



WheelAir



WheelAir

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# Cool, Comfortable, in Control

Our vision is to create a world where every wheelchair user feels comfortable and in control of their temperature and skin microclimate.

With years of product design experience, clinical partnerships, and input from wheelchair users, the WheelAir team understands how to tackle problems caused by heat, sweat, and moisture.

**WheelAir** is the first temperature, humidity, and moisture control system designed specifically for, and to fit all, wheelchairs. By dispersing air evenly across your back or seat using the patented channel technology, it helps avoid issues caused by overheating and (over) sweating while keeping skin dry and clean.



# Why WheelAir?

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## Overheating

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Take control of body temperature.

Whether as a result of medication, autonomous nervous system dysregulation, or a worsening of neurological symptoms, cooling yourself down when you are unable to sweat sufficiently can be a challenge.

Once the overheating process has started, it will take much longer to cool back down, which is why we focus on preventing it altogether.

Problem:

- Increased risk of developing heat exhaustion or heatstroke.
- Muscle spasms, cramps, heat-induced seizures, and nausea.

## Over-Sweating

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Prevent sweat build-up.

Sweating too much can be mentally distressing and have an impact on the skin tissue with symptoms such as red marks on the skin, rashes, and the possibility of developing moisture associated skin damage.

Problem:

- A need to change clothing multiple times per day.
- Skin macerates and becomes vulnerable: risk of moisture lesions and skin ulcers.
- Difficulty finding the right seating solution.

## Microclimate Control

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Manage skin temperature and relative humidity.

For individuals struggling with overheating or over-sweating, managing skin microclimate can be a challenge. Research indicates that the ideal skin temperature is 32°C; however, when sitting against a standard seat, the skin temperature rises 2.2°C on average within 30 minutes.

Problem:

- Temperature and moisture are factors known to affect the physiological resilience of skin and underlying tissue.

# Conditions Index

## General

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The physiological process of overheating has obvious implications for one's ability to perform cognitively, as well as physically. Early research into this has shown that personal climatisation devices, such as cooling or heating office chair backrests, significantly improve the thermal comfort of users and their cognitive abilities (Rønneseth, 2018).

## Pressure sores and ulcers

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All wheelchair users can be prone to pressure ulcers due to the prolonged periods of sitting. Changes to the skin microclimate—that is, the temperature, humidity, and airflow next to the skin surface—affects the structure and function of the skin, potentially causing damage (Kottner et al., 2018). For instance, when a patch of skin is warmed beyond 33°C (depending on core temperature), local perspiration in the region increases and the accompanying moisture softens the skin (maceration), which makes it more susceptible to breakdown (Lachenbruch, 2005) and increases the risk of pressure ulcers (Kottner et al., 2018).

## Epilepsy

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Overheating and temperature changes are commonly cited triggers for seizures among wheelchair users with epilepsy. Brief heat alone increased brain excitability and induced multiple types of seizures, suggesting that mutations may alter brain thermoregulation and precipitate seizures during temperature elevations (Warner et al., 2017).

## Spinal cord injury (SCI)

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Individuals with a SCI have impaired autonomic thermoregulation, causing a loss of vasomotor control and sweating below the level of lesion due to the disruption of the sympathetic nervous system (Yoda et al., 2015). Consequently, they are susceptible to hyperthermia and subsequent heat exhaustion and even heat stroke.

## Multiple Sclerosis (MS)

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Of all the people living with MS, it is estimated that up to 80% experience temporary worsening of clinical signs and neurological symptoms, and symptomatic premature fatigue with heat exposure (Davis et al., 2010). Heat sensitivity is one of the primary barriers to performing daily activities and participating in exercise and rehabilitation (Reynolds et al., 2011).

## Cerebral Palsy (CP)

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People with CP typically display an impairment in muscular coordination and movement efficiency which results in a greater metabolic cost of movement for a set intensity, relative to able-bodied individuals (Griggs et al., 2020). As a result, metabolic heat production for a given external workload is significantly greater in those with CP (Maltais et al., 2004). This lower efficiency of movement and higher energy cost can cause an earlier onset of fatigue, exacerbated by an additional environmental heat load (Griggs et al., 2020).

## Muscular dystrophy (MD)

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Muscular dystrophies (MD) currently comprise over 30 clinical disorders, and are characterised by progressive skeletal muscle weakness and wasting (Morgan & Zammit, 2010). Skeletal muscles represent up to 35% to 45% of total body mass and are responsible for many vital functions including thermoregulation (Dufresne et al., 2015). In some MD impairments of the autonomic nervous system have been described with all the consequences for thermoregulation.

# Conditions Index

## **Medication and thermal regulation**

Many classes of drugs can predispose their users to heat-related illnesses, including heat stroke. Among heat-interacting medications are antidepressants, antihistamines, antipsychotics, and diuretics. Drugs can interfere with normal thermoregulatory function in multiple ways, mediated through: the hypothalamus, which sets normal body temperature; changes in cardiac output, peripheral vasodilation, sweat rate or due to renal function and/or body dehydration (Lomax et al. 1998).

## **Hyperhidrosis:**

Hyperhidrosis is a common condition in which a person sweats excessively. As such, maintaining a stable body temperature is important to avoid excessive sweating, which can lead to skin conditions, body odor, and have an emotional impact on emotional wellbeing.

## **Ehlers Danlos syndrome (EDS)**

Patients with EDS can have problems with their thermoregulation due to dysautonomia, therefore they are more prone to experiencing heat related discomfort.

## **Autonomic neuropathy & Central nervous system (CNS) disorders**

Thermoregulation, in response to cold and heat stress, is a vital function of the autonomic nervous system. By keeping body core temperature within a degree or two of 37°C, thermoregulation sustains a healthy body and enables normal cellular function. Autonomic neuropathy, such as small fiber neuropathy, diabetic neuropathy, cholinergic neuropathy, autoimmune autonomic ganglionopathy, and CNS disorders have an impact on the body's ability to regulate the temperature, which can result in all kinds of heat induced symptoms and can even cause heat stroke (William, 2016).

## **Skin conditions**

Sitting for long periods can mean that parts of the skin are not sufficiently exposed to circulating air throughout the day. This heightens the risk of developing heat rash because the sweat ducts are unable to "breathe" properly (evaporative cooling). Furthermore, repeated exposure to heat also means that these rashes may inflame the deeper layer of the skin. Heat rash can be especially dangerous if it affects large areas of skin since the lack of ability to sweat in those regions can lead to heat-related illnesses like heat cramps, heat exhaustion, or heat stroke. Heat and moisture also play a role in other skin conditions. Conditions like cholinergic urticaria (heat hives), psoriasis, and eczema can be aggravated or induced by heat.

## **Autoimmune diseases**

There are more than 80 types of autoimmune diseases (e.g. type 1 diabetes (Yardley et al. 2013), rheumatoid arthritis, systemic lupus erythematosus, inflammatory myopathies, MS, Sjögren syndrome, and inflammatory bowel disease), in which the immune system attacks your own healthy cells by mistake. For many people with an autoimmune disease, heat makes their symptoms worse and they experience heat intolerance. This can trigger flare-ups that include excessive fatigue, muscle aches, pain, inflammation and swelling, as well as an increased risk of overheating for some.

**For more information and copies of the full literature reviews, please contact [info@wheelair.co.uk](mailto:info@wheelair.co.uk) or visit our website. For full list of references please visit [www.wheelair.co.uk/references](http://www.wheelair.co.uk/references)**

# Selection Tool

With a range of WheelAir products available, it is important to choose the right WheelAir package for you. At present, it is not possible to combine the WA Cushion Cover and Slingback during usage, however you can own both and switch between them depending on your current needs. We recommend using the selection tool to decide which product best suits you.

Product Line	Wcare pg. 9	Wgo pg. 12	
<b>Product</b>	WA System	WA Cushion Cover	WA Slingback
<b>Description</b>	An integrated modular solution in partnership with our Recognised Partners available in all types of seating systems, such as power chairs and custom seating solutions.	A ready-to-go cover transforming any cushion into a microclimate cushion for optimal temperature and humidity control of the seat surface.	A ready-to-go back support for wheelchairs with velcro straps at the back offering full temperature control for the active user.
<b>User Profile</b>	Struggles with temperature regulation, sweat, and/or humidity control	Prone to skin damage at the seat surface	Struggles with temperature regulation
<b>Location</b>	Seat, backrest, sleeping systems	Seat cushion	Backrest support
<b>Channel positioning</b>	Fully customisable	Underneath cushion	At seat surface
<b>Wheelchair fit</b>	All	All, requires breathable cushion	Wheelchairs with velcro straps
<b>Temperature control</b>	++++	+++	++++
<b>Sweat control</b>	++++	++	++++
<b>Humidity control</b>	++++	++++	++++
<b>Airflow sensation</b>	+++	++	++++
<b>Customisation</b>	++++	+	++
<b>Quick installation</b>	++	++++	++++



WheelAir

Wcare





## A modular solution for all seating needs.

The field of seating and positioning often requires medical practitioners to find creative solutions to complex cases. The **WAcare** line provides a fully customisable solution in partnership with seating manufacturers. As a modular system, the clinician or technician can select the desired components and place the **Fluid Flow™** channels wherever airflow, temperature, or humidity control is most needed.

With a **WAcare** integration as part of the seating system, the client regains full control of the internal and seat-surface temperature and humidity, often replacing desk fans and towels. The optimal thermal comfort assists in maintaining skin integrity by reducing the risk of heat and moisture associated skin damage.

Due to the modularity there are really no limits as to how and where the products can be integrated. The

request for a **WAcare** integration can be made by the medical practitioner with one of our recognised partners, with whom we work closely together to integrate as desired. Please contact us or one of our recognised partners to discuss possibilities near you.

### Features:

- **Modular system**
- **Integrates in all seating systems**
- **6 airflow settings**
- **Silent airflow**
- **Fluid Flow™ channel technology**
- **Up to 27 hours battery life**



## Case Study

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WheelAir was integrated into a close-fitting system to help manage skin care, comfort, and care needs.

Mr. R is a 52 year old man with Cerebral Palsy, a learning disability, asthma, and h/o respiratory failure. He has complex seating needs due to pelvic and spinal deformities and a large abdominal mass.

Mr. R has extreme temperature regulation issues and tends to scratch his knees and forehead as well as develop redness on his back. His mum, who is his primary carer, manages this by:

- changing his T-shirt 4x/day
- constantly wiping perspiration off his face
- using four fans to cool him down
- changing in situ slings 2x/day
- placing a towel behind his back

Seating and positioning for Mr. R has always been challenging as he requires a close-fitting seating system due to his complex seating needs and impingement issues. His longstanding issues with overheating and perspiration all year round also prove to be a challenging factor when manufacturing an intimate seating system.

To integrate **WheelAir**, a copy of his current seating was made, and material was removed from the centre of the backrest. The **WheelAir Fluid Flow™** channel were embedded into the backrest with a double layer of padding over the channels.

The result of using **WheelAir**:

- uses 1-2 shirts a day (previously 4)
- his mother no longer has to wipe perspiration from his face
- no longer need to change in situ slings
- no towel required behind his back
- no longer scratches his head and knees
- reduction of redness on his back

This study was presented at PMG 2019 by Victoria Curling and Suzanna Shari from NHS Guys & St Thomas Wheelchair Services (Kings College Hospital).

“After a 12 month study, it has become clear that the **WheelAir** has significantly improved Mr. R’s life and that of those around him. He now needs his clothes changed only once per day and barely shows any sign of sweating anymore.”

[To read the detailed case study, please visit our website.](#)



Wigo



Say goodbye to handheld fans, water sprays, ice packs.

**Wago** is a ready to use line of **WheelAir** products designed to provide powerful but discreet, temperature and humidity control for wheelchair users struggling with heat, sweat, or skincare management.

The **WheelAir Cushion Cover** can be used in every wheelchair with a removable cushion, given that there is an opening and space in the back for the Fanbox to hang. The **WheelAir Slingback** can be used with all types of wheelchairs that have velcro straps at the back, whether it is a rigid, folding chair or a light powerchair.

The WheelAir Go line includes:

- **WheelAir Cushion Cover**
- **WheelAir Slingback**
- **Tension Adjustable Straps**
- **Lumbar Support**



# Wigo Cushion Cover

The **WheelAir Cushion Cover** provides the microclimate, humidity, and temperature control benefits of the **WheelAir** system while keeping the pressure relieving, shear force qualities, and comfort of the existing seat cushion.

Removing the existing cushion cover and placing the cushion inside the **WheelAir** cover instantly promotes even airflow distribution throughout the cushion, lowering relative humidity, and significantly decreasing the speed at which the temperature rises. Temperature and humidity control are two defining factors in maintaining skin integrity by reducing the risk of heat and moisture associated skin damage and by keeping skin dry and clean.

The **WheelAir Cushion Cover** was tested with several cushion types to research performance. Naturally, the more permeable the cushion, the better the results, but even with dense foam cushions the results were still astounding. We do want to

note that with a non-permeable cushion or incontinence cover there will be no effect. For more information on these tests, please visit page 18.

The **WheelAir Cushion Cover** can be used in every wheelchair with a removable cushion, given that there is an opening and space in the back for the Fanbox to hang.

Features:

- 6 airflow settings
- Silent airflow
- Fluid Flow™ channel technology
- Anti-Slip cover base
- Up to 27 hours battery life
- Available in 12 sizes



# Wgo Slingback

The **WheelAir Slingback** is a seating system created to be your ultimate tool for temperature and sweat control.

Equipped with the **WheelAir** airflow system and **FluidFlow™** channel technology to control and stimulate ventilation across the backrest, the **WheelAir Slingback** is designed to instantly improve comfort.

Due to the **Fluid Flow™** channel technology sitting in close proximity to the skin, the **Slingback** is designed to help regulate body temperature and improve thermal comfort, giving back control over daily heat generating activities and internal heat buildup, all while promoting comfort and healthy skin.

The **WheelAir Slingback** can be used with all types of wheelchairs that have velcro straps at the back, whether it is a rigid, folding or light powerchair. The product also works in conjunction with tapered or

contoured backrests such as the ILSA backrest. If you have a hard shell backrest please refer to our product partnerships to see whether we collaborate with your chosen brand.

#### Features:

- 6 airflow settings
- Silent airflow
- Fluid Flow™ channel technology
- Antibacterial finish
- Up to 27 hour battery life
- Available in 12 sizes



## Accessories

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### WheelAir Tension Adjustable Straps

The **Tension Adjustable Straps** are an easy-to-install support system to carry a canvas backrest or the **WA Slingback**, offering thoracic stability and customisable backrest positioning. A perfect alternative for the standard wheelchair strap system, it easily secures to the wheelchair canes, with anti-slip fabric for extra security. The system adjusts to various back contours, with a customisable number of straps.

Features:

- Modular system
- Max. user weight: 140kg
- One size fits all



## Accessories

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### WheelAir Lumbar Support

The **WheelAir Lumbar Support** allows for customisable seating solutions and positioning abilities. The lightweight cushion creates relief areas and can accommodate postural deformities where needed, while still allowing optimal airflow delivered through the **Fluid Flow™** channels.

The currently available **Lumbar Support cushion** can be placed at any height in between the inner and outer cover of the **Slingback**.

#### Features:

- Customisable postural support
- Optimal airflow
- Designed for WA Slingback
- Available in 6 sizes







## Case Study

“With my WheelAir, I worry less about heat and moisture related issues. I do think in summer it will mean that I won’t have to use creams or antibiotics. This is a significant improvement.”

Nienke is 29 years old, lives in Rotterdam, and has used a wheelchair permanently since 2012 as a result of damage to her balance organs and to the dorsal horn of the spinal cord. Nienke suffered from heat rashes on her skin which show up as red bumps. Additionally, she often became limp or felt unwell when she was hot. The heat rash was made worse due to the heat generated from leaning against her wheelchair backrest. Furthermore, the bumps on the lower back and

buttocks tend to open easily, which leads them to getting infected.

Since using the WheelAir Slingback, Nienke no longer feels limp, nauseous, and dizzy due to overheating and also has more energy.

“I can easily turn on the WheelAir, for example, when entering a store, to limit exposure to big temperature changes. It’s great to not need to worry about getting too hot.”

# WA Clinical Temperature & Relative Humidity Test Results

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## Control Temperature and Humidity with WheelAir.

We conducted in-house Clinical Temperature and Relative Humidity tests with the **WA Slingback** and **WA Cushion Cover**. The test procedure was based on the ISO 16840-11 testing standards and procedures for cushion microclimate testing.

We compared the temperature and relative humidity of the contact area between the seat surface/back of a wheelchair user and the cushion/backrest, measured for a period of two hours. For the cushion tests the effect of both the cushion with its original cover and the **WheelAir Cushion Cover** was tested. For the

backrest test only, the **WheelAir Slingback** was used. Two tests were conducted per item: one with airflow being distributed by the Fanbox and one without.

### **Conclusion**

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Overall, the results indicate that, when operating at full capacity, the Fanbox airflow has a significant effect on reduction of temperature and relative humidity build-up over time, in both the **WA SB** and **WA CC**, with exception of a combination between the **WA CC** and a non-permeable cushion. This gives an

early indication of the dissipating temperature, perspiration, and moisture levels that can be achieved when using the **WheelAir** products, and reflects wider clinical research on microclimate, temperature control, and overheating for wheelchair users.

**WA SB: WheelAir Slingback**

**WA CC: WheelAir Cushion Cover**

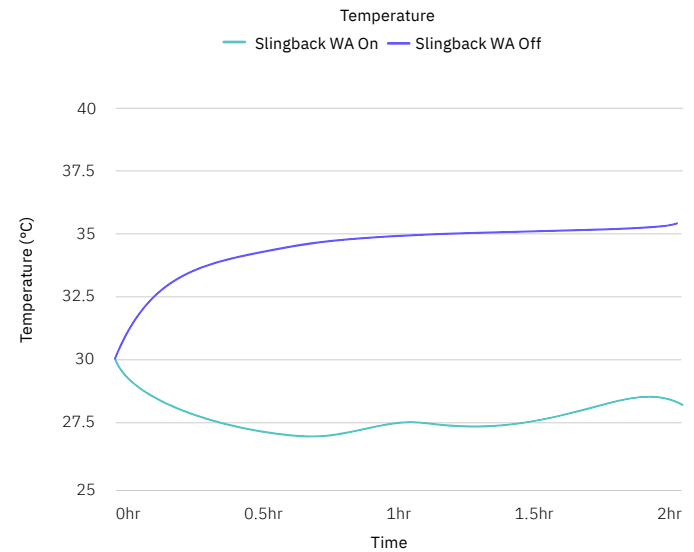
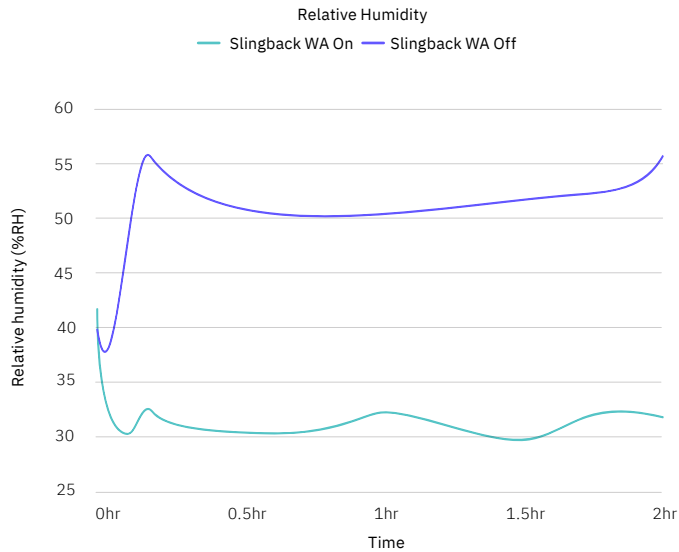
# W

## Slingback —Test Results

The results show that it took less than an hour for the Slingback to cool the contact area by 4°C. This is compared to a 6.6°C rise when the fanbox is turned off. The results also indicate that, over a two-hour test period, the WA Slingback keeps the back contact area up to 9.2°C cooler when the fanbox is on, compared to when it is off.

In terms of humidity, the Slingback reduced the relative humidity levels at the contact area by 25.2% when the Fanbox was on, compared to when it was off. This is a considerable difference, which was sustained throughout almost the entire two-hour test period.

Relative Humidity: 34.1% (+/- 4.8%)  
Room Temperature: 25.5°C (+/- 0.75°C)





# Cushion Cover —Test Results

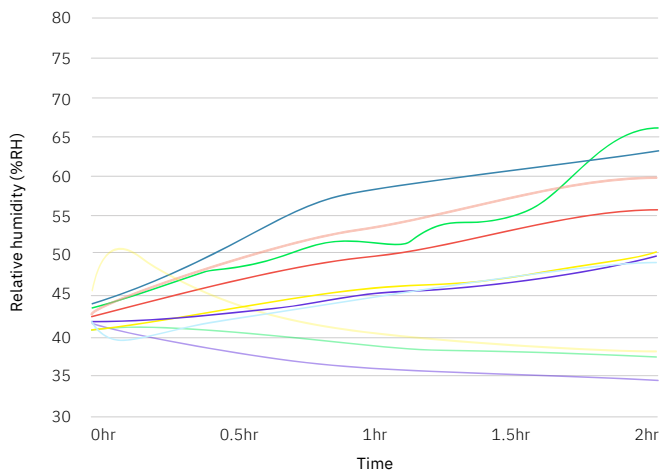
Relative humidity: 35.5 % ( $\pm 2.5\%$ )  
Room Temperature: 23.7 °C ( $\pm 0.5\text{°C}$ )

For the single-density foam cushion, mixed-density foam cushion, the air and moisture permeable compartmented air cell based cushion and lattice ‘honeycomb’ structure cushion, relative humidity reduced steadily while fitted with the WA CC and increased steadily while using the own-brand cover. For instance, test results for the lattice ‘honeycomb’ cushion show a **39.8% difference at the end of the two-hour period.**

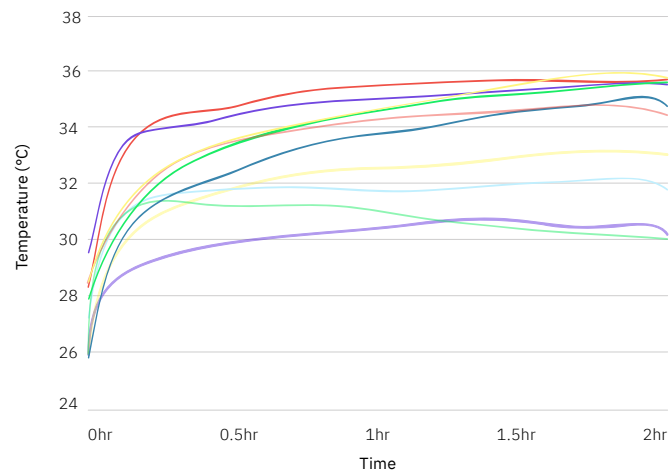
Temperature generally increased with both covers across the tests, but the temperature of the contact area when using the WA CC generally plateaued at a lower temperature than the own-brand covers. The biggest difference was found in the single-density foam cushion where the temperature measured on the WA CC **was almost 6°C lower than the own-brand cover at the end of the two-hour period.** We recorded no reduction in either relative humidity or temperature for the non-

permeable air cell cushion fitted with the WA CC. Instead, relative humidity and temperature rose steadily for both cushion covers equally. This largely reflects our expectations given the very limited internal airflow capacity of non-permeable air-filled cushions. Similar results can be expected with valve-operated single or multi-chamber cushions consisting of non-breathable materials, as well as with other non-permeable cushions or in combination with an incontinence cover.

Relative Humidity Testing



Temperature Testing



Air cell CC — Air cell WA CC — Compartmented air cell CC — Compartmented air cell WA CC — Lattice CC — Lattice WA CC — Mixed-density CC — Mixed-density WA CC — Single-density CC — Single-density WA CC

# How to purchase your WheelAir

How and where you purchase WheelAir products depends on which product line fits your personal needs or requirements.

All **WheelAir** products are eligible for reimbursement if a clinical need can be proven. Our Clinical Assessment Toolkit has all the information you need on how to determine whether you have a clinical need for **WheelAir**. To access the Clinical Assessment Toolkit, visit [www.wheelair.co.uk](http://www.wheelair.co.uk) or contact the team directly at [info@wheelair.co.uk](mailto:info@wheelair.co.uk).

For more information on how to purchase your **WheelAir**, or any of our other products, please visit [www.wheelair.co.uk/how-to-buy](http://www.wheelair.co.uk/how-to-buy).

## WAcare

If you have a custom seating system on your wheelchair or other specific needs that require a **WheelAir System** fitted to your chair, then you are required to purchase the System through one of our manufacturing partners or your local wheelchair services. They will work with you and give necessary expert advice on finding the right fit.

## WAgO

WAgO is our “off-the-shelf” product line, meaning they can be purchased directly from us or through one of our retail partners and be delivered to you to use right away. The **WAgO** products seamlessly integrate with wheelchairs with tension adjustable straps and removable cushions, meaning that you can fit them yourself without the need of expert help.



# Warranty & Technical Information

<b>Slingback Sizes</b>	Width ranging from 29cm to 44cm, length in 73cm or 84cm
<b>Cushion Cover Sizes</b>	Ranging from 40x40cm to 50x50cm in length and depth, and 6cm or 10cm in height
<b>Tension Adjustable Straps</b>	One size fits all
<b>Lumbar Support</b>	Width ranging from 29cm to 44cm
<b>Fanbox Size</b>	26.5cm/10.5cm/3.9cm
<b>User Care</b>	Textile Covers Machine Washable (See Care Label)
<b>Battery Battery Life</b>	3.7V 8000mAh Lithium-Ion 27 hours (lowest setting)
<b>Charger Charge Time</b>	18W USB-C 2 Hours to 80%
<b>Airflow Fan Lifespan</b>	9m/s - 28m/s output    m/s=meters per second 70,000 hours
<b>Safety</b>	Transit Approved and tested to IEC60601
<b>Certification</b>	CE Marked
<b>Aftercare</b>	Each Part can be Replaced Individually



Available from Medifab in New Zealand

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