AIREZ 2.0 Microclimate Testing & Results

Microclimate Test Relevance, Method & Setup

Based off independent testing at University of Pittsburg Human Engineering Research Laboratories - Sept. 2018 draft of ISO 16840-7

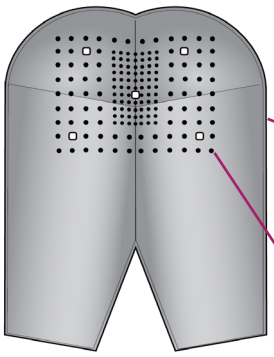
Prolonged heat and moisture exposure can reduce tissue tolerance. At the University of Pittsburgh's Human Engineering Research Laboratories (HERL), temperature and humidity are measured simultaneously at the body-cushion interface to evaluate microclimate performance.

The biggest difference is what each measurement tells us:

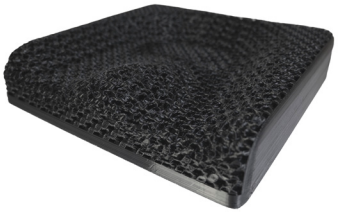
Microclimate Factor	What it Measures	Clinical Relevance
Interface Temperature (°C)	Heat buildup between the body and cushion during sitting.	Increased tissue metabolic demand and thermal stress.
Relative Humidity (%RH)	Moisture in the air between the body and cushion relative to what the air can hold at that temperature.	Skin moisture exposure, over-hydration, and increased susceptibility to friction-related damage.

TEST PROTOCOL

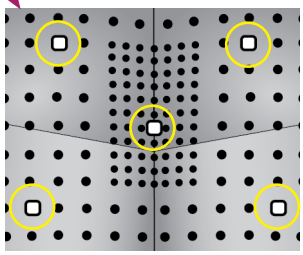
- **Circulated heat -** Water heated to ~35°C (~95°F) circulated through the indenter.
- **Sustained load** - 500 N load (incl. indenter weight) applied for 3 hours, removed for 1 minute, then reapplied for 15 minutes.
- **Averaged readings** - Five sensor readings averaged into one temperature curve and one humidity curve per cushion, across three trials per configuration



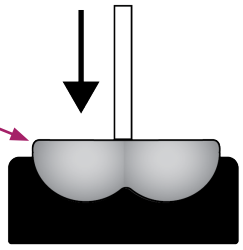
Rigid Loading Indenter



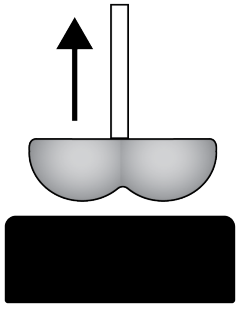
AIREZ 2.0 Cushion
shown without cover



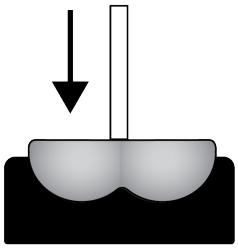
Five Indenter Sensors



500 N Load 180 min (3 hrs)



Wait 1 min



500 N Load 15 min

AMBIENT CONDITIONS

- Temperature: 23–25°C (73–77°F)
- Relative humidity: 45–55%
- Continuous load duration: >3 hours

This procedure characterizes the cushion-and-cover system's resistance to heat and vapor transfer, a configuration that restricts vapor movement shows greater humidity accumulation.

CLINICAL RELEVANCE:

Standardized laboratory testing provides objective, reliable measurements of how well a cushion manages heat and moisture. By simulating prolonged sitting, researchers measure changes in temperature and humidity at the body-cushion interface, providing a more accurate assessment of microclimate performance rather than perceived warmth or comfort alone *(Couzens et al., 2026)*.

Interface Temperature Under Prolonged Loading

AIREZ 2.0 cushion; standard cover

KEY FINDINGS:

Independent HERL testing showed **AIREZ 2.0 cushion maintained the lowest interface temperature of the cushions evaluated**, with only a 0.1°C (0.2°F) rise across more than three hours of continuous loading *(Brienza & Brienza, 2026)*.

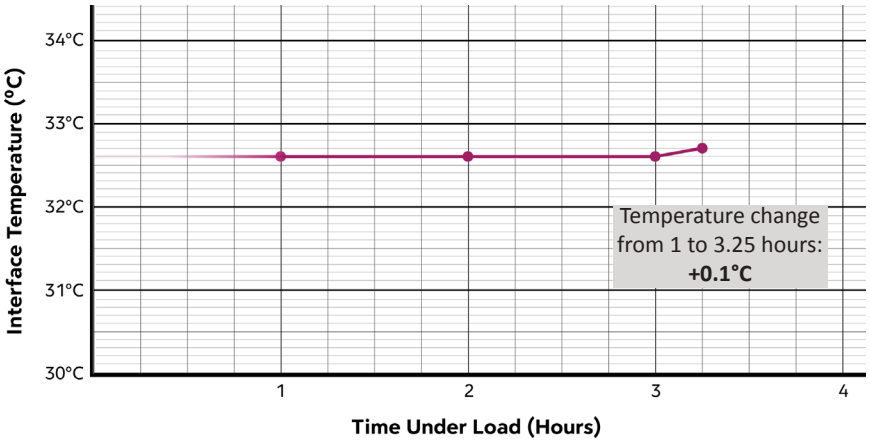


AIREZ 2.0 Cushion
shown with standard cover

AIREZ 2.0 Interface Temperature During Prolonged Laboratory Loading (Brienza & Brienza, 2026).

Time Under Load	Interface Temperature
1 hour	32.6°C (90.6°F)
2 hours	32.6°C (90.6°F)
3 hours	32.6°C (90.6°F)
3.25 hours	32.7°C (90.8°F)

These lab findings characterize one extrinsic variable, not reduced pressure-injury incidence.



CLINICAL RELEVANCE:

Temperature is not simply a comfort measure. Research suggests that tissue metabolic demand increases approximately **6–13% for every 1°C increase in skin/tissue temperature**. Under sustained mechanical loading, that increased metabolic demand occurs at the same time that tissue perfusion may be compromised *(Gefen et al., 2022; Kottner et al., 2018; Zeevi et al., 2018)*.



Human experimental research has further demonstrated that a **1°C increase in temperature can have an effect on post-load reactive hyperemia comparable to approximately 12–15 mmHg of additional interface pressure** *(Gefen et al., 2022; Zeevi et al., 2018)*.

	DURING PRESSURE	STRESS ON TISSUE	CELL WASTE BUILDUP	BLOOD SURGE WHEN PRESSURE RELIEVED	RISK OF SKIN DAMAGE
Normal Skin Temperature	**Baseline**	**Body Weight**	**Moderate**	**~3.5x**	**Low**
	Cells burn oxygen at a steady pace	Standard pressure from body weight	Some waste builds up while blood is blocked	Strong, healthy rush of returning blood	Redness fades quickly; skin recovers
1°C Warmer Skin Temp	**+10-13%**	**~+12-15 mmHg**	**Heavy**	**Up to 5x**	**High**
	Cells burn oxygen faster & run out sooner	Each 1°C stresses tissue like added pressure	Rapid waste buildup & severe oxygen debt	Forceful surge of returning blood	Swelling & reperfusion injury

(Jimenez Cerquera et al., 2025)

Bottom Line: Keeping skin just 1°C cooler slows oxygen use while blood flow is cut off, so the returning blood surge stays gentle enough to heal skin rather then injure it.

Interface Relative Humidity by Cushion Configuration

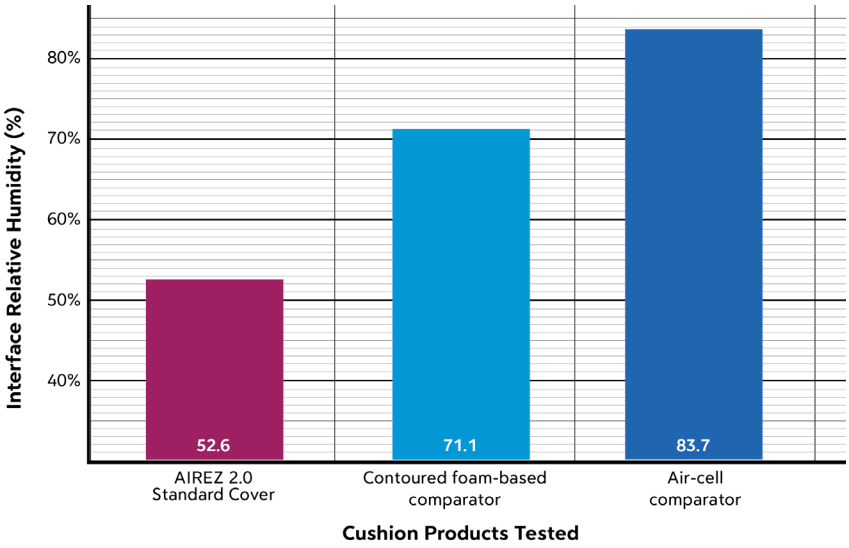
Testing performed under the same loading and environmental conditions.

KEY FINDINGS:

The **AIREZ 2.0 standard-cover configuration recorded the lowest interface relative humidity** among the cushions evaluated *(Brienza & Brienza, 2026)*.

Interface Relative Humidity (RH) Among Tested Cushion Configurations (Brienza & Brienza, 2026).

Cushion Configuration	Interface RH
AIREZ 2.0 with standard cover	52.6%
Contoured foam-based comparator	71.1%
Air-cell comparator	83.7%



Results apply only to the specific cushions, covers, sizes, and laboratory conditions evaluated.

SYSTEM MATTERS

An alternate-cover AIREZ configuration produced a similar temperature profile, but higher humidity of 60.4%. Microclimate performance depends on the complete system (cushion, cover, liner, construction), not the cushion core alone (Couzens et al., 2024; Damiao & Gentry, 2024).

CLINICAL RELEVANCE:

Elevated interface humidity may indicate limited moisture evaporation and an environment that promotes increased skin hydration. Studies show the skin's outer layer is stable between about 40% and 60% humidity and absorbs water faster above 60% relative humidity. *(Imhof et al., 2009)*

Although normal skin hydration is essential, prolonged excessive moisture exposure can compromise the skin barrier and increase susceptibility to mechanical damage. Skin hydration rises disproportionately when surrounding humidity exceeds about 60% *(Imhof et al., 2009; Kottner et al., 2018)*

Under the same laboratory conditions, AIREZ 2.0 with the standard cover measured 52.6% RH, below the 60% threshold. The contoured foam comparator (71.1% RH) and air-cell comparator (83.7% RH) were above it. These differences are important because higher interface humidity may limit moisture evaporation and contribute to prolonged skin hydration leading to maceration.



One factor alone might not have the most detrimental effects on skin integrity and health. The seating microclimate consists of the interaction between interface temperature, relative humidity, airflow, friction, and shear. Together, these variables influence tissue tolerance during prolonged sitting.

Maintaining a stable skin-support microclimate may therefore represent an important component of tissue protection alongside pressure redistribution, positioning, and shear management.

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