

# ERGONOMICS STUDY IN TWO-WHEELER ASSEMBLY

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**Abstract-** The REBA method assesses the whole body, including the upper arm, lower arm, wrist, neck, back, and legs. The assessment involves identifying the tasks within the job, understanding the main job tasks and demands, and determining the most difficult components of the job. The evaluator then captures the "worst" moment with a photo and completes the REBA data collection form by comparing the position or postures of each body segment to those outlined on the form. The REBA provides a score for each body segment based on these postures, and the scores are then used to determine the REBA score, which ranges from 1 to 15 and represents the work-related MSD risk to the operator.

## INTRODUCTION

Ergonomics will be usually studied in the working environment, workers working posture and provide the comfortability, safety, and productivity of the industry. Ergonomics will be one of the repetitive and demanded industrial problems throughout the world. If we ignore the ergonomic principle in the design stage of the workstation it will affect workers' health, productivity, efficiency. Ergonomics will be an important consideration for the initial stage of the workstation and the development of any projects. The assessment tools like and REBA will be mostly used for the postural analysis.

The present study was conducted in the Two-wheeler manufacturing plant in the TVS Motor company. In a three-wheeler manufacturing plant, the overall process like PPC (Production Planning and Control), Machining, Engine Assembly, Paint shop, Vehicle Assembly, Test drive). The assessment will be conducted in the Engine Assembly and Vehicle Assembly. During this process workers will face ergonomic-related problems. This study will be conducted on the work area observation, interview sessions, photographs, and Postural analysis. During this study Material lifting, Repetitive action and Awkward postures are exposed to the ergonomic hazards. During the tightening stage, workers are exposed to noise hazards. Based on this data collection tools like REBA are used for postural analysis. Depending upon the working postures scores will come High, Medium, and Low. The suggestion will be provided on the scoring level of each stage.

## OBJECTIVE OF THE STUDY

The objective of the study presence of work-related musculoskeletal disorders among the workers involved in Assembling the Vehicle in Two-wheeler industry. It can be identified that the maximum number of musculoskeletal problems are related to the awkward posture line bending, twisting, handling of the weight, Repetitive action etc. Moreover, mostly this

problem is still faced in the Two-wheeler manufacturing industries. Hence the present study's main objective is to identify and assess the Work-Related Musculoskeletal Disorder due to awkward posture by REBA.

## SCOPE OF THE STUDY

The scope of the present ergonomic study on that Assembly line is to develop comfortable, safe, and productive systems in their workplace. To develop a new system for improving their work culture and work environment. People do not know their uncomfortable or pain at the time of working. So ergonomic assessment will Make the System more efficient.

of a journal or research paper. In this researcher can take the reference of already accomplished work as a starting building block of its paper.

## Jump Start

This approach works the best in guidance of fellow researchers. In this the authors continuously receives or asks inputs from their fellows. It enriches the information pool of your paper with expert comments or up gradations. And the researcher feels confident about their work and takes a jump to start the paper writing.

## METHODOLOGY

The present ergonomic risk assessment was conducted in the Two-wheeler manufacturing plant in vehicle and engine assembly. Totally 2 to 3 workers will take each stage total of 250 workers will be subjected to the postural analysis. In Assembly line workers perform works like Engine Loading, Rear Wheel Assy, Fuel tank tight, Frame loading, Handlebar tight, Head lamp tightening. The hazards involving these stages like causing the back pain for Lifting frame, Rear wheel assembly. Operating the pneumatic tools cause wrist pain because of vibration, Noise Exposure in work area and standing for a long period.

At the time of the assessment, all the workers from each stage were observed thoroughly before starting the assessment work and detailed information will be collected from the workers to ensure the completion of ergonomic risk assessment tools. Photographs were taken at the time of work in different stages in the assembly line. The purpose photographs for analysis of different movements and working postures of the workers. The photographs are used to analyze to fill the REBA scores sheet. To evaluate the risk assessment of a job or task use REBA.

REBA assessment tool used for analyzing such activities such as whole body and motion of limbs. The range of worker's body

posture will be divided into different body parts.

The score of the body parts will be given to assigning score work posture risk level will be maintained minimum. To assign a body score will be high work posture risk level is an extreme risk factor. The score is categorized into different levels such as negligible, low risk, medium risk, and high risk. Medium risk and High risk they addressed urgently to reduce the exposure levels.

Analyzing employees' work postures using the Rapid Entire Body Assessment (REBA) method. This process includes assessing various body parts, such as the trunk, neck, legs, upper arms, lower arms, and wrists, to determine the risk levels associated with different postures. The methodology often includes scoring different body regions based on specific criteria outlined in tables A, B, and C, along with load/force and coupling factors. The scores obtained from these assessments are then used to calculate the overall REBA score, which indicates the level of risk for musculoskeletal issues and guides actions to improve work posture and reduce the risk of injuries. The methodology typically involves the following steps:

- 1) Assessing posture factors for critical tasks of a job by assigning scores to different body regions.
- 2) Scoring Group A (Trunk, Neck, and Legs) and Group B (Upper Arms, Lower Arms, and Wrists) postures for left and right sides.
- 3) Calculating scores for Load/Force and Coupling factors.
- 4) Determining the Activity score.
- 5) Summing up scores from tables A and B, Load/Force, and Coupling to calculate Score A and Score B.
- 6) Using Table C to determine Score C based on Score A and Score B.
- 7) Calculating the overall REBA score by summing Score C and the Activity score.
- 8) Referring to the REBA Decision table to identify the degree of risk associated with the assessed postures.

**POSTURE ANALYSIS**

Overall, the methodology of a REBA journal paper involves a systematic process of assessing work postures using specific scoring criteria and tables to quantify the risk levels and guide interventions to improve ergonomics and reduce the risk of work-related injuries.

NAME OF THE STAGE	TASK	PROCESS	REBA SCORE
FRAME AND MIDDLE STAND ASSEMBLY	LIFTING	Picking, lifting, handling and placing frame.	10
SPARK PLUG ASSEMBLY	TIGHTENING	Picking the tool, placing into the engine, pulling the pneumatic hose, and tightening the screw.	8
FRAME NUMBERING AND PRESSING SUB ASSEMBLY	LIFTING	Picking, lifting, handling and placing frame.	10
EV HANDLEBAR TIGHTENING	TIGHTENING	Picking the tool, placing into the EV handlebar, pulling the pneumatic hose, and tightening the screw.	9
CRANK CASE LEFT NUMBERING MACHINE	LIFTING	Lifting the crankcase, placed into the machine, pick and shift into another tray.	9
JUPITER HANDLEBAR TIGHTENING	TIGHTENING	Picking the tool, placing into the Jupiter handlebar, pulling the pneumatic hose, and tightening the screw.	8
JUPITER SIDE STAND ASSEMBLY	TIGHTENING	Picking the stand, pulling the hose, and tightening the stand	8
REAR WHEEL TIRE ASEMBLY	LIFTING TIGHTENING	Lifting the EV motor, placing into the machine, after fixing the tire tightening by dc gun.	11
UNLOADING EV MOTORS	LIFTING	Place the trolley, lifting the EV motor, placed into the trolley and push the trolley.	11
JUPITER FRONT FORK ASSEMBLY	LIFTING	Lifting the front fork, placing, and tightening into the frame	10

**TABLE 1: Stage and work process**

**Step 1:** Task Analysis: The task is observed and analyzed, breaking it down into its constituent elements.

**Step 2:** Posture Assessment: In this step, the evaluator assesses the posture of the entire body, including upper and lower limbs, neck, trunk, and legs. Each body part's posture is assigned a risk score based on ergonomic guidelines.

**Step 3:** Force and Duration Assessment: Besides posture, REBA also considers the force exerted during the task and its duration. These factors are incorporated into the assessment to provide a more comprehensive risk evaluation.

**Step 4:** Final Assessment: The risk scores for each body part, force, and duration are combined to calculate an overall risk score. Based on this score, the task is categorized into different risk levels, and recommendations for ergonomic improvements are provided.

STAGE No.	NAME OF THE STAGE	REBA SCORE	ACTION REQUIRED
01	FRAME AND MIDDLE STAND ASSEMBLY	10	Implement Change
02	SPARK PLUG ASSEMBLY	8	Implement Change
03	FRAME NUMMMERING AND PRESSING SUB ASSEMBLY	10	Implement Change
04	EV HANDLEBAR TIGHTENING	9	Implement Change
05	CRANK CASE LEFT NUMBERING MACHINE	9	Implement Change
06	JUPITER HANDLEBAR TIGHTENING	8	Implement Change
07	JUPITER SIDE STAND ASSEMBLY	8	Implement Change
08	REAR WHEEL TIRE ASSEMBLY	11	Change soon
09	UNLOADING EV MOTORS	11	Change soon
10	JUPITER FRONT FORK ASSEMBLY	10	Implement Change

**TABLE 2: Distribution of REBA score according to scores**

According to the postural analysis Rear wheel tire Assembly, Unloading EV motors workers have faced a very high-risk level, and immediate changes will be required according to the postural analysis on the REBA Assessment. The score of the REBA Assessment is 11. Around Frame and middle stand assembly, Frame numbering and Pressing sub assembly, EV Handlebar tightening, Crankcase left numbering machine, spark plug assembly, Jupiter Handlebar Tightening, Jupiter side stand.

assembly stage workers have faced the high-risk level and changes will be required according to the postural analysis. The score level of the REBA Assessment is 8 to 10.

**RESULT AND DISSCUSSION**

**FRAME AND MIDDLE STAND ASSEMBLY**

**WORK PROCESS**

1. In an EV scooter, the middle stand is assembled through the EV Frame.

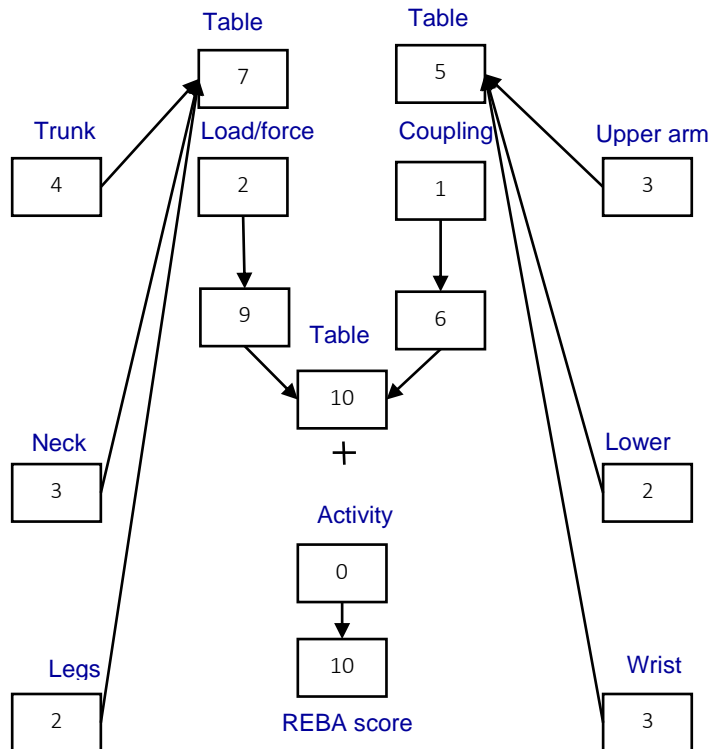
**PROBLEMS**

1. In this process the trunk is side bended, and the neck is twisted.
2. And he lifts the frame manually and it around 16 kg weight.

**SOLUTION**

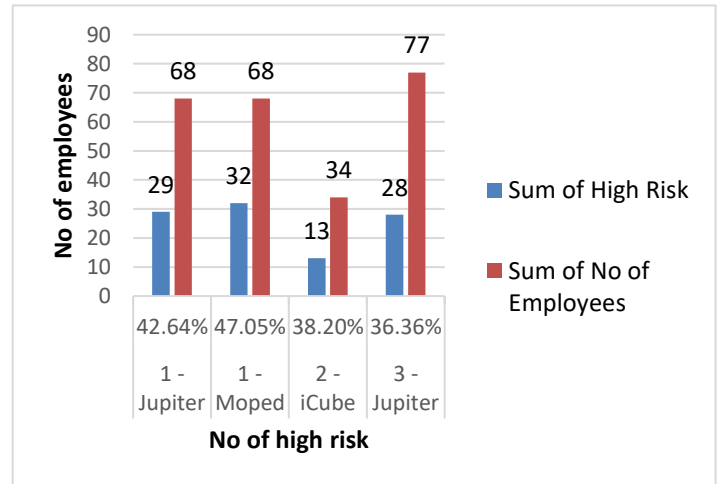
1. Using Zimmerman to lift the Frame.
2. In Shift basis - job rotation should be given

**REBA Calculation**



**PLANT 1 Vehicle Assembly Risk factor**

Conveyor	No of Employees	High Risk	High risk %
1 - Moped	68	32	47.05%
1 - Jupiter	68	29	42.64%
2 - iQube	34	13	38.20%
3 - Jupiter	77	28	36.36%



**LINE WISE REBA CALCULATION**

Conveyor 1	A	B	C	Activity score	RISK
PL 1 -LH	6	5	8	0	8
PL 1 -RH	7	4	9	0	9
PL 2 -LH	7	5	8	0	8
PL 2 -RH	6	4	7	0	7
PL 3 -LH	6	3	7	0	7
PL 4 -LH	7	3	7	0	7
PL 5 -LH	5	3	4	0	4
PL 5 -RH	5	3	4	0	4
PL 6 -LH	7	5	10	0	10
PL 6 -RH	5	5	6	0	6
PL 7 -LH	6	6	8	0	8
PL 8 -LH	6	5	8	0	8
PL 8 -RH	6	3	6	0	6
PL 9 -LH	5	5	6	0	6
PL 10 -LH	6	5	8	0	8
PL 10 -RH	6	6	8	0	8
PL 11 -LH	6	2	6	0	6
PL 12 -LH	8	2	8	0	8
PL 13 -LH	7	6	9	0	9
PL 14 -LH	5	5	6	0	6
PL 15 -LH	6	3	6	0	6
PL 15 -RH	6	2	6	0	6
PL 16 -LH	6	2	6	0	6
PL 17 -LH	7	5	9	0	9
PL 17 -RH	6	3	6	0	6
PL 18 -LH	5	2	4	0	4
PL 18 -RH	6	3	6	0	6
PL 19 -LH	5	3	4	0	4
PL 20 -LH	6	3	6	0	6
PL 21 -LH	6	5	8	0	8

**CONCLUSION**

The majority of Two-wheeler manufacturing industrial workers are affected by Work-related muscular-skeletal disorder (WMSDs) according to the study. It revealed that the major case of WMSDs is lack of ergonomics and working in awkward position. The average of REBA score indicating high to very high-level risk. It is concluded that certain risk factors causing muscular-skeletal disorder problems and stress. So, it is essential to redesign the workstation. Workers must get technical training in ergonomic safety, risk factors and working position. Recommendation to provide the Engineering controls and administrative controls like giving platform to reduce the continuous shoulder rise, customized trolley, Zimmerman for lifting implementing the conveyor system for entire process and change their working procedure and postures and job rotation for workers. Health check-up program must be intimated at regular intervals and work period must be intimated to include frequents short brakes, which could improve their working ability.

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