Weld Quality Standards

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Visual Inspection Criteria

This section will familiarize the student with inspection criteria that will be applied to the evaluation of their projects. PCC Welding Department utilizes the visual inspection requirements set forth in AWS D1.1. The following criteria are gathered from this source.

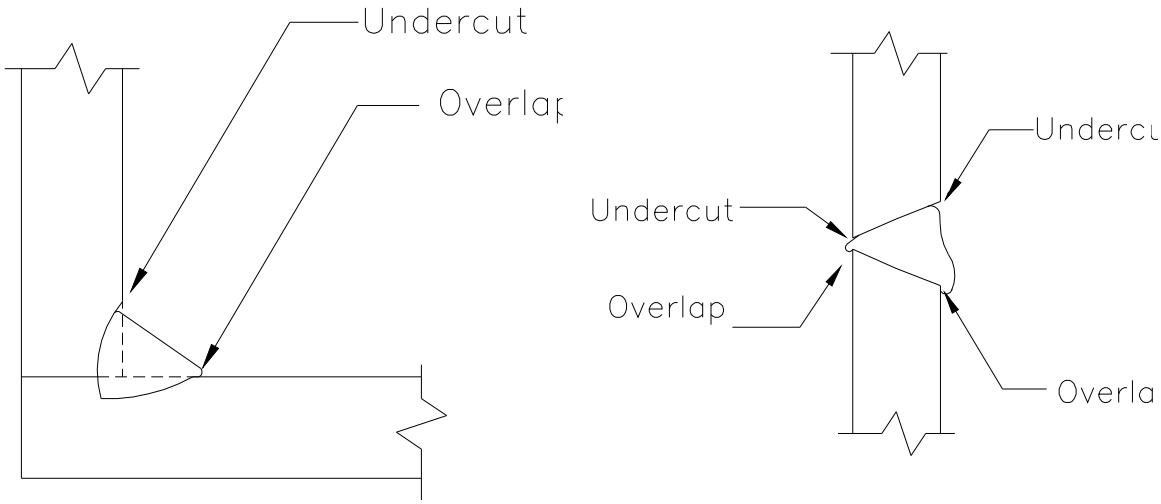
Undercut

Is a condition where the base metal has been melted away during the welding operation and there is insufficient filler metal deposited to adequately fill the resulting depression. These grooves vary in depth and length. Undercut can be present at a weld-to-weld junction or a weld to base metal junction (toe of weld). Undercut causes a stress concentration point (stress riser) that is a potential starting point for weld cracking.

Causes:

Improper welding technique
Arc length too long
Oscillation too abrupt, not spending enough time on the sides of the puddle.
Amperage too high
Base material too hot
Travel speed too fast

Maximum undercut allowed is 1/32" in depth.

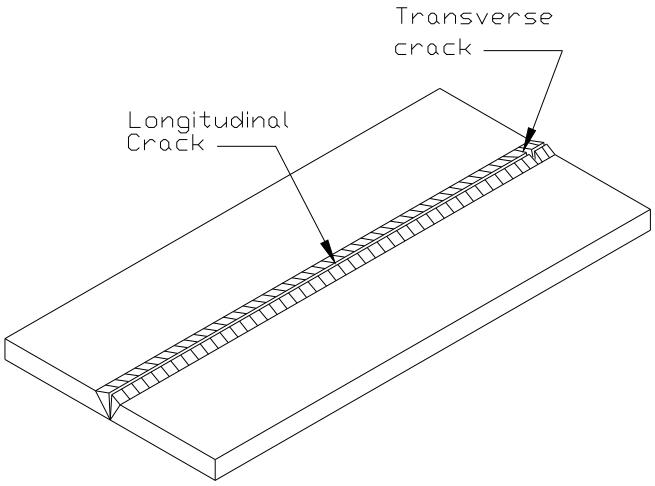


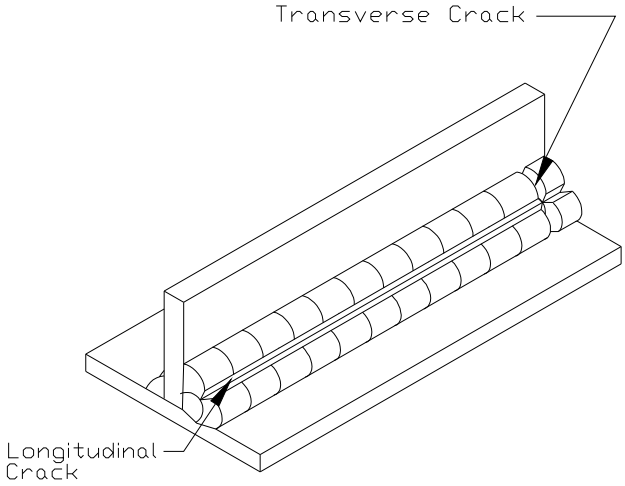
Cracks

Cracks are caused by stresses in the immediate area that exceed the strength of weld metal or base metal (tensile strength).

Cracks are a major concern because of their ends, which are generally sharp and jagged. With increased stress, the crack can then propagate (travel) in the weld or base metal causing catastrophic (total) failure.

Maximum Cracks Allowed: None





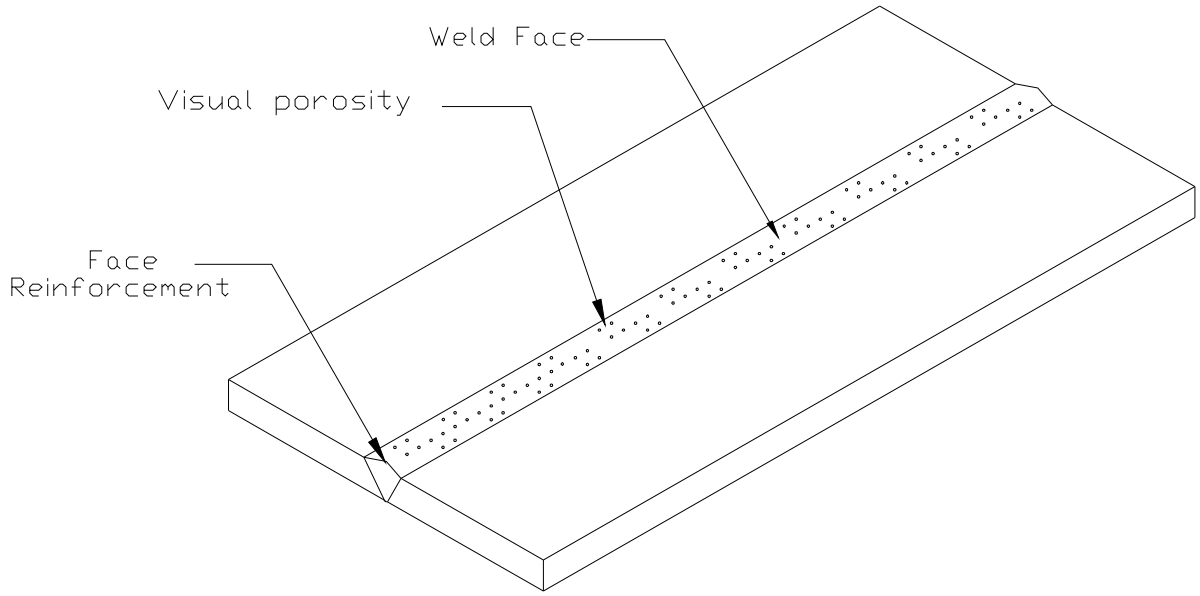
Porosity

A cavity type discontinuity caused by gas trapped during weld solidification. Due to its spherical shape, porosity is considered the least detrimental discontinuity.

Causes:

Loss of shielding gas
Base metal contamination (oils, grease, water)
Too long of an arc length.

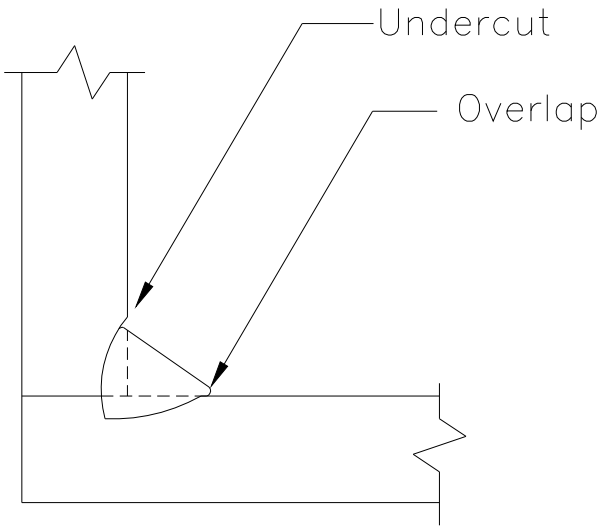
Visual porosity is unacceptable

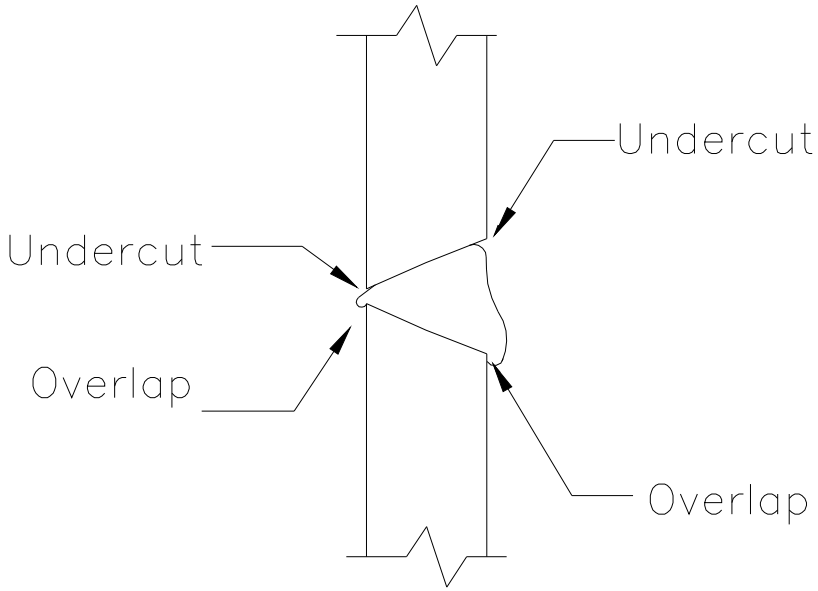


Overlap (Also known as: Cold Lap, Roll Over or Cold Roll)

Is the protrusion of weld metal beyond the weld toe or root. Due to its linearity and relatively sharp end condition, over lap represents a significant weld discontinuity.

Overlap is not allowed

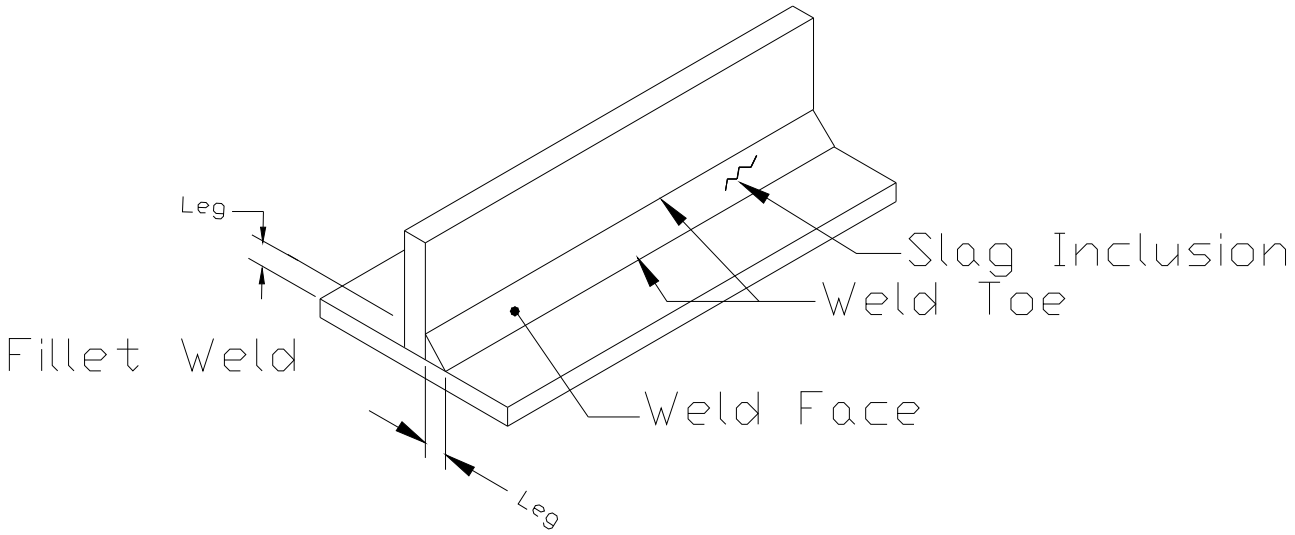




Slag Inclusions

Slag is a nonmetallic by product of the welding process. If slag is not cleaned out thoroughly before depositing the next pass it can be trapped. Or, if the previous weld(s) have poor weld profile slag can become trapped in the crevices when welded over.

Improper cleaning, improper electrode manipulation or poor bead placement most often causes slag inclusions



Weld Profile

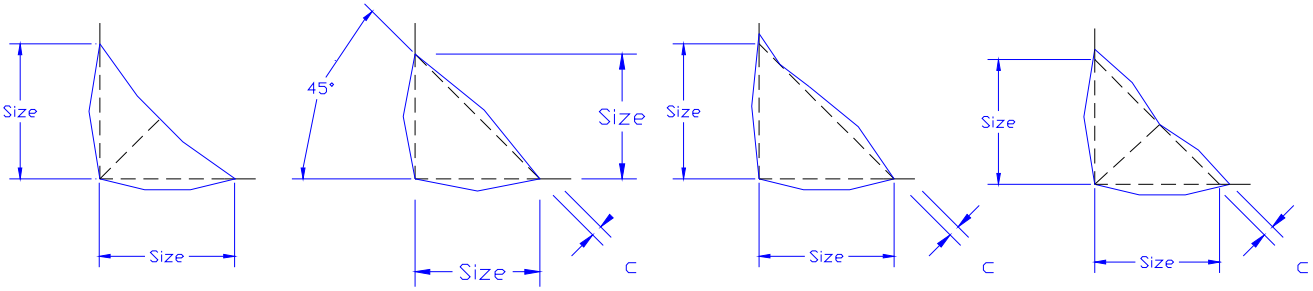
This is an important aspect of welding. Statistics have proven that the weld profile is the cause for more weld failure then internal flaws.

Reinforcement

Minimum: Flush with base metal
Maximum: 1/8" high

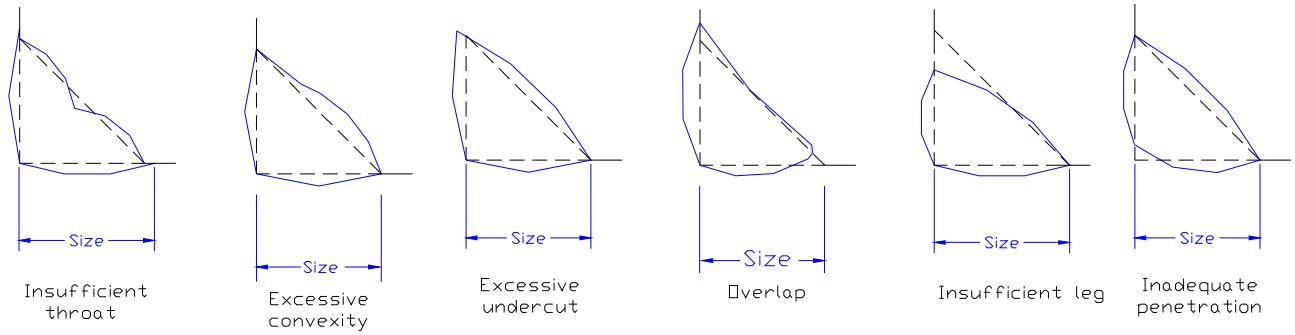
Bead Contour

Smooth transition from bead to bead and weld metal to base metal.



(A) Desirable Fillet weld profiles. (B) Acceptable fillet weld profiles.

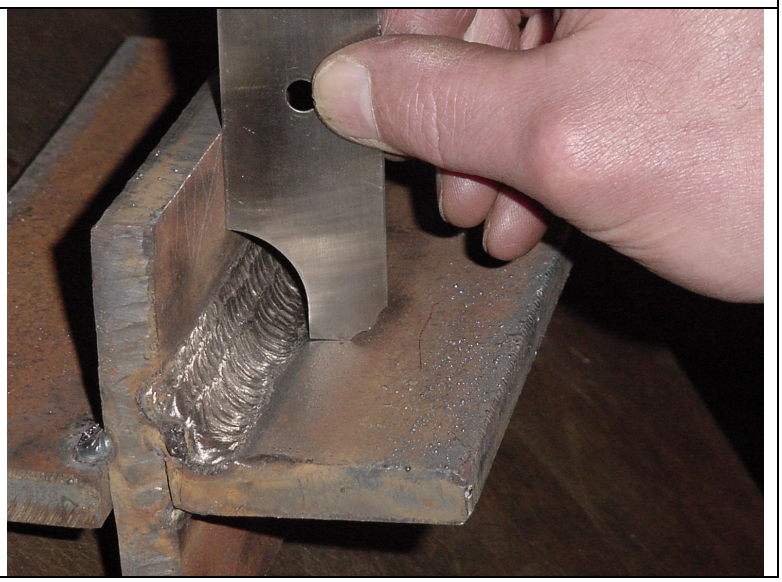
Width of weld face or individual surface Bead,W	max. convexity, C
W≤ 5/16" (8MM)	1/16" (1.6 MM)
W> 3/8"to W<1" (25MM)	1/8" (3MM)
W≥ 1"	3/16" (5MM)



Unacceptable fillet weld profiles

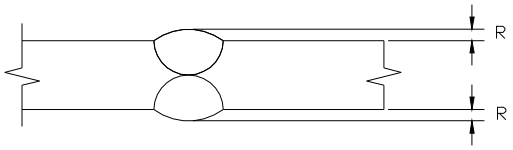
Reference AWS D1.1

Using a Fillet Weld Gage
(Flat and Convex Fillet Welds)

Select the size gage that is needed. Use the Concave side of the Fillet Weld Gage to measure leg size (see picture). The gage must be sitting flush on the metal to get an accurate measurement. **Note:** In this picture the weld leg is touching the tip of the weld gage. The weld equals the size of the gage.	
Rotate the gage to measure the other leg size. **Note:** In this picture, the weld is not large enough.	

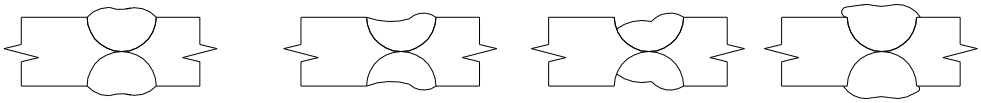
See the <u>Welding Principles and Applications</u> textbook for a thorough explanation for the correct use of a fillet weld gage.

Groove Weld Information Sheet



Acceptable butt weld profile.

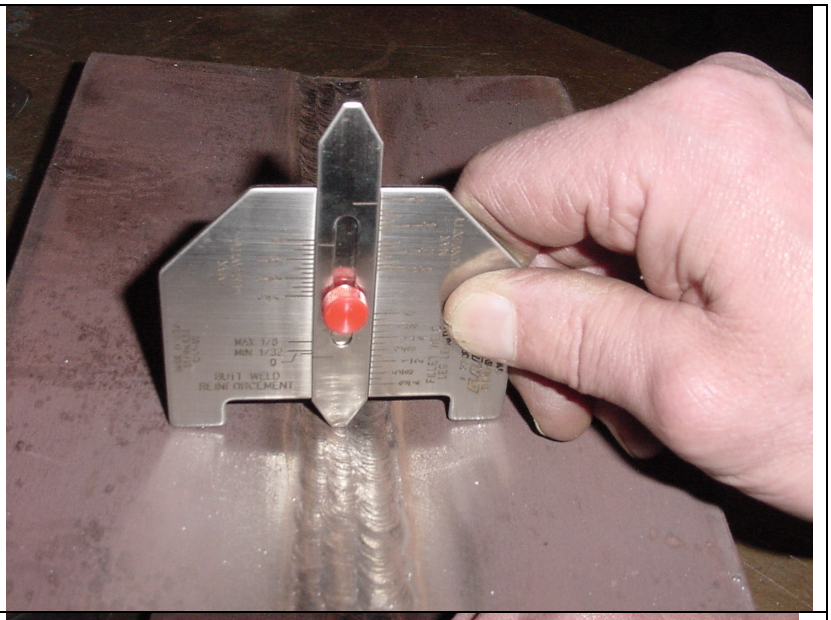
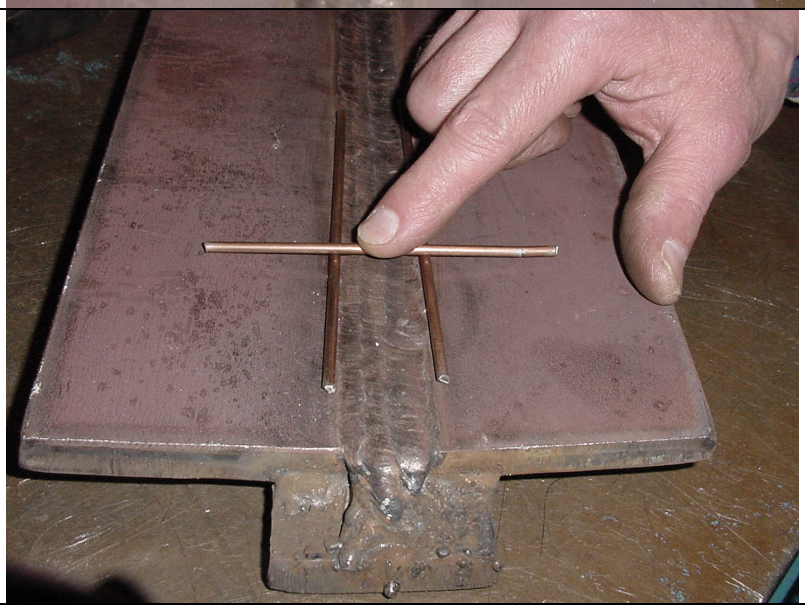
NOTE: Reinforcement (R) shall not exceed 1/8".

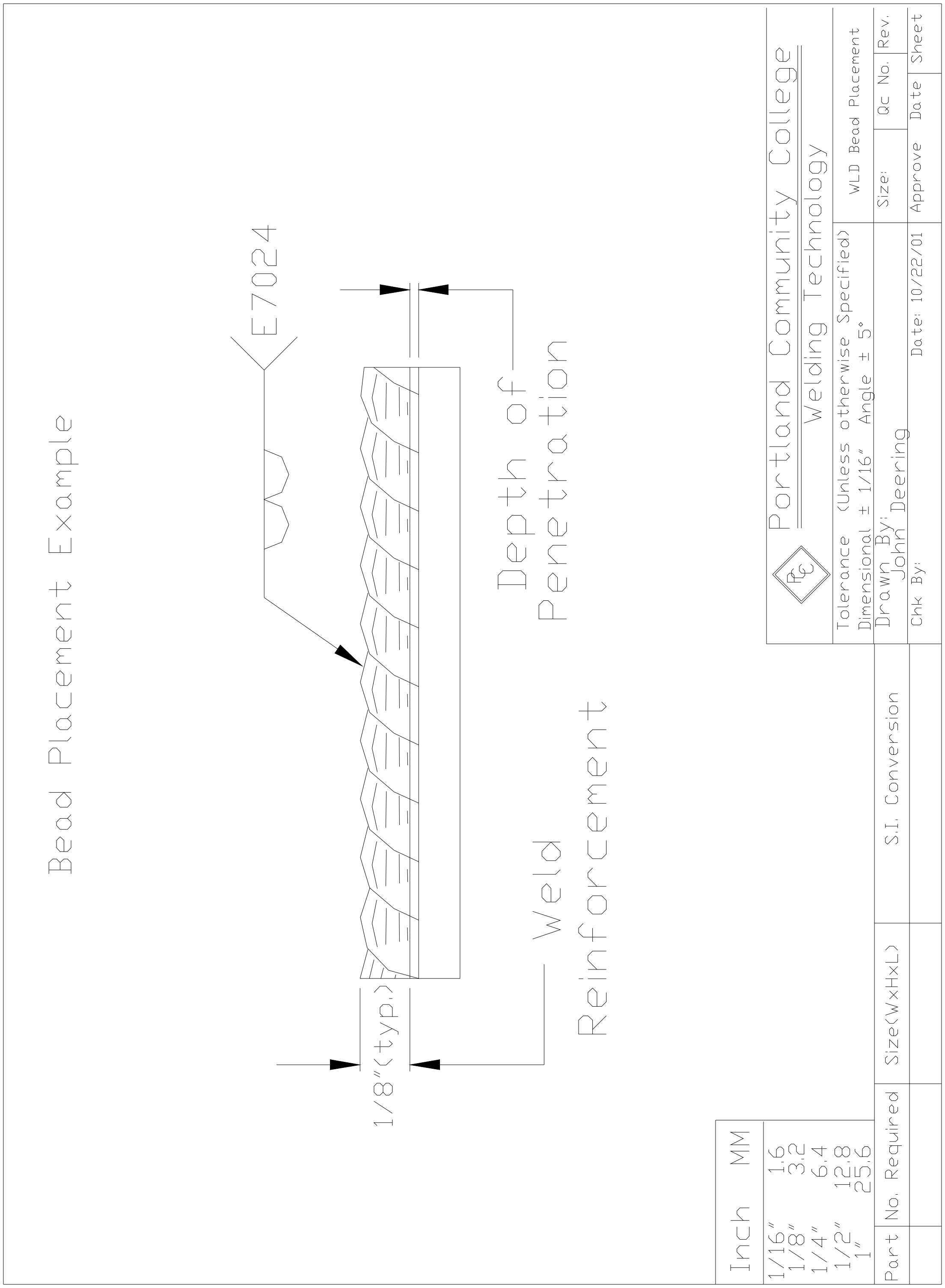


Excessive Reinforcement | Insufficient Weld Size | Excessive Undercut | Overlap

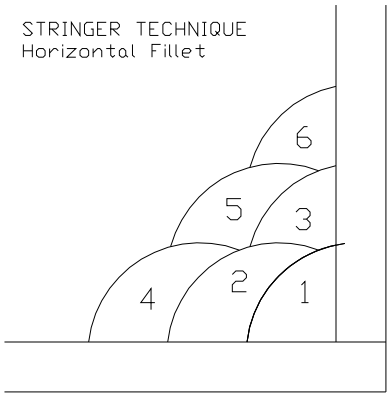
WLD Infor. Sheet 2

Measuring Weld Reinforcement for a Groove Weld

The weld gage is being used to measure weld reinforcement in this picture. The gage is positioned over the weld area and the pointer is extended to contact the weld. The pointer has an indicator line on it that can be read for reinforcement size.	
Three pieces of 1/8" filler metal are being used to measure reinforcement. Although this is not a "scientific gage," it will assist in determining if there is too much reinforcement.	


Bead Placement Example
E7024
Depth of Penetration
Weld Reinforcement
1/8"(typ.)
Portland Community College
Welding Technology
Tolerance (Unless otherwise Specified)
Dimensional ± 1/16" Angle ± 5°
WLD Bead Placement
Drawn By:
John Deering
Size:
Qc No.
Rev.
Date: 10/22/01
Chk By:
Approve
Date
Sheet
Inch MM
1/16" 1.6
1/8" 3.2
1/4" 6.4
1/2" 12.8
1" 25.6
Part No. Required
Size(WxHxL)
S.I. Conversion

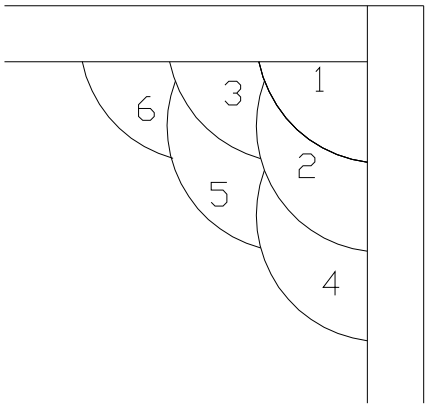
STRINGER TECHNIQUE
Horizontal Fillet



The Weave Technique is not recommended for the Horizontal Fillet..

STRINGER TECHNIQUE

Overhead Fillet



The Weave Technique is not recommended for the Overhead Groove.

Fillet Weld Information Sheet

WRONG

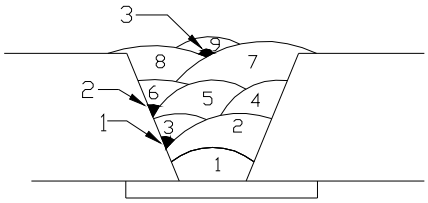


Figure C

RIGHT

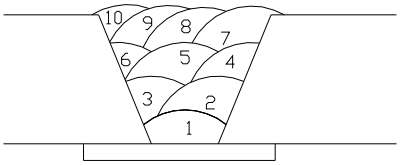


Figure D

In Figure C, Points 1, 2, and 3 represent slag, porosity or lack of fusion

STRINGER BEAD TECHNIQUE
Flat Groove

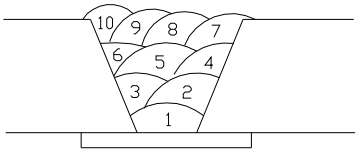


Figure E

WEAVE BEAD TECHNIQUE
Maximum width of bead 1"
Flat Goove

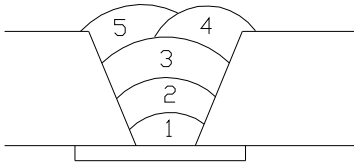
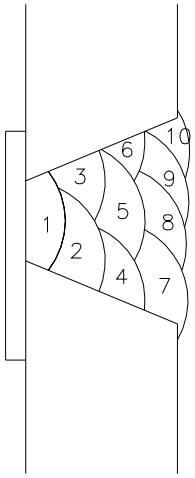


Figure F

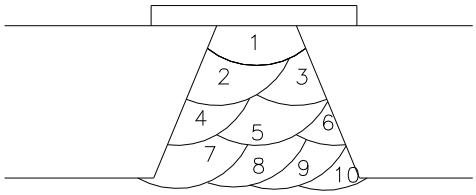
Groove Weld Information Sheet



The Weave Technique is not recommended for the Horizontal Groove.

STRINGER BEAD TECHNIQUE

Overhed Groove

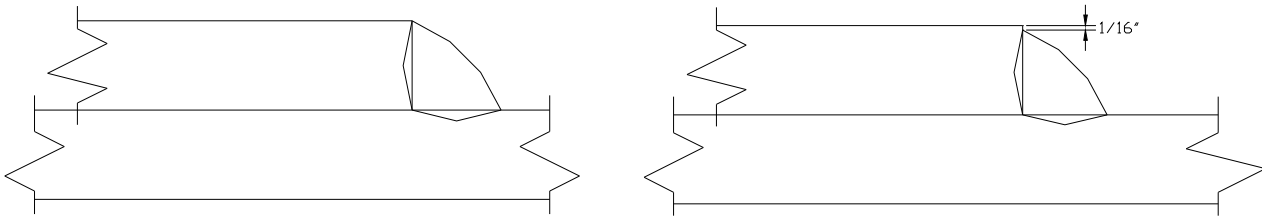


The Weave Technique is not recommended for the Overhead Groove.

Weld Information Sheet

II. PICTORIAL ILLUSTRATION OF ACCEPTABLE AND UNACCEPTABLE WELD PROFILES

MAXIMUM SIZE OF FILLET WELD ALONG EDGES



Base metal less than 1/4" thick

Reference AWS D1.1-1998 2.4.5

The distance between the edge of the base metal and the toe of the weld may be less than 1/16" provided the edge is clearly visible and the weld size clearly verifiable.