ALMAC
INDUSTRIAL SYSTEMS

Almac Whitepaper

Moving extreme loads: **planning for profitability**

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Table of Contents

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Moving extreme loads: planning for profitability

Finding the safest, most efficient way to get your product or materials from Point A to Point B is a crucial part of profitable operations. When you're moving a load that involves special characteristics such as extreme weight, high temperatures or clean-room requirements, consulting a materials handling expert will ensure you find the smartest solution, no matter how well you know your product.

There are two major benefits to planning smart:

1. Resource savings.

This is a pretty obvious benefit. By doing it right the first time, you won't have to worry about having to spend more to fix the problem after the fact – or completely rebuild your conveyor system. Adequate planning will ensure you identify all the custom requirements for your unique load in advance, saving time, money, and eliminating the need for duplicated efforts.

2. Greater output.

A custom-designed conveyor system can address specific environmental and load characteristics to maximize efficiency. As the demand for shorter production times and greater output volume skyrockets, your high-efficiency system will be able to handle greater volume and enhance your profitability.

The risks of NOT planning are significant; if you have wet environment, you need to factor in conveyor parts that won't rust. If you're dealing with heavy loads of steel, building your system with anything less than ultra-durable parts will result in failure. This paper focuses on key considerations for successfully moving ten types of extreme materials, illustrating potential pitfalls and solutions and helping companies streamline the experience of selecting and planning for a conveyor project.

Initial planning: Define load and production rate

Start off by identifying the following factors:

- The nature of the load.
- The dimensions and weight of the load.
- What surface of the load will be touching the conveyor. For example, it's possible that the underside of the load is textured in a way that will not allow it to run on rollers, thereby making a chain conveyor the best solution.
- The ideal rate of movement (how fast items can efficiently move through the conveyor system, whether it requires stop-start capabilities for assembly purposes, how fast items accumulate, how well the materials deal with back pressure, etc.). For example, for systems that accumulate product, it's important to determine if products can touch during accumulation. Can they handle the increased pressure caused by gathering loads, or do they require zero pressure? And most importantly, can operators safely interface with the product on the conveyor?

All of these variables must be ironed out before building your system. Customers often come to Almac with a specific plan for what kind of system they want, with money often being the most decisive factor. However, building the wrong conveyor just because it comes with a lower price tag will only end up costing more in the end; the right solution is the one that will work best with your materials and your needs.

In action: How poor planning can dramatically increase costs

Here's an example of a situation in which a lack of professional planning around a specialized load resulted in lost revenue. Almac had a potential client who was looking for an inclined belt conveyor to move their product. Their choice was based on the fact that this was the cheapest option for their requirements, and they hadn't explored other possibilities. They needed to move containers that were 72" long and 32" tall and 48" wide, each containing a heavy, bulky, awkwardly shaped garden tractor mounted on a wooden platform for forklift transportation. Their goal was to take the containers from a level area and up a 30˚ incline to a second level for loading into a truck.

The problem was that the company had not considered what would happen to the load as it transitioned from level to incline, and then back to level. Would the wooden platform support the full weight of the tractor as it bridged the transition, or would it crack and break?

Almac engineers realized that a level-to-incline-to-level belt conveyor was not the correct solution. A vertical elevator or a reciprocal conveyor would have allowed the product to be moved straight up and be driven off, rather than trying to change angles while climbing up a hill.

Ultimately, the contract was awarded to another company that was willing to build the solution the client wanted, and the result was predictable. The inadequate system caused the wooden platforms to break, which led to significant damage – and losses that could have been avoided with a carefully considered solution.

However knowledgeable companies are about the products they make, they may not know exactly how to move those products in a safe and efficient way. In smaller organizations where the maintenance manager or production supervisor (as opposed to a trained engineer) is making decisions, important subtleties can easily get overlooked.

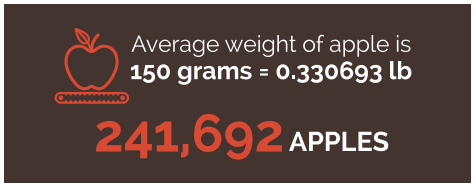
Your short guide to extreme loads

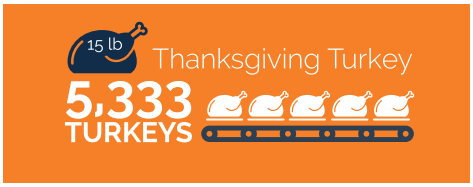
Almac clients deal with a variety of extreme loads; below are a few examples of the challenges they face and the potential solutions Almac has built to meet those challenges:

1. Extreme weight

When you're moving incredibly heavy products such as cement boards or plate steel and bars, you're looking at loads of up to 80,000 lb. Major consideration must be given to the support structure, since the equipment will likely be interfacing with cranes or forklifts that will introduce shock loading to the structure. In some cases you will also be weighing loads and incorporating load cells, which also require special consideration.

Almac created a specialized materials handling solution for an automatic storage and retrieval system that used a magnetic overhead crane to move bundles of structural steel tubing. These loads were extreme both in weight and in size, with the longest being 60' long and 24" square. Almac was challenged to create a system that would precisely position and square the load so a crane could accurately pick it up for automated storage and retrieval. Loads were stacked up to nine bundles high, and with items of this extreme size and weight, being off by even a couple of centimeters could be disastrous.



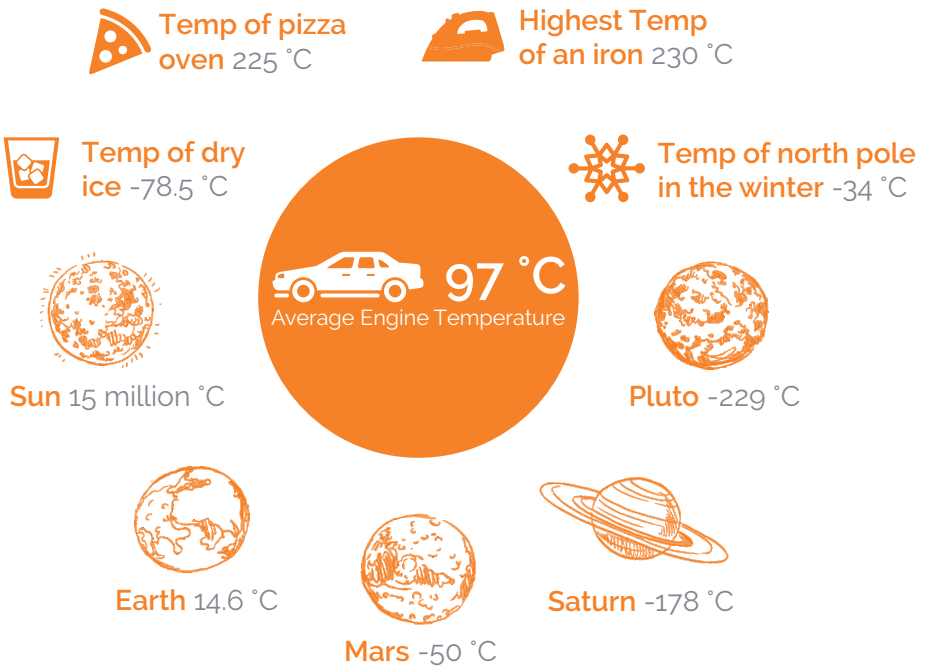


Almac also designed and manufactured a materials handling solution for HerrVoss for materials entering a steel processing line. The system was designed to infeed coils of steel weighing up to 80,000 lbs. These coils were carried to a transfer car, then delivered to the HerrVoss uncoiler. Handling this heavy load required extensive work and calculations to ensure the structures were strong enough to take both the load and the impact as the coils were lowered onto the system via crane. After the coils were delivered and processed through the new HerrVoss equipment, the system had to accommodate handling of the flattened and cut plates.

After flattening and cutting, steel pieces 8' x 25' up to 1-1/4" thick were drop-stacked from an 8' height onto a specially-designed Almac roller conveyor. These steel stacks created loads of up to 80,000 lb. The biggest challenge was to engineer a frame sturdy enough to support the load with only two hydraulic hoist support positions.

Almac's systems addressed these challenges by increasing the size of the conveyor elements to support the load. Through structural analysis, a huge substructure was designed to hold the load under impact conditions with minimal deflection. The system also incorporated engineered rollers, wider shafts, larger bearings, and significantly more steel. Not only did the conveyor structure have to lift the 80,000 lb. loads, it had to support the 30,000 lb. heft of the conveyor itself. Almac supplied HerrVoss with a total of three conveyors for this system. The first two drove the load through the stacker and then delivered it to the scale and packaging conveyor.

2. Extreme temperatures



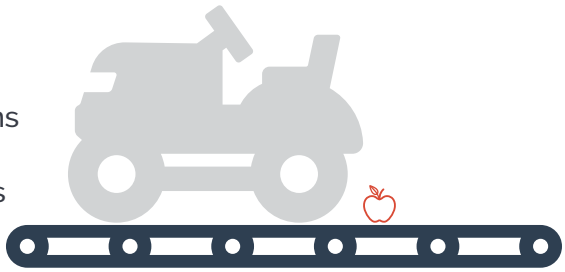
When loads are moved through extreme heat or cold environments, specialty materials handling systems are integral to the success of the production line. Fiery or high-temperature environments can only use chain or roller conveyor systems because rubber or plastic belt conveyors will melt. These settings require graphite bearings, designed specifically to withstand heat. Unlike regular bearings, they don't require grease for lubrication. Most greases are only operational up to about 120˚C / 248˚F; at higher temperatures, they will cook, and dramatically shorten the life of the bearing. Another option for chain conveyors is drip-feeding heat-resistant lubricant through a central lubrication system. A liquid quench solution of water and oil is another alternative, depending on the context.

Another client solution was a specialized heat-resistant conveyor system that staged automotive engine heads so a robot could pick them up from the conveyor, place them in the furnace, then remove them once they had reached a specific temperature. With the furnaces reaching 500˚C / 1200˚F, the equipment had to stand up to some very extreme temperatures. The Almac solution included steel-chain tabletop conveyors, high-temperature bearings, and surface finishes such as stainless steel or plated material, all of which were designed to withstand extreme-heat bombardment without failure. Electrical and pneumatic hoses were carefully selected and shielded from the heat as well.

Extreme cold environments such as freezers also call for specialty belts that can withstand very low temperatures, as well as specialty bearings, gearboxes and controls. Graphite bearings are the optimal solution for extreme cold settings because they don't require grease. Although specialty greases are available for temperatures as low as -40˚C, anything below that will freeze.

3. Extreme size

Extreme size loads can be tiny or enormous; both have special requirements. Miniature loads tend to be materials such as nuts and bolts or other small parts, or automatic assembly applications handling systems such as capping lines, which require conveyor belts to ensure that nothing is lost through the gaps in the chains or rollers. Small items may also call for a basket system to contain the pieces.



Extra-large loads can include heavy, oversized items such as steel and automotive products, which are best moved using rollers. Rollers allow the weight and frictional force to spread out over a larger area than is possible with a belt or chain. A conveyor in a car wash is a great example; it drags the weight of multiple cars through the washing system, and has to be build to withstand extreme size and weight, as well as the corrosive elements of water and detergent.

4. Electrostatic

Electrostatic environments such as poly conversions and plastic conversions (e.g garbage bag manufacturing) can cause severe shocks and require special attention to ensure workplace safety. Using non-metal conveyors is vital to preventing sparks caused by friction. Providing appropriate grounding straps and precautions to prevent the buildup of static also reduces risk. For plastic loads, rubber conveyors are preferred; using a plastic belt with a plastic load only builds static electricity as the items rub together.

Specialty anti-static parts containing materials such as carbon can be used to safely discharge the static to the floor. Another not so common option for electrostatic loads and environments is the use of magnets or air to move materials; not having them touching a metal or plastic conveyor eliminates the risk of static buildup.

5. Ultra-sanitary wash down and chemical environments

In the food, pharmaceutical and chemical industries, special considerations must be put in place for environments with extreme sanitation measures, as caustic cleaning will quickly destroy a standard conveyor system.

Systems under constant moisture or chemical bombardment require non-rusting rollers, chains and bearings that are made of stainless steel or specialty plastics and designed to stand up to thorough wash-down and caustic spills. Conveyors must also be designed to eliminate areas that can trap dirt or bacteria. In some circumstances, food-grade, non-toxic lubricants must be used to ensure the end product is safe for consumption.

For some rollers, a drainage system must be engineered to allow water to flow out. In most cases, this requires stainless steel or plastic bearings that are sealed to keep lubrication from being washed away. Conveyors must be plated or made of stainless steel to withstand moisture, and construction must resist the erosion of daily wash-down cycles.

In addition, electrical components such as fittings, cables and junction boxes must be rated to withstand moisture and the stress of pressurized water. Electrical equipment in a conveyor system that undergoes wash-downs or total submersion must adhere to strict guidelines provided by the National Electrical Manufacturers Association (NEMA) to prevent accidents associated with water in an electrical environment.

A good example of a wash-down environment is a meat packing plant, where the equipment must undergo sterilization on a daily basis. A well-known food manufacturer recently made headlines when their meats were found to be contaminated with bacteria, a problem that stemmed from a processing system that simply was not sterile enough. Meat particles stayed in the conveyor and bred bacteria, which was then passed on to fresh product. A properly specified materials handling system and cleaning process would have taken these microscopic particles into account, and the design would have incorporated elements to help contamination.

6. Abrasive

Abrasive or sharp loads may require rubber and plastic conveyor belts to avoid punctures or to keep objects from getting stuck in the chains and rollers. Carboxylated, heavy-duty polyethylene belts offer heightened cut- and oil-resistance and have a longer life for abrasive materials handling. Conveyor belt sides and guiderails must also be resistant to extreme wear and tear.

Almac constructed a specialized system for Cascade Canada, a producer of forklift forks. These items are highly abrasive, and the company was having a problem with them wearing out roller surfaces very quickly. The solution was to provide extra-large, core-hardened surface rollers to withstand the abrasion.

7 . Explosive

In an explosive environment, a single spark can destroy an entire building and everyone in it. One example of an extremely explosive environment is a flour mill. Because of the high-static atmosphere, a spark could instantly ignite all the flour in the air, causing an explosion. Another example is a petroleum plant with fumes in the air. One spark would also light up those fumes in a second.

Preventing accidents in an explosive setting means preventing sparks. And that requires careful planning with explosion-proof design. Every piece of equipment that might cause a spark must be completely contained, so if a relay fails and there's an electrical flash, it will not get into the atmosphere.

The entire conveyor system and all of its electrical components must be fully grounded and all parts of the system must be labeled as "Intrinsically Safe" and sealed to prevent any sparks from reaching the explosive load or affecting an explosive atmosphere. These conveyor systems must also adhere to strict NEMA guidelines.

8. Nuclear

Rubber and plastics break down quickly in radioactive environments such as some medical materials manufacturing. Therefore, steel, aluminum or brass rollers and chains are a much better option than basic conveyor belt systems, which would need constant replacement. Only graphite bearings or those using very specific lubricants such as TSI301 can be used.

There is no one-size-fits-all solution for materials handling, especially when you are dealing with extreme loads. The load characteristics and environments discussed in this paper only represent a fraction of the types of situations companies face every day. To ensure proper handling, materials with special characteristics require customized solutions tailored to load type and environment. If you are looking for a materials handling system for your company, it is vital to find out everything you can about the most up-to-date solutions available – and to start your planning early. A knowledgeable, creative engineer and materials handling manufacturer are your keys to building an efficient, safe, durable conveyor system.