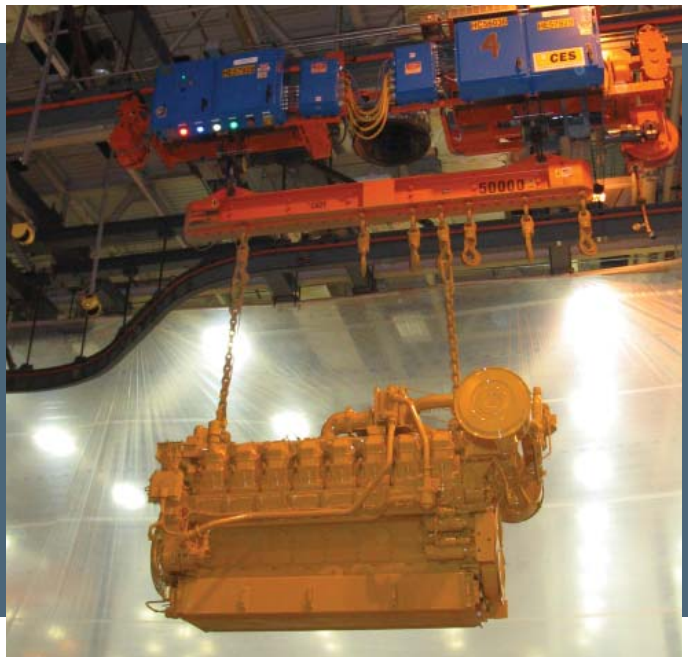
MAGNETEK ENGINEERED SYSTEMS

Caterpillar, Inc. Automated Paint Line Monorail System Project



Project — Caterpillar, Inc. Automated Paint Line Monorail System Project

Application — Automated Paint Line Monorail System

Products Used

- IMPULSE®•VG+ Series 3
- IMPULSE®•G+ Series 3
- Carrier Control Enclosures
- Carrier Power Enclosures
- PulseStar Radio Remote Crane Control System
- SBP2 Pendant
- Main Power Distribution Enclosure
- Main Monorail Control Enclosure
- Operator Interface Enclosures
- FABA-100 Conductor Bar

CHALLENGE

- Build an automated paint line to handle a new series of larger 34,000-pound engines
- Expand production capacity from under 50 engines painted per day to a goal of over 70 engines per day
- Meet customer's requirements for assembly line efficiency and manufacturing flexibility
- Replace an outdated manual paint line system with a state-of-the-art automated system within time constraints

SOLUTION

- Magnetek Engineered a customized system that increased efficiency and manufacturing flexibility, expanded production capacity and reduced lead times for the end user
- Automated a paint line for 600HP to 7300HP diesel engines
- Increased line's daily production output over 10%, with an almost 50% increase projected upon completion of Phase 2
- Replaced an outdated paint line in a small window of time with a manufacturing system to set new standards for quality, safety and speed in the industry

The newest and largest diesel engines Caterpillar has ever produced, the 3500 and 3600 Series, are manufactured at their facility in Lafayette, Indiana. The engines cover a horsepower range from 600 to 7300 and weigh up to 34,000 pounds. In preparation for their production, Caterpillar initiated a program to transform their manufacturing systems to set new standards for quality, safety and speed in the industry.

Improving manufacturing flexibility and providing additional production capacity were the goals of the production line initiative at the Lafayette facility. One of the improvement projects was to create an automated paint line monorail system that could handle the size and weight of their new engines.

Magnetek's Engineered Systems Group designed an automated paint line monorail system which eliminates idle time, rework and excess inventory. The facility can now paint these new engines in the safest, most reliable and fastest way possible. The old paint line was completely removed and the new system was put into place with 13 carriers running through wash, dry, paint and cure stations. To facilitate a smooth, efficient and safe workflow, an RF communication network between the floor equipment and each of the carriers was installed.

This automated system provides the customer the ability to paint more engines per day than ever before, from a maximum of 50 engines painted per day to over 70 engines per day.

THE SYSTEM

Engines are continuously delivered to the monorail system via an on-ground line conveyor running at 1.75 feet per minute. The IMPULSE adjustable frequency drive on the carrier is programmed to match the line speed of the on-ground conveyor, enabling a smooth transition of the engine from the delivery system to the paint system. The load station operator uses a PulseStar radio transmitter to manually adjust the carrier position and attach the engine to the carrier.

Once the engine is loaded, a bar code is scanned that informs the system of the engine shipping order (ESO), size, style and color code. RFID technology is also used throughout the system to ensure that the information for each engine and carrier is tracked appropriately. This information is retained by the monorail system and communicated to the paint system later in the production cycle. The engine is now dispatched into a fully automated wash, dry, paint and cure oven process.

Just after the carrier automatically raises the engine to its travel elevation, it passes the engine through an array of photo-eyes to verify that the engine configuration will not interfere with any of the platforms or process control equipment on the line. Faults are reported on scoreboard displays and several HMIs throughout the system.

As the carrier automatically moves the engine through the painting preparation system, it sends and receives commands from the wash booths, blowers and drying oven to ensure that it is safe to enter. Certain areas, such as the wash booths, require timed stops, while in other areas the carrier moves through at a constant rate of 1.75 feet per minute. This allows adequate wash and dry time before reaching the manual blow off and final paint preparation station.

A second PulseStar radio transmitter is used at the manual blow-off area to provide flexibility for the operators to perform final engine preparation before paint. In order to maintain production throughput, the carrier is only allowed to remain in this work station for a short time period. A countdown timer is displayed on a scoreboard adjacent to this station, along with a series of lights and horns, to alert the operators when the carrier is about to advance to the paint booths. Because personnel work in this area, safety interlocks with the man-lifts and floor mats are in place to ensure that the carrier does not automatically advance when it is unsafe to do so.

While waiting in queue before entering the paint booths, the carrier reports the engine ESO number and color code to the paint system robots. This information is critical as the robotic arms need to articulate around the engine in order to provide a smooth paint finish without colliding with the engine to prevent damage to the robots and production stopage. When traveling through the paint booths, the carrier automatically moves at a constant speed of 2 feet per minute.

A final cure oven is just beyond the paint booths where the engine remains for 54 minutes. Because the oven only holds three carriers, it is critical that the monorail system continuously advances the carriers to the furthest available position to allow oncoming carriers to enter and maintain system throughput.

After exiting the cure oven, the carrier passes through a cool down area as it advances towards the unload station. A stop position can be activated or bypassed in front of the cooling fans via a password protected override on the operator interface. The unload operator uses a third PulseStar radio transmitter to unload the engine onto an outbound conveyor system. The carrier ID number and engine ESO number are displayed on a scoreboard display to confirm that the painting process is complete for that engine. Once the engine is unloaded, the operator dispatches the carrier to a queuing location where it waits to be called by the load station operator.

Magnetek's Engineered Systems Group contributed to improving the production efficiency and throughput in Caterpillar's diesel engine manufacturing facility by providing a complete turn-key controls solution. The automated paint line monorail system was designed by Magnetek engineers, using IMPULSE adjustable frequency drives, FABA conductor bar, PulseStar remote radio controls and SBP2 pushbutton pendants. The system further incorporates programmable logic controllers, touch screen operator interfaces, scoreboard displays, RFID technology and RF data communication, all programmed by Magnetek. And to ensure that the system operated per the specification, Magnetek's system engineers performed on-site start-up services and performance testing, along with maintenance and operator training.

ADVANTAGES OF USING MAGNETEK'S ENGINEERED SYSTEMS GROUP

- Expertise in crane, hoist and monorail control systems
- Experience in automated carrier and bridge monorail systems
- Turn-key design, programming, and field start-up
- 100 years of combined experience in the Engineered Systems Group designing and implementing automated crane, hoist and monorail systems

MAGNETEK
MATERIAL HANDLING

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