Shielded Metal Arc Welding

Welding Technology

By Matt Scott
Introduction

- SMAW – a “tried and true” process excellent for many applications that is still widely used today!
- SMAW Excellent choice for:
  - Maintenance Work
  - Field Work
  - Pipe Applications (GTAW too)
  - Structural Steel
Shielded Metal Arc Welding (SMAW) Defined

- SMAW is a process where electrical power is converted from high voltage and low amperage into low voltage and high amperage current used to melt the base metal through the electrode arc to make a weld.
Shielded Metal Arc Welding (SMAW)

- The electrodes that are used with SMAW are approximately 14 inches long and will be consumed into the weld.
- These electrodes are flux covered and it’s this flux that distinguishes its arc characteristics and its ability to weld out of position.
**Shielded Metal Arc Welding (SMAW)**

- The electrode flux has several functions that include:
  - Gas shielding
  - Controls Penetration
  - Helps remove oxides
  - Adds Alloys to the weld
  - Provides Arc Stabilizers
  - Increases deposition rates
SMAW Essential Factors

- Safety
- Equipment Selection
- Electrode Selection
- Set-Up
SMAW Essential Factors

- Safety
  - Personal
  - Equipment
  - Environment
  - Tool Safety
- Safety Check
- Electrical Safety
- Light (UV, IR, and Intense visible Light)
- Fume Control
- Fire Control
SMAW Essential Factors

Equipment Selection

– Money, money, money
– Input power (220v, 460v, gas/diesel)
– Out Put (Max Amperage and Duty Cycle)
– Output Current (AC, DCRP, DCSP)
Selecting an Electrode

- Things to Consider
  - Metal Thickness
  - Position
  - Condition (wet, oily, greasy, painted)
  - Joint design
  - Service Application
  - Part goes into a static or dynamic situation (i.e. how does it handle vibration stresses).
  - Bead Appearance
  - Metal’s Susceptibility to Cracking - High carbon content (above 0.35% Carbon)
  - What does the Welding Procedure Specification (WPS) specify
## Electrode Characteristics Chart

<table>
<thead>
<tr>
<th></th>
<th>E6010 or E6011</th>
<th>E7018</th>
<th>E7024</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>As Welded Strength</strong></td>
<td>60,000 psi tensile strength</td>
<td>70,000 psi tensile strength</td>
<td>70,000 psi tensile strength</td>
</tr>
<tr>
<td><strong>Welding Positions</strong></td>
<td>All Position</td>
<td>All Position</td>
<td>Flat and Horizontal</td>
</tr>
<tr>
<td><strong>Flux Type</strong></td>
<td>Cellulose</td>
<td>Lime – Fluorine Low-Hyrogen</td>
<td>Rutilte</td>
</tr>
<tr>
<td><strong>Current Type</strong></td>
<td>6010 = DCRP 6011 = AC or DCRP</td>
<td>DCRP</td>
<td>DCRP</td>
</tr>
<tr>
<td><strong>Arc Characteristics</strong></td>
<td>Aggressive</td>
<td>Medium</td>
<td>Soft</td>
</tr>
<tr>
<td><strong>Storage Considerations</strong></td>
<td>Room Temperature</td>
<td>Rod Oven</td>
<td>Room Temperature</td>
</tr>
<tr>
<td><strong>Slag Consistency</strong></td>
<td>Light</td>
<td>Medium</td>
<td>Heavy</td>
</tr>
<tr>
<td><strong>Toughness (vibratory stress)</strong></td>
<td>Good</td>
<td>Excellent</td>
<td>Good</td>
</tr>
<tr>
<td><strong>Welding Technique</strong></td>
<td>Whip and Pause</td>
<td>Tight Arc</td>
<td>Tight Arc</td>
</tr>
</tbody>
</table>
SMAW Essential Factors

- Common Problems
  - Porosity
  - Undercut
  - Arc blow (finger nailing)
SMAW Essential Factors

- Technique
  - Striking the Arc (arc strikes)
  - Slag you Drag
  - Oscillation E6010 Vs. E7018
    - Whip and Pause
    - Arc length
Topic Two – Set it Up

- Safety Scan
- On/Off Switch location
- Polarity Check
- Amperage Adjustment
  - Scrap Metal
  - Ease in starting
  - Puddle fluidity and slag mobility
WLD FFA-1
Advance SMAW Mild Steel
Horizontal Position T-Joint (2F)

NOTE: 7018 stick all sides

<table>
<thead>
<tr>
<th>Inch</th>
<th>MV</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/16&quot;</td>
<td>1.6</td>
</tr>
<tr>
<td>1/8&quot;</td>
<td>3.2</td>
</tr>
<tr>
<td>1/4&quot;</td>
<td>6.4</td>
</tr>
<tr>
<td>1/2&quot;</td>
<td>12.7</td>
</tr>
<tr>
<td>3/4&quot;</td>
<td>25.4</td>
</tr>
</tbody>
</table>

Portland Community College
Welding Technology

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

Drawn By: John Deering
Date: 09/10/04
Approve Date: Sheet
Where to Get More Information

- Owners Manual
- Welding Principles and Applications text book
- PCC
- Local Suppliers