

# Automation of the stacking & packaging process of aluminium traffic signs

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Specialization Electromechanical Engineering Technology



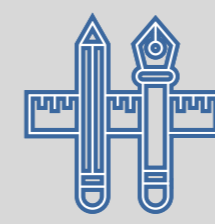
## Situation

Decomecc is a company specialised in processing aluminium coils to semi-finished products. The company's activities range from the automotive to the silo industry. To stay competitive, Decomecc is always looking for innovation, hence this bachelor's thesis.

Hall 2 contains a line where the company strives to maximize efficiency by testing various equipment on smaller projects such as the fabrication of traffic signs used in Germany and the Netherlands. This thesis aims to automate the stacking and packaging process of this line.

The main **restrictions** are:

- Scratches on the disks or sheets before application of a coat of paint will remain visible.
- Movement of an unpacked stack is prohibited to avoid scratches. Stacking and packaging has to be done in one location.
- Different types of products have to be packaged with the same installation. The line may be used for other products in the future, so flexibility is a must.
- The process is overseen by governmental bodies, so the placement of the products on a pallet is standardised and the packaging has to be waterproof.



## Development

### Function

Analysation of the problem showed us five functions that needed to be filled in to have a functional result.

- i. Pre-alignment
- ii. Stacking
- iii. Cutting the packaging to size...
- iv. ...and placing it over the pallet
- v. Sealing the package

### Execution

After careful consideration and debate with the company supervisor, the following concepts were selected:

- i. Cylindrical guides: well-placed cylinders popping out over the transporter will ensure every disk is well oriented and aligned. Since the installation has to be flexible, the alignment was built to be as modular as possible.
- ii. Drop with adjustable templates: when dropping a flat disk or sheet onto another flat surface, an air cushion will form for about 1 second, which ensures scratch free stacking. A lifting table will be placed underneath to minimize drop distance.
- iii. Guillotine: A sheet of packaging material will be cut off from its roll by guillotine.
- iv. Clamps: The sheet will then be placed over the pallet, 4 clamps will guide the corners of the sheet to the place of the seal.
- v. Shrinking: by selecting a material that shrinks when heat is applied, a simple infrared module will tightly shut the package. By creating an overlap at the top of the stack, a waterproof seal is obtained.



## Results and reflection

### Results

The created machine receives the signs on a conveyor, where it centres and orients them. From the conveyor, they are dropped into the templates which hold them in place while actuators position them to be dropped on a pallet. This pallet is placed on top of a lifting table to keep the drop-off height constant.

The pallet is a standard Euro-pallet with a layer of multiplex screwed in on top.

A set of clamps along with a worm gear transmission make sure the packaging material is present before the first sign drops. It will also compensate the stretch caused by the lowering of the lifting table by steadily closing to the point where a infrared module can heat-seal the package closed.

### Reflection

This thesis gave a better insight in the range of mechanical design.

It also taught us that implementing changes in a design becomes increasingly difficult as the project progresses.

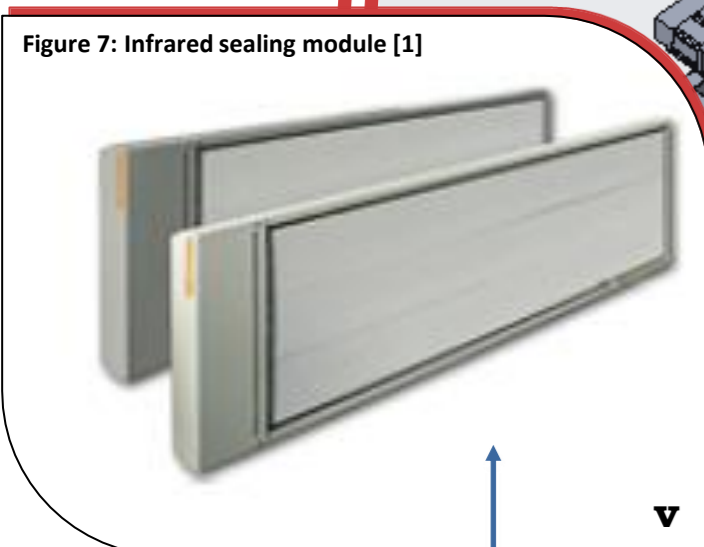
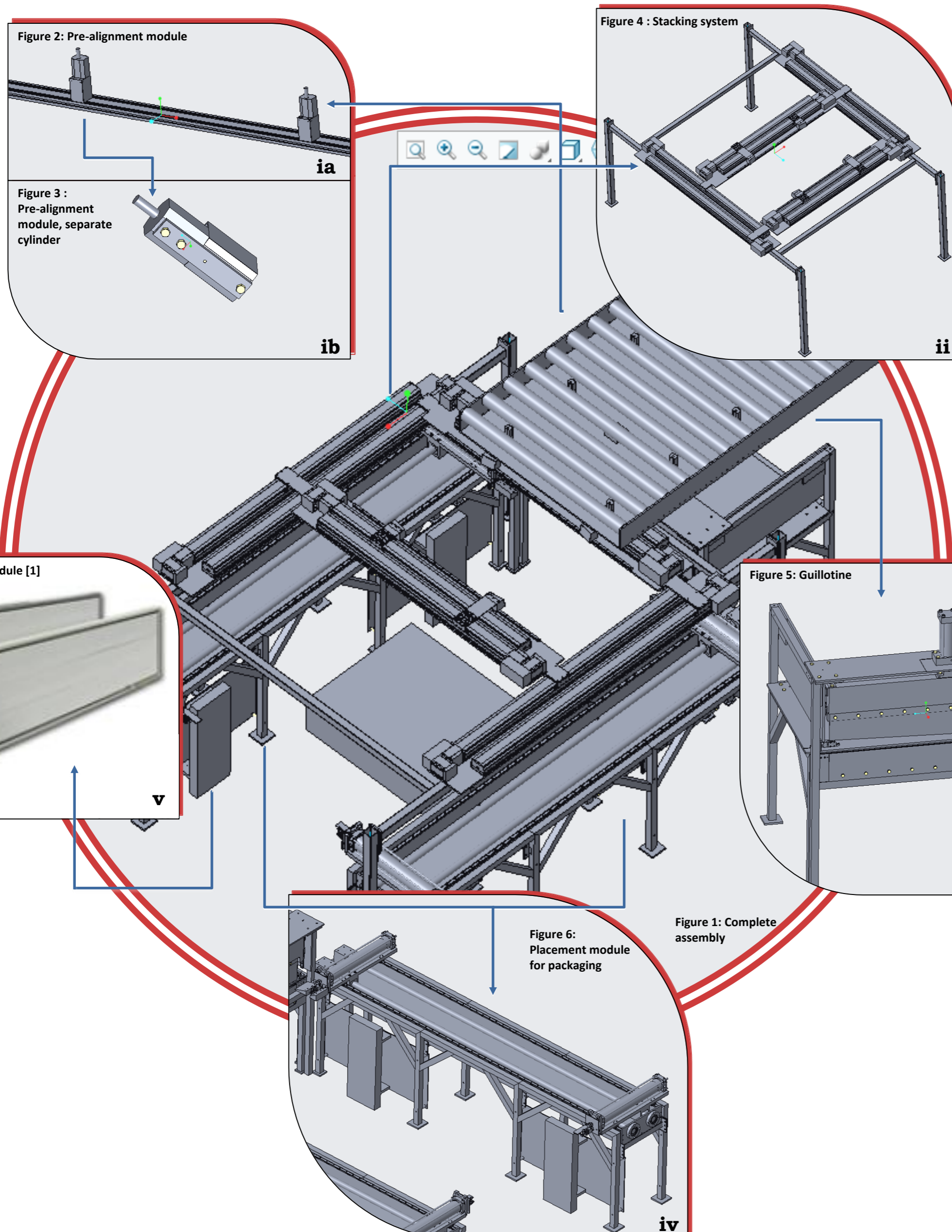


Figure 7: Infrared sealing module [1]

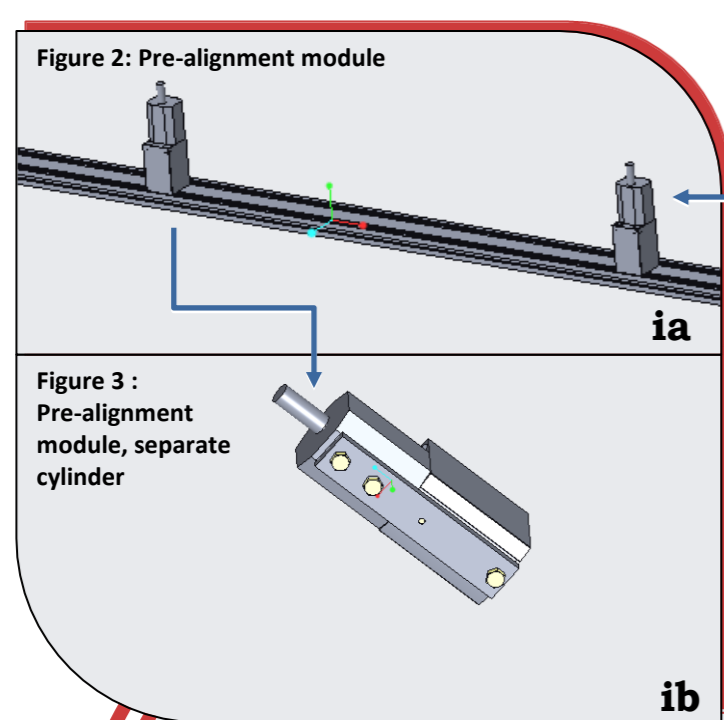


Figure 2: Pre-alignment module

Figure 3: Pre-alignment module, separate cylinder

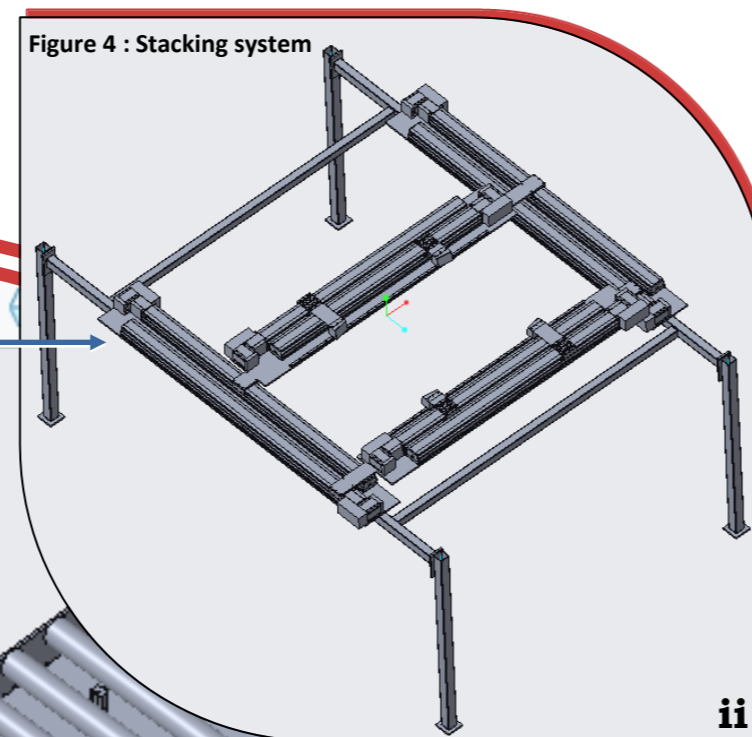


Figure 4: Stacking system

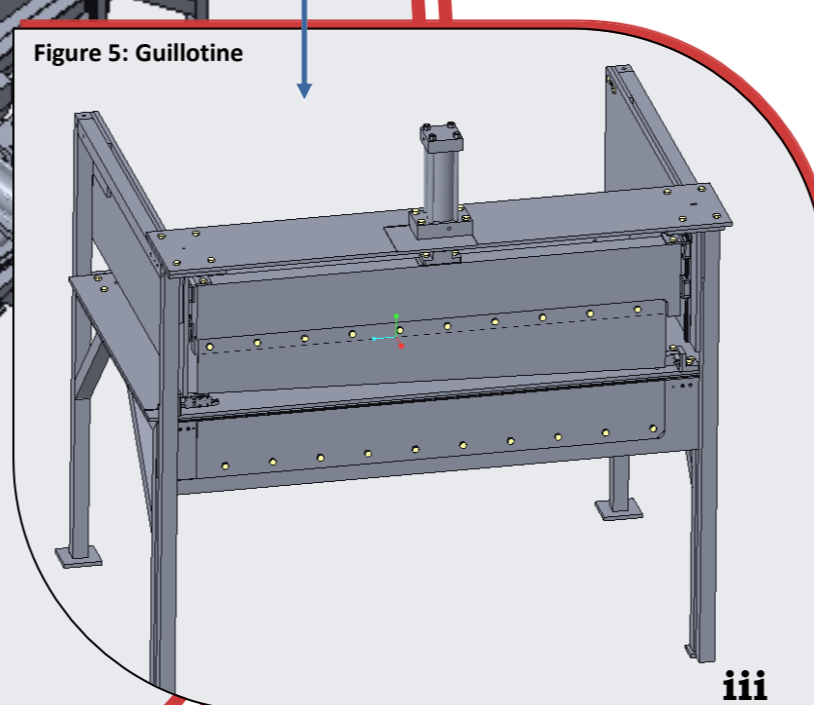


Figure 5: Guillotine

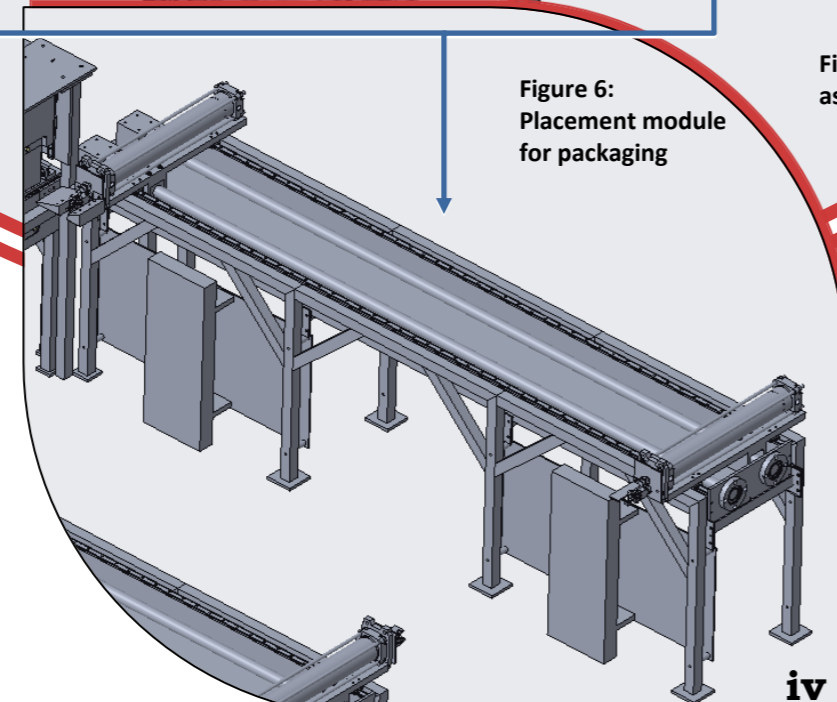


Figure 6: Placement module for packaging

Figure 1: Complete assembly

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[1] Warmtshop Benelux, „Warmtshop prijslijst 2022 versie 1.1,“ Roeselare, 2022.