ServiceMed
HUMAN WIDE CARE

Rev 00 06-08-25

FLOW AIR

SILENT FLOW TECHNOLOGY

INTRODUCTION

The main cause of pressure injuries is intense and prolonged pressure on soft tissues, which is often associated with shear and friction forces, leading to inflammation, oedema, tissue deformation and ischaemia with consequent damage frequently occurring at bony prominences. These factors are affected by patient-specific risk factors and local conditions, such as moisture, skin breathability and temperature, which reduce tissue tolerance to mechanical stress and increase the risk of pressure injuries [1,2,3].

For patients at high risk of developing pressure injuries, particularly those with skin microclimate changes, using a device that combines air pressure relief with effective immersion and real moisture control through active air loss could be a more effective and practical alternative to solutions currently used to prevent pressure injuries in clinically more complex cases.

Thanks to an innovative proprietary technology called Silent Flow and a highly breathable cover, the Flow Air anti-decubitus system ensures efficient air circulation and microclimate control on the support surface, thereby:

- promoting the diffusive evaporation and natural skin thermoregulation process
- preventing maceration and pressure injuries caused by moisture
- preserving skin integrity and hydration without interfering with medications.

This advanced feature complements the performance of the most innovative air anti-decubitus systems, offering customised interface pressure control, a high level of immersion and optimal pressure distribution through different operating modes.

The aim is to tackle the main cause of pressure injuries: prolonged excessive pressure on skin tissue.

DESCRIPTION OF AN INNOVATIVE, HIGH-TECH ANTI-DECUBITUS SYSTEM

The Silent Flow system ensures air loss at each cell, acting on both sides of the surface. Unlike traditional systems (Figure 1), in which air holes are made directly on the cells, in the Silent Flow system the holes are located on special lateral manifolds (Figure 2) and are angled to optimise air flow.

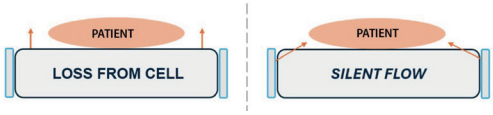
The comparison table below shows the benefits of this solution compared to the traditional approach with direct loss from the cell:

SILENT-FLOW	CESSIONE DA CELLA
PRO	**PRO**
Holes corresponding to each cell	Holes corresponding to each cell
No risk of occlusion by the cover	No risk of occlusion by the patient
No risk of occlusion by the patient	**CON**
Larger holes for more efficient flow	Risk of occlusion by the cover
Lower pressure loss	Higher pressure loss
Quieter at the same flow	Noisier at the same flow
Unchanged cell temperature	Cell warm-up due to air passage

Below is a short description of the points covered in the table:

NO RISK OF OCCLUSION

The Silent Flow system guarantees continuous and constant air loss regardless of the patient's position. The air release holes, on both sides at each cell, are designed with an inclination of about 30° in relation to the support surface. This angle directs the air flow towards the cover, effectively replicating the direct loss mechanism from the cells, while preventing occlusions caused by patient pressure or cover adhesion.



Furthermore, the position of the holes upstream of the cell reduces pressure loss inside the cell itself, thus improving efficiency in delivery, pressure control and turbine longevity.

The larger hole diameter reduces friction from the edges, allowing a more efficient air flow and quieter operation. This means that a single 2 mm hole ensures faster air flow and less noise than two 1 mm holes.

Figure 1 Typical position of holes for direct loss from the cell. However, the position is strongly lateralised to reduce the risk of occlusion by the patient's body but not by the cover.

Figure 2 Position of "Silent Flow" holes. As you can see, the difference is only a few centimetres compared to standard solutions with direct loss from the cell. The angle of the hole ensures that the flow is delivered to the same area but without any risk of occlusions caused by the patient and/or cover.

UNCHANGED CELL TEMPERATURE

The Silent Flow system uses two high-efficiency low-voltage turbines that minimise the temperature increase of the outlet air compared to traditional AC blowers. Furthermore, the position of the outlet holes upstream of the cells means that any air temperature increase is prevented from reaching the cells or to the patient's body, unlike traditional direct loss systems.

The Flow Air system, with its automatic feedback-controlled mechanism, continuously monitors the pressure levels multiple times per second to maintain stable therapy conditions even with patient movements or position changes. It features Dual-Drive™ technology, which manages the two inflation lines of the support surface separately using high-efficiency turbines. This technology can quickly respond to surface load changes and maintain constant pressure throughout the treatment. The very short response times combined with the separate control of the lines ensures extremely accurate and customised pressure profiles.

The surface is composed of 20 8-inch air cells, divided into three separate and independently-controlled zones (head, trunk, heels), designed to optimise the distribution of pressure and avoid cross-interference between zones. Each cell can be detached and replaced individually using Quick-Disconnect connectors located on the side. The head zone can be entirely excluded with a single operation to allow for endotracheal intubation operations.

The heel zone includes five cells with a specific Full Immersion design, which increases compliance of the support and maximises immersion even with minimal body weight. This ensures the effective distribution of the pressure across a wide range of clinical conditions.

LABORATORY TEST RESULTS

Flow Air is the result of a long development process based on numerous experimental tests and proprietary protocols designed to simulate real clinical conditions. The assessment process focused on three key performance areas: immersion, dynamic pressure relief and microclimate regulation.

1. Immersion (Pressure Area Index – PAI):

The level of immersion guaranteed by Flow Air was assessed using full-body pressure mapping with the XSensor X3 Medical system. The main reference parameter was the Pressure Area Index (PAI), defined as the percentage of the body surface area in contact with the support surface that remains below 30 mmHg. This threshold is widely recognised as critical for maintaining proper tissue perfusion and preventing pressure injuries [1,3]. Pressure mapping showed a large area of contact maintained at pressures below 30 mmHg. The average PAI value recorded was 100%, indicating excellent immersion capacity and effective distribution of the pressure over the entire support surface.

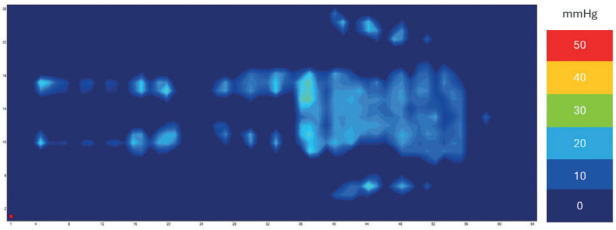


Figure 1 pressure map during Immersion treatment

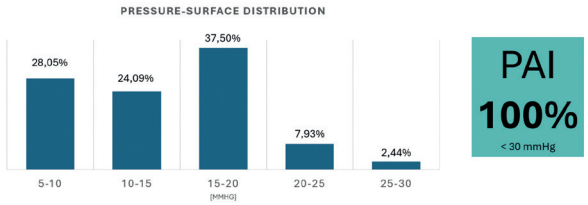


Figure 2 (left) pressure distribution in relation to the contact area (right) PAI Pressure Area Index

2. Alternating "Zero Pressure" mode (Pressure Relief Index - PRI):

The system's alternating "zero pressure" mode was assessed by calculating the Pressure Relief Index (PRI), an indicator that quantifies the pressure reduction between the loading and discharge phases of the dynamic cycle. Measurements were taken using capacitive sensors over a 6.5 × 6.5 cm² area, placed at the ischial prominence and heel of a Simulaids manikin representing a patient weighing 90 kg and measuring 180 cm.

Following the recommendations of the Tissue Viability Society (2010), the performance of dynamic surfaces should be assessed using sub-threshold pressure time (e.g. time spent below 30, 20 and 10 mmHg) and pressure amplitude parameters during the cycle. These parameters are physiologically relevant, as minimising pressure levels for prolonged periods has been proven to improve tissue perfusion in both healthy volunteers and subjects with vascular impairment [2,4–7].

During operation in alternating Zero-Pressure™ mode, measurements taken at the ischial areas and heels showed a clear distinction between the loading and discharge phases. The system kept pressures below 30 mmHg for over 50% of each cycle, with high pressure amplitude, consistent with physiological recommendations to promote tissue perfusion [2, 4–6].

Thanks to Dual-Drive™ technology, unlike conventional valve systems, pressure can alternate between the two lines in just a few seconds, thereby maximising the discharge time in the target area.

In the heel zone, the use of specially designed cells, calibrated to ensure the maximum immersion of bony prominences, has allowed complete discharge of the heel during the discharge phase, with contact pressures not exceeding 14 mmHg.

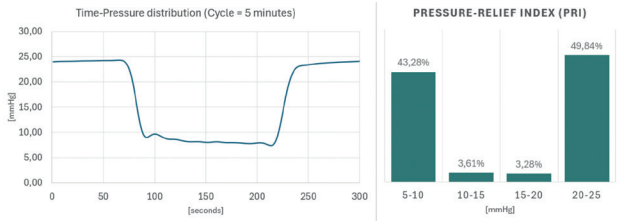


Figure 3 ISCHIUM - (left) contact pressure trend over time (right) Pressure Relief Index

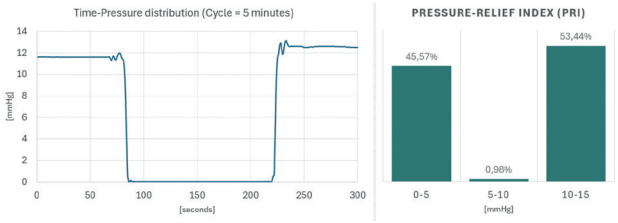


Figure 4 HEEL - (left) contact pressure trend over time (right) Pressure Relief Index

3. Microclimate control (Diffusive Evaporation Index - DEI):

Diffusive evaporation is the passive process by which water vapour passes through the device's cover material along a concentration gradient, without any contribution from active air flows. This mechanism is crucial for maintaining an optimal microclimate and preventing moisture-related skin damage. It depends mainly on the vapour permeability of the cover material and the moisture gradient between the skin surface and the micro-environment inside the support surface.

The standard test methods (e.g. ASTM E96, JIS L1099) used to determine the Moisture Vapour Transmission Rate (MVTR) are designed to assess the breathability of fabrics under controlled laboratory conditions. However, these tests have two main limitations:

- Failure to compare different protocols even though the results are given in the same unit (g/m²/24h).
- Assessment of only the cover material in isolation, ignoring the actual conditions of use of the support surface.

For this reason, Flow Air's breathability was assessed using a proprietary protocol designed to quantify an effective Diffusive Evaporation Index.

Under standard ambient temperature and pressure conditions (21°C, 50% RH), an absorbent support (55 × 40 cm, 100 g dry) saturated with 200 g of water was placed directly on the support surface cover. To prevent direct evaporation into the ambient, the setup was sealed with a PVC film (60 × 45 cm, 0.35 mm thick).

A heating plate, set at 36°C and regulated by a thermocouple and PID controller, was placed on top of the film to simulate body temperature. Lastly, a rigid plate of the same surface area with a load of 40 kg was applied to simulate the average pressure exerted by a supine patient.

After 8 hours, the weight loss of the absorbent pad was measured to calculate the Diffusive Evaporation Index in g/m²/24h.

The measured Diffusive Evaporation Index reached 1870 g/m²/24h, significantly higher than that of any standard air flow system. This result confirms the system's ability to actively control the microclimate, effectively reducing moisture at the interface between skin and support surface and helping to prevent moisture-related skin damage.

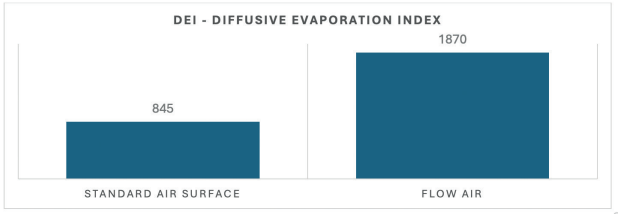


Figure 5 Diffusive Evaporation Index

BIBLIOGRAPHICAL REFERENCES

1. Defloor T. (2006). The risk of pressure ulcers: a conceptual scheme. Journal of Clinical Nursing, 15(4), 469–476.
2. Tissue Viability Society. (2010). Laboratory measurement of the interface pressures applied by active therapy support surfaces: a consensus document. Journal of Tissue Viability, 19(1), 2–6. doi:10.1016/j.jtv.2009.11.010
3. Phillips LD. (2007). Interface Pressure Measurement: Appropriate Interpretation of This Simple Laboratory Technique Used in the Design and Assessment of Pressure Ulcer Management Devices. Primary Intention: The Australian Journal of Wound Management, 15, 106.
4. Rithalia SV, Heath GH, Gonsalkorale M. (2000). Assessment of alternating-pressure air mattresses using a time-based pressure threshold technique and continuous measurements of transcutaneous gases. Journal of Tissue Viability, 10, 13–20.
5. Van Schie C, Ragunathan S, Rithalia S, Boulton AJM. (2004). Heel blood flow studies using alternating pressure air mattress systems in diabetic patients. Manchester Diabetes Centre, Manchester Royal Infirmary, University of Salford.
6. Goossens RM, Rithalia SVS. (2005). Can interface pressure be used to study tissue perfusion? Oral presentation, 12th International Conference of Biomechanical Engineering, Singapore.
7. Rithalia SVS, Goossens R, Gonsalkorale M. (2005). Does new technology in alternating pressure air mattress systems improve physiological performance? Oral presentation, EWMA Conference, Stuttgart.

FOR INFORMATION AND PURCHASE:

info@servicemed.it / 800-688841 / www.servicemed.it / www.medicair.it