# Hill-Rom's Support for Standardized Testing of Support Surfaces

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## Abstract

The National Pressure Ulcer Advisory Panel's (NPUAP) Support Surface Standards Initiative committee (S3I) was created in 2001 to develop uniform terminology, test methods and reporting standards for support surfaces. It is composed of a variety of experts in the industry representing academia, independent test labs, industry, physicians, nurses, and other clinicians. Hill-Rom believes very strongly in, and is very supportive of this effort. The first mattress performance standards were published in 2014 to evaluate microclimate management performance and depth of immersion of the body into the surface. Also approved and awaiting publication are tests of envelopment — another key indicator of pressure redistribution capability — and horizontal stiffness, or shear "pushback force" on the body. These tests are now available to provide interested facilities with independent performance information determined by experts to be relevant to the management of the risk factors for pressure injury. For more information, please consult "Standardizing Support Surface Testing and Reporting: A National Pressure Ulcer Advisory Panel Executive Summary" in the September 2015 edition of the Journal of Wound Ostomy and Continence Nurses (WOCN).

## Introduction

At Hill-Rom, we understand how important it is for caregivers to be confident that their patients are being cared for on support surfaces that manage the risk factors for skin breakdown at the highest level of effectiveness. We also realize how difficult this is to determine without the assistance of a knowledgeable, impartial third party.

This is why we strongly support the work of the National Pressure Ulcer Advisory Panel's (NPUAP) Support Surface Standards Initiative (S3I). The NPUAP is an independent, not-for profit organization dedicated to the prevention and management of pressure ulcers through education, best practice statements, and research. They are a recognized resource for health care professionals, government and health care agencies.[1] Their S3I initiative is a direct response to this need for objective, credible information on surface performance.

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Hill-Rom has worked closely with the committee since it was formed to develop, evaluate, and validate these methods. The first standards were published in 2014 to evaluate microclimate management performance and depth of immersion into the surface.[2] Also approved and awaiting publication are tests of envelopment — another key indicator of pressure redistribution capability — and horizontal stiffness, or shear "pushback force" on the body.

Each test was carefully evaluated through a series for studies by clinicians and researchers to determine clinical relevance and by engineers to determine accuracy and consistency of measurements. Finally, a "validation procedure" was conducted on each method. This involved using each proposed test to evaluate the same set of support surfaces at a series of labs across the country. The test methods are outlined below.

## Microclimate Management

Microclimate management products are intended to combat the accumulation of heat and humidity at the skin surface.[3] Warmer skin has a higher demand for nutrients and is therefore more vulnerable to ischemic breakdown when blood flow is reduced by pressure.[4,5] Wetter skin is weaker, more susceptible to tearing, and less able to bear mechanical loads.[6] It is therefore generally valuable to remove a) greater amounts of heat to keep the skin cool (as long as the patient is comfortable) and b) greater amounts of humidity or moisture.

The S3I committee has validated and approved two methods of determining microclimate management performance. One of these is the Sweating Guarded Hot Plate (SGHP) method that Hill-Rom uses for all developmental and verification work. The SGHP method measures the rate at which heat and humidity pass from the skin and through the support surface. Results are most intuitively reported in terms of a rate of heat withdrawal in Watts/$m^2$ and evaporative capacity in g/$m^2$-hr **(Figure 1).**

## Pressure Redistribution

Pressure redistribution performance is obviously extremely important because this characterizes the degree to which a surface can offload pressure at the bony prominences that deform the tissue and occlude blood flow. Tests of Immersion and Envelopment have been validated and approved by the NPUAP. (The Immersion test has been published; the Envelopment is not expected to be published until late 2017.)

**Immersion:** the depth of penetration into the surface

**Envelopment:** the degree to which a surface is able to conform to the irregularities of the body.

The distinction between the two terms is best understood by reference to **Figure 2.** Both the depth of penetration and the degree of conformability have been used as surrogates for pressure redistribution. The index that emerged most favorably from the S3I validation study was peak interface pressure. A pelvis-sized sensored mannequin is pressed into the seat region with a force representing a 180 lb. patient. Lower levels of peak interface pressure in this region are associated with greater therapeutic performance **(Figure 3).**

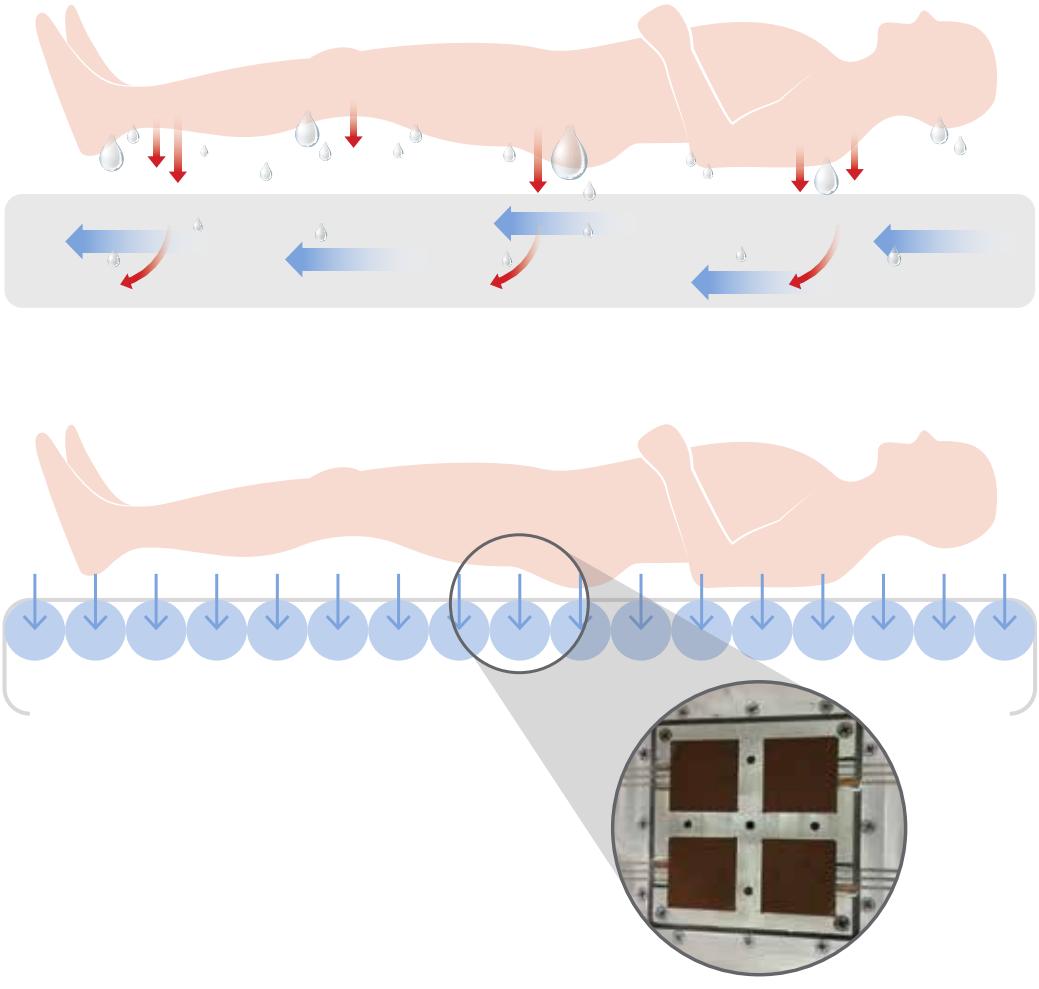

**Figure 1:** The Sweating Guarded Hot Plate is one of two methods approved to measure microclimate management performance. It measures equilibrium rates at which heat and moisture pass through surface.

*Note: Sensor plate upwards facing for illustrative purposes.*

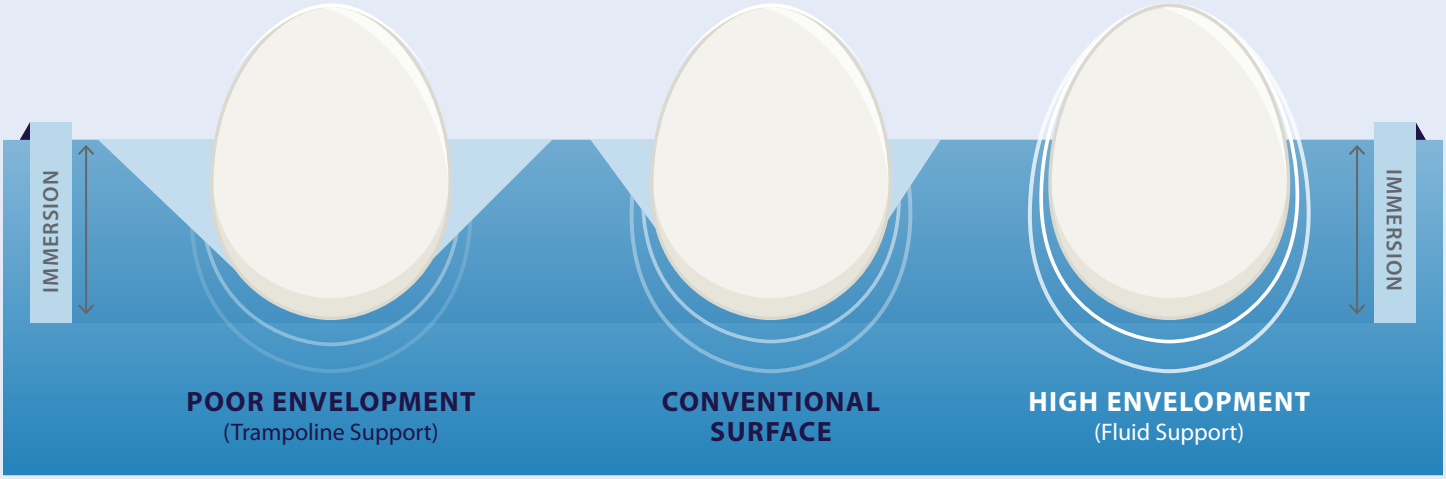


**Figure 2:** Distinction between Immersion and Envelopment. Three Eggs with Identical Levels of Immersion (penetration depth into the surface) but different levels of Envelopment (conformability and contact area). Despite identical immersion, the difference in envelopment leads to significantly different levels of peak interface pressure

## Shear (Horizontal Stiffness test)

Shear is normally thought of as the push-back force on the body when it moves across the surface. Higher levels of shear, like pressure, cause increased tissue deformation that can occlude blood flow and cause delamination and sloughing of the layers of the skin. The Horizontal Stiffness test is a simple measure of shear in which a pelvic mannequin is weighted to represent a 180 lb. patient. The indenter placed in the seat section and pulled horizontally 10 mm towards the foot end of the bed. The force is recorded during the movement and after movement stops at intervals of one minute for a total of five minutes. Higher values represent greater shear, or push back force on the pelvis **(Figure 4).**

For more information on the tests, how to use them, and how to interpret the results, we recommend you consult the S3I publication ***"Standardizing Support Surface Testing and Reporting: A National Pressure Ulcer Advisory Panel Executive Summary".*** The document was published in the September 2015 edition of the Journal of WOCN.[7]

## Summary

Hill-Rom is committed to using the objective, third party testing methods of the S3I to validate the performance of our surfaces. Whatever testing claims we make about our surfaces, you can be sure we've taken appropriate measures to ensure an unbiased stance.

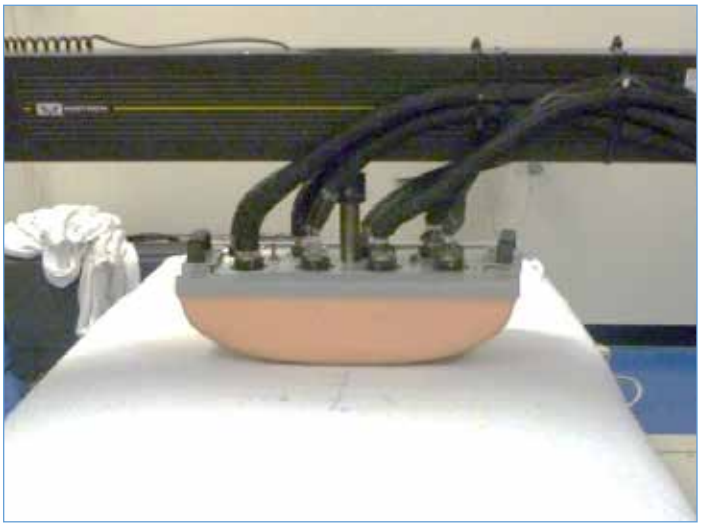

**Figure 3:** Envelopment: A pelvic-sized mannequin is pressed into the seat section of the surface at the force level applied by a 180 lb. patient. Sensors in the device are used to measure the peak interface pressure.

**Figure 4:** Horizontal Stiffness Test. A pelvic-shaped device is placed in the seat section and pulled 10 mm toward the foot f the bed. The resulting pushback force, a measure of shear, is recorded at 0, 1 2 3, 4, and 5 minutes after the motion.

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