vhp human performance b.v.
Huijgensstraat 13a
2515 BD The Hague / The Netherlands
T +31 (0)70 - 38 92 010
F +31 (0)70 - 38 92 413
info@vhphp.nl
www.vhphp.nl

IBAN NL27ABNA0486072894
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Ergonomics approved quality label

Matador TORO® wheelbarrow

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Authors
drs. Kees Peereboom
ir. Bas van Leeuwen

Client
Matador bv

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1 Introduction

This report contains the assessment for a vhp quality mark for working conditions and ergonomics for the Matador TORO® (versions M-170-L4; TORO with 4-ply tyres and M-170-CT; TORO® with puncture-proof tyres). During the assessment of the vhp quality mark for working conditions and ergonomics, functional and user aspects of the product are assessed in terms of compliance with the guidelines for physical load from the Dutch Handbook of Physical working load. Compliance with regulations regarding physical load[1], including lifting and carrying and pushing and pulling, was also tested.

2 Product: Matador Toro®

The Matador TORO® is designed as a replacement for the conventional wheelbarrow that is used in the construction sector in particular. Unlike the conventional wheelbarrow, the TORO® has not one but three wheels and is equipped with two sets of handle bars, each at different heights. The TORO ® is designed so that almost all operations can be performed by pushing, where conventional wheelbarrows have to be lifted, this involves manual lifting by the operator. The TORO® has a capacity of 90 litres and has a flat bin, so that loads are less likely to fall out of the bin. The TORO® has a length of 144 cm, a maximum width of 62 cm, a maximum height of 110 cm and a weight of 24 kg. Compared to previous versions of the TORO®, the current version is more compact.

3 Features Matador Toro®

The Matador TORO® has the following ergonomically relevant features:

- The TORO® is designed so that almost all operations can be carried out by pushing instead of lifting. With a load of 100 kg and when pushing on level ground, the load is about 40 N[2] and when pushing through loose sand the load is about 110 N. The generally accepted limit for pushing is 300 N (Mital standard)[3]. When pushing the TORO® one stays well below this mark (see appendix 1).
- Due to the higher position of the handles, the user does not have to bend down as deeply when the load has to be lifted compared to working with a traditional wheelbarrow (e.g. when going up a scaffold board and emptying a wheelbarrow). This reduces the strain on the back by an average of 15%. See appendix 1.
- Due to the presence of various handles, it is possible to tip while the user remains upright. This reduces the physical load compared to a conventional wheelbarrow.

[1] According to the Dutch Working Conditions Act, employers must ensure that physical load does not endanger the safety and health of their employees (Working Conditions Decree 5.2). Employers are obliged to include the risks of pushing and pulling in their risk inventory and evaluation and the Plan of Action. Employers must also provide proper information on how employees can push and pull objects in a safe and healthy manner, see: www.arboportaal.nl (in Dutch).

[2] N stands for Newton, 1 Kgf (kilogram force) of pushing force equals 10 Newton.

[3] Dutch Handbook of Physical Workload, editors K.J. Peereboom Eur.Erg. and N.C.H. de Langen, seventh revised edition, 2016. The standards of Mital et al (1997) are used for pushing and pulling.

4 Ergonomics approved quality label

The Matador TORO® is approved and carries the vhp occupational health and safety and ergonomics label.

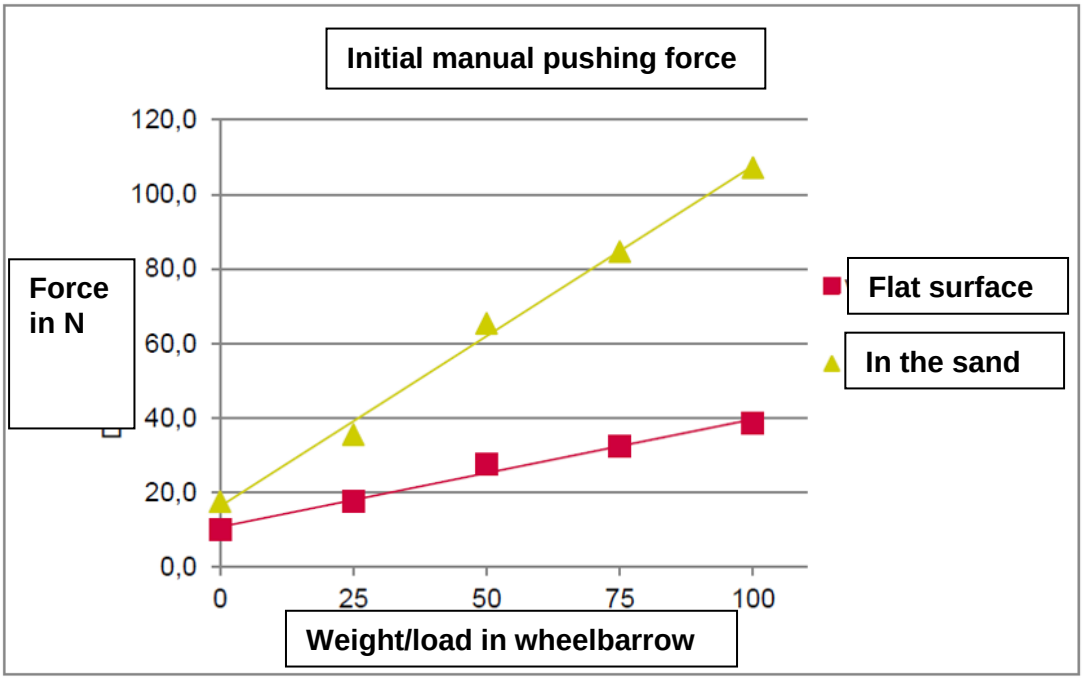
The Matador TORO® makes it possible to move loads of up to 110 kg (by pushing without lifting) without exceeding health limits. This is because, in contrast to conventional wheelbarrows, the TORO® has not one, but three wheels. Pushing TORO® complies with appropriate standards, up to pushing a maximum load of 110kg (see appendix 5.1 and 5.3).

As a principle, lifting hardly ever occurs when working with an TORO® wheelbarrow. If lifting is occasionally required (e.g. when tipping over or when running up a scaffolding board), the higher position of the handles in TORO® reduces back strain by an average of 15% compared to using a conventional wheelbarrow (see appendix 5.2).

5 Appendixes

5.1 Pushing a TORO®

The graph below shows the results of measurements concerning the starting force required to get TORO® going, both on a flat tiled surface and on a loose sand surface. In both cases the starting force remains far below the standard of 300 N (Newton).



5.2 Lifting a TORO®

Using the biomechanical 3DSSPP Michigan Model (see figure 1), the load in the lower back (between L5 and S1) has been determined when the maximum allowed load of 25 kg is placed on the hands. This was done for small, medium and large Dutch men aged 20-60 (Body measurements according to DINED 2004). Because the handles for wheelbarrowing in the TORO® are placed higher than the handles in a conventional wheelbarrow, the load on the back when using the TORO® is on average 15% lower. This is explained in the table below.

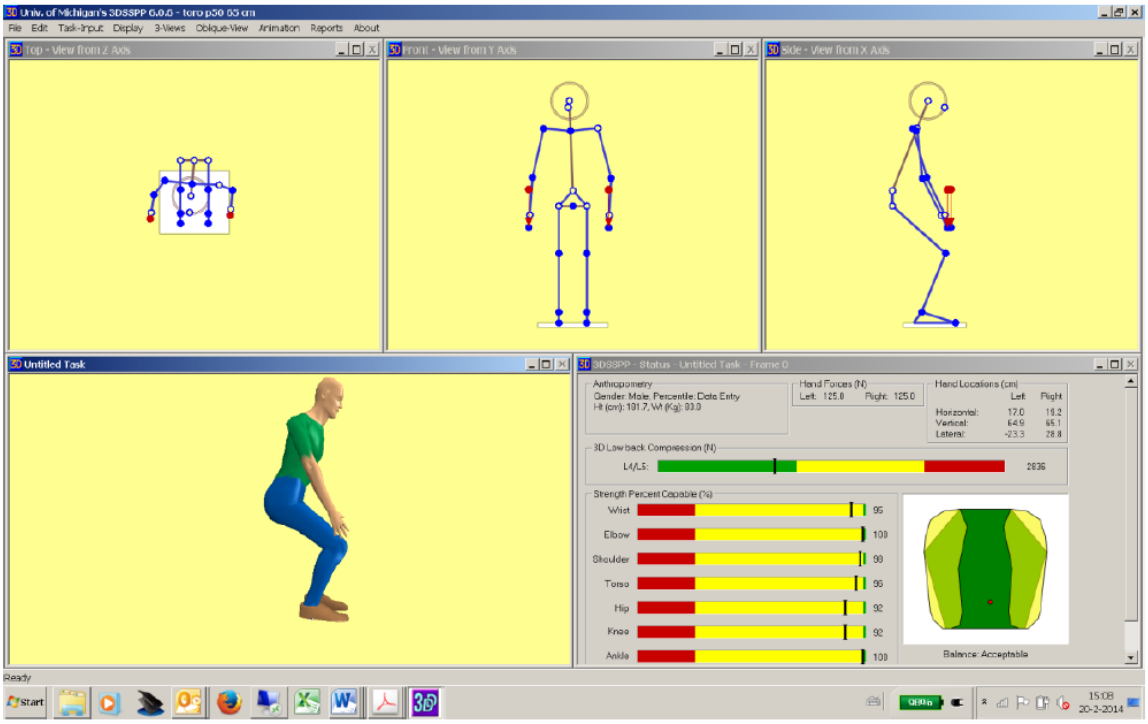


Figure 1: 3DSSPP model showing backload of an average Dutch male lifting a TORO when using 25 Kg of force manually (GREEN zone 3D low back compression means: no overload).

5.3 Appropriate Standards

NEN-EN 1005-1:2001+A1:2008 en	Safety of machinery - Human physical performance - Part 1: Terms and definitions
NEN-EN 1005-2:2003+A1:2008 en	Safety of machinery - Human physical performance - Part 2: Manual handling of machinery and component parts of machinery
NEN-EN 1005-3:2002+A1:2008 en	Safety of machinery - Human physical performance - Part 3: Recommended force limits for machinery operation
NEN-EN 1005-4:2005+A1:2008 en	Safety of machinery - Human physical performance - Part 4: Evaluation of working postures and movements in relation to machinery
Mital , A. et al: 1997	A Guide to Manual Materials Handling, Taylor & Francis, London.
Building sector Sheet on lifting from Arbouw/Volandis	https://www.volandis.nl/media/2323/a-blad-tillen.pdf
Publications Dutch Government Gazette, May 2012.	A violation can be detected when > 60 kg of weight is being lifted. This agreement was made among other things for road workers and construction workers and was checked by the Labour Inspectorate.

	In various ways of loading the wheelbarrow with stones up to a total weight of 60 kg, the weight on the handles can vary from 23.3 to about 28 kg. This report shows demonstrably on the basis of research that with the TORO® the weight/load limit lies at 110 KG.