Welding

# Module 29112

# SMAW – Open-Root Groove Welds (Plate)

## 2.0.0 Open-Root Single V-Groove Welds

# Objective

**Successful completion of this module prepares you to do the following:**

Summarize techniques for making open-root single V-groove welds.

a. Describe producing the root pass for open-root single V-groove welds.
b. Describe making open-root single V-groove welds in the 1G and 2G positions.
c. Describe making open-root single V-groove welds in the 3G and 4G positions.

# Performance Tasks

**Under supervision, you should be able to do the following:**

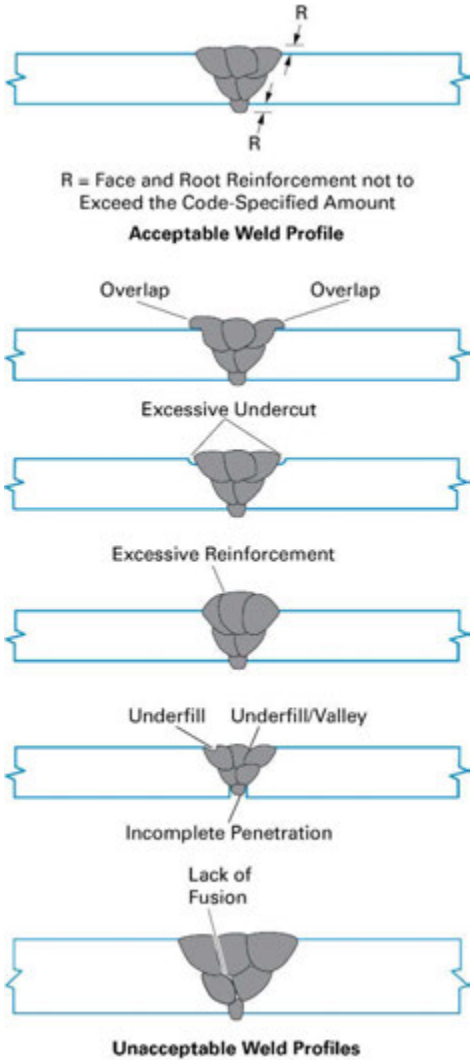
2. Use E6010/E6011 and E7018 electrodes to make flat (1G) open-root single V-groove welds.
3. Use E6010/E6011 and E7018 electrodes to make horizontal (2G) open-root single V-groove welds.
4. Use E6010/E6011 and E7018 electrodes to make vertical (3G) open-root single V-groove welds.
5. Use E6010/E6011 and E7018 electrodes to make overhead (4G) open-root single V-groove welds.

# Trade Terms

There are no trade terms in this section.

# 2.0.0 – Open-Root Single V-Groove Welds

- Make groove welds with slight face reinforcement and a gradual transition to the base metal at each toe.
- Groove welds must not have excessive reinforcement (face or root), underfill, or overlap.



# 2.1.0 – Producing the Root Pass (1 of 4)

- Producing the root pass is the most challenging part of making an open-root single V-groove weld.
- The welder makes the root pass from the V-groove side. It must completely penetrate but not have excessive root reinforcement.
- Welders use a technique called “running a keyhole” to control penetration.
- The arc makes the keyhole by melting away the root faces (lands) of the plates.
- The molten metal flows to the back side of the keyhole, forming the weld.

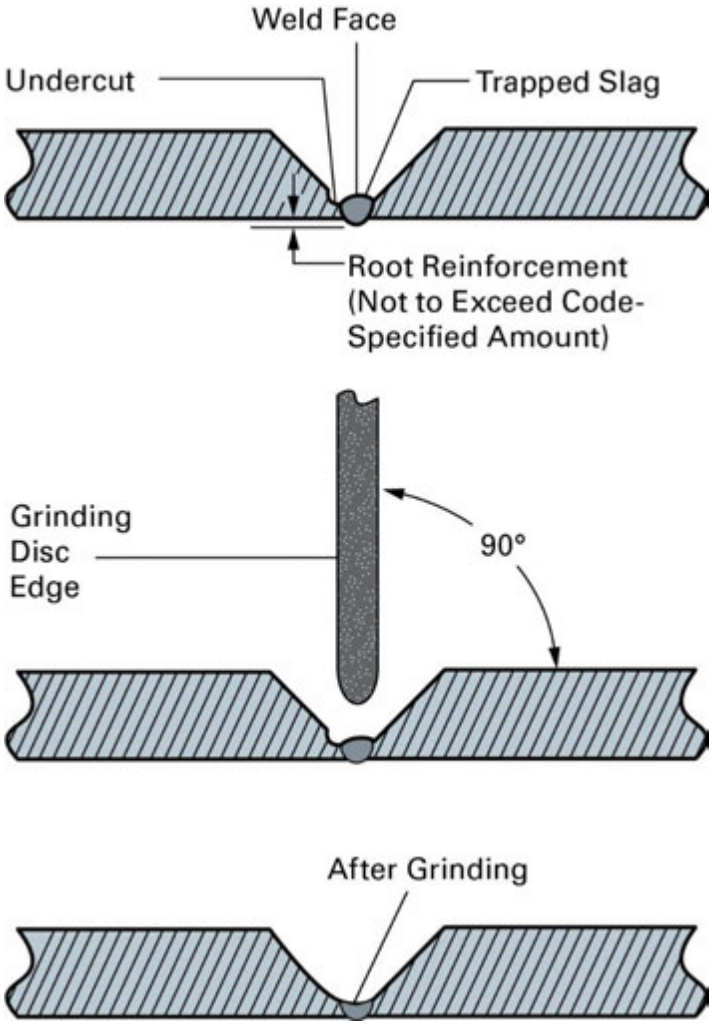
# 2.1.0 – Producing the Root Pass (2 of 4)

- The keyhole should be centered and about ⅛" to ³⁄₁₆" (~3 mm to 5 mm) in diameter.
- Root reinforcement should be either flush or no more than the code, WPS, or jobsite quality specifications permit.
- Control the keyhole by using a fast-freeze E6010/E6011 electrode and whipping it.
- Carefully watch the keyhole's back edge to ensure good fusion. This area should be round. If it becomes V-shaped, proper fusion isn't happening.
- If the keyhole starts to grow, reduce the pause time and increase the whip's forward length.

# 2.1.0 – Producing the Root Pass (3 of 4)

- If the keyhole starts to close, increase the pause time and decrease the whip's forward length.
- After running the root pass, clean and inspect it.
- Remove excessive buildup or undercut with a hand grinder.
- Grind the root pass face with the grinding disc's edge.
- Don't grind through the root pass or widen the groove.

# 2.1.0 – Producing the Root Pass (4 of 4)



# 2.2.1 – Practicing Open-Root Single V-Groove Welds (1G Position) (1 of 2)

Follow these steps to practice making open-root single V-groove welds in the 1G position:

**Step 1** Tack weld the practice coupon.

**Step 2** Clean and feather (taper) the tack welds with the edge of a grinding disc. Feathering the tack welds helps fuse them into the root pass.

**Step 3** Position the practice coupon flat on the welding table.

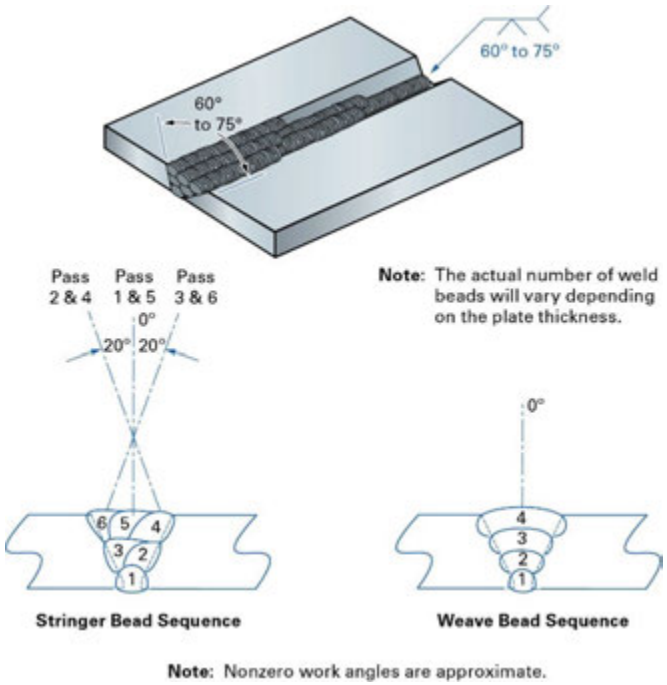
**Step 4** Run the root pass using E6010/E6011 electrodes.

**Step 5** Chip, clean, and brush the root weld. Grind if required.

# 2.2.1 – Practicing Open-Root Single V-Groove Welds (1G Position) (2 of 2)

**Step 6** Run the fill and cover passes using E7018 electrodes.
Chip, clean, and brush each bead. Use stringer or weave beads as your instructor directs.

**Step 7** When you're finished welding, *always* remove the electrode from its holder. This prevents arcing. Discard the stub in the proper container.



# 2.2.2 – Practicing Open-Root Single V-Groove Welds 2G Positions (1 of 5)

- Before you try this weld, practice running horizontal stringer beads.
- Do this by building a pad in the horizontal position.
- Follow these steps to practice making horizontal stringer beads in the 2G position:

**Step 1** Tack weld a flat plate coupon in the horizontal position.

**Step 2** Run the first pass along the coupon's bottom edge. Use E6010/E6011 electrodes.

# 2.2.2 – Practicing Open-Root Single V-Groove Welds 2G Positions (2 of 5)

**Step 3** Chip, clean, and brush the weld.

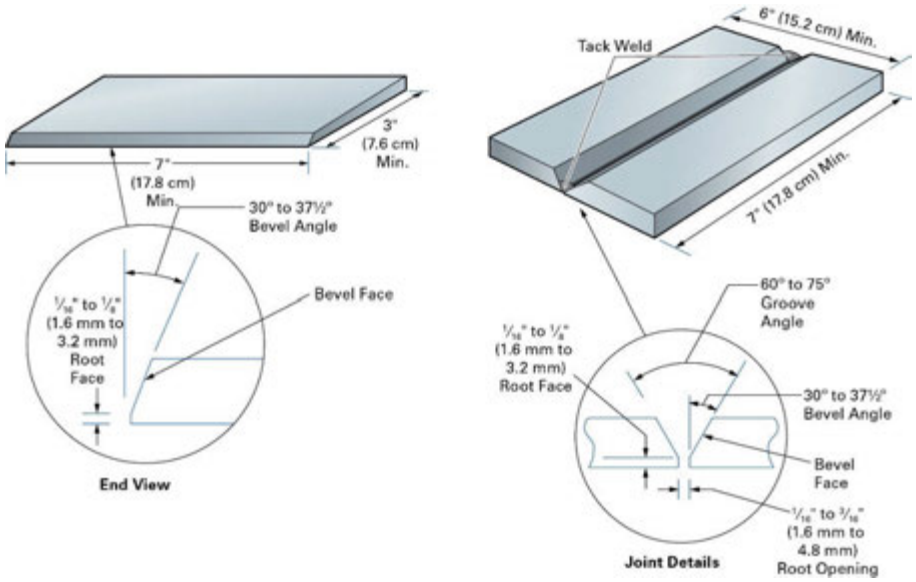
**Step 4** Weld the second bead just above the first bead. The beads should overlap as the figure below shows. Chip, clean, and brush it.

**Step 5** Continue running beads until you complete the pad.

# 2.2.2 – Practicing Open-Root Single V-Groove Welds 2G Positions (3 of 5)

Follow these steps to practice making open-root single V-groove welds in the 2G position:

**Step 1** Tack weld the practice coupon. Use the standard or alternative coupon preparation as your instructor directs.



# 2.2.2 – Practicing Open-Root Single V-Groove Welds 2G Positions (4 of 5)

**Step 2** Clean and feather (taper) the tack welds with the edge of a grinding disc. Feathering the tack welds helps fuse them into the root pass.

**Step 3** Tack weld the practice coupon in the horizontal position.

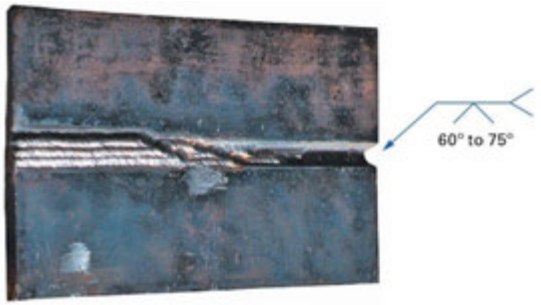
**Step 4** Run the root pass using E6010/E6011 electrodes.

**Step 5** Chip, clean, and brush the weld.

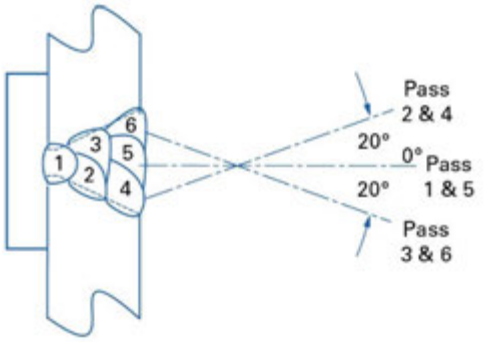
# 2.2.2 – Practicing Open-Root Single V-Groove Welds 2G Positions (5 of 5)

**Step 6** Run the fill and cover passes using E7018 electrodes. Chip, clean, and brush each bead.

**Step 7** When you're finished welding, *always* remove the electrode from its holder. This prevents arcing. Discard the stub in the proper container.




**Note:** The actual number of weld beads will vary depending on the plate thickness and electrode diameter.




**Note:** Nonzero work angles are approximate.

# 2.3.1 – Practicing Open-Root Single V-Groove Welds 3G Position (1 of 4)

- Practice running vertical weave beads.
- Do this by building a pad in the vertical position.
- Use a 0- to 10-degree push angle.
- Follow these steps to practice making vertical weave beads in the 3G position:

**Step 1** Tack weld a flat plate coupon in the vertical position.

**Step 2** Using a whipping motion, run the first pass along one of the coupon's vertical edges from bottom to top. Use E6010/E6011 electrodes.

# 2.3.1 – Practicing Open-Root Single V-Groove Welds 3G Position (2 of 4)

**Step 3** Chip, clean, and brush the weld.

**Step 4** Weld the second bead next to the first bead. The beads should overlap. Chip, clean, and brush it.

**Step 5** Continue running beads until you complete the pad.

# 2.3.1 – Practicing Open-Root Single V-Groove Welds 3G Position (3 of 4)

Follow these steps to practice making open-root single V-groove welds in the 3G position:

**Step 1** Tack weld the practice coupon.

**Step 2** Clean and feather (taper) the tack welds with the edge of a grinding disc. Feathering the tack welds helps fuse them into the root pass.

**Step 3** Tack weld the practice coupon in the vertical position.

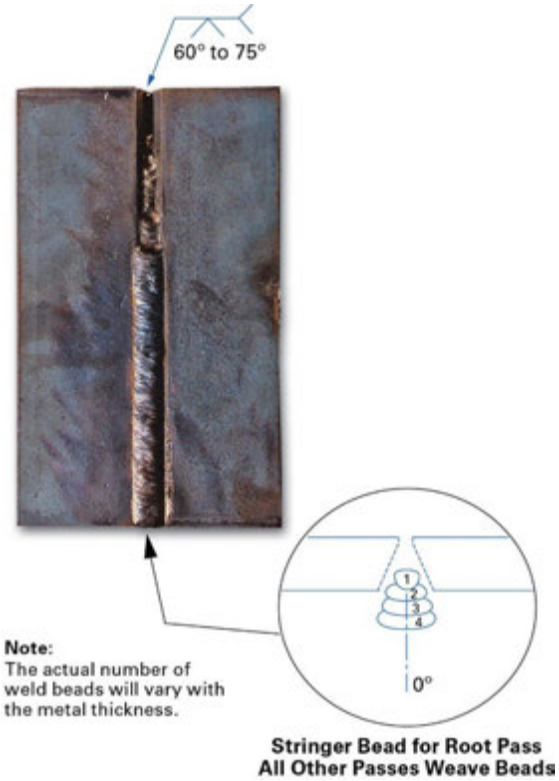
**Step 4** Run the root pass as a stringer bead using E6010/E6011 electrodes from bottom to top (uphill progression).

**Step 5** Chip, clean, and brush the weld.

# 2.3.1 – Practicing Open-Root Single V-Groove Welds 3G Position (4 of 4)

**Step 6** Run the fill and cover passes uphill as weave beads using E7018 electrodes. Chip, clean, and brush each bead.

**Step 7** When you're finished welding, *always* remove the electrode from its holder. This prevents arcing. Discard the stub in the proper container.



# 2.3.2 – Practicing Open-Root Single V-Groove Welds (4G Position) (1 of 4)

- Before trying open-root groove welding in the 4G position, practice building pads with overhead stringer beads.
- Follow these steps to practice making overhead stringer beads in the 4G position:

  **Step 1** Tack weld a flat plate coupon in the overhead position.

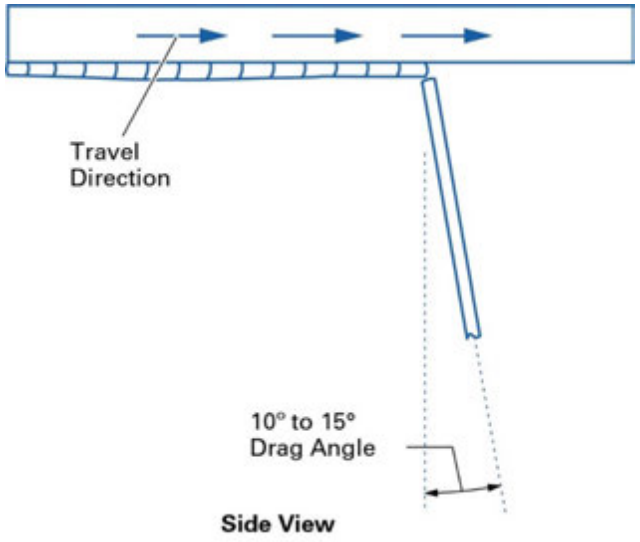
  **Step 2** Run the first pass along one of the coupon's edges. Use E6010/E6011 electrodes.

  **Step 3** Chip, clean, and brush the weld.

# 2.3.2 – Practicing Open-Root Single V-Groove Welds (4G Position) (2 of 4)

**Step 4** Weld the second bead next to the first bead. The beads should overlap. Chip, clean, and brush it.

**Step 5** Continue running beads until you complete the pad.



# 2.3.2 – Practicing Open-Root Single V-Groove Welds 4G Position (3 of 4)

Follow these steps to practice making open-root single V-groove welds in the 4G position:

**Step 1** Tack weld the practice coupon.

**Step 2** Clean and feather (taper) the tack welds with the edge of a grinding disc. Feathering the tack welds helps fuse them into the root pass.

**Step 3** Tack weld the practice coupon in the overhead position.

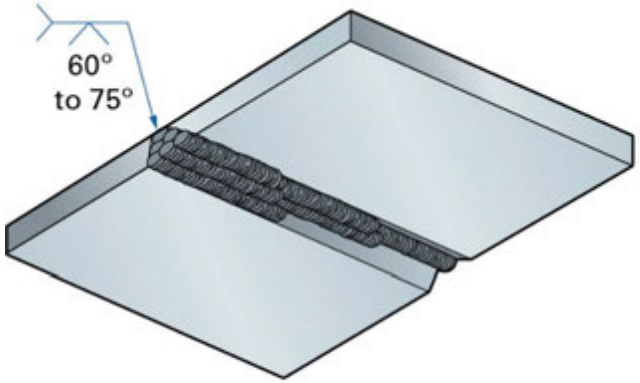
**Step 4** Run the root pass using E6010/E6011 electrodes.

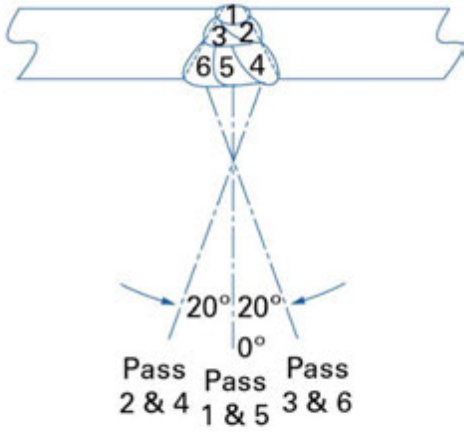
**Step 5** Chip, clean, and brush the weld.

# 2.3.2 – Practicing Open-Root Single V-Groove Welds 4G Position (4 of 4)

**Step 6** Run the fill and cover passes using E7018 electrodes. Chip, clean, and brush each bead.

**Step 7** When you're finished welding, *always* remove the electrode from its holder. This prevents arcing. Discard the stub in the proper container.




**Stringer Bead Sequence**

**Note:** Nonzero work angles are approximate.

# 2.0.0 Section Review Question One

The key to a successful root pass when welding an open-root single V-groove weld is controlling the _____.

- weave
- groove angle
- keyhole
- bevel angle

# 2.0.0 Section Review Question One Answer

The key to a successful root pass when welding an open-root single V-groove weld is controlling the _____.

- weave
- groove angle
- **keyhole**
- bevel angle

# 2.0.0 Section Review Question Two

When making an open-root single V-groove weld horizontally, you are welding in the _____.

- 1G position
- 2G position
- 3G position
- 4G position

# 2.0.0 Section Review Question Two Answer

When making an open-root single V-groove weld horizontally, you are welding in the _____.

1G position

**2G position**

3G position

4G position

# 2.0.0 Section Review Question Three

You're producing an open-root single V-groove weld in the 3G position. Unless the applicable code, WPS, or jobsite quality specifications forbid it, what bead style should you use?

- Weave beads
- Root face beads
- Stringer beads
- Keyhole beads

# 2.0.0 Section Review Question Three Answer

You're producing an open-root single V-groove weld in the 3G position. Unless the applicable code, WPS, or jobsite quality specifications forbid it, what bead style should you use?

- **Weave beads**
- Root face beads
- Stringer beads
- Keyhole beads

## Next…

## Module Review and Exam

Review the complete module to prepare for the Module Exam. In addition, complete the Module Review.