Transporting and buffering of sealed packages with pharmaceutical components

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Bridging programme for Master of Electromechanical Engineering Technology

SITUATION

This integrated project focuses on the production process of Datwyler Pharma Packaging, a subsidiary of Datwyler Holding AG, specialized in manufacturing and supplying high-quality pharmaceutical products. The company's headquarters is located in Alken and is renowned for their extensive product portfolio, including elastomer components, aluminum closures, plastic components, and medical sealing components. These products are used worldwide in locations where sterility and hygiene are of critical importance.

The immediate context of the project at Datwyler Pharma Packaging concerns the existing conveyor belt system, which is utilized to transport packaged products from the cleanroom to the packaging area. Despite being in operation for several years, this conveyor belt system faces issues and shortcomings. The primary driver for modernizing the system is the introduction of new, extra-long packaging, commonly referred to as long sleeve packaging. Additionally, there is a need to implement buffering of packages to optimize packaging procedures.

Figure 2: Current setup

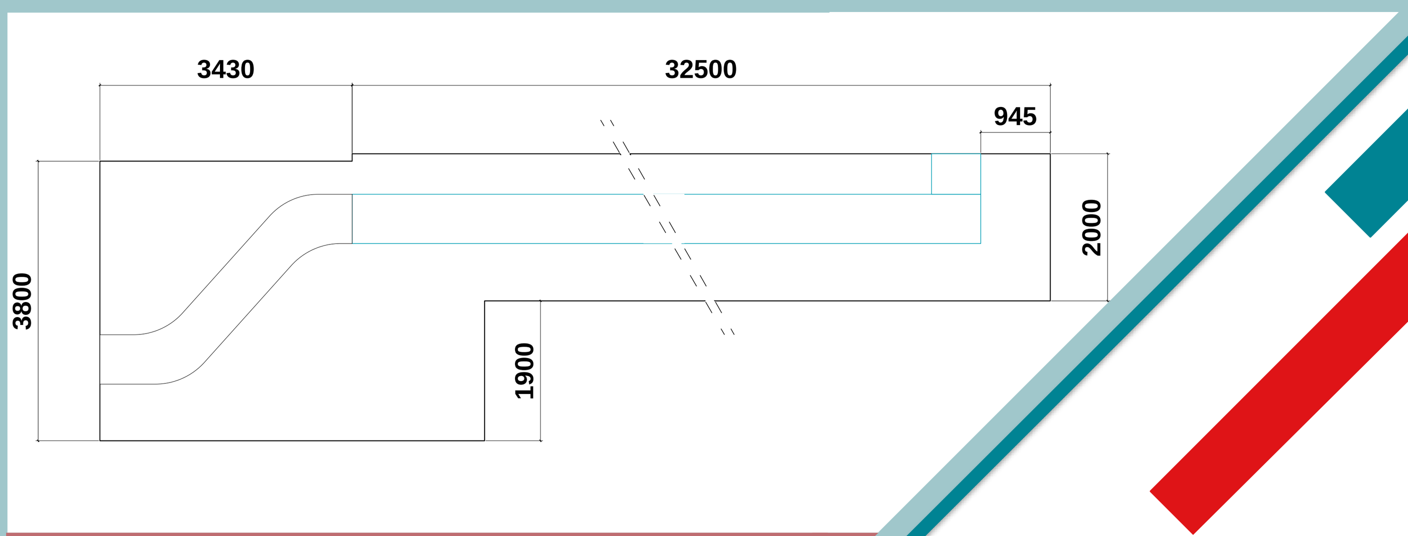


Figure 1: Current setup with dimensions

OBJECTIVES

The main objectives of this integrated project are to design a buffering and transportation system that enhances and complements Datwyler's existing conveyor belt installation. The new system must meet strict requirements and specifications to ensure efficient and safe buffering and transfer of the packaged pharmaceutical products. Only if these requirements are met will there be a viable solution for Datwyler. The solution will only be considered for on-site implementation in collaboration with a certified machine builder. Table 1 outlines the key design requirements, which have the greatest impact on the design process.

Questions	Demands
Maximum dimensions	L32,5m x H3,5m x B2m
Maximum access gate dimensions	H2,10m x B1,10m
Maximum weight processable product	12 kg
Minimum processable product dimensions	L300mm x H50mm x B200mm
Maximum processable product dimensions	L1000mm x H150mm x B300mm
Processing speed	6 packages/min
Buffering capacity	100 packages of MAX dimensions
Maximum duration of monthly maintenance	4 hours
Maximum duration of annual maintenance	36 hours

Table 1: Development demands

RESULTS

The result of this structured process is a 3D design of the installation. It consists of different subassemblies, each fulfilling its own function and contributing to the project objectives. The most important units are further discussed below.

Figure 5 shows the vertical divider unit. This unit plays an important role in the process. It ensures that the packages are stored at the correct buffering conveyor belt, thus minimizing the risk of batch mix-ups. Equipped with an electric linear actuator, the unit can adjust its operating angle when transitioning to a different buffering conveyor belt. This feature allows for precise fine-tuning during on-site implementation, enhancing the unit's flexibility.

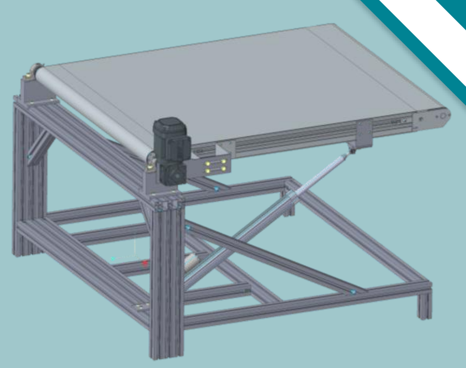


Figure 5: Vertical devider unit

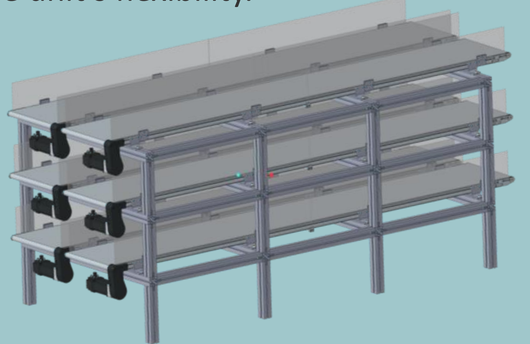


Figure 6: Buffer belts unit

Figure 6 illustrates the beating heart of the installation, the buffer belts unit. This unit is approximately 3 meters long and can be assembled multiple times in sequence to create a longer buffer zone, thereby contributing to the flexibility of the system. The unit is controlled by 6 servo motors, ensuring that each belt is individually controllable, allowing each payload to be sent to the packaging area at different times.

Figure 7 depicts the flipper unit. This unit ensures a controlled orientation of the packages at the end of the process. Some of Datwyler's customers order their products in special packaging that includes RTP ports. These ports enable much faster, hygienic transfer of the products to customer installations. It is important that the port is always in the same position when opening the packaging box. The flipper unit has the capability to flip incorrectly oriented packages and allow correctly oriented packages to pass through without intervention. This unit reflects Datwyler's high standards and commitment to its customers.

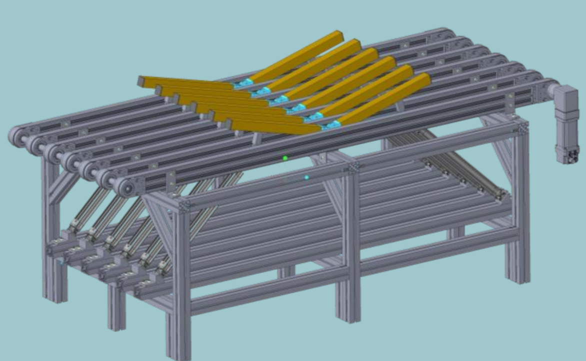


Figure 7: Flipper unit

METHODOLOGY

Once the limitations and objectives are established, several iterative phases are undertaken to arrive at the most effective installation design.

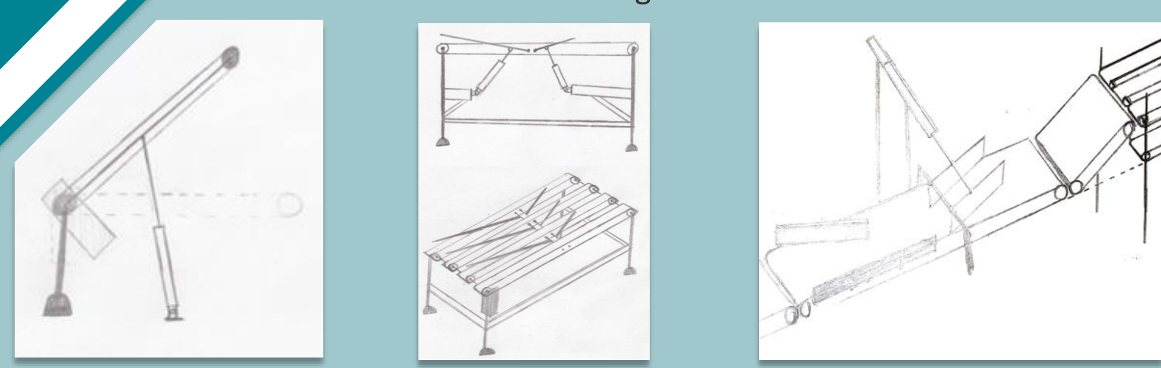


Figure 3: Concept drawings

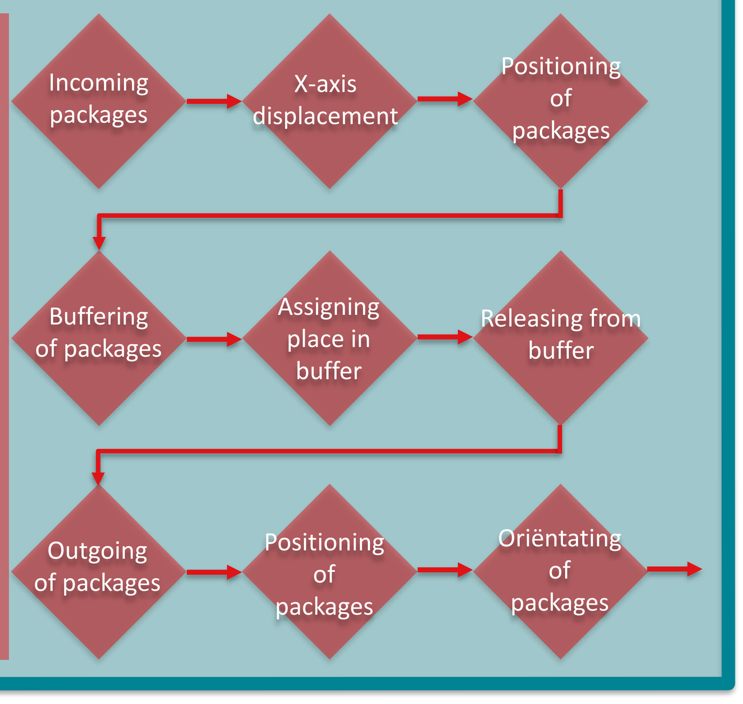
1. Functional analysis phase
This phase involves creating a functionblockdiagram. This diagram visually illustrates the functions the installation must perform, clarifying the primary and secundary functions, and determining if functions can be performed in different sequences to optimize the process.

2. Exploration phase
The next phase involves research, scouring the market for components and existing machines to gain creative insights into how the functions can be realized.

3. Concept development phase
Following this, the next phase entails rough pencil sketching of installation parts derived from the required functions. The aim here is to identify potential problems early and gain a sense of how the installation can be structured. Numerous sketches are produced and combined during this phase.

4. Finalization of design phase
After extensive evaluation and thorough iteration, the process proceeds to the subsequent phase. Here, crucial decisions are made that ultimately determine the form, cost, and flexibility of the installation. Detailed sketches of installation parts are created.

Figure 4: Functionblockdiagram



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