

An ergonomic look at the assembly of tyres on rims at Volvo Europe Truck

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We follow the entire assembly process, from the receipt of the tyres to the final assembly on rims. The flow is partly robot-controlled but we cannot exclude manual intervention. The presentation shows the start-up of this completely new concept but, above all, it introduces us to the accompanying physical problems of monitoring this automated process. All the staff members are new, which implies that they are not familiar with this job but that they have no prejudices against posture either. We mainly focus on physical interventions during the robotized handling process, and we provide solutions to avoid overuse injuries in the future.

Keywords: dynamic load, posture training, robotisation

1. Introduction

The brand new tire-mounting facility within the Volvo Europe Truck company in Belgium supplies fully mounted tires to the European market. The diversity of the tires for different markets and the use thereof on all terrains makes the assembly into a challenging assignment. The tires and rims are joined by a specifically designed robot in a unique way.

2. Objectives

All manual handling was screened during this mainly robotised process. The screening process itself indicated the potential trouble spots which might be in need of more attention. We consulted with the team on what further actions needed to be taken. If an immediate solution was not at hand, we moved on to a more in-depth assessment of the problem situations. The following analysis should eliminate any trouble spots. This way of assessing a work site allows us to involve the workers themselves in advancing suggestions for improvement in an open dialogue. Each participant to this meeting can be of added value with a view to creating a balanced work site.

3. Methods, results and discussion of studied work sites

The screening process yielded the following work sites which are to be looked at. *The rim manipulator, the stacking process of the finished tires and tire balancing.* As external ergonomics engineers, we have mapped the working process, and have integrated all focal points in a PowerPoint presentation through digital photography. During the observations, we have taken account of the body positions currently assumed by the workers, and where necessary of the corrected working postures. Video recordings accentuated the succession of moving parts. The training comprised PowerPoint presentations to groups of about 4 employees.

Every component of the manual handling process was analyzed and reviewed. Since we have on our hands a mixture of static and dynamic loads, we try to execute alternating movements (Decabooter 2001) and actions through job rotation. Besides the general principles of primary prevention (Saunders 1995) and motion training, the selected working method was trained on-site. During this practice training, employees were able to compare postures, make comments and finally reach a consensus on the most appropriate physical approach. Surely, the main advantage was that all workers were completely new to the company and had no previous experience with the product. Posture prejudice was non-existent, and all were open to the least straining working method. Afterwards, a coach was assigned to further follow up on the working method within the team itself. We applied this practice to three trouble points.

3.1 Rim manipulator

Workstation assignment

Using a mechanical tool, various rim types are positioned on an automated roller track. Line feed is performed every 20 seconds. The computer-guided robot automatically selects the appropriate rim for the tire, but this may vary constantly. Using the manipulator, the operator needs to supply the appropriate rim from his stock next to the roller track. Because of the sheer diversity of the offer, little space is available for positioning all rims in an accessible location.

Identified problems

Limited space, dynamic strain for operating the manipulator, time pressure.

Points of action

Creating space, division of work, manipulator posture training. In light of this work site having been only recently started up, we cannot perform any relevant research into injuries due to excessive strain in the long term, but only in a 6-month cycle.

Staff number and ages.

Three operators aged between 20 and 30 years old work here. A three-shift system is in place (early, late, and night shifts). No operator has any previous history in this work site. Frequent use of the manipulator causes lower back pain and excessive strain to the upper limbs in some of the operators. Since musculoskeletal injuries due to excessive strain develop cumulatively and are less acute in nature, we were unable to verify whether the complaints were inherent to the new job specifically.

Discussion.

By applying conscious posture training we were able to minimise existing complaints. We have adjusted the tool itself so that almost all operators may grab the handles below shoulder level. We are able to grab the manipulator in various heights depending on picking level. Waste (pallets) disposal is taken care of by another person, allowing the operator to focus more on manipulator action itself. Rotation is done every 2 hours.

All operators have been given an initiation into a sound motion plan (Decabooter 2001) in order to better handle physical efforts.

3.2 Stacking process of finished tires

Workstation assignment.

The tires are stacked using a specific tool, ready for transport.

Tires weighing over 100 kg are no toys and should be positioned using sound judgment and with the least possible amount of physical strain.

Identified problems.

Despite the use of a tool, many operators nonetheless assume unsound posture and use the wrong leverages.

The work is executed simultaneously by 2 operators at all times. This requires perfect timing and fine-tuning of body techniques.

Points of action.

As for training, we adhered to the same manner of operation as for the rim manipulator, also with a clear physical message. Every operator has his own strain limit, and it is very important to be considerate of your partner's possibilities. Advance agreements make for harmonious teamwork.

Staff number and ages.

Two operators aged between 20 and 40 years old work here. A three-shift system is in place (early, late, and night shifts).

No operator has any previous history in this work site. Frequent use of the tool causes lower back pain and excessive strain to the upper limbs in some of the operators.

Discussion.

By using back school techniques and material training (Saunders 1995) , physical discomfort has dropped significantly. Besides the use of techniques, a 2-hour job rotation cycle is also in effect.

3.3 Tire balancing

Workstation assignment.

Some tires need extra balancing. The rolling motion and the placement of the tire in balancing position are partly executed manually.

Identified problems.

Ergonomics will not solve all problems without the active cooperation of the operators themselves. Tools are of great value, but humans need to coordinate their action.

Points of action.

Here too, body positions (Decabooter 2001) and back school techniques came to bear.

Staff number and ages.

Six operators aged between 20 and 40 years old work here. A three-shift system is in place (early, late and night shifts). No operator has any previous history in this work site. Frequent use of the rolling motion and the placement of the tire causes lower back pain and excessive strain to the upper limbs in some of the operators.

Discussion.

Status report after 6 months. Fewer complaints of the musculoskeletal system, smooth manipulator operation, rise in worker satisfaction and drop in stress.

4. Conclusion

Experience has taught us that working methods and work postures are usually group-controlled. Unfortunately, we were not given the right manual for optimal use of and strain to our backs at birth. This carefreeness will dissipate in the blink of an eye the minute we feel any pain. Suddenly, the back is used with the right leverage, anything is possible and we immediately take the necessary time.

Not just the employee needs to be informed but the entire team, the team leader, and the management!

The change in mentality needs to go up the chain of command and spread slowly like an oil stain. The upper management is very pleased with these initiatives and fully backs this project. Naturally, we are aware that all new proposals and methods incite resistance. This is only normal. Humans are creatures of habit who do not like to wander off the beaten track. This is why participational ergonomics (group-driven optimisation of the work site) is of crucial importance to success in implementing any kind of change. However, the 'ideal' work site needs to be fine-tuned without prejudice, and by factoring out unilateral input by a few overbearing colleagues who aren't even experiencing any discomfort themselves (yet) anyway.

A team is composed of different people, and each has his own strain limit. Continuous defiance of one's physical limits at work will in the long run lead to injury, which may often be irreversible.

Naturally, this remains a very young but challenging business, one which will require constant vigilance from us, ergonomics and motion experts, in order to achieve optimal harmonic unity between ergonomics and body consciousness.

References

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