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Research Article

Ergonomic Work Place Design for Assembly Table

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Abstract

Ergonomics is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design to optimize human well-being and overall system performance. The goal of ergonomics is to fit the task to the individual, not the individual to the task. Practicing good ergonomics achieves increased productivity, improved health and safety of workers, higher job satisfaction and better compliance with government regulations. The objective of this paper is to provide a perspective of ergonomics, the main aim being to create a point of departure for the development of strategic objectives to enhance existing health and safety initiatives through the application of ergonomics principles. To suggest what is good ergonomic design for standing posture.

Keywords: *Work place design, Ergonomics*

Introduction

There are 95th percentile Male & 5th Percentile Female working in different shift. Female worker can work comfortably while Male worker find himself working difficultly due to fixed work station height & male worker height is more. This is the reason male worker need to bend more than the allowable limit & creating ergonomic issue to male operator. Below are the dimension of male & female operator for India.

Table 1-Anthropometric Data of Indian Human dimension

Population	Stature	Eye Height	Shoulder Height	Elbow Height	Knee Height	Hand Grip Height
95th % Male	1830	1712	1504	1127	577	840
5th % Female	1514	1410	1234	932	464	670

Problem Statement

There are 95th percentile Male & 5th Percentile Female working in different shift. Female worker can work comfortably while Male worker find himself working difficultly due to fixed work station height & male worker height is more.

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This is the reason male worker need to bend more than the allowable limit & creating ergonomic issue to male operator. Male operator suffering from back pain, neck pain problems.

Need of this Project

To resolve the musculoskeletal disorders of Men Operator, we need to design ergonomically safe work place for men operator.

Designs should apply the following principles to maximize the fit to the worker capabilities:

Design for the Extremes

Designs should consider the largest and smallest of the user populations to ensure a good fit between the work and the user. Designing for the maximum populations value is the appropriate strategy if a given maximum value of some design feature should accommodate all people. Thus, it frequently is the practice to use the 95th male & 5th female percentile of the distributions of relevant populations characteristics as the maximum and minimum design parameter.

Design Around the Averages

The average is a good starting point, but only designing for the average means that many people are working outside of their comfort zone. Be sure to allow for accommodation when designing around the average.

Design with Adjustability

Designs should be made with flexibility to be adjusted to the needs of the worker. Adjustments should be

made easily and quickly, or the user might not make the necessary adjustment.

Users should be trained on the adjustment features. Adjustment should accommodate a range of workers that include the 5th percentile female to the 95th percentile male, or 95 % of the workforce.

Project Methodology –

For this project we are going to design assembly work bench by using the Design with Adjustability principle.

Operation-

The operator is assembling motor winding cover on motor by using Phillips. Operator is doing 120 assembly per shift.

Operator is doing the product sub assembly on work bench which is at 640 mm height as shown below figure.

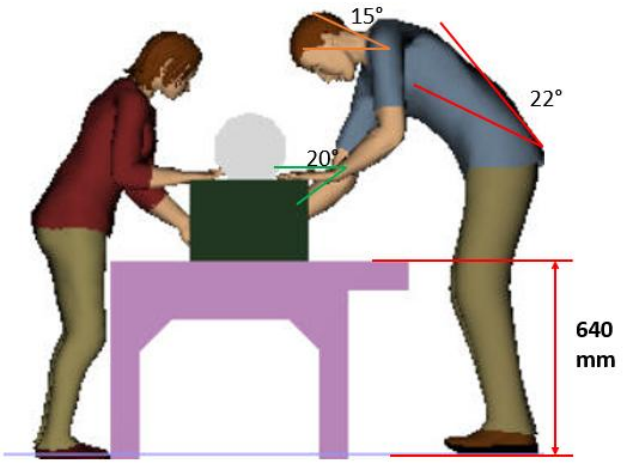

Figure 1 Working Height of Assembly Work Bench

Table 2 Pre-Posture Flection Measurement for Operator

Posture	Male Operator	Female Operator	Allowable Factor
Back Flection	22°	16°	20°
Shoulder Flexion*	20°	15°	20°
Neck Rotation	15°	9°	< 10°

Male & Female Posture Analysis-

above posture analysis it is clear that Male operator is at higher risk factor and not ergonomically safe.

To overcome this problem, we have designed the Work station adjustable due to which Male operator will increase the work station height as per his comfort zone & same as female operator. We have adjusted table height such that it can reach to 810 mm. so total height adjustability of 170 mm is provided by using hydraulic jack system.

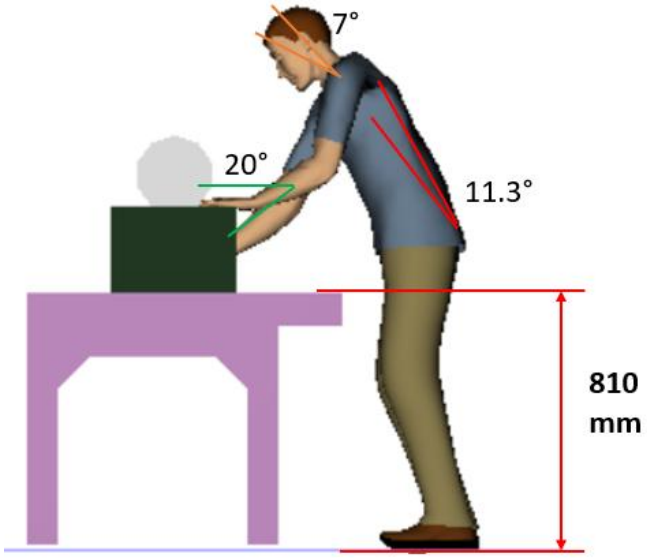

Figure 2 Revise Working Height of Assembly Work Bench

Table 3 Post-Posture Flection Measurement for Operator

Posture	Male Operator	Female Operator	Allowable Factor
Back Flection	11.3°	16°	20°
Shoulder Flexion *	20°	15°	20°
Neck Rotation	15°	9°	<10°

To make work bench adjustable we have provided hydraulic jack for work bench which can be operate by push button by operator.

The telescopic leg arrangement provided to lift work bench evenly.

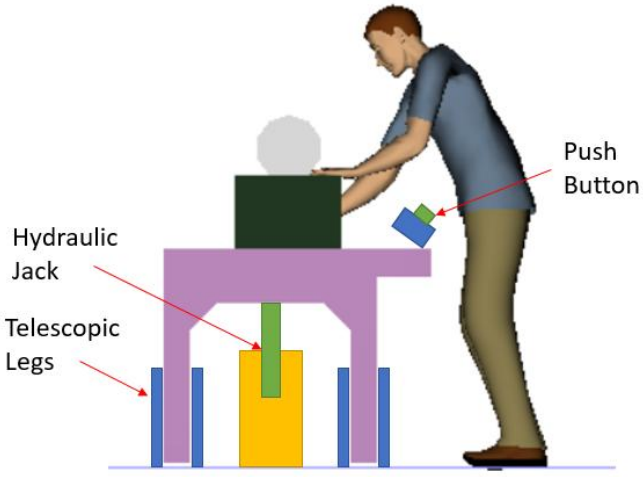

Figure 3 New Work Bench Design

RULA Analysis-

Rapid Upper Limb Assessment (RULA) is a survey method developed for use in ergonomic investigations of workplaces where work related upper limb disorders are reported. RULA is a screening tool that assesses biomechanical and postural loading on the

whole body with particular attention to the neck, trunk and upper limbs. Reliability studies have been conducted using RULA on groups of VDU users and sewing machine operators. A RULA assessment requires little time to complete and the scoring generates an action list which indicated the level of intervention required to reduce the risks of injury due to physical loading on the operator. RULA is intended to be used as part of a broader ergonomic study.

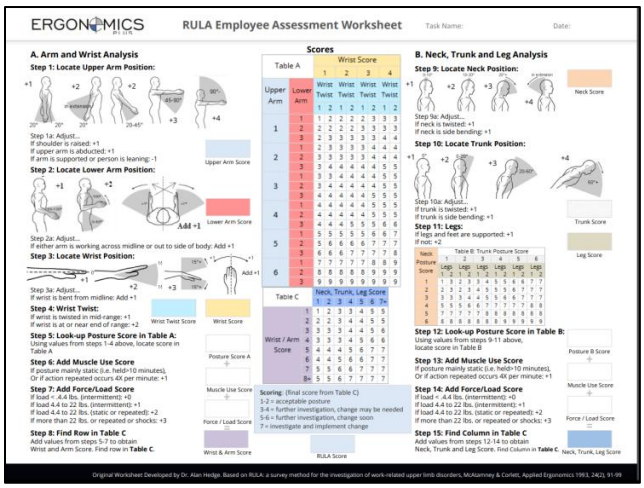

Figure 4- RULA employee assessment worksheet

Pre-Analysis-

We have done pre-analysis RULA assessment for current posture.

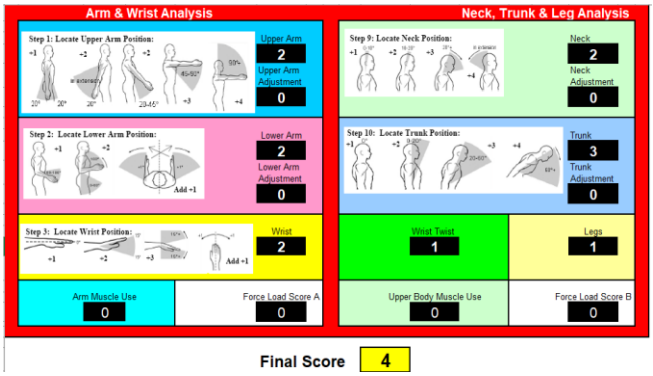

Figure 5 RULA pre-analysis Assessment Score

The upper arm score is 02, Lower arm score is 02, Wrist position score is 02, Neck position score is 02 & Truck position score is 03.

The total final score is 04, which is indication of the posture is not accepted and further investigation is needed.

Post-Analysis-

After proposing the adjustable table height, we did post RULA analysis.

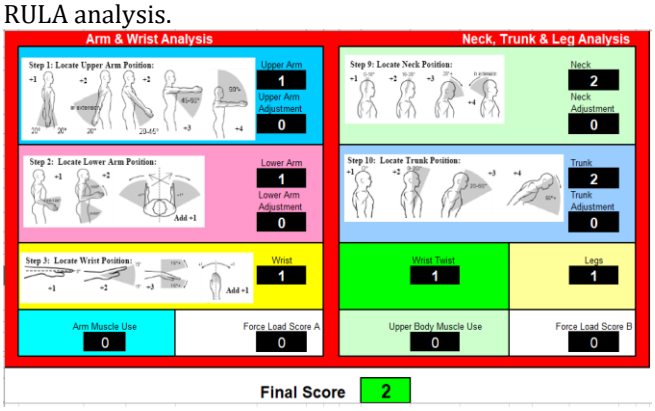

Figure 6 RULA post-analysis Assessment Score

The upper arm score is 01, Lower arm score is 01, Wrist position score is 01, Neck position score is 02 & Truck position score is 02.
The total final score is 02, which is acceptable.

Conclusion

While Designing the Work station there is no consideration of Ergonomically principle which results into dis comfort working environment for 95th percentile of Male where 5th Percentile female is working comfortably.

We have used Designing for Adjustable Range principle to design the ergonomically safe work station due to which the 95th percentile Male operator work posture are safe and within the acceptable level of ergonomics.

We need total 170 mm adjustability in work bench to so that Male operator will work comfortably.

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