

Electronic Force Control™

Information Based Clamp Force Control
For Intelligent Warehousing

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Electronic Force Control™

As part of its Smart Clamp Technology™ product line, Cascade Corporation has designed a new clamp force control system which applies the customer specified clamp force automatically, accurately and specifically to each product in the warehouse. This 'product specific' system automates clamp force selection, improves lift truck driver productivity, and eliminates damage caused by slippage or excessive clamp force. The new technology, called Electronic Force Control (EFC™), is a revolutionary; information based clamping system that takes the guesswork and costly errors out of clamp operation.

The Case for Information Based Clamping System

The warehouse industry has evolved to be very productive at moving millions of packages of all sizes and shapes. One of the more economical and efficient means of moving these loads is with a clamping device commonly referred to as a carton clamp. This method of handling does not require a pallet to support the load. Pallets have their drawbacks in terms of initial investment, maintenance and transportation weight. The use of a carton clamp for storing and moving product without pallets is more than 30 years old and its benefits are well documented. The white goods industry also uses the carton clamp as a means to efficiently move product without a pallet which results in the benefit of maximizing volumetric efficiencies when handling this type product. Because most applications using a carton clamp attachment involve a wide variety of product, it is necessary that the clamp and lift truck be set up to accommodate the wide spectrum of load types. Clamp force control is a critical element to efforts aimed at minimizing cost associated with product damage which decreases customer satisfaction. The warehouse industry is challenged with finding ways to consistently apply the appropriate clamp force on various types of loads and imparting that knowledge to drivers.

The challenge of product variety and proper clamp force

The typical warehouse, moving today's consumer goods, is composed of unit loads that are highly diverse in product type, load weight, and clamp-ability. Package damage due to over-clamping is a primary complaint by both producers and consumers. Too little clamp force and the load drops. Too much clamp force and the load is damaged. In an effort to produce the most cost effective packaging for shipping purposes, the industry has reduced the material content of the packaging, resulting in a structure that demands a defined amount of clamp force to assure damage free handling. Use of excessively strong packaging for light loads is a waste. As the cost of corrugated box material increases, the opportunity for cost savings becomes even more important. This is also the case for other specialized packaging using material such as Styrofoam. Millions of dollars are spent every year either repairing damaged loads or sending new products to the customer after hidden damage is discovered at the final destination. If you factor in the cost of returned goods due to hidden damage, it quickly becomes apparent that preventing damage with precise clamp force is the best course of action.

Lift Truck/Carton Clamp driver and clamp force.

Historically, many hydraulic and mechanical devices have been used to control clamp force. Electro-mechanical systems can have one or three pressure relief settings that change and control clamp force. They all have a common challenge for the driver; 1) determining what is the optimal clamp force to handle all products if only one pressure relief setting is available, or 2) which of the three pressure relief settings should be used at any one time to handle a wide variety of products? A typical small warehouse may have as many as 500 different products to handle, whereas a larger scale warehouse may easily have 3500 different products. Given the large number of product types being handled, the driver is always estimating the best clamp force to use. Much of the time the guess is on the conservative side to assure the load is not dropped. This practice results in over clamping and damaged loads. This issue is exacerbated with inexperienced drivers.

Fatigue life of packaging

The industry has studied the design of packaging and like any other structure; packaging has a finite number of times it can be clamped without a rapid decrease in structural integrity. Further, when clamped on the high end of the clamp-ability range, the number of times a package can be clamped without damage decreases. This translates into damage downstream in the supply chain where damage free handling is just as important as when product ships fresh from the factory.

Electronic Force Control™

With today's sophisticated level of information management in the warehouse environment, it is now conceivable to capture the specific product knowledge necessary to determine the proper clamp force for every load handled. No more guessing how much clamp force is required. Information based clamp force management that works in conjunction with warehouse information management systems is now available. All that is necessary is to determine the product being handled and the specific clamp force that the unit load requires. EFC works in conjunction with any of the more popular automatic data capture (ADC) methods including:

- 1. Bar code scanning**
- 2. RFID**
- 3. WMS Inventory control data transfer**

The EFC system accurately and automatically sets the ideal clamp force for each load based on pre-terminated and tested values stored in either 1) the EFC on-board databox or 2) the WMS database. Using the product ID, the EFC system sets the clamp force to the proper value. EFC is more precise than even the most experienced lift truck operator. Observation has shown that an experienced clamp operator, with a typical hydraulic system, can miss the target clamp force by as much as 100% for a given product. EFC enables any lift truck driver, at any experience level, to clamp a load with the optimal clamp force each and every time.

How The EFC System Works

EFC is a computer controlled, information based, clamp force system that controls lift truck hydraulic pressure to provide the proper clamp force on every unit load handled. The EFC system continuously monitors the electronic input sources for the product ID or the clamp force that is required for the load to be handled. When the driver actuates the clamping circuit, the EFC system sets the proper clamp force based on the information the system has gathered. In the event that product information is not available, an override system is readily available at the push of a button to allow the driver to clamp the load manually.

EFC Using a Mobile Cascade Database

The EFC system can be configured to work separately or in parallel with a WMS. When set up as a stand alone system, a mobile databox is provided that the user can easily load with the product ID and the corresponding clamp force for each product. This is accomplished with a simple excel spreadsheet that is resident on a laptop or desktop computer. Software automatically loads the data into the Cascade databox. When the warehouse product mix changes, new data is updated in the spreadsheet and subsequently the mobile database so that new clamp force data is always available for the driver.

When configured with the databox, the EFC system is designed to accept the product ID transmitted from a bar code or RFID scan. The database system automatically looks up the clamp force for any product which had been previously loaded via the excel spreadsheet. The databox sends the proper clamp force data to the EFC computer which then activates the final hydraulic pressure required to pick up a load without damage. Each time a new scan takes place, the required clamp force is immediately available for the driver to pick the scanned load.

EFC Using The WMS Database

The EFC system can also be configured to interface with a warehouse management system. The WMS can be modified to add clamp force data that corresponds to each product ID. The benefit of this method of data storage is that the data can be maintained and distributed centrally by the IT department.

Fundamentally, the system works the same as when using the Cascade databox except that the bar code scanner interfaces with the WMS database which transmits the proper clamp force value to the EFC system. Alternately, the WMS can be designed so that every time a warehouse pick or move command is sent to the lift truck driver via the mobile computer, the clamp force is included in the data string. The EFC system monitors this transmission and immediately resets the clamp force based on the new data received.

Benefits of maintaining clamp force data centrally and adapting locally

The majority of warehouse operations don't have a method to share clamp force data between them that would ensure damage free handling of products in all locations. This results in inconsistent material handling methods when handling the same product. This is also true of most shippers throughout the supply chain. Each location is left with the duty of determining what clamp force to use on a product and also finding a way to assure that the clamp force does not exceed the manufacturers recommended value.

With EFC, the clamp force data can be easily organized as follows:

1. The clamp force data can be established by the manufacturer of the product and entered into a database. During this process, consideration is given to the packaging design and empirical testing to arrive at the optimum clamp force value.
2. In applications where this data is not available from the manufacturer, it can be easily established and recorded by noting the clamp force being successfully used in the current operation.
3. Once the database is established, the data is then easily maintained and adjusted when necessary. Centrally established data can be modified on a regional basis by applying a change factor based on things such as humidity, warehouse floor conditions or other conditions that might dictate a slight change in clamp force.
4. The clamp force data is easily distributed when change is found necessary. A complete new set of clamp force data can be sent to a local site, or individual changes can be distributed to the local database. In larger and more sophisticated operations data can be maintained centrally and accessed remotely by the local warehouse. The benefit of this is no local involvement in establishing or maintaining the proper clamp force.

Flexibility in Operation

The EFC system is very flexible. Its software has been designed to interact with various pick and move instructions. Because clamp force may change when handling different load configurations, the system is designed so that the driver can change the clamp force setting depending on the configuration of the load to be handled. The driver can select the setting for handling one layer of a unit load, a full unit load or a double wide unit load with each having a different clamp force setting based on product ID. This is accomplished with a push-button switch ergonomically placed for the driver to use. This same push button switch allows the driver to choose the manual operation mode in case the automatic system loses its ability to receive clamp force information (due to a damaged bar code or a malfunction in the system for example). The driver is always kept informed by means of an indicator light that confirms which setting is active.

The Cascade EFC system can also be designed to integrate with RFID mobile computer systems that obtain product information based on reading RFID tags located on the product. The mobile computer and the EFC system can be designed to act as an integrated solution for controlling clamp force completely automated with RFID tag reads.

Speed of clamp operation

The EFC system is designed to keep productivity at its highest level. Drivers prefer to have the arms move as quickly as possible so that there is no delay during the clamping process. Unfortunately, in the real world of clamp operation, when clamping pressure is lowered to meet the low clamp force requirements of certain product loads, the movement of the clamp arm also slows down. With mechanical pressure control systems, if the pressure setting is changed to a lower setting to prevent damage, arm movement can be also slowed. This slower arm movement is undesirable for the driver, and can result in the driver setting the clamp force to a value that is far too high for some easily damaged loads. The EFC system has sensors that will allow the arms to move with full hydraulic pressure and full speed until the arms are within a few inches of the load. This feature keeps the driver working at maximum velocity and keeps his productivity high.

Cost Savings via Damage Reduction:

In today's market, where customers choose the non-creased box, where palletless handling of display-ready packaging is the trend, where there is a more focused attempt to reduce product damage in the white goods industry and where inexperienced drivers in the warehouse is the norm, Cascade's EFC handling system pays big dividends by turning all lift truck drivers into clamp force experts which in the end results in significant savings from damage reduction. EFC flattens the learning curve for inexperienced drivers and takes the guess work out of the clamping operation.

For additional information on how EFC can be used to reduce product damage in the warehouse please contact: Cascade Corporation at 1-800-227-2233 or visit Cascade online at www.cascorp.com.