AN EVALUATION OF SOUTH AFRICAN CLOTHING RELATED POPULATION MEASURES AND SIZING SYSTEMS

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Dissertation

M Cons Sc (Clothing Management)

Study Leader: Prof HM de Klerk

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by

Mariette Strydom

Dissertation submitted in partial fulfilment of the requirements for Masters Degree in Consumer Science (Clothing Management)

in the Faculty of Natural and Agricultural Science

Department of Consumer Science

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Study Leader: Prof HM de Klerk

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Abstract

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MARIETTE STRYDOM

Supervisor: Prof HM de Klerk
Department: Consumer Science
Degree: Masters in Consumer Science

The aim of the study was to investigate and describe how the South African clothing industry ensures well-fitting garments to their target consumers. The study was approached from the viewpoint that, if body measurements of the population are not current and accurate, all other aspects such as block patterns, sizing systems, and fit and wear testing cannot contribute to the achievement of an acceptable or proper fit.

The following procedures were followed:

- ✓ **Literature and research** on body measurements and sizing systems were studied.
- ✓ A **survey** was conducted among clothing and footwear manufacturers and retailers in South Africa, to determine the use of body measurements, problems experienced with body measurements, and knowledge of body measurement descriptions, what the South African sizing system entails, how block patterns are generated and how fit and wear testing is done.

- ✓ The **research strategy** consisted of postal questionnaires to all respondents and structured interviews with selected respondents.
- ✓ A **comparison** was made between the international and the respondents' descriptions of body measurements, with regard to consensus among the different descriptions.
- ✓ The **findings** conclude that various outdated and unscientific practices result in many problems being experienced by the industry. A wide variety of body measurements are needed and are used in the South African clothing industry and an alarming number of problems exist with regard to these measurements, probably resulting in the lack of well-fitting garments that satisfy the South African consumer. The problems experienced with the key dimensions are particularly alarming because these measurements are so important in achieving good fit. The supply of good quality garments to their target customers seemed to be a very important consideration to the retailers and manufacturers, but they need help in solving the problems identified.
- ✓ **Recommendations** include the establishment of a national standard for identifying landmarks and exact methods of how the measurements should be taken on the body, before a much needed survey of the South African population can be undertaken.

Opsomming

'N ONDERSOEK NA SUID-AFRIKAANSE KLEDINGVERWANTE BEVOLKINGSMATES EN GROOTTE-SISTEME

deur

MARIETTE STRYDOM

Studieleier: Prof HM de Klerk
Departement: Verbruikerswetenskap
Graad: Magister in Verbruikerswetenskap

Die doel van die studie was om te ondersoek en te beskryf hoe die Suid-Afrikaanse kleding-industrie goedpassende klere aan hul teikenmark verskaf. Die studie is benader vanuit die standpunt dat, as die liggaamsmates van die bevolking nie heersend en akkuraat is nie, die ander aspekte soos blokpatrone, grootte-sisteme, en pas- en dra-toetse nie 'n goeie pas kan verkry nie.

Die volgende prosedure is gevolg:

- ✓ **Literatuur en navorsing** in verband met liggaamsmates en grootte-sisteme is bestudeer.
- ✓ 'n **Opname** is gedoen onder die Suid-Afrikaanse klere- en skoenvervaardigers asook kleinhandelaars om die gebruik van en probleme met liggaamsmates te bepaal. Daar is ook vasgestel hoe en waar liggaamsmates geneem moet word, wat die Suid-Afrikaanse grootte-sisteem behels, hoe blokpatrone opgetrek word en hoe pas- en dra-toetse gedoen word.

- ✓ Die **navorsingstrategie** het posvraelyste na alle respondente en gestruktureerde onderhoude met uitgesoekte respondente behels.
- ✓ Internasionale en respondente se beskrywings van liggaamsmates is met mekaar **vergelyk** met betrekking tot konsensus ten opsigte van die verskillende beskrywings van mates.
- ✓ Die **bevindinge** was dat verouderde en selfs onwetenskaplike praktyke bydra tot die probleme wat deur die industrie ondervind word. ‘n Wye verskeidenheid liggaamsmates is nodig en word gebruik deur die Suid-Afrikaanse klere-industrie, en ‘n verontrustende hoeveelheid probleme bestaan met betrekking tot die mates. Dit dra waarskynlik by tot die gebrek aan goedpassende kledingstukke om die Suid-Afrikaanse verbruiker se behoeftes te bevredig. Die probleme wat met die sleutelmates ondervind word, is veral kommerwekkend, aangesien die mates so belangrik vir die verkryging van goeie pas is. Dit blyk dat die voorsiening van klere van goeie gehalte aan hul teikenmarkte ‘n baie belangrike oorweging vir die kleinhandelaars en vervaardigers is, maar dat hulle hulp nodig het om die bestaande probleme te bowe te kom.
- ✓ **Aanbevelings** sluit in die daarstel van ‘n nasionale standaard met betrekking tot die identifisering van landmerke op die liggaam en presies hoe die mate geneem moet word, voordat ‘n broodnodige opname van die Suid-Afrikaanse bevolking se liggaamsmates gedoen word.

Acknowledgements

I would like to express my sincere gratitude to the following people, who had a share in the completion of this study:

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- ✓ My family and friends: Thank you for understanding and believing in me, but most of all, for your prayers.

- ✓ Karla, my baby girl: You were my inspiration to persevere and to complete the study. Your existence makes it all worthwhile!

And to our Heavenly Father: All the praise and honour.

"I can do all things through Christ who strengthens me."
(Phil. 4:13)

Table of Contents

List of Tables

List of Figures

List of Addenda

Chapter 1: The study in perspective

1.1 INTRODUCTION

Clothing is an extension of the self. It helps to define who a person is, what a person likes and how a person feels about him-/herself (Kaiser, 1990:145). Attributes of clothing that are often associated with positive feelings include an attractive appearance, comfort, freedom of movement and fashion. One of the basic qualities underlying all of these attributes is fit (Farmer & Gotwals, 1982:3). One of the most important consumer needs regarding clothing or apparel is that of well-fitting garments. Salusso-Deonier in Sieben and Chen-Yu (1992:74) states that consumers often use garment fit as a means of evaluating the quality of the garment. Le Pechoux (2000) as well as Brown and Rice (1998:39) agree with this view and states that fit affects comfort, as well as wear life or durability of a garment.

When a garment is ill-fitting, the consumer is dissatisfied, irrespective of the quality of the material or the workmanship, or the fashionability of the garment (Winks, 1997a:4). Ill-fitting garments will probably also have negative consequences for clothing retailers and manufacturers because the only true competitive advantage that the clothing industry has is keeping existing customers satisfied, since it is much more cost-effective for the retailer and manufacturer to retain loyal customers instead of seeking new customers all the time (Brown & Rice, 1998:38). The ideal situation for clothing retailers and manufacturers in South Africa is therefore to keep the consumer satisfied with regard to the fit of clothes. One of the challenges that the clothing industry therefore has to meet is to provide garments that will fit a three-dimensional human body form (Knight, 1994:1).

Dissatisfaction with fit of women's ready-to-wear clothing is widely expressed, both in the academic literature and in popular literature (Anderson, Brannon, Ulrich, Presley, Woronka, Grasso & Stevenson, 2001). The inability of the consumer to find satisfactory fit relates to the deviation of the human form from the standard pattern shape, as well as the great variety of human forms (Anderson et al, 2001). By improving the fit of garments, to be consistent with consumers' expectations and as a result improving the perceived quality of garments, clothing retailers and manufacturers can achieve a loyal customer base and expand their business at the same time (Brown & Rice, 1998:38).

From the clothing retailer's and manufacturer's point of view it is not possible to address the consumer's problems with fit without a set of accurate body measurements (Istook & Hwang, 2001:120). The ultimate success of any sizing system lies with the accuracy of body measurements, since problems with fit often originate from outdated and inaccurate measurement data. Size charts currently in use provide outdated standards, which remain the basis for pattern development (Anderson, Brannon & Pittman, 2005) and this eventually leads to ill-fitting garments. The development of new technology such as three dimensional body scanners makes accurate measurements a very real and achievable goal. It allows for the extraction of body measurements within seconds. It also allows consistent measurements and takes measurements without any physical contact, which would be the most desirable method for the majority of people (Simmons & Istook, 2003).

It is assumed that the standards used by the industry in South Africa are also outdated. To be able to revise current standards used by the South African clothing industry, it is first necessary to obtain current measurements of the South African population. It is however important to consider which measurements are needed, and also exactly how they should be measured on the body. One also needs to investigate what practices are followed by the industry in the process of supplying well-fitting garments.

1.2 THE CONCEPT OF FIT AS PART OF GARMENT QUALITY

Fit refers to the way a garment conforms to or differs from the body (Workman & Lentz, 2000:252) or the relationship between apparel and the body (Ashdown & DeLong, 1995:48). Well-fitting garments do not necessarily imply a close fit, it rather refers to the fit being fashionable at a given time (Farmer & Gotwals, 1982: 6). Good fit can be determined by four main factors, namely appearance, comfort, design and fabric. Appearance refers to the visual appeal of the garment when the consumer is wearing it. Attractive garments will however not be worn if they are not comfortable. It is thus important to be able to sit, bend, walk and stretch in any garment without feeling restricted or straining the seams. Design will determine the features of the garment. This creates a certain look, for example close-fitting or loose-fitting. Ease of movement and/or design ease are added to the body measurements when the pattern is created. This ensures that the desired look is created, a certain level of comfort is achieved, and in this way the appearance of the garment is enhanced. Fabric is crucial to good fit. The same style will look and fit differently according to the fabric type used – soft or crisp fabric, for example. The clinging tendency, drape, and grainline (for example, a bias cut) can lead to even a loose fitting garment defining the shape of the body (*Reader's Digest*, 1999:106). For this reason certain fabrics should be avoided when manufacturing for certain figure types. It is thus clear that the intrinsic cues related to fit are linked to the body measurements of the consumer. Consumers often use garment fit as a means of evaluating the quality of the garment (Salusso-Deonier in Sieben & Chen-Yu, 1992:74).

Garment quality is also evaluated by consumers in terms of the extrinsic cues, namely price, brand name, apparel firm's reputation, product presentation and advertising (Brown & Rice, 1998:39 and Glock & Kunz,1995:106). According to Brown and Rice (1998:38), consumers become loyal to certain brands because they can depend on that brand to deliver the same fit every time. Consumers want to be able to select the same size for different styles from the same brand or retailer, and expect a similar fit of the different garments (Glock & Kunz, 1995:106). Sizing and fit standards are often used by apparel firms as a marketing tool and a means of differentiating their products from the competition (Workman, 1991:33). This causes

confusion among consumers about which size to choose. The importance of quality control during production, to ensure consistency in sizing among different styles, is highlighted by Hudson (1980).

It is clear that fit enhances the consumer's evaluation of apparel quality by contributing to both intrinsic and extrinsic attributes of the garment, and that intrinsic as well as extrinsic factors that influence fit relate to body measurements and sizing. This is confirmed by Salusso-Deonier (in Sieben and Chen-Yu, (1992:74) by stating that sizing (and fit as a result) is an essential component of apparel quality assessment.

Apparel fit problems are costly and frustrating for manufacturers and retailers as well as for consumers. When a garment is ill-fitting, the customer is dissatisfied, irrespective of the quality of the material or the workmanship or the garment fashion (Winks, 1997a:4). It is therefore necessary to investigate problems relating to garment fit experienced by consumers. Because a satisfied consumer is so important to the industry, this study will address the problem of fit from the industry's viewpoint. This study aims to determine what the clothing industry is doing to provide their customers with well-fitting garments.

1.3 THE CONSUMER'S PROBLEMS WITH FIT

From the consumer's viewpoint, finding a garment that fits can be a time consuming and frustrating task. Consumers often have to try on several garments before finding one that fits. Sizing and size labelling is often used as a marketing tool or sales function, a way of differentiating between competitors' products (Workman, 1991:38). Accurate size information is beneficial to consumers as well as to manufacturers and retailers because it may improve consumers' perceptions of quality and therefore increase the manufacturers' and/or retailers' competitive edge (Le Pechoux & Ghosh, 2002:11 and Sieben & Chen-Yu, 1992:74). However, the information on size labels in many cases do not assist the consumer in finding the correct size since all the necessary body measurements to facilitate the selection of a garment are not

provided. A study by Chun-Yoon and Jasper (1995) concluded that consumers prefer a size labelling system that features both pictograms and key body dimensions. Such a system would quickly communicate to the consumer the body dimensions the garment was designed for. To add to the confusion, manufacturers often use the same size designation – the number that identifies each size – for clothing that fits different body measurements (Workman & Lentz, 2000: 252; Ashdown, 1998:327; Tamburrino, 1992a:44). Down-sizing strategies are designed to flatter the egos of consumers and are connected to each company's perception of its competitive advantage (Le Pechoux & Ghosh, 2002:11 and Desmarteau, 2000:1). It appeals to the female consumer because it enables her to wear a smaller size. This strategy promotes sales by making the consumer feel good about herself. It contributes to her psychological and social well-being and in this way creates loyalty to the brand or store. Women will always buy from the store where they take the smaller size providing the other factors influencing garment quality are perceived in a positive way (Workman, 1991:32).

Consumers' lack of knowledge concerning which body measurements are necessary when choosing certain garments aggravates the problem. They often do not know how to take their own measurements accurately or which measurements act as key indicators of size (Le Pechoux & Gosh, 2002:11). It therefore seems as if a proper size labelling system and education of salespeople as well as consumers might assist the consumers in their search for well-fitting garments. However, the best size labelling and education campaign will not ensure good fit if the clothing sizes are based on outdated and inaccurate anthropometric or body measurement data.

It is not only female consumers that insist on well-fitting garments. A study by Hogge, Baer and Kang-Park (1988:52) regarding men's clothing preferences, perceived availability and fitting problems, indicated that both older and younger men rate fit as the most important garment property. The clothing industry can therefore not afford to ignore the problem of fit. This is why it is important that the industry continuously renew the standards and systems used for the manufacturing of garments, particularly with regard to the sizing of garments.

1.4 THE INDUSTRY'S PROBLEM WITH FIT

Apparel fit problems are not a new phenomenon. It is however now highlighted by body-fitting fashions. As stated earlier, fit is not only judged in terms of how closely it relates to the body but also in terms of being fashionable at a given time (Farmer & Gotwals, 1982: 6). The current body fitting fashion is one of the reasons why there is a renewed worldwide interest in sizing and fit. One of the challenges that the apparel production and retail industry has to meet is to provide garments that will fit a three-dimensional human body form (Knight, 1994:1). According to Istook and Hwang (2001:120), it is not possible to address the consumer's problems with fit without a set of accurate body measurements. Body measurements are the basis for pattern construction (Workman, 1991:32). Pattern construction has a very important influence on the fit of the garment. Two bodies with the same dimensions but with different attributes may each require a different pattern (Tamburrino, 1992b:54), because the same garment will not fit individuals with similar body measurements but different proportions equally well. Body measurements must therefore be considered together with proportions to enable a decent fit for different people. The apparel industry is moving toward more diversity by providing more choices and therefore should evaluate the basis of its sizing systems and develop new systems that would provide more consumers with better fit (LaBat & DeLong, 1990:44). An accurate sizing system can benefit the retailer by facilitating the selling task in that customers would have to try on fewer garments, and thus reducing the number of returns. Consumers will also benefit from a better fit by having to make less alterations (Tamburrino, 1992c:72,74).

To industry the expense of fit problems may come in the form of returned merchandise, lost sales, more markdowns, unmarketable stock and dissatisfied customers (Senanayake & Little, 2001; Desmarteau, 2000; Winks, 1997b; Tamburrino, 1992c:72). A study by McVey, referred to in Workman (1991:33), revealed that 70% of garments on markdown racks end up as markdowns because of problems in workmanship and/or fit. Workman (1991:32) states that "…retailers [and manufacturers] lose money when garments do not fit properly, do not sell in a timely manner and have to be marked down". To the industry a dissatisfied customer means

lost sales. Dissatisfied customers can also harm the brand image and/or reputation of the manufacturer or retailer, resulting in great financial costs to improve this image again.

Industry's effort to supply well-fitting garments is based on their sizing systems. In its simplest form a sizing system is a set of pre-determined body sizes designated in a standard manner (Winks, 1997b:24). A sizing system generates the size charts, which provide the measurements necessary for garment production (Kunick, 1984:9). Various efforts have been made to standardise sizing systems. The ideal figure influences the underlying systems for sizing apparel. Sizing systems based on ideal proportions are however too limited (LaBat & DeLong, 1990:44).

Chun-Yoon and Jasper (1993) identified the problems with fit as the result of: (1) sizing systems being based on outdated anthropometric data and (2) sizing systems' lack of appropriate sizes to accommodate the full range of variation in body types that exist in the current population. Very few sizing systems accommodate differences in body proportions related to age, ethnicity or body weight (Winks, 1997a; Goldsberry, Shim & Reich, 1996b and Giddings & Boles, 1990). One of the problems encountered when designing for people, especially in South Africa with its multi-cultural population, is that they are different; for instance, tall or short, slim or fat, long arms, short legs, big heads, small feet, young or old (Ashby, 1978:1). This can be overcome if the variation in the size of a population is given due consideration. It is however necessary to establish limits to the variability that can be accommodated (Ashby, 1978:1,2), and this is the function of a sizing system for clothing. Current sizing systems are based on the principle that the difference between sizes is measurable in equal linear distances. Linear increments between sizes in a sizing system facilitate pattern making and grading. Actual human measurements, however, do not support the assumption that the difference between the principal girths is constant (Schofield in Desmarteau, 2000:2). It is clear that how and where these measurements should be measured on the human body must be described in detail, to be able to make accurate assumptions and comparisons.

The selection of key dimensions to develop sizing systems offers another problem. Key dimensions are measurements that serve as predictors of the sizes of other

parts of the body (Chun-Yoon & Jasper, 1996:90). A key dimension is a body dimension that has a strong relationship with most other body dimensions that are important to the garment. According to Winks (1990:22), the correlations among relevant body measurements are critical in the manufacture of body-fitting garments. Key dimensions are fundamental to the definition of body size and are used to assign an appropriately sized garment to a wearer (Winks, 1997b:24 and ISO/TR 10652, 1991:1). It is therefore critical for fit that one is exactly sure how and where these key dimensions should be measured on the human body. For consistency in sizing it is also important that the key dimensions be measured in a standardised way by all manufacturers and retailers. According to Green (1981:28), key dimensions could be used to generate the matrix of intervals on which an entire system of sizes could be imposed. Key dimensions should fulfil the following requirements: they should 1) be convenient to measure; 2) be an integral part of the garment; 3) have a high degree of correlation with other dimensions important in design and sizing; and 4) not correlate highly with each other (McConville in Chun-Yoon & Jasper, 1996:90).

Key dimensions, however, are not the only important factor in the prediction of body shape. Ashdown (1998:324), in collaboration with graduate student Beatrix Paal, developed a method from which an optimised sizing system can be inferred that uses as many body dimensions as are needed to account for the variability in the population. These sizing systems will potentially fit the population better than sizing systems based on one or two dimensions only, as is currently the case in most instances. The goal of any sizing system is to choose subgroups of the population in such a way that a limited number of sizes will provide clothing that fit most individuals in the population, while taking into account the variability within the population (Ashdown, 1998:324,325).

Differences in body shapes and sizes are repeatedly put forward as a reason why a workable standard sizing system cannot be reached (Winks, 1997b:46; Price & Zamkoff in Workman, 1991:32,34). Desmarteau (2000:6) considers body shape as the missing link to achieve better fit. It is also important to keep in mind that people's shape and proportion change over time as a result of change in nutrition, lifestyle, ethnic composition and age (Goldsberry, Shim & Reich, 1996a:109). Very few sizing systems accommodate differences in body proportions, for example as a result of

age, ethnicity or body weight (Winks, 1997a:4; Goldsberry, Shim & Reich, 1996b; Giddings & Boles, 1990). The most difficult aspect of sizing, especially large-size sizing, is the variance in body type. The differences between body types become more pronounced in larger women (Lebow, 1985:14). It is obvious that variation in body shape must be incorporated in any system that sets out to meet the requirements of the population. The best way to provide for variation in shape is to construct separate size charts for this purpose (Kunick, 1984:19). The development of new technology such as three-dimensional body scanners makes it possible to take body shape into account when developing sizing systems (Workman & Lentz, 2000:258). It also makes more accurate measurements a very real and achievable goal since the ultimate success of any sizing system lies with the accuracy of body measurements. Fit problems originate from outdated and inaccurate measurement data.

When designing for a market, it is necessary to have available reliable anthropometric data, otherwise the product (in the case of this study, apparel and shoes) may be totally unsuitable for the user (Ashby, 1978:4). Scientific garment cutting is based upon measurements of the human form. The correct set of body measurements related to the specific product is vitally important. Various aspects can determine which body measurements are required to manufacture certain garments, for example who the garment is for and which part of the body will be covered by the garment. Tamburrino (1992b:52,54) explains for example that a tailored jacket may require at least six dimensions for construction, namely chest or bust girth, waist girth, seat girth, jacket length, sleeve length and waist length, while a men's dress shirt requires three dimensions – neck girth, shoulder girth and sleeve length. These measurements are the first steps towards drafting a correct pattern. Fit is determined by pattern making (Hudson, 1980:109), and pattern making starts with the body measurements. According to Morris (194?:14), the finest cutting system in existence would be a complete failure if the measurements used in conjunction with it were inaccurate.

The situation in South Africa, with its multi-cultural population, regarding sizing and fit is not different from anywhere else in the world. To be able to solve fit problems, it is however necessary to know how the industry functions with regard to providing well-

fitting garments. The problem that exists and that will be addressed in this study is that very little is known about how the South African clothing industry ensures well-fitting garments.

1.5 CONCEPTUAL FRAMEWORK, PROBLEM STATEMENT AND OBJECTIVES FOR THE STUDY

This study is approached from the viewpoint that if population measurements are not current and accurate, all the other aspects cannot contribute to the achievement of an acceptable or proper fit. This is illustrated in the conceptual framework as presented in **Figure 1.1**.

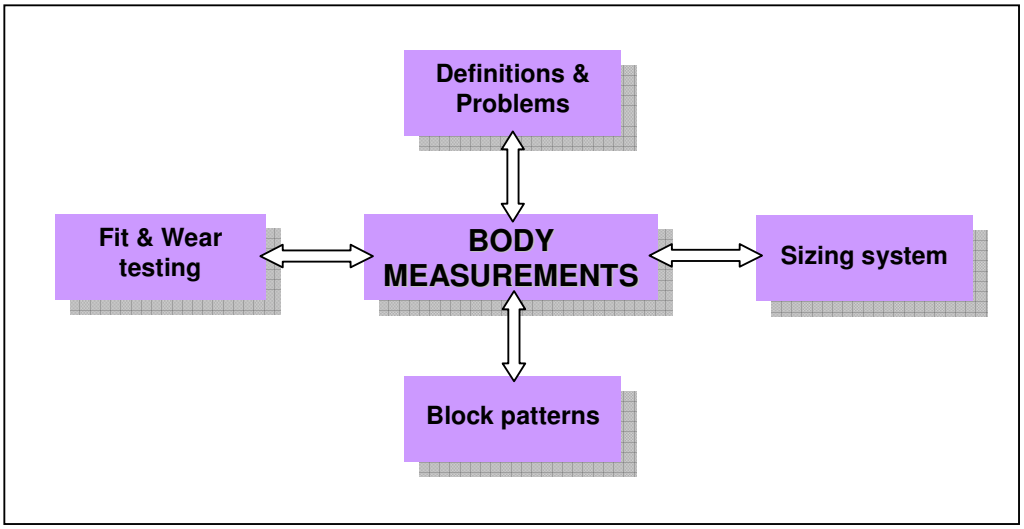

FIGURE 1.1: CONCEPTUAL FRAMEWORK

Body measurements are the focus of the study because they will determine the applicability of a sizing system for a population, the accuracy of the block patterns and the relevance of the fit and wear testing. Almost no information is available on how the South African clothing industry operates regarding the use of body measurements and ensuring well-fitting garments. The problem that will therefore be

addressed in this study is how the South African clothing industry ensures well-fitting garments for their customers.

Subproblems that arise are the following:

- ✓ Which measurements should be included in a South African database?
- ✓ How are these measurements described by the industry?
- ✓ What are the problems regarding body measurements?
- ✓ What is the origin of the South African sizing system?
- ✓ How do the sizing systems currently used in South Africa function?
- ✓ How are block patterns generated?
- ✓ How is fit testing done?
- ✓ How is wear testing done?

Since almost no information is available about the measurements and sizing systems used in the South African clothing industry, and keeping in mind the conceptual framework in **Figure 1.1**, the following objectives are set for this study:

1. To compile a comprehensive list of all body measurements required by South African apparel manufacturers and retailers, covering the garments in the following categories:
   - ✓ Men's/Boys'/Women's/Girls'/Babies' garments that cover the full body;
   - ✓ Men's/Boys'/Women's/Girls'/Babies' garments that cover the upper body;
   - ✓ Men's/Boys'/Women's/Girls'/Babies' garments that cover the lower body;
   - ✓ Men's/Boys'/Women's/Girls'/Babies' headwear;
   - ✓ Men's/Boys'/Women's/Girls'/Babies' gloves;
   - ✓ Men's/Boys'/Women's/Girls'/Babies' footwear.

2. To compare international descriptions of the identified body measurements with the South African respondents' descriptions and evaluation of the identified body measurements.

3. To describe the problems experienced with body measurements by the South African manufacturers and/or retailers.

4. To describe currently used South African sizing systems.

5. To describe how block patterns are generated by the South African manufacturers and/or retailers.

6. To describe how fit testing is done by the South African manufacturers and retailers.

7. To describe how wear testing is done by the South African manufacturers and retailers.

1.6 COURSE OF THE STUDY

1.6.1 Chapter 2: Theoretical framework

This chapter explains the theoretical framework of Ashdown, which forms the basis of the conceptual framework for the study. Concepts are clarified and the research problem is stated in this chapter.

1.6.2 Chapter 3: Research design

This is a discussion of the plan according to which the research is conducted. It gives the objectives of the study and then the research strategy, sampling, data collection methods, data analysis and ways to ensure validity and reliability of the data are explained.

1.6.3 Chapter 4: Results, discussion and interpretation

In this chapter the results of the research are presented in tables, bar charts and pie charts according to the objectives of the study. The results are also discussed and interpreted and possible explanations for the results are presented.

1.6.4 Chapter 5: Conclusion, recommendations and evaluation

In the final chapter conclusions are made regarding the South African clothing industry and the way that well-fitting garments are ensured. Recommendations are made to the clothing industry. The study is also evaluated in terms of strengths and weaknesses, and recommendations are made for future studies.

For further reference the questionnaires for the postal survey are included in **Addendum A**, the interview schedule in **Addendum B** and the results and discussion of the descriptions of some body measurements are included in **Addendum C**. These are the body measurements for which no international description is available, and where respondents gave only one or no description.

The technical presentation and references are done in accordance with the requirements of the Department of Consumer Science at the University of Pretoria. The method for referencing is a variation of the Harvard method. The report is written in British/South African English.

Chapter 2: Theoretical Framework

2.1 INTRODUCTION

Fit is clearly a complicated problem that can be approached from different viewpoints. This chapter will attempt to explain the various factors that determine and influence garment fit.

The framework of Susan Ashdown (2002), as presented in **Figure 2.1**, is used as a point of departure in this study. Ashdown views sizing systems as the focus around which all factors concerning sizing and fit evolve.

2.2 SIZING SYSTEMS

For the purposes of the framework, Ashdown (2002) defines sizing systems as a set of sizes derived using common assumptions and methods of development. Size categories within a system will be defined as the various groupings of sizes as they would be presented in a retail situation. The sizing system indicates the difference between sizes, thus how much bigger or smaller the following size must be. Loose fitting styles may have fewer sizes since the intervals between sizes can be bigger. Close fitting styles might need more sizes, because the difference between sizes would be smaller. A sizing system can therefore be as simple as one-size-fits-all or Small/Medium/Large (SML), or as complex as a system that provides a custom fitted garment for every individual (Ashdown, 2002). The sizing system generally used for ready-to-wear in the USA, and also in South Africa, makes use of a base size and a set of sizes proportionately graded from this size. Grading may be defined as the

increasing or decreasing of a pattern according to a set of corresponding body measurements (Handford, 1980:vii). A master pattern is graded up and down to create the other sizes in the range of the particular sizing system (Ashdown, 1998:336). As stated in the previous chapter, pattern making starts with body measurements of an individual from a specific population, and a good pattern is key in obtaining well fitting garments.

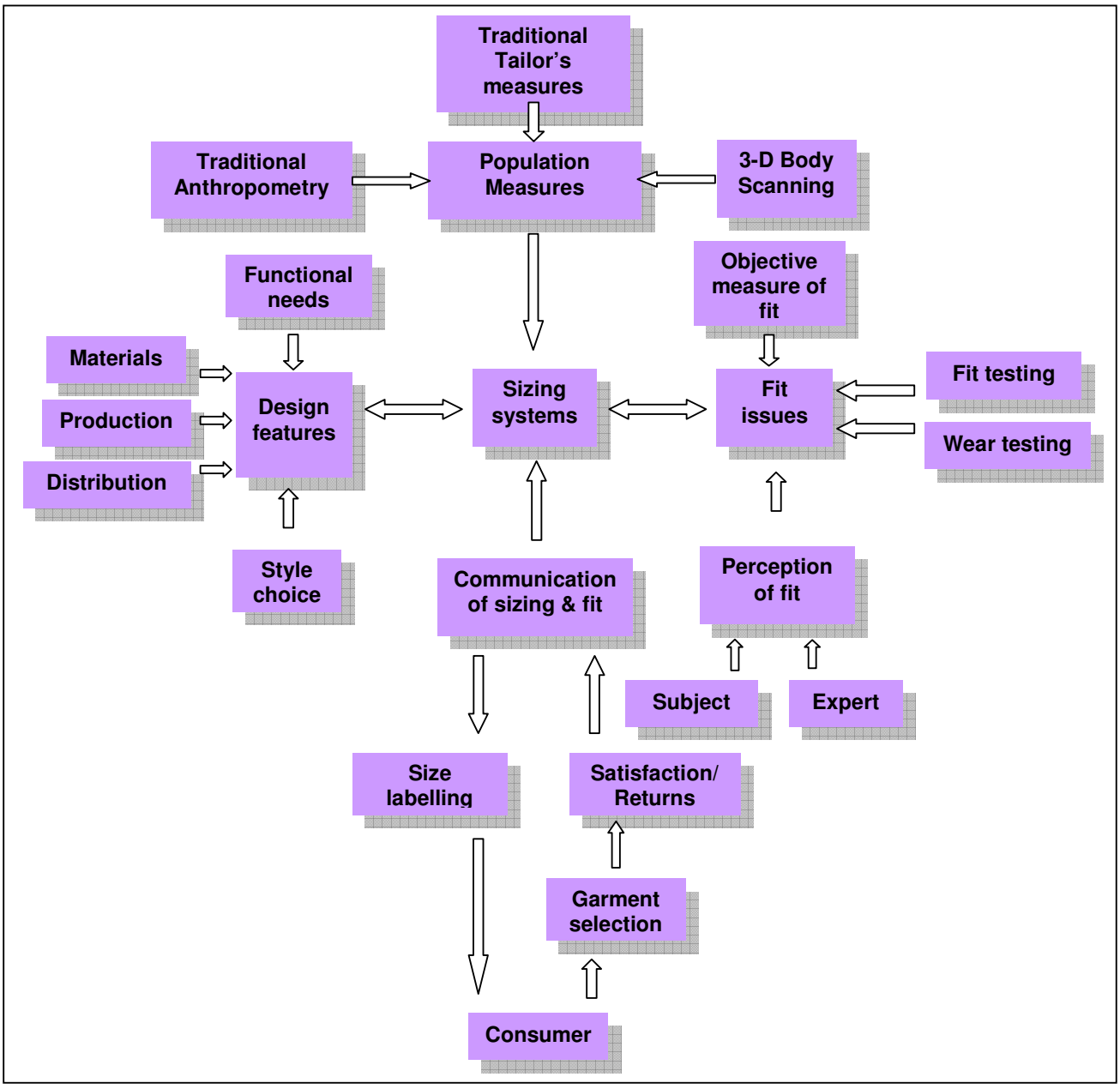

FIGURE 2.1: THEORETICAL FRAMEWORK (Ashdown, 2002)

2.3 POPULATION MEASUREMENTS

The framework in **Figure 2.1** illustrates that the effectiveness of any sizing system depends on the population measurements on which it is based. It is important that these measurements be current, accurate and representative for the population for which the sizing system is being developed. Ashdown (2002) states that population measures can be used to determine the range (smallest to largest), as well as the variation (differences in proportions) of the people in a population. Population measurements are especially important in countries where variations are the result of the population consisting of a variety of ethnic groups, as is the case in South Africa. If population measurements are outdated and inaccurate for a specific population, the best sizing system will not be able to ensure well-fitting garments for that population.

Measurements can be obtained by different methods, namely traditional tailor's measurements, traditional anthropometry or three-dimensional body scanning. The accuracy as well as the representativeness of the population's measurements may be influenced by the measuring methods used. It is therefore necessary to briefly discuss the different measuring methods.

2.3.1 Traditional tailor's measurements

Traditional tailor's measurements refer to measurements taken by hand using a measuring tape. Measurements taken and landmarks are directly related to the garments that are to be made. Most measurements are taken along the contours of the body and not in a straight line between two points. Due to the variability in identifying landmarks and the placement of the measuring tape on the body by different measurers, it is not always possible to repeat measurements. The accuracy of traditional tailor's measurements can be significantly reduced as a result of posture shifts by the person being measured. Although a skilled tailor or dressmaker can take very accurate measurements, methods and measurements can vary considerably among different professionals (Ashdown, 2002).

2.3.2 Anthropometry

Anthropometry literally means the measurement of people (Norgan in Ulijaszek & Mascie-Taylor, 1994:141). It can be defined as the science of measurement. The name derives from *anthropos*, meaning human, and *metrikos*, meaning measuring (Roebuck, 1995:1). It deals with measurements of the physical characteristics of human beings – particularly their sizes and shapes (Pheasant, 1996:3; Norgan in Ulijaszek & Mascie-Taylor, 1994:141). Anthropometric measurement methods and tools have been developed to make valid and reliable measurements of individuals in a population possible. Anthropometric tools include anthropometers (a standing tool that measures straight linear distances), callipers (measures linear depths and widths), and calibrated measuring tapes (Ashdown, 2002). Observer error is the most troublesome source of anthropometric error and includes imprecision in landmark location, subject positioning and instrument applications (Simmons & Istook, 2003). Accuracy is therefore dependent on the person taking the measurements. It is often advised that two people should measure each subject to ensure the least amount of error. Careful and accurate location and marking of landmarks on the body, as well as proper training of personnel can ensure consistency and accuracy of measurements. It is clear that the collection of anthropometric data is a time consuming and expensive process that requires skilled personnel. The development of three-dimensional body scanners has opened up new possibilities for the measurement and analysis of the human body (Ashdown, 2002).

2.3.3 Three–dimensional body scanning

In recent years, researchers have developed three-dimensional body scanners that can capture the outside surface of the human body within a few seconds by using optical techniques. This measurement technique can be non-contact, instant and accurate through the use of laser light or white light and cameras. This technology has the potential to enable researchers to collect and process more accurate anthropometric data than ever before almost instantaneously (Le Pechoux, 2000). Three-dimensional scanning produces a 360 degree replica of a solid object, for example the human body, on a dimensionally accurate computer screen. This image

of the human body can be stored and then viewed, rotated, sliced and measured on the computer screen by using automated measuring procedures whenever information is needed. This makes it possible to analyse body postures and proportions in new ways (Ashdown, 2002). Unfortunately, there are still some shaded body areas that cannot be scanned effectively. For the time being, three-dimensional body imaging has to be used in conjunction with hand measurement.

The use of three-dimensional body scanners can help overcome the constraints in the use of body dimensional data as listed by Laing and Sleivert (2002:4). These constraints include that the data are current, the data reflect the potential user group and that the methods used are comparable and reproducible (Laing & Sleivert, 2002:4). Body scanning is a less time-consuming and therefore also a less expensive method of obtaining body measurements than traditional anthropometric methods. This increases the possibility of repeating body measurement surveys on a regular basis, resulting in more recent body measurement data being available. Information regarding the population being scanned, such as gender, age, ethnic origin, and other relevant data can be collected and stored with the scanned data, since taking the measurements does not take as much time as with traditional anthropometry. Human error is greatly reduced, resulting in the survey data being more comparable and reproducible. Definition of landmarks and clear descriptions of measurements are, however, still a very important requirement to ensure comparability and reproducibility of any body measurement survey, regardless of which measurement method is used.

Three-dimensional body scanners have not been available in South Africa for use by the clothing industry. In general, measurements are taken in the traditional tailor's manner with normal tape measures. It is therefore very difficult to compare measurements used by different companies because of the variation in measurements and methods between different professionals. Anthropometric surveys have been undertaken in the past, but because of the time and financial implications involved the number of measurements have to be limited. These measurements are also not available for use by everybody involved in the clothing industry, but are restricted to the companies involved in undertaking the survey. The use of a three-dimensional body scanner can make body measurement surveys more

accessible to the clothing industry in general. Using less time to scan one person it might be possible to take more measurements on more people in the same time that a traditional anthropometric survey took to complete. Therefore it would be ideal to undertake such a survey by using a 3D-body scanner. It is however necessary to establish how and where measurements are taken on the body, to ensure that critical and useful measurements are taken.

2.4 DESIGN FEATURES

In the process of producing well-fitting garments the design features of the actual garment play a significant role, as indicated in **Figure 2.1**. The relationship between design and fit of clothing is complex because each garment style has its own ideal relationship to the body. It is generally accepted that, the more style ease a garment has, the greater the range of body variations that the garment will fit (Ashdown, 2002). Ease is the difference between the body measurements of the intended wearer and the measurements of the garment (Brown, 1992:265). Ease can be differentiated in movement and design ease. Movement or fitting ease is the amount added to the body dimensions to allow for movement and comfort. Design ease is the amount added to the body dimensions to create a specific style, silhouette or fit. Design ease is added in addition to movement ease (Laing & Sleivert, 2002:6 and Brown, 1992:265,266). The importance of comfort and freedom of movement in clothes was discussed in the previous chapter. Design features may limit or expand the range of dimensions that can be fitted by a style; for example, princess lines on a dress create a more fitted style which will fit a limited number of people in an acceptable way. Sleeves with cuffs, on the other hand, can be adjusted to different wrist sizes and create an acceptable fit for a variety of arm lengths. Ashdown (2002) is therefore of the opinion that the number of sizes needed to fit a population can be reduced by the creative use of design or design features.

2.4.1 Functional features

When designing functional features, the needs of the wearer and the expectations for the garment have to be considered. According to Laing and Sleivert (2002:7), garment sizing is more critical for work and sports garments than for fashion garments. Poor fit can compromise the protection offered by a specialised garment, and as a result the safety of the wearer. Movement, interaction with the environment, specialised fabrics and thermal properties are other factors to consider when designing functional garments. The fit and performance of a functional garment may be significantly affected by decisions taken during the design process (Ashdown, 2002).

2.4.2 Materials

Regarding materials, Solinger (1980:55) indicates that it is vital that the pattern maker considers the drape and stress characteristics of the fabric to be used for the garment. Stress characteristics are the tendencies of the fabric to stretch, shrink, and/or distort under body stress induced during wear. Drape characteristics are the fabric's tendencies to change constructional dimension when the orientation of the grain structure of the fabric is changed with respect to gravitational forces (Solinger, 1980:55). These characteristics of the fabric often influence and dictate style choices and the amount of ease needed in the design process. Stretch fabrics will extend and move with the body and will need less ease to be comfortable. A stretch fabric can therefore be fitted more closely to the body than fabrics with less stretch. According to Ashdown (2002), material properties affect the way a garment fits on a body. It can also impact how many people of different shapes and sizes can be fitted with one garment size; for example, if a garment is made from a stretch material, it will be possible to fit more people with a variety of body shapes into one size.

2.4.3 Production

The precision of garment sizes can be affected by methods such as spreading, cutting, sewing and pressing, used during the production phase. Inaccurate cutting and sewing as well as shrinkage due to heat and steam from pressing, could result in identical garments being labelled with the same size but having completely different physical dimensions. According to Hudson (1980:113), it is possible to destroy a well-fitting pattern through inaccurate, inconsistent sewing practices. The introduction of unit production or modular production systems increased the number of sizes that can be handled by one manufacturer and as a result the number of sizes that can be accommodated in a sizing system. Modern technology even makes it possible to produce custom-made garments economically (Ashdown, 2002). Quality control during the production process is of the utmost importance in order to maintain consistent size of garments.

2.4.4 Distribution

Distribution goes hand in hand with production, as the number of sizes in a system are dependent on warehousing, retrieval and shipping issues (Ashdown, 2002). Distribution involves the selection of the appropriate styles and numbers of each size to be sold at each store location to a particular target market. Stock keeping units are one style made in one colour and one size (Glock & Kunz, 1995:77), and is currently based on what has sold in the past. This usually included fewer garments in the smallest and largest sizes. The optimised sizing system has the advantage that the number of individuals who fit into each size are more evenly distributed across the range of sizes. An added advantage is that if each retailer has an accurate database of their customers it would be possible to calculate the number of the different sizes necessary to accommodate the population in that area (Ashdown, 1998:338). Retailers will thus be able to offer their consumers a better selection of styles and sizes.

2.4.5 Style choices

The designer's style choices can affect the overall fit of a garment, because structural seams and darts incorporated into the design of a garment will influence how the garment will fit the consumer. Fashion is an important consideration, since it is a design aspect of apparel. It is the distinct look that is being created and is identifiable by the silhouette produced. The achievement of the intended silhouette in the finished garment is a function of fit, and is determined by pattern making and the amount of ease added. Length of sleeves, pants, skirts, jackets, coats and dresses; placement of waistline; shoulder shape; neckline and collar shape have to be considered (Hudson, 1980:109). Consumer perception of the fit of the garment is influenced by these style features of the garment.

2.5 FIT ISSUES

Fit issues represent another set of factors related to sizing systems that should be considered to eliminate fit problems. According to Le Pechoux (2000), fit is a function of sizing. Fit affects comfort, as well as wear life or durability of a garment. "How well a garment fits" is based on individual perceptions of comfort, fit and fashion. To complicate matters, the designer, the pattern maker and the consumer each has a very different concept of fit. Since individual perceptions differ regarding tolerance, it is an important factor concerning fit issues. It is imperative to know how much tolerance is acceptable to the consumer before he/she regards the garment as ill-fitting. The fit threshold is the smallest difference in fit that can be sensed. Information regarding fit thresholds can be useful when developing increments between sizes (Ashdown & DeLong, 1995:48). Since fit is one of the aspects used by consumers to evaluate quality, consumers' perceptions of fit is an important consideration when trying to improve the fit, as well as the quality of garments.

2.5.1 Perceptions of fit and the objective measure of fit

Subject or wearer responses to the fit of garments are important in assessing the success of a garment or a sizing system. Such responses can however be difficult to interpret. The subject's perception of fit is shaped by past experiences with the fit of clothing and by their own personal preferences. It is essential that informed subjects who can analyse and communicate garment function and fit are used for fit testing and also for testing sizing systems (Ashdown, 2002).

Methods to subjectively measure fit through visual analysis by experts have been developed by researchers in the apparel field. These methods rely on the expert's visual inspection of garment wrinkles and seam placement of the garment as it is worn by a subject. Expert fit testing methods can increase the quality of fit in a garment. It is necessary that members of an expert panel be trained specifically for the study or test of fit, because the ability to repeatedly assess a garment in the same way, as well as a common understanding among the panel members are necessary for good results from such a panel (Ashdown, 2002).

Since individual perceptions – regardless of whether they are made by the wearer or by an expert – are mostly subjective, it is also necessary to be able to objectively analyse fit. Fit is clearly a complicated concept because every individual has his/her own idea of what it entails. Garment quality depends on the fit and therefore a thorough and objective understanding of what is meant by good fit is crucial. Most of the objective methods to analyse fit are only suitable to answer simple questions about fit, but cannot address the many interactions that occur in the complex system of the clothed body. The body scanner however does show possibilities for the development of more objective measures of fit (Ashdown, 2002). A person can be scanned wearing a garment and the relationship between the garment and the body can then be studied objectively. The difference between the body and the garment can for example be measured, or the silhouette observed without any subjective influence such as personal preference of the wearer or the observer.

2.5.2 Fit testing

The way a garment fits and wears can also influence the perception of fit and the actual fit. To minimise negative effects, fit and wear tests should be conducted. Fit testing is critical to reveal key problems with the fit or functionality of a garment. This can result in a better product. To conduct a fit test it is important to understand exactly what information is needed. Careful planning is needed on how to collect, record and analyse data since data from fit tests may be conflicting and difficult to interpret (Ashdown, 2002).

2.5.3 Wear testing

Wear testing is necessary to address issues of durability, garment performance and fit or changes in fit over time. Subjects wear the garment for a period of time in order to observe the garment's response to normal handling. The lengths of time are specified, with cleaning at specified intervals using appropriate methods. Wear tests occur over time in uncontrolled circumstances and rely on subjective reporting of results from the wearer. Wear tests can however provide important information regarding the success of a garment under actual wearing conditions (Ashdown, 2002).

2.6 COMMUNICATION OF SIZING AND FIT

A sizing system can only be regarded as successful when satisfaction with fit is achieved. This conclusion was already reached at the end of the fifties by Emanuel, Alexander, Churchill and Truett (1959:39) while developing a height-weight sizing system for flight clothing. They state that "…a sizing system can be considered successful only after it has been used in the design of one or more garments and these garments have proved, from a functional and comfort standpoint, to fit the individuals for whom they were intended". Once a successful sizing system is developed, it is important to communicate this to the consumer. According to

Ashdown (2002), retailers should communicate any sizing problems that are encountered by consumers back to the manufacturer, but this seldom happens.

2.6.1 Size labelling and the consumer

The size label is a way to communicate sizing information to the consumer. The size label should assist the consumer in selecting the appropriate size garments. Brown (in Chun-Yoon & Jasper, 1993:32) indicates that retailers and manufacturers use the size label as a marketing tool. Consumers however use size labels to find out the garment size before they actually try on a garment (Chun-Yoon & Jasper, 1993:31). A labelling system should enable consumers to find their correct garment sizes easily without trying on too many garments, even if manufacturers use different body measurements for the same size code. Clear size labelling will reduce manufacturers' and retailers' costs because of frequent returns and damage to garments caused by customers frequently trying them on (Chun-Yoon & Jasper, 1993:36). It will also simplify garment selection which is important, since the modern consumer is more pressed for time and not willing to spend time trying on multiple garments in order to find a good fit. Effective communication is therefore essential for the consumer and for the clothing industry.

2.7 CONCEPTUAL FRAMEWORK

The aim of this study is to investigate and describe how the South African clothing industry ensures well-fitting garments for their target consumers. With Ashdown's model (2002) as point of departure and the objectives of the study in mind, the following conceptual framework was developed for this particular study. A model of this framework is represented in **Figure 1.1**. Following Ashdown's framework, it is clear that accurate body measurements of a population form the basis of any sizing system. This means that sizing systems cannot be revised or improved without an up-to-date and representative anthropometric database of a target population.

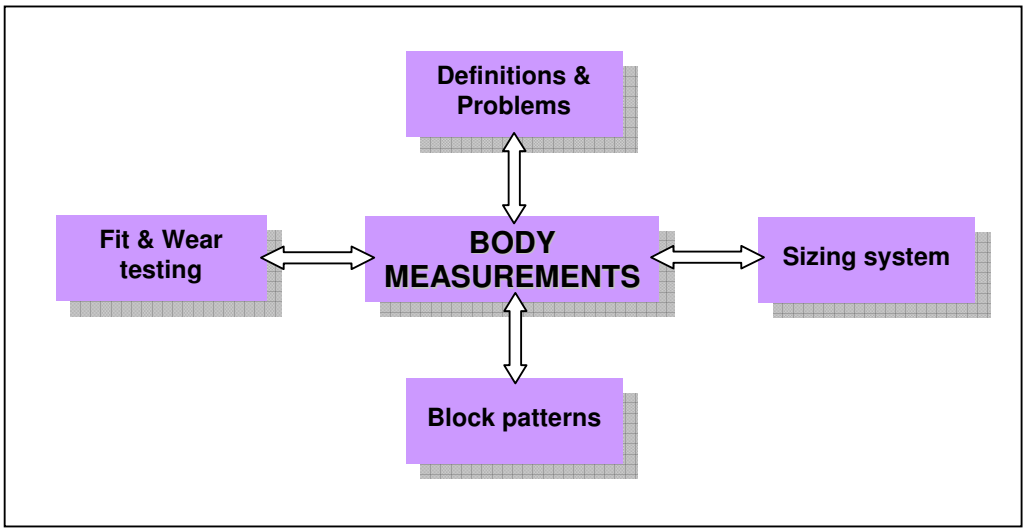

FIGURE 1.1: CONCEPTUAL FRAMEWORK

2.7.1 Body measurements

Figure 1.1 clearly indicates that body measurements are the central focus of the conceptual framework because without body measurements there can be no sizing systems, and no block patterns. Tamburrino (1992b:56) identifies three requirements for anthropometric data to be of practical use. Firstly, such data must be current. Secondly, the data must reflect the distribution of the population's body measurements by geographical area. Manufacturers and retailers need local data of the customers, not general data about the entire country. Sampling of anthropometric data from selected areas needs to be a continuous process in order to satisfy the commercial needs of the apparel industry. Thirdly, the anthropometric data must satisfy the technical requirements of apparel manufacturers. Data must therefore be collected following uniform and standard criteria.

Measurement guidelines are necessary to ensure that a South African anthropometric database is relevant and accurate. This will involve decisions regarding the scope of the number of measurements that should be taken and accurate descriptions of exactly where they are to be taken (definitions). Since three-dimensional body scanning technology does not restrict the measurement process to

only a few measurements, it is possible to include the widest spectrum of measurements.

The above procedures are in line with prescriptions suggested in the literature. The planning of an anthropometric survey involves the decision of which parts and attributes of the human body are to be measured (Roebuck, 1995:10).

According to Roebuck (1995:7), a fundamental requirement when selecting measurements and measurement methods is to plan ahead for future applications or uses of the data. A very important future application of the data in a South African anthropometrical database should be the development of revised sizing systems. A clear description and understanding of the current South African sizing systems will be necessary before developing new sizing systems or revising sizing systems currently in use.

2.7.2 Sizing systems

As has already been stated, sizing systems are generally based on a selection of dimensions from an anthropometric study of the population for which the sizing system is designed. Key dimensions are used to divide the population into size groups (Ashdown, 1998:325). Various statistical methods are used to identify key dimensions from which sizing systems can be developed. Most sizing systems are based on two to four key dimensions (Chun-Yoon & Jasper, 1993:34). However, sizing systems created using an optimisation methodology make use of any number of dimensions (Ashdown, 1998:328). Therefore it is necessary to evaluate the different methods used to identify key dimensions in the process of structuring a sizing system. Salusso-Deonier, DeLong, Martin and Krohn (1986:38) state: “Receiving little attention but also critical to assuring apparel sizing adequacy is the classification methodology used to structure a database into sizing systems.” Le Pechoux (2000) also states that “…the statistical models used to derive sizing systems need to be redesigned to better account for the wide variation between individuals”. The above statements clearly indicate the importance of investigating and evaluating different methods for structuring a sizing system. First, the currently

used sizing systems should be described and understood. The success of any sizing system lies in the accuracy of the body measurements that it is based on. Evident from **Figure 1.1** is the fact that any problems experienced with body measurements will also be transferred to the sizing system derived from those measurements. The origin and functioning of the South African sizing system is vague and should therefore be investigated before any structuring of new or revised sizing systems can be undertaken.

2.7.3 Block patterns

Figure 1.1 clearly indicates the interaction and interdependence of body measurements with sizing systems, block patterns and fit and wear testing. Sizing systems are derived from the body measurements of a population. The sizing system then prescribes the set of body measurements relevant to a specific size, which are then used in the drafting of the block patterns for the specific garment size. If the pattern maker starts off with inaccurate body measurements, no matter how accurate all other aspects of the production of a garment up to labelling and fit and wear testing are executed, it will be nearly impossible to create a good fit. Hudson (1980:109) confirms that fit is determined by pattern making.

During pattern making, body measurements are used together with specific amounts for ease of movement and design ease to create a specific silhouette or garment styling. The combination of body measurements together with the correct amounts of ease will result in garment measurements appropriate for the given body measurements. It is not possible to create suitable garment measurements without an applicable set of body measurements as a starting point. It is thus clear how inaccurate and outdated body measurements can result in block patterns that do not fit.

2.7.4 Fit and wear testing

Before any pattern goes into production, a sample garment is made. The sample is evaluated in terms of fit to ensure that it meets the requirements of the company involved. Yu (in Fan, Yu & Hunter, 2004:33) states that a live model or a dress form (dummy) can be used to verify whether a garment fits the measurement specifications. Choice of a live model and/or an appropriate dummy, is based on the body measurements prescribed by the sizing system for the sample size of garments.

As discussed earlier, wear testing is necessary to address issues of durability, garment performance and fit or changes in fit over time (Ashdown, 2002). Garments are worn for a continuous period and cared for in the prescribed manner. This can be done in controlled (Laing & Sleivert, 2002:11) or uncontrolled conditions. The assumption is that in the industry, wear testing is mostly done in uncontrolled conditions. The choice of people to take part in wear testing is again based on the body measurements that the garment is supposed to fit.

Improving garment fit before mass production is undertaken is necessary to ensure garment quality and consumer satisfaction, and also to avoid unnecessary expenses due to the production of unsuitable garments. Fit and wear testing are the means to improve garment fit before mass production. The South African situation regarding fit and wear testing will thus be investigated.

2.7.5 Definitions and problems regarding body measurements

The correct set of body measurements related to the specific product will determine the relevance of the database. The importance of clear definitions is confirmed by Pargas, Staples and Davis (1997:161): “A key in the successful use of measurements obtained from body scans will be in the clear definition of where and how the measurements were taken.” This view is also confirmed by Laing and Sleivert (2002:4) in their discussion of the use of body measurement data. This applies to any method, for example traditional tailor’s measurements, traditional anthropometry or three-dimensional body scanning, used for taking the

measurements. It is therefore necessary to determine which measurements are important and useful to the South African clothing industry and how and where these measurements should be taken.

A clear understanding of the problems experienced with body measurements will also be useful. As illustrated in **Figure 1.1**, measurement problems together with vague descriptions of where and how the body measurements should be taken, will ultimately result in inaccurate body measurement data. This leads to the development of inaccurate sizing systems, which causes inaccurate block patterns to be created, and unsuitable fit and wear testing to be done.

2.8 CONCLUSION

Databases of the South African population's body dimensions are not readily available. In most cases they are developed for the exclusive use of specific clothing manufacturing and/or retailing companies. The South African Standard Code of Practice for Definitions for and measurement of body dimensions (SABS 0184-1982) contains only fifteen measurements. The origin of anthropometric data used for key dimensions and sizing systems in South Africa is also vague. Since the anthropometric database provides the foundation on which a sizing system that would function optimally (that is, provide the option of well-fitting garments for the majority of the population), would be based, it is important to ensure that measurements are accurate and reliable.

When looking at Ashdown's framework in **Figure 2.1** as compared to the conceptual framework for this study in **Figure 1.1**, it is clear that design features and communication of sizing and fit are not included in this study. The reason for this is that body measurements do not have such a direct influence on design features, choice of materials, production and distribution. Even in the case of size labelling (communicating with the consumer), especially in the case of ladies wear, size designation has become abstract numbers with no direct relation to any body dimension. According to Le Pechoux and Ghosh (2002:11), women do not know what

their measurements are and most probably do not know how to measure them correctly. This researcher is of the opinion that the aspects regarding design features and production, and their effect on fit, as well as communicating sizing and fit to the consumer, as illustrated in **Figure 1.1**, are areas to be investigated in separate studies.

The problem that will therefore be addressed in this study is how the South African clothing industry ensures well-fitting garments for their customers.

Subproblems that arise are the following:

- ✓ Which measurements should be included in a South African database?
- ✓ How are these measurements described by the industry?
- ✓ How do these descriptions compare with international descriptions?
- ✓ What are the problems regarding body measurements?
- ✓ What is the origin of the South African sizing system?
- ✓ How do the sizing systems currently used in South Africa function?
- ✓ How are block patterns generated?
- ✓ How is fit testing done?
- ✓ How is wear testing done?

A strategy to address the above problems will be discussed in the following chapter.

Chapter 3: Research Design

3.1 INTRODUCTION

From the previous chapters it is clear that the problem of sizing and fit is not a simple problem. This study is approached from the view that if population measurements are not current and accurate, all the other aspects cannot contribute to the achievement of an acceptable or proper fit. Since little information is known about measurements and sizing systems used in the South African clothing industry and keeping in mind the conceptual framework in **Figure 1.1**, the following objectives are set for this study:

1. To compile a comprehensive list of all body measurements required by South African apparel manufacturers and retailers, covering the garments in the following categories:
   - ✓ Men's/Boys'/Women's/Girls'/Babies' garments that cover the full body;
   - ✓ Men's/Boys'/Women's/Girls'/Babies' garments that cover the upper body;
   - ✓ Men's/Boys'/Women's/Girls'/Babies' garments that cover the lower body;
   - ✓ Men's/Boys'/Women's/Girls'/Babies' headwear;
   - ✓ Men's/Boys'/Women's/Girls'/Babies' gloves;
   - ✓ Men's/Boys'/Women's/Girls'/Babies' footwear.

2. To compare international descriptions of the identified body measurements with the South African respondents' descriptions and evaluation of the identified body measurements.

3. To describe the problems experienced with body measurements by the South African manufacturers and/or retailers.

4. To describe currently used South African sizing systems.

5. To describe how block patterns are generated by the South African manufacturers and/or retailers.

6. To describe how fit testing is done by the South African manufacturers and retailers.

7. To describe how wear testing is done by the South African manufacturers and retailers.

These objectives will enable the researcher to identify problems and possible reasons for problems that are currently experienced in the South African clothing industry with regards to the size and fit of clothing items. The objectives of the study have definite implications for the execution of the study. In this chapter the choice of research strategy, sampling methods, data collection, data analysis and presentation, and validity and reliability of the study will be discussed.

3.2 RESEARCH STRATEGY

According to Babbie and Mouton (2001:75), studies that address “real-life” problems can be classified as empirical studies. This exploratory and descriptive study in the field of sizing and fit can therefore be classified as an empirical study.

The scope of the objectives of this study necessitates a quantitative research paradigm. Quantitative data collection techniques have been applied to adequately address the research problem and objectives. To identify the body measurements required by South African apparel and footwear manufacturers and retailers, a representative postal survey was conducted. To define the measurements identified by the above survey, interviews were conducted with selected manufacturers and

retailers individually. An interview is also an appropriate technique to gain information regarding currently used South African sizing systems and procedures regarding fit and wear testing. The research problem was resolved by collecting new or primary data and by analysing existing or secondary data.

3.3 SAMPLING

The target population for this study was South African apparel and footwear manufacturers and retailers. The sampling frame is defined as clothing manufacturers and retailers listed in the Clothing Federation of South Africa Handbook. For footwear and accessories the Shoes and Views' Directory was consulted. These lists of manufacturers were chosen because they give an indication of which type of garment or shoe is manufactured and also included the name of a contact person.

In South Africa, as elsewhere in the world, product development is retail driven. Because of the prescriptive relationship existing between retailers and manufacturers, the major retail chains were included in the target population. Chain stores are a group of stores that sell essentially the same merchandise and are centrally owned, operated and merchandised (Frings, 1999:362). It is assumed that the smaller chains and boutiques are too small to influence the sizing systems used by manufacturers. Furthermore it is assumed that smaller retailers will have to follow the lead of the major chains to survive in the competitive clothing and footwear retail environment. This view is supported in a report by Dunne (2000:11). A combined list of retailers was obtained from the Clofed Handbook and Shoes and Views' Directory. For this study, only national retailers of both clothing and footwear products were included. Last manufacturers for the footwear industry and figure form manufacturers for the clothing industry are important users of body measurements and therefore also formed part of the target population for this study.

After consultation with the statistician it was decided to include the entire target population in the study. This is mainly due to the fact that a postal survey was conducted and the response rate for postal surveys is often poor.

The lists of manufacturers and retailers were consolidated and a total number of 472 respondents were identified. A breakdown of the respondents is given in **Table 3.1**.

TABLE 3.1: COMPOSITION OF SAMPLE FOR POSTAL SURVEY

Category	Quantity
Clothing manufacturers	264
Footwear manufacturers	169
Headwear manufacturers	20
Hat & Glove manufacturers	1
Last manufacturers	2
Figure form manufacturers	1
Retailers	15
Total	**472**

From the manufacturers and retailers that responded to the postal survey and returned a completed questionnaire, a purposive or judgemental sample was taken for the interviews. This means that the sample was selected based on the researcher's judgement and the purpose of the study. Since the number of responses to a postal survey may be low, this sampling technique ensured a representative sample for the interviews. According to Kvale (1996:102), the number of interviews in current interview studies tend to be around 10 to 15. For this study, 12 companies were chosen for the interviews. Parameters for selection of this second sample included the following:

- ✓ geographical area;
- ✓ manufacturers and retailers covering the whole spectrum of garment categories;
- ✓ manufacturers and retailers catering for specific figure requirements;
- ✓ manufacturers and retailers that indicated problems with specific measurements;
- ✓ involvement in the development of sizing systems;

✓ number of years in business.

Table 3.2 and **Table 3.3** reflect some results from the postal survey that were required for the purposive sampling of the interviews.

TABLE 3.2: PROVISION FOR SPECIAL FIGURE REQUIREMENTS

Special requirements	Number	%*	Interviewed
Short, Regular, Long	14	25,93	6
Disabled people in wheelchairs	2	3,7	0
Disabled people missing limbs	2	3,7	0
Petite figures	10	18,52	4
Outsizes / Plus sizes	26	48,15	9
Different body shapes	10	18,52	4
Narrow, medium, wide fitting shoes	2	3,7	0
Posture	1	1,85	0
Customised garments	1	1,85	1

* Respondents could choose more than one option therefore the percentage column does not add up to 100%.

Of the 12 companies selected for the interviews, nine claimed to provide for outsizes. Of the 12 companies selected for the interviews, six claimed to provide for different lengths, four companies claimed to provide for petite figures and different body shapes, and one company claimed to provide customised garments.

TABLE 3.3: INVOLVEMENT IN THE DEVELOPMENT OF SIZING SYSTEMS

	MEN		WOMEN		BOYS		GIRLS		INFANTS	
Garment type	Number	Interviewed	Number	Interviewed	Number	Interviewed	Number	Interviewed	Number	Interviewed
OUTERWEAR	6	4	9	5	9	5	8	5	4	2
UNDERWEAR	3	3	7	4	5	3	5	3	4	3
PROTECTIVE WEAR	3	1	5	0	1	0	1	0	0	0
FOOTWEAR	4	2	5	3	3	2	3	2	2	1
HEADWEAR	3	2	5	3	5	3	5	3	5	3
GLOVES	0	0	1	0	1	0	1	0	1	0

Companies involved in the development of sizing systems for most of the garment types, were included in the sample for the interviews. Protective wear and gloves were not represented well in the interviews since there were a limited number of respondents to choose from in these categories.

3.4 DATA COLLECTION METHODS

The data collection techniques included a structured questionnaire and individual interviews. The questionnaire consisted of closed questions and is included in **ADDENDUM A**. Closed questions consist of the question and the response options (Fink, 1995:35). The individual interview was an open interview where the person being interviewed was allowed to speak freely (Babbie & Mouton, 2001:289). A structured interview schedule was used to guide the interview and is included in **ADDENDUM B**.

3.4.1 Questionnaire for postal survey

Since the objective with the postal survey was to identify body measurements that are used by the clothing industry, the closed question questionnaire seemed appropriate. According to Neuman (2000:261), closed questions are also easier and quicker for respondents to answer. This is an important consideration as time is of the essence in the clothing and footwear industries.

Response rates is a big concern in postal survey research (Neuman, 2000:266). Because the survey was followed by an interview, the researcher kept a complete and accurate record of questionnaires posted and returned. Confidentiality was guaranteed, although the survey was not anonymous. The questionnaire included a cover letter and an addressed, postage-paid return envelope. Non-responses were followed-up with phone calls and where necessary a second questionnaire was sent, either by post or in most cases by e-mail. The above strategies were followed to

achieve a better response rate. Although the response rate was still poor (17,5%), it was better than expected according to the statistician's prediction (10%).

The questionnaire was developed by identifying measurements from existing documents and previous anthropometric surveys. Existing documents that were consulted included:

- ✓ American Society for Testing and Materials (ASTM) D5219-99 Standard terminology relating to body dimensions for apparel sizing;
- ✓ ASTM D4910-99 Standard tables of body measurements for infants, sizes 0 to 24;
- ✓ ASTM D5585-95 Standard tables of body measurements for adult female misses figure type, sizes 2 to 20;
- ✓ ASTM D5586-95 Standard tables of body measurements for women aged 55 and older (all figure types);
- ✓ ASTM D5826-95 Standard tables of body measurements for children, sizes 2 to 6x/7;
- ✓ ASTM D6192-98 Standard tables of body measurements for girls, sizes 7 to 16;
- ✓ ASTM D6240-98 Standard tables of body measurements for men sizes thirty-four to sixty (34 to 60) regular;
- ✓ ASTM D6458-99 Standard tables of body measurements for boys, sizes 8 to 20 regular;
- ✓ British Standard – Size designation of clothes part 1: Terms, definitions and body measurement procedure (BS EN 13402-1:2001);
- ✓ Ergotech internal document;
- ✓ Fort Knox Foot Survey (Freedman, Huntington, Davis, Magee, Milstead & Kirkpatrick, 1946);
- ✓ International Standard – Basic human body measurements for technological design (ISO 7250:1996);
- ✓ International Standard – Garment construction and anthropometric surveys – body dimensions (ISO 8559:1989);
- ✓ International Standard – Size designation of clothes – definitions and body measurement procedure (ISO 3635-1981);
- ✓ South African Standard – Code of practice for definitions for and measurement of body dimensions (SABS 0184-1982);

- ✓ Voluntary Product Standard PS 42-70: Body measurements for the sizing of women's patterns and apparel;
- ✓ Voluntary Product Standard PS 45-71: Body measurements for the sizing of apparel for young men (students);
- ✓ Voluntary Product Standard PS 54-72: Body measurements for the sizing of girls' apparel;
- ✓ Voluntary Product Standard PS 36-70: Body measurements for the sizing of boys' apparel.

Body dimensions that were included in the Nedscan (Dutch part of the CAESAR project) and SizeUK anthropometric surveys were also considered for inclusion in the questionnaire.

To ensure quick and easy completion of the questionnaire, the questionnaires for the different categories of manufacturers contained only relevant body measurements. The comprehensive questionnaire included all the possible measurements and was sent to the clothing manufacturers and retailers. The questionnaires for headwear, gloves and footwear included only measurements concerning these specific areas of the body. The questionnaire was reviewed by an expert in the clothing industry as recommended by Fink (1995:25). Following this expert's recommendation, figures indicating the positions of the body dimensions were included in the questionnaire to enhance the clarity and understandability of the questionnaire. Copies of the questionnaires are included in **ADDENDUM A**.

Following the survey it was necessary to describe the identified measurements. For this purpose the individual interview seemed an appropriate technique.

3.4.2 Individual interviews

In order to ensure accurate definitions of the identified measurements the individual interview was identified as an appropriate technique. To ensure reliability of the data, the interviews were conducted with the following people: four production managers, one quality assurance manager, six fit/garment technologists, and two

designers/pattern makers. These were also the same people who completed the questionnaire for the postal survey. It was estimated that one interview per respondent would be sufficient. A structured interview schedule was used to ensure that all the topics were covered during the interview. The topics to be discussed during the interview were chosen in accordance with the conceptual framework and the objectives of the study. A copy of the interview schedule is included in **ADDENDUM B**. Babbie and Mouton (2001:289) state that the interview schedule is a general plan and not a questionnaire, serving as a guide according to which the interviewer can structure the interview.

In the industry, taking measurements are in most cases not based on theoretical knowledge of the definitions of the measurements but on years of experience. It is not always easy to describe or explain how and where measurements are taken. The interview technique provided the respondent with the opportunity to demonstrate rather than describe measurements. The interviewer was then able to observe how and where a specific measurement is taken. The definitions provided by the respondent were compared to international definitions extracted from the lists named in paragraph 3.4.1 above. This allowed for more accurate interpretation of information.

To prevent any information from being lost or missed during the interview, audiotapes were kept and notes were taken where possible during the interview. Audiotapes were made with the respondents' permission in order to preserve the original data and to confirm the credibility of the data.

Information regarding currently used South African sizing systems, as well as the use of block patterns and fit and wear testing, was gathered during interviews with manufacturers and retailers. It was also possible to discuss the problems that are experienced regarding body measurements.

3.5 DATA ANALYSIS

According to Mouton (2001:108), all data collection culminates in the analysis and interpretation of some set of data. Analysis of data involves separating the data into manageable themes, patterns, trends and relationships. The aim of analysis is to understand the various elements of one's data through an inspection of the relationships between concepts, constructs or variables, and to see whether there are any patterns or trends that may be identified or themes that may be established in the data (Mouton, 2001:108).

3.5.1 Analysis of postal survey

The data obtained from the postal survey was analysed to identify all the measurements needed for the different garment types, as well as to identify problematic measurements. This was done with the use of descriptive statistics in the form of frequency tables. It was possible to compile a list of all the body measurements that should be included in a South African anthropometrical database to ensure that it is representative of the clothing and footwear industries. The purpose was not to understand or explain the choice of body measurements by industry, but simply to identify all the measurements used. Frequency tables gave a complete overview of collected data and seemed sufficient for this stage of the research. It also assisted in the identification of respondents that have been in business for a longer period of time, who are involved in the development of sizing systems and provide for special figure requirements. These aspects were important considerations in the sampling for the interviews.

3.5.2 Analysis of individual interviews

Audiotapes from the interviews were transcribed. Only information directly relevant to the study was transcribed completely. Where a discussion was not related to the study, it was not transcribed in full but just listed as "discussion of …". Words or

phrases repeated in a sentence was not repeated in the transcriptions, unless it added to a better understanding of what was being said by the respondent. The transcriptions of the interviews, together with notes taken during the interview and documents regarding body measurements received from a few respondents, were analysed by means of content analysis. Since the data consists of interviews as well as existing documents, content analysis methods seemed appropriate because according to Babbie and Mouton (2001:383), content analysis methods may be applied to practically any form of communication. The classic question that is usually answered through content analysis and that Babbie and Mouton (2001:384) refer to (namely *Who says what, to whom…* etc) can for the purpose of this study be changed to: "Who does what, to whom, why, how, and with what effect?"

According to Krippendorff (2004) in Trochim (2005:127), content analysis is the systematic analysis of text. The analysis can be quantitative and/or qualitative and the main purpose is to identify patterns in the text (Trochim, 2005:128). Data analysis for this study included qualitative analysis such as thematical analysis, and quantitative analysis such as frequency distributions (Mouton, 1998:163). The steps followed in content analysis included sampling of documents, unitising, coding and quantitative or qualitative analysis (Trochim, 2005:128). Since all the transcribed interviews, notes and documents gathered during the interviews were included for analysis, there was no need for sampling of documents.

3.5.2.1 Unitising

Unitising, or separating the units of analysis, was done according to the main categories as identified in the conceptual framework for the study illustrated in **Figure 1.1**, namely block patterns, fit testing, wear testing, sizing systems, descriptions of body measurements and problems experienced with body measurements. These are the key variables of this study and refer to the individual units about which descriptive and explanatory statements are to be made (Babbie & Mouton, 2001:384). These units were further coded according to a specific plan which can be viewed in **Addendum C**.

3.5.2.2 Coding

Content analysis is essentially a coding operation (Babbie & Mouton, 2001:388). The themes and questions listed in the interview schedule (see **Addendum B**) served as the plan for coding of the data. The coding plan is listed in **Addendum C**. Additional themes uncovered during classification of the text were coded as they occurred. Since only one person, namely this researcher, did the coding, there should not be any question about the reliability and specificity of the analysis (Babbie & Mouton, 2001:388).

A quantitative analysis was then done to determine the frequency with, and the context in which the themes occurred. Frequency tables are a form of descriptive statistics concerned with organising and summarising the data, enabling the researcher to make sense from the data (Mouton, 1998:163). Descriptive statistics, such as frequency distributions, describe the basic features of the data in the study, in other words it describes what the data shows (Trochim, 2005:205). It seemed appropriate for this particular study because of its exploratory and descriptive nature.

3.6 VALIDITY AND RELIABILITY

The value and applicability of the results of any research study depend on the validity and reliability of the respective data collection techniques. Formulated in conventional terms, validity implies that a measuring instrument should reflect the real or true meaning of the concept measured (Babbie & Mouton, 2001:122). Validity implies truthfulness and refers to the match between a construct and a measure (Neuman, 2000:164).

Reliability on the other hand refers to consistency and dependability (Neuman, 2000:164). Emory and Cooper (1991:179) confirm that reliability has to do with the accuracy and precision of measurement procedures.

In the instance of this particular study, measurement of validity pertains to both a quantitative approach (postal survey) to identify body dimensions used in the clothing and footwear industries, and a qualitative technique (interview technique) to verify definitions of measurements, obtain information on sizing systems, block patterns and fit and wear testing currently in use.

Emory and Cooper (1991:178) point out that one can distinguish between two major forms of validity, namely external and internal validity. External validity is the ability to generalise findings from a specific setting and a small group to a broad range of settings and people (Neuman, 2000:172). In the instance of this particular study where it is important to collect the widest possible range of body dimensions needed by the clothing and footwear manufacturing and retail industries, external validity is very important.

Prerequisites for generalisation of findings are:

- ✓ using a representative sample of the target population; and
- ✓ ensuring a sizeable and representative response.

Steps to ensure the above were:

- ✓ inclusion of the entire population in the survey in order to accomplish a representative sample in the event of a low response rate;
- ✓ keeping record of the responses and following up non-responses by means of phone calls to encourage the respondents to participate.
- ✓ using purposive sampling to select the respondents to participate in the interview in order to maximise the range of specific information that can be obtained. Respondents that were different from one another were thus purposely selected according to the criteria set out earlier in this chapter.

Internal validity refers to the end results of a validation process. Procedures to ensure internal validity include face validity, content, construct and criterion-related validity. In the instance of this study, content and construct procedures are important to ensure valid results.

Content validity represents the degree to which the content contains the universe of all relevant items under investigation (Emory & Cooper, 1991:184). To support content validity, the following steps were taken in compiling the postal survey questionnaire:

- ✓ a wide variety of sources were consulted in order to identify the most representative list of measurements applicable to the clothing and footwear industries;
- ✓ the questionnaire was evaluated by an expert from the clothing retail and production industry for content as well as construct validity.

Construct validity refers to the extent to which a list of items measures the relevant construct and not something else (Mouton, 1998:168). To establish construct validity, the meaning of the construct must be understood and the relationship between constructs identified (De Vos, 1998:85). An understanding of the constructs and the relationship between constructs as proposed by the theory, has been achieved. To support construct validity the following steps were taken:

- ✓ a deductive approach was used by studying existing theory to clarify constructs tested in the questionnaire and the interview schedule;
- ✓ the questionnaire was evaluated by an expert;
- ✓ vagueness and ambiguity were avoided in the questionnaire by including graphic figures to indicate measurement positions;
- ✓ vagueness and ambiguity were avoided in the interview schedule by doing individual interviews personally.

Researchers also aim to produce reliable data. This means that if the same measures were used and conditions under which data were collected were held as constant as possible, the same data should be collected from situation to situation (Mouton, 1998:111). Mouton (1998:144,148) argues that the reliability of data is threatened by the following 'observation effects':

- ✓ the researchers, 'experimenters', 'interviewers' or 'observers' (researcher effects);
- ✓ the individuals or subjects who participate in the research project (participant effects);

- ✓ the measuring instruments such as questionnaires and interview schedules (measuring instrument effects); and
- ✓ the research context or circumstances under which the research is conducted (context effects).

To reduce error as a result of 'observation effects' with regard to the questionnaire, the following precautions were considered. A cover letter was included with the questionnaire to emphasise the importance of participation in the survey. In an effort to motivate respondents to answer questions seriously and truthfully, the letter also stated the researcher's affiliation and informed respondents that confidentiality would be guaranteed although the survey is not anonymous. The questionnaire was compiled in such a manner that it did not take too long to complete. The questions were easy to understand and were relevant to the topic. To avoid ambiguity or misunderstandings, figures indicating the location of dimensions on the body were included. To ensure that the questionnaire reached the person most competent to complete it, the letter was addressed to the contact person available in the address list with the request to pass it on if he/she was not the competent person. The above steps contributed to the accuracy and precision of information supplied by respondents, and therefore will enhance the reliability of data collected.

To reduce error as a result of 'observation effects' with regard to the interview, the following precautions were considered. The possibility existed that the researcher could be observed as being too young (not sufficiently knowledgeable), and that the respondents could feel threatened by the questions. The clothing industries are not known to share information readily. To limit these 'researcher and participant effects', the researcher explained the reasons for the study and confirmed confidentiality of any information disclosed.

The timing of the interviews was carefully considered, in order to reduce 'context effects' as the industry closes down between 16 December and approximately 10 January. Therefore the factories and even retailers are extremely busy from November onwards until the end of the year. The interviews were conducted during July. The interviews were conducted by appointment at the respondent's office. In this way respondents felt comfortable and at ease. Setting aside time specifically for

the interview also improved the accuracy of responses in the way that it ensured that the respondent was more relaxed. The researcher again assured respondents of the confidentiality of the study in order to ensure truthful responses.

The researcher recorded the interview by means of audiotapes (with the respondent's permission) together with notes of the responses. The researcher also noted any responses such as hesitation or unwillingness to disclose information. During the interview the researcher repeated the responses to ensure that it was accurately understood, recorded and interpreted (member checks). Guba and Lincoln (in Babbie and Mouton, 2001:211) suggest this procedure to enhance *credibility*. In this way responses could be verified, corrected if necessary and accurately recorded. It also gave the respondent the opportunity to provide additional information. It is believed that the above considerations did enhance the reliability of the data collected through the interview technique.

In the following chapter the results are presented using tables, pie charts and bar charts. Demographic information is given first and then the results are discussed and interpreted according to the objectives of the study.

Chapter 4: Results, Discussion and Interpretation

4.1 INTRODUCTION

In this chapter, the information gathered during the postal survey and the interviews is analysed to determine the South African situation regarding body measurements used, problems experienced with body measurements, fit and wear testing, block patterns and sizing systems used.

The results of the postal survey were analysed with the use of frequency tables. The demographics of the respondents are given in table form. The response as well as the breakdown of the respondents according to garment type are discussed. The results from the interviews were analysed by means of content analysis. A breakdown of the respondents for the interviews is given in a pie chart. Information gathered during the interview regarding returns of garments is also presented and discussed.

Following the demographic information of the respondents, the results are discussed according to the objectives of the study. The body measurements required by South African manufacturers and retailers are listed in a table together with the international descriptions, and the response. Problem measurements are also identified in this table. Following the discussion of this table are the responses of the South African manufacturers and retailers regarding the descriptions of the body measurements, as well as the problems they experience with the measurements concerned. The descriptions as given by the South African retailers and manufacturers are also compared to the international definitions.

Frequency distributions regarding the relevant aspects of how block patterns are created, how fit and wear testing is done and how South African sizing systems operate are illustrated with pie charts and bar charts.

4.2 DEMOGRAPHICS

4.2.1 Total number of questionnaires sent and response

A total number of 472 questionnaires were posted to manufacturers and retailers as indicated in **Table 4.1**. One hundred and sixty three respondents were rejected because of factories that had closed down, respondents that were not manufacturers but only distributors or importers, and respondents that were untraceable. The new total of 309 manufacturers and retailers were thus used as the grand total of questionnaires in the study.

TABLE 4.1: TOTAL NUMBER OF QUESTIONNAIRES SENT AND RESPONSE

	Sent	Rejected	Total	No response	% no response	Returned	% returned
Clothing manufacturers	264	88	176	146	83%	30	17%
Footwear manufacturers	169	70	99	85	86%	14	14%
Headwear manufacturers	21	5	16	12	75%	4	25%
Retailers	15	0	15	10	67%	5	33%
Lasts / Figure forms	3	0	3	2	67%	1	33%
TOTAL	**472**	**163**	**309**	**255**	**82,5%**	**54**	**17,5%**

The response to the postal survey, namely 54 of the 309 questionnaires posted, was 17,5%. The statistics department of the University of Pretoria indicated that a 10% response to a postal survey in South Africa could be regarded as acceptable. A response of more than 10% was achieved in each of the key categories in this study. This can be accepted as a satisfactory response for the postal survey.

4.2.2 Breakdown of respondents for the survey according to garment type

Table 4.2 gives a breakdown of respondents according to garment type. The number of respondents involved in the manufacturing or retailing of a specific garment type for more than ten years is also indicated in **Table 4.2**. This is an important figure, because the number of years in business gives an indication of experience in and knowledge of the clothing industry.

TABLE 4.2: RESPONDENTS ACCORDING TO GARMENT TYPE AND YEARS IN BUSINESS

GARMENT TYPE	Number of respondents	Number of respondents in business for 10+ years	% of respondents in business for 10+ years
BABIES' / INFANTS' wear	12	10	83,3
BABIES' / INFANTS' HEADWEAR	6	5	83,3
BABIES' / INFANTS' GLOVES	4	3	75
BOYS' coats, overalls	3	1	33,3
BOYS' jackets, shirts, t-shirts	12	10	83,3
BOYS' pants, shorts	10	7	70
BOYS' swimwear	3	3	100
BOYS' underwear	6	5	83,3
GIRLS' dresses, coats, overalls	14	11	78,6
GIRLS' jackets, blouses, t-shirts	13	11	84,6
GIRLS' skirts, trousers, shorts	13	11	84,6
GIRLS' swimwear	5	4	80
GIRLS' underwear	9	7	77,8
BOYS' / GIRLS' SOCKS	6	5	83,3
BOYS' / GIRLS' HEADWEAR	5	4	80
BOYS' / GIRLS' GLOVES	3	2	66,7
SCHOOL WEAR	9	5	55,6
MEN'S coats, overalls	7	4	57,1
MEN'S jackets, shirts, t-shirts	19	15	78,9
MEN'S pants, shorts	14	12	85,7
MEN'S swimwear	4	4	100

GARMENT TYPE	Number of respondents	Number of respondents in business for 10+ years	% of respondents in business for 10+ years
BABIES' / INFANTS' wear	12	10	83,3
MEN'S underwear	9	6	66,7
LADIES' dresses, coats, overalls	17	13	76,5
LADIES' jackets, blouses, t-shirts	21	18	85,7
LADIES' skirts, trousers, shorts	18	15	83,3
LADIES' swimwear	6	4	66,7
LADIES' underwear	11	9	81,8
LADIES' foundation wear	5	5	100
MATERNITY WEAR	8	6	75
ETHNIC WEAR	0	0	0
PROTECTIVE WEAR	3	3	100
MEN'S / LADIES' SOCKS	7	6	85,7
MEN'S / LADIES' HEADWEAR	7	5	71,4
MEN'S / LADIES' GLOVES	2	2	100
Men's SANDALS	11	5	45,5
Ladies' SANDALS	15	8	53,3
Boys' SANDALS	8	5	62,5
Girls' SANDALS	10	5	50
Men's CLOSED SHOES	14	11	78,6
Ladies' CLOSED SHOES	15	11	73,3
Boys' CLOSED SHOES	9	6	66,7
Girls' CLOSED SHOES	6	4	66,7
MOULDED FOOTWEAR	3	3	100
HEALTH SHOES	4	2	50
SPORTS / ATHLETIC SHOES	5	3	60
SCHOOL SHOES	6	3	50
INDUSTRIAL FOOTWEAR (no steel cap)	4	3	75
INDUSTRIAL FOOTWEAR (steel cap)	4	2	50
CONTRACT FOOTWEAR	4	3	75
BABIES' / INFANTS' FOOTWEAR	6	4	66,7

From the information in **Table 4.2** it is clear that for most of the garment types, the majority of the respondents have been in business for ten years or longer. For men and boys, more companies were involved with garments covering the upper and

lower body separately. For ladies and girls, more companies were involved in garments covering the upper body, lower body and whole body (for example, dresses). This is understandable since men wear few garments that cover the whole body. In the case of footwear, the companies were mainly involved in ladies' sandals, and men's and ladies closed shoes. With the exception of ethnic wear, all garment types were represented in the postal survey.

4.2.3 Breakdown of the respondents for the interviews

Thirteen interviews were conducted at twelve companies. This is because the clothing and the footwear departments were interviewed separately at the one retailer. The breakdown of the interviews is illustrated in **Figure 4.1**. The respondents for the interviews consisted of seven clothing manufacturers, one footwear manufacturer, one fit-dummy manufacturer, three retailers and one footwear retailer. The seven clothing manufacturers consisted of one hat and cap manufacturer for adults, children and infants, two ladies' wear manufacturers, one manufacturer of mainly men's wear, one manufacturer of children's and infants' wear, and two manufacturers of men's, ladies' and children's wear. The shoe manufacturer made steel toe-cap safety shoes.

When referring to the first objective for the study, namely to compile a comprehensive list of all body measurements required by South African apparel manufacturers and retailers, covering the garments in the following categories:

- ✓ Men's/Boys'/Women's/Girls'/Babies' garments that cover the full body;
- ✓ Men's/Boys'/Women's/Girls'/Babies' garments that cover the upper body;
- ✓ Men's/Boys'/Women's/Girls'/Babies' garments that cover the lower body;
- ✓ Men's/Boys'/Women's/Girls'/Babies' headwear;
- ✓ Men's/Boys'/Women's/Girls'/Babies' gloves;
- ✓ Men's/Boys'/Women's/Girls'/Babies' footwear;

it is clear that the last two categories, namely gloves and footwear, were not sufficiently represented. In the case of gloves, the number of respondents involved in the manufacturing of gloves were limited. In the case of footwear, the geographical location restricted their inclusion in the sample.

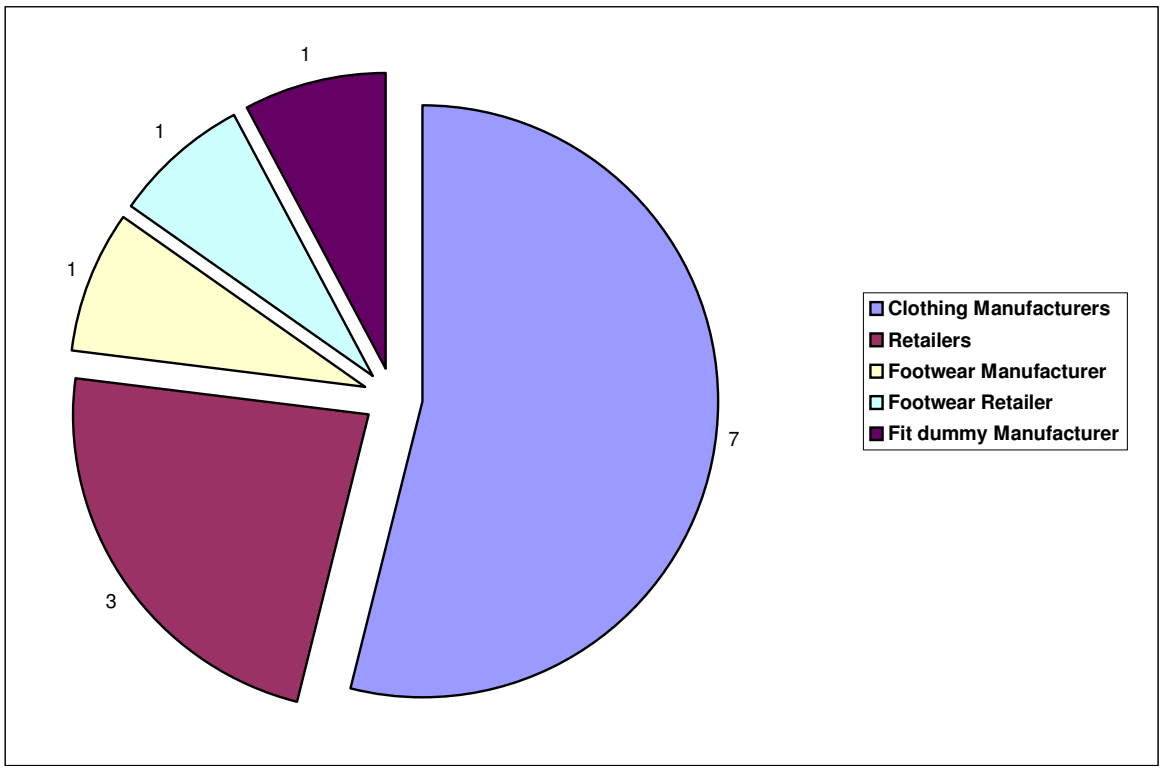

FIGURE 4.1: BREAKDOWN OF INTERVIEWS

4.2.4 Returns

The respondents were asked to give an indication of returns as a percentage of total sales. The results are illustrated in **Figure 4.2**. Four companies (two clothing manufacturers, one footwear manufacturer and one retailer) were willing to disclose that returns are about 1% or less of total sales. Two companies indicated that returns were “very low” or “very little”. These two companies were grouped with the 0-1% category. Two companies – one retailer and one clothing manufacturer – indicated that returns as a percentage of sales are confidential information, and three companies were unsure or did not know.

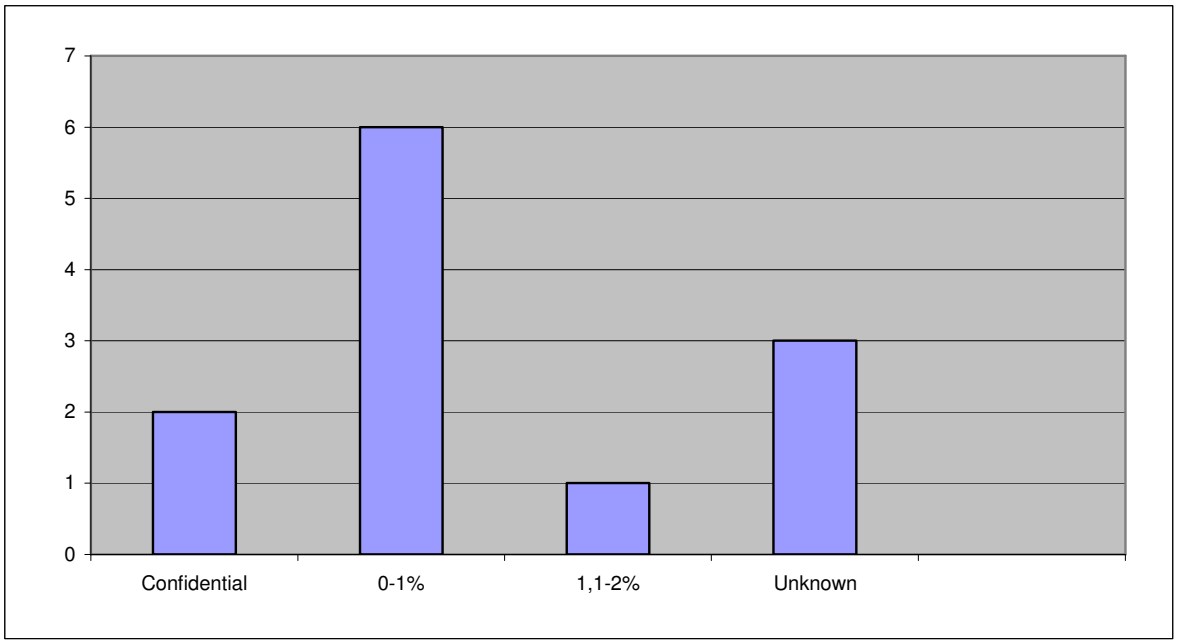

FIGURE 4.2: RETURNS AS A PERCENTAGE OF SALES

Respondents were asked whether returns were related to any specific garment type, since it could give an indication of problems with specific measurements. Returns were however not limited to one particular garment type, but for most of the respondents were evenly distributed across all garment types – as illustrated in **Figure 4.3**. This was confirmed by 10 of the 12 respondents. One manufacturer indicated that most of their returns are wet suits (diving suits), although they also manufacture other garments. The footwear retailer indicated that sports shoes and ladies' high heel shoes present the most returns.

Another reason why returns are not related to a specific garment type could be because there is no proper system of record keeping regarding returns. The returns policy of the different stores should also be considered.

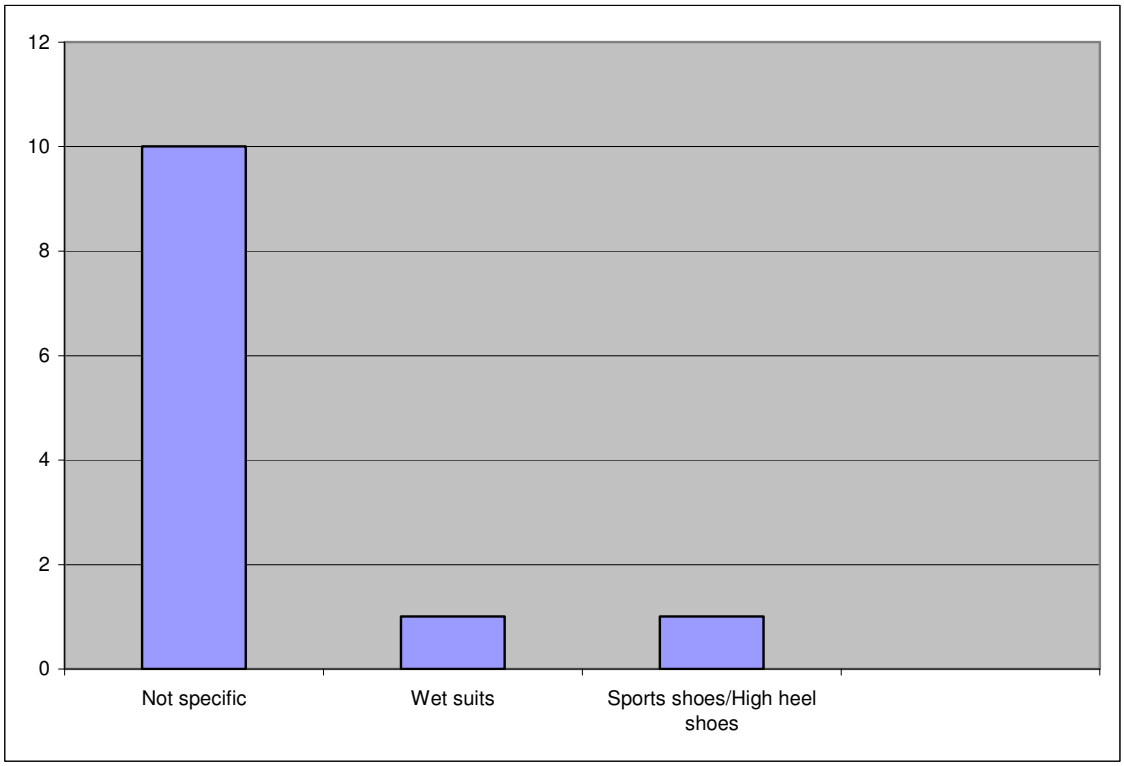

FIGURE 4.3: GARMENT TYPE RETURNED

Wet suits are the main garment type manufactured by the specific manufacturer that mentioned them as a problem. The specific manufacturer custom-make the garments and the clients have to send their measurements to the manufacturer. The fact that individuals have to take their own measurements could explain the problems that the company experiences, and it also confirms that laymen probably do not know where and how to take his measurements and do not know what their correct measurements are.

The sport shoes that the retailer referred to are in this case actually for casual wear and not for use in sports. The shoes are however not used for their intended end use (indicating customer abuse as a reason for returns) and therefore present a problem. Heels breaking off from ladies high heel shoes were mainly related to a manufacturing problem that has been sorted out since.

Reasons for returns are listed in **Figure 4.4**. Respondents were able to list more than one reason for returns. Problems with the quality of construction, as well as fabric quality, were listed as the most frequent reasons for returns. Component failure and customer abuse were also listed as reasons for returns. Component failure refers to the different items, such as zips and buttons, used in the manufacturing of a garment. Three companies listed fit as a reason for returns. One of these companies manufactures custom-made garments. Customers have to measure themselves and then send these measurements to the manufacturer, and therefore wrong body dimensions are occasionally a cause for returns. The other company manufactures uniforms to standard sizes according to a sizing system developed for the military together with Ergotech. Although fit problems for the specific company are very rare, they have experienced fit problems in the past. Fit is a very important aspect and consideration in the case of uniforms, since a neat and professional appearance is important. However, people are less likely to complain about uniforms, as will be discussed later. The third company that experienced fit problems manufactures ladies' corporate wear and noted that pattern making is sometimes a problem. This was coded as fit, since a problem with the pattern implies a problem with the fit of the garment.

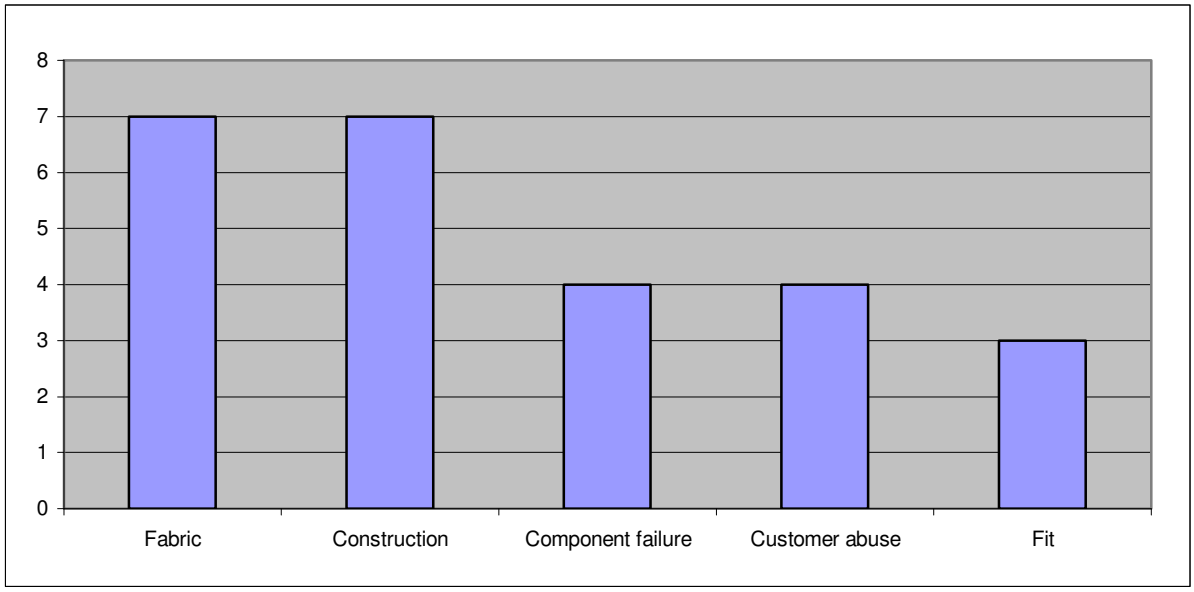

FIGURE 4.4: REASONS FOR RETURNS

Although fit is an important consideration in the case of uniforms, people accept and adjust to the way that a uniform fits and are therefore less likely to complain. People are more likely to complain about fashion garments. Retailers however handle fit problems before the garments go into the stores. Sample garments are made, fitted and examined before the go-ahead is given for production. This explains why fit is not seen as a major reason for returns. One retailer did however mention that the record keeping system regarding returns is not an accurate reflection of what happens in the stores. For example, a customer can exchange a wrong size for another size without the staff recording that there was a problem. There is also no record of lost sales, for instance, when a customer tries on a garment and then decides not to purchase. Retailers are however working on a better record keeping system. Proper training of staff with regard to recognising customer abuse, as well as bad fit, is also necessary.

One must keep in mind that it is much easier to identify problems related to the construction and the fabric quality of a garment. Even for the consumer it is difficult to verbalise the problem when a garment does not fit. Considering the difficulty of identifying fit problems, as well as the insufficient record keeping, it is not surprising that it seems as if fit is not a major problem for these companies. However, three out of twelve companies is a significant number which cannot be ignored.

4.3 IDENTIFICATION OF BODY MEASUREMENTS REQUIRED BY SOUTH AFRICAN CLOTHING MANUFACTURERS AND RETAILERS OF MEN'S, LADIES', CHILDREN'S, BABIES' AND INFANTS' CLOTHING AND FOOTWEAR (Objective 1)

Since most of the survey respondents (**Table 4.1**) have been operating for ten years or longer, one can assume that the measurements indicated in **Table 4.3** are used by experienced manufacturers and retailers in the clothing and footwear industry.

It was not possible to link the body measurements to manufacturers of specific types of garments, the reason being that in most cases manufacturers produced a variety of garment types for men and women, and in some cases also for children. If the

respondents had to indicate for which garment types every body measurement is used, it would have lengthened and complicated the questionnaire, and therefore would have had a negative impact on the reliability of the study.

Table 4.3 includes:

- ✓ a total list of required body measurements (divided into height, width, circumference, arc, seated, head, hand and foot measurements);
- ✓ number and percentage of respondents using each measurement;
- ✓ number and percentage of respondents experiencing problems with each measurement;
- ✓ sample size for each body measurement.

TABLE 4.3: MEASUREMENTS USED AND PROBLEM MEASUREMENTS

	BODY MEASUREMENTS	Sample size (N)	Number of respondents using the measurement	%	Number of respondents with problems	%
HEIGHTS – VERTICAL						
1	Height	54	21	38,89	0	0
2	Chin height	34	0	0,0	0	0
3	Cervical height	34	7	20,59	0	0
4	Side neck height	34	5	14,71	2	40
5	Side neck to front ground level	34	2	4,88	2	100
6	Shoulder height	34	7	20,59	2	28,6
7	Underarm height (Axilla height)	34	9	26,47	3	33,3
8	Across back height	34	9	26,47	3	33,3
9	Chest height	34	8	23,53	1	12,5
10	Bust level height	34	10	29,41	0	0
11	Underbust level height	34	3	8,82	0	0
12	Underbust to waist	34	12	34,29	1	8,3
13	Armscye to waist	34	12	34,29	2	16,7
14	Waist height	34	13	38,24	0	0
15	Preferred waist height	34	7	20,59	2	28,6
16	Waist height (at belly button level)	34	12	34,29	1	8,3
17	Upper hip height	34	12	34,29	0	0

	BODY MEASUREMENTS	Sample size (N)	Number of respondents using the measurement	%	Number of respondents with problems	%
18	Top hip height	34	12	34,29	0	0
19	Hip height (at maximum circumference)	34	12	34,29	0	0
20	Centre back waist to top hip	34	15	44,12	1	6,7
21	Centre back waist to upper hip	34	13	38,24	0	0
22	Centre back waist to hip (max circumf.)	34	12	34,29	0	0
23	Centre back waist to knee	34	9	26,47	0	0
24	Centre back waist to ground	34	13	38,24	0	0
25	Front waist to thigh	34	6	17,65	0	0
26	Front waist to knee	34	10	29,41	1	10
27	Front waist to calf	34	8	23,53	0	0
28	Front waist to ground	34	13	38,24	0	0
29	Side waist to hip	34	10	29,41	0	0
30	Side waist to knee length	34	10	29,41	0	0
31	Outside leg length	34	26	76,47	1	3,8
32	Inside leg length / crotch height	50	27	54	2	7,4
33	Trunk length	34	15	44,12	1	6,7
34	Total crotch length	34	20	58,82	1	5
35	Front crotch length	34	22	66,71	3	13,6
36	Back crotch length	34	22	66,71	3	13,6
37	Body rise / Crotch depth	34	20	58,82	3	15
38	Back waist length (cervical to waist)	34	17	50,00	0	0
39	Cervical to top hip	34	6	17,65	0	0
40	Cervical to upper hip	34	7	20,59	0	0
41	Cervical to hip	34	7	20,59	0	0
42	Cervical to knee hollow	34	5	14,71	0	0
43	Cervical to chest level	34	6	17,65	1	16,7
44	Side neck to chest level	34	6	17,65	2	33,3
45	Cervical to breast point	34	8	23,53	1	12,5
46	Side neck to breast point	34	9	26,47	4	44,4
47	Cervical to underbust level	34	5	14,71	1	20
48	Side neck to underbust level	34	5	14,71	2	40
49	Cervical to front waist	34	8	23,53	2	25
50	Front waist length (Side neck to waist)	34	12	34,29	2	16,7
51	Centre shoulder to bust point	34	13	38,24	2	14,4
52	Centre shoulder to underbust level	34	9	26,47	1	11,1
53	Centre shoulder to front waist – straight	34	11	32,35	2	18,2

	BODY MEASUREMENTS	Sample size (N)	Number of respondents using the measurement	%	Number of respondents with problems	%
54	Centre shoulder to front waist – contoured	34	10	29,41	2	20
55	Centre shoulder to back waist – contoured	34	11	32,35	1	9,1
56	Armscye depth (Cervical to underarm level)	34	10	29,41	2	20
57	Top arm length (Shoulder to underarm level)	34	14	41,18	2	14,3
58	Arm length straight (Cervical to wrist)	34	21	61,76	2	9,5
59	Arm length straight (Shoulder to wrist)	34	28	82,35	2	7,1
60	Arm length bent (Cervical to wrist)	34	14	41,18	3	21,4
61	Arm length bent (Shoulder to wrist)	34	13	38,24	2	14,4
62	Upper arm length (Cervical to elbow)	34	15	44,12	1	6,7
63	Upper arm length (Shoulder to elbow)	34	18	52,94	1	4,6
64	Under arm length (to wrist)	34	21	61,76	1	4,8
65	Under arm length (to elbow)	34	13	37,14	1	7,7
66	Thigh height	50	6	12,00	1	16,7
67	Mid-thigh height	50	3	6,00	1	33,3
68	Thigh length	50	7	14,00	0	0
69	Knee height	50	11	22,00	1	9,1
70	Calf height	50	7	14,00	1	14,3
71	Ankle height (outside leg)	50	10	20,00	2	20
72	Ankle height (inside leg)	50	10	20,00	1	10
	WIDTH – HORIZONTAL					
73	Neck width – front	38	19	50,00	4	21,1
74	Neck width – back	38	19	50,00	4	21,1
75	Back Neck width – contoured	38	17	44,74	3	17,6
76	Shoulder length	34	26	76,47	4	14,4
77	Shoulder width – back	34	19	54,88	1	4,3
78	Shoulder width – front	34	16	47,06	3	18,8
79	Across back width	34	27	79,41	2	7,4
80	Across front width	34	23	67,65	3	13
81	Breast prominence	34	11	32,35	2	18,2
82	Bust width	34	16	47,06	2	12,5
83	Chest depth	34	12	34,29	2	16,7
84	Waist width	34	21	61,76	0	0
85	Waist depth	34	7	20,59	1	14,3
86	Hip width (from front at max circumf.)	34	19	54,88	0	0
87	Buttock depth (back to front at max point –	34	11	32,35	2	18,2

	BODY MEASUREMENTS	Sample size (N)	Number of respondents using the measurement	%	Number of respondents with problems	%
	measured form the side)					
88	Armscye width (front to back across top of arm)	34	12	34,29	2	16,7
89	Armspan	34	8	23,53	1	12,5
	CIRCUMFERENCES					
90	Neck girth	38	18	47,37	2	11,1
91	Neck girth – around Adam's apple	38	11	28,95	2	18,2
92	Neck base girth	38	14	36,84	3	21,4
93	Shoulder girth	34	11	32,35	1	9,1
94	Chest girth	34	27	79,41	0	0
95	Bust girth	34	24	70,59	0	0
96	Bust girth contoured	34	9	26,47	0	0
97	Underbust girth	34	17	50,00	0	0
98	Waist girth	34	27	79,41	0	0
99	Preferred waist girth	34	10	29,41	1	10
100	Waist girth at belly button level	34	15	44,12	0	0
101	Upper hip girth (at prominent hip bone)	34	17	50,00	0	0
102	Top hip girth	34	17	50,00	0	0
103	Hip girth (at max circumf.)	34	25	73,35	0	0
104	Trunk circumference (Body loop)	34	11	32,34	1	9,1
105	Centre trunk circumference	34	9	26,47	1	11,1
106	Armscye girth	34	17	50,00	2	11,8
107	Upper arm girth – straight	34	16	47,06	0	0
108	Upper arm girth – bent	34	12	34,29	0	0
109	Elbow girth – straight	34	11	32,35	0	0
110	Elbow girth – bent	34	14	41,18	0	0
111	Forearm girth	34	12	34,29	0	0
112	Wrist girth	34	21	61,67	0	0
113	Thigh girth	50	18	36,00	0	0
114	Mid-thigh girth	50	12	24,00	0	0
115	Knee girth	50	14	28,00	0	0
116	Lower knee girth	50	7	14,00	0	0
117	Calf girth	50	13	26,00	0	0
118	Minimum leg girth	50	9	18,00	0	0
119	Ankle girth	50	16	32,00	0	0

	BODY MEASUREMENTS	Sample size (N)	Number of respondents using the measurement	%	Number of respondents with problems	%
ARC MEASUREMENTS						
120	Bust arc anterior	34	1	2,94	1	100
121	Waist arc anterior	34	1	2,94	1	100
122	Abdominal extension arc anterior	34	0	0,0	1	
123	Hip arc posterior	34	0	0,0	1	
SEATED – HEIGHTS						
124	Height	50	0	0,0	0	0
125	Cervical height	34	1	2,94	0	0
126	Shoulder height	34	0	0,0	0	0
127	Waist height	34	1	2,94	0	0
128	Knee height	50	1	2,00	0	0
129	Popliteal height (lower leg length)	50	0	0,0	0	0
SEATED – WIDTHS						
130	Hip width	34	2	4,88	0	0
131	Thigh length	50	2	4,00	0	0
SEATED – GIRTHS						
132	Waist girth	34	2	4,88	0	0
133	Hip girth	34	2	4,88	0	0
134	Thigh girth	50	2	4,00	0	0
135	Knee girth	50	1	2,00	0	0
OTHER						
136	Body mass (in kg)	50	4	8,00	0	0
137	Shoulder blade skinfold	34	0	0,00	1	
138	Triceps skinfold	34	0	0,00	1	
139	Bust to waist drop	34	4	11,76	1	25
140	Hip to waist drop	34	5	14,71	1	20
141	Bust to underbust drop	34	4	11,76	1	25
142	Front neck depth	34	5	14,71	1	20
143	Back neck depth	34	5	14,71	1	20
144	Back seat angle	34	2	4,88	2	100
145	Shoulder slope	34	9	26,47	3	33,3
146	Height (Lying down – infants)	50	2	4,00	0	0
HEAD MEASUREMENTS						
147	Head height	34	8	23,53	0	0
148	Face length (Menton-glabella)	34	2	4,88	1	50
149	Crown of scull to brows (Vertex to glabella)	38	1	2,63	1	100

	BODY MEASUREMENTS	Sample size (N)	Number of respondents using the measurement	%	Number of respondents with problems	%
150	Chin to nose bridge (Menton-sellion)	38	0	0,00	1	
151	Chin to pit of neck	38	2	4,26	2	100
152	Head length (brow to back of scull)	38	8	21,05	1	12,5
153	Head width – cheekbone to cheeckbone	38	4	10,53	1	25
154	Head width – above ears	38	7	18,42	1	14,3
155	Inter-pupillary distance	38	0	0,00	1	
156	Sagittal arch	38	3	7,89	1	33,3
157	Surface distance from above the ears across the top of the head (Bi-tragion coronal arch)	38	2	4,26	1	50
158	Head girth	38	14	36,84	1	7,1
	HAND MEASUREMENTS					
159	Hand thickness	34	1	2,94	1	100
160	Palm length	34	1	2,94	2	
161	Hand length (wrist to middle finger)	34	1	2,94	2	
162	Wrist to index finger length	34	1	2,94	1	100
163	Wrist to thumb tip length	34	1	2,94	2	
164	Thumb length	34	1	2,94	1	100
165	Index finger length	34	1	2,94	1	100
166	Middle finger length	34	1	2,94	1	100
167	Ring finger length	34	1	2,94	1	100
168	Little finger length	34	1	2,94	1	100
169	Hand width	34	1	2,94	2	
170	Hand girth	34	1	2,94	2	
171	Thumb girth	34	0	0,00	1	
172	Index finger girth	34	0	0,00	1	
173	Middle finger girth	34	0	0,00	1	
174	Ring finger girth	34	0	0,00	1	
175	Little finger girth	34	0	0,00	1	
	FOOT MEASUREMENTS					
176	Height of foot arch	50	9	18,00	2	22,2
177	Height of the big toe	50	8	16,00	1	12,5
178	Toe height	50	8	16,00	0	0
179	Ball height	50	6	12,00	2	33,3
180	Plantar arch height	50	3	6,00	2	66,7
181	Dorsal arch height	50	5	10,00	3	60

	BODY MEASUREMENTS	Sample size (N)	Number of respondents using the measurement	%	Number of respondents with problems	%
182	Outside ball height	50	6	12,00	3	50
183	Ankle length	50	5	10,00	0	0
184	Posterior heel contour	50	6	12,00	1	16,7
185	Foot length	50	17	34,00	3	17,6
186	Ball length (heel to ball of foot)	50	6	12,00	0	0
187	Fifth toe length	50	3	6,00	0	0
188	Outside ball length	50	5	10,00	0	0
189	Outside ball length (diagonal)	50	4	8,00	0	0
190	Width of three forward toes	50	4	8,00	0	0
191	Foot width – diagonal	50	12	24,00	4	33,3
192	Foot width (ball width)	50	12	24,00	3	25
193	Width (center line to medial border)	50	8	16,00	0	0
194	Width of instep	50	9	18,00	2	22,2
195	Heel width	50	7	14,00	1	14,3
196	Girth of heel / instep (Heel-ankle circumf.)	50	7	14,00	2	28,6
197	Instep girth (Bridge circumference)	50	13	26,00	5	38,5
198	Foot girth (ball of foot)	50	13	26,00	4	30,8
199	Angle line	50	4	8,00	1	25
200	Flare (ratio)	50	3	6,00	2	66,7
201	Proportion of sole in contact with ground	50	6	12,00	2	33,3
202	Lateral foot contour by template	50	4	8,00	1	25

Body measurements that were not used at all included chin height, abdominal extension arc anterior, hip arc posterior, shoulder height (seated), popliteal height, shoulder blade skinfold, and triceps skinfold. In some instances, more companies identified a measurement as being a problem measurement than the number that used the particular measurement. The explanation for this could be that such measurements are not used by industry because they are seen as problem measurements and are therefore not accurate or reliable to use.

The head measurement that is mainly used is, as expected, head girth. Head girth is the measurement used to indicate hat and cap sizes. It is therefore not surprising that the manufacturers make use of this measurement. Head height, head length and

head width are other measurements mostly used. Head measurements that were not used at all included chin to nose bridge (menton-sellion), and inter-pupillary distance.

Of the 54 companies that responded, there were only two glove manufacturers that used the hand measurements. It seems that the girths of the different fingers are not necessary for the manufacturing of gloves, but the different finger lengths seem to be important.

Foot length is the foot measurement that is mostly used by the respondents. This is because foot length is the measurement related to the size of footwear, but it is also used for the manufacturing of clothing such as Babygros™. Instep girth, foot girth, and foot width (diagonally and straight) are also used by a number of manufacturers.
Although all measurements are important to the clothing industry, the interview results of only those body measurements that one or more international descriptions were found for, and that more than one respondent provided a description for, are discussed and interpreted in detail. Results regarding all other measurements are presented in **Addendum D**. The reason for this is that where no international description is available there is nothing to compare the discussion of the respondent's descriptions with, and therefore one cannot make valid conclusions regarding these specific measurements. The situation is the same where no description was given by respondents. When only one description from the respondents is available it does not provide significant information about the situation regarding the specific measurement, and again one cannot make valid conclusions regarding such measurements.

4.4 COMPARISON OF INTERNATIONAL DESCRIPTIONS WITH RESPONDENTS' DESCRIPTIONS OF BODY MEASUREMENTS USED AND THE PROBLEMS THAT THE RESPONDENTS EXPERIENCE WITH BODY MEASUREMENTS (Objectives 2 and 3)

The results are grouped according to vertical height, horizontal width and depth, circumferences and other body measurements. Results are presented, discussed and interpreted in the following order:

- ✓ Percentage of survey respondents and number of interview respondents that use the measurement and/or experienced problems;
- ✓ International description of the measurement;
- ✓ Interview respondent's descriptions of the measurements and/or problem;
- ✓ Discussion / Interpretation;
- ✓ Tables summarising the results.

4.4.1 Vertical height measurements

Height (1)

Although not directly used in the manufacturing of clothing items, this measurement can indicate to the manufacturer the average height of the population that the manufacturer is catering for. This measurement is also important as an indicator when classifying the measurements of a population into a sizing system. It is clear from **Table 4.3** that 38,9% of the survey respondents made use of this measurement and none experienced problems with the measurement. Nine of the respondents interviewed indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

- ✓ Distance between the crown of the head and the ground (SizeUK).
- ✓ The vertical distance between the crown of the head and the ground, measured using the measuring stand (anthropometer) (Ergotech).

- ✓ The vertical distance between the crown of the head and the soles of the feet, measured with the subject standing erect without shoes and with the feet together (ISO 8559, 1989; ISO 3635, 1981).
- ✓ The vertical distance from the crown of a standing subject to the soles of the feet (ASTM 5219, 1999).

It is clear that all international descriptions describe the measurement as taken from the crown of the head to the ground.

Interview respondents' descriptions:

Respondent 1: *From head to toe, floor, without shoes.*
Respondent 3: *Total length, straight.*
Respondent 4: *Top of head straight to the floor.*
Respondent 6: *Full length.*
Respondent 7: *Mark the top of the head on the grid and measure in a straight line.*
Respondent 9: *A straight measurement from the top to the ground, no shoes.*
Respondent 11: *We'll put the person against the wall, make a mark and measure.*
Respondent 12: *Your actual height is a straight measurement.*
Respondent 13: *We let them stand against a wall, straight. Some people know their height, then we just ask them.*

It is clear that the descriptions given by the respondents correspond with the international descriptions, being a straight vertical measurement and measured without shoes. None of the respondents used an anthropometer. The reason why none of the respondents experienced problems with this measurement is probably because it is a straight-forward measurement to take.

Cervical height (3)

This measurement is useful when making garments that cover the full body and for the manufacturing of fit dummies. The measurement is used by 20,59% of the survey respondents and none of them experience problems with the measurement. Of the 13 respondents interviewed, four respondents used the measurement and none experienced problems with the measurement.

International description of the measurement:

- ✓ Distance from the level of the centre back neck point straight to the ground (SizeUK).
- ✓ The distance, using the tape measure, from the 7th cervical vertebra, following the rear contour of the spinal column to the level of the hips, then vertically to the ground (ISO 8559, 1989).

The international descriptions do not correspond because the one describes it as a straight vertical measurement while the other description mentions following the curvature of the spine.

Interview respondents' descriptions:

Respondent 3: *Back neck straight to the floor.*

Respondent 4: *Nape to floor, following the contour of the back. Nape is identified by the prominent cervical bone at the back of the neck.*

Respondent 7: *From the nape, a straight measurement.*

Respondent 12: *A straight measurement from the back of the neck.*

The respondent's descriptions do not correspond with each other with regard to the measurement being a straight or a contoured measurement. The situation is the same internationally, although more of the respondents mentioned the straight measurement. It seems that the measurement can be measured as a straight vertical measurement, or as following the contour of the back.

Side neck height (4)

This measurement is not generally used for the manufacturing of most ordinary clothing items, but could be useful for the manufacturing of special garments that cover the full body and for the manufacturing of fit dummies. Although only 14,71% of the survey respondents use this measurement, two of the postal survey respondents using it experienced problems with the measurement. Of the 13 respondents interviewed, four respondents indicated that they used the measurement and one experienced problems with the measurement.

International description of the measurement:

- ✓ Only one international index, namely SizeUK, describes the measurement. It is described as the distance between the right side neck point level and the ground.

Interview respondents' descriptions:

Respondent 3: *Side neck level (neck shoulder position) straight to the floor. Marking the neck base with a chain helps to identify the side neck position.*

Respondent 4: *Side neck to floor following the contour of the back. Identifying side neck is a problem; judge with the eye where the neck and shoulder joins.*

Respondent 9: *We normally take it as a straight measurement and when we make the pattern we add on to accommodate the bust.*

Respondent 11: *Mark at side neck point.*

It is clear that the descriptions do not correspond with each other, because some respondents take the measurement as a straight vertical height while one respondent indicated that they prefer the measurement to be taken on the contour of the body. None of the respondents indicated that the measurement should be taken on the right side of the body.

It is also clear that the problems that two of the survey respondents experienced with the measurement are probably due to the fact that it is difficult to landmark the side point of the neck. The side neck point is the position where the neck and shoulder meet, and identifying this position is the main problem. This position is usually identified by judging where the neck and shoulder meet. The ability to consistently judge it at the same point, even by the same measurer, is questionable. This is the reason why most measurements involving side neck point were identified as problem measurements. When a chain is used to mark the base of the neck, the position of the chain on the side of the neck is then used as a point of reference.

Shoulder height (6)

This measurement is useful for the manufacturing of special garments that cover the full body and also in the manufacturing of fit dummies. The measurement is used by 20,59% of survey respondents and two of the survey respondents using it experienced problems with the measurement. Of the 13 respondents interviewed, only three used the measurement and one respondent experienced problems with the measurement.

International description of the measurement:

- ✓ Again, only the SizeUK standards describe the measurement as the distance between the level of the right armhole shoulder point and the ground (SizeUK).

Interview respondents' descriptions:

Respondent 3: *Level of the shoulder (protruding bone at shoulder) straight to the floor.*

Respondent 4: *From shoulder to floor, straight.*

Respondent 11: *Shoulder to floor.*

All the respondents describe this measurement as a straight vertical measurement, similar to the international description; however, none mentioned that it should be taken on the right side of the body. Finding the position of the shoulder may be a problem because locating the bone that is used as the landmark is not always easy. That may be the reason why two of the survey respondents indicated that they usually experienced problems with this measurement.

Underarm height (7)

This measurement is useful for the manufacturing of special garments that cover the full body and also in the manufacturing of fit dummies. The measurement is used by 26,47% of survey respondents and three of the survey respondents using it experienced problems with the measurement. Of the 13 respondents interviewed, five used the measurement and two indicated that they experienced problems with the measurement.

International description of the measurement:

- ✓ Again, only the SizeUK standards describe the measurement as the distance between the right underarm level and the ground (SizeUK).

Interviewed respondents' descriptions:

Respondent 3: *Underarm straight to the floor.*

Respondent 4: *From underarm position along the side contour of the body to maximum hip, and then straight to the floor.*

Respondent 7: *Unsure about how high up under the arm it should be measured.*

Respondent 11: *From the armpit and measured straight.*

Respondent 13: *Armpit to floor, straight.*

It is clear that there is uncertainty about exactly how the measurement should be taken. Three of the respondents mentioned that it should be taken as a straight measurement and one indicated that they measure it along the body contour. The uncertainty with this measurement is as respondent 7 queries: how high up under the arm should the measurement be taken? To be able to take the measurement consistently one should know exactly from where to take the measurement. The international description is also vague about exactly how high up under the arm the measurement should be taken, since it just refers to underarm level. Land-marking the underarm point is probably the reason why so many respondents experienced problems with this measurement.

Across back height (8)

This measurement is useful for the manufacturing of fit dummies. The measurement is used by 26,47% of survey respondents and three of the survey respondents using it experienced problems with the measurement. Of the 13 respondents interviewed, three used the measurement and two indicated that they experienced problems with the measurement.

International description of the measurement:

- ✓ Only the SizeUK standards describe the measurement as from midway between centre back neck and underarm level to the ground (SizeUK). The across back position is usually identified as 12 cm below the nape of the neck.

However, the SizeUK description only identifies the position as midway between centre back neck and underarm level. To take consistent measurements it will be better to identify a specific distance below the nape, or a more identifiable position such as the crease where the arm and the body meet.

Interview respondents' descriptions:

Respondent 4: *From middle of armscye, following the contour of the back.*

Respondent 7: *In line with the crease or 12cm below nape, and it is a straight measurement.*

Respondent 11: *Twelve centimeters down from nape.*

It is clear that the respondents differ with regard to the taking of the measurement, and it is also, as in the case of the SizeUK standards, not clear as to exactly where the landmarks should be placed and how the measurement should be taken. Keeping in mind that the only sizing standard that actually describe the measurement, namely the SizeUK standards, is vague about the land-marking and also does not indicate whether it should be measured as a straight or contoured measurement, the uncertainty amongst the respondents is understandable.

Chest height (9)

This measurement could be useful when manufacturing men's wear covering the full body and for the manufacturing of fit dummies. The measurement is used by 23,53% of the survey respondents and one experienced problems with the measurement. Of the 13 respondents interviewed, three used the measurement and none experienced problems with the measurement.

International description of the measurement:

Only one international description was found.

✓ Distance between the level of the maximum chest and the ground (SizeUK).

Interview respondents' descriptions:

Respondent 4: *Measured on men and children, from the widest part of the chest to the floor.*

Respondent 7: No description given.

Respondent 11: *Widest part* [of the chest] *to floor.*

The descriptions of the respondents correspond with the international description with regard to the landmarks. It is assumed that this is a straight vertical measurement, although this is not clearly stated in the descriptions.

Bust level height (10)

This measurement could be useful when manufacturing garments covering the full body and for the manufacturing of fit dummies for ladies' wear. The measurement is used by 29,41% of the survey respondents and none experienced problems with the measurement. Of the 13 respondents interviewed, five used the measurement and none experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

- ✓ Distance between the level of the maximum bust projection and the ground (SizeUK).

Interview respondents' descriptions:

Respondent 1: *From bust to floor.*

Respondent 4: *Measured on women, from the widest part of the bust to the floor.*

Respondent 6: No description given.

Respondent 7: *Straight down from the most prominent part of the bust.*

Respondent 11: *Most prominent part to floor.*

The descriptions of the respondents correspond with the international description with regard to the landmarks. It is not clear from the international description whether this is a straight vertical measurement. One of the respondents did mention that it should be a straight vertical measurement.

Underbust level height (11)

This measurement could be useful when manufacturing garments covering the full body and for the manufacturing of fit dummies for ladies' wear. This measurement is used by 8,82% of the survey respondents and none experienced problems with the

measurement. Of the 13 respondents interviewed, two used the measurement and none experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

- ✓ Distance between the rib cage at underbust level and the ground (SizeUK).

Interview respondents' descriptions:

Respondent 4: *Underbust position to the floor, on women.*

Respondent 11: *Directly under the bust straight to the floor.*

The descriptions of the respondents correspond with the international description with regard to the landmarks.

Underbust to waist (12)

This measurement is used in the manufacturing of upper body garments and underwear for women and it can also be useful for the manufacturing of fit dummies. The measurement is used by 35,29% of the survey respondents and one respondent experienced problems with the measurement. Of the 13 respondents interviewed, six used the measurement and none indicated that they experienced problems with the measurement.

International description of the measurement:

- ✓ Only Ergotech (South Africa) describes the measurement as the distance measured using the tape measure, from under the bust to the waist level, following the contour of the body (Ergotech).

Interview respondents' descriptions:

Respondent 1: *Just below bust to waistline.*

Respondent 3: *On the body from under the bust to the natural waistline.*

Respondent 4: *Under bust to natural waist on the contour of the body.*

Respondent 7: *Just below the bust along the body, to the waist. It could be a problem on big busted women to get the tape measure in right up under her boobs.*

Respondent 11: *On the body from under the bust to the waist.*

Respondent 12: This measurement was not marked on the questionnaire but the respondent made the following comment regarding the measurement: *"I actually put it flat against the contour of the body."*

Respondent 13: *Below bust to waist, on women.*

This measurement is taken only on women. The reason being that style lines (for example an empire line) which are related to such a measurement are more prevalent in ladies' wear. The descriptions given by the respondents do not correspond with the international description, because not all the respondents indicated that it should be taken on the contour of the body. The problem that two of the survey respondents experience with the measurement may also be due to the fact that it is, especially in the case of big-busted women, as respondent seven states, difficult to locate the exact "under the bust" point.

Armscye to waist (13)

This measurement is also used for the manufacturing of upper body garments and it can also be useful for the manufacturing of fit dummies. The measurement is used by 35,29% of survey respondents, and two indicated that they experienced problems with the measurement. Of the 13 respondents interviewed, six use the measurement and one indicated that they experienced problems with the measurement.

International description of the measurement:

- ✓ Only one standard describes the measurement as measured from the mid-underarm point along the side of the body to the waist height (ASTM 1998).

Interview respondents' descriptions:

Respondent 1: *From underarm to waist on the side of the body.*

Respondent 3: *From underarm, on the side of the body, to the natural waist.*

Respondent 4: *Underarm to natural waist on the side of the body.*

Respondent 6: *On the body measured from underarm.*

Respondent 11: *On the side from under the arm to the natural waist.*

Respondent 12: *Armpit to waist, flat against the contour of the body.*

The international description does not clearly state whether the measurement should be taken along the contour of the body. If one assumes that "along the side of the body" refers to the contour, then it is clear that the respondents' descriptions correspond with the international description of this measurement.

Waist height (14)

This measurement is useful for determining the length of skirts and trousers, and for the manufacturing of fit dummies. The measurement is used by 38,24% of the survey respondents and none of them experience any problems with the measurement. Of the 13 respondents interviewed, six used the measurement and none experienced problems with the measurement.

International description of the measurement:

- ✓ Distance between the natural waist level at the right side of the body and the ground (SizeUK).
- ✓ The vertical distance from the natural waist level to the ground, measured using the measuring stand (anthropometer) at the side of the body, with the subject standing upright (ISO 8559, 1989).
- ✓ Measure from the waist level at the side of the body following the contour of the body to hip level, then vertically to the soles of the feet (ASTM 5585, 1995). The waist is described as the part of the body at the location between the lowest rib and hip identified by bending the body to the side (ASTM 5219, 1999).

It is clear that the international descriptions correspond with each other.

Interview respondents' descriptions:

Respondent 4: *From natural waist to the floor.*
Respondent 6: *Waist to ground.*
Respondent 7: *Waist, at the narrowest area, straight down.*
Respondent 11: *Waist straight to floor.*
Respondent 12: *Natural waist to floor – this is a straight measurement.*
Respondent 13: *Waist to floor, straight.*

This measurement is taken in a straight line. The description given by the respondents correspond with the international descriptions. It is a straightforward measurement to take and therefore none of the respondents experienced problems with the measurement.

Upper hip height (17)

This measurement is used for the manufacturing of lower body garments and can also be useful for the manufacturing of fit dummies. It can be useful to determine the position of the corresponding girth measurement on the pattern or fit dummy. The measurement is used by 35,29% of the survey respondents and none experienced problems with the measurement. Of the 13 respondents interviewed, five indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

- ✓ Distance between the top hip bone and the ground (SizeUK).
- ✓ High-Hip height at the side of the body, measured from the level of the prominent high-hip (approximately 7,5cm below the waist level) following the contour of the body to the soles of the feet (ASTM 5586, 1995).

It is clear that the ASTM describes the taking of the measurement in more detail. The SizeUK standard does not indicate whether the measurement should be taken at the side of the body.

Interview respondents' descriptions:

Respondent 1: *From 10cm below waistline to the floor.*
Respondent 4: *Top hip bone to the floor.*
Respondent 6: *Measure hip 10cm lower from waist of the person.*
Respondent 7: *10cm below waist. These are straight measurements.*
Respondent 11: *10cm below waist.*

According to the respondents, this is a straight vertical measurement; however, the ASTM description refers to taking the measurement along the contour of the body. Only one of the descriptions given correspond with the international description used

by SizeUK. The respondents referred to taking the measurement from 10cm below the waist. This is more similar to the ASTM description where the measurement is taken 7,5cm below the waist. To ensure consistency it would probably be more sensible to take the measurement from a specific distance below natural waist, whether it be at 7,5cm or 10cm, instead of "from the top hip bone".

Top hip height (18)

This measurement is used for the manufacturing of lower body garments and can also be useful for the manufacturing of fit dummies. It can be useful to determine the position of the corresponding girth measurement on the pattern or fit dummy. The measurement is used by 35,29% of the survey respondents and none experienced problems with the measurement. Of the 13 respondents interviewed, six indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

- ✓ Only the SizeUK standards describe this measurement as taken from midway between the waist and hip levels to the ground (SizeUK).

This description corresponds strongly with the previous measurement. It is not clear what is meant by "midway between waist and hip levels". Such a vague description could confuse those who have to take the measurement while it would probably also be difficult for the same person to take the measurement consistently.

Interview respondents' descriptions:

Respondent 1: *From 20cm below waistline to the floor.*
Respondent 3: *Straight to the floor from a position 10cm below the natural waist.*
Respondent 4: No description given.
Respondent 6: *This is from 18cm lower than waist.*
Respondent 7: *20cm below waist.*
Respondent 11: *20cm below waist.*

There seems to be confusion about where this measurement should be taken. Half of the respondents interviewed were of the opinion that it should be measured from

20cm lower than the natural waist, while one respondent gave the exact description as for the previous measurement. The international description does not specify a certain distance but refers to midway between waist and hip levels. This probably contributes to the difference in opinion as to where the measurement should be taken. As "halfway between" is not a clear indication of the exact position of the landmark, one would have expected that at least some respondents would indicate that they were experiencing problems with this measurement.

Hip height (19)

This measurement is used for the manufacturing of lower body garments and can also be useful for the manufacturing of fit dummies. It can be useful to determine the position of the corresponding girth measurement on the pattern or fit dummy. The measurement is used by 35,29% of the survey respondents and none experienced problems with the measurement. Of the 13 respondents interviewed, six indicated that they used the measurement and none experienced problems with the measurement. It is interesting to note that the same number of survey respondents used all three the hip measurements. This may be an indication that all three hip heights are equally important to the different respondents.

International description of the measurement:

- ✓ The vertical distance from the trochanteric projections to the ground, measured using the measuring stand (anthropometer) with the subject standing upright (ISO 8559, 1989).
- ✓ Measure at the side of the body from the level of the prominent full hip to the soles of the feet (ASTM 5586, 1995).

This is a straight vertical height taken from where the widest circumference of the hips is. Only the ASTM description is clear about exactly where on the body, namely on the side, the measurement should be taken.

Interview respondents' descriptions:

Respondent 3: *From the widest part straight to the floor.*

Respondent 4: *Maximum hip to the floor.*

Respondent 6: *Measure from where the biggest part of the person is.*

Respondent 7: *At the widest circumference.*

Respondent 9: *In a straight line from the widest part.*

Respondent 11: *From the widest part.*

The descriptions of the respondents correspond with each other and also with the international description. Although all of the descriptions correspond, none of the respondents mention the position on the body where the measurement should be taken, for example on the side or at the centre back. The widest hip should be a horizontal measurement parallel to the floor, therefore one should get the same measurement regardless of whether it is measured from the front, side or back. However, to be consistent it is important to take the measurement from the same position on all the people that are being measured. In this case the ASTM suggests taking the measurement from the side of the body.

Front waist to thigh (25)

This measurement is used by 17,65% of the survey respondents and none of them experienced problems with the measurement. Of the 13 respondents interviewed, three used the measurement and none experienced problems with the measurement.

International description of the measurement:

Only one international description was found.

- ✓ Distance from the natural waist position over the contour of the stomach and straight to the maximum thigh girth level (SizeUK).

Interview respondents' descriptions:

Respondent 3: *Natural waist to the widest part of the thigh, at centre front.*

Respondent 4: *Centre front waist to maximum thigh.*

Respondent 11: *Waist to the widest part of the thighs.*

The descriptions of the respondents correspond with each other and with the international description with regard to the landmarks. The descriptions of the respondents do not mention taking the measurement over the contour of the stomach. If one considers how a garment fits on the body, the measurement would be more useful for patternmaking purposes, if taken over the contour of the stomach.

Front waist to calf (27)

This measurement could be useful when manufacturing skirts, to determine the front length of the garment, and it can also be useful for the manufacturing of fit dummies. The measurement is used by 23,53% of the survey respondents and none experienced problems with the measurement. Of the 13 respondents interviewed, three used the measurement and none experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

- ✓ Distance from natural waist over the contour of the stomach to the calf level (SizeUK).

Interview respondents' descriptions:

Respondent 3: *Natural waist to the widest part of the calf, at centre front.*

Respondent 4: *Centre front waist to the widest part of the calf.*

Respondent 11: *Up to the widest part of the calf.*

The descriptions of the respondents correspond with each other and with the international description with regard to the landmarks. It is however not clear from the descriptions of the respondents whether the contour of the stomach should be accommodated, as the international description suggests. If one considers how a garment fits on the body, the measurement would be more useful for patternmaking purposes, if taken over the contour of the stomach.

Front waist to ground (28)

This measurement could be useful when manufacturing skirts, to determine the front length of the garment, and it can also be useful for the manufacturing of fit dummies. The measurement is used by 38,24% of the survey respondents and none experienced problems with the measurement. Of the 13 respondents interviewed, five used the measurement and none experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

- ✓ Distance from the natural front waist over the contour of the stomach and straight to the ground (SizeUK).

Interview respondents' descriptions:

Respondent 3: *Natural waist to the floor, at centre front.*
Respondent 4: *Centre front waist to the floor.*
Respondent 6: *Waist to ground on centre front.*
Respondent 7: *Straight measurement from the waist down.*
Respondent 11: *Straight to the floor.*

The descriptions of the respondents correspond with each other and with the international description with regard to the landmarks. However, some respondents state that it is a straight measurement, while the other descriptions are not clear regarding this issue. For patternmaking purposes and if one considers how a garment fits on the body, it would be more useful to take the measurement over the contour of the stomach.

Side waist to hip (29)

This measurement could be useful when making patterns for trousers and skirts, and it can also be useful for the manufacturing of fit dummies. The measurement is used by 29,41% of the survey respondents and none experienced problems with the measurement. Of the 13 respondents interviewed, five used the measurement and none experienced problems with the measurement.

International description of the measurement:

- ✓ Distance along the right side of the body from the natural waist level to the hip level (SizeUK).
- ✓ The distance along the side of the body from the natural waist level to the hips at the level of the greatest lateral trochanteric projection following the hip contour (ISO 1989).

The international descriptions do correspond, although the one description does not specify measuring on the right side of the body.

Interview respondents' descriptions:

Respondent 3: *Natural waist to the widest part of the hip, along the side of the body.*

Respondent 4: *Natural waist to the maximum hip on the side curve of the body.*

Respondent 7: *Follow the curve from waist to widest hip area.*

Respondent 11: *Waist to the widest part of the hip on the side.*

Respondent 12: *Natural waist to the widest part flat against the side of the body.*

The descriptions of the respondents correspond with each other and also with the international descriptions. The respondents did however not state that the measurement should be taken on the right side of the body. To be consistent it is important to measure on the same side of the body.

Side waist to knee (30)

This measurement could be useful when manufacturing skirts, to determine the length of the side seam, and it can also be useful for the manufacturing of fit dummies. The measurement is used by 29,41% of the survey respondents and none experienced problems with the measurement. Of the 13 respondents interviewed, four used the measurement and none experienced problems with the measurement.

International description of the measurement:

✓ The distance from the waist to the knee circumference level following the contour of the hip (Ergotech).

Interview respondents' descriptions:

Respondent 3: *Natural waist to the level of the knee, along the side of the body.*

Respondent 4: *Natural waist to knee level following the side curve of the body.*

Respondent 7: *Follow the curve and then straight to the level of the crease of the knee.*

Respondent 11: *Waist to the knee. Follow the contour and then straight.*

The descriptions of the respondents correspond with each other and also with the international description. The identification of the knee level as a landmark is

however not clearly described and could be a problem as discussed with previous measurements.

Outside leg length (31)

This measurement is used for the manufacturing of skirts and trousers. This measurement is used by 76,47% of the survey respondents and one experienced problems with the measurement. Of the 13 respondents interviewed, nine indicated that they used the measurement and one company experienced problems with the measurement.

International description of the measurement:

- ✓ Distance from the right side waist level to the ground following the contour of the hip then straight to the ground (SizeUK).
- ✓ The distance from the waist to the ground measured using the tape measure following the contour of the hip, then vertically down (ISO 8559, 1989).
- ✓ The distance from the side waist to the soles of the feet, following the curve of the body (ASTM 5219, 1999).

It is clear that the international descriptions correspond with each other.

Interview respondents' descriptions:

Respondent 1: According to the questionnaire, this measurement is not used. The measurement chart that the respondent provided however shows outside leg as *taken from the waist to the floor over the curve of the hip and then straight.*

Respondent 3: *Natural waist to the floor, along the side of the body and then straight.*

Respondent 4: *Natural waist to the floor on the side curve of the body.*

Respondent 6: *Side seam length.*

Respondent 7: *From the waist along the side of the body and then straight to the floor.*

Respondent 8: *From the waist to the eh…, where you want the hem to be. From the waist it would naturally follow the curve of the body.*

Respondent 9: *A straight measurement from waist to ground.*

Respondent 11: *Measure waist to floor on the body and then straight.*

Respondent 12: *I go from waist to hip on the curve and then straight down (on women).*

Respondent 13: *Straight from ankle to waist.*

Two of the respondents suggested a straight vertical measurement, which would be the same as waist height (number 14). The international descriptions, as well as the rest of the respondents suggest that it be measured on the side curve of the body from waist to hip and then straight to the ground. Taking the measurement in this way is more useful for patternmaking, since this is how the side seam of a garment fits on the body. Measuring to the ground also gives more consistency than measuring to the ankle.

Inside leg length (32)

This measurement is used for the manufacturing of trousers. The measurement is used by 54% of survey respondents and two experienced problems with the measurement. Of the 13 respondents interviewed, nine respondents indicated that they used the measurement and two experienced problems with the measurement.

International description of the measurement:

- ✓ Distance between the crotch level at centre of body and the ground (SizeUK).
- ✓ The distance between the crotch and the ground, measured using the tape measure in a straight line with the subject upright, feet slightly apart, and the body mass equally distributed on both legs (ISO 8559, 1989).
- ✓ The vertical distance from the crotch to the soles of the feet (ASTM 5219, 1999).

It is clear that the international descriptions correspond with each other and that the ISO gives a more complete description of exactly how to take the measurement.

Interview respondents' descriptions:

Respondent 1: *Crotch to floor.*

Respondent 3: *Level of the crotch straight to the floor. This is a sensitive measurement to take.*

Respondent 4: *From crotch level to the floor, straight or along the leg. Not taken very often because it is a very personal measurement.*

Respondent 7: *A straight measurement from the crotch down to the floor.*

Respondent 8: *Straightforward, again to the hem. People will have to take their shoes off otherwise you have the heel height in the measurement.*

Respondent 9: *Crotch to the ground in a straight line.*

Respondent 11: *Straight down from the crotch.*

Respondent 12: *Inside leg would be a straight measurement (on men).*

Respondent 13: *Crotch to ankle. Also a very awkward measurement. Person has to wear tight fitting clothes so that you are able to identify the crotch when measuring.*

This is a straight vertical measurement as suggested by the international descriptions. The respondents also note that it is a "sensitive" measurement to take, and this is where the problem with this measurement lies. Identifying the crotch position that is the landmark, also poses a problem that can negatively impact on the accuracy of the measurement. Reference is made to having to wear tight fitting clothes in order to make the identification of landmarks on the body easier. Again it is mentioned that the person should be measured without shoes. It is very important that the correct clothes are worn during measuring in order to assist with landmark identification and the taking of accurate measurements.

Trunk length (33)

This measurement is used when manufacturing one-piece garments that cover the whole body, for example swimwear and bodysuits. The measurement can also be useful for the manufacturing of fit dummies. This measurement is used by 44,12% of survey respondents and one experienced problems with the measurement. Of the 13 respondents interviewed, seven indicated that they used the measurement and one company experienced problems with the measurement.

International description of the measurement:

- ✓ The distance from the 7th cervical vertebra to the crotch level, measured using the measuring stand (anthropometer), with the subject standing upright (ISO 8558, 1989).

Interview respondents' descriptions:

Respondent 3: *Neck shoulder point straight to the level of the crotch.*

Respondent 4: *Side neck to crotch. Not really used because it is more applicable to bodysuits and swimwear.*

Respondent 7: *Vertical trunk, from side neck to crotch.*

Respondent 9: *That's a measurement that we only use for the children, for infants and toddlers, that is our most important measurement. Neck shoulder point to crotch.*

Respondent 11: *Side neck to crotch and it is straight.*

Respondent 12: *Like vertical front. From the neck point and it's on the contour of the body. We use this in ladies, it is important for swimwear and girls.*

Respondent 13: *Shoulder seam to the middle of the crotch. Where the neck enters the shoulder, to centre seam of crotch, standing up.* On the measurement chart provided, the description refers to the imaginary middle line at the top of the shoulder, but the picture points to the centre shoulder position. *Difficult to measure accurately, but it is so critical. It's a very sensitive measurement, but it's critical.*

It seems that this measurement is mostly measured in a straight line. The description that most of the respondents give refers to taking the measurement from the side neck point to the crotch level in a straight vertical line. Only one respondent refers to taking the measurement on the contour of the body. The respondents did not specify whether the measurement should be measured from the front or the back. This does not correspond with the international description, which suggests the measurement be taken from the nape instead of side neck. This means that the measurement should then be measured from the back. As stated before, the side neck point can be a problem to identify consistently and therefore the nape could be a more reliable position to identify on the body.

Total crotch length (34)

This measurement is critical in the manufacturing of trousers. The measurement is used by 58,82% of the survey respondents and one experienced problems with the

measurement. Of the 13 respondents interviewed, eight indicated that they used the measurement and one company experienced problems with the measurement.

International description of the measurement:

- ✓ Distance from the centre of the natural waist level at the front, through the crotch to the centre of the back waist level (SizeUK).
- ✓ The distance, measured using the tape measure, from the centre of the natural waist level at the front of the body, through the crotch, to the centre of the back at the waist level (ISO 8559, 1989).
- ✓ The distance from the waist level at center front through the crotch to the waist level at center back (ASTM 5219, 1999).

It is clear that the international descriptions correspond with each other.

Interview respondents' descriptions:

Respondent 1: *From front waistline through the legs to back waistline on the contour of the body.*

Respondent 3: *Natural waist in the front through to the natural waist at the back.*

Respondent 4: *From the waist, front to back through the crotch.*

Respondent 6: *From front below waistband, go through and measure to waist.*

Respondent 7: *A bit of a difficult one that. We don't pull it right up in between the bum cheeks where a g-string would go. It's got to be on the outside of the body.*

Respondent 9: *We do standing and seated. From the front, right through to the back.*

Respondent 11: *Front waist to the back waist, flush against the body shape.*

Respondent 12: *It's measured from waist right through to waist. I make sure of the tape position between the legs, that it sits against the body.*

The descriptions given by the respondents correspond with the international descriptions. However, one respondent mentioned taking the measurement in a seated position as well as standing. This is unusual since none of the international descriptions listed this as a seated measurement. It could be useful to have a seated version of the measurement to compare with the standing one. It could provide useful

information for improving the fit of trousers. Total crotch length is a critical measurement for the manufacturing of trousers because it will dictate the shape of the center front and center back seams of the trousers. How much of the measurement is allocated toward the front or toward the back of the garment will depend on the shape of the individual person.

Body rise (37)

This measurement is also used for the manufacturing of trousers. This measurement is used by 58,82% of survey respondents and three experienced problems with the measurement. Of the 13 respondents interviewed, nine indicated that they used the measurement and two companies experienced problems with the measurement.

International description of the measurement:

- ✓ Distance between the waist level at centre back and the crotch height (SizeUK).
- ✓ The vertical distance, measured using the measuring stand (anthropometer), between the waist level and the crotch level (ISO 8559, 1989).
- ✓ While sitting on a hard, flat surface, measure straight down from the waist level at the side of the body to the flat side (ASTM 5585, 1995).

The international descriptions are similar in that it is a straight vertical measurement from the waist level to the crotch. There is however no consensus on whether it is a standing or a seated measurement and whether it should be taken from the back or the side of the body.

Interview respondents' descriptions:

Respondent 1: *Waistline to crotch level.*

Respondent 3: *Waist to seat position measured on the side, with the person sitting upright on a hard surface.*

Respondent 4: *Waist to crotch.*

Respondent 6: *Waist to crotch, measured standing from the front.*

Respondent 7: *Waist to crotch, a straight line through the body.*

Respondent 8: *On a man's thing you subtract the inside leg from the outside leg, that's a calculated thing so you don't measure. On a woman,*

typically what you would do is measure the seat to waist seated, and that would determine your inside leg measurement.

Respondent 9: *Taken as a standing measurement, not seated.*

Respondent 11: *Waist to crotch, standing.*

Respondent 12: *I do it as a straight measurement (standing).*

The international descriptions are not consistent on whether the measurement should be taken on the side of the body or at center back. They also differ regarding whether the measurement should be taken in a standing or a seated position. This is also the case in South Africa if one looks at the various descriptions of the respondents. Reference is made to measuring the person in a standing as well as in a seated position. Two respondents agree with the ASTM (1995) description, which suggests taking the measurement in a seated position. The other respondents describe the measurement as being measured in a straight line from waist to crotch level although they do not clearly indicate whether measuring takes place from the side or back of the body. The measurement is critical for determining the distribution of the total crotch length on the pattern, and this ultimately determines the fit of the trousers. Such confusion regarding how to take the measurement, together with both landmarks being difficult to determine consistently on the body, should surely lead to major problems, yet less than 20% of the respondents experienced problems with this critical measurement. The only explanation for this can be total ignorance or a "don't care" attitude towards the importance of fit.

Back waist length (38)

This measurement is used for determining style lines and for the positioning and shaping of darts on patterns for full body and upper body garments. It can also be useful for the manufacturing of fit dummies. This measurement is used by 50% of the survey respondents and none experienced problems with the measurement. Of the 13 respondents interviewed, seven indicated that they used the measurement and not one experienced problems with the measurement.

International description of the measurement:

- ✓ Distance between the nape and the natural waist level. Measured on the contour of the centre back (SizeUK).

- ✓ The distance, measured using the tape measure, from the 7th cervical vertebra, following the contour of the spinal column, to the waist (ISO 8559, 1989).
- ✓ The vertical distance along the spine from the cervicale (*sic*) to the waist. The cervicale (*sic*) (or nape) is described as the prominent point of the seventh or lowest neck vertebra at the back of the body (ASTM 5219, 1999).
- ✓ Measure from the cervicale (*sic*) following the contour of the spinal column to the center back waist level (ASTM 5585, 1995).

It is clear that the international descriptions correspond with each other. Determining these two landmarks is also not an easy task.

Interview respondents' descriptions:

Respondent 1: *Nape to waist at centre back.*
Respondent 3: *Nape to waist on the body.*
Respondent 4: *Nape to natural waist on the contour of the back.*
Respondent 6: *Centre back down to waist.*
Respondent 7: *Nape to waist on the contour.*
Respondent 11: *Nape to waist against the back.*
Respondent 12: *Nape to waist, against the contour of the body.*

The respondents agree that the measurement should be taken on the contour of the body between the two landmarks and this also corresponds with the international descriptions. The respondents however do not indicate exactly how the landmarks are located or identified on the body.

Cervical to knee hollow (42)

This measurement is used by 14,71% of the survey respondents and none experienced problems with the measurement. Of the 13 respondents interviewed, three used the measurement and none experienced problems with the measurement.

International description of the measurement:

- ✓ The distance from the 7th cervical vertebra following the rear contour of the spinal column to the level of the hips and ending vertically at the level of the knee hollow (ISO 1989).

Interview respondents' descriptions:

Respondent 4: *Nape to the crease of the knee following the contour of the back.*

Respondent 11: *Nape to widest hip on the curve of the back, and then straight to the crease at the back of the knee.*

Respondent 12: *Nape to the mid-point of the knee cap.*

The descriptions of the respondents do not correspond with each other with regard to the knee position. The identification of the knee level as the landmark is a problem with this measurement. More respondents refer to the crease at the back of the knee as being the knee position, although one respondent states the mid-point of the kneecap. This position is however difficult to identify consistently on the human body. Therefore the crease at the back of the knee would be a more reliable position to identify on the body.

Side neck to chest level (44)

This measurement is used for the positioning of detail and to determine dart length on upper body garments, and it can also be useful for the manufacturing of fit dummies. Although only 17,65% of the survey respondents used this measurement, two of the survey respondents using it experienced problems with the measurement. Of the 13 respondents interviewed, two indicated that they used the measurement and one company experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

- ✓ Measure from the intersection of the neck base/shoulder point down to the bust point (ASTM 5586, 1995).

Interview respondents' descriptions:

Respondent 4: Although it was marked on the questionnaire, the respondent never uses this measurement. *Always measure from nape.*

Respondent 11: *Side neck to nipple point.*

As stated before, determining the side neck position is the problem with all measurements involving the side neck point. This is the reason why respondent 4

said that they always measure from the nape. According to this respondent, the nape as a landmark can be controlled, while the side neck point is difficult to control because: where exactly is "side neck"? It is true that the nape as a position on the body can be described precisely. However, finding that exact point on the body is not always easy.

Cervical to bust point (45)

This measurement could be useful when positioning darts and design detail on ladies' upper body garments, and it could also be useful for the manufacturing of fit dummies. The measurement is used by 23,53% of the survey respondents and one of the respondents using the measurement experienced problems with it. Of the 13 respondents interviewed, four used the measurement and none experienced problems with the measurement.

International description of the measurement:

- ✓ The distance from the 7th cervical vertebra, round the base of the neck, to the nipple (ISO 8559, 1989).
- ✓ The distance from the cervicale (*sic*) around the base of the neck and down to the bust point (ASTM 5219, 1999).

It is clear that the international descriptions correspond with each other.

Interview respondents' descriptions:

Respondent 1: On the questionnaire this measurement is not marked. The measurement chart provided does however show that it is *measured from the nape to bust point.*

Respondent 4: *Nape to the bust point, on women.*

Respondent 6: This measurement was not marked on the questionnaire, but the picture on the body chart describes this measurement as:.*From the centre back around the neck to the bust point.*

Respondent 7: *Nape over side neck to bust point.*

Respondent 11: *Same as to chest level, to the bust point or nipple point on women.*

Respondent 12: *Same as cervical to chest level, but on women.*

The descriptions of the respondents correspond with each other as well as with the international descriptions.

Side neck to breast point (46)

This measurement is used for the positioning of detail and to determine dart length on upper body garments, and it can also be useful for the manufacturing of fit dummies. The measurement is used by 26,47% of survey respondents and four of the survey respondents using it experienced problems with the measurement. Of the 13 respondents interviewed, five indicated that they used the measurement and two companies experienced problems with the measurement.

International description of the measurement:

- ✓ Distance from the neck right shoulder point to the maximum prominence of breast (SizeUK).
- ✓ The distance from the neck shoulder point to the breast point (ISO 8559, 1989).
- ✓ Measure from the intersection of shoulder and front neck base to the bust apex (ASTM 5585, 1995).

The international descriptions correspond with each other regarding the landmarks. Only one of the descriptions specifies that the measurement be taken from the right side.

Interview respondents' descriptions:

Respondent 3: *Side neck to the bust point (most prominent position).*

Respondent 4: Although it was marked on the questionnaire, the respondent never uses this measurement. *Always measure from nape.*

Respondent 6: Although it was marked on the questionnaire, the respondent never uses this measurement. *Always measure from centre back neck, because the problem is: where is the shoulder?*

Respondent 7: This measurement was not marked on the questionnaire, but the respondent made the following remark: *The problem with this measurement is: where do you hold it, to get the exact shoulder line?*

Respondent 11: *The same (as side neck to chest level).*

Respondent 13: *Side neck, where the neck enters the shoulder, to the nipple.*

It seems that some of the respondents indicated the wrong measurement on the questionnaire, since they stated during the interview that they measure from the nape and not from the side neck point. The descriptions from the other respondents correspond with the international descriptions. However, not one of the respondents mentions measuring from the right side, as is the case with the SizeUK description. The problem with a measurement such as this one, as stated before, is to determine the side neck point. Even if the point where the shoulder and the neck meet is identified, the position of the imaginary shoulder seam also presents a problem.

Cervical to under bust level (47)

This measurement is used for determining style lines such as empire lines, and can also be useful for the manufacturing of fit dummies. Although only 14,71% of the survey respondents use this measurement, one of those respondents experienced problems with the measurement. Of the 13 respondents interviewed, three indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

- ✓ Distance from the nape through the right shoulder neck point over the breast point to the under bust (SizeUK).

Interview respondents' descriptions:

Respondent 3: *Nape over the shoulder to just below the bust, following the contour of the body.*

Respondent 4: *Nape through side neck to just below the bust, following the contour of the bust.*

Respondent 11: *Nape over the side neck and over the shape of the bust to directly below.*

The descriptions of the respondents correspond with the international description although none of them mention measuring on the right side of the body. In this case

the problem is locating exactly where the under bust position is, especially on the fuller figure.

Side neck to under bust level (48)

This measurement is used for determining style lines such as empire lines, and it can also be useful for the manufacturing of fit dummies. Although only 14,71% of the survey respondents use this measurement, two of those respondents experienced problems with the measurement. Of the 13 respondents interviewed, three indicated that they used the measurement and one company experienced problems with the measurement.

International description of the measurement:

- ✓ Distance from the right shoulder neck point over the breast point to the under bust (SizeUK).

Interview respondents' descriptions:

Respondent 3: *Side neck position over the bust curve to just below the bust.*

Respondent 4: Although it was marked on the questionnaire, the respondent never uses this measurement. *Always measure from nape.*

Respondent 11: *Just start at side neck point.*

These descriptions correspond with the international description. The problem is again identifying the side neck point as well as locating the under bust position.

Cervical to front waist (49)

This measurement is used for positioning the waistline on full and upper body garments, and it can also be useful for the manufacturing of fit dummies. The measurement is used by 23,53% of survey respondents and two of those respondents experienced problems with the measurement. Of the 13 respondents interviewed, four indicated that they used the measurement and one company experienced problems with the measurement.

International description of the measurement:

- ✓ Distance from the nape around the base of the neck, to the right shoulder neck point, over the breast point, then straight to the waist (SizeUK).
- ✓ The distance from the 7th cervical vertebra, around the base of the neck (neck point) and over the nipple, then vertically to the waist (ISO 8559, 1989).

The international descriptions correspond with each other, although only the SizeUK description refers to measuring on the right side of the body.

Interview respondents' descriptions:

Respondent 1: According to the questionnaire this measurement is not used, but on the measurement chart provided, it is described as *nape to waist over bust*.

Respondent 3: *Nape to natural waist, over the bust.*

Respondent 4: *Nape through side neck, over the bust contour to the natural waist.*

Respondent 7: *From nape over the side neck and then to waist. Not sure whether it should be measured straight or over the curve of the bust.*

Respondent 11: *Nape to waist over the side neck and the bust curve.*

The problem with this measurement is that the respondents are not sure how to take the measurement over the bust curve, and that causes uncertainty about the accuracy of the measurement. Some respondents mention that it should be measured over the bust or over the bust curve. One respondent was not sure whether it should be measured over the bust contour or in a straight line from the neck shoulder point. Both the international descriptions, however, state that the measurement should be taken over the bust point or nipple and then straight to the waist. This implies following the contour of the body from the neck point to the bust point or nipple.

Side neck to waist (front waist length) (50)

This measurement is used for positioning the waistline on full and upper body garments, and it can also be useful for the manufacturing of fit dummies. This measurement is used by 35,29% of the survey respondents and two experienced problems with the measurement. Of the 13 respondents interviewed, five indicated

that they used the measurement and one company experienced problems with the measurement.

International description of the measurement:

- ✓ Distance from the right neck shoulder point, over the breast point, then straight to the front waist (SizeUK).
- ✓ The distance from the neck shoulder point, over the nipple, then vertically straight to the front waist (ISO 8559, 1989).
- ✓ The vertical distance from the neck baseline at the center front to the waist level (ASTM 5219, 1999).

The international descriptions do not correspond. The descriptions of SizeUK and the ISO are similar. According to the ASTM description, front waist length is measured from the front base of the neck while the SizeUK and the ISO descriptions state the side neck point. Again it is only the SizeUK description that refers to measuring on the right side of the body.

Interview respondents' descriptions:

Respondent 3: *Shoulder neck point to bust to natural waist.*

Respondent 4: Although it was marked on the questionnaire, the respondent never used this measurement. *Always measure from nape.*

Respondent 6: *From the back neck to over the bust point to the waist.*

Respondent 9: *Side neck to waist as a straight measurement.*

Respondent 11: *Side neck to waist over the bust point.*

It seems that respondent 4 and respondent 6 marked the wrong measurement on the questionnaire because their descriptions refer to the previous measurement, namely cervical to front waist. The descriptions given by the other respondents correspond with regard to the landmarks. However, some refer to measuring in a straight line and others measure over the bust point. It is surprising that more problems are not experienced with this measurement, since it is not at all clear whether this is a straight or a contoured measurement.

Centre shoulder to bust point (51)

This measurement is used to determine the length of shoulder darts on upper body garments and can also be useful for the manufacturing of fit dummies. This measurement is used by 38,24% of the survey respondents and two experienced problems with the measurement. Of the 13 respondents interviewed, five indicated that they used the measurement and one company experienced problems with the measurement.

International description of the measurement:

Only one international description was found.

- ✓ Distance between the centre of right shoulder length and the bust point (SizeUK).

Interview respondents' descriptions:

Respondent 1: *From the shoulder to the bust point.*

Respondent 3: This measurement was marked on the questionnaire, but during the interview, the respondent noted that it is *always measured from neck shoulder point and not from centre shoulder*.

Respondent 4: Although it was marked on the questionnaire, the respondent never uses this measurement. *Always measure from nape.*

Respondent 6: *Middle of the shoulder to the bust point.*

Respondent 11: *Mid-shoulder straight to nipple point.*

Two of the five respondents above indicated that this is not the measurement that they use. They either use side neck to bust point or nape to bust point. Marking the wrong measurement on the questionnaire can simply be a mistake, or it can indicate that they did not read or understand the measurements clearly. This can be an indication of ignorance, not knowing the difference between the measurements, or alternatively just a "don't care" attitude towards the importance of specific measurements in the achievement of good fit. The description of respondent 1 is unclear as it only refers to "shoulder"; it does not specifically refer to centre shoulder or shoulder neck point, but since the measurement is for centre shoulder to bust, one can assume that the centre shoulder position was implied. The descriptions therefore correspond with the international description.

Centre shoulder to under bust level (52)

This measurement could be useful with style lines such as empire lines, as well as other design detail on ladies' upper body garments, and it could also be useful for the manufacturing of fit dummies. The measurement is used by 26,47% of the survey respondents and one of those respondents experienced problems with it. Of the 13 respondents interviewed, three used the measurement and one experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

- ✓ Distance between the centre of the right shoulder length and underbust level, following the bust contour (SizeUK).

Interview respondents' descriptions:

Respondent 4: Although it was marked on the questionnaire, the respondent never use this measurement. *Always measure from nape.*

Respondent 6: *Centre shoulder over the bust to underbust position.*

Respondent 11: *Mid-shoulder over the nipple to directly below the bust.*

One of the respondents indicated that they do not use this measurement, but that they use the one taken from the nape. The other two descriptions correspond with each other and with the international description.

Centre shoulder to front waist – straight (53)

This measurement is used for determining the waistline on full and upper body garments, and it can also be useful for the manufacturing of fit dummies. This measurement is used by 32,35% of the survey respondents and two experienced problems with the measurement. Of the 13 respondents interviewed, four indicated that they used the measurement and one company experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

- ✓ Distance from the centre of the right shoulder line over the bust point, then straight to the front waist (SizeUK).

Interview respondents' descriptions:

Respondent 4: Although it was marked on the questionnaire, the respondent never uses this measurement. *Always measure from nape.*

Respondent 6: No description given.

Respondent 9: *Just as it says.*

Respondent 11: *Mid-shoulder to waist as a straight measurement, not taking any curves into account.*

Again, one of the five respondents marked the wrong measurement. One respondent did not give a description, and the other two are of the opinion that it should be a straight measurement. This does not correspond with the international description which partly takes the bust curve into account. If one considers the way clothes fit on the upper body, it makes sense to take some of the curve into account.

Centre shoulder to front waist – contoured (54)

This measurement is useful for the manufacturing of tight-fitting upper body garments, and it can also be useful for the manufacturing of fit dummies. The measurement is used by 29,41% of survey respondents and two of those respondents experienced problems with the measurement. Of the 13 respondents interviewed, four indicated that they used the measurement and one company experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

- ✓ Distance from the centre of the right shoulder to the front waist, following the bust and rib cage contour (SizeUK).

Interview respondents' descriptions:

Respondent 1: *Shoulder to waistline on the curve of the body.*

Respondent 3: This measurement was marked on the questionnaire, but during the interview the respondent noted that it is *always measured from neck shoulder point and not from centre shoulder*.

Respondent 4: Although it was marked on the questionnaire, the respondent never uses this measurement. *Always measure from nape.*

Respondent 11: *Mid-shoulder to waist but then following the curve over the bust, the tape against the body.*

Two of the four respondents marked the wrong measurement. One of the other two descriptions corresponds with the international description, and the remaining description does not specify the position on the shoulder where it should be measured from. It is however not very simple to take a measurement accurately on the contour of the body and this is why problems are experienced with the measurement. It can be difficult to keep the tape measure flat against the body while measuring and this may result in inconsistent and inaccurate measurements. Determining the centre of the shoulder is another problem with these measurements, therefore some respondents prefer to measure from the nape which is perceived as a controlled landmark. Taking the body contour into consideration makes the measurement more useful for pattern construction. The contoured measurement, as opposed to the previous straight measurement, gives an indication to the pattern maker of the amount of ease needed in the front of the garment. Using the straight and the contoured measurements together can also give an indication of the shape of the body.

Centre shoulder to back waist – contoured (55)

This measurement is used for determining the waist position on full and upper body garments, and it can also be useful for the manufacturing of fit dummies. This measurement is used by 32,35% of the survey respondents and one experienced problems with the measurement. Of the 13 respondents interviewed, five indicated that they used this measurement and one company experienced problems with it.

International description of the measurement:

Only one international description was found:

- ✓ Distance between the centre of the right shoulder length, over the shoulder blade to the back natural waist level (SizeUK).

Interview respondents' descriptions:

Respondent 1: No description given.

Respondent 3: This measurement was marked on the questionnaire, but during the interview the respondent noted that it is *always measured from neck shoulder point and not from centre shoulder*.

Respondent 4: *Centre shoulder to the natural waist on the contour of the back.*

Respondent 6: No description given.

Respondent 11: *Mid-shoulder to waist with the tape against the body.*

One of the respondents again noticed that they marked the wrong measurement on the questionnaire. Two respondents did not give a description. The other two respondents' descriptions correspond with the international description, which is taken on the contour of the body. However, the respondents do not mention taking the measurement on the right side of the body. It would be important for consistency to take all measurements on the same side of the body. It is generally accepted that more people are right-handed and therefore the right side of the body is more developed. It can thus be expected that the right arm or leg might be thicker than the left arm or leg. A garment has to fit the bigger side of the body to be comfortable, and therefore it makes sense to measure that side of the body for pattern and clothing construction purposes.

Armscye depth (cervical to underarm level) (56)

This measurement is used to assist with shaping the armhole and positioning of style lines on patterns for upper body garments, and it can also be useful for the manufacturing of fit dummies. The measurement is used by 29,41% of survey respondents and two of those respondents experienced problems with the measurement. Of the 13 respondents interviewed, seven indicated that they used the measurement and one company experienced problems with the measurement.

International description of the measurement:

- ✓ Distance between the centre back neck and the armscye underarm level (SizeUK).
- ✓ The distance, measured vertically on the body using the tape measure, from the 7th cervical vertebra to the upper edge of a tape passed horizontally under the armpits (ISO 8559, 1989).
- ✓ The distance from the cervicale (*sic*) to a point level with the armpit (ASTM 5219, 1999).

It is clear that the international descriptions correspond with each other and that the ISO gives the most comprehensive description.

Interview respondents' descriptions:

Respondent 1: This measurement is not marked on the questionnaire. However, the measurement chart shows that it is *measured from the nape to the underarm level*.

Respondent 3: *Straight from nape to the level of the underarm.*

Respondent 4: *Nape to underarm level.*

Respondent 6: *Centre back to underarm.*

Respondent 7: *Scye depth is quite useful. That's usually from nape to underarm.*

Respondent 9: *Back neck straight to underarm.*

Respondent 11: *No, we don't measure it. Technically it is a measurement but I've seen it ignored in my whole entire life.*

Respondent 12: *Nape to level of armpit on the contour.*

These descriptions correspond with the international descriptions in terms of the landmarks. It is however not clear whether the measurement should be taken on the back contour or in a straight vertical line. The international descriptions do not refer to the back contour, therefore it can be assumed that it is taken as a straight vertical measurement. Identification of the landmarks is the major problem experienced with this measurement. As mentioned before, the nape is perceived as a controlled landmark even though it is not always that easy to identify on the body. The other problem is the underarm level. It is advisable to mark the position of the underarm with a tape as the ISO description suggests, but how high up under the arms should

the tape go? This question remains unanswered since none of the responses offered any suggestion on identifying the underarm position.

Top arm length (shoulder to underarm level) (57)

This measurement is necessary to determine the cap height on sleeve patterns, and it can also be useful for the manufacturing of fit dummies. This measurement is used by 41,18% of the survey respondents and two experienced problems with the measurement. Of the 13 respondents interviewed, four indicated that they used the measurement and one company experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

- ✓ Distance between the right armhole shoulder point and the right underarm level (SizeUK).

Interview respondents' descriptions:

Respondent 3: *Top of the shoulder to the level of the underarm.*

Respondent 4: No description given.

Respondent 9: *Shoulder point to underarm.*

Respondent 11: *Side neck to underarm, but on a pattern, not on a body.*

The description given by respondent 11 refers to a pattern or garment measurement and not a body measurement. The other descriptions correspond with the international description. It is however not clear, not from the international description nor from the responses, whether the measurement is taken as a straight vertical measurement, or from the shoulder over the curve of the top of the arm as suggested by some patternmaking textbooks (Amaden-Crawford, 2000:79).

Arm length straight (shoulder to wrist) (59)

This measurement is used for drafting of sleeve patterns. This measurement is used by 82,35% of the survey respondents and two of them experienced problems with the measurement. Of the 13 respondents interviewed, ten indicated that they used the measurement and two companies experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

- ✓ Distance from the right armscye shoulderline intersection straight to the far end of the prominent wrist bone (SizeUK).

Interview respondents' descriptions:

Respondent 1: *Shoulder point to wrist bone, arm hanging naturally.*

Respondent 3: *Also called overarm. Measured from the shoulder to the wrist (prominent bone) on a straight arm.*

Respondent 4: *Shoulder to the wrist, arm hanging comfortably.*

Respondent 6: *Top of crown over slightly bent elbow to wrist.*

Respondent 7: *Crown to wrist bone. So crown would be the acromion bone. On the bent arm and on the straight arm, we do it both.*

Respondent 8: *Shoulder point to the wrist.*

Respondent 9: *Shoulder to elbow to wrist.*

Respondent 11: Although this measurement was marked on the questionnaire, the respondent indicated that they measure *the arm bent*.

Respondent 12: *On woman's arm just slightly bent. Shoulder is identified by the back bone of the shoulder, the most prominent bone at the back.*

Respondent 13: *Top of shoulder to wrist.*

Most of the respondents refer to the arm hanging naturally, indicating a slightly bent arm and not a completely straight arm. The international description however seems to be measured as a straight arm. For garment construction purposes, it is more useful to have the measurement taken on the slightly bent arm. Identifying the shoulder and armscye intersection could also present some problems, and therefore identifying the more prominent back shoulder bone as respondent 12 suggests, might be a better landmark. This is also the reason why some respondents use both measurements, or prefer the previous measurement. The nape is seen as being a more reliable landmark than the shoulder armscye intersection or shoulder point; it is therefore doubtful whether this measurement is always taken consistently.

Arm length bent (cervical to wrist) (60)

This measurement is used for determining sleeve length. This measurement is used by 41,18% of the survey respondents and three experienced problems with the measurement. Of the 13 respondents interviewed, seven indicated that they used the measurement and two companies experienced problems with the measurement.

International description of the measurement:

- ✓ Distance from the nape over the top of the shoulder and along the arm (bent at 90° in a horizontal position) to the right prominent wrist bone (SizeUK).
- ✓ The distance between the 7th cervical vertebra to the extremity of the wrist bone (outer point of cubitus), measured on the body using the tape measure passed over the top of the shoulder (acromion) and along the arm bent at 90° in a horizontal position (ISO 8559, 1989).
- ✓ With the arm bent at 90°, measure from the cervicale (*sic*) over the top of the shoulder to the shoulder joint, then along the outside of the arm over the elbow to the prominent wrist bone (ASTM 5585, 1995).
- ✓ With the arm bent 90° at the elbow, and raised to the chest height, measure the distance from the cervicale (*sic*) to the shoulder joint, along the outside surface of the arm, over the elbow to the greater prominence on the outside of the wrist (ASTM 6240, 1989).

The international descriptions correspond with each other. It is however not clear exactly how the arm should be held when measured; two descriptions state that the arm must be held horizontally or at chest level while the other two descriptions do not mention the position of the arm.

Interview respondents' descriptions:

Respondent 1: *Back neck to wrist bone with hand on the hip.*

Respondent 3: No description given.

Respondent 4: Although this measurement was marked on the questionnaire, the respondent indicated that *the arm must not be bent 90°*. This measurement is apparently only used *when they want to build in tolerance into the sleeve of the garment*.

Respondent 6: *On bent arm it became too long actually*.

Respondent 7: *From nape around to wrist. On the bent arm and on the straight arm, we do it both ways.*

Respondent 11: *For men, we measure from the nape over the shoulder to the wrist on a bent arm.*

Respondent 12: *Men's wear we measure on a bent (90°) elbow: nape to shoulder point to the wrist. This measurement is also called overarm.*

The problem with this measurement is that, applying the measurement to the sleeve length of garments, the sleeve becomes too long when measured on an arm bent at 90°. Too much tolerance is added to the sleeve length when the arm is measured in this position. It can however still be a useful measurement for pattern development as the pattern maker will then have an indication of the maximum length that the sleeve should be. Some of the international measurements also mention lifting the arm in a horizontal position. The respondents did not mention the exact position that the arm should be held in. It seems that for men it is measured with the arm lifted horizontally, and for women the hand is placed on the hip.

Arm length bent (shoulder to wrist) (61)

This measurement is used for determining sleeve length. This measurement is used by 38,24% of the survey respondents and two experienced problems with the measurement. Of the 13 respondents interviewed, six indicated that they used the measurement and two companies experienced problems with the measurement.

International description of the measurement:

- ✓ Distance from the right armscye shoulder line intersection over the elbow (bent at 90°) to the far end of the prominent wrist bone (in line with small finger) (SizeUK).
- ✓ The distance, measured using the tape measure, from the armscye/shoulderline intersection (acromion), over the elbow, to the far end of the prominent wrist bone (ulna), with the subject's right fist clenched and placed on the hip, and with the arm bent at 90° (ISO 8559, 1989).
- ✓ With the arm bent at 90° and the clenched fist placed on the hip, the distance from the shoulder joint along the outside of the arm over the elbow to the greatest prominence on the outside of the wrist (ASTM 5219, 1999).

The international descriptions generally correspond regarding landmarks. The SizeUK description does not mention placing the hand on the hip, although this is the accepted way of taking this measurement, and the ASTM description does not refer to taking the measurement on the right side of the body. The problem that can be foreseen with this measurement is identifying the armscye-shoulder intersection.

Interview respondents' descriptions:

Respondent 1: *Shoulder point to wrist bone with hand on the hip.*

Respondent 3: *From the shoulder to the prominent bone at the wrist, with the arm bent at 90°.*

Respondent 4: Although this measurement was marked on the questionnaire, the respondent indicated that *the arm must not be bent 90°*. This measurement is only *used when they want to build in tolerance into the garment*.

Respondent 7: *Crown to wrist bone. So crown would be the acromion bone. On the bent arm and on the straight arm, we do it both ways.*

Respondent 11: *For ladies' wear and children's wear just from the shoulder, with the arm bent.*

Respondent 12: No formal description given. *I'd say the overarm is the critical measure because it's not dependent on your shoulder point. The shoulder can be anywhere and yet you still control the length of your sleeve because you measure from here (nape).*

Some respondents only refer to the arm "being bent", but not specifically bent at 90°, and for this reason the descriptions do not correspond with each other or with the international descriptions. The international descriptions refer to taking the measurement with the arm bent at 90°. Some of the respondents also refer to bending the arm at 90°, but not all the descriptions from the respondents indicate placing the hand on the hip. It would be more comfortable for the person being measured to keep the arm bent in the same position if the hand is placed on the hip. Again, one respondent noted that too much tolerance is built into the measurement when the arm is bent at 90°. It is also difficult to consistently identify the shoulder-armscye intersection. For this reason, one of the respondents stated that the overarm

measurement (number 60) that is measured from the nape to the wrist, is more critical.

Upper arm length (cervical to elbow) (62)

This measurement is used for determining the length of short sleeves as well as the position of elbow darts on long sleeves. This measurement is used by 44,12% of the survey respondents and one experienced problems with the measurement. Of the 13 respondents interviewed, seven indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

✓ Distance from the nape over the top of the shoulder to the elbow (SizeUK).

Interview respondents' descriptions:

Respondent 1: *Back neck to the elbow.*
Respondent 3: No description given.
Respondent 4: *Nape over the shoulder to the elbow.*
Respondent 7: No description given.
Respondent 9: *Back neck over the shoulder to the elbow.*
Respondent 11: *Just up to the elbow.*
Respondent 12: No description given.

Not all of these descriptions specifically mention to measure over the top of the shoulder but it was understood that this was implied. The descriptions therefore correspond with the international description. The ASTM (5219, 1999: 3) defines the elbow as the joint that articulates between the upper arm and the lower arm.

Upper arm length (shoulder to elbow) (63)

This measurement is used for determining the length of short sleeves as well as the position of elbow darts on long sleeves. This measurement is used by 52,94% of the survey respondents and one of them experienced problems with the measurement. Of the 13 respondents interviewed, eight indicated that they used the measurement and one experienced problems with the measurement.

International description of the measurement:

- ✓ Distance from the right armscye-shoulderline intersection to the elbow, bent at 90° (SizeUK).
- ✓ The distance, measured using the tape measure, from the armscye-shoulderline intersection (acromion) to the elbow, with the subject's right fist clenched and placed on the hip, and with the arm bent at 90° (ISO 8559, 1989).
- ✓ With the arm bent, the distance from the shoulder joint along the outside of the arm to the prominence of the elbow (ASTM 5219, 1999).

The international descriptions correspond with each other, although the ASTM does not specify measuring on the right side of the body.

Interview respondents' descriptions:

Respondent 1: *Shoulder point to the elbow.*
Respondent 3: No description given.
Respondent 4: *Shoulder to elbow.*
Respondent 6: *Top of arm to the elbow.*
Respondent 7: No description given.
Respondent 9: *Shoulder to elbow.*
Respondent 11: *Shoulder to elbow.*
Respondent 12: No description given.

The responses correspond with regard to landmarks although none of the respondents suggests ways to accurately identify the landmarks. Identifying the shoulder-armscye intersection consistently can again be a problem, which might reduce the accuracy of the measurements. Bending the arm as the international descriptions suggest will assist in identifying the landmark at the elbow. It is clear that locating the landmarks should be described in more detail.

Underarm length (to wrist) (64)

This measurement is used for drafting of sleeve patterns. This measurement is used by 61,76% of the survey respondents and one experienced problems with the measurement. Of the 13 respondents interviewed, five indicated that they used the measurement and none of the companies experienced problems with it.

International description of the measurement:

- ✓ Distance between the right underarm level mid-point and the level of the inside of the wrist at the same level as the prominent wrist bones (SizeUK).
- ✓ The distance from the mid-point of the armpit to the inside of the wrist at the same level as the prominent wrist bone (ulna), measured with the arm hanging naturally (ISO 8559, 1989).
- ✓ With the arm hanging naturally, measure from the armpit to the mid-point of the inside of the wrist in line with the wrist bone. (ASTM 5586, 1995).

The international descriptions do correspond with regard to the landmarks. The SizeUK and ISO description specifically refer to the mid-point of the armpit, while the ASTM description refers to the mid-point of the wrist. Only the SizeUK description mentions measuring on the right side of the body.

Interview respondents' descriptions:

Respondent 1: *Under arm to the crease of the wrist.*

Respondent 3: No description given.

Respondent 4: *Crease of the arm to the wrist, arm hanging comfortably.*

Respondent 8: This measurement was not marked on the questionnaire. The respondent suggested it as *an alternative to the arm length because the shoulder is not always a good landmark. The fold where the arm joins the body in front gives a better landmark, so measure from that fold to the wrist.*

Respondent 9: *Front arm crease to the wrist.*

Respondent 11: *From the crease in the front to the wrist.*

Respondent 13: This measurement was not marked on the questionnaire but appears on the measurement chart. *Place the start of the tape in armpit and measure to just above wrist bone.*

One of the respondents suggested using this measurement instead of measuring arm length from the shoulder, because the shoulder can be a difficult landmark to identify. This highlights the importance of being able to identify the landmarks clearly on the different bodies being measured. The descriptions of the respondents do not

correspond with each other or with the international descriptions, because the armpit and the crease of the arm where the arm joins the body are two completely different landmarks. Placing the tape measure in the correct position under the armpit is problematic. It should not be too high under the arm and because of the close contact it can also be a sensitive measurement to take. The crease of the arm is a landmark which can be identified more accurately on all figures. However, the international descriptions measure from the underarm point or armpit and it would therefore be more acceptable to measure from the armpit.

Thigh height (66)

This measurement could be useful when shaping the legs on trouser patterns and to apply the corresponding girth measurement in the correct position on the pattern. It could also be useful for the manufacturing of fit dummies. The measurement is used by 12% of the survey respondents and one of the survey respondents using the measurement experienced problems with it. Of the 13 respondents interviewed, five used the measurement and none experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

- ✓ Distance between the level of the maximum girth of the right thigh and the ground (SizeUK).

Interview respondents' descriptions:

Respondent 3: *From the widest part of the thigh straight to the floor.*

Respondent 4: *Maximum thigh to the floor along the leg.*

Respondent 9: *Widest part of the thigh straight to ground.*

Respondent 11: *It's a straight measurement from the widest part of the thigh.*

Respondents 13: *Straight from widest level to the floor.*

The descriptions of the respondents correspond with each other and also with the international descriptions. None of the respondents however mentions taking the measurement on the right side of the body.

Mid-thigh height (67)

This measurement can be used for determining the length of shorts and skirts, and it can also be useful for the manufacturing of fit dummies. Although only 6% of the survey respondents use this measurement, one of the survey respondents using it experienced problems with the measurement. Of the 13 respondents interviewed, two indicated that they used the measurement and none experienced problems with it.

International description of the measurement:

Only one international description was found:

- ✓ Midway between crotch height and right knee level (SizeUK).

Interview respondents' descriptions:

Respondent 4: *Halfway between maximum thigh and knee, to the floor.*

Respondent 11: *Middle of the upper leg, straight.*

The descriptions correspond with the international descriptions. The length between crotch and knee should be measured first in order to locate the mid-thigh position. As explained before, locating the crotch can be a problem. Any measurement involving the crotch position is sensitive to take. This could explain why one of the survey respondents had problems with this measurement.

Thigh length (68)

This measurement could be useful when shaping the legs on trouser patterns, and it could also be useful for the manufacturing of fit dummies. The measurement is used by 14% of the survey respondents and none of the survey respondents using the measurement experienced problems with it. Of the 13 respondents interviewed, four used the measurement and none experienced problems with it.

International description of the measurement:

- ✓ Distance between crotch level and knee level at back (SizeUK).
- ✓ The vertical distance, measured on the inside leg using the tape measure, between the crotch (perineum) and the knee girth level (ISO 8559, 1989).

The international descriptions correspond with regard to the landmarks, but it is not clear how the knee position is identified.

Interview respondents' descriptions:

Respondent 4: *Crotch level to the crease of the knee.*

Respondent 6: No description given.

Respondent 11: *Top of the thigh to the crease of the knee.*

Respondent 13: *Crotch to knee.*

The descriptions of the respondents correspond with each other and also with the international descriptions. It is however not clear how the knee position is located on the body. Some of the respondents mentioned the crease at the back of the knee, which could be an easily identifiable landmark for the knee position. To be able to measure consistently, it is important to have a very specific description of how exactly to locate the knee position.

Knee height (69)

This measurement is used to determine the length of shorts and skirts, the knee position on trousers, and also to determine where the flare on bootleg and bell-bottom trousers should start. The measurement can also be useful for the manufacturing of fit dummies. This measurement is used by 22% of the survey respondents and one experienced problems with the measurement. Of the 13 respondents interviewed, five indicated that they used the measurement and one company experienced problems with it.

International description of the measurement:

- ✓ Distance between the right front knee level and the ground (SizeUK).
- ✓ The vertical distance, measured using the measuring stand (anthropometer), from the knee (tibial) level to the ground (ISO 8559, 1989).
- ✓ Measure from the crease in the back of the knee to the soles of the feet (ASTM 5585, 1995).

The international descriptions do not correspond with each other. It is not clear where exactly the knee position is located.

Interview respondents' descriptions:

Respondent 3: *From the knee straight to the floor.*

Respondent 4: *Crease of the knee to the floor.*

Respondent 7: *Crease of the knee to floor, straight.*

Respondent 11: *Crease of knee to floor.*

Respondent 12: This measurement was not marked on the questionnaire but the respondent mentioned that *it was not something that they really measure*. *To establish the knee position on a pattern they would calculate half inside leg plus 5cm.*

Respondent 13: Their measurement chart shows *a measurement from knee to ankle*.

Three of the descriptions correspond with the ASTM description, which is measured from the crease at the back of the knee. It is difficult to locate the knee position from the front; therefore finding the crease at the back can be done more consistently. Measuring to the floor instead of to the ankle is also better because the measurement is more controlled. One respondent indicated that the knee position on a pattern is calculated and not measured. It can however be useful to have the correct measurement of the knee position on the body. This will make it possible to compare whether such calculations are accurate or still applicable.

Calf height (70)

This measurement is used by 14% of the survey respondents and one experienced problems with the measurement. Of the 13 respondents interviewed, three used the measurement and one company experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

- ✓ Distance between the level of the maximum girth of the right calf and the ground (SizeUK).

Interview respondents' descriptions:

Respondent 4: *Maximum calf to the floor.*

Respondent 7: No description given.

Respondent 11: *Widest part of the calf just below the knee.*

The descriptions of the respondents correspond with each other and also with the international description.

Ankle height (outside leg) (71)

This measurement is used for determining the length of trousers and skirts, and it can also be useful for the manufacturing of fit dummies. The measurement is used by 20% of survey respondents and two of these respondents experienced problems with the measurement. Of the 13 respondents interviewed, five indicated that they used the measurement and one company experienced problems with it.

International description of the measurement:

- ✓ Distance between the right outer ankle bone prominence and the ground (SizeUK).
- ✓ The vertical distance, measured using the measuring stand (anthropometer), from the outer ankle bone to the ground (ISO 8559, 1989).
- ✓ With the subject standing barefoot, the distance from the center of the prominent outside ankle bone to the floor (ASTM 5219, 1999).

The international descriptions agree with regard to measuring from the outside ankle bone and straight to the floor. The ASTM is more specific by referring to the center of the outside ankle bone. The SizeUK mentions taking the measurement on the right side of the body.

Interview respondents' descriptions:

Respondent 3: *From the protruding bone on the outside of the ankle straight to the floor.*

Respondent 4: *Ankle to the floor on the outside of the leg.*

Respondent 7: No description given.

Respondent 11: *From the bone on the outside of the leg.*

Respondent 12: No description given.

These descriptions correspond with the international descriptions, although none of the respondents refers to taking the measurement on the right side of the body. Ankle height can be useful when determining the different lengths of garments, for example clamdiggers, pedal pushers or capri pants.

Ankle height (inside leg) (72)

This measurement could be useful when determining the length of trousers and skirts. The measurement is used by 20% of the survey respondents and one experienced problems with the measurement. Of the 13 respondents interviewed, five used the measurement and none experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

- ✓ Distance between the right inner ankle bone prominence and the ground (SizeUK).

Interview respondents' descriptions:

Respondent 3: *From the protruding bone on the inside of the ankle straight to the floor.*

Respondent 4: *Ankle to floor on the inside of the leg.*

Respondent 7: *Distance from the inner ankle bone to floor.*

Respondent 11: *From the bone on the inside.*

Respondent 12: No description given.

The descriptions of the respondents correspond with each other and also with the international description.

4.4.1.1 Summary of results regarding vertical height measurements

In order to be able to make valid conclusions about the use of body measurements by the respondents from the South African clothing industry, aspects of the result are summarised in **Tables 4.4, 4.5, 4.6 and 4.7**.

The results are summarised according to:

- ✓ whether an international description was available;
- ✓ whether there was consensus among the international descriptions or only one international description;
- ✓ whether there was consensus among the respondents' descriptions, only one description or no description from respondents;
- ✓ whether there was consensus among the international and the respondents' descriptions;
- ✓ whether problems were related to no consensus about measuring straight or on the contour;
- ✓ whether problems were related to landmarking;
- ✓ whether problems were related to landmarking as well as no consensus.

This enabled the researcher to get a clear picture of the relationship between consensus or no consensus on how the measurement should be taken, and the problems that the participants experienced with the measurement.

The researcher summarised the responses in **Tables 4.4, 4.5, 4.6 and 4.7**. The decisions and summaries were checked by professional peers. In cases where the researcher and professional peers could not make a 100% clear decision from the responses, it was calculated as a "no".

TABLE 4.4: SUMMARY OF RESULTS FOR VERTICAL HEIGHT MEASUREMENTS

Measurement (* = key dimension)	Number of respondents using the measurement	Number of respondents indicating problems	International description	International consensus	Consensus among respondents	Consensus between International and respondents' descriptions	Problems – yes / no	Problems related to straight / contoured	Problems related to landmarking	Landmarking difficulties and no consensus
1 Height *	21	0	Yes	Yes	Yes	Yes	No	No	No	No
2 Chin height	0	0	Yes	One description	No description	N/A	No	N/A	N/A	N/A
3 Cervical height *	7	0	Yes	No	No	No	No	Yes	No	No
4 Side neck height *	5	2	Yes	One description	No	No	Yes	Yes	Yes	Yes
5 Side neck to front	2	2	Yes	One description	One description	Yes	Yes	Yes	Yes	No
6 Shoulder height	7	2	Yes	One description	Yes	Yes	Yes	No	Yes	No
7 Underarm height	9	3	Yes	One description	No	No	Yes	Yes	Yes	Yes

Refer to addenda for further information

Measurement (* = key dimension)	Number of respondents using the measurement	Number of respondents indicating problems	International description	International consensus	Consensus among respondents	Consensus between International and respondents' descriptions	Problems – yes / no	Problems related to straight / contoured	Problems related to landmarking	Landmarking difficulties and no consensus
8 Across back height	9	3	Yes	One description	No	No	Yes	Yes	Yes	Yes
9 Chest height	8	1	Yes	One description	Yes	Yes	Yes	No	No	No
10 Bust level height	10	0	Yes	One description	Yes	Yes	No	Yes	No	No
11 Underbust level height	3	0	Yes	One description	Yes	Yes	No	No	Yes	No
12 Underbust to waist	12	1	Yes	One description	Yes	Yes	Yes	Yes	Yes	No
13 Armscye to waist	12	2	Yes	One description	Yes	Yes	Yes	Yes	Yes	No
14 Waist height	13	0	Yes	Yes	Yes	Yes	No	No	Yes	No
15 Preferred waist height	7	2	No description	N/A	One description	N/A	Yes	No	Yes	No

Refer to addenda for further information

Measurement (* = key dimension)	Number of respondents using the measurement	Number of respondents indicating problems	International description	International consensus	Consensus among respondents	Consensus between International and respondents' descriptions	Problems – yes / no	Problems related to straight / contoured	Problems related to landmarking	Landmarking difficulties and no consensus
16 Waist Height (belly button)	12	1	No description	N/A	Yes	N/A	Yes	No	No	No
17 Upper hip height	12	0	Yes	No	No	No	No	Yes	Yes	Yes
18 Top hip height	12	0	Yes	One description	No	No	No	No	Yes	Yes
19 Hip height	12	0	Yes	Yes	Yes	Yes	No	No	No	No
20 Centre back waist to top hip	15	1	No description	N/A	No	N/A	Yes	Yes	No	No
21 Centre back waist to upper hip	13	0	No description	N/A	Yes	N/A	No	Yes	No	No
22 Centre back waist to maximum hip	12	0	No description	N/A	Yes	N/A	No	Yes	No	No

Refer to addenda for further information

Measurement (* = key dimension)	Number of respondents using the measurement	Number of respondents indicating problems	International description	International consensus	Consensus among respondents	Consensus between International and respondents' descriptions	Problems – yes / no	Problems related to straight / contoured	Problems related to landmarking	Landmarking difficulties and no consensus
23 Centre back waist to knee	9	0	No description	N/A	No	N/A	No	No	Yes	Yes
24 Centre back waist to ground *	13	0	No description	N/A	No	N/A	No	Yes	No	No
25 Front waist to thigh	6	0	Yes	One description	No	No	No	Yes	Yes	Yes
26 Front waist to knee	10	1	No description	N/A	No	N/A	Yes	Yes	Yes	Yes
27 Front waist to calf	8	0	Yes	One description	No	No	No	Yes	Yes	No
28 Front waist to ground *	13	0	Yes	One description	No	No	No	Yes	Yes	No
29 Side waist to hip	10	0	Yes	Yes	Yes	Yes	No	No	No	No

Refer to addenda for further information

Measurement (* = key dimension)	Number of respondents using the measurement	Number of respondents indicating problems	International description	International consensus	Consensus among respondents	Consensus between International and respondents' descriptions	Problems – yes / no	Problems related to straight / contoured	Problems related to landmarking	Landmarking difficulties and no consensus
30 Side waist to knee length	10	0	Yes	One description	Yes	Yes	No	No	No	No
31 Outside leg length *	26	1	Yes	Yes	No	No	Yes	Yes	Yes	Yes
32 Inside leg length *	27	2	Yes	Yes	Yes	Yes	Yes	No	Yes	No
33 Trunk length *	15	1	Yes	One description	No	No	Yes	Yes	Yes	Yes
34 Total crotch length *	20	1	Yes	Yes	Yes	Yes	Yes	No	No	No
35 Front crotch length	22	3	No description	N/A	No description	N/A	Yes	No	Yes	No
36 Back crotch length	22	3	No description	N/A	No description	N/A	Yes	No	Yes	No
37 Body rise *	20	3	Yes	No	No	No	Yes	No	Yes	Yes
38 Back waist length *	17	0	Yes	Yes	Yes	Yes	No	Yes	Yes	No

Refer to addenda for further information

Measurement (* = key dimension)	Number of respondents using the measurement	Number of respondents indicating problems	International description	International consensus	Consensus among respondents	Consensus between International and respondents' descriptions	Problems – yes / no	Problems related to straight / contoured	Problems related to landmarking	Landmarking difficulties and no consensus
39 Cervical to top hip	6	0	No description	N/A	No	N/A	No	Yes	Yes	Yes
40 Cervical to upper hip	7	0	No description	N/A	No	N/A	No	Yes	Yes	Yes
41 Cervical to hip	7	0	No description	N/A	No	N/A	No	Yes	Yes	Yes
42 Cervical to knee hollow	5	0	Yes	One description	No	No	No	Yes	Yes	Yes
43 Cervical to chest level	6	1	No description	N/A	Yes	N/A	Yes	No	No	No
44 Side neck to chest level	6	2	Yes	One description	Yes	Yes	Yes	No	Yes	No
45 Cervical to breast point	8	1	Yes	Yes	Yes	Yes	Yes	No	No	No

Refer to addenda for further information

Measurement (* = key dimension)	Number of respondents using the measurement	Number of respondents indicating problems	International description	International consensus	Consensus among respondents	Consensus between International and respondents' descriptions	Problems – yes / no	Problems related to straight / contoured	Problems related to landmarking	Landmarking difficulties and no consensus
46 Side neck to breast point *	9	4	Yes	Yes	Yes	Yes	Yes	No	Yes	No
47 Cervical to under bust level	5	1	Yes	One description	Yes	Yes	Yes	No	Yes	No
48 Side neck to under bust level	5	2	Yes	One description	Yes	Yes	Yes	No	Yes	No
49 Cervical to front waist	8	2	Yes	Yes	Yes	Yes	Yes	Yes	No	No
50 Side neck to waist	12	2	Yes	No	No	No	Yes	Yes	Yes	Yes
51 Centre shoulder to bust point	13	2	Yes	One description	Yes	Yes	Yes	No	Yes	No
52 Centre shoulder to underbust level	9	1	Yes	One description	Yes	Yes	Yes	No	Yes	No

Refer to addenda for further information

Measurement (* = key dimension)	Number of respondents using the measurement	Number of respondents indicating problems	International description	International consensus	Consensus among respondents	Consensus between International and respondents' descriptions	Problems – yes / no	Problems related to straight / contoured	Problems related to landmarking	Landmarking difficulties and no consensus
53 Centre shoulder to front waist straight	11	2	Yes	One description	Yes	No	Yes	No	Yes	No
54 Centre shoulder to front waist contoured	10	2	Yes	One description	No	No	Yes	No	Yes	Yes
55 Centre shoulder to back waist contoured	11	1	Yes	One description	Yes	Yes	Yes	No	Yes	No
56 Armscye depth *	10	2	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
57 Top arm length	14	2	Yes	One description	Yes	Yes	Yes	Yes	Yes	No
58 Arm Length straight	21	2	No description	N/A	Yes	N/A	Yes	No	Yes	No

Refer to addenda for further information

Measurement (* = key dimension)	Number of respondents using the measurement	Number of respondents indicating problems	International description	International consensus	Consensus among respondents	Consensus between International and respondents' descriptions	Problems – yes / no	Problems related to straight / contoured	Problems related to landmarking	Landmarking difficulties and no consensus
59 Shoulder to wrist *	28	2	Yes	One description	No	No	Yes	No	Yes	Yes
60 Arm length bent *	14	3	Yes	Yes	No	No	Yes	No	Yes	Yes
61 Shoulder to wrist bent	13	2	Yes	Yes	No	No	Yes	No	Yes	Yes
62 Upper arm length	15	1	Yes	One description	Yes	Yes	Yes	No	No	No
63 Shoulder to elbow	18	1	Yes	Yes	Yes	Yes	Yes	No	Yes	No
64 Underarm length *	21	1	Yes	Yes	No	No	Yes	No	Yes	Yes
65 Underarm to elbow	13	1	No description	N/A	No	N/A	Yes	No	Yes	No
66 Thigh height	6	1	Yes	One description	Yes	Yes	Yes	No	No	No

Refer to addenda for further information

Measurement (* = key dimension)	Number of respondents using the measurement	Number of respondents indicating problems	International description	International consensus	Consensus among respondents	Consensus between International and respondents' descriptions	Problems – yes / no	Problems related to straight / contoured	Problems related to landmarking	Landmarking difficulties and no consensus
67 Mid-thigh height	3	1	Yes	One description	Yes	Yes	Yes	No	Yes	No
68 Thigh length	7	0	Yes	Yes	Yes	Yes	No	No	Yes	No
69 Knee height	11	1	Yes	No	No	No	Yes	No	Yes	Yes
70 Calf height	7	1	Yes	One description	Yes	Yes	Yes	No	No	No
71 Ankle height	10	2	Yes	Yes	Yes	Yes	Yes	No	No	No
72 Ankle height (inside leg)	10	1	Yes	One description	Yes	Yes	Yes	No	No	No
Totals – Yes			**56** ***77,8%***	**18** ***25,0%***	**38** ***52,8%***	**34** ***47,2%***	**48** ***66,7%***	**28** ***38,9%***	**50** ***69,4%***	**23** ***31,9%***
Totals – N/A			**0** ***0,0%***	**16** ***22,2%***	**0** ***0,0%***	**17** ***23,6%***	**0** ***0,0%***	**1** ***1,4%***	**1** ***1,4%***	**1** ***1,4%***

Refer to addenda for further information

Measurement (* = key dimension)	Number of respondents using the measurement	Number of respondents indicating problems	International description	International consensus	Consensus among respondents	Consensus between International and respondents' descriptions	Problems – yes / no	Problems related to straight / contoured	Problems related to landmarking	Landmarking difficulties and no consensus
Totals – No			**0** ***0,0%***	**5** ***6,9%***	**29** ***40,3%***	**21** ***29,2%***	**24** ***33,3%***	**43** ***59,7%***	**21** ***29,2%***	**48** ***66,7%***
Totals – No description			**16** ***22,2%***	**0** ***0,0%***	**3** ***4,2%***	**0** ***0,0%***	**0** ***0,0%***	**0** ***0,0%***	**0** ***0,0%***	**0** ***0,0%***
Totals – One description			**0** ***0,0%***	**33** ***45,8%***	**2** ***2,8%***	**0** ***0,0%***	**0** ***0,0%***	**0** ***0,0%***	**0** ***0,0%***	**0** ***0,0%***
Total			**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**

Refer to addenda for further information

From **Table 4.4** it is clear that only one of the vertical height measurements was not used by any of the survey respondents, namely chin height.

With regard to the availability and consensus of international descriptions, the following is clear from **Table 4.4**:

- ✓ Only one description 45,8%
- ✓ International consensus 25,0%
- ✓ No description 22,2%
- ✓ No consensus 6,9%

It is alarming to note that for almost one third (29,1%) of the vertical height measurements, there are either no international descriptions available or no consensus among the international descriptions as to how the measurements should be taken.

With regard to the respondents' descriptions, the following is clear from **Table 4.4**:

- ✓ Consensus 52,8%
- ✓ No consensus 40,3%
- ✓ Only one description 2,8%
- ✓ No description 4,2%

Again it is alarming that for such a large proportion of the vertical height measurements (40,3%), the respondents do not agree on the description of how and/or where the measurement should be taken. If one considers the number of measurements for which no international description is available and for which there is no consensus among international descriptions, it is understandable that respondents are unsure about these measurements. The lack of international guidelines adds to the lack of consensus among the respondents' descriptions, and this has implications for the accuracy of measurements.

With regard to consensus between the international and the respondents' descriptions, the following is clear from **Table 4.4**:

- ✓ Consensus 47,2%
- ✓ No consensus 29,2%

- ✓ Not applicable 23,6% (because of no international or respondent descriptions)

It is a worrying fact that there seems to be consensus between the international and the respondents' descriptions in less than half of the vertical height measurements. Since international descriptions are available for 77,8% of the vertical height measurements, this result clearly shows that the respondents do not always agree with the international description. It may also be an indication that the international description is vague and not clearly described, which leads to confusion and a different interpretation of the description by the respondents. This has definite implications for the taking of consistent and accurate measurements, which further impacts on the drafting of well-fitting patterns.

From **Table 4.4** it is clear that the respondents experience problems with 66,7% of the vertical height measurements. This constitutes an alarming number of problem measurements, which can only predict problems with the sizing of clothing items. It is however a good sign that the respondents admit to having problems with the body measurements. It implies that the respondents from the industry probably value and strive for accurate body measurements, which highlights the need for a body measurement survey of the South African population.

From **Table 4.4** it is clear that problems are related to:

- ✓ Landmarking 69,4%
- ✓ Landmarking and consensus 31,9%
- ✓ Straight/contoured measurement 38,9%

It is clear that the problems are mostly related to landmarking, and also whether measurements should be taken in a straight line or along the contour of the body. This has important implications for taking accurate body measurements and drafting well-fitting patterns. Once again, the importance of having clear and detailed descriptions on the identification of landmarks and measuring techniques is highlighted.

The vertical height measurements for which no international description could be found were not discussed in detail in this chapter; the relevant descriptions given by respondents are listed in **Addendum D**. From **Table 4.4** it is clear that some of these measurements are used by a significant number of survey respondents. Problems with these measurements can be expected since the South African companies depend on international descriptions in order to take accurate body measurements.

The situation regarding the descriptions of the key dimensions will be discussed later in this chapter, under paragraph 4.5.5.

4.4.2 Horizontal width and depth measurements

The horizontal measurements are divided in width and depth measurements and circumferences. The width measurements are taken in a straight horizontal line, from side to side, from the front or the back of the body. Note that the width measurements differ from the arc measurements which are taken from “side seam” to “side seam”. The depth measurements are taken in a straight horizontal line, from front to back, from the side of the body. The terms from side to side or front to back used in the width and depth measurements refer to the outline or silhouette of the body. The circumference measurements, also referred to as girths, are measured horizontally around the body, starting and ending at the same position.

Width and depth measurements are not always directly used for pattern making or garment construction, but they are needed in order to analyse the shape of the body. These measurements can give an indication of how a circumference measurement is distributed around the body. Therefore the width measurements are particularly important for the manufacturing of fit dummies.

Neck width (front) (73)

This measurement is useful to determine the shape of the neckline on a basic pattern, and it can also be useful for the manufacturing of fit dummies. This measurement is used by 50% of the survey respondents and four of those respondents experienced problems with the measurement. Of the 13 respondents

interviewed, eight indicated that they used the measurement and three companies experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

- ✓ Distance between the side neck points measured at right angles through the centre front neck point (SizeUK).

Interview respondents' descriptions:

Respondent 1: *Side to side at the base of the neck, measured straight.*

Respondent 3: *Measure straight across from the front at the base.*

Respondent 4: *We do not actually take this measurement because callipers are needed. It is necessary for knitwear, but to check the neck opening for woven garments they use half of the neck circumference*. No description was given, but the respondent stated that it was *an important measurement for making the patterns as well as for the dummy*.

Respondent 6: *Width from the front of the neck.*

Respondent 7: This measurement was not marked but the respondent made the following comment: *"they did a calliper width on the neck at the base there, which is very useful for us for dummies."*

Respondent 9: No description given.

Respondent 11: *At the neck base.*

Respondent 12: *Width of neck base from the front.*

Respondent 13: No description given.

The descriptions of the respondents refer to measuring at the neck base in a straight line, which correspond with the international description. The respondents experienced problems with this measurement because special equipment is needed to take the measurement. Finding the neck base can also present some problems. As suggested previously in this chapter, a chain can be used to mark the base of the neck and this will assist in taking the measurement consistently. The importance of the measurement for pattern making and manufacturing of fit dummies is highlighted

by the respondents. This is because the width measurement gives an indication of how the circumference is distributed around the body.

Neck width (back) (74)

This measurement is useful to determine the shape of the neckline on a basic pattern, and it can also be useful for the manufacturing of fit dummies. This measurement is used by 50% of the survey respondents and four of those respondents experienced problems with the measurement. Of the 13 respondents interviewed, eight indicated that they used the measurement and three companies experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

- ✓ Distance between the side neck points measured at right angles through the nape (SizeUK).

Interview respondents' descriptions:

Respondent 1: *At the back of the neck from side to side, measured straight.*

Respondent 3: *Measure from the back, straight across at the base.*

Respondent 4: *Do not actually take this measurement because callipers is needed. It is necessary for knitwear, but to check the neck opening for woven garments they use half of the neck circumference.* No description was given, but the respondent stated that it was *an important measurement for making the patterns as well as for the dummy*.

Respondent 6: *The width at the base of the neck.*

Respondent 9: No description given.

Respondent 11: *Neck base.*

Respondent 12: *Width of neck base from the back.*

Respondent 13: No description given.

The descriptions refer to measuring straight across at the neck base, which correspond with the international description. The situation regarding the problems experienced is the same as with the previous measurement. The respondents

experienced problems with this measurement because special equipment is needed to take the measurement and identifying the neck base consistently can be problematic.

Back neck width (contoured) (75)

This measurement is used for the shaping of the neckline on basic patterns, and it can also be useful for the manufacturing of fit dummies. This measurement is used by 44,74% of the survey respondents and three experienced problems with it. Of the 13 respondents interviewed, five indicated that they used the measurement and two companies experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

✓ Distance between the side neck shoulder points over the nape (SizeUK).

Interview respondents' descriptions:

Respondent 3: *Shoulder neck point over the nape to shoulder neck point.*

Respondent 4: *Side neck to side neck following the contour.*

Respondent 7: *Across over the curve of the neck.*

Respondent 11: *Over the back of the neck.*

Respondent 12: *Side neck over the curve of the nape.*

The descriptions correspond with the international description. This measurement, together with the previous measurement, will determine the curve of the neckline on the pattern. The side neck point is located where the neck base and the shoulder line meet. Identifying this position consistently on different bodies can present a problem. Considering the difficulty with locating the side neck point, it is surprising that only three of survey the respondents experienced problems with the measurement. When drafting a pattern the neckline is usually formed by previously determined dimensions that automatically form the neckline; therefore this measurement is not directly used. This might explain why only three of the survey respondents experienced problems with the measurement. It is however necessary to compare the shape and length of the neckline against the real body measurement in order to determine whether

pattern drafting formulas are still applicable, and also to ensure proper fit of the garment on the body.

Shoulder length (76)

This measurement is used to determine the shoulder length on patterns for upper body garments, and it can also be useful for the manufacturing of fit dummies. This measurement is used by 76,47% of the survey respondents and four experienced problems with the measurement. Of the 13 respondents interviewed, eight indicated that they used the measurement and three companies experienced problems with the measurement.

International description of the measurement:

- ✓ Distance from the base of the right side neck (neck point) to the shoulder point (SizeUK).
- ✓ Distance from the base of the side of the neck (neck point) to the acromion extremity, measured with the arms hanging naturally (ISO 8559, 1989).
- ✓ The distance from the side neck base to the armscye line at the shoulder joint (ASTM 5219, 1999).

The international definitions correspond with each other, and it is clear that the ISO description is more complete.

Interview respondents' descriptions:

Respondent 1: *Side of neck to the shoulder point.*

Respondent 3: *Shoulder neck point to the protruding bone of the shoulder.*

Respondent 4: *Calculate this measurement by using cervical to wrist, shoulder to wrist and the neck measurement.*

Respondent 6: *Side neck to the top of the arm. We don't grade the size of the shoulders because the person doesn't get bigger.*

Respondent 7: *Side neck to the acromion bone.*

Respondent 9: *Side neck to shoulder.*

Respondent 11: *Single shoulder, as close as you can get to the neck to that little bone (back of shoulder).*

Respondent 12: *Where neck and shoulder joins, before it flattens out, to the most prominent part of the back shoulder bone.*

Respondent 13: No description given.

The descriptions correspond with the international descriptions. The most prominent part or bone at the back of the shoulder that some respondents refer to is the acromion process (Thibodeau & Patton, 1992:87), which is used as a landmark for the shoulder position. Both landmarks for this measurement are difficult to identify, as previously discussed in this chapter. The use of a chain to mark the base of the neck can assist in locating the side neck point. The shoulder point however is the position where the armscye and shoulder line intersect, and the acromion process is not clearly visible on all bodies. Again it is surprising that only four of the survey respondents have problems with a measurement with such difficult landmarks, and a similar explanation is also applicable to this measurement. The shoulder length dimension is not directly used when drafting a pattern; the length of the shoulder seam is formed in the process of drafting. However, that length should be compared to the actual body dimension in order to ensure a well-fitting garment.

Shoulder width – back (77)

This measurement is useful to determine the garment measurement over the shoulders of upper body garments, and it can also be useful for the manufacturing of fit dummies. This measurement is used by 55,88% of the survey respondents and one experienced problems with the measurement. Of the 13 respondents interviewed, eight indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

- ✓ Horizontal distance between the back shoulders, following the contour of the back (SizeUK).
- ✓ The horizontal distance between the acromion extremities, measured with the arms hanging naturally (ISO 8559, 1989).
- ✓ The distance from shoulder joint to shoulder joint across the back (ASTM 5219, 1999).

The international descriptions correspond with regard to landmarks, but it is not always clear whether the measurement should be taken on the contour or as a straight horizontal measurement.

Interview respondents' descriptions:

Respondent 1: *From left shoulder to right shoulder, just below the nape.*
Respondent 3: *Shoulder to shoulder over the back.*
Respondent 4: No description given.
Respondent 6: *Side to side on the shoulders.*
Respondent 7: *Over the back to the acromion bones on the sides.*
Respondent 9: *Left to right on the back of the shoulders.*
Respondent 11: *Total shoulder width.*
Respondent 12: *Measure from back (shoulder) bone flat against the back.*

The descriptions correspond with each other and with the international descriptions with regard to the landmarks, namely the shoulders. The shoulders as a landmark are, as discussed previously in this chapter, not that easy to identify since the prominent bones of the acromion process are not prominent on all bodies. There is also not agreement between the respondents about measuring on the contour or in a straight horizontal line. It is important that the measurement be taken over the contour of the back. If one keeps in mind how a garment fits on the body, measuring on the contour builds some tolerance into the measurement, which is useful for pattern making and also for determining garment measurements.

Shoulder width – front (78)

This measurement is useful as an indication of a slumping posture or round shoulders, and it can also be useful for the manufacturing of fit dummies. This measurement is used by 47,06% of the survey respondents and three experienced problems with the measurement. Of the 13 respondents interviewed, seven indicated that they used the measurement and two companies experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

✓ Horizontal distance between the front shoulders (SizeUK).

Interview respondents' descriptions:

Respondent 1: *From left shoulder to right shoulder, just below the base of the neck.*

Respondent 3: *Shoulder to shoulder from the front.*

Respondent 4: No description given.

Respondent 6: *From the front of the body measured at the shoulders.*

Respondent 7: No description given.

Respondent 9: *Left to right on the front of the shoulders.*

Respondent 11: *Total width, measured from the front.*

Respondent 12: *From the front, in line with the back (shoulder) bones.*

The international description is not clear on the landmark for the shoulders in the front. The clavicle bone (Thibodeau & Patton, 1992:86) could serve as a landmark, but can sometimes be difficult to identify. Measuring up to a position in line with the acromion at the back, as respondent 12 suggests, might also be a logical position, however it can still be difficult to physically identify the position on the body. Again, it is not a measurement that is directly used in drafting the pattern, but it can be used as a control measurement to compare the pattern with, in order to ensure a proper fit. This would then explain why only three of the survey respondents indicate a problem with this measurement where the description of landmarks is vague.

Across back width (79)

This measurement is used for drafting patterns of upper body garments, and it can also be useful for the manufacturing of fit dummies. This measurement is used by 79,41% of the survey respondents and two experienced problems with the measurement. Of the 13 respondents interviewed, eight indicated that they used the measurement and one company experienced problems with the measurement.

International description of the measurement:

- ✓ Horizontal distance between the back armscyes on the level of the back width height (SizeUK). (The across back height was measured at midway between centre back neck and underarm level.)
- ✓ The horizontal distance across the back, measured half-way between the upper and lower scye levels (ISO 8559, 1989).
- ✓ The distance from back-break point to back break-point. Back-break point is defined as the location on the back of the body where the arm separates from the body (ASTM 5219, 1999).

The SizeUK and ISO description correspond with regard to the level where the across back measurement should be taken, namely at the mid-point of the armscye. The ASTM measurement measures where the arm separates from the body, in other words, where the crease is visible. This gives a position that is easier to identify on the body than the mid-point of the armscye.

Interview respondents' descriptions:

Respondent 1: *From side to side across the back, 12cm below the nape.*

Respondent 3: *When you put your arm down, your crease here, from that crease across back.*

Respondent 4: *Across the back at the centre of the armscye.*

Respondent 6: *Across back to the arm-shoulder line.*

Respondent 7: *It can be from the crease, or at 12cm below nape which is going to be safe.*

Respondent 9: *12cm below back neck.*

Respondent 11: *12cm down from nape.*

Respondent 12: *For ladies I measure 12cm down from nape. For men I would use mid-arm.*

From the above descriptions and international descriptions it seems that the position where this measurement is taken can vary. It would be difficult to identify the mid-point of the armscye on the body and therefore it is easier and more consistent to measure at a specific distance below the nape. Alternatively, one can follow the ASTM description, which identifies the break point where the arm separates from the

body as a landmark. For pattern-making purposes a specific distance below nape would be advisable, since this would ensure a more accurate translation of the measurement to a pattern.

Across front width (80)

This measurement is used to draft patterns for upper body garments as well as to determine the position of straps on off-shoulder garments, and it can also be useful for the manufacturing of fit dummies. This measurement is used by 67,65% of the survey respondents and three experienced problems with the measurement. Of the 13 respondents interviewed, eight indicated that they used the measurement and one company experienced problems with the measurement.

International description of the measurement:

- ✓ Horizontal distance between the front armscyes on the across front level. (2/3 depth of armscye from shoulder – for women and men) (SizeUK).
- ✓ The distance from front-break point to front-break point. Front-break point is defined as the location on the front of the body where the arm separates from the body (ASTM 5219, 1999).

The international descriptions do not agree as to where the across front level is located. The description of the ASTM indicates a landmark which could possibly be identified consistently.

Interview respondents' descriptions:

Respondent 1: *From side to side at 12cm below mid-shoulder.*

Respondent 3: *When you put your arm down, your crease here, from that crease across front.*

Respondent 4: *Across front at the centre of the armscye.*

Respondent 6: *On the same level as across front.*

Respondent 7: *From where the crease is.*

Respondent 9: *Above the bust, more or less where the crease of the arm is.*

Respondent 11: *12cm down from mid-shoulder.*

Respondent 12: *12cm down from mid-shoulder, for ladies and for men it is measured at mid-arm.*

The South African descriptions do not correspond with regard to the level where the "across front" is located. A variety of locations are given where "across front" should be measured. Being able to consistently identify the same position on a number of different bodies is the key in deciding on the exact location of the measurement. The descriptions by the respondents mention two options, namely 12cm down from mid-shoulder or alternatively the crease where the arm separates from the body. Measuring at the crease corresponds with the ASTM description. Again, to accommodate the translation of the measurement to a pattern, measuring at a specific distance from the shoulder might be the more reliable position.

Breast prominence (81)

This measurement is used for the manufacturing of upper body garments, specifically ladies' underwear, and it can also be useful for the manufacturing of fit dummies for ladies' wear. This measurement is used by 32,35% of the survey respondents and two experienced problems with the measurement. Of the 13 respondents interviewed, four indicated that they used the measurement and one company experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

- ✓ Distance from the centre front between the breasts, over the bust point to the edge of the outer side of the breast (SizeUK).

Interview respondents' descriptions:

Respondent 3: *Centre front to side over the bust.*

Respondent 4: *Centre front over the contour of the bust to the side.*

Respondent 7: No description given.

Respondent 11: *Centre front over the bust to the "side seam".*

This measurement is taken only on women, for obvious reasons, and the respondents' descriptions correspond with the international description. Identifying the "side seam" on the body can present some problems; however, it is not indicated as a problem measurement.

Bust width (82)

This measurement is used for the manufacturing of upper body garments and it can also be useful for the manufacturing of fit dummies. It is specifically used for the positioning of style lines and design detail on garments, and to determine the length of the bust darts. It must also be considered when grading a pattern, since the bust width does not necessarily increase with fuller figures. This measurement is used by 47,06% of the survey respondents and two experienced problems with the measurement. Of the 13 respondents interviewed, seven indicated that they used the measurement and one company experienced problems with the measurement.

International description of the measurement:

- ✓ Horizontal distance between the bust points (SizeUK).
- ✓ The horizontal distance between the nipples (ISO 8559, 1989).
- ✓ The distance across the front from the apex of one breast to the apex of the other (ASTM 5219, 1999).

It is clear that the international descriptions correspond with each other.

Interview respondents' descriptions:

Respondent 1: *Inter-nipple distance.*
Respondent 3: *Distance between nipples.*
Respondent 4: *Nipple to nipple.*
Respondent 6: *How far apart the nipples are.*
Respondent 7: *Bust point to bust point.*
Respondent 11: *Nipple to nipple.*
Respondent 12: *Literally nipple to nipple.*

The descriptions correspond with the international descriptions, and it is therefore not surprising that only two of the survey respondents experience problems with the measurement.

Chest depth (83)

This measurement is useful to describe the body shape and it is therefore also useful for the manufacturing of fit dummies. This measurement is used by 35,29% of the

survey respondents and two experienced problems with the measurement. Of the 13 respondents interviewed, five indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

- ✓ The horizontal distance between the chest, at the level of the bust point landmark, and the back at the same level. The subject stands erect looking straight ahead and is measured from the side. The shoulders and upper extremities are relaxed. The measurement is taken at the maximum point of quiet respiration (Ergotech).

Interview respondents' descriptions:

Respondent 1: *Straight from front to back at the widest part of the chest.*

Respondent 4: *Front to back on the side of the person at chest level. The depth measurements give an idea of body mass distribution.*

Respondent 6: *From the side at the level of the chest.*

Respondent 7: No description given.

Respondent 11: *Side width of the body where chest girth is measured.*

Respondent 12: None of the depth measurements were marked on the questionnaire, but the respondent had the following to say about depth measurements: *"What I'd like to see is depth. I don't know how you'd actually control or measure it but it would be interesting…"*

The descriptions correspond with the international description. Depth measurements, together with width measurements as stated earlier, can give an indication of how the circumference measurement is distributed around the body. Thus it can assist with the analysis and classification of body shapes. However, only 22,2% of the survey respondents indicated that they used this measurement, which can be an indication of ignorance about the role of figure type in achieving good fit.

Waist width (84)

This measurement is useful to describe body shape and is therefore also useful for the manufacturing of fit dummies. This measurement is used by 61,76% of the survey

respondents and none experienced problems with the measurement. Of the 13 respondents interviewed, five indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:
Only one international description was found:

✓ Width of front waist at natural waist level (SizeUK).

Interview respondents' descriptions:

Respondent 1: *From side to side straight across the body at waistline.*
Respondent 3: *Side to side across the natural waist.*
Respondent 4: *The width at the natural waist position.*
Respondent 6: *The width of the body at the waist, straight across.*
Respondent 11: *Width of the body at the narrowest point, measured from the front.*

The descriptions of the respondents correspond with the international description. It is however not clear where exactly the natural waist is located on the body. According to Ashdown (2005), this is one of the most difficult positions to determine.

Waist depth (85)

This measurement is useful to describe body shape and is therefore also useful for the manufacturing of fit dummies. The measurement is used by 20% of the survey respondents and one of them experienced problems with the measurement. Of the 13 respondents interviewed, three used the measurement and none experienced problems with the measurement.

International description of the measurement:
Only one international description was found:

✓ Horizontal distance between the front and back of the waist at the level of the omphalion. Subject stands erect and is measured from the side (Ergotech).

Interview respondents' descriptions:

Respondent 1: *From front to back at waist level.*
Respondent 4: *Front to back on the side of the person at natural waist level.*

Respondent 11: *Sideways at the narrowest point.*

The descriptions of the respondents correspond with each other. The natural waist is also the narrowest point on the body. This does not correspond with the international description which takes the measurement at the level of the belly button. For the purposes of pattern making, the width and depth measurements should be taken at the same position as the girth measurement in order to be of any use. When taken at the same position the measurements serve as control measurements to transfer the measurement onto a pattern.

Hip width (from front at maximum circumference) (86)

This measurement is useful to describe body shape and is therefore also useful for the manufacturing of fit dummies. This can be very helpful in achieving a better fit, especially for trousers. This measurement is used by 55,88% of the survey respondents and none experienced problems with the measurement. Of the 13 respondents interviewed, seven indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

✓ Maximum width of the hips, viewed from the front (SizeUK).

Interview respondents' descriptions:

Respondent 1: *From side to side on the body at 20cm below waistline.*

Respondent 3: *Side to side at the widest part of the hips.*

Respondent 4: *The width of the body at maximum hip.*

Respondent 6: *From the front at the biggest part.*

Respondent 9: No description given.

Respondent 11: *Width from the front at the widest part on the hips.*

Respondent 12: *Measured at widest part.*

Only one of the descriptions does not correspond with the international description because it specifies that the measurement be taken at 20cm below the waist. The descriptions of the other respondents correspond with the international description.

Buttock depth (87)

This measurement can be very useful to determine the shape of the curve of the crotch seam on trousers and it can also be useful for the manufacturing of fit dummies. This measurement is used by 32,35% of the survey respondents and two experienced problems with the measurement. Of the 13 respondents interviewed, six indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

- ✓ The distance between the anterior and posterior maximum buttock point. The subject stands erect and is measured from the side (Ergotech).

Interview respondents' descriptions:

Respondent 1: *From front to back at the widest part of the hip.*

Respondent 3: *Back to front, from the side, at the widest part.*

Respondent 4: *Front to back on the side of the person at hip level.*

Respondent 6: *From the side, same level as biggest hip.*

Respondent 7: No description given.

Respondent 11: *Sideways where the widest hip was measured.*

The descriptions of the respondents correspond with the international description, although they are not as detailed as the international description. One respondent refers to hip level, which can be confusing since it can be understood as the widest part of the hip or it can refer to the hip being at a specific distance, for example 20cm, below the waist.

Because callipers would be necessary to take the width and depth measurements, and the respondents do not readily have access to such equipment, it is surprising that so few of the survey respondents experienced problems with bust width (82), chest depth (83), waist width (84), hip width (86) and buttock depth (87). This can possibly be explained by the fact that these measurements are not directly used when drafting the basic blocks, but are rather used to identify body shape and then to alter the pattern with a specific body shape in mind.

Armscye width (88)

This measurement is used for shaping the armhole on the bodice patterns as well as for shaping of the sleeve cap on sleeve patterns, and it can also be useful for the manufacturing of fit dummies. This measurement is used by 35,29% of the survey respondents and two experienced problems with the measurement. Of the 13 respondents interviewed, four indicated that they used the measurement and two companies experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

- ✓ Distance between the right front and right back armscye measured over the top of the arm (SizeUK).

Interview respondents' descriptions:

Respondent 3: *Front to back over the upper arm.*

Respondent 4: *From front to back on top of the arm.*

Respondent 7: *That's a calliper measurement you'd have to take.*

Respondent 11: No description given.

One respondent mentions that it is a calliper measurement, in other words it is measured in a straight line. The other descriptions mention measuring over the top of the arm, which seems like a contoured measurement. It is also not clear from the international description whether it is a straight or a contoured measurement. For the purpose of manufacturing a fit dummy, a straight measurement might be more useful; however, for pattern making the contoured measurement would be more applicable. Since there is no agreement among the respondents and also no clear indication from the international description, it is surprising that so few respondents experienced problems with the measurement.

Armspan (89)

This measurement could be useful to develop this garment measurement for upper body garments. The measurement is used by 20% of the survey respondents and one respondent experienced problems with the measurement. Of the 13 respondents

interviewed, three used the measurement and none experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

- ✓ The distance between the tips of the middle fingers of the horizontally outstretched arms, which are even with the level of the shoulders. Subject stands erect against a wall mounted scale (Ergotech).

Interview respondents' descriptions:

Respondent 3: *Left to right fingertips, standing with the arms stretched out horizontally.*

Respondent 9: *Lift the arms and measure horizontally from fingertips.*

Respondent 11: No description given.

The descriptions of the respondents correspond with each other and also with the international description.

4.4.2.1 Summary of results regarding horizontal width and depth measurements

From **Table 4.5** it is clear that international descriptions were found for all the width and depth measurements that were included in this study.

TABLE 4.5: SUMMARY OF RESULTS FOR HORIZONTAL WIDTH AND DEPTH MEASUREMENTS

Measurement (* = key dimension)	Number of respondents using the measurement	Number of respondents indicating problems	International description	International consensus	Consensus among respondents	Consensus between International and respondents' descriptions	Problems – yes / no	Problems related to straight / contoured	Problems related to landmarking	Landmarking difficulties and no consensus
73 Neck width (front)	19	4	Yes	One description	Yes	Yes	Yes	No	Yes	No
74 Neck width (back)	19	4	Yes	One description	Yes	Yes	Yes	No	Yes	No
75 Neck width (contoured)	17	3	Yes	One description	Yes	Yes	Yes	No	Yes	No
76 Shoulder length	26	4	Yes	Yes	Yes	Yes	Yes	No	Yes	No
77 Shoulder width (back) *	19	1	Yes	No	No	No	Yes	Yes	Yes	Yes
78 Shoulder width (front)	16	3	Yes	One description	Yes	Yes	Yes	No	Yes	No

Refer to addenda for further information

Measurement (* = key dimension)	Number of respondents using the measurement	Number of respondents indicating problems	International description	International consensus	Consensus among respondents	Consensus between International and respondents' descriptions	Problems – yes / no	Problems related to straight / contoured	Problems related to landmarking	Landmarking difficulties and no consensus
79 Across back width *	27	2	Yes	No	No	No	Yes	No	Yes	Yes
80 Across front width *	23	3	Yes	No	No	No	Yes	No	Yes	Yes
81 Breast prominence	11	2	Yes	One description	Yes	Yes	Yes	No	Yes	No
82 Bust width *	16	2	Yes	Yes	Yes	Yes	Yes	No	No	No
83 Chest depth	12	2	Yes	One description	Yes	Yes	Yes	No	No	No
84 Waist width	21	0	Yes	Yes	Yes	Yes	No	No	Yes	No
85 Waist depth	7	1	Yes	One description	Yes	No	Yes	No	Yes	Yes
86 Hip width (max)	19	0	Yes	One description	No	No	No	No	No	No

Refer to addenda for further information

Measurement (* = key dimension)	Number of respondents using the measurement	Number of respondents indicating problems	International description	International consensus	Consensus among respondents	Consensus between International and respondents' descriptions	Problems – yes / no	Problems related to straight / contoured	Problems related to landmarking	Landmarking difficulties and no consensus
87 Buttock depth	11	2	Yes	One description	Yes	Yes	Yes	No	Yes	No
88 Armscye width	12	2	Yes	One description	No	No	Yes	Yes	No	No
89 Armspan	8	1	Yes	One description	Yes	Yes	Yes	No	No	No
Totals – Yes			**17** ***100,0%***	**3** ***17,6%***	**12** ***70,6%***	**11** ***64,7%***	**15** ***88,2%***	**2** ***11,8%***	**12** ***70,6%***	**4** ***23,5%***
Totals – No			**0** ***0,0%***	**3** ***17,6%***	**5** ***29,4%***	**6** ***35,3%***	**2** ***11,8%***	**15** ***88,2%***	**5** ***29,4%***	**13** ***76,5%***
Totals – One description			**0** ***0,0%***	**11** ***64,7%***	**0** ***0,0%***	**0** ***0,0%***	**0** ***0,0%***	**0** ***0,0%***	**0** **0,0%**	**0** ***0,0%***
Total			**17**	**17**	**17**	**17**	**17**	**17**	**17**	**17**

Refer to addenda for further information

With regard to consensus among the international descriptions, the following is clear from **Table 4.5**:

- ✓ Only one description 64,7%
- ✓ International consensus 17,6%
- ✓ No consensus 17,6%

With regard to the respondents' descriptions, the following is clear from **Table 4.5**:

- ✓ Consensus 70,6%
- ✓ No consensus 29,4%

It seems that there is a high level of agreement among the respondents about how the width and depth measurements should be taken. However, it is alarming that for nearly one third (29,4%) of the measurements the respondents do not agree with each other on how these measurements should be taken.

With regard to consensus between the international and the respondents' descriptions, the following is clear from **Table 4.5**:

- ✓ Consensus 64,7%
- ✓ No consensus 35,3%

Since international descriptions are available for 100% of the horizontal width and depth measurements, one might have expected more consensus among the international and the respondent's descriptions. Again, as with the vertical height measurements, this result clearly shows that the respondents do not always agree with the international descriptions. It can also be an indication that the international descriptions are vague and not clearly described, which leads to confusion and a different interpretation of the description by the respondents. This has definite implications for the taking of consistent and accurate measurements, which further impacts on the drafting of well-fitting patterns.

Although international descriptions are available for all these measurements and a high level of consensus among the respondent's descriptions exist, problems are experienced with 88,2% of the measurements. This is alarming since the horizontal width and depth measurements are important indicators of the body shape. Again,

the fact that the respondents recognise problems with such a large number of width and depth measurements, indicates an interest in and a need for clear descriptions of body measurements as well as accurate body measurement data. Bougourd (2004:10) states that retailers used the SizeUK survey to gain a better understanding of their customers' shapes and sizes, and it seems that the same need exists among the respondents of this study. It is therefore important that a database of current and accurate South African population measures are established. This can only be done if detailed and standard measurement descriptions are available.

From **Table 4.5** it is clear that problems are related to:

- ✓ Landmarking 70,6%
- ✓ Landmarking and consensus 23,5%
- ✓ Straight/contoured measurement 11,8%

Again it is clear that most of the problems are related to landmarking. This has important implications for taking accurate body measurements and drafting well-fitting patterns. This again highlights the importance of clear descriptions of recognisable landmarks.

4.4.3 Circumferences

Neck girth (90)

This measurement is useful for drafting collar patterns, for example polo necks, and it can also be useful for the manufacturing of fit dummies. This measurement is used by 47,37% of the survey respondents and two experienced problems with the measurement. Of the 13 respondents interviewed, six indicated that they used the measurement and two companies experienced problems with the measurement.

International description of the measurement:

- ✓ Narrowest circumference of the neck column (SizeUK).
- ✓ The circumference of the neck approximately 25mm above the neck base (ASTM 5219, 1999).

The two international descriptions do not correspond. It is not easy to find the narrowest circumference on all necks consistently, therefore it would be better to take the measurement at a specific distance above the neck base as the ASTM description suggests. Taking the measurement at a specific distance above the neck base would be a more reliable method of taking the measurement.

Interview respondents' descriptions:

Respondent 1: *Around the widest part of the neck.*
Respondent 3: *Neck girth around the base of the neck.*
Respondent 4: *At the base of the neck.*
Respondent 7: No description given.
Respondent 11: *Measure around the base.*
Respondent 12: *At the neck base.*

The descriptions given by the respondents do not correspond with each other nor with the international descriptions. The respondents refer to measuring around the base of the neck or the widest part of the neck, which is not necessarily the same position on the neck. The international descriptions however refer to the *narrowest* circumference of the neck or at a specified distance from the neck base. The ASTM description, which specifies the distance above the neck base where the measurement should be taken, would be advisable to ensure consistency. Since there is a separate measurement for the neck base girth (no 92), it can be assumed that the respondents had the wrong measurement in mind when they marked the questionnaire and when they gave their descriptions.

Neck girth – Adam's apple (91)

This measurement is useful when drafting collar patterns to determine the length of the collar, specifically shirt collars, and it can also be useful for the manufacturing of fit dummies. This measurement is used by 28,95% of the survey respondents and two experienced problems with the measurement. Of the 13 respondents interviewed, seven indicated that they used the measurement and two companies experienced problems with the measurement.

International description of the measurement:

- ✓ Horizontal circumference of neck measured below the Adam's apple and at the level of the centre back neck point (SizeUK).
- ✓ The girth of the neck measured using the tape measure passed round below the Adam's apple and at the level of the 7th cervical vertebra (ISO 8559, 1989).

It is clear that the international descriptions correspond with each other.

Interview respondents' descriptions:

Respondent 1: *Around the neck, a bit higher than the base.*

Respondent 3: *Neck circumference around the middle of the neck.*

Respondent 4: This measurement was marked on the questionnaire, but according to the respondent it is *not really taken in practise. It depends on the garment neckline, but they mostly work with the base of the neck circumference.*

Respondent 7: *Now that would be fine for a shirt, for a shirt collar button position that would make sense.*

Respondent 11: *Measure around the middle of the neck.*

Respondent 12: *In the middle of the neck.*

Respondent 13: *Around the Adam's apple.*

The descriptions given by the respondents do not correspond with the international descriptions. Only one respondent mentions the Adam's apple. The other descriptions refer to the middle of the neck, which is very vague. The international descriptions also note that the tape measure should pass over the nape at the back of the neck, while none of the respondents mention this. The problems associated with this measurement as well as the previous neck girth measurement, are once again related to the ability to take the measurement consistently. Therefore the description of the ASTM at the previous measurement, giving a specific distance above the base of the neck, would be a reliable method for taking the measurement consistently.

Neck base girth (92)

This measurement is used to determine neckline length and also for drafting collar patterns, and it can also be useful for the manufacturing of fit dummies. This measurement is used by 36,84% of the survey respondents and three of the survey respondents using it experienced problems with the measurement. Of the 13 respondents interviewed, seven indicated that they used the measurement and three companies experienced problems with the measurement.

International description of the measurement:

- ✓ Distance from the nape through the side neck shoulder points to the centre front neck point (SizeUK).
- ✓ The girth of the base of the neck measured using the chainette, which passes over the base of the 7th cervical vertebra, the neck shoulder points and the medial superior borders of the left and right clavicles (ISO 8559, 1989).
- ✓ The circumference of the neck over the cervicale (*sic*) at the back and at the top of the collarbone at the front (ASTM 5219, 1999).

Although all the international descriptions are not as complete as the ISO description, they do correspond with each other.

Interview respondents' descriptions:

Respondent 1: *Around the widest part of the neck, where neck and shoulder join.*
Respondent 3: *Circumference around the base of the neck.*
Respondent 4: *At the base of the neck.*
Respondent 7: *The neck base runs over your nape and around to just above the supersternal notch.*
Respondent 8: *A bit higher up where the collar would fall. A more relaxed measurement, must be able to breathe.*
Respondent 11: *Measure right on that base, right at the bottom of the neck.*
Respondent 12: *Around the neck base.*

The descriptions given by the respondents do not correspond with each other. There are some descriptions that do correspond with the international descriptions; however, most of the respondents just refer to the base of the neck and do not offer

any specific landmarks to help identify the position of the base of the neck. The description of respondent 8 seems to refer more to the previous measurement, since the neck base is not where a shirt collar would fall. Finding the neck base by just looking at a person is sometimes a problem. As discussed earlier in this chapter (refer to side neck height), marking the neck base with a chain is suggested and makes it possible to take the measurement accurately.

Three of the survey respondents who used neck base indicated that it is a problem measurement. Identifying the position of the neck base is one part of the problem. The other part of the problem is related to the use of neck base for collar patterns. The pattern maker must use his/her own judgment to shape the collar to fit snugly around the neck, not too loose and also not too tight.

The previous two circumferences are not always available in the size charts and therefore the neck base girth is mostly used. This also presents a problem to manufacturers of fit dummies with regard to shaping the neck on the dummy. When looking at the descriptions given at neck girth (90), it is clear that the respondents were referring to neck base girth. Therefore it is possible that the number of respondents using neck base girth can actually be higher than indicated in this discussion.

Shoulder girth (93)

This measurement can be useful for the manufacturing of protective wear and for the manufacturing of fit dummies. This measurement is used by 32,35% of the survey respondents and one experienced problems with the measurement. Of the 13 respondents interviewed, four indicated that they used the measurement and one company experienced problems with the measurement.

International description of the measurement:

- ✓ Horizontal circumference at level of maximum protrusion of right deltoid. Subject stands erect with the arms relaxed at the sides (Ergotech).
- ✓ With arms down at sides, the maximum distance around the shoulders at the top of the arms (ASTM 5219, 1999).

The international descriptions do not correspond, since the one description is very vague and it does not give a clear indication of the landmarks that should be used.

Interview respondents' descriptions:

Respondent 3: *Circumference around the shoulders and top of the arms.*

Respondent 4: No description given.

Respondent 7: No description given.

Respondent 11: *Measure around the shoulders and the top of the arms.*

Although the two descriptions are vague they do correspond with each other. No specific landmarks are described by the respondents and for this reason the descriptions of the respondents do not correspond with the international descriptions. It is not a measurement that is generally used for the production of fashion wear and therefore the ignorance regarding the measurement is understandable.

Chest girth (94)

This measurement is used for the manufacturing of patterns and upper body garments for men and children, and it is also necessary for the manufacturing of fit dummies. This measurement is also very important when deriving sizing systems and as a size designation for garments. This measurement is used by 79,41% of the survey respondents and none experienced problems with the measurement. Of the 13 respondents interviewed, nine indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

- ✓ Maximum circumference of chest, measured from the centre back at the level of the armpits, under the armpits and across the front chest to a corresponding point (SizeUK).
- ✓ The maximum horizontal girth measured during normal breathing with the subject standing upright and the tape measure passed over the shoulder blades (scapulae), under the armpits (axillae), and across the chest nipples (ISO 8559, 1989).
- ✓ Measure the circumference of the body parallel to the floor, under the arms, and over the fullest part of the chest (ASTM 6240, 1998).

- ✓ Measure horizontally around the body under the arms and across the nipples so as to include the lower portion of the shoulder blades (ASTM 5826, 1995; ASTM 4910, 1999).

It is clear that the international descriptions correspond with each other, although some descriptions are more specific about the exact landmarks. The ISO gives the most detailed description of how chest circumference should be measured.

Interview respondents' descriptions:

Respondent 1: *On men, around the widest part of the chest.*

Respondent 3: *Measured around the widest part of the chest on men and children.*

Respondent 4: *At the widest part of the chest parallel to the floor, on men.*

Respondent 6: *Around the widest part of the chest.*

Respondent 8: *Perhaps not as simple as it sounds. They must drop their arms and relax, and you must measure as high up under the arms as possible and over the widest point, and to make sure that the tape measure isn't hanging down at the back.*

Respondent 9: *Around the widest part, over the nipples and parallel to the ground.*

Respondent 11: *At the widest part of the chest, tape parallel to the floor.*

Respondent 12: *The most prominent part. We make sure it goes over the shoulder blades and parallel to the floor.*

Respondent 13: *Bust would be similar to a man's chest. On ladies they usually call it bust and on men they call it chest. Measure as high up as possible. Drop your arms after placing tape in position.*

Although the respondents are not very specific about the exact names of the landmarks, the general ideas do correspond with the international descriptions. The respondents mention that the tape measure should be parallel to the floor while measuring, while being as high up as possible under the arms, over the shoulder blades at the back and parallel to the floor. The respondents also note that the measurement, although well known, is not that simple to take and great care should therefore be taken when measuring.

Bust girth (95)

This measurement is exactly the same as the previous measurement but it is measured on women. It is used for the manufacturing of patterns and upper body garments for women, and it is also necessary for the manufacturing of fit dummies. This measurement is also very important when deriving sizing systems and as a size designation for garments. This measurement is used, without any problems, by 70,59% of the survey respondents. Of the 13 respondents interviewed, eight indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

- ✓ Maximum circumference measured over/under the shoulder blades, under the armpits and across the bust points (SizeUK).
- ✓ The maximum horizontal girth measured during normal breathing with the subject standing upright and the tape measure passed over the shoulder blades (scapulae), under the armpits (axillae), and across the nipples (ISO 8559, 1989).
- ✓ Measure the bust circumference horizontally around the body under the arms, across the nipples, and parallel to the floor. (ASTM 5585, 1995).

It is clear that the international descriptions correspond with each other and that the ISO provides the most comprehensive description.

Interview respondents' descriptions:

Respondent 1: *On women, around the widest part of the bust, 3cm below the armhole.*

Respondent 3: *Measured around the most prominent part of the bust on women. Circumferences must be measured snugly, but not so tight as to distort the shape.*

Respondent 4: *Around the widest part of the bust parallel to the floor and high under the underarm.*

Respondent 6: *Around the fullest part of the bust.*

Respondent 7: *Over the widest area of the bust.*

Respondent 8: *Same as chest but measured on women.*

Respondent 11: *For women, around the most prominent part of the bust. Keep the tape straight.*

Respondent 12: *Same as chest but measured on women.*

Respondent 13: *A big problem we think in the women's industry, because you could find a circumference and yet she could have very big [lateral back muscles]. Much bigger around the back than around the front. They are going to have to get to width.*

The bust measurement is taken on women, in the same way that the chest circumference is measured on men. The descriptions of the respondents do not exactly describe the precise landmarks, but the general ideas do correspond with the international descriptions. One respondent mentioned that the tape measure should pass 3cm below the arms.

During the discussion at the interview the respondents did mention that in practice it was difficult to pass over all the landmarks as described for chest and/or bust, and at the same time keep the tape measure parallel to the floor. It seems that the measurement is taken over the nipples and at that level parallel to the floor. Depending on the shape of the body the other landmarks cannot be reached while keeping the tape measure parallel to the floor; for example, on some bodies the tape measure will pass high under the armpits while on others it will be lower down under the armpits in order to keep it parallel to the floor when it is over the nipples.

Underbust girth (97)

This measurement is used for the manufacturing of ladies' wear and specifically for fitted tops, swimwear and underwear. This measurement, together with bust girth, is important for the sizing of underwear. It is also useful for the manufacturing of fit dummies. This measurement is used by 50% of the survey respondents and none experienced any problems with the measurement. Of the 13 respondents interviewed, seven indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

✓ Circumference of the body immediately below the breasts (SizeUK).

- ✓ The horizontal girth of the body just below the breasts (ISO 8559, 1989).
- ✓ The circumference of the body under the breasts and parallel to the floor (ASTM 5219, 1999).

It is generally accepted that girth measurements should be taken parallel to the floor. Therefore it can be accepted that the international descriptions correspond with each other, although only the one description states that it must be parallel to the floor.

Interview respondents' descriptions:

Respondent 1: *Measured just below the bust, on women.*

Respondent 3: *Measured below the bust on women.*

Respondent 4: *This is a tight measurement just below the bust. It is mostly used for underwear and swimwear.*

Respondent 7: *It should be measured against the body, under the bra. The underbust is quite a critical measurement.*

Respondent 11: *Just under the bust. This is a difficult one to measure on the outsizes.*

Respondent 12: *Directly under the bust and it's vital to take it straight (parallel to the floor).*

Respondent 13: *Below the bust measurement, only for ladies.*

The descriptions of the respondents correspond with the international descriptions. However, it is not clear from the international descriptions nor from the respondents' descriptions, how underbust is located. As discussed previously in this chapter, the position of the underbust can be difficult to determine especially on the fuller figure. It is therefore surprising that none of the survey respondents experienced problems with the measurement.

Waist girth (98)

This measurement is used for drafting patterns for upper and lower body garments, and it can also be useful for the manufacturing of fit dummies. This measurement is used by 79,41% of the survey respondents and none experienced problems with the measurement. Of the 13 respondents interviewed, ten indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

- ✓ Circumference of the natural waist between the top of the hip bone and the lower ribs at the sides (SizeUK).
- ✓ The girth of the natural waistline between the top of the hip bones (iliac crest) and the lower ribs, measured with the subject breathing normally and standing upright with the abdomen relaxed (ISO 8559, 1989).
- ✓ The circumference of the waist immediately below the lowest rib (ASTM 5219, 1999).

It is clear that the international descriptions correspond with each other. This measurement refers to the natural waist and it is located below the lowest rib. Despite such a clear description it is not always possible to locate the waist position, for example on men, children and the straight figure type.

Interview respondents' descriptions:

Respondent 1: *Around the narrowest part of the body.*

Respondent 3: *Measured around the natural waistline. Bend sideways and find the crease to locate natural waistline.*

Respondent 4: *Around the natural waist.*

Respondent 6: *The natural waist of the person.*

Respondent 7: *The biggest problem with mens' wear is the waist description. The natural waist is the narrowest part of the torso. When I measure somebody I put an elastic in their waist to begin with.*

Respondent 8: *Measure the waist just above the trouser waistband. Measure snugly or without allowance, but not pulling in too much.*

Respondent 9: No description given.

Respondent 11: *You find the waist by just looking, you often judge with the navel. The waist is just the narrowest point.*

Respondent 12: *Identifying the waist position can be difficult, and it must be natural waist. For women they tie a string around the waist until it's settled. On men they tend to estimate the waist position.*

Respondent 13: *The waist you take it between the eleventh rib and the hip bone.*

The descriptions of the respondents correspond with the international descriptions. The waist is described as the narrowest part of the torso, but on some figure types the narrowest part is not that clearly visible. The international descriptions use the lower ribs and hip bones as reference points to assist in identifying the waist, as do respondent 13. Locating the natural waistline, especially on men, children and straight figure types, is the biggest problem experienced with this measurement. On some bodies it is also not possible to take the waist measurement parallel to the floor. Therefore it is surprising that none of the survey respondents experienced problems with such an important measurement.

Preferred waist girth (99)

This measurement could be useful when making patterns for the currently fashionable dropped waist styles. The measurement is used by 29,41% of the survey respondents and one experienced problems with the measurement. Of the 13 respondents interviewed, four used the measurement and none experienced problems with the measurement.

International description of the measurement:

- ✓ This measurement was listed as a measurement taken for the Nedscan sizing survey, however no international description was listed in the Nedscan document, and no international description could be found in other standards documents.

Interview respondents' descriptions:

Respondent 1: *Measure where the customer wants the waist to be.*
Respondent 4: No description given.
Respondent 11: No description given.
Respondent 12: Did not know how to measure this but would find it interesting. *If there were some kind of consistency it would be interesting.*

The respondents were not sure how this measurement should be taken. The measurement would only be useful if it can be taken consistently. A vertical measurement would have to be taken together with this measurement to identify the

position on the body. In this way it would also be possible to transfer the measurement onto a pattern.

Waist at belly button girth (100)

This measurement is used to determine the waist length on dropped waist garments. This measurement is used by 44,12% of the survey respondents and none experienced problems with the measurement. Of the 13 respondents interviewed, five indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

No international description could be found.

Interview respondents' descriptions:

Respondent 3: *Measure around the body at the level of the belly button.*

Respondent 4: *At the level of the belly button parallel to the floor.*

Respondent 11: *Measure at the level of the navel.*

Respondent 12: *5cm below waist, not at the belly button specifically.*

Respondent 13: *If you ran it across the navel it's spot on. For men and ladies, I would say again around the belly button is going to have to be the spot.*

It seems that measuring at belly button level parallel to the floor would be the acceptable position. This measurement could be useful when manufacturing the currently fashionable hipster styles. Knowing only the circumference would not contribute to manufacturing better fitting garments. It is also necessary to know how much lower the belly button is in relation to the natural waistline. The natural waistline is used as a point of reference when drafting a basic pattern. Therefore the pattern maker will need to know the vertical distance from the natural waist to the belly button in order to take the waist position lower on the pattern.

Upper hip girth (101)

This measurement can assist with the shaping of the waist to hip curve on the patterns of trousers and fitted skirts, and it can also be useful for the manufacturing of

fit dummies. This measurement is used by 50% of the survey respondents and none experienced problems with the measurement. Of the 13 respondents interviewed, six indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

- ✓ Circumference of the upper hip measured at the upper hip level (SizeUK).
- ✓ The circumference of the body at a point approximately 7,5cm below the waist and parallel to the floor (ASTM 5219, 1999).

The international descriptions do not correspond with each other. The one description refers to "the upper hip level", which is a very vague landmark, while the other description states a distance of approximately 7,5cm below the waist. It would be more consistent to measure at a specific distance below the waist.

Interview respondents' descriptions:

Respondent 1: *Measured at 10cm below waistline.*
Respondent 3: *Over the hip bone area, traditionally 10cm below waist (high hip).*
Respondent 4: *Measure at the hip bone.*
Respondent 6: *Measure at 10cm below waist.*
Respondent 7: The respondent did not mark this measurement but made a note next to top hip girth that *it should be measured 10cm below waist.*
Respondent 11: *This is 10cm below waist.*
Respondent 12: *I measure 10cm down (from waist).*

The descriptions of the respondents do not correspond with the international definitions. Nearly all the respondents refer to 10cm below waist, while the international description states that upper hip is at about 7,5cm below the waist. There seems to be agreement among the respondents about measuring at 10cm below waist. This differs from the international descriptions but should not present a problem if it is measured consistently at this position.

Top hip girth (102)

This measurement can also assist with the shaping of the waist to hip curve on the patterns of trousers and fitted skirts, and it can also be useful for the manufacturing of fit dummies. This measurement is used by 50% of the survey respondents and none experienced problems with the measurement. Of the 13 respondents interviewed, seven indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

- ✓ Circumference of the top hip measured at top hip level (midway between natural waist and hip level) (SizeUK).

Identifying the mid-point between natural waist and the maximum hip circumference can be difficult. The vertical distance from natural waist to top hip can vary greatly since the level of maximum hip girth can also vary considerably on different body types. This can lead to some confusion between this and the previous measurement.

Interview respondents' descriptions:

Respondent 1: *Measured at 20cm below waistline.*
Respondent 3: *Traditionally 20cm below waist (full hip).*
Respondent 4: No description given.
Respondent 6: *Measure at 18cm below waist.*
Respondent 7: This measurement was marked by mistake. (Note comment at upper hip girth)
Respondent 11: *This is 20cm below waist.*
Respondent 12: *20 cm down from waist.*

The descriptions of the respondents do not correspond with the international description. The respondents' descriptions refer to measuring at 20cm, and one respondent at 18cm, below natural waist. The international description refers to "midway between natural waist and hip level", which is more difficult to identify on the body, and it will also not be at a specified distance below the waist. From all the descriptions it is not clear where on the body this measurement should be taken and

it is surprising that none of the survey respondents experienced problems with the measurement. However, there seems to be agreement among most of the respondents about measuring at 20cm below waist, and this could explain why it is not identified as a problem measurement. When transferring the measurement to a pattern to determine the waist to hip curve, it should not present a problem if the measurement is consistently taken at this position, 20cm below natural waist.

Hip girth (103)

This measurement is very important when deriving sizing systems and as a size designation for lower body garments because it is the maximum circumference on the lower body. It is used for drafting patterns for trousers and skirts, and it is also necessary for the manufacturing of fit dummies. This measurement is used for the manufacturing of lower body garments and can also be useful for the manufacturing of fit dummies. This measurement is used by 73,35% of the survey respondents and none experienced problems with the measurement. Of the 13 respondents interviewed, nine indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

- ✓ Circumference of the hip measured around the fullest part of the buttocks (SizeUK).
- ✓ The horizontal girth measured round the buttocks at the level of the greatest lateral trochanteric projections, with the subject standing upright (ISO 8559, 1989).
- ✓ The maximum circumference of the body at the level of maximum prominence of the buttocks (ASTM 5219, 1999).

It is clear that this measurement should be taken around the widest part of the lower body, and that the international descriptions correspond with each other in this regard.

Interview respondents' descriptions:

Respondent 1: *Around the widest part of the hips.*

Respondent 3: *Should be the fullest part of the hip. It is also important to determine the distance of the fullest part of the hip from waist.*

Respondent 4: *At the maximum hip.*

Respondent 6: *Measure at 30cm below waist.*

Respondent 7: *This is the circumference at the widest part of the hip area. Some women are wider at a lower point; can be up to 38cm below waist.*

Respondent 8: *This should be at the widest point of the hips.*

Respondent 11: *This is the widest part on the hips.*

Respondent 12: *Measure the widest part.*

Respondent 13: *Measure around the centre of the buttocks, widest area.*

The descriptions of the respondents do not correspond with each other nor with the international descriptions, although most respondents state that it should be measured around the widest part of the hips. One of the respondents states a specific distance of 30cm below natural waist. It is not really possible to measure at a specific distance below natural waist because on different bodies the widest part can be at a variety of levels below waist. This is supported by respondent 7, who states that the widest part can be up to 38cm below natural waist. It is however very important, as respondent 3 mentions, to also measure the vertical distance from the natural waist to the widest hip in order to be able to use the measurement at all. To locate the position on the pattern where the widest hip dimension has to be applied, the pattern maker will need the vertical distance as well.

Trunk circumference (body loop) (104)

This measurement is used for the manufacturing of garments covering the whole body, for example one piece swimwear, catsuits, overalls and diving suits, and it can also be useful for the manufacturing of fit dummies. This measurement is used by 32,34% of the survey respondents and one experienced problems with the measurement. Of the 13 respondents interviewed, five indicated that they used the measurement and one company experienced problems with the measurement.

International description of the measurement:

- ✓ Distance from the centre of the right shoulder length down the back, between the legs, over the projection of the right breast/nipple to the starting point (SizeUK).
- ✓ The distance, measured using the tape measure, from the right shoulder line, midway between the neck base and the armscye (acromion), with the tape measure passing down the back between the legs, through the projection of the right breast to the starting point (ISO 8559, 1989).
- ✓ The distance from the right shoulder line midway between the neck base and the shoulder joint, down the back through the crotch and over the projection of the right breast to the starting point (ASTM 5219, 1999).

It is clear that the international descriptions correspond with each other.

Interview respondents' descriptions:

Respondent 1: According to the questionnaire this company does not use this measurement. It is however listed on the measurement chart that they provided. It is measured *from neck point to neck point over the bust and through the crotch*.

Respondent 3: *Shoulder neck point over bust through crotch to shoulder neck point.*

Respondent 4: *Side shoulder to side shoulder around the body.*

Respondent 7: *We measure from the shoulder around. And some measure from mid-shoulder. For me it's always better to take it from the highest point and against the body.*

Respondent 11: *Side neck through crotch and up all the way.*

Respondent 12: *Side neck through legs and it is on the contour of the body.*

The descriptions of the respondents differ from the international descriptions with regard to the position on the shoulder from where the measurement should be taken. The respondents agree about taking the measurement from the side neck point instead of from mid-shoulder as the international descriptions suggest. Again, this should not present a problem if measured consistently from the side neck point. All three the international descriptions refer to taking the measurement from the right

shoulder. The interview respondents did not mention taking the measurement from a specific side of the body. To ensure consistency it is important to take all measurements from the same side on the body when doing a body measurement survey.

Centre trunk circumference (105)

This measurement could be useful for the manufacturing of garments that cover the full body, for example diving suits, and it could also be useful for the manufacturing of fit dummies. The measurement is used by 20% of the survey respondents and one experienced problems with the measurement. Of the 13 respondents interviewed, four used the measurement and one of the respondents experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

✓ Distance from the nape between the legs to the base of the front neck (SizeUK).

Interview respondents' descriptions:

Respondent 3: *Centre front neck through the crotch to nape.*

Respondent 4: *Supersternal notch to nape.*

Respondent 7: This measurement was not marked but the respondent indicated that it could be useful.

Respondent 11: *Centre front through crotch and up to nape.*

Respondent 13: Although this measurement was marked on the questionnaire, the respondent indicated that it was not used.

The descriptions of the respondents correspond with each other and also with the international description. Any measurement concerning the crotch is regarded as a sensitive measurement to take and therefore the accuracy with which the measurement can be taken is affected.

Armscye girth (106)

When drafting a bodice pattern, the armhole opening usually is formed automatically. This measurement is useful to compare the armscye on the pattern with the actual

body measurement. In this way it is also possible to check that pattern drafting methods are still applicable. It can also be useful for the manufacturing of fit dummies. This measurement is used by 50% of the survey respondents and two experienced problems with the measurement. Of the 13 respondents interviewed, seven indicated that they used the measurement and two companies experienced problems with the measurement.

International description of the measurement:

- ✓ Circumference of right armscye measured from the underarm mid-point, around the arm, over the shoulder point and back to mid-point (SizeUK).
- ✓ The girth of the armscye measured using the tape measure passed through the underarm mid-point and vertically over the shoulder, with the subject standing upright with the arm hanging naturally (ISO 8559, 1989).
- ✓ With the arm hanging down, the distance from the shoulder joint through the front-break point, the armpit, the back-break point, and to the starting point (ASTM 5219, 1999).

Only one of the three international descriptions states that the measurement must be taken on the right side of the body. However, the descriptions do agree with regard to the landmarks. The ASTM description seems to be the most comprehensive.

Interview respondents' descriptions:

Respondent 1: *Top of the shoulder through under arm.*

Respondent 3: *Shoulder through under arm, not too tight.*

Respondent 4: No description given.

Respondent 7: *The other difficult measurement is the scye measurement, armhole. Are you going to take it right up into the armpit. Some people take that measurement with a chain, because then you can actually see where it is going. The chain is also useful for the other scye measurements.*

Respondent 9: *Measure around from the shoulder point through the underarm.*

Respondent 11: *Shoulder around through armpit.*

Respondent 12: No description given.

The descriptions correspond with the international descriptions. Using a chain to identify the armscye, as respondent 7 suggested, could be very useful and would also assist in identifying the landmark in other measurements involving the armscye, as well as the shoulder point.

Upper arm girth – straight (107)

This measurement is used when drafting sleeve patterns. This measurement is used by 47,06% of the survey respondents and none experienced problems with the measurement. Of the 13 respondents interviewed, six indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

- ✓ Maximum girth of the right upper arm measured with arm straight (SizeUK).
- ✓ The maximum girth of the upper arm at lowest scye level, measured with the subject standing upright with arms hanging naturally (ISO 8559, 1989).
- ✓ The maximum circumference of the arm usually midway between the elbow and the shoulder joint (ASTM 5219, 1999).

The international descriptions do correspond with each other. Again only one description refers to measuring on the right arm.

Interview respondents' descriptions:

Respondent 3: *Around the widest part of the upper arm, with the arm hanging naturally.*

Respondent 4: *Measure at the widest part of the upper arm.*

Respondent 7: *Bicep, at the widest part of the upper arm.*

Respondent 11: *This measurement was marked but it is taken with the arm bent.*

Respondent 12: Although this measurement was marked on the questionnaire the respondent stated that it was *taken with a bent arm*.

Respondent 13: *Around the biceps part, widest part of the arm.*

Two of the respondents marked the wrong measurement because they indicated that the measurement is taken with the arm bent, which is the next measurement. The other respondents agree on measuring around the widest part of the upper arm

which also corresponds with the international descriptions. However, the respondents do not mention measuring around the right arm like the SizeUK description does. As discussed earlier in this chapter it is important to take all measurements on the same side of the body. In most people the right side is more developed because most people are right-handed. It is therefore also important that specifically upper arm girth be measured around the right arm since the right arm is bound to be thicker than the left arm on the majority of people.

Upper arm girth – bent (108)

This measurement is used when drafting sleeve patterns. This measurement is used by 35,29% of the survey respondents and none experienced problems with the measurement. Of the 13 respondents interviewed, six indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

- ✓ Maximum circumference of right upper arm with arm bent at 90° and fist clenched (SizeUK).

Interview respondents' descriptions:

Respondent 1: *Midway around the upper arm with the arm bent.* The diagram provided with the measurement chart shows a straight arm though.

Respondent 3: *Around the widest part of the upper arm with the arm bent at 90°.*

Respondent 4: Not measured with a bent arm, although the measurement was indicated on the questionnaire.

Respondent 6: *Biggest top arm measurement, arm slightly bent.*

Respondent 11: *The widest part of the upper arm, with the arm bent.*

Respondent 12: *The widest part. We do it bent.*

The descriptions do not correspond with the international description because only one of the respondents mention bending the arm at 90° and none of the respondents mention measuring around the right arm. The others just refer to a bent arm. To ensure consistency when taking the measurement, it would be advisable to take the

measurement as the international description suggests, on the right arm and with the arm bent at 90°. This measurement is used by respondents that did not use the previous measurement around the straight arm. Respondent 3 was the only respondent that used both measurements. The straight arm girth was used for sleeve patterns for ladies, and the bent girth for sleeve patterns on menswear. This is probably because men are more muscular and therefore the difference between the bent and straight arm girth would be more significant.

Elbow girth – straight (109)

This measurement is used when drafting sleeve patterns. This measurement is used by 32,35% of the survey respondents and none experienced problems with the measurement. Of the 13 respondents interviewed, six indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

✓ Circumference of right elbow with arm straight (SizeUK).

Interview respondents' descriptions:

Respondent 3: *Around the protruding elbow bones with the arm hanging naturally.*

Respondent 4: *Measure at the elbow.*

Respondent 7: No description given.

Respondent 11: *This measurement was marked, but it is taken with the arm bent.*

Respondent 12: *Although this measurement was marked on the questionnaire, the respondent stated that it was taken with a bent arm.*

Respondent 13: No description given.

Two of the respondents indicated that the measurement is actually taken on a bent arm, which indicates that they did not read the questionnaire properly. The other description mentions that the arm must hang naturally. The international description states that it must be measured with the arm straight. It is not clear whether the term "straight" refers to the arm hanging naturally or having the arm really straightened. It would be important to clarify this before a survey is undertaken. Considering how the garment is worn, taking the measurement on the arm hanging naturally might be the

preferable method. The descriptions also do not mention taking the measurement on the right arm, which is another important aspect as discussed previously.

Elbow girth – bent (110)

This measurement is used for drafting sleeve patterns. This measurement is used by 41,18% of the survey respondents and none experienced problems with the measurement. Of the 13 respondents interviewed, six indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

- ✓ Circumference of the right elbow with arm bent at 90° (SizeUK).
- ✓ The girth of the elbow measured with the subject standing upright, the arm bent at approximately 90°, and the hand and fingers facing forward (ISO 8559, 1989).
- ✓ With the arm bent at 90° and the clenched fist placed at the hip, the circumference of the elbow (ASTM 5219, 1999).

The international descriptions correspond with each other although different positions are described for the hand. Only one of the international descriptions refers to measuring on the right side of the body. The description of the ISO of "the arm bent at approximately 90°" is probably more accurate since it might not be humanly possible for all bodies to bend the arm at exactly 90°, but they can bend as close to 90° as possible.

Interview respondents' descriptions:

Respondent 1: *Around the elbow with the arm bent.* The picture provided with the measurement chart however shows a straight arm.

Respondent 3: *Around the protruding elbow bones with the arm bent at 90°.*

Respondent 4: Not measured with a bent arm although the measurement was indicated on the questionnaire.

Respondent 7: *Take the measurement around a bent elbow.*

Respondent 11: *I would always take it as bent.*

Respondent 12: *Bent.*

The descriptions given by the respondents correspond with the international descriptions. Although only one respondent specifically state that the arm must be bent at 90°, it seems that the "bent arm" always refers to the arm bent at 90°. None of the respondents refers to measuring on the right arm, but as discussed earlier it is important for the sake of consistency and also because the right arm might be thicker than the left arm on most human bodies.

Forearm girth (111)

This measurement is used for sleeve patterns to determine the hem circumference on three-quarter sleeves. This measurement is used by 35,29% of the survey respondents and none experienced problems with the measurement. Of the 13 respondents interviewed, four indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

- ✓ Maximum circumference of the right forearm measured with the elbow at 90° (SizeUK).

Interview respondents' descriptions:

Respondent 3: *Around the widest part of the forearm.*
Respondent 4: *Just below the elbow.*
Respondent 11: No description given.
Respondent 13: *Below the elbow.*

The descriptions given by the respondents do not correspond with the international description. The descriptions given by the respondents do not specify whether the arm must be bent and that the measurement must be taken on the right side. To ensure that the measurement is taken consistently it would be best to follow the international description.

Wrist girth (112)

This measurement is used for drafting sleeve patterns, and it is also necessary to determine the length of cuffs. This measurement is used by 61,67% of the survey

respondents and none experienced problems with the measurement. Of the 13 respondents interviewed, seven indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

- ✓ Circumference of the right wrist measured over the prominent wrist bone in line with the little finger (SizeUK).
- ✓ The girth over the wrist-bone measured with the arms hanging naturally (ISO 8559, 1989).
- ✓ The circumference over the prominence of the inner and the outer forearm bones (ASTM 5219, 1999).

It is clear that the international descriptions correspond, although the ASTM description mentions the inner forearm bones as an additional landmark. Again only the SizeUK states that the measurement must be taken on the right arm.

Interview respondents' descriptions:

Respondent 1: *Around the wrist, where the hand joins the arm.*
Respondent 3: *Around the protruding wrist bones.*
Respondent 4: *At the wrist over the wrist bone.*
Respondent 7: *Over the bone.*
Respondent 11: *Over the wrist bones.*
Respondent 12: *The wrist.*
Respondent 13: *Around the wrist, and over the wrist bones.*

The descriptions given by the respondents correspond with the international descriptions. None of the respondents mention taking the measurement around the right arm. It is an important aspect to consider, because taking the circumferences around the right arm could result in a wider sleeve pattern.

Thigh girth (113)

This measurement is used for drafting trouser patterns, to determine the leg width, and it can also be useful for the manufacturing of fit dummies. This measurement is used by 36% of the survey respondents and none experienced problems with the

measurement. Of the 13 respondents interviewed, six indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

- ✓ Maximum circumference of the right thigh (SizeUK).
- ✓ The horizontal girth measured, without constriction, at the highest thigh position, with the subject standing upright (ISO 8559, 1989).
- ✓ The maximum circumference of the upper leg close to the crotch (ASTM 5219, 1999).

The international descriptions do not correspond with each other. There is no agreement about the position on the leg where the measurement should be taken. The highest thigh position is not necessarily the maximum circumference. Only one of the descriptions refers to measuring on the right side of the body.

Interview respondents' descriptions:

Respondent 1: On the questionnaire it is indicated that this measurement is not used. The measurement chart however shows the measurement as *taken around the widest part of the thigh.*

Respondent 3: *Just below the crotch, around the widest part of the thigh.*

Respondent 4: *Over the widest part of the thigh.*

Respondent 7: *Top thigh obviously is the widest.*

Respondent 11: *The girth around the widest part of the upper leg.*

Respondent 12: *Generally on the widest part.*

Respondent 13: *It is just below where the buttock comes into the leg. Measure as high up the leg as possible.*

There is no agreement among the respondents about where on the upper leg the measurement should be taken. Most of the respondents state that the measurement should be taken over the widest part of the upper leg; however, one respondent states that it should be taken at the highest position. Not one of the respondents refers to measuring on the right side of the body. The situation is therefore the same as with the international descriptions. Since there is no agreement about where the circumference should be measured, it is surprising that none of the survey

respondents experienced problems with the measurement. The explanation for this could be that the difference between the girth at the highest point of the thigh and around the widest part of the thigh is not significant.

Mid-thigh girth (114)

This measurement is used for drafting trouser patterns, specifically for tapering the leg and also to determine the hem circumference of shorts, and it can also be useful for the manufacturing of fit dummies. This measurement is used by 24% of the survey respondents and none experienced problems with the measurement. Of the 13 respondents interviewed, four indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

- ✓ Circumference of the right thigh measured midway between the crotch and knee levels (SizeUK).
- ✓ The horizontal circumference of the thigh measured, without constriction, midway between the hip level and the knee, with the subject standing upright (ISO 8559, 1989).
- ✓ Measure the mid-thigh circumference of the upper leg between the hip and the knee, parallel to the floor (ASTM 5586, 1995).

The international descriptions do not correspond with each other. They differ in that the SizeUK and the ASTM describe mid-thigh as midway between the hip and the knee. The ISO description takes mid-thigh at midway between the crotch and the knee. Again only one description mentions measuring on the right side of the body.

Interview respondents' descriptions:

Respondent 4: *Halfway between the crotch and the knee.*
Respondent 7: No description given.
Respondent 11: *The middle from the widest part to the knee.*
Respondent 13: *In the middle of the thigh.*

The respondents do not agree on the level where mid-thigh is located and also do not correspond with the international descriptions. The respondents also do not mention

measuring on the right side of the body. The mid-thigh girth is not a critical measurement, but it is again surprising that although there is such variation in the descriptions to locate mid-thigh, none of the survey respondents indicated that they experienced problems with this measurement.

Knee girth (115)

This measurement is used for drafting trouser patterns and is especially important when shaping the leg for bootleg or bell-bottom styles. It can also be useful for the manufacturing of fit dummies. This measurement is used by 28% of the survey respondents and none experienced problems with the measurement. Of the 13 respondents interviewed, six indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

- ✓ Circumference of the right knee measured with leg straight (SizeUK).
- ✓ The circumference of the knee measured with the subject standing upright and the upper border of the tape measure at the tibial level (ISO 8559, 1989). With the leg straight, the circumference of the knee over the knee cap and parallel to the floor (ASTM 5219, 1999).

The international descriptions do not correspond with each other. The way that the knee is identified as a landmark varies, or is vaguely described. Again only one description mentions measuring on the right side of the body.

Interview respondents' descriptions:

Respondent 1: *Measured around the knee on a straight leg.*
Respondent 3: *Measure around the knee where it can bend.*
Respondent 4: *Knee circumference at the crease.*
Respondent 7: *Measure around the knee, with the leg straight.*
Respondent 11: *Around the knee, at the centre of the kneecap or in line with the crease.*
Respondent 13: *Around the knee.*

None of the respondents states that the measurement should be taken on the right leg. As discussed earlier in this chapter, this is important for consistency but also because measurements on the right side might be slightly larger and in this case would influence the width of trouser legs. The descriptions given by the respondents in some instances are vague and do not specify exactly how the knee is located, while the others do offer some ways of identifying the knee consistently. It is assumed that the measurement is taken on a straight leg, although not all the respondents indicated that the leg should be straight.

Lower knee girth (116)

This measurement could be useful for shaping the legs and to allow ease when making patterns for fitted trousers, and it could also be useful for the manufacturing of fit dummies. The measurement is used by 14% of the survey respondents and none experienced problems with the measurement. Of the 13 respondents interviewed, three used the measurement and none of the respondents experienced problems with the measurement.

International description of the measurement:

- ✓ Circumference of the right leg measured immediately below the kneecap (SizeUK).
- ✓ The circumference of the knee measured with the subject standing upright and the upper border of the tape measure at the tibial level (ISO 8559, 1989).

It is clear that the international descriptions correspond with each other.

Interview respondents' descriptions:

Respondent 1: *Measured just below the knee.*
Respondent 4: *Circumference just below the knee.*
Respondent 11: *Narrowest part just under the knee.*

The descriptions given by the respondents correspond with each other and also with the international descriptions.

Calf girth (117)

This measurement is used to determine the circumference of the hemline on pedal pushers and capri pants. It can also be useful for the manufacturing of fit dummies. This measurement is used, by 26% of the survey respondents and none experienced problems with the measurement. Of the 13 respondents interviewed, six indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

- ✓ Maximum circumference of the right calf (SizeUK).
- ✓ The maximum circumference around the leg between the knee and ankle, parallel to the floor (ASTM 5219, 1999).

It is clear that the international descriptions correspond with each other, although only the one description states that it should be measured around the right leg.

Interview respondents' descriptions:

Respondent 1: This measurement was not marked on the questionnaire, but it is indicated on the measurement chart as *measured around the widest part of the calf*.
Respondent 3: *Around the widest part of the calf.*
Respondent 4: *Circumference at the widest part of the calf.*
Respondent 7: *At the widest point.*
Respondent 11: *The widest part of the calf.*
Respondent 12: *Widest part below the knee.*
Respondent 13: *Around the biggest part of the calf.*

The descriptions given by the respondents correspond with each other as well as with the international descriptions. None of the respondents states that the measurement should be taken on the right leg. As discussed previously it is important to measure the "bigger" side of the body and to do so consistently.

Minimum leg girth (118)

This measurement could also be useful for shaping the legs and to allow ease when making patterns for fitted trousers, and it could also be useful for the manufacturing of fit dummies. The measurement is used by 18% of the survey respondents and none experienced problems with the measurement. Of the 13 respondents interviewed, three used the measurement and none of the respondents experienced problems with the measurement.

International description of the measurement:

- ✓ Minimum girth of the right lower leg measured above the ankle (SizeUK).
- ✓ The minimum girth of the lower leg measured horizontally just above the ankle with the subject standing upright (ISO 8559, 1989).

It is clear that the international descriptions correspond with each other.

Interview respondents' descriptions:

Respondent 1: *Around the smallest part of the leg.*
Respondent 4: *Just above the ankle bones.*
Respondent 11: *Narrowest point below the calf and above the ankle.*

The descriptions given by the respondents correspond with each other and also with the international descriptions.

Ankle girth (119)

This measurement is used for drafting trouser patterns and to determine the minimum width of tapered trousers. It can also be useful for the manufacturing of fit dummies. This measurement is used by 32% of the survey respondents and none experienced problems with the measurement. Of the 13 respondents interviewed, seven indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

- ✓ Circumference of the right ankle measured over the centre of the ankle bone prominence (SizeUK).

- ✓ The circumference of the leg measured at the level of the centre of the ankle bone with the subject standing upright (ISO 8559, 1989).
- ✓ The circumference of the leg over the greatest prominence of the ankle (ASTM 5219, 1999).

Although only one description states that it should be measured on the right ankle, it is clear that the international descriptions correspond with each other.

Interview respondents' descriptions:

Respondent 1: *Over the ankle bones.*
Respondent 3: *Around the protruding ankle bones.*
Respondent 4: *The circumference around the ankle.*
Respondent 7: *Measure over the ankle bones.*
Respondent 11: *Measure over the ankle bones.*
Respondent 12: *At the narrowest point because it gives an idea of bone structure.*
Respondent 13: *Just above the ankle, about a centimetre above the ankle.*

The descriptions of the respondents do not correspond with each other. Two of the respondents describe the measurement as taken just above the ankle or around the narrowest point. These two descriptions do not correspond with any of the international descriptions. Even though the descriptions do not correspond, none of the survey respondents experienced problems with this measurement. The hemline of trousers is never tight fitting and therefore with the necessary ease added it accommodates some variation in the measurement. This could explain why no problems are experienced with the measurement, even though the descriptions of the respondents vary.

4.4.3.1 Summary of results regarding circumferences

Because of the importance of these measurements one would expect a high level of consensus among the international and also between the respondents' descriptions.

TABLE 4.6: SUMMARY OF RESULTS FOR CIRCUMFERENCES

Measurement (* = key dimension)	Number of respondents using the measurement	Number of respondents indicating problems	International description	International consensus	Consensus among respondents	Consensus between International and respondents' descriptions	Problems – yes / no	Problems related to straight / contoured	Problems related to landmarking	Landmarking difficulties and no consensus
90 Neck girth	18	2	Yes	No	No	No	Yes	No	Yes	Yes
91 Neck girth (Adam's apple)	11	2	Yes	Yes	No	No	Yes	No	Yes	Yes
92 Neck base girth *	14	3	Yes	Yes	No	No	Yes	No	Yes	Yes
93 Shoulder girth	11	1	Yes	No	Yes	No	Yes	No	Yes	Yes
94 Chest girth *	27	0	Yes	Yes	Yes	Yes	No	No	Yes	No
95 Bust girth *	24	0	Yes	Yes	No	No	No	No	Yes	Yes
96 Bust girth contoured	9	0	Yes	One description	One description	Yes	No	No	Yes	No
97 Underbust girth	17	0	Yes	Yes	Yes	Yes	No	No	Yes	No
98 Waist girth *	27	0	Yes	Yes	Yes	Yes	No	No	Yes	No

Refer to addenda for further information

Measurement (* = key dimension)	Number of respondents using the measurement	Number of respondents indicating problems	International description	International consensus	Consensus among respondents	Consensus between International and respondents' descriptions	Problems – yes / no	Problems related to straight / contoured	Problems related to landmarking	Landmarking difficulties and no consensus
99 Preferred waist girth	10	1	No description	N/A	One description	N/A	Yes	No	No	No
100 Waist girth at belly button	15	0	No description	N/A	No	N/A	No	No	No	No
101 Upper hip girth	17	0	Yes	No	Yes	No	No	No	Yes	Yes
102 Top hip girth	17	0	Yes	One description	No	No	No	No	Yes	Yes
103 Hip girth *	25	0	Yes	Yes	No	No	No	No	Yes	Yes
104 Trunk circumference	11	1	Yes	Yes	Yes	No	Yes	No	Yes	Yes
105 Centre trunk circumference	9	1	Yes	One description	Yes	Yes	Yes	No	Yes	No
106 Armscye girth	17	2	Yes	Yes	Yes	Yes	Yes	No	Yes	No
107 Upper arm girth straight *	16	0	Yes	Yes	Yes	Yes	No	No	No	No
108 Upper arm girth bent	12	0	Yes	Yes	No	No	No	No	No	No

Refer to addenda for further information

Measurement (* = key dimension)	Number of respondents using the measurement	Number of respondents indicating problems	International description	International consensus	Consensus among respondents	Consensus between International and respondents' descriptions	Problems – yes / no	Problems related to straight / contoured	Problems related to landmarking	Landmarking difficulties and no consensus
109 Elbow girth straight *	11	0	Yes	One description	No	No	No	No	No	No
110 Elbow girth bent	14	0	Yes	Yes	Yes	Yes	No	No	No	No
111 Forearm girth *	12	0	Yes	One description	No	No	No	No	No	No
112 Wrist girth *	21	0	Yes	Yes	Yes	Yes	No	No	No	No
113 Thigh girth *	18	0	Yes	No	No	No	No	No	Yes	Yes
114 Mid-thigh	12	0	Yes	No	No	No	No	No	Yes	Yes
115 Knee girth	14	0	Yes	No	No	No	No	No	Yes	Yes
116 Lower knee girth	7	0	Yes	Yes	Yes	Yes	No	No	No	No
117 Calf girth	13	0	Yes	Yes	Yes	Yes	No	No	No	No
118 Minimum leg girth	9	0	Yes	Yes	Yes	Yes	No	No	No	No
119 Ankle girth	16	0	Yes	Yes	No	No	No	No	No	No

Refer to addenda for further information

Measurement (* = key dimension)	Number of respondents using the measurement	Number of respondents indicating problems	International description	International consensus	Consensus among respondents	Consensus between International and respondents' descriptions	Problems – yes / no	Problems related to straight / contoured	Problems related to landmarking	Landmarking difficulties and no consensus
Totals – Yes			**28** ***93,3%***	**17** ***56,7%***	**14** ***46,7%***	**12** ***40,0%***	**8** ***26,7%***	**0** ***0,0%***	**18** ***60,0%***	**12** ***40,0%***
Totals – N/A			**0** ***0,0%***	**2** ***6,7%***	**0** ***0,0%***	**2** ***6,7%***	**0** ***0,0%***	**0** ***0,0%***	**0** ***0,0%***	**0** ***0,0%***
Totals – No			**0** ***0,0%***	**6** ***20,0%***	**14** ***46,7%***	**16** ***53,3%***	**22** ***73,3%***	**30** ***100,0%***	**12** ***40,0%***	**18** ***60,0%***
Totals – No description			**2** ***6,7%***	**0** ***0,0%***	**0** ***0,0%***	**0** ***0,0%***	**0** ***0,0%***	**0** ***0,0%***	**0** ***0,0%***	**0** ***0,0%***
Totals – One description			**0** ***0,0%***	**5** ***16,7%***	**2** ***6,7%***	**0** ***0,0%***	**0** ***0,0%***	**0** ***0,0%***	**0** ***0,0%***	**0** ***0,0%***
Total			**30**	**30**	**30**	**30**	**30**	**30**	**30**	**30**

Refer to addenda for further information

With regard to the availability and consensus of international descriptions, the following is clear from **Table 4.6**:

- ✓ Only one description 16,7%
- ✓ International consensus 56,7%
- ✓ No descriptions 6,7%
- ✓ No consensus 20,0%

Considering the importance of the girth measurements with regard to the sizing of garments, as well as for pattern drafting, it is alarming that for 26,7% of the circumferences there are no consensus or no descriptions available internationally.

With regard to the respondents' descriptions, the following is clear from **Table 4.6**:

- ✓ Consensus 46,7%
- ✓ No consensus 46,7%
- ✓ Only one description 6,7%

Because of the importance of these measurements one would have expected a much higher level of consensus among the respondents' descriptions. Uncertainty or confusion about taking the circumference measurements can only predict chaos with the fit and sizing of garments.

With regard to consensus among the international and the respondents' descriptions, the following is clear from **Table 4.6**:

- ✓ Consensus 40,0%
- ✓ No consensus 53,3%
- ✓ Not applicable 6,7% (because of no international descriptions)

It is a worrying fact that there seems to be consensus among the international and the respondent's descriptions for less than half of the circumference measurements. Since international descriptions are available for 93,3% of the circumference measurements, this result clearly shows that the respondents do not always agree with the international description of a measurement. It can also be an indication that the international description is vague and not clearly described, which leads to confusion and a different interpretation of the description by the respondents. This

has definite implications for the taking of consistent and accurate measurements, which further impacts on the drafting of well-fitting patterns.

It is surprising that problems are only experienced with 26,7% of the circumference measurements. One would have expected more of the measurements to be regarded as problem measurements, since there is no consensus and no international descriptions for 60,0% of the circumference measurements. The low number of problems experienced is not supported by the 60% of measurements with landmarking problems and 36,7% of measurements with problems related to landmarking together with no consensus. This could be an indication of ignorance or a "don't care" attitude towards problems with the circumference measurements. Another explanation could also be that, because the circumference measurements are commonly used everyday in the clothing industry, it could be that the problems with the measurements are so well-known and solutions for handling it have been established, and therefore the measurements are not seen as problem measurements.

The respondents' attitudes during the interviews were one of "people know how to take the measurements". But the results of this study seem to indicate that people are not so sure, and this is an indication of the dilemma in which the South African industry finds itself with regard to taking accurate standardised body measurements.

4.4.4 Other body measurements

To be able to compile a comprehensive list of body measurements needed by the clothing industry in South Africa, the widest possible spectrum of measurements was included in this study. This included arc measurements, head, hand and foot measurements.

From **Table 4.7** it is clear that these other body measurements are not used much. Due to low response from footwear, headwear and glove manufacturers, valid conclusions regarding these measurements were not possible. Therefore, the

measurements included in the following discussion are the ones specifically related to the manufacturing of garments.

4.4.4.1 Head measurements

Head height (147)

This measurement could be useful for the manufacturing of protective headwear. The measurement is used by 23,53% of the survey respondents and none experienced problems with the measurement. Of the 13 respondents interviewed, five used the measurement and none experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

- ✓ Distance between the high point of the crown of the head and the chin (SizeUK).

Interview respondents' descriptions:

Respondent 3: *Top of the head to the bottom of the chin.*
Respondent 4: *Length of the head up to the chin.*
Respondent 7: No description given.
Respondent 11: No description given.
Respondent 12: No description given.

A number of the respondents did not give any description, which is an indication of their uncertainty about how to take the measurement. The descriptions do correspond with the international description.

Crown of skull to brows (Vertex to glabella) (149)

This measurement was used by only one survey respondent, who also had a problem with the measurement. This respondent was included for the interview.

International description of the measurement:

Only one international description was found:

✓ The vertical distance from the vertex (crown of skull) to the glabella (brows). The subject sits erect with head in the Frankfort plane (Ergotech).

Interview respondents' descriptions:

Respondent 2: This measurement was not indicated on the questionnaire but during the interview the respondent mentioned that it was *necessary. It is measured from the centre of the head on top, over the forehead up to and in line with the brows.*

Respondent 4: *Top of the head to the eyebrows.*

According to the one description, the measurement is measured on the contour of the head, while the other description does not specify. The international description is however a straight vertical measurement. Again confusion regarding how exactly the measurement should be taken is the main cause for problems with this measurement, and also the fact that the respondents do not have the correct equipment to take the measurement with.

Head length (brow to back of skull) (152)

This measurement could be useful when making patterns for hooded upper body garments. It could also be useful to determine the distribution of the head girth around the head, in other words to determine the shape of the head. The measurement is used by 21,05% of the survey respondents and one experienced problems with the measurement. Of the 13 respondents interviewed, five used the measurement and none experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

✓ The horizontal distance between the glabella landmark (between the eyebrows) to the most posterior surface on the back of the skull (Ergotech).

Interview respondents' descriptions:

Respondent 3: *Front to back in a straight line, just above the brows to the back of the head.*

Respondent 4: *From the eyebrows to the back of the head.*

Respondent 7: No description given.
Respondent 11: No description given.
Respondent 12: No description given.

Again there are a number of respondents that do not give any description, which indicates that they do not have the knowledge how to take the measurement. The descriptions given do correspond with the international description.

Head width (above the ears) (154)

This measurement could be useful for the manufacturing of protective headwear. The measurement is used by 18,42% of the survey respondents and one experienced problems with the measurement. Of the 13 respondents interviewed, five used the measurement and none experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

- ✓ The maximum horizontal breadth of the head just above the attachment of the ears. The subject sits erect with the head in the Frankfort plane (Ergotech).

Interview respondents' descriptions:

Respondent 2: *The production manager indicated that this measurement is not used and that it should have been the head girth.*
Respondent 3: *In a straight line from side to side, just above the ears.*
Respondent 4: *Width of the face in line with the top of the ears.*
Respondent 7: No description given.
Respondent 13: *Across the face, just above the ears.*

The descriptions of the respondents correspond with the international description.

Head girth (above ears) (158)

This measurement is used to determine the size of headwear. It is also an important measurement to consider for garments without an opening, for instance t-shirts. This measurement is used by 36,84% of the survey respondents and one experienced

problems with it. Of the 13 respondents interviewed, seven indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

✓ The maximum circumference of the head above the ears (ASTM 5219, 1999).

Interview respondents' descriptions:

Respondent 2: *This measurement was mistakenly not marked on the questionnaire by the hat and cap manufacturer. It is however a very important circumference which is measured around the head above the ears and above the brows.*

Respondent 3: *Circumference of the head just above the ears.*

Respondent 4: No description given.

Respondent 7: No description given.

Respondent 8: *Typically just above the ear, around the widest point.*

Respondent 11: *Measure above the ears.*

Respondent 12: *Above the ears.*

Respondent 13: *Head circumference just above the ears.*

The descriptions given by the respondents correspond with the international description. This measurement is critical for the sizing of headwear. The head circumference measurement also has implications for the inclusion of neck fasteners in garments' necklines. With knitwear, and especially with children's and babies' garments, it is extremely important that the garment go over the head comfortably. The use of this measurement is necessary to ensure that the neck opening on such garments is large enough.

4.4.4.2 Foot measurements

Foot length (185)

This measurement is necessary for the manufacturing of one piece garments or lower body garments that include a closed foot, for instance Babygros. This measurement is used by 34% of the survey respondents and three experienced

problems with it. Of the 13 respondents interviewed, five indicated that they used the measurement and two companies experienced problems with the measurement.

International description of the measurement:

- ✓ Distance between the most prominent toe and the most prominent part of the heel on the right foot (SizeUK).
- ✓ With the subject standing barefoot, the distance from the most prominent part of the heel where it touches the floor to the end of the most prominent toe (ASTM 5219, 1999).

It is clear that the international descriptions correspond with each other, although only the SizeUK mentions measuring the right foot.

Interview respondents' descriptions:

Respondent 3: No description given.

Respondent 5: *From the back of the heel to the longest toe, straight.*

Respondent 7: No description given. Marked all measurements since no information on hands and feet are available.

Respondent 10: *Longest toe to the back of the heel.*

Respondent 12: No description given.

The descriptions correspond with the international descriptions; however, the respondents do not mention measuring the right foot as the SizeUK description does.

Instep girth (bridge circumference) (197)

This measurement is used by 26% of the survey respondents and five of the survey respondents using it experienced problems with it. Of the 13 respondents interviewed, five indicated that they used the measurement and two companies experienced problems with the measurement.

International description of the measurement:

- ✓ Circumference of the right foot at the highest point of the arch (SizeUK).

- ✓ The circumference at the bridge of the foot, measured across the navicular bone. The subject stands erect with the body weight evenly distributed between both feet (Ergotech).

The international descriptions correspond with each other, although only the SizeUK mentions measuring the right foot.

Interview respondents' descriptions:

Respondent 3: No description given.

Respondent 5: *Circumference around the bridge of the foot. Foot flat on the floor.*

Respondent 7: No description given. Marked all measurements since no information on hands and feet are available.

Respondent 10: *Girth around the bridge of the foot.*

Respondent 12: No description given.

The descriptions given do not clearly identify where the bridge of the foot is. Difficulty in identifying the exact position to measure is probably the reason why problems are experienced with this measurement.

4.4.4.3 Summary of results regarding other body measurements

It seems clear that the respondents were not familiar with these measurements or that they did not regularly use these measurements.

TABLE 4.7: SUMMARY OF RESULTS FOR OTHER BODY MEASUREMENTS

Measurement (* = key dimension)	Number of respondents using the measurement	Number of respondents indicating problems	International description	International consensus	Consensus among respondents	Consensus between International and respondents' descriptions	Problems – yes / no	Problems related to straight / contoured	Problems related to landmarking	Landmarking difficulties and no consensus
120 Bust arc anterior	1	1	Yes	Yes	One description	Yes	Yes	No	Yes	No
121 Waist arc anterior	1	1	Yes	One description	One description	Yes	Yes	No	Yes	No
122 Abdominal extensions arc anterior	0	1	Yes	One description	No description	N/A	Yes	N/A	Yes	N/A
123 Hip arc posterior	0	1	Yes	One description	No description	N/A	Yes	N/A	Yes	N/A
124 Seated height	0	0	Yes	One description	No description	N/A	No	N/A	N/A	N/A
125 Seated cervical height	1	0	Yes	One description	No description	N/A	No	N/A	N/A	N/A

Refer to addenda for further information

Measurement (* = key dimension)	Number of respondents using the measurement	Number of respondents indicating problems	International description	International consensus	Consensus among respondents	Consensus between International and respondents' descriptions	Problems – yes / no	Problems related to straight / contoured	Problems related to landmarking	Landmarking difficulties and no consensus
126 Seated shoulder height	0	0	Yes	One description	No description	N/A	No	N/A	N/A	N/A
127 Seated waist height	1	0	Yes	One description	No description	N/A	No	N/A	N/A	N/A
128 Seated knee height	1	0	Yes	One description	No description	N/A	No	N/A	N/A	N/A
129 Popliteal height	0	0	Yes	One description	No description	N/A	No	N/A	N/A	N/A
130 Seated hip width	2	0	Yes	One description	One description	Yes	No	No	No	No
131 Seated thigh length	2	0	Yes	One description	One description	No	No	No	No	No
132 Seated waist girth	2	0	Yes	One description	One description	Yes	No	No	Yes	No
133 Seated hip girth	2	0	Yes	Yes	One description	Yes	No	No	No	No

Refer to addenda for further information

Measurement (* = key dimension)	Number of respondents using the measurement	Number of respondents indicating problems	International description	International consensus	Consensus among respondents	Consensus between International and respondents' descriptions	Problems – yes / no	Problems related to straight / contoured	Problems related to landmarking	Landmarking difficulties and no consensus
134 Seated thigh girth	2	0	Yes	One description	One description	No	No	No	No	No
135 Seated knee girth	1	0	Yes	One description	One description	Yes	No	No	No	No
136 Body mass	4	0	Yes	Yes	No description	N/A	No	N/A	N/A	N/A
137 Shoulder blade skinfold	0	1	No description	N/A	No description	N/A	Yes	N/A	N/A	N/A
138 Triceps skinfold	0	1	No description	N/A	No description	N/A	Yes	N/A	N/A	N/A
139 Bust to waist drop	4	1	Yes	One description	One description	Yes	Yes	No	Yes	No
140 Hip to waist drop	5	0	No description	N/A	One description	N/A	No	No	Yes	**No**

Refer to addenda for further information

Measurement (* = key dimension)	Number of respondents using the measurement	Number of respondents indicating problems	International description	International consensus	Consensus among respondents	Consensus between International and respondents' descriptions	Problems – yes / no	Problems related to straight / contoured	Problems related to landmarking	Landmarking difficulties and no consensus
141 Bust to underbust drop	4	1	No description	N/A	One description	N/A	Yes	No	Yes	No
142 Front neck depth	5	1	Yes	One description	One description	Yes	Yes	No	Yes	No
143 Back neck depth	5	1	Yes	One description	One description	Yes	Yes	No	Yes	No
144 Back seat angle	2	2	Yes	One description	No description	N/A	Yes	N/A	N/A	N/A
145 Shoulder slope	9	3	Yes	Yes	One description	Yes	Yes	No	No	No
146 Height (infants)	2	0	Yes	One description	One description	Yes	No	No	No	No
147 Head height	8	0	Yes	One description	Yes	Yes	No	No	No	No
148 Face length	2	1	Yes	One description	No description	N/A	Yes	N/A	N/A	N/A

Refer to addenda for further information

Measurement (* = key dimension)	Number of respondents using the measurement	Number of respondents indicating problems	International description	International consensus	Consensus among respondents	Consensus between International and respondents' descriptions	Problems – yes / no	Problems related to straight / contoured	Problems related to landmarking	Landmarking difficulties and no consensus
149 Crown of skull to brows	1	1	Yes	One description	Yes	No	Yes	Yes	No	No
150 Chin to nose bridge	0	1	Yes	One description	No description	N/A	Yes	N/A	N/A	N/A
151 Chin to pit of neck	2	2	No description	N/A	No description	N/A	Yes	N/A	N/A	N/A
152 Head length	8	1	Yes	One description	Yes	Yes	Yes	No	No	No
153 Head width (cheekbones)	4	1	Yes	One description	One description	Yes	Yes	No	No	No
154 Head width	7	1	Yes	One description	Yes	Yes	Yes	No	No	No
155 Inter-pupillary distance	0	1	No description	N/A	No description	N/A	Yes	N/A	N/A	N/A
156 Sagittal arch	3	1	Yes	One description	No description	N/A	Yes	N/A	N/A	N/A

Refer to addenda for further information

Measurement (* = key dimension)	Number of respondents using the measurement	Number of respondents indicating problems	International description	International consensus	Consensus among respondents	Consensus between International and respondents' descriptions	Problems – yes / no	Problems related to straight / contoured	Problems related to landmarking	Landmarking difficulties and no consensus
157 Surface distance from above the ears across the top of the head	2	1	Yes	One description	One description	Yes	Yes	No	No	No
158 Head girth *	14	1	Yes	One description	Yes	Yes	Yes	No	No	No
159 Hand thickness	1	1	Yes	One description	No description	N/A	Yes	N/A	N/A	N/A
160 Palm length	1	2	Yes	One description	No description	N/A	Yes	N/A	N/A	N/A
161 Hand length	1	2	Yes	One description	No description	N/A	Yes	N/A	N/A	N/A
162 Wrist to index finger	1	1	Yes	One description	No description	N/A	Yes	N/A	N/A	N/A
163 Wrist to thumb tip length	1	2	Yes	One description	No description	N/A	Yes	N/A	N/A	N/A
164 Thumb length	1	1	Yes	One description	No description	N/A	Yes	N/A	N/A	N/A

Refer to addenda for further information

Measurement (* = key dimension)	Number of respondents using the measurement	Number of respondents indicating problems	International description	International consensus	Consensus among respondents	Consensus between International and respondents' descriptions	Problems – yes / no	Problems related to straight / contoured	Problems related to landmarking	Landmarking difficulties and no consensus
165 Index finger length	1	1	Yes	One description	No description	N/A	Yes	N/A	N/A	N/A
166 Middle finger length	1	1	Yes	One description	No description	N/A	Yes	N/A	N/A	N/A
167 Ring finger length	1	1	Yes	One description	No description	N/A	Yes	N/A	N/A	N/A
168 Little finger length	1	1	Yes	One description	No description	N/A	Yes	N/A	N/A	N/A
169 Hand width	1	2	Yes	One description	No description	N/A	Yes	N/A	N/A	N/A
170 Hand girth	1	2	Yes	One description	No description	N/A	Yes	N/A	N/A	N/A
171 Thumb girth	0	1	Yes	One description	No description	N/A	Yes	N/A	N/A	N/A
172 Index finger girth	0	1	Yes	One description	No description	N/A	Yes	N/A	N/A	N/A

Refer to addenda for further information

Measurement (* = key dimension)	Number of respondents using the measurement	Number of respondents indicating problems	International description	International consensus	Consensus among respondents	Consensus between International and respondents' descriptions	Problems – yes / no	Problems related to straight / contoured	Problems related to landmarking	Landmarking difficulties and no consensus
173 Middle finger girth	0	1	Yes	One description	No description	N/A	Yes	N/A	N/A	N/A
174 Ring finger girth	0	1	Yes	One description	No description	N/A	Yes	N/A	N/A	N/A
175 Little finger girth	0	1	Yes	One description	No description	N/A	Yes	N/A	N/A	N/A
176 Height of foot arch	9	2	Yes	One description	No description	N/A	Yes	N/A	N/A	N/A
177 Height of big toe	8	1	Yes	One description	One description	Yes	Yes	No	No	No
178 Toe height	8	0	No description	N/A	No description	N/A	No	N/A	N/A	N/A
179 Ball height	6	2	No description	N/A	No description	N/A	Yes	N/A	N/A	N/A
180 Plantar arch height	3	2	No description	N/A	No description	N/A	Yes	N/A	N/A	N/A

Refer to addenda for further information

Measurement (* = key dimension)	Number of respondents using the measurement	Number of respondents indicating problems	International description	International consensus	Consensus among respondents	Consensus between International and respondents' descriptions	Problems – yes / no	Problems related to straight / contoured	Problems related to landmarking	Landmarking difficulties and no consensus
181 Dorsal arch height	5	3	No description	N/A	No description	N/A	Yes	N/A	N/A	N/A
182 Outside ball height	6	3	No description	N/A	No description	N/A	Yes	N/A	N/A	N/A
183 Ankle length	5	0	No description	N/A	No description	N/A	No	N/A	N/A	N/A
184 Posterior heel contour	6	1	No description	N/A	No description	N/A	Yes	N/A	N/A	N/A
185 Foot length *	17	3	Yes	Yes	Yes	Yes	Yes	No	No	No
186 Ball length	6	0	Yes	One description	One description	Yes	No	No	No	No
187 Fifth toe length	3	0	No description	N/A	No description	N/A	No	N/A	N/A	N/A
188 Outside ball length	5	0	No description	N/A	No description	N/A	No	N/A	N/A	N/A

Refer to addenda for further information

Measurement (* = key dimension)	Number of respondents using the measurement	Number of respondents indicating problems	International description	International consensus	Consensus among respondents	Consensus between International and respondents' descriptions	Problems – yes / no	Problems related to straight / contoured	Problems related to landmarking	Landmarking difficulties and no consensus
189 Outside ball length diagonal	4	0	No description	N/A	No description	N/A	No	N/A	N/A	N/A
190 Width of three forward toes	4	0	No description	N/A	No description	N/A	No	N/A	N/A	N/A
191 Foot width diagonal	12	4	No description	N/A	No description	N/A	Yes	N/A	N/A	N/A
192 Foot width (ball width) *	12	3	Yes	Yes	One description	Yes	Yes	No	No	No
193 Width	8	0	No description	N/A	No description	N/A	No	N/A	N/A	N/A
194 Width of instep	9	2	No description	N/A	No description	N/A	Yes	N/A	N/A	N/A
195 Heel width	7	1	Yes	One description	No description	N/A	Yes	N/A	N/A	N/A

Refer to addenda for further information

Measurement (* = key dimension)	Number of respondents using the measurement	Number of respondents indicating problems	International description	International consensus	Consensus among respondents	Consensus between International and respondents' descriptions	Problems – yes / no	Problems related to straight / contoured	Problems related to landmarking	Landmarking difficulties and no consensus
196 Instep *	7	2	Yes	Yes	One description	No	Yes	No	No	No
197 Bridge circumference	13	5	Yes	Yes	Yes	Yes	Yes	No	Yes	No
198 Foot girth (ball of foot)	13	4	Yes	One description	One description	Yes	Yes	No	No	No
199 Angle line	4	1	No description	N/A	No description	N/A	Yes	N/A	N/A	N/A
200 Flare	3	2	No description	N/A	No description	N/A	Yes	N/A	N/A	N/A
201 Proportion of sole in contact with ground	6	2	No description	N/A	No description	N/A	Yes	N/A	N/A	N/A
202 Lateral foot contour by template	4	1	No description	N/A	No description	N/A	Yes	N/A	N/A	N/A
Totals – Yes			**59** ***71,1%***	**8** ***9,6%***	**7** ***8,4%***	**23** ***27,7%***	**59** ***71,1%***	**1** ***1,2%***	**11** ***13,3%***	**0** ***0,0%***

Refer to addenda for further information

Measurement (* = key dimension)	Number of respondents using the measurement	Number of respondents indicating problems	International description	International consensus	Consensus among respondents	Consensus between International and respondents' descriptions	Problems – yes / no	Problems related to straight / contoured	Problems related to landmarking	Landmarking difficulties and no consensus
Totals – N/A			**0** ***0,0%***	**24** ***28,9%***	**0** ***0,0%***	**56** ***67,5%***	**0** ***0,0%***	**54** ***65,1%***	**52** ***62,7%***	**54** ***65,1%***
Totals – No			**0** ***0,0%***	**0** ***0,0%***	**0** ***0,0%***	**4** ***4,8%***	**24** ***28,9%***	**28** ***33,7%***	**20** ***24,1%***	**29** ***34,9%***
Totals – No description			**24** ***28,9%***	**0** ***0,0%***	**54** ***65,1%***	**0** ***0,0%***	**0** ***0,0%***	**0** ***0,0%***	**0** ***0,0%***	**0** ***0,0%***
Totals – One description			**0** ***0,0%***	**51** ***61,4%***	**22** ***26,5%***	**0** ***0,0%***	**0** ***0,0%***	**0** ***0,0%***	**0** ***0,0%***	**0** ***0,0%***
Total			**83**	**83**	**83**	**83**	**83**	**83**	**83**	**83**

Refer to addenda for further information

With regard to the availability and consensus of international descriptions, the following is clear from **Table 4.7**:

- ✓ Only one description 61,4%
- ✓ International consensus 9,6%
- ✓ Not applicable 28,9% (because no international description was available)

For more than one quarter (28,9%) of the other body measurements there are no international descriptions available.

With regard to the respondents' descriptions, the following is clear from **Table 4.7**:

- ✓ Consensus 8,4%
- ✓ Only one description 26,5%
- ✓ No descriptions 65,1%

It seems clear that the respondents were not familiar with these measurements or that they did not regularly use these measurements, because for nearly two thirds of these other body measurements no descriptions were received from the respondents.

Problems were experienced with 71,1% of these body measurements. For only 1,2% of the measurements the problems were related to measuring straight or on the contour of the body and for 13,3% of the measurements problems were related to landmarking. Since the respondents gave descriptions for so few of these measurements, one would have expected problems with a larger number of these measurements. Problems seem to be mostly related to landmarking, but because of the limited feedback on these measurements it is not conclusive what the problems with these other body measurements are.

It seems that a wide variety of measurements are needed and are used in the South African clothing industry, and that an alarming number of problems exist with regard to the taking of these measurements – probably resulting in the consumer's current dilemma of not being able to find well-fitting garments.

4.5 SOUTH AFRICAN SIZING SYSTEMS (Objective 4)

The manufacturer of the fit dummies was not interviewed regarding sizing systems, block patterns, fit testing and wear testing (illustrated in **Figures 4.5 to 4.28**), since the company is not involved in the manufacturing of garments. Therefore the total number of respondents for the following results will be 12. It is however important to note that in some cases there were more than 12 responses because the respondents could give more than one answer, or less than 12 responses because the question was not applicable to all 12 of the respondents.

A study by Chun-Yoon and Jasper (1993) which compared international sizing systems, was used as the basis for the analysis of South African sizing systems. The South African sizing system will be described according to the following aspects:

- ✓ how it defines figure types or body shapes
- ✓ how it groups garment types
- ✓ how long the sizing system has been used
- ✓ where the sizing system originated
- ✓ how garment sizes are described
- ✓ which key dimensions are used for different garment types

4.5.1 Defining figure types or body shapes

From the results illustrated in **Figure 4.5** it is clear that the sizing systems being used in South Africa do not define figure type. Ten companies, including the three retailers, indicated that they do not differentiate between different figures and only cater for the average figure. Two manufacturers do provide for different heights. One retailer indicated that age is taken into account in the case of children's wear. One company made use of weight and age for infants. Three companies, one retailer and two manufacturers indicated that height and age are used in the case of children's wear. Three companies do provide for the fuller figure and one company provides for petite

or short figures. None of the companies define figure types by drop value (i.e. the difference between hip and bust circumference measurements) or body shape.

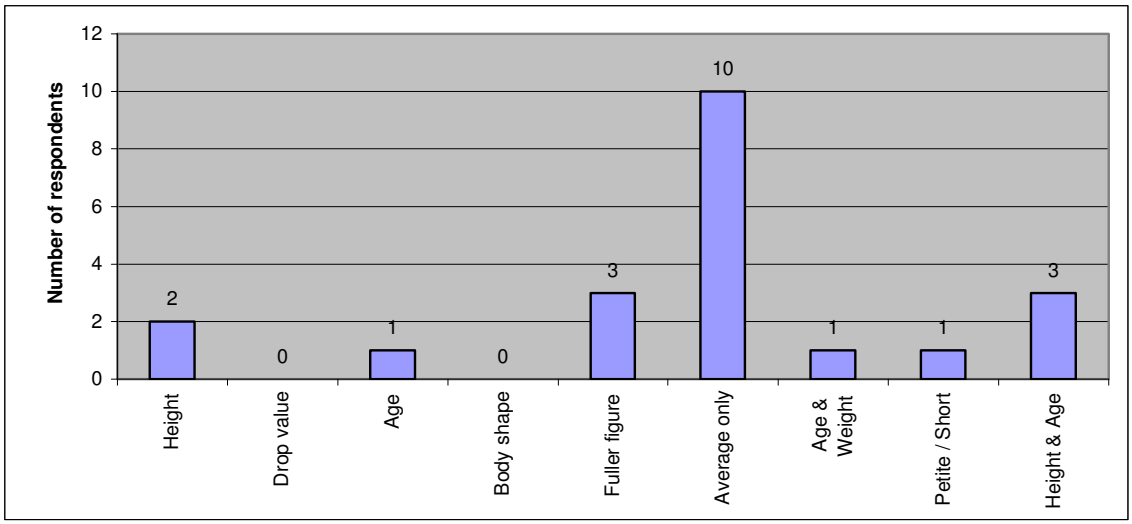

FIGURE 4.5: THE SA SIZING SYSTEM: DEFINING FIGURE TYPES

Drop value can assist in defining body shape. The international sizing systems studied by Chun-Yoon and Jasper (1993) classified female figure types in different terms although the same criterion were used, namely the drop value. The South African sizing system is not as sophisticated and this is confirmed by the fact that none of the companies use drop value or body shape to define different figure types. The use of height and age are mainly found in children's wear and it is more related to the size indication than to different height groups. It is not related to the changing of the body shape, proportions and posture with age. The average figure that the South African sizing system caters for, differs from one company to another, as will be discussed later. It is also true that the South African consumer is not as sophisticated as the international consumer, and the existing sizing system is already confusing. The general opinion is also that the market is too small for the sizing to be further split into different figure types and height groups. It would also complicate the distribution of stock to retail stores. This is precisely why a survey of the South African population measurements is so necessary. Only then will it be possible to establish exactly the shapes of the South African market. A proper survey of the body measurements of the South African population will not only provide accurate and current measurements, but also information on geographical distribution of the

population with regard to specific garment sizes. This will enable retailers to distribute garment sizes and styles more precisely to different locations, which will have a definite financial benefit for the retailers and manufacturers alike.

4.5.2 Classification of garments within the sizing system

Figure 4.6 illustrates how garments are grouped or classified. Two companies, one retailer and one manufacturer, group garments according to outerwear, underwear, lounge wear and swimwear, which is similar to the South Korean sizing system as discussed by Chun-Yoon and Jasper (1993). Six companies group garments by item or garment type, for example skirts, trousers, and so forth. One retailer groups garments according to formal wear, casual wear, outerwear and underwear. The other retailer groups garments according to smart wear, casual wear, active wear, lingerie, and each category divided into knitted or woven tops or bottoms. Shoes are grouped according to SAFLIA's classification.

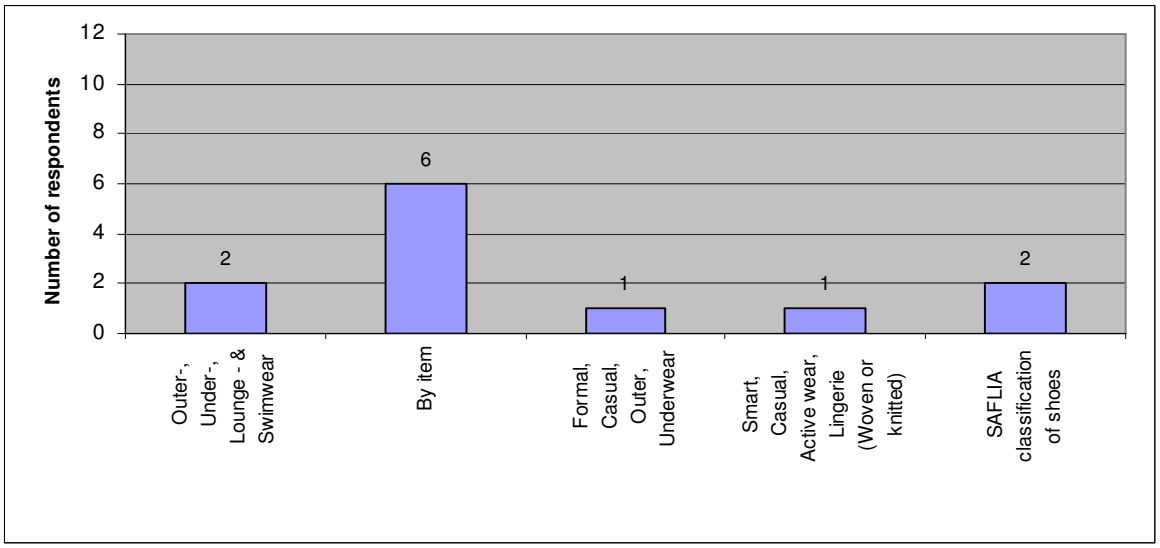

FIGURE 4.6: THE SA SIZING SYSTEM: GARMENT CLASSIFICATION

According to Chun-Yoon and Jasper (1993), most sizing systems classified garments into outerwear, underwear and other, and then sub-classified into upper-, whole, and

lower-body garments. In this study however, more of the respondents grouped garments by item, which is similar to the Japanese sizing system as discussed by Chun-Yoon and Jasper (1993). This means that size indication and key dimensions within the same grouping or classification of garments would be similar.

4.5.3 Origin and use of the sizing system in South Africa

From **Figure 4.7** it seems that the sizing system used in South Africa has been in use for a long time. Nine of the twelve companies indicated that the sizing system has been in use “forever”, or that they have “always” used it. Only three respondents did not know or, were not sure how long the sizing system has been used. It can be accepted that the sizing system used in South Africa has been in use for more than ten years, since more of the respondents have been in business for ten years or longer (see **Table 4.4**).

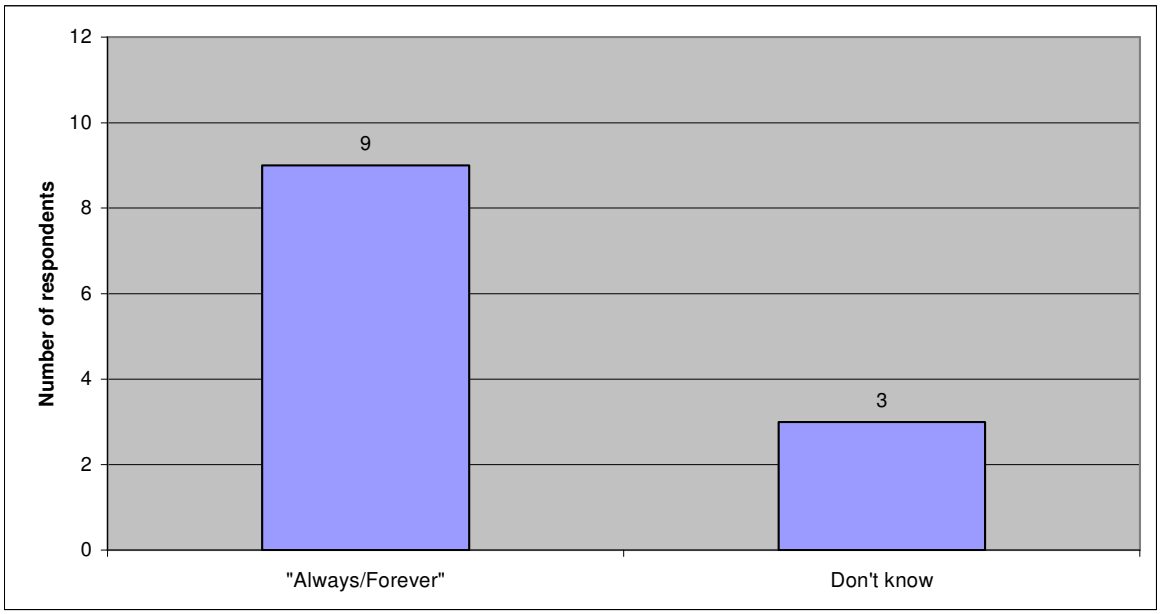

FIGURE 4.7: THE SA SIZING SYSTEM: HOW LONG HAS IT BEEN USED IN SA

The fact that the respondents do not really know since when the sizing system has been used, could be an indication of a don’t care attitude towards proper garment fit, since it is just another way of saying: “I don’t know.” It seems that the suitability of the

measurements of the sizing system is not considered, it is just accepted since it has been used "forever". This is obviously not necessarily an indication of a good or flawless system.

The sizing system in use in South Africa seems to be based on the British system as shown in **Figure 4.8**. Five companies indicated that the origin of our sizing system is British. Moritz (2000:40) also states that South Africa's sizing system has historically been based on the SizeUK charts. One manufacturer thought that the origin is a European system and another one, the manufacturer of diving suits, indicated that the sizing system is South African. The remaining five respondents were unsure of where the sizing system originated from. None of the respondents were of the opinion that the sizing system is of American or Japanese origin. The large number of respondents that do not know where the sizing system originated is a worrying aspect since this is an indication of ignorance, or a don't care attitude. The body size and shape of the population of the country where the sizing system was developed and the body size and shape of the South African population could give an indication of the applicability of the sizing system currently in use.

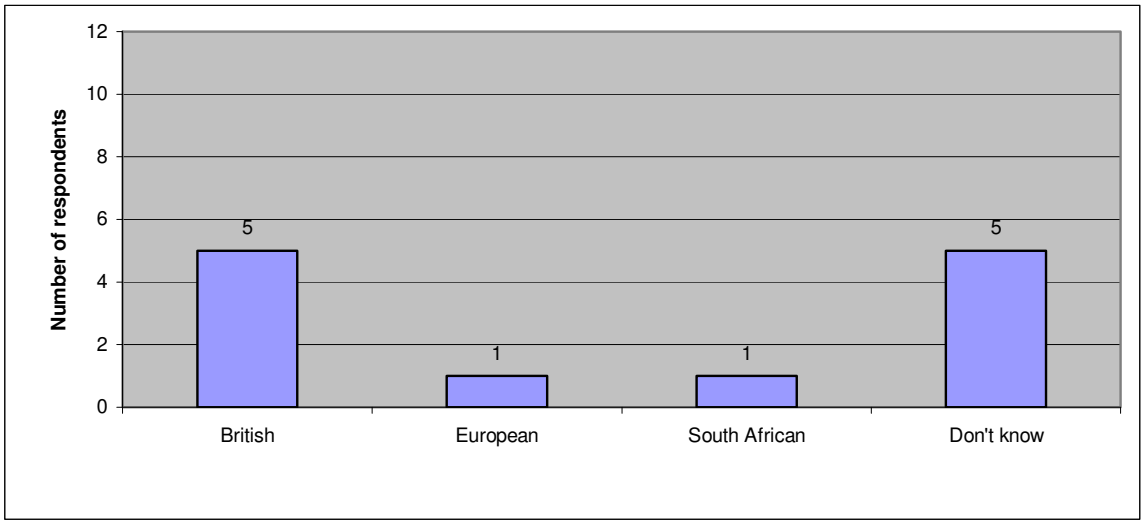

FIGURE 4.8: ORIGIN OF SOUTH AFRICAN SIZING SYSTEM

Measurements have been adjusted (see **Figure 4.9**) over time as changes were noticed in the South African consumer. According to Defty (1988:16), no rigid rules

can be applied to sizing charts. Seven respondents confirmed that the standard measurements supporting the sizing system are adjusted from time to time. All seven did however state that it was not done on a regular basis or at specific intervals. The remaining five respondents did not adjust the measurements. These five respondents included the hat and cap manufacturer, the footwear retailer, the footwear manufacturer and two clothing manufacturers who were more involved in the manufacturing of uniforms and corporate clothing, which could explain why they do not alter their standard size charts. Hats and caps are made from standard blocks and footwear is made on standard lasts, and therefore depended on the measurements used for the manufacturing of the equipment. Uniforms and corporate wear are not so much influenced by fashion and the fit has to stay consistent. Uniforms and corporate wear are supplied over longer periods and do not change as often as fashion garments. This explains why these five respondents indicated that their sizing charts are not adjusted.

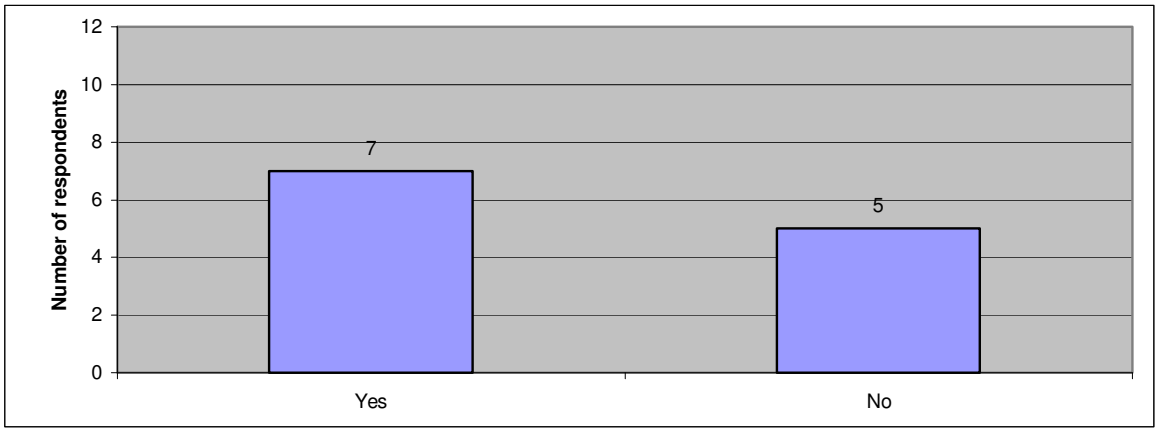

FIGURE 4.9: THE SA SIZING SYSTEM: ADJUSTMENTS OVER TIME

Although the South African system seems to be based on the British system, according to the respondents, the data behind the sizing system are South African as far as possible. This data is gathered through experimenting with measurement changes and experience of the South African consumers' preferences. Measurement surveys have been undertaken in the past by some retailers, but the information is not available for everybody in the clothing industry to use. Experimenting with the

measurements can be costly to the retailer and the manufacturer, because sales are lost when garments do not fit. This once again highlights the importance of an independent survey of the body measurements of the South African population.

The measurements of the size chart supporting the sizing system are adjusted for a variety of reasons and these are illustrated in **Figure 4.10**. Customer complaints are the most common reason for altering the measurements of the sizing system, with five companies listing that as a reason. Two companies based the changes on research (doing body measurement surveys). One company used feedback from fit testing, and three companies monitored their sales. This included investigating lost sales, as well as good sellers.

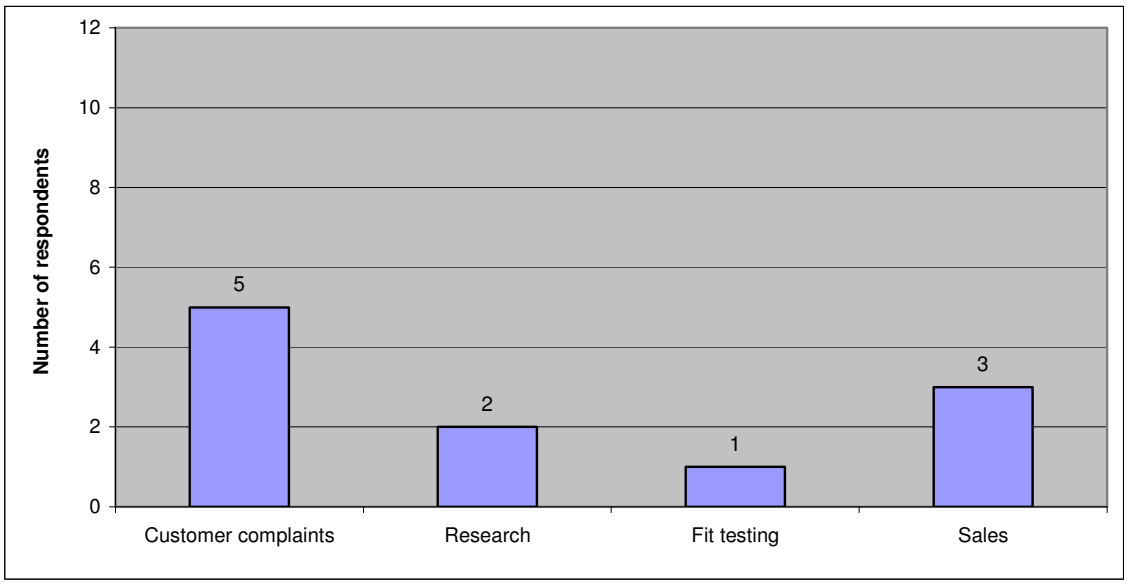

FIGURE 4.10: THE SA SIZING SYSTEM: REASONS FOR ADJUSTING MEASUREMENTS

It seems that customers play an important role in identifying the need for changes to the body measurements used in the size charts. Sales information also reflects customer satisfaction with the garments. Only two companies mentioned the use of research, which included measurement surveys and focus groups, to base amendments to the standard measurements on. This again highlights the need for a comprehensive South African body measurement survey with information that is

accessible to all the interested parties in the clothing industry. It is interesting that only one company makes use of fit testing for feedback regarding the body measurements. It might be worthwhile for all the companies to investigate the potential of gaining more information from fit testing, since it is done in any case.

4.5.4 Size designation

Consumers use size labels to establish the garment size before they try on the garment (Chun-Yoon & Jasper, 1993). Size designation will be illustrated and discussed according to garment type. **Figure 4.11** indicates that for sportswear or non-fitting garments, six companies make use of small, medium, large and so forth to identify the size of the garment. One manufacturer noted that in the case of children's wear, age is used to indicate size for this garment type.

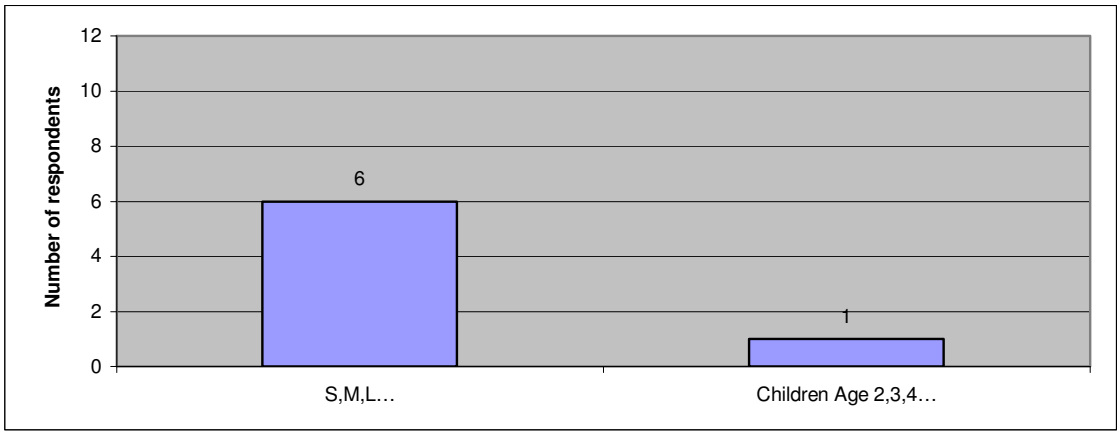

FIGURE 4.11: THE SA SIZING SYSTEM: SIZE DESIGNATION FOR SPORTSWEAR OR NON-FITTING GARMENTS

When clothes are loose fitting, fewer sizes are necessary to accommodate the whole population. Additional tolerance is built into a size to make it possible for individuals of different body measurements to fit into the same size, a medium for example. The use, availability and fashionability of stretch fabrics make this an acceptable size designation even for fitting garment styles, since the stretch fabrics can accommodate a variety of body measurements within one size.

For trousers, four companies use the codes 8, 10, 12, and so forth on ladies' trousers and/or 32, 34, 36, and so forth on ladies' as well as men's wear to indicate the size (see **Figure 4.12**). One retailer used both size codes together: 8/32, 10/34, 12/36 and so forth, on their ladies' wear trousers. For tailored pants, traditional men's suit sizes are used by two companies to indicate size. Two companies also indicated that men's waist measurement in centimetres, for example 76 or 81 and so forth is used to indicate the size of men's trousers. For children's trousers, age in years, for example 2, 3 and older, indicate the size of the trousers. These results are illustrated in **Figure 4.12**.

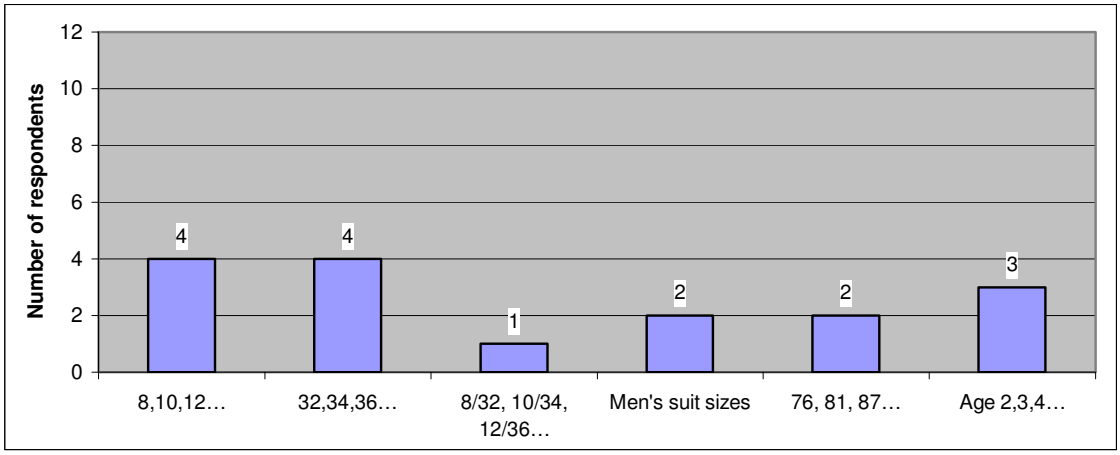

FIGURE 4.12: THE SA SIZING SYSTEM: SIZE DESIGNATION FOR TROUSERS

Figure 4.13 gives a breakdown of how sizes are indicated on skirts. Four companies use the symbols 8, 10, 12 and larger. Three companies still use 32, 34, 36 and larger. One retailer used both size designations (8/32, 10/34, 12/36 and so forth) to identify the size of their skirts. Only one manufacturer, making uniforms, uses hip circumference in centimetres to indicate skirt sizes. For children's skirts, age in years, for example 2, 3, 4 and older indicates size.

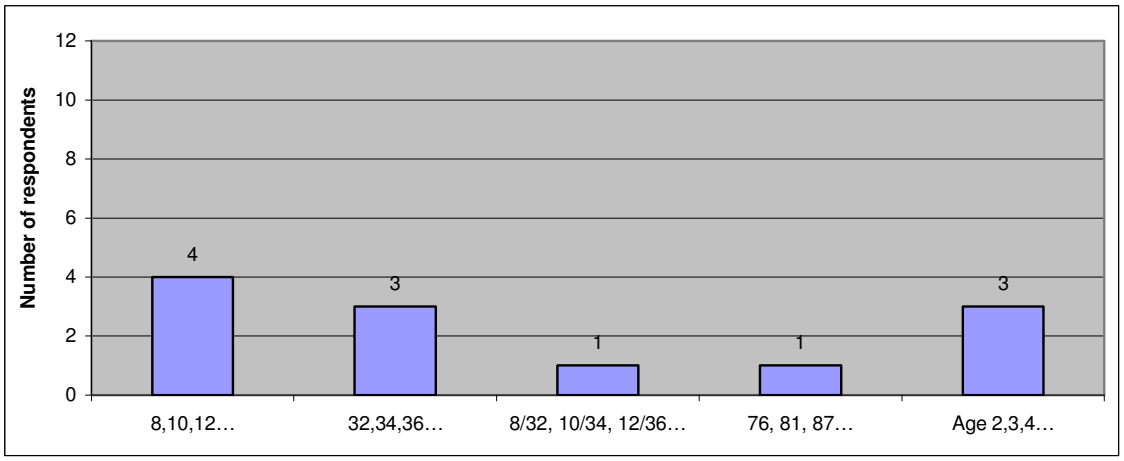

FIGURE 4.13: THE SA SIZING SYSTEM: SIZE DESIGNATION FOR SKIRTS

The size designation for upper body garments are illustrated in **Figure 4.14**. Four companies use the size codes 8, 10, 12 and larger to indicate the size of ladies' upper body garments. Three companies use 32, 34, 36 and larger to indicate the size of ladies' upper body garments. One retailer used both 8/32, 10/34, 12/36 and larger to identify the size of ladies' upper body garments. Five companies confirmed that for men's shirts the neck circumference in centimetres is used to indicate size, for example 38, 39, 40 and larger. Two companies indicated that traditional men's suit sizes are used for size identification on men's upper body garments. Two companies use chest circumference in centimetres to indicate the size of men's upper body garments. For children's upper body garments, three companies use age in years, for example 2, 3, 4, and older to indicate the size.

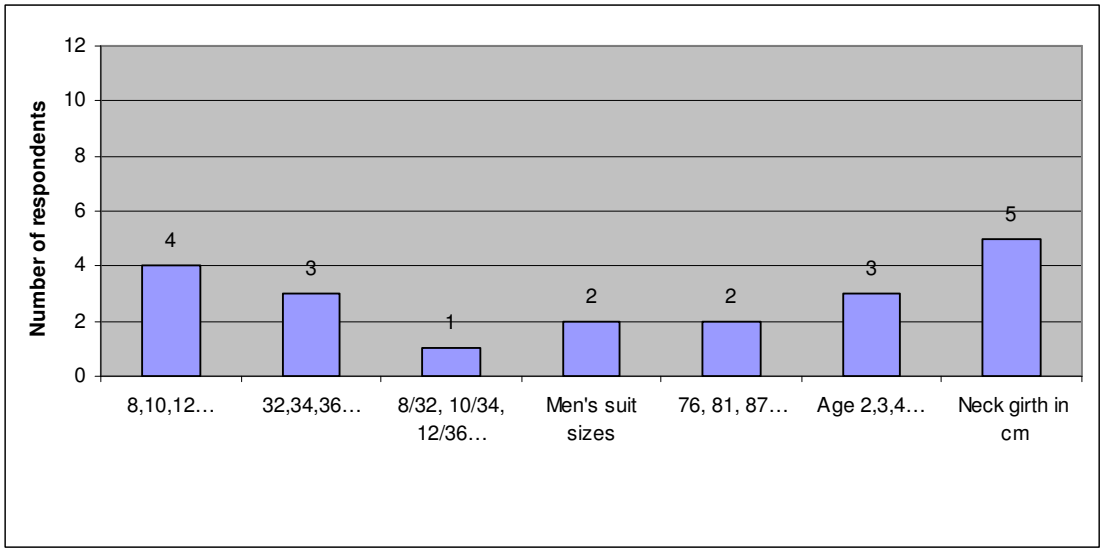

FIGURE 4.14: THE SA SIZING SYSTEM: SIZE DESIGNATION FOR UPPER BODY GARMENTS

It is clear from **Figures 4.12, 4.13 and 4.14** that in the case of trousers, skirts and upper body garments a numerical value is used to indicate the size on a garment. Women's sizes are labelled by arbitrary numeric codes which do not represent body measurements or age (Winks, 1997b:2 and Chun-Yoon & Jasper, 1993). This practise is confirmed by the South African companies, where the numerical size code on ladies' wear is not an indication of any specific body measurement.

In the case of men's wear the numerical code is related to the relevant body measurement for the garment type, for instance waist circumference in centimetres in the case of trousers and neck circumference in centimetres in the case of shirts. Traditional suit sizes are also sometimes used in the sizing of men's tailored pants and jackets.

It seems that infants' and children's wear are mostly sized according to age, regardless of whether it is loose fitting garments such as tracksuits or something more snugly fitting such as jeans. The numerical size code on children's wear therefore refers to the age group that the garment is supposed to fit. This confirms

Winks's (1997b:4) statement that children's and infants' clothing is often designated by age alone.

TABLE 4.8: THE SA SIZING SYSTEM: SIZE DESIGNATION FOR HATS AND CAPS

Garment type	Size designation		
Hats	Children and adult sizes: S, M, L and larger	Baby sizes: 0-6 months; 6-12 months; 12-18 months; 18-24 months	
Caps			Baby all fit; 2-6 years; 7-14 years; Adult all fit

Only one company manufactured hats and caps. The size designations for headwear are listed in **Table 4.8**. Caps often have an adjustable strap at the back, which makes it possible to fit a variety of head circumferences with just a few sizes.

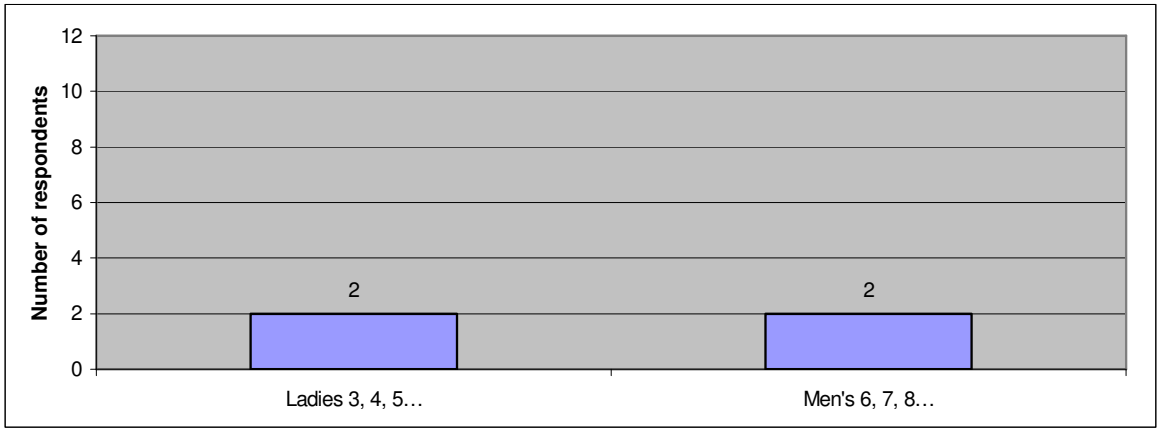

FIGURE 4.15 THE SA SIZING SYSTEM: SIZE DESIGNATION FOR SHOES

The shoe retailer and manufacturer both indicated that shoe sizes are for ladies' shoes from size 3 to size 9, and for men's shoes from size 6 to size 13. This is illustrated in **Figure 4.15.**

The shoe retailer noted that only some sport shoes are available in half sizes, which allow a bit of extra width in the shoe. According to the International Shoe Size Conversion Charts, the size designation used in South Africa seems to be similar to that used in the United Kingdom.

4.5.5 Key dimensions

Key dimensions are the suggested body measurements that can be used to describe the size of a garment (Chun-Yoon & Jasper, 1993). The ISO suggests that key dimensions be indicated on the size labels, but this is not the case in South Africa. The respondents were asked to name the critical measurements for pattern making and thus for ensuring a good fit.

The descriptions of the key dimensions were compared with regard to the following aspects:
Whether an international description was available;

- ✓ whether an international description was available;
- ✓ whether there was consensus among the international descriptions or only one international description;
- ✓ whether there was consensus among the respondent's descriptions, only one description or no description from respondents;
- ✓ whether there was consensus between the international and the respondents' descriptions;
- ✓ whether problems were related to no consensus about measuring straight or on the contour;
- ✓ whether problems were related to landmarking;
- ✓ whether problems were related to landmarking as well as no consensus.

Table 4.9 reflects the complete list of key dimensions identified by the respondents as well as the summary of the results from the above comparison.

TABLE 4.9: SUMMARY OF RESULTS FOR KEY DIMENSIONS

Key dimension	International description	International consensus	Consensus among respondents	Consensus between International and respondents' descriptions	Problems – yes / no	Problems related to straight / contoured	Problems related to landmarking	Landmarking difficulties and no consensus
1 Height	Yes	Yes	Yes	Yes	No	No	No	No
3 Cervical height	Yes	No	No	No	No	Yes	No	No
4 Side neck height	Yes	One description	No	No	Yes	Yes	Yes	Yes
24 Centre back waist to ground	No description	N/A	No	N/A	No	Yes	No	No
28 Front waist to ground	Yes	One description	No	No	No	Yes	Yes	No
31 Outside leg length	Yes	Yes	No	No	Yes	Yes	Yes	Yes
32 Inside leg length	Yes	Yes	Yes	Yes	Yes	No	Yes	No
33 Trunk length	Yes	One description	No	No	Yes	Yes	Yes	Yes
34 Total crotch length	Yes	Yes	Yes	Yes	Yes	No	No	No
37 Body rise	Yes	No	No	No	Yes	No	Yes	Yes

Refer to addenda for further information

Key dimension	International description	International consensus	Consensus among respondents	Consensus between International and respondents' descriptions	Problems – yes / no	Problems related to straight / contoured	Problems related to landmarking	Landmarking difficulties and no consensus
38 Back waist length	Yes	Yes	Yes	Yes	No	Yes	Yes	No
46 Side neck to breast point	Yes	Yes	Yes	Yes	Yes	No	Yes	No
56 Armscye depth	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
59 Shoulder to wrist	Yes	One description	No	No	Yes	No	Yes	Yes
60 Arm length bent	Yes	Yes	No	No	Yes	No	Yes	Yes
64 Under arm length	Yes	Yes	No	No	Yes	No	Yes	Yes
77 Shoulder width (back)	Yes	No	No	No	Yes	Yes	Yes	Yes
79 Across back width	Yes	No	No	No	Yes	No	Yes	Yes
80 Across front width	Yes	No	No	No	Yes	No	Yes	Yes
82 Bust width	Yes	Yes	Yes	Yes	Yes	No	No	No
92 Neck base girth	Yes	Yes	No	No	Yes	No	Yes	Yes
94 Chest girth	Yes	Yes	Yes	Yes	No	No	Yes	No
95 Bust girth	Yes	Yes	No	No	No	No	Yes	Yes
98 Waist girth	Yes	Yes	Yes	Yes	No	No	Yes	No
103 Hip girth	Yes	Yes	No	No	No	No	Yes	Yes

Refer to addenda for further information

Key dimension	International description	International consensus	Consensus among respondents	Consensus between International and respondents' descriptions	Problems – yes / no	Problems related to straight / contoured	Problems related to landmarking	Landmarking difficulties and no consensus
107 Upper arm girth straight	Yes	Yes	Yes	Yes	No	No	No	No
109 Elbow girth straight	Yes	One description	No	No	No	No	No	No
111 Forearm girth	Yes	One description	No	No	No	No	No	No
112 Wrist girth	Yes	Yes	Yes	Yes	No	No	No	No
113 Thigh girth	Yes	No	No	No	No	No	Yes	Yes
158 Head girth	Yes	One description	Yes	Yes	Yes	No	No	No
185 Foot length	Yes	Yes	Yes	Yes	Yes	No	No	No
192 Foot width (ball width)	Yes	Yes	One description	Yes	Yes	No	No	No
196 Instep	Yes	Yes	One description	No	Yes	No	No	No

Refer to addenda for further information

Key dimension	International description	International consensus	Consensus among respondents	Consensus between International and respondents' descriptions	Problems – yes / no	Problems related to straight / contoured	Problems related to landmarking	Landmarking difficulties and no consensus
198 Foot girth (ball of foot)	Yes	One description	One description	Yes	Yes	No	No	No
Totals – Yes	**34** ***97,1%***	**20** ***57,1%***	**12** ***34,3%***	**15** ***42,9%***	**21** ***60,0%***	**9** ***25,7%***	**21** ***60,0%***	**15** ***42,9%***
Totals – N/A	**0** ***0,0%***	**1** ***2,9%***	**0** ***0,0%***	**1** ***2,9%***	**0** ***0,0%***	**0** ***0,0%***	**0** ***0,0%***	**0** ***0,0%***
Totals – No	**0** ***0,0%***	**6** ***17,1%***	**20** ***57,1%***	**19** ***54,3%***	**14** ***40,0%***	**26** ***74,3%***	**14** ***40,0%***	**20** ***57,1%***
Totals – No description	**1** ***2,9%***	**0** ***0,0%***	**0** ***0,0%***	**0** ***0,0%***	**0** ***0,0%***	**0** ***0,0%***	**0** ***0,0%***	**0** ***0,0%***
Totals – One description	**0** ***0,0%***	**8** ***22,9%***	**3** ***8,6%***	**0** ***0,0%***	**0** ***0,0%***	**0** ***0,0%***	**0** ***0,0%***	**0** ***0,0%***
Total	**35**	**35**	**35**	**35**	**35**	**35**	**35**	**35**

Refer to addenda for further information

With regard to the availability and consensus of international descriptions, the following is clear from **Table 4.9**:

- ✓ Only one description 22,9%
- ✓ International consensus 57,1%
- ✓ No description 2,9%
- ✓ No consensus 17,1%

Because these are the key dimensions for pattern drafting and sizing of garments, it is alarming that for 20,0% of the measurements there are no international consensus or no international description. One would have expected international descriptions for all key dimensions, since they are so important for ensuring good fit.

With regard to the respondents' descriptions, the following is clear from **Table 4.9**:

- ✓ Consensus 34,3%
- ✓ No consensus 57,1%
- ✓ Only one description 8,6%

Again, it is alarming that for such a large number of key dimensions (57,1%), the respondents do not agree on the description of how and/or where the measurement should be taken. Because of the importance of the key dimensions, this finding is real cause for concern. This aspect needs serious attention from the industry, since these measurements are critical for providing a good fit in garments.

With regard to consensus between the international and the respondents' descriptions, the following is clear from **Table 4.9**:

- ✓ Consensus 42,9%
- ✓ No consensus 54,3%
- ✓ Not applicable 2,9% (because no international description was available)

It is a worrying fact that there seems to be consensus between the international and the respondents' descriptions for less than half of the key dimensions. Since international descriptions are available for 97,1% of the key dimensions, this result clearly shows that the respondents often disagree with the international descriptions.

It can also be an indication that the international description is vague with regard to landmarking and measuring method, which leads to confusion and a different interpretation of the description by the respondents. This has definite implications for the taking of consistent and accurate measurements, which further impacts on the drafting of well-fitting patterns.

From **Table 4.9** it is clear that the respondents experience problems with 60,0% of the key dimensions. This is an alarming number of problem measurements, which can only predict problems with the sizing and fit of clothing items. The industry clearly realises the problem by admitting to having problems with the key dimensions. It implies that the respondents from the industry probably value and are interested in having accurate body measurements, which highlights the need for a body measurement survey of the South African population.

From **Table 4.9** it is clear that problems are related to:

- ✓ Landmarking 60,0%
- ✓ Landmarking and consensus 42,9%
- ✓ Straight/contoured measurement 25,7%

It is clear that the problems are more related to landmarking, as well as landmarking and consensus. This has important implications for taking accurate body measurements and drafting well-fitting patterns, especially because the key dimensions are the foundation of the basic patterns. Once again, the importance of having clear and detailed descriptions on the identification of landmarks and measuring techniques is highlighted. Since the key dimensions are so important for proper fit and correct sizing of garments, it is clear that the situation regarding the descriptions of key dimensions needs serious attention from the clothing industry.

The key dimensions named by the respondents are now illustrated and discussed according to main garment types. A study by Simmons and Istook (2003:308) identified 16 body measurements, as identified by pattern making experts and textbooks, which were considered critical for the drafting of basic block patterns. In the discussion and interpretation, the identified key dimensions will also be compared

to the relevant measurements from the 16 identified for the study by Simmons and Istook (2003).

The key dimensions used for trousers are illustrated in **Figure 4.16**. For trousers, eight respondents used waist circumference as a key dimension. Seven respondents used hip circumference. All the retailers and manufacturers of garments (nine) listed outer leg length and eight listed inner leg length as key dimensions. One respondent noted that inner leg is used for men's trousers and outside leg for ladies' trousers. Crotch length is used by six of the respondents. Only one respondent indicated that rise height was a key dimension for trousers. Thigh girth was used by four respondents.

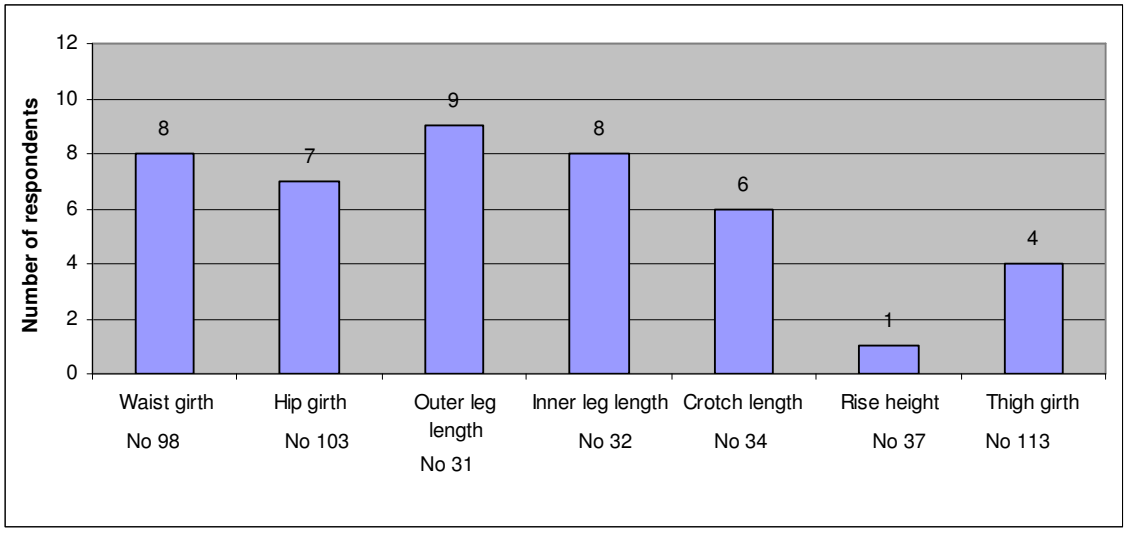

FIGURE 4.16: THE SA SIZING SYSTEM: KEY DIMENSIONS FOR TROUSERS

The critical measurements identified by Simmons and Istook (2003) that would be applicable to trousers included waist by natural indentation/waist by navel circumference, hips/seat circumference, inseam, outseam, rise, crotch length and thigh circumference. The key dimensions stated by the respondents correspond with the critical measurements identified in the study by Simmons and Istook (2003). It is important to note that the respondents refer to the circumference at the natural waist and not at the level of the navel which is suggested as an alternative measurement

by Simmons and Istook (2003). Rise is however identified as a key dimension by one respondent only, which is a worrying fact. Rise is very important in order to distribute the crotch length and subsequently determine the curve of the crotch seam. The correct shape of the crotch seam is critical for the fit of trousers, and it is therefore surprising that more respondents did not regard the rise measurement as a key dimension.

The key dimensions used for skirts are illustrated in **Figure 4.17**. Five companies use waist as a key dimension and six companies use hip as a key dimension. Three companies indicated that centre back length of the garment is also necessary. Only one company listed centre front length of the garment as a key dimension. These however refer to garment measurements and not actual body measurements, although garment measurements are based on body measurements. Waist and hip girth are also the only ones among the 16 critical measurements identified by Simmons and Istook (2003) that are applicable to skirts.

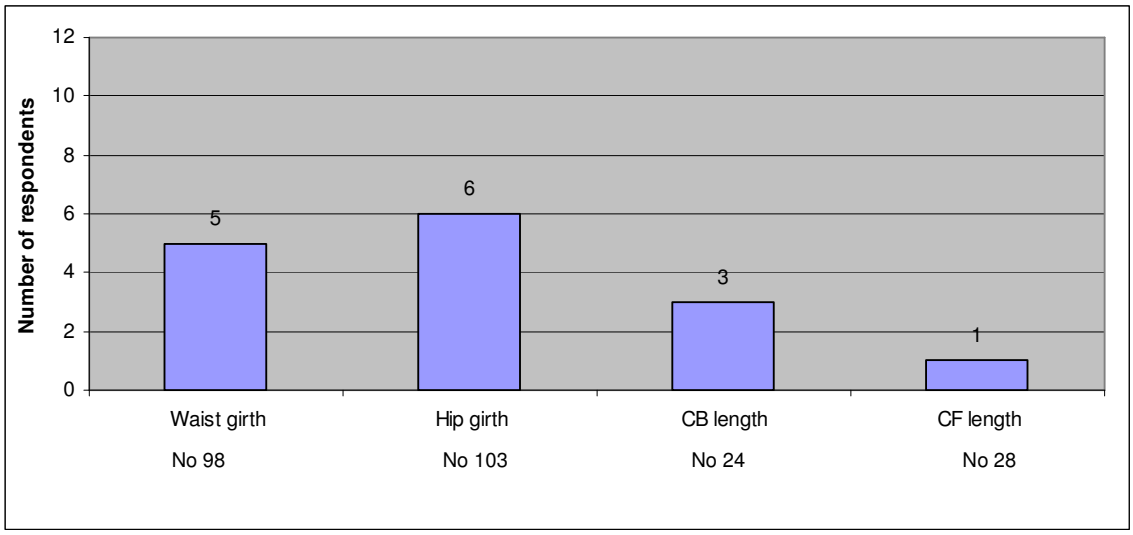

FIGURE 4.17: THE SA SIZING SYSTEM: KEY DIMENSIONS FOR SKIRTS

Hip circumference, waist circumference and garment length (outer leg length for trousers) are the most used measurements for skirts and trousers, as suggested by

Chun-Yoon and Jasper (1993:34). If one refers to **Figures 4.15** and **4.16**, this is confirmed by the results from this study.

Key dimensions for upper body garments are illustrated in **Figure 4.18**. All the retailers and clothing manufacturers use bust or chest circumference as a key dimension for upper body garments. Waist circumference and hip circumference are used by six and seven respondents respectively. Bicep circumference is used by four and wrist circumference by one manufacturer. These two measurements are necessary when manufacturing tight fitting ladies' garments. Neck circumference was listed by five respondents and is critical for the manufacturing of men's shirts. Nape to waist was listed by one respondent and centre back length of the garment was listed as a key dimension by three of the respondents. Across back and across front were listed as key dimensions by three and two companies respectively. Overarm or sleeve length (measured differently) was noted to be a key dimension by four of the respondents. Two of the respondents use shoulder to shoulder as a key dimension. One respondent listed shoulder to bust point and bust point to bust point as critical measurements for ladies' wear. These measurements are important for the placement of pockets or embroidery on the front of ladies' blouses. One respondent also listed scye depth, forearm circumference and underarm length as key dimensions.

The critical measurements from the study by Simmons and Istook (2003) that would be applicable to upper body garments included mid-neck/neck base circumference, chest/bust circumference, waist by natural indentation/waist by navel circumference, hips/seat circumference, sleeve length/arm length, shoulder length, across-back, across-chest, back of neck to waist, biceps circumference, and wrist circumference. These measurements were also identified as key dimensions by the respondents, except for shoulder length, which refers to the distance from side neck to the shoulder joint (Simmons and Istook, 2003:313). A study by Chun-Yoon and Jasper (1996:90) also identified shoulder length as a key dimension for ladies' upper body garments. The respondents noted that shoulder to shoulder is a key dimension; however, the above two studies did not mention this measurement. Shoulder to shoulder could be critical for men's wear to aid in determining the corresponding garment measurement. This would be applicable to men's shirts and t-shirts that are

not really close-fitting. For ladies the appearance of the garment at the shoulder can determine the success of the garment, particularly in tailored jackets for instance. If the shoulder seams do not fit properly the garment can appear to be too small or too large, regardless of whether the bust dimension is correct. Therefore the shoulder length, from side neck to shoulder, is a critical measurement.

The respondents identified centre back garment length as a key dimension. Although only one respondent identified nape to waist as a key dimension, the centre back garment length would incorporate the nape to waist dimension. Garment length was also listed as a key dimension for ladies' upper body garments by Chun-Yoon and Jasper (1993:35).

Again, it must be noted that the respondents referred to the circumference at the natural waist, and not at the level of the navel, which is also suggested as an alternative measurement by Simmons and Istook (2003). The neck girth that the respondents referred to is also the neck base girth and not the mid-neck girth, which is suggested as an alternative measurement. The mid-neck girth is more applicable to men's formal shirts, since it is used as the collar measurement. The neck base girth is however more useful for ladies because of the variety of collarless garment styles (Simmons & Istook, 2003). The respondents also noted that bicep girth is especially important when manufacturing for the fuller figure. It seems that the upper arm is a problem area on the body and that little information is available regarding accurate measurements.

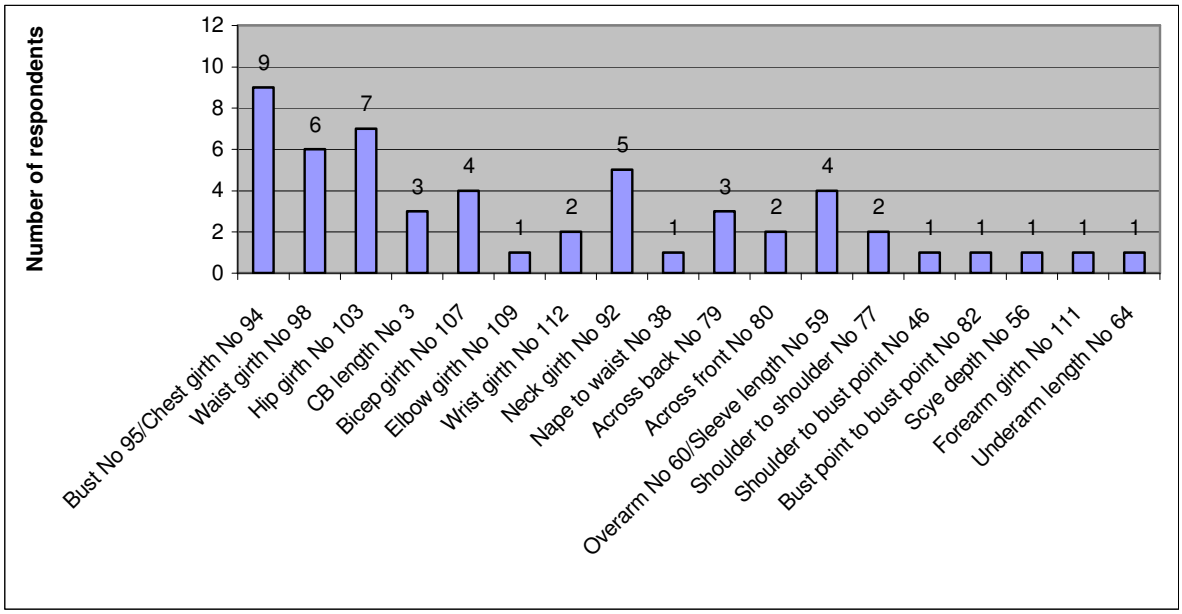

FIGURE 4.18: THE SA SIZING SYSTEM: KEY DIMENSIONS FOR UPPER BODY GARMENTS

Measurements that are required for garments covering the whole body are illustrated in **Figure 4.19**. These measurements are required together with the key dimensions for upper body garments as well as trousers and skirts. One company noted that neck shoulder point to foot, and neck shoulder point to crotch are critical for making Babygros™. The other company stated that neck shoulder point to crotch and total height, were critical in the manufacturing of diving suits. These measurements are used together with the relevant measurements from lower and upper body garments as illustrated in **Figures 4.16, 4.17** and **4.18**, for instance bust, waist, hip circumference and garment length.

The measurements identified in **Figure 4.19** for full body garments were not included in the list of 16 critical measurements identified by Simmons and Istook (2003).

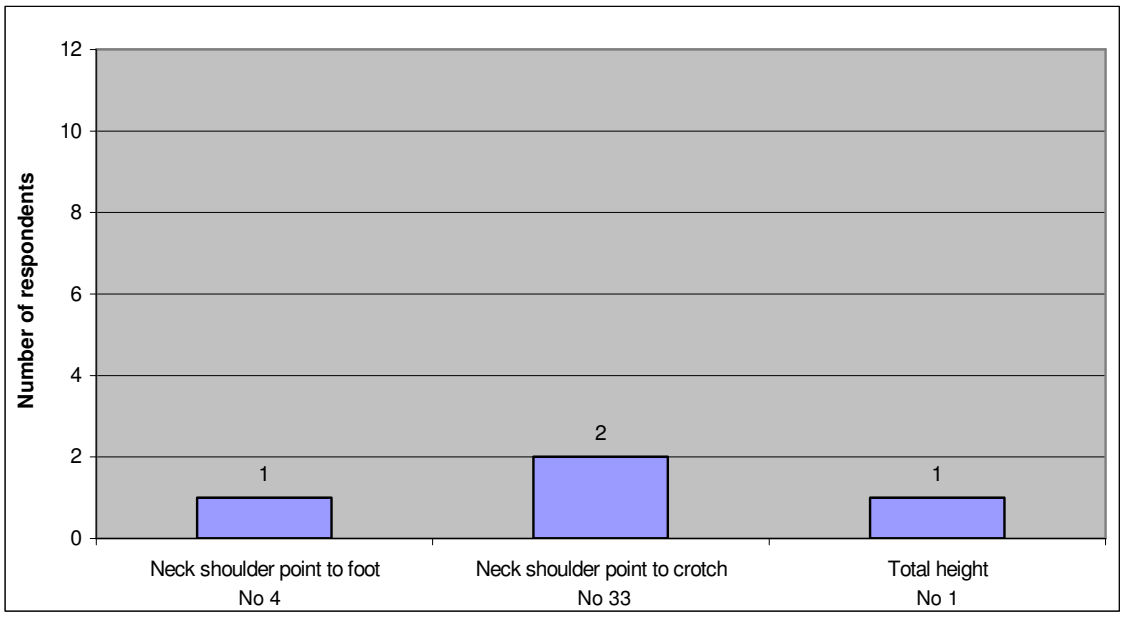

FIGURE 4.19: THE SA SIZING SYSTEM: KEY DIMENSIONS FOR FULL BODY GARMENTS

The one hat and cap manufacturer confirmed Winks' (1990:22) statement that for the sizing of headwear a single body measurement – that of head girth – is sufficient to provide a range of fittings. This is illustrated in **Figure 4.20**.

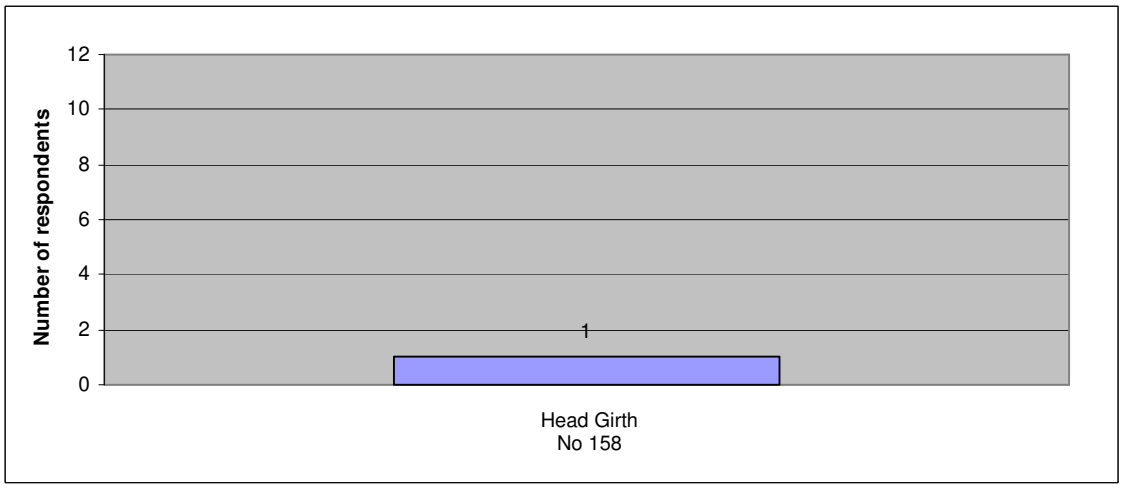

FIGURE 4.20: THE SA SIZING SYSTEM: KEY DIMENSIONS FOR HEADWEAR

The key dimensions for footwear are illustrated in **Figure 4.21**. The shoe manufacturer listed foot length, foot width and instep girth as critical measurements. The shoe retailer listed foot length, instep girth and joint girth, or girth around ball of foot, as critical measurements.

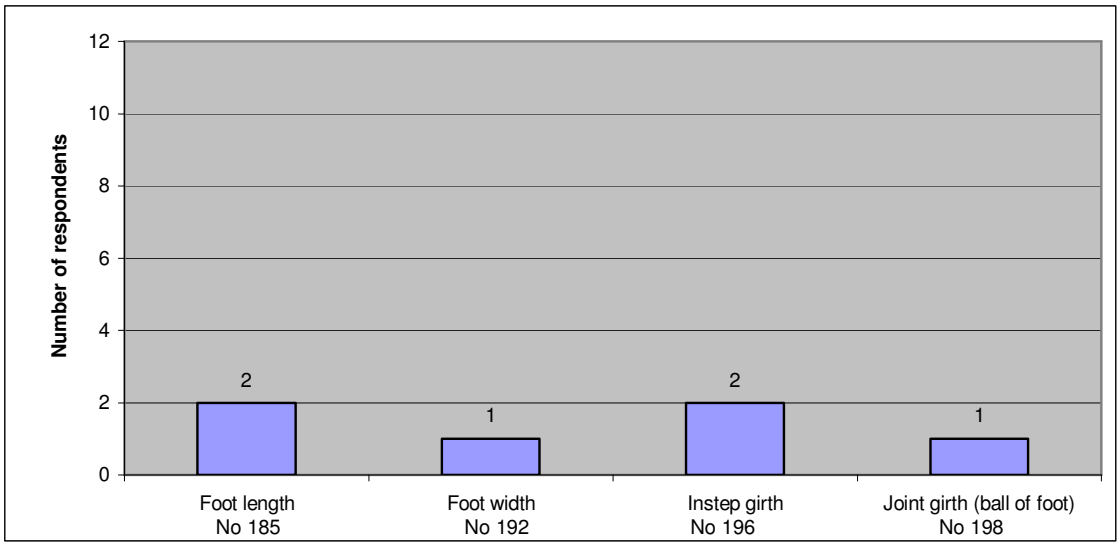

FIGURE 4.21: THE SA SIZING SYSTEM: KEY DIMENSIONS FOR FOOTWEAR

4.6 BLOCK PATTERNS (Objective 5)

The basic pattern is a simple pattern that fits the body with just enough ease for movement and comfort. It is sometimes called a master or foundation pattern and the drafted pattern is referred to as a block. The basic pattern is the starting point for pattern designing and it is the basis for fit of garments (LaBat & DeLong, 1990:44; Hollen, 1981:5).

One retailer developed the basic blocks and supplied them to their manufacturers. The other two retailers, as well as six of the seven clothing manufacturers, indicated that the manufacturers were responsible for developing the block patterns. The

headwear manufacturer used existing block patterns of which the origin was unknown. The shoe manufacturer and retailer both indicated that standard lasts were used for developing the patterns for shoes.

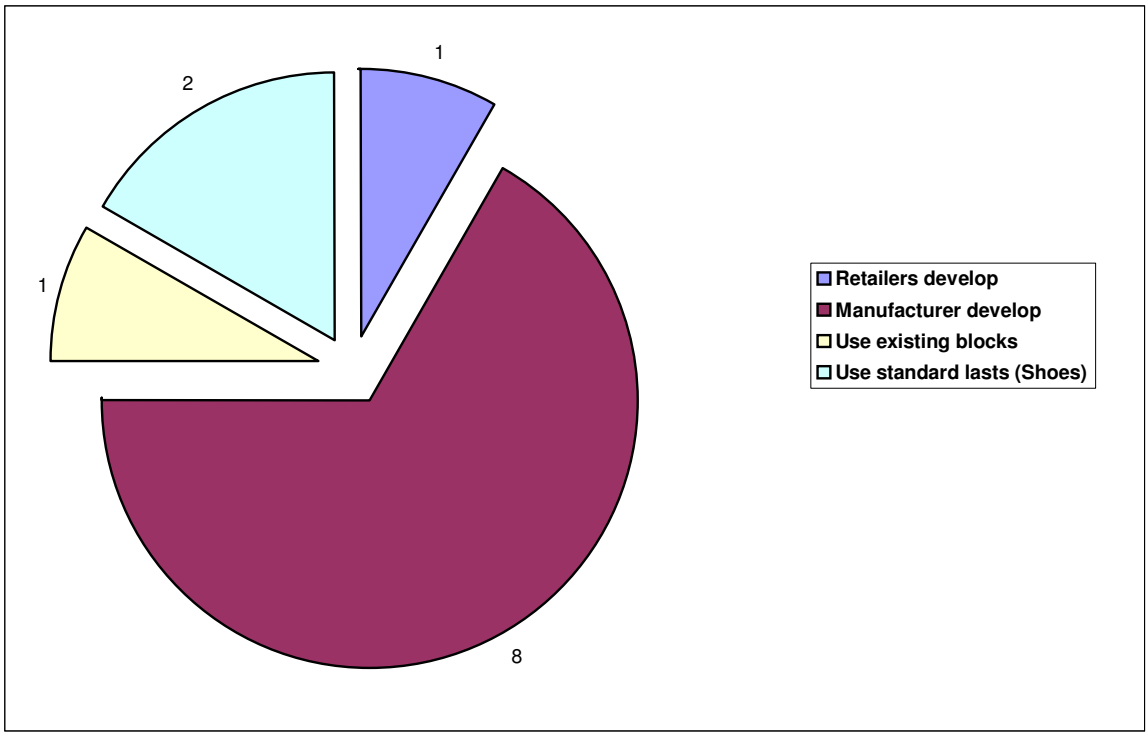

FIGURE 4.22: ORIGIN OF BASIC BLOCKS

The respondents were not willing to explain which method was used for drafting a basic or foundation pattern. It seems that existing patterns that have been used in the production of various styles are adjusted for the new styles every season. For instance, if a particular style of pants sells well in the current season, the necessary changes will be made to the pattern to accommodate the style changes for the new season. The pattern for a new style is not drafted from the basic or foundation pattern each time. This method is an economic and less time consuming way of drafting a new style. However, smaller problems with the fit are transferred to the pattern of the new style and may be enhanced by different fabrics.

4.7 FIT TESTING (Objective 6)

Testing for fit entails verifying that a garment designed for a specific size does indeed fit the dimensional specifications determined by the sizing system (Le Pechoux & Ghosh, 2002:26). A live model or a dummy can be used to verify whether a garment fits the measurement specifications (Fan, Yu & Hunter, 2004:33).

As illustrated in **Figure 4.23**, all twelve of the respondents do fit testing on their products. None of the companies interviewed fitted on a fit-model only. Two manufacturers fitted on the dummy only with no live person involved in the fitting. These were the footwear manufacturer, who fitted the shoes on the lasts, and the headwear manufacturer, who fitted the hats and caps on the blocks. The footwear department of the one retailer did fit testing by fitting only on staff members. Three different people from the staff, with the same shoe size are used to fit shoes. Foot shapes of the three people were however different. One of the retailers did fit testing both on the dummy and on a fit model, as well as fitting children's and infants' wear at schools and crèches. One ladies' wear manufacturer fitted on the dummy and on staff members. One manufacturer of infants' and children's wear and ladies' sleepwear, fitted on the dummy, staff and at schools and crèches. The other six companies made use of dummies as well as live models to do fit testing. These in-house models are employed by these companies for the specific purpose of fitting garments. The models' measurements were checked for consistency at regular intervals as illustrated in **Figure 4.25.**

According to Le Pechoux and Ghosh (2002:17), fit is subjective and therefore live models must be used to test for fit. Each person has personal preferences and the way a garment feels can vary with movement; that is why live model testing can be useful (Le Pechoux & Ghosh, 2002:31). The majority of respondents do use live fit models, together with dummies to do fit testing. Staff as well as children and infants at schools and crèches are other live persons used for fit testing. This proves the statement by Le Pechoux and Ghosh (2002:17) that these tests are not done in a standardised manner by industry and that the statistical significance may be very low.

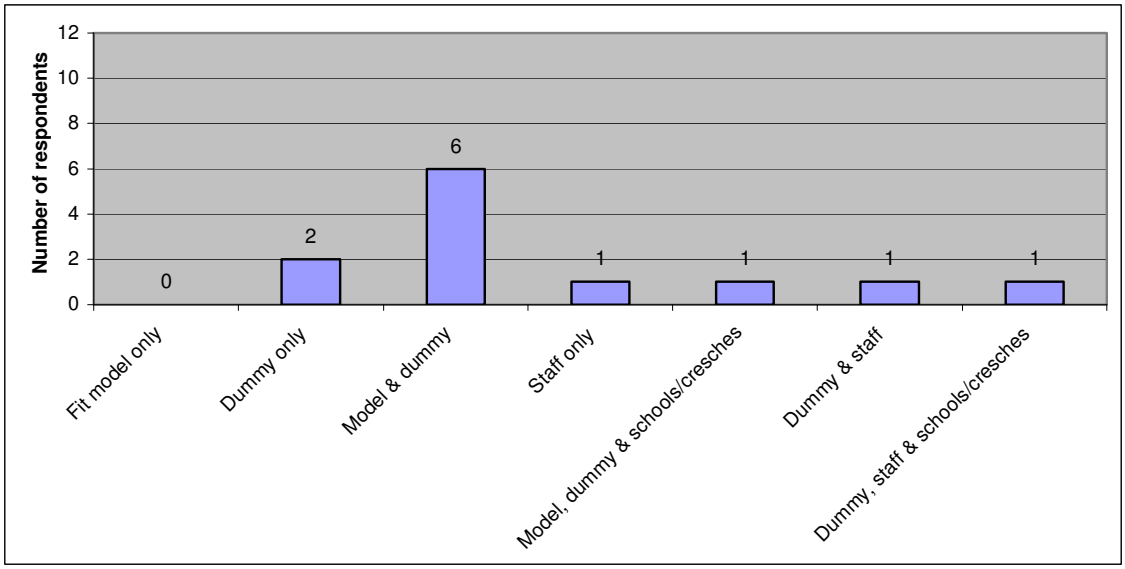

FIGURE 4.23: HOW FIT TESTING IS DONE

Le Pechoux and Ghosh (2002:26) suggest that fit testing can be done at the end of production as part of quality control. The South African companies, however, do fit testing before mass production commences. One retailer mentioned that fit testing is done before and after production. It is a good practice to ensure fit before production starts and also to check it again before the garments go into the stores.

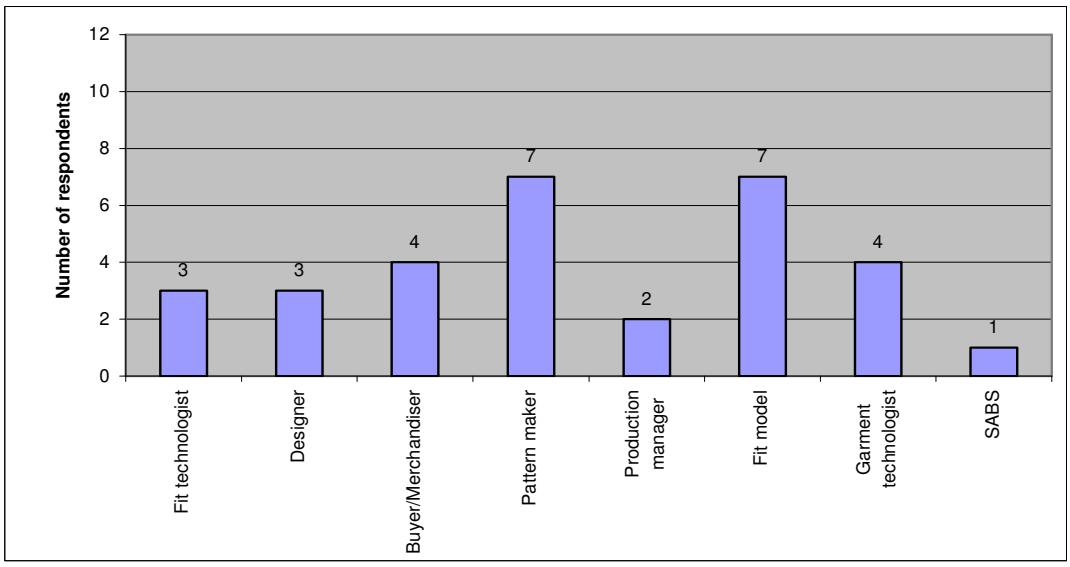

FIGURE 4.24: PEOPLE INVOLVED IN EVALUATING FIT

The people involved when fit is evaluated, are illustrated in **Figure 4.24**. The footwear manufacturer indicated that the fit of their products is evaluated by the SABS. For the manufacturers, fit of the garments was evaluated by the designer, pattern maker and technologists. For the retailers, fit was evaluated by the fit and/or garment technologists and the buyer. The pattern maker of the retailer that supplies block patterns to its manufacturers, also evaluated fit.

It is clear that the fit model, as well as the pattern maker, has an important role to play in fit testing. The model can give feedback on the comfort and movement of the garment. The pattern maker is equally important, since he/she has to interpret the feedback from the model and other experts in order to adjust the pattern. Fitting on dummies can be more objective because they provide ideal dimensions, but they are static and again part of the objectivity is lost due to the personal preference of each individual person involved in the assessment of fit (Le Pechoux & Ghosh, 2002:31).

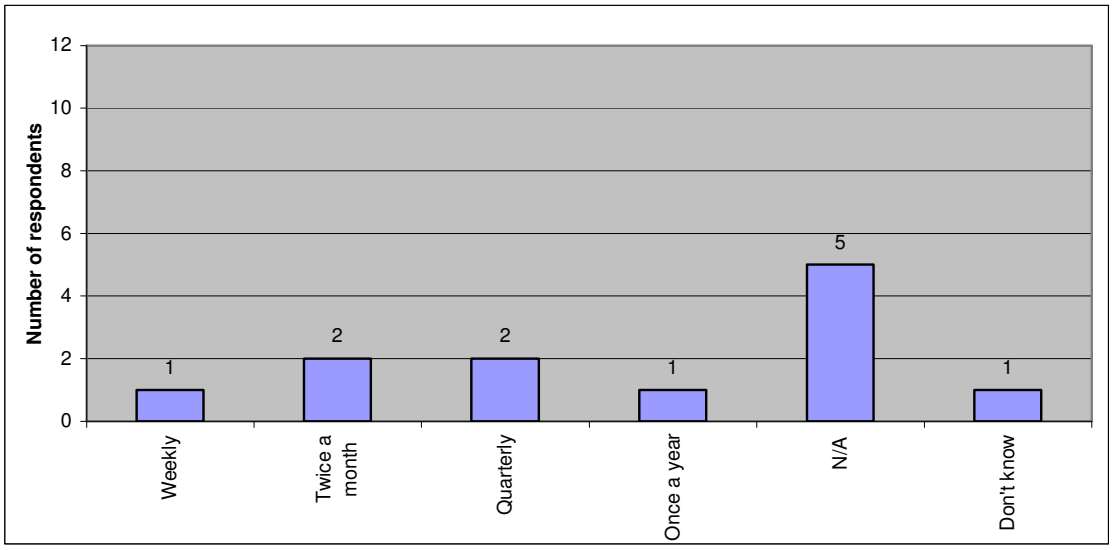

FIGURE 4.25: MEASUREMENT OF FIT MODEL

The measurements of employed fit models should be checked on a regular basis to ensure that it stays consistent, and this is illustrated in **Figure 4.25**. Five companies did not employ a fit model and measured on dummies and/or staff, and therefore the

question was not applicable to their situation. One company measured the fit models every week. Two companies, both retailers, measured the models at least twice a month. Two companies, one retailer and one manufacturer, measured the models on a quarterly basis. One company, a manufacturer, measured their fit models once a year only. One company did not know how often fit models were measured.

None of the respondents indicated measuring the fit models every six months. It seems that measuring of the fit models is not a priority in the industry, although it is very important to ensure consistency of the fit testing. The respondents seemed to rely on the stability of the fit model's body, since they did mention that the fit models were very good and that his/her body measurements did not vary much. One company did mention that they would fit a previous garment to check if the model has changed. According to Le Pechoux and Ghosh (2002:31), fitting on dummies can be more objective because they provide ideal dimensions. It is therefore very important to ensure that the live model's measurements have remained unchanged before every fitting. The model's measurements should at least be checked before every fitting.

The body shapes that are provided for are illustrated in **Figure 4.26**. Five companies indicated that they only provide for the average person. They did however not describe what this average person looks like. This could be because they were not willing to share the information or because they were themselves not sure what "average" meant. Four companies (including the dummy manufacturer) indicated that different retailers provide for different body shapes. Sometimes different shops within the same group will each target a different body shape. In other cases different clothing ranges within the same shop will target different body shapes. The dummy manufacturer confirmed this practice, since they manufacture the fit dummies used by all South African retailers and manufacturers. Defty (1988:16) also confirms this practice by stating that each manufacturer (and retailer) has what are to him/her "ideal" measurements. The other four companies were able to supply custom-made garments when required.

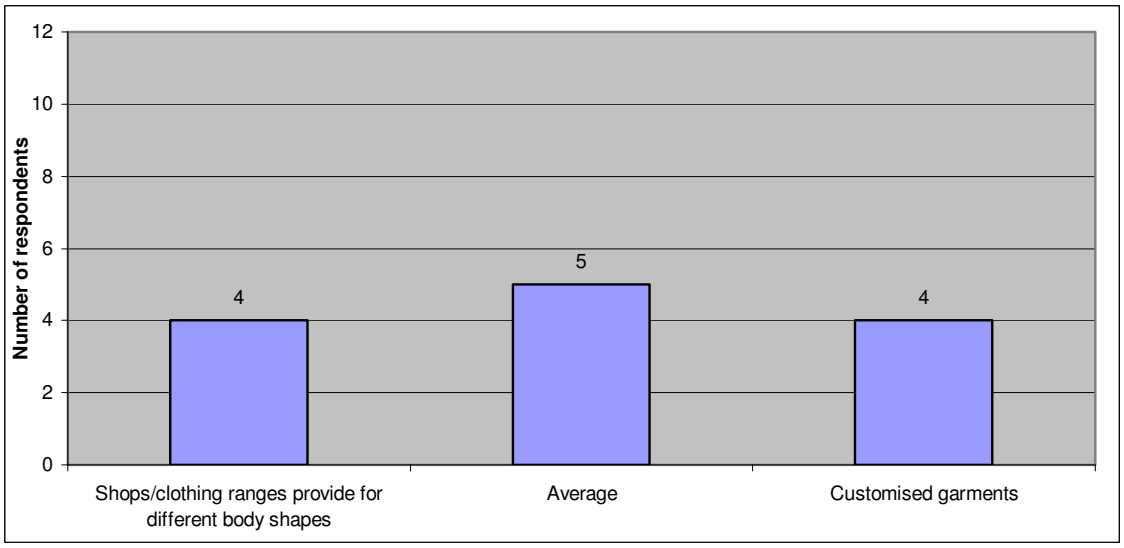

FIGURE 4.26: BODY SHAPES PROVIDED FOR

4.8 WEAR TESTING (Objective 7)

Nine of the 12 respondents indicated that wearer trials are done. This is illustrated in **Figure 4.27**. Three of the nine stated that wearer trials are done by the retailer or customer that they manufacture for. The three companies that did not do wearer trials included the shoe manufacturer, the hat and cap manufacturer, and the manufacturer of ladies' corporate wear.

From **Figure 4.28** it is clear that the main purpose of wearer trials is to evaluate fabric behaviour and performance. Nine companies indicated that wearer trials are done to test functionality and durability of the garment fabric. One company indicated that it is also done to test a style or colour. Two companies stated that wearer trials are only done when new fabric is used. Two retailers stated that wearer trials are only done in the case of high volume products. Only one company indicated that wearer trials are done to evaluate fit.

Wearer trials can be a valuable source of information regarding fit and fit changes over time (Ashdown, 2002). It seems however that the South African companies

focus mainly on performance characteristics of fabrics. It would be worthwhile to also pay some attention to the fit information that can be gained during the process.

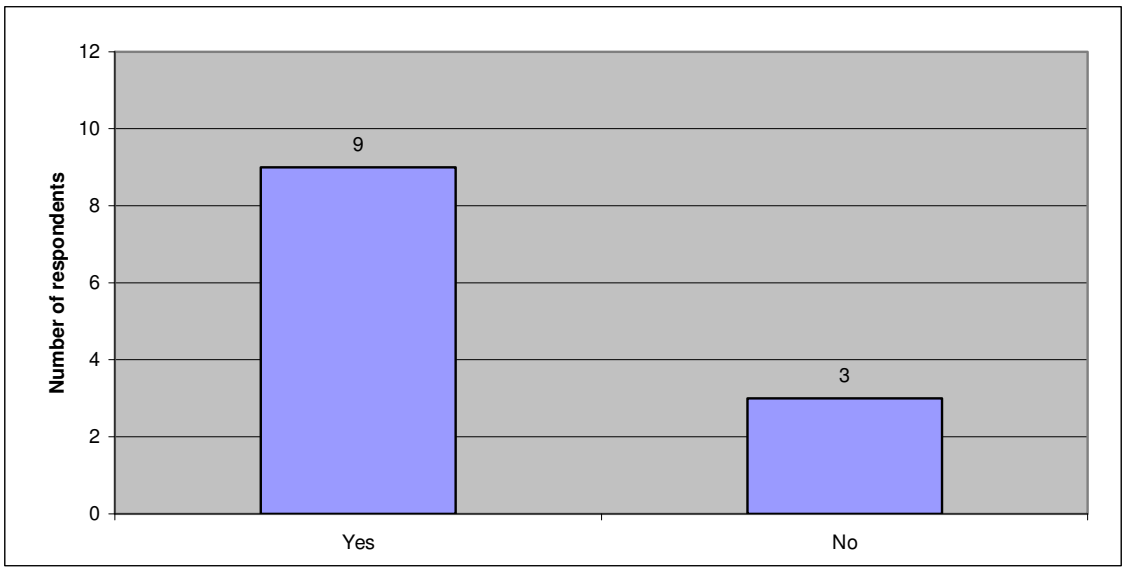

FIGURE 4.27: WEARER TRIALS

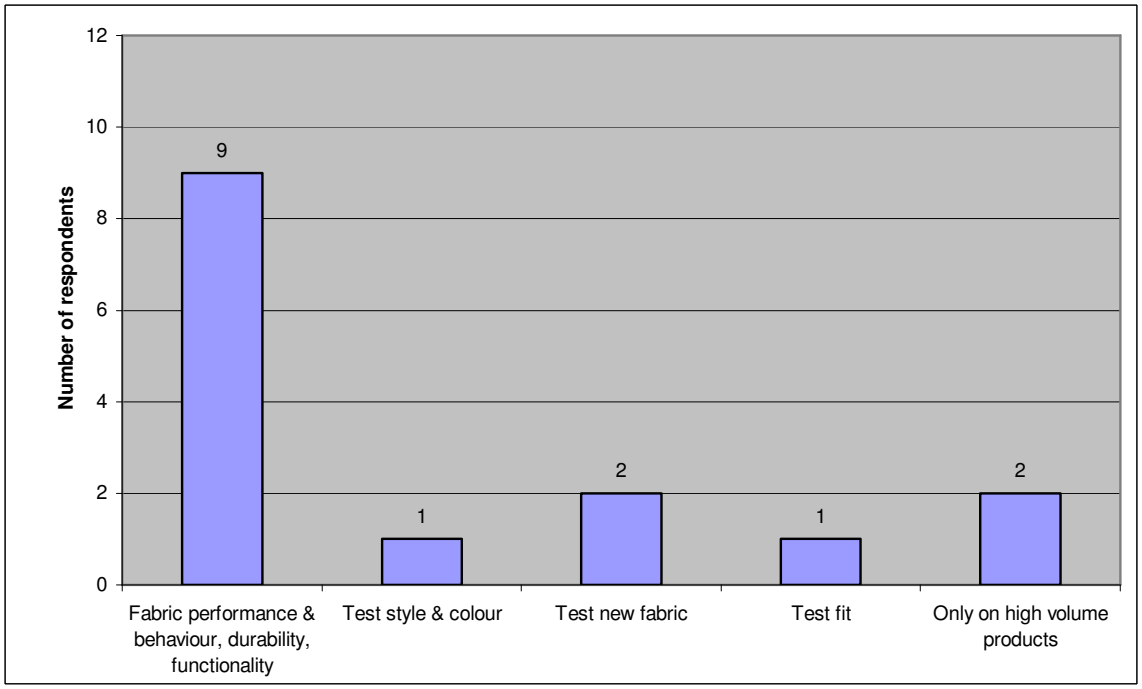

FIGURE 4.28: PURPOSE OF WEARER TRIALS

The respondents were not specific about exactly how the wearer trials are done. They vaguely mentioned that the garments are given to people to be worn and cared for according to prescribed instructions, for a specific period of time, usually a maximum of 14 days. The participating person has to evaluate the garment and it is then returned to the company to be evaluated as well. The criteria used for these evaluations vary according to garment type and end use.

Clearly the supply of well-fitting garments is of concern and of great importance to the South African manufacturers and retailers. Problems are however experienced and because of the risks involved there are no quick solutions to these problems.

Chapter 5: Conclusion, Recommendations and Evaluation

The purpose of the study was to describe the situation in the South African clothing industry regarding the supply of well-fitting garments. The objectives of this study was to compile a comprehensive list of all body measurements required by South African apparel manufacturers and retailers, to compare the descriptions of the identified body measurements with international descriptions, and to describe the problems experienced with body measurements. To achieve the objectives of the study it was also necessary to describe the sizing systems currently used in South Africa, to describe how block patterns are created, and to describe how fit testing and wear testing are done by the South African manufacturers and retailers. As explained in the conceptual framework for the study, a clear description of the above aspects is necessary in the process of supplying well-fitting garments to the South African consumer.

In this chapter the study will also be evaluated with regard to the limitations and success of the research strategy, sampling methods, data collection techniques, data analysis and the validity and reliability of the study. Some recommendations for future studies will also be done.

5.1 CONCLUSIONS AND RECOMMENDATIONS

It can be concluded that the situation within the South African clothing industry with regard to practices that may contribute to the manufacturing of well-fitting garments, is problematic. It seems to be characterised by various different, outdated and in many cases unscientific practices and in some cases also a “don’t care” attitude. This

results in the problems that are experienced by the industry and/or the lack of well-fitting garments to satisfy the South African consumer.

In order to get a clear picture, conclusions are drawn and recommendations made with regard to each of the objectives.

5.1.1 Conclusions and recommendations regarding body measurements

The overall conclusion that can be drawn is that a wide variety of measurements are needed and are used in the South African clothing industry, and that an alarming number of problems exist with regard to the taking of these measurements – probably resulting in the consumer's current dilemma of not being able to find well-fitting garments.

In order to ensure well-fitting garments and good fit in general, it is of the utmost importance that manufacturers and retailers should have a sound knowledge on exactly how and where on the body the various measurements should be taken, and should have and use the equipment that will enable them to consistently take accurate measurements. There should preferably be consensus, both locally and also with standardised international descriptions, with regard to exactly how and where the measurements should be taken on the body.

In the absence of the above, one would expect that manufacturers and retailers will experience problems regarding the taking and use of measurements (as is the case with 66,7% of the height measurements, 88,2% of the width and depth measurements, 26,7% of the circumference measurements, and 71,1% of the other measurements). One would also expect a number of consumers to be dissatisfied with the fit of garments and a high return rate due to poor fit. According to the retailers and manufacturers however, the return rate as a result of poor fit is not that high. The retailers do admit though that the recordkeeping system for returns is unreliable and should be better developed, in order to give a more accurate reflection of the current situation. Taking into account the many cases where there are no international descriptions available, or no international consensus and no national

consensus with regard to exactly how and where specific measurements should be taken, one would expect the above percentages to have been even higher.

It was clear from the results that the taking of vertical measurements is problematic among the respondents. This may be due to the fact that in 22,2% of cases there were no international descriptions available and for a further 6,9% there were no international consensus with regard to the descriptions. If one assumes that South African retailers and manufacturers probably rely on standardised international descriptions, one can understand the uncertainty in the industry as to where and how the measurements should be taken. This uncertainty is reflected in the 52,8% of cases with consensus among respondents, which is just more than half of the measurements, and in consensus among respondents and international descriptions for less than half of the measurements (47,2%). One would expect, and in fact require, a much higher rate of consensus in order to ensure consistency and accuracy of measurements.

It was clear from the results that the highest percentage of problem measurements was experienced with the taking of width and depth measurements. This is in spite of the fact that international descriptions were available for all measurements. To be able to take the width and depth measurements consistently and accurately, special equipment is necessary which the respondents did not have, and this lack of equipment could possibly contribute to the large number of problems experienced with the width and depth measurements. For the sake of consistency and accuracy of measurements, one would also expect a higher rate of consensus among respondents' descriptions of measurements, and between the international and the respondents' descriptions.

It was clear from the results that the taking of circumference measurements is the least problematic among the respondents. This is in spite of the fact that in 26,7% of cases there were no international descriptions available or no international consensus with regard to the descriptions. If one assumes that South African retailers and manufacturers probably rely on standardised international descriptions, one would expect a much higher number of problems regarding the taking of the circumference measurements. A high level of uncertainty is however reflected in the

46,7% of measurements with consensus among respondents, which is less than half of the measurements, and in consensus between respondents' and international descriptions, also for less than half of the measurements (40%). One would expect, and in fact require, a much higher rate of consensus in order to ensure consistency and accuracy of measurements, especially because of the importance of the circumference measurements. It is clear that the circumference measurements are more problematic than the respondents were willing to admit.

It was clear from the results that the taking of the other measurements is problematic among the respondents. This may be due to the fact that in 28,9% of cases there were no international descriptions available and only 9,6% there were international consensus with regard to the descriptions. If one assumes that South African retailers and manufacturers probably rely on standardised international descriptions, one can understand the uncertainty in the industry as to where and how the measurements should be taken. This uncertainty is reflected in the 65,1% of cases where the respondents did not offer any description. This clearly illustrated that the respondents were not familiar with these body measurements, although some of these measurements might be relevant for a detailed description of the population's body shape.

It was also clear that the problems that the respondents experienced, and/or the fact that there was no consensus between the respondents' and the international descriptions, were due to the fact that:

- ✓ It was a difficult measurement to take (as in the case of crotch length, for instance);
- ✓ The international description was not clear with regard to the landmarking – exactly where and how the landmark should be determined (as in the case of armscye depth, for instance) ;
- ✓ Uncertainty with regard to whether the measurement should be taken on the contour of the body or in a straight line (as in the case of cervical height, for instance);
- ✓ The unavailability of the necessary anthropometric tools (as in the case of neck width, for instance);

- ✓ The unavailability of actual data on some measurements (as in the case of most of the hand and foot measurements).

The results clearly show that a lack of consensus among descriptions of body measurements is the cause of many problems that are being experienced. A study by Hwang and Istook (2001) also found a lack of consensus of terminology and acceptance of standard measurements for apparel. They found that traditional body measurement methods for apparel have been based on "feel" by hand. This is also true for the respondents of this study, since measurements are taken with a tape measure. It is therefore important for the measurer to be trained to know what he or she is feeling even on fuller figures where important landmarks are covered. The importance of consistently being able to identify landmarks was repeatedly emphasised by the respondents. This was seen as a very important influence on whether the accuracy of the data could be trusted. There seemed to be a definite need for as much as possible information on the body measurements of South African consumers. It is of vital importance to potential industry users that measurement definitions be absolute and repeatable, so that they can be used most accurately for customisation and production activities (Simmons & Istook, 2003:311). Landmarking was identified as a problem with a number of measurements and this problem needs to be addressed, not only by the local industry but also internationally.

Hwang and Istook (2001) also found that different methods and definitions add to the lack of consensus, for instance where arm length can be measured with a bent or straight arm and from different landmarks, and that imaginary lines such as "side seam to side seam" were very vague descriptions. The situation is similar in the results of this study, where an important discrepancy between the international and the respondents' descriptions was the issue of measuring either along the contour of the body or in a straight line. This has important implications for the fit of garments, since contoured measurements could assist in defining the body shape to the pattern maker. For patternmaking purposes, it is important to have the actual measurement taking the contour into consideration, but also to have the straight measurement as a control in order to apply the measurements correctly to the pattern. It is however difficult to take the contoured body measurements accurately. It is important that consensus is reached on the method used for taking the measurements, for instance

whether arm length should be taken over a bent or a straight arm. One of the requirements that Tamburrino (1992b:56) sets for anthropometrical data to be of practical use, is that the data must satisfy the technical requirements of the clothing industry. This would imply that measurements be taken following uniform and standard criteria. In order to increase efficiency in CAD garment sizing, pattern development and the alteration process as Hwang and Istook (2001) suggest, it is critical that the clothing industry in South Africa reach consensus on their preferred measuring methods, although it is also an international problem.

There is widespread consensus amongst the clothing manufacturing and retail industries as well as academics in the field, that a more relevant and representative anthropometric database should be developed and that sizing systems should be revised accordingly. The results of this study confirm the need and urgency of such a survey since little information is available on the South African body. Retailers and manufacturers in the UK have experienced the value of the SizeUK survey by revealing a reduction in returns. Using accurate and current body measurement data and understanding the relationship of body shape to size, had definite advantages for retailers and manufacturers in the UK, commercially as well as by enhancing customer satisfaction (Bougourd, 2004:10,11). This also confirms the importance of and the need for a survey of South African body measurements. By doing such a survey the first requirement set by Tamburrino (1992b:56), namely that anthropometrical data should be current, can be met. The second requirement, namely that data must reflect the distribution of the population's body measurements by geographical area can also be incorporated in such a survey. The ideal would be to do such a survey by using a body scanner. The use of 3D body scanning technology makes it possible to capture the shape of a population and as Bougourd (2004:11) states: "The existence of shape information provides retailers with a new concept on the basis of which to consider customer satisfaction." One such an example where shape information would be crucial to improve the fit, and as a result the customers' satisfaction with the garment, is the crotch measurement. Allocating the total crotch length correctly to the front and the back of the garment is critical to ensure well-fitting trousers. The respondents agreed that it would be very useful to have a crotch front and a crotch back measurement, if it was possible to measure it on the human body. With the development of 3D body scanning it seems as if such

measurements are not just wishful thinking anymore. According to Simmons and Istook (2003:9), it is possible with the [TC]2 body scanning system to define whether a front, back or full crotch length is needed. Since the CSIR has received a body scanner during 2005, a South African body measurement survey might become a reality in the near future. Accurate measurements, obtained from body scans for example, would depend on clear definitions of where and how the measurements are to be taken (Laing & Sleivert, 2002:4 and Pargas et al, 1997:161), and therefore consensus on where and how measurements are to be taken needs to be the first priority before a survey can be undertaken in South Africa.

5.1.2 Conclusion and recommendations regarding South African sizing systems

The overall conclusion that can be drawn with regard to the sizing system used in South Africa is that it is not as sophisticated as some international sizing systems and that it needs to be revised with updated body dimensions and body shape data on the South African population specifically. For this purpose a representative body measurement survey would be necessary.

Figure types or different body shapes seem to be taken into account by different companies targeting different consumers through a variety of clothing ranges, but this is not communicated to the consumer by different size designations, which contributes to consumers' confusion regarding the size that they should wear. The fit models of different companies might have the same body measurements but their shapes may vary. Ladies' wear seems to be only made for an average height, while men's wear seems to provide for different heights, and children's wear are sized according to age, which is very unsatisfactory.

The concept of the system and the coding used, seem to be largely based on the British sizing system. A numerical size code is used to indicate the sizes on garments. It seems that for ladies' wear the size code is not necessarily related to body measurements, but for men's wear the size code and body dimensions are related; for instance, on lounge shirts the size indicates the neck circumference in

centimetres. The data regarding the body measurements applicable to the size code, seem to be South African. The data seem to be re-evaluated and adjusted from time to time, however not by means of proper body measurement surveys. It seems that it is also not done on a regular basis, but as and when problems are identified. Companies seem to become aware of changes through customer complaints. However, record-keeping of exactly why customers return garments does not seem to be accurate and more efficient systems should be developed. Other possible sources of information about changes in the dimensions or shapes of customers that were identified by the respondents, are fitting sessions and ranges that do not sell well. This again highlights the importance of a South African body measurements survey, in order to obtain current data about the size and shape of our population.

Bougourd (2004) reports that the UK population has grown taller, larger and heavier than 50 years ago. The average height, bust and hip measurements for women in the UK have increased by 4 cms. What was surprising however, and it has a major influence on the drafting of patterns, is the 14 cms increase in the waist circumference of women in the UK. This implies a rather straight figure and much less of an hourglass figure as in the 1950s (Bougourd, 2004:11). The hourglass figure has always been viewed as the ideal figure type, and most of the existing block patterns for the “average” woman that the retailers cater for, are probably based on such a figure type (LaBat & DeLong, 1990:44). If one considers these major changes in the body measurements and shape of the UK female population, together with the fact that the South African sizing system is based on the British sizing system, it becomes even more clear how important and necessary a body measurement survey of the South African population is, and that the full co-operation and support therefor from the clothing industry is needed.

5.1.2.1 Key dimensions

The overall conclusion that can be drawn with regard to key dimensions is that an alarming number of problems seem to be experienced with the taking of the key dimensions and this situation needs urgent attention.

It was clear from the results that the taking of key dimensions is problematic among the respondents. This is in spite of the fact that international descriptions are available for 97,1% of the measurements. The problems may be due to the fact that in 17,1% of the cases there were no international consensus with regard to the descriptions or no international descriptions. If one assumes that South African retailers and manufacturers probably rely on standardised international descriptions, one can understand the uncertainty in the industry as to where and how the measurements should be taken. This uncertainty is reflected in only 34,3% of cases with consensus among respondents, which is less than half of the key dimensions, and in consensus among respondents and international descriptions for less than half of the measurements (42,9%). One would expect, and in fact require, a much higher rate of consensus in order to ensure consistency and accuracy of measurements. Since these are the key dimensions, it has serious implications for the sizing as well as the fit of garments and will require serious attention from the industry.

Sixteen measurements that were considered critical in the design of the initial blocks or slopers, needed for well-fitting garments, were identified for a study by Simmons and Istook (2003:308). According to Simmons and Istook (2003:308) patternmaking experts and textbooks were consulted to determine these sixteen critical measurements. In **Table 5.1** the sixteen critical measurements are compared with what the respondents identified as key dimensions. Only measurements relevant to garments were included and not key dimensions of headwear or footwear. They were the following:

TABLE 5.1: COMPARISON OF KEY DIMENSIONS

Simmons & Istook (2003)	Respondents	Number of respondents
1. Mid-neck / neck base	Neck girth (92)	5
2. Chest / bust	Bust (95) / Chest (94)	9
3. Waist by natural indentation / waist by navel	Waist girth (98)	8
4. Hips / seat	Hip girth (103)	7
5. Sleeve length / arm length	Overarm (60)/ sleeve length	4

Simmons & Istook (2003)	Respondents	Number of respondents
	(59)	
6. Inseam	Inner leg length (32)	8
7. Outseam	Outer leg length (31)	9
8. Shoulder length		
9. Across back	Across back (79)	3
10. Across chest	Across front (80)	2
11. Back of neck to waist	**Nape to waist (38)**	1
12. Rise	**Rise height (37)**	1
13. Crotch length	Crotch length (34)	6
14. Thigh circumference	Thigh girth (113)	4
15. Biceps circumference	Biceps girth (107)	4
16. Wrist circumference	Wrist girth (112)	2
	Elbow girth (109)	1
	Forearm girth (111)	1
	Shoulder to shoulder (77)	2
	Shoulder to bust point (46)	1
	Scye depth (56)	1
	Underarm length (64)	1
	Neck shoulder point to foot (4)	1
	Neck shoulder point to crotch (33)	2
	Total height (1)	1
	CF length (28)	1
	CB length (4 & 24)	3

What was surprising was that nape to waist, which is a critical measurement for upper body garments, namely to position the waistline correctly, and rise height, which is critical for the fit of trousers, were both identified by one respondent only. Shoulder length was not identified as a key dimension by any of the respondents. The reason for this could be that the respondents question the accuracy of measurements concerning side neck point as a landmark, because of the difficulty to consistently identify the exact position of the landmark. Centre back length and centre front length refer to garment measurements, although they are based on certain body measurements. It is clear that the use of key dimensions compares well with what is being used as key dimensions internationally.

According to McConville in Chun-Yoon and Jasper (1996:90), key dimensions should fulfil the following requirements:

1) be convenient to measure;
2) be an integral part of the garment;
3) have a high degree of correlation with other dimensions important in design and sizing; and
4) should not highly correlate with each other.

To fulfil the first requirement, it is clear that participants from the clothing industry need to discuss the identification of landmarks, as well as specific methods for taking the measurement on the body. Once consensus on these issues has been reached, the key dimensions will be convenient to measure.

When one looks at **Figures 4.16 – 4.21** it is clear that some of the key dimensions identified seem to be integral parts of specific garments. This is the reason why quite a few measurements were listed that were not included by Simmons and Istook (2003). These key dimensions were mainly identified by only one respondent and were necessary for specialised garments or where a very close fit was needed. Therefore one can conclude that the key dimensions identified by the respondents do form an integral part of the different garment types.

To be able to fulfil the last two requirements, the correlation between actual dimensions need to be tested and this did not form part of the objectives of this study. However, to be able to test the correlation between measurements in a meaningful way, one would need current and accurate data to work from. This again highlights the need for a South African body measurement survey. Differences between sizes as well as grading rules are based on the correlations between key dimensions, and to test whether these rules are still applicable it is crucial to have data applicable to the current South African population. It is also critical, for accuracy and comparability, that the data be collected using consistent measuring methods and landmark identification.

5.1.3 Conclusion and recommendations regarding block patterns

The overall conclusion that can be drawn with regard to block patterns is that block patterns need to be revised and adjusted according to current and accurate measurements of the South African population. It is necessary to pay some attention to the fact that different block patterns are needed to accommodate better fit for different figure types, especially because fit is determined by pattern making as Hudson states (1980:109).

It seems to be the manufacturer's responsibility to create or obtain block patterns. Retailers supplied size charts and garment measurements, and then manufacturers had to develop the necessary patterns in order to make the garments according to the specified measurements. Although most companies indicated that they develop their own blocks, it was also mentioned that a well-fitting pattern will be re-used and adjusted from season to season. This method saves time and effort, but small problems in the pattern are transferred from season to season and may become enhanced only at a later stage. It might be necessary to check the production patterns against the basic blocks from time to time.

It is advisable to start with new block patterns, specifically when the dimensions of some body measurements are adjusted. However, there seems to be a great amount of uncertainty regarding the adjustment of body measurements, because it is not based on the results of a controlled survey. Any adjustments to the dimensions listed in the size chart seem to be based on guesswork. Again the importance of an accurate body measurement survey of the South African population stands out as a basic requirement to be able to improve the fit of garments. Together with this is the need for clear and detailed descriptions of landmarks and measuring methods of the body measurements to be included in such a survey. The combination of body measurements together with the correct amounts of ease will result in a suitable pattern. It is not possible to create a suitable pattern if the pattern maker is unsure how the measurement was taken; for example, an arm length that was measured over a bent or a straight arm will influence the amount of ease needed to create a pattern of the correct length. A study on the consumers' preference regarding the

amount of ease that needs to be added to certain body measurements might also be useful in the effort to improve garment fit.

5.1.4 Conclusion and recommendations regarding fit and wear testing

The overall conclusion that can be drawn with regard to fit and wear testing is that the supply of good quality garments to their target customers seemed to be a very important consideration to the retailers and manufacturers. It was however clear that there is some uncertainty about how to go about handling the fit problem because it entails huge financial investments and risks to work with the competition in order to solve a national problem. It seemed clear that fit and wear testing was not done in controlled conditions.

The live fit model has a very important input during fit testing. It seemed that the garment's approval totally depended on the fit model's opinion about the comfort and the fit of the garment. Evaluation of fit is specific to garment types and end use of the garments, and therefore it was difficult to obtain the criteria used when evaluating fit. Respondents were not really willing to share this information. It is recommended that the people involved in the evaluation of the garment fit be trained with regard to the criteria used for the fit testing of different garment types. This will increase the reliability and objectivity of the fit testing, because the people involved will be less biased by their own personal preference.

It was clear that a lot of effort goes into fit testing, and live models as well as dummies are used. The respondents also put a lot of effort into developing the perfect dummy. It is very good to use both methods for fit testing because the dummy is the control for the garment specifications. Fit testing is done before mass-production starts, which is a good practice since any fit problems can be corrected before the garment reaches the consumer (Smit, 1997:64). It also prevents wastage due to garments being manufactured to the wrong size specifications. It is recommended to check the measurements of the fit model, or at least the key dimensions for the specific garment type, before every fitting to ensure reliability and objectivity of the fit testing.

With regard to wear testing it was clear that it is being done rather to evaluate fabric or garment behaviour and performance, as Ashdown (2002) suggests. Again, the respondents were not really willing to share details of exactly how it is done. This is partly due to the fact that the criteria for wearer trials are linked to the garment type and end use of the garment. It is therefore variable with different garment types. In this case it could also be recommended that the personnel involved in the evaluation of the returned product be trained with regard to the criteria. This would increase the objectivity of the results to the wearer trials.

Ashdown (2002) mentions that wearer trials can also be valuable with regard to fit or fit changes over time. It is therefore recommended that some criteria for evaluation by the consumer as well as by the technical staff be incorporated when doing wearer trials.

5.2 EVALUATION OF THE STUDY

It is important to evaluate the study in order to be able to contribute to future and follow-on studies.

5.2.1 Evaluation of data-collection and other methods

The purpose of the study was to investigate and describe how the South African clothing industry ensures well-fitting garments to their target customers. Although this could be interpreted as a qualitative problem, the intent was to establish what the current situation is, which is more suited to a quantitative approach (Leedy & Ormrod, 2005:95). The researcher wanted to get an overview of the situation regarding the supply of well-fitting garments in South Africa, and objective facts were to be measured, which also justifies the quantitative research approach (Neuman 2000:16).

First, a postal survey was done, for which the entire target population was included. This ensured an acceptable response to draw the purposive sample from, for the interviews. Information gathered through the postal survey enhanced the researcher's judgment with regard to the purposive sample. Because the respondents represented only two of the three centres of the clothing industry in South Africa, as identified in the report by Dunne (2000:12), the findings cannot be generalised. The purpose of the study was not to generalise but to investigate and describe how the industry ensures well-fitting garments. It is however doubtful that the type of information gathered for this study, namely the respondents' descriptions of body measurements, their understanding of the sizing system used in South Africa, their use of block patterns, and the way they do fit and wear testing, would be influenced by the geographical location of the manufacturers, or the retailers' head offices.

The postal survey might have been unnecessary and time consuming, although it did give an indication of who would be willing to participate in the interviews. The postal survey also gave important background information to assist the researcher with the purposive sampling. One could argue that the inclusion of body measurements with no international description was unnecessary and that it made the questionnaire too long. However, valuable information was collected regarding the use of measurements where no international description was available. It was clear from the results of the study that the measurements without international descriptions cannot be ignored and that one cannot assume that a measurement is not used simply because no international descriptions are available.

Interviews enhanced the reliability of the study because any ambiguity from the survey questionnaire regarding the use of certain measurements could be clarified. The interviews also gave the respondents the opportunity to demonstrate how a measurement is taken. The interviews took up to two hours and even longer in some cases, which could have been tiring for the respondents and might have influenced their responses in the last part of the interview. Although the respondents were very friendly and helpful, there were instances where they were not willing to share information.

5.2.2 Validity and reliability of the data

The researcher rejected questionnaires from the postal survey that were not fully completed. Responses to the postal survey were analysed using descriptive statistics, namely frequency tables. This was suitable for analysis of the data because it gives a complete overview of the collected data.

The transcriptions of the interviews were analysed by using content analysis. Content analysis seemed suitable because it is the systematic analysis of text to identify patterns. Again, frequency tables were suitable for analysing the data and to give a complete overview of the data on sizing systems, block patterns, fit testing and wear testing. Because of the exploratory and descriptive nature of this study, the above methods were appropriate for the analysis of the data.

External validity might have been limited by the low response from certain garment categories which also resulted in such manufacturers not being included in the purposive sample. Inclusion of respondents from only two of the three clothing industry centres might also limit external validity. However, as stated above, it is uncertain whether geographical location would influence the type of data collected for this study.

With regard to internal validity, it was a good strategy to have the questionnaire reviewed by an expert and to include graphic figures to avoid ambiguity. Some misunderstandings were clarified during the interviews, and therefore the interview was a good combination to support the validity of data collected.

Instead of only relying on the cover letter, it might have been a good idea to phone all companies included for the postal survey in order to get the contact details of the correct person to fill in the questionnaire. This could have been more personal and could possibly have increased the response rate. This could have contributed to the accuracy and precision of the information supplied by the respondents, and could have enhanced the reliability of the data collected. The interviews contributed to the

reliability of the data because the researcher was able to explain and ensure that questions were understood and answered correctly.

The timing of the interviews contributed to the reliability of the data, because during July the clothing industry was not too busy. Respondents were willing and able to take time to participate in the interview in a relaxed manner.

5.2.3 Achievement of objectives

After completion of the study it is now possible to compile a list of all the body measurements that the respondents for this study used. The comparison of respondents' descriptions with international descriptions of body measurements made it possible to gain insight in the problems that the manufacturers and retailers experienced with body measurements. The description of the sizing system used in South Africa and the use of block patterns enabled the researcher to form a better understanding about the practices followed in the industry and the difficulties facing manufacturers and retailers with regard to providing well-fitting garments.

The specific criteria for doing fit and wear testing were not obtained, but some insight was gained into the procedures used. The complicated nature of setting criteria for the evaluation of the fit of different types of garments limited the achievement of this objective and a separate study focusing on this area is recommended.

5.3 RECOMMENDATIONS FOR FUTURE RESEARCH

Advice to future studies would be to include respondents from all the clothing industry centres in order to be able to generalise to the overall South African industry. This should be possible for another researcher to achieve, provided there are no time and funding limitations.

To clarify exact measurements and to get industry involved in the establishment of a South African database of population measures, focus groups rather than an

individual interview technique could be considered for future studies. It might be less time consuming and could encourage more debate and discussion about exactly how to take the measurements. However, it would have to be handled very carefully because respondents might not be willing to participate or share information in such a situation.

Because of the complex nature of fit and wear testing with regard to different garment types, it might be worthwhile to undertake a study specifically investigating how fit and wear testing is done on different garment types. More meaningful data could possibly be collected in such a study and the analysis and interpretation of data would also be more simplified.

Another useful study would be to investigate the preferences of the consumer regarding the amount of ease needed in specific garments. This information would assist the pattern maker in creating a pattern that will achieve more satisfactory fit.

5.4 RECOMMENDATIONS TO INDUSTRY

Retailers have to redefine their focus and take cognisance of customer demands for better prices and quality (Dunne, 2000:23). As a result of more competition in the clothing retail sector and to be competitive with Eastern markets, it is important for retailers and manufacturers to improve fit because better quality is the only way to stay competitive (Dunne, 2000:9,10).

The importance of accurate and current body measurements can no longer be ignored. It is therefore necessary that the local industry address the problem of consensus with regard to landmarking and measuring method. Even if the problem is not addressed on an international level, it is to the advantage of the local industry that they reach consensus on which landmarks are to be used, describe in detail how these landmarks can be identified consistently, and agree on the method for taking body measurements on the human body. These descriptions must be acceptable to everybody involved in the clothing industry.

It is imperative and urgently required that a body measurement survey of the South African population be undertaken. The success of such a project depends heavily on the involvement and support of the retailers and manufacturers. It is therefore recommended that the industry become involved and support the establishment of a database of South African body measurements.

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Addendum A

Cover letter and Questionnaires

University of Pretoria

Department of Consumer Science
22 October 2002

The Department of Consumer Science of the University of Pretoria in collaboration with Ergotech and Potchefstroom University formed an initiative, known as African Body Dimensions, with the aim to establish, maintain and manage a national anthropometric database. The need for an updated South African anthropometric database was identified, and the design of many household and industrial products as well as clothing sizing and fit will be adressed. The latest scanner technology will be used to generate an accurate anthropometric database.

This study will serve as a pilot study to ensure the accuracy and representativeness of a South African anthropometric database for use by the South African clothing and footwear industry. By developing guidelines for the establishment of a database and for the identification of key dimensions to base sizing systems on, this study will ensure that such a database will be useful to the clothing and footwear industry.

Your expertise is needed for the completion of the attached questionnaire. The purpose of the questionnaire is to identify body measurements currently used by South African clothing and footwear manufacturers and retailers. Follow-up interviews will be conducted at selected manufacturers and retailers to determine the definitions of the identified body measurements. All information will be treated as confidential. Please return the questionnaire by 16 November 2002.

The list of body measurements with their definitions will be available on request to interested parties. Your participation in this study will be greatly appreciated. For more information, or if you have any questions, please contact:

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Kind regards

Ms Mariette Strydom

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

QUESTIONNAIRE: CLOTHING MANUFACTURERS/FACTORIES

Number | | | | 1 - 3

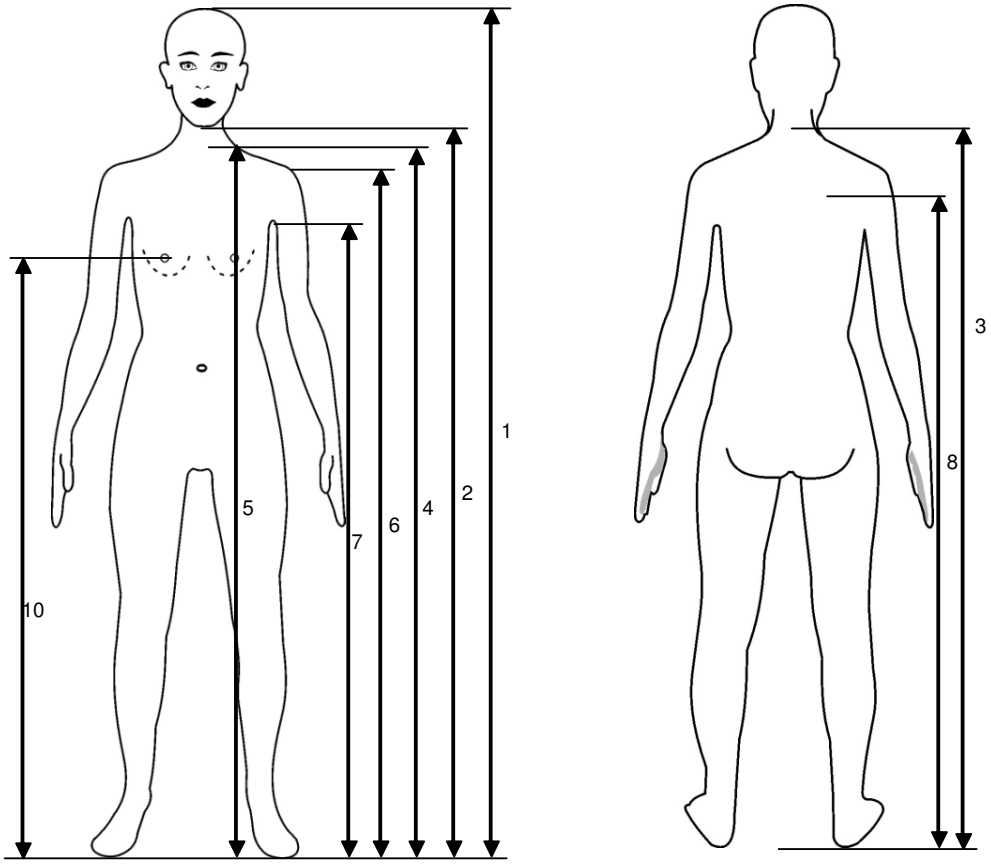
COMPANY NAME:	CONTACT PERSON:	E-MAIL / TEL NO:

1. Indicate next to the appropriate garment type which age group you cater for and how long you have been manufacturing the specific garment type.

BABIES / INFANTS	AGE GROUPS (in months)			YEARS INVOLVED			
GARMENT TYPE	0-12	12-24	24-36	0-4	5-9	10+	
BABIES' / INFANTS wear							4-7
BABIES' / INFANTS FOOTWEAR							8-11
BABIES' / INFANTS HEADWEAR							12-15
BABIES' / INFANTS GLOVES							16-19

CHILDREN	AGE GROUPS (in years)		YEARS INVOLVED			
GARMENT TYPE	1-8	9-16	0-4	5-9	10+	
BOYS' coats, overalls						20-22
BOYS' jackets, shirts, t-shirts						23-25
BOYS' pants, shorts						26-28
BOYS' swimwear						29-31
BOYS' underwear						32-34
GIRLS' dresses, coats, overalls						35-37
GIRLS' jackets, blouses, t-shirts						38-40
GIRLS' skirts, trousers, shorts						41-43
GIRLS' swimwear						44-46
GIRLS' underwear						47-49
BOYS' / GIRLS' SOCKS						50-52
BOYS' / GIRLS' HEADWEAR						53-55
BOYS' / GIRLS' GLOVES						56-58
SCHOOL WEAR						59-61

	AGE GROUPS (in years)					YEARS INVOLVED			
GARMENT TYPE	17-29	30-39	40-49	50-59	60+	0-4	5-9	10+	
MEN'S coats, overalls									62-67
MEN'S jackets, shirts, t-shirts									68-73
MEN'S pants, shorts									74-79
MEN'S swimwear									80-85
MEN'S underwear									86-91
LADIES' dresses, coats, overalls									92-97
LADIES' jackets, blouses, t-shirts									98-103
LADIES' skirts, trousers, shorts									104-109
LADIES' swimwear									110-115
LADIES' underwear									116-121
LADIES' foundation wear									122-127
MATERNITY WEAR									128-133
ETHNIC WEAR									134-139
PROTECTIVE WEAR									140-145
MEN'S / LADIES' SOCKS									146-151
MEN'S / LADIES' HEADWEAR									152-157
MEN'S / LADIES' GLOVES									158-163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FOOTWEAR	AGE GROUPS (in years)							YEARS INVOLVED			
CATEGORY	1-8	9-16	17-29	30-39	40-49	50-59	60+	0-4	5-9	10+	
MEN'S SANDALS											164-171
LADIES' SANDALS											172-179
BOYS' SANDALS											180-187
GIRLS' SANDALS											188-195
MEN'S CLOSED SHOES											196-203
LADIES' CLOSED SHOES											204-211
BOYS' CLOSED SHOES											212-219
GIRLS' CLOSED SHOES											220-227
MOULDED FOOTWEAR											228-235
HEALTH SHOES											236-243
SPORTS / ATHLETIC SHOES											244-251
SCHOOL SHOES											252-259
INDUSTRIAL FOOTWEAR (steel cap)											260-267
INDUSTRIAL FOOTWEAR (steel cap)											268-275
CONTRACT FOOTWEAR											276-283

2. Do you provide for the following special figure requirements?

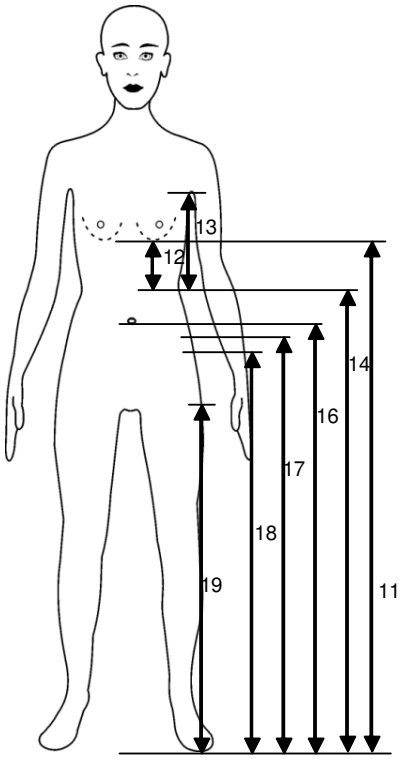
	YES	NO	
Short, Regular, Long			284
Disabled people in wheelchairs			285
Disabled people missing limbs			286
Petite figures			287
Outsizes / Plus sizes			288
Different body shapes			289
Other, specify			290-291
			292-293

3. Indicate if you have ever been involved in the process of developing sizing systems for any of the following garment types:

	MEN'S		WOMEN'S		BOYS'		GIRLS'		INFANTS		
	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	
OUTERWEAR											294-298
UNDERWEAR											299-303
PROTECTIVE WEAR											304-308
FOOTWEAR											309-313
HEADWEAR											314-318
GLOVES											319-323
Other, specify											324-329
											330-335
											336-341

4. Mark the measurements that you use and if applicable indicate if you experience measuring problems with any of these.

	BODY MEASUREMENTS	USED		PROBLEMS		
	HEIGHTS - VERTICAL	YES	NO	YES	NO	
1	Height					342-343
2	Chin height					344-345
3	Cervical height					346-347
4	Side neck height					348-349
5	Side neck to front ground level					350-351
6	Shoulder height					352-353
7	Underarm height (Axilla height)					354-355
8	Across back height					356-357
9	Chest height					358-359
10	Bust level height					360-361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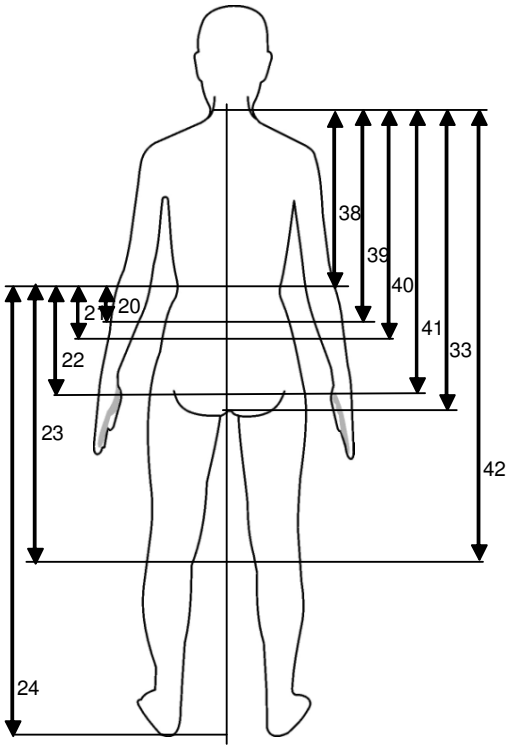
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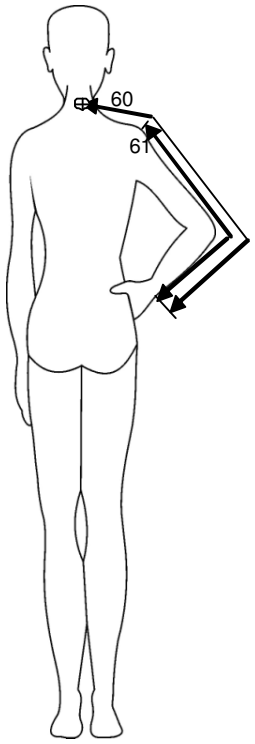
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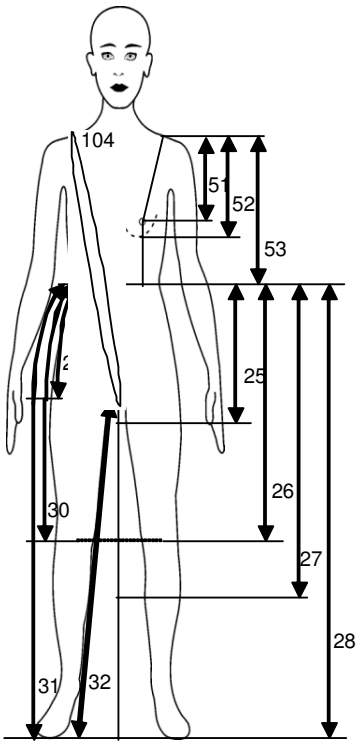
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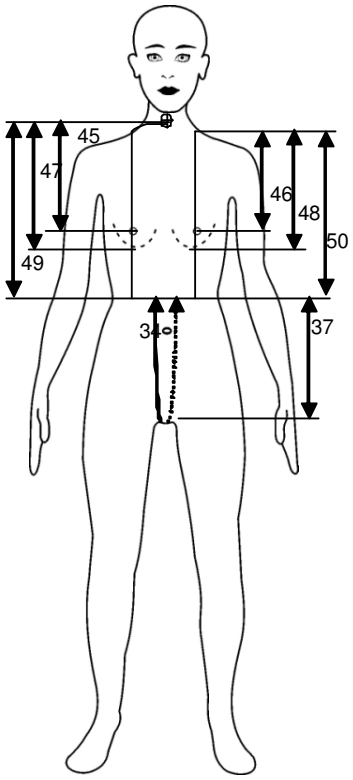
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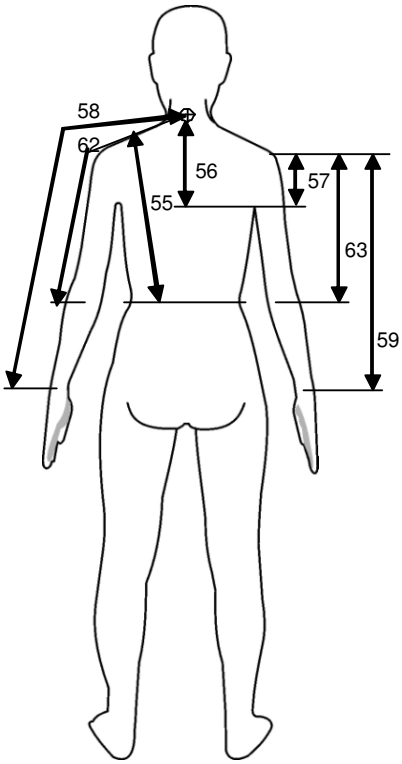
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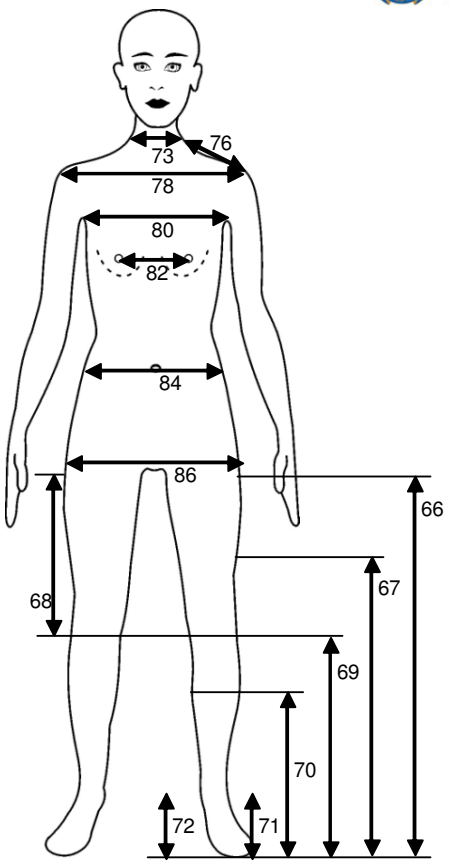
	BODY MEASUREMENTS	USED		PROBLEMS		
	HEIGHTS - VERTICAL	YES	NO	YES	NO	
11	Underbust level height					362-363
12	Underbust to waist					364-365
13	Armscye to waist					366-367
14	Waist height					368-369
15	Preferred waist height					370-371
16	Waist height (at belly button level)					372-373
17	Upper hip height					374-375
18	Top hip height					376-377
19	Hip height (at max circumference)					378-379
20	Centre back waist tot top hip					380-381
21	Centre back waist to upper hip					382-383
22	Centre back waist to hip (max circumference)					384-385
23	Centre back waist to knee					386-387
24	Centre back waist to ground					388-389
25	Front waist to thigh					390-391
26	Front waist to knee					392-393
27	Front waist to calf					394-395
28	Front waist to ground					396-397
29	Side waist to hip					398-399
30	Side waist to knee length					400-401
31	Outside leg length					402-403
32	Inside leg length / crotch height					404-405
33	Trunk length					406-407
34	Total crotch length					408-409
35	Front crotch length					410-411
36	Back crotch lenth					412-413
37	Body rise / Crotch depth					414-415
38	Back waist length (cervical to waist)					416-417
39	Cervical to top hip					418-419
40	Cervical to upper hip					420-421
41	Cervical to hip					422-423
42	Cervical to knee hollow					424-425
43	Cervical to chest level					426-427
44	Side neck to chest level					428-429
45	Cervical to breast point					430-431
46	Side neck to breast point					432-433
47	Cervical to under bust level					434-435
48	Side neck to under bust level					436-437
49	Cervical to front waist					438-439
50	Front waist length (Side neck to waist)					440-441
51	Centre shoulder to bust point					442-443
52	Centre shoulder to under bust level					444-445
53	Centre shoulder to front waist - straight					446-447
54	Centre shoulder to front waist - contoured					448-449
55	Centre shoulder to back waist - contoured					450-451
56	Armscye depth (Cervical to underarm level)					452-453
57	Top arm length (Shoulder to underarm level)					454-455
58	Arm length straight (Cervical to wrist)					456-457
59	Arm length straight (Shoulder to wrist)					458-459
60	Arm length bent (Cervical to wrist)					460-461
61	Arm length bent (Shoulder to wrist)					462-463
62	Upper arm length (Cervical to elbow)					464-465
63	Upper arm length (Shoulder to elbow)					466-467
64	Under arm length (to wrist)					468-469
65	Under arm length to elbow					470-471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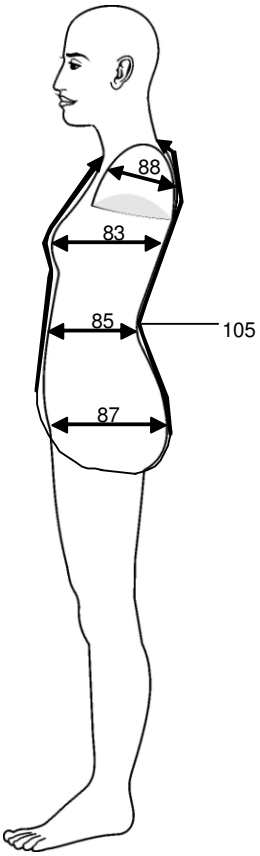
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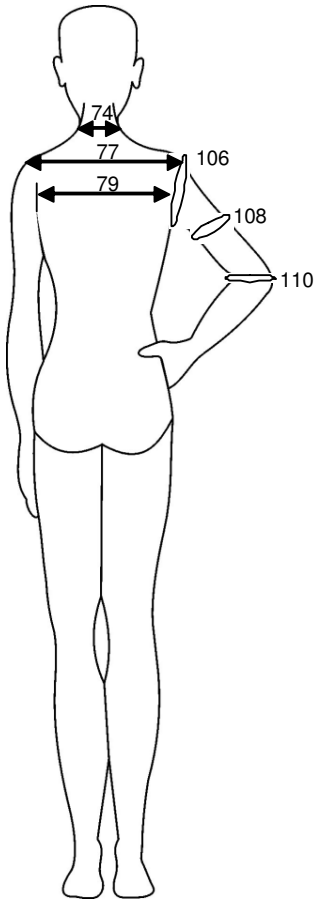
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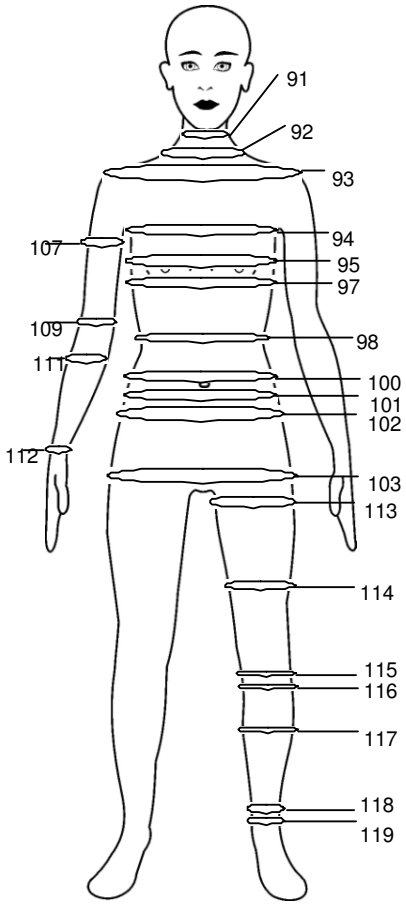
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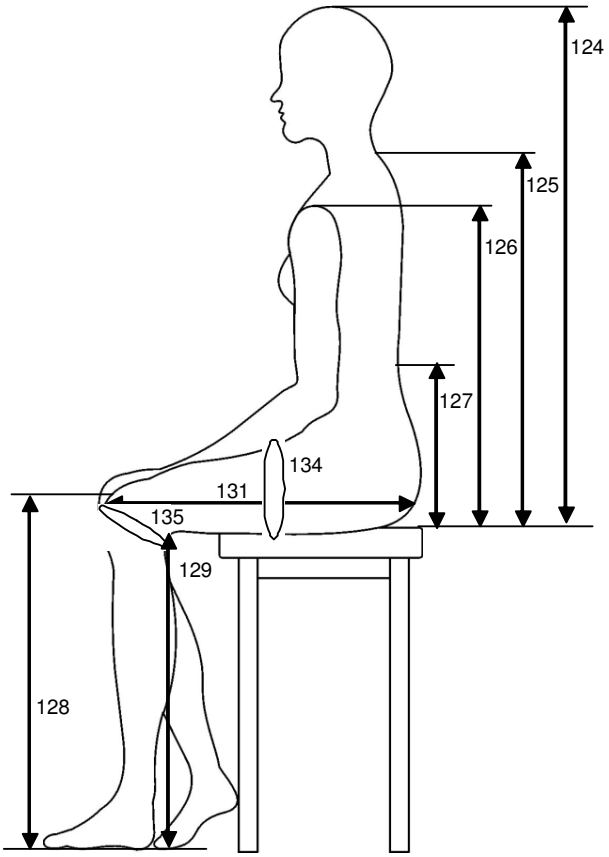
	BODY MEASUREMENTS	USED		PROBLEMS		
	HEIGHTS - VERTICAL	**YES**	**NO**	**YES**	**NO**	
66	Thigh height					472-473
67	Mid-thigh height					474-475
68	Thigh length					476-477
69	Knee height					478-479
70	Calf height					480-481
71	Ankle height (outside leg)					482-483
72	Ankle height (inside leg)					484-485
	WIDTH - HORIZONTAL					
73	Neck width - front					486-487
74	Neck width - back					488-489
75	Back Neck width contoured					490-491
76	Shoulder length					492-493
77	Shoulder width - back					494-495
78	Shoulder width - front					496-497
79	Across back width					498-499
80	Across front width					500-501
81	Breast prominence					502-503
82	Bust width					504-505
83	Chest depth					506-507
84	Waist width					508-509
85	Waist depth					510-511
86	Hip width (from front at max circumference)					512-513
87	Buttock depth (back to front at max point - measured form the side)					514-515
88	Armscye width (front to back across top of arm)					516-517
89	Armspan					518-519
	CIRCUMFERENCES					
90	Neck girth					520-521
91	Neck girth - around Adam's apple					522-523
92	Neck base girth					524-525
93	Shoulder girth					526-527
94	Chest girth					528-529
95	Bust girth					530-531
96	Bust girth contoured					532-533
97	Underbust girth					534-535
98	Waist girth					536-537
99	Preferred waist girth					538-539
100	Waist girth at belly button level					540-541
101	Upper hip girth (at prominent hip bone)					542-543
102	Top hip girth (midway between natural waist and max hip)					544-545
103	Hip girth (at max circumference)					546-547
104	Trunk circumference (Body loop)					548-549
105	Centre trunk circumference (nape through to front base of neck)					550-551
106	Armscye girth					552-553
107	Upper arm girth - straight					554-555
108	Upper arm girth - bent					556-557
109	Elbow girth - straight					558-559
110	Elbow girth - bent					560-561
111	Forearm girth					562-563
112	Wrist girth					564-565
113	Thigh girth					566-567
114	Mid-thigh girth					568-569
115	Knee girth					570-571
116	Lower knee girth					572-573
117	Calf girth					574-575
118	Minimum leg girth					576-577
119	Ankle girth					578-579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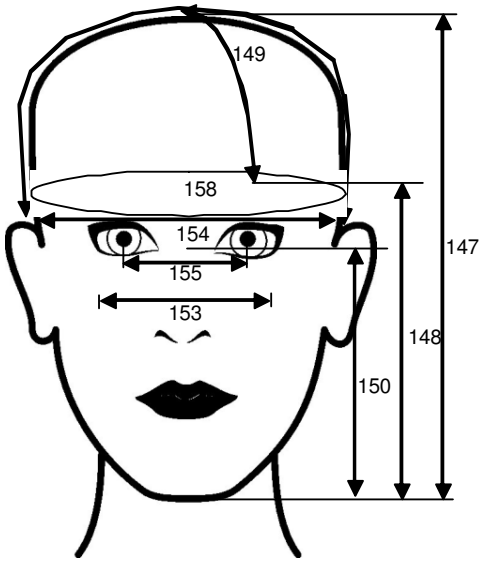
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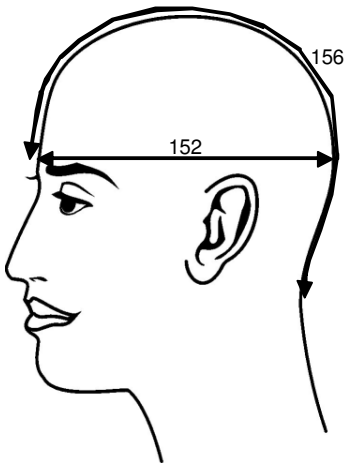
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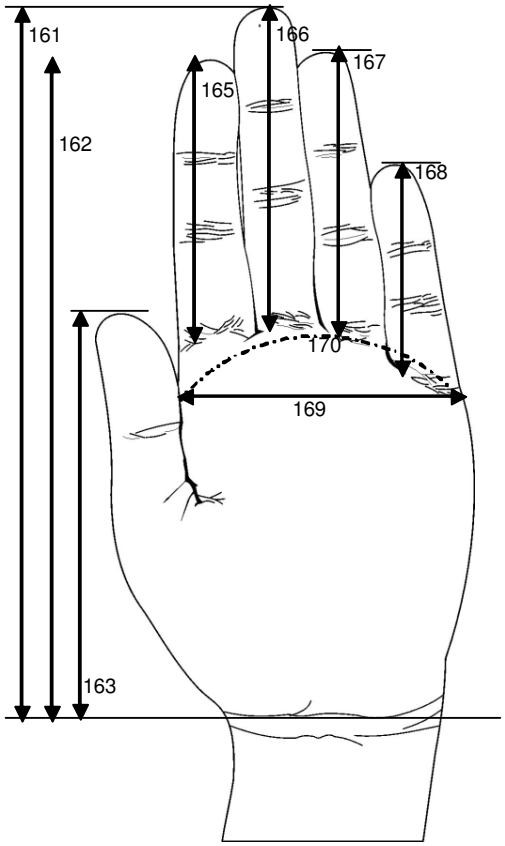
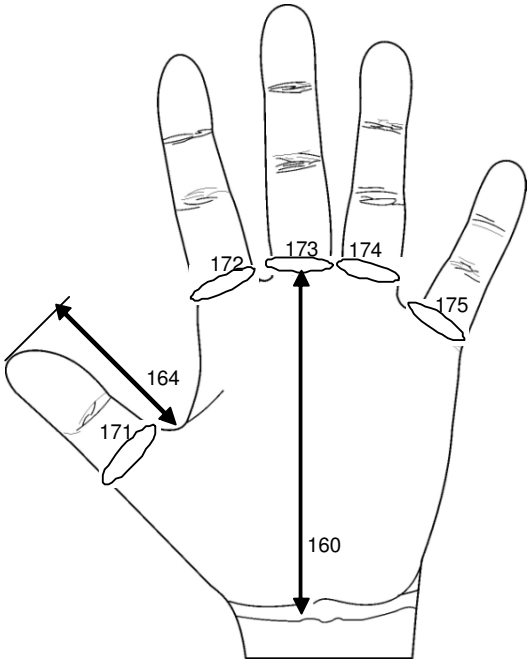
	BODY MEASUREMENTS	USED		PROBLEMS		
	ARC MEASUREMENTS	**YES**	**NO**	**YES**	**NO**	
120	Bust arc anterior					580-581
121	Waist arc anterior					582-583
122	Abdominal extension arc anterior					584-585
123	Hip arc posterior					586-587
	SEATED - HEIGHTS					
124	Height					588-589
125	Cervical height					590-591
126	Shoulder height					592-593
127	Waist height					594-595
128	Knee height					596-597
129	Popliteal height (lower leg length)					598-599
	SEATED - WIDTHS					
130	Hip width					600-601
131	Thigh length					602-603
	SEATED - GIRTHS					
132	Waist girth					604-605
133	Hip girth					606-607
134	Thigh girth					608-609
135	Knee girth					610-611
	OTHER					
136	Body mass (in kg)					612-613
137	Shoulder blade skinfold					614-615
138	Triceps skinfold					616-617
139	Bust to waist drop					618-619
140	Hip to waist drop					620-621
141	Bust to underbust drop					622-623
142	Front neck depth					624-625
143	Back neck depth					626-627
144	Back seat angle					628-629
145	Shoulder slope					630-631
146	Height (Lying - infants)					632-633
	HEAD MEASUREMENTS					
147	Head height					634-635
148	Face length (Menton-glabella)					636-637
149	Crown of scull to brows (Vertex to glabella)					638-639
150	Chin to nose bridge (Menton-sellion)					640-641
151	Chin to pit of neck					642-643
152	Head length (brow to back of scull)					644-645
153	Head width - cheekbone to cheeckbone					646-647
154	Head width - above ears					648-649
155	Inter-pupillary distance					650-651
156	Sagittal arch					652-653
157	Surface distance from above the ears across the top of the head (Bi-tragion coronal arch)					654-655
158	Head girth					656-657





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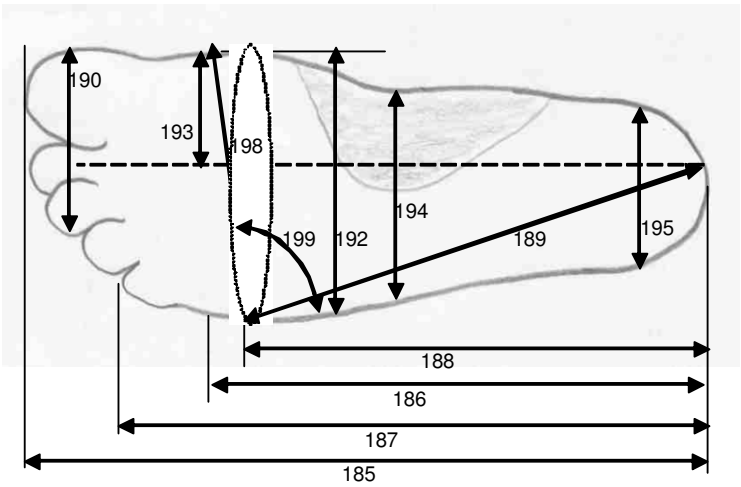

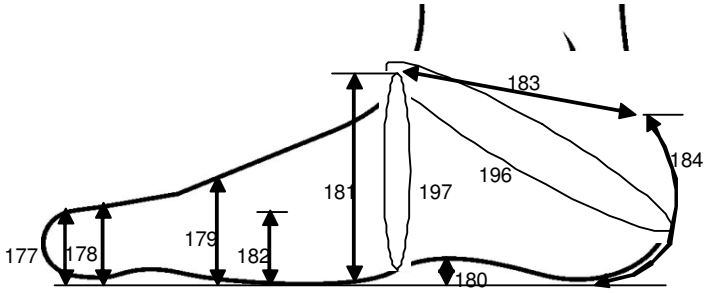

	BODY MEASUREMENTS	USED		PROBLEMS		
	HAND MEASUREMENTS	**YES**	**NO**	**YES**	**NO**	
159	Hand thickness					658-659
160	Palm length					660-661
161	Hand length (wrist to middle finger)					662-663
162	Wrist to index finger length					664-665
163	Wrist to thumb tip length					666-667
164	Thumb length					668-669
165	Index finger length					670-671
166	Middle finger length					672-673
167	Ring finger length					674-675
168	Little finger length					676-677
169	Hand width					678-679
170	Hand girth					680-681
171	Thumb girth					682-683
172	Index finger girth					684-685
173	Middle finger girth					686-687
174	Ring finger girth					688-689
175	Little finger girth					690-691
	FOOT MEASUREMENTS					
176	Height of foot arch					692-693
177	Height of the big toe					694-695
178	Toe height					696-697
179	Ball height					698-699
180	Plantar arch height					700-701
181	Dorsal arch height					702-703
182	Outside ball height					704-705
183	Ankle length					706-707
184	Posterior heel contour					708-709
185	Foot length					710-711
186	Ball length (heel to ball of foot)					712-713
187	Fifth toe length					714-715
188	Outside ball length					716-717
189	Outside ball length (diagonal)					718-719
190	Width of three forward toes					720-721
191	Foot width - diagonal					722-723
192	Foot width (ball width)					724-725
193	Width (centre line to medial border)					726-727
194	Width of instep					728-729
195	Heel width					730-731
196	Girth of heel / instep (Heel-ankle circumference)					732-733
197	Instep girth (Bridge circumference)					734-735
198	Foot girth (ball of foot)					736-737
199	Angle line					738-739
200	Flare (ratio)					740-741
201	Proportion of sole in contact with ground					742-743
202	Lateral foot contour by template					744-745
	ADDITIONAL					746-748
						749-751
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						755-757
						758-760

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UNIVERSITY OF PRETORIA
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QUESTIONNAIRE: RETAIL

Number | | | | 1 - 3

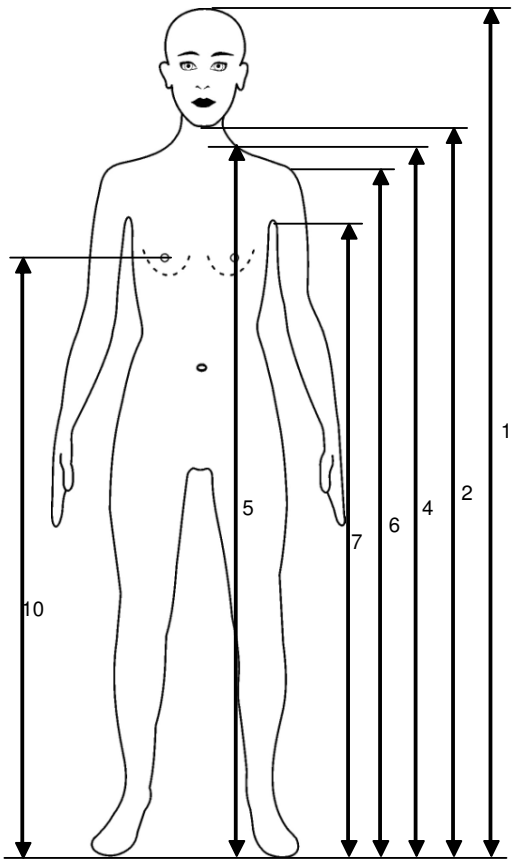
COMPANY NAME:	CONTACT PERSON:	E-MAIL / TEL NO:

1. Indicate next to the appropriate garment type which age group you cater for and how long you have been marketing the specific garment type.

BABIES / INFANTS	AGE GROUPS (in months)			YEARS INVOLVED			
GARMENT TYPE	0-12	12-24	24-36	0-4	5-9	10+	
BABIES' / INFANTS wear							4-7
BABIES' / INFANTS FOOTWEAR							8-11
BABIES' / INFANTS HEADWEAR							12-15
BABIES' / INFANTS GLOVES							16-19

CHILDREN	AGE GROUPS (in years)		YEARS INVOLVED			
GARMENT TYPE	1-8	9-16	0-4	5-9	10+	
BOYS' coats, overalls						20-22
BOYS' jackets, shirts, t-shirts						23-25
BOYS' pants, shorts						26-28
BOYS' swimwear						29-31
BOYS' underwear						32-34
GIRLS' dresses, coats, overalls						35-37
GIRLS' jackets, blouses, t-shirts						38-40
GIRLS' skirts, trousers, shorts						41-43
GIRLS' swimwear						44-46
GIRLS' underwear						47-49
BOYS' / GIRLS' SOCKS						50-52
BOYS' / GIRLS' HEADWEAR						53-55
BOYS' / GIRLS' GLOVES						56-58
SCHOOL WEAR						59-61

	AGE GROUPS (in years)					YEARS INVOLVED			
GARMENT TYPE	17-29	30-39	40-49	50-59	60+	0-4	5-9	10+	
MEN'S coats, overalls									62-67
MEN'S jackets, shirts, t-shirts									68-73
MEN'S pants, shorts									74-79
MEN'S swimwear									80-85
MEN'S underwear									86-91
LADIES' dresses, coats, overalls									92-97
LADIES' jackets, blouses, t-shirts									98-103
LADIES' skirts, trousers, shorts									104-109
LADIES' swimwear									110-115
LADIES' underwear									116-121
LADIES' foundation wear									122-127
MATERNITY WEAR									128-133
ETHNIC WEAR									134-139
PROTECTIVE WEAR									140-145
MEN'S / LADIES' SOCKS									146-151
MEN'S / LADIES' HEADWEAR									152-157
MEN'S / LADIES' GLOVES									158-163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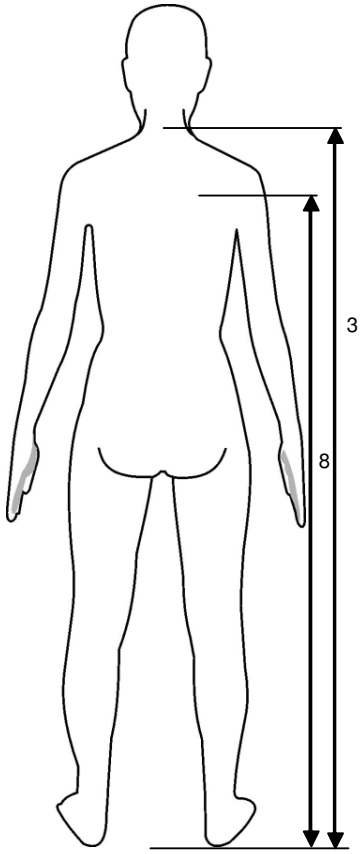
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FOOTWEAR	AGE GROUPS (in years)							YEARS INVOLVED			
CATEGORY	1-8	9-16	17-29	30-39	40-49	50-59	60+	0-4	5-9	10+	
MEN'S SANDALS											164-171
LADIES' SANDALS											172-179
BOYS' SANDALS											180-187
GIRLS' SANDALS											188-195
MEN'S CLOSED SHOES											196-203
LADIES' CLOSED SHOES											204-211
BOYS' CLOSED SHOES											212-219
GIRLS' CLOSED SHOES											220-227
MOULDED FOOTWEAR											228-235
HEALTH SHOES											236-243
SPORTS / ATHLETIC SHOES											244-251
SCHOOL SHOES											252-259
INDUSTRIAL FOOTWEAR (steel cap)											260-267
INDUSTRIAL FOOTWEAR (steel cap)											268-275
CONTRACT FOOTWEAR											276-283

2. Do you provide for the following special figure requirements?

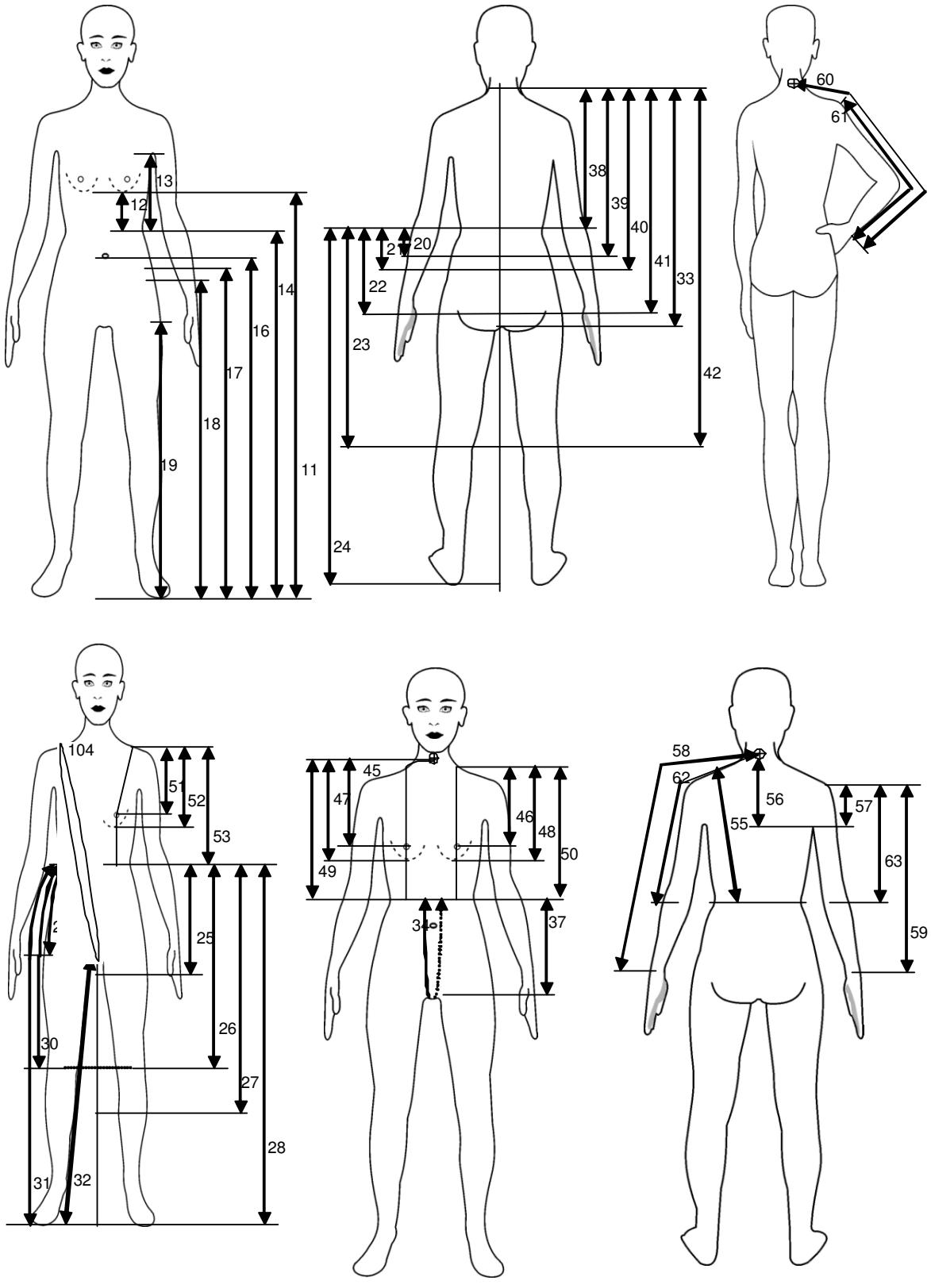
	YES	NO	
Short, Regular, Long			284
Disabled people in wheelchairs			285
Disabled people missing limbs			286
Petite figures			287
Outsizes / Plus sizes			288
Different body shapes			289
Other, specify			290-291
			292-293

3. Indicate if you have ever been involved in the process of developing sizing systems for any of the following garment types:

	MEN'S		WOMEN'S		BOYS'		GIRLS'		INFANTS		
	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	
OUTERWEAR											294-298
UNDERWEAR											299-303
PROTECTIVE WEAR											304-308
FOOTWEAR											309-313
HEADWEAR											314-318
GLOVES											319-323
Other, specify											324-329
											330-335
											336-341

4. Mark the measurements that you use and if applicable indicate if you experience measuring problems with any of these.

	BODY MEASUREMENTS	USED		PROBLEMS		
	HEIGHTS - VERTICAL	YES	NO	YES	NO	
1	Height					342-343
2	Chin height					344-345
3	Cervical height					346-347
4	Side neck height					348-349
5	Side neck to front ground level					350-351
6	Shoulder height					352-353
7	Underarm height (Axilla height)					354-355
8	Across back height					356-357
9	Chest height					358-359
10	Bust level height					360-361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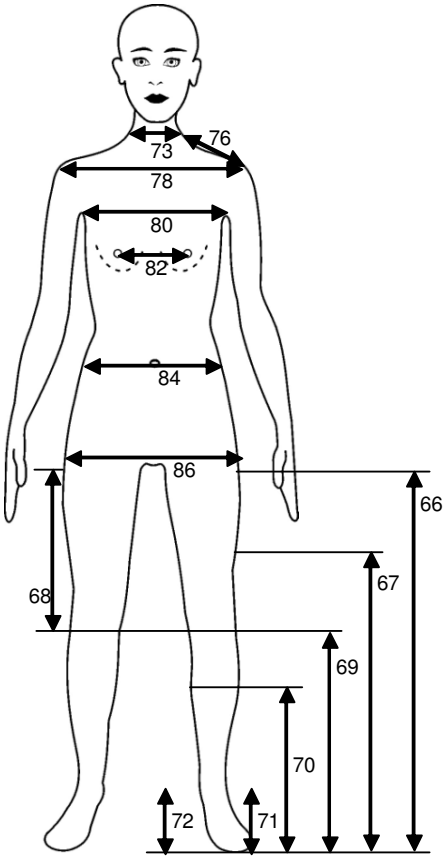
	BODY MEASUREMENTS	USED		PROBLEMS		
	HEIGHTS - VERTICAL	YES	NO	YES	NO	
11	Underbust level height					362-363
12	Underbust to waist					364-365
13	Armscye to waist					366-367
14	Waist height					368-369
15	Preferred waist height					370-371
16	Waist height (at belly button level)					372-373
17	Upper hip height					374-375
18	Top hip height					376-377
19	Hip height (at max circumference)					378-379
20	Centre back waist tot top hip					380-381
21	Centre back waist to upper hip					382-383
22	Centre back waist to hip (max circumference)					384-385
23	Centre back waist to knee					386-387
24	Centre back waist to ground					388-389
25	Front waist to thigh					390-391
26	Front waist to knee					392-393
27	Front waist to calf					394-395
28	Front waist to ground					396-397
29	Side waist to hip					398-399
30	Side waist to knee length					400-401
31	Outside leg length					402-403
32	Inside leg length / crotch height					404-405
33	Trunk length					406-407
34	Total crotch length					408-409
35	Front crotch length					410-411
36	Back crotch lenth					412-413
37	Body rise / Crotch depth					414-415
38	Back waist length (cervical to waist)					416-417
39	Cervical to top hip					418-419
40	Cervical to upper hip					420-421
41	Cervical to hip					422-423
42	Cervical to knee hollow					424-425
43	Cervical to chest level					426-427
44	Side neck to chest level					428-429
45	Cervical to breast point					430-431
46	Side neck to breast point					432-433
47	Cervical to under bust level					434-435
48	Side neck to under bust level					436-437
49	Cervical to front waist					438-439
50	Front waist length (Side neck to waist)					440-441
51	Centre shoulder to bust point					442-443
52	Centre shoulder to under bust level					444-445
53	Centre shoulder to front waist - straight					446-447
54	Centre shoulder to front waist - contoured					448-449
55	Centre shoulder to back waist - contoured					450-451
56	Armscye depth (Cervical to underarm level)					452-453
57	Top arm length (Shoulder to underarm level)					454-455
58	Arm length straight (Cervical to wrist)					456-457
59	Arm length straight (Shoulder to wrist)					458-459
60	Arm length bent (Cervical to wrist)					460-461
61	Arm length bent (Shoulder to wrist)					462-463
62	Upper arm length (Cervical to elbow)					464-465
63	Upper arm length (Shoulder to elbow)					466-467
64	Under arm length (to wrist)					468-469
65	Under arm length to elbow					470-471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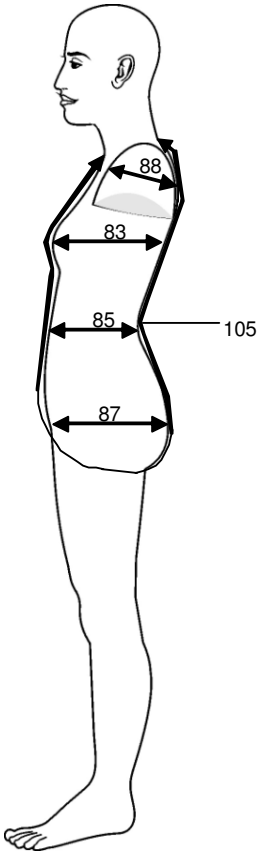
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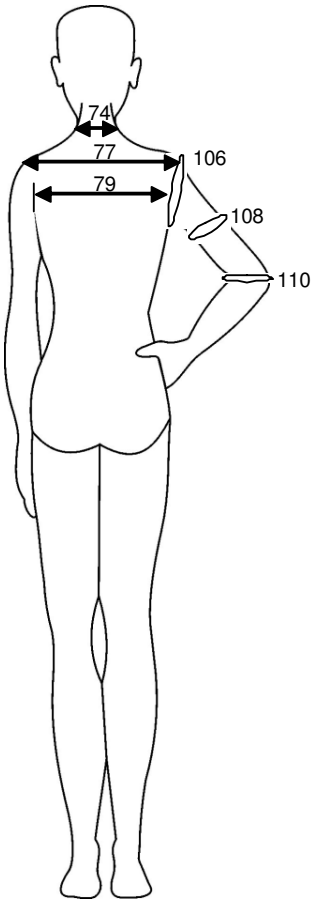
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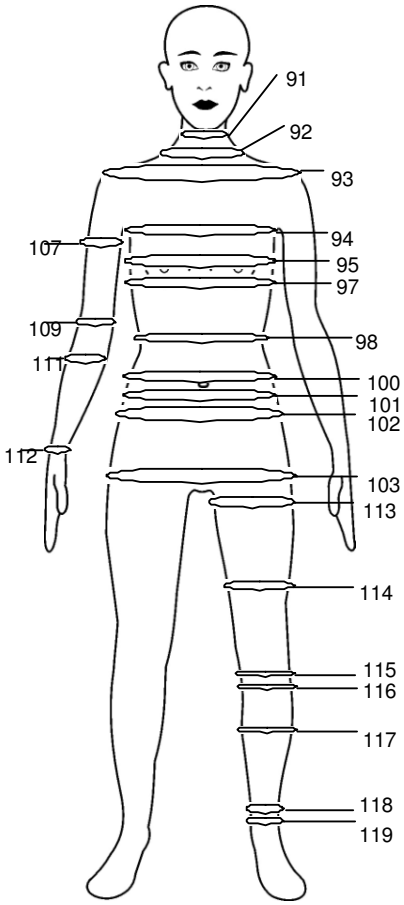
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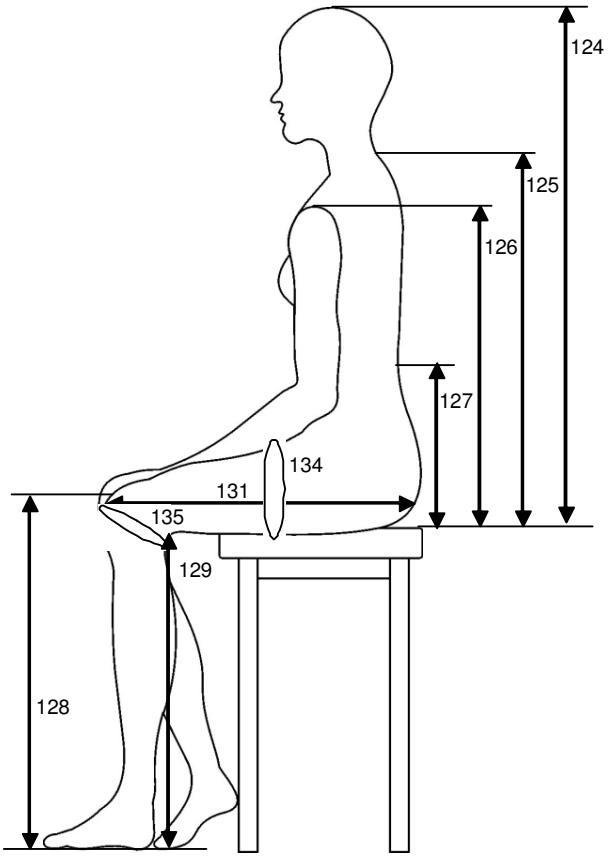
	BODY MEASUREMENTS	USED		PROBLEMS		
	HEIGHTS - VERTICAL	**YES**	**NO**	**YES**	**NO**	
66	Thigh height					472-473
67	Mid-thigh height					474-475
68	Thigh length					476-477
69	Knee height					478-479
70	Calf height					480-481
71	Ankle height (outside leg)					482-483
72	Ankle height (inside leg)					484-485
	WIDTH – HORIZONTAL					
73	Neck width – front					486-487
74	Neck width – back					488-489
75	Back Neck width contoured					490-491
76	Shoulder length					492-493
77	Shoulder width – back					494-495
78	Shoulder width - front					496-497
79	Across back width					498-499
80	Across front width					500-501
81	Breast prominence					502-503
82	Bust width					504-505
83	Chest depth					506-507
84	Waist width					508-509
85	Waist depth					510-511
86	Hip width (from front at max circumference)					512-513
87	Buttock depth (back to front at max point - measured form the side)					514-515
88	Armscye width (front to back across top of arm)					516-517
89	Armspan					518-519
	CIRCUMFERENCES					
90	Neck girth					520-521
91	Neck girth - around Adam's apple					522-523
92	Neck base girth					524-525
93	Shoulder girth					526-527
94	Chest girth					528-529
95	Bust girth					530-531
96	Bust girth contoured					532-533
97	Underbust girth					534-535
98	Waist girth					536-537
99	Preferred waist girth					538-539
100	Waist girth at belly button level					540-541
101	Upper hip girth (at prominent hip bone)					542-543
102	Top hip girth (midway between natural waist and max hip)					544-545
103	Hip girth (at max circumference)					546-547
104	Trunk circumference (Body loop)					548-549
105	Centre trunk circumference (nape through to front base of neck)					550-551
106	Armscye girth					552-553
107	Upper arm girth - straight					554-555
108	Upper arm girth - bent					556-557
109	Elbow girth - straight					558-559
110	Elbow girth - bent					560-561
111	Forearm girth					562-563
112	Wrist girth					564-565
113	Thigh girth					566-567
114	Mid-thigh girth					568-569
115	Knee girth					570-571
116	Lower knee girth					572-573
117	Calf girth					574-575
118	Minimum leg girth					576-577
119	Ankle girth					578-579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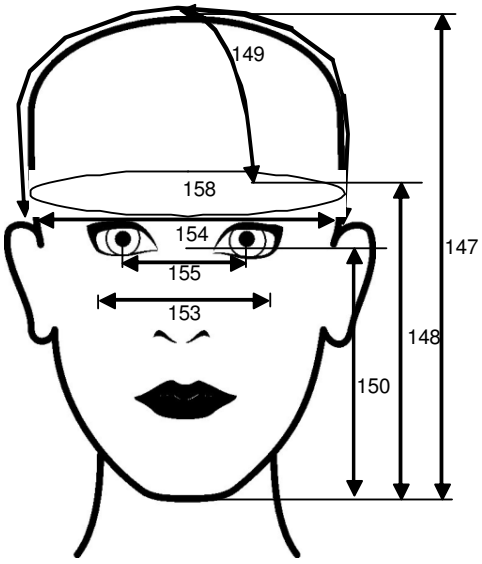
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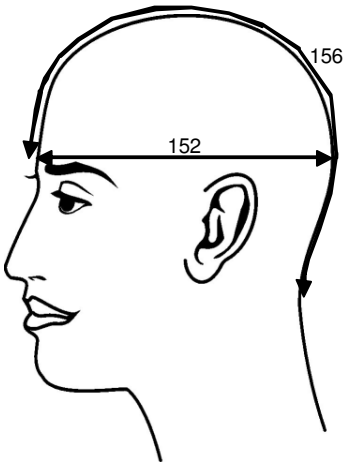
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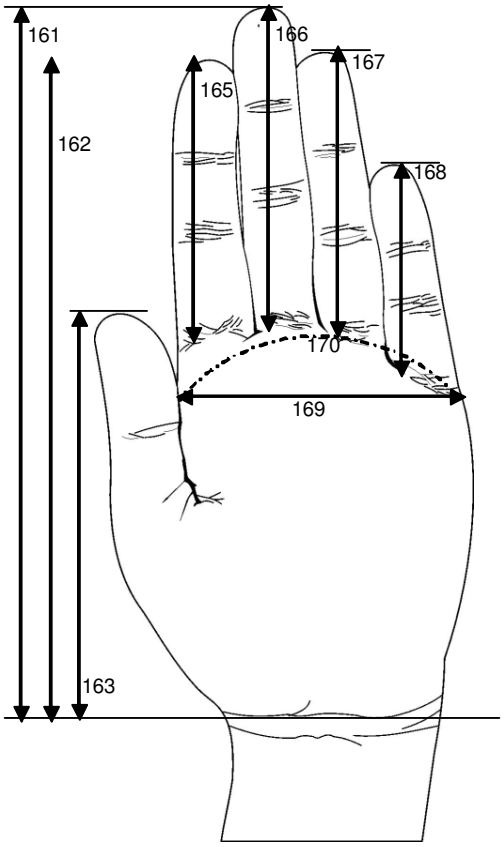
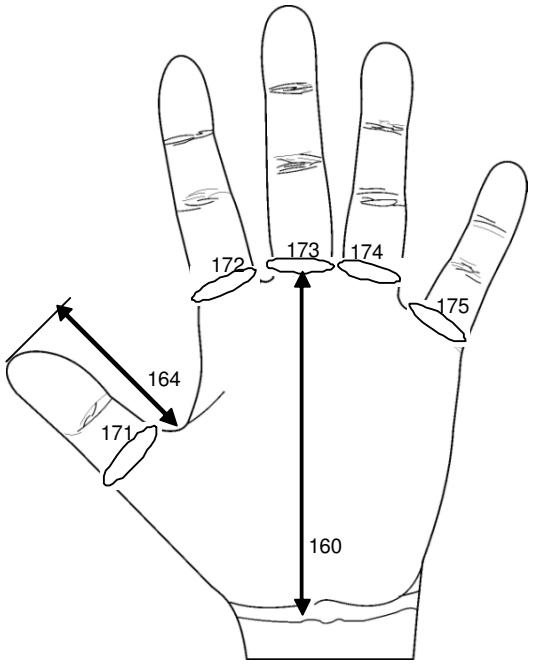
	BODY MEASUREMENTS	USED		PROBLEMS		
	ARC MEASUREMENTS	**YES**	**NO**	**YES**	**NO**	
120	Bust arc anterior					580-581
121	Waist arc anterior					582-583
122	Abdominal extension arc anterior					584-585
123	Hip arc posterior					586-587
	SEATED - HEIGHTS					
124	Height					588-589
125	Cervical height					590-591
126	Shoulder height					592-593
127	Waist height					594-595
128	Knee height					596-597
129	Popliteal height (lower leg length)					598-599
	SEATED - WIDTHS					
130	Hip width					600-601
131	Thigh length					602-603
	SEATED - GIRTHS					
132	Waist girth					604-605
133	Hip girth					606-607
134	Thigh girth					608-609
135	Knee girth					610-611
	OTHER					
136	Body mass (in kg)					612-613
137	Shoulder blade skinfold					614-615
138	Triceps skinfold					616-617
139	Bust to waist drop					618-619
140	Hip to waist drop					620-621
141	Bust to underbust drop					622-623
142	Front neck depth					624-625
143	Back neck depth					626-627
144	Back seat angle					628-629
145	Shoulder slope					630-631
146	Height (Lying - infants)					632-633
	HEAD MEASUREMENTS					
147	Head height					634-635
148	Face length (Menton-glabella)					636-637
149	Crown of scull to brows (Vertex to glabella)					638-639
150	Chin to nose bridge (Menton-sellion)					640-641
151	Chin to pit of neck					642-643
152	Head length (brow to back of scull)					644-645
153	Head width - cheekbone to cheeckbone					646-647
154	Head width - above ears					648-649
155	Inter-pupillary distance					650-651
156	Sagittal arch					652-653
157	Surface distance from above the ears across the top of the head (Bi-tragion coronal arch)					654-655
158	Head girth					656-657





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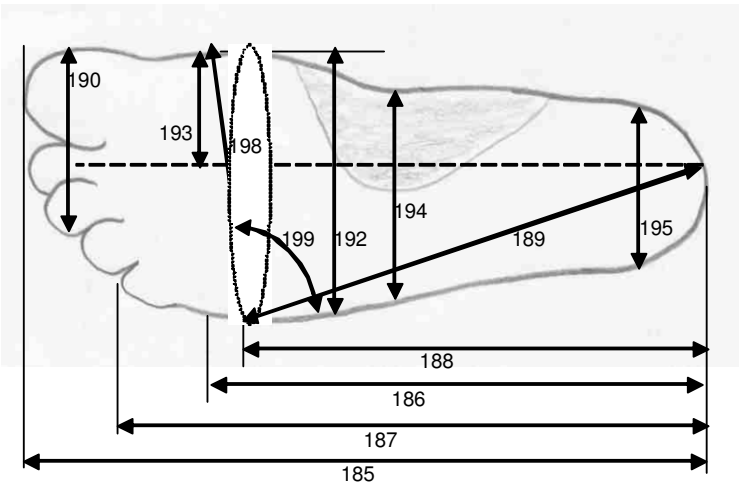
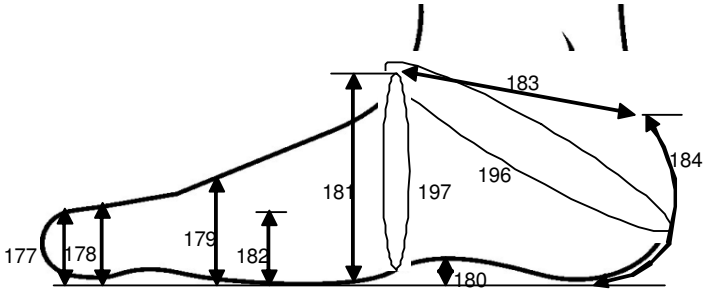




	BODY MEASUREMENTS	USED		PROBLEMS		
	HAND MEASUREMENTS	**YES**	**NO**	**YES**	**NO**	
159	Hand thickness					658-659
160	Palm length					660-661
161	Hand length (wrist to middle finger)					662-663
162	Wrist to index finger length					664-665
163	Wrist to thumb tip length					666-667
164	Thumb length					668-669
165	Index finger length					670-671
166	Middle finger length					672-673
167	Ring finger length					674-675
168	Little finger length					676-677
169	Hand width					678-679
170	Hand girth					680-681
171	Thumb girth					682-683
172	Index finger girth					684-685
173	Middle finger girth					686-687
174	Ring finger girth					688-689
175	Little finger girth					690-691
	FOOT MEASUREMENTS					
176	Height of foot arch					692-693
177	Height of the big toe					694-695
178	Toe height					696-697
179	Ball height					698-699
180	Plantar arch height					700-701
181	Dorsal arch height					702-703
182	Outside ball height					704-705
183	Ankle length					706-707
184	Posterior heel contour					708-709
185	Foot length					710-711
186	Ball length (heel to ball of foot)					712-713
187	Fifth toe length					714-715
188	Outside ball length					716-717
189	Outside ball length (diagonal)					718-719
190	Width of three forward toes					720-721
191	Foot width - diagonal					722-723
192	Foot width (ball width)					724-725
193	Width (centre line to medial border)					726-727
194	Width of instep					728-729
195	Heel width					730-731
196	Girth of heel / instep (Heel-ankle circumference)					732-733
197	Instep girth (Bridge circumference)					734-735
198	Foot girth (ball of foot)					736-737
199	Angle line					738-739
200	Flare (ratio)					740-741
201	Proportion of sole in contact with ground					742-743
202	Lateral foot contour by template					744-745
	ADDITIONAL					746-748
						749-751
						752-754
						755-757
						758-760

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

QUESTIONNAIRE: FOOTWEAR

Number | | | | 1 - 3

COMPANY NAME:	CONTACT PERSON:	E-MAIL / TEL NO:

1. Indicate whether you manufacture lasts for the following footwear types, and how long your company have been manufacturing the specific types of lasts. (If applicable, indicate whether the last sizes would be applicable to all age groups)

BABIES / INFANTS	AGE GROUPS (in months)			YEARS INVOLVED			
GARMENT TYPE	0-12	12-24	24-36	0-4	5-9	10+	
BABIES' / INFANTS FOOTWEAR							8-11

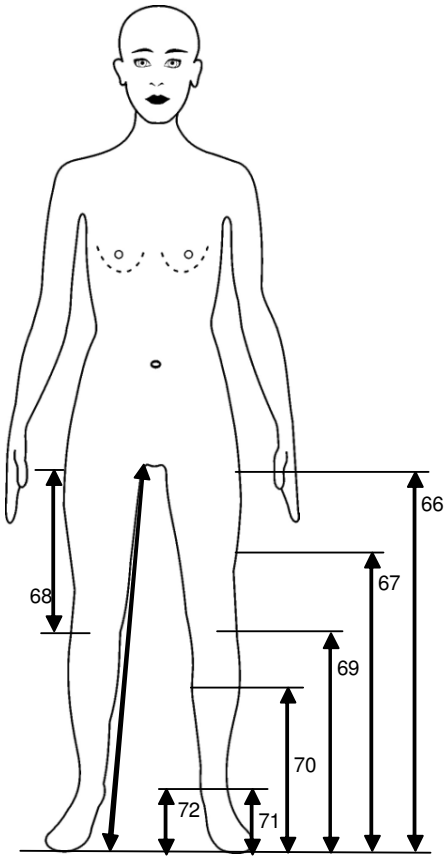
FOOTWEAR	AGE GROUPS (in years)							YEARS INVOLVED			
CATEGORY	1-8	9-16	17-29	30-39	40-49	50-59	60+	0-4	5-9	10+	
MEN'S SANDALS											164-171
LADIES' SANDALS											172-179
BOYS' SANDALS											180-187
GIRLS' SANDALS											188-195
MEN'S CLOSED SHOES											196-203
LADIES' CLOSED SHOES											204-211
BOYS' CLOSED SHOES											212-219
GIRLS' CLOSED SHOES											220-227
MOULDED FOOTWEAR											228-235
HEALTH SHOES											236-243
SPORTS / ATHLETIC SHOES											244-251
SCHOOL SHOES											252-259
INDUSTRIAL FOOTWEAR (steel cap)											260-267
INDUSTRIAL FOOTWEAR (steel cap)											268-275
CONTRACT FOOTWEAR											276-283

2. Do you provide for the following special figure requirements?

	YES	NO	
Short, Regular, Long			284
Disabled people in wheelchairs			285
Disabled people missing limbs			286
Petite figures			287
Outsizes / Plus sizes			288
Different body shapes			289
Other, specify			290-291
			292-293

3. Indicate if you have ever been involved in the process of developing sizing systems for any of the following garment types:

	MEN'S		WOMEN'S		BOYS'		GIRLS'		INFANTS		
	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	
OUTERWEAR											294-298
UNDERWEAR											299-303
PROTECTIVE WEAR											304-308
FOOTWEAR											309-313
HEADWEAR											314-318
GLOVES											319-323
Other, specify											324-329
											330-335
											336-341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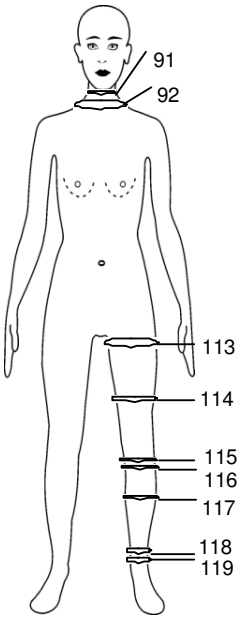
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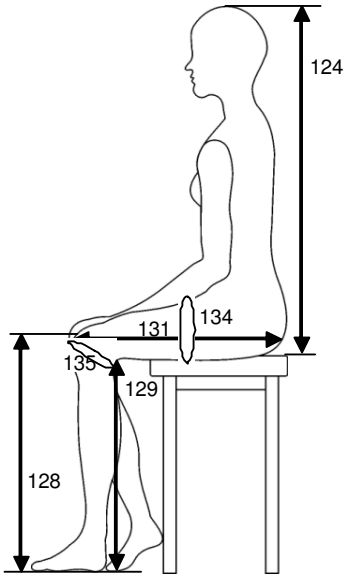
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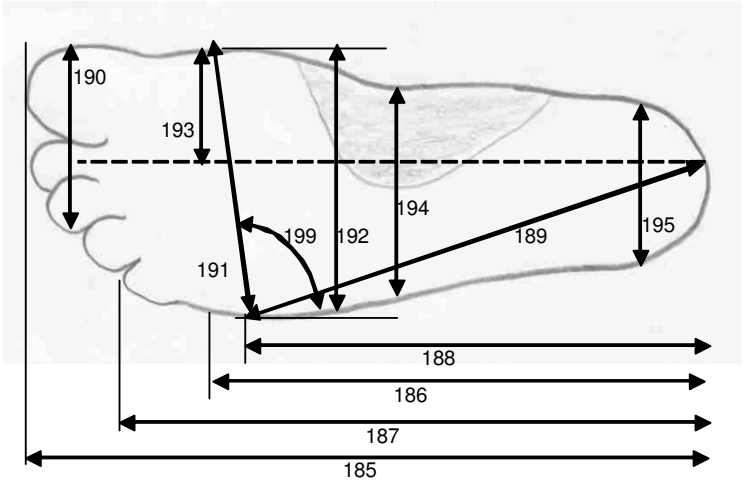
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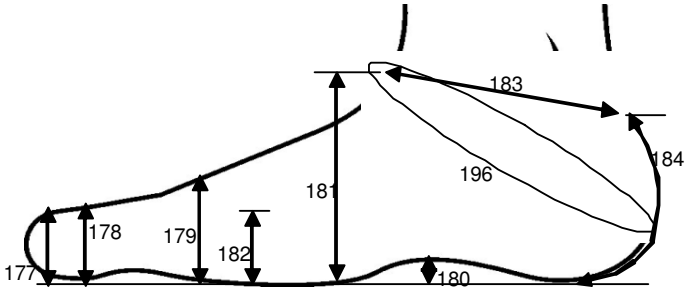
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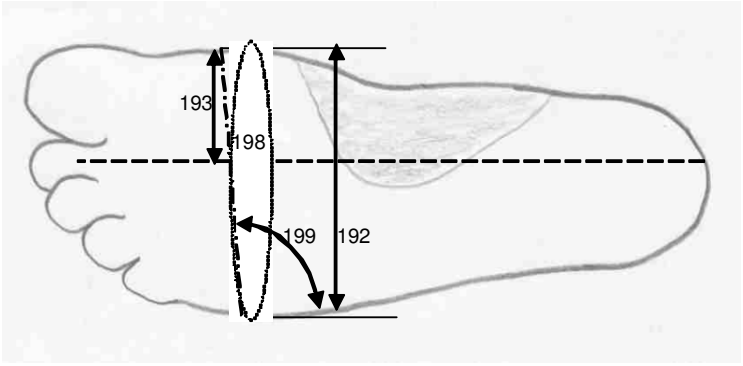
4. Mark the measurements that you use and if applicable indicate if you experience measuring problems with any of these.

	BODY MEASUREMENTS	USED		PROBLEMS		
	HEIGHTS - VERTICAL	**YES**	**NO**	**YES**	**NO**	
1	Height					342-343
32	Inside leg length / crotch height					404-405
66	Thigh height					472-473
67	Mi thigh height					474-475
68	Thigh length					476-477
69	Knee height					478-479
70	Calf height					480-481
71	Ankle height (outside leg)					482-483
72	Ankle height (inside leg)					484-485
	CIRCUMFERENCES					
113	Thigh girth					566-567
114	Mid-thigh girth					568-569
115	Knee girth					570-571
116	Lower knee girth					572-573
117	Calf girth					574-575
118	Minimum leg girth					576-577
119	Ankle girth					578-579
	SEATED - HEIGHTS					
124	Height					588-589
128	Knee height					596-597
129	Popliteal height (lower leg length)					598-599
	SEATED - WIDTHS					
131	Thigh length					602-603
	SEATED - GIRTHS					
134	Thigh girth					608-609
135	Knee girth					610-611
	OTHER					
136	Body mass (in kg)					612-613
146	Height (Lying - infants)					632-633
	FOOT MEASUREMENTS					
176	Height of foot arch					692-693
177	Height of the big toe					694-695
178	Toe height					696-697
179	Ball height					698-699
180	Plantar arch height					700-701
181	Dorsal arch height					702-703
182	Outside ball height					704-705
183	Ankle length					706-707
184	Posterior heel contour					708-709
185	Foot length					710-711
186	Ball length (heel to ball of foot)					712-713
187	Fifth toe length					714-715
188	Outside ball length					716-717
189	Outside ball length (diagonal)					718-719
190	Width of three forward toes					720-721
191	Foot width - diagonal					722-723
192	Foot width (ball width)					724-725
193	Width (centre line to medial border)					726-727
194	Width of instep					728-729
195	Heel width					730-731
196	Girth of heel / instep (Heel-ankle circumference)					732-733
197	Instep girth (Bridge circumference)					734-735



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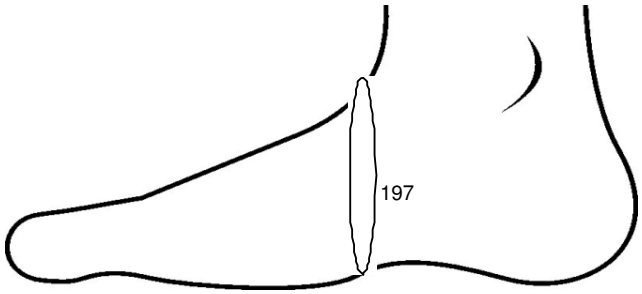

	BODY MEASUREMENTS	USED		PROBLEMS		
	FOOT MEASUREMENTS	**YES**	**NO**	**YES**	**NO**	
198	Foot girth (ball of foot)					736-737
199	Angle line					738-739
200	Flare (ratio)					740-741
201	Proportion of sole in contact with ground					742-743
202	Lateral foot contour by template					744-745
	ADDITIONAL					746-748
						749-751
						752-754
						755-757
						758-760

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QUESTIONNAIRE: HEAD AND FOOTWEAR

Number | | | | 1 - 3

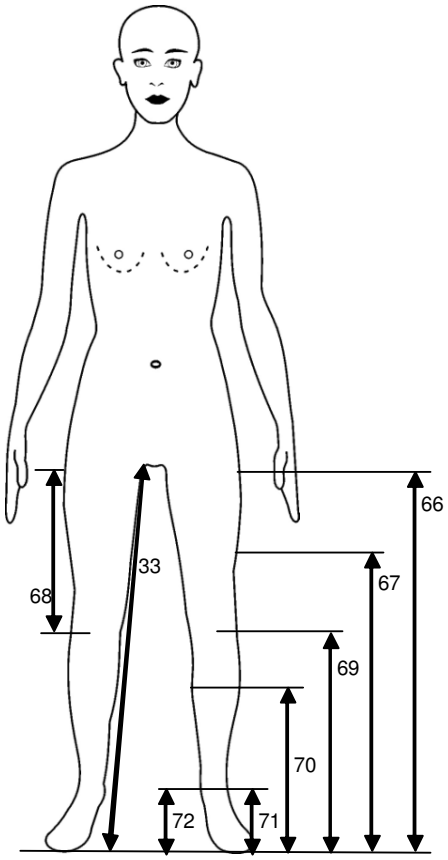
COMPANY NAME:	CONTACT PERSON:	E-MAIL / TEL NO:

1. Indicate next to the appropriate garment type which age group you cater for and how long you have been manufacturing the specific garment type.

BABIES / INFANTS	AGE GROUPS (in months)			YEARS INVOLVED			
GARMENT TYPE	0-12	12-24	24-36	0-4	5-9	10+	
BABIES' / INFANTS wear							4-7
BABIES' / INFANTS FOOTWEAR							8-11
BABIES' / INFANTS HEADWEAR							12-15
BABIES' / INFANTS GLOVES							16-19

CHILDREN	AGE GROUPS (in years)		YEARS INVOLVED			
GARMENT TYPE	1-8	9-16	0-4	5-9	10+	
BOYS' coats, overalls						20-22
BOYS' jackets, shirts, t-shirts						23-25
BOYS' pants, shorts						26-28
BOYS' swimwear						29-31
BOYS' underwear						32-34
GIRLS' dresses, coats, overalls						35-37
GIRLS' jackets, blouses, t-shirts						38-40
GIRLS' skirts, trousers, shorts						41-43
GIRLS' swimwear						44-46
GIRLS' underwear						47-49
BOYS' / GIRLS' SOCKS						50-52
BOYS' / GIRLS' HEADWEAR						53-55
BOYS' / GIRLS' GLOVES						56-58
SCHOOL WEAR						59-61

	AGE GROUPS (in years)					YEARS INVOLVED			
GARMENT TYPE	17-29	30-39	40-49	50-59	60+	0-4	5-9	10+	
MEN'S coats, overalls									62-67
MEN'S jackets, shirts, t-shirts									68-73
MEN'S pants, shorts									74-79
MEN'S swimwear									80-85
MEN'S underwear									86-91
LADIES' dresses, coats, overalls									92-97
LADIES' jackets, blouses, t-shirts									98-103
LADIES' skirts, trousers, shorts									104-109
LADIES' swimwear									110-115
LADIES' underwear									116-121
LADIES' foundation wear									122-127
MATERNITY WEAR									128-133
ETHNIC WEAR									134-139
PROTECTIVE WEAR									140-145
MEN'S / LADIES' SOCKS									146-151
MEN'S / LADIES' HEADWEAR									152-157
MEN'S / LADIES' GLOVES									158-163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FOOTWEAR	AGE GROUPS (in years)							YEARS INVOLVED			
CATEGORY	1-8	9-16	17-29	30-39	40-49	50-59	60+	0-4	5-9	10+	
MEN'S SANDALS											164-171
LADIES' SANDALS											172-179
BOYS' SANDALS											180-187
GIRLS' SANDALS											188-195
MEN'S CLOSED SHOES											196-203
LADIES' CLOSED SHOES											204-211
BOYS' CLOSED SHOES											212-219
GIRLS' CLOSED SHOES											220-227
MOULDED FOOTWEAR											228-235
HEALTH SHOES											236-243
SPORTS / ATHLETIC SHOES											244-251
SCHOOL SHOES											252-259
INDUSTRIAL FOOTWEAR (steel cap)											260-267
INDUSTRIAL FOOTWEAR (steel cap)											268-275
CONTRACT FOOTWEAR											276-283

2. Do you provide for the following special figure requirements?

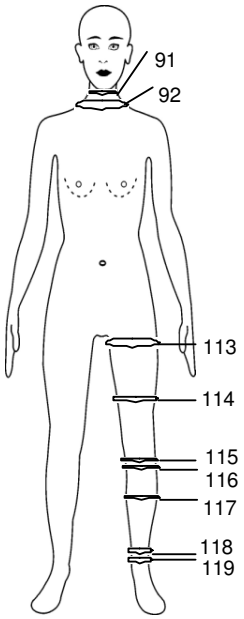
	YES	NO	
Short, Regular, Long			284
Disabled people in wheelchairs			285
Disabled people missing limbs			286
Petite figures			287
Outsizes / Plus sizes			288
Different body shapes			289
Other, specify			290-291
			292-293

3. Indicate if you have ever been involved in the process of developing sizing systems for any of the following garment types:

	MEN'S		WOMEN'S		BOYS'		GIRLS'		INFANTS		
	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	
OUTERWEAR											294-298
UNDERWEAR											299-303
PROTECTIVE WEAR											304-308
FOOTWEAR											309-313
HEADWEAR											314-318
GLOVES											319-323
Other, specify											324-329
											330-335
											336-341

4. Mark the measurements that you use and if applicable indicate if you experience measuring problems with any of these.

	BODY MEASUREMENTS	USED		PROBLEMS		
	HEIGHTS - VERTICAL	YES	NO	YES	NO	
1	Height					342-343
32	Inside leg length / crotch height					404-405
66	Thigh height					472-473
67	Mid-thigh height					474-475
68	Thigh length					476-477
69	Knee height					478-479
70	Calf height					480-481
71	Ankle height (outside leg)					482-483
72	Ankle height (inside leg)					484-485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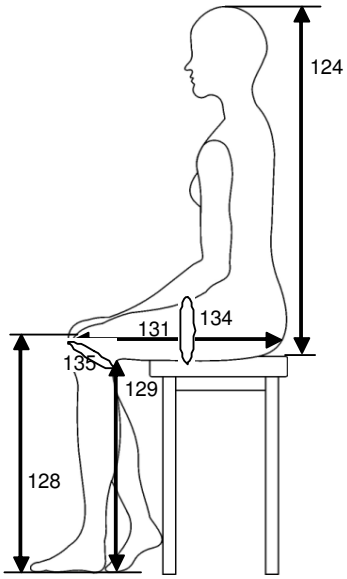
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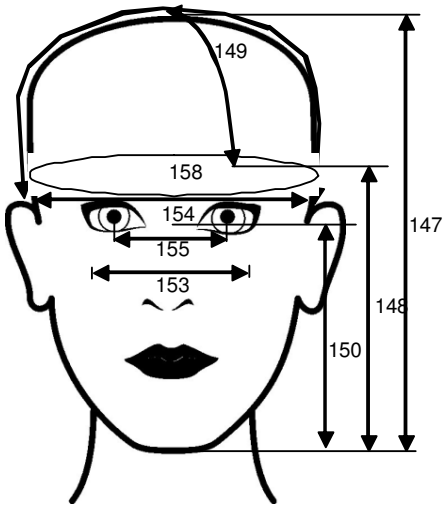
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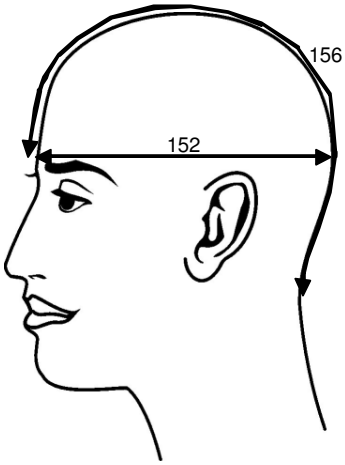
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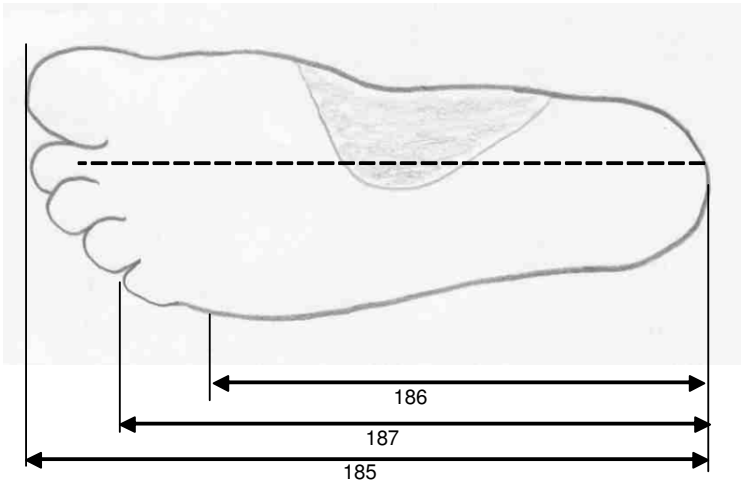
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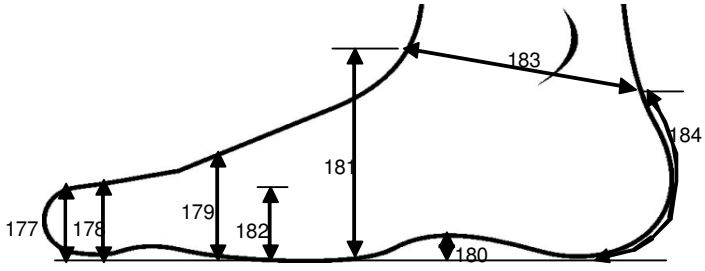
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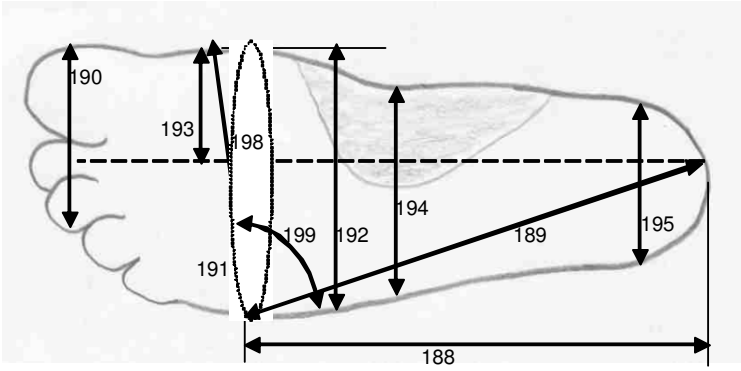
	BODY MEASUREMENTS	USED		PROBLEMS		
	WIDTH - HORIZONTAL	**YES**	**NO**	**YES**	**NO**	
73	Neck width - front					486-487
74	Neck width - back					488-489
75	Back Neck width contoured					490-491
	CIRCUMFERENCES					
90	Neck girth					520-521
91	Neck girth - around Adam's apple					522-523
92	Neck base girth					524-525
113	Thigh girth					566-567
114	Mid-thigh girth					568-569
115	Knee girth					570-571
116	Lower knee girth					572-573
117	Calf girth					574-575
118	Minimum leg girth					576-577
119	Ankle girth					578-579
	SEATED - HEIGHTS					
124	Height					588-589
128	Knee height					596-597
129	Popliteal height (lower leg length)					598-599
	SEATED - WIDTHS					
131	Thigh length					602-603
	SEATED - GIRTHS					
134	Thigh girth					608-609
135	Knee girth					610-611
	OTHER					
136	Body mass (in kg)					612-613
146	Height (Lying - infants)					632-633
	HEAD MEASUREMENTS					
147	Head height					634-635
148	Face length (Menton-glabella)					636-637
149	Crown of scull to brows (Vertex to glabella)					638-639
150	Chin to nose bridge (Menton-sellion)					640-641
151	Chin to pit of neck					642-643
152	Head length (brow to back of scull)					644-645
153	Head width - cheekbone to cheeckbone					646-647
154	Head width - above ears					648-649
155	Inter-pupillary distance					650-651
156	Sagittal arch					652-653
157	Surface distance from above the ears across the top of the head (Bi-tragion coronal arch)					654-655
158	Head girth					656-657
	FOOT MEASUREMENTS					
176	Height of foot arch					692-693
177	Height of the big toe					694-695
178	Toe height					696-697
179	Ball height					698-699
180	Plantar arch height					700-701
181	Dorsal arch height					702-703
182	Outside ball height					704-705
183	Ankle length					706-707
184	Posterior heel contour					708-709
185	Foot length					710-711
186	Ball length (heel to ball of foot)					712-713
187	Fifth toe length					714-715



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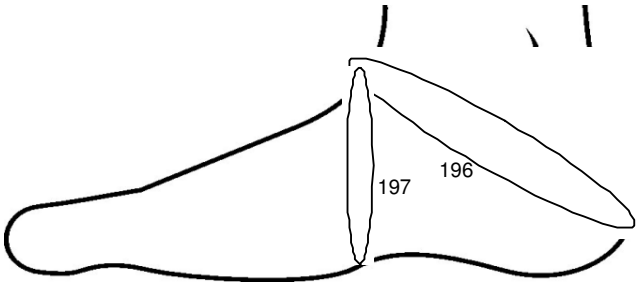

	BODY MEASUREMENTS	USED		PROBLEMS		
	FOOT MEASUREMENTS	**YES**	**NO**	**YES**	**NO**	
188	Outside ball length					716-717
189	Outside ball length (diagonal)					718-719
190	Width of three forward toes					720-721
191	Foot width - diagonal					722-723
192	Foot width (ball width)					724-725
193	Width (centre line to medial border)					726-727
194	Width of instep					728-729
195	Heel width					730-731
196	Girth of heel / instep (Heel-ankle circumference)					732-733
197	Instep girth (Bridge circumference)					734-735
198	Foot girth (ball of foot)					736-737
199	Angle line					738-739
200	Flare (ratio)					740-741
201	Proportion of sole in contact with ground					742-743
202	Lateral foot contour by template					744-745
	ADDITIONAL					**746-748**
						749-751
						752-754
						755-757
						758-760

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YUNIBESITHI YA PRETORIA

QUESTIONNAIRE: HEADWEAR

Number | | | | 1 - 3

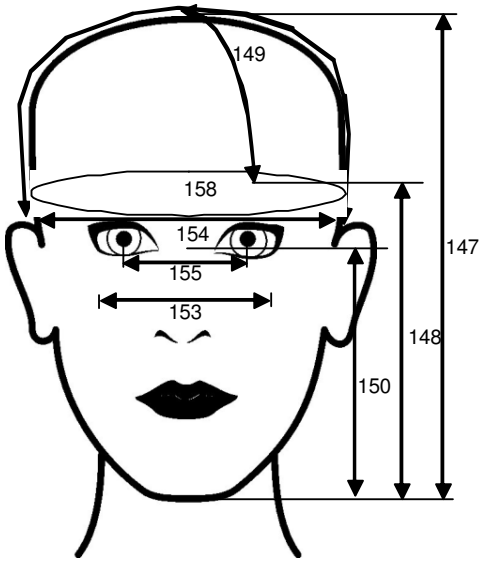
COMPANY NAME:	CONTACT PERSON:	E-MAIL / TEL NO:

1. Indicate next to the appropriate garment type which age group you cater for and how long you have been manufacturing the specific garment type.

BABIES / INFANTS	AGE GROUPS (in months)			YEARS INVOLVED			
GARMENT TYPE	0-12	12-24	24-36	0-4	5-9	10+	
BABIES' / INFANTS wear							4-7
BABIES' / INFANTS FOOTWEAR							8-11
BABIES' / INFANTS HEADWEAR							12-15
BABIES' / INFANTS GLOVES							16-19

CHILDREN	AGE GROUPS (in years)		YEARS INVOLVED			
GARMENT TYPE	1-8	9-16	0-4	5-9	10+	
BOYS' coats, overalls						20-22
BOYS' jackets, shirts, t-shirts						23-25
BOYS' pants, shorts						26-28
BOYS' swimwear						29-31
BOYS' underwear						32-34
GIRLS' dresses, coats, overalls						35-37
GIRLS' jackets, blouses, t-shirts						38-40
GIRLS' skirts, trousers, shorts						41-43
GIRLS' swimwear						44-46
GIRLS' underwear						47-49
BOYS' / GIRLS' SOCKS						50-52
BOYS' / GIRLS' HEADWEAR						53-55
BOYS' / GIRLS' GLOVES						56-58
SCHOOL WEAR						59-61

	AGE GROUPS (in years)					YEARS INVOLVED			
GARMENT TYPE	17-29	30-39	40-49	50-59	60+	0-4	5-9	10+	
MEN'S coats, overalls									62-67
MEN'S jackets, shirts, t-shirts									68-73
MEN'S pants, shorts									74-79
MEN'S swimwear									80-85
MEN'S underwear									86-91
LADIES' dresses, coats, overalls									92-97
LADIES' jackets, blouses, t-shirts									98-103
LADIES' skirts, trousers, shorts									104-109
LADIES' swimwear									110-115
LADIES' underwear									116-121
LADIES' foundation wear									122-127
MATERNITY WEAR									128-133
ETHNIC WEAR									134-139
PROTECTIVE WEAR									140-145
MEN'S / LADIES' SOCKS									146-151
MEN'S / LADIES' HEADWEAR									152-157
MEN'S / LADIES' GLOVES									158-163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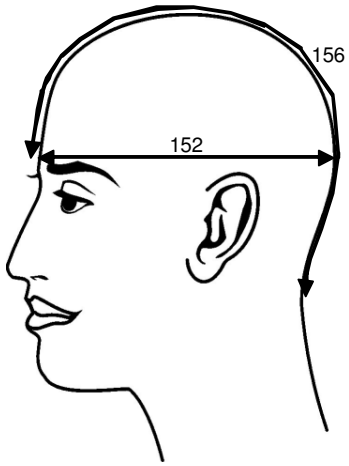
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2. Do you provide for the following special figure requirements?

	YES	NO	
Short, Regular, Long			284
Disabled people in wheelchairs			285
Disabled people missing limbs			286
Petite figures			287
Outsizes / Plus sizes			288
Different body shapes			289
Other, specify			290-291
			292-293

3. Indicate if you have ever been involved in the process of developing sizing systems for any of the following garment types:

	MEN'S		WOMEN'S		BOYS'		GIRLS'		INFANTS		
	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	
OUTERWEAR											294-298
UNDERWEAR											299-303
PROTECTIVE WEAR											304-308
FOOTWEAR											309-313
HEADWEAR											314-318
GLOVES											319-323
Other, specify											324-329
											330-335
											336-341

4. Mark the measurements that you use and if applicable indicate if you experience measuring problems with any of these.

	BODY MEASUREMENTS	USED		PROBLEMS		
	HEIGHTS - VERTICAL	YES	NO	YES	NO	
1	Height					342-343
	WIDTH - HORIZONTAL					
73	Neck width - front					486-487
74	Neck width - back					488-489
	CIRCUMFERENCES					
90	Neck girth					520-521
91	Neck girth - around Adam's apple					522-523
92	Neck base girth					524-525
	HEAD MEASUREMENTS					
149	Crown of scull to brows (Vertex to glabella)					638-639
150	Chin to nose bridge (Menton-sellion)					640-641
151	Chin to pit of neck					642-643
152	Head length (brow to back of scull)					644-645
153	Head width - cheekbone to cheeckbone					646-647
154	Head width - above ears					648-649
155	Inter-pupillary distance					650-651
156	Sagittal arch					652-653
157	Surface distance from above the ears across the top of the head (Bi-tragion coronal arch)					654-655
158	Head girth					656-657
	ADDITIONAL					746-748
						749-751
						752-754
						755-757
						758-760

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YUNIBESITHI YA PRETORIA

QUESTIONNAIRE: HEADWEAR AND GLOVES

Number | | | | 1 - 3

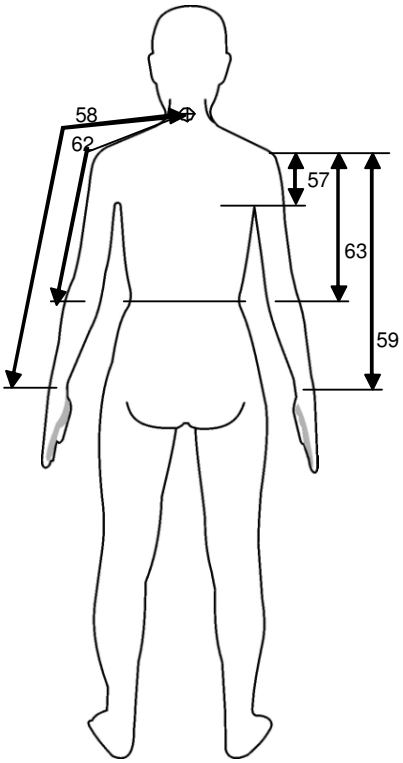
COMPANY NAME:	CONTACT PERSON:	E-MAIL / TEL NO:

1. Indicate next to the appropriate garment type which age group you cater for and how long you have been manufacturing the specific garment type.

BABIES / INFANTS	AGE GROUPS (in months)			YEARS INVOLVED			
GARMENT TYPE	0-12	12-24	24-36	0-4	5-9	10+	
BABIES' / INFANTS wear							4-7
BABIES' / INFANTS FOOTWEAR							8-11
BABIES' / INFANTS HEADWEAR							12-15
BABIES' / INFANTS GLOVES							16-19

CHILDREN	AGE GROUPS (in years)		YEARS INVOLVED			
GARMENT TYPE	1-8	9-16	0-4	5-9	10+	
BOYS' coats, overalls						20-22
BOYS' jackets, shirts, t-shirts						23-25
BOYS' pants, shorts						26-28
BOYS' swimwear						29-31
BOYS' underwear						32-34
GIRLS' dresses, coats, overalls						35-37
GIRLS' jackets, blouses, t-shirts						38-40
GIRLS' skirts, trousers, shorts						41-43
GIRLS' swimwear						44-46
GIRLS' underwear						47-49
BOYS' / GIRLS' SOCKS						50-52
BOYS' / GIRLS' HEADWEAR						53-55
BOYS' / GIRLS' GLOVES						56-58
SCHOOL WEAR						59-61

	AGE GROUPS (in years)					YEARS INVOLVED			
GARMENT TYPE	17-29	30-39	40-49	50-59	60+	0-4	5-9	10+	
MEN'S coats, overalls									62-67
MEN'S jackets, shirts, t-shirts									68-73
MEN'S pants, shorts									74-79
MEN'S swimwear									80-85
MEN'S underwear									86-91
LADIES' dresses, coats, overalls									92-97
LADIES' jackets, blouses, t-shirts									98-103
LADIES' skirts, trousers, shorts									104-109
LADIES' swimwear									110-115
LADIES' underwear									116-121
LADIES' foundation wear									122-127
MATERNITY WEAR									128-133
ETHNIC WEAR									134-139
PROTECTIVE WEAR									140-145
MEN'S / LADIES' SOCKS									146-151
MEN'S / LADIES' HEADWEAR									152-157
MEN'S / LADIES' GLOVES									158-163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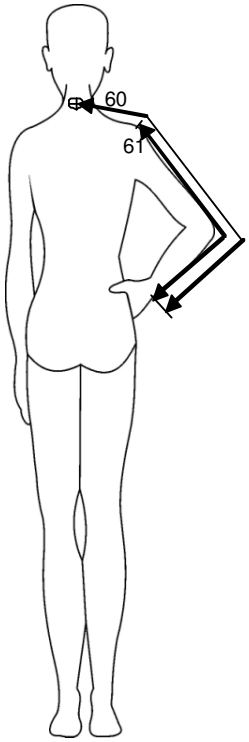
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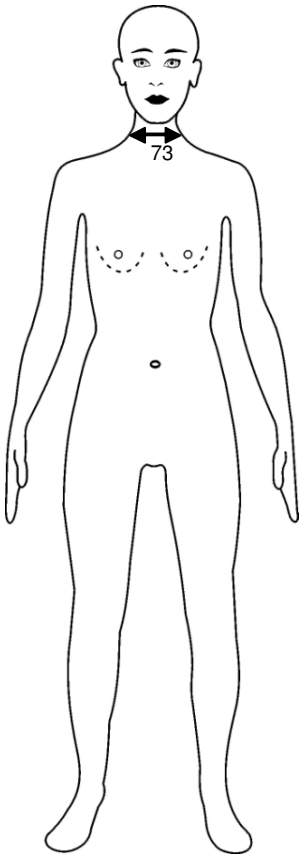
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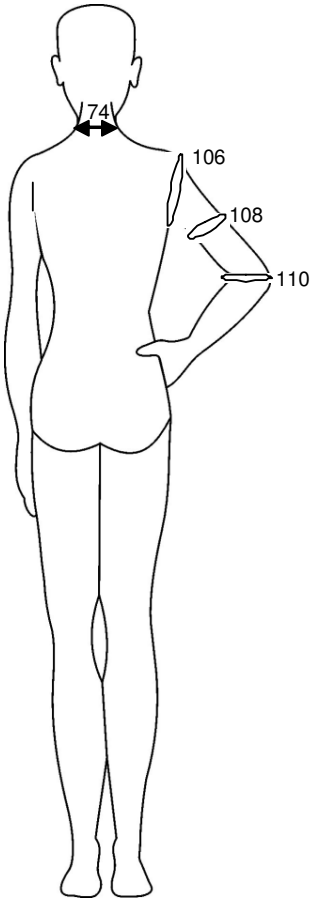
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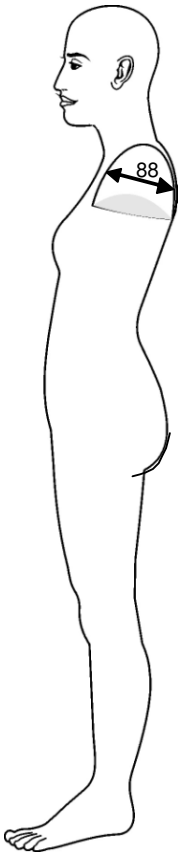
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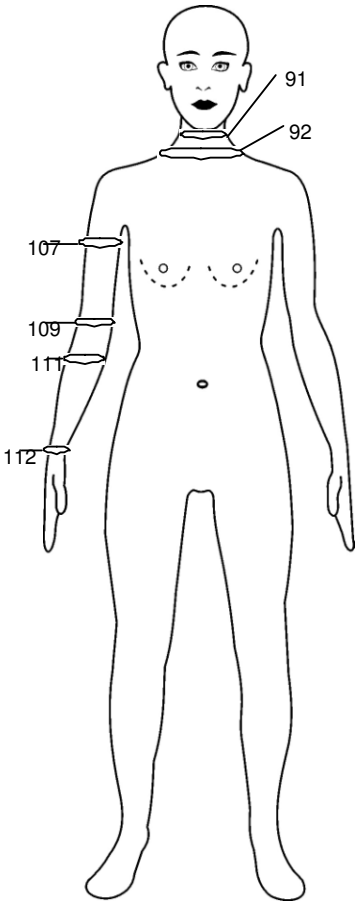
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2. Do you provide for the following special figure requirements?

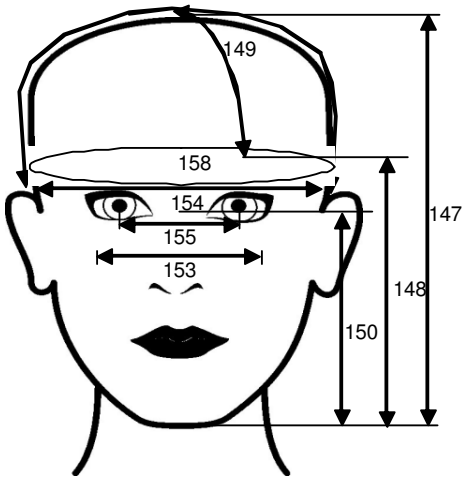
	YES	NO	
Short, Regular, Long			284
Disabled people in wheelchairs			285
Disabled people missing limbs			286
Petite figures			287
Outsizes / Plus sizes			288
Different body shapes			289
Other, specify			290-291
			292-293

3. Indicate if you have ever been involved in the process of developing sizing systems for any of the following garment types:

	MEN'S		WOMEN'S		BOYS'		GIRLS'		INFANTS		
	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	
OUTERWEAR											294-298
UNDERWEAR											299-303
PROTECTIVE WEAR											304-308
FOOTWEAR											309-313
HEADWEAR											314-318
GLOVES											319-323
Other, specify											324-329
											330-335
											336-341

4. Mark the measurements that you use and if applicable indicate if you experience measuring problems with any of these.

	BODY MEASUREMENTS	USED		PROBLEMS		
	HEIGHTS - VERTICAL	YES	NO	YES	NO	
1	Height					342-343
57	Top arm length (Shoulder to underarm level)					454-455
58	Arm length straight (Cervical to wrist)					456-457
59	Arm length straight (Shoulder to wrist)					458-459
60	Arm length bent (Cervical to wrist)					460-461
61	Arm length bent (Shoulder to wrist)					462-463
62	Upper arm length (Cervical to elbow)					464-465
63	Upper arm length (Shoulder to elbow)					466-467
64	Under arm length (to wrist)					468-469
65	Under arm length to elbow					470-471
	WIDTH - HORIZONTAL					
73	Neck width - front					486-487
74	Neck width - back					488-489
75	Back Neck width contoured					490-491
88	Armscye width (front to back across top of arm)					516-517
89	Armspan					518-519
	CIRCUMFERENCES					
90	Neck girth					520-521
91	Neck girth - around Adam's apple					522-523
92	Neck base girth					524-525
106	Armscye girth					552-553
107	Upper arm girth - straight					554-555
108	Upper arm girth - bent					556-557
109	Elbow girth - straight					558-559
110	Elbow girth - bent					560-561
111	Forearm girth					562-563
112	Wrist girth					564-565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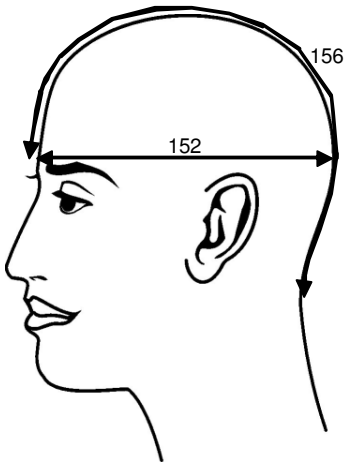
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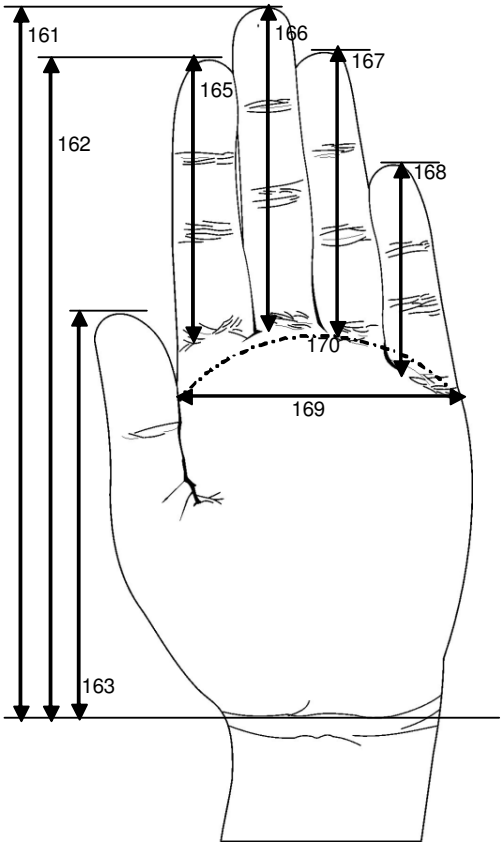
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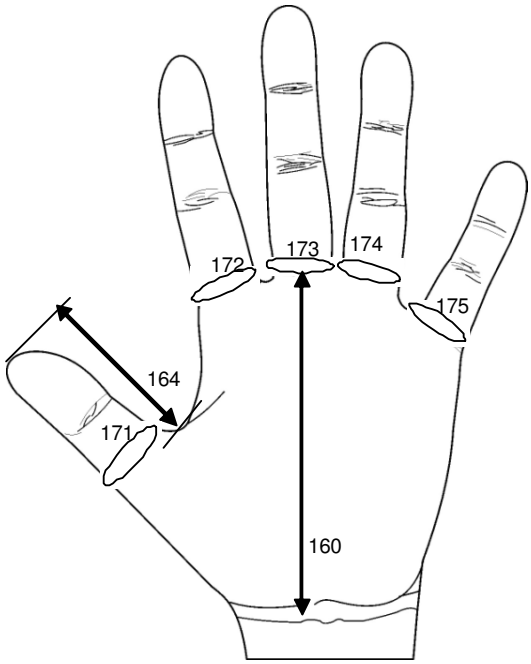
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	BODY MEASUREMENTS	USED		PROBLEMS		
	OTHER	**YES**	**NO**	**YES**	**NO**	
136	Body mass (in kg)					612-613
137	Shoulder blade skinfold					614-615
138	Triceps skinfold					616-617
139	Bust to waist drop					618-619
140	Hip to waist drop					620-621
141	Bust to underbust drop					622-623
142	Front neck depth					624-625
143	Back neck depth					626-627
144	Back seat angle					628-629
145	Shoulder slope					630-631
146	Height (Lying - infants)					632-633
	HEAD MEASUREMENTS					
147	Head height					634-635
148	Face length (Menton-glabella)					636-637
149	Crown of scull to brows (Vertex to glabella)					638-639
150	Chin to nose bridge (Menton-sellion)					640-641
151	Chin to pit of neck					642-643
152	Head length (brow to back of scull)					644-645
153	Head width - cheekbone to cheeckbone					646-647
154	Head width - above ears					648-649
155	Inter-pupillary distance					650-651
156	Sagittal arch					652-653
157	Surface distance from above the ears across the top of the head (Bi-tragion coronal arch)					654-655
158	Head girth					656-657
159	Hand thickness					658-659
160	Palm length					660-661
161	Hand length (wrist to middle finger)					662-663
162	Wrist to index finger length					664-665
163	Wrist to thumb tip length					666-667
164	Thumb length					668-669
165	Index finger length					670-671
166	Middle finger length					672-673
167	Ring finger length					674-675
168	Little finger length					676-677
169	Hand width					678-679
170	Hand girth					680-681
171	Thumb girth					682-683
172	Index finger girth					684-685
173	Middle finger girth					686-687
174	Ring finger girth					688-689
175	Little finger girth					690-691
	ADDITIONAL					746-748
						749-751
						752-754
						755-757
						758-760

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QUESTIONNAIRE: GLOVES

Number | | | | 1 - 3

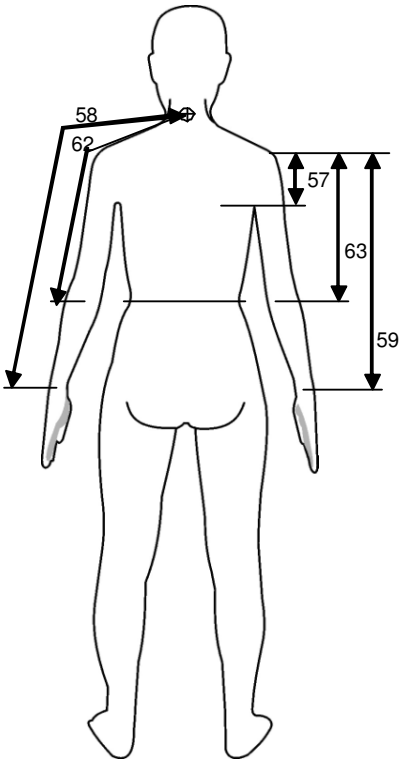
COMPANY NAME:	CONTACT PERSON:	E-MAIL / TEL NO:

1. Indicate next to the appropriate garment type which age group you cater for and how long you have been manufacturing the specific garment type.

BABIES / INFANTS	AGE GROUPS (in months)			YEARS INVOLVED			
GARMENT TYPE	0-12	12-24	24-36	0-4	5-9	10+	
BABIES' / INFANTS wear							4-7
BABIES' / INFANTS FOOTWEAR							8-11
BABIES' / INFANTS HEADWEAR							12-15
BABIES' / INFANTS GLOVES							16-19

CHILDREN	AGE GROUPS (in years)		YEARS INVOLVED			
GARMENT TYPE	1-8	9-16	0-4	5-9	10+	
BOYS' coats, overalls						20-22
BOYS' jackets, shirts, t-shirts						23-25
BOYS' pants, shorts						26-28
BOYS' swimwear						29-31
BOYS' underwear						32-34
GIRLS' dresses, coats, overalls						35-37
GIRLS' jackets, blouses, t-shirts						38-40
GIRLS' skirts, trousers, shorts						41-43
GIRLS' swimwear						44-46
GIRLS' underwear						47-49
BOYS' / GIRLS' SOCKS						50-52
BOYS' / GIRLS' HEADWEAR						53-55
BOYS' / GIRLS' GLOVES						56-58
SCHOOL WEAR						59-61

	AGE GROUPS (in years)					YEARS INVOLVED			
GARMENT TYPE	17-29	30-39	40-49	50-59	60+	0-4	5-9	10+	
MEN'S coats, overalls									62-67
MEN'S jackets, shirts, t-shirts									68-73
MEN'S pants, shorts									74-79
MEN'S swimwear									80-85
MEN'S underwear									86-91
LADIES' dresses, coats, overalls									92-97
LADIES' jackets, blouses, t-shirts									98-103
LADIES' skirts, trousers, shorts									104-109
LADIES' swimwear									110-115
LADIES' underwear									116-121
LADIES' foundation wear									122-127
MATERNITY WEAR									128-133
ETHNIC WEAR									134-139
PROTECTIVE WEAR									140-145
MEN'S / LADIES' SOCKS									146-151
MEN'S / LADIES' HEADWEAR									152-157
MEN'S / LADIES' GLOVES									158-163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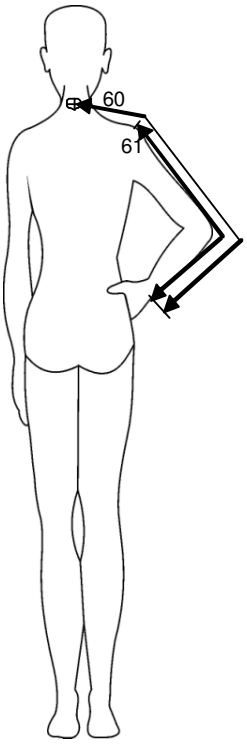
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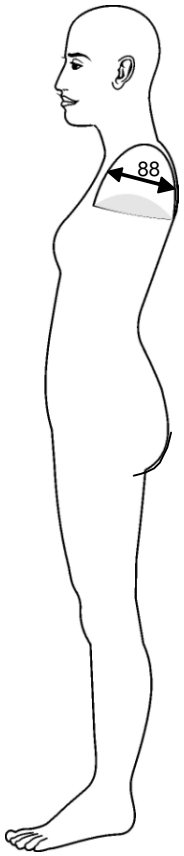
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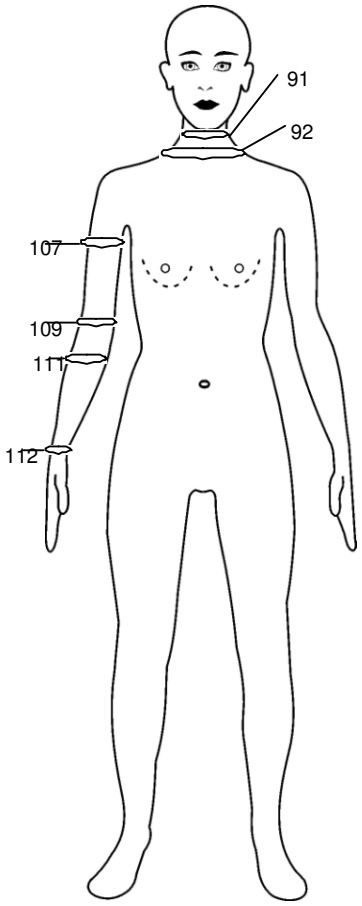
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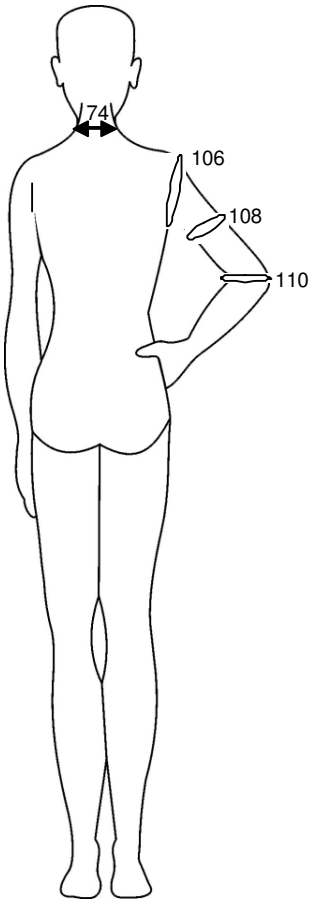
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2. Do you provide for the following special figure requirements?

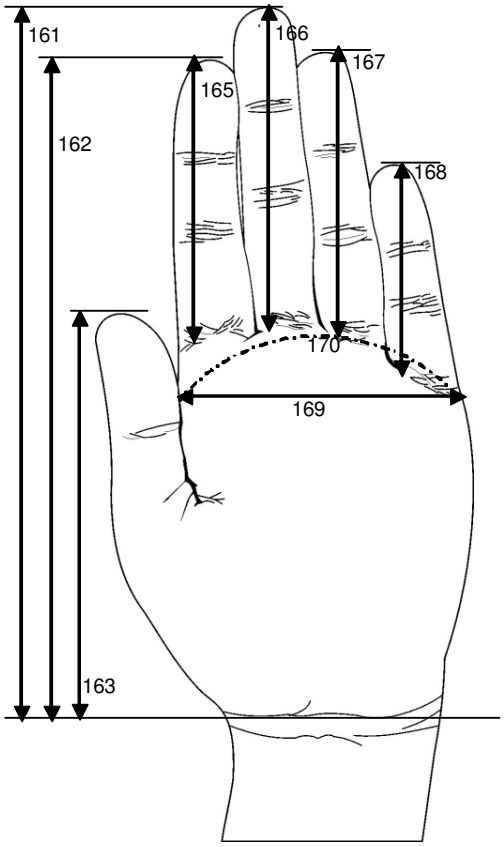
	YES	NO	
Short, Regular, Long			284
Disabled people in wheelchairs			285
Disabled people missing limbs			286
Petite figures			287
Outsizes / Plus sizes			288
Different body shapes			289
Other, specify			290-291
			292-293

3. Indicate if you have ever been involved in the process of developing sizing systems for any of the following garment types:

	MEN'S		WOMEN'S		BOYS'		GIRLS'		INFANTS		
	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	
OUTERWEAR											294-298
UNDERWEAR											299-303
PROTECTIVE WEAR											304-308
FOOTWEAR											309-313
HEADWEAR											314-318
GLOVES											319-323
Other, specify											324-329
											330-335
											336-341

4. Mark the measurements that you use and if applicable indicate if you experience measuring problems with any of these.

	BODY MEASUREMENTS	USED		PROBLEMS		
	HEIGHTS - VERTICAL	YES	NO	YES	NO	
1	Height					342-343
57	Top arm length (Shoulder to underarm level)					454-455
58	Arm length straight (Cervical to wrist)					456-457
59	Arm length straight (Shoulder to wrist)					458-459
60	Arm length bent (Cervical to wrist)					460-461
61	Arm length bent (Shoulder to wrist)					462-463
62	Upper arm length (Cervical to elbow)					464-465
63	Upper arm length (Shoulder to elbow)					466-467
64	Under arm length (to wrist)					468-469
65	Under arm length to elbow					470-471
	WIDTH - HORIZONTAL					
88	Armscye width (front to back across top of arm)					516-517
89	Armspan					518-519
	CIRCUMFERENCES					
107	Upper arm girth - straight					554-555
108	Upper arm girth - bent					556-557
109	Elbow girth - straight					558-559
110	Elbow girth - bent					560-561
111	Forearm girth					562-563
112	Wrist girth					564-565
	OTHER					
136	Body mass (in kg)					612-613
138	Triceps skinfold					616-617
146	Height (Lying - infants)					632-633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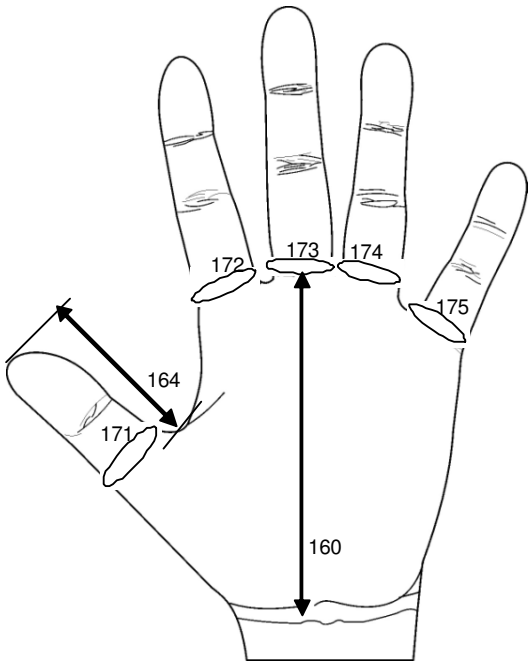
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	BODY MEASUREMENTS	USED		PROBLEMS		
	HAND MEASUREMENTS	**YES**	**NO**	**YES**	**NO**	
159	Hand thickness					658-659
160	Palm length					660-661
161	Hand length (wrist to middle finger)					662-663
162	Wrist to index finger length					664-665
163	Wrist to thumb tip length					666-667
164	Thumb length					668-669
165	Index finger length					670-671
166	Middle finger length					672-673
167	Ring finger length					674-675
168	Little finger length					676-677
169	Hand width					678-679
170	Hand girth					680-681
171	Thumb girth					682-683
172	Index finger girth					684-685
173	Middle finger girth					686-687
174	Ring finger girth					688-689
175	Little finger girth					690-691
	ADDITIONAL					746-748
						749-751
						752-754
						755-757
						758-760

Addendum B

Interview Schedule

COMPANY NAME: _____

RESPONDENT: _____

POSITION: _____

TEL NO: _____

FAX NO: _____

e-MAIL: _____

1. How many **returns** does the company experience? (% of sales)

2. Which garment types are mostly returned?

Garment	Men	Ladies	Boys	Girls	Infants
Coats					
Jackets					
Shirts					
t-shirts					
Sweaters					
Jerseys					
Skirts					
Shorts					
Trousers					
Underwear					
Other					

Shoes					
Sandals					
Closed shoes					
Boots					
Moulded shoes					
Sports / Athletic shoes					
Other					

3. Are returns related to the following problems: (Order of importance)

Quality of construction	
Quality of fabric	
Wrong size	
Fit Body dimensions Distribution of sizes Type of ease added Grading Variation of body shape	

4. What is the origin of the **basic block patterns** currently used?

Retailers supply	
Create own – which method?	
Existing blocks	

5. **Fit testing** – How is it done?

Live fit models	
Dummy – Figure form	

5.1 How often are dummies of models re-measured?

Weekly	Monthly	Quarterly	Every 6 months	Once a year	Other

5.2 Are different body shapes, as influenced by culture or age, considered? How? Which body shapes?

5.3 How and by whom is garment fit evaluated during testing?

How?	**Who?**
	Model (person fitting)
	Designer
	Pattern maker
	Buyer
	Other

5.4 Is any wear testing done on garments? How?

6. **Sizing systems** currently used in SA:
   How do they define figure types?

Height	Drop value (Hip-Bust)	Age	Body shape

7. How are garment sizes described by the sizing systems? (on the garment label)

Garment type	Size description

8. Which key dimensions are used for the sizing system?

Garment type	Key dimensions

9. How are garment types grouped?

Outerwear, Underwear and Others Sub: Upper body, Whole body, Lower body	
Outerwear and Underwear Sub: Upper body, Whole body, Lower body	
Outerwear, Underwear, Lounge wear and Swimwear Sub: Upper body, Whole body, Lower body	
Classify by item: coat/dress, skirt, pants, uniform, sweater/jacket/blouse/shirt, underwear and swimwear	
Other	

10. How long has this system been in use in SA?

11. Where did this system originate from?

Britain	
USA	
France	
Japan	
Self developed	More info
SA	More info
Other	More info

12. Is the system adjusted from time to time to accommodate the changing shape / dimensions of customers?
13. How often?

14. How do you become aware of changes in the dimensions / shape of your customer?

15. **Definitions**

    Describe how the following measurements should be taken, as well as the position on the body. Name the landmarks for each measurement.

16. Explain why the following measurements were identified as problems.

Addendum C

Coding plan

1. How much **returns** do the company experience? (% of sales)

   Categories were established according to the responses.

Confidential information	1
0-1% (including very low, or very little)	2
1,1-2%	3
Unknown	4

2. Which garment type is mostly returned?

   Respondents were given a range of garment types to choose from. Returns were not more related to any specific garment type except for the two which were added to the coding plan.

Not specific	1
Wetsuits	2
Sport shoes & ladies high heel shoes	3

3. Are returns related to the following problems:

   Pattern making was listed as a problem related to returns. This was coded as a problem of fit, because if the pattern is wrong the garment will not fit properly.

Quality of construction	1
Quality of fabric	2
Wrong size	3
Customer abuse	4
Fit	5

4. What is the origin of the basic block patterns currently used?

Retailers supply	1
Create own	2
Existing blocks	3

Other	4

5. Fit testing – how is it done?

Fit models only	1
Dummy only	2
Both fit model and dummy	3
Staff only	4
Fit model, dummy and crèche/school	5
Dummy and staff	6
Dummy, staff and crèche/school	7

5.1 How often are models re-measured?

Weekly	1
Monthly	2
Quarterly	3
Every 6 months	4
Once a year	5
Don't know	6
Not applicable	7

5.2 Are different body shapes, as influenced by culture or age, considered?

Yes	1
No	2

5.3 How? Which body shapes?

Different shops or ranges cater for different figure types	1
Average figure	2
Customised garments	3

5.4 How and by whom is garment fit evaluated during testing?

Fit technologist	1
Designer	2
Buyer / Merchandiser	3
Pattern maker	4
Production manager	5
Fit model	6
Garment technologist	7
SABS	8

5.5 Is any **wear testing** done on garments?

Yes	1
No	2

5.6 How?

Respondents were not really willing to disclose exactly how wearer trials are being done. They did, however, supply more information on the reasons why wear testing is done.

To test fabric behaviour & performance (functionality & durability)	1
Test style & colour	2
Test new fabric	3
Test fit	4
Only done on high volume products	5
Not done	6

The questions regarding **sizing systems** used in South Africa were formulated with reference to a comparison of internationally used sizing systems (Chun-Yoon & Jasper, 1993). This enabled the researcher to describe the South African sizing systems in terms of internationally used sizing systems.

6. How do they define figure types?

The international sizing systems discussed by Chun-Yoon and Jasper (1993) differentiate between different body shapes according to a combination of height, drop value and/or age. These aspects, namely height, drop value, age and body shape, were listed as answer options, and more categories were added and coded from the responses received.

Height	1
Drop value	2
Age	3
Body shape	4
Fuller figure	5
Average only	6
Age & weight	7
Petite / Short	8
Height & age	9

7. How are garment sizes described by the sizing systems? (on the garment label). The size designation was coded according to different garment types. This was an open-ended question and the responses were then coded according to the information gathered.

Size designation of **Sportswear / Non-fitting garments**	S,M,L …	Age
	1	2

Size designation of **Trousers**	8,10…	32,34…	8/32, 10/34…	Men's suit sizes	76, 81, 87…	Age (yrs) 2, 3, 4…
	1	2	3	4	5	6

Size designation of **Skirts**	8,10,12…	32,34,36…	8/32, 10/34…	76, 81, 87…	Age(yrs) 2, 3, 4…
	1	2	3	4	5

Size designation of **Upper body garments**	8,10 12,…	32,34,36…	8/32, 10/34…	Men's suit sizes	76,81,87,…	Age (yrs) 2, 3, 4…	Neck girth cm
	1	2	3	4	5	6	7

Size designation of **Hats**	Children & adult S,M,L…	Baby sizes (months) 0-6; 6-12; 12-18; 18-24; 24-36	
Caps	1	2	Baby all fit: 2-6 yrs; 7-14 yrs; Adult all fit
			3

Garment type	Ladies size 3, 4, 5…	Men's size 6, 7, 8…
Ladies' shoes	1	2
Men's shoes	3	4

8. Which key dimensions are used for the sizing system?

   The key dimensions were coded according to the garment type that they are used for. This was an open-ended question and the responses were then coded according to the information gathered.

Key dimensions for **Trousers**	Waist girth	Hip girth	Outer leg	Inner leg	Crotch length	Rise height	Thigh girth
	1	2	3	4	5	6	7

Key dimensions for **Skirts**	Waist girth	Hip girth	Centre Back length	Centre Front length
	1	2	3	4

Key dimensions for **Upper body garments**	
Bust / Chest girth	1
Waist girth	2
Hip girth	3
Centre back length	4
Bicep girth	5
Elbow girth	6
Wrist girth	7
Neck girth	8
Nape to waist	9
Across back	10
Across front	11
Over-arm / Sleeve length	12
Shoulder to shoulder	13
Shoulder to bust point	14
Bust point to bust point	15
Scye depth	16
Forearm girth	17
Underarm length	18

Key dimensions for **Full body garments**	Neck shoulder point to foot	Neck shoulder point to crotch	Total height
	1	2	3

Key dimensions for **Headwear**	Head girth
	1

Key dimensions for **Shoes**	Foot length	Foot width	Instep girth	Joint girth
	1	2	3	4

9. How are garment types grouped?

   The international comparison of sizing systems (Chun-Yoon & Jasper, 1993) refers to the classification of garments and therefore similar classifications were offered as possible responses.

Outerwear, Underwear, Lounge wear and Swimwear Sub: Upper body, Whole body, Lower body	1
Classify by garment type: coat/dress, skirt, pants, uniform, sweater/jacket/blouse/shirt, underwear and swimwear	2
Formal, Casual, Outerwear, Underwear	3
Smart, Casual, Active, Lingerie Sub: Knitted tops and bottoms; woven tops and bottoms	4
SAFLIA classification of shoes	5

10. How long has this system been in use in SA?

Always / Forever	1
Don't know	2

11. Where did this system originate from?

Britain	1
USA	2
Europe	3
Japan	4

Self developed	5
South Africa	6
Don't know	7

12. Is the system adjusted from time to time to accommodate the changing shape / dimensions of customers?

Yes	1
No	2

13. How often?

    The companies that did adjust their size charts all indicated that it was not done at regular intervals.

14. How do you become aware of changes in the dimensions / shape of your customer?

Customer complaints	1
Research (surveys)	2
Fit testing	3
Sales figures	4

15. Descriptions

    Describe how the following measurements should be taken, as well as the position on the body. Name the landmarks for each measurement.

    The complete list of body measurements used in the questionnaire was used. Each body measurement was used as a theme for coding the comments and or description regarding that specific body measurement. Interpreted descriptions of body measurements will be verified by comparing them to existing definitions used by International Standards

Organisations, and definitions used in other anthropometrical surveys such as CEASER and SizeUK.

16. Explain why the following measurements were identified as problems.
    The problems experienced were coded according to body measurement, as they occurred in the responses.

The respondents' descriptions for the body measurements were compared to the international descriptions available, with regard to:

- ✓ whether an international description was available;
- ✓ whether there was consensus among the international descriptions or only one international description;
- ✓ whether there was consensus among the respondents' descriptions, only one description or no description from respondents;
- ✓ whether problems were related to no consensus about measuring straight or on the contour;
- ✓ whether problems were related to landmarking;
- ✓ whether problems were related to landmarking as well as no consensus.

Tables with the summary of these comparisons are presented, discussed and interpreted in the following chapter. The discussion of body measurements for which no international description was available, and for which no description or only one description was received from respondents, are presented in **Addendum D**.

Addendum D

Descriptions of measurements with no international descriptions, no description by respondents or not used by respondents

1. Vertical height measurements

Chin height (2)

This measurement was not used by any of the survey respondents and no problems were indicated with this measurement.

International description of the measurement:

✓ Distance between the chin point and the ground (SizeUK).

Side neck to front ground level (5)

This is a measurement that is not generally used for the manufacturing of most ordinary garments. The measurement could however be useful for the manufacturing of special garments that cover the full body and for the manufacturing of fit dummies. Both of the survey respondents that use this measurement experienced problems with it. Of the 13 respondents interviewed, only one used the measurements and also experienced problems with the measurement.

International description of the measurement:

✓ Only the SizeUK standards describe the measurement, namely as the distance from the right shoulder neck point, over the breast point and straight down to the outside of the foot on the ground (UK Sizing).

Interview respondents' descriptions:

Respondent 4: *Side neck to floor, over the bust contour.*

The respondent did not mention that the measurement should be taken on the right side of the body and down to the outside of the foot. The difficulty with landmarking the neck point and taking the measurement over the body contour, is probably the reason why 100% of the survey respondents that used the measurement also experienced problems with the measurement. Identifying the exact location of side neck point, as stated before, is the main problem with regard to all measurements involving the side neck point. The comment of respondent 9 at the side neck height measurement (4), about taking a straight measurement and adding to it when making

the pattern, implies that taking the measurement over the contours also presents some problems. It is understandable that it would be easier to take an accurate measurement in a straight line. But the fact that the pattern maker has to add something to the measurement to accommodate the bust, highlights the necessity of taking the measurement over the contour of the body.

Preferred waist height (15)

This measurement can be useful in the manufacturing of skirts and trousers, especially if one considers the currently fashionable hipster styles. The measurement is used by 20,59% of survey respondents and two of the survey respondents using it experienced problems with the measurement. Of the 13 respondents interviewed, two use the measurement and none indicated that they experienced problems with the measurement.

International descriptions of the measurement:

- ✓ This measurement was listed as a measurement taken for the Nedscan sizing survey; however, no international description was listed in the Nedscan document, or could be found in any of the other international standards available.

Interview respondents' descriptions:

Respondent 4: *From where the customer prefers the garment waist to be, to the floor.*

Respondent 11: No description given.

Most manufacturers that manufacture ready-to-wear garments would probably not use the measurement. Those who manufacture for a specific client that indicated the preferred waistline measurement may however use the measurement. It is not clear why more than 20% of the survey respondents indicated that they experienced problems with the measurement, however. It could be due to the fact that it may be difficult for the manufacturer to pin-point the measurement as to be taken "x centimetres below or above the natural waistline" position, as most probably then given by the client. To ensure that such a measurement is useful to the pattern maker it is important that an additional control measurement be taken. Another

explanation why more than the number of respondents that use the measurement, indicated that they experienced problems with the measurement is because the actual measurement data is not available in the normal size charts.

Waist height (at belly button level) (16)

This measurement is also useful for dropped waistline fashions as is currently in fashion. The measurement is used by 35,29% of survey respondents and one of the survey respondents using it experienced problems with the measurement. One might have expected a higher usage of this measurement but this survey was done just before the current dropped waistline styles became so popular. It could also be due to the fact that the actual measurement is not generally available in the size charts. Of the 13 respondents interviewed, four use the measurement and none indicated that they experienced problems with the measurement.

International descriptions of the measurement:

No international description could be found.

Interview respondents' descriptions:

Respondent 3: *Belly button level straight to the floor.*

Respondent 4: *From belly button to the floor.*

Respondent 11: *From narrowest point above hip.*

Respondent 12: *Belly button straight to floor.*

This is not a complicated measurement to take and therefore few respondents experienced problems with the measurement. The description given by respondent 11 refers to natural waist height rather, since the belly button is usually a little lower than the narrowest point above the hip. The other three respondents' descriptions corresponded with each other.

Centre back waist to top hip (20)

This measurement is useful for the shaping of the patterns for lower body garments. It can also be useful in the manufacturing of fit dummies. This measurement is used by 44,12% of survey respondents, and one respondent experienced problems with

the measurement. Of the 13 respondents interviewed, seven indicated that they use the measurement and none experienced problems with the measurement.

International description of the measurement:
No international description could be found.

Interview respondents' descriptions:

Respondent 1: *10cm down from waistline at centre back.*
Respondent 3: *Centre back waist to a position on the same level as the prominent hipbone.*
Respondent 4: *From the waist at centre back to where the top hip bone is.*
Respondent 6: No description given.
Respondent 7: *10cm below waist.*
Respondent 11: *10cm down from waist.*
Respondent 12: *10cm below waist.*

From the respondents' descriptions it is not clear whether this measurement should be taken straight or on the contour of the body. To be of any use in pattern making it is advisable to take the measurement on the contour of the body. Four of the respondents refer to taking it at 10cm below waist, in which case it is not necessary to take the measurement from waist to 10cm below waist, because the dimension is already specified. The respondents probably referred to the top hip height measurement that is taken from a level 10cm below waist. When taking the measurement on the body contour to a level that is 10cm straight down from the waist, one would most probably get a dimension slightly longer than 10cm, which highlights the importance of taking the measurement on the body contour. Since there is no consensus among the companies about how to take the measurement, one would have expected more of the respondents to experience problems with the measurement. The reason that it is not indicated as a problem measurement could be because it is accepted as being 10cm.

Centre back waist to upper hip (21)

This measurement is useful for the shaping of the patterns for lower body garments and can also be useful in the manufacturing of fit dummies. This measurement is

used by 38,24% of survey respondents, and none experienced problems with the measurement. Of the 13 respondents interviewed, six indicated that they use the measurement and none experienced problems with the measurement.

International description of the measurement:
No international description could be found.

Interview respondents' descriptions:
Respondent 1: *20cm down from waistline at centre back.*
Respondent 4: *From the waist at centre back to 20cm below the natural waist.*
Respondent 6: No description given.
Respondent 7: *20cm below waist.*
Respondent 11: *20cm down from waist.*
Respondent 12: *20cm below the waist.*

Again, taking the measurement to 20cm below the waist is not necessary since the dimension is already known. Taking the measurement on the contour of the body to a level 20cm straight down from the waist would be more useful.

Centre back waist to maximum hip (22)
This measurement is useful for the shaping of patterns for lower body garments and for the manufacturing of fit dummies. It is particularly useful when shaping the hip curve from the waist to the widest part of the hip. This measurement is used by 26,47% of survey respondents and none experienced problems with the measurement. Of the 13 respondents interviewed, six indicated that they use the measurement and none experienced problems with the measurement.

International description of the measurement:
No international description could be found.

Interview respondents' descriptions:
Respondent 3: *Centre back to the widest part of the hips.*
Respondent 4: *From the waist at centre back to the maximum hip.*
Respondent 6: *Centre back down to where the biggest part is.*

Respondent 7: *Waist to widest hip circumference.*
Respondent 11: *From waist to widest part.*
Respondent 12: *Waist to where the widest part is.*

The descriptions of the respondents do correspond with each other. However, the respondents do not indicate clearly whether the measurement is taken in a straight line or on the body contour. For use in pattern making it would be more useful to have the measurement taken on the body contour, since this would give a better indication of the shape of the hip curve. Confusion and inconsistency as to how to take the measurement could lead to bad fit in fitted skirts and trousers.

Centre back waist to knee (23)

This measurement could be useful when manufacturing garments covering the full body, for example to determine the hem positions on knee length dresses. It could also be useful for the manufacturing of fit dummies. The measurement is used by 26,47% of the survey respondents and none experienced problems with the measurement. Of the 13 respondents interviewed, five used the measurement and none experienced problems with the measurement.

International description of the measurement:
No international description could be found.

Interview respondents' descriptions:
Respondent 3: *Natural waist to the level of the knee, at centre back.*
Respondent 4: *From the waist at centre back to the crease of the knee.*
Respondent 7: *Waist over the back curve to the crease of the knee.*
Respondent 11: *To the crease of the knee.*
Respondent 12: *Waist to midpoint of kneecap.*

The descriptions of the respondents do not correspond with regard to identifying the position of the knee.

Centre back waist to ground (24)

This measurement is useful for determining the length of skirts and trousers. This measurement is used by 38,24% of survey respondents and none of the respondents experienced problems with the measurement. Of the 13 respondents interviewed, seven indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

No international description could be found.

Interview respondents' descriptions:

Respondent 3: *Natural waist to the floor, at centre back.*

Respondent 4: *From the waist at centre back on the contour of the body, to the floor.*

Respondent 6: *Centre back waist over the bum to the ground, from waist to floor.*

Respondent 7: *Measure against the body and then straight.*

Respondent 9: *Over the curve of the back and then straight.*

Respondent 11: *Follow the curve to the widest hip and then straight to the floor.*

Respondent 12: *Waist to hip on the contour of the body and then straight down.*

The descriptions of the respondents correspond with each other with regard to the landmarks. Respondent 3 does not clearly indicate whether it is a straight or contoured measurement. All the other respondents agree that this measurement should be taken over the contour at the back of the body and then straight to the floor. Taking the measurement over the contour and then straight, allows for the extra length that might be needed over the back to ensure that a skirt's hem hangs straight.

Front waist to knee (26)

This measurement could be useful when manufacturing knee length skirts, to determine the front length of the garment, and it can also be useful in the manufacturing of fit dummies. The measurement is used by 29,41% of the survey respondents and one respondent experienced problems with the measurement. Of

the 13 respondents interviewed, five used the measurement and one experienced problems with the measurement.

International description of the measurement:
No international description could be found.

Interview respondents' descriptions:
Respondent 3: *Natural waist to the level of the knee, at centre front.*
Respondent 4: *Centre front waist to knee.*
Respondent 7: *Waist to the level of the crease.*
Respondent 11: *Waist to the middle of the kneecap.*
Respondent 13: *Waist to knee, straight.*

The descriptions of the respondents do not correspond with regard to identifying the knee position.

Front (35) and back crotch length (36)
Front crotch length and back crotch length are both used by 66,71% of the survey respondents. For both measurements three of the survey respondents using them experienced problems with the measurements. Of the 13 respondents interviewed, seven indicated that they used the measurements and one company experienced problems with the measurement.

International description of the measurement:
No international description could be found.

During the interview it became clear that the respondents were referring to garment measurements and not actual body measurements. The following comment illustrates this: "But we do front and back (crotch length), we use the separate measurements when we're measuring on the garment." It is not possible to take such measurements by hand since there is no physical landmark to define where the front or back crotch should stop. Total crotch length is already a sensitive measurement to take on a person. However, all the companies agreed that it would be very useful measurements if it was possible to measure it on the human body. Allocating the

total crotch length correctly to the front and the back of the garment is critical to ensure well-fitting trousers. With the development of body scanning it seems as if such measurements are not just wishful thinking anymore. According to Simmons and Istook (2003:314), it is possible with the [TC]2 body scanning system to define whether a front, back or full crotch length is needed.

Cervical to top hip (39)

This measurement is used by 17,65% of the survey respondents and none experienced problems with the measurement. Of the 13 respondents interviewed, four used the measurement and none experienced problems with the measurement.

International description of the measurement:

No international description could be found.

Interview respondents' descriptions:

Respondent 4: *Nape to the level of the top hip bone following the contour of the back.*

Respondent 6: *Cervical to 10cm below waist.*

Respondent 11: *Nape to 10cm below waist following the shape of the back.*

Respondent 12: *Nape, following the contour to 10cm below waist.*

The descriptions of the respondents do not correspond with each other.

Cervical to upper hip (40)

This measurement is useful when shaping the waist to hip curve on lower body garments such as skirts and trousers. It is important to know where to apply the corresponding girth positions on the pattern. The measurement could also be useful for the manufacturing of fit dummies. The measurement is used by 20,59% of the survey respondents and none experienced problems with the measurement. Of the 13 respondents interviewed, four used the measurement and none experienced problems with the measurement.

International description of the measurement:

No international description could be found.

Interview respondents' descriptions:

Respondent 1: *Nape to 10cm below waistline.*

Respondent 4: No description given.

Respondent 11: *Nape to 20cm below waist following the shape of the back.*

Respondent 12: *Nape to 20cm below waist, against the contour.*

From the descriptions it is clear that the respondents confused the top hip and upper hip positions. One respondent marked that they use cervical to upper hip on the survey questionnaire; however, the description given corresponds with the cervical to top hip (number 39) description. It is clear that the measurement should be taken against the contour of the back. This is very important when making patterns for figures with protruding buttocks. To get to a level 20cm below the natural waist, when following the contour of the back the actual dimension might be quite a few centimetres longer than 20cm.

Cervical to hip (41)

This measurement is useful when shaping the waist to hip curve on lower body garments such as skirts and trousers. It is important to know where to apply the corresponding girth positions on the pattern. The measurement could also be useful for the manufacturing of fit dummies. This measurement is used by 20,59% of the survey respondents and none experienced problems with the measurement. Of the 13 respondents interviewed, four used the measurement and none experienced problems with the measurement.

International description of the measurement:

No international description could be found.

Interview respondents' descriptions:

Respondent 1: *Nape to 20cm below waistline.*

Respondent 4: *Nape to maximum hip, following the contour of the back.*

Respondent 11: *Nape to widest hip, following the shape of the back.*

Respondent 12: *Nape to widest part, against the body.*

The descriptions of the respondents do not correspond with each other. The description of the one respondent corresponds with the cervical to upper hip description, number 40. It seems that there is some confusion among the respondents about the position of the top hip, upper hip and hip positions on the body. This could also explain the similarity in the use of these measurements.

Cervical to chest level (43)

This measurement is used by 17,65% of the survey respondents and one respondent experienced problems with the measurement. Of the 13 respondents interviewed, four used the measurement and none experienced problems with the measurement.

International description of the measurement:

No international description could be found.

Interview respondents' descriptions:

Respondent 4: *Nape over the shoulder to the widest part of the chest, on men.*

Respondent 7: *Nape over the side neck to the level of the widest part of the chest.*

Respondent 11: *Nape to widest chest level, at the nipple point.*

Respondent 12: *Nape over the shoulder to the most prominent part of the chest.*

The descriptions of the respondents correspond with each other.

Arm length straight (cervical to wrist) (58)

This measurement is used for determining the sleeve length mainly on men's wear, shirts and jackets. This measurement is used by 61,76% of the survey respondents and two respondents experienced problems with the measurement. Of the 13 respondents interviewed, eight indicated that they used the measurement and one company experienced problems with the measurement.

International description of the measurement:

No international description could be found.

Interview respondents' descriptions:

Respondent 1: *Back neck to wrist bone, arm hanging naturally.*

Respondent 3: No description given.

Respondent 4: *Nape over the shoulder to the wrist, arm hanging comfortably.*

Respondent 6: *Centre back, half a shoulder, and then I go just a little bit bent and down to the wrist.*

Respondent 7: *From nape around to wrist. On the bent arm and on the straight arm, we do it both.*

Respondent 8: This measurement was not marked on the questionnaire, but the respondent mentioned that *a tailor would measure arm length from the centre back around to the wrist*.

Respondent 9: *Back neck over shoulder, elbow to the wrist. Arm should be slightly bent.*

Respondent 11: Although this measurement was marked on the questionnaire, the respondent indicated that they measure *the arm bent*.

Respondent 12: *I have them bend their arm just slightly, not 90°. I just found that that (bent at 90°) adds in too much. (On women)*

The descriptions of the respondents refer to the arm hanging naturally or comfortably or just slightly bent, which implies not forcing the arm into a straight position and also not bent as much as 90°. No international description has been found to compare the descriptions to. The descriptions given by the respondents correspond with one another. Since the nape is seen as a controllable landmark, this measurement is preferred by some respondents.

Underarm length (to elbow) (65)

This measurement is used for determining the underarm length of short sleeves and the positioning of elbow darts on long sleeves. This measurement is used by 37,14% of the survey respondents and one respondent experienced problems with the measurement. Of the 13 respondents interviewed, five indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

No international description could be found.

Interview respondents' descriptions:

Respondent 1: *Under arm to the crease of the elbow.*

Respondent 3: No description given.

Respondent 4: *Under arm to where the elbow bends.*

Respondent 9: *Front crease to the elbow crease.*

Respondent 11: No description given.

This measurement is taken in the same way as the previous measurement, but only up to the landmark at the elbow. Again, the descriptions of the respondents do not correspond with each other nor with the international descriptions because the armpit and the crease of the arm where the arm joins the body are two completely different landmarks. Similar problems can be expected with this measurement with regard to identifying the underarm position. The exact position of the elbow can also be described in more detail. There is no agreement among the respondents about how to take the measurement.

2. Circumferences

Bust girth contoured (96)

This measurement could be useful for the manufacturing of ladies' underwear and swimwear, and it could also be useful for the manufacturing of fit dummies. The measurement is used by 20% of the survey respondents and none experienced problems with the measurement. Of the 13 respondents interviewed, three used the measurement and none experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

- ✓ Maximum circumference measured over/under the shoulder blades, under the armpits, across the bust points and into the centre front between the breasts (UK Sizing).

Interview respondents' descriptions:

Respondent 3: *Around the most prominent part of the bust following the contour in between and over the bust.*

Respondent 4: No description given. *This measurement is necessary for underwear.*

Respondent 11: No description given.

Only one of the respondents offered a description, and it corresponds with the international description. Most respondents did not give any descriptions, which probably indicates that they are unsure about how the measurement should be taken.

Preferred waist girth (99)

This measurement could be useful when making patterns for the currently fashionable dropped waist styles. The measurement is used by 29,41% of the survey respondents and one respondent experienced problems with the measurement. Of the 13 respondents interviewed, four used the measurement and none experienced problems with the measurement.

International description of the measurement:

✓ This measurement was listed as a measurement taken for the Nedscan sizing survey; however, no international description was listed in the Nedscan document, and no international description could be found in other standards.

Interview respondents' descriptions:

Respondent 1: *Measure where the customer wants the waist to be.*

Respondent 4: No description given.

Respondent 11: No description given.

Respondent 12: Did not know how to measure this but *would find it interesting. If there were some kind of consistency it would be interesting.*

The respondents were not sure how this measurement should be taken. The measurement would only be useful if it can be taken consistently. A vertical measurement would have to be taken together with this measurement to identify the

position on the body. In this way, it would also be possible to transfer the measurement onto a pattern.

Waist at belly button girth (100)

This measurement is used to determine the waist length on dropped waist garments. This measurement is used by 44,12% of the survey respondents and none experienced problems with the measurement. Of the 13 respondents interviewed, five indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

- ✓ No international description could be found. This is confirmed by Simmons and Istook (2003:311) who also state that: "No current standard could be found that had a waist-at-the-navel definition."

Interview respondents' descriptions:

Respondent 3: *Measure around the body at the level of the belly button.*

Respondent 4: *At the level of the belly button parallel to the floor.*

Respondent 11: *Measure at the level of the navel.*

Respondent 12: *5cm below waist, not at the belly button specifically.*

Respondent 13: *If you ran it across the navel it's spot on. For men and ladies. I would say again, around the belly button is going to have to be the spot.*

It seems that measuring at belly button level parallel to the floor would be the acceptable position. This measurement could be useful when manufacturing the currently fashionable hipster styles. Knowing only the circumference would not contribute to manufacturing better fitting garments. It is also necessary to know how much lower the belly button is in relation to the natural waistline. The natural waistline is used as a point of reference when drafting a basic pattern. Therefore the pattern maker will need to know the vertical distance from the natural waist to the belly button in order to take the waist position lower on the pattern.

3. Other body measurements

3.1 Arc measurements

All four of the arc measurements were listed as problem measurements. The first two, namely bust and waist arc anterior, were only used by one (2,94%) of the survey respondents and both measurements were marked as problem measurements. The abdominal extension and hip arc anterior were not used by any of the respondents included in the postal survey, but in both cases one respondent did indicate that these were problem measurements. These measurements are probably not used by the respondents because they are seen as problem measurements. The main problem with these measurements is identifying the position of the side seam, since the arc measurements are measured from side seam to side seam. The arc measurements are also not used directly for pattern making or garment construction. They are however useful measurements because they can be helpful in giving an indication of the body shape, that is of the distribution of the circumference measurements, and can thus lead to the creation of a balanced garment.

Bust arc anterior (120)

This measurement was used by only one of the survey respondents. It was also indicated as a problem measurement. The respondent that used the measurement was included for the interview.

International description of the measurement:

- ✓ Distance, at level of nipples, from the mid-point of the scye width at right underarm, over the breasts to the corresponding point at left underarm (UK Sizing).
- ✓ Measure parallel to the floor from one mid-underarm point across the nipples to the other mid-underarm point (ASTM 5586, 1995).

It is clear that the international descriptions correspond with each other. However it might present a problem to locate the mid-underarm point consistently on the human body.

Interview respondent's description:

Respondent 4: *From the front at the bust level over the bust curve from side seam to side seam.*

This description corresponds with the international descriptions. Identifying the side seam is however the main concern with this measurement.

Waist arc anterior (121)

This measurement was used by only one of the survey respondents. It was also indicated as a problem measurement. The respondent that used the measurement was included for the interview.

International description of the measurement:

Only one international description was found:

✓ Measure across the front of the body at waist level from one imaginary side seam to the other imaginary side seam (ASTM 5586, 1995).

The word "imaginary" is problematic here. One would expect a better indication on how to locate this side seam position.

Interview respondent's description:

Respondent 4: *From side seam to side seam on the contour of the body at natural waist level.*

The description corresponds with the international description. Again, locating the position of the side seam consistently is the main concern regarding the measurement.

Abdominal extension arc anterior (122)

This measurement was not used by any of the survey respondents although one respondent indicated a problem with the measurement. However, none of the respondents interviewed indicated a problem with the measurement.

International description of the measurement:

Only one international description was found:

- ✓ The distance from one imaginary side seam to the other imaginary side seam at the high-hip level (ASTM 5219, 1999, 1995).

Again, locating this "imaginary side seam" consistently on the human body can present a problem.

Hip arc posterior (123)

This measurement was not used by any of the survey respondents although one respondent indicated a problem with the measurement. However, none of the respondents interviewed indicated a problem with the measurement.

International description of the measurement:

Only one international description was found:

- ✓ Measure across the back at the fullest hip level from one imaginary side seam to the other imaginary side seam (ASTM 5586, 1995).

Again, one would have expected a better indication on how to locate this imaginary side seam position on the human body. Such a vague description can present problems with the accuracy and consistency of measurements.

3.2 Seated measurements

3.2.1 Heights

Height (124)

This measurement was not used by any of the survey respondents.

International description of the measurement:

Only one international description was found:

- ✓ The vertical distance between a sitting surface and the top of the head. The subject sits erect and symmetrical with the head in the Frankfort plane, a block is placed on the crown of the head and the level indicates the reading. The shoulders and upper arms are relaxed (Ergotech).

Cervical height (125)

The measurement was used by one of the survey respondents and none of the survey respondents experienced problems with the measurement. This respondent was included in the interview but did not give a description for this measurement.

International description of the measurement:

Only one international description was found:

Distance from the nape to the seat base (UK Sizing).

Shoulder height (126)

This measurement was not used by any of the survey respondents.

International description of the measurement:

Only one international description was found:

- ✓ The vertical distance between a sitting surface and the acromion landmark on the tip of the right shoulder. The subject sits erect looking straight ahead. The shoulders and upper extremities are relaxed (Ergotech).

Waist height (127)

This measurement was used by one of the survey respondents and none of the survey respondents experienced problems with the measurement. This respondent was included in the interview but did not give a description for this measurement.

International description of the measurement:

Only one international description was found:

- ✓ Distance between the right side at natural waist level and the seat base (UK Sizing).

Knee height (128)

The measurement was used by one of the survey respondents and none of the survey respondents experienced problems with the measurement. This respondent was included in the interview but did not give a description for this measurement.

International description of the measurement:

Only one international description was found:

- ✓ The vertical distance between a footrest surface and the patella landmark at the top of the right knee (located and drawn while the subject stands). The subject sits with the thighs parallel, the feet in line with the thighs, and the knees flexed at 90° (Ergotech).

Popliteal height (129)

This measurement was not used by any of the survey respondents.

International description of the measurement:

Only one international description was found:

- ✓ The vertical distance from a footrest surface to the under surface of the right knee (where the knee meets the thigh). The subject sits with the thighs parallel, the feet in line with the thighs, and the knees flexed at 90°.

3.2.2 Widths

Hip width (130)

This measurement was used by two of the survey respondents and none of them experienced problems with the measurement. One of the respondents that used the measurement was included in the interview.

International description of the measurement:

Only one international description was found:

- ✓ The distance between the lateral points of the hips at the junction of the hips and the thighs. The subject sits erect with the feet and knees together and is measured from the front at an angle of 45° (Ergotech).

Interview respondents' descriptions:

Respondent 4: *In a straight line from side to side at the position of the hips.*

The description given by the respondent is very vague regarding how to find the hip position when the person is sitting.

Thigh length (131)

This measurement was used by two of the survey respondents and none of them experienced problems with the measurement. One of the respondents that used the measurement was included in the interview.

International description of the measurement:

Only one international description was found:

- ✓ The horizontal distance between the buttocks of a subject (seated against the contact point of the seated surface and the wall) and the anterior surface of the patella (knee). The subject sits erect. The thighs are parallel to the floor and the knees flexed 90° with the feet in line with the thighs (Ergotech).

Interview respondents' descriptions:

Respondent 4: *From the hip position to the front of the bent knee.*

The description does not correspond with the international description. The starting point of the measurement differs for the two descriptions; the hip position and the buttocks cannot be regarded as the same point on the body.

3.2.3 Girths

Waist girth (132)

The measurement was used by two of the survey respondents and none of the survey respondents experienced problems with it. Both respondents were included in the interview but one did not give a description for this measurement.

International description of the measurement:

Only one international description was found:

- ✓ Circumference of the natural waist (UK Sizing).

Interview respondents' descriptions:

Respondent 3: No description given

Respondent 4: *Around the natural waist, sitting comfortably upright.*

The description of the respondent corresponds with the international description.

Hip girth (133)

The measurement was used by two of the survey respondents and none of them experienced problems with it. Both respondents were included in the interview but one did not give a description for this measurement.

International description of the measurement:

- ✓ Circumference of the hips measured diagonally around the buttocks and stomach (UK Sizing).
- ✓ With the subject seated on a rigid flat surface and the thighs together, the distance around the hips (diagonally) from the point where the back of the buttocks contacts the sitting surface and over the widest part of the hips (ASTM 1999).

The international descriptions correspond with each other.

Interview respondents' descriptions:

Respondent 3: No description given.

Respondent 4: *Diagonally around the seat.*

Although the description given by the respondent is vague it does correspond with the international descriptions.

Thigh girth (134)

The measurement was used by two of the survey respondents and none of the survey respondents experienced problems with the measurement. Both respondents were included in the interview but one did not give a description for this measurement.

International description of the measurement:

Only one international description was found:

✓ Maximum circumference of the right thigh (UK Sizing).

Interview respondents' descriptions:

Respondent 3: No description given

Respondent 4: *Around the widest part of the thigh with the knee bent at 90°.*

The international description does not mention that the knee must be bent, but since it is a seated measurement one can assume that this is implied. The description given by the respondent corresponds with the international description although the respondent did not mention measuring on the right side of the body. As discussed earlier, it is important for consistency to take measurements on the same side of the body throughout a body measurement survey.

Knee girth (135)

This measurement was used by one of the survey respondents and no problems were indicated with it. This respondent was included in the interview.

International description of the measurement:

Only one international description was found:

✓ Circumference of the right knee bent at 90° (UK Sizing).

Interview respondents' descriptions:

Respondent 4: *Circumference taken diagonally around the knee, bent at 90°.*

The description given by the respondent corresponds with the international description.

3.3 Other body measurements

Body mass (kg) (136)

The measurement was used by four of the survey respondents and no problems were indicated with the measurement. All four respondents using the measurement were included in the interview.

International description of the measurement:

Only one international description was found:

✓ The value in kilograms indicated on a balance (UK Sizing). Mass in kilograms (ASTM 1999).

Interview respondents' descriptions:

Respondent 3: *Weight; the weight distribution is important. On the bigger woman how the weight is distributed.*

Respondent 4: *Weight is not critical.*

Respondent 12: *Only as an inference.*

Respondent 13: *Body mass, it is necessary to tell us that there's something incorrect with the measurements.*

The respondents did not describe how to measure weight, but highlighted the necessity of the measurement as a control for the accuracy of the actual body measurements.

Shoulder blade skinfold (137)

This measurement was not used by any of the survey respondents and no international description could be found.

Triceps skinfold (138)

This measurement was also not used by any of the survey respondents and no international description could be found.

Bust to waist drop (139)

The drop measurements are used for classifying the figure type and they can be useful for the manufacturing of fit dummies. Although only 11,76% of the survey respondents used this measurement, 25% of the survey respondents using it experienced problems with the measurement. Of the 13 respondents interviewed, two indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

Only one international description was found.

✓ The difference between the chest and the waist girth (ASTM 5219, 1999).

Interview respondents' descriptions:

Respondent 4: *Difference between the bust and waist measurements.*

Respondent 7: No description given.

The description corresponds with the international description. As discussed earlier, locating the natural waist can be problem. The other problem with these measurements is that they are not widely available; therefore they are not used and are also seen as problem measurements.

Hip to waist drop (140)

The drop measurements are used for classifying the figure type and they can be useful for the manufacturing of the dummies. The measurement was used by five of the survey respondents and none of them experienced problems with the measurement. Of the 13 respondents interviewed, three indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

No international description could be found.

Interview respondents' descriptions:

Respondent 4: *Difference between the hip and waist measurements.*

Respondent 7: No description given.

Respondent 11: No description given.

The measurement is important for classifying figure types, and therefore the hip and waist measurements should be accurate and clear descriptions as to how and where to locate the landmarks is essential. The fact that no international description and only one national description could be found, indicate however an ignorance or "don't care" attitude towards the importance of figure types to achieve good fit.

Bust to underbust drop (141)

The drop measurements are used for classifying the figure type and they can be useful for the manufacturing of the dummies. The measurement was used by four of the survey respondents and one of the respondents experienced problems with the measurement. Of the 13 respondents interviewed, three indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

No international description could be found.

Interview respondents' descriptions:

Respondent 4: *Difference between the bust and the underbust measurement.*

Respondent 7: No description given.

Respondent 13: No description given.

This dimension is mostly used for the sizing of ladies' underwear, for identifying the bra cup size. It should however become more important when certain styles, such as empire lines and close fitting tops, are in fashion.

Front neck depth (142)

This measurement can be useful to shape the neckline curve when drafting a bodice pattern, and it is used for the manufacturing of fit dummies. The measurement was used by five of the survey respondents and one of the respondents experienced problems with the measurement. Of the 13 respondents interviewed, three indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

- ✓ Distance between the right neck shoulder point and the centre front neck (UK Sizing).

Interview respondents' descriptions:

Respondent 3: *Shoulder neck point to the level of the front neck base.*

Respondent 4: No description given.

Respondent 11: No description given.

The description corresponds with the international description. The problem experienced with this measurement is related to the landmarks. As discussed earlier, the location of the shoulder neck point is no easy task. Being able to consistently identify the landmark on different bodies is very important when taking measurements. It has been suggested that the base of the neck be marked with a chainette, since the chainette makes it easier to identify the neck shoulder intersection.

Back neck depth (143)

This measurement can also be of help in shaping the neckline curve when drafting a bodice pattern and it is used for the manufacturing of fit dummies. The measurement was used by five of the survey respondents and one of the respondents experienced problems with the measurement. Of the 13 respondents interviewed, three indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

- ✓ Distance between the centre back neck level and the right neck shoulder point level (UK Sizing).

Interview respondents' descriptions:

Respondent 3: *Shoulder neck point to the level of the nape.*

Respondent 4: No description given.

Respondent 11: No description given.

The description corresponds with the international description. This measurement can be very useful to improve the fit of garments for older people with a hunchback. Again the problems are related to the landmarks. As discussed previously, the location of the shoulder neck point can be problematic. Being able to consistently identify the landmark on different bodies is very important when taking measurements. It has been suggested that the base of the neck be marked with a chainette, since the chainette makes it easier to identify the neck shoulder intersection.

Back seat angle (144)

This measurement is useful to study the posture of a person. Posture has an influence on how a garment fits the body. The measurement was used by two of the survey respondents and two of the respondents experienced problems with the measurement. Of the 13 respondents interviewed, two indicated that they used the measurement and one company experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

- ✓ Value in degrees of the angle of inclination between the centre back waist level and the hip level (UK Sizing).

Interview respondents' descriptions:

Respondent 3: No description given. *Posture has a very important influence on fit.*

No description was given but the importance of the measurement was highlighted since posture can indeed influence fit.

Shoulder slope (145)

This measurement is used for style choices and also to determine the size of shoulder pads in certain upper body garments, and it is also necessary for the manufacturing of fit dummies. The measurement was used by nine of the survey respondents and three of the respondents experienced problems with the measurement. Of the 13 respondents interviewed, five indicated that they used the measurement and two companies experienced problems with the measurement.

International description of the measurement:

- ✓ Value in degrees of the angle of inclination following a line joining the right side neck point and the shoulder point (UK Sizing).
- ✓ The value, in degrees, on the angle of inclination measured using the inclinometer placed on the shoulder following a line joining the acromion and the neck-base shoulder point (ISO 8559, 1989).
- ✓ The angle formed when the slant of the shoulder line deviates from the horizontal line that originates at the side neck base (ASTM 5219, 1999).

The international descriptions do correspond with each other, although only one description states that it must be measured on the right shoulder.

Interview respondents' descriptions:

Respondent 3: *Angle that the shoulder drops from the neck shoulder point.*

Respondent 4: *Very important for the development of dummies.* No description given.

Respondent 7: *Now you need a special thing for that.*

Respondent 11: No description given.

Respondent 12: *Do not know how to measure shoulder slope. Information regarding a reliable shoulder slope measurement would be vital. It needs to be an angle more than a measurement.*

It seems that the respondents did not know how to take the measurement. Only one respondent offered a vague description and it corresponded with the international descriptions. This is the main reason for problems with the measurement, together with not having the equipment to take the measurement with. This measurement is also not available in the general size charts. The importance of such a measurement is however highlighted by the respondents.

The head, hand and foot measurements are not directly used for the manufacturing of fashion garments. The manufacturing process for shoes differs completely from that of clothes, and could therefore constitute a separate study. These measurements were however included in order to make this study more complete. Therefore, not all the measurements will be discussed in detail but the focus will be more on those measurements that are necessary for the production of clothes.

Height (Infants – lying down) (146)

The measurement was used by two of the survey respondents and none experienced problems with the measurement. Of the 13 respondents interviewed, only one used this measurement.

International description of the measurement:

Only one international description was found:

- ✓ Measure from the top of the head to the soles of the feet while subject is lying down flat with legs extended (ASTM 1999).

Interview respondents' descriptions:

Respondent 3: *Top of head to the feet while child lies down.*

The description corresponds with the international description.

3.4 Head measurements

These measurements are not necessarily used for the manufacturing of fashion garments such as hats and caps, but also for any other form of headwear or protective headwear such as helmets and gas masks. It is also important to keep in mind that fashion headwear are made using a block or replica of the head. Patterns for fashion headwear are made according to the block and then used for production of the items. Some measurements are therefore necessary for the production of these blocks, and not for making the headwear as such.

Face length (148)

The measurement was used by two of the survey respondents, one respondent experienced problems with the measurement. Of the 13 respondents interviewed, two indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

- ✓ Distance from menton at the bottom of the chin to glabella on the brow ridge in mid-sagittal plane (Ergotech).

Interview respondents' descriptions:

Respondent 7: No description given.

Respondent 12: No description given.

No descriptions were given. This can only be explained as follows: that the respondents did not know how the measurement should be taken and therefore experience problems with the measurement. This measurement is more applicable to full-face helmets, although it might also be useful in the case of hooded garments.

Chin to nose bridge (Menton-sellion) (150)

Although none of the respondents used this measurement, one respondent indicated that they experienced problems with the measurement. Again the explanation for this could be that the measurement is not used by any of the companies because it is seen as a problem measurement. None of the 13 respondents interviewed indicated a problem with this measurement.

International description of the measurement:

Only one international description was found:

- ✓ The distance between the menton landmark at the bottom of the chin and the sellion landmark at the deepest point of the nasal root depression is measured with the teeth closed lightly together (Ergotech).

Chin to pit of neck (151)

The measurement was used by two of the survey respondents and two respondents experienced problems with the measurement. Both respondents that use the measurements were included for the interviews and one experienced problems with the measurement.

International description of the measurement:

No international description could be found.

Interview respondents' descriptions:

Respondent 3: No description given

Respondent 7: No description given.

The respondents were not sure how this measurement should be taken and this is the reason why problems are experienced. This dimension is also not readily available in the general size charts used by manufacturers.

Head width (cheekbone to cheekbone) (153)

The measurement was used by seven of the survey respondents and one of the respondents experienced problems with the measurement. Of the 13 respondents

interviewed, two indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

- ✓ The distance between the lateral points of the zygion (cheekbone) landmarks (Ergotech).

Interview respondents' descriptions:

Respondent 4: *Width of the face across the cheekbones.*

Respondent 7: No description given.

The description corresponds with the international description.

Inter-pupillary distance (155)

This measurement was not used by any of the survey respondents, although one of the survey respondents indicated that it was a problem measurement. None of the 13 respondents interviewed experienced problems with this measurement and no international description could be found.

Sagittal arch (156)

The measurement was used by three of the survey respondents and one of the respondents experienced problems with the measurement. Of the 13 respondents interviewed, two indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

- ✓ Distance from glabella to nugal point over the rounding of the head (Ergotech).

Interview respondents' descriptions:

Respondent 4: No description given.

Respondent 12: No description given.

The respondents did not know how to take this measurement and this is probably the reason why problems are experienced.

Surface distance from above the ears across the top of the head (Bi-tragion coronal arch) (157)

Although only two of the survey respondents used this measurement, one of the respondents experienced problems with the measurement. Of the 13 respondents interviewed, one indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

- ✓ The surface distance between the right and left tragion landmarks across the top of the head. The head is in the Frankfort plane (Ergotech).

Interview respondents' descriptions:

Respondent 2: *From above the ears over the top of the head.*

The description corresponds with the international description.

3.5 Hand measurements

As with the arc measurements, the hand measurements are used by only one of the survey respondents or not at all. All of them are however indicated as problem measurements, whether they are used or not. The explanation is that the measurements are probably not used because they are seen as problem measurements and therefore not accurate. The hand measurements are also not readily available in size charts, as pointed out by one of the respondents.

Hand thickness (159)

This measurement could assist the pattern maker when determining the minimum circumference at the wrist of fitted knitwear. It is important, especially in children's

and babies' garments, that the hand could pass comfortably through the sleeve opening. The measurement was used by two of the survey respondents and one of the respondents experienced problems with the measurement. Of the 13 respondents interviewed, two indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

- ✓ The thickness of the right hand at metacarpal III joint, the fingers are held together in a straight plane. The middle finger is parallel to the long axis of the forearm (Ergotech).

Interview respondents' descriptions:

Respondent 3: No description given, but *would find these measurements interesting. "Things that would also be interesting are things like hands."*

Respondent 7: No description given. Marked all measurements since *no information on hands and feet is available.*

Palm length (160)

The measurement was used by two of the survey respondents and two of the respondents experienced problems with the measurement. Of the 13 respondents interviewed, two indicated that they used the measurement and one company experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

- ✓ The distance between the interstylion line and the base of the 3rd metacarpal. The palm is open and held straight (Ergotech).

Interview respondents' descriptions:

Respondent 3: No description given, but *would find these measurements interesting.*

Respondent 7: No description given. Marked all measurements since *no information on hands and feet is available.*

Hand length (wrist to middle finger) (161)

The measurement was used by two of the survey respondents and two of the respondents experienced problems with the measurement. Of the 13 respondents interviewed, two indicated that they used the measurement and one company experienced problems with the measurement.

International description of the measurement:

✓ The distance between the tip of the longest finger and the crease nearest the base of the right hand (UK Sizing).

Interview respondents' descriptions:

Respondent 3: No description given, but *would find these measurements interesting.*

Respondent 7: No description given. Marked all measurements since *no information on hands and feet is available.*

Wrist to index finger length (162)

The measurement was used by two of the survey respondents and one of the respondents experienced problems with the measurement. Of the 13 respondents interviewed, two indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

✓ The distance between the stylion landmark on the right wrist and the tip of the right index finger. The fingers are aligned together in a straight line (Ergotech).

Interview respondents' descriptions:

Respondent 3: No description given, but *would find these measurements interesting.*

Respondent 7: No description given. Marked all measurements since *no information on hands and feet is available.*

Wrist to thumb tip length (163)

The measurement was used by two of the survey respondents and two of the respondents experienced problems with the measurement. Of the 13 respondents interviewed, two indicated that they used the measurement and one experienced problems with the measurement.

International description of the measurement:

Only one international description was found.

✓ The horizontal distance between the stylion landmark on the right wrist and the tip of the right thumb. The thumb is adducted against the index finger and the hand is measured with the palm in a vertical plane (Ergotech).

Interview respondents' descriptions:

Respondent 3: No description given, but *would find these measurements interesting.*

Respondent 7: No description given. Marked all measurements since *no information on hands and feet is available.*

Thumb length (164)

The measurement was used by two of the survey respondents and one of the respondents experienced problems with the measurement. Of the 13 respondents interviewed, two indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

✓ The distance between the distal point of the thumb and the webspace between the thumb and the index finger (Ergotech).

Interview respondents' descriptions:

Respondent 3: No description given, but *would find these measurements interesting.*

Respondent 7: No description given. Marked all measurements since *no information on hands and feet is available.*

Index finger length (165)

The measurement was used by two of the survey respondents and one of the respondents experienced problems with the measurement. Of the 13 respondents interviewed, two indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

- ✓ The distance between the webspace and the distal point of index finger (Ergotech).

Interview respondents' descriptions:

Respondent 3: No description given, but *would find these measurements interesting.*

Respondent 7: No description given. Marked all measurements since *no information on hands and feet is available.*

Middle finger length (166)

The measurement was used by two of the survey respondents and one of the respondents experienced problems with the measurement. Of the 13 respondents interviewed, two indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

- ✓ The distance between the webspace and the distal point of middle finger (Ergotech).

Interview respondents' descriptions:

Respondent 3: No description given, but *would find these measurements interesting.*

Respondent 7: No description given. Marked all measurements since *no information on hands and feet is available.*

Ring finger length (167)

The measurement was used by two of the survey respondents and one of the respondents experienced problems with the measurement. Of the 13 respondents interviewed, two indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

✓ The distance between the webspace and the distal point of ring finger (Ergotech).

Interview respondents' descriptions:

Respondent 3: No description given, but *would find these measurements interesting.*

Respondent 7: No description given. Marked all measurements since *no information on hands and feet is available.*

Little finger length (168)

The measurement was used by two of the survey respondents and one of the respondents experienced problems with the measurement. Of the 13 respondents interviewed, two indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

Only one international description was found.

✓ The distance between the webspace and the distal point of little finger (Ergotech).

Interview respondents' descriptions:

Respondent 3: No description given, but *would find these measurements interesting.*

Respondent 7: No description given. Marked all measurements since *no information on hands and feet is available.*

Hand width (169)

This measurement could also assist the pattern maker when determining the minimum circumference at the wrist of fitted knitwear. It is important, especially in children's and babies' garments, that the hand pass easily through the sleeve opening. The measurement was used by two of the survey respondents and two of the respondents experienced problems with the measurement. Of the 13 respondents interviewed, two indicated that they used the measurement and one company experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

✓ Maximum width across knuckles with palm facing upwards (UK Sizing).

Interview respondents' descriptions:

Respondent 3: No description given, but *would find these measurements interesting.*

Respondent 7: No description given. Marked all measurements since *no information on hands and feet is available.*

Hand girth (170)

This measurement could also assist the pattern maker when determining the minimum circumference at the wrist of fitted knitwear. It is important, especially in children's and babies' garments, that the hand pass easily through the sleeve opening. The measurement was used by two of the survey respondents and two of the respondents experienced problems with the measurement. Of the 13 respondents interviewed, two indicated that they used the measurement and one company experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

✓ Maximum circumference of the open right hand measured over the knuckles (UK Sizing).

Interview respondents' descriptions:

Respondent 3: No description given, but *would find these measurements interesting.*

Respondent 7: No description given. Marked all measurements since *no information on hands and feet is available.*

Hand girth, hand width and hand thickness should be considered together with wrist circumference, to ensure that the sleeve opening on knitwear are big enough for the hands to pass through easily and comfortably.

Thumb girth (171)

The measurement was used by one of the survey respondents and one of the respondents experienced problems with the measurement. Of the 13 respondents interviewed, one indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

✓ The circumference of the thumb at the head of the proximal phalanx (Ergotech).

Interview respondents' descriptions:

Respondent 7: No description given. Marked all measurements since *no information on hands and feet is available.*

Index finger girth (172)

The measurement was used by one of the survey respondents and one of the respondents experienced problems with the measurement. Of the 13 respondents interviewed, one indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

✓ The circumference of the proximal interphalangeal joint (Ergotech).

Interview respondents' descriptions:

Respondent 7: No description given. Marked all measurements since *no information on hands and feet is available.*

Middle finger girth (173)

The measurement was used by one of the survey respondents and one of the respondents experienced problems with the measurement. Of the 13 respondents interviewed, one indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

✓ The circumference of the proximal interphalangeal joint (Ergotech).

Interview respondents' descriptions:

Respondent 7: No description given. Marked all measurements since *no information on hands and feet is available.*

Ring finger girth (174)

The measurement was used by one of the survey respondents and one of the respondents experienced problems with the measurement. Of the 13 respondents interviewed, one indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

✓ The circumference of the proximal interphalangeal joint (Ergotech).

Interview respondents' descriptions:

Respondent 7: No description given. Marked all measurements since *no information on hands and feet is available.*

Little finger girth (175)

The measurement was used by one of the survey respondents and one of the respondents experienced problems with the measurement. Of the 13 respondents interviewed, one indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

✓ The circumference of the proximal interphalangeal joint (Ergotech).

Interview respondents' descriptions:

Respondent 7: No description given. Marked all measurements since *no information on hands and feet is available.*

It is clear that the respondents did not know how the hand measurements should be taken, but felt that it would be beneficial to have access to such information. The problem with the hand measurements is that they are not available in the size charts for the respondents to use and that is why so few of the survey respondents use them.

3.6 Foot measurements

Manufacturing of footwear differs in the sense that footwear is made according to a last. The same pattern cannot just be altered for different styles as is sometimes done with garment patterns. Different lasts are used for different types of shoes, for example closed shoes and sandals, and lasts also vary with regard to heel height. The measurements are therefore actually not used by the manufacturers of footwear but rather by the last manufacturers and they did not respond to the survey questionnaire.

Height of foot arch (176)

The measurement was used by nine of the survey respondents and two of the respondents experienced problems with the measurement. Although only 18% of the survey respondents used this measurement, 22,2% of the survey respondents using it experienced problems with the measurement. Of the 13 respondents interviewed, three indicated that they used the measurement and one company experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

- ✓ Distance between the highest point of the arch of the right foot and the ground (UK Sizing).

Interview respondents' descriptions:

Respondent 3: No description given

Respondent 7: No description given. Marked all measurements since *no information on hands and feet is available.*

Respondent 10: No description given. *The arch is a big problem. There is a big variation in measurements; some people have a high arch, some a low arch and some people haven't got an arch.*

It is clear that the respondents did not know how this measurement is taken. This is probably the reason why problems are experienced with the measurement.

Height of the big toe (177)

The measurement is used by eight of the survey respondents and one experienced problems with the measurement. Of the 13 respondents interviewed, four used the measurement and none experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

Distance between the highest level of the tip of the big toe on the right foot and the ground (UK Sizing).

Interview respondents' descriptions:

Respondent 5: *From the floor to the top of the big toe, straight.*

Respondent 7: No description given. Marked all measurements since *no information on hands and feet is available.*

Respondent 10: No description given. *Does not really know where the measurements must be taken. Suggests that I contact the SABS.*

Respondent 12: No description given.

The one description given does correspond with the international description. A number of respondents did not offer any description, which indicates their ignorance regarding how body measurements should be taken.

Toe height (178)

The measurement is used by eight of the survey respondents and none experienced problems with the measurement. Of the 13 respondents interviewed, three used the measurement and none experienced problems with the measurement.

International description of the measurement:

No international description could be found.

Interview respondents' descriptions:

Respondent 5: No description given.

Respondent 7: No description given. Marked all measurements since *no information on hands and feet is available.*

Respondent 10: No description given. *Does not really know where the measurements must be taken. Suggests that I contact the SABS.*

Ball height (179)

The measurement was used by six of the survey respondents and two of the respondents experienced problems with the measurement. Although only 12% of the survey respondents used this measurement, 33,3% of the survey respondents using it experienced problems with the measurement. Of the 13 respondents interviewed, three indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

✓ Although no international description could be found, the measurement was taken from a picture in the Technical Report EP-10 by Jeffrey and Thurstone (1955:6).

Interview respondents' descriptions:

Respondent 7: No description given. Marked all measurements since *no information on hands and feet is available.*

Respondent 10: No description given. *Does not really know where the measurements must be taken. Suggests that I contact the SABS.*

Respondent 12: No description given.

It is clear that the respondents did not know how this measurement is taken. This is probably the reason why problems are experienced with the measurement.

Plantar arch height (180)

The measurement was used by six of the survey respondents and two of the respondents experienced problems with the measurement. Of the 13 respondents interviewed, two indicated that they used the measurement and one company experienced problems with the measurement.

International description of the measurement:

✓ Although no international description could be found, the measurement was taken from a picture in the Technical Report EP-10 by Jeffrey and Thurstone (1955:6).

Interview respondents' descriptions:

Respondent 3: No description given

Respondent 7: No description given. Marked all measurements since *no information on hands and feet is available.*

It is clear that the respondents did not know how this measurement is taken. This is probably the reason why problems are experienced with the measurement.

Dorsal arch height (181)

The measurement was used by five of the survey respondents and three of the respondents experienced problems with the measurement. Of the 13 respondents interviewed, two indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

- ✓ Although no international description could be found, the measurement was taken from a picture in the Technical Report EP-10 by Jeffrey and Thurstone (1955:6).

Interview respondents' descriptions:

Respondent 3: No description given

Respondent 7: No description given. Marked all measurements since *no information on hands and feet is available.*

It is clear that the respondents did not know how this measurement is taken. This is probably the reason why problems are experienced with the measurement.

Outside ball height (182)

The measurement was used by six of the survey respondents and three of the respondents experienced problems with the measurement. Of the 13 respondents interviewed, three indicated that they used the measurement and one company experienced problems with the measurement.

International description of the measurement:

- ✓ Although no international description could be found, the measurement was taken from a picture in the Technical Report EP-10 by Jeffrey and Thurstone (1955:6).

Interview respondents' descriptions:

Respondent 7: No description given. Marked all measurements since *no information on hands and feet is available.*

Respondent 10: No description given. *Does not really know where the measurements must be taken. Suggests that I contact the SABS.*

Respondent 12: No description given.

No descriptions were given. This is probably the reason why problems are experienced with the measurement.

Ankle length (183)

The measurement is used by five of the survey respondents and none experienced problems with the measurement. Of the 13 respondents interviewed, two used the measurement and none experienced problems with the measurement.

International description of the measurement:

No international description could be found.

Interview respondents' descriptions:

Respondent 3: No description given

Respondent 7: No description given. Marked all measurements since *no information on hands and feet is available.*

Posterior heel contour (184)

The measurement is used by six of the survey respondents and one of the respondents that use the measurement experienced problems with the measurement. Of the 13 respondents interviewed, one used the measurement and none experienced problems with the measurement.

International description of the measurement:

No international description could be found.

Interview respondents' descriptions:

Respondent 7: No description given. Marked all measurements since *no information on hands and feet is available.*

Ball length (heel to ball of foot) (186)

The measurement is used by six of the survey respondents and none experienced problems with the measurement. Of the 13 respondents interviewed, two used the measurement and none experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

- ✓ The distance from the back of the heel to the landmark at the first metatarsophalangeal protrusion on the ball of the right foot. The subject stands erect with the body weight evenly distributed on both feet (Ergotech).

Interview respondents' descriptions:

Respondent 5: *From the back of the heel to the ball of the foot.*

Respondent 7: No description given. Marked all measurements since *no information on hands and feet is available.*

The description given by one respondent does not clearly state how the ball of the foot must be located and also does not refer to measuring the right foot.

Fifth toe length (187)

The measurement is used by three of the survey respondents and none experienced problems with the measurement. Of the 13 respondents interviewed, one used the measurement.

International description of the measurement:

No international description could be found.

Interview respondents' descriptions:

Respondent 7: No description given. Marked all measurements since *no information on hands and feet is available.*

Outside ball length (188)

The measurement is used by five of the survey respondents and none experienced problems with the measurement. Of the 13 respondents interviewed, two used the measurement and none experienced problems with the measurement.

International description of the measurement:

No international description could be found.

Interview respondents' descriptions:

Respondent 7: No description given. Marked all measurements since *no information on hands and feet is available.*

Respondent 12: No description given.

Outside ball length (diagonal) (189)

The measurement is used by four of the survey respondents and none experienced problems with the measurement. Of the 13 respondents interviewed, two used the measurement and none experienced problems with the measurement.

International description of the measurement:

No international description could be found.

Interview respondents' descriptions:

Respondent 7: No description given. Marked all measurements since *no information on hands and feet is available.*

Respondent 12: No description given.

Width of three forward toes (190)

The measurement is used by four of the survey respondents and none experienced problems with the measurement. Of the 13 respondents interviewed, two used the measurement and none experienced problems with the measurement.

International description of the measurement:

No international description could be found.

Interview respondents' descriptions:

Respondent 7: No description given. Marked all measurements since *no information on hands and feet is available.*

Respondent 10: No description given. *Does not really know where the measurements must be taken. Suggests that I contact the SABS.*

Foot width (diagonal) (191)

This measurement is used by 24% of the survey respondents and four of the survey respondents using it experienced problems with it. Of the 13 respondents interviewed, four indicated that they used the measurement and one company experienced problems with the measurement.

International description of the measurement:

No international description could be found.

Interview respondents' descriptions:

Respondent 3: No description given

Respondent 7: No description given. Marked all measurements since *no information on hands and feet is available.*

Respondent 10: No description given. *Does not really know where the measurements must be taken. Suggests that I contact the SABS.*

Respondent 12: No description given.

It is clear that the respondents did not know how this measurement is taken. This is probably the reason why problems are experienced with the measurement.

Foot width (ball width) (192)

This measurement is used by 24% of the survey respondents and three of the survey respondents using it experienced problems with it. Of the 13 respondents interviewed, three indicated that they used the measurement and one company experienced problems with the measurement.

International description of the measurement:

- ✓ The maximum breadth of the foot, between the lateral aspect of the protrusion of the large toe metacarpal to the lateral aspect of the protrusion of the metacarpal of the 5th toe. The subject stands erect with the body weight evenly distributed between both feet (Ergotech).
- ✓ With the subject standing barefoot, the distance from the one side of the foot to the other at the widest part at the bottom (ASTM 5219, 1999).

Interview respondents' descriptions:

Respondent 5: *Width of the foot at the ball of the foot.*

Respondent 7: No description given. Marked all measurements since *no information on hands and feet is available.*

Respondent 12: No description given.

Only one description was given and it corresponds with the international descriptions. Neither the respondent, nor the international descriptions indicate taking the measurement on the right foot. It is however advisable to continue taking the measurement on the same side if previous measurement were taken on the right side. The other respondents did not know how the measurement should be taken and this is probably the reason why problems are experienced with the measurement.

Width (centre line to medial border) (193)

The measurement is used by eight of the survey respondents and none experienced problems with the measurement. Of the 13 respondents interviewed, three used the measurement and none experienced problems with the measurement.

International description of the measurement:

No international description could be found.

Interview respondents' descriptions:

Respondent 3: No description given

Respondent 7: No description given. Marked all measurements since *no information on hands and feet is available.*

Respondent 10: No description given. *Does not really know where the measurements must be taken. Suggests that I contact the SABS.*

Width of instep (194)

The measurement was used by nine of the survey respondents and two of the respondents experienced problems with the measurement. Of the 13 respondents interviewed, two indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

- ✓ Although no international description could be found, the measurement was taken from a picture in the Technical Report EP-10 by Jeffrey and Thurstone (1955:6).

Interview respondents' descriptions:

Respondent 7: No description given. Marked all measurements since *no information on hands and feet is available.*

Respondent 12: No description given.

It is clear that the respondents did not know how this measurement is taken. This is probably the reason why problems are experienced with the measurement.

Heel width (195)

The measurement is used by seven of the survey respondents and one experienced problems with the measurement. Of the 13 respondents interviewed, two used the measurement and none experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

- ✓ The maximum horizontal distance of the widest portion between the medial and lateral aspects of the heel. The subject stands erect with the body weight evenly distributed between the feet (Ergotech).

Interview respondents' descriptions:

Respondent 7: No description given. Marked all measurements since *no information on hands and feet is available.*

Respondent 10: No description given. *Does not really know where the measurements must be taken. Suggests that I contact the SABS.*

Girth of heel/Instep (heel-ankle girth) (196)

This measurement is not only useful in the manufacturing of shoes, but also for trousers. The measurement is important to determine the minimum circumference for trousers' hemline to allow the foot to pass through the trouser leg comfortably, especially for trousers styles with narrow tapered legs.

The measurement was used by seven of the survey respondents and two of the respondents experienced problems with the measurement. Of the 13 respondents interviewed, three indicated that they used the measurement and one experienced problems with the measurement.

International description of the measurement:

- ✓ Widest circumference measured around the right back of the heel and diagonally over the instep (UK Sizing).
- ✓ The circumference of the right foot at the ankle and base of the heel is measured with a tape passing over the point at which the heel first contacts the surface and over the dorsal juncture of foot and leg landmark at the front of the ankle. The subject stands erect with the weight distributed evenly on both feet (Ergotech).
- ✓ With the subject standing barefoot, the distance around the foot from the point where the back of the heel contacts the floor and over the juncture of the foot and leg at the front of the ankle and back to the starting point (ASTM 5219, 1999).

The international descriptions correspond with each other, although one of the descriptions does not state that the measurement should be taken on the right foot.

Interview respondents' descriptions:

Respondent 3: No description given

Respondent 7: *Measured diagonally across the ankle with toes pointed.*

Respondent 12: No description given.

The description given does not correspond to the international descriptions because it states that the measurement must be taken with the toes pointed, and also no reference is made to whether the left or the right foot should be measured. Two of the international descriptions indicate that the measurement should be taken on the right side and that the foot is measured with the person standing barefoot. Not being clear about whether to measure with a flat foot or pointed toe is probably the reason why problems are experienced with the measurement.

Foot girth (ball of foot) (198)

This measurement is used by 26% of the survey respondents and four of the survey respondents using it experienced problems with it. Of the 13 respondents interviewed, five indicated that they used the measurement and one company experienced problems with the measurement.

International description of the measurement:

Only one international description was found:

- ✓ Circumference of the right foot measured over the 'knuckles' of the toes (UK Sizing).

Interview respondents' descriptions:

Respondent 3: No description given

Respondent 5: *Circumference around the ball of the foot, just behind the toes. Also called joint girth.*

Respondent 7: No description given. Marked all measurements since *no information on hands and feet is available.*

Respondent 10: No description given. *Does not really know where the measurements must be taken. Suggests that I contact the SABS.*

Respondent 12: No description given.

The description given corresponds with the international description. The majority of respondents however did not offer any descriptions. This indicates that they are experiencing problems with the measurement.

Angle line (199)

The measurement was used by four of the survey respondents and one of the respondents experienced problems with the measurement. Of the 13 respondents interviewed, two indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

- ✓ Although no international description could be found, the measurement was taken from a picture in the Technical Report EP-10 by Jeffrey and Thurstone (1955:6).

Interview respondents' descriptions:

Respondent 7: No description given. Marked all measurements since *no information on hands and feet is available*.

Respondent 10: No description given. *Does not really know where the measurements must be taken. Suggests that I contact the SABS.*

It is clear that the respondents did not know how this measurement is taken. This is probably the reason why problems are experienced with the measurement.

Flare (ratio) (200)

The measurement was used by three of the survey respondents and two of the respondents experienced problems with the measurement. Of the 13 respondents interviewed, one indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

- ✓ Although no international description could be found, the measurement was taken from a picture in the Technical Report EP-10 by Jeffrey and Thurstone

(1955:6). This is not an actual measurement, but a calculation given in the above-mentioned source.

Interview respondents' descriptions:

Respondent 7: No description given. Marked all measurements since *no information on hands and feet is available.*

It is clear that the respondents did not know how this measurement is taken. This is probably the reason why problems are experienced with the measurement.

Proportion of sole in contact with ground (201)

This measurement was used by six of the survey respondents and two of the respondents experienced problems with the measurement. Of the 13 respondents interviewed, two indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

✓ Although no international description could be found, the measurement was taken from a picture in the Technical Report EP-10 by Jeffrey and Thurstone (1955:6).

Interview respondents' descriptions:

Respondent 7: No description given. Marked all measurements since *no information on hands and feet is available.*

Respondent 10: No description given. *Does not really know where the measurements must be taken. Suggests that I contact the SABS.*

It is clear that the respondents did not know how this measurement is taken. This is probably the reason why problems are experienced with the measurement.

Lateral foot contour by template (202)

The measurement was used by four of the survey respondents and one of the respondents experienced problems with the measurement. Of the 13 respondents

interviewed, one indicated that they used the measurement and none experienced problems with the measurement.

International description of the measurement:

- ✓ Although no international description could be found, the measurement was taken from a picture in the Technical Report EP-10 by Jeffrey and Thurstone (1955:6).

Interview respondents' descriptions:

Respondent 7: No description given. Marked all measurements since *no information on hands and feet is available.*

It is clear that the respondents did not know how this measurement is taken. This is probably the reason why problems are experienced with this measurement.