measure weld reinforcement

- Determine acceptability of welded samples in accordance with provided acceptance criteria

Demonstrate knowledge of welding positions and terminology

- Start, stop and restart stringer beads in the flat, horizontal, vertical up and down and overhead positions
WELDING Knowledge & Skills Statements

- Weld a pad with a multiple pass weld in the flat, horizontal, vertical up and down and overhead positions

- Weld a lap joint with a single pass, fillet weld in flat, horizontal, vertical up and down and overhead positions

- Weld a lap joint with a multiple pass, fillet weld in the flat, horizontal, vertical up and down and overhead positions

- Weld a T-joint with a single pass, fillet weld in the flat, horizontal, vertical up and down and overhead positions

- Weld a T-joint with a multiple pass, fillet weld in the flat, horizontal, vertical up and down and overhead positions

- Weld a butt joint with a single pass square groove weld in the flat, horizontal, vertical up and down and overhead positions

- Weld a butt joint with a partial joint penetration, single pass, double V-groove weld in the flat, horizontal, vertical up and down and overhead positions

- Weld a butt joint with a multiple pass V-groove weld in the flat, horizontal, vertical up and down and overhead positions

Work Force Ready System 3

- Weld a butt joint with complete joint penetration, multiple pass, double groove weld in the flat, horizontal, vertical up and down and overhead positions

- Weld a 2" diameter, schedules 40 to 80 pipe, single/multiple pass V-groove weld in the 2G, 5G and 6G positions
### WELDING Knowledge & Skills Statements

- Lay out, weld, cut and prepare coupons for evaluation

Demonstrate professional development skills in a simulated customer service or employment situation. Examples may include:
  - Job interview
  - Customer service scenario

- Communications

- Decision making, problem solving and/or critical thinking

### Committee Identified Academic Skills

The SkillsUSA national technical committee has identified that the following academic skills are embedded in the welding training program and assessment:

**Math Skills**

- Use fractions to solve practical problems

- Measure angles

- Construct three-dimensional models

**Science Skills**

- Describe and recognize solids, liquids and gases

- Use knowledge of principles of electricity and magnetism
### WELDING Knowledge & Skills Statements

#### Language Arts Skills

- Provide information in conversations and in group discussions
- Provide information in oral presentations
- Demonstrate use of verbal communication skills, such as word choice, pitch, feeling, tone and voice
- Demonstrate use of nonverbal communication skills: eye contact, posture, and gestures using interviewing techniques to gain information
- Demonstrate comprehension of a variety of informational texts
- Understand source, viewpoint and purpose of texts
- Demonstrate knowledge of appropriate reference materials
- Use print, electronic databases, and online resources to access information in books and articles
- Demonstrate informational writing
- Edit writing for correct grammar, capitalization, punctuation, spelling, sentence structure and paragraphing

### Connections to National Standards

State-level academic curriculum specialists identified the following connections to national academic standards

#### Math Standards

- Geometry
## WELDING Knowledge & Skills Statements

**Measurement**

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**Problem solving**

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**Communication**

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**Connections**

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**Representation**

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### Science Standards

**Understands the structure and properties of matter**

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**Understands the sources and properties of energy**

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<td>IRE</td>
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**Understands forces and motion**

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**Understands the nature of scientific inquiry**

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Source: *McREL compendium of national science standards.* To view and search the compendium, visit: [www.mcrel.org/standards-benchmarks/](http://www.mcrel.org/standards-benchmarks/).
**WELDING Knowledge & Skills Statements**

**Language Arts Standards**
- Students apply a wide range of strategies to comprehend, interpret, evaluate and appreciate texts.
- They draw on their prior experience, their interactions with other readers and writers, their knowledge of word meaning and of other texts, their word identification strategies, and their understanding of textual features (e.g., sound-letter correspondence, sentence structure, context, graphics).

Source: IRA/NCTE Standards for the English Language Arts. To view the standards, visit: www.readwritethink.org/standards/index.html.

**WELDING FABRICATION BLUEPRINT**

This Blueprint contains the subject matter content of this Skill Connect Assessment. This Blueprint does NOT contain the information one would need to fully prepare for a SkillsUSA Championships contest. Please refer to the SkillsUSA Championships Technical Standards CD-ROM for the current year or purchase and download the relevant "Contest Singles." Both are available through www.skillsusa.org > Shop > Educational Materials Catalog.

**Standards and Competencies**

**Safety**

- Demonstrate personal safety
- Demonstrate general shop safety
- Demonstrate gas, electrical and chemical safety
- Demonstrate knowledge of proper actions to be taken in an emergency
# WELDING Knowledge & Skills Statements

## Measurements

- Identify basic metal working tools used in measuring

- Use visual measuring tools to accuracy of 1/32 of an inch

- Employ the components of a combination square set

- Use layout and marking tools are required

## Blueprint Reading

- Use information found in the block of the drawing

- Read and understand three-dimensional drawings

- Identify the basic views used in blueprints including assembly detail and fit-up drawings

- Identify commands types of the lines, abbreviations and symbols in accordance with national drawing standards ANSI

- Identify basic welding symbols and components of a symbol (such as arrow, reference line, size or length) in accordance with the national welding symbol standard AWS

## Shielding Metal Arc Welding (SMAW)

- Demonstrate safety procedures for SMAW
Set up and shut down equipment for welding of carbon steel

* Correctly identify base metal prior to welding

* Demonstrate ability to correct set up GMAW power sources, related welding equipment and do basic troubleshooting

Gas Metal Arc Welding (GMAW)

* Overhead positions
  * Vertical up and down and
  * Start, stop and restart stronger beads on carbon steel in the flat, horizontal.

* Prepare carbon steel for welding

* Select correct type of filler metal size of electrode based on carbon steel (3/4"

* Set up and shut down equipment for welding of carbon steel

* Correctly identify base metal prior to welding

* Demonstrate ability to correct set up SMAW power sources, related welding equipment and do basic troubleshooting
• Select correct type of filler metal size of electrode based on carbon steel (1/4 inch to 3/8 inch thickness)

• Prepare carbon steel, stainless steel and/or aluminum for welding

• Start, stop and restart stringer beads on carbon steel in the flat, horizontal, vertical up and down and overhead positions

• Weld a lap joint with a multiple pass, fillet weld on carbon steel

Demonstrate professional development skills in a simulated customer service or employment situation. Examples may include:
• Job interview

• Customer service scenario

• Communications

• Decision making, problem solving and/or critical thinking

Connections to National Standards
State-level academic curriculum specialists identified the following connections to national academic standards

Math Standards

• Geometry
WELDING Knowledge & Skills Statements

- Connections
- Representation


### Science Standards

- Understands the structure and properties of matter

- Understands the sources and properties of energy

- Understands forces and motion

- Understands the nature of scientific inquiry

Source: McREL compendium of national science standards. To view and search the compendium, visit: www.mcrel.org/standards-benchmarks/.

### Language Arts Standards

- Students apply a wide range of strategies to comprehend, interpret, evaluate and appreciate texts.

  They draw on their prior experience, their interactions with other readers and writers, their knowledge of word meaning and of other texts, their word identification strategies, and their understanding of textual features (e.g., sound-letter correspondence, sentence structure, context, graphics)

Source: IRA/NCTE Standards for the English Language Arts. To view the standards, visit: www.readwritethink.org/standards/index.html.