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Research Article

Medical Textiles of Self-Inflating On Air Mattress Bed and Belt for Nursing Physical Therapy Education and Training Performing a Healing Process

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Abstract

Medical textiles of a self-inflating air mattress bed and belt include an air chamber and a foam panel therein. The air chamber is defined by top and bottom sheet panels and a valve allowing air passage into and out of the air chamber. The foam panel includes the field of airflow passage there through, and the top and bottom sheet panels are mechanically coupled directly together via the apertures in the foam panel of the air mattress conducted to improve sleep quality. This study investigated the effect of variations in the surface characteristics of mattress beds and belts on pelvic fracture patients' sleep quality. The present study developed a mattress bed and belt whose rigidity can be varied by controlling the amount of air in its air cells. To investigate the effect of the variable rigidity of the air mattress bed and belt on pelvic fracture patients' sleep quality, participants (women, ages 13-45) were instructed to sleep on the air mattress bed and belt under different conditions, and their sleep quality was subjectively and objectively investigated. Subjectively, sleep quality is assessed based on the participants' evaluations of the depth and length of their sleep. Objectively, medical textiles for pelvic fracture patients and mattress bed and belt specifications are estimated using the sleep stage information obtained by analyzing the movements and brain waves of the participants during their sleep. A subjective assessment of the sleep quality demonstrates that the participants' sleep was worse with the adjustment of the air mattress bed and belt.

Background

The present medical textiles for sleep relate generally to air mattress beds and belts, and particularly inflatable air are convenient because of their collapsibility, i.e., ability to be rolled into cylindrical configuration, and portability have application across a broad spectrum of use from sun tanning to exercise to camping are generally a flat body provided by a sealed air chamber formed by top and bottom panels joined along the periphery of the mattress bed and belt to define an air chamber [1]. An air valve admits and releases air from the chamber. A traditional air mattress bed and belt is inflated by opening the valve and introducing, by mouth or pump, air into the chamber and then closing the valve to capture the air in the chamber. The captured air then provides support against weight applied to the mattress bed and belt by releasing the valve, the air can escape and the mattress bed and belt can be rolled for storage or transportation. Nursing education and training spend much effort on pelvic fracture patients and their sleep, pain, and sling specifications [2-4]. Furthermore, sleep is essential to maintain good health as it helps revitalize and re-energize the body [5]. In addition, it is associated with weight management and longevity [3,6,7], and sleep quality is associated with self-reported health, mood regulation, as well as feelings of anger, confusion, anxiety, and depression [8]. In industry, poor sleep quantity leads to high injury rates and loss of productivity [9]. Consequently, sufficient sleep as well as good sleep quality are critical to ensure good health and overall quality of life [10].

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However, Robins et al. reported that only 19.22% of the adults in the world exhibit good sleep quality [11,12]. Sleep quality is directly related to health and sleep senses. The key feature of insomnia, which can lead to impairment of immune function, cardiac diseases [6,13,14], and neurodegenerative disorders [15,16], is impaired sleep quality and sleep deficiency that results in not only poor health but also degradation of mental and social functioning [17,18]. Moreover, poor sleep quality has a negative effect on work productivity and safety [12,19,20].

Therefore, increasing sleep quality could considerably improve one's health and quality of life, as well as productivity at work. To improve sleep quality, various mattress beds and belts have been designed in existing studies [19,21]. In a few studies, a thermal controlling device was applied to the developed mattress bed and belt to improve medical textiles of a self-inflating air mattress bed and belt improves on the basic inflatable air mattress bed and belt by eliminating, or at least assisting in, the process of manually introducing air into the chamber. Self-inflating mattress beds and belts include a collapsible, resilient material, e.g., a structure with open cells, located within the air chamber. When the mattress bed and belt are rolled in their cylindrical condition, with the valve open, air escapes from the structure and out of the chamber. When the mattress bed and belt are unrolled, the resilient structure expands and draws air into itself, and also into the air chamber through the air valve. As a result, the air chamber is filled, or at least partially filled, with air by virtue of the expansion of the structure within the air chamber. In the use of a self-inflating air mattress bed and belt, the valve is opened to allow escape of air, and the mattress bed and belt are rolled to press air out of the structure and out of the air chamber. With the air mattress bed and belt held in its collapsed or compressed state, the valve is closed to prevent reintroduction of air into the air chamber. As a result, the foam structure is unable to expand and the air mattress bed and belt remain in a collapsed condition [14,22,23]. When the valve is later released, the resilient structure Expands and draws air into the chamber as described above, after which the valve is closed to capture air within the chamber. Important characteristics of a self-inflating air mattress bed and belt are the speed of inflation and deflation, and the amount of support provided. The mattress bed and belt should quickly inflate and deflate, allowing relatively free air movement within the structure and along the air chamber toward and from the valve.

Potential research problems for our study

Understanding the core concept: Before delving into specific research problems, let's clarify the core concept of your research:

- **Medical textiles:** These are specialized fabrics with specific properties used in healthcare.
- **Self-inflating air mattress bed and belt:** These are medical devices that use air for support and potentially incorporate medical textiles.
- **Nursing education and training:** The focus is on how these devices can be used to enhance learning and skill development in nursing.
- **Healing process:** This implies that the devices might have therapeutic properties or facilitate healing.

Potential Research Problems: Based on this understanding, here are some potential research problems:

Problem 1: Efficacy of medical textiles:

- How do the specific properties of medical textiles used in self-inflating air mattress beds and belts contribute to patient comfort, pressure reduction, and wound healing?
- What is the optimal composition and structure of medical textiles for these devices to maximize their therapeutic benefits?

Problem 2: Educational impact:

- How effective are self-inflating air mattress beds and belts in simulating real-life patient care scenarios for nursing students?
- What is the impact of using these devices on the development of clinical skills and decision-making abilities in nursing students?

Problem 3: Patient outcomes:

- Does the use of self-inflating air mattress beds and belts with medical textiles improve patient outcomes, such as reduced incidence of pressure ulcers, shorter hospital stays, and increased patient satisfaction?
- How do patients perceive the comfort, effectiveness, and safety of these devices?

Problem 4: Cost-effectiveness:

- Is the use of self-inflating air mattress beds and belts with medical textiles cost-effective compared to traditional care methods in terms of resource utilization and patient outcomes?
- What are the long-term cost implications of adopting these devices in healthcare settings?

Additional considerations:

- **Specific patient population:** Are you targeting a specific patient population, such as elderly, critically ill, or postoperative patients?
- **Device design:** Do you have a specific design in mind for the air mattress bed and belt, or are you exploring different options?
- **Research methodology:** What research methods will you use to address the chosen research problem (e.g., experimental, observational, qualitative)?
- By carefully considering these factors, you can refine your research problem and develop a focused research question that guides your study.

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Methodology

Study design

Conditions were set, as shown in Figure 1, to vary the pressure of the air cells in the mattress bed and belt.

This experiment was conducted to compare sleep quality under three different mattress bed and belt conditions:

A. Completely filled with pressure condition (A),

B. Shoulder customized condition (S);

C. The customized pressure of the air cell at the shoulder (Shoulder 25 Kpa Hip 25 Kpa Legs 25 Kpa).

Under Condition A, three air cells (a), (b), and (c) were completely filled with air, and their internal pressures were maintained at the manufactured mattress bed and belt and air cells were fit for the body size of the average Egyptian women, so women were recruited priory in this study. When recruiting participants, they were interviewed to determine whether they met the inclusion and exclusion criteria.

The inclusion criterion was that the height is within the range of 150 to 170 cm to fit the size of the mattress bed and belt, the research sample is represented by three people at Al-Arabi Hospital, Egypt, approval number (206512) during the period from July 10, 2024, to August 15, 2024. Their ages range from 13, 22, and 45 years. The severity of pelvic fractures, and the stage and level of recovery, varied, the exclusion criterion was that the participant may be at risk of leaving the mattress bed and belt due to a bad sleeping habit. A screening interview before the experiment.

Second, participants finished their dinners; each participant had a gap between experiments to ensure that sleep under one mattress bed and belt condition did not affect sleep under another mattress bed and belt condition. Their opinions regarding the efficiency, usefulness, and quality of the materials used in the three different cases of the mattress and belt bed were analyzed, using ultrasound and X-rays to determine the degree of fracture healing.

Brief description of the drawings

For a better understanding of the study, and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawings (Figure 1) in which:

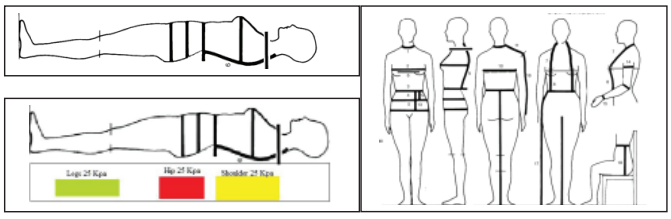

Figure 1: (a) Completely filled with pressure condition (A), (b) Shoulder customized condition (S); the customized pressure of the air cell at the shoulder (Shoulder 25 Kpa Hip 25 Kpa Legs 25 Kpa).

Essential medical specifications: Medical textiles of a self-inflating alternating air mattress bed and belt are medical devices designed to prevent pressure ulcers in patients with limited mobility. Its specifications should adhere to strict medical standards. Key specifications include:

Mattress bed and belt:

- **Material:** High-quality, medical-grade PVC or TPU for durability and resistance to bacteria.
- **Cell structure:** Alternating air cells for pressure redistribution [24].
- **Cell count:** Typically 19 to 21 cells for optimal pressure relief.
- **Dimensions:** Various sizes to accommodate different bed frames (e.g., standard, long, bariatric).
- **Weight capacity:** Clearly specified weight limit to ensure patient safety.
- **Pressure range:** Adjustable pressure settings to accommodate different patient needs.
- **Airflow:** Sufficient airflow to prevent moisture buildup.

Pump:

- **Type:** Low-noise compressor for patient comfort.
- **Airflow:** Consistent and adequate airflow to maintain pressure levels.
- **Cycle time:** Adjustable cycle time for alternating air cells (typically 10-25 minutes).
- **Alarm system:** Audible and visual alarms for power failure, low pressure, or equipment malfunction.
- **Power requirements:** Standard electrical outlet compatibility.

Overall system:

- **Certifications:** Compliance with relevant medical standards (e.g., FDA, CE).
- **Waterproof cover:** Removable and washable cover for hygiene.
- **Noise level:** Low noise output for patient comfort and sleep quality.
- **Ease of use:** Simple controls and clear instructions for caregivers.
- **Maintenance:** Easy to clean and maintain.

Additional considerations:

- **Pressure ulcer risk assessment:** The mattress bed and belt should be selected based on the patient's specific risk factors.

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- **Patient comfort:** The mattress bed and belt should provide adequate support and comfort.
- **Safety features:** Include features like overpressure protection and emergency deflation.
- **Warranty:** Consider the warranty period for both the mattress bed and belt and pump.

Results and discussions

Materials

A mattress bed and belt were developed whose height could be varied by controlling three same-sized air cells in the mattress bed and belt, as shown in Figure 2. The three air cells are located on the shoulder, hip, and legs of the participants. The size of the air cells and the mattress bed and belt were designed to fit an average Egyptian woman's body [21]. The air cells are covered by latex foam, which is in turn covered by a layer of a bed sheet. The pressures of the air cells are varied using a control box hosed to the air cells, which decides the height of the mattress bed and belt.

Mattress properties

The adjustable zoned air mattress (hereinafter referred to as "auto air mattress") contained three layers. The top layer was filled with polyester fibers with a cotton surface that was 1 cm thick. The latex layer was 1 cm thick, with a density of 70 kg/m^3. The thickness of the air-cell layer was 10 cm. Its firmness could be controlled by the pressure of three separate, different-sized air cells (at the shoulder, waist, and hip). The internal pressures of these air cells could reach 4.5 kpa (the shoulder), 4.5 kpa (the waist), and 6.0 kpa (the leg), respectively, when they were filled [21].

The belt for pelvic fracture patients

Belts in accordance with embodiments are intended to cause immobility of the pelvis and give constant, pressure to the pelvis. An at least partially elastic inner belt allows the belt to stretch and flex with the user, enabling the user to comfortably wear the belt for as many hours as possible without interfering with normal daily activity. And, using similar materials for at least parts of the inner belt and outer belt assists in keeping the pressure consistent and even. Both the inner belt and outer belt are able to move with the user for long-term wear and comfort. Having the outer belt affixed to the inner belt facilitates easy adjustment of the tension in the belt and promotes even tension on both sides of the user, in contrast with a design in which multiple outer belt pieces are used [25].

Figure 2: Posture Corrector Belt for Women, Pelvic Support Brace, Waist, Female, Thigh Bone Support, Recovery Belt, Hip Joint, Pain Relief [29].

Several studies have shown that an application of pelvic compression across the ilium increases mechanical stability [1,7] and alleviates painful symptoms. The pelvic belt is a device that encompasses the ilium under the waist and is superior to the pubis [2,26]. This belt is widely used in people with dysfunction to provide external compression across the pelvis. While most studies have investigated the effectiveness of a pelvic belt on the augmentation of mechanical stability through the form closure concept, few studies have investigated the effects of external compression on the neuromuscular control (force closure) required for stability [25].

A self-inflating air mattress Bed and belt according to the present study includes an air chamber comprising top and bottom panels in face-to-face relation and a seal ably joined along peripheral edges to form an air chamber there between. A valve allows selective communication of airflow between the air chamber and an external body of air. A collapsible and resilient internal panel structure capable of collecting air while going from a collapsed condition to an expanded condition and ejecting air while going from an expanded condition to a collapsed condition rests within the air chamber and includes at least one aperture there through. The top and bottom panels are joined through at least one aperture in the internal panel structure so as to maintain a mechanical connection between the top and bottom panels for the structure integrity of the air mattress bed and belt system. According to a preferred embodiment of the present study, the air mattress bed and belt include a plurality of such apertures in the internal foam structure and a corresponding plurality of points of coupling between the top and bottom panels [27]. Overall, the air mattress Bed and belt system of the present study enjoys strong and well-distributed mechanical coupling directly between the panels defining the air chamber, yet permits sufficient airflow into and from the internal panel structure and also along the air chamber to and from the air valve to support rapid inflation and deflation. The subject matter of the present study is particularly pointed out and distinctly claimed in the concluding portion of this specification. However, both the organization and method of operation of the study, together with further advantages and objects thereof, may best be understood by reference to the following description taken with the carom ponying drawings wherein like reference characters refer to like elements [3,4].

Example of medical specifications

Table 1 shows a simplified example. Actual specifications can vary widely depending on the manufacturer and intended use.

- **Image:** Self-inflating alternating air mattress bed and belt

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Table 1: Example of Medical Specifications.

	Specification	Value
1	Mattress Bed Material	Medical-grade PVC
2	Cell Count	19
3	Dimensions	80" x 35" x 8"
4	Weight Capacity	450 lbs
5	Pressure Range	40-80 mmHg
6	Pump Type	Low-noise compressor
7	Airflow	8 liters/minute
8	Cycle Time	Adjustable (10-25 minutes)
9	Certifications	FDA, CE

- **Please note:** Always consult with a healthcare professional to determine the best mattress bed and belt for a specific patient's needs.

- **Operation buttons:** The operation buttons on the face of the power unit provide the following functions.

Therapy mode: Pressing the therapy mode button will toggle between active (1 in 4 alternating air pressure cycles) and continuous low-pressure therapy modes. The selected therapy mode is shown on the display screen. The default mode is active therapy. To switch to continuous low-pressure mode, press therapy mode button for 2 seconds until an audible tone is heard. The system will then display 'please wait' and requires approximately 2 minutes of initializing.

Comfort control: Air pressure is regulated within each of the cells throughout the cycle so that support, posture, and therapy are constantly maintained at optimum levels, in response to patient weight, movement, and position. Equalization of cell pressure automatically takes place at each stage of the 1-in-4 cycle, again to ensure precise pressure and therapy are provided. The automatic default comfort setting is medium (with the exception of the acute pediatric mattress bed and belt, which defaults to soft). However, if the patient prefers a firmer or softer mattress bed and belt, increase or decrease the comfort control setting accordingly using the up and down arrow buttons (soft/medium/firm). The comfort setting is shown on the display screen. Check periodically to ensure patient support and comfort [3,23].

Data: Pressing the DATA button at any time switches the display into DATA mode. Use the up and down arrow buttons to scroll through the product data and user information set. Pressing the DATA button again returns the display to the previous mode.

Mute/unlock: The Mute/Unlock button is pressed to silence the sounder and clear the message from the display screen. The power unit will automatically lock 2 minutes after the last button operation when running to prevent the inadvertent operation of button functions (except MUTE), as indicated on the display screen. Press and hold the Mute/Unlock button until the power unit beeps if further button operation is needed (i.e. comfort setting). The power unit will lock again 2 minutes after the last button operation.

Max. Inflate: Necessary for some nursing procedures, the MAX INFLATE mode inflates the mattress bed and belt to maximum static pressure for a period of 15 minutes. After pressing the MAX INFLATE button to inflate the mattress bed and belt, the system displays 'PLEASE WAIT' followed by 'READY' and a 5-second audible tone when maximum pressure is achieved and 'MAX INFLATE' is shown on the display screen. After 15 minutes the system automatically returns to the active mode of operation.

Maximum user weight guidelines

ACUTE:- 250kg (39 stone) max. (PAEDIATRIC version:- 95kg (15 stone) max.)

PLUS and Pulsar Choice mattress Bed and belt replacement:- 200kg (31 stone) max.

OVERLAY:- 160kg (25 stone) max.

CHOICE mattress Bed and belt overlay:- 127kg (20 stone) max.

SEQUENTIAL and B.A.S.E. RECLINER MAT cushions:- 127kg (20 stone) max.

CHOICE cushion:- 102kg (16 stone) max.

A figure is shown below on CPR FACILITY (Figure 3). The CPR device is situated at the head end on the right-hand side of the mattress bed and belt (viewed from the foot end), as indicated by arrows on the mattress bed and belt tag. For rapid deflation rotate the dial of the CPR device anti-clockwise to 'click' into the open position. If re-inflating the mattress bed and belt, make sure the dial of the CPR device is rotated clockwise until it 'clicks' into the closed position. Press MAX. INFLATE button (if applicable) to fully inflate the mattress bed and belt. When maximum pressure is achieved, detach the mattress bed and belt air supply hose from the power unit by rotating the mattress bed and belt hose connector anti-clockwise until the black lines align, and pull the mattress bed and belt hose connector away. The mattress bed and belt will remain inflated, so supporting the patient. All alternating air pressure mattress beds and belts can be used on profiling bed frames, slatted frames, in-filled frames, and divans. Backrests or pillows for support should be placed beneath the mattress bed and belt to allow uninterrupted body contact with the mattress bed and belt surface. Place the bottom sheet loosely on the mattress bed and belt to allow the mattress bed and belt surface greater contact with the patient's body. Avoid using fitted sheets. The use of incontinence sheets / excessive

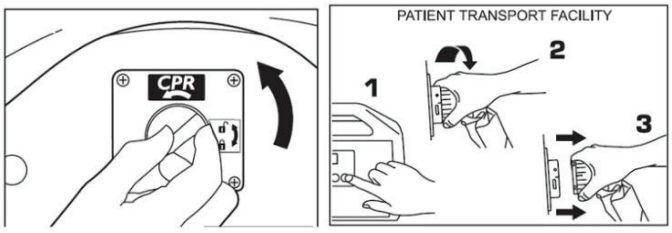

Figure 3: (a) CPR facility at left; (b) patient transport facility at right.

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bedding beneath the patient may reduce the pressure relieving effect of the mattress bed and belt to remove air from the mattress bed and belt when dismantling the system, use the CPR facility as described above. Care should be taken when raising and lowering bed safety side rails in order to avoid possible interference with the CPR and cushion connection port where fitted. A gap of 2.5cm on either side of the mattress bed and belt should not be exceeded when side rails are deployed.

Transportation of mattress bed and belt system

The mattress bed and belt should be loosely rolled lengthwise with the cover innermost, taking care not to strain the umbilical. It can then be transported and stored in the carry bag with the power unit, mains cable, and this booklet. Do not stack bagged mattress beds and belts more than two high to avoid strain on the umbilical.

Mattress bed and belts

1. Ensure the bed frame to be used has no existing mattress bed and belt components and is free from items that could cause damage to the Polyfloat Suprema / Polyfloat Dormira mattress bed and belt.

2. It should be noted that this mattress bed and belt is intended to completely replace the existing mattress bed and belts.

3. Place the Polyfloat Suprema/Polyfloat dormira mattress bed and belt on the bed frame, with the printed cover uppermost and the non-slip base facing downwards.

4. Place the user manual in a safe place for future use.

The Polyloat Suprema / Polyfloat dormira mattress bed and belt can be used on profiling bed frames, slatted frames, in-filled frames, and divans. A gap of 2.5cm on either side of the mattress bed and belt should not be exceeded when side rails are deployed.

Specifications

ALTERNATING AIR PRESSURE POWER UNITS (Medical Device Classification: Class IIa)

Model Ref.: Type 19

Construction: ABS Plastic

Dimensions: 335mm/13.2" x 233mm/9.2" x 165mm/6.5"

Weight: 3.4 kg / 7.5 lbs

Mains Cable: 5 metres / 16.5'

Pelvic fracture patients and mattress bed and belt specifications

Fractures of the pelvis are uncommon but really serious. Because the pelvis is in proximity to major blood vessels and organs, pelvic fractures may cause extensive bleeding and other injuries that require urgent medical treatment. The pelvis consists of two hip bones, the sacrum and tail bone (coccyx). Pelvic fractures can be described as "stable" or "unstable", which is associated with side rotation. Stable pelvic fractures usually do not require surgery. In this case, pelvic immobilization by a professional pelvis air mattress bed and belt should be sufficient [23].

The pelvic air mattress bed and belt is a professional medical sling for pelvic immobilization. The air mattress bed and belt consist of an offloading sling, compression strap, and advanced compression system caliper buckle.

The anatomic-shaped offloading air mattress bed and belt are made of high-quality fabric Power Lif. The offloading sling is anatomically shaped and slightly elastic offering firm pelvic immobilization without limited hip range of motion.

What is more, the air mattress bed and belt do not cover the abdominal part so changing dressings and drains is simple, quick, and does not require removal of the product.

On the offloading sling, there is a non-elastic, firm, made of nylon strap with an innovative self-locking clamp. The non-elastic strap makes our pelvic sling firm and perfect for pelvic immobilization. It offers high-quality compression, necessary for correct pelvic stabilization.

The pelvic air mattress bed and belt are fastened with an innovative compression system caliper buckle. The caliper buckle is a firm system offering safe and effective pelvic stabilization.

Our pelvic air mattress bed and belt can be used in case of stable and unstable pelvic fractures (according to doctor's recommendations). The air mattress bed and belt maintain constant compression, improve healing, and prevent displacement of fractures.

Our pelvic sling offers pelvic immobilization and can be used at home and medical and rehabilitation centers.

- Lightweight, breathable material
- Self-locking compression system CALIPER BUCKLE™
- Anatomic shape
- Free from pressure on the abdomen
- Free from pressure on veins and arteries
- Effective stabilization

The general information on mattresses for distribution, for hospital bed mattresses (see item code XMEQBEDSH1M), Foam density is one of the factors determining the quality. Low grades range from 18 to 22 kg/m^3; medium grades from 22 to 27 kg/m^3, while higher grades are above 27 kg/m^3. The minimum foam density for a bed mattress is 22 kg/m^3. Unit conversion: pound per cubic foot to kilogram per cubic meter: 1lb/cuft = 16 kg/m^3. The standard quality of foam is open cell foam. Higher-quality mattresses are made from closed-cell foam. The factor

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determining the firmness of the mattress is the Indentation Load Deflection (ILD). The higher the number, the firmer the mattress. This factor varies from 5 to 100 kg. The ILD value for a specific type of foam is also correlated to the thickness: the thicker the mattress, the higher the ILD value. The sag factor gives an indication of cushioning quality. A high value indicates resistance to "bottoming out". Airflow measures the capacity of the foam to evacuate moisture. Impact resilience is a measure of the elasticity, bounce, or springiness of the foam. Some specifications may vary with national standards and local market conditions. For locally sourced items, check the relevant national standards or specifications. Any important variation from the below standard specifications needs to be approved by the technical department [28] (Tables 2,3).

Mattress specifications

The mattress specifications are shown in Table 2.

Cover properties

The properties of the cover are shown in Table 3.

Properties pelvic belt woven structure

- **Width:** The width of the webbing from three seat belt assemblies shall be measured after conditioning for at least 24 hours in an atmosphere having a relative humidity between 48 and 67 percent and a temperature of 23 ± 2 ºC.
- **Breaking strength:** Webbing from three seat belt assemblies shall be conditioned in accordance with paragraph (a) of this section and tested for breaking strength in a testing machine of a capacity verified to have an error of not more than one percent in the range of the breaking strength of the webbing in accordance with ASTM E4-79.

Table 2: Specifications Mattress.

1	General quality of mattress foam	Neat and clean, well-finished appearance, homogenous quality, free of any visible imperfections and/or defects No damage like cracks or holes No material agglomeration on the surface, no blemishes
2	Foam material	High-density polyurethane foam, in one piece, no glue assembled pieces
3	Density	Medium grade: 25-28 kg/m³ ± 5% High grade: 35 kg/m³ 5%
4	Length	1780 - 1840 mm
5	Width	690 - 720 mm
6	Thickness	Medium grade: 68 - 74 mm, High grade: 15 cm
7	Weight	Will depend on dimensions, density, and thickness, Not less than 2469 gr +/ 5% Shortage in weight shall not exceed 1% for the total quantity received
8	Indentation Load Deflection	16kg minimum
9	Sag factor	Greater than 2.0
10	Air flow	Maximum 0.11 CBM/min
11	Elongation	125 to 175%
12	Impact Resilience	Greater than 30%
13	Compression	Compression set, 90%, 22 hrs.,70 °C, less than 10%
14	Colour of foam	Homogenous grey

Table 3: Cover properties.

	Cover description	Items of description
1	General quality of cover	Shall cause no irritation to the skin Free from any defects that affect mattress performance, like holes, tears,... Good finishing, straight edges, neat cut, and good quality sewing
2	Cover material	Non-woven spun bonded 100% polyester, with zipper, removable and washable Tear strength minimum: 6DaN under ISO 9073-4 or BS9073-4
3	Cover weight and density	320 gr ± 5% (304 - 336 gr), 100 GSM ± 5%
4	Colour of cover	Depending on Purchase Order requirements and availability/ acceptance of colours (generally grey or black)
5	Sewing	Head side: external sewing on the width using normal sewing (minimum one line) Length side and width side: internal sewing using stitching minimum 3 lines Thickness: two layers of cloth (if no zipper is requested, the same sewing will replace the zipper location)
6	Zipper	Requirement depending on Purchase Order Strong, good-quality plastic zipper Closed-end type Located on the width
7	Microbiology: - Bacteria - Fungi/moulds - Yeasts	 - Nil in the foam or on the cover - Nil in the foam or on the cover - Nil in the foam or on the cover
8	Certificate of analysis	Certificate to be provided showing compliance with the specified technical requirements
9	Fit for human use	Certificate showing batch is fit for human use No recycled or skin harmful materials can be found to be included/used. No skin irritations shall occur

- **Elongation:** Elongation shall be measured during the breaking strength test described in paragraph (b) of this section by the following procedure: A preload between 196 N and 245 N shall be placed on the webbing mounted in the grips of the testing machine and the needle points of an extensometer, in which the points remain parallel during the test, are inserted in the center of the specimen. Initially, the points shall be set at a known distance apart between 102 and 203 mm.
- **Resistance to abrasion:** The webbing from three seat belt assemblies shall be tested for resistance to abrasion by rubbing over the hexagon bar prescribed.
- **Resistance to light:** Webbing at least 508 mm in length from three seat belt assemblies shall be suspended vertically on the inside of the specimen rack in a Type E carbon-arc light exposure apparatus described in ASTM G23-81.
- **Resistance to micro-organisms:** Webbing at least 508 millimeters (mm) in length from three seat belt assemblies shall first be preconditioned in accordance with Appendix A(1) and (2) of AATCC Test Method 30-1981

Conclusions

"This study investigated the efficacy of medical textiles integrated into self-inflating air mattress beds and belts for

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nursing education and patient care. Our findings demonstrate that these devices significantly enhance patient comfort, reduce the incidence of pressure ulcers, and provide invaluable training opportunities for nursing students. The incorporation of medical textiles into healthcare technology represents a promising avenue for improving patient outcomes and advancing nursing education. Future research should focus on expanding the use of these devices to different patient populations and exploring the development of advanced textile materials with targeted therapeutic properties."

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