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# Overview on Welding and Ergonomics

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# Approaching ergonomics in welding fabrication

- Welding fabrication involves several operations which might have a significant ergonomic impact
  - Some of these are specifically related to welding
  - This presentation is aimed at providing an overview on these typical activities, in relation to the most common welding processes and products delivered.

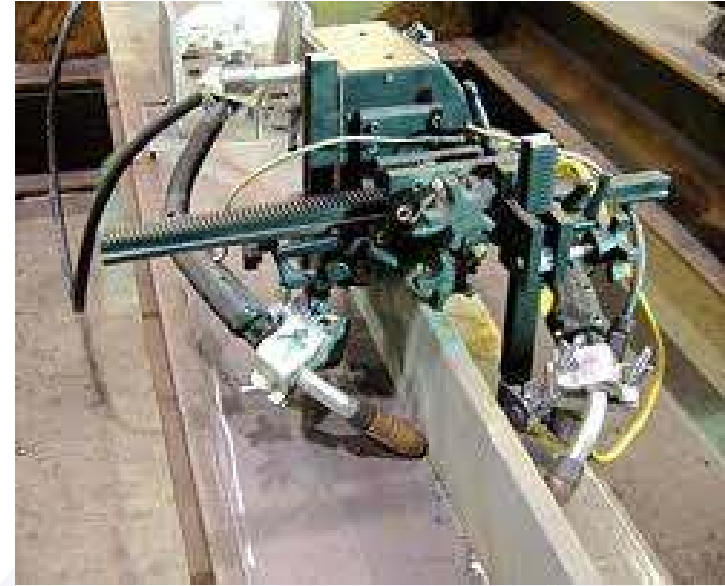


**UNCORRECT APPROACH  
TO WELDING ERGNOMICS**



# The role of welding personnel in welding processes

- Based on the **level of automation**, processes are defined by applicable industrial standards as:
  - **Manual processes**, involving welders
  - **Partly mechanized** (or semiautomatic) processes, involving welders;
  - **Fully mechanized** (or automatic) processes, involving welding operators
  - **Automatic** and/or robotized processes, involving welding programmers, operators.
- Depending on the industrial needs, some processes may be used with different levels of automation.

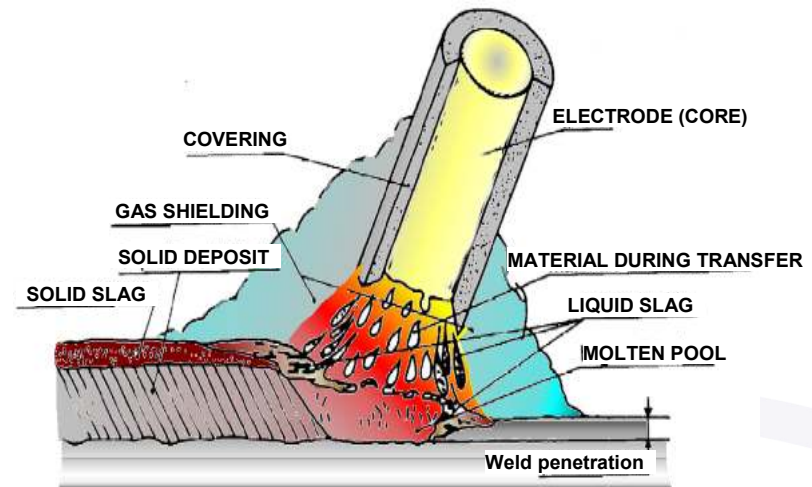


FULLY MECHANIZED GMAW



# SMAW or MMA

- The process is referred to as:
  - Shielded Metal arc welding (SMAW);
  - Manual Metal Arc Welding (MMA)
  - Stick welding
- The process use an **electrode made of a core wire of steel covered by a coating**.
- Arc welding with a coated electrode is a typical **manual arc welding process**.
- The electrode has a limited length that means that the welding process is frequently interrupted
- For some types of electrodes grinding the slag is always necessary



PRINCIPLE OF SMAW

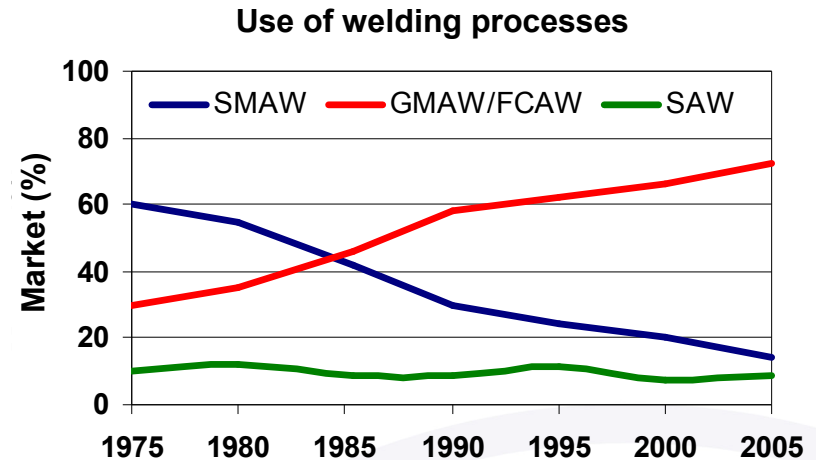


SMAW welding of pressure vessels

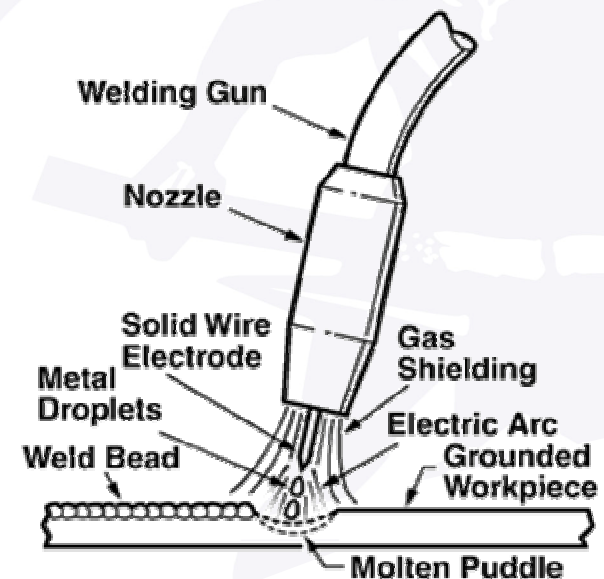


# GMAW or MIG/MAG and FCAW

- These are processes referred to as:
  - Gas Metal Arc Welding
  - Metal Inert Gas and Metal Active gas (MIG/MAG)
  - Flux Cored Arc Welding
- It's an arc welding process where a torch is needed:
  - The **wire feeding device** supplies the melt pool with a **solid or tubular flux cored wire**
  - The protection of the weld may be given by a **shielding gas**, inert or active



### APPLICATION OF THE PROCESS IS INCREASING



# GMAW or MIG/MAG and FCAW

- The **torch** itself sets some issues on ergonomics:
  - Weight of the torch;
  - Handling factor
  - Weight of cables
- The process may be **automated** at different levels:
  - partly mechanized,
  - Fully mechanized
  - Robotized.
- Welding is commonly carried out in workshop, but **self shielded FCAW has been developed for on-site welding**
- Manual welding may involve long welds



**WELDING OUT OF POSITION**



**FCAW welding**



### GTAW / TIG

- The process is referred to as:
  - Gas Tungsten Arc Welding (GTAW)
  - Tungsten (Wolfram) Inert Gas (TIG/WIG)
- It is an arc welding process working **with an arc between a tungsten electrode and the workpiece under and inert gas shield.**
- The possible filler rod is added by hand; in the mechanised process, the filler wire is added by external feed rollers.
- The process requires a very good dexterity and great attention.



Manual GTAW

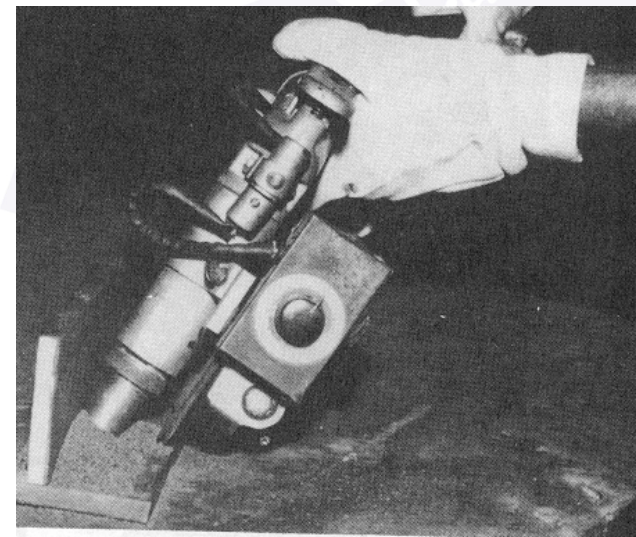


# SAW

- The Submerged Arc Welding processes uses an arc striking between a bare metal electrode and the workpiece **under a solid flux shielding**.
- The flux forms a glass-like slag that is lighter in weight than the deposited weld metal and floats on the surface as a protective cover; therefore **the arc is not visible**.
- The process is commonly fulli automatic, even if **torches for partly mechanized applications are available**



FULLY MECHANIZED SAW



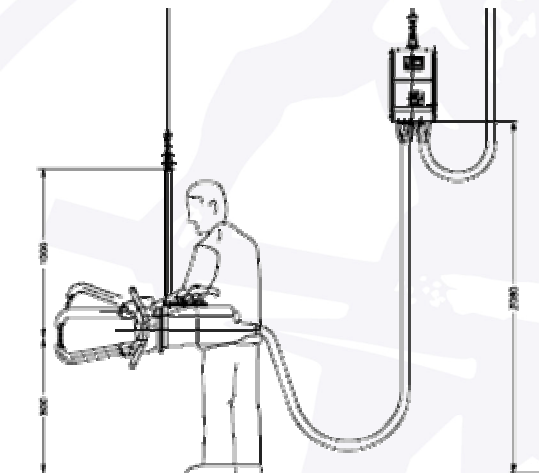
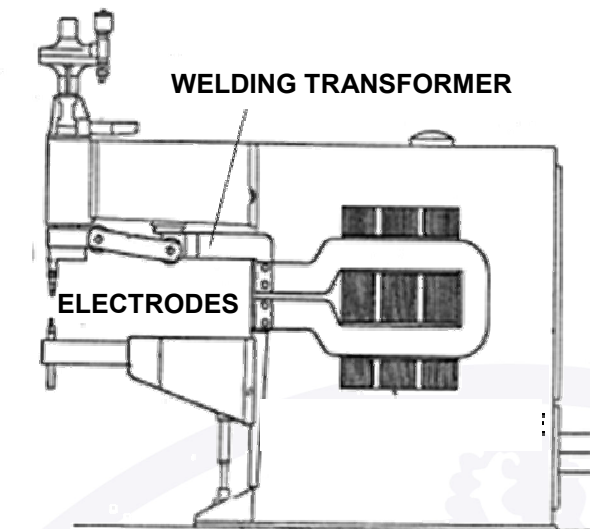
PARTLY MECHANIZED SAW





### Resistance Spot or Seam welding

- The process is based on a very high current flow through the workpiece and electrodes.
- In manual applications, the welder:
  - Moves a welding gun, which is suspended
  - Moves the piece to the gun



## Welding Fabrication – structural steelwork



## Welding Fabrication – structural steelwork

