Overhead handling equipment basics

Overhead handling equipment like cranes, hoists and monorails can increase productivity, enhance safety, improve ergonomics and maximize floor space.

By Lorie King Rogers, Associate Editor

Up, up and safely on its way. Sometimes the best way to transport product through a warehouse or manufacturing facility is to lift it up then move it along. Handling materials overhead can increase productivity, enhance safety, improve ergonomics and maximize available floor space.

There are many types of overhead materials handling equipment, but they all share the same goal of safely lifting product and moving it efficiently and ergonomically from one point to another without damage to the product or the facility—or injury to the worker.

The right equipment for the job depends on the process, the product being moved, the task being performed and the desired rate of throughput. "There is a range of solutions in overhead handling," says Jeff McNeil, marketing manager at Gorbel. Different configurations and technology mean there are a lot of choices in overhead handling equipment, he says, and an operation's final equipment selections are usually based on performance and cost.

Overhead handling solutions can range from simple, manual hoists to fully automated systems with movements directed by software. Regardless of the complexity, the equipment, especially the equipment in the middle where people are working together with technology, should shoulder the bulk of the work. This equipment report looks at the primary overhead handling equipment: cranes, hoists and monorails.

CRANES

Today's overhead cranes enable the movement of product above the floor, especially when handling materials manually or by lift truck isn't practical, productive or safe. Instead of being limited to available aisle space and moving materials by a lift truck or other floor traveling systems, overhead cranes allow you to cover a broad area of the manufacturing plant and move products through the manufacturing or storage process using all of the free space overhead, explains John Paxton, president of Demag Cranes & Components.

Cranes can be manual or power driven, depending on the application and the size of the load that's being moved. For example, workstation cranes and jib cranes are used to improve ergonomics in small areas, while bridge and gantry cranes handle the heavy lifting tasks over longer distances.

While there are a variety of crane styles, all include three basic components: bridge, trolley and hoist.

- The bridge, which can be stationary or mobile, is made of rails and can carry one or more trolleys.
- The trolley is the unit that travels side to side and carries the hoist.
- The hoist is the lifting device that hooks onto and manipulates the load.

Cranes are also available in various load capacities, from workstation cranes that enable operators in a work cell to safely manipulate light loads (typically below 2 tons) to very large overhead cranes capable of transporting loads weighing as much as 500 tons.

While many cranes are pre-engineered solutions, which are produced from standard hoist and drive components, Paxton explains that the cranes with lifting capacities above 50 tons are usually engineered solutions with controls specifically designed for the manufacturing process that the cranes support.

Workstation cranes

On a smaller scale, free-standing workstation cranes enable operators in a work cell to safely and accurately maneuver light loads. These free-standing units improve ergonomic handling of product in a limited area, like production environments.

Some of the newest workstation cranes are intelligent devices that combine manual and servo-driven operations. The manual function allows workers to move at their own pace as they walk to a bin, select a part, and guide the crane to a machining center process.

The servo-driven function controls the positioning of the part on the machine, preventing damage to both by slowing down for part placement and release.

Gantry cranes are comprised of two uprights connected by an I-beam that serves as the bridge for the trolley. Gantry cranes can be manual or powered. In a powered gantry crane, the uprights run on a track at floor level; in a lighter-duty crane, the uprights are on wheels and can be manually positioned and repositioned around a facility. With load capacities of up to 5 tons and spans of up to 30 feet, gantry cranes are most commonly used in maintenance operations. They are a cost-effective solution for applications that require infrequent duty.

Jib cranes are also used for spot handling. These cranes include a single bridge that rotates to cover a circular area. Because the crane rotates, loads are easy to position. Jib cranes are often used in conjunction with an overhead crane to improve throughput in areas with more traffic and production than a single crane can handle.

Free-standing jib cranes are bolted to the floor and require a strong enough foundation to support the load without the crane tipping over. Because they are free-standing, they offer 360-degree rotation.

Articulating-arm jib cranes are simply jib cranes equipped with a pivoting two-piece arm. This gives the operator more precise control in positioning the load.

Overhead cranes

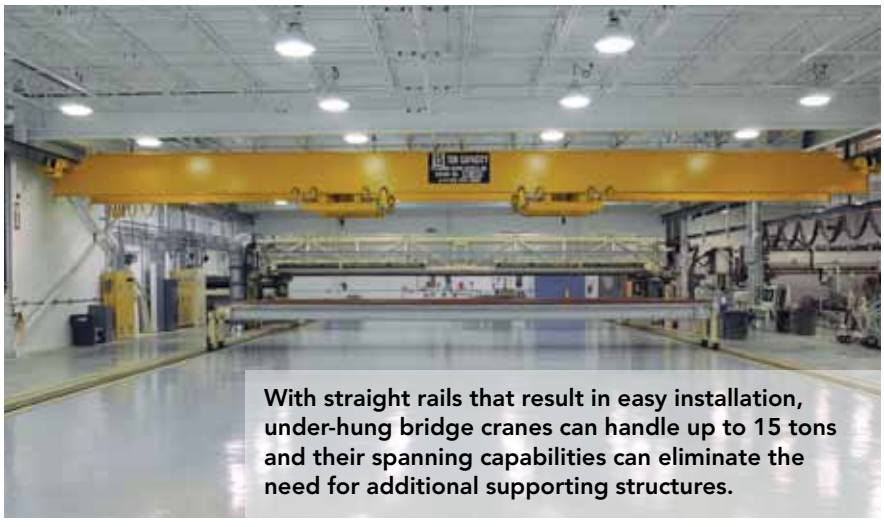
When it comes to muscle, overhead cranes have the most lifting capacity. Bridge and gantry cranes do the heavy

lifting over long distances.

Bridge cranes are ceiling-mounted and allow loads to move in six directions: up and down, forward and backward, and side to side. They are typically part of a building's structure and installed when the facility is being built.

Always powered, bridge cranes consist of a trolley that runs across a bridge (which can have one or two girders). The bridge moves across a bay along a runway. The largest capacity units—known as top-running, double-girder cranes—mount the bridge on top of the runway and have two girders for the bridge. With capacities of up to 600 tons, a top running crane gives you the maximum headroom of any crane. Alternately, underhung cranes, which are ideal for loads of 15 tons or less, have a trolley that runs on the bottom of the support I-beams.

In addition to top-running cranes, there are under-hung cranes where the trolley runs on the bottom of the support I-beams and can get loads closer to the wall. While distance is no impediment for this type of crane, an underhung crane cannot lift a load as high as a top-running crane system and is meant for loads of 15 tons or less.



With straight rails that result in easy installation, under-hung bridge cranes can handle up to 15 tons and their spanning capabilities can eliminate the need for additional supporting structures.

HOISTS

This is an old industry, says Bret Lussow, business development sales manager for Harrington Hoists. "This is not a high-tech industry such as computers or cell phones. However, this old industry is adapting the latest technology, making hoists more reliable and safer than ever before."

A hoist can be a key part of a crane system. But these mechanical devices can also stand alone for vertical lifting jobs, raising and lowering loads, like individual work-in-process.

Hoists can be divided into three categories based on power source:

- electric (including wire rope and chain hoists),
- air-driven,
- and manual (including hand chain and ratchet lever hoists).

Lately there have been improvements in the areas of material, construction and safety, explains Lussow.

Electric

Electric hoists, which are the most common type, are using more efficient motors that reduce amperage draw. Electric hoists range in lift capacities of 250 pounds, which can be purchased off-the-shelf, to several hundred tons, which are usually custom engineered.

All electric hoists are rated by duty cycle. The rating determines how long the hoist's electric motor can run before it needs to cool. Meaning, an electric hoist with a 25% duty cycle can be used continuously for 25% of an hour, or 15 minutes, before it needs to cool.

Electric hoists are available with single-speed, double-speed or variable-speed electric motors. While single-speed motors are the least expensive, double- and variable-speed motors offer some advantages. For example, an operator can begin lifting a load at a slow speed then ease into a higher lifting speed. This reduces shock on the system and extends the life of the hoist. Operators can also slow the hoist at the end of a lift, allowing for more precise and gentle positioning of the load.

Because they are hard-wired to a power source, electric hoists have a dedicated location in a facility. Electric hoists are also available in wire rope and chain designs, which, according to Lussow, have seen improvements to the strength of wire rope or chain used as the lifting medium.

Wire rope hoists, which are used to lift very heavy loads, are controlled by an operator who

A free-standing workstation crane lets the operator use his eyes and brain, but uses the machine's "muscle" to handle the heavy lifting.

presses a button to start the motor. The motor drives a set of gears, which then turns a grooved drum. The wire rope winds around the drum as it turns and lifts the load. These hoists can reach capacities of hundred of tons, but the majority are 5-ton and 10-ton models and used for such jobs as assembling automotive equipment.

Chain hoists are also manually activated. An operator starts the electric motor that turns a set of gears, which then turns a lift wheel. Pockets in the lift wheel engage the links of the chain that raise the load as the chain rides over the wheel. The chain coming off the wheel either hangs or is collected in a container below the hoist. Chain hoists range in capacity from 250 pounds up to about 20 tons. They are slower than their wire rope hoist counterparts, smaller and more maneuverable.

Automated overhead handling systems use software to communicate the direction and movement of the load.

Air driven

Air driven, or pneumatic, hoists don't have electric motors, don't require electricity and don't overheat. What they do have is the ability to facilitate highly repetitive assembly line applications because they can be used continuously and don't need the cooling time that electric hoists require.

"Speed, speed, speed. It's all about increased production," says Lussow. "These hoists are ideal for mass production, production lines and foundries," he adds.

The majority of air-driven hoists use chain as the lifting medium. They function much like electric chain hoists, but they are not hard-wired to an electrical system.

Manual

Slower, manual hoists are small and mobile, and usually used for maintenance and other non-repetitive tasks. Manual lifting devices like hand chain and rachet lever hoists are simple lifting technology that are very affordable and very effective, says Gorbel's McNeil.

Hand chain hoists have two chains: one chain attached to the load and a pull chain. As the operator pulls the pull chain, the hoist's internal gears raise and lower the lift chain and provide the mechanical advantage for easing the lifting process. For example, lifting a 1-ton load with a hand chain hoist requires just 54 pounds of effort. While these hoists can lift 70-ton loads, the majority of the market is in the 1- to 5-ton range.

Rachet lever hoists can use either wire rope or chain. They work like hand chain hoists, but use a lever rather than a pull chain to rotate the sprocket that activates the lifting mechanism. With capacity ranges from 500 pounds to 9 tons, rachet lever hoists are best suited for low-lift applications, usually less than 5 feet. These hoists can lift vertically and pull horizontally, and are commonly used for pulling rather than lifting.

MONORAILS

Monorails consist of a single rail, or I-beam, from which a hoist or hook hangs. Together, the monorail system components allow loads to move both horizontally and vertically.

The basic concept of the monorail system has not changed much over the years, but what has changed are its applications. In addition to heavy-duty cycles, monorails are being used more and more for medium- and light-duty cycles in warehousing and a variety of manufacturing applications.

With load weight capacities of up to 30,000 pounds, electrified monorail is durable and flexible. Each carrier unit has its own drive unit and can run at variable speeds in different areas, traveling at up to 600 feet per minute. Product transported by monorail is powered by a bus bar, or power rail, inside the I-beam.

Monorail can be an expensive solution, and should be seen primarily as a high-speed, long-distance transportation system. "The cost of automation equipment is going down, but it's still relatively expensive compared to more simple solutions like manual cranes and hoists," says Gorbel's McNeil. □

For more information about the Crane Manufacturers Association of America (CMAA) and the Hoist Manufacturers Institute (HMI) go to www.mhia.org/industrygroups/cmaa and www.mhia.org/industrygroups/hmi.