

Optimised working conditions in warehouses

Warehouse workers are constantly exposed to risk factors contributing to work related musculoskeletal disorders. These risks can be reduced by the employment of a pallet turning device as attachment for lift trucks. The turning device provides for the pallets in storage racks being positioned in such a way that the goods can be handled in a more favourable posture. At the same time, productivity increases.

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The technological progress and increasing prevention measures within the field of occupational health and safety show its effect. The European agency for occupational health and safety announces a decrease of the notifiable industrial accidents in 2004 of about 46% as compared to 1991. Despite of this positive trend, there is still a strong need for constantly analysing and controlling ergonomic risk factors at the workplace because musculoskeletal diseases and their consequences are increasing at the time being although the ergonomic situation at many work-places has been improving and heavy work was diminished.

Sets of statistics from different health and pension insurance companies show high prevalence and incidence rates of these diseases regarding cases, absenteeism and inability to work. Approximately one third of all diagnoses are related to musculoskeletal disorders. For 2003, Germany's Federal Institute for Occupational Safety and Health (BAuA) announces an average inability to work of 13,7 days per employees, totalling to 468 million inability to work days. On the basis of this inability to work volume the BAuA estimates the economical losses of production on altogether about 43 billion euros.

It is well known, that these diseases may be caused by a lot of factors with working conditions during manual heavy lifting and stacking tasks playing an important part. A major risk factor in the workplace that is likely to cause manual handling injuries is the workers' awkward posture while handling heavy goods.

A high frequency of repetitive motions involving heavy lifting and stacking can be found in grocery warehouses. In the central wholesale storage depots the goods are temporarily stored in high rack warehouses, whereby the warehouse workers manually handle the goods on the two lowest storage racks. The warehouse manager arranges the goods for the retail businesses on the basis of order lists. For this they drive along the lanes of the high rack warehouse according to the order lists, take the goods off the racks and place them on the carried pallets or trucks. Thereby, the goods are usually taken from the front end of the pallet, with the result of the warehouse worker lifting heavy goods in unfavourable postures since they have to constantly bend down and reach far into the lowest levels of the storage racks.



Figure 1: As attachment for lift trucks, the pallet turning device developed by IWS reduces the risks for warehouse workers of work related musculoskeletal disorders and improves productivity.

In order to prevent workers from handling goods in unfavourable postures, the engineering company IWS, Kamp-Lintfort, Germany, in cooperation with Germany's Wholesale and Warehouse Professional Association (GroLa BG) have developed an attachment for forklift trucks, with which partly unpacked pallets can semiautomatically be taken out of the rack, turned by 180° and replaced. As a result, the goods on the pallets are more easily accessible by the warehouse workers.

For the execution of these functions the CAN-bus control unit of the pallet turning device is adapted to the lift truck's control. The lift truck

together with the attachment forms a special vehicle. The base vehicle for the first prototype is a Linde E30 counterbalanced lift truck, Series 336 which was provided by Linde Material Handling.

The attachment consists of a carrying and a turning frame, which are manufactured by IWS, as well as a mast, a horizontally movable fork adaptor as well as telescopic forks, supplied by Kaup. The main difference to conventional attachments is, that the pallets can be turned and set off at the same place using the special vehicle. So far, those kind of operations had only been possible by means of a hand-operated or electric lift truck, a solution, which is time consuming and blocks the lane for other workers during the turning process.

The pallet turning device does not only improve the warehouse workers working conditions but can also contribute to increased productivity. The University of Duisburg-Essen, Germany, conducted several tests including video and time recordings of picking operations in order to analyse pick times in conventional warehouses. For this purpose, real storage racks were built and the two lowest levels of the racks were filled with pallets of different load. Thereby, amount, weight and size of the boxes varied. Twelve test persons were video recorded during the picking operations (lifting the boxes and stacking them on the hand-operated lift truck) to determine the time difference between handling goods at the front and the further end of the pallets in the racks. The results show, that 25% of the pick time could be reduced if all goods were placed on the front side of the pallet, which is much easier to be reached by the workers. Current test series with the pallet turning device show, that the total pick time per warehouse worker can be reduced by 6,7% (with an average share of pick time of 30%). In other words, the time per pick decreases by 1s.

Moreover, the test persons were equipped with the Cuela measuring system (developed by the institute for research and testing of the German trade associations BGIA and the GroLa BG). The Cuela measuring system (computer-assisted recording and long-term analysis of musculoskeletal loading) was developed at the BGIA to measure the loading of the musculoskeletal system that occurs in a large number of occupations, with the measurements being made at the workplace itself under real working conditions. It is a personal measuring system using advanced sensor-technology, which can be worn on the person's work wear. The associated WIDAAN software permits the automatic evaluation of the readings on the basis of ergonomic and biomechanical assessment criteria. Preliminary results show – similar to the results found at the university – that it takes the worker about three times longer to handle goods at the far end of the pallet in a bend position as compared to the front side.



Figure 2: The test persons were equipped with the Cuela measuring system to evaluate the load of the musculoskeletal system and analyse body postures of warehouse workers.

For the purpose of verifying the test results described above, the prototype of the pallet turning device was tested eight weeks at the MGL Metro Group Logistics in Saarstedt, Germany. The MGL storage depots annually manage around 1.9 million tons of goods, equalling approximately 350 million packing units. The test run at MGL show that it takes 45 seconds to turn a pallet with the pallet turning device, whereby one driver manages to turn 250 pallets per shift. Moreover, the warehouse workers response to the pallet turning device was very positive and they felt a great relief for their back.

Start of production is planned for the end of 2006. At the same time, the prototype will undergo further test series in different member companies of the GroLa BG. During the tests the Cuela measuring system will analyse the workers postures while working with the pallet turning device under real working conditions.

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Figure 3: Current test series with the pallet turning device show, that the total pick time per warehouse worker can be reduced by 6,7%.