

## 4-H Machine Series

# Discovering Oxyacetylene Welding & Cutting



## Welcome 4-H Leaders!

Welcome to the 4-H Discovering Oxyacetylene Welding & Cutting Leader's Guide.

This guide provides you with project meeting plans (**Skill Builders**) that include a skills list, background information, activity suggestions and ways to know if your members have learned the skills. In short, all the information and tools necessary to make this project rewarding for you and your members.

In this project, members will examine, through a hands on approach, how to set up and safely use oxyacetylene welding and cutting torches. The project meetings are designed to engage the members in the discovery process. It is important to stress to members that we can learn just as much from our mistakes as from our successes in the design process.

This guide is written with the expectation that the project leaders will have a working knowledge of oxyacetylene torches. **Do not attempt to teach this project if you do not have experience welding.** This project manual serves as a guide to assist an experienced welder to transfer his/her skills to young people. For any activities that require a demonstration or hands on work by members, we recommend that leaders do them ahead of time. This ensures leaders will have a greater understanding of each activity and therefore will be able to more effectively teach members. This also allows for any adjustments should an activity not work well or if any equipment or supplies are unavailable.

**The 3D's of Learning** - Each builder has three sections called "Dream it!", "Do it!" and "Dig it!".

**Dream it! Plan for Success** - this gives members a chance to help plan their activities. A skills checklist, background information, important words, and activating questions are included in the Member Manual so they will be able to think about the topic and activity and decide how they will approach it. The Leader Guide contains in depth background information on the topics, material lists, suggestions and time requirements for activities. Activating, acquiring, and applying questions are included to engage members' thinking through each step of the learning process.



**Do it! Hands on learning** - this is where members are engaged in the activity planned / discussed in the *Dream it!* Section. Here members are doing the activities and leaders are observing, recording, and providing feedback on how well they are doing. Allow as much individual practice as required; you are assessing the progress and understanding of individual members.

**Dig it! What did you learn?** - this simply means that members and leaders need to 'dig into their learning'. For the learning cycle to be completed, both need to reflect on how things went and how well they did. For members, this involves self-assessment, giving feedback, creating meaning from their experiences, and thinking about what they would do differently next time. Once this is done they will be in a good position to apply what they have learned to the next experience.

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- Revised 2019 -



The sequence of project meetings and skill building outcomes for members in this project are on the chart on the following page.

# What Skills Will You Learn?

Each section or Skill Builder (or Builder) in this project has activities that will help your project group learn to do by doing while learning new skills and having fun!



To complete this project, you must:

- Complete the activities in each Builder **OR** a similar activity that focuses on the same skills, as you and your leader may plan other activities.
- Plan and complete the Showcase Challenge.
- Complete the Portfolio Page.
- Participate in your club's Achievement (See the inside back cover for more information about 4-H Achievements).

	Members will be able to...	Activities	Page
Skill Builder 1	Basic Equipment and Safety: <ul style="list-style-type: none"> <li>• Identify basic equipment</li> <li>• Understand functions of basic equipment</li> <li>• Understand the safety rules for working in the shop</li> <li>• Understand what safety equipment is required</li> <li>• Identify WHMIS symbols and know what they mean</li> </ul>	<ul style="list-style-type: none"> <li>• Equipment Basics</li> <li>• WHMIS</li> </ul>	11 12
Skill Builder 2	Set Up, Lighting, and Shutting Down: <ul style="list-style-type: none"> <li>• Set up an oxyacetylene unit properly and safely</li> <li>• Test an oxyacetylene unit for leaks</li> <li>• Set up a welding torch for use</li> <li>• Adjust the flame of a welding torch</li> <li>• Shut down an oxyacetylene unit properly and safely</li> </ul>	<ul style="list-style-type: none"> <li>• Oxyacetylene Unit Assembly</li> <li>• Lighting &amp; Shutting Down the Flame</li> <li>• Adjusting the Flame</li> </ul>	21 22 22
Skill Builder 3	Basic Weld Positions: <ul style="list-style-type: none"> <li>• Perform forehand and backhand horizontal welds</li> <li>• Understand the difference between horizontal and vertical welds</li> </ul>	<ul style="list-style-type: none"> <li>• Welding Word Search</li> <li>• Getting the Feel for the Torch</li> <li>• Weld Positions</li> </ul>	27 27 28
Skill Builder 4	Basic Welding Joints: <ul style="list-style-type: none"> <li>• Identify and be able to weld the five basic joints - Lap, Tee, Butt, Edge, and Corner</li> <li>• Identify basic factors for creating a quality weld</li> <li>• Clean tips</li> <li>• Understand basic trouble shooting</li> </ul>	<ul style="list-style-type: none"> <li>• Corner and Edge Joints</li> <li>• Butt, Lap, and Tee Joints</li> <li>• Creating a Quality Weld</li> <li>• Cleaning Tips</li> </ul>	34 35 35 36
Skill Builder 5	Using the Cutting Torch: <ul style="list-style-type: none"> <li>• Set up a cutting torch</li> <li>• Make straight and shaped cuts</li> </ul>	<ul style="list-style-type: none"> <li>• Setting up and using the Cutting Torch</li> </ul>	43
Skill Builder 6	Select a Project: <ul style="list-style-type: none"> <li>• Plan and complete a project</li> </ul>	<ul style="list-style-type: none"> <li>• Basic Toolbox Or Select a Project</li> </ul>	48 49
When you successfully complete your builders, you will showcase what you have learned.			
Showcase & Portfolio	<ul style="list-style-type: none"> <li>• Explain success in using the skills listed above</li> </ul>	<ul style="list-style-type: none"> <li>• Showcase Challenge</li> <li>• My Portfolio Page</li> </ul>	52 53

## Showcase Challenge and My Portfolio Page

At the end of the members' section are the "Showcase Challenge" and "My Portfolio Page". The Showcase Challenge page gets members to think about their accomplishments and explain or demonstrate how they were successful. There are a number of suggestions along with planning information to help them decide how they will best "showcase" their learning to friends, family, community members and/or fellow 4-H members.



Record keeping is an important part of every 4-H project. "My Portfolio Page" is a graphic organizer used to keep track of members' 4-H experiences. As each member learns skills, the evidence of learning (through participation and completion of the various activities) is recorded on the page. When the Portfolio Page has been completed and confirmed by the leader, then it becomes a record of the member's completion of the project and participation in other 4-H activities beyond the project.

**4-H leader assessment** of members will happen throughout the project as you assess the progress and understanding of individual members. You need to observe the members doing the skill and record what you see and hear. Your feedback should be positive and descriptive (not just "well done"). Share that feedback with members frequently so they can put your suggestions into action. How you choose to observe and record is up to you. Some methods are to create checklists, videos and notes while encouraging discussions, peer observations and questions. Recognize that members may improve over the course of a builder and that records should be updated to reflect when they demonstrated their best learning. You are discussing how well members are meeting the skills checklists that are at the beginning of each of the project books, in each Builder and on the Portfolio Page.

Projects promote technical, communication, meeting management, and leadership skills, as well as community involvement and real-world experiences. In addition to the specific skills members are to learn in each builder, the following general learning goals for members are important: Following instructions - Working with others - Using supplies safely - Using the key words - Improving with practice - Respecting timelines.

### **4-H Project Series Skill Development Levels**

Each project topic series contains three levels of skill development: explore, discover, and master.

**Explore** - each project series has one project outlining the fundamentals. All members will be expected to complete the Explore level project before moving into the Discover level of projects. It introduces the basic skills and terms needed by members for subsequent projects in that series.

**Discover** - each project series has several project options and members are encouraged to take as many as they would like. At this level, members practice topic specific techniques and gain theme related skills through specialized builders.

**Master** - multiple project options encourage members to specialize in a topic. They may branch out and take advantage of community options such as cooking for a canteen or participating in a food drive. The leader's role is to look for opportunities for their members to have more authentic experiences by: working with other mentors, partnering with outside agencies, participating in exchanges, entering competitions, etc. Projects at this level may include the "Partner-a-Project" whereby pre-approved courses will allow members to advance their skills, while applying their learning to the 4-H program.

## 4-H LEADER TIPS FOR SUCCESS!

### DISCOVER

- ◆ To complete, members **must** complete all the activities referred to on the “Project Completion Requirements” page **OR** alternate idea for an activity that would teach the same skill or an age appropriate variation. If activity substitutions are used, be sure to have the member make note in their manuals.
- ◆ Dependent on time available at each meeting, group size and abilities of group members, you may wish to break the Builders into more than one project meeting.
- ◆ The internet has lots of interesting websites and educational activities. You may choose to use a search engine to explore the options available. We do not endorse any website or the safety or functionality of any products they may sell. Information/products will be used at your own discretion.
- ◆ Safety is a number one priority. Care has been taken to create safe, age appropriate activities throughout this manual. As leaders, it is important for you to emphasize safety rules and manage or adapt activities in a manner that will safely match your members abilities. Ensure members have a good understanding of safe working and handling practices when using tools, that they use the appropriate safety equipment when necessary, and that appropriate supervision is provided. A quality experience needs to be a safe experience.
- ◆ The multiple intelligences theory teaches us that people learn in at least 8 different ways. All individuals will be stronger in some ways of “intelligences” and weaker in others. It follows that the more ways we teach, the more members we will reach. Throughout this project, you will find a mix of writing, reading, hands-on work, artwork, self-evaluation, group discussion and performance. Teaching projects using a broad blend will help increase the learning potential of all members.
- ◆ Projects are designed to teach many skills. However, the 4-H member is always more important than the subject matter. Stress cooperation in the activities where possible to develop teamwork and cooperation skills – valuable skills that will assist them in a number of settings. Ensure the work is completed in a manner that members feel good about themselves and their efforts. This can be done by assigning appropriate tasks or roles based on member’s individual abilities. Modelling and expecting supportive behaviour - that is, no “put-downs” – amongst members, or by other adults, also contributes to a positive experience.
- ◆ There will be opportunity for experimentation and applying skills that members have learnt throughout this project. Experimenting can be frustrating, but learning through trial and error is an important life skill. Explain to members that it is alright to either go onto the next builder or do the builder again if they need the practice. Help the members work through their challenges until they are satisfied with the quality of their work. Creating inventive 4-H members will be very rewarding.
- ◆ Celebrating success is an important but sometimes overlooked part of our lives. We encourage you to use the final section to empower the members by celebrating all they have learned in a fun manner. Anything that you do to add to the spirit of fun and the sense of accomplishment of each member will likely be remembered as the high-light of their 4-H year.



CANADA  
4-H Manitoba

**Have fun and thanks for your belief in young people!**



CANADA  
4-H Manitoba

# Skill Builder 1: Basic Equipment & Safety



## Skills Checklist

- Identify basic equipment
- Understand functions of basic equipment
- Understand the safety rules for working in the shop
- Understand what safety equipment is required
- Identify WHMIS symbols and know what they mean

## Dream it!

### Background for Leaders

Almost every farming business has an “Oxyacetylene Setup” and “Arc Welder” as part of the standard repair and fabrication equipment. The greatest use for the oxyacetylene equipment is as a heating and metal cutting device. With instruction and practice it can also be used to weld and braze steel and cast iron, which can sometimes be too difficult with the arc welding process. The equipment can be kept in the shop, or if properly secured, can be taken out to the field. It does not require any electrical power, and can be used on a variety of thickness of materials.

As a welding torch, the basic operation of an oxyacetylene unit is blending two gases, oxygen and acetylene, together in the right proportion to create a proper size flame. The flame is used to melt two pieces of metal to the point that they reach a liquid type state and flow together. This is called fusion and in most cases a filler metal rod is also heated and added to the liquid puddle. If done properly, the cooled weld can be very strong and have the same characteristics as the original part. As a cutting torch, the operation also introduces a stream of pure “higher pressured” oxygen to the heated metal. This stream cuts (burns) a path through the metal and allows us to separate sections of base material. As a heating tool, the torch can be helpful for bending metal, getting bent parts back to where they belong, or for freeing rusted bolts.

With proper instruction, a caring attitude, and practice the set up and use of oxyacetylene welding, heating, or cutting equipment can be a safe and versatile tool for farm repair and fabrication. If abused and used foolishly it can be a real danger. Be smart and be safe!

### Age Considerations

- Ages 15 and up

### Thinking Ahead

- What will you discuss with members? Gather observations and think of examples that will help support your discussion.

### Preparing for Success

- Linking back to the Skills Checklist, help members identify how they will know they have been successful in learning from this builder. Discuss what success in these activities might look like, sound like, or feel like.



## Important Words

Help members define the following words and listen for them using these words in their discussions. To increase the members' understanding try providing a synonym members know or provide examples. The more personalized the examples the better.

### DISCOVER

Oxygen	A nonmetallic element constituting 21 percent of the atmosphere by volume that occurs as a diatomic gas, O <sub>2</sub> . Required for most combustion.
Acetylene	A colorless gas, C <sub>2</sub> H <sub>2</sub> , having an etherlike odour, produced usually by the action of water on calcium carbide
Cylinder	A tank used to safely store gas
Torch	A portable apparatus that produces a hot flame by the combustion of gases
Goggles	Large spectacles equipped with special lenses to protect the eyes
WHMIS	Workplace Hazardous Materials Information System that labels substances through a series of symbols

## Activating Strategies

Activate member's prior knowledge about welding by asking and discussing the following questions:

- What do you know about welding?
- Do you know anyone who welds? If so, what kinds of things do they weld?
- Why is it important to practice safety precautions when welding? What can we do to be safe?

Have the members fill out the web with steps they can take to be safe in the shop. They may branch out and create more answers on their web.

An answer might include

- Keep the shop as clean as possible.
- Ensure that anything flammable is removed prior to beginning welding.
- Never put oil on any part of an oxyacetylene system as this is highly dangerous/ explosive.
- Check for gas leaks using soapy water
- Never weld or cut without appropriate eye protection.
- Do not pick up metal without welding gloves - it is HOT!
- Know location of emergency supplies (fire extinguisher, water, closest phone, etc.).

## Basic Equipment

*Oxygen Cylinders* - These tanks are made of steel and come in many sizes. Cylinders are under a lot of pressure so be careful when handling them. They have a high-pressure valve on them with a safety nut that will burst and let the oxygen out safely if the pressure in the cylinder becomes too great. Never move cylinders around with out the safety cap on, unless attached to an approved oxyacetylene mobile cart. Oxygen from these cylinders is not a substitute for compressed air. This oxygen can be 99% pure and makes things burn really fast

*Acetylene Cylinders* - These cylinders have lower amounts of pressure in them, but can be quite dangerous because acetylene is a fuel and can easily ignite. As a safety measure, acetylene should never be released or used at a rate above 15 pounds per square inch (p.s.i.). If the acetylene in the cylinder gets too hot, there are plugs on them which will melt and release the acetylene. Raw acetylene gas has a very strong odour (worse than propane) when released. It is a bad smell, but if it is leaking you know it right away.

**Regulators** – A regulator is a device used to control pressure from the tanks by reducing pressure and regulating flow rate. Regulators for oxygen and acetylene are different. Acetylene regulators have a male fitting with a left hand thread and oxygen regulators have a female fitting with a right hand thread. Normally, both types will have two gauges on them. One will indicate the amount of pressure left in the cylinder and the other will indicate the amount of pressure that has been set by the operator to go to the torch. There is an adjusting screw in the centre of the regulator that is used to adjust the flow of gas.

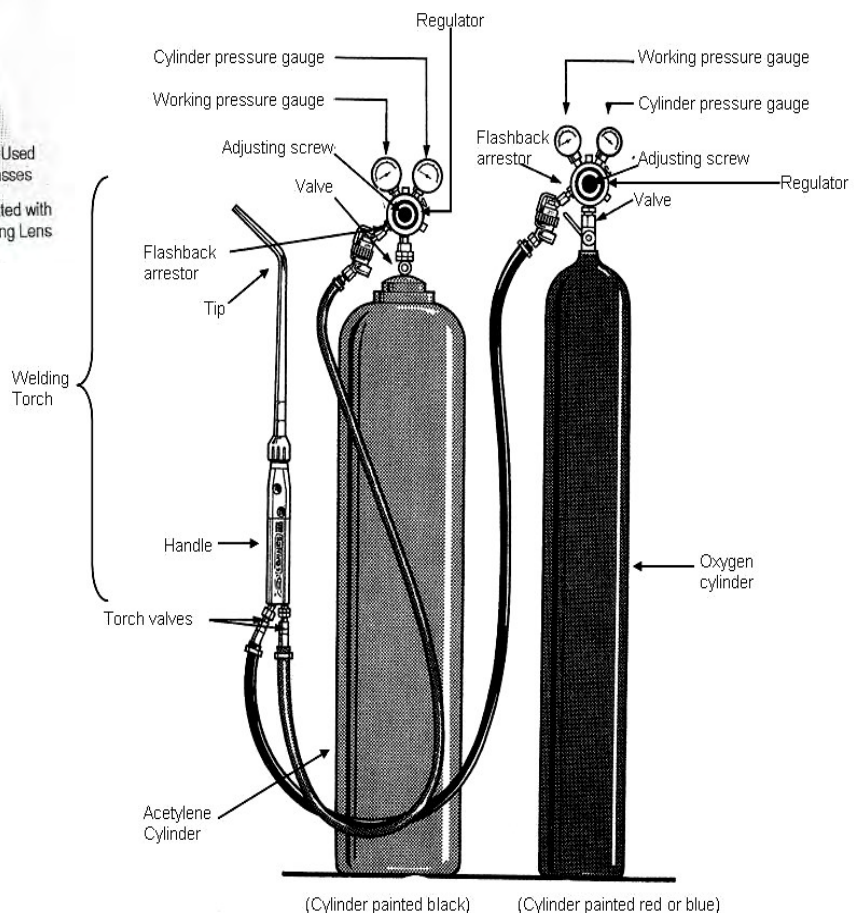


**Hoses** – As with regulators, the fittings on oxyacetylene hoses are different than the oxygen ones. The acetylene (fuel) hose has left hand threads and the oxygen hoses have standard threads. The acetylene hoses are usually red and the oxygen hoses are green. You must be careful to keep the hoses protected from damage as they are made of a flexible rubber.

**Flashback Arrestors** – Not all oxyacetylene setups will have flashback arrestors or one-way check valves on them, but they are highly recommended and in some places, safety laws require them. This is to stop the travel of a spark up a hose and into a cylinder; which may result in an explosion.

**Torches** – The torch is the part that the welder holds and manipulates to make the weld. The most common torch for general versatility is a “combination torch”. This allows the operator to install welding tips (various sizes), heating tips (also called a rose bud), and cutting attachments to the body (handle) of the torch.

**Goggles** – Welding/cutting goggles should be worn at all times when welding, brazing, cutting, or when a lot of heating is required. They should have a number 4, 5, or 6 shade filter lens in them and be C.S.A. approved. They are made to protect your eyes from sparks, dust, and damaging light rays that can be produced. At all times in a shop where there are potential sparks or fragments, safety glasses with a side shield should be worn.





## DISCOVER

### Safety

Personal safety needs to be a priority when working at any job. Accidents often occur because someone was in too much of a hurry to get a job done and didn't take the proper steps or precautions to make the work safer. Welding and cutting with an oxyacetylene outfit can be safe if we respect the equipment and understand the potential danger. The following are some general considerations and rules when using the welding and cutting processes:

- Dress for the job. You will be working with sparks and a flame that is 3500 degrees C. Proper eye protection is extremely important. A good set of coveralls, gloves, and proper foot wear can be the first line of defence against burns. Choose heavy cotton or denim clothing, not nylon or fleece. Leather covered shoes or boots are better choices than running shoes.
- Never use oil. Oil, along with other petroleum base lubricants should never come in contact with oxyacetylene equipment. These products in combination with high-pressure gases can cause spontaneous combustion (explosions/fire). If cylinder valves won't open by hand or are not functioning properly, return them to the supplier. Oxyacetylene equipment is to be serviced by professionals.
- Is the area safe? The area that you are welding or cutting in needs to be free of combustible or explosive materials. Sparks from a cutting torch can travel quite a distance and sometimes when cutting things apart, those sparks can pop back at you. Welding or cutting near concrete is not a good idea as the heat can cause damage when hot materials come popping back at you.
- Is there good ventilation? Welding and cutting with oxyacetylene can create harmful fumes. Welding done on galvanized metal and the brazing process are examples where zinc oxides become present. Heating, welding, or cutting on painted surfaces can cause extra smoke and fumes that are very irritating to our bodies.
- Don't weld on or cut apart containers unless you know for sure what was contained in them was safe. The risk of explosion or toxic fume creation is too high. Do not work on anything that has had fuel or solvents in it.
- Use a proper striker to light the torch. Using matches or lighters becomes a safety issue. Combustion can occur without a spark. Do not have both the acetylene and oxygen gases flowing when you go to light the torch.
- Protect your equipment. Make sure the cylinders are secured properly. The oxyacetylene hoses are made from a durable rubber, but they can have holes melted in them or be cut open by a heavy piece of material dropping on them. Dirty or partly plugged torch tips can become inefficient and cause backfiring and an increased risk of flashback. Don't ever use the end of a cutting torch attachment to tap a piece of material that you have cut which didn't release from the base material. Be aware of where the sparks from cutting and grinding are heading. Regulators or other pieces of equipment can be damaged from them.
- Shut the equipment down if you're going to be away from it for a while. At times, small gas leaks have occurred without notice. This is a waste of valuable gas supplies and can become dangerous. For example, if a grinder spark makes contact with a gas leak the result will be explosion and/or fire.
- Ask permission before using other shop equipment.





First things first... what does WHMIS mean and why was it created? It means **Workplace Hazardous Materials Information System** and was developed nationally by divisions of labour, industry, and government over a number of years to try to ensure that all hazardous materials that are produced and supplied to industry come with proper safety information. With the regulations of WHMIS legislation and the federal *Hazardous Products Act*, this information must be categorized and printed on a MSDS, which stands for **Material Safety Data Sheet**. The products must also be properly labelled with the more important information and warning symbols.

#### SECTION

- |                             |  |
|-----------------------------|--|
| 1 - Material Identification | 2 - Hazardous Ingredients              |
| 3 - Physical Data           | 4 - Fire and Explosion Data            |
| 5 - Reactivity Data         | 6 - Health Hazard Data                 |
| 7 - First Aid Measures      | 8 - Preventative Measures              |
| 9 - Storage and Handling    | 10 - Spill Clean up and Waste Disposal |

Each of the above sections must be filled out, even if it only states: "not determined" or "not applicable".

The WHMIS system groups hazardous materials into six classes or categories based on the type of hazard which they represent. These materials are also called controlled products. Each category has its own hazard symbol and it is important that the worker be able to recognize these.

The following are standard symbols and an explanation of them that can be found on product labels.

#### A - COMPRESSED GAS



A compressed gas is a material which is a gas at normal room temperature (20 C) and pressure but is packaged as a pressured gas, dissolved gas or gas liquefied by compression or refrigeration. The hazard from these materials, aside from their chemical nature, arises from sudden loss of integrity of the container. A compressed gas cylinder is usually quite heavy and when ruptured can become a projectile with the potential to cause significant damage. Acetylene and oxygen are examples of compressed gases.

#### B - FLAMMABLE AND COMBUSTIBLE MATERIAL



Flammable or combustible materials will ignite and continue to burn if exposed to a flame or source of ignition. Materials are classified as a flammable gas, flammable aerosol, flammable liquid, combustible liquid, flammable solid, or reactive flammable material. Methane, acetone, aniline, and lithium hydride are examples of flammable materials.



## C - OXIDIZING MATERIAL



An oxidizing material may or may not burn itself, but will release oxygen or another oxidizing substance, and thereby causes or contributes to the combustion of another material. Ozone, chlorine, and nitrogen dioxide are oxidizing materials. These chemicals will support a fire and are highly reactive.

## D - POISONOUS AND INFECTIOUS MATERIAL

### D1- Materials Causing Immediate and Serious Toxic Effects



These materials may be classified as toxic or very toxic based on information such as LD50 or LC50. *Examples: Styrene, hydrogen cyanide are very toxic substances.*

### D2 - Materials Causing Other Toxic Effects



A pure substance or mixture that may be any one of the following: a carcinogen, teratogen, reproductive toxin, respiratory tract sensitizer, irritant or chronic toxic hazard. *Examples: Asbestos causes cancer, ammonia is an irritant.*

### D3 - Biohazardous Infectious Material



This classification includes any organisms and the toxins produced by these organisms that have been shown to cause disease or are believed to cause disease in either humans or animals. For example, a blood sample containing the Hepatitis B virus is a biohazardous infectious material. It may cause hepatitis in persons exposed to it.

## E - CORROSIVE MATERIAL



Corrosive materials can attack (*corrode*) metals or cause permanent damage to human tissues such as the skin and eyes on contact. Burning, scarring, and blindness may result from skin or eye contact. Corrosive materials may also cause metal containers or structural materials to become weak and eventually to leak or collapse.

Ammonia, fluorine, and hydrochloric acid are examples of corrosive substances.

## F - DANGEROUSLY REACTIVE MATERIAL



Dangerously reactive materials may undergo vigorous polymerization, decomposition or condensation. They may react violently under conditions of shock or an increase in pressure or temperature. They may also react vigorously with water to release a toxic gas. Ozone, hydrazine, and benzoyl peroxide are examples of dangerously reactive materials.

## Product Labeling

The following picture is an example of what a supplier product label looks like, and what basic information can be found on it.



Product identifier →

A risk phrase →

A hazard symbol →

Precautionary measures →

First aid measures →

Statement indicating a MSDS is available →

Supplier identifier →

**TOLUENE SULPHONIC ACID 70%, LIQUID**

**RISK PHRASE(S)**  
Highly irritating to skin, eyes, and nose

**HEALTH HAZARD DATA:**  
Strong Acid: Treat as per sulphuric acid  
EFFECTS OF OVEREXPOSURE, ACUTE OVEREXPOSURE: Skin and eye

**PRECAUTIONARY MEASURES**  
SPECIFIC PERSONAL PROTECTIVE EQUIPMENT  
EYE: Face shield and goggles  
GLOVES: Rubber  
OTHER CLOTHING AND EQUIPMENT: Rubber apron, rubber boots

**FIRST AID MEASURES:**  
EYES: Flush with copious quantities of water for 15 minutes. Consult physician  
SKIN: Flush with water as per sulphuric acid  
Ingestion: Treat as per sulphuric acid. Consult physician.

**REFER TO MATERIAL SAFETY DATA SHEET FOR FURTHER INFORMATION**

Henkel Canada Ltd.  
162 Ward Ave. Hamilton, Ontario L8N 3M8  
(416) 525-4660

## Do it!

## Equipment Basics

Time required: 1 hour

### Equipment/Supplies

- Cylinders - Oxygen and Acetylene
- Regulators - Oxygen and Acetylene
- Hoses - Oxygen and Acetylene
- Flashback Arrestors
- Welding Torch
- Goggles/ Helmet
- Project manuals
- Pencils

### Instructions

1. Before beginning, set the basic ground rules for being in the shop. Some suggestions might include:
  - Do not touch anything without permission.
  - Ask questions first, take action second.
  - Pay attention and no rough housing.
  - If at all uncertain, don't do it. Ask questions.
2. Take the members to the shop and explain the names and uses of the different pieces of oxyacetylene welding equipment.
3. Have members complete the labels on the diagram in their Member's Manual
4. As they go through the different parts ask them questions to reinforce what you have taught them
  - ◆ Why do you have to handle oxygen cylinders so carefully? Answer: Because they are under very high pressure and could explode.
  - ◆ What color is the oxygen tank? Answer: red or blue
  - ◆ What gives the oxyacetylene torch a very hot flame?

# WHMIS

Time required: 30 minutes

## Equipment/Supplies

- Common sample products having WHMIS symbols
- Project manuals

A diamond-shaped logo with the word "DISCOVER" written in white capital letters inside a black diamond with a white border.

## Instructions

1. Use your manual to outline the WHMIS system including the symbols used and what those symbols represent.
2. Bring it to life with real examples such as the "Compressed Gas" symbol on the cylinders.
3. Have the members fill in the blanks in their Member's Workbook as a review of some of the symbols.

## **Dig it!**

To help members reflect on their learning and apply what they know, ask them the following questions:

- What were some of the things that were hard to understand when you started this project?
- What did you learn from observation?
- How can you apply what you have learned about WHMIS to other things in your life?

## What's next?

In the next project meeting members will learn about the proper set up, lighting, and shutting down of the oxyacetylene unit. To get members thinking about the next meeting, ask them what safety issues have to be addressed before they can operate the welding torch.

## Leader's Notes






# In the Member Manual

## Skill Builder 1: Basic Equipment & Safety


**Gizmo says...**

With proper instruction, a safety attitude and practice, the set up and use of oxyacetylene welding, heating, or cutting equipment can be a safe and versatile tool for farm repair and fabrication. If abused and used foolishly it can be a real danger. **Be smart and be safe!**




**Important words**

Watch for these important words throughout this builder: **Oxygen, Acetylene, Cylinder, Torch, Goggles, WHMIS**



- SKILLS CHECKLIST**
- Identify basic equipment
  - Understand functions of basic equipment
  - Understand the safety rules for working in the shop
  - Understand what safety equipment is required
  - Identify WHMIS symbols and know what they mean

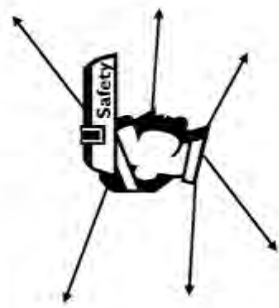
### Dream it!

As a welding torch, the basic operation of an oxyacetylene unit is blending two gases, oxygen and acetylene, together in the right proportion to create a proper size flame. The flame is used to melt two pieces of metal to the point that they reach a liquid type state and flow together. This is called fusion and in most cases a filler metal rod is also heated and added to the liquid puddle. If done properly, the cooled weld can be very strong and have the same characteristics as the original part.

As a cutting torch, the operation also introduces a stream of pure "higher pressured" oxygen to the heated metal. This stream cuts (burns) a path through the metal and allows us to separate sections of base material. As a heating tool, the torch can be helpful for bending metal, getting bent parts back to where they belong, or for freeing rusted bolts.



Safety in the shop is very important. Branch off of this word web with things you can do to keep safe while welding.



### DISCOVER



### Basic Equipment

**Oxygen Cylinders** – are tanks made of steel and come in many sizes. Cylinders are under a lot of pressure. Be careful when handling them. They have a high-pressure valve on them with a safety nut that will burst and let the oxygen out safely if the pressure in the cylinder becomes too great. Never move cylinders around without the safety cap on, unless attached to an approved oxyacetylene mobile cart. Oxygen from these cylinders is not a substitute for compressed air. This oxygen can be 99% pure and makes things burn really fast.

**Acetylene Cylinders** – These cylinders have lower amounts of pressure in them, but can be quite dangerous because acetylene is a fuel and can easily ignite. As a safety measure, acetylene should never be released or used at a rate above 15 pounds per square inch (p.s.i.). If the acetylene in the cylinder gets too hot, there are plugs on them which will melt and release the acetylene. Raw acetylene gas has a very strong odour (worse than propane) when released. It is a bad smell, but if it is leaking you know it right away.

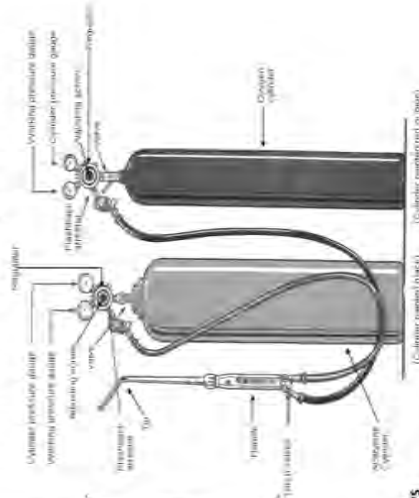
**Regulators** – A regulator is a device used to control pressure from the tanks by reducing pressure and regulating flow rate. Regulators for oxygen and acetylene are different. Acetylene regulators have a male fitting with a left hand thread and oxygen regulators have a female fitting with a right hand thread. Normally, both types will have two gauges on them. One will indicate the amount of pressure left in the cylinder and the other will indicate the amount of pressure that has been set by the operator to go to the torch. There is an adjusting screw in the centre of the regulator that is used to adjust the flow of gas.

**Hoses** – As with regulators, the fittings on oxyacetylene hoses are different than the oxygen ones. The acetylene (fuel) hose has left hand threads and the oxygen hoses have standard threads. The acetylene hoses are usually red and the oxygen hoses are green. You must be careful to keep the hoses protected from damage as they are made of a flexible rubber.

**Flashback Arrestors** – Not all oxyacetylene setups will have flashback arrestors or one-way check valves on them, but they are highly recommended and in some places, safety laws require them. This is to stop the travel of a spark up a hose and into a cylinder; which may result in an explosion.

**Torches** – The torch is the part that the welder holds and manipulates to make the weld. The most common torch for general versatility is a "combination torch". This allows the operator to install welding tips (various sizes), heating tips (also called a rose bud), and cutting attachments to the body (handle) of the torch.

**Goggles** – Welding/cutting goggles should be worn at all times when welding, brazing, cutting, or when a lot of heating is required. They should have a number 4, 5, or 6 shade filter lens in them and be C.S.A. approved. They are made to protect your eyes from sparks, dust, and damaging light rays that can be produced. At all times in a shop where there are potential sparks or fragments, safety glasses with a side shield should be worn.





# In the Member Manual

## Safety

Personal safety needs to be a priority when working at any job. Accidents don't just happen. They often occur because someone was in too much of a hurry to get a job done and didn't take the proper steps or precautions to make the work safer. Welding and cutting with an oxyacetylene outfit can be safe if we respect the equipment and understand the potential danger. The following are some general considerations and rules when using the welding and cutting processes.



- Dress for the job. You're going to be working with sparks and a flame that is 3500 degrees C. Proper eye protection is extremely important. A good set of coveralls, gloves, and proper foot wear can be the first line of defence against burns. Choose heavy cotton or denim clothing over nylon or fleece. Leather covered shoes or boots are better choices than running shoes.

- Never use oil, along with other petroleum base lubricants should never come in contact with oxyacetylene equipment. These products in combination with high-pressure gases can cause spontaneous combustion (explosions/fire). If cylinder valves won't open by hand or are not functioning properly, return them to the supplier. Oxyacetylene equipment is to be serviced by professionals.



- Is the area safe? The area where you are welding or cutting needs to be free of combustible or explosive materials. Sparks from a cutting torch can travel quite a distance. Welding or cutting near concrete is not a good idea as the heat can cause damage and hot materials can come popping back at you.

- Is there good ventilation? Welding and cutting with oxyacetylene can create harmful fumes. Welding done on galvanized metal and the brazing process are examples where zinc oxides become present. Heating, welding, or cutting on painted surfaces can cause extra smoke and fumes that are very irritating to our bodies.

- Don't weld on or cut apart containers unless you know that what was contained in them was safe. The risk of explosion or toxic fume creation is too high. Do not work on anything that has had fuel or solvents in it.

- Use a proper striker to light the torch. Using matches or lighters becomes a safety issue. Combustion can occur without a spark. Do not have both the acetylene and oxygen gases flowing when you go to light the torch.

- Protect your equipment. Make sure the cylinders are secured properly. The oxyacetylene hoses are made from a durable rubber, but they can have holes melted in them or be cut open by a heavy piece of material dropping on them. Dirty or partly plugged torch tips can become inefficient and cause backfiring and an increased risk of flashback. Don't ever use the end of a cutting torch attachment to tap a piece of material that you have cut which didn't release from the base material. Be aware of where the sparks from cutting and grinding are heading. Regulators or other pieces of equipment can be damaged from them.



- Shut the equipment down if you're going to be away from it for a while. At times, small gas leaks have occurred without notice. This is a waste of valuable gas supplies and can become dangerous. For example, if a grinder spark makes contact with a gas leak the result will be explosion and/or fire.

## DISCOVER

## DISCOVER



## WHMIS and MSDS

First things first... what does WHMIS mean and why was it created? It means Workplace Hazardous Materials Information System and was developed nationally by divisions of labour, industry, and government over a number of years to try to ensure that all hazardous materials that are produced and supplied to industry come with proper safety information. With the regulations of WHMIS legislation and the federal Hazardous Products Act, this information must be categorized and printed on a MSDS, which stands for Material Safety Data Sheet. The products must also be properly labelled with the more important information and warning symbols.

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Take the time to read the following WHMIS categories and memorize their symbols.

### WHMIS Hazardous Material Categories

#### A - COMPRESSED GAS



This category poses an explosion danger because the gas is being held in a cylinder under pressure. Handle with care; do not drop the cylinder and keep cylinders away from fire and ignition sources. Eg. Helium, oxygen, propane, acetylene and oxygen are examples of compressed gases



#### B - FLAMMABLE AND COMBUSTIBLE MATERIAL

These materials burn and are potential fire hazards. Flammable materials will catch fire at lower temperatures than combustibles, so keep them away from heat sources and other combustible materials. Eg. Paint thinner, gasoline, methane, acetone, are examples of flammable materials.



#### C - OXIDIZING MATERIAL

These pose a fire &/or explosion hazard in the presence of flammable & combustible materials. Keep oxidizers away from combustible materials such as wood and flammables such as fuels. Eg. fertilizers, oxygen, hydrogen peroxide



# In the Member Manual

## D - POISONOUS AND INFECTIOUS MATERIAL (Divided into 3 sub groups)



### D1 - Materials Causing Immediate and Serious Toxic Effects

These materials may be classified as toxic or very toxic. *Examples: Styrene, hydrogen cyanide, sodium cyanide*



### D2 - Materials Causing Other Toxic Effects

These materials that are not immediately dangerous to health but may cause death or permanent damage as a result of repeated exposures over time (known as Other Toxic Effects). *E.g. Asbestos causes cancer, ammonia is an irritant.*



### D3 - Biohazardous Infectious Material

These are Biohazardous infectious materials which may cause a serious disease resulting in illness or death such as Hepatitis B Virus. Handle all poisonous and infectious materials with extreme caution and avoid contact with the skin or eyes by wearing proper protective equipment such as gloves.



## E - CORROSIVE MATERIAL

These materials cause severe eye and skin irritation or burns upon contact. Avoid inhaling and avoid skin and eye contact by wearing proper protective equipment such as gloves. *E.g. acids, Ammonia, fluorine, hydrochloric acid.*



## F - DANGEROUSLY REACTIVE MATERIAL

These are materials which are extremely unstable such as sodium metal and some cyanides. They may react with water to release a toxic or flammable gas, or explode as a result of shock, friction or increases in temperature. *E.g. Ozone, hydrazine, and benzoyl peroxide are examples of dangerously reactive materials.*

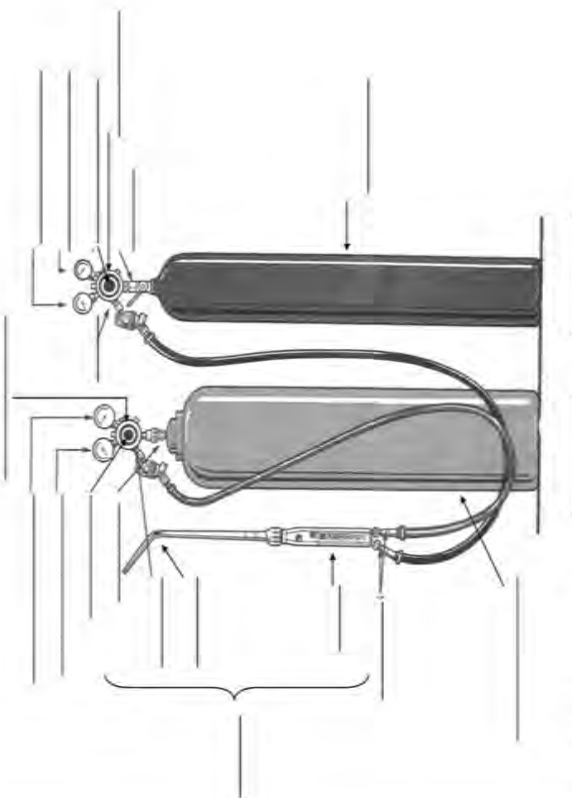
## DISCOVER

### Equipment Basics

**What You Need?** oxyacetylene unit with welding torch, gloves, goggles/helmet

- What are all the parts of an oxyacetylene unit and what do they do?
- 1. Read the section of your manual on the basic equipment of a oxyacetylene unit and study the diagram labelling the various parts.
- 2. After your leader has shown you the welding equipment and what each part does, try and label the parts on diagram below (without peeking at the diagram on page 4!).

### Oxyacetylene Equipment (Label the parts below)



- How did you do? What strategy did you use to help remember all the parts?

### Welding on the Web

Try this fun oxyacetylene equipment labeling activity on the internet at <http://www.schools.ash.org.au/dkcc/techt/weld2/desew.htm>

### Product Labeling

The following is an example of what a supplier product label looks like, and what basic information can be found on it.

Product identifier	TOLUENE SULPHONIC ACID 70%, LIQUID
A risk phrase	R10 (Irritant)
A hazard symbol	
Precautionary measures	P201 (Attention) and P202 (Hazardous for the environment)
First aid measures	P301 (If swallowed) and P312 (Call a poison centre or doctor if you feel unwell)
Statement indicating a MSDS is available	P501 (Dispose of contents in accordance with local regulations)
Supplier identifier	Supplier: Chem Service Pty Ltd 123 Street, Melbourne, Victoria 3000



# In the Member Manual

## WHMIS

- How are hazardous materials identified?

**What You Need?** A variety of products with WHMIS symbols, manual, pencil

1. Read the WHMIS section of your manual.
2. Listen carefully as your leader shows you examples of hazardous materials with WHMIS labels
3. Label each of the WHMIS symbols below and explain what they stand for (try not to peek at the notes in your manual!)

## WHMIS




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## Welding on the Web

Interested in a career in industrial welding? These post-secondary institutions have programs for you! To find out more information visit the school's website as listed below:

- Assiniboine Community College: [www.assiniboine.net](http://www.assiniboine.net)
- Red River College: <http://www.rrc.mb.ca>
- Winnipeg Technical College: <http://www.wtc.mb.ca>
- University College of the North: <https://www.ucn.ca>

## Dig It!

Think about this builder and the activities you did ...

Review the Skills Checklist on page 3. What skills or knowledge have you acquired? Do you need more practice? Why do welding and safety go hand in hand?



### Record it ...

Discuss what you have learned with your leader so that the information can be recorded on your Portfolio Page.

### Apply it ...

How would you explain to others what welding safety is all about?

## DISCOVER



**How Did it Go?**  
(Write down any thoughts, comments, questions, and what you have learned in this builder)



## Welding on the Web

For information on the history of welding, check out this excellent website: <http://www.weldinghistory.org/whistoryfolder/welding/index.htm>



## What's next?

Now that you know about the oxyacetylene unit and all the welding/shop safety rules, it is time to learn about how to properly set up, light, and shut down the unit. To get ready for the next meeting, review what you have learned so far about safety precautions and how the basic oxyacetylene equipment works.



## Skill Builder 2: Set Up, Lighting & Shutting Down



DISCOVER

### Skills Checklist

- Set up an oxyacetylene unit properly and safely
- Test an oxyacetylene unit for leaks
- Set up a welding torch for use
- Adjust the flame of a welding torch
- Shut down an oxyacetylene unit properly and safely

### Dream it!

#### Background for Leaders

##### Oxyacetylene Torch Setup:

Although a torch system does not look complicated, it must be setup and tested for leaks before ever lighting and using for welding or cutting procedures. Because the combination of oxygen and acetylene can produce one of the hottest flames, acetylene has always been quite popular as a fuel gas. The down side to acetylene is the ease at which it can light up, so we must insure that there are no leaks in the system.

When setting up a torch system, **safety has to come first**. The cylinders must be properly secured to something stable such as a wall or if mobility is required, an approved cart.

Before installing the regulators on to the acetylene and oxygen cylinders, we must ensure that there is no dirt or oily matter on or in the cylinder valves. Visually check the valve. Then crack the valve open momentarily and quickly close it to allow a small amount of gas to come out of the cylinder. It is very important to **NOT** stand in front of the valve opening. The amount of pressure that may be released can cause harmful damage to you. This is called "sniffing out".

You can now install the regulators on to the cylinders by hand screwing the fittings together and then tightening with a proper fitting wrench. Remember that fuel fittings such as acetylene or propane have left hand threads, which means you have to turn them the opposite direction to tighten.

Now attach the hoses to the regulators and tighten firmly being careful not to over tighten and bust the fittings off the regulators. If the hoses are new or have not been hooked up to a system for some time, they should be blown out with compressed air to ensure that there is no unwanted matter in them.

Next, attach an approved set of flashback arrestors. There are two types of arrestors - one fits between the torch and hose and the other fits between the hose and the regulator.

The torch body can now be attached and either a welding or cutting tip attached to the body. Note: The nut that attaches the welding or cutting tip to the body should be hand tightened only.



## DISCOVER

Once the oxyacetylene outfit has been assembled, you need to set the system up for the work that is going to be performed. The following steps setup the system for torch welding and/or brazing.

1. Check to see if the pressure adjustment screws on the two regulators has been backed off (counter-clockwise). They should feel loose. This is both a safety and a good maintenance procedure that should be practiced.
2. While standing to the side of the regulator, slowly open the acetylene cylinder valve allowing the pressure to build up on the regulator. It is recommended to open the valve from 1 to 1 1/2 turns. The oxygen valve can be opened slowly until it is fully opened.
3. Now with the torch body in one hand, open the acetylene valve of the torch a 1/2 turn and adjust the gas flow pressure by turning in (clockwise) the adjustment screw of the regulator till the line pressure gauge indicates 4 or 5 p.s.i. and then close the torch valve. Make sure you have good ventilation, as raw acetylene smells very bad and a build up of any fuel gas can be dangerous.
4. As with the acetylene cylinder, stand to the side of the oxygen regulator and slowly open the oxygen cylinder valve allowing the pressure to build up on the regulator and then continue to open the valve all the way.
5. Open the oxygen valve of the torch and adjust the oxygen regulator until there is 8 to 10 p.s.i. flow for welding and 25 to 35 p.s.i. flow for cutting. Close the torch valve.
6. The system should now be ready for use.

Before lighting the torch, test the system for leaks with soapy water. Using a spray bottle to apply the soapy water is a good idea. The operator must, also, consider personal protection first. You need to be wearing proper gloves and goggles and insure that the area you are using the torch in is safe.

### Lighting the Torch and Flame Adjustment:

Having done this, guide your members through the following light up, flame adjustment, and shut off procedures.

1. Being careful that the torch tip is facing a safe direction, open the torch acetylene (fuel) valve a small amount. Using a proper friction striker, light the acetylene flame and adjust it so that it is feathering at the end and there is no great amount of black (carbon) smoke being given off. **IMPORTANT:** Make sure you hold the striker in a way that when the acetylene ignites, the flame is not near your hand. It is possible that the striker does not ignite the acetylene the first time and a gas build up may form near the end of the tip. If you have problems getting the torch ignited, shut off the torch acetylene valve and let the area clear of raw gas.
2. Once your acetylene flame is adjusted, slowly open the torch oxygen valve and adjust the flame to form a "neutral flame". This is where there is a small bright blue cone at the end of the tip and an envelope of flame around it. Provided that the tip is clean and in good shape this flame will not be noisy. If the flame is noisy (aggressive hiss, squeal, or screeching), you may be using too much gas flow or the torch may need to be shut down and the tip cleaned. Some regulators may "creep" a little, so the flame might have to be adjusted more than once when first starting out.



## Shutting down the torch

To extinguish the flame you can simply shut off the torch acetylene (fuel) valve. This will usually result in a small pop or snap sound which is okay.

**Always shut down the acetylene valve first.** Be sure to also shut the torch's oxygen valve. Oxygen does not smell, so it might not be obvious if the valve was left open a bit. The result is a waste of compressed oxygen which costs the equipment owner money to replace.



It is important to maintain your tips between uses.

The tip wears, becomes blackened, and pitted as you work with it. The tip-cleaning tool has a flat file that you can use to file the tip flat again. The cleaning tool has tip cleaners for each size of tip. Be sure to use the right size of cleaner for the tip you are cleaning as you may damage it. Be very careful when using these cleaners as they can break off inside the tip.

## Shutting Down the O/A Outfit

To shut the complete system down, you can first close both cylinder valves. Next you should drain (purge) the regulators and hoses by opening the torch valves, watching the regulator gauges to insure they are being emptied, and then closing the torch valves. Remember that the acetylene smells bad and is a fuel gas, so you need good ventilation. Once the system has been drained, back the regulator adjustment screws off so they are ready for the next time. Hang up the hoses and place the torch where it will not get damaged.

## Important Words

Help members define the following words and look for members using this vocabulary in their discussions. Have members describe the words in terms of their experiences to solidify.

Valve	Device for halting or controlling the flow of a gas, through a passage, pipe, inlet, outlet.
Regulator	A valve for regulating the pressure of flowing gas to maintain a predetermined pressure.
Flame	The zone of burning gases used to apply heat.

## Age Considerations

- Ages 15 and up

## Thinking Ahead

- What will you discuss with members? Gather observations that will help support your discussion.

## Preparing for Success

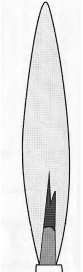
- Linking back to the Skills Checklist, help members identify how they will know they have been successful in learning from this builder. Discuss what success in these activities might look like, sound like, or feel like.

## Activating Questions

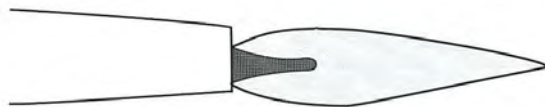
- How will you ensure the oxyacetylene unit is safe?
- What steps will you take before lighting the unit?

### DISCOVER

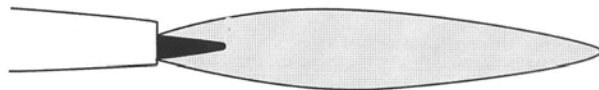
Have the members choose one of the three types of flames (oxidizing, neutral, or carburizing) and fill in the blanks. Then have them find two other members who chose the other types and compare notes. One answer might be:

<b>Word:</b> Carburizing Flame	<b>Picture:</b> 	<b>Synonym:</b> Carbonizing Flame
<b>Sentence:</b> Carburization can make metal more malleable and flexible.		<b>Definition:</b> A flame with an excess of acetylene

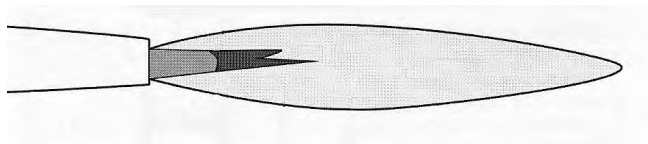
Oxidizing Flame



Neutral Flame



Carburizing Flame



## Do it!

### Oxyacetylene Unit Assembly

Time required: 15 minutes

#### Equipment/Supplies

- Disassembled oxyacetylene unit
- Soapy water

#### Instructions

1. Have your oxyacetylene unit disassembled ahead of your members coming. As a review, go through the different parts of an oxyacetylene unit one by one.
  2. Demonstrate and guide each member through the assembly of the oxyacetylene unit.
  3. Have them test the system for any possible gas leaks with soapy water (squirt bottle or dipped clean paint brush) and tighten any required fittings.
- Why do you use soapy water to test for gas leaks?

## Lighting and Shutting Down the Flame

Time required: 15 minutes

### Equipment/Supplies

- Oxyacetylene unit
- Gloves
- Goggles



### Instructions

1. Demonstrate how to hold the striker and safely light a welding torch. Carefully guide each of them as they light up and shut down a number of times. Be sure to ensure proper striker positioning. Emphasize the need to shut the acetylene valve down first and not to forget to shut off the oxygen valve.
- Where should you hold the striker when lighting the unit?

## Adjusting the Flame

Time required: 15 minutes

### Equipment/Supplies

- Oxyacetylene unit
- Gloves
- Goggles

### Instructions

1. Demonstrate to the members what feathering in a flame means.
  2. Demonstrate the three types of working flames (oxidizing, neutral and carbonizing) and demonstrate what they are used for.
  3. Guide each member in adjusting the flame to reach the most used type of flame - the neutral flame.
- What is the differences between the three types of flames?

## **Dig it!**

To help members reflect on their learning and apply what they know, ask hem; the following questions:

1. How did you light the oxyacetylene torch?
2. What do you feel you need to work on to be good at operating the oxyacetylene torch?
3. In what other ways could you apply the skills you gained in this builder?

### What's next?

With knowledge of how to operate the oxyacetylene unit members will practice the basic weld positions in the next project meeting.

# Leader's Notes

DISCOVER



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# In the Member Manual

## Skill Builder 2: Set Up, Lighting, & Shutting Down

Gizmo says...

When setting up a torch system, **safety has to come first**. The cylinders must be properly secured to something stable such as a wall or if mobility is required, an approved cart. In addition, the unit must be setup and tested for leaks before ever lighting and using for welding or cutting procedures.

### SKILLS CHECKLIST

- Set up an oxyacetylene unit properly and safely
- Test an oxyacetylene unit for leaks
- Set up a welding torch for use
- Adjust the flame of a welding torch
- Shut down an oxyacetylene unit properly and safely

### Important words

Watch for these important words throughout this builder:

**Valve, Regulator, Flame**

### Dream it!

#### Setting up the oxyacetylene unit

Although a torch system does not look complicated, it must be setup and tested for leaks before ever lighting and using for welding or cutting procedures. The combination of oxygen and acetylene can produce one of the hottest flames, acetylene has always been quite popular as a fuel gas. The down side to acetylene is the ease at which it can light up, so we must ensure that there are no leaks in the system.

Before installing the regulators on to the acetylene and oxygen cylinders, we must ensure that there is no dirt or oily matter on or in the cylinder valves. Visually check the valve. Now use a process called "sniffing out." Open the valve for a second and quickly close it to allow a small amount of gas to come out of the cylinder. It is very important to **NOT** stand in front of the valve opening. The amount of pressure that may be released can cause harmful damage to you.



You can now install the regulators onto the cylinders by hand, screwing the fittings together and then tightening with a proper fitting wrench. Remember that fuel fittings such as acetylene or propane have left hand threads, which means you have to turn them the opposite direction to tighten.

Now attach the hoses to the regulators and tighten firmly, being careful not to over tighten and bust the fittings off the regulators. If the hoses are new or have not been hooked up to a system for some time, they should be blown out with compressed air to ensure that there is no unwanted matter in them.

Next, attach an approved set of flashback arrestors. There are two types of arrestors - one fits between the torch and hose and the other fits between the hose and the regulator. Then, the torch body can be attached and either a welding or cutting tip attached to the body. The nut that attaches the welding or cutting tip to the body should be hand tightened only.

### DISCOVER



### DISCOVER

Once the oxyacetylene outfit has been assembled, you need to set the system up for the work that is going to be performed. The following steps setup the system for torch welding and/or brazing.

1. Check to see if the pressure adjustment screws on the two regulators has been backed off (counter-clockwise). They should feel loose. This is both a safety and a good maintenance procedure that should be practiced.
2. While standing to the side of the regulator, slowly open the acetylene cylinder valve allowing the pressure to build up on the regulator. It is recommended to open the valve from 1 to 1 1/2 turns. The oxygen valve can be opened slowly until it is fully opened.
3. Now with the torch body in one hand, open the acetylene valve of the torch a 1/2 turn and adjust the gas flow pressure by turning in (clockwise) the adjustment screw of the regulator till the line pressure gauge indicates 4 or 5 p.s.i. and then close the torch valve. Make sure you have good ventilation as raw acetylene smells very bad and a build up of any fuel gas can be dangerous.
4. As with the acetylene cylinder, stand to the side of the oxygen regulator and slowly open the oxygen cylinder valve allowing the pressure to build up on the regulator and then continue to open the valve all the way.
5. Open the oxygen valve of the torch and adjust the oxygen regulator until there is an 8 to 10 p.s.i. flow for welding and a 25 to 35 p.s.i. flow for cutting. Close the torch valve.
6. The system should now be ready for use.



Before lighting the torch, test the system for leaks with soapy water. Using a spray bottle to apply the soapy water. Remember, you need to be wearing proper gloves and goggles and ensure that the area in which you are using the torch is safe.

### Lighting the Torch and Flame Adjustment:

Have your leader guide you through the following light up, flame adjustment, and shut off procedures.

1. Being careful that the torch tip is facing a safe direction, open the torch acetylene (fuel) valve a small amount.

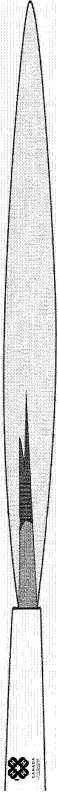
Using a proper friction striker, light the acetylene flame and adjust it so that it is feathering at the end and there is no great amount of black (carbon) smoke being given off. Make sure you hold the striker in a way that when the acetylene ignites, the flame is not near your hand. It is possible that the striker does not ignite the acetylene the first time and a gas build up may form near the end of the tip. If you have problems getting the torch ignited, shut off the torch acetylene valve and let the area clear of raw gas.

2. Once your acetylene flame is adjusted, slowly open the torch oxygen valve and adjust the flame to form a "neutral flame". This is where there is a small bright blue cone at the end of the tip and an envelope of flame around it. Provided that the tip is clean and in good shape, this flame will not be noisy. If the flame is noisy (aggressive hiss, squeal, or screeching), you may be using too much gas flow or the torch may need to be shut down and the tip cleaned. Some regulators may "creep" a little, so the flame might have to be adjusted more than once when first starting out.





# In the Member Manual



There are three main types of flames you can have with oxyacetylene welding: **oxidizing, neutral, and carburizing**. The ratios of oxygen to acetylene are what makes them different. Each one has a special purpose. Research one and fill in the boxes below. Compare your findings with those who picked the other types.

### Shutting down the torch

#### DISCOVER

Word:	Picture:	Synonym:
Sentence:	Definition:	

To extinguish the flame you can simply shut off the torch acetylene (fuel) valve. This will usually result in a small pop or snap sound which is okay. **Always shut down the acetylene valve first.** Be sure to also shut the torch's oxygen valve. Oxygen does not smell, so it might not be obvious if the valve was left open a bit. The result is a waste of compressed oxygen which costs the equipment owner money to replace. It is important to maintain your tips between uses.

### Shutting Down the O/A Outfit

To shut the complete system down, you can first close both cylinder valves. Next you should drain (purge) the regulators and hoses by opening the torch valves, watching the regulator gauges to ensure they are being emptied, and then closing the torch valves. Remember that the acetylene smells bad and is a fuel gas, so you need good ventilation. Once the system has been drained, back the regulator adjustment screws off so they are ready for the next time. Hang up the hoses and place the torch where it will not get damaged.

### Do it!

#### Oxyacetylene Unit Assembly

- What are the steps when assembling the oxyacetylene unit?
- Review the torch set up procedure on pages 11 & 12 and the equipment diagram on page 4.
- Observe as your leader shows the proper unit assembly
- With your leader's guidance assemble the oxyacetylene unit
- Use soapy water to test for any gas leaks
- Check the appropriate box in each column

**What You Need:** Disassembled oxyacetylene unit, soapy water

	Set up the Torch	Set up the Oxyacetylene Unit	Test for Gas Leaks
I can do this			
I need more practice			

### Lighting and Shutting Down the Flame

- How do you safely light a welding torch?
- Review the notes on lighting the torch and on safety.
  - Observe your leader demonstrate the proper way of holding the striker and lighting and shutting down the torch
  - Now you try. Do it a number of times to get comfortable with the procedure

#### What You Need:

Oxyacetylene unit, gloves, goggles

#### DISCOVER

Make sure you shut the acetylene valve down first and remember to shut off the oxygen valve.

### Adjusting the Flame

#### What You Need: Oxyacetylene unit, gloves, goggles

- What are the different kinds of working flames used for?
- Discuss everyone's findings about oxidizing, neutral, and carburizing flames.
  - After your leader has demonstrated the different flames and explained what they are for, practice adjusting the flame so that it is neutral
  - Correctly label each flame below.



### Big It!

Why is it important to have the right kind of flame when welding?

How will your new knowledge help you in future projects?



### Welding on the Web

For a great additional resource on oxyacetylene welding and cutting check out: [http://www.esabna.com/EUWeb/OXY\\_handbook/589oxy1\\_1.htm](http://www.esabna.com/EUWeb/OXY_handbook/589oxy1_1.htm)

### What's next?

How do you feel about operating the oxyacetylene unit? Are you ready to do some welding? In the next builder you will get comfortable handling the torch as you practice the basic weld positions.

# Skill Builder 3: Basic Weld Positions

## Skills Checklist

- Perform forehand and backhand horizontal welds
- Understand the difference between horizontal and vertical welds



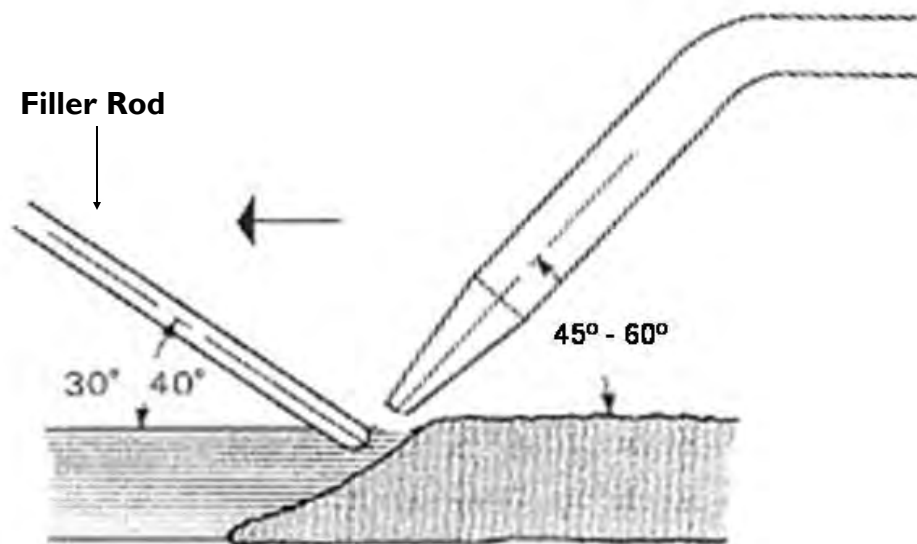
## Dream it!

### Background for Leaders

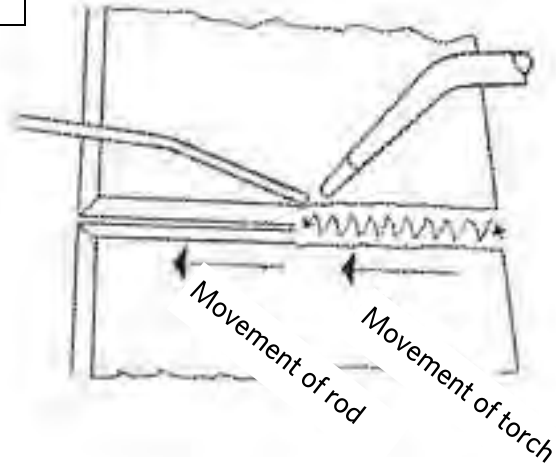
Note: Dependent on group size and member's ability, this unit may take two meetings.

Before welding, discuss with the members how to set up a proper welding workbench. You should have a steel welding table or bench - never weld on wood. Ideally, you would have a steel table with some firebricks on top to hold the heat away from the table.

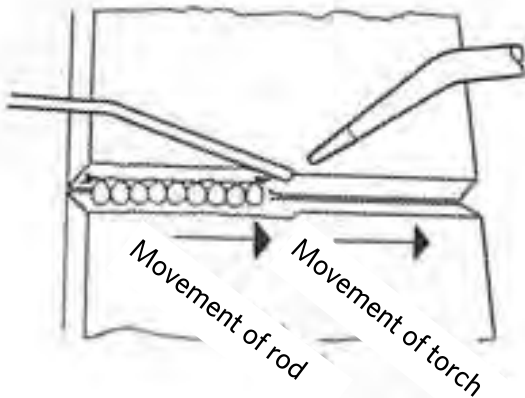
To begin welding, have your goggles on and your flame adjusted appropriately. When all is ready, place your welding tip approximately one inch (2.5 cm) from the steel that you are working on - this brings the flame tip in to about 1/8 - 1/4 inches away (2-4 mm). Form a weld puddle of molten metal. The torch should be held at a 45 - 60 degree angle above the metal. Only practice will tell the welder what is the best angle for them to work at. Point the flame in the direction that you are forming the bead. Move the tip along with a slight side to side motion. This is called fusion welding and basically melts two pieces of steel together. Most situations require you to use filler rod to reinforce and strengthen the bond between the two pieces. When using filler rod, place the filler rod in front of your flame dipping it into the pool of molten steel that you have made. Gradually move your way along in the direction of the bead. You can weld in either direction. It is good to learn how to do it both ways - left to right (backhand) or right to left (forehand) as different situations may arise that will only allow you to move in one direction.



## Forehand welding



## DISCOVER



## Backhand welding

For basic welding, the horizontal position is the easiest and most often used. If members get skilled at horizontal welding in both directions, vertical welding could be demonstrated to them for practise. The difference between the two techniques is the puddling of the filler so the rod is held in a different position (more aligned with the torch tip) to compensate for the gravity at play.

### Important Words

Help members define the following words and look for members using this vocabulary in their discussions. A few strategies you can use include;

- Teach synonyms by providing a synonym members know.
- Also, teach antonyms. Not all words have antonyms, but thinking about opposites requires the members to evaluate the critical attributes of the words in question.
- Provide non-examples. Similar to using antonyms, providing non-examples requires students to evaluate a word's attributes. Invite students to explain why it is not an example.

Backhand	Welding from left to right
Puddling	The small area of molten metal that forms during welding. The cooled weld puddle forms the permanent joint
Forehand	Welding from right to left
Horizontal	Welding that occurs either left to right or right to left, not up and down

### Age Considerations

- Ages 15 and up

## Thinking Ahead

What will you discuss with members? Gather observations that will help support your discussion.

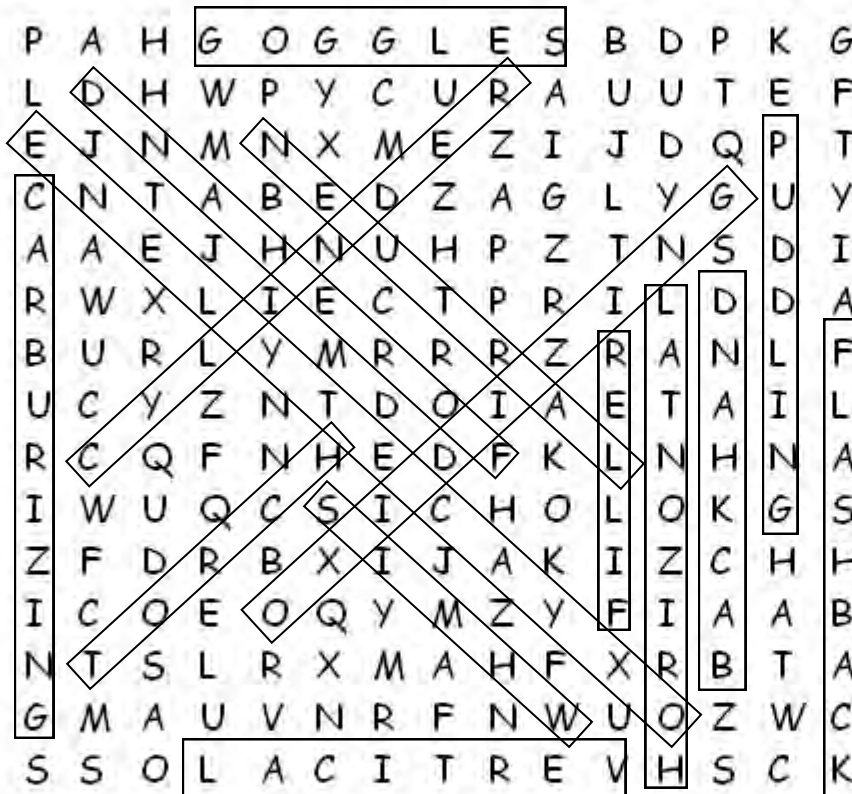
## Activating Questions

- What are the steps you will take to light the oxyacetylene torch?
- How will you adjust the flame?

DISCOVER

## Welding Word Search

Have the members complete the word search. Have them define each term in their own words as they find it. A completed word search is provide below:



BACKHAND  
CARBURIZING  
CYLINDER  
FILLER  
FLASHBACK  
FOREHAND  
GOGGLES  
HORIZONTAL  
NEUTRAL  
OXIDIZING  
OXYACETYLENE  
PUDDLING  
TORCH  
VERTICAL  
WHMIS

## Do it!

### Getting the Feel of the Torch

Time required: 30 minutes

#### Equipment/Supplies

- Gauge material
- Oxyacetylene unit
- Steel filler
- Gloves
- Goggles

#### Instructions

You may wish to have the members just puddle lines on gauge material to get their eye/hand coordination and comfort levels up before setting up and welding joints. This is basic fusion welding.

- Is welding similar to other activities you have done with your hands?



## Weld Positions

Time Required: 1 1/2 hours

### Required Equipment:

- Gauge material
- Gloves
- Oxyacetylene unit
- Goggles
- Steel filler

### Instructions

1. Demonstrate forehand and backhand methods of horizontal welding.
  2. Bring in the filler rod and demonstrate how to run a bead using the rod.
  3. Have each of the members practice the weld positions until some confidence is gained. Dependent on skill levels, it is likely most successful to have members practice forehand and backhand fusion lines and then move on to using the filler rod.
  4. Outline the situations where each of the weld positions would be most likely used.
- Which welding position do you find easiest—forehand or backhand?

## Vertical Positions (Optional)

Time Required: 1 hour

### Instructions

### Required Equipment:

- Gauge material
- Oxyacetylene unit
- Steel filler
- Gloves
- Goggles

1. If members are confident and skilled – you may consider demonstrating vertical welds and let them experiment.

## **Dig it!**

To help members reflect on their learning and apply what they know, ask them the following questions:

1. What is your favourite weld position?
2. How would you describe your skill at welding?
3. What would you do differently if you did this builder again?

### What's next?

In the next builder members will use their welding position skills to make basic welding joints.

## **Leader's Notes**





# In the Member Manual

## Skill Builder 3: Basic Weld Positions

Gizmo says...

There are three basic welding positions: backhand horizontal, forehand horizontal, and vertical. The horizontal position is the easiest and most often used.



DISCOVER

### SKILLS CHECKLIST

- Perform forehand and backhand horizontal welds
- Understand the difference between horizontal and vertical welds



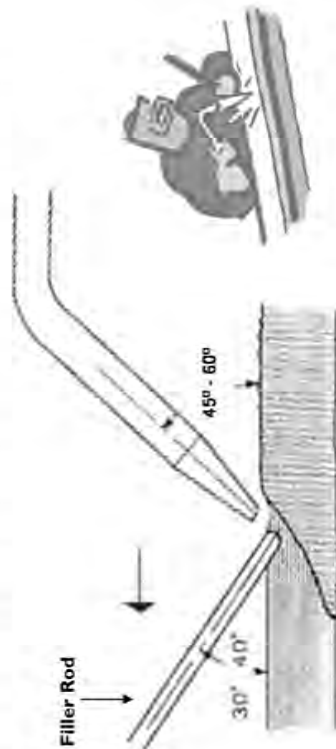
### Important words

Watch for these important words throughout this builder:  
**Backhand weld, Forehand weld, Horizontal weld, Puddling, Vertical weld**

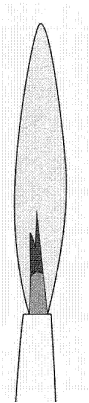


### Dream it!

To begin welding, have your goggles on and your flame adjusted appropriately. When all is ready, place your welding tip approximately one inch (2.5 cm) from the steel that you are working on - this brings the flame tip in to about 1/8 - 1/4 inches away (2-4 mm). Form a weld puddle of molten metal. The torch should be held at a 45 - 60 degree angle above the metal. However, only practice will tell the welder what is the best angle for them to work at. Point the flame in the direction that you are forming the bead. Move the tip along with a slight side to side motion. This is called fusion welding and melts two pieces of steel together. Most situations require you to use filler rod to reinforce and strengthen the bond between the two pieces. When using a filler rod, place the filler rod in front of your flame dipping it into the pool of molten steel that you have made. Gradually move your way along in the direction of the bead. You can weld in either direction. It is good to learn how to do it both ways - left to right (backhand) or right to left (forehand) as different situations may arise that will only allow you to move in one direction.



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### Welding Word Search

DISCOVER

Find the following words in the word search. Define and consider why each word would be included in a search about oxyacetylene welding.

P A H G O G G L E S B D P K G  
 L D H W P Y C U R A U U T E F  
 E J N M N X M E Z I J D Q P T  
 C N T A B E D Z A G L Y G U Y  
 A A E J H N U H P Z T N S D I  
 R W X L I E C T P R I L D D A  
 B U R L Y M R R Z R A N L F  
 U C Y Z N T D O I A E T A I L  
 R C Q F N H E D F K L N H N A  
 I W U Q C S I C H O L O K G S  
 Z F D R B X I J A K I Z C H H  
 I C O E O Q Y M Z Y F I A A B  
 N T S L R X M A H F X R B T A  
 G M A U V N R F N W U O Z W C  
 S S O L A C I T R E V H S C K

BACKHAND  
 CARBURIZING  
 CYLINDER  
 FILLER  
 FLASHBACK  
 FOREHAND  
 GOGGLES  
 HORIZONTAL  
 NEUTRAL  
 OXIDIZING  
 OXYACETYLENE  
 PUDDLING  
 TORCH  
 VERTICAL  
 WHMIS

Do it!

### Getting the Feel of the Torch

**What You Need:** Gauge material, Oxyacetylene unit, Steel filler, Gloves, Goggles

1. Practice puddle lines on gauge material to get your hand/eye coordination and comfort levels up before welding joints. This is basic fusion welding.

### Weld Positions

**What You Need:** Gauge material, Oxyacetylene unit, Steel filler, Gloves, Goggles

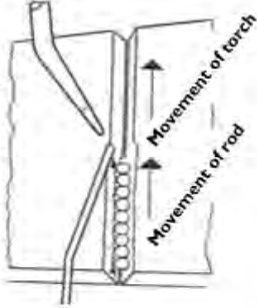
1. Observe your leader demonstrate forehand and backhand methods of horizontal welding and using the filler rod to show how to run a bead.
2. Practice the weld positions until you feel confident in doing them.

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# DISCOVER

## In the Member Manual

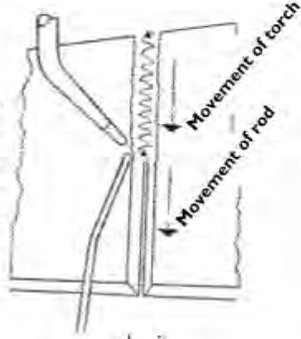
Backhand Welding



Backhand welding moves \_\_\_\_\_  
to \_\_\_\_\_

# DISCOVER

Forehand Welding



Forehand welding moves \_\_\_\_\_  
to \_\_\_\_\_

### Dig it!

I am better at \_\_\_\_\_ welding.

**How Did it Go?**  
Why should you be comfortable working with all three of the basic welding positions?  
  
Write down any other thoughts, comments, questions, and what you have learned in this builder.



### Welding on the Web

This site has a variety of videos on all kinds of welding, that you might find helpful. Use a search engine for "oxyacetylene welding video" or look at [www.tonywelding.com/](http://www.tonywelding.com/)

### What's next?

Hopefully you are now comfortable working with the three basic weld positions. In the next builder you will put the experience you have just gained to good use as you practice making the five basic welding joints.

# Skill Builder 4: Basic Welding Joints

## Skills Checklist

- Identify and be able to weld the five basic joints - Lap, Tee, Butt, Edge, and Corner
- Identify basic factors for creating a quality weld
- Clean tips
- Understand basic trouble shooting



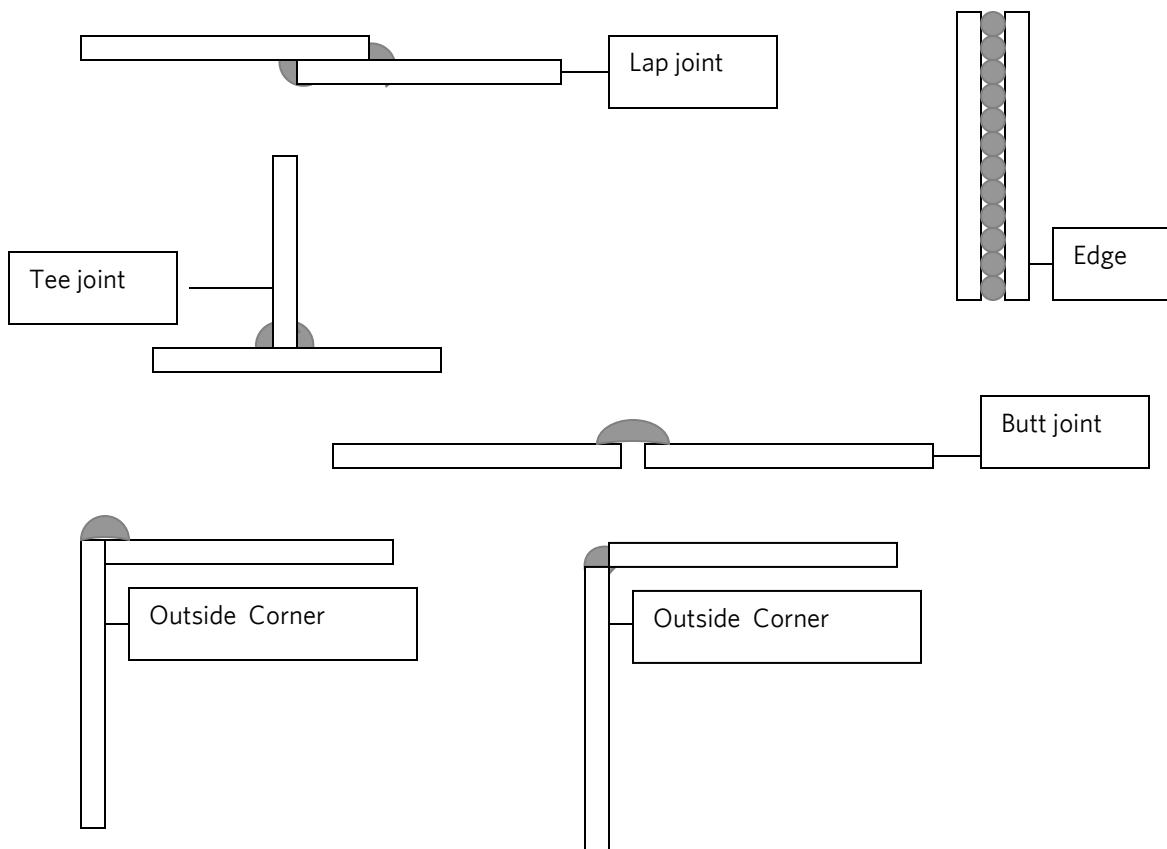
## Dream it!

### Background for Leaders

#### Basic Welding Joints

There are numerous joints and variations that you will need to weld. However, most come from five basic joints. These joints are:

- Butt joint - the most common joint with two edges butt up against each other
- Corner joint- when the two edges are at 90 degrees to each other
- Tee joint - when the edges come together - one horizontal and one vertical to make a "T"
- Edge joint- when two faces are welded together to form an edge
- Lap joint - when two faces overlap and are joined at the seam

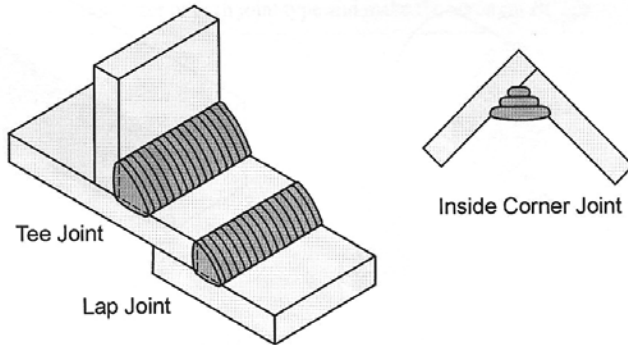
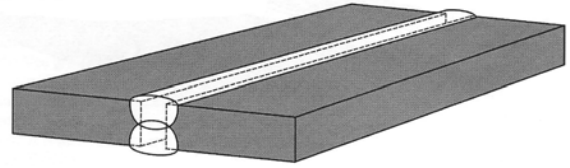


## DISCOVER

### Basic Weld Types

The two most common types of weld used in oxyacetylene welding are:

**Groove** - The groove weld is used mainly for the butt joint and can be used in the edge joint. Basically, you leave a space between your two pieces of metal that you are welding in a butt joint and fill it with a bead of weld.



**Fillet** - The fillet weld is generally a layer of weld to fill in corners created in joints. The weld looks like a triangular shape. It is most commonly used on lap, tee and corner joints.

### Braze Welding

This is a weld done with a brass-brazing rod. The brazing rod is coated with a flux on the outside of the rod or a brass rod can be dipped into a can of flux coating it as you go. Brazing is used on broken castings such as engine manifolds, thin or delicate metals and it will join galvanized metals better than gas welding. When brazing the metal, the metal should not be melted. It should be heated more to a dull red color and the brazing rod should be dipped in to it. The torch should be held about two inches (5 cm) from the metal. You will know when the area is hot enough as the braze will flow evenly. If metal is too hot, the braze will spread out over a wide area and white smoke will be given off. Materials to be brazed should be cleaned with a wire brush removing all rust and paint. Brazing, when done right, will be as strong as welding.

### Perfecting the Weld

There are several factors that impact on the quality of your weld. These factors include:

- Tip size
- Flame size
- Torch or rod angle
- Speed and method of torch movement
- Rod size
- Preparation of metal
- Distance between torch and work
- Maintenance of equipment

When you take all of the factors into consideration, the result is a high quality weld.





**Tip and rod size:** You need to select the proper tip size for the job to get the correct heat for the metal being welded. Experience and experimenting is the best teacher here. Some general guidelines include:

- Tips need to be selected to match the size of filler rod used and the thickness of the gauge metal being welded. The larger the filler rod, the thicker the metal, the higher the number of tip to be used.
- As a basic rule of thumb, choose a rod size that is the same thickness as the metal that you are welding.
- Tip sizes 3, 5 and 7 are common sizes to use for steel between 1/16" (1.6 mm) and 1/8" (3.2 mm) thick.

**Flame size:** If the puddle is not moving properly, it may be your tip size or it may mean you need to adjust your torch valve settings slightly. Remember that you also need to have the torch set for the correct flame type - usually neutral.

**Preparation of metal:** Metal should be free of rust, grease, oil and paint. Use a grinder or wire brush to remove rust or paint. Anything that has had oil or grease on it should be avoided as it is potentially toxic and flammable when heated.

**Torch or rod angle:** The angle between the torch flame and the steel helps you to move the weld puddle where you want it. Change the angle that you are working from until you find the angle that works best.

**Distance between torch and work:** The closer you hold the torch to your work, the more heat is created. The greater heat increases the depth of penetration of the weld and makes the weld puddle narrower.

**Speed and method of torch movement:** Slower speed will make a wider weld with a deeper penetration. The object is to get a flat weld. To achieve that you may need some slight back and forth or oval motions with the torch. A steady, even speed and movement is important to achieving a quality weld.

**Maintenance of equipment:** If your tip becomes plugged, the flame will go sideways and splutter or go out. You need to be sure that your tips are kept clean with a tip cleaner.

#### Troubleshooting Guide

Problem	Cause	Solution
Backfire: Produces a whistling noise and the torch handle gets hot	Flame is being sucked into the torch. This may be caused by: <ul style="list-style-type: none"><li>• a spark from the metal going up the tip</li><li>• the tip being clogged</li><li>• the pressures being too low.</li></ul>	<ul style="list-style-type: none"><li>• clean the tip</li><li>• adjust the pressures</li><li>• cool down the torch</li></ul>
Flashback: Popping noises during operation	This is very serious and is actually a series of explosions in the gas line usually caused by: <ul style="list-style-type: none"><li>• very unequal pressures between the two gases</li><li>• clogged tips</li></ul>	<ul style="list-style-type: none"><li>• be sure your equipment has flashback arrestors</li><li>• clean your tips</li><li>• adjust your pressures</li><li>• cool down the torch</li></ul>

## Important Words

Help members define the following words and look for members using this vocabulary in their discussions



### DISCOVER

Edge joint	Two faces are welded together.
Corner joint	Two edges form a right angle and are welded together.
Tee joint	Two edges meet perpendicularly and the one is welded on both sides to the other.

Butt joint	The simplest and weakest joint where two ends meet each other and are welded.
Groove	Used for a butt joint and edge joint, fills in the space in between the two pieces of metal.
Fillet	A layered weld in a corner that resembles a triangle. Used for lap, tee and corner joints.
Backfire	The momentary retrogression of the flame into the torch tip. The user hears a "pop," and the flame is extinguished.
Flashback	Momentary or sustained retrogression of the flame upstream of the mixer, usually in the torch or hoses.

### Age Considerations

- Ages 15 and up

### Thinking Ahead

- What will you discuss with members? Gather observations and think of examples that will help support your discussion.

### Preparing for Success

- Linking back to the Skills Checklist, help members identify how they will know they have been successful in their learning in this builder. Discuss what success in these activities might look like, sound like, or feel like.

### Activating Strategies

- Have the members take a look around the shop and find an example of each joint weld. They should write it down beside the picture. Picnic tables, gates and signs might be good things to have nearby.

## Do it!

### Corner and Edge joints

Time Required: 1 hour

#### Equipment/Supplies

- Gauge material
- Steel filler rod
- Oxyacetylene unit
- Gloves
- Goggles

#### Instructions

1. Take some gauge material and show the members the basic design for the corner and edge joints. The corner and edge joints can be welded with or without filler.
2. Have the member work on these joints until they have some success.
3. Have the members label and save their best samples.

## Butt, Lap and Tee joints

Time Required: 1 hour

### Equipment/Supplies

- Gauge material
- Oxyacetylene unit
- Goggles
- Steel filler rods
- Gloves

### Instructions

1. Take some gauge material and show the members the basic design for the butt and tee joints. The butt and tee joints are best welded with filler.
2. Have the members work on these joints until they have some success.
3. Have the members label and save their best samples.

## Braze Welding (Optional)

Time Required: 1 hour

### Equipment/Supplies

- Gauge material
- Oxyacetylene unit
- Goggles
- Braze filler rods and/or flux
- Gloves

### Instructions:

1. Once you feel the members have reached their goals in welding with steel filler, you could demonstrate and explain braze welding.
2. Have them run some braze filler stringers on gauge material.
3. When they have gained good heat control/timing etc. of using braze filler, you could demonstrate and have them setup and braze lap and tee joints with gauge material.
4. Have the members label and save their best samples.

## Creating a Quality Weld

Time Required: 1 hour

### Equipment/Supplies

- Gauge material
- Oxyacetylene unit
- Goggles
- Filler rods
- Gloves

### Instructions:

1. After reviewing all the factors, have the members practice considering the different factors that can impact on their weld quality.
2. Have the members evaluate their welds.



## Cleaning Tips

Time Required: 15 minutes

### Equipment/Supplies

- Tips
- Tip cleaner

**DISCOVER**

### Instructions:

1. Demonstrate how to clean the tips.
2. Discuss why it is important to keep your tips clean.
3. Have members practice by cleaning a tip.

### **Dig it!**

To help members reflect on their learning and apply what they know, ask them the following questions:

- How did it feel to do the activities in this builder?
- What did you learn?
- How would you teach someone how to make basic welding joints?

Have members attach a picture of them doing something from this builder. They should also begin to collect different samples of their work and place it into a box.

### What's next?

In the next builder members will get a chance at using a different kind of torch — a cutting torch. Ask them if they think the setup, lighting, and operation of a cutting torch might be different than the welding torch and why?

### **Leader's Notes**





# In the Member Manual

## Skill Builder 4: Basic Welding Joints

There are numerous joints and variations that you will need to weld. However, most come from five basic joints. These joints are:

- Butt joint - the most common joint with two edges butt up against each other
- Corner joint- when the two edges are at 90 degrees to each other
- Tee joint - when the edges come together - one horizontal and one vertical to make a "T"
- Edge joint- when two faces are welded together to form an edge
- Lap joint - when two faces overlap and are joined at the seam

### DISCOVER



### SKILLS CHECKLIST

- Identify and be able to weld the five basic joints - Lap, Tee, Butt, Edge, and Corner
- Identify basic factors for creating a quality weld
- Clean tips
- Understand basic trouble shooting

### Important words

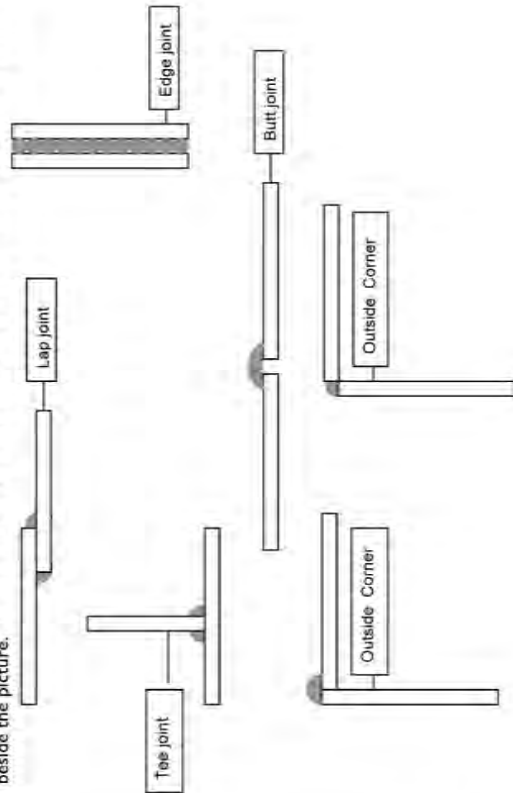
Watch for these important words throughout this builder:  
**Butt joint, Corner joint, Tee joint, Edge joint, Groove, Fillet, Backfire, Flashback**



### Dream it!

#### Basic Welding Joints

Take a look around your welding shop. Can you find an example of each of these? Write it down beside the picture.



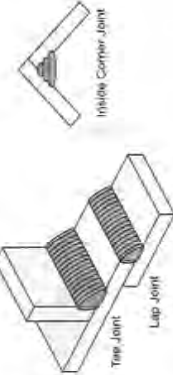
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### DISCOVER



**Fillet** - The fillet weld is generally a layer of weld to fill in corners created in joints. The weld looks like a triangular shape. It is most commonly used on lap, tee and corner joints.

#### Perfecting the Weld

There are several factors that impact on the quality of your weld. These factors include:

- Tip size
- Rod size
- Flame size
- Preparation of metal
- Torch or rod angle
- Distance between torch and work
- Speed and method of torch movement
- Maintenance of equipment



When you take all of the factors into consideration, the result is a high quality weld.

**Tip and rod size:** You need to select the proper tip size for the job to get the correct heat for the metal being welded. Experience and experimenting is the best teacher here. Some general guidelines include:

- Tips need to be selected to match the size of filler rod used and the thickness of the metal being welded. The larger the filler rod, the thicker the metal, the higher the number of tip to be used.
- As a basic rule of thumb, choose a rod size that is the same thickness as the metal that you are welding.
- Tip sizes 3, 5 and 7 are common sizes to use for steel between 1/16" (1.6 mm) and 1/8" (3.2 mm) thick.

**Flame size:** If the puddle is not moving properly, it may be your tip size or it may mean you need to adjust your torch valve settings slightly. Remember that you also need to have the torch set for the correct flame type - usually neutral.

# In the Member Manual

**Preparation of metal:** Metal should be free of rust, grease, oil and paint. Use a grinder or wire brush to remove rust or paint. Anything that has had oil or grease on it should be avoided as it is potentially toxic and flammable when heated.

**Torch or rod angle:** The angle between the torch flame and the steel helps you to move the weld puddle where you want it. Change the angle that you are working from until you find the angle that works best.

**Distance between torch and work:** The closer you hold the torch to your work, the more heat is created. The greater heat increases the depth of penetration of the weld and makes the weld puddle narrower.

**Speed and method of torch movement:** Slower speed will make a wider weld with a deeper penetration. The object is to get a flat weld. To achieve that you may need some slight back and forth or oval motions with the torch. A steady, even speed and movement is important to achieving a quality weld.

**Maintenance of equipment:** If your tip becomes plugged, the flame will go sideways and splutter or go out. You need to be sure that your tips are kept clean with a tip cleaner.

The tip wears, becomes blackened, and pitted as you work with it. The tip-cleaning tool has a flat file that you can use to file the tip flat again. The cleaning tool has tip cleaners for each size of tip. Be sure to use the right size of cleaner for the tip you are cleaning as you may damage it. Be very careful when using these cleaners as they can break off inside the tip.



## Troubleshooting Guide

Problem	Cause	Solution
Backfire: Produces a whistling noise and the torch handle gets hot	Flame is being sucked into the torch. This may be caused by: <ul style="list-style-type: none"> <li>a spark from the metal going up the tip</li> <li>the tip being clogged</li> <li>the pressures being too low.</li> </ul>	<ul style="list-style-type: none"> <li>clean the tip</li> <li>adjust the pressures</li> <li>cool down the torch</li> </ul>
Flashback: Popping noises during operation	This is very serious and is actually a series of explosions in the gas line usually caused by: <ul style="list-style-type: none"> <li>very unequal pressures between the two gases</li> <li>clogged tips</li> </ul>	<ul style="list-style-type: none"> <li>be sure your equipment has flashback arrestors</li> <li>clean your tips</li> <li>adjust your pressures</li> <li>cool down the torch</li> </ul>

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## Do it!

**What You Need:** Gauge material, Steel filler rod, Oxyacetylene unit, Gloves, Goggles, Tips, Tip Cleaner

## DISCOVER

### Corner and Edge joints

1. Take some gauge material and weld the basic design for the corner and edge joints. The corner and edge joints can be welded with or without filler.
2. Work on these joints until you are successful
3. Label and save your best samples.



### Butt, Lap and Tee joints

1. Take some gauge material and weld the basic design for the butt, lap and tee joints. The butt, lap and tee joints are best welded with filler.
2. Work on these joints until you have some success.
3. Label and save your best samples.



### Creating a Quality Weld

1. After reviewing with your leader all the factors that contribute to a quality weld, do more practice on your joints
2. Evaluate your welds and select the best sample to share with others to demonstrate your skill in welding.

I find the \_\_\_\_\_ joint the easiest to do.

I find the \_\_\_\_\_ joint the hardest to do.

### Cleaning Tips

1. Watch your leader demonstrate how to clean the tips.
2. Now practice cleaning a tip.

### Welding on the Web

Want to know how welding really works? See [science.howstuffworks.com/welding.htm](http://science.howstuffworks.com/welding.htm)

### Gizmo's Fast Fact

Welding is useful in several areas of the workforce. Imagine using your welding skills:

- On the farm for maintenance
- Underwater on offshore oil rigs
- In space on the International Space Station
- To create custom signs and art

The opportunities are endless! Which would you choose?



CANADA  
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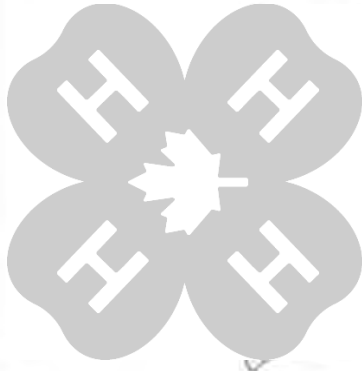
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# In the Member Manual

## Dig it!

Picture This...

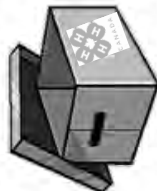
In this picture I am \_\_\_\_\_



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I want you to notice \_\_\_\_\_



### 4-H Storage box

Make sure you save your welding samples. Getting a box to store your samples in helps keep them organized and safe.

Your 4-H storage box can now include labelled samples of (check as you complete):

- \_\_\_\_\_ forehand weld    \_\_\_\_\_ backhand weld    \_\_\_\_\_ lap joint
- \_\_\_\_\_ tee joint    \_\_\_\_\_ butt joint    \_\_\_\_\_ edge joint
- \_\_\_\_\_ corner joint    \_\_\_\_\_ quality weld    \_\_\_\_\_ guided cut (next builder)
- \_\_\_\_\_ circle cut (optional in next builder)    \_\_\_\_\_ freehand cut (next builder)

### What's next?

In the next builder you will get a chance at using a different kind of torch - a cutting torch. Do you think the setup, lighting, and operation of a cutting torch might be any different than the welding torch?





# Skill Builder 5: Using the Cutting Torch

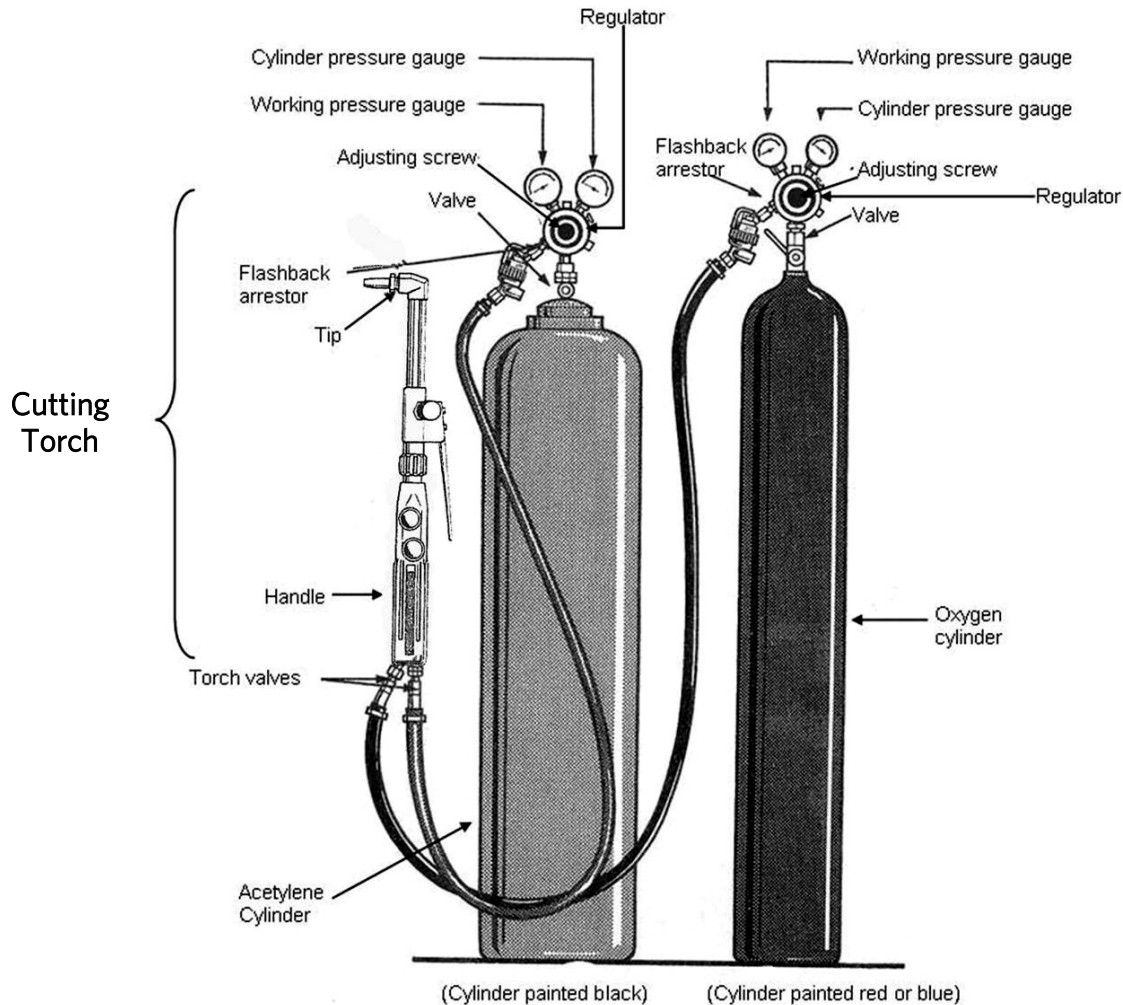
## DISCOVER

### Skills Checklist

- Set up a cutting torch
- Make straight and shaped cuts

## Dream it!

### Background for Leaders



### Using a Cutting Torch

The cutting torch attachment is a very important and widely used tool when it comes to oxyacetylene outfits. Most farmers will tell you that the cutting attachment is almost always set up on their torch. The attachment can be used for both straight heating and for cutting metals of various thicknesses. The attachment works by producing a fast pre-heat system and the induction of a stream of pure oxygen. Having a number of smaller neutral oxyacetylene flames (usually 6) around the center hole of the tip creates the pre-heat. Once these pre-heat flames have gotten the metal hot enough, the operator presses down on a lever that lets higher-pressure oxygen flow through the center hole and cut through the metal.



## Setting up the torch

To set up the torch for cutting, simply remove the welding tip and replace it with the cutting attachment. When installing the attachment, the nut should be hand tightened only. You can damage the rubber "O" rings if you over tighten by using a wrench. The rings are there to keep the gasses separated and to prevent gas leaking at the joint.

DISCOVER

The most common cutting attachment for combination oxyacetylene outfits will have an extra adjustable oxygen valve along with the oxygen release lever. This requires us to modify the way we set up and light the torch. Once the attachment is installed, the oxygen valve on the torch body can be opened all the way. This allows the full amount of line pressure to make its way to the oxygen release lever on the cutting attachment. We can light the torch the same way as before, but in order to add oxygen to the acetylene flame we have to use the adjustable oxygen valve on the cutting attachment. A neutral flame will have all of the inner flame cones at equal lengths and sizes.

The flow pressures that we set on the oxygen and acetylene regulators will have to be changed when using the cutting attachment. For general cutting operations, a common pressure of 3- 5 p.s.i. acetylene and 25 - 35 p.s.i. oxygen will work. If the cutting tip is clean and working properly, this will allow you to cut regular steel up to 3/8 inch (10mm) thick. If the material is thicker, you may need to increase the oxygen pressure or tip size.



Too much acetylene



Too much oxygen



Correct blend

## Producing a Clean Cut

Make sure you guide your members the first time they go through the process of changing the torch from a welding tip to a cutting attachment and the first few times of lighting and adjusting the cutting torch. The cutting process is not difficult but it does take a considerable amount of time and practice to become good at it.

The basic process requires you to use the pre-heat flames to heat a starting area of the material you want to cut till it reaches the right temperature. Hold the flames close to the metal and wait for the material to turn bright red. This indicates that the right temperature has been reached. Once this temperature has been reached, you can press down on the oxygen release lever and then slowly move in the direction that you wish to cut. If you move too fast in that direction the cutting process will stop. You will have to let go of the lever and put the pre-heat flames back to where the process stopped and wait till you see the material turn red once again before continuing.

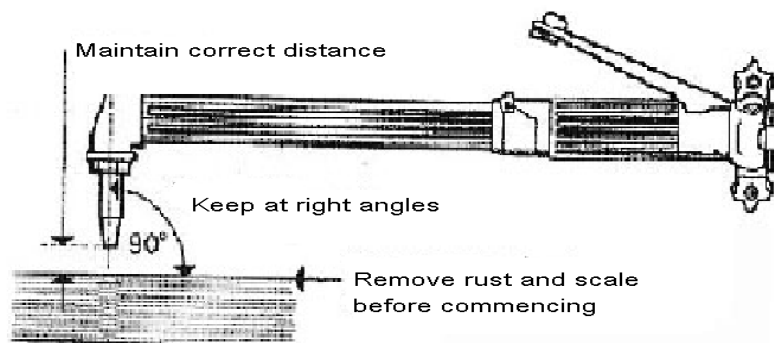
## DISCOVER

A common error made by beginners is getting the pre-heat flames too close to the material when cutting. If the material is hot enough and your travel speed is correct the tips of the flames should be 1/8 inch (3mm) away from the material. You do not want to get too close as you will plug your cutting tip with slag or smother your flame.

The torch tip should be kept perpendicular to the material in most cutting situations. The angle on which you hold the cutting torch will vary according to how thick the material to be cut is and whether you are cutting in a straight line or in a shape. Selecting the correct tip size for the thickness of the material you are cutting is, also, important.

Another difficulty is following the line you want to cut. To help with keeping a straight line, it is a good idea to clamp a straight piece of iron down the line you want to cut (slightly offside to allow for the width of the cutting tip). This will help guide the operator as s/he cuts. When you are cutting shapes, mark the line with chalk. Then use a center punch to punch holes all along the line. This gives you a guide to follow when cutting.

As always, safety is a priority. Slag and hot pieces of metal fly when cutting. Be sure the members are wearing goggles, gloves and protective gear. Make sure hot metal and slag are being deposited on metal to avoid risk of fire or damaging shop floors.



### Important Words

Here are some examples of how to use the "important words" to increase the members understanding:

- Ask members to form a mental image of the new word.
- Get members to use a dictionary and show them the range of information it provides.
- Have members describe (rather than define) the new word in terms of their experiences.

Cutting torch	Heats metal by the flame and once the correct temperature is attained, oxygen is supplied to the heated parts. This reacts with the metal, forming iron oxide and producing heat (which continues the cutting process).
O-ring	A flat ring made of rubber or plastic, used as a gasket.
Slag	The cruddy matter left over after a cutting torch passes through. Can be scraped off or filed down for a smooth finish.

### Age Considerations

- Ages 15 and up

## Thinking Ahead

- What will you discuss with members? Gather observations and think of examples that will help support your discussion.

## Preparing for Success

- Linking back to the Skills Checklist, help members identify how they will know they have been successful in their learning in this builder. Discuss what success in these activities might look like, sound like, or feel like.

## Activating Strategies

- How do you think the cutting torch works?
- What kinds of things do you think farmers would use the cutting torch on?

Have the members fill out what they can in the compare/contrast boxes. They can complete the rest during the Dig it! portion of this builder. A suggested final answer is included under Dig it!

## Do it!

### Setting up the Cutting Torch

Time Required: 1/2 hour

#### Equipment/Supplies

- Cutting torch
- Oxyacetylene unit
- Goggles
- Gauge material
- Gloves

#### Instructions:

1. With close guidance to start with, have your members switch from a welding tip to a cutting torch attachment. If your attachment has a separate oxygen flow valve, explain the different process in lighting and neutral flame adjustment.
2. Have him/her adjust the oxygen regulator for a flow pressure of about 25 to 30 p.s.i. for cutting material up to 3/8 inch thick.

### Using the Cutting Torch

Time Required: 1 hour

#### Equipment/Supplies

- Cutting torch
- Oxyacetylene unit
- Goggles
- Gauge material
- Gloves

#### Instructions:

1. Explain and demonstrate tip distance, travel speed, tip angle, etc.,
2. Start the members with cutting on 3/16 or 1/4 inch plate using a straight edge guide.
3. After some practice, have them move on to free hand cutting.





## Complex Cutting

Time Required: 1/2 hour

### Equipment/Supplies

- Cutting torch
- Oxyacetylene unit
- Goggles
- Different gauges of material
  - Gloves

### Instructions:

1. Challenge the members to move on to more complex cutting such as circles. Have them experiment with cutting different gauges of material.

## Cleaning Tips

Time Required: 10 minutes

### Equipment/Supplies

- Tip cleaner
- Cold cutting torch

### Instructions:

1. Demonstrate to the members how the cutting tips get clogged and pitted. Show them how this can affect cutting quality of the tip.
2. Use the cleaning tool file and tip cleaners to show them how you clean up the tips.

## Dig it!

To help members reflect on their learning and apply what they know, ask them the following questions:

- What surprised you about the oxyacetylene torch?
- What did you learn?
- How could the things you learned in this builder be used to help you in other situations?

Have the members complete the compare/contrast chart. One answer might be:

Compare (are alike)	Contrast (are different)	
Both Welding and Cutting Torch	Welding Torch Only	Cutting Torch Only
Alters metals Used in the shops Require oxygen Require acetylene	One or Two pipes to nozzle Joins metals Nozzle is at 75 degrees 8-10 p.s.i. oxygen flow	Three pipes to nozzle Cuts metals Nozzle is at a right angle 25-35 p.s.i. oxygen flow

### What's next?

Members should now have a good understanding of welding and be comfortable using the oxyacetylene unit. Next up is the final builder where members will have the choice of building a tool box or coming up with and creating their own welding project idea. Discuss with members what they might like to build and have them list the materials required.



# In the Member Manual

## Skill Builder 5: Using the Cutting Torch



Gizmo says...

The cutting torch attachment is a very important and widely used tool when it comes to oxyacetylene outfits. Most farmers will tell you that the cutting attachment is almost always set up on their torch.

DISCOVER



### Important words

Watch for these important words throughout this builder: **Cutting torch, "O" rings, slag**

### SKILLS CHECKLIST

- Set up a cutting torch
- Make straight and shaped cuts

### Dream it!

Begin filling this table in now and finish during Dig it! Consider things like set up, lighting, and function.

Compare (are alike)	Contrast (are different)
Both Welding and Cutting Torch	Welding Torch Only      Cutting Torch Only

### Using a Cutting Torch

The attachment can be used for both straight heating and for cutting metals of various thicknesses. The attachment works by producing a fast pre-heat system and a stream of pure oxygen. Having a number of smaller neutral flames (usually 6) around the center hole of the tip creates the pre-heat. Once these pre-heat flames have gotten the metal hot enough, the operator presses down on a lever that lets higher-pressure oxygen flow through the center hole and cut through the metal.

### Setting up torch

To set up the torch for cutting, simply remove the welding tip and replace it with the cutting attachment. When installing the attachment, the nut **should be hand tightened only**. You can damage the rubber "O" rings if you over tighten by using a wrench. The rings are there to keep the gases separated and to prevent gas leaking at the joint.

The most common cutting attachment for combination oxyacetylene outfits will have an extra adjustable oxygen valve along with the oxygen release lever. This requires us to modify the way we set up and light the torch. Once the attachment is installed, the oxygen valve on the torch body can be opened all the way. This allows the full amount of line pressure to make its way to the oxygen release lever on the cutting attachment. We can light the torch the same way as before, but in order to add oxygen to the acetylene flame we have to use the adjustable oxygen valve on the cutting attachment. A neutral flame will have all of the inner flame cones at equal lengths and sizes.

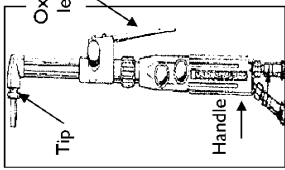
## Leader's Notes



DISCOVER

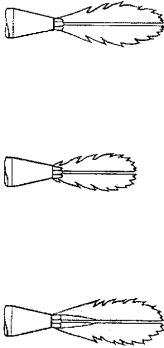
# In the Member Manual

## Cutting Torch



DISCOVER

## Cutting Torch Flame



The flow pressures that we set on the oxygen and acetylene regulators will have to be changed when using the cutting attachment. For general cutting operations, a common pressure of 3 - 5 p.s.i. acetylene and 25 - 35 p.s.i. oxygen will work. If the cutting tip is clean and working properly, this will allow you to cut regular steel up to 3/8 inch (10mm) thick. If the material is thicker, you may need to increase the oxygen pressure or tip size.

### Producing a Clean Cut

The cutting process is not difficult but it does take a considerable amount of time and practice to become good at it. The basic process requires you to use the pre-heat flames to heat a starting area of the material you want to cut until it reaches the right temperature. Hold the flames close to the metal and wait for the material to turn bright red. This indicates that the right temperature has been reached. Once this temperature has been reached, you can press down on the oxygen release lever and then slowly move in the direction that you wish to cut. If you move too fast in that direction the cutting process will stop. You will have to let go of the lever and put the pre-heat flames back to where the process stopped and wait till you see the material turn red once again before continuing.

A common error made by beginners is getting the pre-heat flames too close to the material when cutting. If the material is hot enough and your travel speed is correct, the tips of the flames should be 1/8 inch (3mm) away from the material. You do not want to get too close as you will plug your cutting tip with slag or smother your flame.

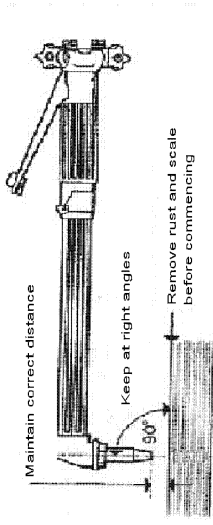
The torch tip should be kept at a right angle to the material in most cutting situations. The angle on which you hold the cutting torch will vary according to how thick the material to be cut is and whether you are cutting in a straight line or in a shape. Selecting the correct tip size for the thickness of the material you are cutting is also important.

Another difficulty is following the line you want to cut. To help with keeping a straight line, it is a good idea to clamp a straight piece of iron down the line you want to cut (slightly offside to allow for the width of the cutting tip). This will help guide the operator as she/he cuts. When you are cutting shapes, mark the line with chalk. Then use a center punch to punch holes all along the line. This gives you a guide to follow when cutting.

### Welding on the Web

Apprenticeship is post-secondary training that leads to certification as a journeyperson in a skilled trade. A difference from other forms of education is as an apprentice YOU GET PAID to learn. Most trade programs take 2-4 years to complete and they combine approximately 80% paid-on-the-job training with 20% technical/in-school learning. Do some research on: [www.gov.mb.ca/tce/apprent/index.html](http://www.gov.mb.ca/tce/apprent/index.html)

## Using the Cutting Torch



DISCOVER

**As always, safety is a priority.** Slag and hot pieces of metal fly when cutting. Be sure you are wearing goggles, gloves and protective gear. Make sure hot metal and slag are being deposited on metal to avoid the risk of fire or damaging shop floors.

### Do it!

**What You Need:** Cutting torch, Gauge material, Oxyacetylene unit, Gloves, Goggles

### Setting up & Using the Cutting Torch

1. With your leader's guidance, switch from a welding tip to a cutting torch attachment. Light the torch and adjust flame to neutral.
2. Adjust the oxygen regulator for a flow pressure of about 25 to 30 p.s.i. for cutting material up to 3/8 inch thick.
3. Start with cutting on a 3/16 or 1/4 inch plate using a straight edge guide.
4. After some practice try free hand cutting.
5. When you are done clean the cutting tip with the cleaning tool file and tip cleaner.

### Dig it!

Head back to page 23 and finish filling out the Compare/Contrast chart now that you know about the cutting torch.

### How Did it Go?

Write down any thoughts, comments, questions, and what you have learned in this builder.

### What's next?

You should now have a good understanding of welding and be comfortable using the oxyacetylene unit. Next up is the final builder where you will have the choice of building a tool box or coming up with and creating your own welding project idea. Think about what you would like to build and discuss it with your leader.

# Skill Builder 6: Putting It All Together

## Skills Checklist

- Plan and complete a project



## Dream it!

### Background for Leaders

Members need to select and create a project using the skills that they have acquired in this project manual. Their project should use oxyacetylene welding and cutting torch techniques to build. You may wish to have the members do the same project or you can choose to accommodate each member by allowing them to select different projects.

One project that suits the learning accomplished is a toolbox. A basic pattern and instructions follows. The members and yourself are free to select any other project you wish. Project selection will be dependent on skill level progression of members, available materials, costs and searching for patterns or projects.

### Important Words

Help members define the following words and look for members using this vocabulary in their discussions. Ask for sentences that "show you know." When members construct novel sentences they confirm their understanding of a new word. Have members use as many terms per sentence to show that connections are useful. Members can also create impromptu speeches using these

Blueprints	A comprehensive plan of action(s).
Evaluation	Used to improve learning, checks if goals have been met. Assessment examines the whole process whereas evaluation just looks at the end product.

terms.

### Age Considerations

- Ages 15 and up

### Thinking Ahead

- What will you discuss with members? Gather observations and think of examples that will help support your discussion.

### Preparing for Success

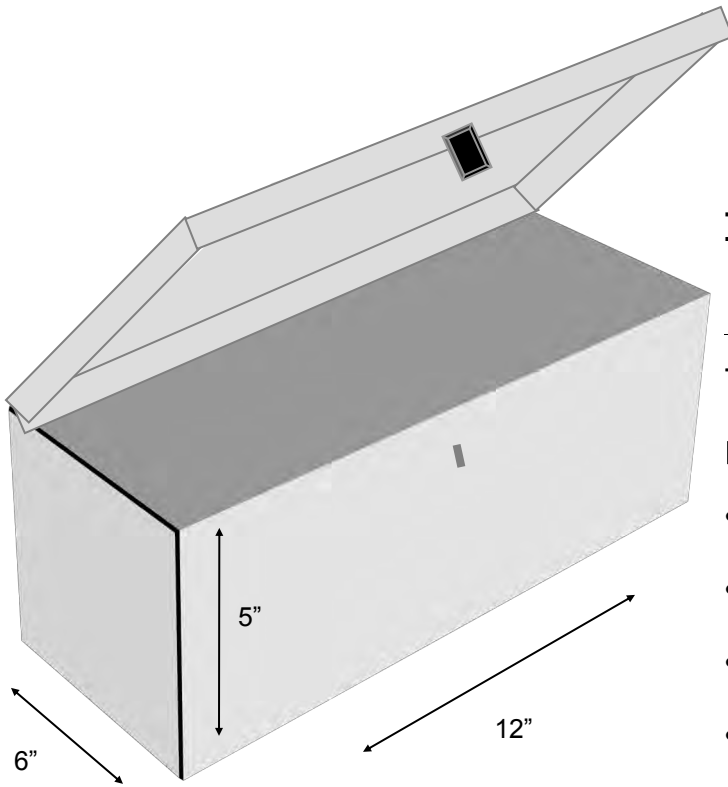
- Linking back to the Skills Checklist, help members identify how they will know they have been successful in learning from this builder. Discuss what success in these activities might look like, sound like, or feel like.

### Activating Strategies

- What are two different things the members can think of that they would like to weld? Have them quickly draw and describe these. They can be anything from a pencil case to a silo.

## DISCOVER

Now the members need to choose to design and build one of their two choices or a toolbox. The member should choose something SMART (specific, measureable, achievable, realistic, and timely). If they are thinking of a 20 foot sculpture that will take them 500 hours to make, that is probably not a good choice for this project. Ensure the members clear their ideas and plans with you before construction begins. If the members choose the tool box, they will follow the instructions below. If not they need to make a list of supplies, instructions, and draw a detailed diagram.



### Do it!

#### Basic Toolbox

Time Required: 2 hours

#### Equipment/Supplies

- 2 pieces of 18" x 6" x 1/16" (45 cm x 15 cm x 1.6 mm) flat plate (sides)
- 1 piece of 12" x 6" x 1/16" (30 cm x 15 cm x 1.6 mm) flat plate (bottom)
- 1 piece of 12 1/4" x 6 1/4" x 1/16" (30.5 cm x 15.5 cm x 1.6 mm) flat plate (lid)
- 1 piece of 1" x 24 3/4" x 1/16" (2.5 cm x 61.5 cm x 1.6 mm) (lid surround)
- 1 metal gate handle (or make your own handle)
- 1 -12" heavy duty piano hinge or 2 door hinges
- 1 clasp

#### Instructions:

1. Bend the first 2 -18" (45 cm) pieces at 6" (15 cm) to right angle.
2. Weld the 2 corner seams of the sides together to form a rectangular box.
3. Weld the 12" x 6" piece (30 cm x 15 cm) on to the bottom.
4. Bend the lid surround - the 1" x 24 3/4" (2.5 cm x 61.5 cm) piece to form three sides. Bends need to be at right angles at 6 1/4" (15.5 cm)
5. Weld the surround to the lid plate - the 12 1/4" x 6 1/4" (30.5 cm x 15.5 cm) piece.
6. Weld the hinge(s) on the back side for smooth movement of the lid.
7. Weld on the handle and clasp.

Encourage members to be proud of their workmanship. They can spray paint it if they like with a metal rust paint.



## Select A Project

### Materials/Supplies

- Possible project ideas
- Oxyacetylene unit
- Project supplies
- Goggles
- Member Manual
  - Cutting torch
- Gloves



### Instructions:

#### A. The Plan

1. Have members' search for project ideas. Their project should use oxyacetylene welding and cutting torch techniques to build. Possible places to search are the project outlined in this manual, the internet, welders, magazines, etc.
2. Have members develop a blue print of their project and a supplies list. Have members gather supplies before the meeting.

#### B. The Project

1. Support the members in building the project in a manner that builds skills and confidence while creating a quality product in a safe environment.

#### C. The Evaluation

1. Have the members evaluate their project by completing the Project Evaluation chart in their Member's Manual.

## **Dig it!**

To help members reflect on their learning and apply what they know, ask them the following questions:

- What did you like best about this project?
- What do you feel you need to work on to be an excellent welder?
- Will you use the skills you have learned to do more welding in the future?

Have them include a picture in their members' manual that depicts some step of their project from this builder.

### **Leader's Notes**



# In the Member Manual

## Skill Builder 6: Select a Project

Gizmo says...

So far you have learned a lot about oxyacetylene welding and cutting. In this last builder you will now select and create a project using the skills you have acquired using oxyacetylene welding and cutting torch techniques.



### Important words

Watch for these important words throughout this builder: **Blueprints, Evaluation**




### SKILLS CHECKLIST

- Plan and complete a project



### Dream it!

What are two things you could design and weld? Quickly sketch and describe them below.



You have a choice of making a basic toolbox or choosing one of your designs. If you decide to choose your own project, clear it with your leader. You will need to fill in the blueprint on the next page. If you chose to make the toolbox then follow the instructions on the next page.

### What You Need:

- Possible project ideas
- Member workbook
- Oxyacetylene unit
- Cutting torch
- Welding torch
- Project supplies
- Gloves
- Goggles

### Do it!

#### Select-a-Project

- Develop a blue print of your project and a supplies list.
- Record this supply list in the chart on the next page. Make sure all supplies have been gathered before the meeting.
- With your leader's guidance build your project!
- When your project is complete fill in the project assessment chart on the last page of this builder.

Blueprint for:

Instructions

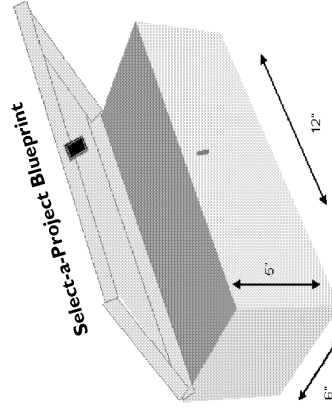
Supply List

Diagrams



### What You Need:

- 2 pieces of 18" x 6" x 1/16" (45 cm x 15 cm x 1.6 mm) flat plate (sides)
- 1 piece of 12" x 6" x 1/16" (30 cm x 15 cm x 1.6 mm) flat plate (bottom)
- 1 piece of 12 1/4" x 6 1/4" x 1/16" (30.5 cm x 15.5 cm x 1.6 mm) flat plate (lid)
- 1 piece of 1" x 24 3/4" x 1/16" (2.5 cm x 61.5 cm x 1.6 mm) (lid surround)
- 1 metal gate handle (or make your own handle)
- 1 - 12" heavy duty piano hinge or 2 door hinges
- 1 clasp



### Basic Toolbox

- Bend the first 2 - 18" (45 cm) pieces at 6" (15 cm) to right angle.
- Weld the 2 corner seams of the sides together to form a rectangular box.
- Weld the 12" x 6" piece (30 cm x 15 cm) on to the bottom.
- Bend the lid surround - the 1" x 24 3/4" (2.5 cm x 61.5 cm) piece to form three sides. Bends need to be at right angles at 6 1/4" (15.5 cm)
- Weld the surround to the lid plate - the 12 1/4" x 6 1/4" (30.5 cm x 15.5cm) piece.
- Weld the hinge(s) on the back side for smooth movement of the lid.
- Weld on the handle and clasp.
- Spray paint your toolbox with metal rust paint if you'd like.
- Fill in the project assessment chart on the following page.

# In the Member Manual

## Dig it!

### Project Evaluation

	Yes	No
Did you use the correct material for your project?		
Are your welds of the appropriate strength?		
Is your welding uniform and smoothly rounded?		
Is your product ready to use?		

What about your project are you most proud of?

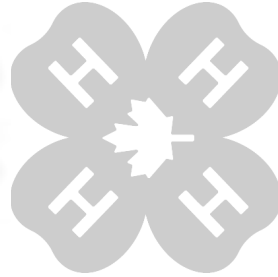
What skills do you feel you have learned?

What would you do differently if you had to make it over again?



### Picture This...

In this picture I am \_\_\_\_\_



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4-H Manitoba



I want you to notice \_\_\_\_\_

### What's Next?

Next is the Showcase Challenge! This is an opportunity to bring together and share what you have learned.

# In the Member Manual

## Showcase Challenge Bringing it all together!

Now that you have finished this project, it is time to think about how you will share your experiences and knowledge with others. You may put your new skills to work by helping at a community event or at your club Achievement or teaching others about your topic. The goal of the Showcase Challenge is to help highlight your new skills and help you understand how you can use them. It can be an opportunity to receive feedback from others on your project. So go back through your manual and find some highlights of your learning (what you are proud of) and think about how you will "showcase" it.

DISCOVER

### Dream It!

#### Here are some Showcase Challenge Suggestions:

- Demonstrate something you made or learned about
- Make a poster or display
- Make a pamphlet
- Make a computer presentation (e.g. PowerPoint)
- Give a speech
- Write a report
- Use your new skills to help with the Club Achievement plans
- Or come up with your own idea. It is up to you and your leader!

### My Showcase Challenge Plan

My showcase idea: \_\_\_\_\_

What materials and resources do I need? \_\_\_\_\_

Who do I need to help me? \_\_\_\_\_

When do I need to have things done by? \_\_\_\_\_



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### Do It!

Insert or attach your finished product or a photo of you sharing your skills in your Showcase Challenge.



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### Big It!

Now that you have showcased your project skills:

- How did your Showcase Challenge go?
- What would you do differently next time?
- How will you use your new skills in the future? (in different situations?)



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# Portfolio Page

Once members have completed all the builders they will have a lot of information recorded in their manuals. These are products of their learning. As a final project activity, members and leaders will pull together all this learning in completing the portfolio page in the Member Manual. There is a skills chart that lists the skills members are expected to complete by the end of the project. Leaders must indicate how they know the member was successful at a particular skill. Leaders will find evidence if they think about what they have observed members doing, what discussions they have had with members, and what members have produced. If leaders think that members need to go back and improve on any skill, this chart helps them clarify what needs to be done.

## **My 4-H Portfolio Page**

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Year in 4-H: \_\_\_\_\_  
 Club: \_\_\_\_\_ Hours Spent on 4-H: \_\_\_\_\_ (Project and Other 4-H Activities)



### Discovering Oxyacetylene Welding & Cutting Skills Chart

To be completed by the leader and the member based on observations and conversations throughout the project.

Skill Builder	Members will be able to... Each Builder had a Skills Checklist which identified the skill you will learn.	We know this because... Identify activities completed and record observations and information from discussions about activities.
1	<ul style="list-style-type: none"> <li>Identify basic equipment</li> <li>Understand functions of basic equipment</li> <li>Understand the safety rules for working in the shop</li> <li>Understand what safety equipment is required</li> <li>Identify WHMIS symbols and know what they mean</li> </ul>	
2	<ul style="list-style-type: none"> <li>Set up an oxyacetylene unit properly and safely</li> <li>Test an oxyacetylene unit for leaks</li> <li>Set up a welding torch for use</li> <li>Adjust the flame of a welding torch</li> <li>Shut down an oxyacetylene unit properly and safely</li> </ul>	
3	<ul style="list-style-type: none"> <li>Perform forehand and backhand horizontal welds</li> <li>Understand the difference between horizontal and vertical welds</li> </ul>	
4	<ul style="list-style-type: none"> <li>Identify and be able to weld the five basic joints</li> <li>Identify basic factors for creating a quality weld</li> <li>Clean tips</li> <li>Understand basic trouble shooting</li> </ul>	
5	<ul style="list-style-type: none"> <li>Set up a cutting torch</li> <li>Make straight and shaped cuts</li> </ul>	
6	<ul style="list-style-type: none"> <li>Plan and complete a project</li> </ul>	

Additional Comments/Activities: \_\_\_\_\_

**Leader Point of Praise!**

I am most impressed by...

I acknowledge that the member has completed the 4-H project requirements.

Leader's Signature: \_\_\_\_\_



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## Above and Beyond!

In addition to project skills, 4-H also increases skills in meeting management, communications, leadership, community involvement through participation in club, area, or provincial 4-H events or activities. List below any activities you participated in this year in 4-H.

(Some examples include Executive Positions Held, Workshops, Communication, Community Service, Rally, Bonspiels, Conferences, Judging, Camps, Trips, Awards, Representation to Area or Provincial Councils, etc)

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

\*\*Feel Free to add additional pages that include awards, certificates, new clippings, photos or other items that describe your 4-H involvement.

## Member Point of Pride!

What I learned...

What I need to improve on...

What I want others to notice...

Member's Signature: \_\_\_\_\_



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## Point of Praise! Another's perspective on your achievements in 4-H.

Community professionals, 4-H club head leaders, friends of 4-H

I am most impressed by...

I believe that you have learned...

In the future I encourage you to...

Signature: \_\_\_\_\_



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