

A Best Practices Guide for the Reduction of Musculoskeletal Disorders in Food Distribution Centers

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Executive Summary

The occurrence of occupational injuries and illnesses in the grocery warehouse industry (SIC 514) has a direct effect on the productivity of their employees, as well increases in costs due to lost productivity and medically related issues. Since a majority of these losses can be traced to the activities associated with moving the product through the facility, efforts to reduce the incidence and severity of the injuries resulting from this activity can have a positive impact on production as well as costs. This book, titled, *A Best Practices Guide for the Reduction of Musculoskeletal Disorders in Food Distribution Centers* provides guidance to Distribution Centers for the development of a process to address the hazards associated with the food distribution process, as well as the identification of both engineering and administrative controls that have been observed in many Distribution Centers across the country.

Because Distribution Centers across the country use different systems for moving product through the facility (e.g., traditional order pick, belt-pick), Chapter III identifies factors that increase the risk of musculoskeletal disorders (MSDs) within each system observed. These factors consist primarily, among others, of bending and twisting of the back when selecting an order, repetitive lifting in awkward postures, and extended reaches. For each type of distribution system, control strategies are identified and discussed. Chapter IV identifies engineering controls, and Chapter V addresses administrative controls. These control strategies were identified through observation at various Distribution Centers, as well as being based on ergonomics principles. Engineering controls are the preferred control strategy, as these controls can permanently reduce or eliminate the hazards associated MSDs. Engineering controls discussed include, among others, changes to the product (e.g., work with suppliers to decrease the weight of the heaviest products, adding handles to the cases), and strategies for changes in slotting (e.g., converting to more full slots, especially for heavier product and faster moving product, using risers or other methods to raise the pallets off the floor to reduce bending when selecting an order). Administrative controls are secondary in preference, as they typically do not completely eliminate the hazards. Administrative controls identified, among others, include the use of job rotation to allow more varied activities, reducing overtime on regular work days, and providing training to employees on safe work practices. Finally, issues regarding medical management are discussed, with strategies aimed at adequate and prompt medical attention and return-to-work strategies.

Many Distribution Centers have safety and health programs in place, and that many of these programs may address components of the ergonomics process identified in this document. Therefore, it is not the intent of this *Guide* to completely revamp existing programs, but to instead enhance the safety and health of the food distribution industry through the application of observed best practices and application of ergonomics principles.

How to Use this *Guide*

This book, *A Best Practices Guide for the Reduction of Musculoskeletal Disorders in Food Distribution Centers*, has been categorized into three major parts, including:

- An overview of ergonomics (Chapter I);
- Ergonomics issues relevant for different Distribution Center systems (Chapter II); and
- Engineering controls, and administrative controls and work practices issues (Chapters III and IV, respectively) for the reduction or elimination of risk factors associated with musculoskeletal disorders (MSDs) within the Food Distribution environment.

The **Introduction** to this document (Chapter I) contains basic information about the ergonomics discipline and the costs of musculoskeletal injuries arising from cumulative trauma disorders. It also summarizes how the *Guide* was developed.

Distribution Centers across the country use different distribution systems to move product through their facilities. Each system has both advantages and disadvantages when considering the risk for development of MSDs and are discussed in Chapter II (**Food Distribution Center Issues and Preliminary Solutions**). It can be used to identify the system(s) currently in place in a Distribution Center, the ergonomics issues for that particular system, and preliminary solutions to reduce the risk of MSDs.

Chapter III (**Engineering Controls**) and Chapter IV (**Administrative Controls and Work Practices Issues**) identify and discuss many of the controls observed in Distribution Centers, as well as applicable controls used in other industries. **Engineering controls**, by definition, are those physical changes that were implemented to permanently reduce or eliminate the MSD risk to Selectors. These include changes to case features (e.g., weight, handles), slot features (e.g., use of full slots, raising pallets to reduce bending for bottom layer), and others. **Administrative controls**, by definition, are organizational changes implemented to reduce exposure to the risk factors. These include practices such as limiting overtime and rotating employees among jobs having different physical requirements, among others.

The information contained in Chapters II through IV are categorized by the type of distribution system a facility may use (Traditional, Belt-Pick, Cross-Dock, or Flow-Through) and the warehouse feature that would be affected (e.g., case features, slot features). Tabs are located on each page to assist the reader in maneuvering through the information in this *Guide*. An example page is shown in Figure 1. The tabs on the right margin of the page show the major chapters of the *Guide* and, in this example, would indicate that the reader is in the **Engineering Controls** chapter. The tabs across the top indicate to which pick system the information on the page is applicable. In this example, the engineering controls contained on that page apply only to the Traditional Order Pick distribution system. If a distribution facility is some hybrid of the four systems, then any shaded tabs that comprise those systems making up that hybrid system are relevant. Using the tabs in this way, the reader can navigate through this document to locate the controls applicable to the distribution system of interest.

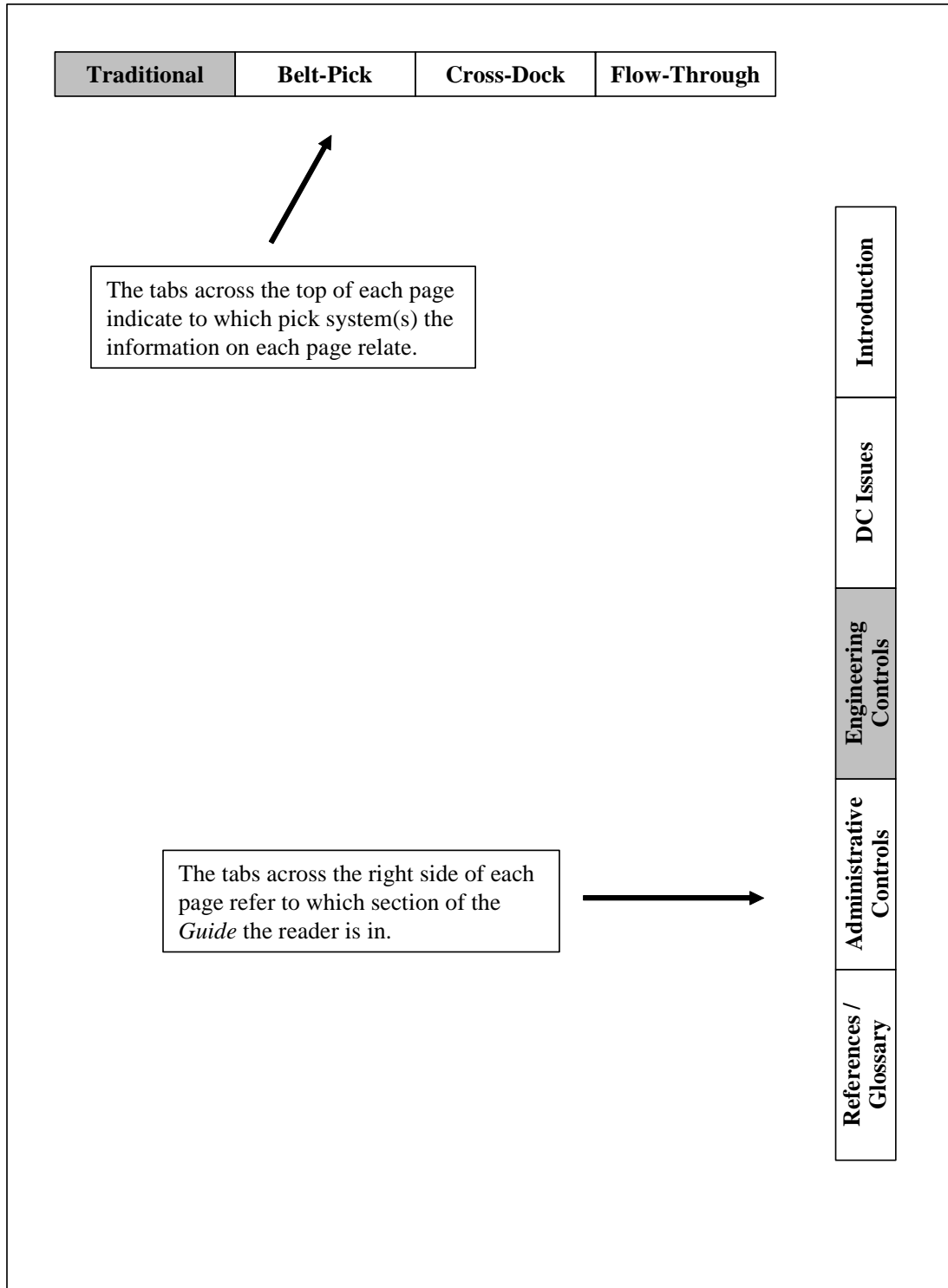


Figure 1. Example page showing document navigation tabs.

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Chapter I

Introduction

- A. Overview of Ergonomics
- B. A Systems Approach to Using Ergonomics
- C. The Costs of Musculoskeletal Disorders
- D. The Ergonomics Philosophy
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Chapter I. Introduction

A. Overview of Ergonomics

Ergonomics is the multi-disciplinary science that is used to assess and design work environments to match the physical and cognitive capabilities of individuals operating within the work system. Application of ergonomics in an occupational environment can have a positive impact on the safety and health experience of the facility, the production process, as well as the quality of the product or process engaged in. For example:

- Injuries such as low back disorders resulting from physical stressors in the job can be reduced or eliminated by implementing controls in the work environment that reduce or eliminate the exposure to the causes of these disorders.
- Production can be impacted positively by reducing or eliminating tasks or work conditions within jobs that increase the fatigue of the workers, thereby allowing employees to continue to work at a desirable rate.
- Keeping employees healthy and injury-free allows production to continue without interruptions such as having to find less-experienced employees to replace an injured employee.
- The quality of the process or product also can be impacted, as fewer mistakes may result as a function of eliminating the factors that increase fatigue or the risk of injury.
- The use of an ergonomics process in the work environment has the potential to improve the attitude of the work force, through employee empowerment, which allows employees to take part in the improvement of the production facility, as well as their own safety and health matters.

B. A Systems Approach to Using Ergonomics

Since ergonomics is multi-disciplinary in nature, drawing from the fields of engineering, biomechanics, psychology, physiology, and medicine, the application of ergonomics in an occupational setting must be approached systematically in order for it to succeed. The Occupational Safety and Health Administration (OSHA) has communicated that for ergonomics to be successfully applied, certain system components must be addressed (U.S. Dept. of Labor, 1990). These system components include:

- The commitment of management towards the prevention of work-related musculoskeletal disorders (MSDs);
- Procedures and structure in place for identifying and controlling workplace hazards;
- Policies for dealing with the medical issues related to injuries and illnesses; and
- Training for all levels of employment to communicate the process.

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This approach, as described, has been successfully applied in many manufacturing industries and has been shown to result in reductions of workers' compensations costs ranging from 36% to 91% in some companies (U.S. General Accounting Office, 1997). Therefore, in order for an ergonomics process to succeed in reducing injury rates for the food distribution industry, it is imperative that a systematic approach also be applied.

C. The Costs of Musculoskeletal Disorders

A systematic ergonomics process will generally be implemented with the objective of reducing or eliminating work-related musculoskeletal disorders. Musculoskeletal disorders are injuries and illnesses that affect the soft tissues of the body, including the muscles, tendons, ligaments, nerves, and intervertebral discs. MSDs include injuries and illnesses, such as sprains and strains to the low back and shoulder, rotator cuff tendinitis, carpal tunnel syndrome, and tendinitis (e.g., at the wrist or elbow).

The U.S. Bureau of Labor Statistics (2004) reported that, in 2002, over 1.4 million non-fatal injuries and illnesses involving days away from work were recorded in private industry. Of these, 43.0% were strains and sprains, 26.5% involved physical overexertion, and 14.5% involved overexertion specifically during lifting.

The costs associated with the development of MSDs are difficult to compute. However, Praemer et al (1999) estimated the direct treatment of MSDs in the U.S. in 1995 to be approximately \$88 billion and that all associated expenses (e.g., direct and indirect costs) totaled nearly \$215 billion.

Further, MSDs are reported to be the most frequent chronic condition causing long-term disability (Badley et al. 1994). Yelin et al. (1999) reported that 90% of disabled older workers had MSDs, and Lawrence et al. (1998) estimated that, by 2020, 18.4% of the U.S. population (nearly 60 million individuals) will suffer from one or more chronic MSDs.

Nationally, low back disorders have been found to account for a disproportionate share of the overall sprains, strains, and injury experience when compared to costs. One insurance company found that while low back disorder claims accounted for 16% to 19% of all workers' compensation claims 1989, they accounted for 33% to 41% of the total cost of all workers' compensation claims (Webster and Snook 1994). The National Association of Wholesale Grocers of America (NAWGA) and the International Foodservice Distribution Association (IFDA) found that 30% of the injuries reported by food distribution warehouse workers were attributable to back sprains and strains (Waters et al. 1993).

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Thus, sprains and strains, including low back disorders, constitute a disproportionate share of the injuries in many food distribution warehouses.

These statistics make clear that systematically addressing the causes of musculoskeletal disorders in the workplace can produce significant cost savings for a company, in addition to reducing discomfort, pain, and suffering of affect employees.

D. The Ergonomics Philosophy

The ergonomics philosophy as applied to the food distribution industry has the potential to make great strides in the reduction of musculoskeletal disorders, as well as the costs associated with MSDs. It is recognized that many DCs have safety and health programs in place, and that many of these programs may address many components of the ergonomics process identified in this guide. Therefore, it is not the intent of this best practices guide to completely revamp existing programs, but to enhance the safety and health of the food distribution industry through the application of observed best practices and application of ergonomics principles.

E. Development of this *Guide*

The methods used to develop the "Best Practices" outlined in this *Guide* were two-fold. First, components of safety and health management programs were identified, and a questionnaire was developed based on these core components. The questionnaire was designed to gain an understanding of how these components were integrated into a Distribution Center, such as the importance of management commitment to the prevention of injuries, the presence of committees and their activities, or through the implementation of a medical management program. Next, more specific Distribution Center issues believed to have an impact on the risk of work-related MSDs were identified. These issues included case features (e.g., weights, use of handles) slot designs, pallet jack features, and administrative policies for employees, among others.

Second, the questionnaire was taken to several Distribution Centers nationwide. An interview team met with labor and management personnel to discuss the presence of the any of the program elements, other program elements aimed at injury prevention, and the identification of specific control strategies for injury prevention. Sites were visited that have had varying levels of successes in controlling musculoskeletal disorders. Injury rates were reviewed from these facilities as well. Groups of Selectors from each of the Distribution Centers visited also were interviewed, using a subset of items from the aforementioned questionnaire. Operations of the Distribution Centers and Selectors

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specifically also were observed, with the emphasis on investigating unique, successful, and unsuccessful approaches to controlling MSDs.

Information gathered from the facilities visited were compiled and placed in this *Guide*, including many photographs and illustrations. No specific companies are identified by name. This document represents the compilation of the best practices observed across many Distribution Centers in the food distribution industry, as well as potential improvements based upon sound ergonomics principles, which have reduced injury rates or have the potential to reduce injuries.

F. Disclaimer

The recommendations contained within this document are based upon the best available knowledge about the causes of musculoskeletal disorders, their prevention through implementation of an ergonomics process and specific control strategies, and the observed practices currently found in the industry. The recommendations contained in this document are purely advisory in nature, and no guarantee of success is offered for the reduction of injuries as a result of implementation of any practices or controls identified in this document.

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Chapter II

Food Distribution Center Issues and Preliminary Solutions

- A. Food Distribution Systems
- B. Distribution System Issues
- C. Summary of Engineering Controls and Administrative Controls
for each Distribution System

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Chapter II. Food Distribution Center Issues and Preliminary Solutions

A. Food Distribution Center Systems

There are a number of different systems that food distributors use to move product through their warehouses. Four specific systems are described here, and these are referred to as:

- Traditional;
- Belt-Pick;
- Cross-Dock; and
- Flow-Through.

These different systems may have their own ergonomics concerns, therefore, many of the potential solutions discussed throughout this *Guide* will be dependent upon which system is in place in a particular location. Also, combinations of these four systems may be present in some facilities. If so, then the ergonomics applications for all of these systems should be reviewed. The four different systems are described below.

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The *Traditional Order Pick* system is used by most distributors. In this system, full pallets of product are taken from the dock and placed in slots. Selectors then pick product from these slots and stack them onto pallets for shipment to stores. A typical traditional order pick system is shown in Figure 2;



Figure 2. Example of a traditional order pick system.

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In a ***Belt-Pick*** system, cases on pallets in storage are coded for specific stores and then loaded onto conveyor belts. The product then is routed (via the belts) to specific feed aisles, where it is manually palletized and shipped to stores. This palletizing portion of this system is illustrated in Figure 3.



Figure 3. Example of a belt-pick system; here the employee palletizes cases coming from a conveyor belt.

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A *Cross-Docking* system is one where pallets are unloaded from the inbound trucks, broken down on the dock, and then transferred to outbound trucks on the dock. One such system is shown in Figure 4.



Figure 4. Example of a cross-dock system.

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With a ***Flow-Through*** system, the products are unloaded from the inbound truck and transferred directly to the outbound dock via conveyors. The product is coded after being unloaded and automatically routed to specific feed aisles, where it is manually loaded on the outbound trucks. A schematic figure of a generic flow-through system is shown in Figure 5.

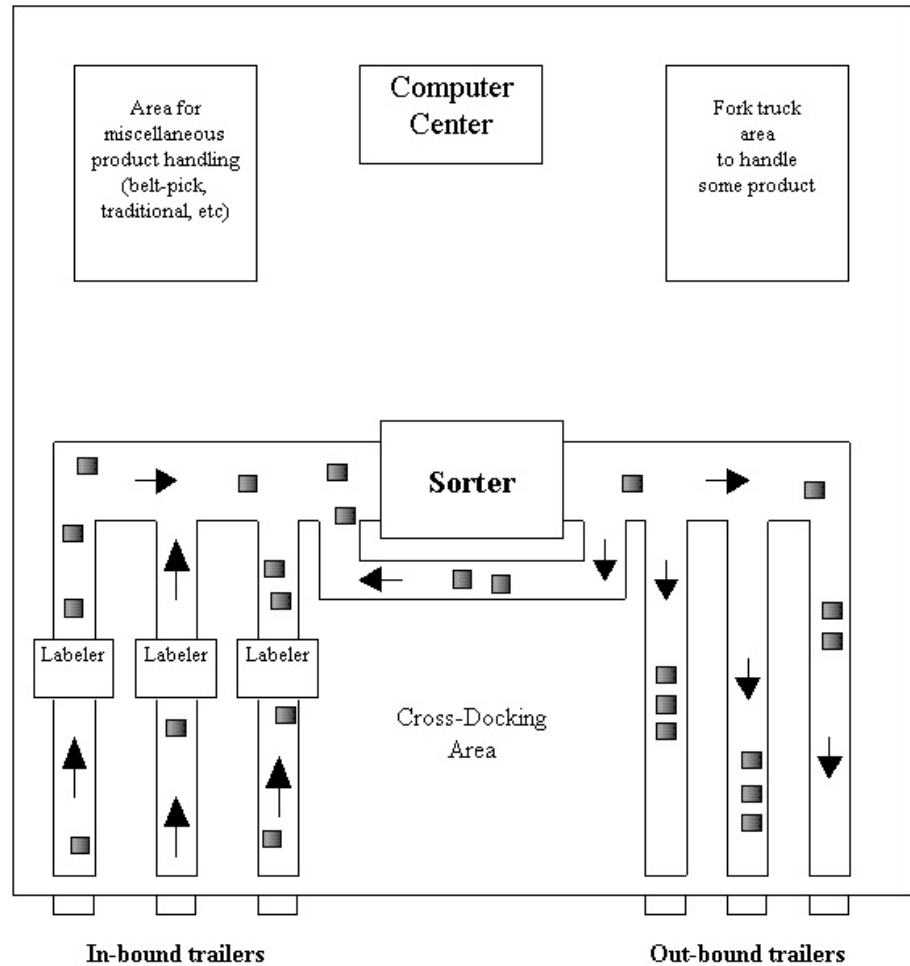


Figure 5. Schematic figure of a generic flow-through distribution system.

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B. Distribution Systems Issues

Each system has its advantages and its ergonomics concerns, as described below.

1. Traditional Order Pick System

This is the most common method of order picking in food Distribution Centers, because it makes good use of vertical space in a warehouse. Pallets of like product usually are stored above the actual pick slots and then are brought down, by the pallet by employees other than selectors, as needed.

The Traditional Order Pick system has several advantages, listed below.

Advantage: **MINIMAL MATERIALS HANDLING.** Ideally, when full slots are used, each case is handled manually only once within this type of system, since cases are moved by entire pallets until they are broken down in the pick slots by Selectors.

Advantage: **MICRO-BREAKS.** In this type of system, Selectors are able to get small "micro" breaks; that is, increments of time when they are not handling cases and, thus, are able to rest their bodies. These breaks occur when Selectors travel from one slot to another when filling their order. Other micro-breaks occur if the filled order is automatically plastic-wrapped and when the Selectors drive the pallet into an out-bound trailer.

This system does have its ergonomics concerns, addressed below.

Issue: **NATURE OF THE MATERIAL HANDLING WORK.** The nature of the Selector's work presents a significant number of musculoskeletal stressors (e.g., repetitive lifting, bending and twisting, lifting heavy loads). With the Traditional Order Pick system, each case must be handled a minimum of one time. Cases may be handled more than once each, for example, if half slots or triple slots are used in a facility, because pallets must be broken down for them to fit within these spaces. The use of half or triple slots also presents ergonomics issues.

Issue: **LACK OF CONSISTENCY.** Because Selectors move around the Distribution Center to pick orders, the use of handling aids often used to reduce material handling requirements in other industries

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(e.g., lifting aids, pallet jacks) are less technically feasible in this environment.

Remedy: Specific issues related to the traditional order picking system (product and rack issues, administrative and employee issues) will be discussed in Chapter III and IV this *Guide*.

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2. Belt-Pick System

In a facility using this type of case handling, the system performs a majority of the product transfer. That is, belts and chutes direct the cases automatically through most of the Distribution Center, rather than having Selectors move the cases themselves on pallet jacks. This system produces some advantages.

Advantage: **UNIFORMITY DURING DEPALLETIZING.** Most pallets are lined up next to each other, and the belt itself is easily accessible. This lends itself to material handling aids that have been used to reduce materials handling stressors in other production facilities. For example, hoists that lift cases can be installed along the length of the pallets. Pallets can be placed on lift tables that raise each case layer to a more appropriate pick height. Similarly, conveyor belt heights can be adjusted to accommodate employees' working heights, and the use of lift and turn tables can reduce bending and reaching during palletizing.

Advantage: **UNIFORMITY DURING PALLETIZING.** The belt brings cases to an employee tasked with loading them onto pallets for shipment to specific stores. As mentioned above, this activity takes place in one area, which lends itself to the implementation of lift assist devices.

There are ergonomics issues with Belt-Pick systems, too. These are outlined below.

Issue: **REPEATED HANDLING.** Belt-pick systems require each case to be handled a minimum of two times: (1) Depalletizing (off the pallet and onto the conveyor belt); and (2) Palletizing (from the feed slot to the out-bound pallet). This contrasts with the Traditional Order Pick System, where, with the use of full slots, employees handle the cases only once manually, when Selectors palletize the cases. Given the nature of this work, additional manual case handling (i.e., repetition) increases the risk of MSDs to Selectors.

Issue: **TRUNK TWISTING.** Observations of belt-pick systems found that loading cases onto the conveyor belt often required twisting of the trunk. This was due to the close proximity of the pallets to the conveyor. Thus, Selectors often did not have to move their feet to

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transfer the cases, and, instead, moved at the waist. Trunk twisting has been associated with low-back disorders (Kelsey et al. 1984, Marras et al. 1993, 1995), suggesting that this system presents some additional risks to Selectors beyond those found with other pick systems.

Issue: **LACK OF MICRO-BREAKS.** Palletizers and depalletizers, working at opposite ends of the belt, stay in the same general area of the facility throughout the day. This provides them with less opportunity to take small breaks between handling of cases, as seen with Selectors performing traditional order selecting. This could lead to more rapid muscular fatigue than in the traditional approach.

Remedy: Lift assist devices which can run the length of the belt could reduce the weight of the product assumed by the Selector, bring the product closer to the Selector, and potentially reduce some of the twisting. Administrative controls aimed at reducing the duration of exposure to the job stressors include rotating Selectors to other jobs in addition to the current job, or adding more employees to the belt pick line to share the workload and reduce the exposure to these stressors. These and other controls applicable to the Belt-Pick system are discussed in Chapters III and IV.

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3. Cross-Docking System

The cross-docking system also offers advantages over the Traditional or Belt-Pick systems, namely in the reduction of storage space required for product. Other advantages are discussed below:

- Advantage: **REDUCED CASE HANDLING.** If full pallet quantities are shipped to the stores, this eliminates the handling of cases manually completely.
- Advantage: **USE OF LIFTING AIDS.** When partial pallets of goods are requested and pallets are broken-down in docking areas, they are not physically bounded by slots. This offers more latitude for engineering controls, such as lifting devices or lift tables to assist in case handling, especially for heavier cases.
- Advantage: **REDUCED ORDER-FILLING TIME.** The time that product is housed within the facility is potentially reduced, since product can go directly from the in-coming dock to the out-bound, store-specific dock with little or no storage in slots.

The engineering controls identified above, as well as others in addition to administrative controls are further discussed in Chapters III and IV in this *Guide*.

Although a Cross-docking system has the potential for reduced material handling, there are some concerns as to the feasibility of this approach.

- Issue: **PRACTICALITY.** Many grocery stores do not need a full pallet of a specific item at any one time, so this system may not be practical for many Distribution Center operations.
- Issue: **FLOOR SPACE.** Because much of the transfer takes place between docks, product is housed on the floor and not in vertical slots, as in traditional order pick Distribution Centers. It can be costly to provide this additional warehouse space. Additionally, the number of different products handled increases every year, so the potential exists for a future floor space constraint.
- Issue: **INCREASED COORDINATION.** With this system comes a high level of organization and structure, so that in-bound pallets are directed to the appropriate out-bound locations. This can

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create additional concerns and costs not found with the Traditional Order Pick or Belt-Pick systems.

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4. Flow-Through System

In comparison with the traditional or belt-pick systems, a Flow-Through system allows the best potential to reduce or eliminate material handling activities. Selectors working in a Flow-Through systems typically break down a pallet and may use a conveyor in some capacity to transport product from the receiving to the outgoing docks, reducing or eliminating the storage of cases in the Distribution Center. There are several reasons why this approach may be better, as outlined below:

Advantage: **REDUCED CASE HANDLING.** Quantities requested from grocery stores by-the-pallet eliminate manual handling of the goods altogether, since fork lifts can be used to transfer cases from the incoming to the out-going docks.

Advantage: **USE OF LIFTING AIDS.** When partial pallets of goods are requested and pallets are broken-down in docking areas or are transferred to conveyors for transport to outgoing docks, they are not physically bounded by slots. This presents more latitude for engineering controls, such as lifting devices or lift tables to assist in case handling, especially for heavier items. These can be used at either the receiving or outgoing docks, or both, where feasible.

Advantage: **REDUCED ORDER-FILLING TIME.** The time that product is housed within the facility is potentially reduced, since much of the product can go directly from the receiving dock to the out-bound, store-specific dock with little or no storage in slots.

Though the Flow-Through system has the potential for reduced material handling, there are some concerns as to the feasibility of this approach.

Issue: **FLOOR SPACE.** Because much of the transfer takes place between docks, some of the product is housed on the floor and not in vertical slots, like in traditional order pick Distribution Centers. It can be costly to provide this additional warehouse space. Additionally, the number of products handled increases every year, so all facilities may eventually have a floor space constraint.

Issue: **INCREASED COORDINATION AND COST.** With this system comes a high level of organization and structure, so that inbound pallets and individual product are directed to the appropriate

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out-bound locations. This can create additional concerns and costs not found with the tradition order pick or belt pick systems. Additionally, the complexity of routing the product on conveyors from inbound to outbound docks may require a large initial outlay of capital which may take a significant amount of time to recover. Thus, this may be more appropriate for large volume distributors.

Issue: **REPETITIVE CASE HANDLING.** With this system, the potential exists for repetitive handling of cases using awkward trunk postures. This can occur at both the receiving dock and the out-bound dock when re-palletizing product. To counter these problems, controls such as lift tables or turn tables, as discussed above, can be used to reduce the risk of MSDs.

The engineering controls identified above and others which are applicable to the Flow-Through system are further discussed in Chapter III. Applicable administrative controls are identified and discussed in Chapter IV of this *Guide*.

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5. Mixture of Different Systems

One additional type of Distribution Center system would include a mixture of several pick systems, with features from the different systems included in strategic locations that would increase the efficiency as well as reduce the risk of MSDs. For example, a Cross-Docking System approach could be used for the heaviest and most frequently picked products, whereas a Traditional Order Pick System would be used for lighter or slower-moving product.

From a musculoskeletal disorder prevention perspective, a distribution system hierarchy does exist. The Flow-Through system contains the greatest potential to reduce musculoskeletal disorders. This reduction potential stems from reductions of exposure to activities associated with repeated selecting of heavy cases from slots that require repetitive awkward trunk postures, as well as the added flexibility of being capable of using material handling devices and aids for raising and turning pallets. The systems with the next greatest potential include both the belt-pick and cross-docking systems. As with the Flow-Through, material handling aids can be used to transfer product from pallets to the belt, or aids for raising and turning pallets can be used to reduce repetitive awkward postures during selecting. The Traditional Order Selecting system ranks behind the other three systems, as there are many case and slot features, among others, which increase the risk of MSDs which would need to be addressed. The feasibility of which distribution system to use in any particular Distribution Center, however, is dictated also by many other factors, such as space requirements and limitations, as well as product volume and other cost considerations.

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C. Summary of Engineering Controls and Administrative Controls for each Distribution System

Each of the four distribution systems identified in this *Guide* have their own set of advantages and disadvantages. They also have specific issues and potential remedies for improving these concerns. The issues and remedies related to engineering controls are identified in Chapter III. Chapter IV lists numerous administrative controls and work practice issues. Chapters III and IV cover these topics in detail. However, summary tables are listed on the following pages for all the issues and remedies covered in this *Guide*. There is a summary table included for each distribution system. More information about these issues and remedies can be found by going to the referenced page number listed in these tables.

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Table 1. Summary of Issues and Remedies for a Traditional Order Pick System.

TRADITIONAL ORDER PICK SYSTEM	
Issue	Remedy
Engineering Controls	
A. CASE FEATURES (p. III-2)	
1. Excessive case weights (p. III-2)	<ul style="list-style-type: none"> • Reduce weights for the heaviest cases (p. III-2). • Raise cases further from the floor (p. III-2).
2. Lack of handle cut-outs on cases (p. III-6)	<ul style="list-style-type: none"> • Request handle cut-outs from suppliers (p. III-6).
3. Handling tray packs (plastic-wrapped cases) (p. III-7)	<ul style="list-style-type: none"> • Educate suppliers about ergonomics concerns with tray packs (p. III-7). • Incorporate lift assists (p. III-8). • Add slip sheets between layers (p. III-8). • Treat tray packs as heavy cases (p. III-8). • Use tray packs that are not wrapped completely (p. III-8).
4. Layer-by-layer depalletizing of cases (p. III-9)	<ul style="list-style-type: none"> • Allow pyramiding depalletizing, but with training (p. III-9). • Rotate pallet after it has been half-way unloaded (p. III-9).
5. Combined heavy case weights and picks near the floor (p. III-9)	<ul style="list-style-type: none"> • Provide a means to lift pallets from floor level--lift tables (p. III-10).
6. Unexpected spinal loading during case handling (p. III-10)	<ul style="list-style-type: none"> • Tag slots to indicate case weights (p. III-10). • Request sturdy cases from suppliers (p. III-10).
7. Slippery cardboard cases (p. III-11)	<ul style="list-style-type: none"> • Have Selectors wear friction-increasing gloves (p. III-11)
B. SLOT FEATURES (p. III-12)	
1. Posture of individuals working in half or triple slots (p. III-12)	<ul style="list-style-type: none"> • Use a mechanical load splitter (p. III-12). • Use full-slots whenever possible (p. III-15). • Incorporate flow racks for slow-moving products (p. III-15). • Use half-slots (p. III-17). • Maximize the flow rack/full-slot ratio (p. III-17). • Seldom use triple-slots (p. III-17). • Develop/revise the facility's slot-management system (p. III-17).

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TRADITIONAL ORDER PICK SYSTEM	
Issue	Remedy
2. Lifting cases from the lowest pallet layers (<i>p. III-18</i>)	<ul style="list-style-type: none"> • Provide a means to lift pallets from floor level (<i>p. III-18</i>). • Implement lift tables (<i>p. III-18</i>). • Stack pallets (<i>p. III-18</i>). • Use roller conveyors (<i>p. III-18</i>).
3. Difficulty in reaching cases further back in slots (<i>p. III-19</i>)	<ul style="list-style-type: none"> • Provide turn tables (<i>p. III-19</i>). • Turn pallets around with fork trucks (<i>p. III-19</i>). • Redesign racks to elevate the pallet (<i>p. III-19</i>).
4. Little clearance between pallets within the same slot (<i>p. III-21</i>)	<ul style="list-style-type: none"> • Provide fork lift driver and Selector training to maintain clearances between pallets (<i>p. III-21</i>). • Increase slot width to increase clearances between pallets (<i>p. III-21</i>).
C. AISLE FEATURES (<i>p. III-22</i>)	
D. PALLET FEATURES (<i>p. III-23</i>)	
Weight of wooden pallets (<i>p. III-23</i>)	<ul style="list-style-type: none"> • Use plastic pallets when possible (<i>p. III-23</i>). • Ask that suppliers use plastic pallets (<i>p. III-23</i>). • Use a pallet dispenser (<i>p. III-23</i>).
E. PALLET JACK FEATURES (<i>p. III-24</i>)	
1. Lack of adjustability in fork vertical heights (<i>p. III-24</i>)	<ul style="list-style-type: none"> • Use pallet jacks with raisable forks (<i>p. III-24</i>). • Use several pallets stacked on top of each other on the pallet jack (<i>p. III-25</i>).
2. Added physical stress from using poorly maintained pallet jacks (<i>p. III-25</i>)	<ul style="list-style-type: none"> • Implement a system of routine, scheduled preventative maintenance on pallet jacks (<i>p. III-26</i>). • Provide pallet jack education (<i>p. III-26</i>).
F. OTHER PRODUCT AND RACK FEATURES (<i>p. III-26</i>)	
Manual wrapping of pallet cases using plastic (<i>p. III-26</i>)	<ul style="list-style-type: none"> • Provide automatic wrappers (<i>p. III-26</i>). • Provide handles for plastic wrap (<i>p. III-27</i>). • Supply smaller rolls of plastic wrap (<i>p. III-27</i>). • Modify pallet jacks to securely hold plastic wrap (<i>p. III-27</i>).
G. PICK STICKS (<i>p. III-28</i>)	
Pick sticks not used by Selectors or not available (<i>p. III-28</i>)	<ul style="list-style-type: none"> • Educate Selectors and Supervisors regarding pick sticks (<i>p. III-28</i>). • Provide easier access to pick sticks (<i>p. III-28</i>).

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TRADITIONAL ORDER PICK SYSTEM	
Issue	Remedy
H. COUPLING ISSUES (p. III-29)	
Selectors holding the grocery order sheets during case handling (p. III-29)	<ul style="list-style-type: none"> • Use a sticker dispenser (p. III-29). • Provide a clipboard hook (p. III-30). • Implement headsets to replace the order sheets (p. III-30).
I. BATTERY CHARGING SPACE (p. III-31)	
Excess space used for charging pallet jack batteries (p. III-31)	<ul style="list-style-type: none"> • Implement a battery charging station (p. III-31).
Administrative Controls and Work Practice Issues	
A. WORK STANDARDS (p. IV-3)	
Selectors working through scheduled breaks (p. IV-3)	<ul style="list-style-type: none"> • Incorporate injury rates and costs into the determination of a standard (p. IV-3). • Do not automatically increase work rates following ergonomics improvements (p. IV-3). • Incorporate a ramp-in work rate for new-hires (p. IV-4).
B. WORK RATES AND OVERTIME (p. IV-4)	
Potential to exceed Selectors' physical abilities (p. IV-4)	<ul style="list-style-type: none"> • Eliminate overtime (p. IV-4). • Limit overtime to off-days (p. IV-4). • Limit overtime to volunteers (p. IV-4).
C. PICKING ORDER AND SELECTOR START TIMES (p. IV-5)	
1. Picking order (p. IV-5)	<ul style="list-style-type: none"> • Stagger Selector start times (p. IV-5). • Create a selection order committee (p. IV-5).
2. Congestion at the beginning of a shift (p. IV-6)	<ul style="list-style-type: none"> • Stagger Selector start times (p. IV-6).
D. JOB ROTATION (p. IV-7)	
Repetitive, continuous exposure to risk factors for MSD (p. IV-7)	<ul style="list-style-type: none"> • Rotate employees to other jobs (p. IV-7).
E. PERSONAL PROTECTIVE EQUIPMENT (p. IV-7)	
1. Use of back belts and lack of proper training regarding their use (p. IV-7)	<ul style="list-style-type: none"> • Provide detailed training regarding back belt use (p. IV-9). • Administer back supports only under an occupational physician's care (p. IV-9). • Screen Selectors for cardiovascular problems (p. IV-9).
2. Leg fatigue due to continual standing (p. IV-10)	<ul style="list-style-type: none"> • Provide employees with shoe inserts (p. IV-10).

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TRADITIONAL ORDER PICK SYSTEM	
Issue	Remedy
F. EMPLOYEE WARM-UP PROGRAMS (p. IV-10)	
G. EMPLOYEE SCREENING/SELECTION (p. IV-12)	
H. MEDICAL MANAGEMENT FEATURES (p. IV-12)	
No medical management strategy in place (p. IV-12).	<ul style="list-style-type: none"> • Hire a medical specialist for the facility (p. IV-12). • Contract with a local medical clinic (p. IV-13). • Develop a return-to-work program (p. IV-13). • Encourage early reporting of MSD symptoms (p. IV-13).
I. TRAINING AND EDUCATION (p. IV-13)	
Little or no new-employee training (p. IV-13)	<ul style="list-style-type: none"> • Develop a "train-the-trainer" program (p. IV-14). • Provide new Selectors with a mentor (p. IV-14). • Provide instructional demonstrations and videos (p. IV-14). • Explain the medical management system (p. IV-14).
J. PSYCHOSOCIAL ISSUES (p. IV-15)	
Many psychosocial stressors in the facility (p. IV-15)	<ul style="list-style-type: none"> • Issue a management values statement (p. IV-15). • Involve employees in the ergonomics process (p. IV-16). • Form work teams (p. IV-16). • Implement mechanisms to foster suggestions (p. IV-16).
K. OTHER ISSUES (p. IV-16)	
1. Dehydration of Selectors during work (p. IV-16)	<ul style="list-style-type: none"> • Provide fluids to Selectors during hot periods (p. IV-16).
2. Additional concerns other than musculoskeletal disorders (p. IV-17)	<ul style="list-style-type: none"> • Coordinate safety issues with the ergonomics process (p. IV-17).

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Table 2. Summary of Issues and Remedies for a Belt-Pick System.

BELT-PICK SYSTEM	
Issue	Remedy
Engineering Controls	
A. CASE FEATURES (p. III-2)	
1. Excessive case weights (p. III-2)	<ul style="list-style-type: none"> • Reduce weights for the heaviest cases (p. III-2). • Raise cases further from the floor (p. III-2).
2. Lack of handle cut-outs on cases (p. III-6)	<ul style="list-style-type: none"> • Request handle cut-outs from suppliers (p. III-6).
3. Handling tray packs (plastic-wrapped cases) (p. III-7)	<ul style="list-style-type: none"> • Educate suppliers about ergonomics concerns with tray packs (p. III-7). • Incorporate lift assists (p. III-8). • Add slip sheets between layers (p. III-8). • Treat tray packs as heavy cases (p. III-8). • Use tray packs that are not wrapped completely (p. III-8).
4. Layer-by-layer depalletizing of cases (p. III-9)	<ul style="list-style-type: none"> • Allow pyramiding depalletizing, but with training (p. III-9). • Rotate pallet after it has been half-way unloaded (p. III-9).
5. Combined heavy case weights and picks near the floor (p. III-9)	<ul style="list-style-type: none"> • Provide a means to lift pallets from floor level-lift tables (p. III-10).
6. Unexpected spinal loading during case handling (p. III-10)	<ul style="list-style-type: none"> • Tag slots to indicate case weights (p. III-10). • Request sturdy cases from suppliers (p. III-10).
7. Slippery cardboard cases (p. III-11)	<ul style="list-style-type: none"> • Have Selectors wear friction-increasing gloves (p. III-11)
D. PALLET FEATURES (p. III-23)	
Weight of wooden pallets (p. III-23)	<ul style="list-style-type: none"> • Use plastic pallets when possible (p. III-23). • Ask that suppliers use plastic pallets (p. III-23). • Use a pallet dispenser (p. III-23).
F. OTHER PRODUCT AND RACK FEATURES (p. III-26)	
Manual wrapping of pallet cases using plastic (p. III-26)	<ul style="list-style-type: none"> • Provide automatic wrappers (p. III-26). • Provide handles for plastic wrap (p. III-27). • Supply smaller rolls of plastic wrap (p. III-27). • Modify pallet jacks to securely hold plastic wrap (p. III-27).

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BELT-PICK SYSTEM	
Issue	Remedy
H. COUPLING ISSUES (p. III-29)	
Selectors holding the grocery order sheets during case handling (p. III-29)	<ul style="list-style-type: none"> • Use a sticker dispenser (p. III-29). • Provide a clipboard hook (p. III-30). • Implement headsets to replace the order sheets (p. III-30).
I. BATTERY CHARGING SPACE (p. III-31)	
Excess space used for charging pallet jack batteries (p. III-31)	<ul style="list-style-type: none"> • Implement a battery charging station (p. III-31).
Administrative Controls and Work Practice Issues	
A. WORK STANDARDS (p. IV-3)	
Selectors working through scheduled breaks (p. IV-3)	<ul style="list-style-type: none"> • Incorporate injury rates and costs into the determination of a standard (p. IV-3). • Do not automatically increase work rates following ergonomics improvements (p. IV-3). • Incorporate a ramp-in work rate for new-hires (p. IV-4).
B. WORK RATES AND OVERTIME (p. IV-4)	
Potential to exceed Selectors' physical abilities (p. IV-4)	<ul style="list-style-type: none"> • Eliminate overtime (p. IV-4). • Limit overtime to off-days (p. IV-4). • Limit overtime to volunteers (p. IV-4).
D. JOB ROTATION (p. IV-7)	
Repetitive, continuous exposure to risk factors for MSD (p. IV-7)	<ul style="list-style-type: none"> • Rotate employees to other jobs (p. IV-7).
E. PERSONAL PROTECTIVE EQUIPMENT (p. IV-7)	
1. Use of back belts and lack of proper training regarding their use (p. IV-7)	<ul style="list-style-type: none"> • Provide detailed training regarding back belt use (p. IV-9). • Administer back supports only under an occupational physician's care (p. IV-9). • Screen Selectors for cardiovascular problems (p. IV-9).
2. Leg fatigue due to continual standing (p. IV-10)	<ul style="list-style-type: none"> • Provide employees with shoe inserts (p. IV-10).
F. EMPLOYEE WARM-UP PROGRAMS (p. IV-10)	
G. EMPLOYEE SCREENING/SELECTION (p. IV-12)	

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BELT-PICK SYSTEM	
Issue	Remedy
H. MEDICAL MANAGEMENT FEATURES (p. IV-12)	
No medical management strategy in place (p. IV-12).	<ul style="list-style-type: none"> • Hire a medical specialist for the facility (p. IV-12). • Contract with a local medical clinic (p. IV-13). • Develop a return-to-work program (p. IV-13). • Encourage early reporting of MSD symptoms (p. IV-13).
I. TRAINING AND EDUCATION (p. IV-13)	
Little or no new-employee training (p. IV-13)	<ul style="list-style-type: none"> • Develop a "train-the-trainer" program (p. IV-14). • Provide new Selectors with a mentor (p. IV-14). • Provide instructional demonstrations and videos (p. IV-14). • Explain the medical management system (p. IV-14).
J. PSYCHOSOCIAL ISSUES (p. IV-15)	
Many psychosocial stressors in the facility (p. IV-15)	<ul style="list-style-type: none"> • Issue a management values statement (p. IV-15). • Involve employees in the ergonomics process (p. IV-16). • Form work teams (p. IV-16). • Implement mechanisms to foster suggestions (p. IV-16).
K. OTHER ISSUES (p. IV-16)	
1. Dehydration of Selectors during work (p. IV-16)	<ul style="list-style-type: none"> • Provide fluids to Selectors during hot periods (p. IV-16).
2. Additional concerns other than musculoskeletal disorders (p. IV-17)	<ul style="list-style-type: none"> • Coordinate safety issues with the ergonomics process (p. IV-17).

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Table 3. Summary of Issues and Remedies for a Cross-Dock System.

CROSS-DOCK SYSTEM	
Issue	Remedy
Engineering Controls	
A. CASE FEATURES (p. III-2)	
1. Excessive case weights (p. III-2)	<ul style="list-style-type: none"> • Reduce weights for the heaviest cases (p. III-2). • Raise cases further from the floor (p. III-2).
2. Lack of handle cut-outs on cases (p. III-6)	<ul style="list-style-type: none"> • Request handle cut-outs from suppliers (p. III-6).
3. Handling tray packs (plastic-wrapped cases) (p. III-7)	<ul style="list-style-type: none"> • Educate suppliers about ergonomics concerns with tray packs (p. III-7). • Incorporate lift assists (p. III-8). • Add slip sheets between layers (p. III-8). • Treat tray packs as heavy cases (p. III-8). • Use tray packs that are not wrapped completely (p. III-8).
4. Layer-by-layer depalletizing of cases (p. III-9)	<ul style="list-style-type: none"> • Allow pyramiding depalletizing, but with training (p. III-9). • Rotate pallet after it has been half-way unloaded (p. III-9).
5. Combined heavy case weights and picks near the floor (p. III-10)	<ul style="list-style-type: none"> • Provide a means to lift pallets from floor level-lift tables (p. III-10).
6. Unexpected spinal loading during case handling (p. III-11)	<ul style="list-style-type: none"> • Tag slots to indicate case weights (p. III-11). • Request sturdy cases from suppliers (p. III-11).
7. Slippery cardboard cases (p. III-12)	<ul style="list-style-type: none"> • Have Selectors wear friction-increasing gloves (p. III-12)
D. PALLET FEATURES (p. III-23)	
Weight of wooden pallets (p. III-23)	<ul style="list-style-type: none"> • Use plastic pallets when possible (p. III-23). • Ask that suppliers use plastic pallets (p. III-23). • Use a pallet dispenser (p. III-23).
E. PALLET JACK FEATURES (p. III-24)	
1. Lack of adjustability in fork vertical heights (p. III-24)	<ul style="list-style-type: none"> • Use pallet jacks with raisable forks (p. III-24). • Use several pallets stacked on top of each other on the pallet jack (p. III-25).

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CROSS-DOCK SYSTEM	
Issue	Remedy
2. Added physical stress from using poorly maintained pallet jacks (<i>p. III-25</i>)	<ul style="list-style-type: none"> • Implement a system of routine, scheduled preventative maintenance on pallet jacks (<i>p. III-26</i>). • Provide pallet jack education (<i>p. III-26</i>).
F. OTHER PRODUCT AND RACK FEATURES (<i>p. III-26</i>)	
Manual wrapping of pallet cases using plastic (<i>p. III-26</i>)	<ul style="list-style-type: none"> • Provide automatic wrappers (<i>p. III-26</i>). • Provide handles for plastic wrap (<i>p. III-27</i>). • Supply smaller rolls of plastic wrap (<i>p. III-27</i>). • Modify pallet jacks to securely hold plastic wrap (<i>p. III-27</i>).
H. COUPLING ISSUES (<i>p. III-29</i>)	
Selectors holding the grocery order sheets during case handling (<i>p. III-29</i>)	<ul style="list-style-type: none"> • Use a sticker dispenser (<i>p. III-29</i>). • Provide a clipboard hook (<i>p. III-30</i>). • Implement headsets to replace the order sheets (<i>p. III-30</i>).
I. BATTERY CHARGING SPACE (<i>p. III-31</i>)	
Excess space used for charging pallet jack batteries (<i>p. III-31</i>)	<ul style="list-style-type: none"> • Implement a battery charging station (<i>p. III-31</i>).
Administrative Controls and Work Practice Issues	
A. WORK STANDARDS (<i>p. IV-3</i>)	
Selectors working through scheduled breaks (<i>p. IV-3</i>)	<ul style="list-style-type: none"> • Incorporate injury rates and costs into the determination of a standard (<i>p. IV-3</i>). • Do not automatically increase work rates following ergonomics improvements (<i>p. IV-3</i>). • Incorporate a ramp-in work rate for new-hires (<i>p. IV-4</i>).
B. WORK RATES AND OVERTIME (<i>p. IV-4</i>)	
Potential to exceed Selectors' physical abilities (<i>p. IV-4</i>)	<ul style="list-style-type: none"> • Eliminate overtime (<i>p. IV-4</i>). • Limit overtime to off-days (<i>p. IV-4</i>). • Limit overtime to volunteers (<i>p. IV-4</i>).
D. JOB ROTATION (<i>p. IV-7</i>)	
Repetitive, continuous exposure to risk factors for MSD (<i>p. IV-7</i>)	<ul style="list-style-type: none"> • Rotate employees to other jobs (<i>p. IV-7</i>).

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CROSS-DOCK SYSTEM	
Issue	Remedy
E. PERSONAL PROTECTIVE EQUIPMENT (p. IV-7)	
1. Use of back belts and lack of proper training regarding their use (p. IV-7)	<ul style="list-style-type: none"> • Provide detailed training regarding back belt use (p. IV-9). • Administer back supports only under an occupational physician's care (p. IV-9). • Screen Selectors for cardiovascular problems (p. IV-9).
2. Leg fatigue due to continual standing (p. IV-10)	<ul style="list-style-type: none"> • Provide employees with shoe inserts (p. IV-10).
F. EMPLOYEE WARM-UP PROGRAMS (p. IV-10)	
G. EMPLOYEE SCREENING/SELECTION (p. IV-12)	
H. MEDICAL MANAGEMENT FEATURES (p. IV-12)	
No medical management strategy in place (p. IV-12).	<ul style="list-style-type: none"> • Hire a medical specialist for the facility (p. IV-12). • Contract with a local medical clinic (p. IV-13). • Develop a return-to-work program (p. IV-13). • Encourage early reporting of MSD symptoms (p. IV-13).
I. TRAINING AND EDUCATION (p. IV-13)	
Little or no new-employee training (p. IV-13)	<ul style="list-style-type: none"> • Develop a "train-the-trainer" program (p. IV-14). • Provide new Selectors with a mentor (p. IV-14). • Provide instructional demonstrations and videos (p. IV-14). • Explain the medical management system (p. IV-14).
J. PSYCHOSOCIAL ISSUES (p. IV-15)	
Many psychosocial stressors in the facility (p. IV-15)	<ul style="list-style-type: none"> • Issue a management values statement (p. IV-15). • Involve employees in the ergonomics process (p. IV-216). • Form work teams (p. IV-16). • Implement mechanisms to foster suggestions (p. IV-16).
K. OTHER ISSUES (p. IV-16)	
1. Dehydration of Selectors during work (p. IV-16)	<ul style="list-style-type: none"> • Provide fluids to Selectors during hot periods (p. IV-16).
2. Additional concerns other than musculoskeletal disorders (p. IV-17)	<ul style="list-style-type: none"> • Coordinate safety issues with the ergonomics process (p. IV-17).

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Table 4. Summary of Issues and Remedies for a Flow-Through System.

FLOW-THROUGH SYSTEM	
Issue	Remedy
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A. CASE FEATURES (p. III-2)	
1. Excessive case weights (p. III-2)	<ul style="list-style-type: none"> • Reduce weights for the heaviest cases (p. III-2). • Raise cases further from the floor (p. III-2).
2. Lack of handle cut-outs on cases (p. III-6)	<ul style="list-style-type: none"> • Request handle cut-outs from suppliers (p. III-6).
3. Handling tray packs (plastic-wrapped cases) (p. III-7)	<ul style="list-style-type: none"> • Educate suppliers about ergonomics concerns with tray packs (p. III-7). • Incorporate lift assists (p. III-8). • Add slip sheets between layers (p. III-8). • Treat tray packs as heavy cases (p. III-8). • Use tray packs that are not wrapped completely (p. III-8).
4. Layer-by-layer depalletizing of cases (p. III-9)	<ul style="list-style-type: none"> • Allow pyramiding depalletizing, but with training (p. III-9). • Rotate pallet after it has been half-way unloaded (p. III-9).
5. Combined heavy case weights and picks near the floor (p. III-9)	<ul style="list-style-type: none"> • Provide a means to lift pallets from floor level-lift tables (p. III-10).
6. Unexpected spinal loading during case handling (p. III-10)	<ul style="list-style-type: none"> • Tag slots to indicate case weights (p. III-10). • Request sturdy cases from suppliers (p. III-10).
7. Slippery cardboard cases (p. III-11)	<ul style="list-style-type: none"> • Have Selectors wear friction-increasing gloves (p. III-11)
D. PALLET FEATURES (p. III-23)	
Weight of wooden pallets (p. III-23)	<ul style="list-style-type: none"> • Use plastic pallets when possible (p. III-23). • Ask that suppliers use plastic pallets (p. III-23). • Use a pallet dispenser (p. III-23).
F. OTHER PRODUCT AND RACK FEATURES (p. III-26)	
Manual wrapping of pallet cases using plastic (p. III-26)	<ul style="list-style-type: none"> • Provide automatic wrappers (p. III-26). • Provide handles for plastic wrap (p. III-27). • Supply smaller rolls of plastic wrap (p. III-27). • Modify pallet jacks to securely hold plastic wrap (p. III-27).

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FLOW-THROUGH SYSTEM	
Issue	Remedy
H. COUPLING ISSUES (p. III-29)	
Selectors holding the grocery order sheets during case handling (p. III-29)	<ul style="list-style-type: none"> • Use a sticker dispenser (p. III-29). • Provide a clipboard hook (p. III-30). • Implement headsets to replace the order sheets (p. III-30).
I. BATTERY CHARGING SPACE (p. III-31)	
Excess space used for charging pallet jack batteries (p. III-31)	<ul style="list-style-type: none"> • Implement a battery charging station (p. III-31).
Administrative Controls and Work Practice Issues	
A. WORK STANDARDS (p. IV-3)	
Selectors working through scheduled breaks (p. IV-3)	<ul style="list-style-type: none"> • Incorporate injury rates and costs into the determination of a standard (p. IV-3). • Do not automatically increase work rates following ergonomics improvements (p. IV-3). • Incorporate a ramp-in work rate for new-hires (p. IV-4).
B. WORK RATES AND OVERTIME (p. IV-4)	
Potential to exceed Selectors' physical abilities (p. IV-4)	<ul style="list-style-type: none"> • Eliminate overtime (p. IV-4). • Limit overtime to off-days (p. IV-4). • Limit overtime to volunteers (p. IV-4).
D. JOB ROTATION (p. IV-7)	
Repetitive, continuous exposure to risk factors for MSD (p. IV-7)	<ul style="list-style-type: none"> • Rotate employees to other jobs (p. IV-7).
E. PERSONAL PROTECTIVE EQUIPMENT (p. IV-7)	
1. Use of back belts and lack of proper training regarding their use (p. IV-7)	<ul style="list-style-type: none"> • Provide detailed training regarding back belt use (p. IV-9). • Administer back supports only under an occupational physician's care (p. IV-9). • Screen Selectors for cardiovascular problems (p. IV-9).
2. Leg fatigue due to continual standing (p. IV-10)	<ul style="list-style-type: none"> • Provide employees with shoe inserts (p. IV-10).

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Issue	Remedy
F. EMPLOYEE WARM-UP PROGRAMS (p. IV-10)	
G. EMPLOYEE SCREENING/SELECTION (p. IV-12)	
H. MEDICAL MANAGEMENT FEATURES (p. IV-12)	
No medical management strategy in place (p. IV-12).	<ul style="list-style-type: none"> • Hire a medical specialist for the facility (p. IV-12). • Contract with a local medical clinic (p. IV-13). • Develop a return-to-work program (p. IV-13). • Encourage early reporting of MSD symptoms (p. IV-13).
I. TRAINING AND EDUCATION (p. IV-13)	
Little or no new-employee training (p. IV-13)	<ul style="list-style-type: none"> • Develop a "train-the-trainer" program (p. IV-14). • Provide new Selectors with a mentor (p. IV-14). • Provide instructional demonstrations and videos (p. IV-14). • Explain the medical management system (p. IV-14).
J. PSYCHOSOCIAL ISSUES (p. IV-15)	
Many psychosocial stressors in the facility (p. IV-15)	<ul style="list-style-type: none"> • Issue a management values statement (p. IV-15). • Involve employees in the ergonomics process (p. IV-16). • Form work teams (p. IV-16). • Implement mechanisms to foster suggestions (p. IV-16).
K. OTHER ISSUES (p. IV-16)	
1. Dehydration of Selectors during work (p. IV-16)	<ul style="list-style-type: none"> • Provide fluids to Selectors during hot periods (p. IV-16).
2. Additional concerns other than musculoskeletal disorders (p. IV-17)	<ul style="list-style-type: none"> • Coordinate safety issues with the ergonomics process (p. IV-17).

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A. Cases Features

The sizes, weights, and shapes of cases handled by Selectors vary tremendously. Although this will always be the rule (e.g., no standard-case size will be available), there are features of these cases that can reduce stress on the joints of individuals. These are discussed below.

- Issue: **EXCESSIVE CASE WEIGHTS.** Cases of product handled by Selectors can be excessively heavy. For example, in a some of facilities, it was estimated that slightly more than 5% of all cases handled weighed more than 40 pounds. Clearly, case weight is an issue that must be considered for Selectors. In addition, loads handled by these individuals produce a bending moment about the spine that must be counter-balanced by the trunk muscles. The further cases are held from the body or the higher the case weight, the greater the bending moment and the more force that is required of the trunk muscles to maintain balance. This creates higher loading forces on the spine. Moment generation about the spine during material handling has been identified as the single factor that best differentiates between jobs having either a low or high back disorder risk (Marras et al. 1993, 1995).

Remedy: **REDUCE WEIGHTS FOR THE HEAVIEST CASES.** For the heaviest case weights, work with suppliers to reduce these weights. This would, of course, increase the number of cases handled by Selectors (i.e., repetitive lifting). However, this additional material handling is likely less stressful to the spine than the high case weights currently lifted.

It is important to understand that research has shown excessive case weights to be problematic for risk of low-back disorders only for the lowest pallet layers, or those nearest the floor (Marras et al. 1997, 1999). When heavier cases were handled at higher layer heights, spinal compression was found to be at a more moderate level, which indicates a reduced risk of low-back disorders, as compared to the lower pallet levels.

RAISE CASES FURTHER FROM THE FLOOR. Especially for the heaviest cases, incorporate lift tables (also called scissors lifts) to raise the cases located at the lowest pallet layers. However, these lift

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assists are not needed beneath every pallet in the facility. They would be most useful, and the cost best-justified, for the highest-moving products. Other options for raising cases from the floor include: installing risers in the slots for the pallets to be set on (Figure 6 and Figure 7); putting pallets of product on top of several empty pallets (Figure 8); and using full pallet flow racks (Figure 9).



Figure 6. One method of raising pallets off of the floor, using risers in a full slot.

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Figure 7. A second method of raising pallets off of the floor, using risers in a full slot.



Figure 8. A third method of raising a pallet in a full slot, by stacking several empty pallets under the cases.

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Figure 9. Using full-pallet flow racks (on rollers) to raise pallets off the floor.

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2. Issue: **LACK OF HANDLE CUT-OUTS ON CASES.** Most cases in warehouses do not have handle cut-outs for Selectors to use. As a result, cases often are more difficult to retrieve from slots, because the cardboard is difficult to grip and there may not be a location on the case that allows it to be pulled toward the Selector.

Remedy: **REQUEST HANDLE CUT-OUTS FROM SUPPLIERS.** Work with product suppliers to provide, especially for the heavier or more awkward-to-handle cases, handle cut-outs (Figure 10). Research on case weights between 40 and 60 lbs has found that the use of handles reduces loading on the spine, thus reducing the risk of low-back disorders (Marras et al., 1999). The handles give Selectors an option of how to maneuver the cases as well. With some cases, handles may provide limited benefits, but with others, there could be great advantages, but they would provide Selectors with an alternative method of moving the product efficiently. Additionally, this same research found that the largest reduction of risk of low-back disorders and spinal loading as a result of adding handles occurred at the bottom layer of the pallets.



Figure 10. Handle cut-outs in cases, to ease lifting and carrying.

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3. Issue: **HANDLING TRAY PACKS (PLASTIC-WRAPPED CASES).**
 More suppliers are plastic-wrapping goods rather than packing them in cardboard. Such packaging is shown in Figure 11. This creates an additional stressor for Selectors, who, in an effort to reduce lifting requirements, often slide cases across one another on a pallet before lifting it from the slot. The force to slide tray packs across one another may be higher than the actual weight of the case. In summer months, tray packs likely will stick together even more than usual, further increasing the demands required of Selectors.



Figure 11. Tray-packs of product completely encased in plastic.

Remedy: Several options are available for dealing with tray packs:

EDUCATE SUPPLIERS ABOUT ERGONOMIC CONCERNS WITH TRAY PACKS. Discuss with and educate suppliers about the problems with the plastic on tray packs, in an effort to eliminate their usage.

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INCORPORATE LIFT ASSISTS. Under items in which tray packs are used, incorporate lift or turn tables, so that cases can be brought closer (both horizontally and vertically) to Selectors.

ADD SLIP SHEETS BETWEEN LAYERS. Provide slip sheets or other materials between tray pack layers, to eliminate plastic laying on top of plastic, which would increase the ease of sliding the tray packs.

TREAT TRAY PACKS AS HEAVY CASES. Deal with tray pack items as if they were heavier cases, and consider those remedies suggested earlier.

USE TRAY PACKS THAT ARE NOT WRAPPED COMPLETELY. Discuss with manufacturers the possibilities of wrapping the top and sides of the tray pack with plastic, leaving the bottom of the cardboard pack unwrapped. One such design is shown in Figure 12. This would eliminate the plastic-on-plastic sliding and reduce the force required to slide the case forward.



Figure 12. Tray-packs without plastic wrapped on the bottoms of the cardboard trays.

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4. Issue: **LAYER-BY-LAYER DEPALLETIZING OF CASES.** Some Distribution Centers train their Selectors to depalletize cases layer-by-layer, as a way to maintain the integrity of the pallet. This differs from a pyramiding approach, in which cases are removed on a diagonal, from the top-front to the rear-back of the pallet. However, the layer-by-layer method creates problems from a biomechanical standpoint. For most individuals, reaching to the rear of a pallet to handle a case is difficult and is likely to produce additional loading to the shoulders and back.

Remedy: **ALLOW PYRAMIDING DEPALLETIZING, BUT WITH TRAINING.** The pyramiding approach will enable Selectors to reach each case easier and likely will reduce the moment generated about the spine when lifting. However, it is necessary that training be given to Selectors, so they only unload a case using this technique when it does not support the one above it. This will assure that the integrity of the entire pallet will be maintained. Additionally, care must be used when using the pyramiding method of depalletizing so that the pallets do not flip backwards when only cases to the rear of the pallet remain.

ROTATE PALLET AFTER IT HAS BEEN HALF-WAY UNLOADED. By instructing fork truck drivers to turn around pallet loads after Selectors have removed about half the cases or by providing turn tables underneath these pallets, many of the cases will be easier to reach. This will reduce the physical requirements of the work. This is especially important for pallets which are placed on the upper tier when using half-slots. Rotating the pallets in this way will reduce the reach requirements.

5. Issue: **COMBINED HEAVY CASE WEIGHTS AND PICKS NEAR THE FLOOR.** The percentage of picks that load the spine above high-risk levels of compression force are substantially increased when picking heavy weights (greater than 40 lbs) from near the floor (Marras et al. 1997, 1999). Therefore, the risk of MSDs to the lower back increases for heavier cases picked from near the floor.

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Remedy: **PROVIDE A MEANS TO LIFT PALLETS FROM FLOOR LEVEL-LIFT TABLES.** These devices raise case pick heights as the pallet is being unloaded. They can be raised manually by Selectors using hydraulics, or automatically using a spring-loaded system. These devices, however, can only be used in slots where there is sufficient vertical space to raise the product and allow Selectors sufficient room for access. Therefore, priority should be given to the heaviest cases used in full slots. Other methods to raise cases from the floor include inserting risers within the slots to set the pallets on, or setting full pallets of product on top of one or more empty pallets. Again, vertical space availability must be considered when using these controls.

6. Issue: **UNEXPECTED SPINAL LOADING DURING CASE HANDLING.** Due to the large number of items that Selectors must lift and new items continually being introduced, even experienced employees likely will not remember the general weights of all cases that are handled. This contributes to unexpected loading on the spine; that is, cases weighing more or less than anticipated by the Selectors. Additionally, excessive glue on the cases may make them stick to each other, also contributing to unexpected loading of the spine when picking the case. Finally, vendors use of less than sturdy case material, or not enough glue used to construct the cases, may increase the risk of the case breaking during handling, thus contributing to unexpected loading of the spine when picking the case.

Remedy: **TAG SLOTS TO INDICATE CASE WEIGHTS.** One way to avoid unexpected loading is to provide feedback to Selectors indicating the weight of the cases. This could be accomplished in two ways, especially for the heaviest cases: (1) Mark each slot with the weight of the case, so that Selectors can mentally and physically prepare for the lift; or (2) Color-code the floor in front of slots containing the heaviest cases with red markings, indicating a warning, so that Selectors will be reminded to lift more carefully.

REQUEST STURDY CASES FROM SUPPLIERS. Work with the suppliers of the cases or with other Distribution Centers that may be having the same problems with cases breaking during selecting, to request sturdier cases. The same approach can be used to address the issue of excessive glue on the cases.

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7. Issue: **SLIPPERY CARDBOARD CASES.** Most cases have no handle cut-outs and often must be pushed and pulled along their sides. The cardboard is usually smooth and difficult for Selectors to get a good grasp in this manner. This results in more difficulty accessing some cases (especially those housed in half or triple slots) and a longer pick time for the order.

Remedy: **HAVE SELECTORS WEAR FRICTION-INCREASING GLOVES.** Many types of gloves are commercially available (e.g., ones with rubber surfaces) that enable a better grip be placed on surfaces such as smooth cardboard. The use of gloves, however, has been shown for gripping tasks to actually increase the muscle force, which could lead to faster muscle fatigue. Therefore, if gloves are to be used, they should be selected very carefully and not impede other tasks performed by the Selectors.

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B. Slot Features

Major concerns for food Distribution Centers include the time taken for Selectors to pick an order and the overall pick density, or the amount of picks able to be performed in a given area. These concerns translate to smaller warehouses that locate goods in as small an area as possible. In the short run, this approach may produce faster pick times. However, cumulatively, it may slow Selectors down (e.g., due to physical fatigue) in warehouses that have attempted to condense the area too much. Several slot features are at issue, as discussed below.

1. Issue: **POSTURE OF INDIVIDUALS WORKING IN HALF OR TRIPLE SLOTS.** Given the nature of a Selector's job, reaching cases is easiest when pallets are housed in full slots. In these types of slots, Selectors are more able to lift cases closer to the body (which reduces the lifting moment) or while standing more upright (which reduces spinal loading). The use of half slots (Figure 13) or triple slots (Figure 14) creates several problems: (1) For pallets brought to these slots that don't fit (vertically) into them, additional material handling is required to partially unload some of the cases; (2) Access is limited in these slots, and Selectors are less able to lift cases in a manner that can reduce loading to the back; and (3) Handling empty pallets is more difficult from these smaller slots.

Remedy: The first recommendation addresses the breaking down the pallet. The subsequent recommendations listed in this chapter are listed in order from most- to least-desirable for the picking side of the operation.

USE A MECHANICAL LOAD SPLITTER. When pallets must be broken down, either for placement into half- or triple-slots, or if being broken down in a Cross-Dock or Flow-Through system, the use of mechanical equipment to remove several layers at a time eliminates repetitive handling of the Selectors. Figure 15 shows one piece of equipment called a load splitter, which uses a clamping device to move one or more layers of a pallet at a time. Figure 16 shows another load splitter, which has a flat bed that slides under a slip sheet, to move one or more layers at a time.

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Figure 13. Tight fit of a pallet in a half-slot, making some cases difficult to retrieve and requiring selectors to bend or reach excessively.



Figure 14. Example of a triple slot, which requires more extreme body positions of selectors to reach cases.

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Figure 15. Mechanical load splitter with a clamping device, used to break down pallets.



Figure 16. Load splitter with flat bed to slide under a slip sheet for moving one or more layers of cases.

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USE FULL-SLOTS WHENEVER POSSIBLE. The best practice found, from an ergonomics perspective, is the use of full-slots to house cases. This reduces the potential for awkward postures for many of the cases located on a pallet and increases the chance that cases can be lifted more easily. One problem with this approach is the additional space required to use full slots for all product. If the number of full slots is limited, place the heavier-weight and the faster moving product in them.

INCORPORATE FLOW RACKS FOR SLOW-MOVING PRODUCTS. One solution to the space problem is the use of gravity-fed flow racks (Figure 17). These flow racks were placed above near-full slots, so accessing cases from them does not require awkward trunk postures for Selectors. This design increases the pick density with no increase in the travel time. The design in Figure 17 contrasts with another design (Figure 18) in which slower-moving items were gravity-fed from racks near floor level to above shoulder height. Full aisles of flow racks similar to that shown in Figure 18 could be used for lighter and slower-moving items. This type of system likely produces more stress on the back due to the need to lift some case from near the floor; therefore, the lightest and slowest-moving of these items should be placed near the floor to reduce the repetition of picking at this level. This design also would increase the pick density for the items in these aisles and allow more space to have full slots for the heavier and faster-moving product.

Several other disadvantages exist with the use of flow racks. The flow racks must be filled from behind the racks, requiring another employee to perform material handling. Also, due to the design of the racks, Selectors must lift the cases over the stop bar that keeps the cases from falling off the racks when not being picked. These lifting forces may become high if there are several cases behind the one being picked, essentially wedging it between the stop bar and the cases behind it.

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Figure 17. Gravity-fed flow racks used above a near-full slot.



Figure 18. Gravity-fed flow racks.

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USE HALF-SLOTS. If half-slots (Figure 13) must be used due to space constraints, only house slower-moving and lighter products in them. Prioritize case movement through the facility and determine which items are slower-moving. If many items fit within this category, then put the lighter-weight cases in half-slots and keep the heavier cases in full slots. The use of half-slots should be accompanied by a system that allows fork truck drivers to rotate pallets after they have been half picked, that allow turn tables to be used under these pallets so that Selectors can rotate the pallets themselves, or that enable pick sticks to be used to aid in case retrieval.

To reduce reach distances, especially for the upper slots, reconfigure the width of the slots such that the long side of the pallet is exposed to the aisle.

Finally, if half-slots must be used, consider using a system as shown in Figure 20, where a gravity flow-rack with slower moving product is housed above the half-slot or near full slot.

MAXIMIZE THE FLOW RACK/FULL SLOT RATIO. The flow rack system shown in Figure 17 is useful if only slow-moving items are placed in the lower racks and if full slots house pallets in the rest of the facility. This will ensure that Selectors will only need to access cases in these more awkward rack locations a minimum number of times.

SELDOM USE TRIPLE-SLOTS. Abolish the use of triple-slots in the Distribution Centers, as they require Selectors to contort themselves in postures that substantially increase the risk of MSDs. Not only do triple-slots require excessive bending to retrieve cases, but more of a pallet must be broken down for it to fit, producing additional times that each case must be handled within the facility.

DEVELOP/REVISE THE FACILITY'S SLOT-MANAGEMENT SYSTEM. Review the optimization system used to manage the flow of goods through the warehouse, to ensure that pallets are placed in full slots according to case weight and movement speed of the product. This can greatly affect the physical requirements of Selectors, as well as aid the Selectors to help build stable bases for their orders.

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2. Issue: **LIFTING CASES FROM THE LOWEST PALLET LAYERS.**
The highest loading to the spine and the greatest risk of low-back injury to Selectors arise from lifting cases off the lowest pallet layers, near the floor of the warehouse (Marras et al. 1997).

Remedy: **PROVIDE A MEANS TO LIFT PALLETS FROM FLOOR LEVEL.** Different methods are available, depending on the configuration of the Distribution Center.

IMPLEMENT LIFT TABLES. These devices raise case heights as the pallet is being unloaded. They can be raised manually by Selectors using hydraulics, or automatically using a spring-loaded system. These devices, however, can only be used in slots where there is sufficient vertical space to raise the product and allow Selectors sufficient room for access. Therefore, priority should be given to the heavier cases used in full slots.

STACK PALLETS. By placing a full pallet on top of one or more empty pallets, the bottom case layer will be further from the ground. This technique is best used when full slots (and, thus, more clearance) are being used.

USE ROLLER CONVEYORS. Roller conveyors can be used in double-deep slot configurations, in which two pallets are placed end-to-end. These systems enable the rear pallet to be pulled out and accessed more easily after the front pallet is empty. This system results in the entire pallet being raised off the floor, which can ease the unloading of cases on lower pallet layers. The clearance of the top of the pallet in the slot must be considered, as should the potential for Selectors tripping over these conveyors. Periodic maintenance of the rollers is imperative to reduce the force required to pull the pallets forward.

It may be unrealistic to provide these means within every slot; therefore, priority should be given to the heaviest cases and the fastest-moving products.

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3. Issue: **DIFFICULTY IN REACHING CASES FURTHER BACK IN SLOTS.** Regardless of the type of slot, spinal loading is increased when cases are removed from pallets further back and lower on pallets (Marras et al. 1997). This is because Selectors must bend over further to lift these cases, and they usually pick them up further from their bodies, which increases both the moment generated about the spine and risk of low back MSDs.

Remedy: **PROVIDE TURN TABLES.** In those slots housing especially the heaviest case weights, incorporate turn tables onto which pallets are placed. This will allow Selectors to rotate the entire pallet after it is about half unloaded, for easier access to those cases previously furthest from the aisle. This would reduce the reach distance to the cases as well as the lifting moment generated about the spine. Note that these turn tables require additional floor space within a slot, so they may not be feasible for all locations.

TURN PALLETS AROUND WITH FORK TRUCKS. As an alternative to the above remedy, have forklift drivers rotate the pallets after they have been half unloaded. This technique also will reduce the pick time of cases, since Selectors will have easier access to them and can load them more quickly and with less effort. This approach would require close supervision, initially, to assure the proper timing of these pallet rotations.

REDESIGN RACKS TO ELEVATE THE PALLET. One such design (shown in Figure 19) enables Selectors to access those cases located further back in the slot. This is appropriate for the heaviest cases handled in the facility. It should be assured, however, that the elevated height does not create space problems for the top cases on the pallet, and making them more difficult to retrieve. Additionally, designs as shown in Figure 19 may create tripping hazards and make it more difficult for Selectors to walk between the pallets. Other designs may be possible that may reduce these hazards. One such design is shown in Figure 20. This design requires the full slots to be widened, with curved risers placed on each side of the full slot. This not only elevates the pallet in the slot, but also allows increased access between the two pallets in the full slot.

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Figure 19. Risers used to elevate pallet from the floor and allow easier access to cases, but may create a tripping hazard.



Figure 20. Risers used to elevate pallets off the floor and slot-widened to allow easier access to the rear of pallets.

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4. Issue: **LITTLE CLEARANCE BETWEEN PALLETS WITHIN THE SAME SLOT.** Often, fork lift drivers who move pallets into slots concentrate only on getting them out of the aisles. Pallets that are side-by-side in a slot do not enable Selectors to easily reach those cases at the rear of the pallets (Figure 21).



Figure 21. Pallets side-by-side in a slot, resulting in no access between pallets.

Remedy: **PROVIDE FORK LIFT DRIVER AND SELECTOR TRAINING TO MAINTAIN CLEARANCES BETWEEN PALLETS.** Instruct fork lift drivers to keep a clearance width of at least 16 inches or more between two pallets within a slot (Figure 22). Also, educate them as to the purpose of this action (that Selectors can more easily reach cases and reduce their risk of MSD.) In addition, train the Selectors to use these clearances as well, to better reach those cases located further back on a pallet.

INCREASE SLOT WIDTH TO INCREASE CLEARANCES BETWEEN PALLETS. By increasing the slot width, this allows more clearance between the pallets. As shown in Figure 20, the slot width was increased, and risers were placed in the slot to raise the pallet off the floor as well as increase the ease of access between pallets.

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Figure 22. Pallets set apart in a slot to increase the clearance between pallets and provide easier access to selectors.

C. Aisle Features

Depending on the type of pick system used in the Distribution Center, the width of some aisles may need to be considered. For example, along aisles where faster-moving product is stored, they may need to be wider, so that several Selectors can pick at the same time. Congestion along narrower aisles will likely increase order pick times. However, the effects of these types of changes (i.e., more floor space required) need to be considered within a systematic optimization scheme for order picking within the Distribution Center.

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D. Pallet Features

Issue: **WEIGHT OF WOODEN PALLETS.** Wood pallets can weigh between 50 and 75 pounds. Most goods shipped to food Distribution Centers are placed on wooden pallets. Selectors often must move pallets of these weights in addition to their other tasks. This creates more physical demands and loading on body joints.

Remedy: **USE PLASTIC PALLETS WHEN POSSIBLE.** The substitution of plastic pallets, which weigh about 22 pounds, for wooden ones, will reduce the cumulative weight handled on a daily basis by Selectors. Within a Distribution Center, create a policy whereby all pallets used will be plastic.

ASK THAT SUPPLIERS USE PLASTIC PALLETS. Food suppliers also must handle heavier wooden pallets within their facilities. By educating them as to the benefits of lighter, plastic pallets (reduced spinal loading, cost savings from fewer or lower-severity MSDs), suppliers may be more willing to have goods shipped on plastic pallets.

USE A PALLET DISPENSER. If wooden pallet must be used, one method of eliminating some or all of the handling of the heavy pallets by the Selectors is to use a pallet dispenser (Figure 23). When Selectors need a empty pallet to begin their order, they drive their pallet jack up to the pallet dispenser, and a pallet is dispensed right on the forks of the pallet jack.

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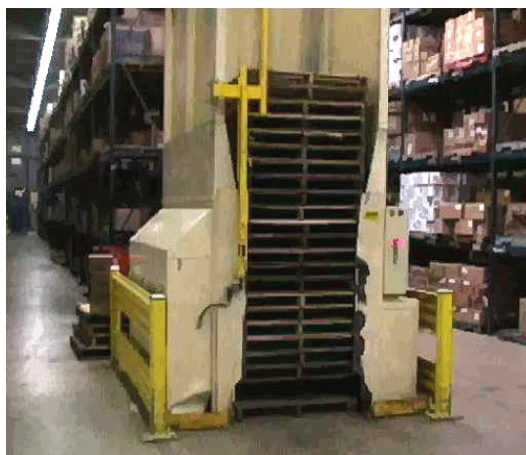


Figure 23. Wooden Pallet Dispenser,
Used to Reduce the Manual
Handling of Pallets.

E. Pallet Jack Features

Many remedies were addressed earlier in this *Guide* to enable cases be more easily accessed from slots. For example, lift tables or stacked pallets can raise cases further from the floor and reduce spinal loading. However, Selectors in a traditional order pick systems must place cases on pallet jacks, and pallet jacks are used in virtually every food DC.. The design of these devices also must be considered.

1. Issue: **LACK OF ADJUSTABILITY IN FORK VERTICAL HEIGHTS.** Even if cases are easily located in slots, pallet jacks usually require the first cases of an order be placed on a pallet near floor level. Typically,

the initial cases are used to build a sturdy base, and may consist of heavier, sturdy cases. As reported earlier, working at this level with heavier product stresses the body and can produce MSDs.

- Remedy: **USE PALLET JACKS WITH RAISABLE FORKS.** Use pallet jacks that enables the Selector to raise the pallet as needed, so that the initial cases can be placed on the lower layers more easily and without the extreme forward bending. This design uses the same concept as raising the pallets in slots higher off the floor to reduce the risk of LBD.

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USE SEVERAL PALLETS STACKED ON TOP OF EACH OTHER ON THE PALLET JACK. To reduce the forward bending necessary for the first few layers on the pallet, raise the initial stacking height by placing more than one pallet on the pallet jack. This practice was observed for less than full cube orders (Figure 24).



Figure 24. Stacking of empty pallets on a pallet jack, to raise the initial stacking height of cases and reduce trunk bending.

2. Issue:
- ADDED PHYSICAL STRESS FROM USING POORLY MAINTAINED PALLET JACKS.** Pallet jacks develop much wear-and-tear from being used extensively by Selectors. This can result in pallet jacks with reduced braking ability and more difficult steering and maneuverability. Increases of stress on the hands and wrists can result from difficulty in braking, and difficulty in steering and maneuverability of the pallet jack can increase the loading on the shoulders.

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Remedy: **IMPLEMENT A SYSTEM OF ROUTINE, SCHEDULED PRE-VENTATIVE MAINTENANCE ON PALLET JACKS.** By periodically checking the working components of all pallet jacks, they can be kept in better condition and remain easier for Selectors to use.

PROVIDE PALLET JACK EDUCATION. Train Selectors to report problems or difficulties with pallet jacks when they are first noticed, so that issues such as steering and braking are addressed before they create additional problems.

F. Other Product and Rack Features

Issue: **MANUAL WRAPPING OF PALLET CASES USING PLASTIC.** Before pallets of product are sent to the stores, they are wrapped with plastic to maintain integrity to prevent movement during shipment. Some facilities have automatic pallet wrappers. However, others require Selectors to wrap the plastic around cases on the pallet manually. Several issues exist for manually wrapping the pallets. First, to wrap the bottom layer of the pallet, Selectors must bend forward extremely far with the trunk. This places additional stress on the lower back that is eliminated when automatic wrappers are used. Second, although the weight of a full plastic roll may not be excessive as compared to some cases, the forward bending posture combined with the weight of the roll serves to increase the risk of LBD. Third, Selectors have been observed putting their fingers in the plastic-wrap tube at each end, and walking around the pallet while rotating the tube around the fingers. This increases the likelihood of lacerations. Plastic wrap handles were not observed that would make applying the wrap easier. Finally, many pallet jacks are not constructed to hold the plastic wrap in place when it is not in use. Selectors may injure themselves trying to catch a plastic roll that may fall off of the pallet jack due to inadequate storage space on the pallet jack.

Remedy: **PROVIDE AUTOMATIC WRAPPERS.** Eliminating manual wrapping reduces one task of a Selector's job and could provide additional rest time for Selectors before a new order is begun. This rest time is important for the body to begin to recuperate from the physical demands of the job.

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PROVIDE HANDLES FOR PLASTIC WRAP. If manual wrapping must be done, develop a handle device onto which Selectors can hold the wrap more properly. These devices may have to be custom-made. This not only will reduce the potential for lacerations to the hands, but it can reduce the time taken for the order to be picked by reducing the wrapping time.

SUPPLY SMALLER ROLLS OF PLASTIC WRAP. For manual wrapping tasks, provide Selectors with smaller rolls of plastic that are lighter-weight and easier to handle.

MODIFY PALLET JACKS TO SECURELY HOLD PLASTIC WRAP. On pallet jacks with no place for the plastic wrap to be held, Selectors have been observed placing the wrap on the jack wherever it was believed it would not fall off. This often did not guarantee the wrap would not fall off the jack. By adapting all pallet jacks so that the plastic wrap can be securely held in place (Figure 25), the potential for accidents and waste will be reduced.



Figure 25. Example of holder on a pallet jack to secure plastic-wrap rolls.

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G. Pick Sticks

Pick sticks are tools used in DCs to reach and pull cases that are located out of easy reach of Selectors.

Issue: **PICK STICKS NOT USED BY SELECTORS OR NOT AVAILABLE.** Some Distribution Centers reportedly distribute pick sticks to all Selectors; other Distribution Centers make them available as needed. A pick stick in use is shown in Figure 26. Unfortunately, these assists come up missing or are seldom used by employees. As a result, difficult-to-reach cases (e.g., those in half- or triple-slots) must be retrieved by hand, adding to the physical requirements of these Selectors.



Figure 26. A pick-stick used by a selector to grab a hard-to-reach case.

Remedy: **EDUCATE SELECTORS AND SUPERVISORS REGARDING PICK STICKS.** Selectors and Supervisors need to be trained of the benefits to using pick sticks (i.e., less physical work), reminders should be posted in the facility, and the value of pick sticks should be addressed periodically, such as at department meetings.

PROVIDE EASIER ACCESS TO PICK STICKS. If pick sticks are not being used in the Distribution Center, ask employees for the reason(s) why. Provide pallet jacks with holders for these sticks. Ensure that pick sticks are kept near slots that present the biggest problem, such as by half- or triple-slots housing the heavier or faster-moving products.

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H. Coupling Issues

Issue: SELECTORS HOLDING THE GROCERY ORDER SHEETS DURING CASE HANDLING. Different Distribution Centers use a variety of methods for coding cases before they go to the stores. Some place stickers on each case. Others use a small clipboard in which they check off items as cases are picked. Regardless of the method, Selectors often hold these objects as they are handling cases. This reduces the coupling between the hands and the cases; that is, the ability for Selectors to pick up and transfer the cases onto pallets. Poor coupling has been identified as a risk factor for low-back disorders (Waters et al. 1993), and increases the risk of dropping loads, which can result in unexpected loading of the back and increase the risk of MSD.

Remedy: USE A STICKER DISPENSER. If stickers must be applied to each case, provide a waist belt-held device that dispenses the stickers and eliminates the need for Selectors to hold the pack while transferring cases. One system used by a Distribution Center is shown in Figure 27.



Figure 27. A waist-held sticker dispenser, used to free up both hands for order selecting.

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PROVIDE A CLIPBOARD HOOK. If a clipboard system is used, provide a belt hook or other method whereby Selectors can easily fasten the clipboard during material handling so that the hands are entirely freed up.

IMPLEMENT HEADSETS TO REPLACE THE ORDER SHEETS. Headset technology allows the Selector to identify the cases to be picked, without having to hold any orders (Figure 28). Both hands, therefore, would be free for the transfer of the cases.



Figure 28. Headsets, used to direct selectors through their order, freeing both hands for selecting.

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I. Battery Charging Space

Issue: **EXCESS SPACE USED FOR CHARGING PALLET JACK BATTERIES.** Many facilities charge batteries while they remain on the pallet jacks. This requires a large amount of space that cannot be used for additional slots or for other purposes.

Remedy: **IMPLEMENT A BATTERY CHARGING STATION.** One facility observed has designed and now successfully uses a battery charging station, shown in Figure 29. In this system, the battery is removed from a pallet jack (using a magnet) and taken to be charged, while a fully charged battery is placed into the pallet jack. This system, using a bank of chargers, requires less floor space, since chargers can be stacked vertically.



Figure 29. A battery-charging station, designed to reduce floor space for this operation, freeing up more area for slots.

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- B. Work Rates and Overtime**
- C. Picking Order and Selector Start Times**
- D. Job Rotation**
- E. Personal Protective Equipment**
- F. Employee Warm-up Programs**
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Chapter IV. Administrative Controls and Work Practices Issues

The pick system used in the Distribution Center, its physical configuration, and case and slot issues all are extremely important to consider when assessing MSD risk to Selectors. However, other issues related to food distribution must be considered within the ergonomics *process*. These involve issues such as how the work is organized, the types of protective equipment available to assist Selectors in their work, and how injured employees are cared for and returned to work. These and related issues will be discussed in this chapter.

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A. Work Standards

Standards relate to the rate at which Selectors must work to satisfy grocery store orders and to maintain their salary. Numerous factors are incorporated into the calculation of a facility's standard.

- Issue: **SELECTORS WORKING THROUGH SCHEDULED BREAKS.**
 As mentioned in Chapter I (Introduction), the numbers of MSDs to Selectors is high, as are their associated costs. However, this information may not be considered when determining the work standard for a Distribution Center. The development of work standards do not take into account the presence and magnitudes of risk factors for MSDs.
- An indication that the standards set are beyond the abilities of Selectors is the number of Selectors who work through their morning or afternoon breaks to complete their orders. This act eliminates the ability for the body to rest and to partially recover from the heavy physical nature of this work. Selectors who consistently work through their breaks place themselves at greater risk of MSD, can miss-pick orders, and are more likely to be involved in accidents due to a higher fatigue level.
- Remedy: **INCORPORATE INJURY RATES AND COSTS INTO THE DETERMINATION A STANDARD.** Work rates that require Selectors to pick orders rapidly will benefit the company by reducing the numbers of Selectors that must be hired. However, work standards that require orders to be picked at rates that exceed the capabilities of individuals will serve to negate any of those benefits because of higher injury rates. Associated with lost-time injuries are medical expenses associated with the injury, the sick time used by the injured employee, and the costs of hiring and training replacement workers. These costs may out-weigh the perceived benefits of raising the work standard, because of the direct and indirect costs associated with MSDs.
- Remedy: **DO NOT AUTOMATICALLY INCREASE WORK RATES FOLLOWING ERGONOMICS IMPROVEMENTS.** The implementation of engineering and/or administrative controls has the potential to reduce the pick times through reductions or elimination of risk factors for MSDs. Any benefit to reduced risk may be negated, however, if the work standards are automatically increased as a result of the realization that pick rates have been reduced.

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Remedy: **INCORPORATE A RAMP-IN WORK RATE FOR NEW-HIRES.**

Work rates set for experienced Selectors may be too high for new-hires who are new to Selecting work. Therefore, it is common practice to allow a gradual ramp-up of the work-rate for new hires, starting at a lower work pace, and eventually, over a several-week period, working up to the work-rate set for experienced Selectors. This allows the new-hires to gradually become conditioned to the physical stresses associated with the Selecting tasks.

B. Work Rates and Overtime

Issue: **POTENTIAL TO EXCEED SELECTORS' PHYSICAL ABILITIES.** Due to the physical demand this job puts on Selectors, the amount of overtime required to be worked may exceed the capabilities and limitations of these employees.

Remedy: **ELIMINATE OVERTIME.** Elimination of overtime will eliminate the added exposure to risk factors for MSD. If overtime cannot be eliminated, reduce the overtime as much as possible to reduce the cumulative physical stress on the Selectors.

LIMIT OVERTIME TO OFF-DAYS. If overtime must be used, limit the overtime to the Selectors off-days instead of adding the overtime on to an already long shift. This will allow the Selectors to recover between shifts and reduce the risk of injury.

LIMIT OVERTIME TO VOLUNTEERS. If overtime must be used, limit the overtime to Selectors on a volunteer basis. This will reduce the physical stress on those individuals who need the recuperation the most, as well as reduce the psychosocial stress which may be generated from a mandatory overtime policy.

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C. Picking Order and Selector Start Times

1. Issue: **PICKING ORDER.** Programming the order in which Selectors pick cases is based on many factors, including case size, weight, picking time, etc. These programs undoubtedly are complex and expensive to develop, especially given the changing and increased number of differing items now found in grocery stores. However, Selectors may not following these picking orders because some orders don't start with large, sturdy cases that are needed to build the base of the pallet. This can contribute to congestion in certain aisles (Figure 30), increased picking times, and less-stable orders.



Figure 30. Congestion in an aisle, that can increase picking time and reduce productivity.

Remedy: **STAGGER SELECTOR START TIMES.** To avoid congestion in the aisles at the beginning of the shift, allow Selectors to begin work at different times, so they all do not begin to pick their orders at the same time in the same aisles.

CREATE A SELECTION ORDER COMMITTEE. Form a committee dealing with optimal order selection, one that includes comments and opinions of experienced Selectors. This will aid in producing better selection systems and reduced pick times.

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2. Issue: **CONGESTION AT THE BEGINNING OF A SHIFT.** When work shifts all begin at the same time, and all Selectors receive their first orders, several slots may need to be accessed at the same time by a number of Selectors (Figure 30). This often occurs because certain items are needed to build a strong base of support for the pallet. This activity creates difficulty in accessing these and other slots, snarls the aisle for other Selectors who need to by-pass this area, and increases order pick time. Because the orders must be picked within a specific time limit, this can create the need for some Selectors to play catch-up, leading to faster, jerkier, and thus more risky body movements.

Remedy: **STAGGER SELECTOR START TIMES.** To avoid this congestion, stagger the Selector start times, so they all do not begin to pick their orders at the same time. This process can avoid much of the congestion found in some Distribution Centers.

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D. Job Rotation

Issue: **REPETITIVE, CONTINUOUS EXPOSURE TO RISK FACTORS FOR MSD.** The nature of the task of Traditional Order Selecting and the Belt-Pick system exposes the employees to repetitive manual material handling, along with other task-related factors that increase the risk of MSD.

Remedy: **ROTATE EMPLOYEES TO OTHER JOBS.** The use of job rotation to other jobs within the facility that do not consist of repeated material handling decreases the repetitive exposure to risk factors for MSD. Tasks within a Distribution Center that may be candidates include hi/low operators, sanitation, truck loading and fork truck operating. Job rotation is an administrative control, which spreads the exposure of order selecting to many employees. Therefore, the use of engineering controls aimed at eliminating or reducing the magnitude of the risk factor should be the first priority. Using administrative controls such as job rotation to supplement engineering controls can be beneficial when no further engineering controls can be implemented.

E. Personal Protective Equipment

Several devices are commercially available that proclaim to assist in reducing stressors on Selectors' bodies as they do their jobs. Few have been scientifically validated. The most common pieces of equipment are discussed below.

- Issue:** **USE OF BACK BELTS AND LACK OF PROPER TRAINING REGARDING THEIR USE.** Back belts (also known as back supports, orthoses, or braces) are similar to those used by weight lifters. There are several hypothesized benefits for using back supports. Among them:
 - They remind people how to lift "properly;"
 - Supports act as a splint, reducing the range of trunk movement and, thus, the risk of injury; and
 - They may reduce the amount of shear loading on the spine as loads are lifted when the trunk is flexed.

Several studies have supported the use of back supports. Walsh and Schwartz (1990) studied three groups of male warehouse workers—a control group, a group that received only a half-hour of training on proper lifting techniques, and a group that received the training as well

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as wore a low-back support for six months. One dependent measure was abdominal flexor strength, since it was hypothesized that belt use may weaken these muscles. No differences in abdominal strength were found between the three groups. The group that wore the belts did, however, had a decrease in lost work time, suggesting that back supports were beneficial only for those who had reported an injury to the low back.

Other studies have suggested a negative impact from wearing belts. Reddell et al (1992) studied airline baggage handlers who either received: a belt; a one-hour training session about back care; both a belt and the training; or nothing (the control group). No differences were found between groups for injury rates, lost work time, or workers' compensation costs. It was found that nearly 60% of those in the belt-wearing groups ended their belt use before the eight-month study ended. Also, the number of injuries and the severity of these injuries increased after the belt-wearing period ended. McCoy and colleagues (1988) monitored subjects who repetitively lifted loads without a belt and with two different types of supports. Subjects were allowed to adjust the amount of weight they were lifting to their own perceived acceptable levels. Results indicated that, when wearing the supports, subjects were willing to lift about 19% more weight than without the belt. It may be that when individuals wear back supports there is a false sense of security that more weight can be lifted safely, which may or may not be true.

It is clear that the benefits of wearing these devices have not yet been proven scientifically. There has been no evidence to date suggesting that back belts prevent injuries (NIOSH 1994). In addition, Lander et al (1992) and Harman and colleagues (1989) found that intra-abdominal pressure (IAP) increased during belt use. They theorized that increased IAP better supports and stabilizes the low back, creating a safer situation for the spine during belt use. However, McGill and Norman (1987) found, using biomechanical models, that increased IAP actually *increased* the compressive load on the spine instead of reducing it. Higher compressive loads are believed to be related, in some way, to higher risk of low back injury.

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Back supports are thought to affect individuals physiologically as well. Hunter et al (1989) measured heart rate and blood pressure while subjects performed various tasks with and without a weight belt. Results showed that both heart rate and blood pressure were higher when the belt was worn. Marley and Duggasani (1996) also found that blood pressure was significantly increased when subjects wore back supports as opposed to no-belt conditions. These results suggest that those with compromised cardiovascular systems may be at higher risk when exercising while wearing these supports.

In summary, there has not been enough research conducted at present to either recommend or discourage the use of back supports. Some agencies, however, have delivered an opinion. The U.S. Department of Health and Human Services (1994) *"...does not recommend the use of back belts to prevent injuries among uninjured workers, and does not consider back belts to be personal protective equipment."*

Remedy: **PROVIDE DETAILED TRAINING REGARDING BACK BELT USE.** Because the back belt controversy has not yet been resolved, some Distribution Centers may opt to supply them to their employees. However, back supports should not be considered an "ergonomic fix," since the nature of a material handling job (the load that must be handled) has not changed. Additionally, because individuals may believe they can physically do more while work while wearing a belt, any belt usage should be combined with training, education on spine physiology, and proper lifting techniques.

ADMINISTER BACK SUPPORTS ONLY UNDER AN OCCUPATIONAL PHYSICIAN'S CARE. For those facilities who do not require mandatory use of back belts, provide them to Selectors only under specific conditions. Some evidence exists that suggests those already injured may benefit from molded orthoses, but there is no evidence that uninjured workers benefit from using these devices. Therefore, blanket distribution of belts to all individuals may not be justified.

SCREEN SELECTORS FOR CARDIOVASCULAR PROBLEMS. Individuals should be evaluated for cardiovascular risk before they are given back supports, since heart rate and blood pressure have been found to increase with belt usage.

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2. Issue: **LEG FATIGUE DUE TO CONTINUAL STANDING.** Regardless of the type of pick system used within the Distribution Center, most employees stand for a majority of their work day. This activity requires the leg muscles to continually support the body, and the work is done mostly on hard, concrete surfaces. Fatigue in the legs is likely to occur.

Remedy: **PROVIDE EMPLOYEES WITH SHOE INSERTS.** Some Distribution Centers dispense padded shoe inserts to Selectors. These inserts serve to cushion the effects of the concrete floors they worked upon, and, thus, reduce leg fatigue and discomfort.

F. Employee Warm-Up Programs

Some Distribution Centers have developed warm-up programs or encourage their employees to stretch before starting their selecting duties. Performing this activity as a group can create a "teamwork" attitude and increase communication among employees. Although no definitive scientific studies have been conducted that show a direct benefit in terms of decreases in injury rates, several points should be kept in mind if warm-up programs are to be used:

- The particular stretching program should be developed by a qualified person such as a physical therapist;
- To increase participation in the stretching, time should be provided at the beginning of the shift, or at other times during the shift (see Figure 31);
- Employees should not be required to participate in the warm-up activities if in fact they are experiencing any discomfort or are injured. Participation status should be evaluated by medical personnel.

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Figure 31. Selectors doing stretching warm-ups at the beginning of their shift.

Posters can be used to remind Selectors of the different stretching postures most beneficial to their jobs (Figure 32).

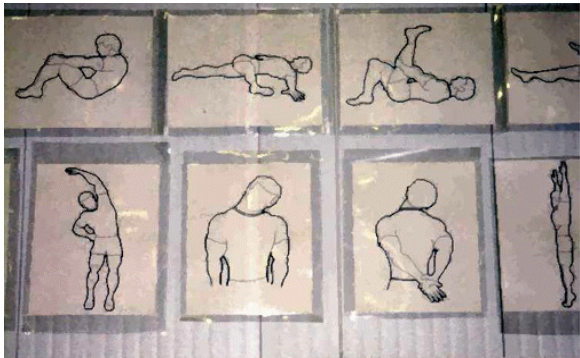


Figure 32. Posters, used in a DC to remind employees of different warm-up stretches they should do before beginning to select.

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G. Employee Screening/Selection

Some Distribution Centers conduct screening programs for new employees. Unfortunately, the effectiveness of such programs have not been established. Regardless of their efficacy, potentially problematic issues exist with this approach:

- The work force will be further limited due to those not passing the screening requirements;
- There are possible discrimination issues related to the Americans with Disabilities Act;
- It has not been established where the appropriate cut-off occurs for one to perform the Selector job effectively, that is, without acquiring a low back disorder. In other words, given a certain cut-off, some individuals may not be hired who *are* qualified for the work, while others may be hired who do not meet the job's requirements; and
- There may be other methods of changing work requirements that do not focus on employee capabilities and limitations.

H. Medical Management Features

As discussed in Chapter I, the management of medical issues is one component of a successful ergonomics process. The lack of such a system in a Distribution Center can produce many concerns, as outlined below:

Issue: **NO MEDICAL MANAGEMENT STRATEGY IN PLACE.** With no medical management program, the facility may be less aware of employees' MSD symptoms and how they are to be treated, injured individuals may not get the appropriate medical care they need, MSD trends are less likely to be followed, and restricted-duty programs probably will not get established.

Remedy: **HIRE A MEDICAL SPECIALIST FOR THE FACILITY.** This may include, for example, a nurse having an occupational background, one who is familiar with work-related MSDs. This employee's duties would include treatment of MSDs within their scope of practice, tracking injury trends, coordination of injured employees visits with the company's occupational physician or the employee's treating physician, and interacting with the ergonomics committee regarding return-to-work activities, among others. A full-time employee dedicated to medical and health issues also can be beneficial in keeping lines of communication open between the health care provider, employees and management regarding health and injury issues.

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CONTRACT WITH A LOCAL MEDICAL CLINIC. In the absence of an on-site health care provider, contracting with a local medical clinic capable of treating occupational musculoskeletal disorders may be an alternative. It is imperative that the health care professionals be familiar with the type of tasks the employees directed to them perform. This will aid in the return-to-work process after an injury.

DEVELOP A RETURN-TO-WORK PROGRAM. Development of a return-to-work program consisting of placement of injured employees on jobs consistent with their medical restrictions allows employees to return to work sooner and also increase the chances that they will return to their original job. The success of the program depends on the availability of jobs or tasks that injured employees can perform that do not violate the restrictions given by the physician, which would allow the injuries to recover.

ENCOURAGE EARLY REPORTING OF MSD SYMPTOMS. A strong management philosophy that is committed to the health and well-being of its employees will urge them to report musculoskeletal problems before they become more serious, and costly, lost-time incidents.

I. Training and Education

Employee training is important so that Selectors understand all aspects of the job early in their employment. Their knowledge job tasks and proper work practices increases the likelihood that the work will be performed correctly sooner after employment begins.

Issue: **LITTLE OR NO NEW-EMPLOYEE TRAINING.** The Selector's job may appear simple on the surface, but there are many aspects to it that must be understood to assure it is done properly and safely. The lack of training, regardless of its type, will affect safety, productivity, and company profits. Also, lack of training for new employees may produce a perception that the company does not have the individual's best interests in mind.

Remedy: There are several methods that Distribution Centers have used to train Selectors. These are discussed below.

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DEVELOP A "TRAIN-THE-TRAINER" PROGRAM. How these programs have worked in some Distribution Centers involve training upper levels of management on various topics, such as ergonomics, safety, etc. These individuals, in turn, train others, who then continue this process through the company. The primary benefit to this approach is that each organizational level within the company learns about and buys into the philosophy being taught. Often, ergonomics processes fail because of the lack of commitment by middle managers. Systems, such as an ergonomics process, that are understood across many levels of a company, produces ownership of its ideals and increases the chances that it will be accepted and will work effectively.

PROVIDE NEW SELECTORS WITH A MENTOR. An experienced Selector, initially paired with a new employee, can provide insights to the new-hire on many levels, among these: how to properly stack a pallet to maintain its integrity, the best method of picking cases from slots, how to correctly use pallet jacks, and other "tricks of the trade," those experiences learned after several years on the job. This type of training appears to be useful in instructing new Selectors.

PROVIDE INSTRUCTIONAL DEMONSTRATIONS AND VIDEOS. Training companies can provide a myriad of on-site presentations or videotapes to teach employees about a specific topic. For Selectors, information about, for example, how the spine works, the importance of exercise, and proper picking techniques, can serve to reinforce these principles. In addition, this information should not only be presented to new employees or following an injury, but periodically, so that these concepts can be better remembered.

EXPLAIN THE MEDICAL MANAGEMENT SYSTEM. It is important for employees to understand how to report an injury and how the company prefers its employees seek medical attention. This can expedite assistance, reduce costs, and improve the lines of communication regarding employee health.

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J. Psychosocial Issues

Psychosocial issues are factors, not necessarily related to the job's physical work, that can affect one's health. Psychosocial factors include stress, perceived levels of work, and one's relationships with co-workers and superiors. If psychosocial factors become overwhelming, they can lead to increased incidence or reporting of MSDs.

Issue: **MANY PSYCHOSOCIAL STRESSORS IN THE FACILITY.**
Facilities that have many psychosocial influences on Selectors, in addition to their physical workloads, can result in higher MSD claims, more lost time, and higher medical costs.

Remedy: Several methods that produce a more positive psychosocial environment are listed below.

ISSUE A MANAGEMENT VALUES STATEMENT. A company that truly believes in its ergonomics process, and in the health and well-being of its employees, needs to advertise the fact. This is easily done by placing the company's mission statement in a prominent location (as one done by one company, shown in Figure 33), so it can be easily read by employees and reinforced, or by periodically including it in the company's newsletter.

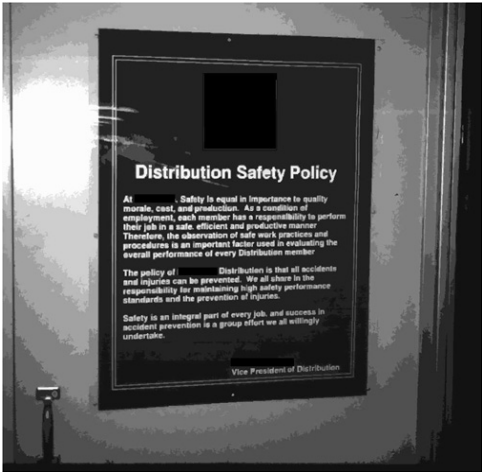


Figure 33. Example management values statement, emphasizing the importance the company places on safety and its employees.

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INVOLVE EMPLOYEES IN THE ERGONOMICS PROCESS.

By encouraging employees to provide feedback and raise issues about their work (e.g., what they like and don't like about the job, how they believe it can be improved), they become more involved with their jobs. They develop a feeling of empowerment, that they are responsible for their own well-being. This can enhance the ergonomics process by creating situations where employees are more willing to communicate new ideas for job changes, test job changes, try new methods of work, and accept changes that do arise.

FORM WORK TEAMS. Selectors often perform the work by themselves. Creation of work teams can foster more positive attitudes toward the job and the company. Work teams may also be given responsibility for issues as housekeeping and ideas for improvements in the jobs for safety and health purposes.

IMPLEMENT MECHANISMS TO FOSTER SUGGESTIONS.

Increasing the lines of communication between the employees and management where safety and health are concerned can have a positive impact on the psychosocial environment. Mechanisms such as suggestion boxes, or open lines of communication, followed up by feedback to the employees on the actions of their suggestions may foster more ideas to improve safety and health issues in the work environment.

K. Other Issues

1. Issue: **DEHYDRATION OF SELECTORS DURING WORK.** Distribution Centers, of course, are located all around the country. In the South or West, or in those areas located where there are hot and humid summer months, employees can become dehydrated and in need of additional fluids. Most Distribution Centers housing dry goods are not air-conditioned.

Remedy: **PROVIDE FLUIDS TO SELECTORS DURING HOT PERIODS.** By providing employees with fluids (e.g., water), the body will be replenished with essential liquids.

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2. Issue: **ADDITIONAL CONCERNS OTHER THAN MUSCULOSKELETAL DISORDERS.** Review of accident and injury records from several Distribution Centers has shown that Selectors are subject to lacerations, contusions, and other injuries due to their job.

Remedy: **COORDINATE SAFETY ISSUES WITH THE ERGONOMICS PROCESS.** Form a commitment by management to the well-being of its employees, involving health, safety, and ergonomics. Some Distribution Centers have implemented programs (e.g., Safety Training Observation Program, nicknamed 'STOP') to address these issues, and they tout these programs in their facilities, as shown in Figure 34. These appear to be successful in reducing injuries and their associated costs. However, coordination within the ergonomics process is necessary.



Figure 34. STOP program reminder posted in a facility.

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A-B slot. See half slot.

administrative controls. Control procedures that limit daily exposure to risk factors for musculoskeletal disorders, typically by manipulating the work schedule. Examples would include job rotation, limiting overtime, increasing the rest breaks, among others.

coupling. Refers to the interface between the hand and an object being grasped.

cross docking. A distribution system where the product received at the distribution center is not put away in slots, but instead is readied for shipment to the stores.

DC. Distribution center.

discomfort. The disturbance of one's comfort or mild pain to the entire body or a particular body part.

double deep. A slotting practice that places two full pallets in one deep slot, with one pallet behind the other. When the front pallet is empty, the rear full pallet is brought forward to the front of the slot.

double slot. See half slot.

engineering controls. Control procedures that result in physical changes to the work areas, equipment, or other relevant aspects of the work environment. Engineering controls typically reduce or eliminate exposure to risk factors for musculoskeletal disorders.

fatigue. The term fatigue, as used in this manual, refers to localized muscle fatigue which develops as a result of continued application of force over a given time period, without adequate recovery time. Typically, localized muscle fatigue will result in a reduced ability of the muscles to produce the needed force.

flow rack. A slotting system which typically incorporates smaller product on rollers in a slot. The rollers on the racks are angled down so that gravity will assist the product to move toward the front of the rack as a case is picked from the front.

flow-through. A distribution system where the product is received, broken down, placed, routed through the facility on conveyors, and re-palletized at the shipment area.

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full pallet quantity. Pallets of product that are shipped directly to the store after being received. Breaking down the pallet is not necessary as the whole pallet is shipped.

full slot. A slot in a traditional order pick system which has enough vertical clearance to allow a full cube pallet to fit in.

half slot. Also called *double-slot* or *A-B slot*. These slots have two pick levels, one near the floor, the other directly above the lower level. Typically, pallets must be broken down in order for them to fit in the reduced vertical space.

health care provider. A person educated and trained in the delivery of health care services who is operating within the scope of their license, registration, certification, or legally authorized practice.

incidence rate. The number of new musculoskeletal disorders that occur during a given period of time, divided by the population at risk at the beginning of that time period. Typically, the incident rate is calculated as the number of new MSDs that occur per 100 workers per year.

load splitter. A mechanical device which moves one or more layers from a pallet to be transferred to another pallet. Can be used for breaking down pallets for product to be placed in half-slots, or for cross-docking activities. Use of the mechanical load splitter eliminates repetitive manual handling of cases during these activities.

low back disorders (lbd). An injury to the structures of the back. Can include injury to the muscles, ligaments, nerves, and intervertebral discs, caused or aggravated by work-place risk factors.

lifting aids. The term used in this manual to refer to mechanical devices used to eliminate exposure to risk factors for MSDs. Includes, but not limited to, hoists, scissors lift tables, and turn tables. Also referred to as *lift assistive devices*.

mixed pallet. A full pallet delivered from the supplier with more than one product on it. These pallets are shipped directly to the stores without being stored in a slot or broken down. Also referred to as *rainbow pallets*.

moment. A measure of spine loading which is measured as the product of the weight of the load multiplied by the horizontal distance in front of the spine, typically measured at the lower back level. Greater magnitudes of moment are associated with higher risk of low back disorders.

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musculoskeletal disorder (msd). An injury or illness of the muscles, tendons, ligaments, peripheral nerves, joint, cartilage (including intervertebral discs) to the upper extremity, neck and back, and lower extremity, caused or aggravated by workplace risk factors.

psychosocial factors. Factors in the workplace the interact with the individual to increase the perceived stress, and affect the health of the employee. If psychosocial factors become overwhelming, they can lead to increased incidence or reporting of MSDs. These factors include, but are not limited to stress, perceived levels of work and lack of control over the job, and the degree of one's relationship with peers and supervisors.

restrictions. Limitations placed on the manner in which an employee performs a job or work tasks during the recovery period after an injury or illness. Restrictions refer collectively to any of the following: *alternative duty*, *alternative work*, *light duty*, *modified duty*, and *restricted duty*.

risk factor. Workplace conditions, workplace activities, or a combination, that may cause or aggravate a musculoskeletal disorder.

severity rate. The number of lost workdays due to musculoskeletal disorders divided by the population at risk. Typically, the severity rate is calculated as the number of lost days per MSD case that occur per 100 workers per year.

spinal loading. Includes the forces and moments generated on the lower back (typically estimated about a intervertebral disc) as a result of material handling activities. Generally, the higher the spinal loading, the greater the risk of low back disorders.

tray pack. A shipping container that typically uses film over-wrap and under-wrap. Product is usually in a low-walled open box, or other sturdy case-bottom.

triple slot. These slots have three pick levels in one bay, one near the floor, the other two directly above the lower level. Typically, pallets must be broken down in order for them to fit in the reduced vertical space.

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APPENDIX A

Example Employee Discomfort Survey

ERGONOMICS is a method of designing work places, tools, and other equipment so they can be used by people safely and efficiently. Ergonomics takes into account that fact that everyone is different, so work should be designed to consider these differences and the capabilities and limitations of each person. An Ergonomics Team has been established here at this facility. One purpose of this team is to find out what concerns you have with your job, before they become more serious and put you at risk of becoming injured.

Please take a few minutes to fill out this form. **All information will be kept confidential!** If you have any questions, please ask a member of the Ergonomics Team. When you are finished with this form, please give it to one of the team members. Thank You!

Your Name (Optional): _____ Date: _____

List below the job(s) you have done in the past 2 years. (If more than 3, just list the last 3 you have done.)

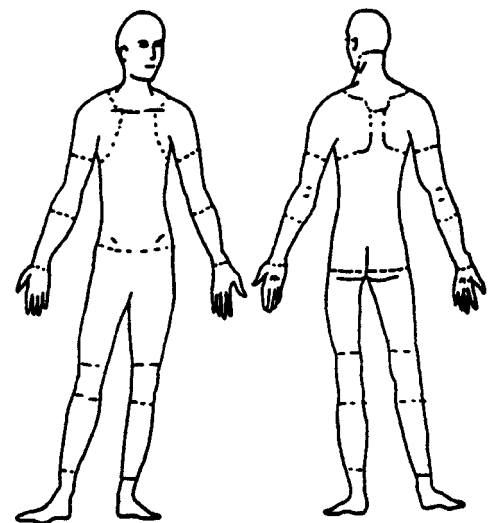
	Job Name	Department	How long on this job?	Did you ever have <i>any</i> discomfort when doing this job?	
Most recent job				YES	NO
Second most recent job (if applicable)				YES	NO
Third most recent job (if applicable)				YES	NO

How you had any job-related pain or discomfort during the **past year**? _____ Yes _____ No

If you answered "No" to the above question, stop now and turn in this survey.

If you answered "Yes" to the above question, please continue.

Carefully mark with an "X" in the drawing to the right those areas which bother you the most.



Front

Back

Please continue on the next page

Employee Discomfort Survey (continued)

Of these body parts listed:

• Neck	• Hand/Wrist	• Lower Back
• Shoulder	• Fingers	• Thigh/Knee
• Elbow/Forearm	• Upper Back	• Lower Leg

• Ankle/Feet

Please answer the following questions for each body part you listed

Write in the space below the body part that causes you the **most discomfort** on the job(s) you do NOW.

Write in the space below the body part that gives you the **second most discomfort** (if any) of the job(s) you do NOW.

Write in the space below the body part that gives you the **third most discomfort** (if any) of the job(s) you do NOW.

When did this discomfort start?

Ÿ

____ (month), ____ (year)

____ (month), ____ (year)

____ (month), ____ (year)

What do you think caused this discomfort?

Ÿ

Using the scale below, what number related to discomfort would you rate how this body part feels:

1 2 3 4 5 6 7 8 9 10
None Moderate Unbearable

Today: _____

Today: _____

Today: _____

At Its WORST: _____

At Its WORST: _____

At Its WORST: _____

Have you had medical treatment for this discomfort?

Ÿ

____No ____Yes

____No ____Yes

____No ____Yes

If "No", why not?

Ÿ

If "Yes", where did you get treatment?

Ÿ

____ First Aid
____ Personal Dr.
____ Other (____)

____ First Aid
____ Personal Dr.
____ Other (____)

____ First Aid
____ Personal Dr.
____ Other (____)

Did the treatment help?

Ÿ

____No ____Yes

____No ____Yes

____No ____Yes

How much time have you lost in the last 2 years because of this discomfort?

Ÿ

_____ Days

_____ Days

_____ Days

Could you have done light duty work, even with this discomfort?

Ÿ

____No ____Yes

____No ____Yes

____No ____Yes

What do you think could have reduced your discomfort?

Ÿ



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