

## Power Wheelchair Seating and Positioning Considerations

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### Determination of a Mobility Assistive Equipment (MAE) will be made by an **Algorithmic Process**.

What MAE device allows the individual to go from Point A to Point B in an:

- **Independent**
- **Safe**
- **AND Timely**

manner in order to accomplish MRADL's?



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### Mobility Related Activities of Daily Living (MRADLs)

- MAE is **reasonable and necessary** for beneficiaries who have a personal mobility deficit sufficient to impair their participation in mobility-related activities of daily living (MRADLs) such as:

- Toileting
- Feeding
- Dressing
- Grooming
- Bathing

- in customary locations within the home.



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Gait Aid

- Can the individual perform mobility consistently throughout their day?
  - Safety
  - Without returning to bed
    - Avoidance of mobility
  - Without significant rest breaks
  - For appropriate distances
  - Without significant increase in pain, swelling, changes in sensation
  - Without dizziness or shortness of breath
- Can the individual participate in activities of daily living or:
  - Limited due to increased mobility related fatigue
  - Limited due to increased time to perform task
  - Avoid due to mobility limitations
  - Cannot keep balance without upper extremity support
- Can the individual utilize a gait aid but still needs additional support for primary mobility?

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MWC

- Can the individual perform mobility consistently throughout their day?
  - Are we putting the end user at risk of biomechanical injury?
  - Without upper extremity pain or functional limitation
    - Avoidance of mobility
  - Without significant rest breaks
  - For appropriate distances
  - Without returning to bed due to mobility related fatigue/discomfort
- Can the individual participate in activities of daily living or:
  - Limited due to increased mobility related fatigue
  - Limited due to increased time to perform task
  - Avoid due to mobility limitations
  - Can not perform repositioning for tasks/skin protection needs
- Even with a custom manual wheelchair with adjustability is the mobility system supporting their independence and efficiency?

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POV

- Can the individual perform mobility consistently throughout their day?
  - Environment provides appropriate space
    - No major thresholds or outdoor use
  - Allows the appropriate range for utilization
  - Without positioning support or skin protection concerns
- Can the individual participate in activities of daily living or:
  - Limited due to lack of functional reach from level of device
  - Limited due to space limitations
  - Must return to bed due to lower extremity swelling
  - Has difficulty transferring into/out of device throughout the day
- Will the client require more customized features/positioning support in the future?

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PWC

- Can the individual perform mobility consistently throughout their day?
  - Environment provides appropriate space
  - If they have customized programing for individual needs
  - safely
- Does a PWC allow the individual participate in activities of daily living:
  - With increased duration and frequency from improved energy conservation
  - Improved comfort and physiological functioning utilizing power seat functions
    - Decreased lower extremity swelling, pain, improved skin protection, independent reposition
  - Perform transfers more independently from taller seat to floor height or addition of a power adjustable seat height
- Will the client require continued positioning support and potential programming modifications to maintain independence?

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## Group 2 VS. Group 3 Characteristics

Basic Power Wheelchair

### Group 2

- Minimum top speed: 3 mph
- Minimal range: 7 miles
- 1.5" obstacle climb (minimum)
- No ability to support alternative drive controls or customized programing
- Only tilt and power leg features

Complex Power Wheelchair

### Group 3

- Minimum top speed: 4.5 mph
- Minimum range: 12 miles
- 2.36" obstacle climb (minimum)
- Drive wheel suspension
- Support all customized programing and drive control options along with all power seating functions

- Average brisk walk speed: 4.5 mph essential when needed i.e. crossing streets
- Consider distance per charge especially for a full time use in a chair up to 12-18 hours/day
  - When going over uneven terrain this pulls from battery life more
- Constant jarring forces have been proved to contribute to pain of PWC users over time
  - Consider need for suspension

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## What does Suspension Provide?

- Absorption of jolting/vibratory forces on wheelchair and wheelchair user
- Ability to maneuver over a variety of terrains, optimizing environmental transitions
- Increased stability of the power base in all environments of use
- Reduced stress/fatigue on components = fewer repairs



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## Wheelchair Base Options

EDGE 3

Stretto

4FRONT.2



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PRO-DRIVE DRIVE

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## EDGE 3

- Mid-Wheel Drive
- Base Width - 24.4"
- 300 lbs. weight capacity
- Max speed 6.25 mph/ Optional 7 mph with 4 pole motors
  - iLevel max: 4.5 mph
- TB3 Tilt, Recline, Tilt and Recline, and AFP
- 12" Seat Elevation with iLevel
- Seat Sizes: 12 - 22 W x 12-22" D (Depending on Seating System)
- Seat to Floor: 16.5" to 19.5" (Depending on Seating System)
- SRS (Smooth Ride Suspension)
- Available with optional Accu-Trac Advanced Tracking Technology
- 20 Color Options

Group 3:  
Standard (K0848/K0849)  
Single Power (K0856/K0857)  
Multiple Power (K0861)



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## Stretto

- 20.47" wide with 12.5" wheels
- Multiple tire options: 12.5" or 14" depending on client needs
- Up to 20.3 miles of range
- Fast 6.25 mph motors come standard
- Climbs 3.5"
- Quantum's lightest full rehab chair-get all four functions for as little as 390 lbs.
- 3.5 MPH speed while driving 12" fully elevated at iLevel

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Edge Series: Stretto and Edge 3

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### Advantages of Mid-Wheel Drive

- Tightest turning radius for a 360° turn
- Comparable control to rear wheel drive
- Climbs obstacles fairly well, can be limited by how high caster wheels lift
- 6 wheels on the ground provides stability to the base
- As long as the front caster suspension has enough travel the MWD PWC will transition over grade changes easily
- Good traction on most surfaces, inclines and side slopes
- Most intuitive to drive for individuals who have previously been ambulatory
- Less cognitive demand to judge turns

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### 4FRONT<sup>2</sup>

Group 3:  
Standard (K0848/K0849)  
Single Power (K0856/K0857)  
Multiple Power (K0861)



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- Base Width - 24"
- 300 lbs. weight capacity
  - HD: 450 lbs
- 4 pole motors standard
- Max speed 6.25 mph
  - HD: 5mph
- Seat elevated max: 3.5 mph
  - HD: 2.6 mph
- 10" Seat Elevation
- Seat Sizes: 12 - 22" W x 12-22" D (Depending on Seating System)
  - Dimensions 20"W - 26"W x 16"W - 24"D for HD system
- Seat to Floor: 15.2" to 19.75 (Depending on seating system)
- NEW Smart Traction Control (STC) Technology
- SRS (Smooth Ride Suspension)

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### Advantages of Front Wheel Drive

- Make tight turns around corners
- Climbs obstacles well
- Large front wheels drive over obstacles with less impact on the user
- Transition over grade changes easily
- Works well for people whose center of mass tends to be "forward" in the seating system.
- Because FWD pulls the chair it typically handles softer terrains better (i.e., grass, gravel, etc.)

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## Power Positioning Considerations

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## Benefits of Tilt

- Significant ischial pressure reduction with 65° tilt (a minimum of 45 degrees to achieve capillary opening)
- Sitting tolerance/Comfort
- Fixed Kyphosis-line of sight correction
- Postural control of the head and trunk-gravity assisted (**Tilting 10° - 15° reduce the effects of gravity** to accommodate poor trunk balance/poor head control)



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## Benefits of Recline

- Redistribute pressure (120° of recline with leg elevation reduces seating surface pressure)
- Comfort
- Increase sitting tolerance
- Helps stretch at hips and knees
- Improve trunk stability
- Can help with supine transfers
- Dressing, bladder and/or bowel care in wheelchair



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## Power Tilt and Recline

### Clinical Benefits

- 25°- 45° Tilt with 110°-150° Recline provides the **greatest pressure relief** when used in combination
- 45° of tilt with 120° of recline provides a **40% load reduction**
- Multiple angles provide ease of independent or caregiver assisted repositioning
- 30° of tilt with full recline improves lower limb hemodynamic states (**edema**)
- Dynamic seating allows a variety of postures throughout the day to participate in or perform ADLs



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## Additionally



Power Adjustable Seat Height (PASH)



Anterior Tilt

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## What is Power Adjustable Seat Height (PASH)?

Power Adjustable Seat Height, also known as Power Seat Elevation (PSE) or Power Elevating Seat (PES), is a power seating device that:

- Raises and lowers the end user while remaining in a seated position
- Utilizes an electromechanical lift system to provide varying amounts of vertical seat to floor height
- Does not change the seated angles or the seat's angle relative to the ground.



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### Power Seat Elevation

It is RESNA's position that power seat elevation devices are medically necessary, as this technology enables certain individuals to:

- ✱Facilitate reach biomechanics, safety and range
- ✱Improve transfer biomechanics, safety and independence
- ✱Enhance visual orientation and line-of-sight
- ✱Support physiological health, safety and well-being
  - ✚Improves position of the neck
  - ✚Promote stable seated positioning
  - ✚Improve safety with performance/participation in ADLs
- ✱Promote communication, social engagement, self-esteem and integration
- ✱Improve wheelchair pedestrian safety

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### What is Anterior Tilt?

- A power seating function that much like traditional posterior tilt changes the angle of the wheelchair seat in the sagittal plane.
- This function raises the posterior aspect of the seat higher than the front which places the person in a partial standing position.

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### What is Required for Anterior Tilt?

- Power Actuators
  - Power Tilt
  - Power Seat Elevation
  - Power Recline
  - Power LE Elevation

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### What is Required for Anterior Tilt?

- Power Actuators
  - Power Tilt
  - Power Seat Elevation
  - Power Recline
  - Power LE Elevation
  - Foot Platform Articulation

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### Maximizing Reach and Function:

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## Transfer Assistance

- Improving independence during transfers
- Decreased caregiver burden for transfers
- Less strain on upper extremities
- Energy conservation
  - Preservation of lower extremity available strength and endurance if appropriate



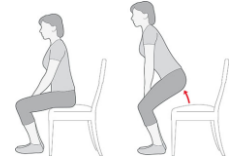
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Pride Assist Power

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## Ways to help facilitate this:

- Increased seat to floor height
  - Taller cushion
  - Seat elevation
- Assist to scoot forward:
  - Use of transfer handles
  - Material selection of cushion & cover
    - Avoid shear when possible
  - Anterior tilt to assist with scooting
    - Gravity assist
- Assist with stand:
  - Anterior tilt to position feet under knees
  - Anterior tilt for pelvis to facilitate into anterior tilt
  - Allow for reduced lower extremity strength and endurance required during initial momentum of stand
    - By increased height and optimal angle



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Pride Assist Power

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10 Degrees



20 Degrees



30 Degrees

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## Visual Field Improvement

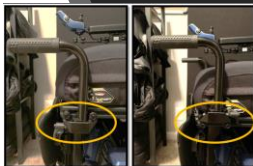


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## Transfer Handles

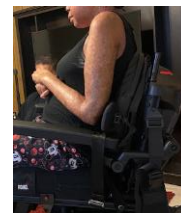


- Mounts to the siderails
- Handle position is 7" or 9"
- Mounting bracket is installed inverted to allow for 2" offset
- Lever allows for positive locking
  - Can be removed for easier user access or replaced with setscrew for a fixed position

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## Arm Support



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## TB4 Lap Tray

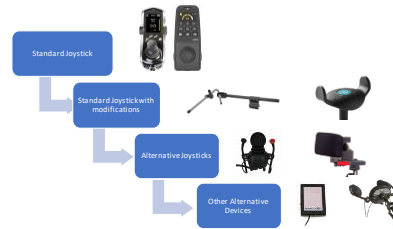
- 13.5" depth (11-19" width depending on back width)
- 9" depth adjustment
- Tool-less angle adjustment
- Available in clear or black



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## Hierarchy of Input Devices

### Proportional Controls



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## Hierarchy of Input Devices

### Switch Input Controls



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## Proportional Considerations

## Benefits:

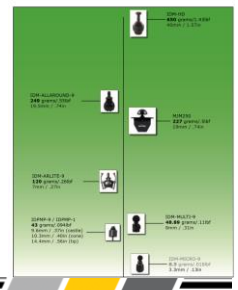
- Efficient due to decreased number of inputs required
- Tends to be intuitive
- Provides best fine control over a power wheelchair when a consumer can adequately control it



250 – 340 grams of force  
20 – 25 mm throw

- Deflection Force – Amount of Force Required to Deflect the Joystick
- Joystick Throw – The Distance the Joystick Travels to Reach Full Deflection

Throw Force and Distance Chart



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## What are Alternative Drive Controls??

- Any drive control device other than a standard joystick
- This device can be altered or adjusted by programming, adjustment of mounting hardware, or variable shape of device (example: different shape of joystick handles)



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## Proportional Controls

### Joystick Modifications

- Hardware Options
- Joystick Mounts



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## Proportional Controls

### Joystick Modifications

- Hardware Options
- Joystick Handles



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## Client Perspective:

- Chin control set up 2 weeks earlier
  - Very fatiguing at first
- Noticed on 7-8 mile drives through neighborhood and with newer bed that vibration helps him increase sitting tolerance by up to 4 more hours
  - Uses vibration mat on chair when inside
- Feature used the most: iLevel
  - Helps for transfers
  - Helps once you "loose" arms
- The power seating features are all essential to reposition



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## Head Array & Seating Access



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