Module 29101-09 has no Performance Profile Sheet; no performance testing is required for this module.
Craft: Welding  
Module Number: 29102-09  
Module Title: Oxyfuel Cutting

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<td>4</td>
<td>3. Shut down oxyfuel cutting equipment</td>
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<td>6</td>
<td>5. Change empty cylinders</td>
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Rating Levels: (1) Passed: performed task  (2) Failed: did not perform task  
Also, list the date the testing for each task was completed.

Recognition: When testing for the NCCER Standardized Craft Training Program, be sure to record Performance testing results on Craft Training Report Form 200, and submit the results to the Training Program Sponsor.
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<td>6. Cut shapes from various thicknesses of steel, emphasizing:</td>
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<tr>
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<td>• Square shape</td>
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<tr>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>• Bevel</td>
<td></td>
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<tr>
<td></td>
<td>• Slot</td>
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<td>7</td>
<td>7. Perform washing.</td>
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<td>7</td>
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<tr>
<td>3</td>
<td>Cutting a Shape from Thick Steel</td>
<td>2.13</td>
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</table>
SETTING UP, IGNITING, ADJUSTING, AND SHUTTING DOWN OXYFUEL EQUIPMENT

Using oxyfuel equipment that has been completely disassembled, demonstrate how to:
• Set up oxyfuel equipment
• Ignite and adjust the flame
  – Carburizing
  – Neutral
  – Oxidizing
• Shut off the torch
• Shut down the oxyfuel equipment

Criteria for Acceptance:
• Set up the oxyfuel equipment in the correct sequence
• Demonstrate that there are no leaks
• Properly adjust all three flames
• Shut off the torch in the correct sequence
• Shut down the oxyfuel equipment
CUTTING A SHAPE FROM THIN STEEL

Using a carbon steel plate, lay out and cut the shape and holes shown in the figure. If available, use a machine track cutter to straight cut the 6" dimensions.

NOTE: MATERIAL – CARBON STEEL ⅛" TO ⅜" THICK
HOLES ¼" DIAMETER
SLOTS ⅛" × 1⅛"

Criteria for Acceptance:
• Outside dimensions ±¼"
• Inside dimensions (holes and slots) ±¼"
• Square ±5°
• Minimal amount of dross sticking to plate which can be easily removed
• Square kerf face with minimal notching not exceeding ½" deep
CUTTING A SHAPE FROM THICK STEEL

Using a carbon steel plate, lay out and cut the shape and holes shown in the figure. If available, use a machine track cutter to bevel and straight cut the 6” dimensions.

**Note:** Material – Carbon steel over ¼” thick or greater
Holes ⅛” diameter
Slots ¼” x 1½”

Criteria for Acceptance:
- Outside dimensions ±⅛”
- Inside dimensions (holes and slots) ±⅛”
- Square ±5°
- Bevel ±2°
- Minimal amount of dross sticking to plate which can be easily removed
- Square kerf face with minimal notching not exceeding ⅛” deep
Objective | TASK | RATING
--- | --- | ---
3 | 1. Set up plasma arc cutting equipment. | 
3 | 2. Set the amperage and gas pressures or flow rates for the type and thickness of metal to be cut. | 
4 | 3. Square-cut metal using plasma arc cutting equipment. | 
4 | 5. Pierce and cut slots in metal using plasma arc cutting equipment. | 
5 | 6. Dismantle and store the equipment. | 

When testing for the NCCER Standardized Craft Training Program, be sure to record Performance testing results on Craft Training Report Form 200, and submit the results to the Training Program Sponsor.

Rating Levels: (1) Passed: performed task (2) Failed: did not perform task

Also, list the date the testing for each task was completed.

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## Plasma Arc Cutting

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PLASMA ARC CUTTING

Using carbon steel, lay out and cut the shape shown in the figure.

Criteria for Acceptance:
- Outside dimensions ±\(\frac{1}{16}\)"
- Inside (holes and slots) dimensions ±\(\frac{1}{16}\)"
- Square ±2°
- Bevel ±2°
- Minimal amount of dross sticking to plate which can be easily removed
- Square kerf face with minimal notching not exceeding ±\(\frac{1}{8}\)" deep
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<td>1. Select and install CAC-A electrodes.</td>
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<td>2. Prepare the work area and CAC-A equipment for safe operation.</td>
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<td>4</td>
<td>3. Use CAC-A equipment for washing.</td>
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<tr>
<td>4</td>
<td>4. Use CAC-A equipment for gouging.</td>
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<td>5</td>
<td>5. Perform storage and housekeeping activities for CAC-A equipment.</td>
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Air Carbon Arc Cutting and Gouging

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<td>CAC-A Washing and Gouging</td>
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CACA WASHING AND GOUGING

PERFORM CACA WASHING
Using any of the materials identified below, perform CACA washing to remove the portion identified by the instructor. Materials that can be used for this task include:
• Steel backing strip on a butt weld
• Excess buildup on the face of a weld
• Rivets or bolts in a plate
• Blocks, angles, clips, eyes, D-rings, or items welded to a plate

Criteria for Acceptance
• Material removed flush with the base metal surface
• No notching in the surface of the base metal

PERFORM CACA GOUGING
Using mild steel plate ½” thick or thicker, gouge a U-groove at least 8” long as shown in the figure in the 1G and 2G or 1F and 2F positions.

Criteria for Acceptance
• Groove width and depth are uniform to ±¼”
• Root face minimum is ¼”
• Groove bottom radius minimum is ¼”
• Included angle of groove walls is 45°, ±10°
• Groove walls are smooth and uniform
• No dross within the groove
Objective 1, 4
1. Mechanically bevel the edge of a mild steel plate \(1/4\)-inch to \(3/4\)-inch thick at 22\(1/2\) degrees (or 30 degrees, depending on the equipment available).

Objective 5
2. Thermally prepare a bevel.
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<td>2</td>
<td>Prepare Joints Thermally</td>
<td>5.10</td>
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</table>
PREPARE PLATE JOINTS MECHANICALLY

Using a nibbler or cutter, mechanically prepare the edge of a \( \frac{3}{8} \)" to \( \frac{3}{4} \)" carbon steel plate with a bevel of 22\( \frac{1}{2} \)° (or 30° bevel depending on equipment available).

Criteria for Acceptance:
- Bevel angle ± 2\( \frac{1}{2} \)°
- Bevel face smooth and uniform to \( \frac{3}{8} \)"
- Root face ± \( \frac{3}{8} \)"

NOTE: BASE METAL = CARBON STEEL PLATE
PREPARE PLATE JOINTS THERMALLY

Using oxyfuel or plasma arc cutting equipment, thermally prepare the edge of a \(\frac{3}{8}\)" to \(\frac{5}{8}\)" carbon steel plate with a bevel of \(22\frac{1}{2}^\circ\) (or 30° depending on equipment available).

NOTE: BASE METAL = CARBON STEEL PLATE

Criteria for Acceptance:

- Bevel angle ±2\(\frac{1}{2}\)°
- No dross
- Minimal notching not exceeding \(\frac{1}{6}\)" deep on the kerf face
- Minimum of \(\frac{1}{8}\)" radius at the top edge and bottom edge of the kerf
- Root face ±\(\frac{1}{8}\)"
Module 29106-09 has no Performance Profile Sheet; no performance testing is required for this module.
**Objective** | **TASK** | **RATING**
--- | --- | ---
5 | 1. Set up a machine for welding. |
Module 29108-09 has no Performance Profile Sheet; no performance testing is required for this module.
## Objective | TASK | RATING
--- | --- | ---
1 | 1. Set up welding equipment. | 
3 | 2. Strike an arc. | 
5 | 3. Make stringer, weave, and overlapping beads using E6010 and E7018 electrodes. | 
continued
<table>
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<td>4. Make fillet welds using E6010 and E7018 in the specified position:</td>
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<tr>
<td></td>
<td>• Horizontal (2F)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Vertical (3F)</td>
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<tr>
<td></td>
<td>• Overhead (4F)</td>
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<td>6</td>
<td>Vertical (3F) Fillet Weld with E7018 Electrodes</td>
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<td>7</td>
<td>Overhead (4F) Fillet Weld with E6010 Electrodes</td>
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<td>8</td>
<td>Overhead (4F) Fillet Weld with E7018 Electrodes</td>
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BUILD A PAD WITH E6010 ELECTRODES IN THE FLAT POSITION

Using ⅛" E6010 electrodes, build up a pad of weld metal on carbon steel plate as indicated.

NOTE: BASE METAL = CARBON STEEL PLATE AT LEAST ¼" THICK

Criteria for Acceptance:

- Weld beads straight to within ⅛"
- Uniform rippled appearance on the bead face
- Craters and restarts filled to the full cross section of the weld
- Face of the pad flat to within ⅛"
- Smooth flat transition with complete fusion at the toes of one bead into the face of the previous bead
- No porosity
- No overlap at weld toes
- No excessive undercut
- No inclusions
- No cracks
BUILD A PAD WITH E7018 ELECTRODES IN THE FLAT POSITION

Using 3/8" E7018 electrodes, build up a pad of weld metal on carbon steel plate as indicated.

NOTE: BASE METAL = CARBON STEEL PLATE AT LEAST 3/4" THICK

Criteria for Acceptance:

- Weld beads straight to within 3/8"
- Uniform rippled appearance on the bead face
- Craters and restarts filled to the full cross section of the weld
- Face of the pad flat to within 3/8"
- Smooth flat transition with complete fusion at the toes of one bead into the face of the previous bead
- No porosity
- No overlap at weld toes
- No excessive undercut
- No inclusions
- No cracks
HORIZONTAL (2F) FILLET WELD WITH E6010 ELECTRODES

Using ⅛” E6010 electrodes, make a horizontal fillet weld as indicated.

NOTE: BASE METAL = CARBON STEEL PLATE AT LEAST ⅛” THICK

Criteria for Acceptance:

- Uniform rippled appearance on the bead face
- Craters and restarts filled to the full cross section of the weld
- Uniform weld size, ±¼”
- Acceptable weld profile in accordance with AWS D1.1
- Smooth transition with complete fusion at the toes of the weld
- No porosity
- No excessive undercut
- No inclusions
- No cracks
- No overlap
HORIZONTAL (2F) FILLET WELD WITH E7018 ELECTRODES

Using ⅝" E7018 electrodes, make a horizontal fillet weld as indicated.

**NOTE:** BASE METAL = CARBON STEEL PLATE AT LEAST ¼" THICK

**Criteria for Acceptance:**

- Uniform rippled appearance on the bead face
- Craters and restarts filled to the full cross section of the weld
- Uniform weld size, ± ⅛"
- Acceptable weld profile in accordance with AWS D1.1
- Smooth transition with complete fusion at the toes of the weld
- No porosity
- No excessive undercut
- No inclusions
- No cracks
- No overlap
Using \( \frac{3}{8}\)" E6010 electrodes, make a vertical fillet weld as indicated.

**NOTE:** BASE METAL = CARBON STEEL PLATE AT LEAST \( \frac{1}{4}\)" THICK

**Criteria for Acceptance:**

- Uniform rippled appearance on the bead face
- Craters and restarts filled to the full cross section of the weld
- Uniform weld size, \( \pm \frac{3}{8}\)"
- Acceptable weld profile in accordance with AWS D1.1
- Smooth transition with complete fusion at the toes of the weld
- No porosity
- No excessive undercut
- No inclusions
- No cracks
- No overlap at weld toes
Using \( \frac{3}{8} \)" E7018 electrodes, make a vertical fillet weld as indicated.

**Criteria for Acceptance:**

- Uniform rippled appearance on the bead face
- Craters and restarts filled to the full cross section of the weld
- Uniform weld size, \( \pm \frac{1}{8} " \)
- Acceptable weld profile in accordance with AWS D1.1
- Smooth transition with complete fusion at the toes of the weld
- No porosity
- No excessive undercut
- No inclusions
- No cracks
- No overlap at weld toes
OVERHEAD (4F) FILLET WELD WITH E6010 ELECTRODES

Using \( \frac{3}{4} \)" E6010 electrodes, make an overhead fillet weld as indicated.

Criteria for Acceptance:
- Uniform rippled appearance on the bead face
- Craters and restarts filled to the full cross section of the weld
- Uniform weld size, \( \pm \frac{3}{4} \)"
- Acceptable weld profile in accordance with AWS D1.1
- Smooth transition with complete fusion at the toes of the weld
- No porosity
- No excessive undercut
- No inclusions
- No cracks
- No overlap
OVERHEAD (4F) FILLET WELD WITH E7018 ELECTRODES

Using \(\frac{3}{4}\)" E7018 electrodes, make an overhead fillet weld as indicated.

**NOTE:** BASE METAL = CARBON STEEL PLATE AT LEAST \(\frac{3}{4}\)" THICK

---

**Criteria for Acceptance:**

- Uniform rippled appearance on the bead face
- Craters and restarts filled to the full cross section of the weld
- Uniform weld size, \(\pm \frac{3}{8}\)"
- Acceptable weld profile in accordance with AWS D1.1
- Smooth transition with complete fusion at the toes of the weld
- No porosity
- No excessive undercut
- No inclusions
- No cracks
- No overlap

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<td>1. Set up the arc welding equipment for making groove welds.</td>
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<td>4</td>
<td>2. Make flat welds with backing on V-groove joints using E7018 electrodes.</td>
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<td>4</td>
<td>3. Make horizontal welds with backing on V-groove joints using E7018 electrodes.</td>
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<td>4</td>
<td>5. Make overhead welds with backing on V-groove joints using E7018 electrodes.</td>
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SMAW – Groove Welds with Backing

29111-09

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V-GROOVE WELDS WITH BACKING IN THE FLAT (1G) POSITION

Using ⅛", ¼", or ½" E7018 electrodes, make a V-groove weld with steel backing on carbon steel plate in the flat position as indicated.

NOTE: BASE METAL = CARBON STEEL PLATE

BACKING STRIP
¼" 1" MIN. 8" LONG
EXTENDING ⅛" FROM PLATES

Criteria for Acceptance:

- Uniform rippled appearance on the bead face
- Craters and restarts filled to the full cross section of the weld
- Uniform weld size ±⅛"
- Acceptable weld profile in accordance with AWS D1.1
- Smooth transition with complete fusion at the toes of the weld
- No porosity
- No overlap
- No excessive undercut
- No inclusions
- No cracks
**V-GROOVE WELDS WITH BACKING IN THE HORIZONTAL (2G) POSITION**

Using ⅛”, ¼”, or ⅜” E7018 electrodes, make a V-groove weld with steel backing on carbon steel plate in the horizontal position as indicated.

**NOTE:** BASE METAL = CARBON STEEL PLATE

Criteria for Acceptance:
- Uniform rippled appearance on the bead face
- Craters and restarts filled to the full cross section of the weld
- Uniform weld size ±¼”
- Acceptable weld profile in accordance with AWS D1.1
- Smooth transition with complete fusion at the toes of the weld
- No porosity
- No excessive undercut
- No overlap
- No inclusions
- No cracks
- Acceptable guided bend test results per AWS QC-10: 2004
Using ⅛", ¼", or ½" E7018 electrodes, make a V-groove weld with steel backing on carbon steel plate in the vertical position as indicated.

**NOTE:** BASE METAL = CARBON STEEL PLATE

**Criteria for Acceptance:**

- Uniform rippled appearance on the bead face
- Craters and restarts filled to the full cross section of the weld
- Uniform weld size ±⅛"
- Acceptable weld profile in accordance with AWS D1.1
- Smooth transition with complete fusion at the toes of the weld
- No porosity
- No overlap
- No excessive undercut
- No inclusions
- No cracks
- Acceptable guided bend test results per AWS QC-10: 2004
V-GROOVE WELD WITH BACKING IN THE OVERHEAD (4G) POSITION

Using \(\frac{5}{16}\), \(\frac{1}{4}\), or \(\frac{3}{8}\) E7018 electrodes, make a V-groove weld with steel backing on carbon steel plate in the overhead position as indicated.

**Criteria for Acceptance:**
- Uniform rippled appearance on the bead face
- Craters and restarts filled to the full cross section of the weld
- Uniform weld size ±\(\frac{3}{32}\)
- Acceptable weld profile in accordance with AWS D1.1
- Smooth transition with complete fusion at the toes of the weld
- No porosity
- No excessive undercut
- No overlap
- No inclusions
- No cracks
- Acceptable guided bend test results per AWS QC-10: 2004
Objective | TASK | RATING
--- | --- | ---
1 | 1. Prepare arc welding equipment for open V-groove welds. | 
2 | 2. Make open V-groove welds with E6010 and E7018 electrodes in the following positions: | 
| • Flat (1G) | 
| • Horizontal (2G) | 
| • Vertical (3G) | 
| • Overhead (4G) | 

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## SMAW – Open V-Groove Welds

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<td>Open V-Groove with E6010 and E7018 Electrodes in the Overhead Position</td>
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OPEN V-GROOVE WITH E6010 AND E7018 ELECTRODES IN THE FLAT POSITION

Using ⅛" E6010 electrodes for the root pass and ⅜" or ¾" E7018 electrodes for the fill and cover passes, make an open-root V-groove weld on carbon steel plate in the flat position as indicated.

Criteria for Acceptance:

- Uniform rippled appearance on the bead face
- Craters and restarts filled to the full cross section of the weld
- Uniform weld size
- Acceptable weld profile in accordance with the ASME ASME Boiler and Pressure Vessel Code
- Smooth transition with complete fusion at the toes of the weld
- Complete uniform root penetration at least flush with the base metal to a maximum buildup of ⅛"
- No porosity
- No excessive undercut
- No inclusions
- No cracks
- Acceptable guided bend test results (optional)
OPEN V-GROOVE WITH E6010 AND E7018 ELECTRODES IN THE HORIZONTAL POSITION

Using ¼" E6010 electrodes for the root pass and ⅛" or ¾" E7018 electrodes for the fill and cover passes, make an open-root V-groove weld on carbon steel plate in the horizontal position as shown.

Criteria for Acceptance:

- Uniform rippled appearance on the bead face
- Craters and restarts filled to the full cross section of the weld
- Uniform weld size
- Acceptable weld profile in accordance with the ASME Boiler and Pressure Vessel Code
- Complete uniform root penetration at least flush with the base metal to a maximum buildup of ½"
- Smooth transition with complete fusion at the toes of the weld
- No porosity
- No excessive undercut
- No inclusions
- No cracks
- Acceptable guided bend test results (optional)
OPEN V-GROOVE WITH E6010 AND E7018 ELECTRODES IN THE VERTICAL POSITION

Using ⅛" E6010 electrodes for the root pass and ⅛" or ¼" E7018 electrodes for the fill and cover passes, make an open-root V-groove weld on carbon steel plate in the vertical position as shown.

Criteria for Acceptance:

- Uniform rippled appearance on the bead face
- Craters and restarts filled to the full cross section of the weld
- Uniform weld size
- Acceptable weld profile in accordance with the ASME Boiler and Pressure Vessel Code
- Complete uniform root penetration at least flush with the base metal to a maximum buildup of ⅛"
- Smooth transition with complete fusion at the toes of the weld
- No porosity
- No excessive undercut
- No inclusions
- No cracks
- Acceptable guided bend test results
OPEN V-GROOVE WITH E6010 AND E7018 ELECTRODES IN THE OVERHEAD POSITION

Using ⅛" E6010 electrodes for the root pass and ⅜" or ⅝" E7018 electrodes for the fill and cover passes, make an open-root V-groove weld on carbon steel plate in the overhead position as indicated.

Criteria for Acceptance:

- Uniform rippled appearance on the bead face
- Craters and restarts filled to the full cross section of the weld
- Uniform weld size
- Acceptable weld profile in accordance with the ASME Boiler and Pressure Vessel Code
- Complete uniform root penetration at least flush with the base metal to a maximum buildup of ¾"
- Smooth transition with complete fusion at the toes of the weld
- No porosity
- No excessive undercut
- No inclusions
- No cracks
- Acceptable guided bend test results