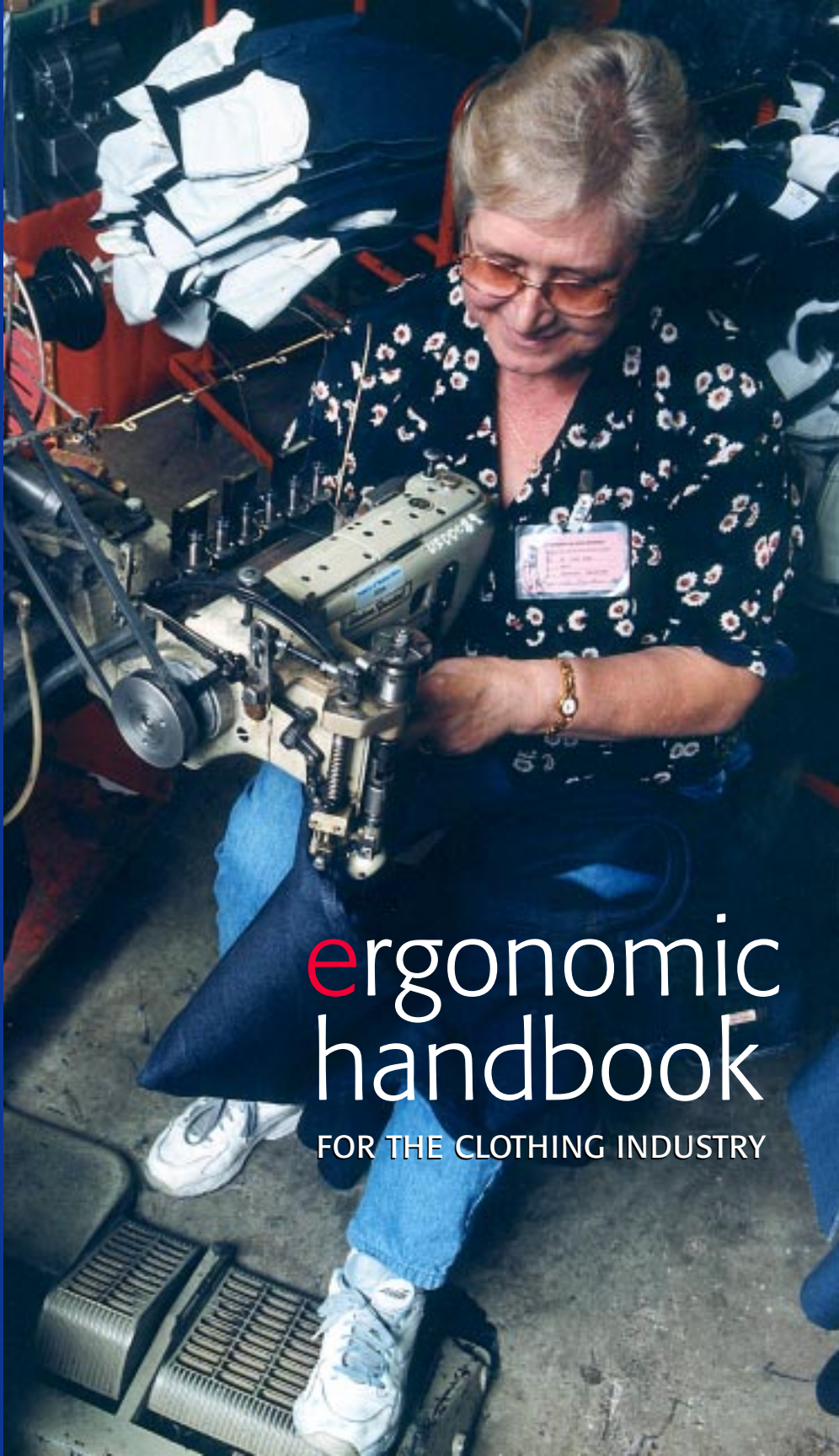

ergonomic handbook

FOR THE CLOTHING INDUSTRY

Ergonomic Handbook for the Clothing Industry

Union of Needletrades, Industrial and Textile Employees

Institute for Work & Health

Occupational Health Clinics for Ontario Workers Inc.

Ergonomic Handbook for the Clothing Industry

Published by the Union of Needletrades, Industrial and Textile Employees, the Institute for Work & Health, and the Occupational Health Clinics for Ontario Workers, Inc.

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Project funding: Workplace Safety & Insurance Board (WSIB #980024)

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Handbook design: Art Kilgour, WriteDesign

Printing: Thistle Printing

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Preface

Injuries and muscle pain affecting the wrists, shoulders, neck and back are common problems for workers in the clothing industry. The purpose of this project was to look at conditions in the clothing industry to find out how these injuries start and how they can be prevented. Twenty-nine Ontario clothing manufacturers participated in the study. Two representatives in each workplace, one worker and one manager, completed a survey about their organization. Then we conducted an ergonomic assessment of five jobs in each workplace. Our researchers identified many features in clothing plants that could be improved to prevent injuries including:

- communication,
- involvement of employees in decision making,
- education and training of employees and management on prevention strategies, and
- the ergonomic conditions in the plant.

The project's final report brings together all of the information gained from this research. This handbook focuses on the potential ergonomic problems and solutions that were identified during our plant visits. We hope this handbook can be used to initiate changes in the

workplace by creating a starting point for discussion and stimulating ideas on how conditions in our plants can be improved.

Acknowledgements

At the outset we want to thank the close to 200 workers and management representatives who directly participated in the project by taking part in interviews and participating in ergonomic audits of their workstations. Under the confidentiality protocol governing this project, employers and participating individuals cannot be identified by name. But to all who took part – thanks!

This project was made possible by a grant from the Research Advisory Council of the Ontario Workplace Safety & Insurance Board (WSIB). Robert Boucher,

Members of our project's reference group included: (back row, L-R) Joe Maltby, Judy Lackner, Sue Ferrier, Mickey Kerr, Nello Corsetti and (front row) Jenny Ahn, Jennifer Gunning and Jonathan Eaton. (Missing from the photo are Steve Kalantzis, Harry Mohabir, Alita Morando and Rudi Trevisan.)

Manager of the WSIB Research Secretariat, provided advice and assistance throughout the project.

The Co-Directors and staff of the UNITE Ontario Council made a key contribution to the project, linking the project coordinator to the industry and facilitating access to all of the plants that took part. The research also benefited from the advice and comments of a committee of union and management representatives, which included Jenny Ahn, Nello Corsetti, Steve Kalantzis, Judy Lackner, Harry Mohabir, Alita Morando and Rudi Trevisan.

Our research team

As project coordinator, Jennifer Gunning was primarily responsible for completing this project. She was assisted by a diverse research team that included Sue Ferrier and Mickey Kerr (Institute for Work & Health [IWH]), Andrew King and Joe Maltby (Occupational Health Clinics for Ontario Workers [OHCOW]), and Jonathan Eaton and Eric Frumin (Union of Needletrades, Industrial and Textile Employees). Marjan Vidmar and Sheilah Hogg-Johnson at the Institute pulled together lost-time injury statistics for the Ontario clothing industry. We would like to thank the WSIB for providing access to these data. Our summer intern, Seemi Sood, assisted with survey tabulation and researching industry trends. Thanks also to Mary Cook, Managing Director of the OHCOW, who acted as Administrator for this project, and Michael Roche (Manager, Financial Support, OHCOW) for providing accounting services and preparing the project's financial report.

Introduction

The clothing industry is generally seen as a safe place to work. Compared to other industries, there are relatively few serious accidents in clothing plants. The hazards we face are different. The major health risks in this industry do not arise from immediate, potentially fatal hazards. Instead, the risks that clothing workers face come from more subtle hazards whose effect accumulates over time.

Research shows that sewing machine operators face a substantially higher risk of muscle pain and injury than workers in other jobs. Studies also show that the frequency of persistent neck and shoulder injuries increases with years of employment. One report found that sewing machine operators experience as many cases of repetitive strain injuries as data entry keyers and secretaries *combined*. These injuries lead to long-term health effects. This is why we wanted to look at the working conditions that can lead to such high rates of disability for clothing workers.

Research has consistently found that the physical characteristics of the job are an important risk factor for muscle pain and injury. The risks for sewing machine operators have been linked to conditions such as poor

workstation design and chairs, and organizational factors such as the piecework system.

Factors such as repetition, force, posture and vibration are associated with higher rates of injury. But you can't look at the workstation alone to understand these injuries. There is growing evidence that other factors are linked to injuries. These include:

- high work pace,
- lack of control over the job,
- workload,
- co-worker support and
- the general work environment.

On the other hand, researchers have identified factors that relate to reduced injury rates. These factors include empowerment of the workforce, delegation of safety activities, greater seniority of the workforce, good housekeeping and an active role of top management.

Few studies, however, have investigated physical and organizational risk factors at the same time in more than one workplace. And most studies have focused only on sewing machine operators, leaving out workers in other jobs.

The purpose of this study was to document and describe the current work conditions throughout the clothing industry. We went to 29 clothing plants in Ontario. Two representatives in each workplace, one worker and one manager, completed a questionnaire on work organization in their plants. Two trained ergonomists conducted assessments of jobs in the cutting, assembly, pressing and finishing departments in each plant. We focused on identifying good practices that are in use in the industry. Our goal in creating this handbook is to share these good practices so that injuries can be reduced across the industry.

What is 'ergonomics' anyway?

Ergonomics is a topic that affects us all; yet few of us have a good understanding of what the term actually means or realize how it affects us.

Ergonomics is a science that focuses on designing a job for the worker. An ergonomically-designed job would ensure that a taller worker had enough space to safely perform his or her job, and also that a shorter worker could reach all of his or her tools and products without reaching beyond a comfortable and safe range. The opposite to this, and what typically happens in the workplace, is that a worker is forced to work within the confines of the job or workstation that is already in place. This may require employees to work in awkward postures, perform the same motion over and over again or lift heavy loads – all of which could cause work-related musculoskeletal disorders (WMSD).

These injuries often start as minor aches and pains but can develop into disabling injuries that affect our activities of daily living such as laundry, hobbies (knitting, golf, etc.) and even the ability to pick up our children.

Ergonomics aims at preventing injuries by controlling the risk factors such as force, repetition, posture and vibration that can cause injuries to develop. Some fundamental ergonomic principals that should be followed in our workplaces are:

1. Use proper tools

Tools should be appropriate for the specific tasks being performed. Your tools should allow you to keep your hands and wrists straight – the position they would be in

if they were hanging relaxed at your side. Bend the tool – not the wrist!

The tool should fit comfortably into your hand. If the grip size is too large or too small it will be uncomfortable and will increase the risk of injury. Tools should not have sharp edges, create contact stresses in your hand, or vibrate.

2. Keep repetitive motions to a minimum

Our workstations or tasks can often be redesigned to reduce the number of repetitive motions that must be performed. Using a power-driven screwdriver or tools with a ratchet device can reduce the number of twisting motions with the arm. Some tasks can be automated or redesigned to eliminate repetitive movements and musculoskeletal injuries.

3. Avoid awkward postures

Your job should not require you to work with your hands above shoulder height on a regular basis. Arms should be kept low and close to your body. Bending and twisting of your wrists, back and neck should also be avoided.

4. Use safe lifting procedures

Avoid lifting objects that are too heavy. Use more than one person or a mechanical device to reduce the load. Your workstation should not require you to lift objects above your head or twist your back while lifting. Keep the load close to your body and ensure that you have a good grip. Heavy and frequently lifted objects should be stored between knee and shoulder height – not on the ground or above your head.

5. Get proper rest

You need to rest your body and mind in order to prevent injuries. Give your muscles a rest during your coffee breaks, lunches and weekends by doing something different from what you do in your job. For example, if you stand all day while performing your job you should sit down to rest your legs and feet during your breaks. If you sit down when working you should stand up and walk around during your breaks to give your back a rest and to increase circulation in your legs.

Remember: *musculoskeletal injuries can be prevented.* The remainder of this booklet takes a closer look at some common ergonomic problems and solutions in the clothing industry.

Common Ergonomic Problems and Solutions in the Clothing Industry

During the course of this study, we were able to do ergonomic assessments of 131 jobs at the 29 plants we visited. We identified common ergonomic problems in each of the four departments: cutting, assembly, pressing and finishing. We looked at work practices that create hazards for workers and also techniques that reduce the risk.

Since we looked at just four to seven jobs in each plant, there may be additional ergonomic solutions that we did not see. However, the list of what we did find is extensive and provides many suggestions for reducing the risk of injuries in clothing plants.

These solutions may not be appropriate in all situations. Management and workers need to jointly assess jobs in their plant to determine the right solutions for the specific problems they face.

Cutting Department

The primary tasks in the cutting department are:

- *Loading the spreading machine*
- *Spreading the fabric*
- *Cutting the fabric*
- *Stacking cut pieces*

LOADING THE SPREADING MACHINE

Loading the spreading machine involves lifting a bolt of fabric from the floor into a spreader, or on to a spreading table if the fabric is spread by hand.

COMMON PROBLEMS

Loading by hand. Bolts of fabric lifted by hand are very heavy and create a substantial risk of low back injury.

Loading with a fixed assist accompanying the spreader. Bolts are rarely in the proper location to be picked up by the fixed assist – operators have to manoeuvre the bolt by hand.

Placing spreader bar in the bolt of fabric.

Note: poor posture required due to low location of bolt, but a good technique is used for ensuring the bolt is in position (sloped skid).

Operators have to lift a metal spreader bar and place it through the centre of the bolt before it is lifted. This bar is sometimes very heavy and awkward to place in the bolt.

Loading with a movable assist or hoist. Spreaders that require the bolt of fabric to be threaded with a spreader bar – some bars are very heavy.

Bolts located on the floor require the operator to adopt a stooped or squat posture to thread the bar. When no spreader bar is required the operator has to lift one end of the bolt at a time to attach the hoist.

Loading with a ramp. Gravity can be used to load the spreader. The bolt of fabric is lifted onto a ramp by a forklift truck. The bolt then rolls directly into the spreader without manipulation by the operator. The problem with this technique is that it can only be used with certain types of spreaders.

POSSIBLE SOLUTIONS

Loading by hand. This technique is not the best. If it is necessary, limit the risk by:

- limiting the weight of the bolt,
- using two people to lift the bolt,
- using the turntable on the spreader to assist with lifting one end of the bolt at a time,
- using hand-made bolt stands to assist with lifting to a tall spreader.

Hand-made bolt stand, used to assist lifting a bolt into a tall spreader.

Loading with a fixed assist accompanying the spreader. This technique has a lower risk of injury than loading by hand.

Place the bolts on a sloped skid so they are in the proper position for loading.

Bolts should be located near waist height of the operator to improve posture when placing the metal spreader bar through the bolt.

Loading with a movable assist/hoist. Electric hoists are better than manual hoists.

The bolt of fabric should be delivered at approximately waist height.

If no spreader bar is required the operator should not have to lift the bolt at all, for example the ends of the bolt could overhang the skid or bolt jack so that the hoist could be attached without lifting.

Spreader loaded with a fixed assist accompanying the spreader.

Ramp for loading the spreader.

Loading with a ramp. From an ergonomics perspective, the ramp is the best technique for loading the bolt of fabric into the spreader.

SPREADING THE FABRIC

COMMON PROBLEMS

Spreading by hand. Long reaches are required to cut across the width of the fabric each time a layer is completed or flaws are removed from the fabric.

Spreading with a fixed holder that holds the bolt in place at the end of the spreading table. A long reach is required to cut across the width of the fabric.

Manual spreading. Using a spreading machine that the operator pushes back and forth on the spreading table.

Manual spreader

Operators have the long reach across the table to cut the fabric and they have to manually pick up weights to hold the fabric down each time a layer is completed before spreading the fabric in the other direction.

Automated spreading. Operators either ride on a platform or walk beside the automatic spreader as it moves along the table.

Operators often have to smooth the fabric while it is being spread.

The table is often too low and operators have to bend their backs while smoothing. This is a risky posture when maintained for extended periods of time.

Operator reaching to smooth fabric during automated spreading.

POSSIBLE SOLUTIONS

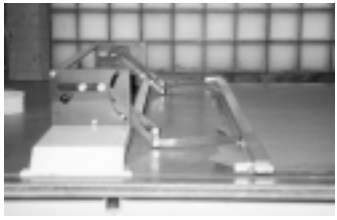
Spreading by hand. Use two people, one on each side of the table, who cut towards each other. This reduces a lot of the reaching and poor postures when cutting across the width of the fabric.

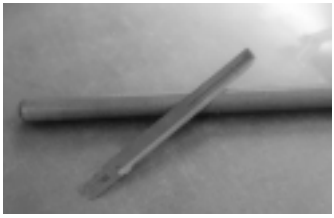
Spreading with a fixed holder. Two people, one on either side of the table, should cut towards each other.

Manual spreading. Use a fabric catcher to eliminate the need for the operator to pick up and manipulate weights to hold the fabric in place.

A blade attached to a wooden stick or a small round electric saw with a long handle are tools that can eliminate the extended reach.

Automatic cutters can also be attached to manual spreaders.





Left: Fabric catcher. Right: Blade and wooden stick.

Automated spreading. Determine first if manual smoothing is required for all fabrics. If not required, this task should not be performed.

Make sure the table and platform are at appropriate heights for the operator, and the operator has something to lean on to support his or her upper body weight while smoothing the fabric.

CUTTING THE FABRIC

There have been great advances in cutting technology in the garment industry. However, not all workplaces are using the latest technology. Not all plants want or need high-tech cutting machines. We considered all of the different techniques for cutting fabric while looking for ergonomic problems and solutions.

COMMON PROBLEMS

Band saw. Excessive reaching caused by improper workstation height.

Inability to get close to the blade.

Poor waste disposal.

Guarding is an issue with this technique.

Die cutters. Workstations that are too high require the operator to work with raised arms. Workstations that are too low require them to bend down.

Controls often require poor thumb postures.

Feeding fabric into the die cutter sometimes requires a lot of forceful pulling.

Electric saws. Excessive reaching with shoulders and back.

Poor wrist postures.

Hand or arm vibration and contact pressure on the hand when stapling the pattern to the fabric or perforating the layers of fabric.

Extreme postures required when cutting with an electric saw.

Automatic cutters. Sometimes it is difficult and requires awkward postures to align the cloth being fed into the automatic cutter.

The out-feed tables require a lot of reaching when removing the fabric from the table.

Controls are not accessible and do not encourage operators to advance the fabric to the end of the table, which would reduce the amount of reaching.

The tracks that the automatic cutters move along create a tripping hazard.

Automated cutter that would benefit from controls in a more accessible location.

Note: controls to advance the out-feed table are at the far side of the table.

POSSIBLE SOLUTIONS

Band saw. The table should be at an appropriate height and the operator should be able to reach the blade without fully extending his/her arms and leaning forward.

Die cutters. A good height for the cutting surface is several inches below elbow height.

The input and the deposit surfaces should be at similar heights and easily accessible.

A good orientation for the press is parallel to the operator so the controls are accessible.

The best location for controls is directly in front of the operator, at approximately elbow height.

The die can be located under the fabric. This is a good technique for large, heavy dies so they do not have to be picked up each time a new section of fabric is cut.

Die cutter at a good working height and a good orientation.

Note: a raised platform was used to bring the operator to a good height.

Electric saws. Improve shoulder and back posture by setting the table and saw at a good working height for the operator.

Extend the handle and cut from both sides of the table to reduce excessive reaching.

Avoid poor wrist posture with an adjustable angle handle.

Maintain saws and use a vibration-dampening handle to reduce the amount of vibration.

The best weights for holding down the pattern are small and have handles on the top. Clamps are also good for holding the fabric in place.

A pattern tacker is good for stapling the pattern to the fabric; it can be manipulated with one hand and causes less contact stress on the hand than an office type stapler. Adhesive spray can also be used to attach the pattern to the fabric.

A good waste-disposal method is to use a garbage pail firmly attached to a dolly.

Place anti-fatigue mats the length of the table to reduce foot and leg fatigue.

Follow other good safety practices such as properly adjusted guards, chain-mail gloves for straight-blade saw operators, and regular maintenance on the blade to ensure it is sharp and lubricated to minimize the force required to push it through the fabric.

Small weight and clamp for holding the pattern and fabric in place.

Pattern tacker

Garbage pail on wheels and anti-fatigue mats running the length of the cutting table.

Automatic cutters. Good solutions for the in-feed table include air tables, tables no wider than necessary, and using two people to align the cloth.

A good out-feed table has narrow sides to allow the operator to get close to the cut fabric if it is necessary to work from the sides of the table.

Working from the end of the table is preferred. Place the controls in an accessible location to encourage the operator to advance the fabric toward the end of the table rather than to reach for it.

The out-feed table should also be adjustable in height to meet the requirements of each operator.

Locate waste bins at the end of the table, running the entire width of the table and providing space for feet underneath.

Install tracks flush with the floor to eliminate the tripping hazard.

For low-ply cutters, folding the fabric in half before cutting creates pieces that are mirror images of each other. This folding procedure reduces the reach necessary to remove cut pieces from the table.

STACKING CUT PIECES

Once the fabric has been cut it has to be removed from the table and delivered to the assembly department. Typically, a worker removes the piles by hand and stacks them on rolling carts.

COMMON PROBLEMS

Piling cut fabric on skids or into large boxes or carts near the floor requires a stooped posture.

POSSIBLE SOLUTIONS

The best carts for this job have one shelf that is at the same height as the cutting table. The cut pieces can be slid off the table directly onto the cart with very little lifting by the operator.

Carts with multiple shelves located close together are also good. This minimizes the operator's range of lifting.

Another type of cart has three shelves. Only the top two are used and the middle shelf slides out from either side to allow easier access to it.

Good carts for stacking cut fabric.

Assembly Department

The primary tasks in assembling clothing are:

- *Sewing*
- *Loading automated rail system*

SEWING

Assembly tasks have many different components that must be considered in an ergonomic assessment including:

- supply and removal of garments,
- sewing table,
- chair,
- floor surface,
- foot pedals,
- lighting,
- hand tools and
- work organization.

We will look at ergonomic problems and solutions for each of these components.

Supply and removal of garments

Supply – methods used to hold the various pieces of the unfinished garment at the workstation prior to the operator assembling them. Removal – deposit of the garment once the operator has completed the job. The operator has to reach to both the supply and removal locations at least once in the work cycle.

COMMON PROBLEMS

Boxes. Large boxes that are low to the ground create an awkward reach and bend during each pickup.

Tables. Tables are often made of overturned or full boxes.

Tables are in poor locations, unstable or garments fall off them so operators have to reach to the floor to pick them up.

Workhorses. Workhorses are too low creating an awkward reach for the operator and are too smooth, causing the garments to fall off.

Attachments to the sewing table. Wooden bars attached to the sewing table are used as the supply location. These bars are sometimes located too far from the operator, are too small or allow the garments to slip off them.

Rolling carts. Problem carts are large and very low creating an extended reach and bend when picking up unfinished garments at the bottom of the cart.

Rolling shelving units are too low and sometimes require the operators to lift the garment over the high rail on the end of the unit.

Wheels are frequently in very poor repair and/or have a build-up of thread on them. This makes the carts very difficult to manoeuvre.

Bend and reach to pickup unfinished garments from a large cart.

Automated stackers. Stackers deposit the garments at a low location that requires someone to bend down to pick them up to move them on to the next workstation.

Non-automated rail system. Inflexible system with poor work organization requires operators to manually remove full hangers from the rail to transport them to another workstation. This is a very awkward and heavy lift and carry.

Automated rail system. Pieces not delivered to the workstation at an ideal height require the operator to reach, bend and/or twist to reach the garment.

Sewing tables larger than necessary do not allow the operator to get close to the hanger.

A lot of force is required to hook and unhook the garments from the hangers.

Hangers fall off the rail and the operators have to lift them back on.

Buttons that control the movement of the hangers are often too far away from the operator or in awkward locations.

This system creates specialized, repetitive tasks and segregated workstations.

POSSIBLE SOLUTIONS

Boxes. Place small boxes on a platform to supply the operator with the necessary pieces at a good height and within easy reach.

Tables. Tables should match the height of the sewing table, or be slightly lower if bundles are placed on them.

They should be stable and sufficiently large or have raised edges to contain the garments on the table.

Use friction tape if the fabric or table is too slippery.

Workhorses. These should be approximately the same height as the table, close to elbow height of the operator, and provide sufficient friction so that the garments do not fall off.

Attachments to the sewing table. Bars extended from the sewing table work well if they are close to the operator, at a good height and have friction tape on them to help prevent the garments from falling off.

A trough located on the back of the sewing table is a good deposit area when the operator has a short reach to slide the garment into the trough.

Attachment to sewing table used for holding unfinished garments.

Rolling carts. Make sure the cart is suitable for the task.

A simple but effective cart for lightweight garments is a small wire frame on wheels with a shallow canvas liner. The operator can reach the back and bottom of the cart

easily and the top of the cart is at the height of the sewing table.

Another good cart is a metal bin on wheels that is open on both ends and has a shelf that can be placed over the top to provide a higher surface. When on the higher surface, the garments are at a good height for the operators. When garments are in the open bin, hoists can be used to lift the carts to an appropriate height.

The best rolling shelves have the shelf located near the height of the sewing table and are large enough to support the weight of the garments.

A specially designed cart that works well for specific tasks is a small table on wheels that has clamps on the top of it to hold the stacks of garments. During the assembly tasks the garments do not have to be removed from the clamps. The bottom of the cart is narrow in the middle to allow it to get in close to the operator.

Eliminate the problem of thread in the wheels through regular maintenance or use spherical castors that do not get filled with thread.

Good carts for some applications.

Castors that resist thread build-up.

Automated stackers. Stackers can eliminate the repetitive reaching to deposit garments after the operator has completed his or her task.

One good stacker that we saw was located close to the operator who placed the garment in the clips. The clips closed, and with the push of a button the stacker transported the garment and placed it neatly on a rolling cart.

Non-automated rail system. A good method is for the operators to work on a raised platform so they can work from the high rail without removing garments from the hanger or having to reach above shoulder height for them.

A raised platform that brings the workstation to the height of the non-automated rail.

Automated rail system. A good practice is to leave the garments attached to the hanger while performing the assembly task.

Locate hangers directly beside the worker or sewing table.

The table should be as small as possible to allow the garment to be close to the operator.

Place a low table under the hanger to help support heavy garments and reduce the reach to lift them up from ground level.

Place the controls for the system close to the common working position of the hands without interfering with the task, or integrate controls into foot controls.

Sewing Table

The dimensions of the sewing table that should be considered are the:

- height,
- size,
- shape,
- tilt and
- leg room.

COMMON PROBLEMS

Height. Sewing tables are not easily adjustable. Tables that are too high create elevated shoulder postures and non-neutral elbow and wrist postures.

Tables that are too low cause the operator to lean forward and flex his or her neck.

Size and shape. Some tables are not large enough to support the weight of the garment.

Other tables are too large and get in the way of easy pickup and deposit, particularly when using automated transport systems.

Many tables are not the appropriate shape for the job.

Table angle. Almost all sewing tables are flat. Flat sewing tables do not maximize visibility and compromise the posture of the upper extremity and neck.

Leg room. Sewing machine operators have limited legroom because of drawers and/or trash chutes attached to the underside of the table.

POSSIBLE SOLUTIONS

Height. A good height for sewing tables is at or slightly above elbow height.

The height should be easily adjustable with the press of a button.

Size and shape. Sewing tables can be modified to meet the requirements of specific garments, machines or operators by:

Making the table smaller to allow carts to get close to the sewing machine.

A sewing table with an extension.

Putting an addition on the table to increase the size of the table. This can be helpful for supporting the weight of large garments or for using the sewing table as the input location.

Placing raised edges on the table, to help to keep the material on the table.

Table angle. A few sewing tables that we saw were tilted 10° to 25° towards the operator. This tilt improves visibility of the task and helps to keep the neck in a more upright position while having the table at an appropriate height for the upper extremity.

Leg room. Make sure that operators have sufficient leg room. Drawers and trash chutes either should be not present or in a location that does not hinder leg room.

Chairs

The chair is a critical piece of equipment for sewing machine operators who work in a seated position. It can have a very large impact on the comfort of the worker and can affect the risk of muscle pain and injury.

COMMON PROBLEMS

Operators are provided with very poor chairs such as stacking chairs. These chairs are not adjustable. They provide no cushioning or back support and the edge of the seat constricts blood flow at the back of the legs because of a large rounded hump or square edge.

A poor chair for prolonged sitting.

Some plants provide slightly better chairs that have some height or back adjustment capabilities but they cannot be adjusted quickly and easily and do not provide sufficient back support.

Some plants purchase chairs that they believe are ergonomically correct, but they do not meet the needs of the operators. Common problems that occur when buying ergonomic chairs are that one individual selects the chair and it does not fit all or even most operators, and it is not right for all tasks. For example, the chair may have castors or may swivel when this is not right for the job.

Often the seat pan is too large, resulting in the backrest not touching the back of the operator. The seat pan may have an uncomfortable hump at the front, causing the operator to sit on the front edge of the seat and not use the backrest.

Individuals are not instructed in how to use the chairs properly. Without proper training the many benefits of ergonomic chairs are lost.

POSSIBLE SOLUTIONS

The best chairs have these features:

- a stable 5-point base of support;
- firm cushioning on the backrest and seat pan;
- the seat can be adjusted in height and tilt quickly and easily;
- the seat does not have a hump on the front edge;
- the backrest can be adjusted in height and from front to back;
- the seat pan is large enough to support the operator but small enough so that he or she can use the backrest;
- the backrest does not interfere with the movement of the shoulder blades or arms;
- the chair can swivel when operators have to turn sideways frequently; and
- the chair has castors only where appropriate, and not where it makes operators slide away from their workstation.

Let operators try the chairs on a temporary basis and then let each operator select the chair that suits her or him best. Allow operators to select from various seat pan and backrest sizes and variable height adjustments. One chair cannot fit all workers.

Good chairs for some applications.

Foot Pedals

Most sewing machine operators use one treadle, which controls the direction and speed of the sewing machine. Some operators use additional smaller pedals that lift the presser foot or cut the thread.

COMMON PROBLEMS

Treadles are very rarely in a proper position for the operators. They are either too far forward or too close to the operator. Both problems are bad for the posture of the operator.

Treadles are usually too small to be comfortably operated by both feet, and some are at a very steep angle.

The pedal is usually not in a comfortable position.

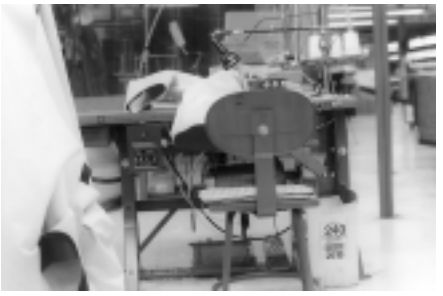
When only one foot is used the operators rarely have a footrest to support the non-working foot.

For standing operations the pedals are too high, requiring the operator to balance on one leg, and they cannot be moved to rotate the effort between both legs.

POSSIBLE SOLUTIONS

One plant that we saw had increased the size of the treadles by placing a thin wooden board over the surface of the pedal. It was located at the most comfortable position and angle for the operator. If a pedal was required it was at the same angle and position as the treadle and was easily accessible by one of the feet. If only one foot was being used, a footrest was located at the same height and angle as the treadle. Pedals for standing operators were close to the floor and allowed the operator to support her or his body weight over both feet. The pedal could be moved so that the operator could rotate between activating the pedal with her or his right or left foot.

Treadle and foot pedal at the same angle and position.



Foot pedal that has been extended so that both feet fit on it comfortably.

Knee Switches

Some operators use knee switches to control the presser foot.

COMMON PROBLEMS

Knee switches are located in a poor position and are hard, creating contact stress on the leg.

POSSIBLE SOLUTIONS

Place the knee switch so that it rests very close to the leg, just above the knee, and is well padded.

Hand Controls

Some automated sewing operations are activated with hand controls rather than foot controls.

COMMON PROBLEMS

Controls are too far from the operator.

Requires excessive force and unnatural direction to activate.

POSSIBLE SOLUTIONS

Ensure controls are located in a convenient position without being in the way.

Controls should be activated with a light touch applied at multiple angles.

Floor surface

Some assembly tasks are performed from a standing position. When working in a standing position the floor surface is very important to the comfort of the worker and may influence the risk of injury.

COMMON PROBLEMS

Operators stand for extended periods of time on hard surfaces.

POSSIBLE SOLUTIONS

Provide standing operators with good quality anti-fatigue mats that cover the entire working area.

Provide operators with a footrest and a sit-stand stool to help relieve the stress on the feet, legs and back.

Allow operators to rotate between sitting and standing work positions.

Lighting

Lighting plays an important role in ergonomics for sewing machine operators. Without proper lighting, operators may be encouraged to adopt poor postures in

order to see their work better; they may strain their eyes or be less productive. Lighting requirements depend on the task, fabric and individual preferences.

COMMON PROBLEMS

Workstations are too dim.

Light sources are not arranged properly and shadows create uneven light across the work surface.

Shiny surfaces that reflect light or task lights that shine directly into the operator's eyes create glare.

POSSIBLE SOLUTIONS

Ensure there is good general lighting and task lights are provided for operators who desire them or have visually demanding tasks.

The task lights should have a "goose-neck" so the light can be directed to the work area.

Lampshades should have ventilation holes, but where necessary these can be covered so that the light is not directed through these holes towards the operator.

Task light with "goose-neck."

Hand tools

Sewing machine operators frequently use several tools such as scissors or knives and occasionally hammers.

COMMON PROBLEMS

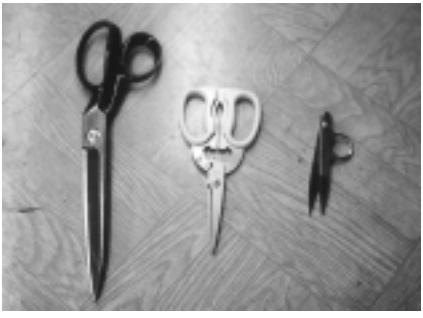
Scissors. Large, heavy scissors are used for trimming threads and are held by the blade to provide accuracy.

Operators cut through several layers of fabric with scissors that are too small and do not provide enough leverage.

Scissor handles are narrow and create contact stresses.

Scissors are dull and require excessive force to operate.

Various scissors are available.



Note: These scissors are all appropriate for different applications.

Knives. Knives without handles are used to remove stitching.

Hammers. Inappropriate items are used for hammering seams on garments such as ball peen hammers and wrenches.

POSSIBLE SOLUTIONS

Scissors. Operators should have appropriate scissors for the task such as small, light clippers or a finger cutter to trim thread, and long scissors that provide leverage for cutting through several layers of fabric.

Knives. Knives for removing seams should have a small blade and a large comfortable handle.

Hammers. A dead blow hammer is better when operators must use a hammer to flatten seams.

Work Organization

COMMON PROBLEMS

Assembly tasks are very repetitive and provide the operators with little opportunity for rest.

Many operators perform only one operation with no job rotation.

The repetitive nature of the job is made worse by automated delivery systems or by other workers delivering unfinished garments to the operators.

"Team work" systems do not always provide task diversity for all operators.

Workstation adjustment policies are not very effective because of lack of training of both the operators and the individuals responsible for the adjustments.

Workplaces have no limit to bundle sizes and they sometimes are much too large.

POSSIBLE SOLUTIONS

Organize work so that operators get up from their workstation to pick up their next work order.

Repetitive strain can be reduced when operators assemble large parts or full garments. This decreases repetition and increases variability and skill.

Set reasonable limits for bundle sizes.

LOADING THE AUTOMATED RAIL SYSTEM

COMMON PROBLEMS

Parts being loaded are poorly organized.

The working height of the table is almost always too low and the height of the hangers is always too high.

Operators are not able to adjust the height of any workstation components.

POSSIBLE SOLUTIONS

The best loading workstation that we saw had the parts arranged on a table to the left and a cart to the right of the worker. The hanger was located directly in front of the worker, which allowed her to use both arms to lift the heavy garment pieces. The foot pedal used to activate the movement of the hangers was low to the ground and easy to operate. The worker was standing on a good quality anti-fatigue mat.

The hanger should be below shoulder height and the table or carts holding the pieces should be at or slightly above waist height.

If loading from large piles, the height of the table should automatically adjust with the height (weight) of the pile.

The workstation should be adjusted to accommodate different workers (for example, an adjustable platform).

Pressing Department

The primary tasks in the pressing department are:

- *Hand Iron*
- *Manual Press*
- *Automatic Press*
- *Fusing*

First we will look at the common aspects of these tasks. Then, we will talk about special considerations for each of these tasks.

COMMON PROBLEMS

Working height. Ironing surfaces that are too low force the operator to assume a flexed back and neck posture while working.

Surfaces that are too high require operators to work with their shoulders and arms elevated.

Floor surface. Pressing operations are performed standing up and many pressing workstations do not have anti-fatigue mats on top of hard floor surface.

Foot pedals. Operators use foot pedals to either activate vacuum suction on hand ironing tables or to activate

Manual press with high foot pedals.

steam and the movement of the press for manual and automatic presses.

Foot pedals not close to the floor require the operator to balance on one leg. Small pedals are difficult to locate.

Input and Output. Hanging garments are located too high and require extended reaches to pick up and deposit garments.

Garments piled on boxes or carts are in a position that is too low and requires bending and reaching.

Lighting. Inadequate lighting creates shadows and glare on some pressing surfaces increasing the visual demand on the operator.

POSSIBLE SOLUTIONS

Working height. A good working height permits operators to work with their shoulders relaxed and their backs in an upright position.

A working height that is easily adjustable is ideal. This enables an individual operator to adjust the height throughout the day to change the body parts that are carrying greater stress. It also allows the workstation to be adjusted to accommodate different operators.

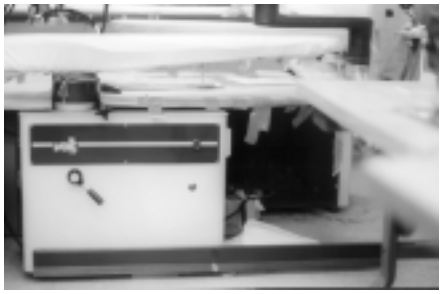
Tilting the work surface toward the operator is often possible with pressing operations and can improve posture and visibility.

Floor surface. Ensure that pressing operations have anti-fatigue mats covering the entire working area.

Foot pedals. A good pedal for hand ironing that we saw was an almost vertical kick plate that extended the length of the table. The operator could simply slide her or his foot forward to activate it.

Good pedals for manual and automated presses are close to or even with the floor; frequently used pedals are most accessible and are directly in line with the foot.

Hand pressing workstation with a good foot pedal.



Input and Output. A good practice that we saw for hanging garments was rolling racks with accessory bars that hung several inches below the height of the rack. This reduced the reaching during input and output.

Two good practices when using carts for holding piled garments are:

1. hoists to lift low carts to a good height for standing workers;
2. carts located a few inches below elbow height of the worker that hold piles of garments, the carts can be rotated to place each pile at a good location for input and output.

Lighting. Position the press perpendicular to overhead lights or use multiple light sources to improve visibility.

HAND IRON

COMMON PROBLEMS

Iron. A steaming button too far from the handle of the iron requires an extended thumb posture to activate.

Iron with steam button too far from the handle.

Balancers. Some irons are not balanced by a spring from a rod above the workstation. This makes the iron more difficult to locate during a very rapid work cycle and the operator has to use additional force to pick up and manipulate the iron.

Some irons are not balanced properly and require excessive force to reach all areas of the garment.

Upright steaming. Operators use the iron with the hot surface in a vertical position to steam a garment. The operator has to support the entire weight of the iron and sometimes has to resist the counter force of the balance.

Catchers. Catchers acted to support the weight of the garment while it was being pressed. Without a catcher in place large garments have a tendency to slip off the work

surface, and it requires more force to position and reposition the garment.

Guarding. When heat guards are not in place, the handles of steam irons and the steam they produce are very hot.

POSSIBLE SOLUTIONS

Iron. Steam buttons directly beside the handle of the iron can be activated with a good thumb posture and some require a very light touch.

Iron with the steam button close to the handle.

Balancers. A good balance supports the weight of the iron just above the work surface, from a track that runs parallel to the work surface. The track is on a slight angle that returns the iron to an ideal position for the start of the next cycle.

Upright steaming. Possibilities for improvement include balancing an iron in a vertical position or using a lightweight steamer rather than an iron.

Catchers. Catchers that support the weight of garments being pressed reduce the force the operator has to use to manipulate the garment. A good catcher that we saw was

a large surface that wrapped around the work surface several inches below it.

Hand pressing workstation with a good catcher and a balanced iron. Height of workstation could be improved.

Guards. Some irons have a handle that is a comfortable size for the operators hand and is made of a heat-resistant material; they have a shield in place to protect the hand from steam.

MANUAL PRESS

COMMON PROBLEMS

Controls. Hand controls are located too high and require excessive force to activate.

Multiple Workstations. Some manual press operators work from more than one press or alternate between manual and hand pressing. When not designed properly this causes unnecessary lifting and carrying through cluttered walkways.

POSSIBLE SOLUTIONS

Controls. Both the closing of the press and the steam can be activated with one well-designed foot pedal.

Multiple Workstations. A good design we saw for multiple workstations was two manual presses parallel to each other with sufficient but not excessive space between them. The operator turns around and walks several paces when switching from one press to the other.

AUTOMATIC PRESS

COMMON PROBLEMS

Hand controls. Controls that are inaccessible require awkward postures and excessive force to activate.

Foot space. Insufficient space for the automatic shirt-press operators' feet requires them to stand further away from the work area which increases the reaching required.

Contact area. Automatic shirt-press operators often rest against the press while they load the shirts. Some presses have hard, sharp edges that create contact stress when the operator rests on them.

POSSIBLE SOLUTIONS

Hand controls. Good hand controls that we saw were two large, easily activated buttons that had to be activated together. They were approximately hip width apart, in front of the worker at waist height.

Foot space. An automatic shirt press that is tapered at the bottom provides room for the feet and allows the operator to get close to the work area.

Contact area. A pillow attached to the hard, sharp edge of the press reduces contract stresses.

Placing foam around the edge is also recommended.

FUSING

Fusing operations bind two fabrics together to make them stronger.

COMMON PROBLEMS

In-feed. Operators who feed fabric into the fusing machine from a seated position do not have enough knee space, causing them to sit further away from the fuser and reach with a flexed back posture.

Standing operators have to carry fabric from the worktable used for organizing fusing materials to the fuser.

Out-feed. Materials are hot when the operator has to pick them up and they have to bend down low to reach them.

POSSIBLE SOLUTIONS

In-feed. A good fusing workstation includes a worktable that is directly inline with the fuser so fabric can be slid

Fusing workstation with worktable directly inline with fuser.

from one to the other. They should both be at a good working height for the operator.

Out-feed. A fusing workstation with an automatic catcher and stacker at the out-feed area allows the fabric to cool before it is touched, and it presents the fabric at a good height for pickup.

Finishing Department

The primary tasks in the finishing department are:

- *Hand Sewing*
- *Final Inspection*
- *Packaging*

HAND SEWING

The workers performing this task sew the finishing touches on the garments, which may include buttons, eyelets, sequins or fur. The important aspects of the task to consider are:

- the work surface,
- the chair,
- the input/output technique and
- accessories.

COMMON PROBLEMS

Work surface. A non-existent or inappropriate work surface results in the worker using his or her lap as the work surface. This creates poor neck and back postures that are maintained for extended periods of time and increases stress on the legs and feet.

Chair. Hand sewers sit on poor chairs.

The chairs are not adjustable; they provide little or no back support and limited cushioning.

Input/Output. Hand sewers must pick up the garments prior to performing their task and deposit them once they have completed it.

Typically sewers stand to remove the garment from a high rail and place it on the rail again upon completion.

This requires the sewer to perform lifts with the arms extended and elevated above shoulder height.

Accessories. Hand sewers are not provided with a footrest to help relieve the stress on their legs and back while seated.

Some are working in poorly lit areas, which can encourage poor posture and result in eyestrain.

Workers are using inappropriate tools such as large, heavy scissors for cutting thread.

A workstation that could benefit from some ergonomic improvements.

POSSIBLE SOLUTIONS

Work surface. A good work surface observed for this task is a large, smooth table that supports the weight of the garment. It should be located slightly above the elbow height of the sewer.

Chair. Workers who are seated for extended periods of time, require an adjustable chair with proper back support and good cushioning.

Input/Output. Garments need to be delivered at a height that does not require high, extended reaches.

Accessories. The best footrest we saw was a low shelf on the table in front of the worker.

The footrest should be independent and adjustable so that it can be placed in the most appropriate location.

Hand sewers should be working in a well-lit area.

They should use small clippers for cutting thread.

A hand sewing workstation with a large work surface. The height of the work surface and the chair could be improved.

FINAL INSPECTION

The task of final inspection typically involves visually inspecting the garment for flaws, trimming threads along seams and in some cases cleaning chalk or lint from the garment. The important aspects of the task to consider are:

- the work surface,
- input/output,
- support surface,
- hand tools,
- lighting and
- work organization.

COMMON PROBLEMS

Work surfaces. Work surfaces that create problems include rolling racks for hanging garments and flat tables.

Rolling racks are typically too high and require reaching above shoulder height.

Flat tables encourage poor neck or shoulder and wrist posture depending on the height of the table.

Input/Output. Rolling racks create difficulties for input and output, as they are typically too high.

Boxes sitting on the floor create problems because they are too low.

Support surface. Final inspection is usually done from a standing position.

Concrete floors can lead to fatigue in the legs, feet and back.

Often no seating option or footrests are provided.

Hand tools. Inspectors use large scissors that are heavy and awkward to use and therefore require a lot of force to operate.

Lighting. Inspectors work in poorly lit areas or ones with inconsistent lighting. This can accentuate poor posture and eyestrain.

Work organization. Inspectors work at a very rapid pace and do not take scheduled breaks. This does not give the body time to recover and is a risk factor for injuries.

Some inspectors have little variation in their tasks. They rarely have to get up from their workstation since garments are delivered directly to them.

Others have to carry large bundles of garments through crowded walkways.

Final inspection workstation which could be improved with a new work surface.

POSSIBLE SOLUTIONS

Work surface.

1. An inclined easel with clips holds the garment and allows the inspector to sit or stand in an upright

position and not have to support the weight of the garment. The inspector should select the desired height for the easel and clips.

2. A large, inclined table improves the posture of the neck and arms.

Input/Output. A rolling rack at an appropriate height reduces the extended reaching. Preferable to this are rolling carts that the garments are draped over, located between waist and elbow height of the inspector.

Support surface. Provide good quality anti-fatigue mats for inspectors.

Give inspectors the option to use a stool and to alternate between sitting and standing throughout the day.

Hand tools. Small, sharp clippers are more suitable for the task as they are easier to use and lighter than large scissors.

Ensure that clippers are available by storing them on a shelf or hanging them directly beside the work surface.

Lighting. Inspection areas should be well lit and task lights should be provided if the inspectors feel they are necessary.

Improve visibility by contrasting the colour of the garment being inspected with the colour of the work surface.

Work organization. Operators can meet or exceed production expectations and still work at a comfortable pace and take scheduled breaks. Inspection tasks have been organized in some workplaces so that inspectors

have as much variability in their tasks as possible and do not inspect the most difficult types of garments for extended periods of time.

A final inspection workstation with a good work surface, stool and anti-fatigue mat.

In some cases, inspectors move from their work area to get more garments to inspect. This change in posture can be beneficial if a safe technique is used for transporting the garments.

A final inspection workstation with a large inclined work surface and the option to sit or stand (stool is not visible in the picture).

PACKAGING

This task can involve folding and packaging the garments in a bag or a box. We looked at several operations for packaging men's dress shirts and special considerations for these packaging stations will be described. Important features to consider include:

- the work surface,
- input/output,
- support surface and
- accessories.

COMMON PROBLEMS

Work surface. Work surfaces are often flat tables that are not height adjustable and are not at a height appropriate for the worker.

When the table is too high the worker has to use an elevated shoulder posture and when it is too low a poor neck and back posture is the result.

Packaging tables are often too deep and require excessive reaching to locate tools and supplies. This is particularly true for the shirt folding tables.

Rolling carts are much too low and require the packer to work with a very flexed back posture.

Overhead racks are too high and require elevated arm postures and heavy overhead lifts.

Input. Cardboard boxes located on the floor.

Extremely high rolling racks.

Output. Garments are placed in very large cardboard boxes that packers can barely reach over, or placed on high, over-filled racks.

Tables or benches are at inappropriate heights.

Workers must lift and carry awkward, heavy boxes.

Support surface. Many packers are required to stand on concrete floors without anti-fatigue mats.

Accessories. Some swift tackers require excessive force to operate and create contact stresses in the hand.

Hangers are often very difficult to open and close.

Irons are heavy and require a poor thumb posture to operate the steam.

POSSIBLE SOLUTIONS

Work surface. A good shirt-folding table that we saw had been adjusted to an appropriate height for the packer by placing wooden spacers under the legs. The packer could reach all items at the back of the table without an extended reach. The tabletop had small recessed areas close to the front of the table to hold small, frequently used items.

We also saw a good automated bagging station. It was at an appropriate height for the worker. The bagging operation was semi-automated; air was used to blow the bag open. The bag was automatically sealed and it slid down a ramp into a box.

Semi-automated bagging workstation.

Input. A good input method is a shelf located at the back of the work surface. It should be low and close to the operator.

Storage bins can be located beside the bagging station so that garments can be transferred from the bins to the bagging station with limited reaching or lifting.

If rolling carts or boxes are used they should present garments to the packer between waist and elbow height.

Output. A good output method is to place the packaged garment on a shelf directly beside the operator. This shelf feeds the garments directly to the next operator in the line.

Another good method we saw was to place packaged garments into a box that the garments fit into perfectly. This allows the packer to put the garment into the box and not have to arrange it neatly by hand.

Conveyors can be used to transport full boxes, which greatly reduces the amount of lifting required.

The packers placing garments into very large cardboard boxes should be able to easily reach over the side of the box.

The overhead rails should not be over-full and require excessive reaching.

Conveyors to transport full boxes of garments.

Support surface. Place anti-fatigue mats over the entire floor in the work area.

Accessories. Foot pedals for activating swift tackers or folding tables should be located on the floor and should be very thin but large enough for easy operation.

Some hangers are more difficult to use than others. If packers rotate among different garment styles throughout the day they will not be using the difficult hangers for extended periods of time.

Choose irons that are lightweight and do not require awkward thumb postures to activate the steam.

Conclusion

This project demonstrates that there is ample room for ergonomic improvements in the clothing industry. We need to continue to identify problems and, more importantly, implement solutions to reduce the risk of injuries in situations where we know problems exist.

Find out more!

A copy of the full report for this project can be obtained from the Canadian Office of UNITE. Call us at 416-441-1806 or 1-800-268-4064. The report includes more detailed results from our ergonomic assessments, information on lost-time injury trends in the clothing industry, and the results of our questionnaire on work organization at 29 clothing plants.

Check out these web sites for more information:

- UNITE: *www.unite-svti.org*
- Institute for Work & Health: *www.iwh.on.ca*
- Occupational Health Clinics for Ontario Workers: *www.ohcow.on.ca*

Ergonomic Handbook for the Clothing Industry

Injuries and muscle pain affecting the wrists, shoulders, neck and back are common problems for workers in the clothing industry. These injuries can be prevented! A team of researchers from UNITE, the Institute for Work and Health and the Occupational Health Clinics for Ontario workers examined working conditions in 29 clothing factories to find out how these injuries start and how they can be prevented. In this handbook you can find:

- How our research project worked.
- What is ergonomics anyway?
- Common ergonomic problems in cutting, assembly, pressing and finishing.
- Solutions and recommendations for reducing the risk of injury.

This handbook is designed as a starting point for workers and managers to improve working conditions. For a copy of the full report from this research project, contact UNITE at 1-800-268-4064 or see this web site: *www.unite-svti.org*.

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