Initial ergonomic assessments for lifting gear: results comparing different models

by

Daniela Colombini and Michele Fanti

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MOVING CASES MANUALLY

LOADING AND UNLOADING ONTO A PALLET ON THE GROUND WITHOUT TWISTING AROUND TO FACE THE PALLET

NET LOADING OR UNLOADING TIME: 24-26 SECONDS
GROSS LOADING AND UNLOADING TIME: 28 SECONDS
FREQUENCY: 8.6 ITEMS PER MINUTE

WEIGHT 16 KG
MOVING CASES MANUALLY

ASSESSMENT OF MANUAL LOAD MOVEMENT USING NIOSH FORMULA

SITUATION UNACCEPTABLE AS DISTANCE FROM BODY IS GREATER THAN 63 CM
MOVING CASES MANUALLY

LOADING AND UNLOADING ONTO A PALLET ON THE GROUND, TWISTING AROUND TO FACE THE PALLET

NET LOADING OR UNLOADING TIME: 26 SECONDS
GROSS LOADING AND UNLOADING TIME: 28 SECONDS
FREQUENCY: 8.6 ITEMS PER MINUTE
**ASSESSMENT OF MANUAL LOAD MOVEMENT USING NIOSH FORMULA**

SITUATION: the risk index is very high if this task is carried out continuously for 480 minutes, both at 8 actions per minute (480 items/h) and at 0.5 actions per minute (30 items/h).

<table>
<thead>
<tr>
<th>No.</th>
<th>Description of action:</th>
<th>Weight (kg)</th>
<th>Height of hands from ground (cm)</th>
<th>Frequency (No. actions per min.)</th>
<th>Time spent raised (min.)</th>
<th>Lifting index**</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CASE FOR PALLET ROLLER CONVEYOR (ON GROUND)</td>
<td>16</td>
<td>90</td>
<td>8.00</td>
<td>480</td>
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</table>

WC = Weight constant: **25**

**Lifting index** rounded to 1 decimal place.
MOVING CASES MANUALLY

LOADING AND UNLOADING ONTO A RAISED PALLET, TWISTING AROUND TO FACE THE PALLET

NET LOADING OR UNLOADING TIME: 26 SECONDS
GROSS LOADING AND UNLOADING TIME: 28 SECONDS
FREQUENCY: 8.6 ITEMS PER MINUTE
### MOVING CASES MANUALLY

**WC = Weight constant: 25**

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<tr>
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<th>Weight (kg)</th>
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<tbody>
<tr>
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### ASSESSMENT OF MANUAL LOAD MOVEMENT USING NIOSH FORMULA

SITUATION: the risk index is still very high if this task is carried out continuously for 480 minutes, either at 8 actions per minute (480 items/h) or at 0.1 actions per minute (6 items/h).
### MOVING CASES MANUALLY

**ASSESSMENT OF MANUAL LOAD MOVEMENT USING NIOSH FORMULA**

SITUATION: the risk index still implies the presence of a risk even when alternating movement 1 hour on/1 hour off.

<table>
<thead>
<tr>
<th>No.</th>
<th>Description of action</th>
<th>Weight (kg)</th>
<th>Height of hands from ground (cm)</th>
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<td>90</td>
<td>0.10</td>
<td>60</td>
<td>1.34</td>
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</tbody>
</table>

**WC =** Weight constant: **25**
MOVING CASES MANUALLY

LOADING AND/OR UNLOADING ONTO A PALLET: PROBLEMS FOR THE UPPER LIMBS

SITUATION
ELBOW: PERFORMS FLEXION/EXTENSION
WRIST: ULNAR DEFLECTION WITH USE OF FORCE
HAND: HOOKED POSITION WITH USE OF FORCE
MOVING CASES USING PN ERGO

LOADING AND UNLOADING ONTO A RAISED PALLET

NET LOADING OR UNLOADING TIME: 74 SEC
GROSS LOADING OR UNLOADING TIME: 76 SEC
FREQUENCY: 3.2 ITEMS PER MINUTE

WEIGHT 16 KG
MOVING CASES USING PN ERGO

LOADING AND UNLOADING ONTO A RAISED PALLET

LEVEL OF FORCE USED:
vertically: MODERATE
in motion: GENTLE/MODERATE
MOVING CASES USING PN FLEX

LOADING AND UNLOADING ONTO A RAISED PALLET

NET LOADING OR UNLOADING TIME: 74 SEC
GROSS LOADING OR UNLOADING TIME: 76 SEC
FREQUENCY: 3.2 ITEMS PER MINUTE

WEIGHT 16 KG
MOVING CASES USING PN FLEX

LOADING AND UNLOADING ONTO RAISED PALLET

LEVEL OF FORCE USED:
vertically: GENTLE/MODERATE – STRONG
in motion: GENTLE
MOVING CASES USING PN FLEX

LOADING AND UNLOADING ONTO RAISED PALLET

ACTIONS on the right = 8

Take handle
Lower
Push down
Press button + raise
Lower
Press button
Push down
Raise

LEVEL OF FORCE USED:
vertically: GENTLE/MODERATE – STRONG
in motion: GENTLE
MOVING CASES USING LIFTRONIC EASY

LOADING AND UNLOADING ONTO A RAISED PALLET

NET LOADING OR UNLOADING TIME: 46 SEC
GROSS LOADING OR UNLOADING TIME: 48 SEC
FREQUENCY: 5 ITEMS PER MINUTE
LOADING AND UNLOADING ONTO A RAISED PALLET

LEVEL OF FORCE USED:
vertically: NONE
in motion: GENTLE

ACTIONS on the right = 6
Take handle
Lower
Push down
Raise
Lower and unhook
Raise
MOVING CASES USING LIFTRONIC EASY

LOADING AND UNLOADING ONTO A PALLET ON THE GROUND

NET LOADING OR UNLOADING TIME: 48 SEC
GROSS LOADING AND UNLOADING TIME: 50 SEC
FREQUENCY: 4.8 ITEMS PER MINUTE
MOVING CASES

LOADING AND UNLOADING ONTO A PALLET ON THE GROUND

SEE STANDARD EN 1005/4
### SUMMARY TABLE FOR CASES

**CASES**

<table>
<thead>
<tr>
<th>EQUIPMENT TYPE</th>
<th>CYCLE TIME</th>
<th>ITEMS/MIN.</th>
<th>PRODUCTIVITY</th>
<th>TECHN. ACTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>PN ERGO</td>
<td>76 sec.</td>
<td>3.2</td>
<td>-36%</td>
<td>8</td>
</tr>
<tr>
<td>PN FLEX</td>
<td>76 sec.</td>
<td>3.2</td>
<td>-36%</td>
<td>8</td>
</tr>
<tr>
<td>LIFTRONIC EASY</td>
<td>48 sec.</td>
<td>5</td>
<td>&lt;-&gt;</td>
<td>6</td>
</tr>
<tr>
<td>MANUAL</td>
<td>60 sec.</td>
<td>5</td>
<td>-</td>
<td>3</td>
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<tr>
<td><strong>NIOSH = 3.83</strong></td>
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</tr>
<tr>
<td>MANUAL</td>
<td>60 sec.</td>
<td>1</td>
<td>-80%</td>
<td>3</td>
</tr>
<tr>
<td><strong>NIOSH = 1.40</strong></td>
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</table>

NIOSH = 3.83 (continuous 480 min.)

NIOSH = 1.40 (continuous 60 min.)
MOVING REELS USING PN ERGO

LOADING AND UNLOADING ONTO A RAISED PALLET

NET LOADING OR UNLOADING TIME: 56-48 SEC
GROSS LOADING AND UNLOADING TIME: 58-50 SEC
FREQUENCY: 4.1 ITEMS PER MINUTE

WEIGHT 11 KG
MOVING REELS USING PN ERGO

LOADING AND UNLOADING ONTO A PALLET ON THE GROUND

LEVEL OF FORCE USED:
vertically: MODERATE
in motion: GENTLE/MODERATE

ACTIONS on the right = 8
Take handle
Lower
Push down
Press button
Raise
Lower
Push down
Raise
MOVING REELS USING PN FLEX

LOADING AND UNLOADING ONTO A RAISED PALLET

NET LOADING OR UNLOADING TIME: 53 SEC
GROSS LOADING OR UNLOADING TIME: 55 SEC
WEIGHT 11 KG
FREQUENCY: 4.5 ITEMS PER MINUTE
MOVING REELS USING PN FLEX

LOADING AND UNLOADING ONTO A RAISED PALLET

LEVEL OF FORCE USED:
vertically: GENTLE/MODERATE – STRONG
in motion: GENTLE
MOVING REELS USING LIFTRONIC EASY

LOADING AND UNLOADING ONTO A RAISED PALLET

NET LOADING OR UNLOADING TIME: 40 SEC
GROSS LOADING OR UNLOADING TIME: 42 SEC
FREQUENCY: 5.7 ITEMS PER MINUTE
MOVING REELS USING LIFTRONIC EASY

LOADING AND UNLOADING ONTO A RAISED PALLET

LEVEL OF FORCE USED:
vertically: NONE
in motion: GENTLE
## SUMMARY TABLE FOR REELS

### REELS

<table>
<thead>
<tr>
<th>EQUIPMENT TYPE</th>
<th>CYCLE TIME</th>
<th>ITEMS/MIN.</th>
<th>PRODUCTIVITY</th>
<th>TECHN. ACTIONS</th>
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<tbody>
<tr>
<td>PN ERGO</td>
<td>58 sec.</td>
<td>4.1</td>
<td>-28%</td>
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<td>PN FLEX</td>
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<tr>
<td>LIFTRONIC EASY</td>
<td>42 sec.</td>
<td>5.7</td>
<td>&lt;*&gt;</td>
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<tr>
<td>MANUAL</td>
<td>60 sec.</td>
<td>6</td>
<td>- -</td>
<td>3</td>
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<tr>
<td><strong>NIOSH = 3.31</strong></td>
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<td>MANUAL</td>
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<td>-82%</td>
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<tr>
<td><strong>NIOSH = 0.93</strong></td>
<td>(continuous 60 min.)</td>
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</tbody>
</table>
MOVING REELS USING LIFTRONIC EASY

LOADING ONTO A RAISED PALLET, INITIAL EQUIPMENT ENHANCEMENTS

SWITCH FROM PINCH HOLD TO OPTIMUM HOLD: GRIP
MOVING REELS USING LIFTRONIC EASY

LOADING ONTO A RAISED PALLET, INITIAL LAYOUT/ORGANISATIONAL ENHANCEMENTS

NET LOAD TIME: 45 SEC

NET LOAD TIME: 45 SEC (same as before: WHY?)
PROPOSED WORKFLOW
FOR CHOOSING ASSISTANCE

LAYOUT ANALYSED WITH CUSTOMER

WORK TIMES ANALYSED WITH MTM

PRODUCTIVITY VERIFIED WITH CUSTOMER

YES

ORDER PROCESSED

NO

Definition
The MTM system is a procedure used to analyse manual work in terms of its basic movements. A time allocated in advance is set for each basic movement, which depends on the circumstances and conditions under which the movement is performed.
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