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CENTRAL WORKSHOP

SUBJECT: WORKSHOP PRACTICES
(INTRODUCTION TO WELDING SHOP)

CONTENT

1. Safety
2. SMAW Basics
3. Equipment Set-Up
4. Welding Variables
5. Process Advantages and Limitations
6. AWS Connection
7. National Academic Standards Connection

The SMAW process is great for maintenance and repair work!

OBJECTIVES

- Upon successful completion of the SMAW Unit of Study, you will have learned to:
  - Properly protect yourself and others while welding
  - Set up and operate SMAW equipment
  - Strike and maintain an arc
  - Make welds in four positions using different electrodes
  - Understand a weld inspection process
  - Apply the AWS electrode classification system

Most structural steel welders are required to be certified

SMAW SAFETY

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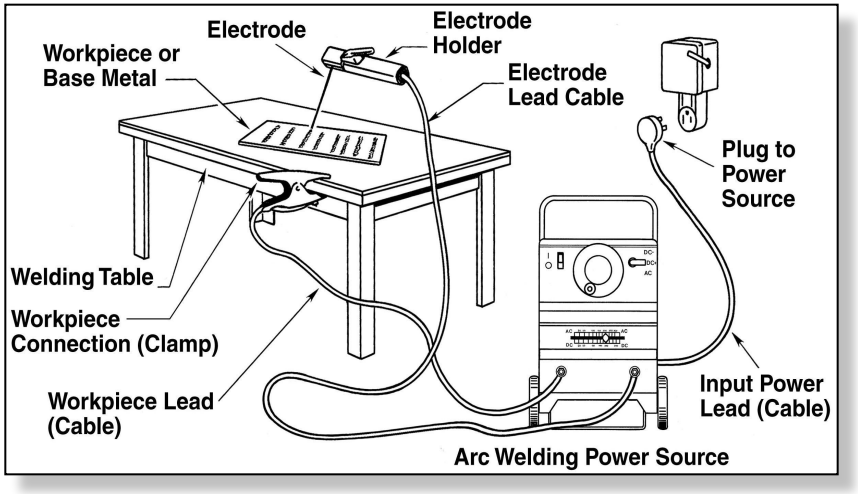
- **Fumes and Gases** can be dangerous
  - Keep your head out of the fumes
  - Use enough ventilation, exhaust at the arc, or both, to keep fumes and gases from your breathing zone and the general area
  - The SMAW process can withstand wind and exhaust near the arc from ventilation equipment
- **Electric Shock** can kill – to receive a shock your body must touch the electrode and work or ground at the same time
  - Do not touch the electrode or metal parts of the electrode holder with skin or wet clothing
  - Keep dry insulation between your body and the metal being welded or ground
- **Arc Rays** can injure eyes and skin - Choose correct filter shade (See chart below)

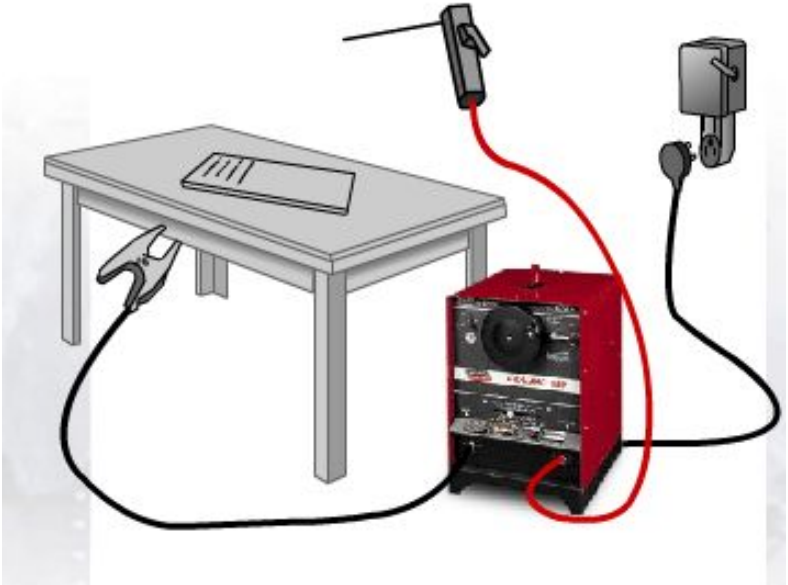
SMAW PRINCIPLES

- The American Welding Society defines SMAW as Shielded Metal Arc Welding
- SMAW:
  - Is commonly known as ‘Stick’ welding or manual arc welding
  - Is the most widely used arc welding process in the world
  - Can be used to weld most common metals and alloys

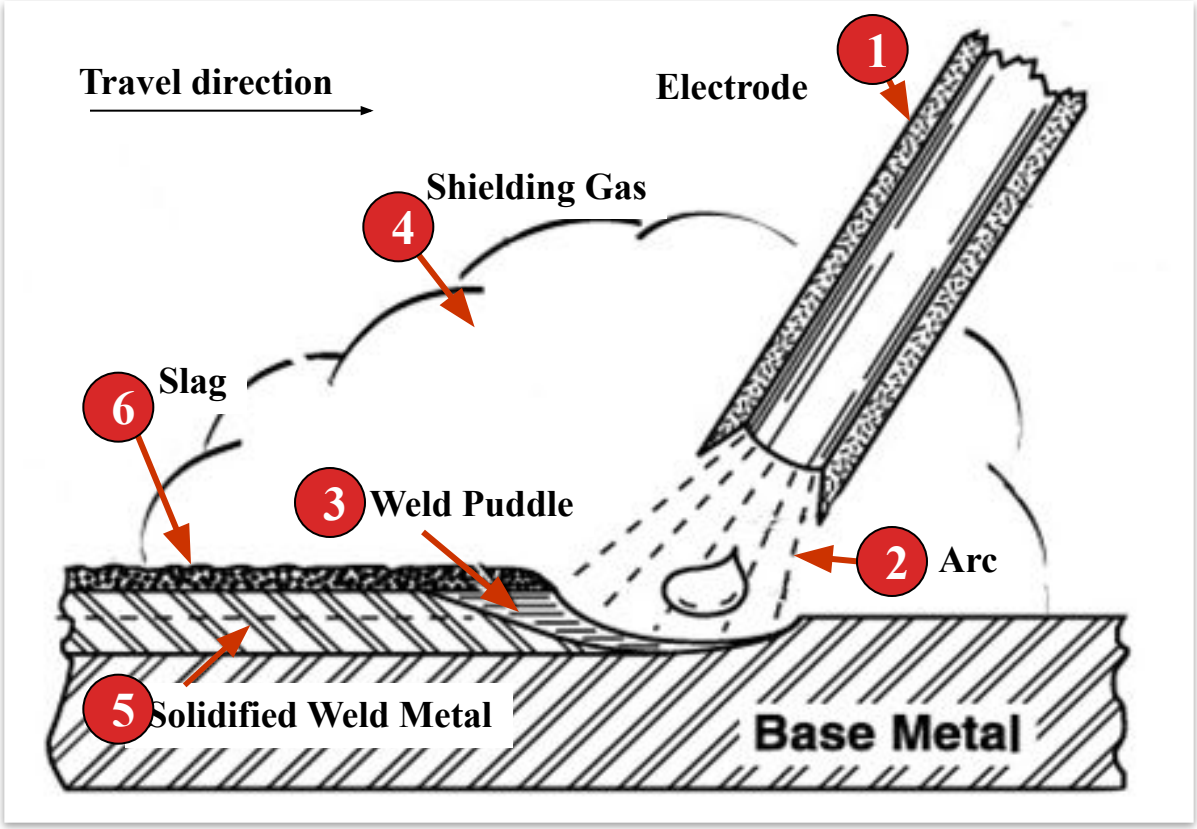


SMAW WELDING CIRCUIT

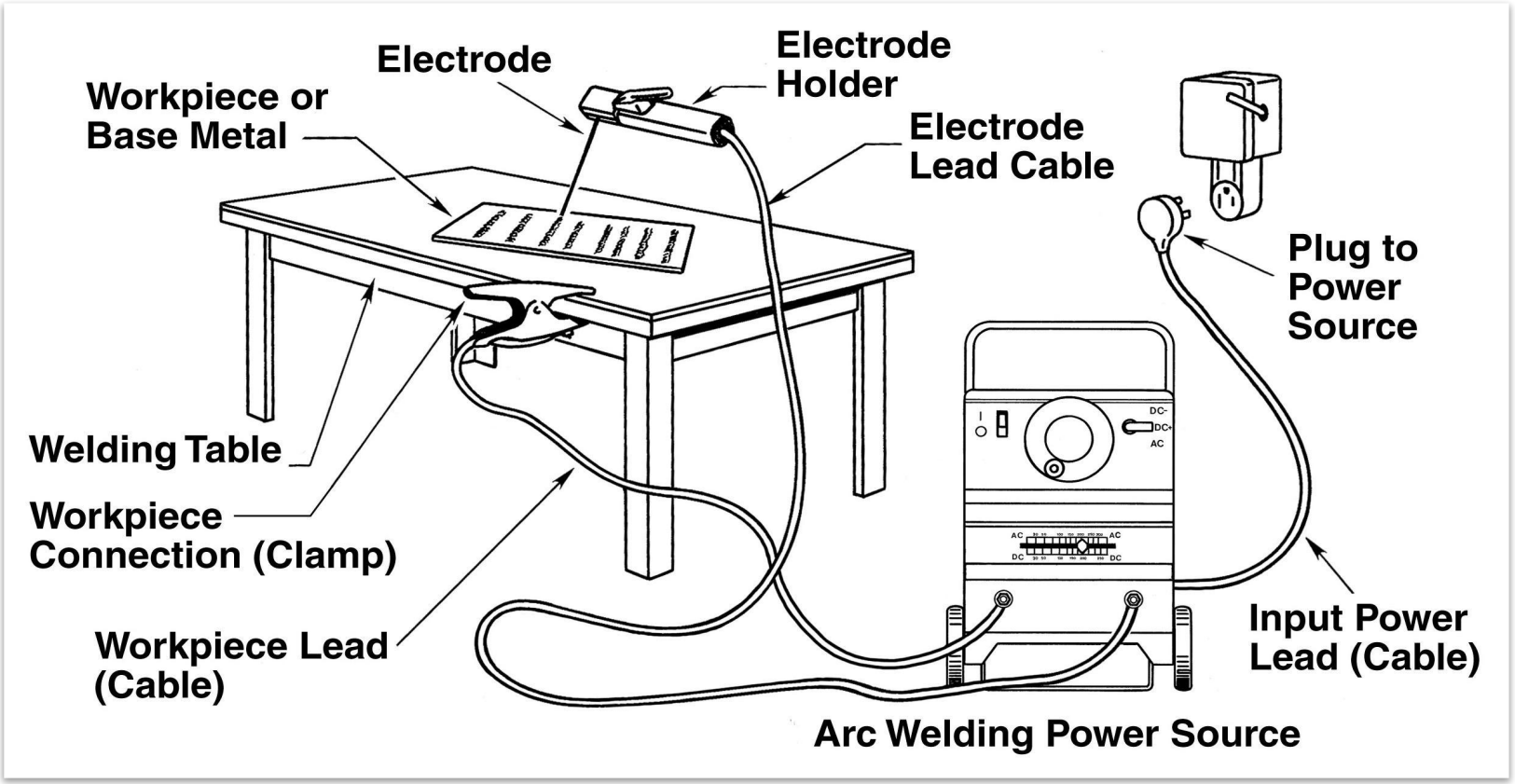
- Current flows through the electrode cable, to the electrode holder, through the electrode, and across the arc
- On the work side of the arc, the current flows through the base material to the work clamp and back to the welding machine



SMAW PROCESS



SMAW EQUIPMENT SET UP



SMAW PROCESS VARIABLES

- Settings on the machine
  - Polarity : AC, DC+, DC-
  - Amperage Output
- Operator Controlled Variables
  - Work Angle
  - Travel Angle
  - Arc Length
  - Travel Speed

A straight AC machine will not have a polarity switch like this AC/DC machine

STRIKING AN ARC

- To begin the SMAW Process, you must first strike an arc. This can be done using one of the following techniques:
  - Scratch start – scratch the electrode on the base
  - [illegible] d aga

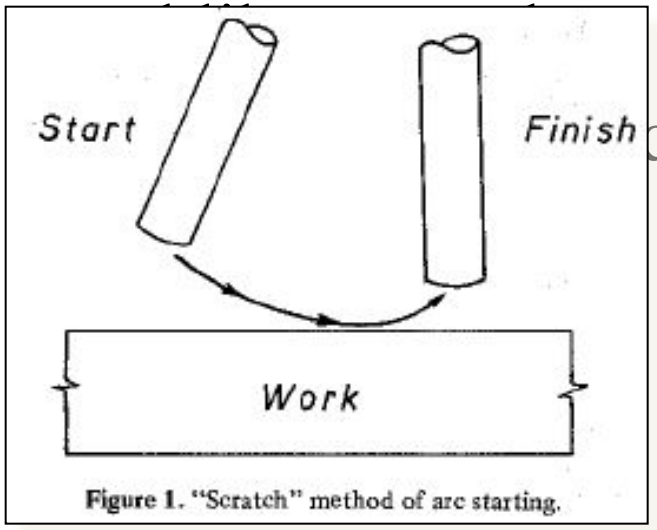


Figure 1. "Scratch" method of arc starting.

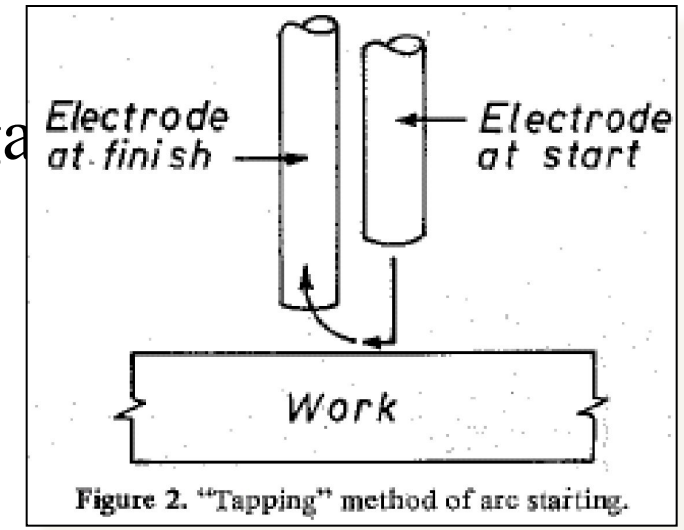
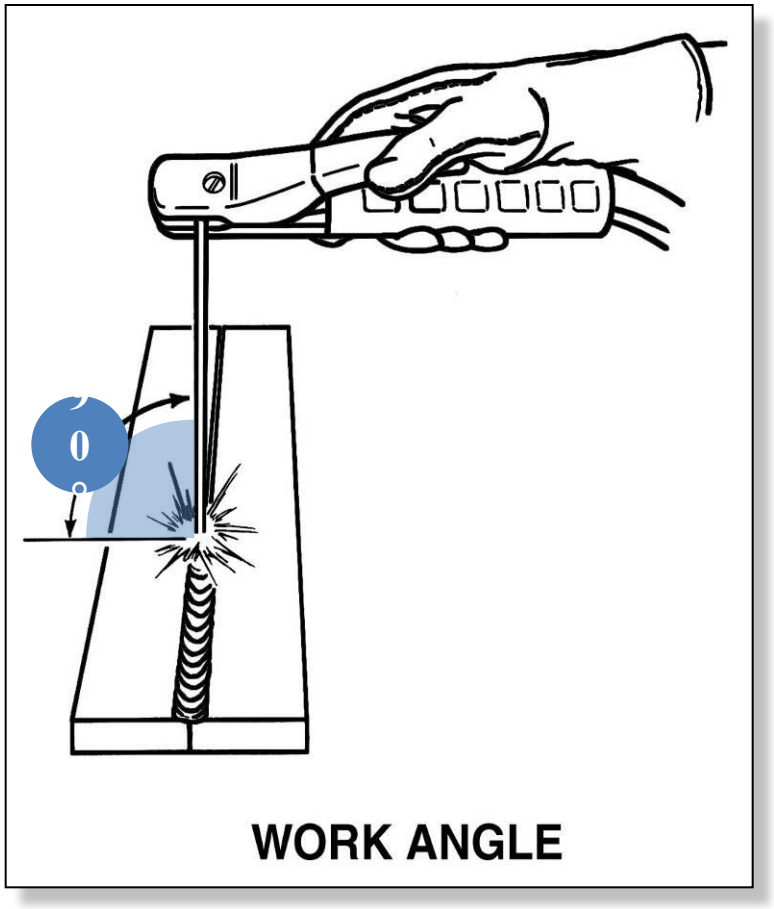


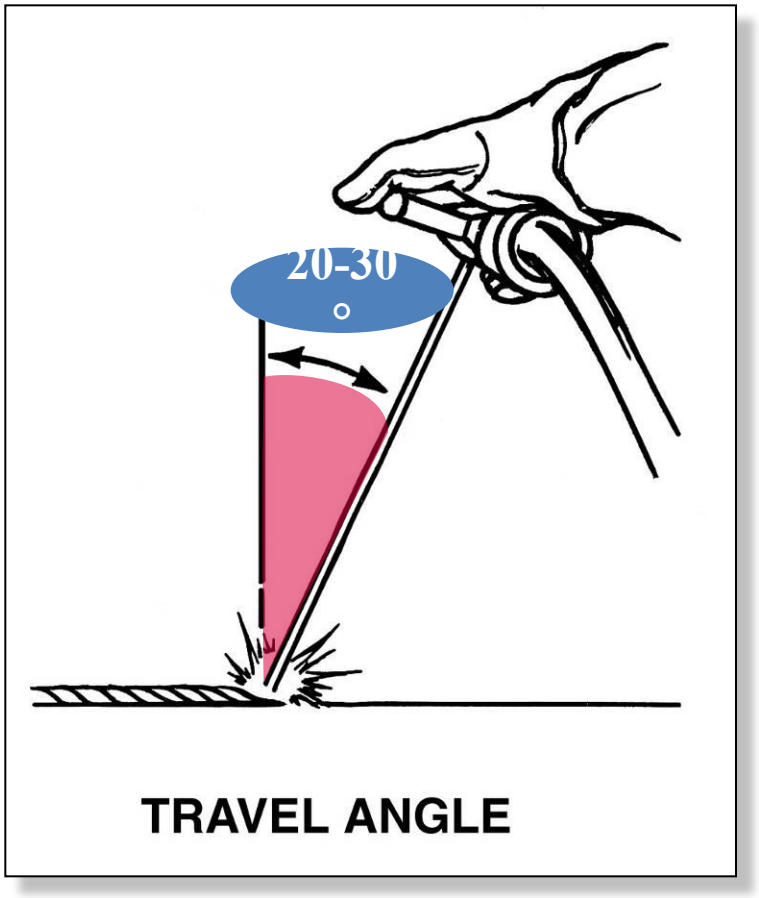
Figure 2. "Tapping" method of arc starting.

WORK ANGLE



- The work angle is the angle between the electrode and the work as depicted on the left
- Work angles can vary depending on the position the weld is being made in

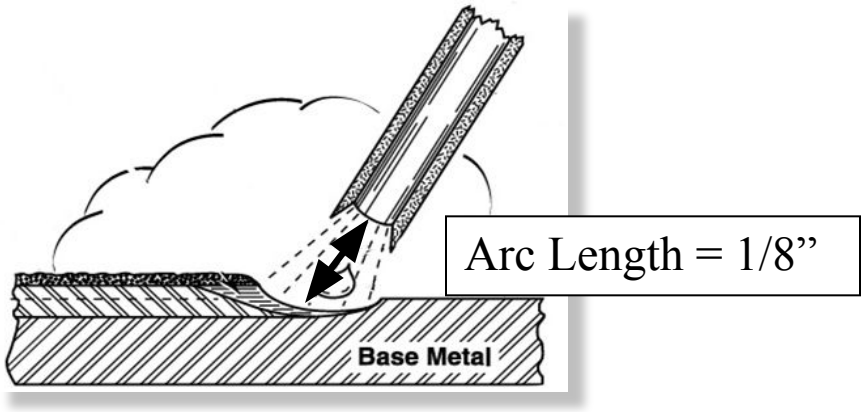
TRAVEL ANGLE



- Also commonly called Lead Angle
- The travel (lead) angle is the angle between the electrode and the plane perpendicular to the weld axis

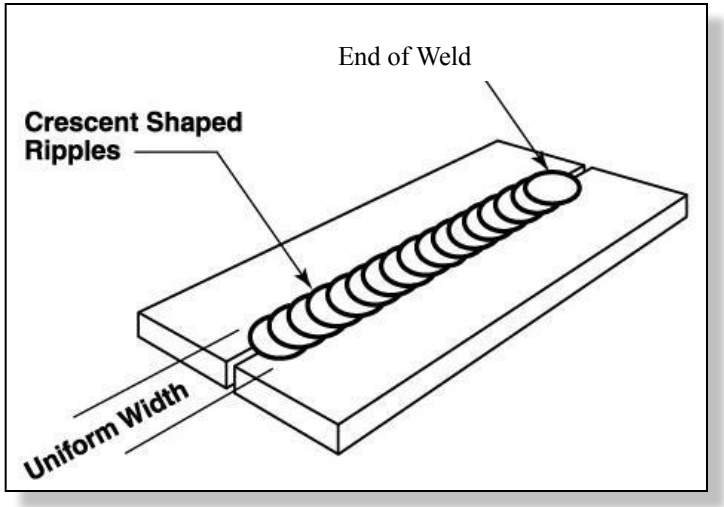
ARC LENGTH

- After striking the arc, maintain a 1/8” distance between the electrode and the workpiece
  - If the arc length becomes too short, the electrode will get stuck to the workpiece or ‘short out’
  - If the arc length becomes too long; spatter, undercut, and porosity can occur



TRAVEL SPEED

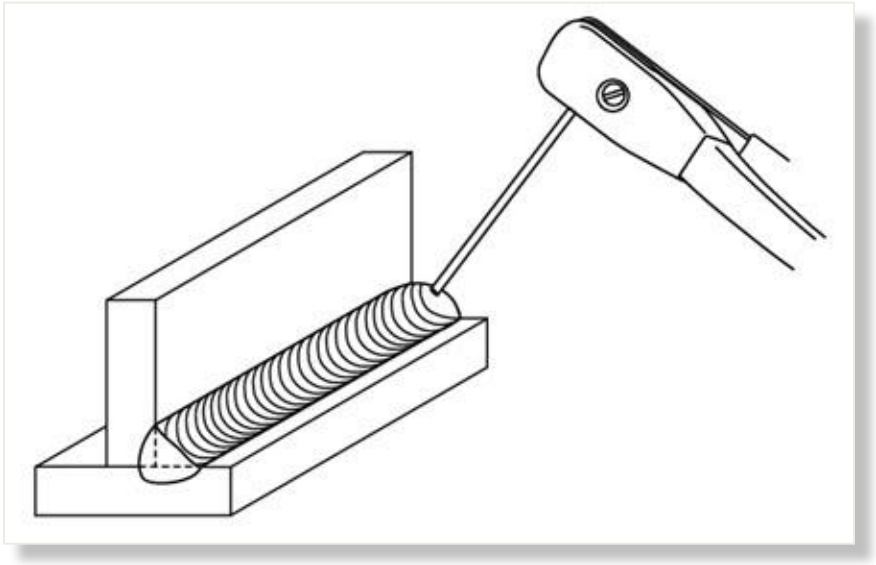
- The travel speed is the speed at which the electrode moves along the base material while welding
  - Too fast of a travel speed results in a ropey or convex weld
  - Too slow of a travel speed results in a wide weld with an excessive metal deposit



The travel speed impacts the shape of the bead.

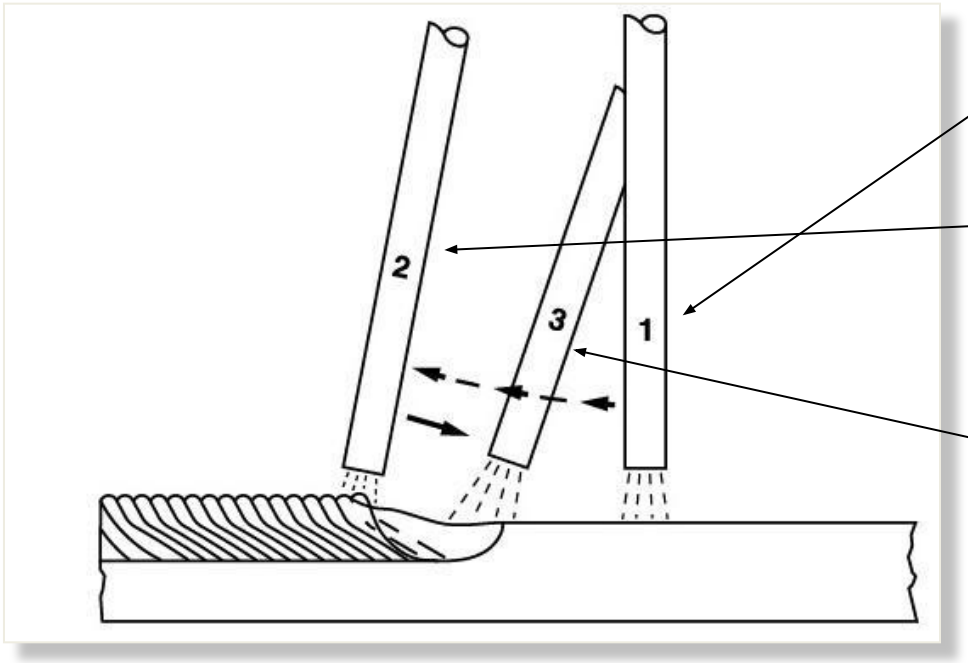
FILLING THE CRATER

- At the end of the weld, the operator breaks the arc which creates a ‘crater’
- Use a short pause or slight back step at the end of the weld to fill the crater
- Large craters can cause weld cracking



RESTARTING A BEAD

- Here is the proper technique for restarting a weld:



1. Strike Arc Here

2. Move Electrode to Crown of Crater

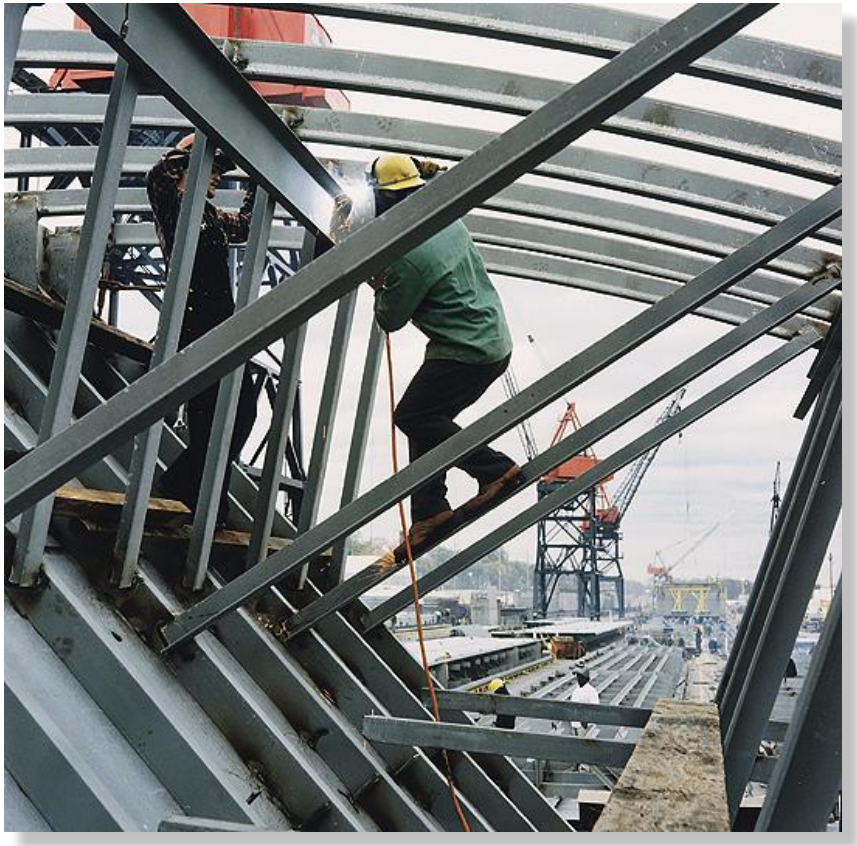
3. Resume Forward Travel

ADVANTAGES OF SMAW

- Low initial cost
- Portable
- Easy to use outdoors
- All position capabilities
- Easy to change between many base materials

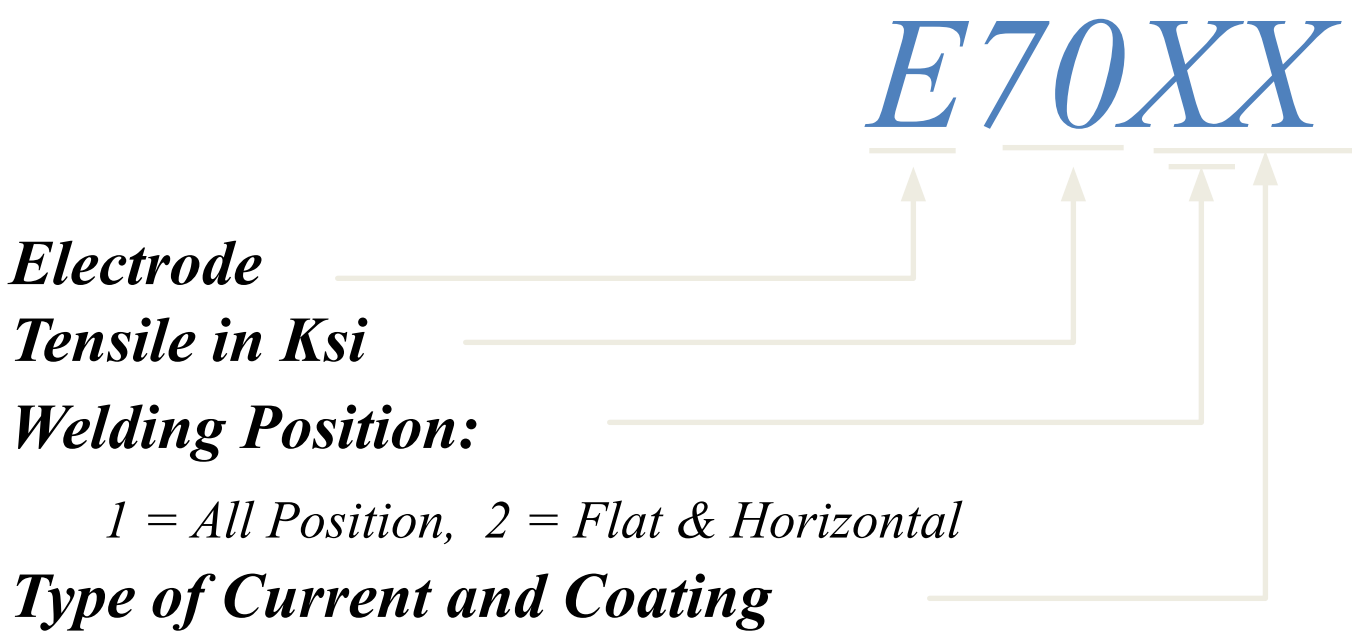
LIMITATIONS OF SMAW

- Lower consumable efficiency
- Difficult to weld very thin materials
- Frequent restarts
- Lower operating factor
- Higher operator skill required for SMAW than some other processes



Building a barge in a large shipyard

AWS CLASSIFICATION OF SMAW ELECTRODES



Thank You