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# **Welding 10, 20, A30, B30 Curriculum Guidelines**

**A Practical and Applied Art**

# **DRAFT**

**Saskatchewan Education  
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## Table of Contents

<b>Acknowledgements</b> .....	<b>i</b>
<b>Introduction</b> .....	<b>1</b>
<b>Philosophy and Rationale</b> .....	<b>1</b>
<b>Aim, Goals, and Foundational Objectives</b> .....	<b>1</b>
Foundational Objectives.....	2
<b>Course Components and Considerations</b> .....	<b>3</b>
Work Study .....	3
Suggested Course Configurations .....	4
Assessment and Evaluation.....	5
Module 1: Safety: General, Oxy-Acetylene Welding, and Electric Arc Welding (Core) .....	6
Module 2: Intermediate Safety (Core).....	8
Module 3: Hand Tools and Power Equipment (Core).....	9
Module 4: Intermediate Hand Tools and Power Equipment (Core).....	10
Module 5: Oxy-Acetylene Start-up, Shut-down, and Cutting (Core).....	11
Module 6: Oxy-Acetylene Cutting (Core) .....	12
Module 7A: Advanced Oxy-Acetylene Cutting (Core) .....	13
Module 7B: Advanced Oxy-Acetylene Cutting (Optional).....	13
Module 8: Oxy-Acetylene Cutting Practice (Core).....	14
Module 9: Oxy-Acetylene Welding (Core) .....	15
Module 10: Intermediate Oxy-Acetylene Welding (Core) .....	17
Module 11A: Oxy-Acetylene Welding Practical Requirements (Core) .....	18
Module 11B: Oxy-Acetylene Welding Practical Requirements (Optional).....	20
Module 12A: Advanced Oxy-Acetylene Welding Projects (Core).....	21
Module 12B: Advanced Oxy-Acetylene Welding Projects (Optional) .....	21
Module 13: Plasma Arc Cutting (Core) .....	22
Module 14: Electric Arc Welding Electrodes and Accessories (Core) .....	23
Module 15: Shielded Metal Arc Welding (S.M.A.W.) Procedures (Core).....	24
Module 16: Electric Arc Welding; Weld Faults (Core).....	26
Module 17: Electric Arc Weld Faults and Causes (Core) .....	27
Module 18A: Electric Arc Gauge Metal Welding (Core).....	28
Module 18B: Electric Arc Gauge Metal Welding (Core).....	28
Module 19: Electric Arc Welding Electrode Selection and Use (Core).....	29
Module 20A: Electric Arc Welding: Electrodes, Weld Joint, and Positions (Core) .....	30
Module 20B: Electric Arc Welding: Electrodes, Weld Joint, and Positions (Core) .....	30
Module 21A: Electric Arc Welding Assignments (Core).....	31
Module 21B, C, D: Electric Arc Welding Assignments (Optional).....	31
Module 22A: Electric Arc Welding “Vee” Butt Weld (Core) .....	32
Module 22B: Electric Arc Welding “Vee” Butt Weld (Optional) .....	32
Module 23A: Metal Inert Gas (MIG) and Electric Arc Welding Projects (Optional) .....	33
Module 23B: MIG and Electric Arc Welding Projects (Optional) .....	34
Module 23C: MIG and Electric Arc Welding Projects (Optional) .....	34
Module 24: Intermediate Projects (Optional) .....	35
Module 25A: Advanced Projects (Core) .....	36
Module 25B: Advanced Projects (Optional) .....	36
Module 26: The Nature and Production of Iron and Steel (Core).....	37
Module 27: Soldering (Optional).....	38
Module 28: Brazing (Optional).....	39
Module 29A: MIG Welding Safety and Equipment (Core).....	40
Module 29B, C, D: MIG Welding Safety and Equipment (Core) .....	40
Module 30A, B: Start-Up and Shut-Down (MIG) (Core).....	41
Module 30C, D: Start-Up and Shut-Down (MIG) (Optional) .....	41
Module 31A: MIG Procedures and Practice (Core).....	42
Module 31B, C: MIG Procedures (Optional) .....	43
Module 32: Intermediate MIG Welding (Core).....	44
Module 33A: Advanced MIG Welding (Core) .....	46
Module 33B: Advanced MIG Welding (Optional) .....	47

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Module 34A: MIG Welding (Core) .....	48
Module 34B, C: MIG Welding (Core).....	49
Module 35A: MIG Welding Practical Assignments (Optional) .....	50
Module 35B, C: MIG Welding Practical Assignments (Optional).....	50
Module 36: Introductory Projects (Core).....	51
Module 37A: Work Study Preparation and Follow-up Activities (Optional) .....	52
Module 37B, C: Work Study Preparation and Follow-up Activities (Optional).....	54
Module 38: Work Study (Optional).....	55
Module 39: Career Opportunities in Welding (Core) .....	56
<b>References .....</b>	<b>58</b>
<b>Appendix A: Determining a Trade Pathway for Students .....</b>	<b>59</b>
<b>Appendix B: Training Plan Checklists .....</b>	<b>62</b>
Training Plan - Checklist for Welding 10 .....	62
Training Plan - Checklist for Welding 20 .....	64
Training Plan - Checklist for Welding A30.....	66
Training Plan - Checklist for Welding B30.....	68
<b>Appendix C: Recordkeeping Charts .....</b>	<b>70</b>
Welding 10 .....	70
Welding 20 .....	71
Welding A30.....	72
Welding B30.....	73
<b>Appendix D: Practical Assignments for Level I.....</b>	<b>74</b>
<b>Appendix E: Assessment Checklists .....</b>	<b>81</b>
Accident Prevention Principles.....	81
MIG Welding Process Checklist .....	82



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## Introduction

Within Core Curriculum, the Practical and Applied Arts (PAA) is a major area of study that incorporates five traditional areas of Home Economics Education, Business Education, Work Experience Education/Career Education, Computer Education, and Industrial Arts Education. Saskatchewan Education, its educational partners, and other stakeholders have collaborated to complete the PAA curriculum renewal. Some PAA curriculum guidelines have been updated by integrating, adapting, or deleting some components; some Locally Developed Courses have been elevated to provincial status; and, some new guidelines have been developed.

A companion, *Practical and Applied Arts (PAA) Handbook*, provides background on Core Curriculum philosophy, perspectives, and initiatives. The Handbook describes a renewed set of goals for PAA. It presents additional information about the PAA area of study, including guidelines about work study and related transition-to-work dimensions. A *PAA Information Bulletin* provides direction for administrators and others. Lists of recommended resources from all guidelines will be compiled into a PAA Bibliography with periodic updates.

## Philosophy and Rationale

In today's rapidly changing world, the use of electric arc, oxy-acetylene, and metal inert gas (MIG) welding is ever expanding. A basic understanding of welding skills at the Secondary Level affords students an opportunity to gain experience and/or employment in the private sector. There may also be an opportunity for students who have completed courses to apply for advanced standing in a post-secondary education or training program. Students of welding may be granted time credit should they register as apprentices following high school completion. Some students may choose to study welding for personal use.

Courses in Welding are offered to:

- introduce high school students to specific life skills that have practical lifetime applications
- give students the opportunity to investigate career options
- develop specific employability skills that will facilitate entry level employment and/or participation in post-secondary training.

## Aim, Goals, and Foundational Objectives

### Aim

The aim of the Welding 10, 20, A30, B30 curriculum is to provide students with opportunities to acquire knowledge and develop skills used in the welding industry and to become familiar with career opportunities in the welding industry in Saskatchewan.

### Goals

**Applied Technology:** To develop skills using hand and power tools of the industry in electric arc, oxy-acetylene, and metal inert gas (MIG) welding procedures.

**Awareness:** To provide students with experiences and information that delineate possible career and post-secondary education and training choices in the industry.

**Communication:** To develop the ability to read welding diagrams and related technical manuals.  
To practice effective listening and communication skills.

**Health and Safety:** To develop an awareness of the responsibility and need for safe procedures that must be followed in the classroom and/or work environment.

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**Mathematics:** To provide students with the practical application of mathematical computations used in the welding industry.

**Personal Development:** To develop teamwork skills, professional ethics and behaviours, time management, and wellness skills.

**Articulation (Optional):** 1) To provide successful students with the opportunity to write the Level I examination administered by the Apprenticeship and Trade Certification Unit of Saskatchewan Post-Secondary Education and Skills Training. 2) To enable students to receive time credit towards Journey person certification upon registration as an apprentice following completion of the high school program.

## Foundational Objectives

Foundational objectives are the major, general statements that guide what each student is expected to achieve for the modules of the PAA curriculum guidelines. Foundational objectives indicate the most important knowledge, skills, attitudes/values, and abilities for a student to learn in a subject. Both the Foundational Objectives and the Common Essential Learnings (CELs) Foundational Objectives to be emphasized are stated in this document. Some of these statements may be repeated or enhanced in different modules for emphasis. Foundational Objectives include:

- To become familiar with the terms, tools, equipment, and techniques used in the welding trade.
- To understand and use terminology related to the trade.
- To demonstrate the safe and proper use and care of welding tools, materials, and equipment.
- To use appropriate safety appliances when engaged in practical activities.
- To develop effective use of tools and equipment in order to develop entry level skills in the workplace.
- To establish a systematic routine for setting up a welding workstation and for putting away materials and equipment in the workplace or school setting.
- To apply some principles of science to the welding trade.
- To introduce students to the issues surrounding safe, fair, and cooperative workplace practices including an awareness of the potential dangers to fellow workers.
- To identify and explain health and safety hazards in the workplace so that the potential for personal injury and damage to the equipment and/or the environment are minimized.
- To use critical evaluation skills in order to judge quality welding workmanship.

All of the subject and CELs Foundational Objectives are stated explicitly at the beginning of each module.

## Common Essential Learnings (CELs)

The incorporation of the Common Essential Learnings (CELs) into the instruction and assessment of the Practical and Applied Arts (PAA) curriculum offers many opportunities to develop students knowledge, skills, and abilities. The purpose of the CELs is to assist students with learning concepts, skills, and attitudes necessary to make the transition to career, work, and adult life.

The CELs also establish a link between the Transition-to-Work dimensions and the Practical and Applied Arts curriculum content. The Transition-to-Work dimensions included in the PAA courses are: apprenticeship, career development, community project(s), employability skills, entrepreneurial skills, occupational skills, personal accountability, processing of information, teamwork, and work study/education.

Throughout the PAA curricula, the CELs objectives are stated and coded as follows:

COM	=	Communication
NUM	=	Numeracy
CCT	=	Critical and Creative Thinking
TL	=	Technological Literacy
PSVS	=	Personal and Social Values and Skills
IL	=	Independent Learning

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It is anticipated that teachers will find additional ways to incorporate the CELs into their classroom instruction.

## **Course Components and Considerations**

### **Welding 10 (Core)**

Welding 10 combines introductory modules in oxy-acetylene, electric arc, and metal inert gas (MIG) welding providing students with knowledge and skills in each of the three types of welding. The curriculum guidelines use theory and practice, including a variety of practical projects that allow students to develop practical skills.

### **Welding 20 (Core)**

Welding 20 provides students with intermediate knowledge and skills in oxy-acetylene electric arc and MIG welding. Various practical projects at the intermediate level are available for use with Welding 20, enabling students to enhance practical welding skills.

### **Welding A30 (Core)**

Welding A30 provides students the opportunity to develop advanced knowledge and skills in each of oxy-acetylene, electric arc, and MIG welding. A range of advanced practical projects enable students to enhance welding knowledge and skills at the advanced level.

NOTE: Completion of Welding 10, 20, and A30 provides students with the theoretical knowledge and skills included in Level I of the Welding trade as outlined by the Apprenticeship and Trade Certification Unit of Saskatchewan Post-Secondary Education and Skills Training (SPEST).

Students who successfully complete Welding 10, 20, and A30 will be afforded the opportunity to write the Level I examination for Welding administered by the Apprenticeship and Trade Certification Unit of SPEST. For more information on trade pathways see Appendix A in this document.

### **Welding B 30 (Core)**

Welding 10, 20, and A30 are prerequisite to Welding B30. Students who have successfully completed Welding 10, 20, and A30, and who intend to pursue a career in the Welding trade may enrol in Welding B30. This course provides students with the opportunity to enhance the knowledge and perfect the skills developed in Welding 10, 20, and A30. Welding B30 provides students an opportunity to select from a variety of practical projects and to explore independent learning opportunities to advance knowledge and skills further. B30 provides students with a greater opportunity for successful completion of the Level I exam in the Welding trade. Students who are seriously considering post-secondary education or training in the Welding trades are encouraged to enrol in Welding B30.

## **Work Study**

Work Study provides the opportunity for students to practice skills, learn industry standards for quality of work, develop employability skills, explore possible career choices in the welding industry, and learn about technical equipment and procedures not available in the school setting. Refer to the Work Study Guidelines, a section of the *Practical and Applied Arts Handbook* and the *Work Experience Education Guidelines* (1989), for information on required and best practices for student preparation, employer partnerships, and teacher responsibilities.

Note: the *Work Experience Education Guidelines* are being renewed as the *Career and Work Exploration Guidelines*.

## Suggested Course Configurations

Module Code	Modules	Suggested Time (hours)
	<b>Welding 10</b>	
WELD01	Module 1: Safety: General, Oxy-Acetylene Welding, and Electric Arc Welding (Core)	6-10
WELD03	Module 3: Hand Tools and Power Equipment (Core)	2-4
WELD05	Module 5: Oxy-Acetylene Start-up, Shut-down, and Cutting (Core)	2-4
WELD09	Module 9: Oxy-Acetylene Welding (Core)	7-10
WELD11A	Module 11A: Oxy-Acetylene Welding Practical Requirements (Core)	15-20
WELD14	Module 14: Electric Arc Welding Electrodes and Accessories (Core)	3-5
WELD15	Module 15: Shielded Metal Arc Welding (S.M.A.W.) Procedures (Core)	15-20
WELD21A	Module 21A: Electric Arc Welding Assignments (Core)	8-10
WELD29A	Module 29A: MIG Welding Safety and Equipment (Core)	3-6
WELD30A	Module 30A: Start-Up and Shut-Down (MIG) (Core)	2-4
WELD36	Module 36: Introductory Projects (Core)	10-15
WELD39	Module 39: Career Opportunities in Welding (Core)	2-5
	<b>Minimum</b>	<b>100</b>
	<b>Welding 20 (Do the Core; select Options)</b>	
WELD02	Module 2: Intermediate Safety (Core)	3-5
WELD04	Module 4: Intermediate Hand Tools and Power Equipment (Core)	2-4
WELD06	Module 6: Oxy-Acetylene Cutting (Core)	5-8
WELD08	Module 8: Oxy-Acetylene Cutting Practice (Core)	35-45
WELD10	Module 10: Intermediate Oxy-Acetylene Welding (Core)	10-12
WELD11B	Module 11B: Oxy-Acetylene Welding Practical Requirements (Optional)	15-20
WELD13	Module 13: Plasma Arc Cutting (Core)	2-4
WELD16	Module 16: Electric Arc Welding; Weld Faults (Core)	2-4
WELD19	Module 19: Electric Arc Welding Electrode Selection and Use (Core)	12-15
WELD20A	Module 20A: Electric Arc Welding: Electrodes, Weld Joint, and Positions (Core)	4-6
WELD21B	Module 21B: Electric Arc Welding Assignments (Optional)	8-10
WELD23A	Module 23A: Metal Inert Gas (MIG) and Electric Arc Welding Projects (Optional)	8-12
WELD24	Module 24: Intermediate Projects (Optional)	15-20
WELD29B	Module 29B: MIG Welding Safety and Equipment (Core)	3-6
WELD30B	Module 30B: Start-Up and Shut-Down (MIG) (Core)	2
WELD31A	Module 31A: MIG Procedures and Practice (Core)	10-14
WELD32	Module 32: Intermediate MIG Welding (Core)	6-12
WELD34A	Module 34A: MIG Welding (Core)	4-6
WELD35A	Module 35A: MIG Welding Practical Assignments (Optional)	20-30
WELD37A	Module 37A: Work Study Preparation and Follow-up Activities (Optional)	5-10
WELD38A	Module 38A: Work Study (Optional)	25-50
	<b>Minimum</b>	<b>100</b>
	<b>Welding A30 (Do the Core; select Options)</b>	
WELD07A	Module 7A: Advanced Oxy-Acetylene Cutting (Core)	3-5
WELD12A	Module 12A: Advanced Oxy-Acetylene Welding Projects (Core)	25-30
WELD17	Module 17: Electric Arc Weld Faults and Causes (Core)	2-4
WELD18A	Module 18A: Electric Arc Gauge Metal Welding (Core)	4-5
WELD20B	Module 20B: Electric Arc Welding: Electrodes, Weld Joint, and Positions (Core)	4-6
WELD21C	Module 21C: Electric Arc Welding Assignments (Optional)	8-10
WELD22A	Module 22A: Electric Arc Welding "Vee" Butt Weld (Core)	3-5

WELD23B	Module 23B: Metal Inert Gas (MIG) and Electric Arc Welding Projects (Optional)	15
WELD25A	Module 25A: Advanced Projects (Core)	25-30
WELD26	Module 26: The Nature and Production of Iron and Steel (Core)	2-4
WELD29C	Module 29C: MIG Welding Safety and Equipment (Core)	3-6
WELD30C	Module 30C: Start-Up and Shut-Down MIG (Optional)	2
WELD31B	Module 31B: MIG Procedures (Optional)	10
WELD33A	Module 33A: Advanced MIG Welding (Core)	16-20
WELD34B	Module 34B: MIG Welding (Core)	4-6
WELD35B	Module 35B: MIG Welding Practical Assignments (Optional)	20
WELD37B	Module 37B: Work Study Preparation and Follow-up Activities (Optional)	5-10
WELD38B	Module 38B: Work Study (Optional)	25-50
<b>Minimum</b>		<b>100</b>
<b>Welding B30 (Do the Core; select Options)</b>		
WELD07B	Module 7B: Advanced Oxy-Acetylene Cutting (Optional)	4
WELD12B	Module 12B: Advanced Oxy-Acetylene Welding Projects (Optional)	25-30
WELD18B	Module 18B: Electric Arc Gauge Metal Welding (Core)	2-3
WELD21D	Module 21D: Electric Arc Welding Assignments (Optional)	8-10
WELD22B	Module 22B: Electric Arc Welding "Vee" Butt Weld (Optional)	3-5
WELD23C	Module 23C: Metal Inert Gas (MIG) and Electric Arc Welding Projects (Optional)	15
WELD25B	Module 25B: Advanced Projects (Optional)	25-30
WELD27	Module 27: Soldering (Optional)	2-4
WELD28	Module 28: Brazing (Optional)	2-4
WELD29D	Module 29D: MIG Welding Safety and Equipment (Core)	3-6
WELD30D	Module 30D: Start-Up and Shut-Down (MIG) (Optional)	2
WELD31C	Module 31C: MIG Procedures and Practice (Optional)	10-14
WELD33B	Module 33B: Advanced MIG Welding (Optional)	16
WELD34C	Module 34C: MIG Welding (Core)	4-6
WELD35C	Module 35C: MIG Welding Practical Assignments (Optional)	20
WELD37C	Module 37C: Work Study Preparation and Follow-up Activities (Optional)	5-10
WELD38C	Module 38C: Work Study (Optional)	25-50
<b>Minimum</b>		<b>100</b>

## Assessment and Evaluation

Student evaluation is an important part of teaching as it allows the teacher to report the successes and challenges of the student to the parent. Evaluation also provides valuable feedback about how a student learns best. It is important that teachers use a variety of evaluation strategies to evaluate student progress. Additional information on evaluation of student achievement can be found in *Student Evaluation: A Teacher Handbook* (Saskatchewan Education, 1991).

It is important that the teacher discuss with students the evaluation strategies to be used in the course, when the evaluation can be expected to occur, the weighting of each evaluation strategy, and how it relates to the overall student evaluation. The weighting of the evaluation should be determined in relation to the amount of time spent and emphasis placed on each area of the course, as suggested in these curriculum guidelines.

The Welding curriculum provides many opportunities for teachers to use a variety of instructional and evaluation strategies. Included in this guide are sample checklists for student skills. Samples are included in Appendix B and C.

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## Module 1: Safety: General, Oxy-Acetylene Welding, and Electric Arc Welding (Core)

**Suggested time:** 6-10 hours

**Level:** Introductory

### Foundational Objectives

- To introduce students to the issues surrounding safe, fair, and cooperative workplace practices.
- To identify and explain health and safety hazards in the workplace so that the potential for personal injury and damage to the equipment and the environment are minimized.

### Common Essential Learnings Foundational Objective

- To develop safety practices related to welding and use in context. (CCT)

Note: Other CELs may be emphasized.

Learning Objectives	Notes
1.1 To recognize and apply safe working practices in the working area.	<p>Use lecture and discussion methods. Students would be required to take notes based on these discussions. In the shop area, demonstrate and identify items with which students must be familiar. Be sure to indicate the location of fire alarms, fire fighting equipment, and the fire exits.</p> <p>Topics include eye protection, protective clothing, health hazards, radiation, ventilation, reporting accidents, safety rules, shop cleanup, tool maintenance, machine maintenance, equipment maintenance, material storage, noise levels, ear protection, radiation control, fire extinguishers, and lifting techniques. (TL, PSVS)</p> <p>Follow workplace procedures and emphasize risk control concerning:</p> <ul style="list-style-type: none"><li>• manual handling</li><li>• slips and falls</li><li>• electrical usage</li><li>• harassment</li><li>• violence</li></ul> <p>General information regarding the Labour Standards Act, Occupational Health and Safety, and WHIMIS is found in the <i>PAA Handbook</i> and the <i>Career and Work Exploration Curriculum Guidelines</i> (under development). Specific information is available from Saskatchewan Labour or is found in recommended resources.</p>
1.2 To apply accident prevention principles and techniques to ensure safe, injury free work performance in the welding area. (CCT)	<p>Safety is a topic to be emphasized throughout the Welding curriculum.</p>

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## Learning Objectives

## Notes

1.3 To recognize the hazards associated with oxy-acetylene welding and take the necessary measures to avoid accidents and injury to self and others. (TL, PSVS, CCT)

1.4 To recognize the safety hazards associated with electric welding processes and take the necessary preventative measures to avoid personal injury and injury to others.

1.5 To understand the regulations of occupational health and safety with respect to the Welding Industry.

Refer to Occupational Health and Safety Regulations accessible from Saskatchewan Labour.

Consider using Occupational Health and Safety personnel and video resources to present and discuss safety standards and safe work habits.

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## Module 2: Intermediate Safety (Core)

**Suggested time:** 3-5 hours

**Level:** Intermediate

### Foundational Objectives

- To introduce students to the issues surrounding safe, fair, and cooperative workplace practices.
- To identify and explain health and safety hazards in the workplace so that the potential for personal injury and damage to equipment and/or the environment are minimized.

### Common Essential Learnings Foundational Objectives

- To enable students to understand and use the vocabulary in the field of welding. (TL, COM)
- To assist other students in a safe and cooperative manner. (PSVS, CCT, TL)

Learning Objectives	Notes
2.1 To be knowledgeable about general shop safety and the specific safe working practices required to work in the welding area.	Refer to Module 1.
2.2 To maintain and repair or replace the safety equipment used in the welding area. (TL, CCT)	Clean and maintain helmets and goggles.
2.3 To be aware of and perform housekeeping in the welding area. (PSVS)	Return tools to storage. Maintain a clean and safe environment.
2.4 To become familiar with the information contained in the Workplace Hazardous Materials Information System (WHMIS) to reduce the risk of injury.	Material to support this learning objective can be obtained from Saskatchewan Labour.
2.5 To handle chemicals according to Work Hazardous Materials Information System (WHMIS) regulations.	Follow WHMIS procedures for the use, handling, and disposal of hazardous materials. Identify the three parts of WHMIS information students have a right to know. (COM) <ul style="list-style-type: none"><li>• labels with warning symbols</li><li>• materials safety data sheets</li><li>• worker training programs</li></ul>

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## Module 3: Hand Tools and Power Equipment (Core)

**Suggested time:** 2-4 hours

**Level:** Introductory

### Foundational Objectives

- To become familiar with tools and equipment used in the welding trade.
- To develop effective use of tools and equipment in order to develop entry level skills in the welding trade.

### Common Essential Learnings Foundational Objectives

- To use the language and terms specific to the welding field and express knowledge of the area using communication skills. (TL, COM)
- To analyze the projects to determine the equipment and procedures necessary to complete the task. (CCT).

### Learning Objectives

### Notes

- |  |  |
|--|--|
| 3.1 To become familiar with hand tools and power equipment prior to the students' need to utilize them. (COM)                            | Students are made familiar with the tools and equipment as they progress through the program and as the need arises to use each item. Teacher explanation and demonstration would be required for each tool and piece of equipment. Reference to this module would occur throughout all grade levels.                    |
|  | Topics include grinders (stationary and portable), buffers (stationary and portable), hammers, pliers, wire brushes, strikers, anvils, files, tip cleaners, screw drivers, hand shears, power shear, iron worker, hand hacksaw, power hacksaw, cutoff saw, band saw, clamps, vices, drill press, and marking tools. (TL) |
| 3.2 To recognize correct procedures for the handling, use, safety, and care associated with the tools and equipment in the welding shop. | Teacher demonstrations and information are required to enable students to understand the processes of acquiring necessary tools and equipment to be used for every task and project. Students need to return tools and equipment to the appropriate storage facility at the end of the work period.                      |
| 3.3 To list the necessary hand tools and power equipment required to perform tasks from start to completion. (TL, COM, CCT).             | Use these terms as organizers for discussion and notes about tools: selection, safety, procedure, shut-down, and cleanup.  |

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## Module 4: Intermediate Hand Tools and Power Equipment (Core)

**Suggested time:** 2-4 hours

**Level:** Intermediate

### Foundational Objectives

- To become familiar with tools and equipment used in the welding trade.
- To develop the knowledge of the care and maintenance of welding tools and equipment.

### Common Essential Learnings Foundational Objectives

- To enable students to understand and use the vocabulary in the field of welding. (COM)
- To maintain the equipment, tools and welding area. (TL, CCT, PSVS)

### Learning Objectives

### Notes

- |  |   |
|--|---|
| 4.1 To list the available hand tools and power equipment in the welding area. (TL, COM)  | Review Welding Module 3: Hand Tools and Power Equipment.  |
| 4.2 To maintain or assist in maintaining tools and equipment in the welding area. (PSVS) | Clean weld spattered tools.<br>Change saw blades.<br>Check and repair extension cords.<br>Grind welding table surfaces.<br>Replace or repair weld-distorted welding surfaces. (TL)<br><br>Students must learn to judge when tools and equipment need maintenance. (CCT) |

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## Module 5: Oxy-Acetylene Start-up, Shut-down, and Cutting (Core)

**Suggested time:** 2-4 hours

**Level:** Introductory

### Foundational Objectives

- To develop a systematic routine for setting up a welding workstation and putting away materials and equipment in the workplace or school setting.

### Common Essential Learnings Foundational Objectives

- To use the language and terms specific to the welding field, and express knowledge of welding using communication skills. (TL, COM)
- To be aware of safety issues when using oxy-acetylene equipment. (TL)

Note: Other CELs may be emphasized.

Learning Objectives	Notes
5.1 To perform the correct start-up and shut down procedures for the oxy-acetylene system.	Review Module 1. <b>Caution students to wear appropriate clothing, gloves, leather apron, footwear, goggles, and to use a catch tub. (PSVS)</b>  Teacher explanation and demonstration must be followed by student practice and demonstration. (COM) Topics include: valves, torches, tips, and types of flames.
5.2 To recognize the required manual adjustments necessary to acquire a quality cut. (CCT)	Discuss and demonstrate: neutral flame, flame distance, angle of tip, tip control, direction of travel, speed of travel, and motion of tip.
5.3 To cut 6 mm. (1/4") mild steel. (TL)	Students are required to cut a uniform straight line with square edges, vertical drag lines, and a minimal amount of slag.  Cut 6 mm. x 100mm. flat bar at 100 mm. Intervals. (NUM)  <b>Note:</b> Autobody students are to cut sheet metal.

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## Module 6: Oxy-Acetylene Cutting (Core)

**Suggested time:** 5-8 hours

**Level:** Intermediate

### Foundational Objectives

- To be aware of the potential danger to fellow workers who are engaged in activities in the accompanying work space.
- To develop effective use of tools and equipment in order to develop entry level skills in the welding trade.

### Common Essential Learnings Foundational Objective

- To use numeracy skills to meet the demands of a specific task in welding. (NUM)

Note: Other CELs may be emphasized.

Learning Objectives	Notes
6.1 To demonstrate knowledge of the oxy-acetylene cutting process by recalling the information required in introductory modules.	See Modules 1 and 2. Students should demonstrate a knowledge of equipment, safety, set up, protective gear, compressed gas, cutting containers, flammable materials, oxidizing materials, and types of materials that can be cut.
6.2 To identify precautionary procedures when using the oxy-acetylene cutting process.	
6.3 To identify the cutting torch and the function of the parts.	
6.4 To describe the relationship between tip size, metal thickness, and gas pressures. (NUM)	Factors affecting cut quality include metal thickness and metal condition. (TL)
6.5 To cut coupons.	
6.6 To cut required material using the semi-automatic cutting torch.	Students may cut materials to be used for an Electric Arc Practical.

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## Module 7A: Advanced Oxy-Acetylene Cutting (Core)

**Suggested time:** 3-5 hours

**Level:** Advanced

### Foundational Objective

- To develop effective use of tools and equipment in order to develop entry level skills in the welding trade.

### Common Essential Learnings Foundational Objectives

- To use the language and terms specific to the welding field and to express knowledge of welding using communication skills. (TL, COM)
- To use numeracy skills to measure and calculate required sizes and shapes of products used and constructed in welding. (NUM)

Note: Other CELs may be emphasized.

Learning Objectives	Notes
7.1 To cut straight lines on gauge metal. (TL)	Review Modules 1, 3, and 4.  Cut 16 gauge and 6mm (1/4") mild steel. (NUM)
7.2 To cut straight lines on heavy plate. (NUM)	Students should select appropriate cutting tip, evaluate hazards, set correct flame, inspect and clean welds, and evaluate the finished cut. (PSVS, COM)
7.3 To bevel cut plate edges for butt welding assignments.	Refer to SIAST Level I resources for bevel cut plate edges practical assignment(s).
7.4 To cut holes and circles.	

## Module 7B: Advanced Oxy-Acetylene Cutting (Optional)

Review or repeat Module 7A as required before progressing to the next module at the A30 level.

**Suggested time:** 4 hours

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## Module 8: Oxy-Acetylene Cutting Practice (Core)

**Suggested time:** 35-45 hours

**Level:** Intermediate

### Foundational Objective

- To develop effective use of tools and equipment in order to develop entry level skills in the welding trade.

### Common Essential Learnings Foundational Objective

- To use numeracy skills to estimate, measure, compute, and interpret numerical data in welding. (NUM)

Note: Other CELs may be emphasized.

<b>Learning Objectives</b>	<b>Notes</b>
8.1 To achieve a high level of cut quality when using an oxy-acetylene cutting torch to cut metals of various thickness and type. (NUM)	Consult the recommended resources.
8.2 To repeat the cutting process until the required cut quality is achieved.	Students may work on group projects. (COM, PSVS)

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## Module 9: Oxy-Acetylene Welding (Core)

**Suggested time:** 7-10 hours

**Level:** Introductory

### Foundational Objectives

- To be knowledgeable about the theory and safe use of oxy-acetylene welding equipment.
- To develop critical evaluation skills in order to judge quality welding workmanship.

### Common Essential Learnings Foundational Objective

- To analyze specific welding processes, complete practical assignments and projects, and recognize that there are different procedures required to produce completed projects and assignments. (CCT)

Note: Other CELs may be emphasized.

Learning Objectives	Notes
9.1 To review the basic processes required to operate the oxy-acetylene equipment.	See Module 5. Discuss procedures; flashbacks and backfires, types of joints, manufacture of oxygen, manufacture and nature of acetylene, and identify the thread type on all connections. (COM)
9.2 To analyze and complete practical assignments (butt weld, edge weld, lines of fusion). (CCT)	For butt weld refer to SIAST modules or recommended resources.  Note: For Autobody include the plug (button hole) weld.  Run lines of fusion without the use of filler rod, in the flat position, on 14 and 16 gauge mild steel -- 75mm (3") x 75mm (3") – a coupon. Four beads are required. (NUM)  <b>Note:</b> For Autobody include 20, 22 gauge mild steel also.  Student assessment criteria: <ul style="list-style-type: none"><li>• Perform an oxy-acetylene test.</li><li>• Five practical hours are required to completed a coupon. Each successive test would require a maximum of one hour.</li><li>• Four evenly spaced beads are required.</li><li>• Slight penetration is permissible.</li><li>• Concave beads with uniform ripples are allowed.</li><li>• Beads must be straight and even with no holes.</li><li>• Buff and clean a completed coupon.</li></ul>

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## Learning Objectives

## Notes

Perform an edge weld, no filler rod in the flat position, on 14 and 16 gauge mild steel. Use two pieces: 25mm (1") x 75mm (3"). (NUM)

- Two hours of practice are required to complete a coupon for the first edge test.
- Each successive test would require a maximum time of one hour.
- Bead has even uniform ripples. (CCT)
- Weld both edges.

**Note:** The Autobody Apprenticeship route requires that students weld 20 and 22 gauge metal in the flat position for Learning Objective 9.2.

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## Module 10: Intermediate Oxy-Acetylene Welding (Core)

**Suggested time:** 10-12 hours

**Level:** Intermediate

### Foundational Objectives

- To develop effective use of tools and equipment in order to develop entry level skills in the welding trade.
- To develop knowledge of the care and maintenance of welding tools and equipment.

### Common Essential Learnings Foundational Objective

- To use numeracy skills to measure and calculate required sizes and shapes of products used and constructed in the welding shop. (NUM)

Note: Other CELs may be emphasized.

<b>Learning Objectives</b>	<b>Notes</b>
10.1 To review oxy-acetylene fusion welding processes.	Review Modules 5 and 9.
10.2 To review oxy-acetylene equipment, handling and maintenance.	Refer to Modules 1 and 2 on safety.
10.3 To complete practical assignments. (NUM)	Demonstrations should be performed. (TL, CCT)
10.4 To achieve the required weld quality.	Examine and discuss all weld faults. (COM, PSVS)

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## Module 11A: Oxy-Acetylene Welding Practical Requirements (Core)

**Suggested time:** 15-20 hours

**Level:** Intermediate

### Foundational Objective

- To develop effective use of tools and equipment in order to develop entry level skills in the welding trade.
- To learn to develop critical evaluation skills in order to judge quality welding workmanship.

### Common Essential Learnings Foundational Objective

- To analyze specific welding processes, complete practical assignments and projects and recognize that there are different procedures required to produce completed projects and assignments. (CCT)

Note: Other CELs may be emphasized.

Learning Objectives	Notes
11.1 To demonstrate basic oxy-acetylene welding practices. (TL)	Follow this procedural outline: assignment (assignment name), base metal (size and metal type), preparation (cleaning, grinding), fit up (spacing and tacking), filler rod (size and type), tip size (size selected), heat adjustment (low to high heat volume), and technique (number of passes).
11.2 To practice the various types of welds. (TL, CCT)	<p>Practical assignments: beads no filler (3 hours), edge weld (1 hour), corner weld (1 hour), beads with filler (3 hours), butt welds (3 hours), and lap weld (1 hour). (COM)</p> <p>After completing practical assignments, the student could complete a project (8 hours).</p> <p>Perform an outside corner weld, no filler rod, in the flat position, on 14 and 16 gauge mild steel. Use two pieces: 25mm (1") x 75mm (3"). (NUM)</p> <ul style="list-style-type: none"><li>• Two hours of practice are required to complete a coupon for the first corner joint test.</li><li>• Each successive test would require a maximum time of one hour.</li><li>• Tack weld each end and set at 90°.</li><li>• Requires slight penetration.</li><li>• Requires a smooth, uniform bead with no overhang.</li></ul> <p>Run lines of fusion using filler rod, in the flat position, on 14 and 16 gauge mild steel. Use one piece: 75mm (3") x 75mm (3"). Three beads are required. (NUM) Various criteria apply:</p> <ul style="list-style-type: none"><li>• Use a filler rod for the first test.</li><li>• Five hours of practice are required to complete a coupon.</li><li>• Each successive test would require a maximum of one hour.</li><li>• Three evenly spaced beads.</li><li>• Slight penetration along entire length.</li><li>• Slight convex bead.</li><li>• Blended edges along bead.</li><li>• No overlap, undercut, or holes. (CCT)</li></ul>

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## Learning Objectives

## Notes

Perform a butt weld using filler rod, in the flat position, on 16 gauge mild steel. Use two pieces: 25mm (1") x 75mm (3") – a coupon.

(NUM) Various criteria apply.

- Three hours of practice are required to complete a coupon.
- Each successive test would require a maximum of one hour.
- Slight, complete penetration required.
- A slight convex bead is required along the entire length.
- A smooth uniform bead is required.
- Free of holes.
- #13 grade 10 minimum requirement.
- #13 and #16 grade 12 minimum requirements.
- See drawing sheets for Level I.

Assess students on welding equipment (setting up and operating), knowledge of oxy-acetylene gases and equipment, and oxy-acetylene practices, especially oxy-acetylene welding -- the flat position.

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## Module 11B: Oxy-Acetylene Welding Practical Requirements (Optional)

Review or repeat Module 11A as required before progressing to the next module at the intermediate level.

**Suggested time:** 15-20 hours

### Learning Objectives

11.2B To practice the various types of welds. (TL, CCT, NUM)

### Notes

Perform a butt weld using filler rod, in the flat position, on 16 gauge mild steel. Use two pieces: 25mm (1") x 75mm (3"). (NUM) Criteria apply.

- Three hours of practice are required to complete a coupon.
- Each successive test would require a maximum of one hour.
- Slight, complete penetration required.
- A slight convex bead is required along the entire length.
- A smooth uniform bead is required.
- Free of holes. (CCT)

Perform a butt weld using filler rod, in the vertical position, on 14 gauge or 16 gauge mild steel. Use two pieces: 25mm (1") x 125mm (3") or 100mm (4") x 125mm (5"). (TL)

Perform a lap weld using filler rod, in the flat position, on 14 and 16 gauge mild steel. Use two pieces: 50mm (2") x 75mm (3"); overlap by half #17 grade 11 minimum requirement. Criteria apply.

- Two hours are required to complete a coupon.
- Each successive test would require a maximum of one hour.
- Smooth, flat weld.
- No holes or melt through.
- No undercut.
- Weld both sides.

Perform a Tee weld, using filler rod, in the flat position, on 14 and 16 gauge mild steel. Use two pieces -- one 50mm (2") x 75mm (3"), and one 25mm (1") x 75mm (3"). Weld both fillets. Criteria apply.

- Two hours of practice are required to complete a coupon for the first Tee test. Each successive test would require a maximum time of one hour.
- Tee weld requirements.
- Bead has even uniform ripples.
- Bead is slightly convex or flat.
- Bead edge is smoothly blended with no undercut.
- No penetration sag evident.

Manufacture two rings. These rings are of 16 gauge mild steel. They are cut 50mm (2") x 300mm (12"). They are rolled to form rings, one that will fit inside the other. They are overlapped by half, tack welded and then completely welded inside and out. (TL) Criteria apply:

- 5 hours.
- Beads on the ring tests must be smooth and uniform.
- No penetration should protrude from underside.

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## Module 12A: Advanced Oxy-Acetylene Welding Projects (Core)

**Suggested time:** 25-30 hours

**Level:** Advanced

### Foundational Objectives

- To develop effective use of tools and equipment in order to develop entry level skills in the welding trade.
- To learn to develop critical evaluation skills in order to judge quality welding workmanship.

### Common Essential Learnings Foundational Objectives

- To use numeracy skills to estimate, measure, compute, and interpret numerical data in welding. (NUM)
- To understand the use of welding technology, its application in the world around us from mining to underwater welding, and its use in space. (TL)

Note: Other CELs may be emphasized.

Learning Objectives	Notes
12.1 To construct a project or projects. (TL)	Projects should be approved by the teacher.  Suggested projects: tool box tray (10 hrs.) and box (15 hrs.). The MIG process for tack welding should be used before completing the required welds with oxy-acetylene. Students should have completed MIG theory and practiced MIG equipment use before completing these projects.
12.2 To use technical language when discussing projects. (COM)	Planning and management: generate different project ideas, plan and use drawings, determine procedure sequence, prepare a material list and cost estimate, and create a timeline. (PSVS)
12.3 To develop organized work practices and skills. (NUM)	Fabrication techniques: cut material and set up in the proper sequence and complete each part as required. (CCT)
12.4 To present the project(s).	Use a check list to determine that the student: interprets and follows directions, adheres to timelines, works cooperatively, follows safety conditions and procedures, follows all handling and storing procedures, and fulfills cleanup and tool maintenance responsibilities. (PSVS)  Students should present the completed project/s and understand the evaluation of the unit.
12.5 To discuss real world applications of welding.	Correlate this objective with the projects and the Careers Module. Reinforce career development throughout the curriculum.

## Module 12B: Advanced Oxy-Acetylene Welding Projects (Optional)

Review or repeat Module 12A as required before progressing to the next module at the B30 level.

**Suggested time:** 25-30 hours

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## Module 13: Plasma Arc Cutting (Core)

**Suggested time:** 2-4 hours

**Level:** Intermediate

### Foundational Objectives

- To demonstrate the safe and proper use of welding tools and materials.
- To develop knowledge of the care and maintenance of welding tools and equipment.

### Common Essential Learnings Foundational Objectives

- To use numeracy skills to measure and calculate required sizes and shapes of products used and constructed in the welding. (NUM)

### Learning Objectives

### Notes

13.1 To be knowledgeable about the use and maintenance of plasma arc equipment.

Topics include equipment, safety, gun parts and consumables, cutting of ferrous and non-ferrous metals, and thickness capabilities. (TL)

13.2 To correctly use plasma arc cutting equipment to perform various cuts of metal of varying thickness and type. (NUM)

Students will set pressures, set up materials, start the arc, control the gun and speed, and recognize a quality cut. (TL)  
Cut gauge steel.  
Cut 6mm (1/4") steel.  
Cut test coupons for electric arc, MIG, and oxy-acetylene assignments and projects.

**Note:** Autobody students are required to cut 16, 20, and 22 gauge metal.

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## Module 14: Electric Arc Welding Electrodes and Accessories (Core)

**Suggested time:** 3-5 hours

**Level:** Introductory

### Foundational Objectives

- To develop effective use of tools and equipment in order to develop entry level skills in the welding trade.
- To develop knowledge of the care and maintenance of welding tools and equipment.

### Common Essential Learnings Foundational Objective

- To enable students to understand and use the vocabulary in the field of welding. (COM)

Note: Other CELs may be emphasized.

Learning Objectives	Notes
14.1 To understand and define common welding terms. (COM)	Terms for definition include alternating current, ampere, anode, arc, backing or backup, backhand welding, backstep welding, base metal, bead, bevel, brazing, capillary attraction, cathode, chipping, circuit, complete penetration contraction, cover glass, crater, direct current, distortion gaseous shield, downhand welding, ductility, duty cycle, elasticity, electrode circuit, excessive penetration, expansion, ferrous, finished bead, finished surface, flux, forehand welding, fusion welding, generator, kerf, non-ferrous, parent metal, peening, penetration, polarity, porosity, root opening, slag, slight penetration, rectifier, solder, spatter, strain, stress, tensile strength, transformer, uphand welding, voltage, warping, and yield point.
14.2 To name and describe two types of electrodes.	6011 and 7014 (electrode types).
14.3 To set the correct type of current.	Direct current and reverse polarity.
14.4 To describe and maintain the accessories associated with arc welding.	Accessories include helmet, lenses, electrode holder, ground clamp, chipping hammers, and wire brush. (COM, TL)
14.5 To describe one type of welding joint.	Describe and demonstrate a Butt joint.
14.6 To describe one basic welding position.	Describe and demonstrate the flat position for a welding joint.

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## Module 15: Shielded Metal Arc Welding (S.M.A.W.) Procedures (Core)

**Suggested time:** 15-20 hours

**Level:** Introductory

### Foundational Objective

- To demonstrate the safe and proper use of welding tools and materials.

### Common Essential Learnings Foundational Objective

- To use the language and terms specific to the welding field, and express knowledge of the area using communication skills. (TL, COM)

<b>Learning Objectives</b>	<b>Notes</b>
15.1 To understand and define common welding terms. (COM)	Define alternating current, anode, bevel, backing or backup, backstep welding, capillary attraction, cathode, ductility, downhand welding, uphand welding, flux, duty cycle, elasticity, brazing, tensile strength, yield point, peening, solder, strain, transformer, rectifier, and generator.
15.2 To name and describe four types of electrodes.	6011, 6013, 7014, 7018. (NUM)
15.3 To describe two types of basic welding positions. (TL)	Flat and horizontal position.
15.4 To describe two types of current available.	Direct and alternating current. Discuss polarity (reverse and straight).
15.5 To demonstrate safe and correct start-up and shut-down procedures.	Review Module 1. Discuss and demonstrate setting up a station, using a ground clamp and electrode, setting amperage, checking voltage, starting the machine, shutting down, and cleaning up.

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**Learning Objectives****Notes**

15.6 To demonstrate basic knowledge of the components of the Electric Arc Welding Machine.

15.7 To demonstrate and explain striking the arc, setting and adjusting amperage, electrode angle, and rate of travel. (TL, COM)

See SIAST Level I Electric Arc.

Practical assignment: vee butt in the flat position.

Create a checklist of criteria to evaluate electric arc welding.

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**Module 16: Electric Arc Welding; Weld Faults (Core)****Suggested time:** 2-4 hours**Level:** Intermediate**Foundational Objective**

- To learn to develop critical evaluation skills in order to judge quality welding workmanship.

**Common Essential Learnings Objective**

- To evaluate the quality of practical skills related to welding and determined corrective measures to identify faults. (CCT)

Note: Other CELs may be emphasized.

<b>Learning Objectives</b>	<b>Notes</b>
16.1 To recognize common electric arc weld faults. (CCT)	Faults include amperage setting, angle of electrode, bead crack, fish eyes, hard spots, hot short, locked stresses, longitudinal and transverse cracks, rate of travel, type of electrode, underbead cracking, and weld dimensions. (IL)  Identify cause of weld faults, how to spot them, and how to avoid them.
16.2 To define the terms.	Written exams should be included as part of student assessment and evaluation.

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## Module 17: Electric Arc Weld Faults and Causes (Core)

**Suggested time:** 2-4 hours

**Level:** Advanced

### Foundational Objective

- To learn to develop critical evaluation skills in order to judge quality welding workmanship.

### Common Essential Learnings Objective

- To use the language and terms specific to the welding field and to express knowledge of the area using communication skills. (COM)

Note: Other CELs may be emphasized.

Learning Objectives	Notes
17.1 To identify electric arc faults and to define the terms. (COM, CCT)	Discuss crater cracking, gas pockets, magnetic arc blow, porosity, stray flash, bead sagging, subsurface defects, undercut, unfilled crater surface preparation, and clamping. (COM)
17.2 To indicate corrections for electric arc faults. (CCT, IL)	Hold a class discussion.
17.3 To fix electric arc weld faults. (IL)	Review Module 15.

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## Module 18A: Electric Arc Gauge Metal Welding (Core)

**Suggested time:** 4-5 hours

**Level:** Intermediate

### Foundational Objectives

- To develop effective use of tools and equipment in order to develop entry level skills in the welding trade.
- To develop critical evaluation skills in order to judge quality welding workmanship.

### Common Essential Learnings Foundational Objectives

- To use numeracy skills to measure and calculate required sizes and shapes of products used and constructed in the welding. (NUM)

Note: Other CELs may be emphasized.

Learning Objectives	Notes
18.1 To understand the essentials associated with arc welding of gauge metal.	Discuss gauge metal sizes, types of joints, and types of electrodes. (NUM, COM)
18.2 To weld gauge metal in the flat position. (TL)	Weld 14 and 16 gauge metal in the flat position with a lap joint.  Weld 14 and 16 gauge metal in the flat position with a tack weld. Assign projects that will allow students to practice welding gauge metal. (IL)

## Module 18B: Electric Arc Gauge Metal Welding (Optional)

Review or repeat module 18A as required before progressing to the next module at the B30 level.

**Suggested time:** 2-3 hours

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## Module 19: Electric Arc Welding Electrode Selection and Use (Core)

**Suggested Time:** 12-15 hours

**Level:** Intermediate

### Foundational Objectives

- To develop effective use of tools and equipment in order to develop entry level skills in the welding trade.
- To develop critical evaluation skills in order to judge quality welding workmanship.
- To use appropriate safety appliances when engaged in practical activities.

### Common Essential Learnings Foundational Objectives

- To use the language and terms specific to the welding field and to express knowledge of the area using communication skills. (COM)
- To analyze work projects to determine the equipment and procedures necessary to complete the task. (CCT)
- To develop students' abilities to meet their own learning needs through practical welding experiences. (IL)

Learning Objectives	Notes
19.1 To select an electrode.	Scratch method. (CCT)
19.2 To describe four types of welding joints. (COM)	Butt, lap, corner, and fillet.
19.3 To describe two basic welding positions.	Flat and horizontal.
19.4 To demonstrate the correct procedure for striking the arc.	Demonstrate arc length, electrode angle, rate of travel, amperage setting, and electrode selection. (TL, IL)
19.5 To run continuous weld beads on mild steel plate. (TL)	Demonstrate preparation, fit up, electrode, current type, amperage, and procedure. (IL)
19.6 Perform a butt weld on mild steel plate.	Teacher demonstration; student practice. (IL)
19.7 To demonstrate basic arc welding practices following the list of procedures. (IL)	Assign practical assignments that require running beads (4 hrs.), tacking welds (2 hrs.), and butt welding (2 hrs.).

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**Module 20A: Electric Arc Welding: Electrodes, Weld Joint, and Positions (Core)****Suggested time:** 4-6 hours**Level:** Advanced**Foundational Objective**

- To become familiar with tools, equipment, and techniques used in the welding trade.

**Common Essential Learnings Foundational Objective**

- To enable students to understand and use the vocabulary in the field of welding. (COM)

Note: Other CELs may be emphasized.

<b>Learning Objectives</b>	<b>Notes</b>
20.1 To name and describe seven types of electrodes. (COM)	6010, 6011, 6013, 7013, 7014, 7018 and 7024.
20.2 To name and describe four specialty electrodes.	The four specialty electrodes are stainless steel, aluminum, nickel, and hard surfacing.
20.3 To describe two types of currents available.	Direct and alternating current.
20.4 To discuss polarity.	Reverse + polarity and straight - polarity.
20.5 To describe basic types of welding joints. (COM)	Butt, lap, corner inside, corner outside, tee, edge, and fillet.
20.6 To describe four types of basic welding positions.	Flat, horizontal, vertical, and overhead.  Student assessment and evaluation should include exams on topics such as joint design, welding terms, and electrodes.

**Module 20B: Electric Arc Welding: Electrodes, Weld Joint, and Positions (Core)**

Review or repeat module 20A as required before progressing to the next module at the A30 level.

**Suggested time:** 4-6 hours

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## Module 21A: Electric Arc Welding Assignments (Core)

**Suggested time:** 8-10 hours

**Level:** Introductory

### Foundational Objectives

- To develop effective use of tools and equipment in order to develop entry level skills in the welding trade.
- To develop critical evaluation skills in order to judge quality welding workmanship.

### Common Essential Learnings Foundational Objectives

- To use numeracy skills to estimate, measure, compute, and interpret numerical data in welding. (NUM)
- To demonstrate safe welding practice. (TL)

Note: Other CELs may be emphasized.

Learning Objectives	Notes
21.1 To run continuous weld beads on mild steel plate. (TL)	Review electrode selection, arc length, electrode angle, rate of travel, amperage setting, and weld faults and causes. (NUM)
21.2 To perform a butt weld on a mild steel plate.	
21.3 To pad a plate with at least two layers on each side.	Practical assignments: beads ( 6011 - 1 hr.), tack welds (6011 - 1 hr.), butt welds (1 hr.), beads (6013 - 1 hr.), beads (7014 - 1 hr.), beads (7018 - 1 hr.), padding (7014 one side - 2 hrs.), and (7018 one side - 2 hrs.). (NUM, TL, IL)

## Module 21B, C, D: Electric Arc Welding Assignments (Optional)

Review or repeat Module 21A as required before progressing to the next module at the 30 level.

**Suggested time:** 8-10 hours

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## Module 22A: Electric Arc Welding “Vee” Butt Weld (Core)

**Suggested time:** 3-5 hours

**Level:** Intermediate

### Foundational Objective

- To develop effective use of tools and equipment in order to develop entry level skills in the welding trade.

### Common Essential Learnings Foundational Objective

- To analyze specific welding processes, complete practical assignments and projects, and recognize that there are different procedures required to produce completed projects and assignments. (CCT)

Note: Other CELs may be emphasized.

Learning Objectives	Notes
22.1 To complete a Vee butt weld on heavy steel plate in the flat position.	Review the Vee butt process: select electrode, bevel metal, set spacing, tack weld, run necessary number of beads, clean after each pass, never cool, use minimal heat settings to get required fusion and penetration, do not overweld, finished beads should be slightly convex, grind smooth, and bend test. (CCT, COM)
22.2 To test using a bend test. (CCT)	Vee butt welding on plate is a 2 hour practicum (SIAST).  See Welder Level I Apprenticeship documents.  Complete at this time and use again at the end as a final practical assignment.

## Module 22B: Electric Arc Welding “Vee” Butt Weld (Optional)

Review or repeat Module 22A as required before progressing to the next module at the B30 level.

**Suggested time:** 3-5 hours

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## Module 23A: Metal Inert Gas (MIG) and Electric Arc Welding Projects (Optional)

**Suggested time:** 8-12 hours

**Level:** Introductory

### Foundational Objectives

- To develop effective use of tools and equipment in order to develop entry level skills in the welding trade.
- To develop critical evaluation skills in order to judge quality welding workmanship.

### Common Essential Learnings Foundational Objectives

- To use numeracy skills to measure and calculate required sizes and shapes of products used and constructed in welding. (NUM)
- To develop a product using learned skills, knowing when new skills are required, and developing a procedure that will ensure product completion. (CCT)

Note: Other CELs may be emphasized.

### Learning Objectives

### Notes

23.1 To construct an assigned or an approved but comparable project. (IL)

**Note: This module is core unless projects are integrated into work study.**

Make connections to the community, if possible.

23.2 To follow guidelines from start to completion. (CCT)

Guidelines for projects.

- Plan and manage the project.
- Generate different project ideas.
- Plan and use drawings.
- Set a procedural sequence.
- Prepare a material list and cost estimate(s). (NUM)
- Create a timeline.
- Determine fabrication techniques.
- Cut material and set up in the proper sequence.
- Complete each part as required.
- Apply work skills.
- Interpret and follow directions.
- Adhere to timelines.
- Work cooperatively. (PSVS)
- Follow all safety requirements.
- Follow all handling and storing procedures.
- Fulfill cleanup and tool maintenance responsibilities.
- Present the completed project and understand the assessment and evaluation criteria for the project(s). (COM, CCT)

23.3 To present the finished project.

See also the Notes in Module 24.

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**Learning Objectives****Notes**

Suggested projects may include:

- gauge metal tool box (23A) (Appendix D)
- stop chocks (23A)
- c-clamps (23A)
- bicycle stand
- gauge metal project recycle waste container (23B) (10 hours) (Appendix D)
- portable tool stand (23B) (10 hours)
- car creeper (23C) (10 hours)
- hitch haul carrier (23 B, C) (15 hours)
- portable fire pit/barbecue (23 C) (15 hours) (Appendix D)

**Module 23B: MIG and Electric Arc Welding Projects (Optional)**

Review or repeat Module 23A as required before progressing to the 30 level.

**Suggested time:** 15 hours

**Learning Objectives****Notes**

23.1B To construct an assigned or an approved but comparable project. (IL)

Suggested projects may include:

- gauge metal project recycle waste container (23B) (10 hours) (Appendix D)
- portable tool stand (23B) (10 hours)
- hitch haul carrier (23 B, C) (15 hours)

**Module 23C: MIG and Electric Arc Welding Projects (Optional)**

**Suggested time:** 15 hours

**Learning Objectives****Notes**

23.1C To construct an assigned or an approved but comparable project. (IL)

Suggested projects may include:

- car creeper (23C) (10 hours)
- hitch haul carrier (23 B, C) (15 hours)
- portable fire pit/barbecue (23 C) (15 hours) (Appendix D)

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## Module 24: Intermediate Projects (Optional)

**Suggested time:** 15-20 hours

**Level:** Intermediate

### Foundational Objectives

- To develop effective use of tools and equipment in order to develop entry level skills in the welding trade.
- To develop critical evaluation skills in order to judge quality welding workmanship.

### Common Essential Learnings Foundational Objectives

- To use numeracy skills to measure and calculate required sizes and shapes of products used and constructed in the welding shop. (NUM, TL)
- To develop students' abilities to meet their own learning needs through practical welding experiences. (IL)

Note: Other CELs may be emphasized.

### Learning Objectives

### Notes

24.1 To construct an assigned or an approved but comparable project. (PSVS, IL)

Projects may be incorporated into the work study.

An approved project would be one of the student's choice that would fit the timeline and would be representative of the skill level at this grade level. Make connections to the community, if possible.

Guidelines for evaluation of projects are:

- Planning and management: generates project ideas; reads a basic blueprint; plans and utilizes drawing; sets a procedure sequence; prepares a material list and estimates cost; and creates a timeline. (NUM)
- Fabrication techniques: cuts material and sets up in the proper sequence; completes each part as required; interprets and follows directions; and, adheres to timelines. (TL, NUM)
- Work skills: works cooperatively; follows all safety requirements; follows all handling and storing procedures; and fulfills cleanup and tool maintenance responsibilities. (PSVS)
- Presentation skills: presents the completed project and understands the evaluation criteria for the project. (COM)

Suggested ideas for projects include:

- project safety stands (Appendix D)
- gauge metal project recycle waste container (Appendix D)
- portable tool stand

Other projects may be selected from recommended welding resources, the Internet, or community partners.

Discuss the possibilities for entrepreneurship.

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## Module 25A: Advanced Projects (Core)

**Suggested time:** 25-30 hours      **Level:** Advanced

### Foundational Objective

- To develop effective use of tools and equipment in order to develop entry level skills in the welding trade.
- To develop critical evaluation skills in order to judge quality welding workmanship.

### Common Essential Learnings Foundational Objectives

- To use numeracy skills to measure and calculate required sizes and shapes of products used and constructed in the welding shop. (NUM, TL)
- To develop students' abilities to meet their own learning needs through practical welding experiences. (IL)

Note: Other CELs may be emphasized.

Learning Objectives	Notes
25.1 To construct an assigned or an approved but comparable project(s). (IL)	See Modules 23 and 24 for guidelines.
25.2 To follow guidelines. (TL)	
25.3 To present the finished project(s). (COM)	Project ideas may include: <ul style="list-style-type: none"><li>• Gauge metal project recycle waste container (10 hours) (Appendix D)</li><li>• Portable tool stand (10 hours)</li><li>• car creeper (10 hours)</li><li>• hitch haul carrier (15 hours)</li><li>• portable fire pit/barbecue (15 hours) (Appendix D)</li></ul>

## Module 25B: Advanced Projects (Optional)

Review or repeat module 25A as required before progressing to the next module at the B30 level.

**Suggested time:** 25-30 hours

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## Module 26: The Nature and Production of Iron and Steel (Core)

**Suggested time:** 2-4 hours

**Level:** Advanced

### Foundational Objective

- To apply some principles of science to the welding trade.

### Common Essential Learnings Foundational Objective

- To develop an understanding of how raw materials are fabricated into ferrous compounds (COM)

### Learning Objectives

### Notes

26.1 To list the sources of iron.

Use textbook and other resource information.

26.2 To explain the production of:

- pig iron
- cast iron
- wrought iron
- steel.

26.3 To explain the following processes: (COM)

- bessemer
- open hearth
- electric furnace
- blast furnace.

Use video materials, if possible.

IPSCO uses electric-arc furnaces.

26.4 To define the following terms:

- hot rolled steel
- cold rolled steel
- cast steels
- ferrous metals
- non-ferrous metals
- metallurgy.

26.5 To explain what is meant when describing:

- low carbon steels
- high carbon steels.

26.6 To list methods used to identify steels.

26.7 To describe the effects of expansion and contraction. (CCT)

Consult with the science teacher. Demonstrate practical examples.

26.8 To describe the principle of hard surfacing.

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## Module 27: Soldering (Optional)

**Level:** Introductory

**Suggested time:** 2 to 4 hours

### Foundational Objectives

- To apply some principles of science to the welding trade.
- To develop critical evaluation skills in order to judge quality welding workmanship.

### Common Essential Learnings Foundational Objectives

- To use the language and terms specific to the welding field and to express knowledge of welding using communication skills. (TL, COM)
- To recognize that there are different procedures required to join various types of metal. (CCT, TL)

Learning Objectives	Notes
27.1 To explain the differences between fusion welding and soldering (lead). (CCT)	Discuss fusion and non-fusion. (COM)
27.2 To explain the lead and lead alloy soldering process. (COM)	Demonstrate soldering rod, heat required, material preparation and cleaning, necessity and use of flux, and timing. (TL, IL)  Solder a copper wire electrical connection.
27.3 To explain the silver soldering process.	Discuss characteristic differences among brazing and other soldering operations.  Demonstrate on a tempered blade. (band saw or hack saw)
27.4 To solder copper pipe connections. (CCT)	1/2" and 3/4" copper tubing and connections. (NUM)
27.4 To perform the soldering of a lap joint. (TL, CCT)	Use 20 gauge mild steel. (IL)

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## Module 28: Brazing (Optional)

**Suggested time:** 2-4 hours

**Level:** Introductory

### Foundational Objective

- To apply some principles of science to the welding trade.

### Common Essential Learnings Foundational Objective

- To recognize that there are different procedures required to join various types of metal. (CCT, TL)

### Learning Objectives

### Notes

28.1 To explain the differences between brazing and fusion welding.

Discuss and demonstrate tinning. (CCT)

28.2 To perform a brazing weld on gauge mild steel in the flat position producing a smooth, flat, clean, yellow joint with a flow of filler between the gauge overlapped surfaces. (TL)

Perform a brazing lap weld utilizing 16, 18 and 20 gauge mild steel.

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## Module 29A: MIG Welding Safety and Equipment (Core)

**Suggested time:** 3-6 hours

**Level:** Introductory

### Foundational Objective

- To be aware of the potential danger to fellow workers engaged in activities in the accompanying work space.

### Common Essential Learnings Foundational Objective

- To use the language and terms specific to MIG welding, and express knowledge of the area using communication skills. (COM)

Note: Other CELS may be emphasized.

Learning Objectives	Notes
29.1 To study MIG welding and to develop safety skills necessary in its use.	Topics include MIG welding process, care and maintenance of MIG equipment, MIG welding equipment, shielding gases, types of wire, weld faults and causes, types of joints and preparation, advantages and disadvantages of MIG welding, types of metals and metal thickness, current supply, and metal transfer. (TL)
29.2 To apply accident prevention principles and practices to ensure a safe, injury free work performance.	Stress personal safety. (PSVS) Stress safety of others. Use or create a "Safety Procedures Checklist."  Students sometimes do not see the value in safety checklists. Ask them which plane they want to fly on, one whose pilot always uses a pre-flight checklist, or one whose pilot sometimes uses the pre-flight checklist. (COM)

## Module 29B, C, D: MIG Welding Safety and Equipment (Core)

Review or repeat module 29A as required before progressing to the next module at the next level.

**Suggested time:** 3-6 hours for all levels

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## Module 30A, B: Start-Up and Shut-Down (MIG) (Core)

**Suggested Time:** 2-4 hours

**Level:** Introductory

### Foundational Objective

- To establish a systematic routine for setting up a welding workstation and for putting away materials and equipment in the workplace or school setting.

### Common Essential Learnings Foundational Objective

- To identify equipment and procedures using technical terms related to the field of welding. (COM)

### Learning Objectives

### Notes

30.1 To explain the principles of MIG welding. (COM)

30.2 To identify the equipment.

Check resources.

30.3 To demonstrate the correct start-up and shut-down procedures of MIG welding equipment. (IL)

Start-up Procedures:

- checks the condition of the workstation welding equipment, and personal protective equipment
- puts up adequate screening to protect people in the immediate area
- ensures proper ventilation
- makes sure all connections are correctly attached
- checks for the proper shielding and wire electrode
- adjusts the machine for the appropriate wire speed, voltage, and amperage
- turns on shielding gas and checks flow meter
- checks shielding nozzle for gas obstructions
- uses the proper personal protective equipment
- posts fire watch if necessary
- turns on machine.

Shut-down Procedures:

- carefully removes and cools all hot welding materials
- turns off power supply to welder
- shuts off shielding gas and closes the cylinder valve
- hangs up all cables and stores equipment as directed
- cleans up the work station.

## Module 30C, D: Start-Up and Shut-Down (MIG) (Optional)

Review or repeat Module 30A as required before progressing to the next module at the next level.

**Suggested time:** 2 hours

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## Module 31A: MIG Procedures and Practice (Core)

**Suggested time:** 10-14 hours

**Level:** Introductory

### Foundational Objectives

- To develop knowledge of the care and maintenance of welding tools and equipment.
- To establish a systematic routine for setting up a welding workstation and for putting away materials and equipment in the workplace or school setting.

### Common Essential Learnings Foundational Objectives

- To use the language and terms specific to the welding field and to express knowledge of the area using communication skills. (COM)
- To practice safe work habits while operating MIG welding equipment. (TL)

Note: Other CELs may be emphasized.

Learning Objectives	Notes
31.1 To demonstrate knowledge of the basic components of a MIG welder.	Demonstrate and discuss stress maintenance, nozzle, contact tips, liners, wire rolls (change), gauges and flowmeters, gas, amperage adjustment, and voltage adjustments. (COM)  Complete selected written exams.
31.2 To demonstrate the start-up, setting and adjusting of a MIG welder. (TL)	See Modules 29 and 30.
31.3 To demonstrate the proper shut-down of the MIG welding unit.	See Modules 29 and 30.
31.4 To demonstrate maintenance of the MIG welder.	
31.5 To be knowledgeable of types of gases and wire used for MIG welding.	
31.6 To be able to disassemble the nozzle, tip, liner, wire, and gauges independently, and then to reassemble these components. (TL, COM)	Demonstrate care and maintenance of equipment. (IL)

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**Learning Objectives****Notes**

31.7 To perform the MIG operating procedure successfully.

Demonstrate and discuss personal safety, safety of others, the MIG welding process, shielding; types of wire, weld faults and causes, types of joints and preparation, advantages and disadvantages of MIG welding, types of metals and metal thickness, metal transfer, and current supply.

Demonstrate welding procedure by laying down a bead on thin steel (16 gauge). (TL)

**Module 31B, C: MIG Procedures (Optional)**

Review or repeat Module 31A as required before progressing to the next module at the 30 level.

**Suggested time:** 10 hours

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## Module 32: Intermediate MIG Welding (Core)

**Suggested time:** 6-12 hours

**Level:** Intermediate

### Foundational Objectives

- To develop knowledge of the care and maintenance of welding tools and equipment.
- To establish a systematic routine for setting up a welding workstation and for putting away materials and equipment in the workplace or school setting.

### Common Essential Learnings Foundational Objective

- To demonstrate the operation of MIG welding equipment. (TL)

Note: Other CELs may be emphasized.

Learning Objectives	Notes
32.1 To set up equipment in a proper and safe sequence.	Demonstrate equipment set up. (TL, IL)
32.2 To show the proper flowmeter or regulator adjustment. (TL)	Demonstrate the adjustment of flowmeter or regulator. Check the type of gas.
32.3 To connect the proper shielding gas and explain its need and use.	Check the type of welding gun. Check cables.
32.4 To select and install electrode wire.	
32.5 To identify metals and perform preparations and assembly tasks prior to welding. (TL, PSVS)	The student must be able to demonstrate the following steps: <ul style="list-style-type: none"><li>• identify metal</li><li>• determine mechanical properties of metal</li><li>• determine physical properties of metal</li><li>• prepare metal for welding</li><li>• check ground clamp</li><li>• check feed rollers</li><li>• check contact tip and nozzle.</li></ul>

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## Learning Objectives

## Notes

32.7 To operate hand tools and hand operated and power equipment. (TL)

The student should show how he/she:

- measures accurately
- utilizes hammers
- utilizes an anvil
- utilizes metal cutting tools and equipment
- performs drilling operations
- performs grinding and buffing operations
- performs filing operations
- utilizes drills and tip cleaners
- utilizes vices
- utilizes clamping devices
- utilizes wrenches
- utilizes pliers
- utilizes metal forming equipment.

Projects for oxy-acetylene and electric arc can be spot welded using the MIG welding process.

**Note:** For Autobody 10, welding operations on 16, 20, and 22 gauge mild steel are required.

32.8 To weld mild steel using the MIG welding process.

Practical assignments: spot welds (2 hrs.) and spot weld 20 gauge (2 hrs.). (IL, CCT)

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## Module 33A: Advanced MIG Welding (Core)

**Suggested time:** 16-20 hours

**Level:** Advanced

### Foundational Objectives

- To establish a systematic routine for setting up a welding workstation and for putting away materials and equipment in the workplace or school setting.
- To develop effective use of tools and equipment in order to develop entry level skills in the welding trade.
- To use critical evaluation skills in order to judge quality welding workmanship.

### Common Essential Learnings Foundational Objectives

- To use numeracy skills to estimate, measure, compute and interpret numerical data in welding. (NUM)
- To analyze specific welding processes, complete practical assignments and projects, and recognize that there are different procedures required to produce completed projects and assignments. (CCT)

Note: Other CELs may be emphasized.

Learning Objectives	Notes
33.1 To set up equipment in a proper and safe sequence.	Students should: <ul style="list-style-type: none"><li>• set up equipment</li><li>• adjust flowmeter or regulator</li><li>• check gas type</li></ul>
33.2 To show the proper flowmeter or regulator adjustment. (NUM)	<ul style="list-style-type: none"><li>• check welding gun</li><li>• check cables</li><li>• check ground clamp</li><li>• check feed rollers</li></ul>
33.3 To connect the proper shielding gas and explain its need and use.	<ul style="list-style-type: none"><li>• check contact tip</li><li>• check nozzle without prompting.</li></ul>
33.4 To select and install electrode wire.	The student should know all of the Introductory and Intermediate MIG procedures.
33.5 To prepare material for welding.	
33.6 To perform supplementary and disassembly procedures. (CCT)	

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## Learning Objectives

## Notes

33.7 To weld mild steel. (IL)

Practical assignments for MIG:

- run beads - 6mm (1 hr.)
- tack weld - 6mm (15 min.)
- butt weld - 6mm (1 hr.)
- butt bend (SIAST Level I) (2 hrs.)
- lap weld (30 min.)
- tack weld - 16 gauge (1 hr.)
- tack weld - 18 & 20 gauge (30 min.)
- lap weld - 6mm (30 min.)
- lap weld - 16 & 18 gauge (30 min.)
- ring-16 gauge (2 hrs.)
- ring-18 gauge (2 hrs.)
- ring-20 gauge (2 hrs.)
- fillet tee (SIAST - Level I) (2 hrs.)
- butt weld (SIAST - Level I) (1 hr.)
- tee weld (SIAST - Level I) (1 hr.)
- lap weld (SIAST - Level I) (1 hr.)
- butt weld (SIAST - Level I) (1 hr.)
- aluminum (SIAST - Level I) (1 hr.). (NUM)

These can be completed at this time and used again at the end as a final practical assignment.

Complete a MIG Welding Exam during or upon completion of the MIG Modules.

### Module 33B: Advanced MIG Welding (Optional)

Review or repeat module 33A as required before progressing to this module at the B30 level.

**Suggested time:** 16 hours

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## Module 34A: MIG Welding (Core)

**Suggested time:** 4-6 hours

**Level:** Introductory

### Foundational Objectives

- To apply some principles of science to the welding trade.
- To develop effective use of tools and equipment in order to develop entry level skills in the welding trade.
- To develop a systematic routine for setting up a welding workstation and for putting away materials and equipment in the workplace or school setting.

### Common Essential Learnings Foundational Objectives

- To enable students to understand and use the vocabulary in the field of welding. (TL, COM)
- To understand the use of welding technology, its application in the world around us from mining to underwater welding, and its use in space (TL)

Note: Other CELs may be emphasized.

### Learning Objectives

### Notes

34.1 To establish the relationship between wire speed and amperage, and welding voltage and arc length. (TL)

34.2 To determine the effects of backhand or pull welding and forehand or push welding.

34.3 To determine the effects of torch angle on weld penetration and weld appearance.

34.4 To identify the probable causes of the following defects: surface porosity, sub-surface porosity, lack of fusion, burn through, and lack of penetration. (COM)

Determine the corrective actions that can be taken to avoid surface porosity, sub-surface porosity, lack of fusion, burn through, and lack of penetration. (IL, CCT)

34.5 To describe the visual characteristics of a quality MIG weld.

Learning Objectives	Notes
34.6 To identify strategies to evaluate and improve weld quality. (TL, CCT)	Identify the parameters that can directly affect weld quality: weld current and voltage, type of shielding gas/flux, diameter and types of filler metal, and type and condition of equipment.
34.7 To identify metals, perform preparation and assembly tasks prior to welding.	Steps for the student: <ul style="list-style-type: none"> <li>• identifies metal</li> <li>• determines mechanical properties of metals</li> <li>• determines physical properties of metal</li> <li>• prepares metal for welding.</li> </ul>
34.8 To perform supplementary and disassembly procedures.	Steps for the student: <ul style="list-style-type: none"> <li>• performs equipment shutdown procedures</li> <li>• de-slags and cleans welds</li> <li>• forms welds to prescribed conditions</li> <li>• inspects final assembly.</li> </ul>
34.9 To correctly use hand tools (both manual and power equipment). (TL, PSVS)	Techniques for the student: <ul style="list-style-type: none"> <li>• measures accurately</li> <li>• utilizes hammers</li> <li>• utilizes anvil</li> <li>• utilizes metal cutting tools and metal forming equipment</li> <li>• performs drilling operations</li> <li>• performs grinding and buffing operations</li> <li>• performs filing operations</li> <li>• utilizes drills and tip cleaners</li> <li>• utilizes vices</li> <li>• utilizes clamping devices</li> <li>• utilizes wrenches and pliers.</li> </ul> <p>Create a rating scale using the above techniques.</p>

**Module 34B, C: MIG Welding (Core)**

Review or repeat Module 34A as required before progressing to the next module at the 30 level.

**Suggested time:** 4-6 hours

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## Module 35A: MIG Welding Practical Assignments (Optional)

**Suggested time:** 20-30 hours

### Foundational Objectives

- To develop effective use of tools and equipment in order to develop entry level skills in the welding trade.
- To develop critical evaluation skills in order to judge quality welding workmanship.
- To demonstrate the safe and proper use of welding tools and materials.

### Common Essential Learnings Foundational Objectives

- To analyze specific welding processes, complete practical assignments and projects, and recognize that there are different procedures required to produce completed projects and assignments. (CCT)
- To develop a product using learned skills, knowing when new skills are required, and developing a procedure that will ensure product completion. (TL, CCT)

Note: Other CELs may be emphasized.

Learning Objectives	Notes
35.1 To set up and complete the listed practical assignments. (TL)	Practice butt joint bend, fillet tee, butt joint vertical down, tee joint vertical down, lap joint vertical up, butt joint vertical up, and aluminum (equipment requirements may allow only for theory). (NUM, COM, PSVS)
35.2 To achieve the required weld quality.	
35.3 To analyze all weld faults. (CCT)	Students should identify the remedy required to overcome weld faults.

## Module 35B, C: MIG Welding Practical Assignments (Optional)

Review or repeat Module 35A as required before progressing to the next module at the B30 level.

**Suggested time:** 20 hours

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## Module 36: Introductory Projects (Core)

**Suggested time:** 10-15 hours

### Foundational Objective

- To develop effective use of tools and equipment in order to develop entry level skills in the welding trade.

### Common Essential Learnings Foundational Objective

- To analyze specific welding processes, complete practical assignments and projects, and recognize that there are different procedures required to produce completed projects and assignments. (CCT, TL)

### Learning Objectives

### Notes

36.1 To construct an assigned or an approved but comparable project. (TL, CCT, IL, PSVS)

Suggested projects may include:

- gauge metal candle holder (10 hours)
- gauge metal tool tray (10 hours) (Appendix D)
- round steel and pipe project chipping hammer (10 hours).

These and other projects may be found in recommended resources for this curriculum.

Network with other teachers and exchange project ideas.

Involve students in community projects.

Discuss entrepreneurship possibilities.

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## Module 37A: Work Study Preparation and Follow-up Activities (Optional)

This module is used to prepare students for work study placement. Learning objectives include pre-placement information, preparation for interviews, and expectations for the workplace experience.

**Suggested time:** 5-10 hours

### Foundational Objectives

- To refine practical skills of the trade in a workplace setting.
- To develop workplace skills that may lead to successful employment.
- To enable students to recognize how the classroom work skills development will be used to meet workplace expectations.
- To introduce students to the issues surrounding safe, fair, and cooperative workplace practices.
- To develop workplace skills, knowledge, and attitudes that may lead to successful employment.

### Common Essential Learnings Foundational Objectives

- To use a wide range of language experiences such as listening, speaking, writing, and reading that are required in the workplace. (COM)
- To support students in gaining an understanding of personal and moral issues in the work place. (PSVS)

Note: all CELs may be emphasized.

### Learning Objectives

### Notes

37.1 To create an awareness of the expectations of each of the partners in the work study component.

In order to establish a successful working relationship with all of the partners involved in the workplace, it is important to define the expectations of each partner. To obtain a list of the roles and responsibilities of business, teacher monitor, school, parents, and student, see the Work Study Guidelines for the Practical and Applied Arts included in the *Practical and Applied Arts Handbook*. If a student is planning to pursue an apprenticeship trade such as Welding, refer to the *High School to Apprenticeship* document and Appendix A in this guide.

37.2 To determine factors that affect student contribution in the workplace. (CCT)

Brainstorm a list. Then verify through experience. Ideas such as previous work experience, volunteer work, teamwork activities or extra curricular participation within the school, etc., should be identified.

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## Learning Objectives

## Notes

37.3 To foster an awareness of building good communication in the workplace. (COM, PSVS)

Discuss verbal and non-verbal communication. List some ways in which negative non-verbal communication may be displayed. Encourage students to role play ways of demonstrating effective techniques of verbal communication on the job when giving or receiving instructions and when resolving conflicts. With the use of case studies, students may work in groups and role play to show how effective communication can be used to resolve conflict on the job.

37.4 To develop a resumé that can be forwarded to a potential employer. (CCT, COM)

The student will develop a resumé using the correct format. The resume may be used as an introduction to the employer at a work place site prior to an interview with the student.

Teachers are encouraged to work with other staff members to ensure resumé preparation is taught. Resumé writing is currently suggested in English Language Arts 20 and A30, Information Processing 10, 20, 30 and the Career and Work Exploration Curriculum Guidelines.

Students should save the resumé on a computer disk and update it during the course, as changes are made and references added.

37.5 To determine student guidelines in preparation for an interview. (COM)

Through discussion in class or in groups, students may generate a list of guidelines for an interview. After the students formulate their list, the instructor may add missing items to the list.

Outline and describe the three stages of an interview. Point out to the students at what stage of the interview each of their guidelines previously discussed will be used.

The **greeting** involves an introduction between the student and employer. Discuss or demonstrate how this should be done.

The **exchange** is the longest part of the interview where the employer asks a series of questions and engages in a dialogue with the student about information on the resumé and other matters relating to the job.

The **parting** provides closure to the interview and can be just as important as the greeting. Explain how this can be done.

Provide the students with a list of questions frequently asked by employers or ask students to formulate a list in a group and role play the stages of the interview.

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## Learning Objectives

## Notes

37.6 To develop procedural guidelines for the work site with respect to:

- a) transportation
- b) absence and tardiness
- c) problems arising on the work site
- d) teacher, student supervisor
- e) evaluation criteria
- f) expected hours of work.

Discuss with the student the issues in 37.5 prior to student placement.

Clarify various issues in the post interview with the students. This may be done by asking students to respond to the points listed below (an assignment or during an interview):

- a) expected hours of work
- b) dress code
- c) job description
- d) school expectations
- e) employer expectations
- f) role of monitor
- g) goal definition.

### Module 37B, C: Work Study Preparation and Follow-up Activities (Optional)

Review Module 37 as required.

**Suggested time:** 5-10 hours

The teacher may select any of the following resources to expand the content:

- Labour Standards Act
- Occupational Health and Safety Act
- Workplace Hazardous Materials Information System (WHMIS) documents.

Basic information on the above topics can be obtained from the *PAA Handbook*, the *Career and Work Exploration Curriculum Guidelines*, and Saskatchewan Labour.

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## Module 38: Work Study (Optional)

**Suggested time:** 25-50 hours

**Level:** Intermediate/Advanced

### Foundational Objectives

- To create an awareness of careers and opportunities in the field of welding that exist in Saskatchewan and other provinces.
- To integrate classroom learning with work-related learning.
- To develop an awareness of employability skills as they relate to the work environment.
- To provide students with experience in welding industries that will enable them to make an informed decision about a career in this field.

### Common Essential Learnings Foundational Objectives

- To provide an opportunity for work study and the development of entry level workplace skills that may lead to sustainable employment. (PSVS)
- To provide opportunities for further development of employability skills. (IL)
- To expand career research beyond the classroom setting. (IL)

For more information about implementing work study in schools see the Work Study Guidelines in the *Practical and Applied Arts Handbook*.

Make connections to Module 39: Career Opportunities in Welding.

Use the Training Plans in Appendix B.

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## Module 39: Career Opportunities in Welding (Core)

**Suggested time:** 2-5 hours

### Foundational Objectives

- To create an awareness of careers and opportunities in the field of welding that exist in Saskatchewan and other provinces.
- To create an awareness of the post-secondary programs within the province that are related to the field of welding.
- To provide students with experience about and in welding industries that will enable them to make informed decisions about careers in this field.

### Common Essential Learnings Foundational Objectives

- To identify personal interests and aptitudes in order to initiate career exploration. (IL, PSVS)
- To develop technological abilities to access and evaluate career information. (TL, CCT, IL)

### Learning Objectives

### Notes

39.1 To explore apprenticeable trades.	Students will define apprenticeship. Ask students in groups to create a list of apprenticeable trades. Outline the advantages and disadvantages of pursuing a career via the apprenticeship route.
39.2 To explore the transition from high school to apprenticeship. (Optional)	Outline the high school to apprenticeship trade pathway (Appendix A). What are the apprenticeable trade offerings within your school, community, region, or province?
39.3 To develop a list of career opportunities related to the field of welding. (COM, IL)	Students will create a list of the many different career opportunities in the professional, semi-professional, and skilled trade areas related to the field of welding. They should begin by listing guest speakers who have made presentations throughout the course and then list career workers within the field of welding in the community. Ideas that may be explored are: self-employed repair shop owner, pipeline welder, specialty welder for energy plants, aircraft welder, production line welder, etc. Students are encouraged to use a variety of sources of information such as guidance counsellors, career software packages, personal interviews, and web sites.  Consult <a href="http://www.sasknetwork.gov.sk.ca">www.sasknetwork.gov.sk.ca</a> .
39.4 To identify personal skills and interests that may lead to a career. (PSVS)	Ask each student to create an inventory of activities and interests. Have students examine their lists to determine how these activities and interests might be job related. This task of creating interest inventory may be done using a variety of computer program software packages. Once students have determined areas of interest related to welding, students should research the careers using available resources in the library, community, or on the Internet.

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**Learning Objectives****Notes**

39.5 To determine skills and interests that would enhance career choices. (CCT)

From the lists created for Learning Objective 39.4 ask the students to select two choices of possible careers for further research. Investigate career choices including the description of work duties, what personal qualities an individual must possess to succeed in the career, process to become certified within the career/trade, length of education and training, school locations, cost of education and upgrading, trends within the business or career, the best and worst parts of the job, beginning salary, and opportunities for advancement.

If the student engages in a work study module, he/she may investigate career links within the community for possible work study placements. As part of the career research, the student may interview a professional/tradesperson within the community or from a distance via phone or e-mail.

A class presentation by students on a welding career may be possible, if time permits.

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## Appendix A: Determining a Trade Pathway for Students

During the renewal of the Practical and Applied Arts (PAA), Saskatchewan Education signed an articulation agreement for Welding with Saskatchewan Post-Secondary Education and Skills Training (SPEST), Apprenticeship Trade Certification Commission (ATCC), and Saskatchewan Institute of Applied Science and Technology (SIASST). Before renewing the program in Welding or starting such a program, teachers must be aware of the following processes and procedures – in summary.

1. As Welding requires a certain level of maturity, it is recommended that certain modules for Middle Level be made available to grade 9 students only as part of a Survey course. Welding modules available for grade 9 students are listed in the PAA Survey Guidelines.
2. Pure 100 hour courses are available in Welding beginning at the grade 10 Level. Welding modules may also be configured into a PAA Survey course(s) at the 10, 20, 30 levels.
3. Students may take Welding 10, 20, 30 with no intent to pursue a Welding career. Therefore, no articulation procedures need be followed.

### Articulation

Saskatchewan Education, in consultation with the PAA Reference Committee, has agreed to develop adequate hours of provincial curriculum in the various designated trades areas of high school curriculum, along with limited practical experience, to meet the Level I requirements (or their equivalent) as outlined by the Apprenticeship and Trade Certification Commission (ATCC) of Saskatchewan Post-Secondary Education and Skills Training (SPEST) in collaboration with the Trade Board. Articulation agreements among these educational partners have been established to accommodate high school graduates who have met the Level I requirements outlined in the high school curricula and who have followed the procedures specified by the *ACTU High School to Apprenticeship*. Those students may challenge the Level I trade exam. Successful students will receive Level I theory advanced standing in appropriate SIASST programs, and Prior Learning Assessment Recognition (PLAR) time credit hours for time spent with a journey person in the workplace toward apprenticeship standing in the trade.

Training plans included in Appendix B have been designed to provide direction for Level I skill development in the classroom and in the workplace.

### **School divisions/schools seeking Welding articulation with Apprenticeship for students graduating from high school may register and challenge the Level I exam, by completing the following steps:**

- Everyone must have studied *High School to Apprenticeship: Link to the Future* (1999).
- The Level I theory identified in Appendix B of these Welding Guidelines must be covered thoroughly by the certified teacher and students.
- If possible, practical experiences must be simulated in the school setting or work study modules must be used in partnership with a local business and journey person.
- If the teacher is not a journey person, the teacher must have taken the Level I Summer Short course offered in partnership by Saskatchewan Education, ATCC, SIASST, SIEA, and the STF. This course will certify teachers to teach Level I theory and evaluate Level I practice in their school or as part of a work study partnership.
- To challenge Level I, the teacher should recommend only those students who have successfully completed the Level 1 practical, and who have aspirations to pursue further training in the apprenticeship trade. Registration for the Level I exam is managed by ATCC. Students challenging the Level I apprenticeship theory exam must attain a mark of 70% to pass, therefore should be achieving at the 80% range in all aspects of the apprenticeship Welding Curriculum Guidelines.
- The students must state their intention to write the Level I Exam prior to the successful completion of the final high school course(s). They must receive permission to proceed.
- The teacher must notify ATCC at least 2 months prior to the writing of the Level I exam, state the intent to have students write, and indicate the number of exams required. Verification of the high school trade course marks and an examination fee must be submitted for each student eligible to write.

- The ATCC will administer the Level I exams to high school students during the January and June Departmental Examination writing sessions as arranged. The dates for the writing weeks are established annually and distributed to the schools in the *Registrar's Handbook for School Administrators*. Contact the Registrar's Office, Student Records at Saskatchewan Education.
- Apprenticeship exams will be returned to the ATCC for grading and evaluation.
- Marks will be mailed to the student/school. ATCC will record the marks for the Level I exams. For more information about trade articulation and guidelines see the *High School to Apprenticeship: Link to the Future* document developed by ATCC.
- SIAST or ATCC notification of changes to the Level I apprenticeship requirements in the trade will be communicated to teachers via the Evergreen Curriculum area on the Saskatchewan Education website ([www.sask.ed.gov.sk.ca](http://www.sask.ed.gov.sk.ca)).
- A high school graduate who has already received all the Secondary Level credits for Welding and who passes the Level I exam will receive 400 hours of advanced standing in the Welding program at SIAST with time credit recognition for documented practical experience under a journeyman.

The following Saskatchewan Education PAA Welding 10, 20, A30, B30 Curriculum Guideline modules must be successfully completed in order to meet the Level I requirements in the trade:

Weld 01: Safety: General, Oxy-Acetylene Welding, Electric Arc Welding
Weld 02: Intermediate Safety
Weld 03: Hand Tools and Power Equipment
Weld 04: Intermediate Hand Tools and Power Equipment
Weld 05: Oxy-Acetylene Start-up, Shut-down, and Cutting
Weld 06: Oxy-Acetylene Cutting
Weld 07A, B: Advanced Oxy-Acetylene Cutting
Weld 08: Oxy-Acetylene Cutting Practice
Weld 09: Oxy-Acetylene Welding
Weld 10: Intermediate Oxy-Acetylene Welding
Weld 11A, B: Oxy-Acetylene Welding Practical Requirements
Weld 13: Plasma Arc Cutting
Weld 14: Electric Arc Welding Electrodes and Accessories
Weld 15: Shielded Metal Arc Welding (S.M.A.W.) Procedures
Weld 16: Electric Arc Welding; Weld Faults
Weld 17: Electric Arc Weld Faults and Causes
Weld 18A, B: Electric Arc Gauge Metal Welding
Weld 19: Electric Arc Welding Electrode Selection and Use
Weld 20A, B: Electric Arc Welding: Electrodes, Weld Joint, and Positions
Weld 21A, B: Electric Arc Welding Assignments
Weld 22A, B: Electric Arc Welding "Vee" Butt Weld
Weld 29A, B, C, D: MIG Welding Safety and Equipment
Weld 30A, B, C, D: MIG Start-Up and Shut-Down
Weld 31A, B, C: MIG Procedures and Practice
Weld 32: Intermediate MIG Welding
Weld 33A, B: Advanced MIG Welding
Weld 34A, B: MIG Welding
Weld 35A, B: MIG Welding Practical Assignments

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The modules have fidelity with the following SIAST modules:

Weld 120	General Shop Safety
Weld 120T	Introduction to Shielded Metal Arc
Weld 121P	Introduction to Shielded Metal Arc
Weld 122T	Introduction to Oxy-Acetylene Welding
Weld 123P	Introduction to Oxy-Acetylene Welding
Weld 124T	Oxy-Acetylene Cutting and Safety
Weld 125P	Oxy-Acetylene Cutting
Weld 134T	Metallic Gas Arc Welding
Weld 135P	Metallic Gas Arc Welding

## Appendix B: Training Plan Checklists

### Training Plan - Checklist for Welding 10

Student's Name: \_\_\_\_\_

Date: \_\_\_\_\_

Business: \_\_\_\_\_

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

Module Component	Observed	Assisted	Demonstrated	Checked By
Module 1: Safety: General, Oxy-Acetylene Welding, Electric Arc Welding: <i>recognize and apply safe working practises to reduce accidents</i>				
Module 3: Hand Tools and Power Equipment: <i>become familiar with safe hand and power tool procedures</i>				
Module 5: Oxy-Acetylene Start-up, Shut-down, and Cutting: <i>demonstrate the safe and proper procedures to use O/A equipment.</i>				
Module 11A: Oxy-Acetylene Welding Practical Requirements: <i>practice various skills and types of welds with and without fill rod.</i>				
• 14 gauge flat weld				
• 14 gauge vertical weld				
Module 14: Electric Arc Welding Electrodes and Accessories				
• identify various electrodes and accessories				
Module 15: Shielded Metal Arc Welding (S.M.A.W.) Procedures as outlined in the guide: <i>describe various aspects of arc welding and define common welding terms.</i>				
Module 21A: Electric Arc Welding Assignments: <i>perform a variety of weld beads on mild steel plate</i>				
• run continuous weld beads				
• perform butt weld				
• pad a plate				
Module 29A: MIG Welding Safety and Equipment: <i>apply the principles and practises and develop the behaviours of safe work habits.</i>				
• safety MIG skills				

Module 30A: Start-Up and Shut-Down (MIG): <i>demonstrate correct start-up and shut-down procedures for MIG welding apparatus</i>				
• start up and shut down				
• MIG welding assignments				
• 14 gauge down hand butt weld				
• 14 gauge lap weld				
• 14 gauge fillet welds				
Welding projects as outlined in the guideline				

## Training Plan - Checklist for Welding 20

Student's Name: \_\_\_\_\_ Date: \_\_\_\_\_

Business: \_\_\_\_\_

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

Module Component	Observed	Assisted	Demonstrated	Checked By
Module 2: Intermediate Safety: <i>maintain, repair, or replace safety equipment and maintain a safe work environment.</i>				
Module 4: Intermediate Hand Tools and Power Equipment: <i>conduct maintenance of necessary hand and power tools for welding operations.</i>				
Module 6: Oxy-Acetylene Cutting: <i>demonstrate knowledge and use of cutting equipment on various thicknesses of material.</i>				
Module 8: Oxy-Acetylene Cutting Practice: <i>develop an advanced level of expertise with an O/A cutting torch.</i>				
• 3/8 plate - 4" x 5"				
• 14 gauge - 3" x 5"				
Module 10: Intermediate Oxy-Acetylene Welding: <i>develop a level of expertise with O/A welding equipment.</i>				
Module 11B: Oxy-Acetylene Welding Practical Requirements: <i>practice and complete a variety of assignments.</i>				
• 14 gauge flat weld (butt)				
• 14 gauge vertical weld (butt)				
Module 13: Plasma Arc Cutting: <i>demonstrate the use of plasma cutting equipment to cut various thicknesses of metal.</i>				
• practical requirements				
• 14 gauge - 4 x 5				
Module 16: Electric Arc Welding; Weld Faults: <i>identify the various weld faults.</i>				
Module 19: Electric Arc Welding Electrode Selection and Use: <i>choose an appropriate electrode for a specific weld in a butt, corner, lap, or fillet joint.</i>				

Module 20A: Electric Arc Welding: Electrodes, Weld Joint, and Positions: <i>describe polarity types and the 4 different welding positions.</i>				
Module 21B: Practical Requirements: <i>practice skills on various thickness materials</i>				
<ul style="list-style-type: none"> <li>• 3/8 V butt flat only</li> </ul>				
Module 23A - Projects as outlined in the guideline or work placement: <i>demonstrate skill on project work.</i>				
Module 24: Projects as outlined in the guideline: <i>continue with larger or more difficult project assignments.</i>				
Module 29B: MIG Welding Safety and Equipment: <i>demonstrate principles and practices of safe operation with MIG equipment.</i>				
Module 30B: Start-Up and Shut-Down (MIG): <i>demonstrate skills from module 30A.</i>				
Module 31A: MIG Procedures: <i>practice safe work habits and maintenance while operating this equipment.</i>				
Module 32: Intermediate MIG Welding: <i>demonstrate knowledge of different gases and the regulation of these gases.</i>				
Module 34A: MIG Welding: <i>determine the effects of various feeder adjustments and movements as well as make judgements regarding materials and procedures.</i>				
Module 35A: MIG Welding Practical Assignments: <i>demonstrate success with a variety of joints and directions and analyze all weld faults.</i>				
<ul style="list-style-type: none"> <li>• 14 gauge downhand butt, lap, fillets</li> </ul>				
<ul style="list-style-type: none"> <li>• 3/8 bench V butt flat and vertical uphand (all passes)</li> </ul>				
<ul style="list-style-type: none"> <li>• 3/8 fillets, single and multi pass horizontal</li> </ul>				
<ul style="list-style-type: none"> <li>• 3/15 or 1/4 aluminum horizontal fillets 2 x 2 x 3/15</li> </ul>				

## Training Plan - Checklist for Welding A30

Student's Name: \_\_\_\_\_ Date: \_\_\_\_\_

Business: \_\_\_\_\_

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

Module Component	Observed	Assisted	Demonstrated	Checked By
Module 7A: Advanced Oxy-Acetylene Cutting: <i>cut straight lines and beveled edges on metal plate.</i>				
Module 12A: Practical Requirements as outlined in the guideline: <i>demonstrate skill in performing various types of welds with O/A equipment.</i>				
Module 17: Electric Arc Weld Faults and Causes: <i>identify various weld faults and indicate corrective measures necessary.</i>				
Module 18A: Electric Arc Gauge Metal Welding: <i>demonstrate ability to weld gauge metal material in the flat position.</i>				
Module 20B: Electric Arc Welding: Electrodes, Weld Joint, and Positions: <i>practice and review the elements of 20A</i>				
Module 21C: Practical Requirements as outlined in the guideline: <i>continue to practice welding with a variety of electrodes on mild steel plate.</i>				
Module 22A: 3/8 flat V butt: <i>test welded joint by bending.</i>				
Module 23B: Practical Requirements as outlined in the guideline: <i>demonstrate objectives of 23A.</i>				
Module 25A: Practical Requirements as outlined in the guideline: <i>plan and construct an advanced project.</i>				
Module 26: The Nature and Production of Iron and Steel: <i>explain the processes and production of iron and steel.</i>				
Module 29C: MIG Welding Safety and Equipment: <i>maintain and build the skill of 29A.</i>				
Module 30B: Start-Up and Shut-Down (MIG): <i>maintain and fine tune skills developed in 30A.</i>				
Module 31B: MIG Procedures: <i>maintain skills learned in 31A.</i>				

Module 33A: Advanced MIG Welding: <i>demonstrate entire set-up procedure; adjust and prepare materials for welding with a MIG apparatus.</i>				
Module 34B: MIG Welding: <i>continue with objectives of 34A as well as perform various operations with hand and power tools.</i>				
Module 35B: Practical assignments as outlined in the guideline: <i>demonstrate skills through project work.</i>				

## Training Plan - Checklist for Welding B30

Student's Name: \_\_\_\_\_

Date: \_\_\_\_\_

Business: \_\_\_\_\_

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

Module Component	Observed	Assisted	Demonstrated	Checked By
Module 7B: Advanced Oxy-Acetylene Cutting: <i>develop improved skill level with various metal thicknesses.</i>				
Module 12B: Advanced Projects as outlined in the guideline: <i>demonstrate O/A skills through project work.</i>				
Module 18B: Electric Arc Gauge Metal Welding: <i>reinforce and demonstrate objectives for 18A.</i>				
Module 21D: 3/8 V butt - flat				
Module 22B: 3/8 V butt - flat				
Module 23C: Projects as outlined in the guideline: <i>demonstrate skills through project work.</i>				
Module 25B: Advanced Projects as outlined in the guideline: <i>show ability to plan and execute the planning and construction of a project to specifications.</i>				
Module 27: Soldering (Optional): <i>explain different types of soldering and perform the operation on 20 gauge material.</i>				
Module 28: Brazing (Optional): <i>differerentiate between fusion and non-fusion welding; explain and perform the operation on 16, 18, and 20 gauge material.</i>				
Module 29D: MIG Welding Safety and Equipment: <i>continue with skill development from 29A.</i>				
Module 30D: Start-Up and Shut-Down (MIG): <i>demonstrate capability of start-up and shut-down procedures.</i>				
Module 31C: MIG Procedures: <i>develop increased levels of knowledge and skill in maintainence of machinery.</i>				
Module 33B: Advanced (MIG) Welding: <i>continue to develop skill with MIG apparatus components.</i>				

Module 34C: MIG Welding: <i>identify various strategies to solve a number of different preparation and performance problems.</i>				
Module 35C: MIG Welding Practical Assignments: <i>demonstrate skills through advanced project work.</i>				
• 14 gauge downhand butt, lap, fillet				
• 3/8 V butt, flat, and vertical uphand (all passes)				
• 3/8 fillet single and multi-pass horizontal				
• 3/16 or 1/4 aluminum horizontal fillets - 2 x 2 x 3/16				

## Appendix C: Recordkeeping Charts

### Welding 10

Student name \_\_\_\_\_

Student number \_\_\_\_\_

Module code	Module Title	Date	Teacher Initial
WELD01	Module 1: Safety: General, Oxy-Acetylene, and Electric Arc Welding C*		
WELD03	Module 3: Hand Tools and Power Equipment C*		
WELD05	Module 5: Oxy-Acetylene Start-up, Shut-down, and Cutting C*		
WELD09	Module 9: Oxy-Acetylene Welding C*		
WELD11A	Module 11A: Oxy-Acetylene Welding Practical Requirements C*		
	<ul style="list-style-type: none"> <li>• Outside corner weld-flat position, no fill rod, 14 and 16 gauge mild steel</li> </ul>		
	<ul style="list-style-type: none"> <li>• Lines of fusion using fill rod on one plate 14 and 16 gauge mild steel</li> </ul>		
	<ul style="list-style-type: none"> <li>• Butt weld 16 gauge mild steel with fill rod in the flat position</li> </ul>		
WELD14	Module 14: Electric Arc Welding Electrodes and Accessories C*		
WELD15	Module 15: Shielded Metal Arc Welding (S.M.A.C.) Procedures C*		
WELD21A	Module 21A: Electric Arc Welding Assignments C*		
	<ul style="list-style-type: none"> <li>• Run continuous beads on mild steel plate</li> </ul>		
	<ul style="list-style-type: none"> <li>• Perform a butt weld on mild steel plates</li> </ul>		
	<ul style="list-style-type: none"> <li>• Pad a mild steel plate with at least 2 layers on each side</li> </ul>		
WELD29A	Module 29A: MIG Welding Safety and Equipment C*		
WELD30A	Module 30A: Start-up and Shut-down (MIG) C*		
WELD36	Module 36: Introductory Projects C		
WELD39A	Module 39: Career Opportunities in Welding C		

C = core module

O = optional module

\* = refers to modules required for post-secondary articulation/recognition

It is recommended that this document be printed on school letterhead.

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## Welding 20

Student name \_\_\_\_\_

Student number \_\_\_\_\_

Module code	Module Title	Date	Teacher Initial
WELD02	Module 2: Intermediate Safety C*		
WELD04	Module 4: Intermediate Hand Tools and Power Equipment C*		
WELD06	Module 6: Oxy-Acetylene Cutting C*		
WELD08	Module 8: Oxy-Acetylene Cutting Practice C*		
WELD10	Module 10: Intermediate Oxy-Acetylene Welding C*		
WELD11B	Module 11B: Oxy-Acetylene Welding Practical Requirements O*		
WELD13	Module 13: Plasma Arc Cutting C		
WELD16	Module 16: Electric Arc Welding; Weld Faults C*		
WELD19	Module 19: Electric Arc Welding: Electrode Selection and Use C*		
WELD20A	Module 20A: Electric Arc Welding: Electrodes, Weld Joints and Positions C*		
WELD21B	Module 21B: Electric Arc Welding: Assignments O*		
WELD23A	Module 23A: Metal Inert Gas (MIG) and Electric Arc Welding Projects O		
WELD24	Module 24: Intermediate Projects O		
WELD29B	Module 29B: MIG Welding Safety and Equipment C*		
WELD30B	Module 30B: Start-up and Shut-down (MIG) C*		
WELD31A	Module 31A: MIG Procedures and Practice C*		
WELD32	Module 32: Intermediate MIG Welding C*		
WELD34A	Module 34A: MIG Welding C*		
WELD35A	Module 35A: MIG Welding Practical Assignments O*		
WELD37	Module 37: Work Study Preparation and Follow-up Activities O		
WELD38A	Module 38A: Work Study O		

C = core module

O = optional module

\* = refers to modules required for post-secondary articulation/recognition

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## Welding A30

Student name \_\_\_\_\_

Student number \_\_\_\_\_

Module code	Module Title	Date	Teacher Initial
WELD07A	Module 7A: Advanced Oxy-Acetylene Cutting C*		
WELD12A	Module 12A: Advanced Oxy-Acetylene Welding Projects C		
WELD17	Module 17: Electric Arc Weld Faults and Causes C*		
WELD18A	Module 18A: Electric Arc Gauge Metal Welding C*		
WELD20B	Module 20B: Electric Arc Welding Electrode, Weld Joints, and Positions C*		
WELD21C	Module 21C: Electric Arc Welding Assignments O		
WELD22A	Module 22A: Electric Arc Welding "Vee" Butt Joint C*		
WELD23B	Module 23B: Metal Inert Gas (MIG) and Electric Arc Welding Projects O		
WELD25A	Module 25A: Advanced Projects C		
WELD26	Module 26: The Nature and Production of Iron and Steel C		
WELD29C	Module 29C: MIG Welding Safety and Equipment C*		
WELD30C	Module 30C: Start-up and Shut-down (MIG) O*		
WELD31B	Module 31B: MIG Procedures O*		
WELD33A	Module 33A: Advanced MIG Welding C*		
WELD34B	Module 34B: MIG Welding C*		
WELD35B	Module 35B: MIG Welding Practical Assignments O*		
WELD37B	Module 37B: Work Study Preparation And Follow-up Activities O		
WELD38B	Module 38B: Work Study O		

C = core module

O = optional module

\* = refers to modules required for post-secondary articulation/recognition

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## Welding B30

Student name \_\_\_\_\_

Student number \_\_\_\_\_

Module code	Module Title	Date	Teacher Initial
WELD07B	Module 7B: Advanced Oxy-Acetylene Cutting O*		
WELD12B	Module 12B: Advanced Oxy-Acetylene Welding Projects O		
WELD18B	Module 18B: Electric Arc Gauge Metal Welding C*		
WELD21D	Module 21D: Electric Arc Welding Assignments O		
WELD22B	Module 22B: Electric Arc Welding "Vee" Butt Joint Weld O*		
WELD23C	Module 23C: Metal Inert Gas (MIG) and Electric Arc Welding Projects O		
WELD25B	Module 25B: Advanced Projects O		
WELD27	Module 27: Soldering O		
WELD28	Module 28: Brazing O		
WELD29D	Module 29D: MIG Welding Safety and Equipment C*		
WELD30D	Module 30D: Start-up and Shut-down (MIG) O*		
WELD31C	Module 31C: MIG Procedures and Practice O*		
WELD33B	Module 33B: Advanced MIG Welding O*		
WELD34C	Module 34C: MIG Welding C		
WELD35C	Module 35C: MIG Welding Practical Assignments O		
WELD37C	Module 37C: Work Study Preparation and Follow-up Activities O		
WELD38C	Module 38C: Work Study O		

C = core module

O = optional module

\* = refers to modules required for post-secondary articulation/recognition

It is recommended that this document be printed on school letterhead.

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## Appendix D: Practical Assignments for Level I

The following practical assignments are identified by Apprenticeship and Trade Certification Unit as practical skills required for Level I Apprenticeship Welding.

### Oxy-Acetylene Welding

- Introduction
- Safety Rules and Practices
- Shop Practices
  - a) gauge flat and vertical butt welds. Use two pieces: 14 gauge 100mm (4") x 125mm (5"); bead length: 125mm (5").
  - b) Cutting 9mm (3/8") mild steel plate, 90° square cut, 30° bevel cut, hole to fit 25mm (1") standard pipe.
- Tests (written and practical).

### Electric Arc Welding

- Introduction
- Safety Rules and Practices
- Related Theory
- Shop Practices
  - c) 9mm (3/8") mild steel plate 100mm (4") x 125mm (5") beveled V-butt joint, flat position. Welded joint 125mm (5").
  - d) Test coupons cut for face and root bend test. Two 38mm (1.5") x 200mm (8") tolerance + or - 2.5mm (3/32").
- Tests (written and practical).

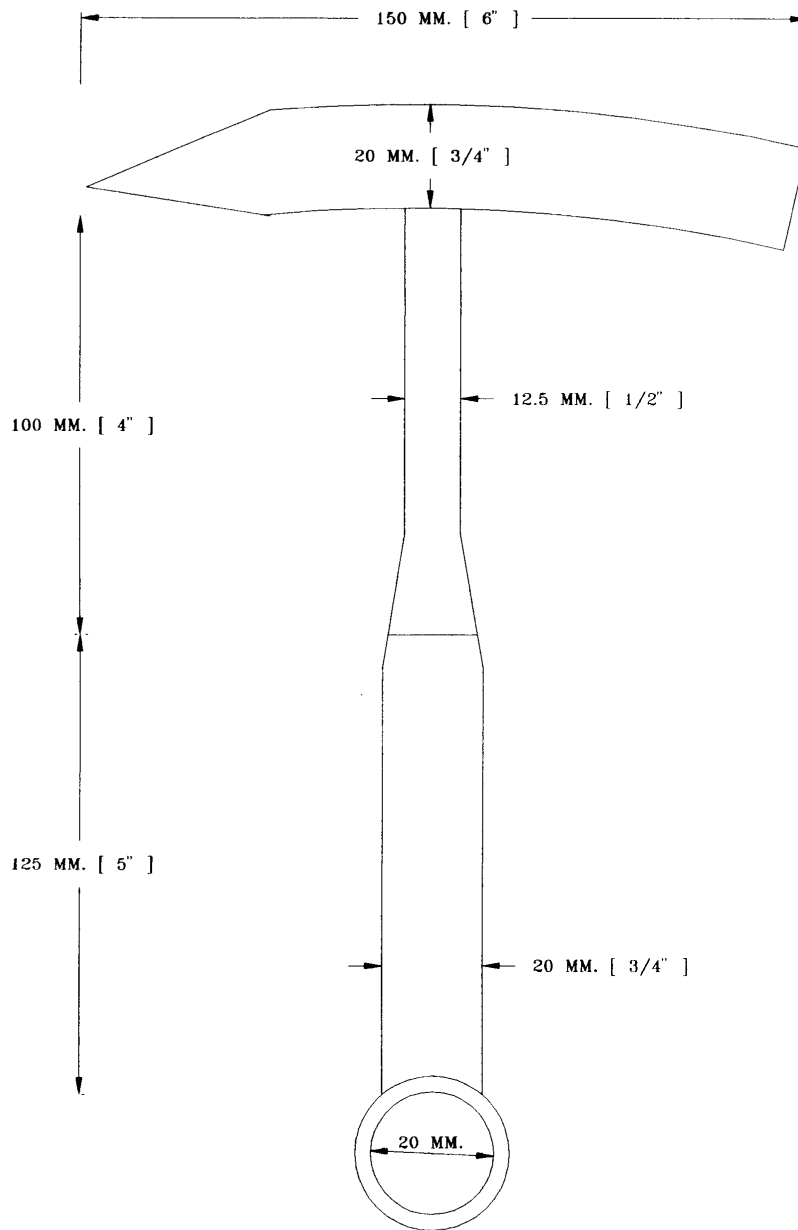
### Metal Inert Gas Welding

- Introduction to MIG welding.
- 14 gauge downhand butt, lap, fillet joints on 100mm (4") x 125mm (5") mild steel.
- 9mm (3/8") mild steel V-bevel butts, flat and vertical. Two pieces 100mm (4") x 125mm (5"). Test coupons cut for face and root bend test. Two 38mm (1.5") x 200mm (8") tolerance + or - 2.5mm (3/32").
- 5mm (3/16") mild steel fillet welds single and multipass horizontal on 50mm (2") x 300mm (12") pieces.
- 6mm (1/4") aluminum fillets, horizontal T-joint. 50mm (2") x 300mm (12") pieces.
- Tests (written and practical).

The above practical skills have been integrated throughout the Saskatchewan Education Welding 10, 20, A30 and B30 modules.

The diagrams on the following pages that suggest possible practical projects for these guidelines were developed by George Kolb, Swift Current Comprehensive High School.

[H]

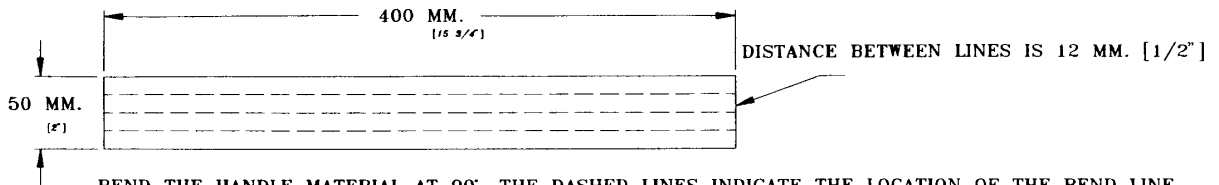


EVALUATION	PROJ. SHT:	/ 10	WELD QUAL.:	/ 50	APPEARANCE:	/ 30	FINISH:	/ 10	MK:
NAME:	START DATE:		COMPLETION DATE:		HOURS:				



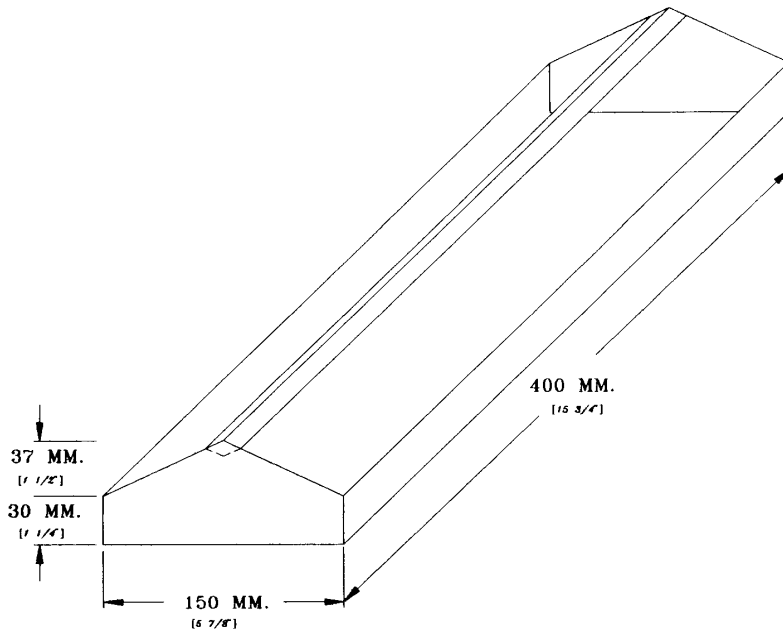
[H]

**HANDLE**



BEND THE HANDLE MATERIAL AT 90°. THE DASHED LINES INDICATE THE LOCATION OF THE BEND LINE.  
TO BEND METAL IS TO FOLD IT USING A MACHINE CALLED A BRAKE.

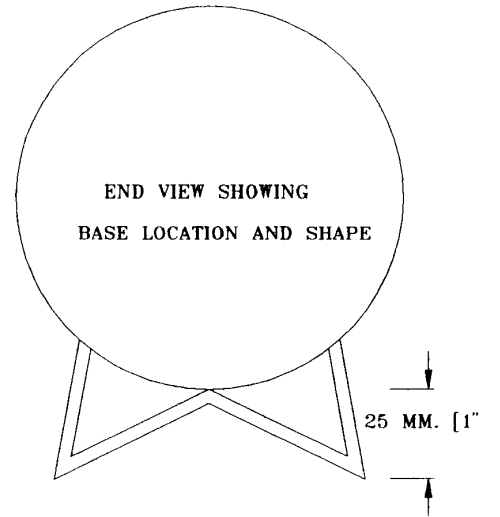
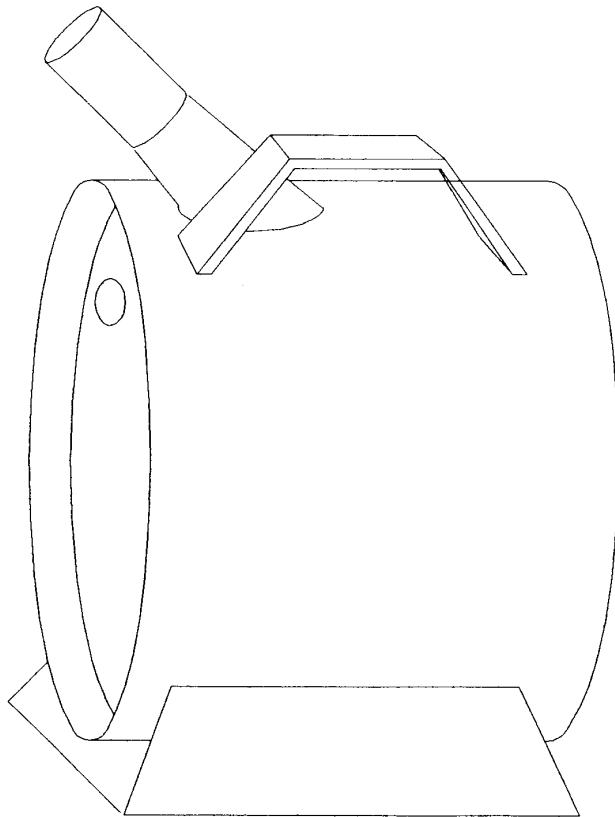
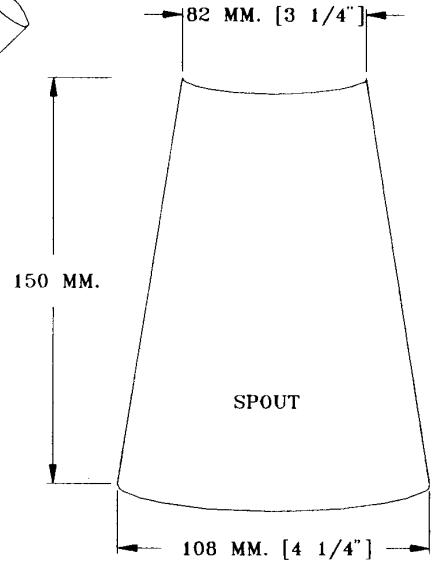
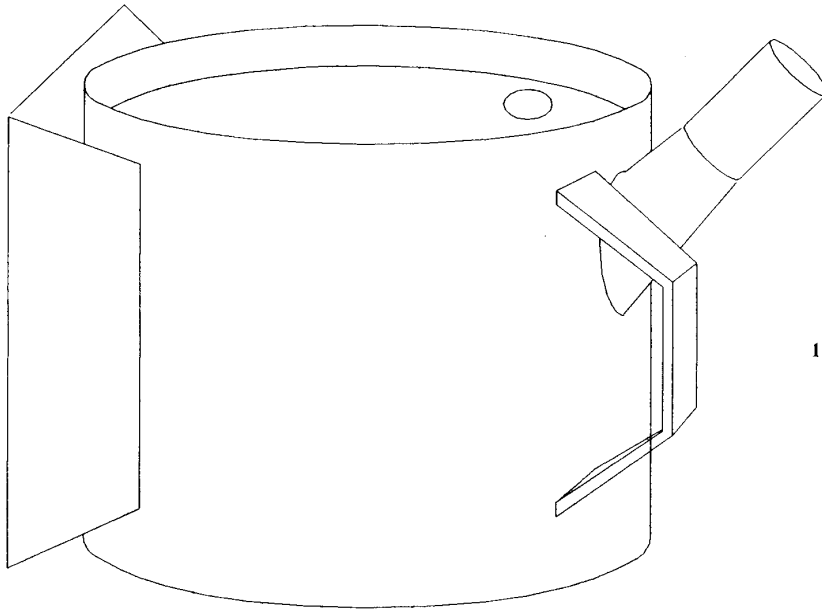
**COMPLETED TRAY**



EVALUATION	PROJ. SHT: / 10	WELD QUAL.: / 50	APPEARANCE: / 30	FINISH: / 10	MK:
NAME:	START DATE:	COMPLETION DATE:	HOURS:		



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EVALUATION	PROJ. SHT: / 10	WELD QUAL.: / 50	APPEARANCE: / 30	FINISH: / 10	MK:
NAME:	START DATE:	COMPLETION DATE:	HOURS:		

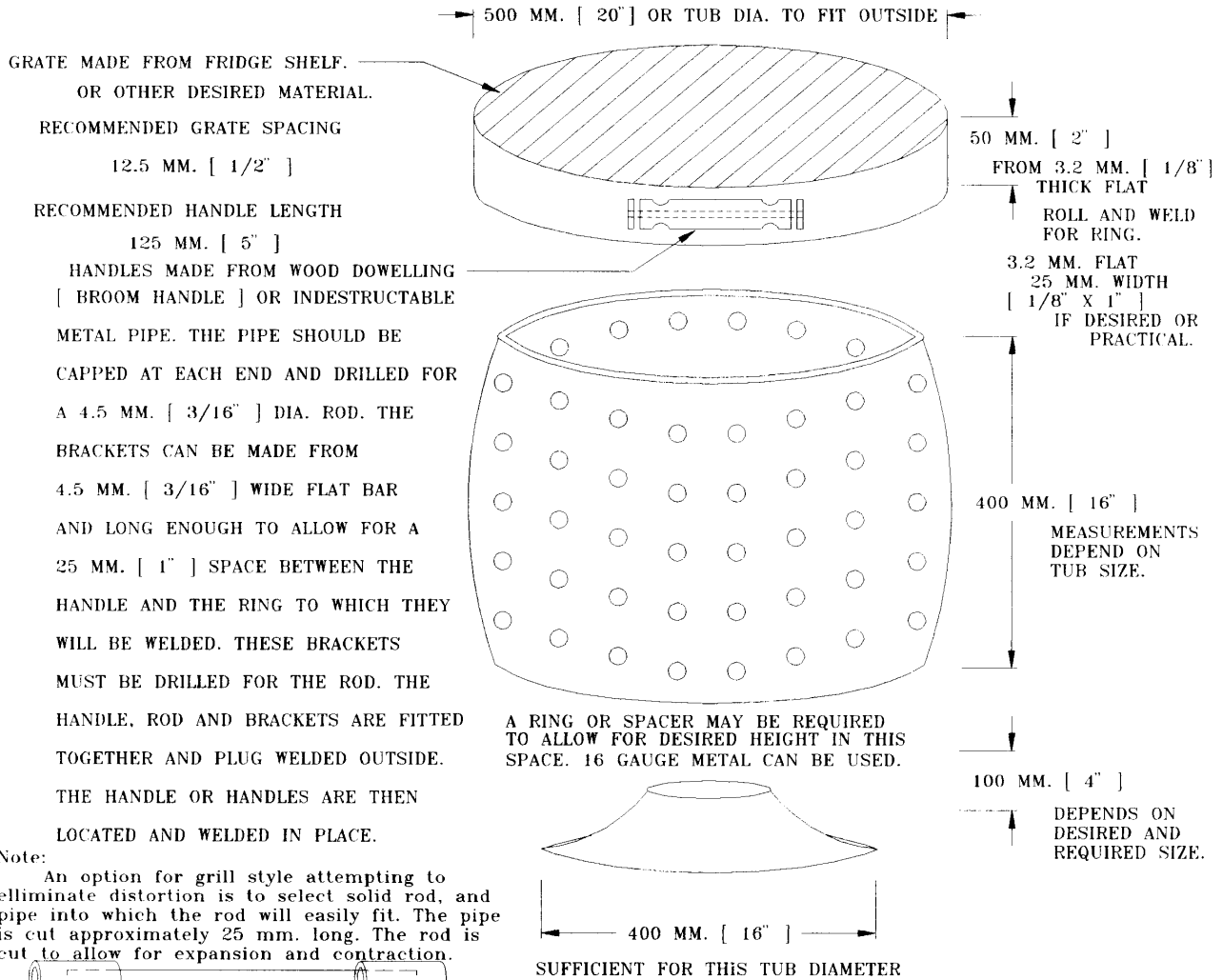
#13 PORTABLE FIREPIT / BARBECUE

The fire pit is a project that can be constructed to contain an outdoor campfire. It can be made with a top that will serve as a barbecue. It will require a base or legs to raise it off the ground. The size may be designed to an individual's taste. Local bylaws and campground bylaws should be checked to find out what restrictions there are with regard to size and openings. The unit can be made so it is portable or by size is fixed. The unit can be designed and completely constructed with new material, or or it can be made by utilizing materials and parts that can be salvaged from discarded items. An excellent fire pit can be made from the main tub of a clothes washing machine. The base can be made from a used disk off a farm implement. A top grate can be salvaged from shelves in a discarded away fridge. An excellent base can be made from the base of a display stand that stores no longer want.

MATERIAL LIST

The material list will be established by an individual's design and requirements.

The cost of the project will be established by the individual's design, desires and ingenuity.



EVALUATION	PROJ. SHT: / 10	WELD QUAL.: / 50	APPEARANCE: / 30	FINISH: / 10	MK:
NAME:	START DATE:	COMPLETION DATE:	HOURS:		

# Appendix E: Assessment Checklists

## Accident Prevention Principles

Student Name														
Is aware of and constantly practises personal safety and safety for others.														
Reports accidents.														
Prepares a safe working environment.														
Ensure availability of approved protective equipment.														
Inspects and controls exposure to fumes, vapor, and dust.														
Determines noise levels and eye safety and takes necessary precautions for personal safety and safety of others.														
Controls exposure to welding radiation.														
Knows how to operate fire extinguishers.														
Utilizes gas cylinders.														
Ensures correct procedures for movement and storage of gas cylinders and safe use of gas cylinders.														
Recognizes and determines disposition of empty, damaged, or leaking cylinders.														
Keeps tools in safe condition.														
Practices correct manual lifting techniques.														

## MIG Welding Process Checklist

Student Name														
<b>Start-up Procedures</b> Checks the condition of the workstation, welding equipment, and personal protective equipment.														
Puts up adequate screening to protect people in the immediate area.														
Ensures proper ventilation.														
Makes sure all connections are correctly attached.														
Checks for the proper shielding and wire electrode.														
Adjusts the machine for the appropriate wire speed, voltage, and amperage.														
Turns on shielding gas and checks flow meter.														
Checks shielding nozzle for gas obstructions.														
Uses the proper personal protective equipment.														
Posts fire watch if necessary.														
Turns on machine.														
<b>Shut-down Procedures</b> Carefully removes and cools all hot welding materials.														
Turns off power supply to welder, shuts off shielding gas, and closes the cylinder valve.														
Hangs up all cables and stores equipment as directed.														
Cleans up the work station.														