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## *Ergonomic Intervention to Improve Safety and Productivity*

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### Abstract

**The purpose of this study was to document and describe the current work conditions in the clothing industry. We went to Reynolds Shirting Pvt ltd. plant situated at Islampur. Two representatives completed a questionnaire on work organization in the plant considering all the departments. Ergonomists assessments of jobs in the cutting section, assembly line, pressing section and finishing section of plant was done. We focused on identifying good practices that can be incorporated in the industry to improve productivity and safety. Our goal in creating this project is to share these good practices so that injuries can be reduced across the industry and improvement in productivity can be achieved.**

**Keywords:** Ergonomic in Cutting, Sewing, Washing, Finishing and Packing departments.

### 1. 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 Keyes 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.

## **II. Literature Review**

The term ergonomics, from Greek words ‘Ergo’ meaning ‘work’, and ‘Nomics’, meaning ‘natural laws’ first entered the modern lexicon when Wojciech Jastrzębowski used the word in his 1857 article “The Outline of Ergonomics; i.e. Science of Work, Based on the Truths Taken from the Natural Science”. The introduction of the term to the English lexicon is widely attributed to British psychologist Hywel Murrell, at the 1949 meeting at the UK's Admiralty, which led to the foundation of The Ergonomics Society. 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 of 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 (MSD). 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**

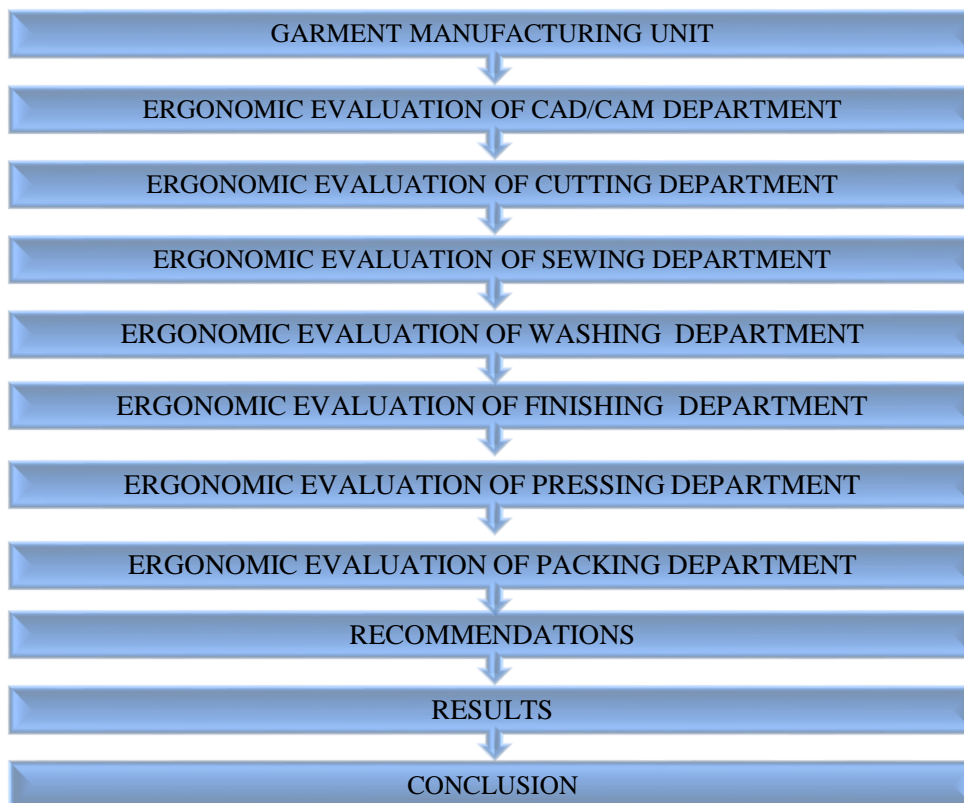
Avoid lifting objects that are too heavy. Use more than one person or a mechanical device to reduce the load. Your workstation should not require you to lift objects above your head or twist your back while lifting.

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

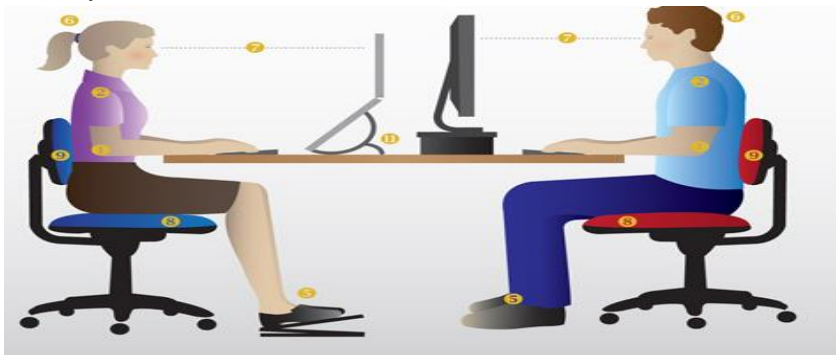
You need to rest your body and mind in order to prevent injuries. Give your muscles a rest during your coffee breaks, lunches and weekends by doing something different from what you do in your job. For example, if you stand all day while performing your job you should sit down to rest your legs and feet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

### III. Plan of Work



### IV. Method Study

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. Bombay Rayon Fashions Limited participated in the study.



**Fig. 1 Ergonomic Approved Postures while using Computer and Laptop**

- **Chairs**



**Fig. 2 Ergonomic Chairs.**

### Cutting Department

#### A] Loading the Spreading Table

##### 1) Fabric Roll Transportation from Table to Table

##### Common Problem

The heavy fabric rolls are manually transported from table to table by lifting the roll. The people doing this operation tend to complain about MSD's to muscle and back.



##### Possible Solution

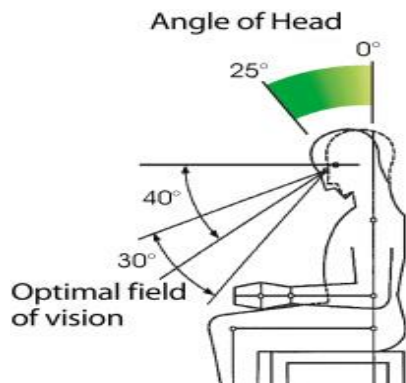
Automated trolleys or vehicles should be used to transport fabric rolls from loading area to spreading table. While loading and unloading trolleys two persons, one from each side should be operated so has to reduce stress and strain on body parts.



### Sewing Department

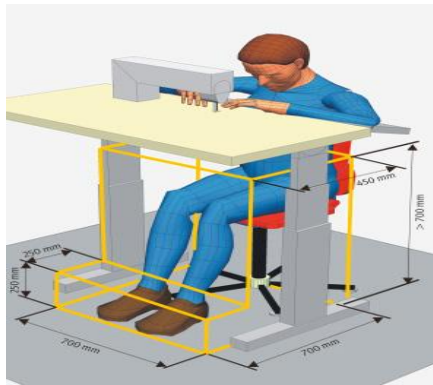
#### Table Angle

A few sewing tables that we saw were tilted  $10^{\circ}$  to  $25^{\circ}$  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. Boxes and trash chutes either should be not present or in a location that does not hinder leg room.



D]

may  
force.

### Stitching Material

### Common Problem

Employees push fabric through the sewing machine, which require extending arms bending at the wrist, and applying force.



**Awkward posture causes ergonomic stress to arms, shoulders, and back**

### Possible Solution

Use height adjustable table which, when properly adjusted, may reduce extension and bending at the wrist. Allow the machine to pull the fabric through rather than having the operator push the fabric. Reduce the distance between the operator and machine.



**Height-adjustable table**

### **Safety Tools/Safety Precautions**

#### **Common Problem**

There is high risk of accidents, if needle of sewing machine break at high speed, the operators operating kansai machine have maximum possibility to face respiratory diseases. Operators performing various operations on sewing machine like single needle, double needle, kansai etc. are not provided with personal protective equipment's.

#### **Possible Solution**

All sewing machines should be provided with eye guard to avoid accident. The operator operating kansai machine, fabric cutter machine should be provided with respiratory protection.



**Operator performing sewing operation with safety precautions**

### **Stain Removing Section**

#### **Actual Process**

The garment with various stain such as pen mark, oil stain, etc. are removed by manually operating the stain removing machine.

#### **Common Problem**

Long standing and working hours, handling of various chemical can causes various skin injuries, long working hours lead to fatigue.

#### **Possible Solution**

1. Operators performing this job should be provided with protective eye glasses, hand glose, respiratory protection, safety shoes without fail

2. Operator should be provided with MSDS instruction sheet for safe handling of chemical.
3. They should be provided anti-fatigue mats.



## RECOMMENDATIONS

### 1) Table Dimensions

As per the survey carried out, it is observed that table dimensions vary in large proportions from the standard norms. Large variations can be seen in heights and width, which cause long term injuries like musculoskeletal disorders. Following are the standard norms for table dimensions which should be applied

Parameters	Cutting Table	Sorting Table	Checking Table	Ironing Table
	StandardNorm	StandardNorm	StandardNorm	StandardNorm
<b>Length</b>	---	180 cm	180 cm	120 cm
<b>Width</b>	120 cm	120 cm	120 cm	90 cm
<b>Height</b>	112.3 cm	112.9 cm	117.3 cm	102 cm

in the industry.

**Table.1: - Standard Table Dimensions**

### 2) Lux Report

As per the survey carried out, it is observed that levels of illumination are not as per the standard norms. This can cause stress and strain to the eyes of the operator performing the job. Following are the standard norms for illumination that should be applied in the industry.

**Table.2: - Standard Lux Report.**

Reading	Department	Standard Readings
01	Cutting Section	950-1050
02	Sewing Section	800-1000
03	End Line checking Table	950-1100
04	Kaj-Button section	800-1000
05	Pressing Section	800-1000
06	Finishing Section	1000-1200
07	Packing Section	800-1000

### 3) Ergonomic Iron



### Characteristics of Iron

- Consistent steam quality for constant use.
- Temperature control accurate within  $\pm 2^{\circ}\text{C}$  ( $\pm 3^{\circ}\text{F}$ ) to iron temperature sensitive fabrics without marks
- Iron sole, high quality and especially smooth, is suitable for ironing without Teflon frame sole
- Ergonomically shaped iron handle with a soft-touch micro switch to release steam.
- Integrated steam and heat protection for comfortable and safe ironing.

The electronically controlled temperature regulation and the special chamber system of the ironing sole provide a condensate-free steam quality. These high pressure irons are optimally suitable for ironing of sensitive fabrics by its exceptionally smooth steam distribution and the accurate temperature control. The pointed design of the ironing sole guarantees an excellent ironing result even for areas which are difficult to access.

Weight approx. 1275 grams (approx. 3 lbs.); 230 Volt; 1250 Watt; 50-60 Hz; ironing surface 220 x 105 mm / 8.7 x 4 inch.

### v. Results & Discussion

#### Cutting Department

- Due to use of semi-automated trolleys in cutting department for fabric transportation, considerable reduction in stress and strain levels in body parts of workers was reported
- Due to change in table dimensions of spreading table, fabric spreading operation become more convenient and fast.
- Due to improved work postures at straight knife and band knife cutting machine, substantial reduction in MSD to body parts and higher production rates were reported.

#### Sewing Department

- After making changes in sewing table dimensions, substantial improvement in work surface and support surface were recorded and substantially higher rates of production were also reported.
- Due to change in table angle by  $10^{\circ}$  to  $25^{\circ}$  towards the operator, proper visibility of task was achieved resulting in low stress levels on eyes was recorded.
- Uses of task lighting system were practised in sewing department for difficult operations thus fulfilling higher visibility demands at difficult task.
- Increase in illumination system of sewing department was done after recording low lux intensity reports according to standard norms.
- Due to use of sharp trimmers and scissors at work, substantial reduction in repetitive motions was achieved.
- Due to use of anti-fatigue mats at end line checking tables, reduction in fatigue levels was achieved.
- Reduction in accidents was achieved after use of all the personnel protective clothing was made mandatory.

#### Washing Department

- Incursion of material safety data sheet (MSDS) and use of personnel protective clothing was made mandatory in washing department.

#### Finishing Department



- Higher production rates of trimming operation were recorded when use of sharp trimmers was started in finishing department.
- Use of measurement templates provided boom for production and reduction in stress and strain levels of workers.
- Improvised work surface, hand tools and work organisation caused improvement in production rates and lowering stress levels at work.

#### **Pressing Department**

- Incursion of new ventilation system reduced humidity levels thus improving working environment.
- Improvised postures at pressing, resulted higher production rates and lowering stress levels at work.
- Incursion of ergonomic irons, felicitated proper and faster working at the pressing department.

#### **Packing Department**

- Improved work surface, support surface and accessories resulted in production rates and work surfaces.

### **VI. Conclusion**

Preventing physiological and psychological stress at workplace needs a lot of cooperation between workers and the management. Besides, both managers and workers should to be acknowledging that stress factors at work may cause a large variety of health complaints and absenteeism, and to prevent these, the primary causes have minimized. The spread of information in the organization and the positive attitude for safety among workers, and also management, is extremely important.

In investigated company, occupational stress can be decreased by using more suitable types of work organization, working tools and techniques, ergonomically designed work places, open discussions between the workers and the management. In order to save workers' health, recommendations were given for healthier work arrangements, working postures and movements. Different prevention methods have been worked out to prevent the accidents and occupational diseases like continuous training of workers on all levels, internal surveillance, personal protective equipment, improvement of workrooms and workplaces, prevent eyes over-extension in the work with computers.

Every workplace is different, which means employers must carry out an assessment of the risks at the workplace concerned so that solutions are developed for specific problems. However, some solutions can work across industry sectors in organisations of different size.

The modifications that we can carry out at workplaces for improvement of workers' work conditions could be divided into three groups:

#### **1. Technical Interventions**

redesign of physical environment or working aids and tools, introduction or lifting and transfer aids, the rearrangement of placement of tools, providing the opportunity to use a sit/ stand stool, as well as an anti-vibration mat to reduce the fatigue caused by a permanent standing working posture, use robot manipulators, roller conveyors and conveyor belts for heavy physical work.

#### **2. Organizational and Administrative Interventions**

Work modification, job rotation, building a bridge between planning and production departments, increasing management's interest and acceptance of ergonomics, relieving physical strain on workers without reducing productivity, avoiding unnecessary lifting, carrying and repetitive work.

### 3. Behavioural Modification

Train the ergonomic experts who can train and educate workers for manual handling techniques, promote physical activity, raise workers' awareness of health and safety issues at work, and persuade the workers that the company values them highly.

#### Acknowledgment

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