

# Ergogrip Grab rail

Solid support you can rely on!

Just what makes the design of our Ergogrip grab rails so special? This frequently asked question is very easy to answer if you think about the human hand and how the Ergogrip works in relation to it. Our starting point was to thoroughly investigate and measure the shape and movements of the hand; We then went on to design the Ergogrip grab rails with the results of these studies in mind.

Available in a variety of sizes, materials and finishes, all Ergogrip grab rails all have the same characteristic shape, diameter and angles; furthermore, when fitted, they are placed the optimal distance from the wall.

## Philosophy of a grab rail

Ergogrip grab rails are part of the LinidoSolutions product portfolio, which is designed and produced by Handicare. Our team of therapists, designers and engineers work closely together with one common goal: to produce solutions that are ergonomically correct for our users. Our aim is to encourage natural postures and movement patterns for all the users of our products so we have taken into account a number of design elements when creating the Ergogrip.

a grab rail allows the user to maintain balance while sitting, standing, transferring and moving so the user requires a product that is ergonomically correct and easy to grip. The firmest grip a human hand can perform is the 'cylinder grip'. The fingers are bent around the product while the thumb exerts counter pressure. The hand muscles, mainly the extrinsic flexors, provide the manual force.<sup>1&2</sup> For an optimal cylinder grip all fingers need to be involved. This creates strong arches in the hand.<sup>2&3</sup> Most strength can be achieved when the fingers are optimally bent.<sup>3</sup>



### 1. Optimal grip

In order to design a grab rail that offers optimal grip there are a number of factors that one needs to consider.



#### a) What is the firmest grip?

Grab rails provide support in risky situations. Holding on to

## b) What is the best shape to grip?

When a hand makes a cylinder grip, the shape between the fingers is almost oval or even circular. With this in mind we have chosen a circular rail because it does not matter from which side the grab rail is gripped. When reaching for a grab rail, the exact contact point can vary a few centimeters. A round shape also feels comfortable and the completely identical, every time. This is important for our users, elderly people and/or people with physical limitations,- because their coordination skills may be limited.

## c) What diameter should the rail be?

The diameter of the grab rail is of great importance as this determines how firmly the user can grip the rail. The maximum circumference is determined by the circle that can be formed with the thumb and index finger. When the diameter is too large, the hand cannot remain in position since the flexors cannot work efficiently (pict. 1). If it is too small, gripping it places too much strain on the fingers and, As these are small joints, they are not suited for excessive stress (pict. 2). With an ideal diameter, the flexors come to their optimal length (pict. 3).

pict. 1

pict. 2

pict. 3



For defining the diameter of the tube, the results of anthropometric ("the measuring of people") studies on grip circumference are used. Percentile values (P-values) give basic information on the frequency of a certain characteristic in a group of people. The results of the average group are P50. The results of the groups with smaller hands (P5 and P1) are shown in table 14.

**Table 1:** maximum circumference<sup>4</sup>

Population	Maximale circumference (mm)		Diameter (mm)	
	P5	P1	P5/ π	P1/ π
60-64 yrs, ♀	101	93	32.1 / 5	29.6 / 0
65-69 yrs, ♀	104	97	33.10 / 0	30.8 / 8
70-74 yrs, ♀	105	98	33.42 / 2	31.19 / 5
75-79 yrs, ♀	94	<b>84</b>	29.92 / 2	26.7 / 5
80+, ♀	96	88	30.5 / 6	28.0 / 1

When developing the Ergogrip we started by looking at the user with the smallest hands, because even the smallest hands should be able to use the grab rail as safely as possible. This means that our calculations were based on the smallest maximum circumference of P1, (75-79 years, female), which was 84mm. With the maximum circumference the ideal diameter of a grab rail for P1 can be calculated:  $84 \text{ mm} / \pi (3,14) = 26,74\text{mm}$ .

The Ergogrip grab rail has a diameter of 28mm (stainless steel) and 28.6mm (mild steel). This diameter even meets the requirements for P1 (elderly 80+ years, female) and can therefore be used by practically the entire population. In products with similar handles, such as hand tools, a diameter of 26-29mm is common.<sup>5</sup>

## 2. Angle of 60°

Grab rails are often installed diagonally on the wall, for example beside a toilet, providing support when sitting down or standing up. During transfer, the hand often slides to the end of the grab rail because the user cannot maintain the force required for the hand to stay positioned in the middle of the grab rail.



A grab rail feels comfortable to hold when the base of the thumb is supported. The visible line in the palm of the hand should make an angle of 60° with the horizontal plane. All Ergogrip grab rails are bent to 60° instead of the more traditional 90°. This means that the hand and wrist maintain a natural position whilst holding onto a diagonally mounted Ergogrip if the hand is placed on either end of the rail during use.

## 3. Distance to the wall

For the right distance to the wall, a number of factors must be taken into account, namely hand width and the length of the fingers.

### a) Hand width

We have already established that many users will hold onto a diagonally installed grab rail at the end of the rail. This means that the end of the grab rail must be suitable for the breadth of a hand at the level of metacarpal phalanx II to V. We can use the anthropometric data to identify what size hand we should be aiming to accommodate (P95 for men), see table 2.<sup>3&4</sup>



**Table 2,** Handbreadth without thumb (nr. 44)<sup>4</sup>

Populatie	Hand breadth without thumb (mm)	
	P50	P95
DINED 2004 (20-30 yrs), ♂	91	<b>99</b>
DINED 2004 (31-60 yrs), ♂	91	98
DINED 2004 (60+ yrs), ♂	<b>90</b>	98



The figures of table 24 substantiate that a space of at least 90 mm, and preferably 99 mm, is necessary to hold a grab rail on its end, Ergogrip is designed to provide 100 mm (pict. 4) which means that it is designed to be suitable for most users.



**b) Length fingers:**

Generally, the hand is open while reaching for a product. This means that the middle finger is pointing out and could touch the wall. Unfortunately, there are no anthropometric data available on the middle finger so we have reviewed the the data for the index finger (see table 3).<sup>4</sup>

**Table 3:** length index finger (nr. 53)<sup>4</sup>

Population	Length index finger (mm)	
	P50	P95
DINED 1982, NL (20-60 jr), ♀	70	77
DINED 1982, NL (20-60 jr), ♂	78	<b>86</b>



A representative measurement of the maximum length of the index finger (P95, male), measured from the meta-carpal phalanx, is 86 mm. The distance between the grab rail Ergogrip and the wall of 75 mm. The section above says distance to the wall is 100mm, without even taking the thickness of the tube (28 or 28.6 mm) into account which minimises the risk of hitting the fingers on the wall when grabbing the rail.



**Conclusion**

With the right combination of shape and diameter of the tube, the user of the grab rail can achieve an optimal grip.

When developing the Ergogrip grab rails kinematics<sup>1,2,3</sup> and anthropometric data 4 has been taken into account; the correct distance to the wall, hand width and finger length were considered to avoid possible collisions and bruises. And the unique 60° angle offers optimal support to the hand and wrist.

Handicare is proud to have utilised scientific data to develop a grab rail that meets the needs of the user by designing a solution that delivers the optimum grab rail shape, diameter, angle and distance to the wall. The Ergogrip grab rail is available in different lengths and models (see back cover). To find out more about our product range or for installation advice visit our website

*References:*

1. Vorm en Beweging , 11e druk – Lohman A.H.M., ISBN 90-313-5147-4, Houten The Netherlands, 2010.
2. Grandjean E., Fitting the task to the man, ISBN 0-85066-380-6, London United Kingdom, 1988.
3. Steenbekkers L.P.A., Beijsterveldt C.E.M., Design-relevant characteristics of ageing users, ISBN 90-407-1709-5, Delft the Netherlands, 1998.
4. <http://dined.io.tudelft.nl/dined/>
5. <http://www.materiaal.nl/phuni>

## Overview grab rails Ergogrip

The Ergogrip grab rails are available in different materials, colours and lengths.

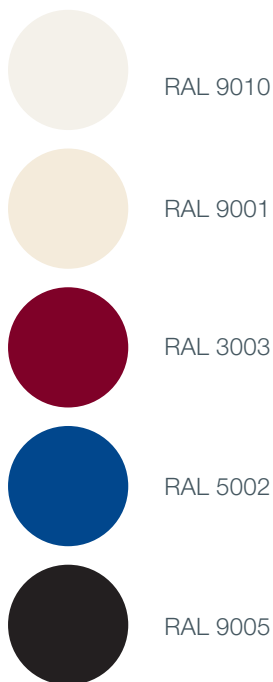
### Materials:

Coated steel, in one of the below colours

Coated stainless steel 304, in one of the below colours

Polished stainless steel 304, with white (standard) or black guards.

### Colours:



### Versions:

When ordering, the product codes below will be completed with codes that determine the Ergogrip colour and material. Check our website for the full product codes or contact our Customer Service Team.

Article number	Description
<b>Ergogrip Grab Rail (with 2 wall flanges)</b>	
LI2611.020	Grab rail, length 200 mm
LI2611.030	Grab rail, length 300 mm
LI2611.040	Grab rail, length 400 mm
LI2611.050	Grab rail, length 500 mm
LI2611.060	Grab rail, length 600 mm
LI2611.070	Grab rail, length 700 mm
LI2611.080	Grab rail, length 800 mm
LI2611.090	Grab rail, length 900 mm
LI2611.100	Grab rail, length 1000 mm
LI2611.120	Grab rail, length 1200 mm
LI2611.140	Grab rail, length 1400 mm

<b>Ergogrip Grab rail with extra wall flange</b>	
LI2611.160	Grab rail, length 1600 mm
LI2611.180	Grab rail, length 1800 mm
LI2611.200	Grab rail, length 2000 mm

<b>Horizontal angled grab rail</b>	
LI2611.015	Horizontal angled grab rail
LI2611.016	Angled grab rail for 2 walls, including vertical combination grab rail

<b>Vertical combination grab rail</b>	
LI2611.017	Vertical combination grab rail, fits all Ergogrip grab rails, length 1015 mm

<b>Grab rail 90°</b>	
LI2611.003	Grab rail, 90° bent to the left
LI2611.004	Grab rail, 90° bent to the right

<b>Grab rail 45°</b>	
LI2611.007	Grab rail, 45°, 2x 200 mm
LI2611.008	Grab rail, 45°, 2x 400 mm

Backing plates and fixing mounts are available for all grab rails. Please refer to the Product Guide or visit our website