Look Way Up

Overhead cranes drive GM V6-engine plant

By Richard Rix

Material flow plays a vital role in the assembly of automotive engines. As such, power conveyors are widely used, with engine assemblies typically mounted on metal pallets that are specially designed to fit the conveyor line. As the pallet travels along, the engine is assembled and dressed at numerous workstations, finally emerging as a complete product to be shipped to a vehicle assembly plant.

It sounds simple, but a lot of careful planning has to go into designing product flow and workstations that ensure efficiency, good ergonomics and general manufacturing excellence. The conveyor line must twist, turn and contort in a myriad of directions to make the process a success.

Designing the conveyor line, however, is only part of the equation, as plant personnel must also implement a materials handling system that can:

- Feed parts onto the production line and take finished engines off it;
- Support all of the tools that are involved in the assembly process (i.e. multi-spindle tools, test devices and jigs) and position them for easy use; and
- Take engines off the main line and divert them to sub-assembly lines or rework areas efficiently.

A crane system is the obvious solution, but finding the right one is imperative. Jib cranes tend to function only in a certain arc around their anchor point, making them ideal for supporting hoists or tool balancers for use in a circular workstation. This isn't the best choice, however, for complex assembly plants wanting to achieve material flow. Freestanding overhead cranes offer a better solution, but they have columns that can be intrusive in and around a continuous production line.

Ceiling-mounted cranes have an advantage over freestanding cranes because they don't require columns. They're the obvious choice for buildings designed from scratch, where the ceiling height and load beams can be set exactly as required.

For an existing building, however, it's trickier. Even though the ceiling may have appropriate load-bearing capacity, headroom can be a limiting factor. If you want to source ceiling-mounted cranes that will succeed, you have some critical decisions to make, not just in terms of capacity and ease-of-installation, but also with regard to possible future change.

GM's St. Catharines, ON, V6-engine plant is using Gorbel overhead cranes with impressive results.

To complicate matters, you must make early decisions, for crane layout has to be determined at the same time as the production line. If it isn't done right, you can impede the design process, lengthen project timelines and cause installation costs to soar.

This was the situation facing the General Motors of Canada (GM) engine plant in St. Catharines, ON. In 2001, GM began designing a production line for the new 3.6-litre VVT V6-engine for vehicles, including the Cadillac CTS. GM responded to the materials handling challenge by selecting a range of

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Gorbel ceiling-mounted cranes that achieve ease-of-movement and load-handling strength, while conforming to existing building parameters.

The "World's Best Powertrains" are produced at the St. Catharines plant, according to signs inside and outside the building. The new V6 is the first variation of the global 6-cylinder to go into production and represents a $440-million investment at the plant. Producing 255-hp and 252 lb-ft of torque, the 3.6-litre engine is approximately 16 percent more powerful than the old CTS engine. The plant also builds the GEN III V8-engine for SUVs and the 5.7-litre aluminum block V8 for the Chevy Corvette.

GM researched many kinds of cranes to service the new V6 production line before selecting the Gorbel range. An important consideration was the Gorbel products' flexible runway construction, which allows the cranes to be installed in a way that complements the existing building, rather than have to make major structural changes.

Headroom was another key factor in crane selection. Height restrictions to the top of the runway imposed a challenge, both to the design engineering team and installation workers. It was crucial for them to be able to source a suitable product "off-the-shelf," without having to resort to major modifications.

To reduce costs, the installation also called for 20-foot support centres along the length of the crane runway. Even with just 1,000-pound lift capacity crane equipment, some suppliers would've faced a problem meeting this requirement, but Gorbel was able to respond to the challenge and satisfy GM's need to lift loads of up to 4,000 pounds.

Among other complicating factors at the St. Catharines plant was that available clear height isn't always consistent. The response was to install plain track on one side, where headroom is low (mountings every 6 feet) and truss track on the other side, where headroom is less of a problem (20-foot spaced mountings). The capability exists to go to 30-foot spaced mountings in the plant.

One of the factors contributing to the cranes' operational success is their unique aluminum design. For easier operator handling, Gorbel uses high-strength aluminum alloy that reduces bridge dead weight by up to 40 percent compared to steel. Reduced weight also creates unparalleled flexibility, in terms of combining spans, capacities, load weights and ease-of-movement into a successful system.

Aluminum bridges used on steel runways provide a cost-effective solution to most overhead handling challenges. As well as being easy to install, such systems are relatively simple to expand and modify in the field. The track design allows the user to create precise track alignment. Users can often insert new cranes on existing runways, as their lifting needs increase. In fact, the Gorbel equipment creates the flexibility to install up to four 1,000-pound bridges on the same runway.

The use of aluminum bridges also facilitates the installation of high-speed precision hoists under pendant control. That's because there's less "bounce" in load handling compared with the use of steel bridges. Less bounce means better positioning and more precise load placement.

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Another GM requirement was that the cranes be rigid, so as to deliver predictable motion and force. Some cranes are articulated, with one end of the bridge operating independently of the other end. This can create a problem with skewing, or one side of the crane moving ahead of the other side, leading to unpredictable crane motion and increased risk of injury.

Other advantages of the rigid design include easier positioning. Plus, in freestanding applications, the rigid design validates system functionality by eliminating the need for the separate support structure that's required by articulating systems. Rigid cranes don't require safety cables, don't "crabwalk" down the runway and assure precise positioning by not skewing.

In addition, with the rigid design, the end-truck on one side of the runway can be free running. The potential exists for binding problems, if both ends are fixed. With the Gorbel equipment, one end floats, for free and easy movement. This means the bridge is always 90 degrees to the runway, and when it stops, both ends stop simultaneously.

Also designed into the operating system was a modular busway bar system. Instead of it being tied to a hardwire conduit, the user is free to plug into the system wherever a connection is needed.

While not directly related to powering the cranes since they're manual, the busway powers the hoists and other electrically driven machinery and apparatus. During the installation phase, the busway saved money and has operated problem free.

Today, the engine assembly area of the plant has 180 cranes. Runway lengths range from 4 to 250 feet. Equipment installation was completed late last year.

Even with the long runs that these cranes are able to achieve, you don't need a lot of support steel to hang and brace them. A simple clamp every 6 to 30 feet is all that's required to hang the rails. Four hangers and braces might be all that's needed for some of the cranes, depending on capacity and span.

At the St. Catharines plant, one crew was able to install eight cranes in a single night. Suffice it to say, the Gorbel cranes will continue to help GM motor in the fast lane. ■

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