

A Plug Assembly Line: An Assessment of Workstation Design and Working Posture

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INTRODUCTION

In most industry, assembly line job environments such as workstation design and working posture are factors contribute to workers’ performance. Workstation design such as: standing or sitting, the use of tools such as jig and the height of working table are influencing worker’s productivity. Meanwhile, working posture such as: position of body: arm and wrist, neck, trunk and leg determine comfortability and safe posture while working. These aspects also play a significant role in productivity.

METHODS

This research is an attempt to investigate the effect workstation design factors i.e. Position of workers, standing or sitting, Table Height 91 cm and 103 cm, and Tools: with Jig and without Jig to conduct the assemble of electrical appliance (a plug), on the response time (time for assemble the plug as a independent variable). The research also investigates working posture at different positions and observe whether the working posture is acceptable according to the RULA method. Design of experiment of 2³ i.e. two level of each factors is used.

Two subjects were employed to conduct the experiments. 36 experiments for each level of factors were done, 288 experiments for 8 different sets were conducted for each subject.

RESULTS AND DISCUSSION

The results show in Table 1 that tool factor in this case the use of Jig and Table Height have significant effect to the response time (assembly time) and position sitting or standing does not influence much to the assembly time.

Table 1: Three-factor ANOVA for Assembly Time

| Source | df | SS | MS | F Stat | F-crit |
|----------|-----|---------|---------|--------|---------|
| Table | 1 | 1785.43 | 1785.43 | 109.58 | 3.87441 |
| Tool | 1 | 1331.88 | 1331.88 | 81.74 | 3.87441 |
| Position | 1 | 1.27 | 1.27 | 0.08 | 3.87441 |
| tab-tool | 1 | 119.15 | 119.15 | 7.31 | 3.87441 |
| tab-pos | 1 | 61.83 | 61.83 | 3.79 | 3.87441 |
| tool-pos | 1 | 31.75 | 31.75 | 1.95 | 3.87441 |
| 3-way | 1 | 826.89 | 826.89 | 50.75 | 3.87441 |
| Error | 280 | 4562.19 | 16.29 | | |
| Total | 287 | 8720.37 | | | |

The working posture for this assembly line has been thoroughly assessed. Table 2 shows that most of the working postures are acceptable according to RULA method. It describes in detail the conditions of workstation and the positions of subjects perform the task. From the various condition of workstation, it can be summarized that 69% of working posture adopted by the subjects is acceptable, and 31% need to be investigated further, as recommended by RULA Score.

Table 2: RULA Score for Working Posture

| Subject | Table Height 91 cm | | | | Table Height 103 cm | | | |
|---------|--------------------|-----|----------|-----|---------------------|-----|----------|-----|
| | Without Jig | | With Jig | | Without Jig | | With Jig | |
| | Stand | Sit | Stand | Sit | Stand | Sit | Stand | Sit |
| 1 | 3 | 2 | 3 | 2 | 2 | 3 | 2 | 3 |
| 2 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 2 |

Score 2 indicates that the working posture is acceptable. The investigation and changes are suggested for scores 3.

CONCLUSION

Design of workstation i.e. the Table Height and Jig in plug assembly line have significant factors in the assembly time, other factor: position of working sitting and standing does not significantly contribute to the assembly time. Most of working postures for this assembly line are acceptable. Further analysis of working postures suggests: two areas of working postures the wrist movement and also the trunk position need to be improved.

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