ACECO American CRANE & EQUIPMENT CORPORATION

How to Choose the Right Crane:

A Crane Buyer's Guide

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Introduction

For many companies, the capital purchase of a crane or lifting system is a major expense of money, time, and resources. Whether you need to upgrade or replace an existing system, buy a new standard model, or custom-engineer an entirely new crane; it is important to understand the equipment that will best suit your needs. To provide a seamless integration, it is best to define the environmental operating conditions to create the highest level of safety, the optimal duty cycle, lifting capacity, and product lifetime.

Tempted to choose cost over quality? Being cost-conscience is a standard operating procedure (SOP) for any successful business. But, a good price does not necessarily mean a good crane. If you choose a manufacturer on price alone, you may end up with equipment that is under-engineered and prone to failure, resulting in increased downtime and significant repair costs. That's why it's important to choose a company with the experience and insight that can deliver the most effective solution possible.

The sheer number of crane types, classes, configurations, applications, and options available can be overwhelming. In the following pages, we will provide information about what you need to know and questions you should be asking your crane vendor. Of course, there is no substitute for speaking with an experienced crane equipment expert. But, understanding your options and what you should be looking for can help to get the process started.

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Factors to Consider

As with any project, the design criteria must begin with the most basic questions:

1. WHAT ARE YOU LIFTING?

Consider how your operation and lifting requirements might change over time. This is fundamental information that can have a major impact down the road.

2. FREQUENCY OF USE (DUTY CYCLE REQUIREMENTS)

How often and at what volume will the crane be used? Plan for the future, if the operation is growing, be sure to consider how added volume will affect the crane design. Usage frequency in regards to cranes is identified by class selection, which we will go into more detail later, the short version is:

Class A: Standby or Infrequent Service
Class B: Light Service
Class C: Moderate Service
Class D: Heavy Service
Class E: Severe Service
Class F: Continuous Severe Service

3. LONGEVITY

How long can the equipment last before maintenence is required? Different crane design standards allow for designs with finite lifetimes.

4. SPEED REQUIREMENTS

Whether you're using a standalone unit or one within a complex manufacturing process, maximizing efficiency is a balance between speed and safety. Rapid and delayed speeds can cause safety hazards. In some cases, speed is also an important factor for productivity.

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5. ENVIRONMENTAL CONDITIONS

In many cases, where you use your crane is as important as how you use it. Conditions such as hazardous environments, excessive dust, heat, and exposure to salt spray; are all are important factors. When determining environmental conditions, consider the day-to-day operations of the shop floor. Typically, dust and dirt is churned up on the shop floor below, along with the added heat of being at a higher elevation. Cranes used outdoors can be exposed to even more adverse conditions. In hazardous applications, equipment must meet industry-specific safety standards.

As previously mentioned, planning is necessary and involves proactively accounting for operating conditions. Some crane vendors customize equipment to the specific application, increasing reliability and service life.

6. PROJECT BUDGET

Cost is always one of the most contentious issues. While operation teams often focus on the purchase of cranes with added features, finance departments attempt to preserve the company's budget.

Looking for the best deal, as opposed to the best crane, is a slippery slope. Though some crane manufacturers will offer what seems like the best price, their equipment may not be engineered to meet the application's requirements efficiently. A crane that is appropriately configured and designed for all operational factors, including longevity, is properly engineered. Although ROI may take longer, the system will also operate for longer, have fewer operational issues, less downtime, and provide better safety.

In addition to the overall design and equipment reliability, there are other important cost considerations. these include installation, the availability of spare parts, maintenance agreements, and the responsiveness of the contracted field service team. All of these components should be added together in order to get an accurate estimate of what the project will cost. If your budget does not get the crane that you need, you may end up with a crane with limited capabilities that costs more throughout its lifetime.

Crane Service Classifications

Modern cranes are used in such a wide array of applications and with an almost unlimited combination of configurations and features, categorization is essential to maintain continuity within the industry. Fortunately, the Crane Manufacturers Association of America (CMAA) developed a detailed classification system over sixty years ago. The CMAA can trace its roots back to 1927, and is currently comprised of America's top 30 crane manufacturers, including American Crane & Equipment Corporation. In addition to the crane service classification system, the CMAA also maintains a set of specifications and Buyer's guides that drive the industry, including:

CMAA Specification #70 for Top Running Bridge & Gantry Type Multiple Girder Electric Overhead Traveling Cranes

CMAA Specification #74 for Top Running & Under Running Single Girder Electric Traveling Cranes Utilizing Under Running Trolley Hoist

CMAA Standards and Guideline #78 for Professional Services Performed on Overhead and Traveling Cranes and Associated Hoisting Equipment

CMAA Specification #79 for Crane Operator's Manual

These standards and classifications are at the core of crane design and important tools for crane manufacturers, users, and Buyers alike. The CMAA crane service classification system that underpins these standards is broken up into six classes. The crane service classification is based on the load spectrum reflecting the actual service conditions as closely as possible. For more information regarding load spectrum and determination of crane classifications, please refer to the CMAA specifications. Below are general definitions of the crane classifications:

Class A: Standby or Infrequent Service

This service class covers cranes which may be used in installations such as power houses, public utilities, turbine rooms, motor rooms and transformer stations where precise handling of equipment at slow speeds with long, idle periods between lifts are required. Capacity loads may be handled for initial installation of equipment and for infrequent maintenance.

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Class B: Light Service

This service covers cranes which may be used in repair shops, light assembly operations, service buildings, light warehousing, etc. where service requirements are light and the speed is slow. Loads may vary from no load to occasional full rated loads with two to five lifts per hour, averaging ten feet per lift.

Class C: Moderate Service

This service covers cranes which may be used in machine shops or paper mill machine rooms, etc., where service requirements are moderate. In this type of service the crane will handle loads which average 50 percent of the rated capacity with 5 to 10 lifts per hour, averaging 15 feet, not over 50 percent of the lift at rated capacity.

Class D: Heavy Service

This service covers cranes which may be used in heavy machine shops, foundries, fabricating plants, steel warehouses, container yards, lumber mills, etc., and standard duty bucket and magnet operations where heavy duty production is required. In this type of service, loads approaching 50 percent of the rated capacity will be handled constantly during the working period. High speeds are desirable for this type of service with 10 to 20 lifts per hour averaging 15 feet, not over 65 percent of the lifts at rated capacity.

Class E: Severe Service

This type of service requires a crane capable of handling loads approaching a rated capacity throughout its life. Applications may include magnet, bucket, magnet/bucket combination cranes for scrap yards, cement mills, lumber mills, fertilizer plants, container handling, etc., with twenty or more lifts per hour at or near the rated capacity.

Class F: Continuous Severe Service

This type of service requires a crane capable of handling loads approaching rated capacity continuously under severe service conditions throughout its life. Applications may include custom designed specialty cranes essential to performing the critical work tasks affecting the total production facility. These cranes must provide the highest reliability with special attention to ease of maintenance features.

Types of Cranes

OVERHEAD CRANES

Overhead cranes represent the largest group of crane types. Also, known as Bridge Cranes, their basic design consists of two runways mounted in parallel, with a single or multiple girder bridge that traverses the length.

- **Single Girder Cranes** consists of a single girder or beam that acts as the bridge. The girder traverses the runway with a trolley/hoist that traverses the girder, providing the horizontal motion.

- **Multiple Girder Cranes** are similar to single girder cranes but with multiple girders, typically two.Multiple girder cranes have several advantages over single girder designs. With the multiple girders,they can accommodate higher capacities and there is a hook clearance advantage, typically around 18-36 inches.

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OTHER CRANE TYPES:

- **Gantry Cranes** are similar in concept to overhead cranes but, rather than a runway system that is the height of the bridge, it is located on the ground supported by legs that run on a fixed rail system. Depending on the design, it can include two or more sets of legs. Gantry cranes are designed for application where the standard overhead crane runway system is not practical. This includes applications that require very long runways, where the space that the runway would require cannot be sacrificed, or in structures that cannot be economically modified to accommodate an overhead runway. In smaller applications, the runway may even be substituted with wheels, making it a very flexible option for smaller low use low capacity scenarios.

- **Jib Cranes** consist of a mast and cantilevered boom also known as the Jib. Though the design places limits on capacity, the ability to rotate up to 360° in some configurations makes it a good choice for limited access applications. An I-beam Jib crane utilizes an I-beam as the Jib. This means that a trolley/hoist can be used, in a similar fashion as a girder crane. I-beam Jib cranes bring much more design and cost flexibility when higher capacity is required.

- **Stacker Cranes** are basically double girder cranes with a fork truck mast and forks in place of the trolley/hoist assembly mounted between the girders. These systems are designed for warehouse applications that require precise control. To adequately meet this need, they must include a number of safety features including twin hoist brakes, fall catching, overweight monitoring, and dead man switches. These are all necessary when moving materials onto rigid shelving that by nature requires extra safety considerations.

Note: Stacker, Jib, and Gantry Cranes can all be single or multiple girder cranes.

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Hoists and Material Handling Equipment

Hoists: A hoist is a device used for lifting or lowering a load by means of a drum or lift-wheel around which a rope or chain wraps. It may be manually operated, electrically or pneumatically driven and may use chain, fiber, or wire rope as its lifting medium. The load is attached to the hoist by means of a lifting hook. A hoist may also be part of a crane.

- **Below the Hook** refers to equipment used to aid in lifting; this includes lift and spreader beams, lower blocks, and grapples. Lift beams are fixed width lifting aids, with permanently mounted lifting lug(s). They are typically configured with a single lug to receive the lifting hook and two lugs for sling attachment. A spreader beam is very similar to a lift beam but, rather than having a lug for the lifting hook, they are configured with two lugs designed for chain or wire rope rigging to the lifting hook. Grapples are available in a wide range of styles and configurations to lift bulk and oddly shaped materials, this includes anything from logs and stones to Jersey barriers.

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Why Choose the American Crane Team?

As this eBook highlights, selecting the right crane for your application can be challenging. American Crane's team of experts understands cranes and has the capabilities to engineer cranes that are custom-built for your needs.

At American Crane, we specialize in providing the highest value and most innovative products in the industry. Our reputation is built on delivering cranes that are made to last and engineered to provide superior operational efficiency. We make sure our customers get the most value for the cost they pay, as our crane systems outlast anything available in the industry today. In fact, our first crane was put into service over 40 years ago and is still in operation to this day.

WHAT YOU GET WHEN YOU WORK WITH AN INDUSTRY LEADER

- A typical project engagement with American Crane starts with the assignment of a dedicated team. Our experts research your project and ask questions that will help them define your project's requirements to deliver the best value.
- Once our project proposal is accepted, our designated project manager kickstarts the crane development. Our PMs are responsive and have years of experience with virtually every type of crane and a plethora of applications. The PM is also the main point of contact between the customer and the rest of the American Crane team; this greatly simplifies the process and ensures that information will flow smoothly in both directions.
- Our engineering staff is on equal footing with our PMs in experience and system understanding. Our designs are complete and include the engineering of every aspect of your crane as well as the installation. We also include electrical drawings for special compliance with customer specification or integration with pre-existing systems.

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- The Quality Assurance Manager is also intimately involved in both the engineering and fabrication. The QA team will provide all applicable documentation, and ensure that the equipment performs as advertised with uncompromising reliability. During the manufacturing process, the QA Manager is on the floor ensuring that the design is being built to spec. Before installation, comprehensive testing is performed which includes operational and load tests, and verification that all safety requirements are fully OSHA compliant.
- When your crane is ready to go out the door, it will be accompanied by a seasoned Service Team and Service Supervisor. They perform and oversee the entire installation and verify operation once erected as well as complete on-site load testing and additional OSHA compliance verification. Once the green light is given, they can provide operational and maintenence training for your staff with a focus on safety. Our Service Team is also available to provide periodic inspections either on a monthly or annual basis.

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Glossary

Anti-Collision
An electrical means of keeping two or more cranes from contacting each other.

Anti-Skewing
Capability of the crane design to maintain squareness with relation to the runway structure.

Auxiliary Hoist
A supplemental hoisting unit usually designed to handle lighter loads at a higher speed than the main host.

Bogie
A type of short end truck, used to allow greater distribution of crane wheel loads by placing multiple wheels at each corner of the crane.

Box Section
The rectangular cross section of girders, trucks or other members, comprised of two rolled steel side plates, a top plate, and a bottom plate.

Bridge
The part of an overhead crane consisting of girders, trucks, end ties, walkway, and the drive mechanism which carries the trolley and travels in a direction parallel to the runway.

Bridge Girder
The main horizontal structural member(s) of the crane bridge supported by the end trucks.

Camber
The slight convex or arched shape given to girders to compensate partially for deflection due to hook load and weight of the crane.

Capacity
The maximum rated load for which a crane is designed to handle (typically rated in tons).

Cask Handling Crane
A crane specifically designed to handle a cask loaded with spent nuclear fuel. A crane of this type is typically provided with single failure proof features.

Clearance
The minimum distance from the extremity of a crane to the nearest obstruction.

C.M.A.A.
Crane Manufacturers Association of America, Inc. (formerly EOCI—Electric Overhead Crane Institute).

Collectors
Contacting devices for collecting current from the runway or bridge conductors. The main line collectors are mounted on the bridge to transmit current from the runway conductors. The trolley collectors are mounted on the trolley to transmit current from the bridge conductors.

Critical Load
Any lifted load whose uncontrolled movement or release could adversely affect any safety-related system when such a system is required for unit safety. A crane used for lifting a critical load shall be designed with single failure proof features so that any credible failure of a single component will not result in the loss of capability to stop or hold the load.

Double Girder Crane
A crane that runs on two bridge girders mounted between and supported by end trucks at each runway.

Drive Girder
The girder on which the bridge drive machinery is mounted.

End Approach
The minimum horizontal distance, between the crane hook(s) and a referent point in a building or supporting structure.

End Tie
A structural member other than the end truck that connects the ends of the girders to maintain the squareness of the bridge.

End Truck
The unit consisting of a truck frame, wheels, bearings, axles, etc., which supports the bridge girders.

Explosion Proof Crane
A crane designed using specially constructed electrical components to prevent the ignition of hazardous materials in the surrounding atmosphere by containing any explosions that may occur within the components.

Festooning
A method for providing power to a hoist traveling along a beam.

Flux Vector Drive
A special type of adjustable frequency motor control, utilizing an incremental encoder to constantly monitor the speed and direction of the motor shaft. This “closed-loop” system allows the control to know what the motor is doing at all times. Flux vector control provides a wide range of speed and reliability in hoisting applications where no mechanical load brake is utilized.

Gauge
The horizontal distance between the centerlines of the rails that support the trolley on a double girder bridge.

Gantry Crane
A crane that is similar to an overhead crane except that the bridge used for carrying the trolley(s) is rigidly supported on two or more legs and running on fixed rails or other runways.

Gear Reducer
A device to convert high-speed motor shaft rotation to usable output shaft speed for a hoist, trolley, or bridge motion.

Grapple
A “job-specific” load handling device, designed to pick up bulk material, containers, barrels or drums. Actuation can be mechanical, electrical or hydraulic.

Hoist
A mechanism used for lifting and lowering a load.

Holding Brake
A brake that automatically prevents motion when the power is off.

Hook Approach
The minimum horizontal distance between the center of the runway rail and the hook (see End Approach).

Jib Crane
A crane design whereby the girder (commonly called the boom) is fixed at one end, allowing the opposite end to cantilever. The fixed end generally is hinged to allow rotation.

Lift
Maximum safe vertical distance through which the hook, magnet, or bucket can move.

Load Block
The assembly of the hook, swivel, bearing, sheaves, pins, and frame suspended by the hoisting ropes.

Load Cycle
One lift cycle with load plus one lift cycle without load.

Overhead Crane
A crane with a moveable bridge carrying a moveable or fixed hoisting mechanism and traveling on an overhead fixed runway structure.

Rated Load
The maximum load that the crane is designed to handle safely.

Reeving
Terminology used to describe the path of the hoist wire rope as it pays off the hoist drum and wraps around the various upper and lower sheaves.

Regenerative Braking
A method of controlling speed in which electrical energy generated by the motor from an overhauling load is fed back into the power system.

Runway
The rails, beams, brackets, and framework on which the crane operates.

Sheave
A grooved wheel or pulley used with a rope or chain to alter the direction and point of application of a pulling force.

Single Girder Crane
A crane that travels on a single bridge girder.

Single Failure Proof
Safety features included in the crane design to ensure that any credible failure of a single component will not result in loss of control of the load.

Span
The horizontal distance from center-to-center of the runway rails.

Takt Time
The rate at which products should be produced to meet customer demand.

Top Running Crane
An overhead traveling crane with the end trucks supported on rails and attached to the top of the runway support beams.

Trolley
The unit carrying the hoisting mechanism that travels along the bridge rails.

Trolley Frame
The basic structure of the trolley where the hoisting and traversing mechanisms are mounted.

Two Blocking
A condition under which the load block or load that is suspended from the hook, becomes jammed against the crane structure, preventing further winding of the hoist drum.

Under Running Crane
A crane that has a movable bridge running on the lower flanges of a fixed overhead runway structure with a movable or fixed hoisting system.

Variable Frequency Drive (VFD)
A motor controller designed to convert fixed frequency AC power to adjustable frequency power for AC motor speed control. The system is used in conjunction with a squirrel cage motor to control speed over a relatively-wide, constant torque range by maintaining a constant voltage / frequency ratio. This type of control “leashes” the in-rush current to deliver startup power to the motor as efficiently as possible, providing a soft-start feature thereby minimizing load swing.

Web Plate
The vertical plate connecting the upper and lower flanges of a girder.

Wheel Load
The load without vertical inertia force on any wheel with the trolley and lifted load (rated capacity) positioned on the bridge to give maximum loading.

Wheelbase
The distance from center-to-center of the wheels, as measured in the direction running parallel with the support rail.

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