



Robot-assisted gait training system

Re-Walking for Perfection  
Goes far beyond the Infinity



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It gives you the hope and conviction that you are able to walk again

Robot-assisted gait training system, WALKBOT, will turn your conviction into reality.



## "Re-Walking for Perfection"

Living up to the utmost dreams of our clients is one thing "Re-Walking for Perfection goes far beyond the infinity".

We created Walkbot®Premium, Walkbot®S, Walkbot®K and Walkbot®G which are ground-breaking innovations to blaze our clients dreams of Re-Walking across the life span.

It was all about answering the question of how to realize "Re-Walking for Perfection".

This is how the next generation, Walkbot® series were created into superior being-interactive, functional, strengthening, motivating, natural, cost-effective locomotor system for patients with neurological or musculoskeletal impairments who wish to achieve their dreams of Re-Walking for Perfection.



# Next step toward Perfection

## Walkbot® Premium

### Dynamic body weight support

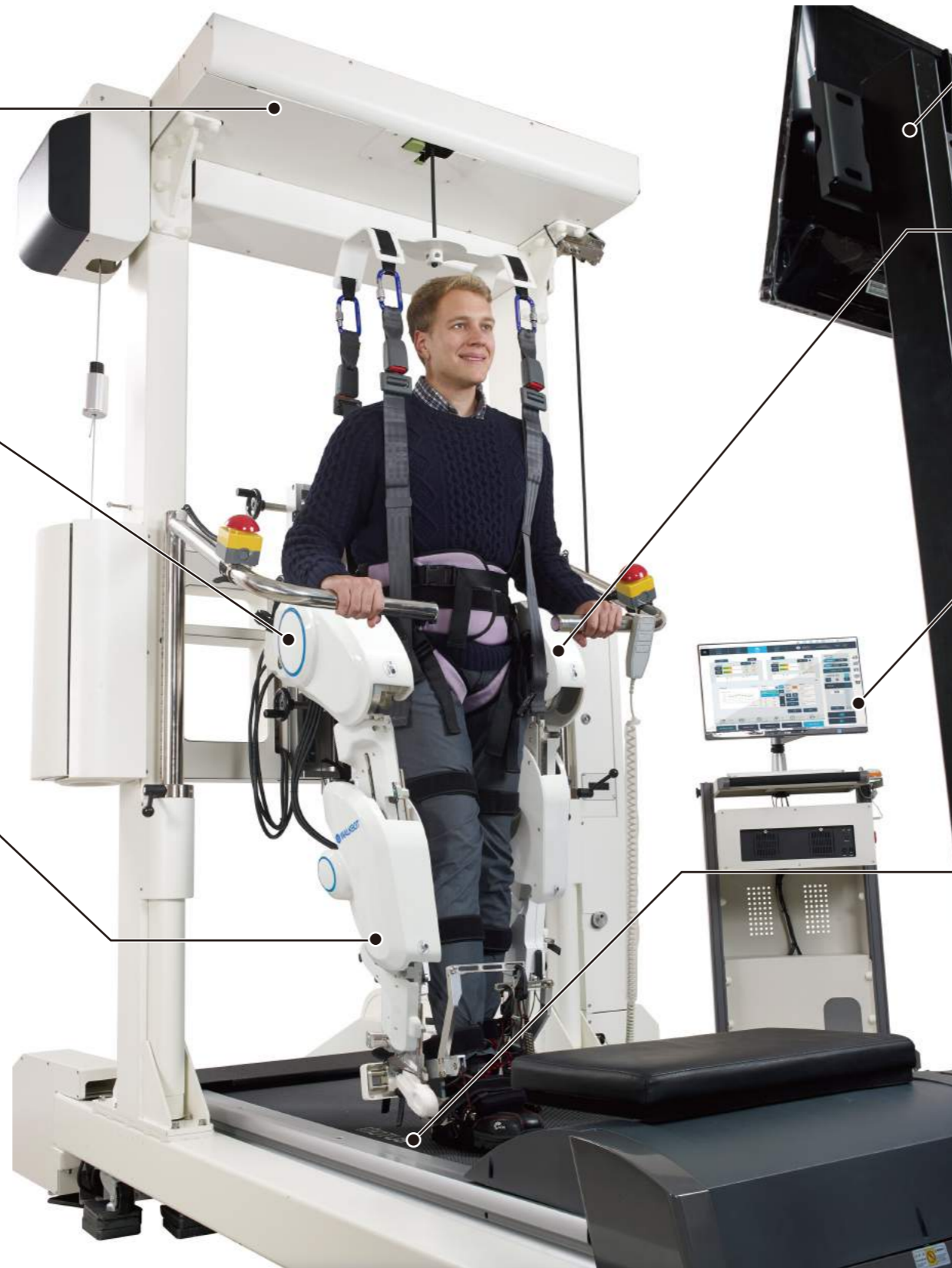
Real-time unload adjustment and inertia compensation during walking enable optimization of the most physiological walking pattern.

### Synchronization of Hip, Knee and Ankle

Walkbot aims at making patients learn correct gait pattern as exactly as possible with the help of perfect synchronization of three actuated joints which is designed based on actual gait algorithm of biomechanics study. In addition, its unique technology, 'Ankle joint drive', assures natural and unobstructed swing phase in gait cycle.

### Automatic adjustment system

This brilliant automatic leg length adjustment system provides unlimited and patient-specific gait pattern according to each patient's anthropometry through precise adjustment by 1mm resulting in more accurate gait training, and reduces time consuming of preparation process that leads to more cost-effective operation.



### Active augmented virtual reality software with 42" wide LCD screen

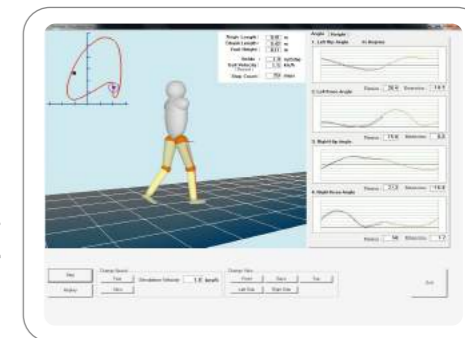
Augmented environment immerses patient in highly repetitive therapy so that it encourages their neuroplasticity leading to more fast recovery.

### Impedance control

The "patient-cooperative" approaches are able to detect patient's voluntary efforts and allow patients to actively influence a gait pattern during rehabilitation processes. The impedance control method is a key technique of "patient-cooperative" strategies that enables patient's increased freedom of movement resulting in much higher self-activation and improved therapeutic outcome.

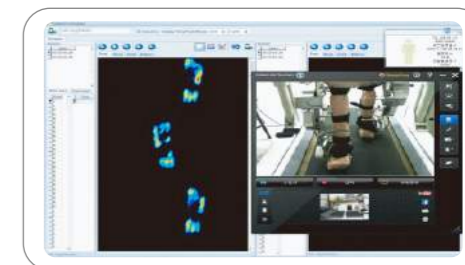
### Motion analysis

Patient's actual kinetic and kinematic data performed during the training are recorded and can be reconstructed as 3-dimensional image to analyze and rectify inaccuracies at an operation panel.



### Force plate (optional)

It analyzes and corrects the patient's gait through measurement of center of pressure, gait balance with time synchronous video recording.







# Walkbot® S

Superlative locomotor therapy dedicated to adult

## SUPERIOR

### Client testimonies

Mr. Aurelio was diagnosed with SCI ASIA B 14 years ago who remarkably enhanced his locomotor function following a 3-month Walkbot® training (Neurocell Institute, Spain, 2014).

Mr. Kim was diagnosed with hemiparetic stroke 2 years ago and underwent the intensive Walkbot® gait training for 2 months. Surprisingly, he was initially afraid of falling and unable to ambulate. However, thanks to Walkbot®, now he can walk independently (Seoul National University Hospital, South Korea, 2013).

### Empirical evidence

Validity and feasibility of intelligent Walkbot system (Electronic Letters, 2009), which Linear regression analysis for kinematic hip and knee angle data showed  $R^2 = 0.8604$  and  $R^2 = 0.9265$ , respectively.

### Clinical evidence

Immediate effect of Walkbot® robotic gait training on neuromechanical knee stiffness in spastic hemiplegia (D.H. Kim et al., Neurorehabilitation, 2013)

Abstract. The purpose of this study was to investigate the immediate effect of Walkbot® gait training on knee joint stiffness in an individual with spastic hemiplegia. A hemiparetic stroke patient underwent a 30-minute Walkbot robotic-assisted gait training session. Knee flexion stiffness associated with hamstring spasticity and knee extension torques during the terminal swing phase was determined before and after the intervention using the Walkbot®-STIFF measurement system. Knee joint extension kinematic at the terminal swing phase increased from 2.44 to 8. Knee joint torque increased from 0.26 Nm to 0.32 Nm. The knee flexion stiffness decreased from 0.0083 Nm/degree to 0.0022 Nm/degree following the training. The Walkbot® robotic-assisted locomotor training was effective for reducing knee joint stiffness and improving extensor torque during functional gait. Moreover, the Walkbot®-STIFF system was useful for assessing and monitoring spasticity during locomotor training.

### INTERACTIVE

The Walkbot® provides an intelligent interactive mode which automatically accommodates spasticity or associated stiffness, assistance and resistance forces, walking speed, and hip, knee, and ankle joint kinetics and kinematics according to the client's ongoing locomotor performance to maximize 'automatic' locomotor relearning, retention, and full recovery.

[Virtual Reality-Induced Cortical Reorganization and Associated Locomotor Recovery in Chronic Stroke An Experimenter-Blind Randomized Study (You et al., Stroke, 2005)]

### STRENGTHENING

The Walkbot® provides a variable resistance mode to stimulate the underactive and weak muscles or augmented with functional electrical stimulation (FES) and electromyographic (EMG) feedback as well as facilitate potential neuroplasticity when combined with a real time electroencephalographic (EEG) brain mapping system during the subacute or chronic phase of rehabilitation. \*FES, EMG, and EEG systems will be available for the optional modes for users.

[A novel EEG-based brain mapping to determine cortical activation patterns (Shin et al., Neurorehabilitation, 2012)]

### FUNCTIONAL

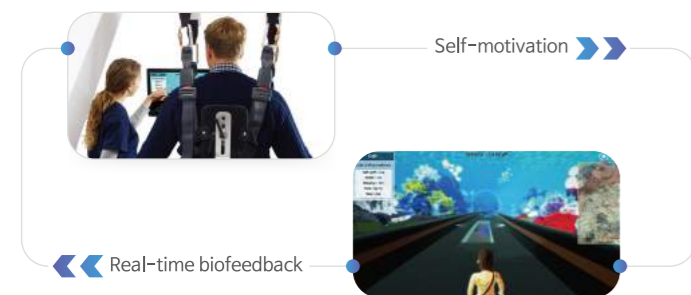
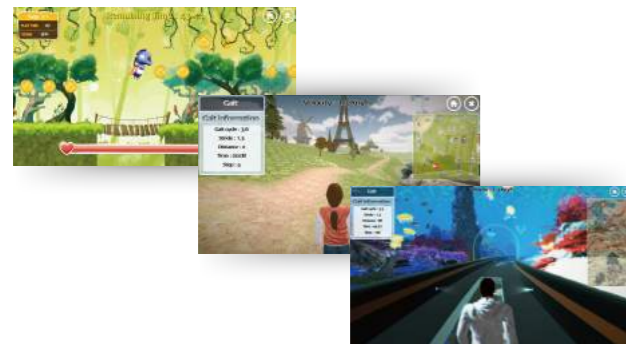
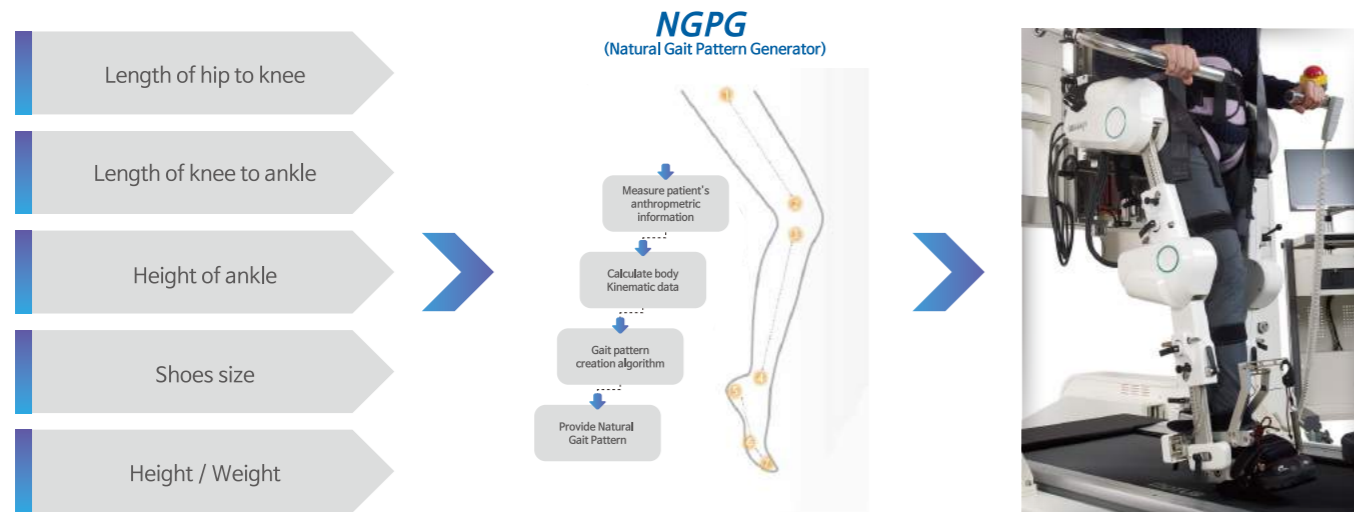
The Walkbot® provides a variety of fun, functional rehabilitation exercises associated with walking such as soccer ball kicking, game, etc., to optimize neuromotor control of locomotion in clients.



WALKBOT®  
BENEFITS

## NATURAL

The Walkbot® is designed to provide the most natural kinematic and kinetic gait patterns, which helps patients with acute or chronic stroke, spinal cord injury or any gait related impairments to relearn the optimal locomotor pattern in order to accelerate faster recovery during the initial rehabilitation phase.



## MOTIVATION

### Active augmented virtual reality software

- 3D reality exploration (Free/Mission)
- Side scrolling game
- Virtual environment walking

The Walkbot® provides exciting customized 3-dimensional virtual reality exercise games so that our clients actually do not perceive the gait training as a form of therapy, rather enjoy walking in interactive and ecologically natural or virtual environments as used.

## ECONOMICAL

The Walkbot® provides cost-effective return in the long-run based on the cost-effectiveness analysis (CEA) of a long-run total cost.

# Walkbot®K

Make a special treatment to children

Walkbot®K is an another independent model of Walkbot® series that is dedicated to children whose heights from 86cm to 148cm of young patients.

In case of children patient, stiffness and resistance are harder than adult and in the most case, they even have no experience of walking after birth. So treatment efficacy is much lower in spite of longer training time.

To expect better outcomes, Walkbot®K was developed with the ankle drive motor in order to give gait balance and correct pattern. Also it provides relevant clinical information related to locomotion, including data on stiffness associated with spasticity or joint contracture, spatiotemporal data, hip, knee and ankle kinematic and kinetic force data during locomotion training.

In addition, the playground design as per children's eye level minimizes the difficulties and unfamiliarity of when children first confronted the equipment. Also, an age-appropriate virtual reality program is integrated into the system to maximize interactive participation and motivation to children.



### Safety

- Managing the reaction sensitivity of the patient to 6 steps
- Three emergency switches, double proximity sensors and two safety sensors

### User convenience

- Intuitive GUI, the systematic training manuals
- Network-based electronic chart support programs (EMR) applicable sensors

### Remote control after service

- Remote control service
- Monitor status of the device, management of device history records



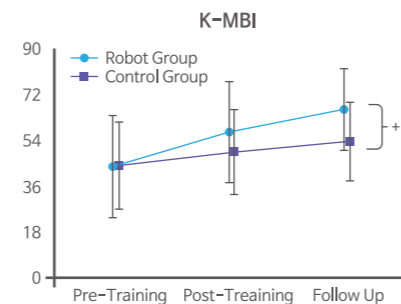
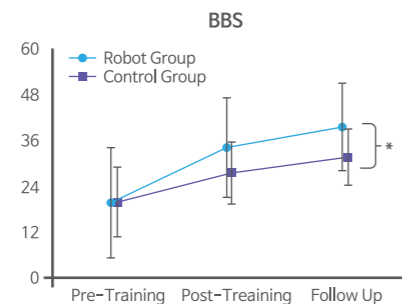
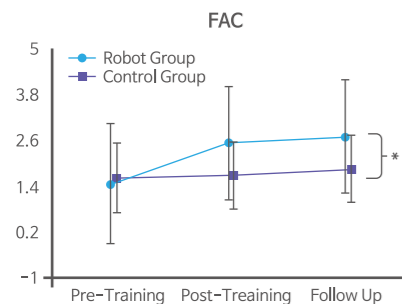
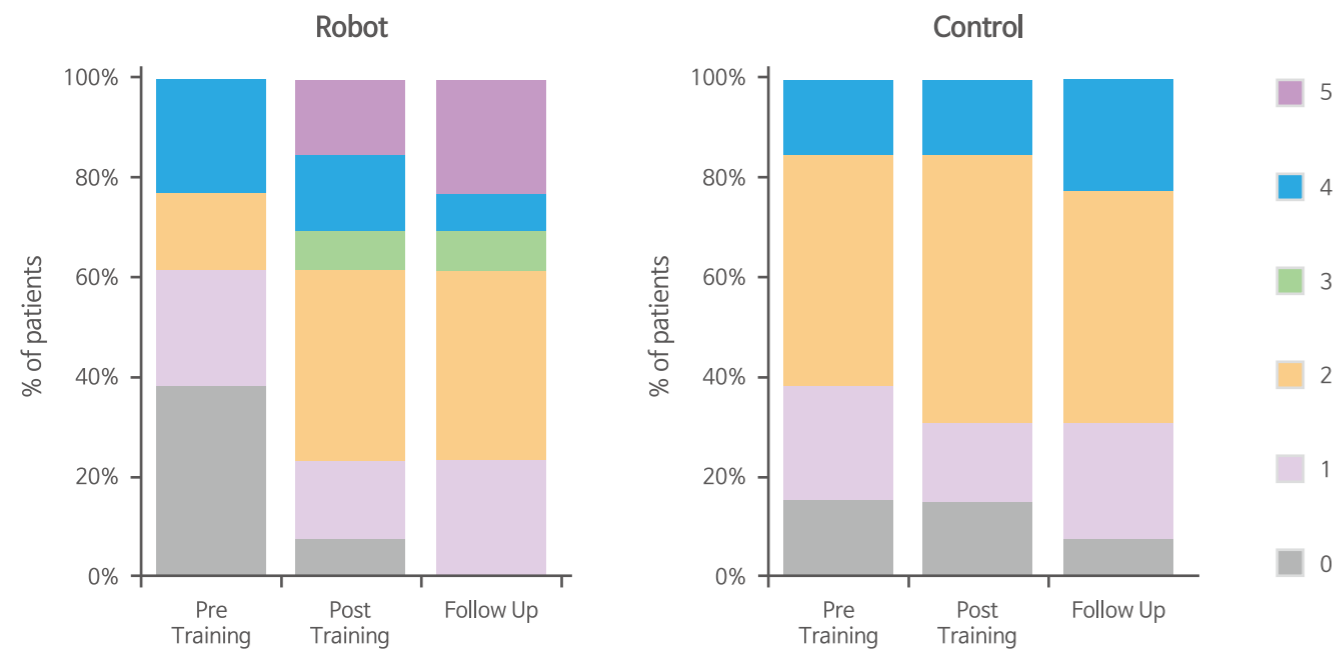
## "Clinically proven equipment"

The Walkbot provides therapeutic effect on locomotor training according to numerous anecdotal testimonies of our clients and clinicians.

Effects of Innovative WALKBOT® Robotic-assisted Locomotor Training on Balance and Gait Recovery in Hemiparetic Stroke : A Prospective, Randomized, Experimenter Blinded Case Control Study with a 4-week Follow-up (in revision, Journal of Neuro Engineering and Rehabilitation, 2015)

Abstract. This is the first clinical trial that highlights the superior, augmented effects of the WALKBOT-assisted locomotor training on balance, gait and motor recovery when compared to the conventional locomotor training alone in patients with hemiparetic stroke.

### FAC



## "Product line-up"

|                       |   | Adult            |            |             | Pediatric    |             |
|-----------------------|---|------------------|------------|-------------|--------------|-------------|
|                       |   | Walkbot® Premium | Walkbot®G  | Walkbot®S   | Walkbot®G(K) | Walkbot®K   |
|                       |   |                  |            |             |              |             |
| Robot Orthosis        | Robotic gait orthosis for adult                   | ✓                | ✓          | ✓           | Compatible   |             |
|                       | Robotic gait orthosis for pediatric               |                  | Compatible |             | ✓            | ✓           |
|                       | Synchronization of motorized Hip-Knee-Ankle drive | ✓                | ✓          | ✓           | ✓            | ✓           |
|                       | Automatic leg length adjustment                   | ✓                | Manual     | ✓           | ✓            | ✓           |
| Reverse-weight system | Dynamic body weight support                       | ✓                | ✓          | Dual active | ✓            | Dual active |
|                       | Augmented reality feedback                        | ✓                | Optional   | Optional    | Optional     | Optional    |
| Option                | Force plate                                       | Optional         | Optional   |             | Optional     |             |
|                       | 3D motion analysis system                         | ✓                | Optional   | Optional    | Optional     | Optional    |

## "Technical specification"

|                                | Walkbot® Premium                  | Walkbot®G | Walkbot®G(K) | Walkbot®S         | Walkbot®K         |
|--------------------------------|-----------------------------------|-----------|--------------|-------------------|-------------------|
| Patient Height                 | 140~200cm                         | 132~200cm | 86~148cm     | 140~200cm         | 86~148cm          |
| Leg length (Hip-Knee)          | 350~480mm                         | 330~480mm | 210~350mm    | 350~480mm         | 210~350mm         |
| Leg length (Knee-Ankle)        | 353~483mm                         | 330~480mm | 212~352mm    | 353~483mm         | 212~352mm         |
| Dimensions (L x W x H)         | 380 x 200 x 257cm                 |           |              | 390 x 168 x 257cm | 390 x 168 x 240cm |
| Space requirements (L x W x H) | 530 x 300 x 265cm                 |           |              | 540 x 400 x 265cm | 540 x 400 x 249cm |
| Power resources                | AC 230V, 50/60Hz Single phase 10A |           |              |                   |                   |