Testing of Safety Steps to: BS EN 14183: 2003 E

For: Excelsior Limited

Test dates: September - November 2008

The steps supplied were:

A) A rotationally moulded fixed one step, approx weight 5kg, tested 26/11/08
B) A rotationally moulded fixed two step, approx weight 10kg, tested 18/09/08
C) A rotationally moulded fixed three step, approx weight 15kg, tested 26/11/08
D) A rotationally moulded four step version of A) with a fixed tubular steel handrail to the right hand side, approx weight 20kg, tested 18/09/08

Equipment:

Cast iron weights ranging from 25kg to 0.25kg
Laminated board
Cord and pulley

Dimensional requirements:

The size and spacing of all the steps A) – B) were within the parameters defined by the standard.

Materials requirements

No data was supplied as to the ageing and other properties of the polymers used. The products were free of burrs and other defects such as flashing.

Vertical Load Test

A 100mm diameter 0.25kg weight was used as a load bearing pad, and placed in the centre of the bottom step of each set A) – B). The height of the top of this pad from the floor was then measured and recorded in each test for steps A) to D). The basic set up is illustrated in Figure 1:

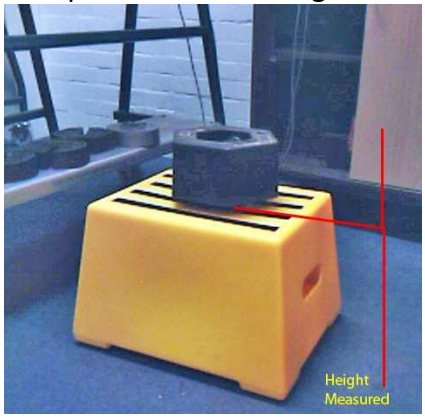

Figure 1
For each test A) to D), 265 kg of weights were loaded onto the 100mm pad and left in place for 1 minute before a second height measurement was taken in order to ascertain the deflection of the step under load.

The measured deflections under load were as follows:

A) 11mm
B) 8mm
C) 12 mm.
D) 9mm

1 minute after the loads were removed, the height of the top of the pad from the floor was again measured to determine the permanent deflection of the steps.

Deflection in steps 1 minute after unloading:

A) 3mm
B) 3mm
C) 4mm
D) 3mm

Hence the permanent deflection in all steps A) to D) was well within the 0.5% limit of the standard, with the greatest deflection being 0.009% = 4/450mm

Determination of friction coefficient:

The test method was to place the steps on a formica laminated table top and load the bottom step with 12.5kg. A cord was tied around the middle of the bottom step at the point required by the standard. The cord was then tied to a tray and the tray hung over the table edge for steps B) and D) and over a bar in front of the table edge for steps A) and C), as illustrated in Figure 2. The table edge and bar were both smooth and rounded surfaces, providing minimal frictional resistance to the slippage of the cord under load. Weights were then added into the tray and the assembly left to stand for 1 minute in order to measure any sliding of the steps.

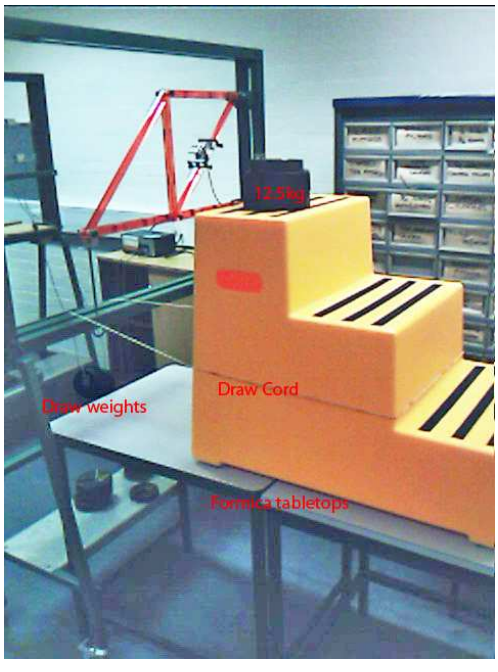

Figure 2

Initial tests showed steps B) and sliding under a 2 kg (19N) load and steps D) under a 5kg load. Removal of the rubber pads from the B) steps and the castors from steps D) improved this to 3 kg for B) and 6kg for D) However, both these lateral forces gave less than the required friction coefficient □.

The testers then abraded the four feet of A) and the six feet of B) to ensure they were flat to the table top and rougher than finished plastic. This improved the performance of both steps, enabling them to meet the standard requirements, with the results being:

B): $\mu = 0.210 = 4/19$kg
D): $\mu = 0.242 = 8/33$kg

Following discussion of the results of these 18th September tests, for the subsequent 26th November tests, steps A) and C) were supplied fitted with three rubber pads on each corner. These significantly improved the grip of the steps, giving the following results:

A): $\mu = 0.25 = 4/16$kg
C): $\mu = 0.272 = 6/22$kg

Comments on the testing of B) and D): This test shows that the alignment of the bottom feet must be carefully checked to ensure that all four feet are touching the ground under a 12kg load. We saw that the four step model B) is actually not fully seated on all four corners, and we actually had to remove the retractable castors completely for this test because one of them was not compressing sufficiently far. The fitting of rubber pads, as on steps A) and C), improves the grip – and the compressibility of the rubber compensates for a 1-2mm deviation between the four feet relative to a truly flat floor beneath.

Lateral stability:

Although not part of the standard, we were concerned by the lateral stability of the four step model B). Anyone leaning on the handrail can easily topple this assembly. In our view, the risk of a lateral toppling is very considerable in product B) and could undercut any safety or liability claims that might be claimed under BS14183.

Recommendation: Very visible and clear warning signs *must* be used on this product, advising users not to lean sideways on these steps. The stability of the four step model could be improved by fitting some sort of fold out stabiliser arms, fixed to pins in the recesses presently used for castors. Indeed, we cannot see the present castors really add much to the manoeuvrability of the product, even though they add considerable manufacturing cost.

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