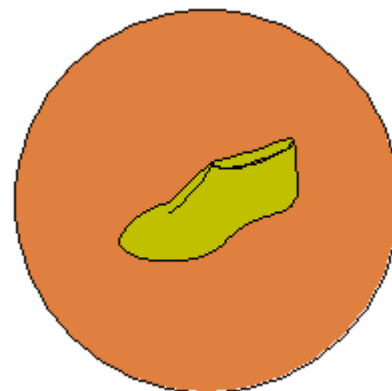
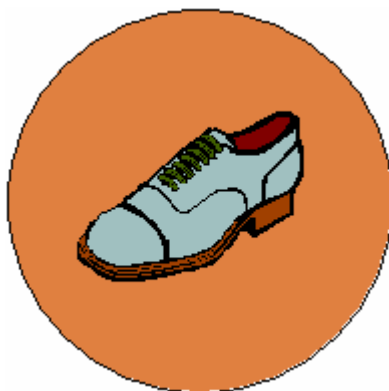
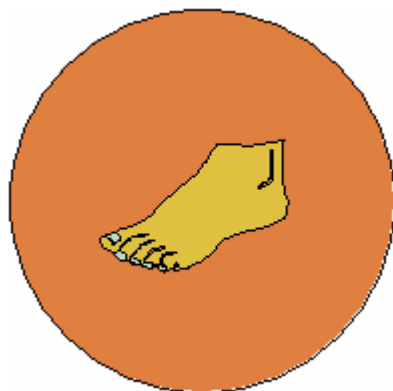


Foot

Last

Shoe



**Recommendation to suppliers and manufacturers
of orthopaedic footwear concerning
sizes of shoes and lasts**

**A report from
The Swedish Handicap Institute, Sweden
Bengt Andersson, 2004-02-04**

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Text: Bengt Andersson, SHI

Illustrations: Peter Wahlström and Bengt Andersson

Translation: Bengt Andersson, SHI and Fiona Barnett, Advanced Prosthetic, Australia

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Summary

For people that are dependent upon orthopaedic shoes, eg those with diabetes or rheumatism, it is essential that their shoes are well fitted, that they are comfortable and functional, as this ensures that they will not cause any problems such as blisters. Several orthopaedic workshops and the Swedish Trade Organisation for orthopaedics have called upon The Swedish Handicap Institute (SHI) to chart the problems with the different systems of shoe sizes, as well as the problems associated with differences in sizes in the same size system.

Lack of a universal and uniform shoe-size-system creates problems when it comes to ordering prefabricated orthopaedic footwear. The fit of a shoe is due to many parameters but the most basic is the length of the shoe. Suppliers of prefabricated orthopaedic shoes use different length and shoe size systems, which can lead to errors when ordering shoes. This lack of standardisation creates a "loose situation" for all involved; the patients, the orthopaedic workshop and the suppliers.

SHI in cooperation with Code of Practice in Sweden has documented the existing systems of shoe sizes and the different ways in which to measure a last. The metric system, Mondopoint, is presented and described as it is the international standard for *shoe sizes as endorsed by ISO 9407:1991*. Mondopoint is used by NATO and the Swedish defence, as well as some manufacturers of ski boots and is an unambiguous system that is especially functional when ordering prefabricated orthopaedic footwear.

Based on the information documented by this project, The Swedish Handicap Institute has composed the recommendations below to remove all possible errors in the process of ordering orthopaedic footwear:

Recommendation to manufacturers and suppliers of orthopaedic footwear:

To facilitate ordering prefabricated orthopaedic footwear, the manufacturers and suppliers of orthopaedic footwear are recommended to:

- declare their products sizes according to ISO 9407:1991 *Shoe sizes – Mondopoint system of sizing and marking*.

As an alternative/during the transitional period, the manufacturers and suppliers are recommended to, as a complement to the existing information provided, declare:

- in written form, such as manuals, the product's length of last in mm
- in written form, such as manuals, the technique used in the measurement of the last:
 1. The last measured from the tip of the toe to the apex of the heel standing with intended heel height
 2. The last measured from the tip of the toe to the apex of the heel without intended heel height.
 3. Measuring the insole of the last from the tip of the toe to the base of the heel

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Background

It can be difficult to find shoes that fit well! Although we know what shoe size we “normally” require, sometimes we may have to try on many different shoe sizes to find the one which fits the best. Yet we all still seem to have shoes in the cupboard that we never use as they are uncomfortable and gives us blisters. Although this is a common problem, for those people who are dependent upon having orthopaedic shoes, eg those with diabetes or rheumatism, this is a significant problem, as their shoes must be comfortable, well fitted and functional!

The fit of a shoe is based upon many parameters but the most basic of these is the length of the shoe. The shoe can not be too long or too short. The lack of a universal and uniform shoe-size-system creates problems when it comes to ordering prefabricated orthopaedic shoes from an external source. Several orthopaedic workshops (OWs) in Sweden have acknowledged this and asked The Swedish Handicap Institute (SHI) to investigate the problem. The Swedish Trade Association for orthopaedics, OTB, has also called upon SHI to take action in this matter.

Suppliers of prefabricated orthopaedic shoes use different length and shoe size systems, which creates confusion and lead to potential errors when ordering shoes. This lack of standardisation creates a very “loose situation” for all involved. In the worst case scenario the patient may receive inappropriate shoes, ie those that are either too large or too small. This error though, will generally be picked up at the point of fitting in the OW which will require the patient to return at a later date to try a different pair of shoes. For the OW this lack of standardisation causes unprofitable extra work, with the shoes having to be returned and exchanged with the supplier and the subsequent rescheduling of another fitting with the patient. For the supplier the return also generates extra work, along with extra charges not only in time wasted but freight costs. In addition it must also be pointed out that several suppliers have changed last sizes for certain shoe models and the OWs have to struggle with different length sizes even within one suppliers catalogue.

This situation is intolerable as almost 50% of the total annual turnover of OWs in Sweden today is based around assistive devices for foot problems.(1).

Purpose and aim

The purpose of this project was to:

- produce a recommendation to suppliers and manufacturers of orthopaedic footwear as to how to specify shoe and last sizes, in order to minimize misunderstandings and errors.
- document existing shoe-size-systems and ongoing national and international projects in this area.

The aim was to:

- compose recommendations for suppliers and manufacturers in order to make it easier to order correct sizes of orthopaedic footwear, based upon measurements taken of the patient’s feet at the OW.

Project cooperation

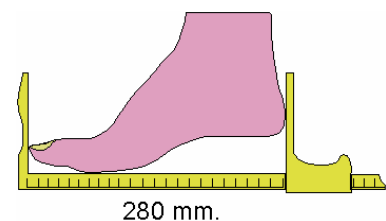
The work has been carried out in cooperation with SHI and the specialist network, Code of Practice in Sweden (CoP). For more information about CoP; www.codeofpractice.se/english/ . The main documentation has been done by shoe modeller Peter Wahlström, who has also produced the illustrations.

Foot, last, shoe

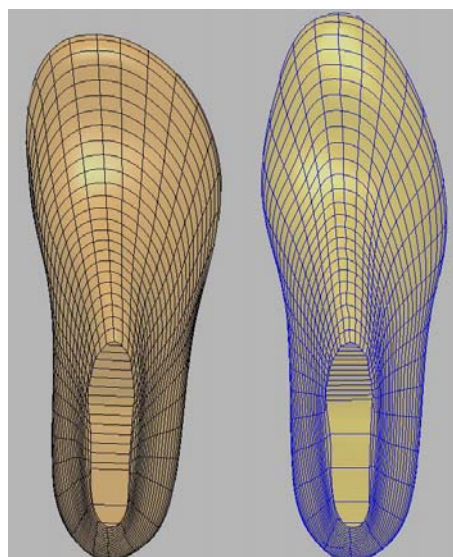
There are several size systems used all over the world. Although there are general rules for comparison between the systems, these comparisons cannot be relied upon, due to a lack of coordination as to how each of these systems are applied in each country. There is also a lack of information as to how the manufacturers have defined the size of the last for the shoe.

What is a shoe size?

It is important to note the difference between foot length and shoe size. Foot length in Europe (except UK) is always measured in millimetres (mm). The size of shoes is specified with different size terms depending upon which system is in use. There are also different opinions as to how long a shoe should be in proportion to the foot, but generally one can say that a shoe should be 12-15 mm longer than the foot depending of the shoe design.



Most size systems will specify the shoe size based upon the nominal length of the last, which corresponds to the length of the inside of the shoe. Therefore, all shoes designated with the same size will not necessarily be of the same length due to the shape of the last. A shoe with a low heel and wide toe shape is probably close to the specified shoe size in length if you measure the last. A shoe with a narrow toe shape will be longer than its specified shoe size.



Size systems

There are several size systems used all over the world. Sweden and most of Europe, except UK and Ireland, use the system called Paris Point. In Sweden size 38 for women and size 43 for men are most common. The scale starts at zero and continues with length intervals of 6,66 mm per size. The Paris Point-system is sometimes called the Continental System. The difference between each system is that the length of the last is measured differently. English and American sizes are also used in Sweden, mainly for sportswear.

In the illustration to the right you can compare the differences between each of the shoe size systems. As can be seen, you may have the same shoe size but a different length, depending on which system you are utilising.

Same shoe size – large length differences!

In this project we studied the information from 3 suppliers of 5 different prefabricated orthopaedic shoes. We found that there are large length differences between shoes with the same shoe size. The information below is collated from the suppliers brochures and provides information of shoe size and shoe inside length:

Engelska size	Engelska tum	Amerikanska size	Paris Point	Centimeter
			2/3 cm ↓	1 cm ↓
			↑ 2	↑ 2
			3	
	1		4	3
			5	
			6	4
	2		7	
			8	5
			9	
			10	6
	3		11	
			12	7
			13	
			14	8
	4	3*	15	
↓ 0		↓ 0	16	9
1/3* ↑ 1	4 1/4	1/3* ↑ 2	17	
↑ 2	4 1/4	↑ 2	18	10
3	5	3	19	
	4*		20	11
		4	21	
		5	22	12
	6	6	23	
		7	24	13
		8	25	
		9	26	14
	7	10	27	
		11	28	15
		12	29	
	8	13	30	16
			31	
13			32	17
1		1	33	
2		2	34	18
3		3	35	
4		4	36	19
5		5	37	
6	10	6	38	20
7		7	39	
8		8	40	21
9	11	9	41	
10		10	42	22
		11	43	
			44	23
			45	
11	12			24

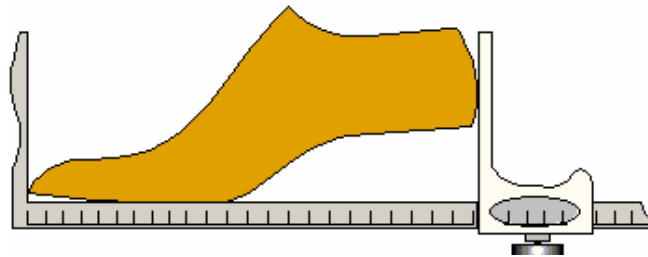
Supplier	Shoe	Size (Paris Point)	Shoe inside length
A	article 1	size 43	281 mm.
B	article 2	size 43	291 mm.
C	article 3	size 43	275 mm.
C	article 4	size 43	282 mm.
C	article 5	size 43	288 mm.

As can be seen there are significant differences in shoe inside lengths. The largest difference found between shoes of the same size was 16 mm! This is just one example of what you can find if you compare shoes from different suppliers. It should also be noted that no supplier provided information as to what their measures indicated or how they were taken.

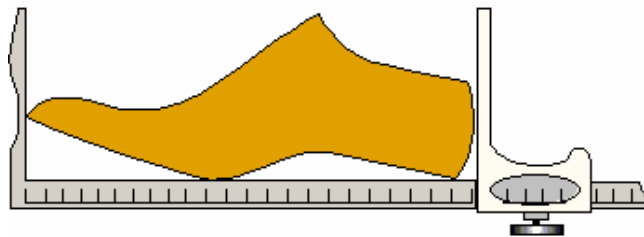
The length of the last

As indicated above there are significant differences, up to 16 mm, between shoes with the same size. These length differences appear for shoes with the same size, in the same shoe system, if the lasts are measured differently. To be able to compare the length of shoes with the same size it is essential to know how the lasts have been measured. The conclusion, after consultation with the manufacturers and suppliers, is that there are three different ways in which a last may be measured. These three different techniques are presented below:

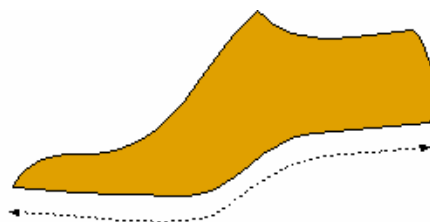
1. The last is measured from the tip of the toe to the apex of the heel with the intended heel height



2. The last is measured from the tip of the toe to the apex of the heel without the intended heel height.



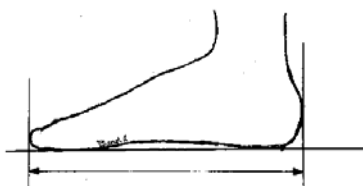
3. The insole of the last is measured, from the tip of the toe to the base of the heel.



Mondopoint – a metric shoe size system

Many years of research and development has led to the metric Mondopoint sizing system. Organisations such as the Shoe and Textile dealers in Sweden (STIL) have lobbied for several years to apply the Mondopoint system to the national shoe industry. They are convinced that this system would solve the chaos created within the shoe industry by different sizing systems. It should be noted that Mondopoint is an internationally standardised measure. The work upon this standard began in the end of the 1980's with publication of the standard; ISO 9407:1991 *Shoe sizes – Mondopoint system of sizing and marking (2)*, in 1991. The technical committee responsible for the work was ISO (International Organization for Standardization) TC 137 (Sizing system, designations and marking for boots and shoes). The standardization organisation of South Africa was responsible for the secretariat and also the driving force in the work. Participating countries were Germany, Italy, France, UK, China, Czech Republic, Iran, Russia, Slovakia and Romania. Sweden was one of the 30 observer countries. Mondopoint is used foremost by NATO and other military organisations, such as Swedish Defence Materiel Administration (FMV), it is also used in South Africa and some eastern European countries. Mondopoint defines the size of a shoe from foot measurements designed to ensure that the shoe will fit. These measurements are the length of the foot and the width of the foot. (See diagrams below.) If a person's length of the foot is 280 mm and the width of the foot is 110 mm, then the shoe size most appropriate in Mondopoint is 280/110. All shoes marked with 280/110 should fit this person's foot, without having to try them on! This is why NATO and FMV use the Mondopoint system. They simply measure the recruit's feet and then order the boots and shoes. FMV has used the system for over ten years and, although no formal evaluation has occurred, they claim that it works very smoothly and that they are very satisfied with the efficiency of the system.

Manufacturers of protective work footwear, for example footwear for firemen or construction workers, have started to use Mondopoint. Like orthopaedic footwear these kinds of footwear need to be ordered. Manufacturers of skiboats have also begun to mark their products with Mondopoint. This is probably due to the international and rental demands of this market. With this system the ski shop employees simply measure the feet accordingly and pick the pair that will fit. One manufacturer claims on its website; "The anatomical shape of the foot forms the guiding principle for the fit of shoes. Research and development for years has led to the Mondopoint sizing system. Once a user is acquainted with this system, he/she can always bank on a perfect fit and optimal comfort."



Length of the foot: Horizontal distance between the perpendiculars in contact with the end of the most prominent toe and the most prominent part of the heel, measured with the subject standing with the weight of the body equally distributed on both feet.



Width of the foot: Projection, on a horizontal plane, of the perimeter measured under the same conditions as the length, and representing the horizontal distance between vertical lines in contact with the first and fifth metatarsophalangeal joints.

Recommendation to suppliers and manufacturers of orthopaedic footwear concerning sizes of shoes and lasts

This projects aim was to compose recommendations concerning standardisation of information from suppliers in regard to last lengths and the techniques by which they were being measured. However, the prime recommendation for manufacturers and suppliers of prefabricated orthopaedic shoes is to declare their products' sizes according to ISO 9407:1991 *Shoe sizes – Mondopoint system of sizing and marking*. Mondopoint can, according to those contacted throughout this consultation, solve the problem of different sizes of shoes today.

During a transitional period, or if the products sizes not are declared according to ISO 9407:1991, it is recommended that manufacturers and suppliers publish information that make it easier to order the correct shoe size. The information, as a complement to the traditional information of the size of the shoe, should include the products length of last in mm and the technique by which the last was measured. The standard ISO 9407:1991 can also be seen as the guideline for how the professionals at the OW should measure the patient's feet.

Recommendation to manufacturers and suppliers of orthopaedic footwear:

To facilitate ordering orthopaedic footwear, the manufacturers and suppliers of orthopaedic footwear are recommended to:

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Reference:

1. **The proportion of orthopaedic footwear at orthopaedic workshops in Sweden**, Bengt Andersson, The Swedish Handicap Institute, 2004-02-04
2. **ISO 9407:1991 *Shoe sizes – Mondopoint system of sizing and marking***

The Swedish Handicap Institute (SHI) is a national resource centre on assistive technology and accessibility for persons with disabilities.

We work for full participation and equality for persons with disabilities by ensuring access to high-quality assistive technology, an effective provision of assistive devices and an accessible environment.

The activities of the Swedish Handicap Institute cover:

- testing and procurement of assistive devices
- research and development
- analyses of needs, knowledge and method development
- training and capacity building
- accessibility and design for all
- international cooperation
- information

The Swedish Handicap Institute is run by the Ministry of Health and Social Affairs, the Federation of Swedish County Councils and the Swedish Association of Local Authorities.



Hjälpmedelsinstitutet

The Swedish Handicap Institute

P.O. Box 510, SE-162 15 Vällingby, Sweden

Phone +46 8 620 17 00

Fax +46 8 739 21 52

Text phone +46 8 759 66 30

E-mail registrator@hi.se

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