

Mechanical design of the automation of the supply of the hydrocooling for cherries

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Electromechanical Engineering Technology : Design and production

Situation

This design project was commissioned by BelOrta, Belgium's largest fruit and vegetable auction. The department in Borgloon, dedicated to the processing of fruit provided the assignment for this project. The design project takes place in the processing of cherries more particular the process step of hydrocooling (Figure 1). These cherries need to be cooled down to a temperature of $\pm 3^{\circ}\text{C}$ using a hydrocooling system. For this purpose, the cherries have to be delivered in boxes of $60 \times 40 \times 12 \text{ cm}^2$ to the hydrocooler. During transport to and from the hydrocooling, the boxes are placed per 30 on block pallets.

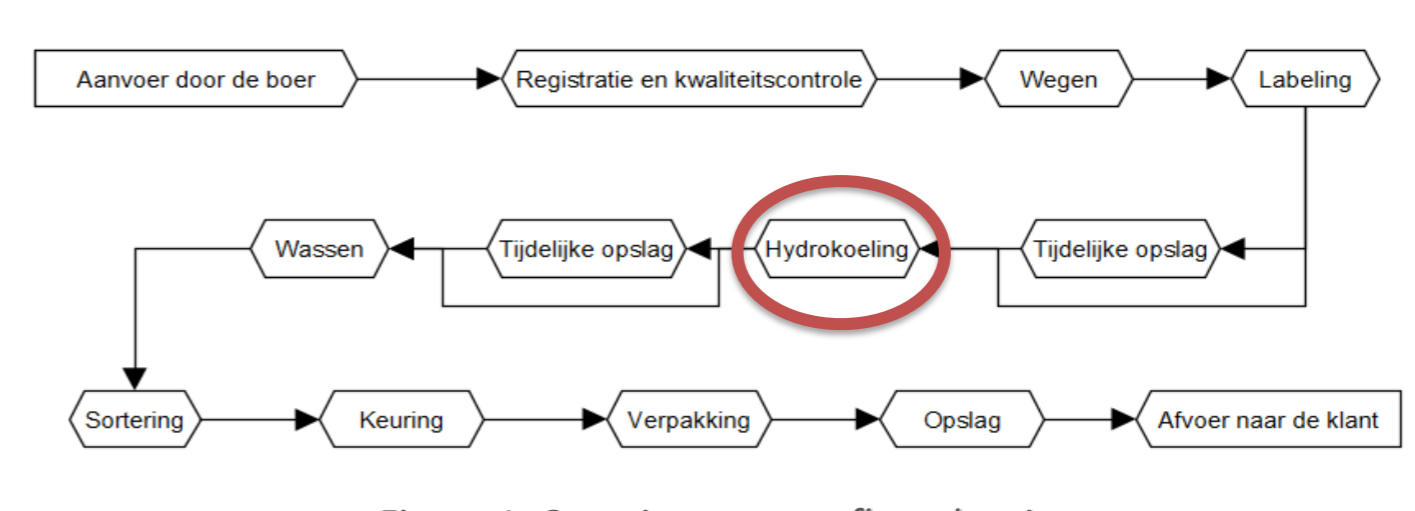


Figure 1: Overview process flow cherries

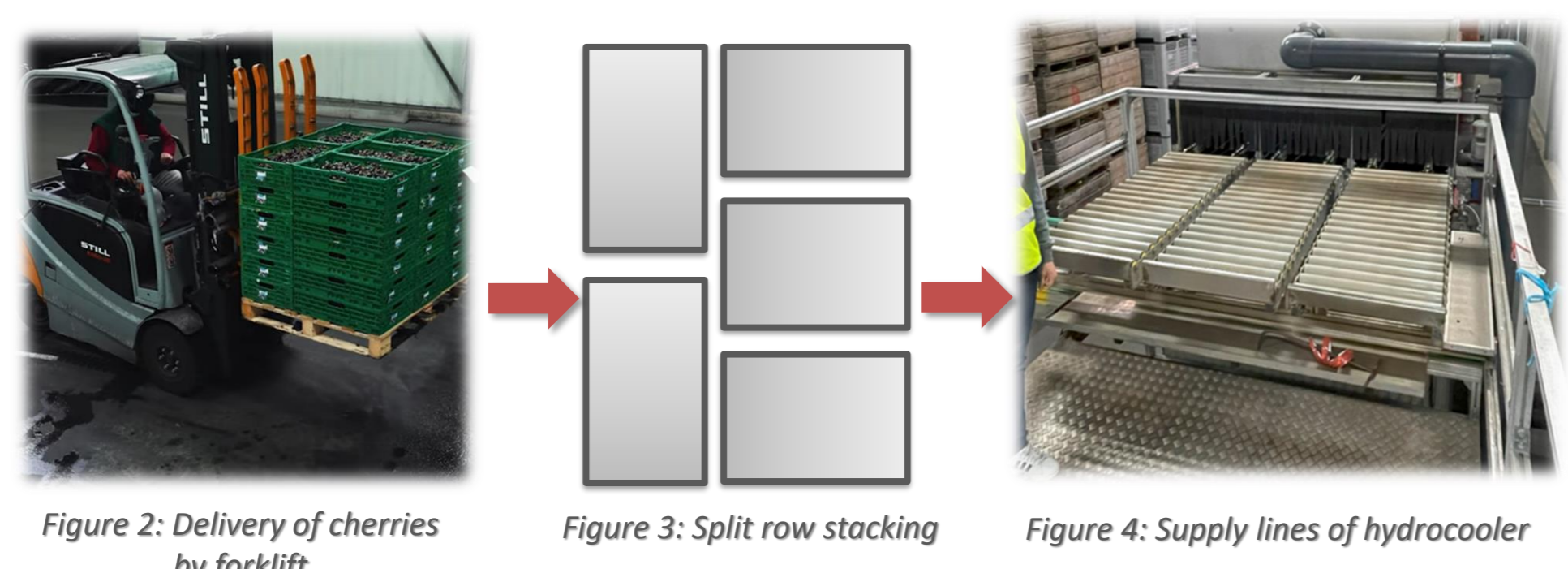


Figure 2: Delivery of cherries by forklift

Figure 3: Split row stacking

Figure 4: Supply lines of hydrocooler

The problem is situated within the automation of the hydrocooling. At the moment the stacking and unstacking of crates during the hydrocooling process is being executed manually, which is labour-intensive. To overcome the labour-intensive task of unstacking, the crates should be unstacked automatically. Here it is important that the crates are delivered to the hydrocooler according to the split row principle stacked on pallets (Figure 2 and 3). However, these should be unstacked to the three different supply lines of the Hydrocooling (Figure 4). Additionally, the empty pallets should be discharged and buffered in groups of 3 to 5 pallets.

Problem

Method

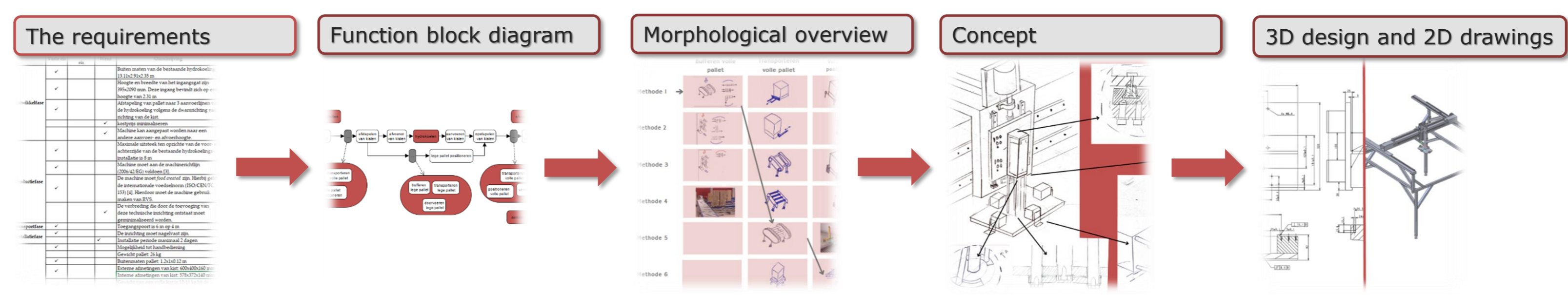


Figure 5: Representation followed methodology based on Kroonenberg's model

Results

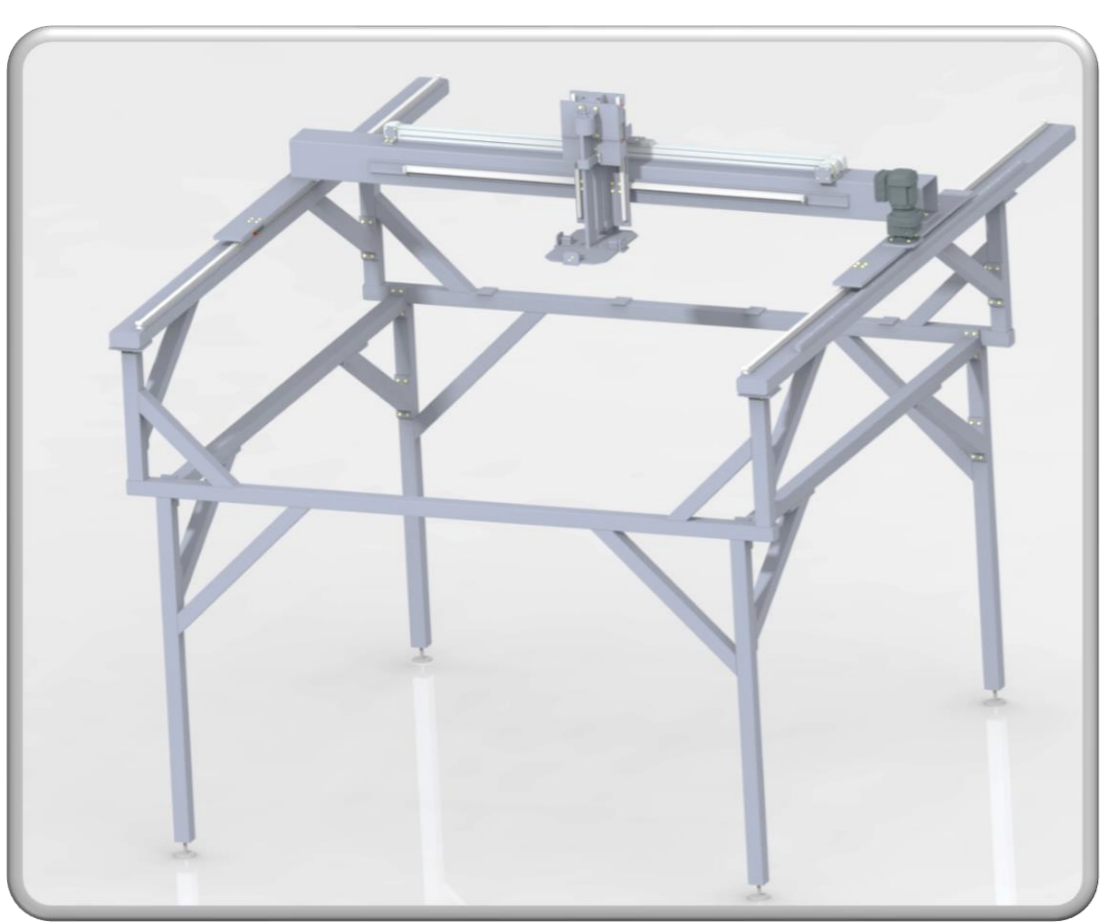


Figure 6: Gantry

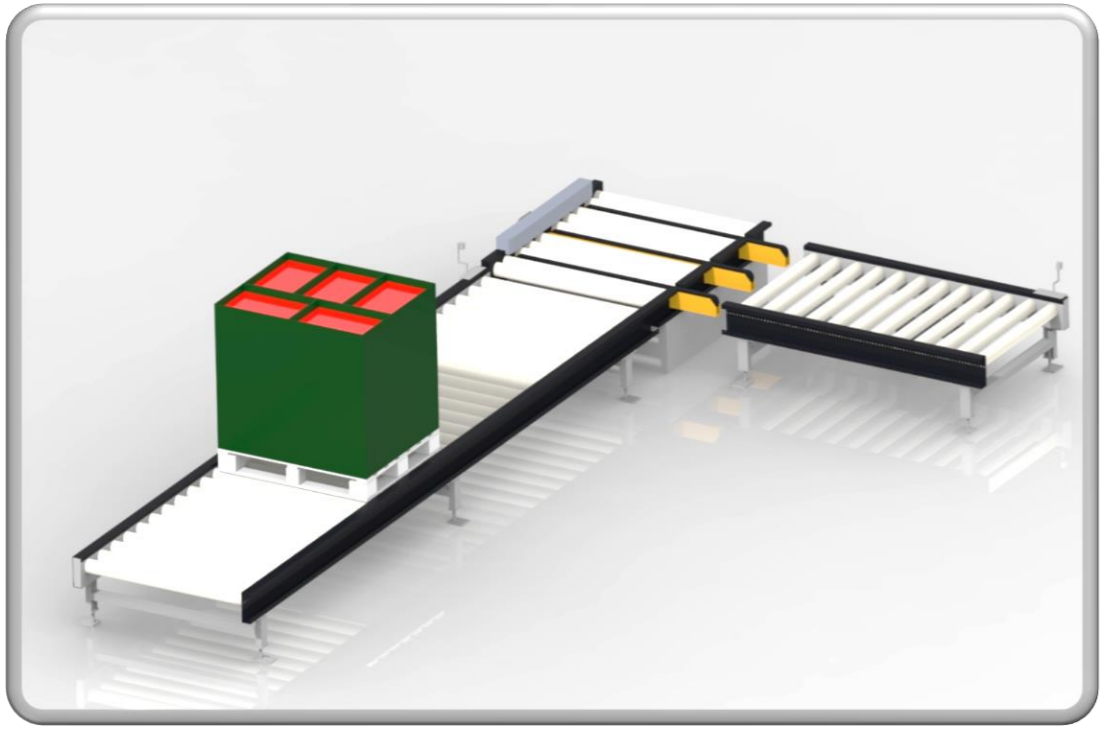


Figure 7: Conveyor

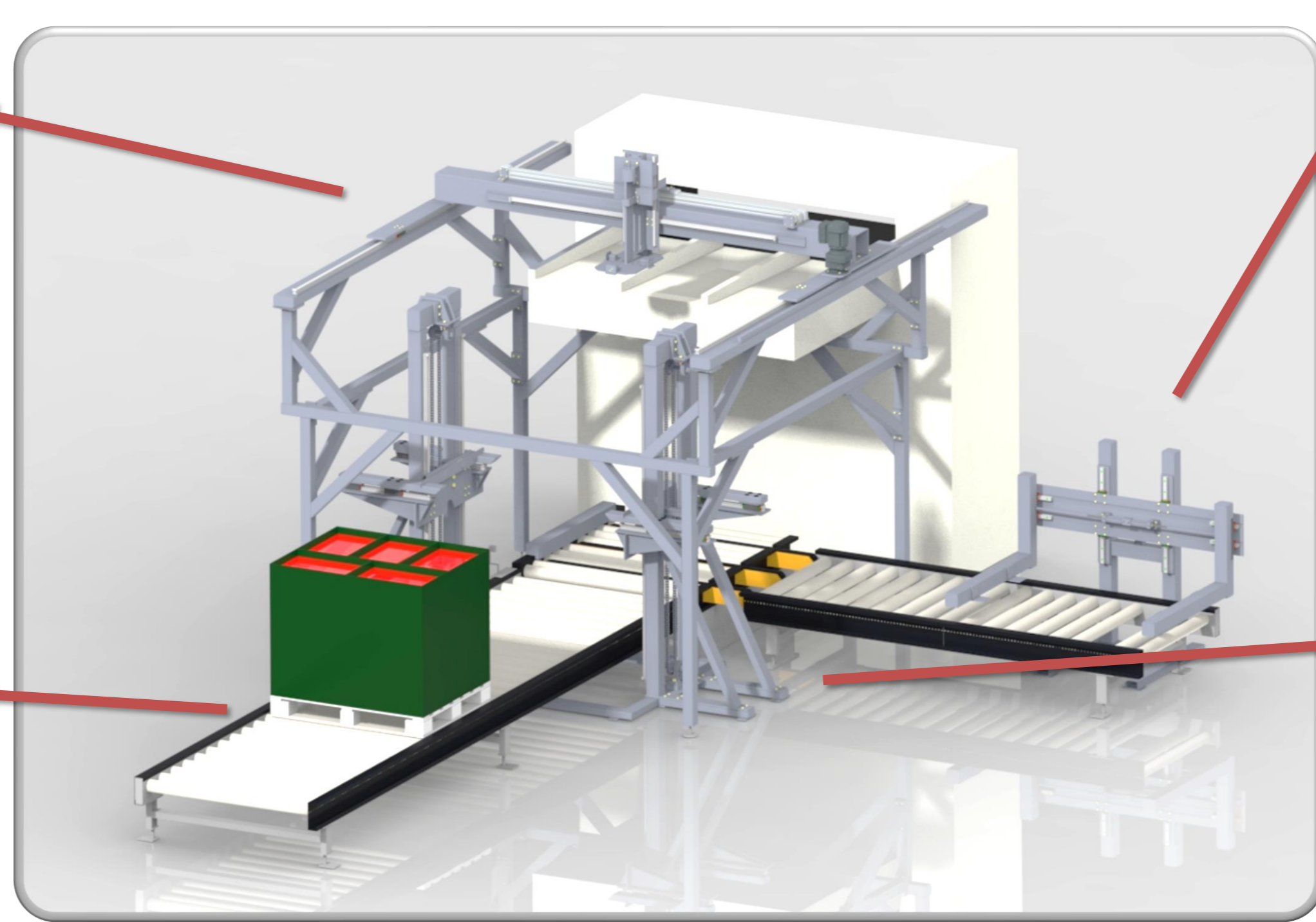


Figure 10: Total assembly

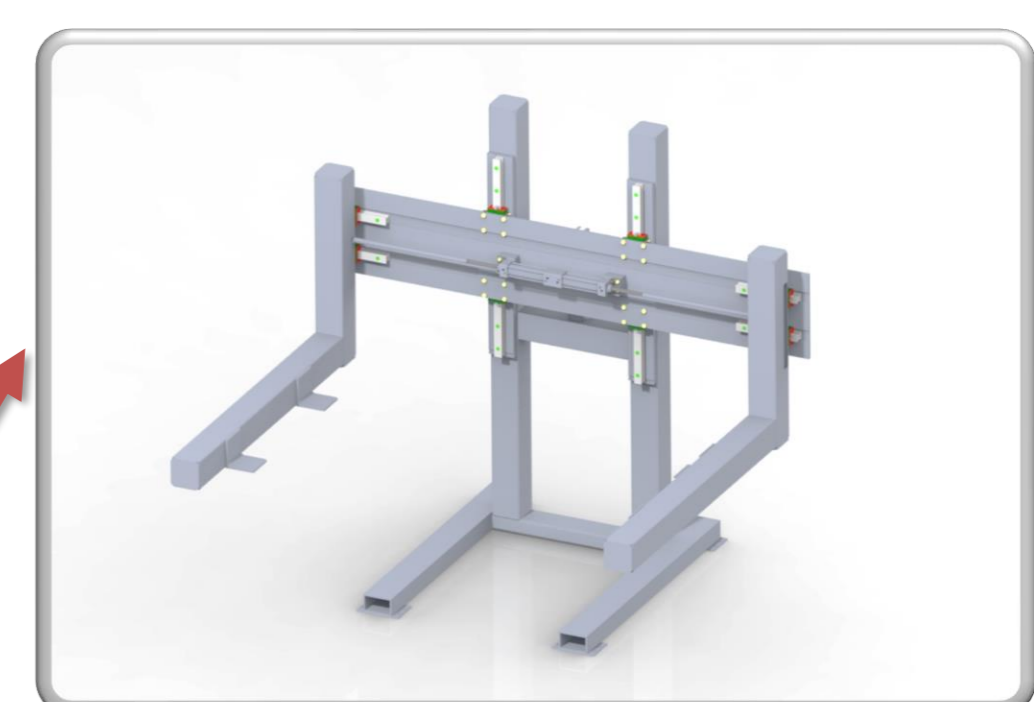


Figure 9: Pallet buffer

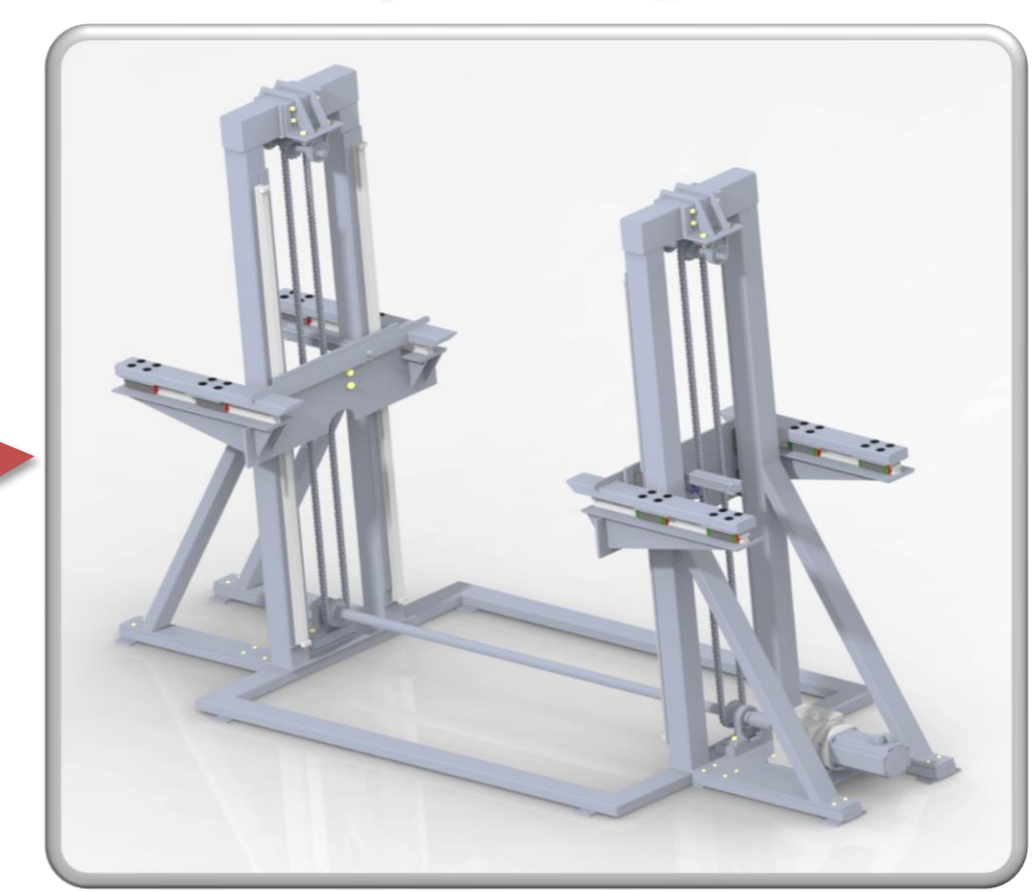


Figure 8: Pallet lift

- The gantry will unstack the crates filled with cherries (Figure 6). This gantry has a special arm, designed to pick up the crates at the handles of the crates so the cherries are not damaged and the crates can be picked one by one. The arm is also capable of rotating the crates 90° to deliver them according to the correct direction of the hydrocooling.
- The conveyor will buffer the loaded pallets in the beginning and will transport the loaded pallets to the gantry and afterwards the empty pallets to the buffer (Figure 7).
- The pallet lift will lift up the pallet, so the gantry is always working at the same level (Figure 8). The pallet lift has four forks that grab the pallet and every time a layer of crates has been unstacked the lift will go up by the height of one crate.
- The pallet buffer will buffer three to five pallets (Figure 9). The grippers of the pallet buffer raise the pallet, allowing another one to be placed beneath it. This enables the buffer to stack pallets on top of each other.

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References:
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 [2] F. J. Siers, Methodisch ontwerpen, volgens H.H. van den Kroonenberg, Oldenzaal: Noordhoff Uitgevers, 2004.