

The Ideal Link between Assembly and Painting Line

A valve manufacturer has installed an innovative conveyor concept to integrate its painting line and several different assembly areas into one process.

HP Valves manufactures valves for power and chemical plants and many of their products need to be painted. In order to be able to produce the valves in the required quantities while maintaining high standards of quality, the company has invested in a new painting line, which is integrated with the assembly areas. Within the very short planning period of two months, Caldan Conveyor A/S was able to link together the assembly and coating zones, which had previously been completely separate. Suggestions for improvements based on the original layout and on the control system requirements were evaluated internally, discussed with the operator and then implemented. Caldan developed the conveyor system as a turn-key project, which means that the scope of supply included the steel structure, the electric control system and the software, in addition to the mechanical conveyor components. One benefit in this respect was the close cooperation between the internal sales, project management, design and control departments. The project was implemented seamlessly and short project cycles enabled the work to be completed on schedule.

In addition to the painting line, several different assembly stations, some of which are equipped with pick-to-light systems, were integrated into the process. At several points in the production line, parts produced for special orders can be loaded onto the system or removed. The ongoing communication with the ERP system has allowed a standardised database to be set up for all the departments.

The process begins with the valve bodies

being loaded onto the overhead conveyor (Power&Free 380). They then move to the individual work stations where the attachment parts are fitted. After this their function is tested, they travel to the masking area and then the paint booth, undergo a quality control and are transferred to a floor conveyor (Power&Free 100) for unloading and packaging.

Overhead conveyor with a chain measuring 1530 metres

In order to implement this logistic task, a total of 1530 metres of chain was installed in four circuits for the overhead conveyor. The floor conveyor has a further 110 metres of chain.

The overhead conveyor is designed to transport parts weighing between 5 and 200 kilograms per wagon with a small accumulation distance of 280 millimetres. The short distance allows the wagons to be accumulated in curves. This minimizes the need for accumulation stops and provides as much accumulation space as possible in a small area.

Continuous data sharing

In the loading area, the serial number of the valves is scanned via a 2D code and the data is transferred from the Caldan PLC to the HP Valve's internal ERP system. In order to link the necessary data to the wagon, each of the three hundred wagons has been fitted with an RFID tag.

The valves can be loaded onto the overhead conveyor in a variety of combinations. This presented a challenge for the control

system. Valves smaller than two inches in size are transported through the system on a single wagon. Valves larger than two inches are transported in a "batch of three" (empty-full-empty) because of their shape, although each valve is only actually attached to a single wagon.

In order to travel from the production area to the first reworking station, the valves have to cross a route used by forklifts. To ensure that everything runs smoothly and that the forklifts are not brought to a standstill, the conveyor system communicates directly with the forklifts. Whenever a forklift is about to pass through, the control system makes sure that there are no wagons in the area.

In the reworking station, some valve bodies are removed from the system for grinding and sand blasting. After they have been processed, they are loaded back onto the conveyor. Additional valve bodies can also be added to the system here at loading station 2. The relevant data is exchanged between the conveyor PLC and the ERP system.

The valves move on to the assembly stations, with the choice of station depending on the size of the valve. The products are assigned to categories ranging from half an inch to four inches. At each assembly station, up to three valves can be removed from the overhead conveyor at the same time, then transferred to the pick-to-light conveyor and processed.

After the attachment parts have been fitted to the valves, the finished products are tested for leaks and returned to the overhead conveyor. The data is always passed on with the valve or the wagon via another



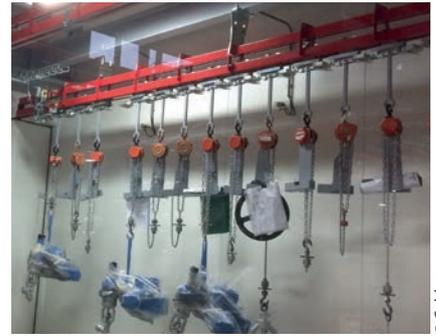
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The components on the overhead conveyor are about to undergo a final inspection. In the background are the individual packaging stations connected to the floor conveyor.



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The short accumulation distance allows the trolleys to be accumulated in curves. This minimizes the need for stop units.



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After the control components have been fitted, the trolleys pass in "batches of three" through the system.

ERP interface. The operators use a control panel to transfer any defective parts to another reworking station and to send the parts without defects to the paint booth. Special parts that have passed the leak test are taken to an additional production station where the motor and pneumatic components are fitted.

The inspection area

After the drive and control components have been assembled, the function of the valves is tested.

Once the valves have been assembled, they cannot be transported any further on single wagons because of the change in their shape. From this point in the system, the "batch of three" configuration is required. A bypass has been planned for this purpose that allows additional empty wagons to be moved from the unloading area to this part of the system.

In addition, assembled valves supplied by other plants can be attached to the overhead conveyor at loading station 3, as well as in loading areas 1 and 2. Their data can be entered into the system via an item barcode.

At the end of the assembly line, all the valves undergo a final inspection. In addition, the name plates are produced on a separate machine on the basis of the data supplied and are included with the valve or the wagon. The valves that have been identified as defective are transported directly to the unloading area.

Entering the painting area

After the valves leave the inspection area, the power & free conveyor moves the wagons through a pre-treatment booth. They are then allowed to dry briefly before passing on to the masking station. This is followed by two manual spray painting booths for standard colours and one for special colours. Valves that do not require painting are moved directly to the appropriate unloading station.

The two booths for standard colours each have a large FIFO buffer area (to compensate for differences in the processing speed). The buffer zones have a capacity of 79 wagons. The spray booth for special colours has five sorting buffers, each with space for 10 wagons. This allows the operator to pre-sort the colours, in order to keep colour changes to a minimum.

After the valves have passed through the ovens and the cooling zone, the thickness of the coating is measured at another inspection station and a visual check of the paint is carried out. The parts identified as defective can be returned to the spray booth, along with parts that require more than one coat of paint.

After the quality control, the components more than two inches in size and the controllable valves, in other words, all the "batch of three" trolleys, move to the three unloading areas in the conveyor system where they are removed. The components smaller than two inches in size are transferred from the overhead conveyor to the floor conveyor at a central transfer station. The data accompanying the parts is taken from the overhead conveyor and

passed to the floor conveyor. The floor conveyor then transports the valves to a designated (customer-specific) place in the palletising area. A gatekeeper organises the logistics in this area and is responsible for ensuring that the valves are moved to one of the twenty unloading stations.

"Because of the short planning phase and the end user tight deadlines, the project presented us with a challenge. The smart control and communication systems also gave our control system department plenty to think about," says Kai Hüter, member of the sales team at Caldan A/S with responsibility for the project. As a result of the close cooperation between everyone involved, the new system has been successfully in operation since September 2016. Because of an increase in orders at HP Valves, the conveyor system capacity was recently upgraded with 200 additional wagons. //

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