



# Pro-care Optima

Alternating Pressure Redistribution System

Clinical Practice Guideline

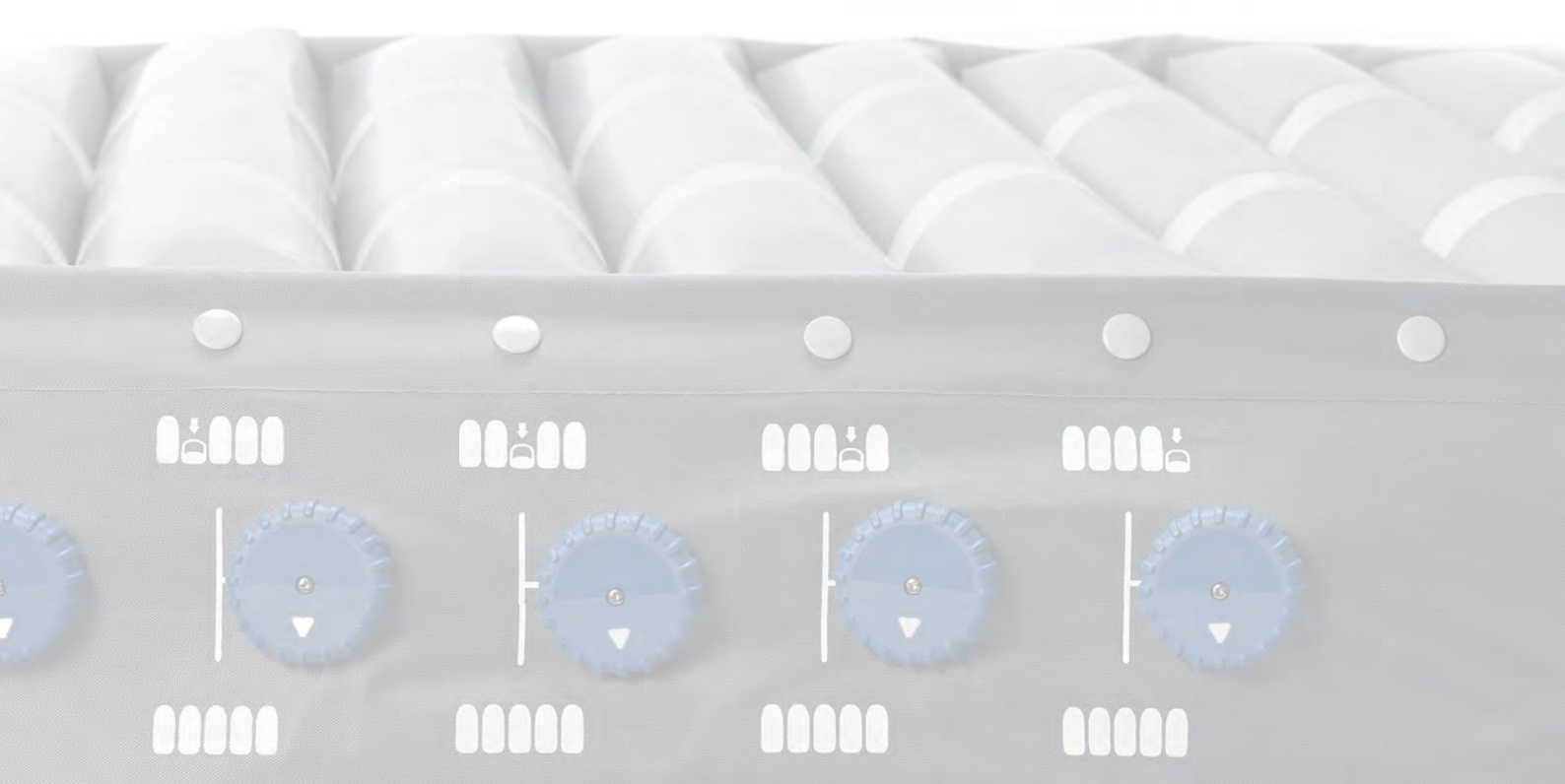
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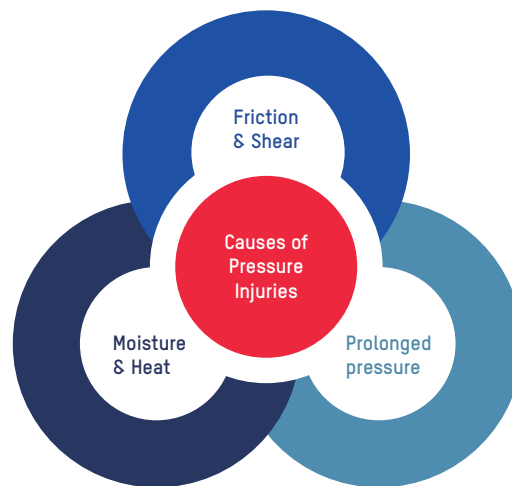
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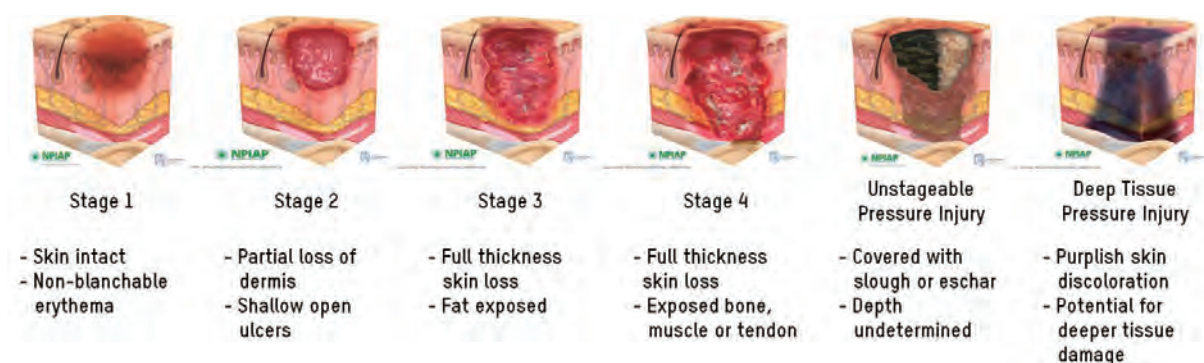
# Risk Factors and Development of Pressure Injuries

Pressure Injuries commonly occur as a result of tissue being exposed to prolonged pressure or pressure associated with friction & shear, or the weaker tissue caused by moisture.<sup>1</sup>



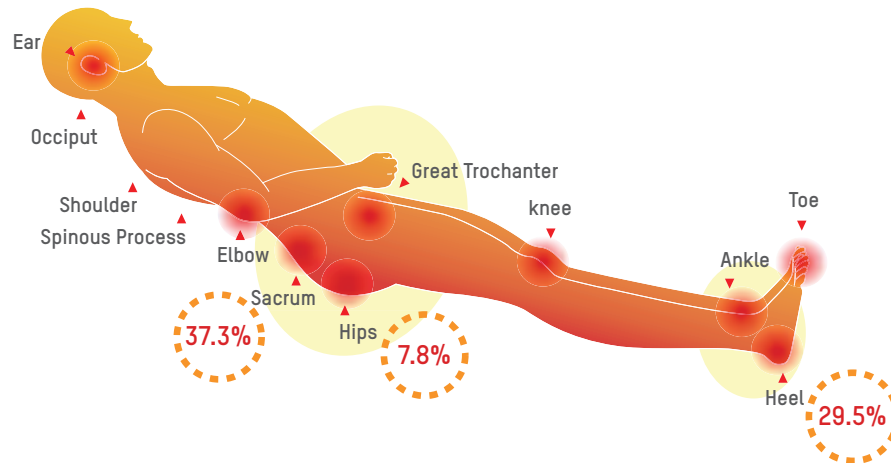
Common Risk Factors of Pressure Injuries

Pressure injuries are categorized into 6 stages<sup>2</sup>: Stage I with a non-blanchable erythema of intact skin; Stage II with a partial-thickness skin loss with exposed dermis; Stage III with a full-thickness skin loss; Stage IV with a full-thickness skin and tissue loss; Unstageable pressure injury is defined as obscured full-thickness skin and tissue loss; And last, Deep tissue pressure injury is the persistent non-blanchable deep red, maroon or purple discoloration of the skin.



Images used with permission from <https://npiap.com/page/PressureInjuryStages>

They may be superficial injuries affecting the epidermis and dermis or they can extend into the subcutaneous tissues and involve muscle, tendon and bone. Pressure injuries typically occur over bony prominences with the lower trunk (sacrum, coccyx, trochanter and ischial tuberosity) and heels being the two most common anatomical locations.<sup>3,4</sup>



Locations in Risk of Pressure Injuries

Localized areas of tissues that have prolonged pressure cause the occlusion of blood flow, preventing the supply of nutrients and oxygen to the tissue, resulting in ischaemia and re-perfusion injury, leading to cell obliteration and eventually tissue death.<sup>5</sup>

From the information of the mechanism of pressure injuries above, additional risk factors that have been correlated with are age of 70 years and older, current smoking history, dry skin, low body mass index, impaired mobility, altered mental status (i.e., confusion), diabetes mellitus, peripheral vascular disease, urinary and fecal incontinence, malnutrition, physical restraints, malignancy, history of pressure injuries, and human race.

Pressure injuries can develop within 2 to 6 hours. Therefore, the key to preventing pressure injuries is to accurately identify at-risk individuals quickly, so that preventive measures may be implemented.<sup>6</sup> A major method of redistributing pressure is the use of support surfaces. Many researches had been conducted on the effectiveness of the use of support surfaces in reducing the incidence of pressure injuries. The concept of pressure redistribution has been embraced by the NPIAP.





**“ Support surfaces are: “Specialized devices for pressure redistribution”<sup>7</sup> “**



“Support surfaces are specialized devices for pressure redistribution designed for management of tissue loads, microclimate, and/or other therapeutic functions (i.e., any mattress, integrated bed system, mattress replacement, overlay, or seat cushion, or seat cushion overlay)”.<sup>7</sup> In this context, pressure refers to the distribution of force on the individual’s body surface that is in contact with the device.

**“ Evaluate the individual’s comfort when using an alternating pressure air mattress or overlay<sup>8</sup> “**

“Evaluate the individual’s comfort when using an alternating pressure air mattress or overlay. Powered alternating pressure air mattresses and overlays can be noisy and generate heat or motion that may be uncomfortable”.<sup>8</sup>

# Support Surface Solution



# Pro-care Optima offers

## Prolonged Pressure



Continuous Low Pressure (CLP)



Alternating Mode



Multi-zone Air Pressure



Auto Seat Inflation



QubiCell™ Design



Heel Relief Function

## Friction & Shear



4-way Stretch Top Cover with Low Friction & High MVTR



TPU Air Cells & Air Cell Holder Design

## Moisture & Heat



Micro Low Air Loss

## Pressure Mapping

By investigating the pressure mapping of Pro-care Optima, we can use the software to analyze the Pressure Area Index (PAI) and Pressure Redistribution Index (PRI) of different modes to see the performance of product, when threshold of interface pressure gets stricter, you can find out that Pro-care Optima can still offer good performance for prevention of pressure injuries.

**Equipment Used: The XSENSOR X3 Display Medical Mattress System**

**Software Used: Xsensor X3 medical V6**

**Method :** Each test is conducted over a 30-minute period during which the average, peak and minimum pressures are recorded.



**Pressure Area Index (PAI):** Pressure Area Index (PAI) is a method used to measure the interface pressure of the surface. The PAI is calculated as the proportion of sensors that register interface pressure values.<sup>9</sup>

**Pressure Redistribution Index (PRI):** Pressure Redistribution Index (PRI) is a method to assess the ability of a dynamic support surface to sustain interface pressures below a chosen set of thresholds. The PRI is calculated as the ratio of the time during which the dynamic support surface interface pressure trace spends below the threshold and the total time of one inflation/deflation cycle.<sup>10</sup>



## Product Therapy Modes and Performance

### Initial Inflation

Once the pump recognizes the mattress size through the quick connector, it will begin to inflate mattress which takes less than 30 minutes to complete the initial inflation.

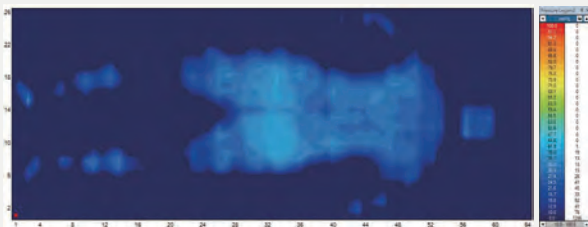


### Continuous Low Pressure (CLP)

**“ Consider using a reactive air mattress or overlay for individuals at risk for developing pressure injuries<sup>11</sup> ”**

Reactive air mattresses redistribute pressure by deforming in response to an individual's weight on the surface.<sup>12</sup> Pro-care Optima offers a Continuous Low Pressure mode, which provides a stable surface with a pressure lower than the corresponding level when in the alternating mode. Also, this therapy mode is for the patients who are not fond of vibrations or alternating sensations.

#### Supine Position:



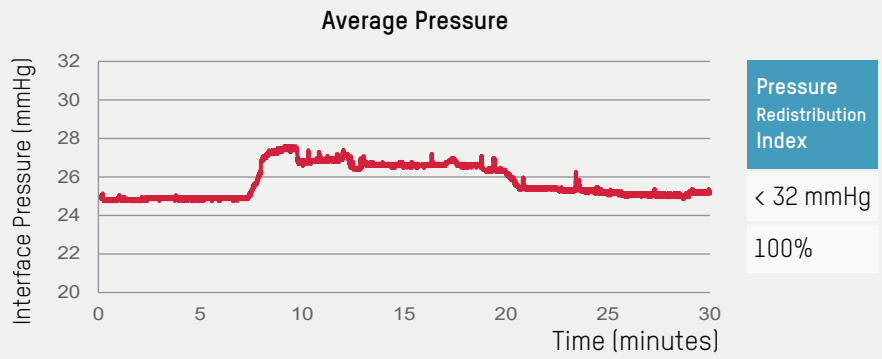
PAI & pressure mapping test of Pro-care Optima in the supine position for 30 minutes

User Height: 175 cm

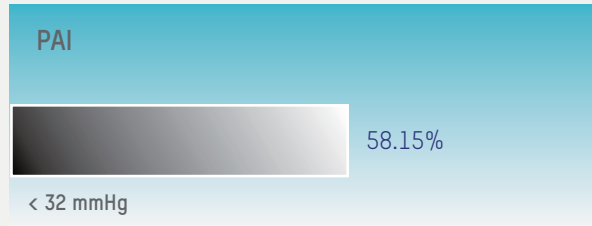
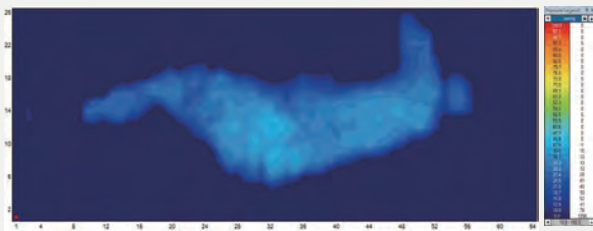
User Weight: 110 Kg

BMI: 35.9

Pro-care Optima (when used in Continuous Low Pressure mode) reaches a maximum of 27.6 mmHg and a minimum of 24.8 mmHg, and the 100% of interface pressures during its 30-minute cycle are all below 32 mmHg.



### Lateral Position:



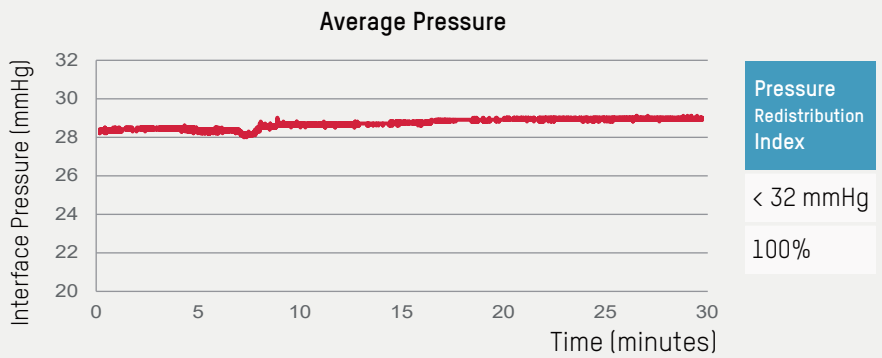
PAI & pressure mapping test of Pro-care Optima in the lateral position for 30 minutes

**User Height: 175 cm**

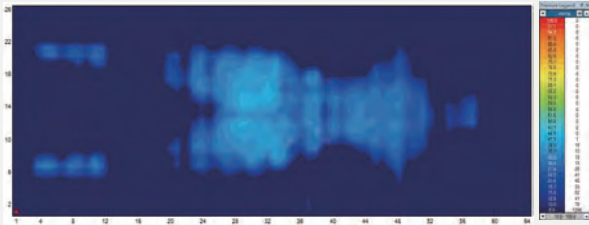
**User Weight: 110 Kg**

**BMI: 35.9**

Pro-care Optima (when used in Continuous Low Pressure mode) reaches a maximum of 29.1 mmHg and a minimum of 28.0 mmHg, and the 100% of interface pressures during its 30-minute cycle are all below 32 mmHg.



### Sitting Position:



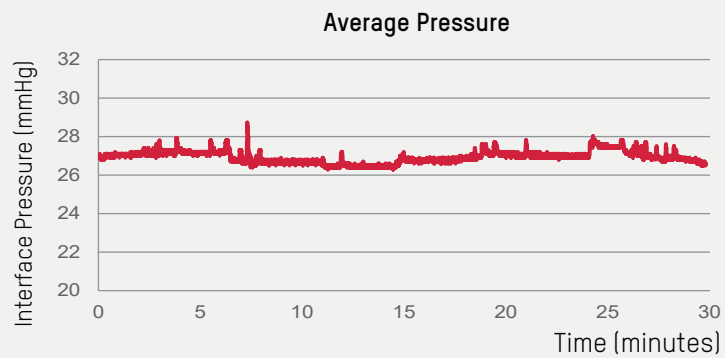
PAI & pressure mapping test of Pro-care Optima in the sitting position for 30 minutes

User Height: 175 cm

User Weight: 110 Kg

BMI: 35.9

Pro-care Optima (when used in Continuous Low Pressure mode) reaches a maximum of 28.8 mmHg and a minimum of 26.4 mmHg, and the 100% of interface pressures during its 30-minute cycle are all below 32 mmHg.



Pressure Redistribution Index

< 32 mmHg

100%

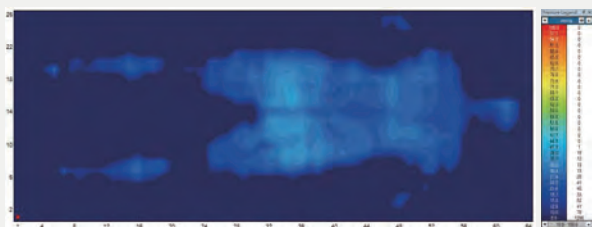


Alternating Mode

“ Assess the relative benefits of using an alternating pressure air mattress or overlay for individuals at risk of pressure injuries<sup>13</sup> “

Pro-care Optima offers an alternating mode, which continuously and sequentially inflate and deflate air cells (1-in-2 alternating) to avoid long term pressurization of tissue, and also provides four kinds of operating cycle time (10, 15, 20, 25 min).

Supine Position:



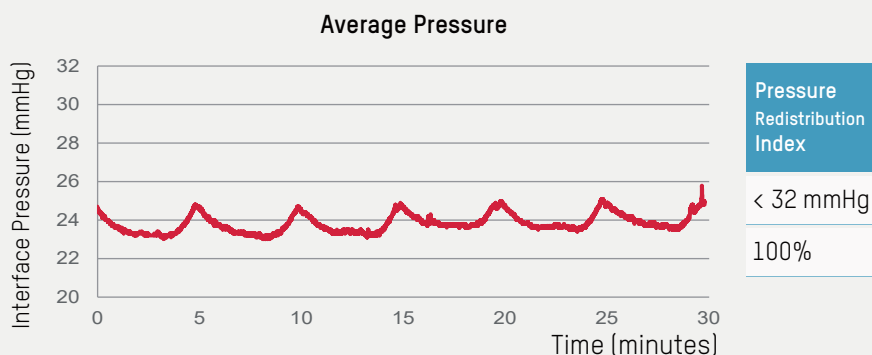
PAI & pressure mapping test of Pro-care Optima in the supine position for 30 minutes

User Height: 175 cm

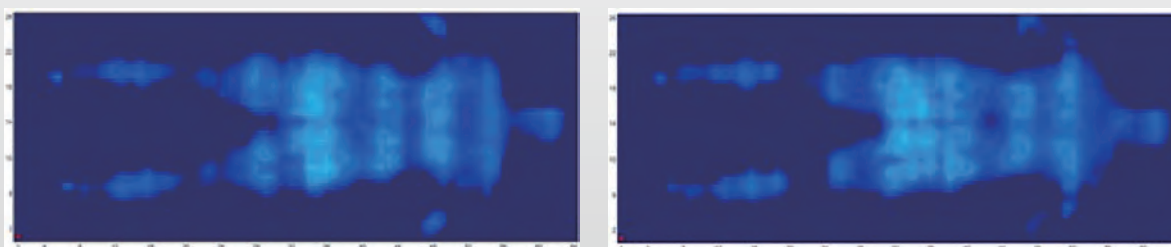
User Weight: 110 Kg

BMI: 35.9

Pro-care Optima (when used in alternating mode) reaches a maximum of 25.9 mmHg and a minimum of 23.1 mmHg, and the 100% of interface pressures during its 30-minute cycle are all below 32 mmHg.

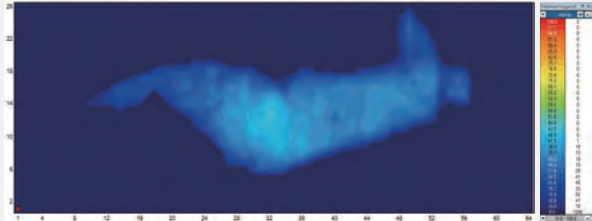


From the pressure mapping images you can easily observe the alternating situation in the supine position:





**Lateral Position:**



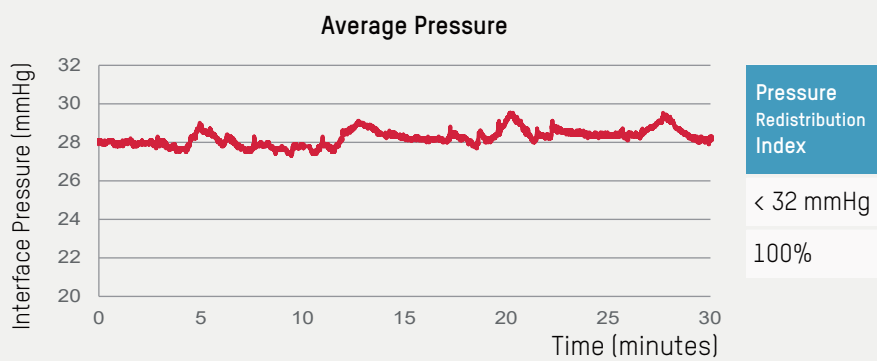
**PAI & pressure mapping test of Pro-care Optima in the lateral position for 30 minutes**

**User Height: 175 cm**

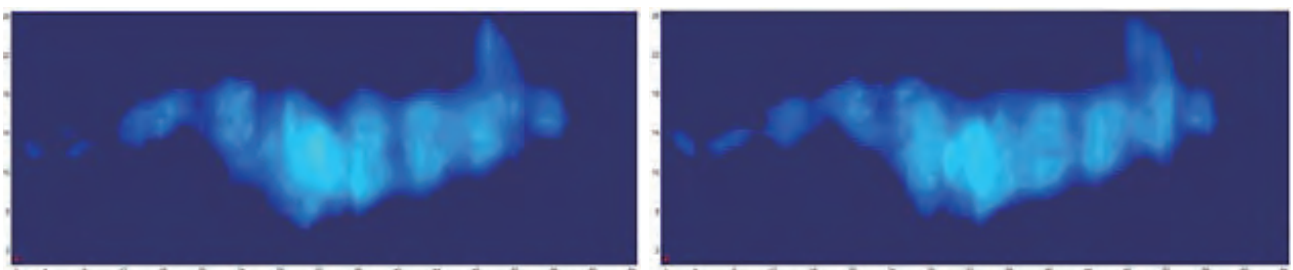
**User Weight: 110 Kg**

**BMI: 35.9**

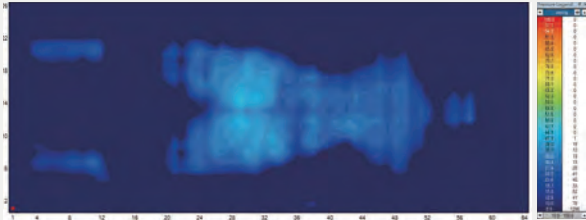
Pro-care Optima (when used in alternating mode) reaches a maximum of 29.5 mmHg and a minimum of 27.3 mmHg, and the 100% of interface pressures during its 30-minute cycle are all below 32 mmHg.



From the pressure mapping images you can easily observe the alternating situation in the lateral position:



**Sitting Position:**



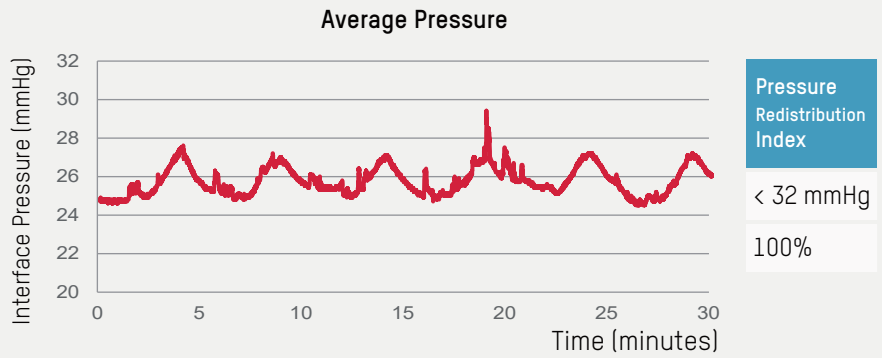
PAI & pressure mapping test of Pro-care Optima in the sitting position for 30 minutes

**User Height: 175 cm**

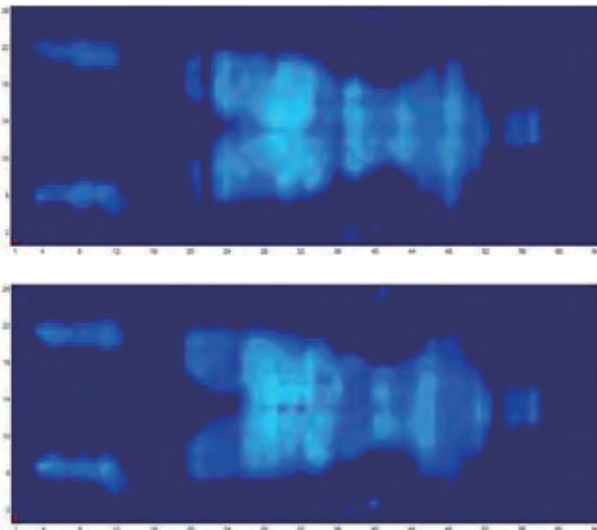
**User Weight: 110 Kg**

**BMI: 35.9**

Pro-care Optima (when used in alternating mode) reaches a maximum of 29.3 mmHg and a minimum of 24.4 mmHg, and the 100% of interface pressures during its 30-minute cycle are all below 32 mmHg.



From the pressure mapping images you can easily observe the alternating situation in the sitting position:



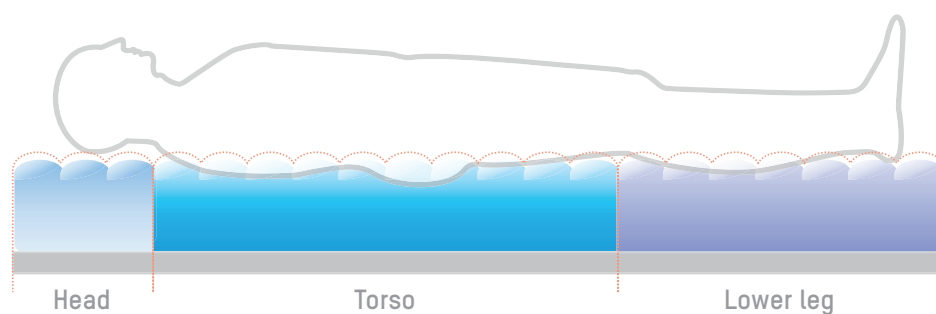
## Multi-zone Air Pressure

**“ Pressure redistribution is achieved by either increasing the body surface area that comes in contact with the support surface through immersion and envelopment (to reduce concentrations of weight over bony prominences).<sup>14</sup> ”**

In consideration of the body segment mass and anatomical structures, the mattress of Pro-care Optima is divided into three zones: Head, torso and lower leg.

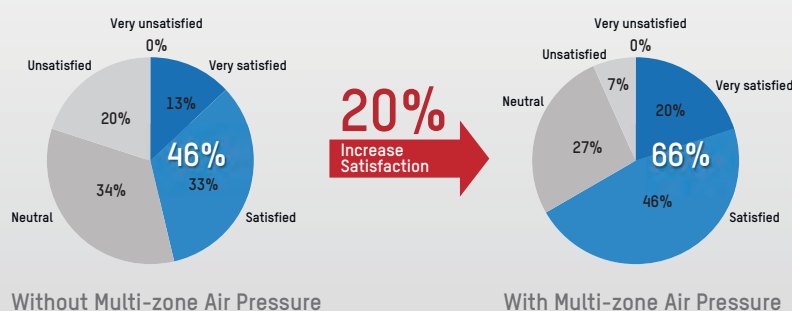
Torso accounts for more than 40% of the body weight and areas such as scapula, sacrum, and hip are susceptible to pressure injuries.<sup>15</sup> For instance, sacrum is known as the most common anatomical sites for pressure injuries<sup>16</sup> due to its thinner soft tissue<sup>17, 18</sup> and is located at the end of the spinal column, which is exposed to higher pressure.<sup>18</sup>

Providing with different inner pressure in each zone, Multi-zone Air Pressure demonstrates significant pressure redistribution to fit different patient contours with stability and comfort by better immersion and envelopment.



An in-house single-blinded test was done to evaluate the comfort level that Multi-zone Air Pressure offers to the participants.

73% (11 out of 15 users) would prefer the optimal comfort Multi-zone Air Pressure provides. In addition, there was a 20% increase in satisfaction percentage showing the comfort level was relatively higher in mattress with Multi-zone Air Pressure.

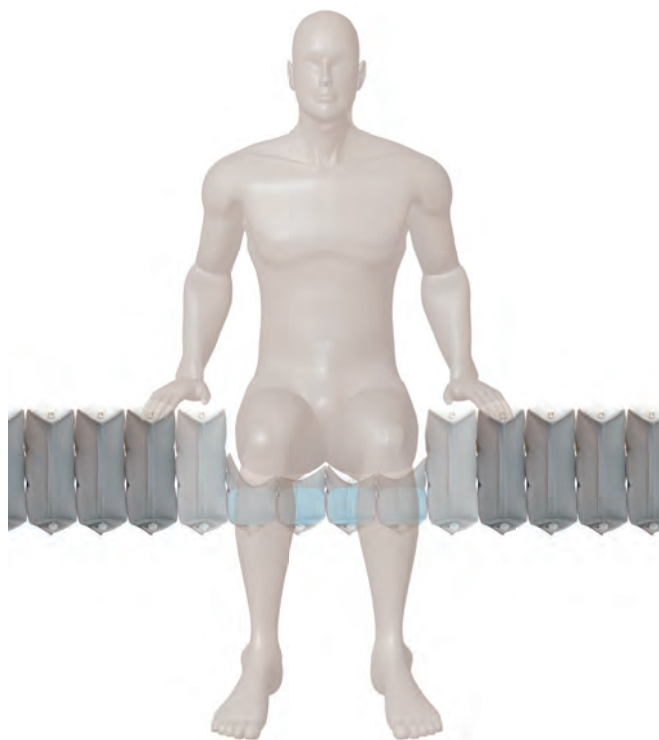


## Auto Seat Inflation

**“ For individuals with a pressure injury, consider changing to a specialty support surface when the individual: ‘Bottoms out’ on the current support surface.”<sup>19</sup> “**

To avoid the situation of bottoming out, Pro-care Optima offers an Auto Seat Inflation function, which automatically inflates when the head section has been raised by  $\geq 30^\circ$ , and provides extra support in sacral area during sitting position. The pressure in the whole mattress increases when the patient is in a fowler’s position for a steady support.

Pro-care Optima is also equipped with 6 Cell-in-Cell air cells at sacrum area, by which provide excellent support for the patient in sitting-up position or when exiting and entering the mattress.



## CPR Operation

CPR knob is located at the patient’s left-hand side of the mattress near the head section area. Whenever a CPR operation is needed, quickly turn the CPR knob to release air from the mattress. The CPR deflation time is within 15 seconds. The quick connector on the pump unit can be disconnected for an even faster deflation process.





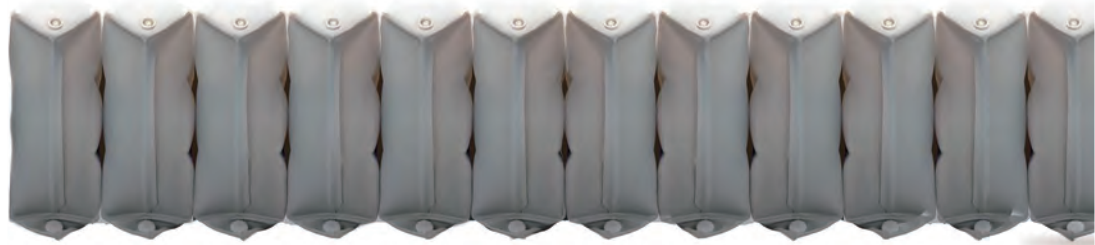
## Design of Mattress

### QubiCell™

**“ Evaluate the safety of alternating pressure air mattresses and overlays when in use. Some individuals may experience difficulty getting into and out of the bed when an alternating pressure air mattress or overlay is in use.”<sup>20</sup>”**

Pro-care Optima consists of 21 rectangular cells, providing a larger contact area and thus lower interface pressure in supine position.

Thanks to its solenoid valve technology, it can enable more stable & comfortable alternating cycles - it inflates odd air cells before deflating even air cells (and vice-versa) during the alternating process by turning the valves on and off sequentially to provide an effective therapy in high comfort for the patient.



### TPU Air Cells & Air Cell Holder Design



Thermoplastic polyurethanes (TPU) air cells used for Pro-care Optima mattress are highly resistant to hydrolysis, soft, less friction and even less noisy when patient is moving their body on the mattress, its material chose and the design of the air cell holders are in aids with reducing friction & shear forces for the patient lying in different postures.

### LCD Monitor

Pro-care Optima pump is equipped with a control knob without grooves (which has been designed for helping prevention of cross infection) and a LCD screen with an intuitive graphic design to save time and effort for operation and troubleshoot, reducing the chance of misuse.



## Heel Relief Function

**“ The heel is one of the two most common anatomical sites for pressure injuries. In a European survey on pressure injury prevalence, almost 80% of all Category/Stage IV pressure injuries were found at the sacrum and heels.<sup>21</sup> ”**



APEX Heel Relief Function is a simple and easy way to prevent and assist in treating heel pressure injuries by eliminating interface pressure from heels as if they are suspended in air. The heel is typically reported as the second most common sites for pressure injury development.<sup>21</sup>

One of the five knobs in the lower leg section can be deflated according to the patient's heel location to achieve zero pressure.

## Information of Top Cover

**“ Consider using textiles with low friction coefficients for individuals with or at risk of pressure injuries<sup>22</sup> ”**

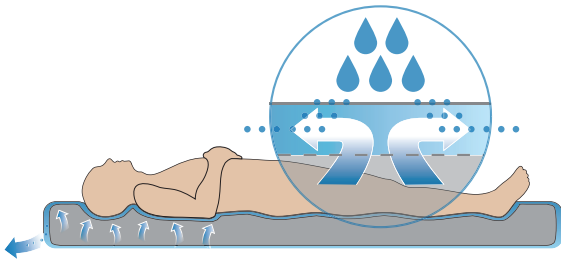


Pro-care Optima alternating pressure redistribution system is provided with a standard cover (sanitary cover sheet) with high-performance technical material which covers them completely and is biocompatible, with low friction ( $\mu = 0.21$  (static),  $\mu = 0.17$  (dynamic)) & shear forces, water resistant and highly vapor permeable.

The Moisture vapor transmission rate (MVTR) is 2315 g/24hrs/m<sup>2</sup> according to ASTM E96 Procedure BW.

## Microclimate Management

“ An increasing body of evidence suggests that the microclimate between skin and the supporting surface plays a role in the development of pressure injuries.<sup>23</sup> ”



As for the microclimate control, Pro-care Optima offers micro low air loss function, which provides good ventilation and reduces the accumulation of heat and moisture.

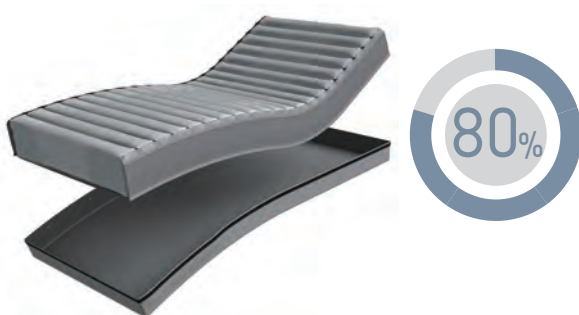
## Transport Mode & Power Failure

“ Contingency plans for power failure should be in place.<sup>24</sup> ”



The Pro-care Optima with optional battery pack can offer a non-stop dynamic pressure relief for up to 6 hours in addition to the 24 hours the standard mattress system can remain inflated during power failure or patient transfer.

## Design of Saving Time



The air cells with quick release detachable base on Pro-care Optima can be easily removed from mattress during decontamination which can save up to 80% of time compared to regular mattress systems. Pro-care Optima is also equipped with a cable management feature which can reduce tripping hazards for a safer healthcare environment.

# FAQ

## **(1) What is the material of air cells?**

Thermoplastic Polyurethanes (TPU) Air Cell has high resistant to hydrolysis, soft, less friction and less noisy when patient is moving their body on the mattress.

## **(2) There are no ventilated cells, why? Due to transport mode?**

Micro Low Air Loss function was adjusted to the side of the mattress.

The Pro-care Optima with optional battery pack can offer a non-stop dynamic pressure relief for up to 6 hours in addition to the 24 hours the standard mattress system can remain inflated during power failure or patient transfer.

## **(3) The mattress consists of how many zones?**

In consideration of the body segment mass and anatomical structures, the mattress of Pro-care Optima is divided into three zones: Head, torso and lower leg.

Providing with different inner pressure in each zone, Multi-zone Air Pressure demonstrates significant pressure redistribution to fit different patient contours with stability and comfort by better immersion and envelopment.

## **(4) What is the purpose of cell-in-cell air cells?**

Pro-care Optima is also equipped with 6 Cell-in-Cell air cells at sacrum area, by which provide excellent support for the patient in sitting-up position or when exiting and entering the mattress.

## **(5) How to achieve Heel Relief Function?**

There are five knobs in the lower leg section, which can be accessed to deflation of air cells according to the patient's heel location to achieve zero pressure.

## **(6) What is the max patient weight of this product?**

Pro-care Optima: 250 kg.



## References

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  2. NPIAP Pressure Injury Stages ([https://cdn.ymaws.com/npiap.com/resource/resmgr/online\\_store/npiap\\_pressure\\_injury\\_stages.pdf](https://cdn.ymaws.com/npiap.com/resource/resmgr/online_store/npiap_pressure_injury_stages.pdf))
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  6. International review. Pressure ulcer prevention: pressure, shear, friction and microclimate in context. A consensus document. London: Wounds International, 2010.
  7. Section 10: Support Surfaces. **Page 155**
  8. Section 10: Support Surfaces. **Page 166**
  9. Kenney L, Rithalia SVS. 1999. Mattress & bed resource file: assessment of support surfaces. *J Wound Care (Suppl)*; Part 2: 1-8.
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  12. Malbrain M, Hendriks B, Wijnands P, Denie D, Jans A, Vanpellicom J, De Keulenaer B. 2010. A pilot randomised controlled trial comparing reactive air and active alternating pressure mattresses in the prevention and treatment of pressure ulcers among medical ICU patients. *J Tissue Viability*. 19(1), 7-15.
  13. Section 10: Support Surfaces: Recommendation 7.7. **Page 165**
  14. Section 10: Support Surfaces. **Page 159**
  15. Robert K. Jensen. 1989. Changes in segment inertia proportions between 4 and 20 years. *Journal of Biomechanics*.
  16. Section 9: Heel Pressure Injuries. **Page 145**
  17. Clark M, Rowland LB, Wood HA, Crow RA. 1989. Measurement of soft tissue thickness over the sacrum of elderly hospital patients using B-mode ultrasound. *J Biomed Eng*.
  18. Abed Elahad, J., McCarthy, M.W., Goverman, J. et al. 2018. An Overview of Sacral Decubitus Ulcer. *Curr Trauma Rep*.
  19. Section 10: Support Surfaces: Good Practice Statement 7.9. **Page 169**
  20. Section 10: Support Surfaces. **Page 166**
  21. Section 9: Heel Pressure Injuries. **Page 145**
  22. Section 6: Preventive Skin Care: Recommendation 3.4. **Page 88**
  23. Section 2: Etiology. **Page 22**
  24. Section 10: Support Surfaces. **Page 157**

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Pro-care Optima Operation Video



Pro-care Optima Promotional Video

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