WLD 151
SMAW Certification Practice:
Unlimited Thickness Mild Steel

Index

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National Science Foundation
Opinions expressed are those of the authors
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Course Assignments

Reading

The Welding Principles and Applications: by Larry Jeffus.
Chapter 22, Welding Codes and Standards
Chapter 23, Testing and Inspection of Welds
Chapter 25, Welding Metallurgy

Math

Practical Problems in Mathematics 6th edition by Robert Chasan
Chapter 16, Decimal Fractions and Common Fraction Equivalents
Chapter 17, Tolerances
Chapter 18, Combined Operations with Decimal Fractions
Chapter 19, Equivalent Measurements

Recommended assignments

Complete review question following each assigned chapter

Quizzes

Complete **Interactive Quiz** in CourseMate for Principles and Applications and **Homework Quiz** for Math for each assigned chapter

Welding Projects

6" Vertical Groove
6" Overhead Groove
Bend Tests Procedures

Final Exam

Closed Book Open note Exam
Practical Final

Reference List

Standard Welding Terms and Definitions: ANSI/AWS A3.0-94
AWS D1.1 Structural Steel Welding Code

Timeline:

Open-entry, open-exit instructional format allows the students to work their own pace. It is the student's responsibility for completing all assignments in a timely manner. See your instructor for assistance.

Outcome Assessment Policy:

The student will be assessed on his/her ability to demonstrate the development of course outcomes. The methods of assessment may include one or more of the following: oral or written examinations, quizzes, written assignments, visual inspection techniques, welding tests, safe work habits, task performance and work relations.

Helpful Hints for Welding Grooves

Groove Welding Techniques

To make a quality weld when welding a groove joint is important because that weld will most likely be inspected by X-ray or Ultrasonic welding inspection techniques because it is a complete joint penetration (CJP) weld. Hence, here are a few techniques to make a successful weld.

First

Adjust the travel speed to control the amount of weld metal deposition. Travel speed controls bead width and penetration. Varying the travel speed so that a consistent width weld will be the outcome. The reason for varying the travel speed is due to the heat build-up while welding.

When the arc if first struck a plate is at a lower temperature as compared to when the weld is stopped approximately six inches later. This temperature difference can be approximately 400 degrees Fahrenheit, Hence, it is important to vary the travel speed to maintain a uniform amount of fill because as the plate gets hotter more weld metal will be deposited.

Second

Maintaining an even filling of the groove is also essential. When welding, the heat input into the plate will cause a heavier deposition near the end of the weld as compare to the beginning of the weld. This can be corrected by not only adjusting your travel speed but also by adjusting your ***work angle***. With this "side angle" adjustment you can deposit more or less metal on the groove face. This is important because when welding out a groove, it is critical to reference the top shoulder on the groove face to keep an even fill for the length of the weld. This will technique will provide for a smoother more even foundation for the cover passes (finish beads).

Review the effects of:

- Travel speed
- Electrode angle (both work and travel)
- Bead placement and Planning
- Inter-pass cleaning
- Heat input control.

Science

on

Steel

The Welding Fabrication Industry needs qualified welder fabricators who can deal with a variety of situations on the job. This portion of the training packet explores science as it relates to industry requirements.

Contents of this Packet

- *Importance of Code Qualification*
- *Why Mechanical Properties Testing?*
- *AWS D1.1 Structural Welding Code – Steel*
- *Significance of Bend Testing*
- *Bend Testing of Welds deposited with E7018 and other Low Hydrogen Electrodes*
- *Guided Bend vs. Free Bend Testing*
- *Tensile Testing and Charpy V-Notch Impact Testing*

Importance of Code Qualification

In all industries, there are applicable codes and standards to assure the quality, reproducibility, and adequacy of welded joints. Depending upon the application, a welded joint may need certain mechanical properties; for example, welds on bridges must pass tests for strength, tensile ductility, bend ductility, and Charpy impact toughness. These codes are based on many years of experience. Changes to codes are ongoing to reflect the dynamic changes that taking place in the industry. There are many welding codes to ensure quality welding. For example, the following is a list of only a few typical industries and governing codes for welding quality.

Pressure Vessels	ASME Boiler and Pressure Vessel Code (Vol. IX – Welding Qualifications)
Pipe and Pipelines	API Standard 1104; Standard for Welding Pipelines and Related Facilities
Pressure Piping	ASME Code for Pressure Piping B31
All Steel Structures	AWS D1.1 Structural Welding Code – Steel
Buildings	AISC Specification for Structural steel Buildings
Bridges	AASHTO/AWS D1.5; Bridge Welding Code
Ships	ABS Rules for Building and Classing Steel Vessels
Sheet Metal	AWS D9.1; Sheet Metal Welding Code
Automotive Frames	ANSI/AWS D8.8; Specification for Automotive Frame Weld Quality
Aircraft	MIL-STD-1595A; Qualification of Aircraft, Missile and Aerospace Fusion Welders

Why Mechanical Properties Testing?

In all codes for welded structures and pipe, various degrees of mechanical testing are performed to assure the quality and integrity of the structure. This includes both procedure qualification and welder qualification. For example, the procedure qualification for steel structures in accordance with the AWS D1.5 Bridge Welding Code–Steel requires that certain welds undergo all-weld-metal tensile testing, transverse-to-weld tensile testing, side bend testing, Charpy v-notch (CVN) impact testing as well as non-destructive testing. Mechanical testing is very important because it ensures that the welding procedure, welder qualification, consumables, and the resulting metallurgy of the weld and heat-affected zone are all acceptable.

AWS D1.1 Structural Steel Welding Code

When a structure is going to be built, the owner and contractor agree on the appropriate welding code, which will be needed to govern the acceptability or rejection of structural welds being fabricated. AWS D1.1 Structural Welding Code – Steel is devised to provide welded joints with acceptable strength, ductility, and CVN impact toughness for the intended application, such as a building, general construction, motorized vehicle, etc. Not only are procedure qualification requirements but also welder qualification and certification. The qualification and certification tests for welders are specially designed to determine the welder's ability to produce sound welds routinely. To achieve these quality standards, the welder qualification and certification provide the means to ensure acceptable welds.

Significance of Bend Testing

Of all the tests prescribed by different welding codes, the bend test provides the best and most reliable measure of ductility of the entire weld joint, including the weld metal, heat-affected zone, and unaffected base metal. Welder qualification tests in AWS D1.1 always specify bend testing of welded joints. This is because the bend test is extremely sensitive to all types of metallurgical problems associated with welding. For example, weld joints which have inadequate ductility and fail the bend test may be have been affected by: (a) hydrogen assisted cracking, (b) micro fissuring due internal solidification cracking, (c) excessive slag inclusions, (d) excessive porosity, (e) wrong filler metal, causing embrittlement, (e) wrong welding parameters, causing embrittlement, and (f) other metallurgical factors affecting the ductility of the weld joint.

There are three types of bend tests, (1) side bend, (2) face bend, and (3) root bend. Side bend tests are generally required for welds that are greater than 3/8-inch thick for AWS D1.1 and over ½-inch thick for API-1104. For example, a 2-inch thick butt joint deposited by single-pass electroslag welding could not be tested by face or root bend testing, because the thickness is too great for practical testing. However, a 2-inch thick butt joint can be machined to several 3/8-inch thick side bend specimens and tested easily.

So, face and root bending are used to test the ductility of butt joints that are thinner than 3/8-inch. Whether face bends, root bends, or both face and root bends specimens are required depends upon the code used. In AWS D1.1 Structural Welding Code, both face and root bends are required in most cases. The root bend test determines the adequacy of the root preparation and soundness of the root portion of the weld joint. This is particularly important in open root welding applications. Similarly, the face bend test determines the adequacy of the weld metal deposited on the face of the joint. These specimens must be able to withstand bending strains that are produced when a plunger forces a 3/8-inch thick welded specimen into a guided bend fixture. The plunger, having a specified bend radius, forces the welded bend specimen into a die in order to endure a specified amount of bending (or plastic deformation), that is required by the code for structural applications. From Table 1, the plunger radius and plunger thickness increase with increasing yield strength of the base metal being tested. Bending becomes more difficult with increasing yield strength, because ductility decreases as the strength of the steel increases. Thus, AWS D1.1 permits the bend radius required for welder qualification to increase with increasing yield strength, as shown in Table 1.

Table 1 Specified Bending Parameters for Guided Bend Test for Steel Welds in accordance with AWS D1.1 Structural Welding Code - Steel

Yield Strength Of Base Metal	Plunger Thickness	Plunger Radius	Interior Die Opening	Die Radius
50,000psi and less	1 ½"	¾"	2 3/8"	1 3/16"
Over 50,000psi to 90,000psi	2"	1"	2 7/8"	1 7/16"
90,000psi and greater	2 ½"	1 ¼"	3 3/8"	1 11/16"

Bend Testing of Welds deposited with E7018 and other Low Hydrogen electrodes

The bend test for steel welds is very sensitive to the presence of diffusible hydrogen in the weld. Typically, these welds will fail in the heat-affected zone of high strength steels. Even if non-destructive testing shows a welded steel to be crack-free, the bend test can activate the hydrogen cracking mechanism in steel weld metal and the heat affected zone. If either the weld metal or heat-affected zone is susceptible to hydrogen cracking, the welded specimen will not pass the guided bend test. The use of E7018 and E7018M electrodes are low hydrogen and should prevent the occurrence of hydrogen assisted cracking in the heat-affected zone of steel welds. In addition to hydrogen assisted cracking, there are many other metallurgical causes for lack of adequate ductility in a welded structure, and the bend test is best suited to separate the "good" welds from the "bad" welds.

Guided Bend vs. Free Bend Testing

The most widely used bend test, which is required by most welding codes, is the guided bend test. The benefit of the guided bend test, like that required by the AWS/AASHTO D1.5 Bridge Welding Code and AWS D1.1 Structural Welding Code is that the weld metal, heat affected zone and the unaffected base metal are subject to bending equally. This test requires expensive fixturing and a hydraulic ram to perform the guided bend test.

There is another test called the free bend test. The free bend testing apparatus is less expensive build and is hand-operated. The disadvantage of this test is that all of the zones of the weld joint (weld metal, heat affected zone and unaffected zone) are not bent equally. In free bend testing, the zone(s) having the lowest tensile strength will bend the most, while the zone(s) having the highest strength will bend the least. This effect may hide potential problems in the weld joint. This is why most codes insist on the guided bend test and not the free bend test.

Tensile Testing and Charpy V-Notch Impact Testing

For welder qualification and certification in accordance with AWS D1.1, tensile testing and Charpy v-notch (CVN) testing of the test weld are not required. However, in other codes, these tests are also used for welder qualification (in addition to bend testing).

1" Test Plate Fit-Up

READ ALL INSTRUCTIONS CAREFULLY BEFORE YOU BEGIN. REMEBER, THE 3/8" PLATE TEST ASSEMBLY IS DIFFERENT FROM THE 1" TEST. SEE YOUR INSTRUCTOR IF YOU HAVE ANY QUESTIONS.

Your test has 6 inspection points. Each inspection must be completed and signed by your instructor before progressing to the next step.

STEP 1: Material Preparation using track burner

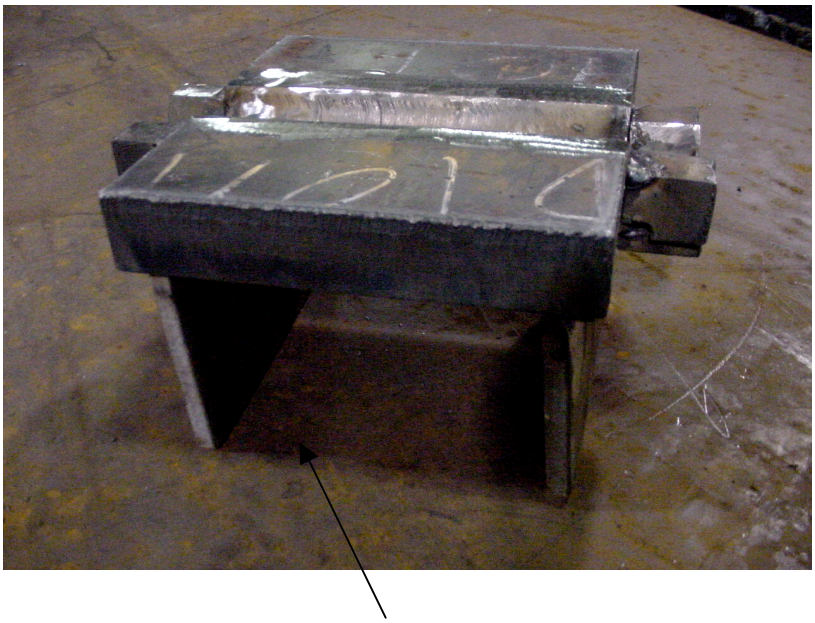
- Cutting List: 4 pieces 1" x 3" x 6"

- Cutting procedure for 6" x 14" steel certification test blank.
    1. Cut stock in half. Length wise (Leaving two pieces @ 6" x 7" plate).
    2. Bevel two 6" sides of each half @ 22 ½º. (10º for Coreshield-8 *innershield* wire.)
    3. Cut 6" x 7" plates in half, resulting in 4 plates 3" x 6".

- Grind all surfaces in the area to be welded until free of mill scale. Surfaces to be cleaned include: all beveled surfaces, **3/16"** to **1/2"** front and back of plate adjacent to each bevel and one side of each back up strip.

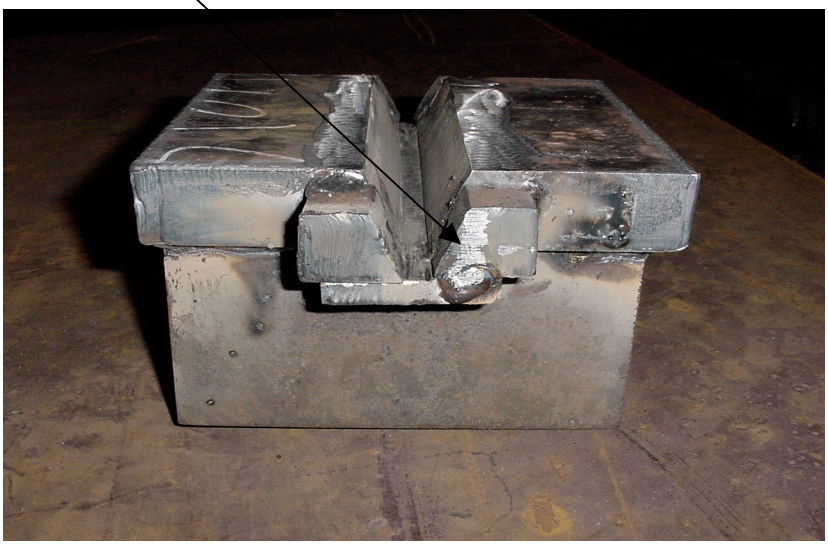
- **CAUTION**: Clean material only. **Excessive Grinding:** will affect the quality of your fit-up.

STEP 2: Assemble Groove Joint and Strong Backs

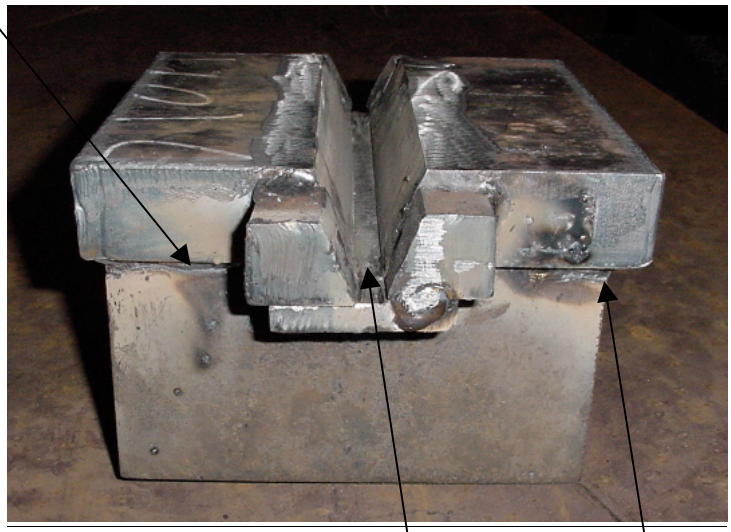


Strong Backs

- Root Opening = ¼”



- Use Clamps or fixturing device to ensure a “tight” fit-up.
- Adjust plate position as needed to ensure proper root opening.
- Ensure that there is **NO** gap between the beveled plates and the back strap surface.
- Tack the assembly together with 1" tack welds at the ends where the plates meet the back up strip.
- Do not tack weld on the backside of the test plate.
- Strong backs are used to control distortion of the plates during welding.
- Position strong backs on the backside of the groove assembly 3/16" in from the ends of the plates.
- Tack the strong backs across the ends of the plates. **Weld only on the outside edge of the strong back.**



V-groove run off tabs

Weld only on outside edge of the strong back.

- **DO NOT** weld on the plate side (inside) of the strong backs.

Helpful Hints

1. Be prepared to feel confident during your test. You need to have demonstrated consistency during your practice tests. Repeat the practice tests as many times as necessary to ensure confidence and consistent performance.

2. **Be comfortable!!!** Plan your test on a day that you know you will be at your best, well rested and able to concentrate. Check your clothing, to be certain you are protected from any stray sparks. Nothing breaks your concentration faster than getting burned or catching on fire!

3. Check the condition of your cover lenses**; make sure that you can see clearly.**

4. Bring a flashlight so you may thoroughly inspect your inter-pass cleaning. Clean the weld thoroughly. Make sure your slag hammer and wire brush are in good condition.

5. Plan the weld carefully to avoid having to patch up low spots. Decide before you strike the arc the size and location of the bead you are about to run. **If the weld fill becomes uneven, fix it immediately by filling in the low areas, don't wait until the flush layer or cover layer.**

6. Notify your fellow students in your area that you are testing; ask their cooperation in avoiding any banging or movement of the booth area while you are welding.

7. **Above all don't panic!** Relax and take your time. Don't hold your breath! If at any time you become uncomfortable stop and reposition.

8. If you cannot see **STOP**. If you feel you have lost or are losing control of the puddle **STOP**.

9. Do not over heat the plates. Allow the plates **to air cool to 200 degrees** before you attempt to weld the cover passes.

10. See **your instructor** at any time if you have a concern. Take a break as needed.

Bend Test Procedure for Shop Tests

Bend tests are used to determine the ductility and soundness of a weld joint. The test will determine if fusion was obtained in the weld joint. Use the following procedure in preparing and bending your coupons.

1. Reference the AWS D1.1 Structural Welding Code to determine the dimensional layout of the bend coupons (use this diagram for all positions).

2. Flush back up strip off of the plate. **Note: flushing of the backing strip maybe removed by flushing provided that at least 1/8 inch of its thickness is left to be removed by grinding.**

3. Layout four 3/8" thick coupons and cut using the track burner**. Do Not Bend coupons greater than 3/8" thick. This will damage the machine.**

4. Allow coupon to air cool. **Do Not Quench!**

5. Grind coupon's smooth, ensuring grinding marks are going with the length of the coupon's and all edges are rounded.

6. Request permission from your instructor to use the bend test machine.

7. **CAUTION***: **Keep hands and fingers clear when operating equipment.***

8. Ensure guard is in the correct position. The coupons sometimes eject out the end of the machine rapidly.

9. Place coupon in the machine taking care to not position your hands/fingers in the way. Locate weld in the center of the die. Position coupons for side bends only.

10. Actuate the machine by the lever on top of the machine and stand clear of end where the coupon will exit.

11. Inspect the coupon for fusion type defects. **Reference AWS D1.1 Structural Welding Code, for acceptance criteria**.

Bend Test Procedure
For 1" Test Plate

Bend tests are used to determine the ductility and soundness of a weld joint. The test will allow the welder to determine if she or he has obtained fusion in the weld joint. Use the following procedure in preparing and bending your coupons.

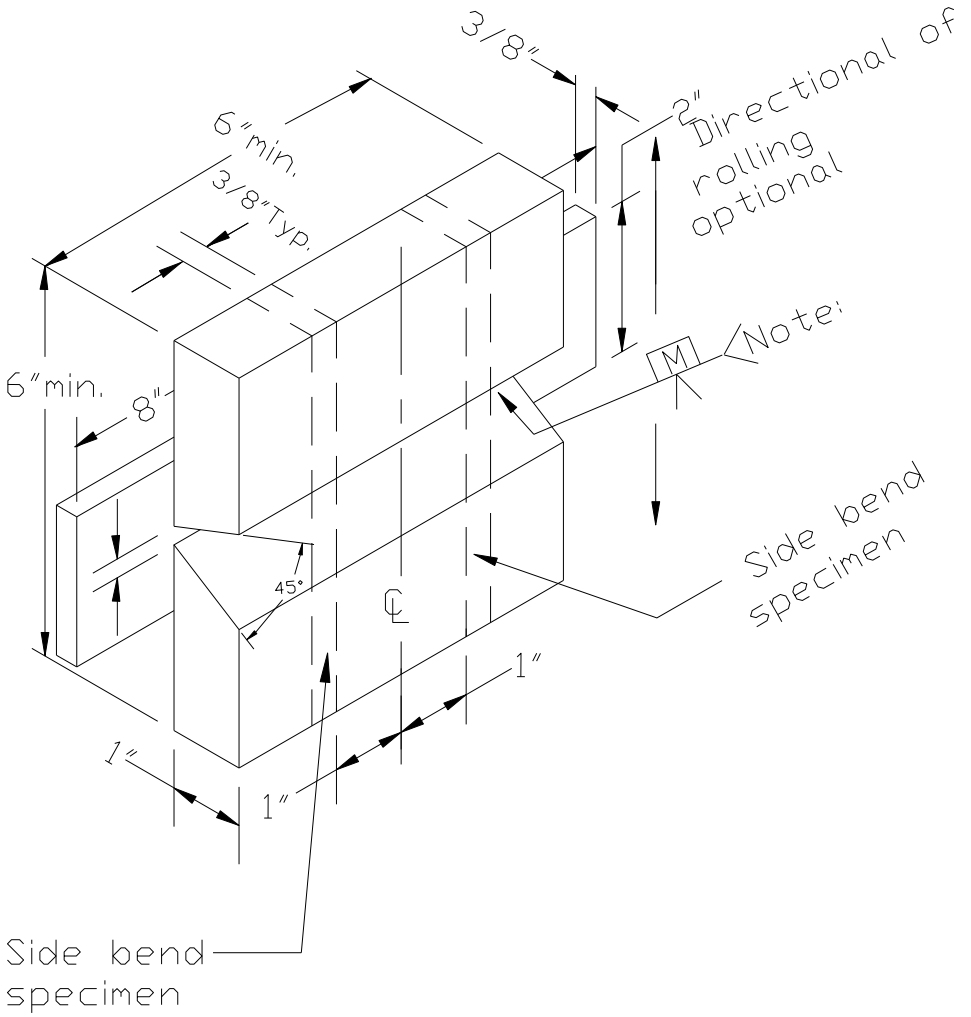
1. Flush back up strip off of the plate at the flushing station.

2. Layout four 3/8" coupons and cut using the track burner**.** **Do Not Bend** coupons greater than 3/8 " thick it will damage the dies in the bending machine!

Final Exam Bend Test Preparation

SHOP TEST

1" Bend Test



Allow coupon to air cool. **Do Not Quench!**

3. Grind coupon's smooth, ensuring grinding marks are going with the length of the coupon's and all edges are rounded.

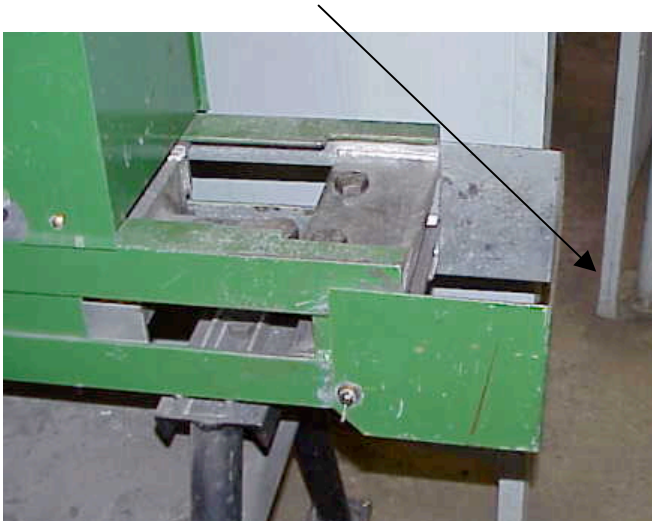
4. Request permission from your instructor to use the bend test machine.

5. **CAUTION*: Keep hands and fingers clear when operating equipment.***

Watts Bend Test Machine

7. Ensure guard is in the correct position. The coupons sometimes eject out of the end of the machine rapidly.

Guard

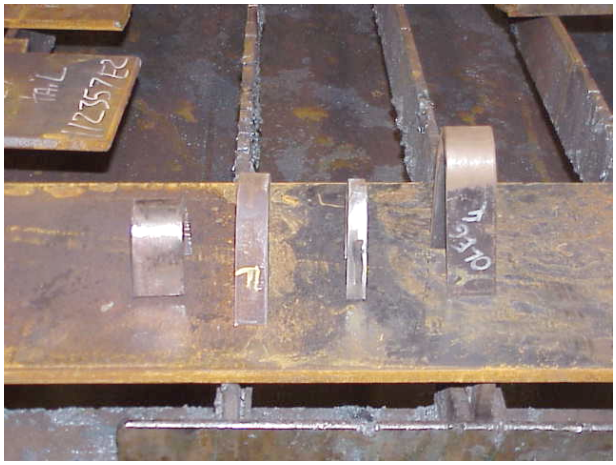


8. Place coupon in the machine taking care not to position your hands/fingers in the way. Locate weld in the center of the die. Bend one coupon (from each plate) to test the face and one to test the root.

9. Actuate the ram by the lever on top of machine and stand clear of the guard area where coupon will exit.

10. Inspect the convex surface of the bend specimen for fusion type defects.

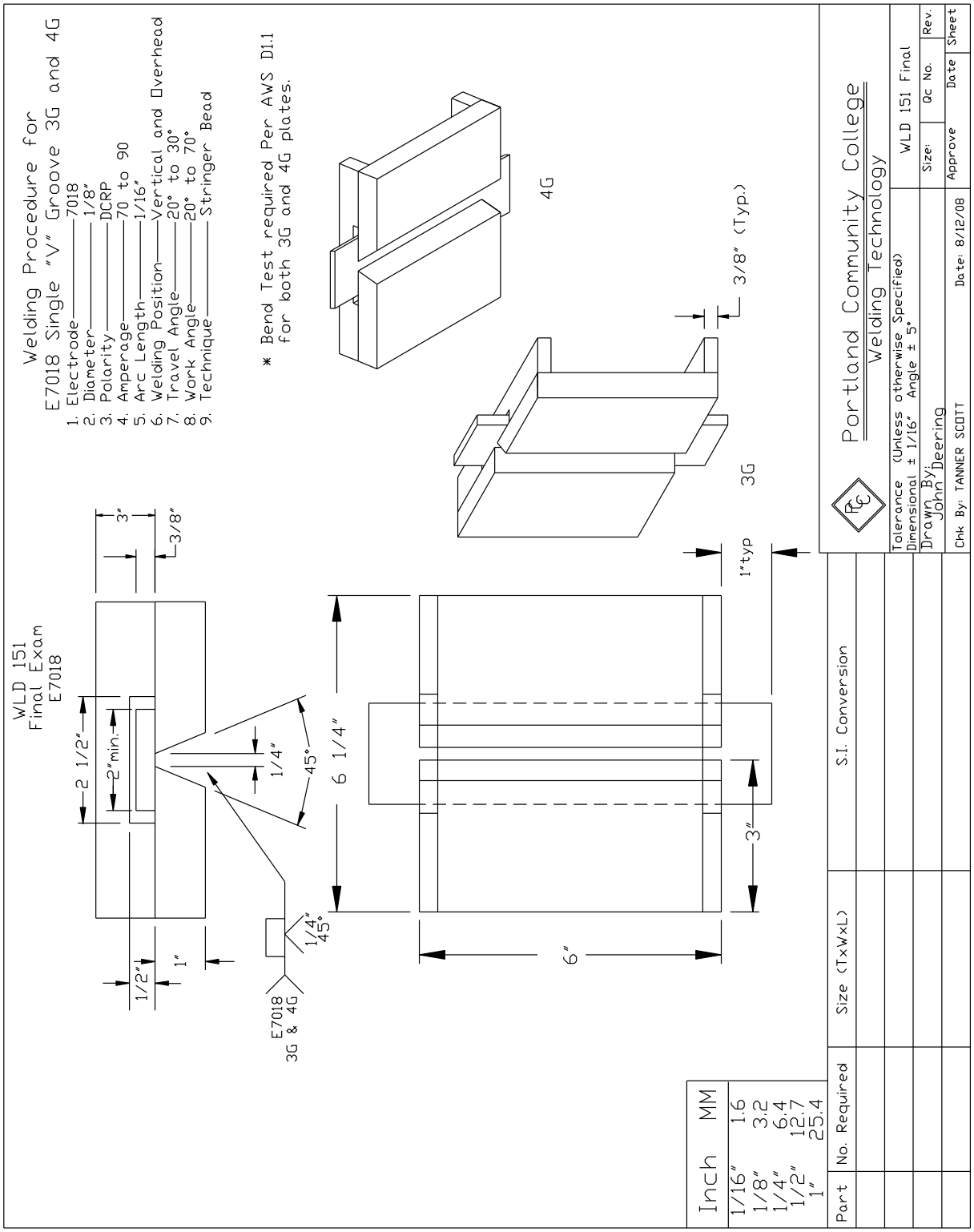
Reference the AWS D1.1 Structural Welding Code for Acceptance Criteria for Bend Tests.



Four types of bend samples are shown above. Left to right are: face bend, face bend, root bend and a side bend

The bend samples shown above differ in the radius that they were bent. This is a requirement set forth by the code or standard that is being used.

Welder Qualification Testing Procedure



Welding Procedure

STEP 1: Read entire procedure before you start your testing.
You have three class periods to complete testing.

STEP 2: Notify your instructor that you are going to begin your test.

STEP 3: Obtain a 300 degrees temp stick from the tool room.

STEP 4: Using a torch preheat the test plates to 70 degrees shall be sufficient to prevent cracking.

STEP 5: **INSPECTION:** ***(See your instructor***): **Test Plate Position**
Position the test plates at your welding station. The plate stamped **3G** is Positioned vertical. The plate stamped **4G** is positioned overhead.

Have your instructor inspect the proper positioning of the test plates. **Test plates must remain in position throughout the test. DO NOT MOVE THE TESTS Plates. Tests Plates must be cleaned and inspected in position. No grinding is allowed on the test.**

STEP 6: Complete the root passes in both positions.

STEP 7: ***INSPECTION:*** **Root Pass Inspection *(See your instructor):* Have your instructor inspect the root pass.**

STEP 8: Complete welding the V groove until the weld is within **1/16 to 1/8"** below the base material.

CAUTION: Control your inter-pass temperature. Use the 300-degree temp stick to monitor maximum heat input in the test material. DO NOT weld on the test plate if it is over 300 degrees to help avoid cracking.

STEP 9: INSPECTION: **Flush Layer Inspection. Have your instructor inspect the test.**

STEP 10: Complete the (cover pass) on both plates.

Craftsmanship Expectations for Welding Projects

The student should complete the following tasks prior to welding.

1. Thoroughly read each drawing.
2. Make a cutting list for each project. Cut at least two project assemblies of metal at a time.
   This will save a great amount of time.
3. Assemble the welding projects per drawing specifications.
4. Review the Welding Procedure portion of the prints to review welding parameter information.
5. See the instructor for the evaluation.

Factors for grading welding projects are based on the following criteria:

Metal Preparation up	Project Layout	Post Weld Clean-up
Oxyacetylene Cut quality	**Accurate (+/- 1/16")**	**Remove Slag/Spatter**
Grind all cut surfaces clean	**Limit waste**	**Remove sharp edges**

Example of a High Quality Weld

Weld Quality per AWS D1.1

VT Criteria	Cover Pass
Reinforcement (groove welds)	Flush to 1/8"
Fillet Weld Size	See specification on drawing
Undercut	1/32" deep
Weld Contour	Smooth Transition
Penetration	N/A
Cracks	None Allowed
Arc Strikes	None Allowed
Fusion	Complete Fusion Required
Porosity	None Allowed
Overlap	None Allowed

E7018 Butt Joint- Single V (3G) Project #1

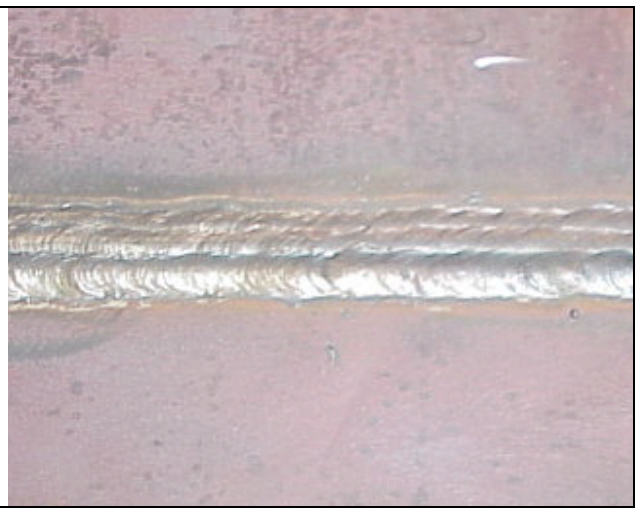
Welding Sequence

E7018-- Root Pass Single pass technique with slight weave to ensure the weld metal is fusing into all three pieces of metal.

E7018—Fill Use the split bead technique with stringer beads ensuring even fill.

E7018—Finish Beads Use stringer bead technique keeping the electrode in the puddle at all times.

Bead Placement

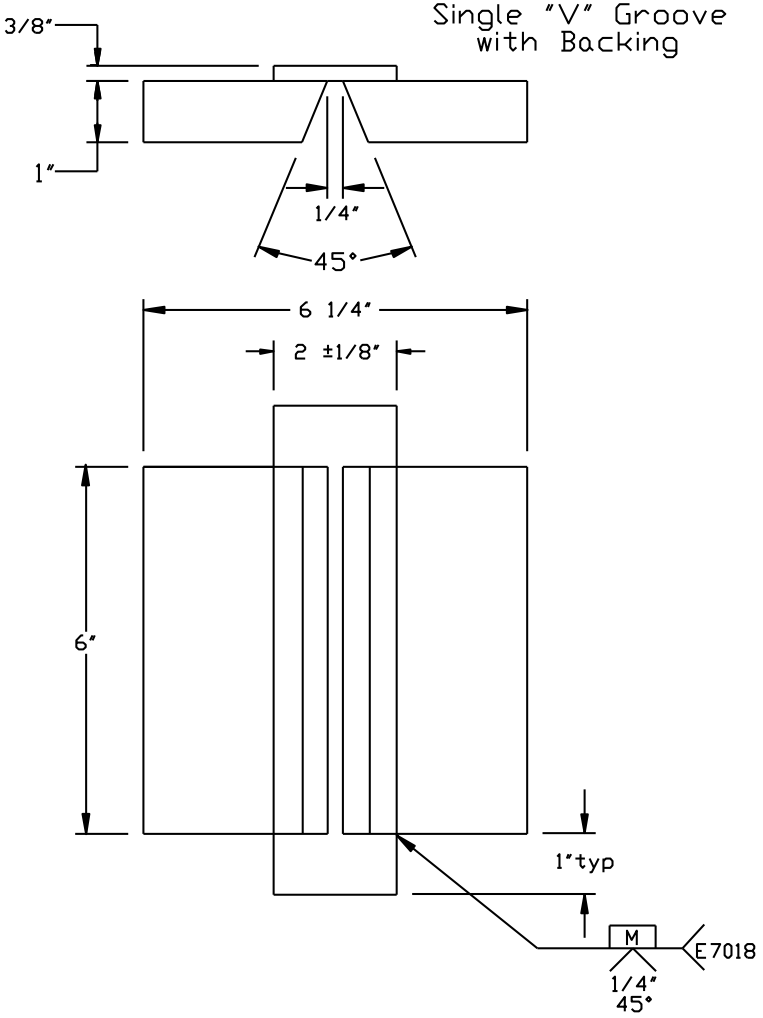


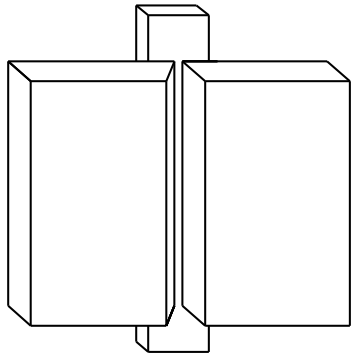
High Quality Cover Passes

Successful completion of this project will require the student to complete two welds that meet both visual testing requirements and bend test requirements set forth in AWS D1.1 Structural Steel Welding Code.

VT Criteria	Project #1	Project #2
Reinforcement		
Undercut		
Bead Contour		
Cracks		
Arc Strikes		
Fusion		
Porosity		
Bend Test		
		Grade Date

WLD 151
Vertical Position (3G)
Single "V" Groove with Backing





Welding Procedure

1. Electrode ——— 7018
2. Diameter ——— 1/8"
3. Polarity ——— DCRP
4. Amperage ——— 85 to 100
5. Arc Length ——— 1/16"
6. Welding Position ——— Vertical Up (3G)
7. Travel Angle ——— 20° to 30°
8. Work Angle ——— Varies
9. Technique ——— Stringer Bead

Inch	MM
1/16"	1.6
1/8"	3.2
1/4"	6.4
1/2"	12.7
1"	25.4

Part	No. Required	Size (TxWxL)	S.I. Conversion

Portland Community College
Welding Technology

Tolerance (Unless otherwise Specified)
Dimensional ± 1/16" Angle ± 5°

WLD 151-01

Drawn By: John Deering

Size: | Qc No. | Rev.

Chk By: TANNER SCOTT Date: 8/12/08

Approve | Date | Sheet

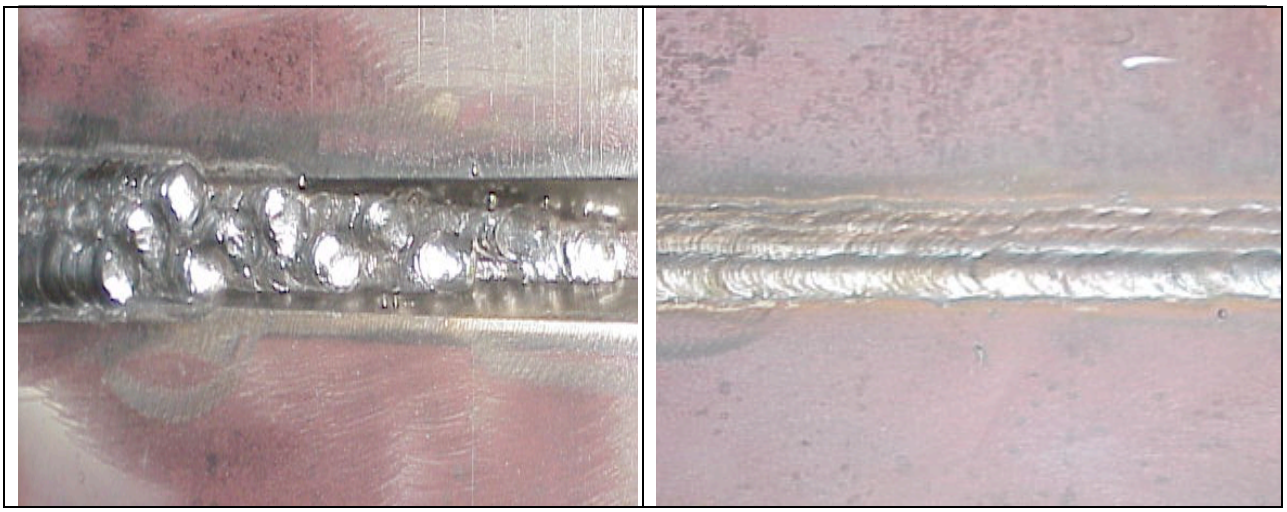
E7018 Butt Joint- Single V (4G) Project #2

Welding Sequence

E7018-- Root Pass Single pass technique with slight weave to ensure the weld metal is fusing into all three pieces.

E7018—Fill Use the split bead technique with stringer beads ensuring even fill.

E7018—Finish Beads Use stringer bead technique keeping the electrode in the puddle at all times.

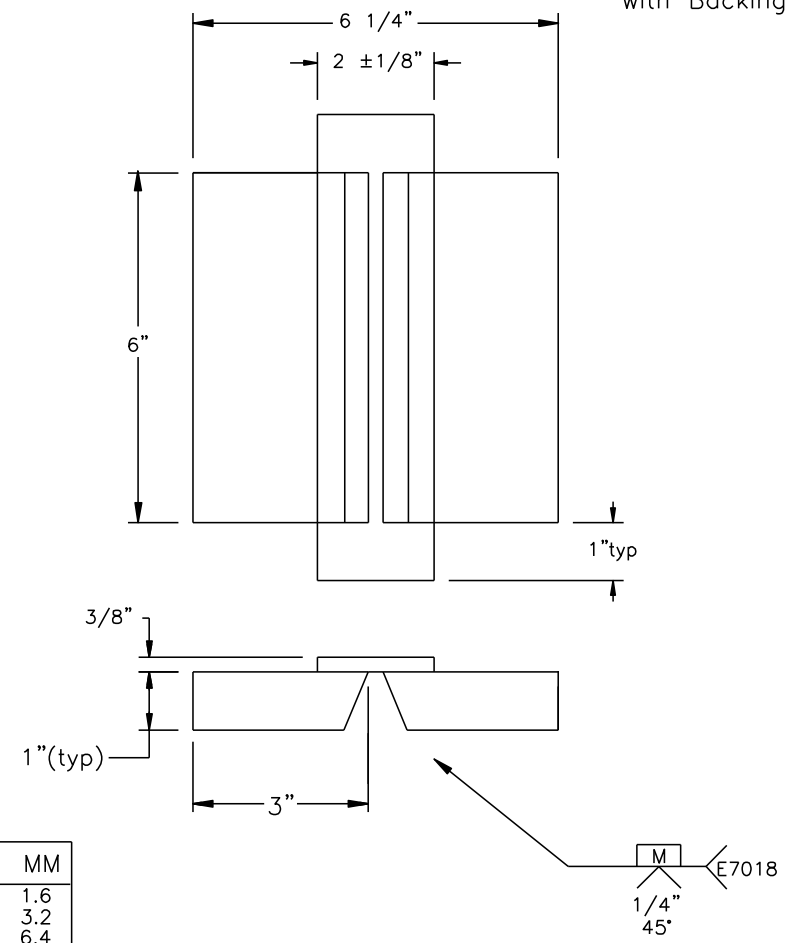


Bead Placement ***High Quality Cover Passes***

Successful completion of this project will require the student to complete two welds that meet both visual testing requirements and bend test requirements set forth in AWS D1.1 Structural Steel Welding Code.

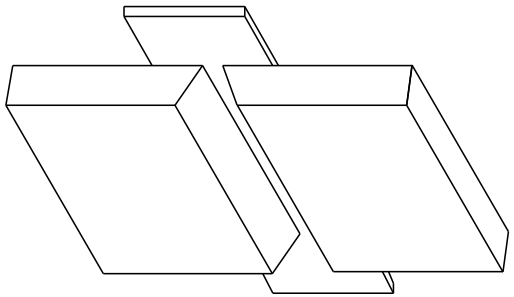
VT Criteria	Project #1	Project #2
Reinforcement		
Undercut		
Bead Contour		
Cracks		
Arc Strikes		
Fusion		
Porosity		
Bend Test		
		Grade Date

WLD 151
Overhead Position (4G)
Single "V" Groove
with Backing



Welding Procedure

1. Electrode — E7018
2. Diameter — 1/8"
3. Polarity — DCRP
4. Amperage — 90 to 105
5. Arc Length — 1/16"–1/8"
6. Welding Position — Overhead (4G)
7. Travel Angle — 20° to 30°
8. Work Angle — Varies
9. Technique — Stringer Bead



Inch	MM
1/16"	1.6
1/8"	3.2
1/4"	6.4
1/2"	12.7
1"	25.4

Part	No. Required	Size (TxWxL)	S.I. Conversion

Portland Community College
Welding Technology

Tolerance (Unless otherwise Specified)
Dimensional ± 1/16" Angle ± 5°

WLD 151–02

Drawn By: John Deering

Size: | Qc No. | Rev.

Chk By: TANNER SCOTT Date: 8/12/08

Approve | Date | Sheet

Written Final Exam

This portion of the final exam is a closed book test. You may use the review questions you completed at the end of the assigned chapters as a cheat sheet. Consult with your instructor to determine items that you may need to review. Once you determine that you are ready for the exam, see your instructor.

Study Guide

Safety

- Oxyacetylene safety
- SMAW safety
- Hand Tool Safety

SMAW and OAC Processes

- Power source specifics
  - Polarity
  - Current out put
- AWS electrode classification
- OAC
  - Theory of cutting
  - Flame types
  - Safety

Welding Symbols and Blueprints

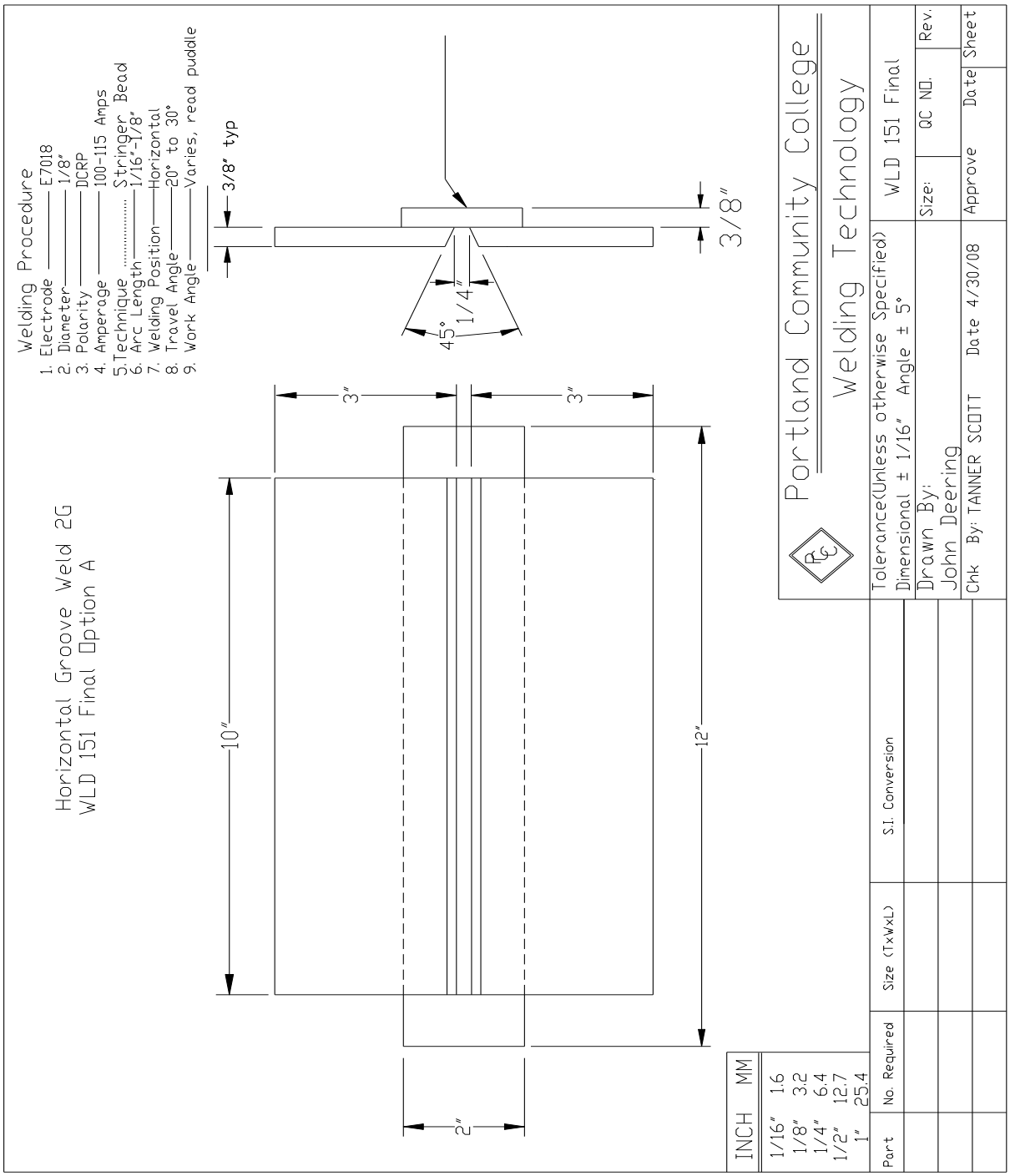
- Orthographic views
- Isometric views
- Welding symbol
  - Weld symbols
  - Reference line
  - Tail

Math and Math conversions

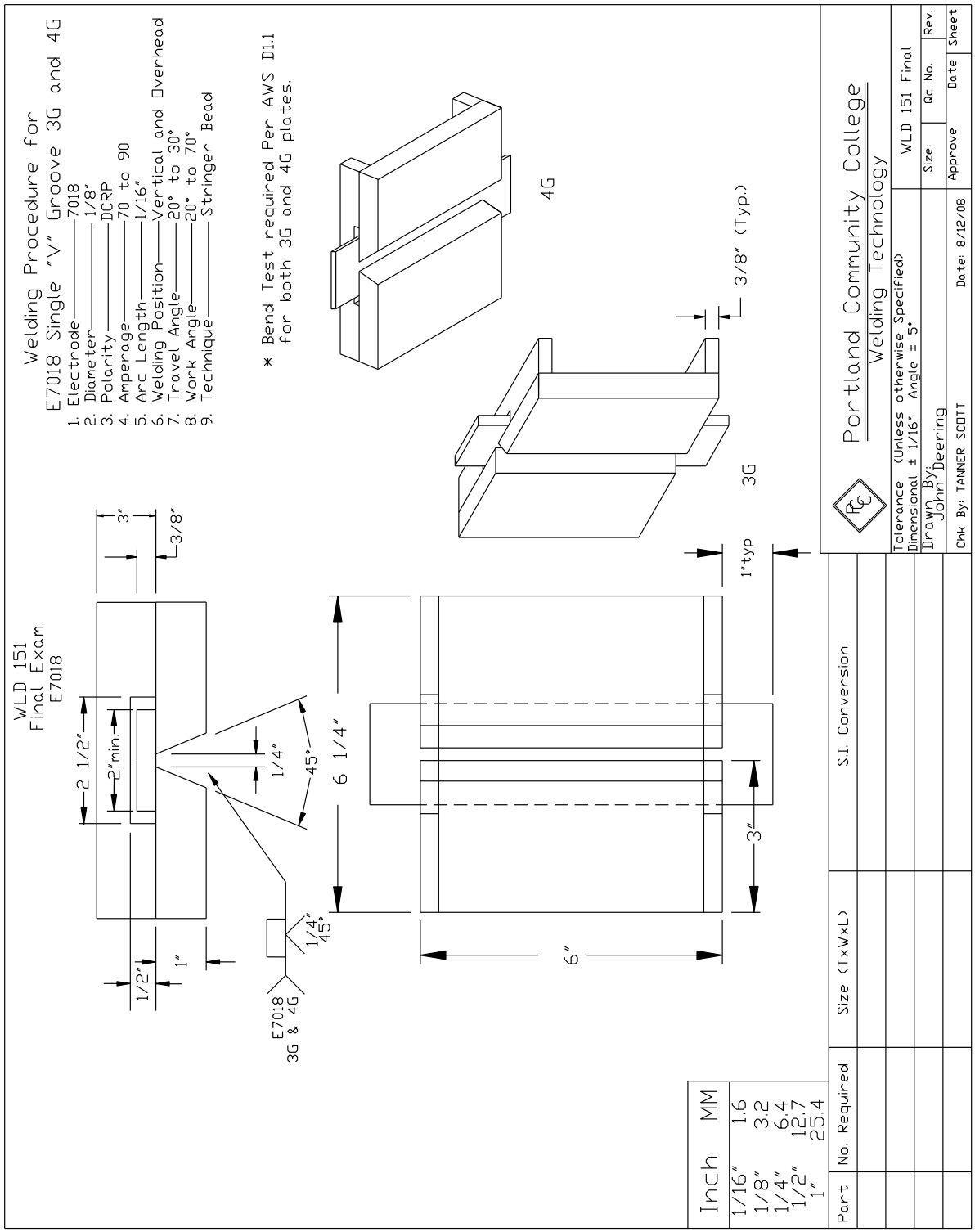
- Adding and subtracting fractions
- Reading a tape measure
- Metric conversions

Practical Final
Option A

The student has the choice to complete either Option A or Option B. Option B is intended for the student who plans to send in the test plates for certifications. This cost additional $$$ please see your instructor for details.



Practical Final Option B
Qualification Testing Procedure



WLD 151
"Final" Traveler

Name: _____ Date: _____

Each step must be "checked off" by your instructor before the student progresses to the next phase in the Final Weld out process.

Inspection Points	***2G or 3G***	***4G***
Fit Up and assembly		
Plate Positioning		
Root Pass Inspection		
Interpass Inspection		
Take down Day #1		
Plate Positioning Day #2		
Cover Pass Inspection		
Final	***Pass Fail***	***Pass Fail***

Final Grades - WLD 151

Name: _____ Instructor: _____ Date: _____

Welding Projects = 40%

Out of 10	~~Out of~~	~~Out of~~
Out of 10	~~Out of~~	~~Out of~~
Out of 10	~~Out of~~	~~Out of~~
Out of 10	~~Out of~~	~~Out of~~
A Total Project pts. _____ / Total pts. Possible _____ X 40 = _____ **%**		

Quizzes = 20%

Out of	Out of	Out of
Out of	Out of	Out of
Out of	Out of	Out of
B Total Project pts. _____ / Total pts. Possible _____ X 20 = _____ **%**		

Attendance = 10% The following attributes will be assessed - attendance, attitude, time management, team work, interpersonal skills, etc.. Daily points (there are no excused absences, hence no points earned for days missed) 3 pts = present and working for the entire shift; 2 pts = late; 1 pt = late and left early; 0 pts = no show.

Out of	Out of	Out of	Out of	Out of	Out of
Out of	Out of	Out of	Out of	Out of	Out of
Out of	Out of	Out of	Out of	Out of	Out of
C Total pts. earned _____ / Total pts. Possible _____ X 10 = _____ **%**					

Final Exams 30%

Written Exam	Out of
Practical Exam	Out of
D Total Project pts. _____ / Total pts. Possible _____ X 30 = _____ **%**	
Add Lines A + B + C + D . This will give you your Final Grade TOTAL % _____ FINAL GRADE _____	