

# **Metal Fabrication and Joining Technologies**

CIP # 480508

Charles H. McCann Technical School

70 Hodges Cross Rd.

North Adams, MA 01247

Instructors: Ed Menard, John Kline

Developed: June 21, 2006

**Freshman Class**

### **Program Philosophy:**

The educational philosophy of the Welder/ Welding Technician Program is to prepare students to be skilled, productive members of the workforce and the community at large. By providing students with a safe learning environment, we promote individual creativity, respect for diversity and formation of a strong work ethic.

### **Freshman Exploratory Goal:**

Our goal is to introduce the metal fabrication trade area to the new freshman class with hands-on projects designed to give each student a completed project they can take home with them. Students will be taught shop safety, measurement, safe and proper operation of basic hand tools and simple power equipment, as well as basic welding and oxy-acetylene cutting.

### **Freshman Goal:**

Our goal is to introduce the freshman student who has chosen metal fabrication as his or her field of study to basic concepts and safety practices. Students will begin their hands-on training with an introduction to basic hand tools and simple power equipment, and will begin to grasp theoretical concepts.

### **Program Description:**

At McCann, students of metal fabrication are required to create finished products of commercial value from stock metal using a variety of fabrication techniques. Those products may be ductwork, wrought iron fencing and other structural parts, or be as creative and artistic as metal sculpture.

Students learn about metal composition, strength of materials, structural design, blueprint reading and sheet metal pattern drafting. Proper sheet metal fabrication and installation techniques are taught in order to satisfy the demand for skilled sheet metal mechanics.

The welding instructor for the metal fabrication program is also an AWS certified welding inspector. This enables our students to pursue welding certifications in a variety of processes with various base materials.

McCann is associated with the American Welding Society (AWS) as an Educational Institution Member. We participate in the AWS SENSE Program (Schools Excelling through National Standards Education). The program is set up in modules. Students will work toward completion of modules through their 4 years in metal fabrication. Students who complete all written and practical modules successfully will be recognized by the AWS as certified entry level welders. More advanced students are eligible to achieve advanced welder status.

Students are taught a variety of welding processes, including: oxy-acetylene welding, shielded metal arc welding (SMAW), metal inert gas (MIG), tungsten inert gas (TIG), plastic welding.

During a student's four years of training they will be instructed in the safe and proper use of a variety of metal forming machines, hand tools and power tools. Students are challenged to problem solve, and allowed to make mistakes in a safe, controlled environment.

The McCann Metal Fabrication department takes in projects from the city and the community, allowing students to not only build or repair real world objects but to

see and take pride in their contribution for years beyond graduation. Past projects include: fabrication of a wrought iron fence surrounding the North Adams Library, fabrication of a steel railing for the handicapped ramp at Haskin's School, repairing a sander body for Notchview Reservation in Windsor, repairing broken or worn parts for the North Adams Highway Department.

A Cooperative Work Program is offered to junior and senior students that maintain good academic standing, as well as attendance and vocational proficiency. Some of the companies that have employed our co-op students in the past are Adams Plumbing and Heating, Morrison Berkshire, Protech Armored Products, R.I. Baker Company, and Atlantis Equipment

### **Course Syllabus for Freshman Year**

Freshman students who have been assigned to the metal fabrication program will be taught, first and foremost, about the importance of shop safety. Once the instructors are convinced that the student understands the safety rules, we will move on to the safe handling and operation of basic hand tools. Students will use this knowledge to begin following simple blueprints to layout and fabricate small projects. Each project will introduce new skills and concepts, building on skills previously learned. Projects include:

1. Sheet metal box project
2. Square scoop
3. Tool tray
4. Dust Pan
5. Small toolbox

6. Candle holder

7. Napkin holder

Students will be taught basic welding skills in both SMAW and GMAW processes. These skills will be expanded upon with further study.

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In theory, students are taught to properly read a ruler. Math skills are assessed with the focus on manipulation of fractions. Welding theory begins with safety, identification of metals, and physical aspects of welding.

### **Evaluation**

Each day, students are evaluated on their work as well as their personal effort and attitude. Each category is given a point value. Maximum point values add up to 100 points. Students earn a daily score, which will be averaged at the end of the week. This weekly score counts as 70% of the students' grade average, with the remaining 30% coming from all written theory assignments. The following rubric shows the categories for daily evaluation:

Week ending	Quality of work	Quantity of work	Proper selection and use of tools	Proper selection and use of materials	Problem solving ability	Safe work habits	Cooperation	Effort	Reliability	Social attitude	Average weekly rating	Hours absent
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**Timeline for Course Activities**

Exploratory Term (2 ½ days in each technical area)

- Identify basic safety practices
- Identify hand tools and stationary equipment
- Introduction to SMAW and GMAW processes
- Introduction to linear measurement

**Freshman Year**

2<sup>nd</sup> Term

- Identify basic shop safety practices
- Identify hand tools and stationary equipment
- Identify basic terminology in Metal Fabrication
- Read a combination square
- Cut Metal using Foot Operated Shear
- Form metals using hand operated pan and box brake
- Use notcher to notch 45 degree angles and 90 degree corners

- Operate spot welder
- Define lines on a basic blueprint
- Math- manipulate fractions
- Identify safety procedures in arc welding
- Set up arc welding equipment
- Form a weld bead with SMAW

#### 3<sup>rd</sup> Term

- Set up of GMAW equipment
- Form a bead
- Form stringer beads using GMAW short-circuit transfer
- Weld a butt joint
- Measure metals to determine gage and decimal equivalent
- Read decimal equivalent chart
- Identify Metals
- Identify metal holding devices and their uses
- Drill holes in metal plates
- Tap holes in metal plates
- Punch holes in metal plates using hand operated punches
- Cut Metal using Power Shear
- Identify safety procedures used with drill press
- Determine drill speeds
- Identify the parts of the drill press and clamping devices
- Operate power drill press
- Math- manipulate decimals

#### 4<sup>th</sup> Term

- Identify electrodes in SMAW welding
- Weld a lap joint with SMAW in the 1F position
- Weld a tee Joint with SMAW in the 1F position
- Weld a tee joint with GMAW in the 1F position
- Weld a lap joint with GMAW in the 1F position
- Operate oxy-acetylene torches
- Cut metal using a band saw
- Operate circular sanders
- Operate pad/ belt sander
- Operate disk sander
- Operate pedestal grinder
- Select dies to be used with an Iron Worker
- Form metals using rollers
- Identify symbols and abbreviations used on welding blueprints
- Operate pittsburgh lock machine
- Operate reciprocating shears

### **Objectives:**

## **I. Orientation of the Metal Fabrication Program**

1. Identify basic safety practices
2. Identify hand tools and stationary equipment
3. Identify Basic terminology in Metal Fabrication
4. Identify Metals

## **II. Taking Measurement**

1. Read a combination square
2. Measure metals to determine gage and decimal equivalent
3. Read decimal equivalent chart
4. Read Circumference Rule

## **III. Cutting Metals**

1. Cut Metal using Foot Operated Shear
2. Cut Metal using Power Shear
3. Cut metal using a band saw

## **IV. Forming Metals**

1. Form metals using hand operated pan and box brake
2. Form metals using rollers

## **V. Operating Stationary Equipment Safely**

1. Use notcher to notch 45 degree angles and 90 degree

corners

2. Operate spot welder
3. Operate disk sander
4. Operate pedestal grinder
5. Select dies to be used with an Iron Worker
6. Identify safety procedures used with drill press
7. Determine drill speeds
8. Identify the parts of the drill press and clamping devices
9. Operate power drill press
10. Operate pittsburgh lock machine

## **VI. Operating Electric Power Tools**

1. Operate circular sanders
2. Operate pad/ belt sander
3. Operate reciprocating shears

## **VII. Punching Holes in Metal**

1. Identify metal holding devices and their uses
2. Drill holes in metal plates
3. Tap holes in metal plates
4. Punch holes in metal plates using hand operated punches

## **VIII. Blueprint Reading**

1. Define lines
2. Identify symbols and abbreviations used on welding blueprints
3. Identify symbols and abbreviations used on precision sheet metal blueprints
4. Read title blocks/ strips

#### **IX. Performing Shielded Metal Arc Welding (flat position)**

1. Identify safety procedures in arc welding
2. Set up arc welding equipment
3. Identify electrodes in arc welding
4. Form a weld bead
5. Weld a lap joint
6. Weld a tee Joint
7. Weld a multiple pass butt weld on heavy plate

#### **X. Performing Metal Inert Gas Welding (MIG)**

1. Identify safety procedures in MIG welding
2. Set up of MIG equipment
3. Form a bead
4. Form stringer beads using short-circuiting
5. Weld a butt joint
6. Weld a tee joint

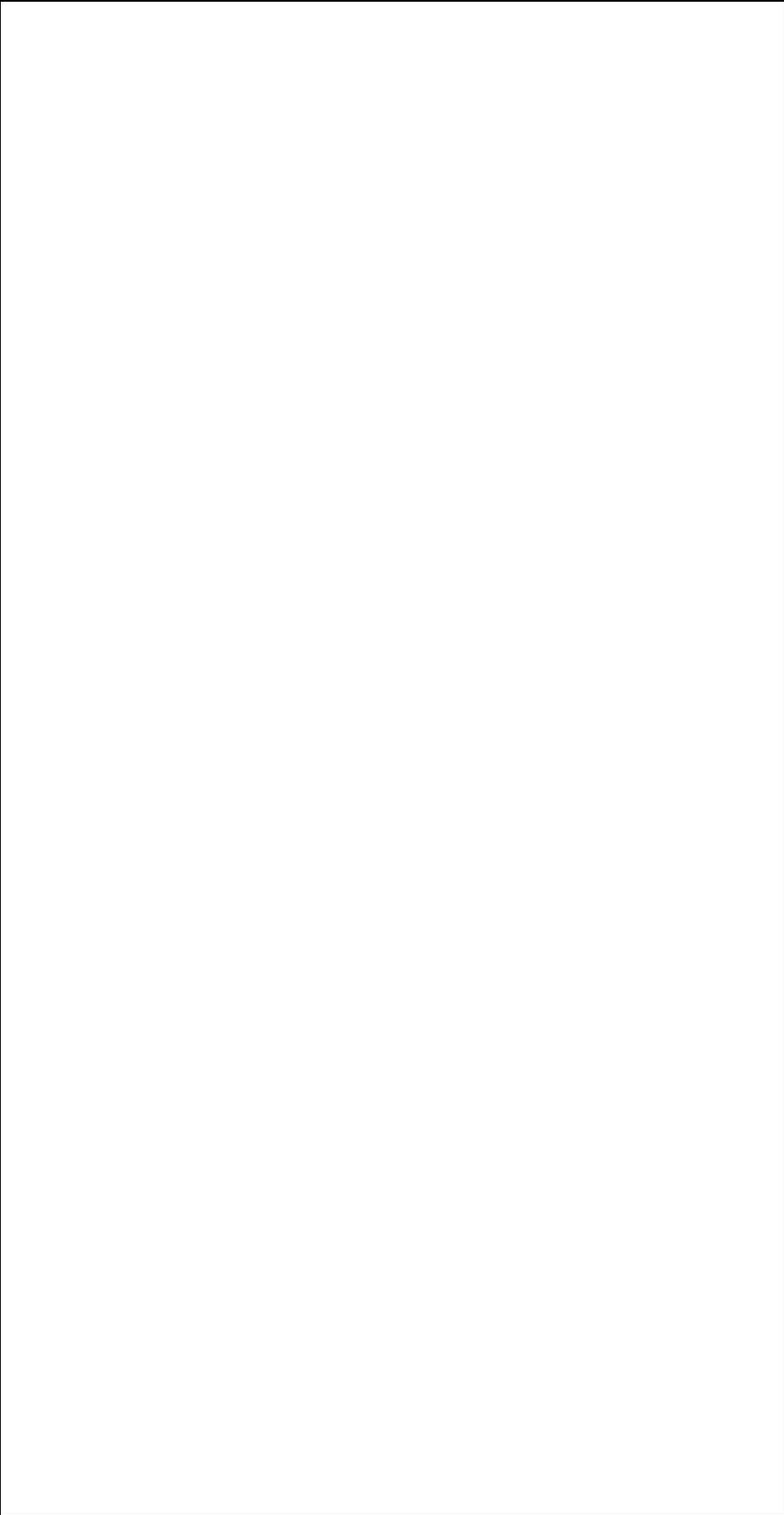
7. Weld a lap joint

**XI. Perform Oxy-acetylene Welding and Cutting**

1. Identify safety procedures in oxy-acetylene torches
2. perform oxy-acetylene welding
3. Perform oxy-acetylene cutting

**Standards:**

<p><b>I. Orientation of the Metal Fabrication Program</b></p> <ol style="list-style-type: none"> <li>1. Identify basic safety practices</li> <li>2. Identify hand tools and stationary equipment</li> <li>3. Identify Basic terminology in Metal Fabrication</li> <li>4. Identify Metals</li> </ol>	<ol style="list-style-type: none"> <li>1.A.01a Identify and apply health and safety regulations specific tasks and job area</li> <li>1.A.03a Identify and apply (Hazard Communication) communicative regulations specific tasks and job area</li> <li>1.A.04a Explain procedures and reporting hazards to authorities</li> <li>1.A.05a List penalties for inappropriate health and safety</li> <li>1.A.06a Identify contact appropriate health and safety resources</li> <li>1.B.01a Identify, describe effective use of Material Safety Data Sheet (MSDS)</li> <li>1.B.02a Read chemical labels to determine safety considerations</li> <li>1.B.03a Identify, describe personal, shop and safety procedures</li> <li>1.B.04a Demonstrate safety gear equipment (PPE), in adjustable workspaces, gloves, boots, earplugs</li> </ol>
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- breathing apparatus
- 1.B.05a Illustrate appropriate mechanics, including techniques and ergonomics
- 1.B.06a Locate emergency lab, shop, and classroom (appropriate) eyewash facilities, sinks, fire blankets, telephones, and emergency exits
- 1.B.07a Demonstrate the maintenance of equipment in the lab, shop, and classroom
- 1.B.08a Describe safety procedures to be followed and around electrical equipment
- 1.B.09a Illustrate proper practices, including material handling, disposal, and storage
- 1.B.10a Demonstrate proper cleaning procedures
- 1.B.11c Discuss the relationship between safety and productivity
- 1.B.12 Describe shop vocabulary
  
- 1.C.01a Illustrate First Aid potential injuries and in the occupational setting
- 1.C.02a Describe the importance of preparedness and a safety plan
- 1.C.03a Illustrate procedures in an emergency situation including identification, evacuation plans, and first aid
- 1.C.04a Identify practical safety accidents
- 1.C.05a Identify and describe safety precautions and responsibilities
- 1.C.06a Discuss the role of the company/organization in workplace safety
- 1.C.07a Discuss ways to improve workplace/school safety
- 1.C.02a Describe the importance of preparedness and a safety plan
- 1.C.03a Illustrate procedures in an emergency situation

	<p>emergency situation including identification, evacuation plans, and</p> <p>1.C.04a Identify practical accidents</p> <p>1.C.05a Identify and discuss precautions and responsibilities</p> <p>1.C.06a Discuss the role of the company/organization in workplace safety</p> <p>1.C.07a Discuss ways to improve workplace/school safety</p> <p>2.G.01 Identify hand tools and equipment and their uses</p> <p>2.G.02 Identify metals and their molecular characteristics</p> <p>2.G.03 Identify basic terms of fabrication and joining</p> <p>2.G.04 Explain the effects of making a weld</p> <p>2.G.05 Explain molecular changes within the heat affected zone</p> <p>2.G.06 Identify common</p>
<p><b>II. Taking Measurement</b></p> <ol style="list-style-type: none"> <li>1. Read a combination square</li> <li>2. Measure metals to determine gage and decimal equivalent</li> <li>3. Read decimal equivalent chart</li> <li>4. Read Circumference Rule</li> </ol>	<p>2.F.01c Define attributes of measurement used</p> <p>2.F.02c Apply a variety of formulas for determining</p> <p>2.F.05c Use measurement to solve problems</p> <p>2.F.06 Identify and explain tools such as squares and trammel points</p> <p>2.F.07 Determine decimal equivalent using a sheet metal</p> <p>2.F.09 Determine measurement equivalent chart</p> <p>2.F.10 Determine measurement combination square (blade protractor)</p> <p>2.F.11 Determine measurement measure</p>
<p><b>III. Cutting Metals</b></p>	<p><b>2.S Mechanical Cutting Operations</b></p> <p>2.S.01 Identify the properties</p>

<ol style="list-style-type: none"> <li>1. Cut Metal using Foot Operated Shear</li> <li>2. Cut Metal using Power Shear</li> <li>3. Cut metal using a band saw</li> <li>4. Cut metal using a beverly shear</li> </ol>	<p>techniques for spec situations</p> <ol style="list-style-type: none"> <li>2.S.02 Demonstrate th a power shear</li> <li>2.S.03 Demonstrate th a foot operated she</li> <li>2.S.05 Demonstrate th a horizontal band s</li> <li>2.S.06 Demonstrate th a vertical band saw</li> <li>2.S.07 Demonstrate th a beverly shear</li> </ol>
<p><b>IV. Forming Metals</b></p> <ol style="list-style-type: none"> <li>1. Form metals using hand operated pan and box brake</li> <li>2. Form metals using rollers</li> </ol>	<ol style="list-style-type: none"> <li>2.R.01 Identify the prop and techniques for situations</li> <li>2.R.02 Demonstrate th a hand operated bo</li> <li>2.R.03 Demonstrate th slip rollers</li> </ol>
<p><b>V. Operating Stationary Equipment Safely</b></p> <ol style="list-style-type: none"> <li>1. Use notcher to notch 45 degree angles and 90 degree corners</li> <li>2. Operate spot welder</li> <li>3. Operate disk sander</li> <li>4. Operate pedestal grinder</li> <li>5. Select dies to be used with an Iron Worker</li> <li>6. Identify safety procedures used with drill press</li> <li>7. Determine drill speeds</li> <li>8. Identify the parts of the drill press and clamping devices</li> <li>9. Operate power drill press</li> <li>10. Operate pittsburgh seamer</li> </ol>	<ol style="list-style-type: none"> <li>2.P.02 Set up and main equipment</li> <li>2.P.03 Perform a spot material</li> <li>2.T.05 Demonstrate th for punching holes and punches</li> <li>2.T.01 Identify safety p tools</li> <li>2.T.02 Demonstrate th grinders and sander</li> <li>2.T.04 Demonstrate th a reciprocating saw</li> <li>2.T.05 Demonstrate th for punching holes and punches</li> <li>2.S.08 Demonstrate th an ironworker</li> <li>2.Q.07 Layout of hole l drilling</li> </ol>

<p><b>VI. Operating Electric Power Tools</b></p> <ol style="list-style-type: none"> <li>1. Operate circular sanders</li> <li>2. Operate pad/ belt sander</li> <li>3. Operate reciprocating shears</li> </ol>	<p>2.T.03 Demonstrate the use of an electric hand sander  2.T.02 Demonstrate the use of grinders and sanders</p>
<p><b>VII. Punching Holes in Metal</b></p> <ol style="list-style-type: none"> <li>1. Identify metal holding devices and their uses</li> <li>2. Drill holes in metal plates</li> <li>3. Tap holes in metal plates</li> <li>4. Punch holes in metal plates using hand operated punches</li> </ol>	<p>2.P.02 Set up and maintain equipment  2.P.03 Perform a spot weld on material  2.Q.07 Layout of hole for drilling</p>
<p><b>VIII. Blueprint Reading</b></p> <ol style="list-style-type: none"> <li>1. Define lines</li> <li>2. Identify symbols and abbreviations used on welding blueprints</li> <li>3. Identify symbols and abbreviations used on precision sheet metal blueprints</li> <li>4. Read title blocks/ strips</li> </ol>	<p>2.Q.01 Develop cut size</p>
<p><b>IX. Performing Shielded Metal Arc Welding (flat position)</b></p> <ol style="list-style-type: none"> <li>1. Identify safety procedures in arc welding</li> <li>2. Set up arc welding equipment</li> <li>3. Identify electrodes in arc welding</li> </ol>	<p>2.1.01 Identify safety procedures  2.1.02 Set up SMAW equipment  2.1.03 Identify various types of electrodes, diameters and functions  2.1.04 Form a weld bead using SMAW Process  2.1.05 Pad weld in all positions using SMAW Process  2.1.06 Fillet weld in all positions using SMAW Process</p>

4. Form a weld bead
5. Weld a lap joint
6. Weld a tee Joint
7. Weld a multiple pass butt weld on heavy plate

2.I.07 Groove weld in a SMAW Process

- X. Performing Metal Inert Gas Welding (MIG)**
1. Identify safety procedures in MIG welding
  2. Set up of MIG equipment
  3. Form a bead
  4. Form stringer beads using short-circuiting
  5. Weld a butt joint
  6. Weld a tee joint
  7. Weld a lap joint

2.J.01 Identify safety p  
 2.J.02 Set up GMAW e  
 2.J.03 Identify the vario  
 transfer process  
 2.J.04 Form a weld bea  
 Process  
 2.J.05 Pad weld in all p  
 Process  
 2.J.06 Fillet weld in all  
 GMAW Process  
 2.J.07 Groove weld in  
 GMAW Process

- XI. Perform Oxy-acetylene Welding and Cutting**

2.H.01 Identify safety p  
 Acetylene Welding  
 2.H.02 Set up Oxy-Ace  
 for operation  
 2.H.03 Identify proper s  
 oxy-acetylene equip  
 2.H.04 Form a weld be  
 the Oxy-Acetylene

	<p>2.M.01 Identify safety p cutting</p> <p>2.M.02 Set up manual operations on plain</p> <p>2.M.03 Perform straight operations on plain Oxy-fuel gas cutting</p> <p>2.M.04 Perform manual of plain carbon steel cutting process</p> <p>2.M.05 Perform bevel c carbon steel using a</p> <p>2.M.06 Perform washin to Oxy-fuel gas cutt</p>
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**Instructional Activities:**

Another tool used to reinforce training is the Skills U.S.A. competition, where students compete against one another within the shop in welding and sheet metal.

**Resources:**

**Text for theory include, but are not limited to:**

Welding; Skills, Processes and Practices for Entry Level Welders  
Jeffus, Bower

AWS D1.1 Structural Welding Code- Steel

Industrial Welding: Wheels of Learning

National center for Construction Education and Research

Welding Technology Fundamentals

William A. Bowditch/ Kevin E. Bowditch

Blueprint Reading For Welders, Fifth Edition

A.E. Bennett/ Louis J. Siy

**Equipment that students are trained on includes, but is not limited to:**

GMAW Machine

GTAW Machine

Electric arc welder

Oxy-acetylene torches

Power press brake

Power band saw

Pirrana iron worker

Rollers

Pittsburg lock machine

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Revised: September 22, 2010

**Grade 10**

## **Program Philosophy:**

The educational philosophy of the metal fabrication program is to prepare students to be skilled, productive members of the workforce and the community at large. By providing students with a safe learning environment, we promote individual creativity, respect for diversity and formation of a strong work ethic.

**Goal:** The goal for sophomore year is to expand on the teachings of freshman year, getting more in depth with each lesson. Students will begin to use their acquired skills to work on some of the simpler outside jobs that the community brings to us, developing a strong work ethic with a focus on quality workmanship. New skills and concepts will be realized by students throughout the year.

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Students learn about metal composition, strength of materials, structural design, blueprint reading and sheet metal pattern drafting. Proper sheet metal fabrication and installation techniques are taught in order to satisfy the demand for skilled sheet metal mechanics.

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Students are taught a variety of welding processes, including: oxy-acetylene welding, shielded metal arc welding (SMAW), metal inert gas (MIG), tungsten inert gas (TIG), plastic welding.

During a student's four years of training they will be instructed in the safe and proper use of a variety of metal forming machines, hand tools and power tools. Students are challenged to problem solve, and allowed to make mistakes in a safe, controlled environment.

The McCann Metal Fabrication department takes in projects from the city and the community, allowing students to not only build or repair real world objects but to see and take pride in their contribution for years beyond graduation. Past projects include: fabrication of a wrought iron fence surrounding the North Adams Library, fabrication of a steel railing for the handicapped ramp at Haskin's School, repairing a

sander body for Notchview Reservation in Windsor, repairing broken or worn parts for the North Adams Highway Department.

A Cooperative Work Program is offered to junior and senior students that maintain good academic standing, as well as attendance and vocational proficiency. Some of the companies that have employed our co-op students in the past are Adams Plumbing and Heating, Morrison Berkshire, Protech Armored Products, R.I. Baker Company, and Atlantis Equipment

## **Course Syllabus for Grade 10**

Sophomore students in the metal fabrication program will review the importance of shop safety. The first week's theory classes will consist of OSHA training. Each student is required to complete a 10 hour OSHA awareness course. After completion, each student will receive an OSHA Card, which is required by most employers when working in the field.

Instructors will expand teaching on hand tools and power tools, and introduce new equipment, concepts and skills.

Students will follow blueprints to layout and fabricate small projects. Each project will introduce new skills and concepts, building on skills previously learned. Projects include:

1. Large toolbox
2. Tackle box
3. Mail box
4. Planter and tray

5. Spice rack
6. Groove seam
7. Dove tail seam
8. Pittsburgh lock
9. Folder seam
10. Wind chimes
11. Horseshoe cowboy
12. The rose
13. Ferris wheel

Students will refresh their welding skills in both SMAW and GMAW processes. These skills will be expanded upon with further study, adding new positions and techniques.

In theory, math skills are built upon with the focus on manipulation of fractions, linear measurement and basic geometry. Welding theory will focus on identification of symbols and abbreviations used on welding blueprints, as well as an in depth look at the theory behind GMAW, FCAW and SMAW.

Students will continue to work toward completion of the AWS SENSE modules.

During term 2, metal fabrication students will collaborate with the CAD department. Metal fabrication students will receive instruction from CAD students, under the direction of the CAD instructor, in the proper use of AutoCAD software. The latest available version will be used. This knowledge will enable them to create two dimensional drawings that can be loaded into our cnc plasma cutting program and automatically cut from sheetstock.

## **Evaluation**

Each day, students are evaluated on their work as well as their personal effort and attitude. Each category is given a point value. Maximum point values add up to 100 points. Students earn a daily score, which will be averaged at the end of the week. This

Possible points	15	15	5	5	15	10	10	10	10	5	100	
Week Ending	Quality of work	Quantity of work	Proper selection and use of tools	Proper selection and use of materials	Problem solving ability	Safe work habits	Cooperation	Effort	Reliability	Social attitude	Average weekly rating	Hours absent

weekly score counts as 70% of the students' grade average, with the remaining 30% coming from all written theory assignments. The following rubric shows the categories for daily evaluation:




## **Timeline for Course Activities**

### **Sophomore Year**

#### 1st Term

- Identify basic shop safety practices
- 10 Hour OSHA awareness course
- Identify electrodes in SMAW welding
- Set up arc welding equipment
- Weld a lap joint with SMAW in the 1F position
- Weld a tee Joint with SMAW in the 1F position
- Weld a multiple pass butt weld on heavy plate with SMAW in the 1G position
- Cut metal using a band saw
- Operate circular sanders
- Operate pad/ belt sander
- Operate disk sander
- Operate pedestal grinder
- Select dies to be used with an Iron Worker
- Form metals using rollers
- Identify symbols and abbreviations used on welding blueprints
- Identify symbols and abbreviations used on precision sheet metal blueprints
- Read title blocks/ strips
- Operate pittsburgh seamer

- Operate reciprocating shears

2<sup>nd</sup> term

- Set up and safety of plasma cutting equipment
- Operate plasma cutting equipment, cutting ferrous and non-ferrous metals
- Set up of GMAW equipment
- Weld a tee joint with GMAW in the 1G position
- Weld a lap joint with GMAW in the 1G position
- Weld a multiple pass butt weld on heavy plate with SMAW in the 1G position
- Math- linear measurement

3<sup>rd</sup> term

- Identify structural shapes
- Work with tolerances
- Form a stringer bead with SMAW in the 1G position
- Form a stringer bead with GMAW in the 1G position
- Math- basic geometry
- Operate a power press brake

4<sup>th</sup> term

- Weld a tee joint with SMAW in the 2F position
- Weld a lap joint with SMAW in the 2F position
- Weld a tee joint with GMAW in the 2F position
- Weld a lap joint with GMAW in the 2F position
- Introduction to GTAW

## **Objectives**

### **I. Shop Safety**

- Identify and demonstrate workplace safety practices
- Define health and safety practices

### **II. Performing Plasma Cutting Process**

- Identify safety procedures in plasma cutting
- Set up and operation of plasma cutting equipment

### **III. Perform GMAW Process**

- GMAW basic joints in horizontal and vertical positions

### **IV. Perform SMAW Process**

- SMAW basic joints in horizontal and vertical positions

**V. Introduction to GTAW**

- Introduce students to GTAW concepts
- Perform GTAW

**VI. Forming Metals**

- Operate a power press brake making simple bends with basic dies

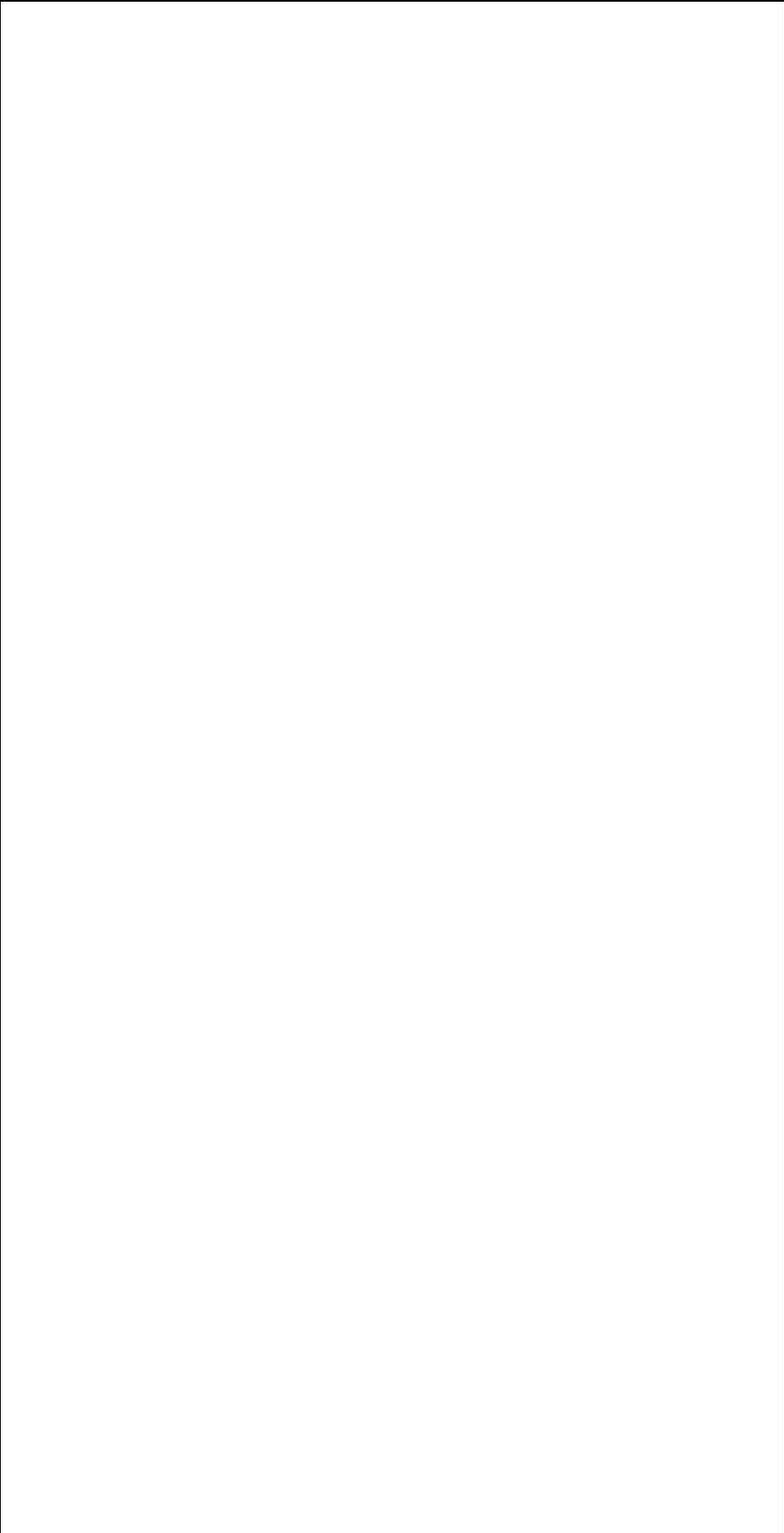
**VII. Theoretical concepts**

- Identify symbols and abbreviations used on welding blueprints
- Identify symbols and abbreviations used on precision sheet metal blueprints
- Read title blocks/ strips
- Math- linear measurement
- Math- basic geometry

**Standards**

<p><b>I. Shop safety</b></p> <ol style="list-style-type: none"> <li>1. Identify and demonstrate workplace safety practices</li> <li>2. Define health and safety practices</li> </ol>
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<p><b>Strand 1: Health and Safety</b></p> <p><b>1.A Define health and safety regulations</b></p> <ol style="list-style-type: none"> <li>1.A.01a Identify and apply health and safety regulations and jobs in the occupational environment</li> <li>1.A.02a Identify and apply environmental protection regulations for specific tasks and jobs</li> <li>1.A.03a Identify and apply Occupational Safety and Health Communication Policy regulations that apply in the occupational environment</li> <li>1.A.04a Explain procedures for reporting hazards to appropriate health and safety agencies</li> <li>1.A.05a List penalties for violations of appropriate health and safety regulations</li> <li>1.A.06a Identify contact information for health and safety agencies</li> </ol> <p><b>1.B Demonstrate health and safety practices</b></p>
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- 1.B.01a Identify, describe effective use of Material Safety Data Sheets (MSDS)
- 1.B.02a Read chemical labels to determine safety considerations
- 1.B.03a Identify, describe shop and job site safety procedures
- 1.B.04a Demonstrate safety gear and personal protective equipment (PPE), including wristbands, safety glasses, earplugs, eye protection apparatus
- 1.B.05a Illustrate appropriate lifting techniques, including proper lifting ergonomics
- 1.B.06a Locate emergency equipment (e.g., fire extinguisher, eyewash station, first aid kit, master power switch) in shop, and classroom
- 1.B.07a Demonstrate the maintenance of every tool in lab, shop, and classroom
- 1.B.08a Describe safety procedures to be followed when working with electricity
- 1.B.09a Illustrate proper practices, including work practices, disposal, and storage of materials
- 1.B.10a Demonstrate proper procedures for cleaning up shop
- 1.B.11c Discuss the relationship between safety and productivity
- 1.B.12 Describe shop ventilation

**1.C Demonstrate responses to health and safety**

- 1.C.01a Illustrate First Aid procedures for injuries and other health issues in occupational area
- 1.C.02a Describe the importance of preparedness and emergency response plans
- 1.C.03a Illustrate procedures for emergency situations, including identification, reporting, and follow-up procedures
- 1.C.04a Identify practices for safe use of tools and equipment
- 1.C.05a Identify and describe safety hazards in the shop

	precautions and resp 1.C.06a Discuss the role company/organization safety 1.C.07a Discuss ways to workplace/school vio
<b>II. Performing Plasma Cutting Process</b>  1. Identify safety procedures in plasma cutting  2. Set up and operation of plasma cutting equipment	<b>2.N Performing the Plasma</b> 2.N.01 Identify safety cutting operations 2.N.02 Set up manual operations on plain c stainless steel 2.N.03 Operate auto equipment
<b>III. Perform GMAW Process</b>  1. GMAW basic joints in horizontal and vertical positions	2.J.01 Identify safety pro 2.J.02 Set up GMAW equ 2.J.03 Identify the variou process 2.J.04 Form a weld bead 2.J.05 Pad weld in all po Process 2.J.06 Fillet weld in all po Process 2.J.07 Groove weld in all Process
<b>IV. Perform SMAW Process</b>  1. SMAW basic joints in horizontal and vertical positions	2.I.01 Identify safety pro 2.I.02 Set up SMAW equ 2.I.03 Identify various typ and functionality 2.I.04 Form a weld bead 2.I.05 Pad weld in all po Process 2.I.06 Fillet weld in all po Process 2.I.07 Groove weld in all Process 2.I.08 Perform 2G & 3G v the SMAW Process
<b>V. Introduction to GTAW</b>  1. Introduce students to GTAW concepts 2. Set up and safe operation of GTAW equipment 3. Form Stringer beads on 1/8" CRS using GTAW in the 1G position with and without filler wire	2.L.01 Identify safety pro 2.L.02 Set up GTAW equ plain carbon, stainles 2.L.03 Form a weld bead steel, and aluminum

<p><b>VI. Forming Metals</b></p> <p>1. Operate a power press brake</p>	<p>2.R.01 Identify the proper techniques for specific power press brake</p> <p>2.R.05 Demonstrate the power press brake</p>
<p><b>VII. Theoretical concepts</b></p> <p>1. Identify symbols and abbreviations used on welding blueprints</p> <p>2. Identify symbols and abbreviations used on precision sheet metal blueprints</p> <p>3. Read title blocks/ strips</p> <p>4. Math- linear measurement</p> <p>5. Math- basic geometry</p>	<p>2.B.02c Use the design process to solve, and evaluate a technical process</p> <p>2.B.03c Read and interpret technical processes</p> <p>3.B.01c Use a ruler, protractor, and compass to draw polygons</p>

### **Instructional Activities:**

Students are allowed to bring in projects from home to work on, provided it relates to metal fabrication. Other projects from people in the community are welcome as well and offer students real world experience in dealing with a customer. Another tool used to reinforce training is the Skills U.S.A. competition, where students compete against one another in welding and fabrication. The top competitors will advance to the state level of competition and compete against other schools.

### **Resources:**

**Text for theory include, but are not limited to:**

Welding; Skills, Processes and Practices for Entry Level Welders  
 Jeffus, Bower

AWS D1.1 Structural Welding Code- Steel

Industrial Welding: Wheels of Learning  
 National center for Construction Education and Research

Welding Technology Fundamentals  
 William A. Bowditch/ Kevin E. Bowditch

Blueprint Reading For Welders, Fifth Edition  
 A.E. Bennett/ Louis J. Siy

**Equipment that students are trained on includes, but is not limited to:**

GMAW Machine

GTAW Machine

Electric arc welder

Oxy-acetylene torches

Power press brake

Power band saw

Pirrana iron worker

Rollers

Pittsburg lock machine

# **Metal Fabrication and Joining Technologies**

CIP # 480508

Charles H. McCann Technical School

70 Hodges Cross Rd.

North Adams, MA 01247

Instructors: Ed Menard, John Kline

Developed: June 21, 2006

**Grade 11**

## **Program Philosophy:**

The educational philosophy of the metal fabrication program is to prepare students to be skilled, productive members of the workforce and the community at large. By providing students with a safe learning environment, we promote individual creativity, respect for diversity and formation of a strong work ethic.

**Goal:** The goal for junior year in the metal fabrication program is to expand on the teachings of sophomore year, adding new concepts and skills. Employability skills will begin to form and be realized as students become eligible for the cooperative work program in the second half of the academic year. Students will use their acquired skills and problem solving ability to work on the more complicated outside projects brought to us by the community, with a focus on quality workmanship and employer expectation.

## **Program Description:**

At McCann, students of metal fabrication are required to create finished products of commercial value from stock metal using a variety of fabrication techniques. Those products may be ductwork, wrought iron fencing and other structural parts, or be as creative and artistic as metal sculpture.

Students learn about metal composition, strength of materials, structural design, blueprint reading and sheet metal pattern drafting. Proper sheet metal fabrication and

installation techniques are taught in order to satisfy the demand for skilled sheet metal mechanics.

The welding instructor for the metal fabrication program is also an AWS certified welding inspector. This enables our students to pursue welding certifications in a variety of processes with various base materials.

McCann is associated with the American Welding Society (AWS) as an Educational Institution Member. We participate in the AWS SENSE Program (Schools Excelling through National Standards Education). The program is set up in modules. Students will work toward completion of modules through their 4 years in metal fabrication. Students who complete all written and practical modules successfully will be recognized by the AWS as certified entry level welders. More advanced students are eligible to achieve advanced welder status.

Students are taught a variety of welding processes, including: oxy-acetylene welding, shielded metal arc welding (SMAW), metal inert gas (MIG), tungsten inert gas (TIG), plastic welding.

During a student's four years of training they will be instructed in the safe and proper use of a variety of metal forming machines, hand tools and power tools. Students are challenged to problem solve, and allowed to make mistakes in a safe, controlled environment.

The McCann Metal Fabrication department takes in projects from the city and the community, allowing students to not only build or repair real world objects but to see and take pride in their contribution for years beyond graduation. Past projects include: fabrication of a wrought iron fence surrounding the North Adams Library,

fabrication of a steel railing for the handicapped ramp at Haskin's School, repairing a sander body for Notchview Reservation in Windsor, repairing broken or worn parts for the North Adams Highway Department.

A Cooperative Work Program is offered to junior and senior students that maintain good academic standing, as well as attendance and vocational proficiency. Some of the companies that have employed our co-op students in the past are Adams Plumbing and Heating, Morrison Berkshire, Protech Armored Products, R.I. Baker Company, and Atlantis Equipment

### **Course Syllabus for Junior Year**

Junior students in the metal fabrication program will review the importance of shop safety. Instructors will expand teaching on power hand tools and larger power equipment. Students will refresh their welding skills in both SMAW and GMAW processes. These skills will be expanded upon with further study, adding new positions and techniques. GTAW will be added to students' skill set to round out their welding abilities.

Students will use their acquired skills and problem solving ability to work on the more complicated outside projects brought to us by the community, with a focus on quality workmanship and employer expectation. Employability skills will begin to form and be realized as students become eligible for the cooperative work program in the second half of the academic year.

In theory, math skills are built upon with the focus on formulas. Students will learn to create an accurate blueprint to scale. Bend allowances will be taught as well as

how to calculate stretch outs.

Students will continue to work toward completion of the AWS SENSE modules.

### **Evaluation**

Possible points	15	15	5	5	15	10	10	10	10	5	100	
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Each day, students are evaluated on their work as well as their personal effort and attitude. Each category is given a point value. Maximum point values add up to 100 points. Students earn a daily score, which will be averaged at the end of the week. This weekly score counts as 70% of the students' grade average, with the remaining 30% coming from all written theory assignments. The following rubric shows the categories for daily evaluation:

Week Ending	Quality of work	Quantity of work	Proper selection and use of tools	Proper selection and use of materials	Problem solving ability	Safe work habits	Cooperation	Effort	Reliability	Social attitude	Average weekly rating	Hours absent
↓												

## Timeline for Course Activities

### Junior Year

#### 1<sup>st</sup> term

- Practice joint preparation and joint finish
- Weld stringer beads with SMAW in the 2F position
- Weld a tee joint with SMAW in the 2F position
- Weld a lap joint with SMAW in the 2F position
- Weld a tee joint with GMAW in the 2F position
- Weld a lap joint with GMAW in the 2F position

#### 2<sup>nd</sup> term

- Review of GTAW
- Set up and safe operation of GTAW equipment
- Form Stringer beads on 1/8" CRS using GTAW in the 1G position with and without filler wire
- Weld together a cube using GTAW
- Weld stringer beads with SMAW in the 3F position
- Weld a tee joint with GMAW in the 3F position
- Weld a lap joint with GMAW in the 3F position
- Create a material list

3<sup>rd</sup> term

- Form Stringer beads on 1/8” stainless steel using GTAW in the 1G position with and without filler wire
- Introduction to carbon arc cutting
- Set up and operation of carbon arc cutting equipment
- Create an accurate blueprint to scale

4<sup>th</sup> term

- Weld together pipe in the 1G position
- Destructive testing of welds
- Form Stringer beads on aluminum using GTAW in the 1G with filler wire
- Performance qualification tests for SENSE certification.

## **Objectives**

### **I. Shop Safety**

- Identify and demonstrate workplace safety practices
- Define health and safety practices

### **II. Perform Carbon Arc Cutting Process**

- Set up and operation of carbon arc cutting equipment

### **III. Perform GMAW Process**

- GMAW basic joints, using short arc transfer, in horizontal , vertical and overhead positions
- GMAW basic joints, using spray arc transfer, in horizontal , vertical and overhead positions

### **IV. Perform SMAW Process**

- SMAW basic joints in horizontal, vertical and overhead positions
- Practice joint preparation and joint finish
- Weld together pipe in the 1G and 2G positions
- Destructive testing of welds

### **V. Perform GTAW Process**

- Introduce students to GTAW concepts
- Perform GTAW

- Form Stringer beads on 1/8" CRS using GTAW in the 1G position with and without filler wire
- Weld together a cube using GTAW
- Form Stringer beads on 1/8" stainless steel using GTAW in the 1G position with and without filler wire
- Form Stringer beads on aluminum using GTAW in the 1G with filler wire

**VI. Forming Metals**

- Operate a power press brake making complicated bends
- Identify the proper dies and techniques for specific projects and situations

**VII. Theoretical concepts**

- Create a material list
- Math- introduction to formulas
- Create an accurate blueprint to scale
- Bend allowances
- Calculating stretchouts

<p><b>I. Shop safety</b></p> <ol style="list-style-type: none"> <li>1. Identify and demonstrate workplace safety practices</li> <li>2. Define health and safety practices</li> </ol>	<p><b>Strand 1: Health and Safety</b></p> <p><b>1.A Define health and safety re</b></p> <ol style="list-style-type: none"> <li>1.A.01a Identify and appl and safety regulation and jobs in the occup</li> <li>1.A.02a Identify and appl environmental protec specific tasks and job</li> <li>1.A.03a Identify and appl Communication Polic regulations that apply in the occupational a</li> <li>1.A.04a Explain procedu reporting hazards to a</li> <li>1.A.05a List penalties for appropriate health an</li> <li>1.A.06a Identify contact i health and safety age</li> </ol> <p><b>1.B Demonstrate health and sa</b></p> <ol style="list-style-type: none"> <li>1.B.01a Identify, describe effective use of Mate (MSDS)</li> <li>1.B.02a Read chemical, labels to determine a considerations</li> <li>1.B.03a Identify, describe</li> </ol>
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<p><b>II. Perform Carbon Arc Air Gouging Process</b></p> <ol style="list-style-type: none"> <li>1. Set up and operation of carbon arc cutting equipment</li> </ol>	<p><b>2.O Performing the Carbon</b></p> <ol style="list-style-type: none"> <li>2.O.01 Identify safe air gouging</li> <li>2.O.02 Set up for m gouging operations</li> </ol>
<p><b>III. Perform GMAW Process</b></p> <ol style="list-style-type: none"> <li>1. GMAW basic joints, using short arc transfer, in horizontal , vertical and overhead positions</li> <li>2. GMAW basic joints, using spray arc transfer, in horizontal , vertical and overhead positions</li> </ol>	<ol style="list-style-type: none"> <li>2.J.01 Identify safety pro</li> <li>2.J.02 Set up GMAW equ</li> <li>2.J.03 Identify the variou process</li> <li>2.J.04 Form a weld bead</li> <li>2.J.05 Pad weld in all po Process</li> <li>2.J.06 Fillet weld in all po Process</li> <li>2.J.07 Groove weld in all Process</li> </ol>
<p><b>IV. Perform SMAW Process</b></p> <ol style="list-style-type: none"> <li>1. SMAW basic joints in horizontal, vertical and overhead positions</li> <li>2. Practice joint preparation and joint finish</li> <li>3. Weld together pipe in the 1G and 2G positions</li> <li>4. Destructive testing of welds</li> </ol>	<ol style="list-style-type: none"> <li>2.I.01 Identify safety pro</li> <li>2.I.02 Set up SMAW equ</li> <li>2.I.03 Identify various typ and functionality</li> <li>2.I.04 Form a weld bead</li> <li>2.I.05 Pad weld in all pos Process</li> <li>2.I.06 Fillet weld in all po Process</li> <li>2.I.07 Groove weld in all Process</li> <li>2.I.08 Perform 2G &amp; 3G v the SMAW Process</li> </ol>
<p><b>V. Perform GTAW Process</b></p> <ol style="list-style-type: none"> <li>1. Introduce students to GTAW concepts</li> <li>2. Perform GTAW</li> <li>3. Form Stringer beads on 1/8" CRS using GTAW in the 1G position with and without filler wire</li> <li>4. Weld together a cube using GTAW</li> <li>5. Form Stringer beads on 1/8" stainless steel using GTAW in the 1G position with and without filler wire</li> <li>6. Form Stringer beads on aluminum using GTAW in the 1G with filler wire</li> </ol>	<ol style="list-style-type: none"> <li>2.L.01 Identify safety pro</li> <li>2.L.02 Set up GTAW equ plain carbon, stainles</li> <li>2.L.03 Form a weld bead steel, and aluminum</li> <li>2.L.04 Perform a fillet we ferrous metals using</li> <li>2.L.05 Perform a groove ferrous metals using</li> </ol>

<p><b>VI. Forming Metals</b></p> <ol style="list-style-type: none"> <li>1. Operate a power press brake making complicated bends</li> <li>2. Identify the proper dies and techniques for specific projects and situations</li> </ol>	<p>2.R.01 Identify the proper techniques for specific projects</p> <p>2.R.05 Demonstrate the proper use of a power press brake</p>
<p><b>V. Theoretical concepts</b></p> <ol style="list-style-type: none"> <li>1. Create a material list</li> <li>2. Math- introduction to formulas</li> <li>3. Create an accurate blueprint to scale</li> <li>4. Bend allowances</li> <li>5. Calculating stretchouts</li> </ol>	<p>2.B.02c Use the design process to solve, and evaluate a problem</p> <p>2.B.03c Read and interpret technical processes</p> <p>3.B.01c Use a ruler, protractor, and polygons</p> <p>2.Q.01 Develop cut size</p> <p>2.Q.02 Perform basic layout</p> <p>2.Q.03 Make patterns by hand</p> <p>2.Q.04 Make patterns by computer development</p> <p>2.Q.05 Make patterns by hand</p> <p>2.Q.06 Make patterns by computer</p> <p>2.Q.07 Layout of hole locations</p> <p>drilling</p> <p>2.Q.08 Layout bend lines</p> <p>2.Q.09 Layout notching</p> <p>2.Q.10 Layout hem lines</p> <p>2.Q.11 Layout bolt hole patterns</p>

**Junior Projects**

Outside projects from the community

**Instructional Activities:**

Students are allowed to bring in projects from home to work on, provided it relates to metal fabrication. Other projects from people in the community are welcome as well and offer students real world experience in dealing with a customer. Another tool used to reinforce training is the Skills U.S.A. competition, where students compete against one another in welding and fabrication. The top competitors will advance to the state level of competition and compete against other schools.

## **Resources:**

**Text for theory include, but are not limited to:**

Welding; Skills, Processes and Practices for Entry Level Welders

Jeffus, Bower

AWS D1.1 Structural Welding Code- Steel

Industrial Welding: Wheels of Learning

National center for Construction Education and Research

Welding Technology Fundamentals

William A. Bowditch/ Kevin E. Bowditch

Blueprint Reading For Welders, Fifth Edition

A.E. Bennett/ Louis J. Siy

**Equipment that students are trained on includes, but is not limited to:**

MIG welder

TIG welder

Electric arc welder

Oxy-acetylene torches

Power press brake

Power band saw

Pirrana iron worker

Rollers

Pittsburg lock machine

# **Metal Fabrication and Joining Technologies**

CIP # 480508

Charles H. McCann Technical School

70 Hodges Cross Rd.

North Adams, MA 01247

Instructors: Ed Menard, John Kline

Developed: June 21, 2006

**Grade 12**

## **Program Philosophy:**

The educational philosophy of the metal fabrication program is to prepare students to be skilled, productive members of the workforce and the community at large. By providing students with a safe learning environment, we promote individual creativity, respect for diversity and formation of a strong work ethic.

**Goal:** The goal for the senior year in the metal fabrication program is for students to draw from skills and concepts previously learned, and demonstrate their knowledge of welding and fabrication through peer teaching of the freshman class.

Seniors will utilize skills previously learned to develop an idea for a senior project, and take that idea through all stages of the project; developing an accurate blueprint, creating a proper material list, ordering material, fabricating and finishing the project. Students will use their problem solving ability to overcome any unforeseen obstacles while producing a quality product.

Seniors will be eligible for the opportunity to experience the cooperative work program. Students will focus on employability skills, such as quality workmanship, personal responsibility, punctuality and dependability.

## **Program Description:**

At McCann, students of metal fabrication are required to create finished products of commercial value from stock metal using a variety of fabrication techniques. Those

products may be ductwork, wrought iron fencing and other structural parts, or be as creative and artistic as metal sculpture.

Students learn about metal composition, strength of materials, structural design, blueprint reading and sheet metal pattern drafting. Proper sheet metal fabrication and installation techniques are taught in order to satisfy the demand for skilled sheet metal mechanics.

The welding instructor for the metal fabrication program is also an AWS certified welding inspector. This enables our students to pursue welding certifications in a variety of processes with various base materials.

McCann is associated with the American Welding Society (AWS) as an Educational Institution Member. We participate in the AWS SENSE Program (Schools Excelling through National Standards Education). The program is set up in modules. Students will work toward completion of modules through their 4 years in metal fabrication. Students who complete all written and practical modules successfully will be recognized by the AWS as certified entry level welders. More advanced students are eligible to achieve advanced welder status.

Students are taught a variety of welding processes, including: oxy-acetylene welding, shielded metal arc welding (SMAW), metal inert gas (MIG), tungsten inert gas (TIG), plastic welding.

During a student's four years of training they will be instructed in the safe and proper use of a variety of metal forming machines, hand tools and power tools. Students are challenged to problem solve, and allowed to make mistakes in a safe, controlled environment.

The McCann Metal Fabrication department takes in projects from the city and the community, allowing students to not only build or repair real world objects but to see and take pride in their contribution for years beyond graduation. Past projects include: fabrication of a wrought iron fence surrounding the North Adams Library, fabrication of a steel railing for the handicapped ramp at Haskin's School, repairing a sander body for Notchview Reservation in Windsor, repairing broken or worn parts for the North Adams Highway Department.

A Cooperative Work Program is offered to junior and senior students that maintain good academic standing, as well as attendance and vocational proficiency. Some of the companies that have employed our co-op students in the past are Adams Plumbing and Heating, Morrison Berkshire, Protech Armored Products, R.I. Baker Company, and Atlantis Equipment

## **Course Syllabus for Grade 12**

Seniors in the metal fabrication program will demonstrate the knowledge they've gained previously in the program by assisting the instructors with the freshman exploratory program through peer teaching.

Students will use their acquired skills and problem solving ability to work on the more complicated outside projects brought to us by the community, with a focus on quality workmanship and employer expectation. Seniors will be eligible for the opportunity to experience the cooperative work program in the first term. Instruction will focus on employability skills, such as quality workmanship, personal responsibility, punctuality and dependability.

New instruction will include pipe welding in different positions with shielded metal arc welding and more in-depth lessons in gas tungsten arc welding of nonferrous metals.

Senior students will demonstrate their knowledge of metal fabrication by creating

Possible points	15	15	5	5	15	10	10	10	10	5	100	
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a senior project of their own design. They will form an idea, and take that idea through all stages of the project; developing an accurate blueprint, creating a proper material list, ordering material, fabricating and finishing. Students will use their problem solving ability to overcome any unforeseen obstacles while producing a quality product. When finished, students will present their project to classmates and instructors to be graded.

Students will continue to work toward completion of the AWS SENSE modules and complete as many performance qualification tests as possible.

**Evaluation**

Each day, students are evaluated on their work as well as their personal effort and attitude. Each category is given a point value. Maximum point values add up to 100 points. Students earn a daily score, which will be averaged at the end of the week. This weekly score counts as 70% of the students’ grade average, with the remaining 30% coming from all written theory assignments. The following rubric shows the categories for daily evaluation:

Week Ending	Quality of work	Quantity of work	Proper selection and use of tools	Proper selection and use of materials	Problem solving ability	Safe work habits	Cooperation	Effort	Reliability	Social attitude	Average weekly rating	Hours absent
↓												

## **Timeline for Course Activities**

### **Senior Year**

#### 1<sup>st</sup> term

Peer Teaching of Freshman Exploratory- demonstrate the following:

- Identify basic safety practices
- Identify hand tools and stationary equipment
- Introduction to SMAW process
- Introduction to linear measurement

#### 2<sup>nd</sup> term

- Weld together pipe in the 1G position
- Destructive testing of welds
- Form Stringer beads on aluminum using GTAW in the 1G with filler wire
- Weld together pipe in the 2G position using the SMAW process
- Weld together pipe in the 5G position using the SMAW process
- Create an accurate blueprint to scale

3<sup>rd</sup> term

Senior project

- Develop blueprint
- Develop bill of materials
- Order materials from supplier
- Develop a plan of procedure
- Performance Qualification Testing

4<sup>th</sup> term

Senior project

- Fabricate project
- Problem solving
- Present project
- Performance Qualification Testing

## **Objectives**

### **I. Peer Teaching**

- Identify and demonstrate workplace safety practices
- Demonstrate health and safety practices
- Identify hand tools and stationary equipment
- Introduction to SMAW process
- Introduction to GMAW process
- Introduction to linear measurement

### **II. Perform SMAW Process**

- Weld together pipe in the 1G position
- Destructive testing of welds
- Form Stringer beads on aluminum using GTAW in the 1G and 1F positions with filler wire
- Weld together pipe in the 2G position using the SMAW process
- Weld together pipe in the 5G position using the SMAW process

### **III. Perform GTAW Process**

- Form Stringer beads on aluminum using GTAW in the 1G with filler wire in different positions

### **IV. Senior Project**

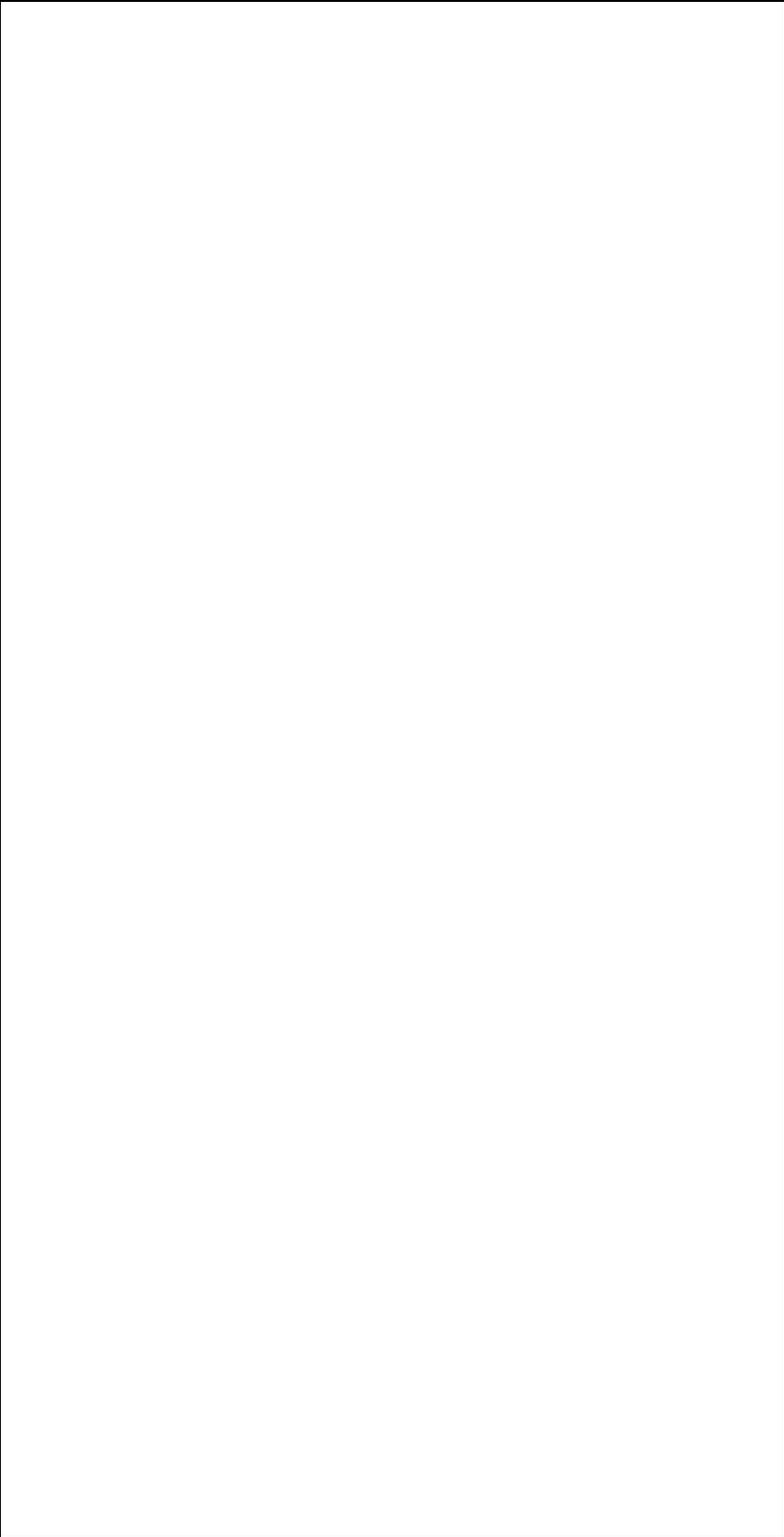
- Develop blueprint
- Develop bill of materials

- Order materials from supplier
- Develop a plan of procedure
- Fabricate project
- Problem solving
- Present project

**V. Performance Qualification Testing**

- GMAW-S
- GMAW
- FCAW-G/GM (gas shielded)
- FCAW-S (self shielded)
- GTAW (Carbon Steel)
- GTAW (Austenitic Stainless Steel)
- GTAW (Aluminum)
- SMAW (Carbon Steel)
  - 2G
  - 3G

<p><b>I. Peer Teaching</b></p> <ol style="list-style-type: none"> <li>1. Identify and demonstrate workplace safety practices</li> <li>2. Define health and safety practices</li> </ol>	<p><b>Strand 1: Health and Safety</b></p> <p><b>1.A Define health and safety re</b></p> <ul style="list-style-type: none"> <li>1.A.01a Identify and apply and safety regulation and jobs in the occup</li> <li>1.A.02a Identify and apply environmental protec specific tasks and job</li> <li>1.A.03a Identify and apply Communication Polic regulations that apply in the occupational a</li> <li>1.A.04a Explain procedu reporting hazards to a</li> <li>1.A.05a List penalties for appropriate health an</li> <li>1.A.06a Identify contact i health and safety age</li> </ul> <p><b>1.B Demonstrate health and sa</b></p> <ul style="list-style-type: none"> <li>1.B.01a Identify, describe effective use of Mate (MSDS)</li> <li>1.B.02a Read chemical, labels to determine a considerations</li> </ul>
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- 1.B.03a Identify, describe shop and job site safety procedures
- 1.B.04a Demonstrate safety gear and personal protective equipment (PPE), including wristbands, safety glasses, earplugs, eye protection apparatus
- 1.B.05a Illustrate appropriate lifting techniques, including proper lifting ergonomics
- 1.B.06a Locate emergency exits, fire extinguishers, (and appropriate) eyewash stations, fire extinguishers, fire extinguisher, fire extinguisher, master power switch
- 1.B.07a Demonstrate the maintenance of every lab, shop, and classroom
- 1.B.08a Describe safety rules to be followed when working with electricity
- 1.B.09a Illustrate proper handling practices, including waste disposal, disposal, and disposal
- 1.B.10a Demonstrate proper safety procedures
- 1.B.11c Discuss the relationship between safety and productivity
- 1.B.12 Describe shop ventilation

**1.C Demonstrate responses to health and safety**

- 1.C.01a Illustrate First Aid for injuries and other health issues in occupational area
- 1.C.02a Describe the importance of preparedness and emergency response
- 1.C.03a Illustrate procedures for emergency situations, including identification, reporting, and follow-up plans, and follow-up plans
- 1.C.04a Identify practices for safe handling of hazardous materials
- 1.C.05a Identify and describe safety precautions and response procedures
- 1.C.06a Discuss the role of safety in a company/organization
- 1.C.07a Discuss ways to prevent workplace/school violence

	<p><b>2.F Use of measurement devices</b></p> <p>2.F.01c Define attributes of measurement used in</p> <p>2.F.02c Apply a variety of formulas for determining</p> <p>2.F.03c Identify appropriate for the task at hand</p> <p>2.F.04c Calibrate and use gauges accurately</p> <p>2.F.05c Use measurement problems</p> <p>2.F.06 Identify and explain such as squares, dividers, trammel points.</p> <p>2.F.07 Determine decimal sheet metal gauge</p> <p>2.F.08 Read and interpret instruments (i.e. micrometers, height gauges)</p> <p>2.F.09 Determine measurement equivalent chart</p> <p>2.F.10 Determine measurement square (centering head)</p> <p>2.F.11 Determine measurement</p> <p>2.F.12 Determine measurement</p> <p><b>2.G Explain the fundamentals of joining processes</b></p> <p>2.G.01 Identify hand tools and their uses</p> <p>2.G.02 Identify metals and molecular characteristics</p> <p>2.G.03 Identify basic terms and joining processes</p> <p>2.G.04 Explain the effect of making a weld</p> <p>2.G.05 Explain molecular within the heat affected zone</p> <p>2.G.06 Identify common</p> <p>2.G.07 Identify sizes and spool and filler wires</p> <p>2.G.08 Determine the application for a specific process and</p> <p>2.G.09 Explain the method when welding at the corner to avoid defects.</p>
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<p><b>II. Perform SMAW Process</b></p>	<p><b>2.O Performing the Carbon</b></p> <p>2.O.01 Identify safe</p>
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<ul style="list-style-type: none"> <li>▪ Weld together pipe in the 1G position</li> <li>▪ Destructive testing of welds</li> <li>▪ Form Stringer beads on aluminum using GTAW in the 1G with filler wire</li> <li>▪ Weld together pipe in the 2G position using the SMAW process</li> <li>▪ Weld together pipe in the 5G position using the SMAW process</li> </ul>	<p>air gouging 2.O.02 Set up for m gouging operations</p>
<p><b>III. Perform GTAW Process</b></p> <ul style="list-style-type: none"> <li>▪ Form Stringer beads on aluminum using GTAW in the 1G with filler wire in different positions</li> </ul>	<p>2.J.01 Identify safety pro 2.J.02 Set up GMAW equ 2.J.03 Identify the variou process 2.J.04 Form a weld bead 2.J.05 Pad weld in all po Process 2.J.06 Fillet weld in all po Process 2.J.07 Groove weld in all Process</p>
<p><b>IV. Senior Project</b></p> <ul style="list-style-type: none"> <li>▪ Develop blueprint</li> <li>▪ Develop bill of materials</li> <li>▪ Order materials from supplier</li> <li>▪ Develop a plan of procedure</li> <li>▪ Fabricate project</li> <li>▪ Problem solving</li> <li>▪ Present project</li> </ul>	<p><b>2.B Demonstrate and apply the</b></p> <p>2.B.01c List the attributes technical fields (biote environmental, power etc) 2.B.02c Use the design p solve, and evaluate a 2.B.03c Read and interpr technical processes 2.C.01c Identify the comp system(equipment) 2.C.02c Identify the prob problem 2.C.03c Develop solution problem solving proc 2.C.04c Use appropriate for diagnosing a prob 2.C.05c Implement the c the problem 2.E.01c Identify custome 2.E.02c Identify resource personnel, equipmen 2.E.03c Identify and crea operational procedure</p>

	2.E.04c Monitor process 2.E.05c Explain inventory implications to product 2.E.06c Test product to v specifications, regula 2.E.07c Demonstrate pro ensure compliance 2.E.08c Insure timely del
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### **Instructional Activities:**

Students are allowed to bring in projects from home to work on, provided it relates to metal fabrication. Other projects from people in the community are welcome as well and offer students real world experience in dealing with a customer. Another tool used to reinforce training is the Skills U.S.A. competition, where students compete against one another within the shop. Top finishers at each grade level will advance to the state competition, where they will represent McCann and compete against other schools.

### **Resources:**

#### **Text for theory include, but are not limited to:**

Welding; Skills, Processes and Practices for Entry Level Welders  
Jeffus, Bower  
AWS D1.1 Structural Welding Code- Steel

Industrial Welding: Wheels of Learning  
National center for Construction Education and Research  
Welding Technology Fundamentals  
William A. Bowditch/ Kevin E. Bowditch  
Blueprint Reading For Welders, Fifth Edition  
A.E. Bennett/ Louis J. Siy

#### **Equipment that students are trained on includes, but is not limited to:**

MIG welder  
TIG welder  
Electric arc welder  
Oxy-acetylene torches  
Power press brake  
Power band saw

Pirrana iron worker  
Rollers  
Pittsburg lock machine