Below-the-Hook Lifting Devices

What do you do if you feel like your crane isn't performing as efficiently or as safely as you think it can? Maybe it takes too long to secure or remove each load using traditional rigging slings and hardware. Or, maybe something just doesn't seem right about the way the load is balanced or moves once it's up in the air. Chances are, using an engineered below-the-hook lifting device can improve the efficiency and safety of your lifts and help secure your loads.

What is a Below-the-Hook Lifting Device?

In simple terms, the American Society of Mechanical Engineers (ASME) states that a below-the-hook lifting device is "a device used for attaching a load to a hoist. The device may contain components such as slings, hooks, and rigging hardware…" In other words, a below-the-hook (BTH) lifting device is a tool or mechanical device that attaches to a crane or other lifting apparatus, and grabs and secures a load so that it can be moved safely from one location to another.

Custom-built below-the-hook devices are very common. Engineered lifting devices are built for picking and moving a very specific load due to its size, shape, or center of gravity. A manufacturer will partner with their customer to develop a completely new device from scratch or may modify an existing product design for their specific lifting needs.

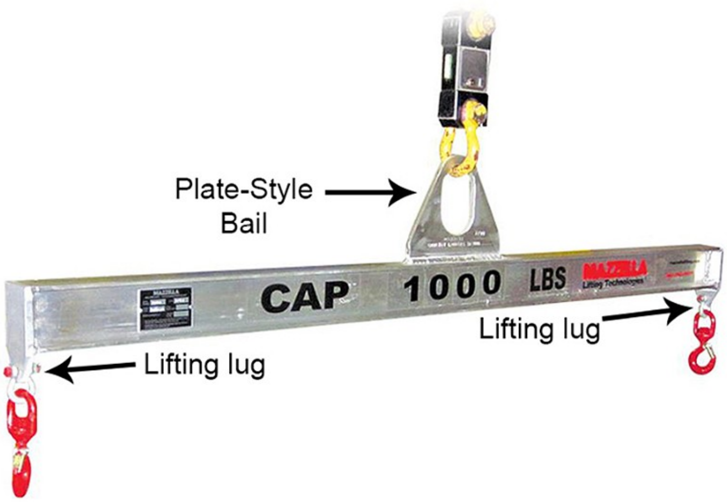
Most manufacturers also carry lifting devices in standard sizes and configurations for common lifting applications like:

- Lifting and moving of pipes or bars
- Lifting and stacking coils
- Lifting, moving, and stacking of sheets, plates, or other horizontally-stacked materials
- Lifting and moving pallets
- Lifting and moving of structural shapes

Below-the-hook lifting devices are most often mechanical, but can also be operated electronically, hydraulically, or pneumatically, as well—with special controls engineered into the design of the product to operate claws, tongs, hooks, or latches.

What are the Components of a Below-the-Hook Lifting Device?

In order to fully understand a below-the-hook lifting device, let's break down some of the common components to see how they affect the performance and design of each device.



Bail

The opening or attachment point where the crane hook engages. Bails can be plate style or pin style.

Lifting Lug

An attachment point on a lifting device where the rigging equipment will connect via a shackle or hook.

Gusset

A reinforcing plate welded on to the device to add strength to an area of extreme stress or usage.

Latch

Device used to hold a lifter in an open or closed position.

Why Should You Use a Below-the-Hook Lifting Device?

Safety and efficiency are the two main reasons for using a below-the-hook lifting device in conjunction with your crane and rigging equipment. Sometimes, using a traditional wire rope sling, alloy chain sling, or synthetic sling just isn't enough to safely and securely move a load from one location to another.

Often, a customer who is already using some type of lifting sling, or a variety of slings, will approach a manufacturer to develop a custom lifting device for their lifting application. It may be because it's taking too long to secure their load using traditional rigging, or it may be due to the size, shape, or weight of the load and they don't feel that their current method is the safest or most effective.

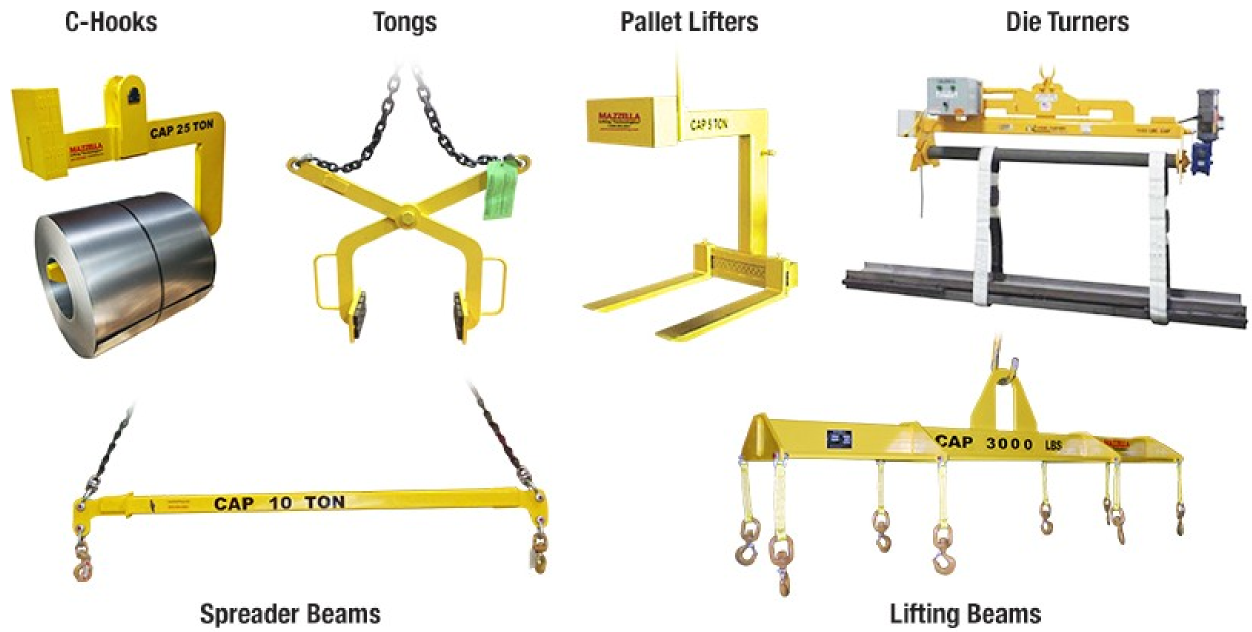
An accident or near miss may be another reason to convert to a custom below-the-hook lifting solution. If the materials you are trying to move just don't look right when they get up into the air, or you don't feel that your load is secure enough—or worse yet, you've actually experienced a rigging failure—then it's probably time to consult with an expert and see if they can help engineer a solution to keep your employees safe and your loads secure.

Often, lifting points on a load are there because the manufacturer found that location to be convenient—not because they're the safest, most balanced locations for lifting and maneuvering.

Instead of trying to get creative using slings, a custom lifting device can be made to provide sufficient load control. A load that is unbalanced with an offset center of gravity, is a perfect candidate for a below-the-hook lifting product because this custom lifter can be designed with an adjustable bail to re-balance the load. Keep in mind, you may be lifting valuable and expensive equipment or materials, and if that load isn't secure, it could potentially injure your employees or cost your business in damaged goods.

What are the Different Types of Below-the-Hook Lifting Devices?

A variety of different application-specific, attachments can be added to a crane's hoist to handle the lifting or positioning of different loads. These can include:



Coil Hook

A lifting device that enables the lifting of a coil through its inner diameter, in a vertical or horizontal orientation. A motorized hook rotator attaches to the bottom block of a hoist and powers the rotation of the hook for additional load control.

Gripping Lifters

Use either friction or indentation-causing pressure to hold a load. Tong grabs or clamps utilize a scissor-type action to grip a load. Coil grabs grasp the outer diameter of a coil via tongs or gripping mechanisms to lift or turn it.

Mechanical Lifters

Composed of two or more rigid parts which move in tandem for attaching a load to a hoisting device.

Sheet Lifters

Use two claws to grab a load of sheet metal or wood by wrapping around the edges. A lip on the lower portion of the claws prevents the sheet from falling out of the lifter.

Pallet Lifters

Use forks to lift pallets from underneath.

Beams

A load supporting lifter typically made from structural shapes or fabricated metal and are suspended from a hoist/crane to provide one or multiple load lifting points for better security and control of the load's movement.

- **Lifting Beams** – They consist of a long beam with one top bail and two or more load lifting points. Lifting beams are generally heavier and more expensive than spreader bars. The main benefit of lifting beams is the substantially-reduced headroom required to perform the lift.
- **Spreader Beams** – They have top rigging consisting of wire rope slings, chain slings, or synthetic slings to better assist in load balance and control. They also tend to be smaller in design than lifting beams.
- **Spreader Bars** – They consist of a long bar that's function is to hold a sling apart to the lifting distance. Spreader bars are lighter and cost less than their lifting beam counterparts. However, they require much more headroom to make the lift than a lifting beam.

Die Turners

Used to rotate or turn large dies safely instead of "flipping" them over with a crane and rigging equipment.

Vacuum Lifters

Utilize an electric-powered extraction pump and sealed pads to create a vacuum to attach the lifter to an object.

Magnet Lifts

Used to carry or release flat or round ferrous objects with or without an electrical power supply.

Drum Turners

Used to turn over drums for filling and emptying.

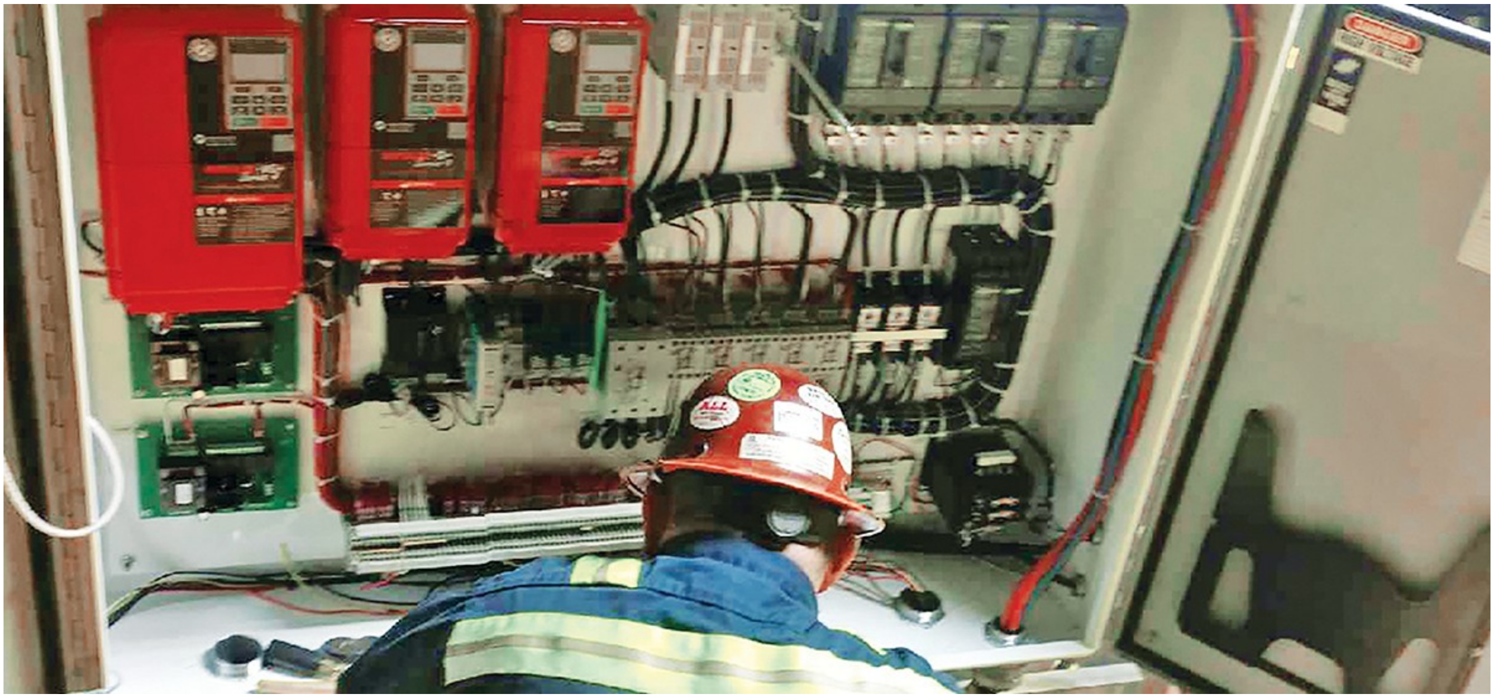
We hope that this lesson was able to give you a basic understanding of what a below-the-hook lifting device is and why you might consider using one in conjunction with your overhead crane system for your specific lifting needs.

A BTH lifting device can be as simple as a standard spreader beam used to evenly distribute the weight of a load, or it can be a more complex, totally customized spreader beam with built-in coil hooks to lift and move multiple coils at once.

The major benefits of using a below-the-hook lifter are that it can increase the efficiency of your lifts, allowing you to make more lifts per shift, and also properly secure the load so that it can be transported safely.

Variable Frequency Drives

Does it seem like you're battling with your older overhead crane system to keep it up and running? Maybe it feels like all you do is tear apart gearboxes and replace the worn-out parts and couplers. Or, maybe you're constantly taking your equipment offline to replace your crane's worn down brakes.



If this sounds familiar, you're not alone. At Mazzella Companies, our Overhead Crane Service team stays busy with maintenance requests, emergency and warranty repairs, and routine inspections. But did you know we also specialize in overhead crane upgrades and modernization? If your crane seems to break down or needs frequent repair due to worn-out parts, you may be able to extend its service life with a smarter and more efficient drive control system.

Keep reading to learn more about how adding a state-of-the-art variable frequency drive can:

- Control all of the motorized motions on an electrified overhead crane
- Reduce excessive wear to multiple crane components
- Improve the performance, safety, and efficiency of your overhead lifts

What is a Variable Frequency Drive and What is it Used For?

Variable Frequency Drives, or VFDs, were introduced to the material handling industry in the late 80's-early 90's after the birth of low cost high speed power transistors. Variable frequency drives were designed to allow greater precision and control of single-speed and 2-speed motors.

Initially, they were only specified on the bridge and trolleys of high-speed Class D and Class E cranes. Today, they're used to control every motorized motion on a crane—including the hoist, bridge, trolley, and even hook rotation in certain applications.

Just like the name implies, a VFD varies the frequency to an AC motor by creating a sinusoidal wave. By varying the voltage and frequency supplied to the motor, the drive "tricks" an AC motor into thinking it's at synchronous speed, even when it's not. This creates better and smoother motor controls and allows for adjustable speed controls and adjustable acceleration and deceleration ramps.

As the cost of these systems have come down, they've increased in popularity and today get specified into all types of crane systems—ranging from lower-duty package crane systems, all the way up to high capacity/high duty cycle process cranes.

What Type of Control Systems Did Variable Frequency Drives Replace?

Prior to the introduction of variable frequency drives, overhead crane operators controlled their cranes using contactor-based controls. For lower duty cycle cranes, the systems were equipped with either a single-speed or 2-speed motor. For higher duty cycle cranes, they used what was called a wound rotor motor.

Single-Speed or 2-Speed Motors

On a single speed motor, the operator pushes a button and the motor accelerates as fast as it can, depending on the load. As soon as the button is released, the brakes set and the crane stops. So, if your crane is equipped with a motor that operates at 50 fpm (feet per minute), then that's the only speed that it can work at.

On a 2-speed motor, there are two speeds available for the crane to operate at—typically within a 3:1 ratio. So, if the crane is equipped with a 2-speed motor, it can operate at 40 fpm or 120 fpm, but there are no other speed options in between.

These lower duty cycle applications can be equipped with "Soft Start" technology, also known as a Reduced Voltage Starter. This technology reduces voltage to the motor which results in a reduction in acceleration at startup and reduces the amount of torque being applied to the overhead crane’s drivetrain during acceleration. However, this control method generates a lot of heat and is not recommended for high-use/high duty cycle cranes, because it can quickly overheat their motors.

Wound Rotor Motor Controls and DC Controls

Years ago, process cranes and other high-performance crane systems were using an effective but fairly complicated motor control system called wound rotor controls. This consisted of windings on the rotor of the motor, which are then brought out to slip rings, then brought out to brushes, and then to resistor banks. Using this system, you could control the acceleration of the motor by changing the resistance on the rotor of the motor.

These systems worked well, but were a headache to troubleshoot problems due to all of the wiring and complexity built into the system. Other high duty cycle cranes used high performance speed, or DC controls, to provide the operator with more motor controls for the crane. These are still popular in mills today, but they’re also a complicated design and inefficient use of the controls.

What are the Advantages of Using Variable Frequency Drives?

One of the greatest benefits of upgrading your overhead crane with variable frequency drive controls, is that they're so adaptable to any type of crane application.

Lower-end systems designed for modular cranes come standard with 30-40 programmable control parameters. On cranes with single-speed or 2-speed motors, a variable frequency drive can be programmed to provide smoother acceleration and deceleration, and also can be programmed to add in additional speed points. For example, on a 2-

speed motor with speeds of 40 fpm and 120 fpm, an additional control could be added to allow for a median speed of 80 fpm, or you could slow it down even more by adding in a 10 fpm control.

On high-end VFD systems, there may be as many as 200-300 programmable control parameters used to dial in the controls for the bridge, trolley, hoist, and hook. A VFD can provide performance similar to DC controls, but with a single-speed motor. Variable frequency drives allow for acceleration and deceleration to be programmed similar to the feel of a Soft Start device. But, because the VFD controls both the voltage and frequency sent to the motor, the risk of overheating is eliminated for Class D, Class, E, and Class F high-use process cranes.

On high-speed crane systems, the speed controls can be programmed to run the bridge and hoist down the runway at 300 fpm and with the flip of a switch, reduce that speed down to 50 fpm in a controlled manner, as the bridge approaches the end of the runway or a pick point.

Reduced Wear on the Brakes

If you ask any Maintenance Manager at a high-output production facility, the single greatest benefit of a variable frequency drive is that it eliminates or greatly minimizes brake wear. On cranes without VFDs, every time you let go of the button, mechanical brakes kick in to slow and stop the motion of the crane. This wears down the brakes over time, and in high-use crane systems, the brakes may need to be replaced every few months, or even every few weeks, due to mechanical wear.

With a VFD system, once the button that controls the forward or reverse motion is released, the VFD controls the deceleration of the crane and slows and stops the crane in a controlled manner. Now, the brakes are primarily being used as a parking brake to hold the crane in place when it’s not in motion. This greatly enhances the service life of the brakes and reduces costly equipment downtime.

Adjustable Acceleration and Deceleration Times

On crane systems not equipped with VFDs, the stops and starts of the bridge and trolley are much more abrupt. Over time, these abrupt movements can cause excessive stress and wear to the following components:

- Drivetrain—including couplings, keyways, and gearboxes
- Trolley, end trucks, and wheels
- Runway beams and structural supports
- Wire rope or chain used to support the load

A VFD allows you to fine-tune the amount of time it takes for the bridge or trolley to get up to desired speed and the amount of time it takes to slow down to a complete stop—greatly reducing stresses on the crane components and also helping to prevent load swing.

Precise Load Positioning

With a variable frequency drive, the bridge, trolley, and hoist can be programmed anywhere within a 40:1 speed ratio. For delicate loads, or loads that need to be very precisely positioned, the operator can nudge the bridge or hook along its path of travel in a very slow and controlled manner.

The operator can run the load down the runway at higher speeds, and as it approaches the end of its travel, he can flip a switch that's programmed to slow the crane down to a predetermined speed—say 10% of the top operating speed, for example—as he fine-tunes the final positioning of the load.

Load Limiting

The drive system can be programmed to detect hoist overload conditions—halting the upward lifting motion if it detects that the hook load is reaching or exceeding a predetermined load limit. These can replace load cells in most applications.

Torque limiting can also be used to prevent the crane from performing a lift that could overload the motor and cause mechanical fatigue.

Fault Codes and Diagnostics

Software and hardware is available to allow operators, maintenance/production personnel, and even remote third-parties to program, monitor, and troubleshoot the drive systems. One crane or multiple cranes can be set up for monitoring and diagnostics related to the drive parameters and drive status.

In the event of a problem, an alert with diagnostic information can be sent to a remote technician or even directly to the operator's transmitter. In most cases, maintenance workers can diagnose and reset the fault without having to climb up on scaffolding or get into a lift to access the crane. If they do have to get up in the air to work on the crane, they at least have an idea of what the problem is and can be prepared with the right tools and parts to perform the repair or adjustment.

Other diagnostics information that can be provided include:

- Number of drives
- Number of cycles
- Routine or preventative maintenance alerts based on the usage of the crane.

What are the Disadvantages of Using Variable Frequency Drives?

Most operators who have transitioned from contactor-controlled cranes to a new variable frequency drive system will tell you that there is an adjustment period. Overall, it can take weeks to even a few months to get used to the new operating characteristics of the crane.

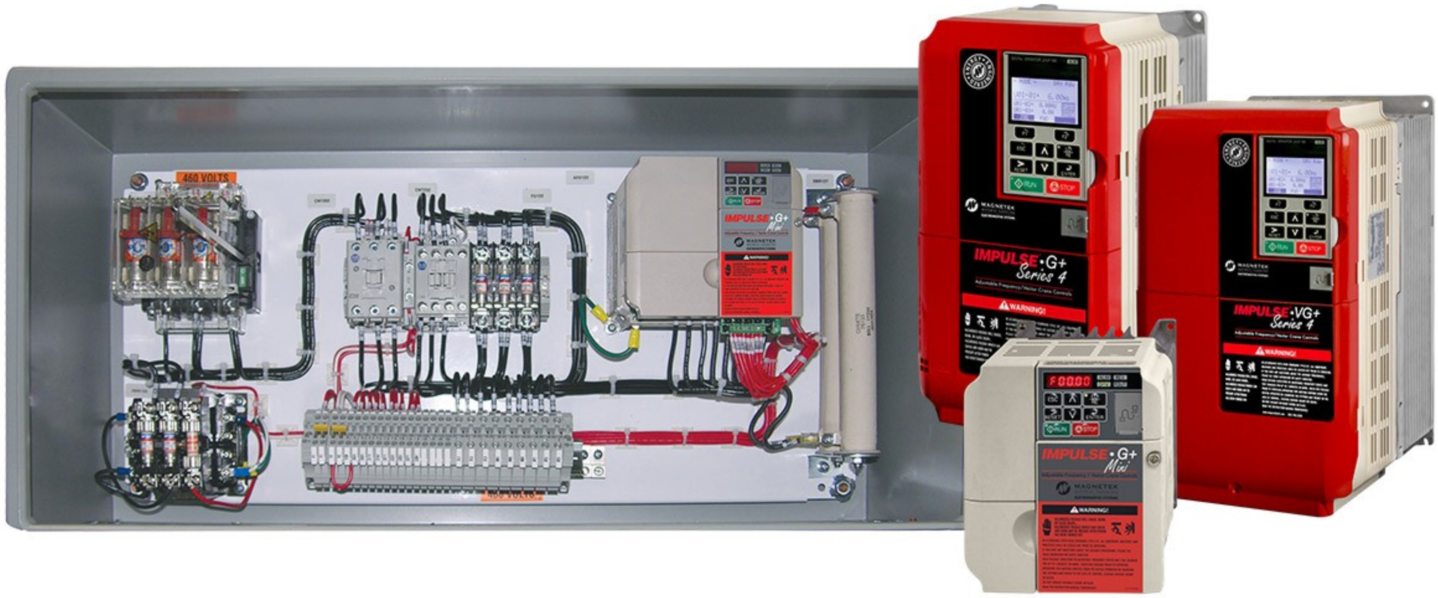
On a contactor system, the operator is used to letting off of a button and the crane stops within a few feet. With a VFD, the crane may continue to travel another 5-10 feet after the operator lets off of the button. This is caused by deceleration time that's built in to prevent torque on the drivetrain components and prevent load sway.

Luckily, variable frequency drives provide the user with every opportunity to operate the crane safely, improve performance, and reduce maintenance and wear. After the system has been installed, a technician can fine-tune the controls based on the operator's preferences to try and get a similar feel to their old style controls, but still prevent excessive torque and abuse of the drivetrain.

The installers or service techs can also provide training to in-house maintenance personnel on how to use the keypads to adjust or program the parameters of the drives and also train them on how to interpret and diagnose problems with the equipment using fault codes.

Want to Add VFD Controls? Here's What You Need to Know

A crane manufacturer will need to know the following information to be able to properly quote and specify the right type of variable frequency drive system, as well as help get the controls tuned to your liking:



- **Type of motor being controlled** – Will you be controlling a single or 2-speed motor? Is it a wound rotor motor or a DC motor?
- **Actual amperage of the motors** – The variable frequency drive will need to be designed around the amperage of the different motors it will be controlling, not necessarily the Horsepower.
- **Duty cycle** – Selecting the right VFD depends on a true understanding of the duty cycle of the crane—including load and usage requirements. Do you foresee any production or lifting requirements changing down the road? Make sure you future-proof your investment.
- **Hoist design/headroom** – Can the hoist accommodate an encoder? Is there enough overhead room to accommodate the encoder?
- **Have an open mind** – Make sure that your operators, maintenance, and production personnel have an open mind to the new features and technologies. There may be a period of adjustment to get used to the way the new system handles, but in the long-run, it will cut down on major wear and maintenance requirements—resulting in less equipment downtime.
- **Communicate effectively with the installer or your maintenance team** – After installation, one of the hardest parts can be communicating what is different about the new system to the person who is programming and dialing in the controls system. Don't just say, "Well, it's faster." Make sure you specify what exactly is different. Is the top speed faster? Is the acceleration faster? Is the load speed faster? If you can communicate what you're actually looking for, and what change is needed, the system can be dialed in for optimal performance.

Modern Safety Systems

When you're designing the specifications for a new overhead crane system, your number one goal should be to improve the safety of the overhead crane equipment and production processes at your facility.

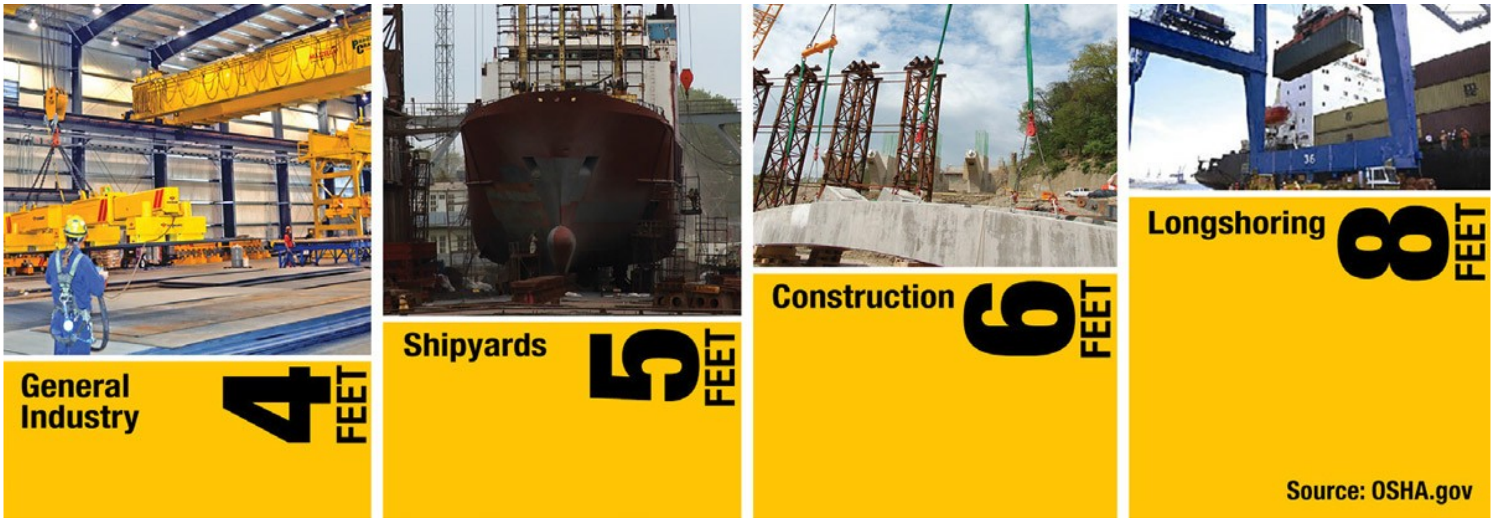
With modern technologies becoming more readily available and more affordable, the safety features available for overhead crane systems have never been better. Newer technologies now allow for:

- Remote monitoring and diagnostic information for individual components
- Automated drives to control the speed and motion of the crane
- Radio controls
- Collision avoidance systems
- Overload sensors and read-outs

In this section, we'll walk you through some of the new systems and technologies that are available to help improve the safety, performance, and reliability of your overhead crane equipment.

Fall Restraint, Lifelines, and Walkways

OSHA states that Fall Protection is the #1 most frequently cited violation and they've established industry specific requirements (OSHA 1926.501 – Duty to Have Fall Protection) to reduce the risk that comes with working at height.



You may be surprised to learn that you can be cited for failing to use fall protection equipment at working heights of as little as 4-8 feet. See below for industry-specific guidelines:

- **Four feet –** General industry
- **Five feet –** Shipyards
- **Six feet –** Construction
- **Eight feet –** Longshore operations

Fortunately, compliance in fall protection is increasing and reaching the board rooms of many corporate executives—in part, because enforcement of mandatory training in fall protection started in May of 2017. If employers are not providing training on fall protection to their employees that are working at height, they can be cited for it.

Many business owners are looking to add fall restraints and engineered lifeline systems to existing overhead crane equipment, and are having it included in the specifications for new crane equipment being installed in their facility. Any operator or maintenance personnel working at heights, or performing service or inspections from a lift, should have some form of fall protection—whether it's a lifeline system engineered into the design of the crane itself, or lanyards or harnesses available for their employees.

Crane walkways can also be designed for higher capacity cranes to provide maintenance personnel with a place to safely tie-off and service or inspect their crane. Walkways can also be designed with kick plates to avoid items falling off the edge onto workers below.

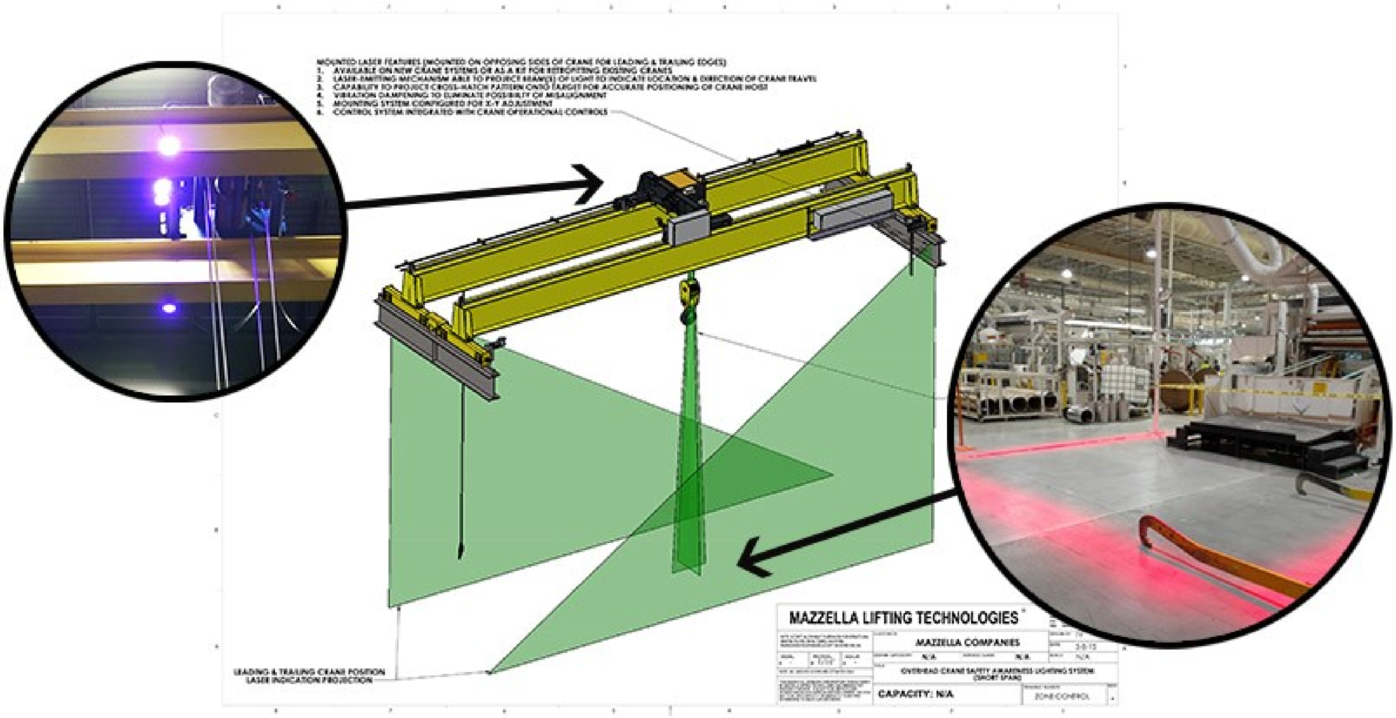
Buzzers, Sirens, and Horns

Per OSHA 1910.179, cranes equipped with radio controls or cab controls are required to have buzzers, horns, or sirens to provide an audible warning to other personnel while the crane or loads are in motion. These can also be added in addition to using a warning light for personnel on the ground who may not be able to see the crane's warning lights.

In addition to the OSHA requirements, you should familiarize yourself with your state and local codes for audible warning device requirements. Some states like Michigan and California require the use of audible warning devices for any crane in motion—regardless of what control method the crane is using.

Warning Lights and Indicator Lights

Warning lights and indicator lights can be built into the design of an overhead crane to provide personnel on the ground with an idea of where the crane bridge is overhead and where the hook will be. These lights are automatically on when the crane equipment is turned on and running—helping to reduce accidents and operator error.



These bright red, blue, or white lights are mounted on the bridge or hoist of the crane and project directly onto the ground using lasers, LED lights, or a combination of both. The warning lights don't take place of audible alarms, but provide an additional visual warning to pedestrian and motorized traffic in the immediate vicinity of the crane. These lights can illuminate an area up to 15 to 20 feet from approaching hooks and crane equipment in operation.

Operators can also use these lights as a point of reference tool to help them position the hoist and hook to make their picks or position a load.

OSHA 29 CFR 1910.179 requires the use of warning lights for any cab-operated overhead crane.

Variable Frequency Drives and Anti-Sway Technologies

With the introduction of variable frequency drives, microprocessors now control all the components of the drive system, and provide smoother acceleration and deceleration curves. This allows for smooth starts, smooth transitions, and smooth stopping which greatly reduces the strain on the gear boxes, couplers, girders, and other essential crane components. This also greatly prolongs the life of the brake system as the microprocessor controls and slows down the motor, while the brakes mostly act as a control to keep the crane from moving.

Also, by eliminating the abrupt starting and stopping of the crane, you get far less load swing because the crane moves in a controlled manner—making it safer for everyone on the floor.

Here are some of the inherent safety features built into most VFD systems:

1. **Safe Torque Off –** A redundant hardware safety circuit that guarantees motor and brake power are removed when an E-STOP switch or safety controller opens the drive input, eliminating the need for external disconnects.
2. **Torque Proving –** On some older systems, the motor is pre-torqued to guarantee that the load can be held before opening the brake.
3. **Load Check –** Continuously checks for hoist overloads and prevents the hoist from lifting when an overload condition is detected.
4. **Brake Checks –** Monitors the opening and closing of a brake to ensure that it is safe and healthy.
5. **Micro-Speed –** Allows the operator to make slow, precise movements.
6. **Electronic Programmable Limit Switches –** Allows slow down and stop limits without physically geared limit switches.

Collision Avoidance Systems

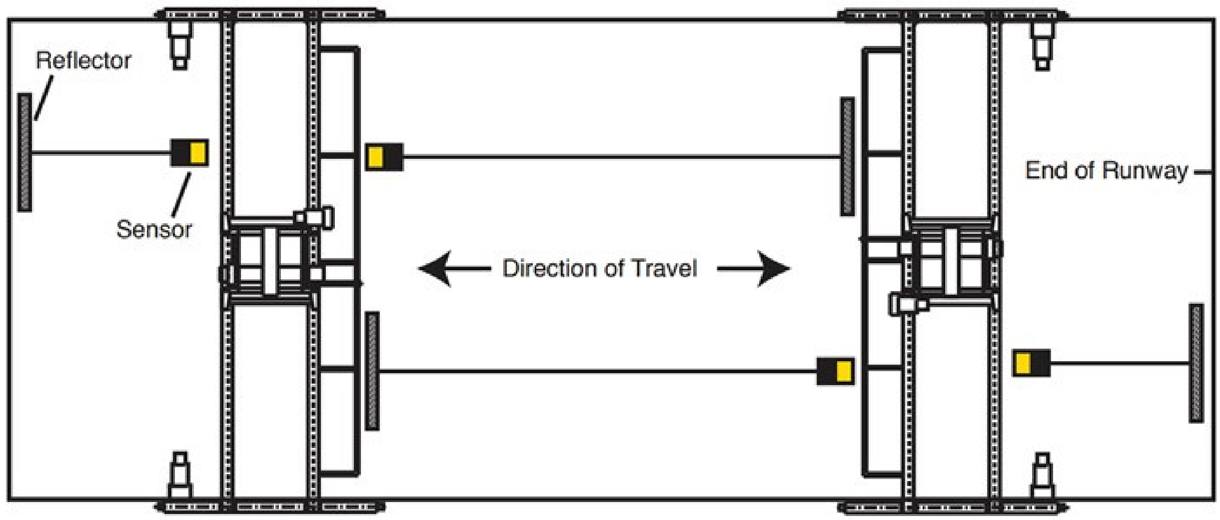
As the demand for workplace safety grows, collision avoidance systems have become popular as an automated way to control the motion of the crane to avoid accidents and collisions. Anti-collision technologies are becoming more common in facilities that are operating multiple cranes on one runway, have multiple runway systems in place, or have cranes operating in areas where there may be other obstacles or obstructions that can block the movement of the crane.

Collision avoidance systems use wired or wireless transmitters that emit radio waves, lasers, LED, or infrared light signals to transmit information to stationary receivers. These receivers process the signal from the transmitting device and use that information to determine the location of the trolley and bridge anywhere in the facility and what obstacles it may encounter. It can then slow or stop the motion of the crane or trolley if it determines there is the possibility for a collision. This helps prevent unintentional contact of the crane or trolley with mechanical end stops and other crane or monorail equipment in operation.

Another benefit of collision avoidance systems is they can be used to help prevent overloading of a runway system that multiple cranes are operating on. Keeping cranes far enough apart, whether they're carrying a load or not, will help prevent undue stress and overloading on certain parts of the runway beams and supports.

Slow Down and Stop Limit Switches

Limit switches can be used for a variety of motion controls on an overhead crane. There can be multiple limit switches used in sequence to slow down and stop the travel of an overhead crane's bridge, hoist, or hook block before it makes hard contact with something that could cause load swing.



As the crane approaches the end of its safe travel limit, an electrical or mechanical switch will trigger and begin to slow down the hoist motion or travel of the bridge. If the hoist or bridge continue to travel, they will activate a stop switch which will immediately stop the motion altogether before it hits an end stop.

There can also be multiple limits set for the lifting and lowering motions of the hoist. When triggered, limit switches on a hoist can manage all of the following:

- Provide slowing and stopping motions to reduce mechanical wear on the hoist
- Control the speed and the height of the lifting or lowering motion to prevent load swing
- Provide a final safeguard to prevent the hoist block from making contact with the floor or the drum, which can cause the load to swing violently and even break the wire rope

Remote Radio Controls

A wireless remote transmitter with a series of buttons or levers is either held by the operator or is clipped onto a harness or belt worn by the operator. The remote transmitter sends a radio signal to a receiver unit mounted on the crane. This unit transforms the signal into electrical energy and passes it on to the intermediate relay unit on the crane, and the appropriate contact is activated to then move the crane up and down the runway, move the hoist or trolley side to side, and raise or lower the hook.

The main advantage of using radio controls for an overhead crane is that it eliminates the dependence on being tethered to the crane itself—either via cab controls or pendant controls. Because the operator doesn't have to be near the load to lift, position, or lower it, radio controls can help protect them from hazards like:

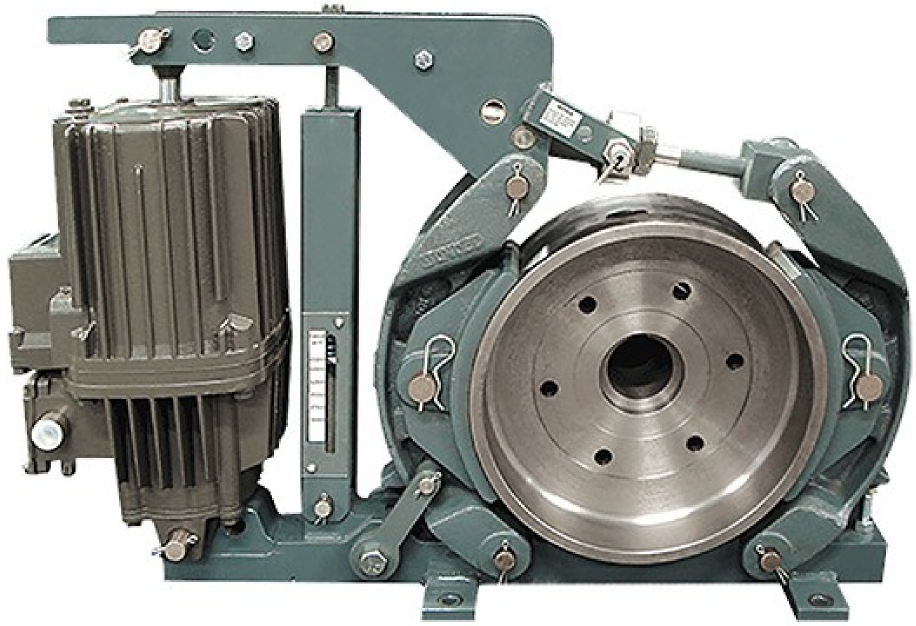
- Vapor, smoke, or chemical exposure
- Radiation
- High heat or hot metals
- High voltage or electric shock
- High humidity

Not only can the operator work on the floor safely away from hazards, but they'll also get a better vantage point to perform the lifts effectively. The operator doesn't necessarily have to walk with the load as it moves down the crane bay, so radio controls help keep the operator away from trip or fall hazards like obstacles on the floor, workers, and other machinery or equipment in operation. They're also ideal for higher duty classes like D, E, or F where the crane runs up and down the runways more often, and at a faster rate.

Productivity can also be improved with better visibility—helping with faster load positioning and damage control as the operator can better judge load and clearance obstacles from the ground.

Brake Slip Detection

If you choose to upgrade your crane's brake system at the same time that you add variable frequency drive controls, you can greatly reduce the wear and tear and maintenance on your brake system. Having a microprocessor control the motor and slow the crane's motion versus using the brakes to slow down the crane, can prolong the life of the brake system.



Overhead cranes with older brake systems can benefit from newer technologies like wear sensors and auto-adjust features. Auto-adjust features make sure the brake is always in proper adjustment, and doesn't require maintenance or service personnel to manually and repeatedly adjust the brakes. This results in equal wear on the brake pads and less wear and tear on the moving components. When the sensors detect anything out of the predetermined variance, they can inform maintenance personnel when brake adjustment is needed.

Monitoring and Diagnostics

Cranes equipped with variable frequency drives or modern-style radio controls have the ability to provide diagnostics and monitoring of overhead crane equipment either on the equipment itself or to users in a remote location.

Operators, and production or maintenance personnel can use a radio or belly box, mobile device, tablet, or workstation computer to view real-time diagnostic data, including:

- Number of lifts and cycles that the drives have made
- Fault codes
- Capacity of lifts
- Maintenance requirements and intervals for individual components
- System amp draw and voltage

Maintenance personnel can monitor the time between recommended maintenance intervals for individual components and also use it as a tool to schedule preventative maintenance to help reduce equipment downtime. For example, by monitoring the predictable preventative maintenance schedule of a crane's hoist, they can help improve the crane's safety by knowing when the hoist has reached the end of its useful life so that they can either rebuild the internal components or replace it with an entirely new unit.

This diagnostic information also helps maintenance personnel troubleshoot problems with overhead crane equipment, and gives others the ability to remotely access the data and troubleshoot for more complex issues or specialized problems.

Another advantage to having a monitoring and diagnostics system is that the crane can alert the operator, safety managers, or other designated personnel if it has been overloaded. An overload occurs when a lift exceeds the crane's rated capacity. Overloads are prohibited according to OSHA and ASME B30 standards, and can stress and damage the crane equipment—putting nearby employees in danger if the crane were to fail.

If the crane is making a lift near, at, or in excess of a calibrated capacity, the drive system can send a read-out to end-users through a variety of methods, including:

- Displaying on the operator's radio control or belly box
- Displaying on pendant stations equipped with an LED read-out
- Displaying on the crane itself, so the operator can read the load the crane is lifting
- Sending it to a remote laptop or workstation

There are also more basic ways to determine if you're overloading a crane's capacity, including installing a load cell sensor that measures the tension force on the hoist's wire rope. When the load exceeds a pre-determined percentage of the rated capacity (usually 100-125%), the overload device temporarily stops the hoist so that the only further action the crane can perform is to lower the load.

Wrapping it up

Ultimately, providing training for your overhead crane operators is the most important thing you can do to make your overhead lifting program safer. A 30-year old crane with single or dual speed drives can be operated just as safely as a brand new crane with variable frequency drives and a collision avoidance system. It doesn't matter how many bells and whistles you add to an overhead crane system if the operators haven't been trained on how to run it safely.

The CMAA Crane Operator's Manual clearly states:

> ***"It is the responsibility of the owner of the Crane to make personnel aware of all federal, state and local rules, codes, and plant safety rules and regulations and instructions, and to make certain operators are properly trained."***

As the owner of the crane equipment, it's up to you to arrange for the following:

- Have your operators trained by a Qualified Person (per ASME and CMAA)
- Determine the frequency of training your operators receive
- Have your overhead crane inspected to OSHA, ASME, and CMAA standards