

# Children's Cot: Are the Manufacturers Aware of the Safety Requirements? A Case Study of Furniture Quality Control in the Greek Market

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**Abstract:** This research is addressing the knowledge of wooden furniture manufacturing companies in Greece with regard to the children's cot as a final product. Ten different cots (from five manufacturers) were examined and tested according to the European Norms EN 716-1:2008+A1:2013 & EN 716-2:2008+A1:2013. The aim of the testing was to identify the design and construction principles of the manufacturers related to the guidelines set by the European authorities and to what extent these tested cots met all the requirements and the standards for safe use as concerns to the Greek market of wooden furniture. This was undertaken at the first stage of production, prior to releasing the product to the end-users. The results of the current research indicate that 100% of the samples which were studied did not comply with the specific standards. Consequently, these products are assessed as inadequate and inappropriate which is a cause for significant concern.

**Key words:** children's cot, wooden furniture, European standards

## 1. Introduction

The wooden bed is a useful object that accompanies people from the first years of their "civilized" life. Immediately after having settled in protected areas and meeting its basic needs in tools and hunting tools, weapons, etc., they began to carry out constructions that would facilitate their daily lives. We have information and evidence from very old furniture constructions made of stone, marble, metals and wood. This last material, wood, was and is the most popular material of furniture manufacturers [1, 2].

The furniture industry is essentially dependent on wood and wood-based materials. Wood as a material is superior due to its characteristics in performance, construction and appearance [3]. From the consumer's

point of view, it is the choice of the vast majority because of its reliability, environmental friendliness and pleasant appearance. Although other non-wood materials, such as metals and plastics, have made significant contributions to furniture manufacturing, still most of them are made of wood. As furniture is intended primarily to meet basic or secondary human needs (sleep, study, work, rest, nutrition, storage, entertainment, etc.) it must be functional, and respond comfortably to the purpose for which was built, to provide security to the user, to have endured in time and use while at the same time satisfying aesthetic requirements. Therefore, various principles must be applied in its construction, which in the modern era, its applications have to satisfy the certain specifications.

The environmental aspects of the furniture depend to a large extent on the raw materials. Therefore, the use of certified wood by sustainable management is essential in the furniture industry [5]. In particular, with

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regard to wooden children's furniture, materials that have high quality and certification are important advantages for the choice of products on the part of consumer parents. Today, most furniture manufacturers are trying to improve the reputation and image of their products by incorporating materials that are more environmentally friendly and human-friendly with regard to furniture production.

The construction of wooden furniture is the largest part of the furniture. The main products manufactured in the EU (38% of the total value of furniture production) are wooden furniture used in bedrooms, dining rooms, living rooms and other spaces, compared to other materials as plastic and metal used for furniture [6]. Environmental certification is one of the indicators for the identification and understanding of environmentally friendly materials by consumers and concerns wood products. This certification can also influence the consumer's opinion about the product they have or intends to buy and create a sense of confidence in the product.

To ensure the quality of children's furniture, tests are usually required to determine the extent to which a product is considered dangerous to the safety of users, and this is normally done in accordance with current European safety standards.

The purpose of the tests undertaken in the present research was to check that the children's cots before being available for sale in the Greek market met all the conditions according to the current standards: EN 716-1: 2008 + A1-2013 & EN 716-2: 2008 + A1-2013.

## 2. Material and Methods

The samples of the children's cots that were intended for the tests were delivered directly by the manufacturer to the quality control laboratory in good condition and assembled according to the manufacturer's instructions. Each sample, remained for ten days (more than a week — according to the EN) in the indoor test area of the department at constant temperature conditions of 18°C (Temperature limits

based on the EN: > 15°C and < 25°C) and humidity 49% [7, 8]. The number of samples was ten and they represented five different Greek construction companies.

Figs. 1-4 show some of the most important tests performed during the tests and concern the measurement of the diameter of the assembly holes which should be within certain limits (Fig. 1), the measurement of the bed base in relation to both sides of the cot (Fig. 2), the possibility of head entrapment on the outside of the cot. In the openings on the outside of the cot, when the small head probe passes, the large head probe (Fig. 3) must pass, and the distance between



**Fig. 1** Measurement of the assembling holes.



**Fig. 2** Bed base and side frame gap measurement.



Fig. 3 Head entrapment on the outside of the cot.



Fig. 4 Distance between footholds and top of cot sides.

the upper side must be measured. Children's cot base/mattress base and the top edge of the children's bed under load, must be at least 600 mm (Fig. 4).

The most important test for the strength of the cot should not be neglected, measuring the strength of the base of the bed, which should not be broken or detached, and the cot should continue to function normally when checked even after a repetition of 1000 test cycles at the seven different points of the bed base

as they are stated in the pre-mentioned European standard.

### 3. Results and Discussion

Table 1 presents the test results and lists the percentages of samples that did not meet the requirements and did not comply with the specifications used. In addition, the results showed that

Table 1 Description of the EN 716-1:2008 +A1 - 2013 tests and results with regard to the non-compliance percentage.

| Requirement's description   | Non-compliance percentage |
|---|---------------------------|
| §4.2 Materials.<br>§4.2.1 Materials and surfaces. The manufacturer/importer/retailer shall provide verification that all accessible parts meet the relevant requirements from EN 71-3.  | 0%                        |
| §4.3 Stability.<br>§4.3 Initial stability. When tested in accordance with §5.2 of EN 716-2:2008+A1:2013, the cot shall not overturn.  | 0%                        |
| § 4.4 Construction.<br>§4.4.1.1 Edges and protruding parts. Edges and protruding parts accessible during normal use shall be rounded or chamfered and free of burrs and sharp edges.  | 0%                        |
| §4.4.1.2 Self-tapping screws. Self-tapping screws shall not be used to fasten any component that is designed to be removed or loosened when dismantling the cot for purposes of transportation or storage.  | 0%                        |
| §4.4.2 Holes, gaps and openings on the inside of the cot.<br>§4.4.2.1 General. With the exception of the holes, gaps and openings specified in §4.4.2.2, 4.4.2.3, 4.4.2.4, 4.4.2.5, 4.4.2.6, 4.4.4.2 and 4.4.4.3 all other accessible holes, gaps and openings shall be less than 7 mm, between 12 mm and 25 mm, or between 45 mm and 65 mm when tested in accordance with §5.4.1" of EN 716- 2:2008+A1:2013. | 30%                       |
| §4.4.2.2 Assembly holes. There shall be no accessible holes between 7 mm diameter and 12 mm diameter, unless the depth is less than 10 mm.  | 70%                       |
| §4.4.2.3 Distance between cot base and sides and ends. When tested in accordance with §5.4.1 of EN 716-2:2008+A1:2013, it shall not be possible for the 25 mm cone to pass between the cot base and the sides, and between the cot base and the ends.   | 50%                       |
| §4.4.2.5 Distance between slats of the cot base When tested in accordance with §5.4.1 of EN 716-2:2008+A1:2013, it shall not be possible for the 60 mm cone to pass between two adjacent slats of the cot base.   | 30%                       |

1118 **Children's Cot: Are the Manufacturers Aware of the Safety Requirements? A Case Study of Furniture Quality Control in the Greek Market**

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| §4.4.3 Head entrapment on the outside of the cot.  | 70%                              |
| §4.4.5 Snag points. When tested in accordance with §5.10 of EN 716-2:2008+A1:2013, the mass shall not be supported by any part accessible from inside the cot. Parts of cot sides and ends more than 1 400 mm above the cot base are considered not accessible.  | 30%                              |
| §4.4.7.2 Adjustable cot base. If the cot base is adjustable, adjustment from a higher position to a lower position shall require the use of a tool or operation of a locking system, which fulfils the requirements of 4.4.6.2.  | 0%                               |
| <b>Requirement's description</b>   | <b>Non-compliance percentage</b> |
| §4.4.7.3 Strength of the cot base. When tested in accordance with §5.7.2 of EN 716-2:2008+A1:2013, no element of the cot base shall break, nor shall the cot base become dislodged and the function of the cot shall not be impaired.  | 0%                               |
| §4.4.8.2 Distance between footholds and top of cot sides and ends. When tested in accordance with §5.9.1 of EN 716-2:2008+A1:2013, under load, the distance between the upper side of the cot base/mattress base and the upper edge of the cot side and end shall be at least 600 mm. When tested in accordance with § 5.3.3 of EN 716-2:2008+A1:2013, there shall be a distance of at least 600 mm between the top of any foothold and the top of the cot side and end.   | 90%                              |
| §4.4.8.3 Strength of side and end components. When tested in accordance with §5.8.1, 5.8.2 and 5.8.3 of EN 716-2:2008+A1:2013, the slats or sides and ends and corners shall neither break nor become detached. The function of the cot shall not be impaired. When tested in accordance with §5.8.4 of EN 716-2:2008+A1:2013, the threads of the mesh and other flexible materials, e.g., fabrics, plastics shall not break and the function of the cot shall not be impaired.  | 0%                               |
| §4.4.8.4 Strength of frame and fastenings. When tested in accordance with §5.9.1 and 5.9.2 of EN 716-2:2008+A1:2013, there shall be no breakage. The function of the cot shall not be impaired.  | 0%                               |
| § 4.5 Final stability. When tested in accordance with §5.12 of EN 716-2:2008+A1:2013, the cot shall not overturn.  | 0%                               |
| §5 Packaging. Any plastic covering used as packaging for cots, folding cots or mattresses, if applicable, that does not fulfil the requirements of EN 71-1, shall be conspicuously marked with the following information or its equivalent: "To avoid danger of suffocation keep this plastic bag away from babies and children."  | 70%                              |
| §6 Instructions for use. Instructions shall be provided in the official language(s) of the country where the cot is sold. These instructions shall be headed "Important, Retain for Future Reference: Read Carefully"  | 70%                              |
| §6 a) Warning: Be aware of the risk of open fire and other sources of strong heat, such as electric bar fires, gas fires, etc. in the near vicinity of the cot.  | 70%                              |
| §6 b) Warning: Do not use the cot if any part is broken, torn or missing and use only spare parts approved by the manufacturer.  | 70%                              |
| §6 c) Warning: Do not leave anything in the cot or place the cot close to another product, which could provide a foothold or present a danger of suffocation or strangulation, e.g., strings, blind/curtain cords, etc.  | 0%                               |
| §6 d) Warning: Do not use more than one mattress in the cot.   | 70%                              |
| §6 f) If the height of the cot base is adjustable, a statement that the lowest position is the safest and that the base should always be used in that position as soon as the baby is old enough to sit up.  | 0%                               |
| §6 i) Assembly drawing, a list and description of all parts and tools required for assembly and a diagram of the bolts and other fastenings required.  | 70%                              |
| <b>Requirement's description</b>   | <b>Non-compliance percentage</b> |
| §6 j) Statement about the minimum size of mattress to be used with the cot. The length and width shall be such that the gap between the mattress and the sides and ends does not exceed 30 mm.   | 70%                              |
| §6 m) Statement that all assembly fittings should always be tightened properly and that fittings should be checked regularly and retightened as necessary.   | 0%                               |
| §7 Marking. All cots for which a claim of conformity to this standard is made shall be permanently marked with the following information: a) name, registered trade name or registered trade mark of either the manufacturer or distributor or retailer together with additional means of identifying the product; b) reference to this EN (EN 716-1:2008+A1:2013); c) if the mattress is not an integral part of the cot, the maximum thickness of the mattress to be used. This can be in the form of text, a distinct mark on the cot at the correct height, e.g., a line, or by other means. | 70%                              |

7 samples (or 70%) did not comply with paragraph 4 of EN716-2008 + A1 — 2013 which is related to the mechanical parts of the product. The table also shows that high levels of non-compliance were also identified

in terms of labelling, instructions and packaging. Many of the non-compliances in section 4.4 concern the holes, gaps and openings inside the cot which include finger trapping in the screw holes, finger trapping in the

insurance systems of the folding sides, trapping the ends, trapping/head between the wings on the sides of the bed, trapping ends/head between the bases of the bed and the sides. In addition, according to the results, high levels of 100% compliance of the product with the standard were found in terms of the endurance tests of the bed base, a factor that is considered very important for the safe use of the bed.

#### 4. Conclusion

The following Fig. 5 presents an overview of the results (the percentage of furniture that met the requirements) of all 10 samples according to EN716 and examines the various types of compliant conditions, as a percentage of all factors observed in terms of mechanical strength and mechanical components of the product.

The overall results of the laboratory tests on the 10 cots exhibited that none of the samples studied had passed all the tests according to the EN716. These results demonstrate the following:

It seems that the furniture manufacturers have to redesign some parts of the cot beds in order to comply with the European Standards and therefore be safe for direct use.

The results of Fig. 6 demonstrate that the largest percentage of non-compliance with the cot beds is due to the deficiencies found in terms of packaging conditions and marking of the products. The instructions for use have a lower non-compliance percentage yet a significant figure once most of the children's cots usually sold as "flat packs" therefore this lack of proper instructions may have a negative impact into the assembly of the cot putting in further danger the overall use of the bed in not assembled correctly.

According to the results of the tests undertaken, 100% of the samples didn't comply with the current EN standard. It is estimated that there is a serious risk to the consumers if the products would be forwarded directly to the market without further redesign and construction changes from the manufacturers. Additional research is

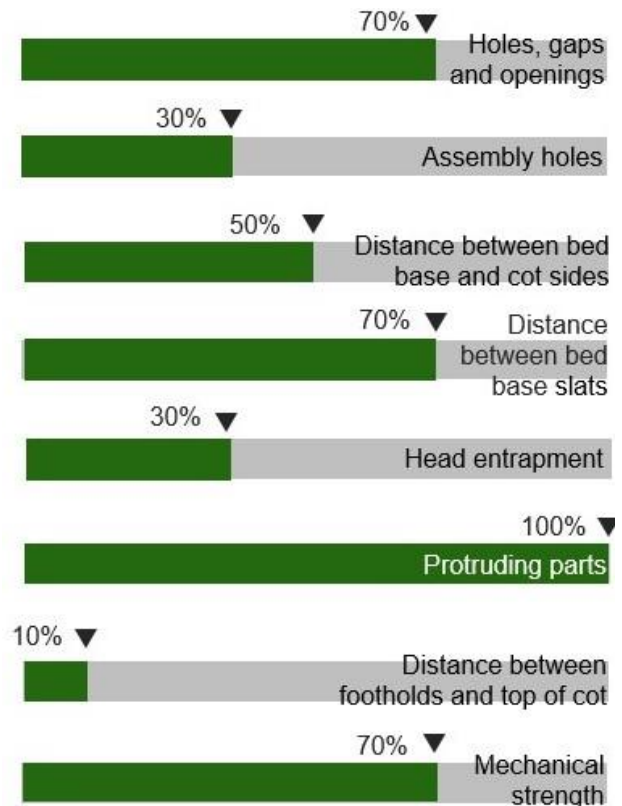


Fig. 5 Breakdown of compliance as concerns mechanical strength and cot's equipment.

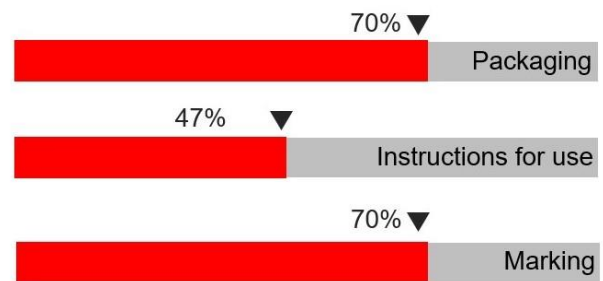


Fig. 6 Breakdown of non-compliance as concerns: Packaging, instructions for use and marking.

proposed with more test samples to be examined to draw more robust conclusions.

This research demonstrated the need to initiate a collaboration between quality control institutes/bodies and furniture manufacturers in order to save time and resources and make the manufacturers design and create improved products. This isn't only about cots, but also about furniture in general. By taking into consideration guidelines established by the authorities who set the criteria for safe and practical furniture the

future products are expected to minimising failures having overall a better quality.

## References

- [1] G. Ntalos and I. Kakaras, Notes on Furniture Production Technology I, Technological Educational Institute (TEI) of Larissa, Department of Wood Technology & Furniture Design, 2000.
- [2] M. Skarvelis, Notes on Furniture Production Technology II, Technological Educational Institute (TEI) of Larissa, Department of Wood Technology & Furniture Design. 2013.
- [3] J. R. Shelly, *Encyclopedia of Materials: Science and Technology*, 2001, accessed on 25.2.2013, pp. 9658-9663, available online at: <http://www.jrreeding.com/WoodMaterials.pdf>.
- [4] T. Pakarinen, Success factors of wood as a furniture material, *For. Prod. J.* 49 (1999) (9) 79-85.
- [5] K. Parikka-Alhola, Promoting environmentally sound furniture by green public procurement, *Ecological Economics* 68 (2008) (1) 472-485.
- [6] Survey on the Access to Finance of Enterprises EU, available online at: [https://ec.europa.eu/growth/access-to-finance/data-surveys\\_en](https://ec.europa.eu/growth/access-to-finance/data-surveys_en).
- [7] EN 716-1:2008+A1:2013 – Furniture — Children's cots and folding cots for domestic use, Part 1: Safety requirements.
- [8] EN 716-2:2008+A1:2013 – Furniture — Children's cots and folding cots for domestic use, Part 2: Test methods.