# Submerged Arc welding of Mild Steel Pipes

**ME 8109**

**Prepared by : Amrish Patel**

**Presented to : Dr. C. Ravindran & class**

# Outline

- Introduction
- Mild Steel Properties
- Manufacturing Methods
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- Defects
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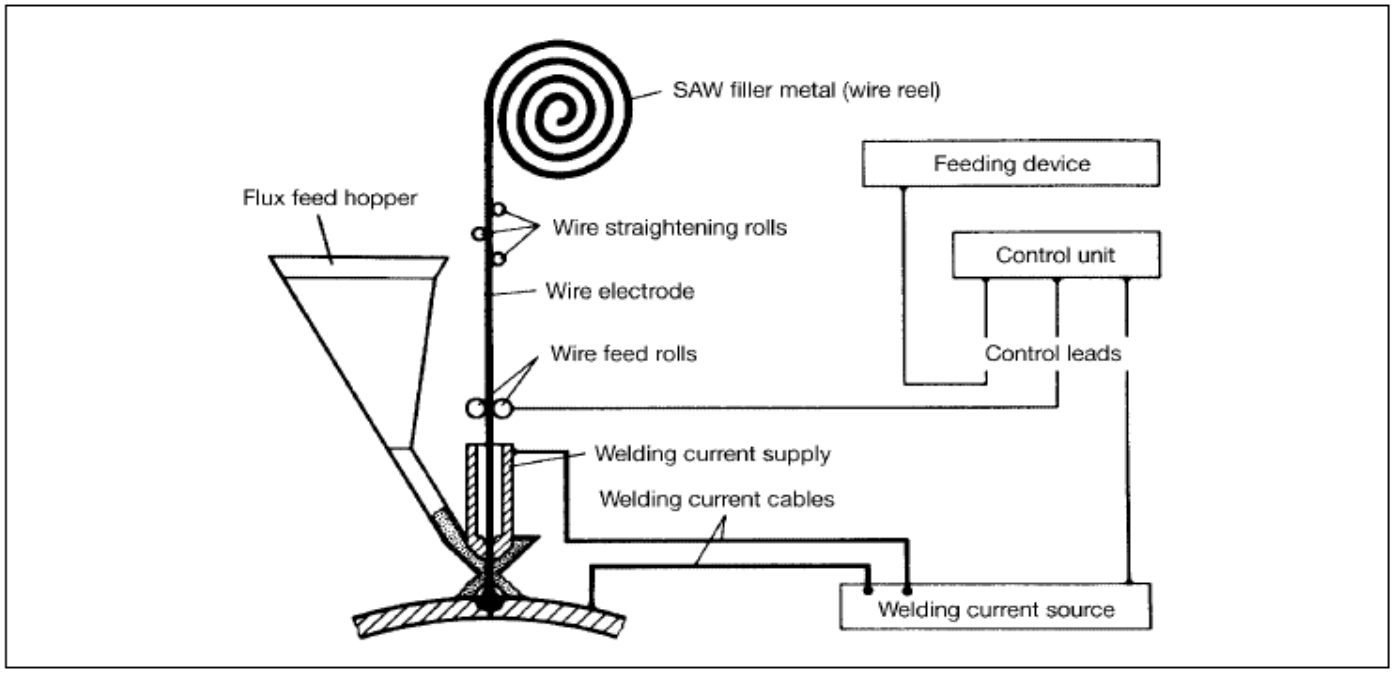
# Introduction

- Submerged Arc welding uses heat generated by an arc formed when an electric current passes between a welding wire and the work piece.




Submerged arc welding process [3]

# Introduction

- Submerged Arc Welding (SAW) has a deposition rate over 100 lb/hr.
- Mild steel is a steel containing carbon up to 0.25% .
- Mild Steel Pipes are mainly used to carry large volume of Oil, Water & gas.
- Mostly automated with some controlling work provide high operator comfort.

# Mild Steel Properties

- Due to softer and malleable properties mild steel can be bent and forged into different shapes with minimal heat treatment.

| | | |
|---|---|---|
| **Minimum Properties** | Ultimate Tensile Stress, psi | 58000-79800 |
| | yield strength, psi | 36,300 |
| | Elongation | 20.00% |
| **Chemical Properties** | Iron(Fe) | 98-99% |
| | Carbon( C ) | 0.20- 0.26% |
| | manganese (Mn) | 0.70-0.75% |
| | Copper (Cu) | 0.1-0.2% |
| | Phosphorus (P) | 0.04%max |
| | Sulfur (S) | 0.05%max |

Table 1: ASTM A36 Mild (low-carbon) steel properties [4]

# Manufacturing Methods

## Longitudinal Submerged Arc Weld

crimping press


JCO Forming press

Figures source : Ratnamani Metals and Tubes Limited Catalogue [6]

# Manufacturing Methods



Mechanical Expander ➔

Figures source : See references 5 & 6

# Manufacturing Methods

## Double Submerged Arc Weld (DSAW)

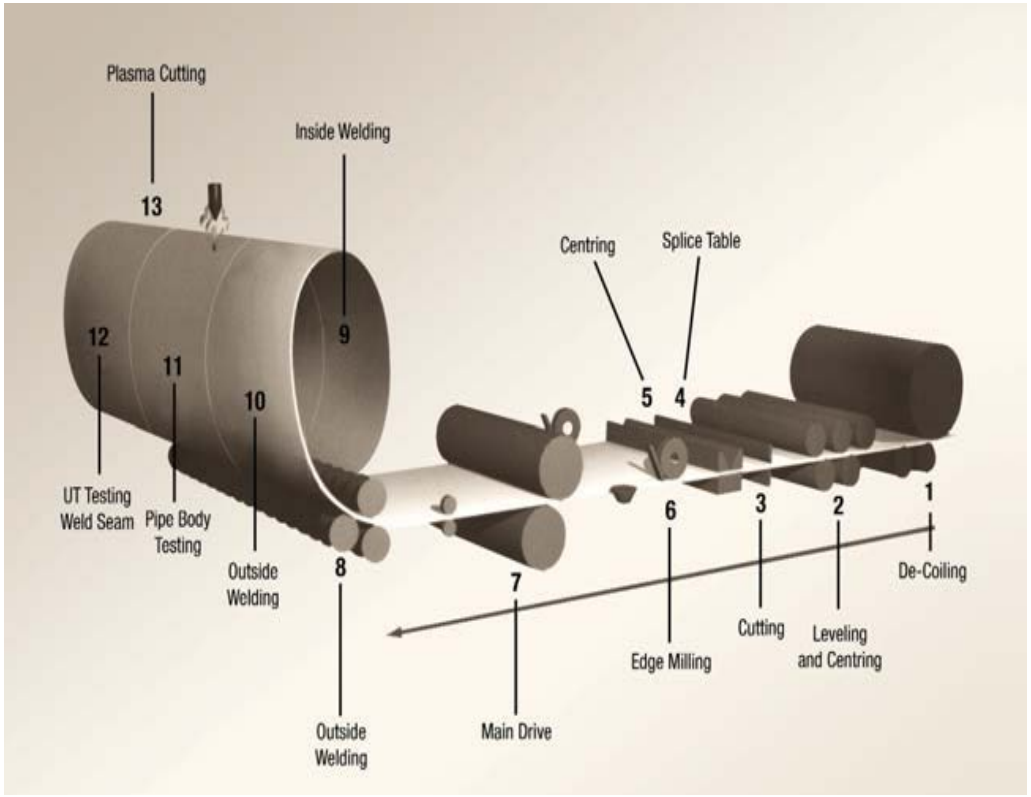
- DSAW was developed for deep and narrow Penetration.
- DSAW pipes are used for high-pressure gas and oil transmission lines.

Welspun pipes DSAW mill [7]

# Manufacturing Methods

## Helical Submerged arc Weld (HSAW)

- Spiral welded pipes have double seam over the entire length of the pipe.
- As welding area is larger, leakage chances are more.




HSAW pipe manufacturing process [8]

# Manufacturing Methods

## Circumferential submerged arc welded (CSAW)

- Pipes having dia more than 36” are manufactured.
- longitudinal welding with circumferential seam welding at 1.8 to 2 meter interval.
- Used for Cooling water supply line or large water sewage projects.

Large diameter pipe [9]

# Testing Methods

- **Chemical Test** – To check steel composition
- **Raw Material Identification** – To check material as per purchase order
- **Tensile test** - To check elastic and plastic properties
- **Flattening test** – To check pipe forming capability
- **Bend test -** To determine ductility or toughness of weld metal
- **Surface inspection** – To check rough surface or chipping

# Testing Methods

## Non Destructive Tests

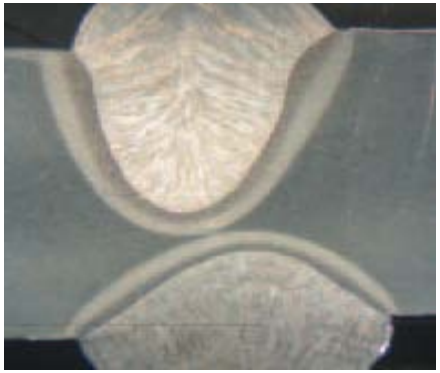
- **Hydrostatic test**

- **Ultrasonic test**

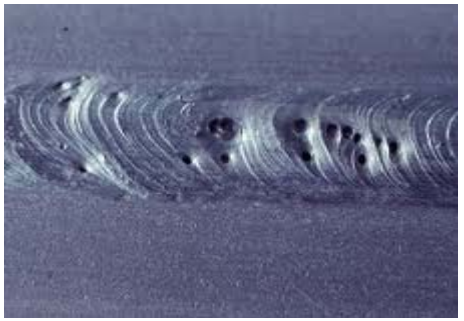
- **Radiography test**

Figures source : See references 10 & 12

# Defects



**Insufficient penetration**



**Porosity**

**Undercut**

**Slag sticking**

Figures source : Minimizing defects in submerged arc welding [11]

# Conclusions

- Sub merged arc welded mild steel pipes are cheaper to manufacture and faster to deliver.
- SAW pipes are available in wide range and can be manufactured even with thin sheet steels, which is difficult for other processes.
- SAW pipes are uniform, ductile and corrosion resistant.
- More than half of flux used during welding process is recoverable.
- SAW pipes are manufacturing generate minimal fume or light emission which is good as per health point of view.
- From negative side SAW pipes process is limited to the flat and horizontal positions.
- It requires precise joint preparation and does not allow observation of the arc and the process during the Weld.
- Considering all positive and negative side it’s up to user to use sub merged arc welded mild steel pipes.

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# THANK YOU