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## Plastic Basics

3 Main Plastic Groups

- Thermoplastics (which soften on heating and then harden again on cooling)
- Thermosets (which never soften when they have been molded)
- Elastomers

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## Weldable Plastics

**Fabric/Plastic Types**

- Vinyl (PVC)
- Thermoplastic Polyurethane(TPU)
- Polyester
- Polyethylene (PE)
- Polypropylene (PP)

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## Welding Basics

- Plastic welding is the joining of thermoplastics using heat and pressure.
- Three important welding parameters
  - Heat (temperature)
  - Pressure
  - Time(speed)

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### Welding Basics

How it works:

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### Welding Basics

Before welding

Heat Source

After welding molecules are intertwined

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### Welding Basics

The quality of the weld depends on the following aspects:

- Material
- The welding method
- The quality of the welding equipment and machines
- Monitoring of the welding parameters during the welding process (closed loop/open loop)
- The ambient influences (power, humidity, ...)
- The knowledge and responsibility of the welder

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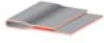
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## Welding Basics

**Types of welds possible**


Pole pockets




Overlap




Keder / Piping




Tapel



Hem



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## Welding Basics

**Applications**

- Awnings
- Signs and Banners
- Geosynthetics
- Inflatables
- Tents
- Tarpaulins
- Covers
- Pools
- Architecture



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## Applications:





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Applications:



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Applications:



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Applications:



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# Applications:



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# Types of Welding Equipment

- Hot Air
- Hot Wedge
- High Frequency (HF) / Radio Frequency (RF)
- Ultrasonic
- Impulse
- Laser

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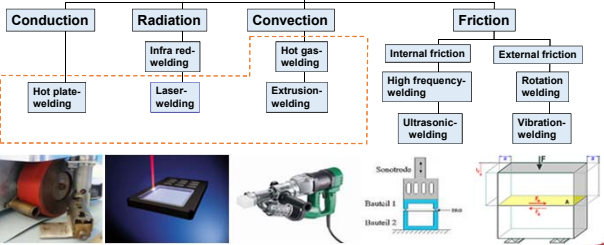
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## Heating procedure



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## Types of Welding Equipment

Hot Wedge

Pressure wheel

Hot wedge

Plastic membrane

Welding direction →

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## Types of Welding Equipment

High Frequency (HF) / Radio Frequency (RF)

High Frequency

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## Types of Welding Equipment

Ultrasonic

Ultrasonic Welding

Transducer

Booster

Controller

Sonotrode

Major Parts:

1. Pneumatic Plastics or Mass
2. Ultrasonic Transducer
3. Booster
4. Sonotrode & Tip

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### Types of Welding Equipment

Impulse

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### Types of Welding Equipment

Laser

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### Types of Welding Equipment

- Small to Large
- Hand Held
- Stationary or Automatic Welder
- Closed Loop or Open Loop
- Welding in the field or a controlled environment

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### Types of Welding Equipment



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### Types of Welding Equipment



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### Types of Welding Equipment



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## Types of Welding Equipment




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## Types of Welding Equipment




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## How to Determine Settings

First check with the material manufacturer that the fabrics can be heat sealed  
 Many material manufacturers may already have settings that they recommend  
 The manufacturer of the welding equipment can also give settings as they are very familiar with welding of many different products

**Important Note** – Any setting you receive is a great starting point – test welds should always be done

Start with a comfortable speed and slowly increase the heat until the bond is to the desired strength

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### How to Determine Settings

#### Tuning of the Welding Parameters (1)

Low welding temperature and longer period of exposure results in



- Plastification of a big material volume
- Low residual welding stress
- Slow temperature drop



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### How to Determine Settings

#### Tuning of the Welding Parameters (2)

Higher welding temperature and a shorter period of exposure results in:



- Plastification of a small material volume
- High residual welding stress
- Steep temperature rise



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### How to Determine Settings

Only change one setting at a time during testing  
Record the parameters/settings – once testing is complete  
One parameter for one material/color  
Make sure the speed at which you are welding is comfortable for the operator



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## How to Determine Settings

Welding Window

Typical welding windows for TPO and PVC

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## How to Determine Settings

- Fast is not always the best
- Pressure is a key component often overlooked
- Many materials today have special coatings or additives
- Once a material is welded it can not be rewelded in the same spot

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## Testing

- Peel Test – Check for delamination
- Destructive/Non-Destructive testing
- Test your welds daily
- Humidity can also play a role in settings
- Testing Equipment

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# Testing



Test welding

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# Testing



Test welding

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# Recap

- Plastic Basics
- Weldable Plastics
- Welding Basics
- Types of Welding Equipment
- How to Determine Settings
- Testing

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