

Ergonomics Followed in Sewing Room in Apparel Industry

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Abstract—In India the readymade garment industry has witnessed impressive growth during the last four decades but the growth of the garment sector however, did not go hand in hand with an improvement of working conditions for the garment workers. Efficient work station design can play an important role in reducing unnecessary physical efforts, thereby increasing working efficiency and productivity, and operator chair is an important part of this workstation. Present paper is an attempt to study ergonomics of apparel industry.

Keywords: Ergonomics, Workstation, Apparel, Effort.

1. INTRODUCTION

Today most of the operators carry out repetitive activities in awkward postures. At First, they will not be aware of this because it feels comfortable. If we do not sit properly, take regular breaks and use correctly positioned furniture and equipment, we become vulnerable to pain and discomfort. Apparel manufacturing is labor - intensive, assembly line process requiring significant amounts of repetitive, skilled manipulation. Injuries and muscle pain affecting the wrists, shoulders, neck and back are common problems for workers in the garments industry. These conditions are usually related to overuse and can become unbearable, if left untreated. Even stress, which causes muscles to tense, can be a contributing factor as can adverse working environments, such as those are too hot or too cold, inadequate illumination, poor air quality and noise level need attention.



Fig.- Flow chart showing the steps involved in design of functional clothing

2. IMPORTANCE AND NEED OF ERGONOMICS IN THE APPAREL INDUSTRY

Features in garment industry that could be improved to prevent injuries include; communication, involvement of employees in decision making, education and training of employees and management on prevention strategies, and the ergonomics condition at the plant. The clothing industry is generally seen as a safe place to work, and when 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.

3. INJURIES AND ILLNESSES AMONG APPAREL WORKERS IN SEWING ROOM:

- 70% of sewing machine operators using foot controls report back pain,
- 35% report persistent lower back pain.
- 25% have suffered a compensable cumulative trauma disorder (CTD).
- 81% reported CTDs to the wrist.
- 14% reported CTDs to the elbow.
- 5% reported CTDs to the shoulder.
- 49% of workers experience neck pains.
- Absenteeism increases as working conditions worsens.
- Loss of worker force due to injuries or high turnover is associated with working conditions.
- Hand sewing, and trimming are stressful to upper limbs.
- Stitching tasks are associated with pain in the shoulders, wrists, and hands.

- Ironing by hand is associated with elbow pain.
- Garment assembly tasks are associated with CTDs of the hands and wrists.
- Foot operated sewing is associated with pain in the back.

3.1 PHYSICAL ERGONOMICS

Concerned with physiological and biomechanical characteristics as they relate to physical activity. Relevant topics include working postures, materials handling, repetitive movements, heavy work, work-related musculoskeletal disorders, workplace layout, noise, thermal conditions and vibration, safety and health, as these relate to work.

3.2 WORK RELATED MUSCULO SKELETAL DISORDER (WMSD)

Work-related musculoskeletal disorders (WMSDs) are a group of painful disorders of muscles, tendons, and tension, and nerves. Carpal tunnel syndrome, tendonitis, thoracic outlet syndrome, and tension neck syndrome are examples. Work activities which are frequent and repetitive, or activities with awkward postures cause these disorders which may be painful during work or at rest.

Work which uses legs can lead to WMSD of the legs, hips, ankles, and feet. Some back problems also result from repetitive activities.

WMSDs are very difficult to define within traditional disease classification.

These disorders have received many names, such as:

- Repetitive motion injuries
- Repetitive strain injuries
- Cumulative trauma disorders
- Occupational cervicobrachial disorders
- Overuse syndrome
- Regional musculoskeletal disorders
- Soft tissue disorders

3.3 WMSDs are associated with work patterns that include:

- Fixed or constrained body positions
- Continual repetition of movements
- Force concentrated on small parts of the body, such as the hand or wrist
- A pace of work that does not allow sufficient recovery between movements generally, none of these factors acts separately to cause WMSD. WMSDs commonly occur due to combination and interaction among them. Heat,

cold and vibration also contribute to the development of WMSD.

WMSDs include three types of injuries:

- Muscle injury
- Tendon injury
- Nerve injury

The Above stated categories of injuries commonly result in following problems in Workers:

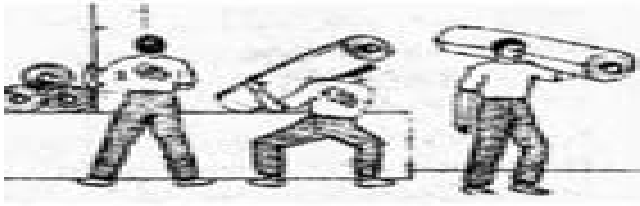
- Headache and head fatigue
- Shoulder pains
- Lower back pains
- Pain in neck area
- Carpal channel syndrome (moderate stadium), pain in wrist
- Fatigue and the disturbances of sensitiveness in hands
- Back pain in breastbone region
- Pain in thing muscle
- Pain in hips
- Pain in leg muscle
- Back pain
- Pain in knees

Identification of Risk Factors:

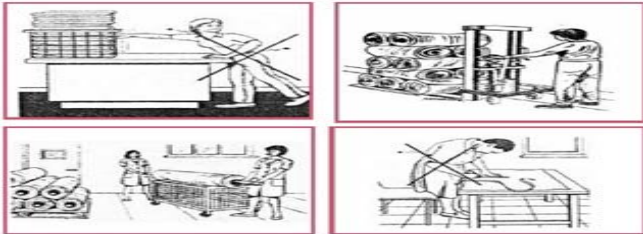
The Schedule in the regulation details the unfavorable ergonomic conditions or risk factors, which should be considered as part of the risk assessment process. Ergonomics Research which has been conducted to identify workplace factors that contribute to the development of musculoskeletal disorders including back injury, has demonstrated,

Hazardous manual handling tasks are ones that involve:

- Lifting heavy objects
- Pulling, pushing or pressing with high force
- Repetitive or sustained lifting, pulling, pushing or pressing – even if not heavy, not high forces
- Awkward body positions or bad postures – either repetitive OR for prolonged periods
- Exposure of whole or part of body to sustained vibration – e.g. using a power tool; driving a vehicle with significant vibration
- Manual handling of loads that are difficult to hold (e.g. slippery), or unstable / unbalanced



1. Keep your head directly over the shoulders (i.e. "chest out, head back")
2. Keep the shoulders directly over the pelvis
3. Tighten the core abdominal muscles
4. Tuck in the buttocks
5. Place the feet slightly apart, with one foot positioned slightly in front of the other and knees bent just a little bit (i.e., not locked).



Examples of Bad Posture and Back Support:

The following are examples of common behavior and poor ergonomics that need correction to attain good posture and back support:

- Slouching with the shoulders hunched forward
- Lordships (also called "swayback"), which is too large of an inward curve in the lower back
- Carrying something heavy on one side of the body
- Cradling a phone receiver between the neck and shoulder
- Wearing high-heeled shoes or clothes that are too tight
- Keeping the head held too high or looking down too much
- Sleeping with a mattress or pillow that doesn't provide proper back support, or in a position that compromises posture

Stretching for Back Pain Relief:



fig.5

LIFTING POSTURES

Plan the Lift

- Use the large muscles of your legs to lift, let the quadriceps and hamstrings do the work.
- Hold the item close to your body and as close to your center of gravity as possible
- Don't twist with your back, move with your feet. Keep your hips and shoulders in alignment.
- Pull or push if able, rather than lift.
- Don't jerk the load. Lift smoothly.

3.1.2 COGNITIVE ERGONOMICS

COGNITIVE ERGONOMICS is concerned with mental processes, such as perception, work environment, memory, reasoning and motor response, as they affect interactions among humans and other elements of a system. Relevant topics include mental workload; decision-making, skilled performance, human-computer interaction, human error, work stress and training as these may relate to the way humans work in systems.

WORKSTATION & SEWING EQUIPMENTS

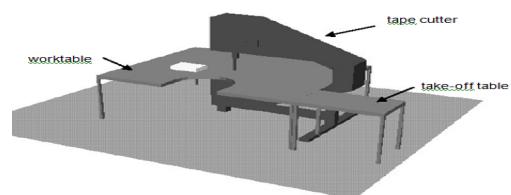
The analyzed workstation is organized for standing work. The work area where the worker is standing has an opening of 590 x 540 mm. This makes easier access and easier transportation of cut layers the tape cutter. The worktable and take-off table heights are 750 mm and the take-off table is placed on the right side of the worktable.

First, we performed the static analysis for 50th percentile reach dimensions for female operator and standing work. We analyzed the reach area and the field of vision. The results clearly showed that the worktable height is too low. The field of vision, because of the posture of the head (40°), is completely inappropriate and the reach area is outside of the tape cutter's area. Then we performed the dynamic analysis which is based on the pee-empro method.

The results show that almost 50 % of all workers' movements are in the yellow area which shows Abnormal body postures what has to be changed. Based on former results we designed the ergonomically optimal workstation which is appropriate.

The workstation consists

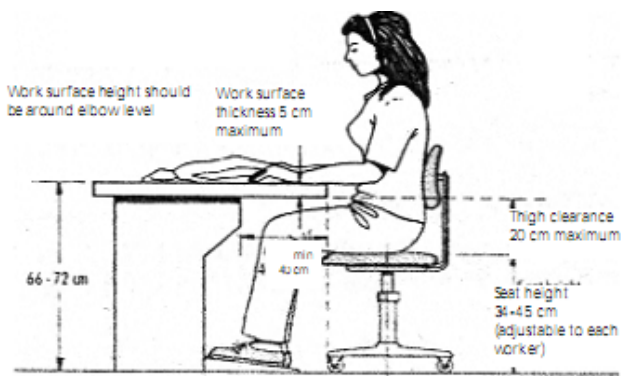
A tape cutter, an integrated worktable, a shelf for cut layers, a container for redundant material and



The workstation is adjusted to the constitution of the human body, body sizes and body movements. The worktable is flexible meaning different heights and inclinations of the work area. This solution prevents the inappropriate inclination of the neck spine and it is good for the general state of health. The worktable is designed to assure comfort and pleasant working conditions which contributes to lower psychophysical loads. The optimized workstation also Prevents inappropriate physiological body postures and partial loads.

The part of the worktable behind the tape cutter has an extra component with the possibility of inclination. This component serves for easier transportation of redundant material. The inclination of the worktable does not represent a problem at leading cut layers because there is an airbag which stabilizes fabric layers. The inclination of the worktable requests a specific construction of the flexible tape cutter because it has to be adjustable regarding worktable inclination.

The adequacy of the workstation was confirmed by both, static and dynamic analyze. The results of the PEE-EMPRO analysis of worker's movements showed that all movements or all body postures are in the optimal green area. So the results confirmed the fact that this workstation is ergonomically optimized.



Assembly Department

The primary tasks in assembling clothing are:

- Sewing
- Loading automated rail system

3.1.2.2 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.

4. ANALYSIS OF ERGONOMICS:

Long work hours, hard edges of chair static and awkward posture can be lead to various WMSD problems, low efficiency and decreased productivity.

The key features required to reduce these problems are:

Easily height adjustable.

Have fine legs rotation not revolution.

Cushioning on seat pan and back support.

Adjustable and back lumbar support.

Chair base which could be adjusted in space between work stations.

Use of waste fabric from company to reduce cost.

5. OBSERVATIONS: AS PER THE REPORT OBSERVATION SOME STEPS NEED TO BE TAKEN NECESSARILY, ONE OF WHICH IS:

5.1 Ergonomics Training Needs

Although every employee should receive basic ergonomic training, it is recommended that all managers, supervisors, and selected key individuals from each functional area receive more intensified training. These individuals should be the leaders of the ergonomic implementation within their respective work areas. This intensified training for the group will serve both to spread the implementation workload and to achieve wider engagement within each work function.

Training for new management and an explanation of their role in the ergonomics process is critical. As with all processes, associates must be knowledgeable about the potential health and safety hazards, including ergonomics risk factors. All team members should go through an orientation procedure that familiarizes them with content of the ergonomics process, reporting requirements, response process, exercise/wellness program, checklists, and how they can impact the overall health and safety process.

More specific training items are addressed in the following areas:

5.2 PROJECT MANAGER

If the project manager has not had training in ergonomics, then that training should be scheduled as soon as possible. The manager and team members should be trained in the following areas: team dynamics, facilitation, group problem- solving techniques, introduction to ergonomics, recognition and evaluation of risk factors, signs and symptoms of

musculoskeletal disorders, developing and implementing ergonomic solutions, principles of motion economy and work station design, the use of evaluation tools, and conducting an ergonomic analysis.

5.3 MEDICAL PERSONNEL

Medical personnel will require training in addition to the basic team member training listed above. These topics should include the anatomy of the upper extremities, neck and lower back and the identification, assessment, treatment, rehabilitation protocols of frequently occurring occupationally-induced MSDs.

5.4 MANAGEMENT OVERVIEW

Management personnel in the facilities do not require an in-depth knowledge level of ergonomics but should be trained in the basics. These should include: the ergonomics-related risk factors in the company; the types, symptoms and consequences of MSDs; the importance of early reporting; common measures to reduce exposure to risk factors; and the existence and function of the ergonomic committee. In addition, management should be trained in the specific prototype, Employed by the company – each manager's responsibility within the protocol, their role in follow-through, and cooperation with ergonomic initiatives in their area.

5.5 EMPLOYEES

All employees should receive ergonomic awareness training at least annually. New employees should have this training as part of their initiation. Topics included should be the primary risk factors, how to recognize symptoms, the importance of early reporting, the reporting procedures, and the existence and functions of the ergonomics committee. Employees should also be advised as to how they can expect to see problem jobs addressed over the coming months.

5.6 EMPLOYEES ON PROBLEM JOBS

Once the worksite analyses have been completed, the analyst should be able to prioritize which jobs have the most potential for ergonomic problems. Employees on those jobs will require additional ergonomic training related to the specific risk factors and changes on their job. Topics include: information on the proper use of the tools and equipment information on the risk factors specific to their job the controls planned or implemented to address them descriptions of the early signs and symptoms of the hazard related to their job and emphasis on the importance of early reporting.

5.7 Early Stages of Team Development

After technical training, the team should conduct additional practice sessions to ensure continuity in analytical processes and problem solving. Several jobs should be identified for group analysis. Each member should conduct each analysis individually, and then share their results with the team.

Discussions should center on differences between the individual evaluations.

5.8 Data Assessment

In Section various data collection areas were discussed. If the data collection was not accomplished prior to issuing the project charter, it must be the initial task of the project manager and ergonomics team. The areas for analysis include the PEE-EMPRO Logs, Worker's Compensation reports, group health insurance claims, first aid logs, lost time and restricted duty records, worker turnover, absenteeism, and quality issues.

5.9 Baseline Surveys

Once the employee awareness training has been completed, the ergonomics team can conduct a baseline survey of the jobs in their facility to identify obvious risk factors. A few examples of these forms can be found in the appendices of this Project report. High level evaluation forms typically use a yes/no format, a simple point assignment process, or a series of sketches/photos that demonstrate the risk factor under evaluation. Baseline surveys are not definitive but along with earlier data can provide the team with a prioritized focus on the jobs that require a more in-depth analysis. Baseline data will also be valuable in documenting improvements made through the ergonomic process implementation.

6. CONCLUSIONS

With Ergonomics employer can not only save their workers from injury and potential misery, but also save huge amount of money involved in the process, thereby increase in efficiency, productivity and time consuming. But then also ergonomics becomes an important work which cannot be overlooked. There for the prototype developmental is based on ergonomics factors and sewing operators

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