EASE ALLOWANCE AND FIT OF SELECTED FEMALE MILITARY UPPER GARMENTS

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Dissertation submitted in fulfilment of the requirements for the degree of:

MAGISTER TECHNOLOGIA: FASHION DESIGN

in the Department of Visual Arts and Design, Faculty of Human Sciences,

Vaal University of Technology.

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December 2007

The financial assistance of the Vaal University of Technology and the SANDF towards this research is hereby acknowledged. Opinions expressed and conclusions arrived at, are those of the author and are not necessarily to be attributed to the Vaal University of Technology or the SANDF.

ACKNOWLEDGEMENTS

"I have the strength to face all conditions by the power Christ gives me" and only by His grace I have managed to reach this goal. I hereby wish to express my sincere gratitude towards the following individuals who enabled this document to be successfully and timeously completed:

- Professor A.M. Trollip as my supervisor for her invaluable advice, guidance and wisdom. Thank you for your significant contribution towards the completion of this project.
- The Dean of the Faculty of Human Sciences, Proff. R. C. van der Bank for her understanding and assistance.
- The Central Research Committee of the Vaal University of Technology for financial assistance and in particular, Professor J. Pretorius for her ongoing support.
- ERGOnomics TECHnologies for financial and technical support. Lorraine McDuff and Karin Bredenkamp for their valuable expertise and assistance.
- Antoinette Engelbreght for language editing of the dissertation.
- To my parents who never fail to support me. You are my constant source of love and guidance. Thank you for your patience and endless support.
- To my sisters, Marinda and Heleen, for your continued moral support.
- To Ian, thank you for your love, encouragement and understanding. Your contribution is greatly appreciated.
- To my friends and colleagues for support and understanding.

My most sincere thanks to all these people

N. Smit

December 2007

ABSTRACT

This study was contracted by the African Warrior Project of the South African National Defence Force (SANDF). The goal was to explore and describe fit in terms of ease of selected female military upper garments, namely the closely fitted dress jacket and the loosely fitted combat shirt issued by the SANDF. The objectives of this study were firstly, to determine and interpret the amount of tolerance that will comply with the functional requirements related to the activities and comfort of an optimum number of wearers and result in an aesthetically acceptable fit; secondly to analyse and interpret the suitability of the key dimensions used to determine the current size designation in terms of body shapes and gender; thirdly, to determine and interpret the relevance and the validity of the currently used sizing system with regard to representativeness of the current population's measurements. The findings indicated that satisfaction with fit was influenced by fit preferences. Insufficient as well as excess ease in a particular location resulted in discomfort or restricted movement and an aesthetically unacceptable garment. Insufficient or excess ease at one location impacted on the comfort experienced in another location on the same horisontal level. Subjects wearing smaller sizes were satisfied with less ease than plus-sized subjects wearing larger sizes. The key dimensions used for the dress jacket and the combat shirt did not ensure sufficient ease at other locations. It was therefore recommended to include the waist and hip dimensions as key dimensions in the size designation to accommodate various body shapes and assist with size allocation. Garments for female wearers cannot be issued according to male body dimensions. The sizing system needs to be revised to represent the population's measurements.

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LIST OF ABBREVIATIONS

ARMSCOR	:	Armaments Corporation of South Africa LTD
BMI	:	Body Mass Index
CEDC	:	Center for Ergonomics of Developing Countries
Ergotech	:	ERGOnomics TECHnologies
I.S.O	:	International Organization for Standardization
NFG	:	Nominal Finished Garment
P.A.R	:	Participatory Action Research
RMSS	:	RSA Military Standards Steering Committee
RSA-MIL-SPEC	:	Republic of South Africa Military Specification
SABS	:	South African Buraeu for Standardization
SANDF	:	South African National Defense Force
V.U.T	:	Vaal University of Technology

CHAPTER 1
INTRODUCTION

1.1 BACKGROUND

Well fitting garments are probably one of the most prevalent worldwide consumer needs. In an era of mass produced apparel and fashion that prescribes well fitting garments, fit has become a world wide problem. Garments that do not fit well not only affect consumers adversely, additionally lost sales, returns and unsold stock have a negative impact on retailers and manufacturers (Winks 1997:46, Desmarteau 2000:42 & Li, Ulrich & Connell 2002:1).

The consumers of corporate wear are in an even worse position. Manufacturers of corporate wear, such as military uniforms, have to make garments according to a pre-determined set of specifications. Consumers of military uniforms are issued with garments and do not have the opportunity to shop around for better fitting and more suitable styles.

In terms of corporate dress, such as the South African National Defense Force (SANDF) uniform, the satisfaction of the wearer with the appearance and comfort of the garment is important. Additionally, if the garment fits poorly, a poor image of the organisation is projected (Kaiser 1990:4).

The definition of fit by Stamper, Sharp and Donnell (1991:295) is especially applicable to uniforms. This definition states that a well fitting garment is comfortable to wear, with sufficient room to allow for easy movement, with neither unnecessary wrinkles nor bunching of the fabric, nor a display of bagginess. It should also be aesthetically acceptable. Good fit is therefore dependent on design and movement ease allowance/tolerance. Ease allowance can be described as the dimensional clearance allowed between the body and the garment. It is an extra measurement (or tolerance) added to the body measurement to allow for body movements (Beazley 1999:67). The amount of tolerance is an important design value (Le Pechoux 2000:2) and is determined by the style of the design (fitted, semi-fitted or loosely-fitted), body movement and the function of the garment. Additionally, the amount of tolerance is influenced by the production ease related to the type of fabrics and the techniques used when producing the garment (Rasband 1994:20). The fit threshold is the smallest difference in fit that can be observed or measured (Ashdown & DeLong 1995:48).

The focus of this study is the fit of military wear. In particular attention is given to the manner in which fit is affected by the amount of tolerance/movement ease allowed. The focus of this research is the female uniform of the SANDF. In particular, two styles of upper garments, namely the service dress jacket (closely fitted garment) and the loosely fitting combat shirt are investigated.

The dress jacket is issued in size categories where each size designation includes a range of five to six bust dimensions, based on the bust dimension as a key dimension. The number that identifies each size is known as the size designation (Ashdown 1998:327). These size designations are based on selected key body dimensions. Key body dimensions are measurements that serve as predictors of the sizes of other parts of the body (Chun-Yoon & Jasper 1996:90). The dress jacket is issued according to these particular size categories. This has serious implications for the ease allowance of the smallest/largest size in each category, subsequently the physical comfort of the wearer and the aesthetic appeal of the garment may be jeopardised.

In order to allow for enough movement ease for the smallest and largest size in each category, the amount of ease allowed must be adequate. The specifications for this particular dress jacket allow 100 millimeters ease/tolerance for the person with the smallest bust dimension in a category. The person with the largest bust dimension is however limited to an ease allowance of 40 millimeters. Forty millimeters equates to the minimum allowance for a tight fitting garment. Although this amount seems acceptable, it only works for the ideal sized body where bust and hip circumference are the same. Few women have ideal figures and there are several variations of figure types. Subsequently, the body measurements at key points can vary immensely.

Hip measurements for the dress jacket are not specified. The bust dimension serves to predict the hip dimension. In the instance of different body shapes, such as the triangle body shape where the hip circumference can be up to 200 millimeters larger than the bust, the fit of the jacket deteriorates drastically.

The second military upper garment that is scrutinised in this study is the combat long sleeve shirt. The same shirt that is issued to male military members is issued to female military members. The sizing charts and key dimensions are based on male measurements. The bodies of males and females differ. Subsequently the long sleeve combat shirt fits female SANDF members poorly. The following comment regarding the fit of the combat shirt, made by an anonymous female soldier, emphasises the poor fit of the garment: " Hierdie klere is nie gemaak vir ons vrouens nie. Dit pas nêrens. Ek moet die neklyn met 'n speldjie vassteek anders is ek oop! Ons moet maar vat wat ons kan kry" (Smit:2005). [1]

With regard to the dress jacket, body shape is not taken into consideration and it is uncertain whether the key body measurements used in the specifications will ensure good fit for an optimal number of persons. Different body proportions determine body shapes. For the purpose of this study, proportion refers to the relationship of each part of the body to every other part and to the relationship of each part to the total height and mass.

Women with special fit problems as a result of different body types, need more sizing options to obtain a better fit. Winks (1997:4) states that very few sizing systems accommodate differences in body proportions that result from age, ethnicity

[1] "These clothes are not made for us women. It does not fit anywhere. I must pin the neckline closed with a (safety) pin, otherwise I am exposed! We just have to accept what we can get".

or body weight. Female consumers appear to have adjusted their expectations to match their circumstances; this is unacceptable, as good fit of clothing should not be compromised. Consumer confusion and dissatisfaction with ill-fitting garments indicates that there is a need for research concerning consumer satisfaction in relation to fit, ease and sizing. The average consumers' lack of knowledge regarding their own body measurements and garment sizes, which are necessary when selecting garments, aggravates the problem of good fit.

The outdated sizing system used for the design specifications of the dress jacket is another factor that may negatively affect the fit of the garment. Winks (1997:24) describes a sizing system as a set of pre-determined body sizes designated in a standard manner. The goal of any sizing system is to make provision for sub groups of a population so that a limited number of sizes will provide clothing that fit an optimal number of individuals in the population, while taking into account variability within the population (Ashdown 1998:324-325).

The specifications for the dress jacket were last revised during May 1989. Research in the field of sizing and fit confirms the importance of up-to-date sizing systems and charts that are representative of the intended population (Workman 1991:31, Ashdown 1998:324). Since the 1980's it has been argued that body measurement charts need to be revised at least every ten years (Brunn 1983:98). The change in the political regime in South Africa during 1994 resulted in major changes in the racial composition of the SANDF. It is accepted that the common body form types of members of different races can differ. The results of a study conducted in 1994 indicated that the hip measurements of black plus-sized women were between 20 and 100 millimeters larger than the hip measurements of white plus-sized women (Ergotech 1994). It seems as if the sizing system used by the SANDF should be re-evaluated and updated to suit the needs of the current SANDF members.

Standards of fit vary from person to person, furthermore, fit is experienced subjectively. Rasband (1994:34) explains that one woman may spend hours to get her clothes perfectly custom cut to fit, while another woman may be happy with ready to wear clothes quickly altered in store to fit. Fashion also influences fit in the way that it prescribes either close or loose fitting garments.

The perception of good fit for a consumer ranges from a desire for a garment to conform loosely to the body with the goal of providing comfort, to a desire for a garment to conform perfectly to the body in order to enhance the body form. It is accepted that consumers have certain fit expectations. An expectation may be described as the anticipation of an occurrence that is expected to happen (Plug *et al.* cited by Tselepis & de Klerk 2004:86). Physical comfort, psychological comfort and appearance all play a role in the consumer's perceived satisfaction with fit (Anderson, Brannon, Ulrich, Presley, Woronka, Grasso & Gray 2000:1). Consumers' experiences of fit vary due to the subjective manner in which fit is perceived and experienced. There is however consensus among researchers that satisfaction relates to consumers' preconceived expectations of a garment compared to their experience of the fit of the garment.

The various definitions of fit and satisfaction with fit, underline the complexity of the process involved in the provision of well-fitting garments. In the majority of cases, the fit of the garment is determined by the sizing system that specifies its production.

The amount of tolerance allowed is a factor that is inseparable from fit. The focus of this study is specifically on sizing systems and the amount of ease/tolerance allowed with regard to the dress jacket and the combat long sleeve shirt. The study of ease allowance and fit of the selected female military upper garments forms the focus of this empirical research. The findings are aimed at resolving female wearers' dissatisfaction with the afore-mentioned garments.

Staff members and the SANDF can benefit from the findings of this study in the following areas:

- Garments can be issued that will fit an optimum number of female staff members.
- Better fitting garments will ensure that the wearer's functional and aesthetic needs are met.

- The SANDF will project a more professional and efficient image when female staff members are issued with better fitting garments.
- The large unused stock of garments that do not fit any staff can be prevented so that money can be saved.

1.2 THEORETICAL FRAMEWORK

A perusal of related literature indicates that Susan Ashdown's model (developed in 2000) regarding sizing systems could serve as a theoretical point of departure for this investigation. Ashdown (2000) views sizing systems as the focus around which all factors concerning sizing and fit evolve. This framework reflects the importance of investigating sizing systems to detect and correct problems with fit.

The framework is presented in Figure 1 overleaf.

THEORETICAL FRAMEWORK FOR SIZING SYSTEMS

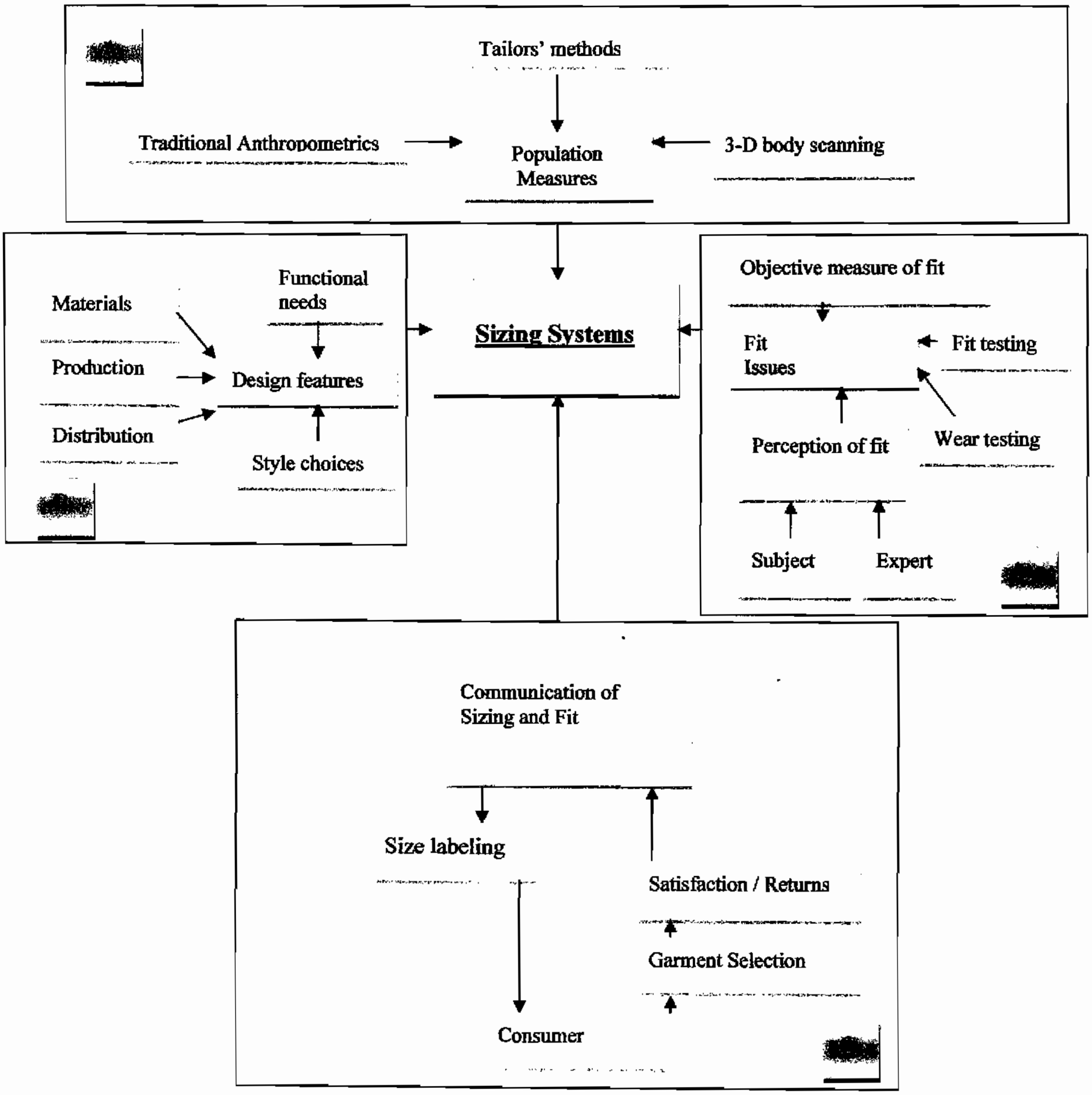


FIGURE 1: Theoretical framework (Ashdown, 2000)

Susan Ashdown's framework, (2000) presented in Figure 1 can be explained as follows: The most important factor affecting any sizing system is the population measurements on which it is based. It is of the utmost importance that the measurements taken of the sample population are current, accurate and a good representation of the entire population for which the sizing system is being developed. These measurements can be obtained by different methods, such as traditional tailors' methods, traditional anthropometrical or three-dimensional body scanning. Traditional tailors' measures refer to measurements taken by hand using a measuring tape. Anthropometry literally means "the measurement of people" (Norgan in Ulijaszek & Mascie-Taylor 1994:141), and can be defined as the science of measuring human beings. The term anthropometry derives from 'anthropos', meaning human and 'metrikos', meaning measuring (Roebuck 1995:1). Researchers have developed three-dimensional body scanners that can capture the outside surface of the human body within seconds by using optical techniques which involve the use of laser or light systems. The measurements are produced instantly and accurately. The technique used to measure the body influences the accuracy and the representativeness of the population's measurements.

In the process of producing well-fitting garments, there are many factors to take into consideration, in particular the design features. The choice of appropriate style in terms of its aesthetic and functional needs will determine the design features of a garment. It is important to examine the type of material used as this choice may greatly influence the fit of the garment. Materials have various stress characteristics that may cause the garment to shrink, stretch and/or distort under body stress induced during wear (Solinger 1980:55). The fabric type may also have an effect on the production techniques used to manufacture the garment, as different fabrics require various specified techniques. Production techniques and production errors may also impact on the quality and fit of the garment. Distribution involves ensuring that the right garments are available to the right clients at the right time and price.

Once an updated and successful sizing system is developed, it is important to communicate the results to the target population. The size label is a convenient manner to indicate the sizing system used and serves to assist the consumer in selecting the appropriate size garment (Brown in Chun-Yoon & Jasper 1996:94).

The size label should be clearly understandable in order to assist the wearer in selecting the appropriately sized garment, without having to try on too many different sizes. A sizing system may be considered successful after it has been used in the design of one or more garments and these garments have proved to fit the individuals for whom they were intended, from a functional and comfort standpoint (Emanuel, Alexander, Churchill & Truett in Strydom 2006:7).

The fit of a garment is a function of the sizing system used and will ultimately affect the wearability of the garment. Fit affects the comfort, aesthetic appeal as well as the wear-life or durability of a garment. The wearer evaluates the fit of a garment in terms of individual perceptions of comfort and fit according to the way the garment fits and wears.

Fit and wear tests should be conducted in order to minimise negative effects. Another important factor pertaining to fit is the perception of the individual regarding fit tolerance. An expert in the field of clothing is likely to perceive fit differently than an uninformed individual. It is therefore imperative to establish how much tolerance the consumer is willing to accept before he/she regards a garment as ill fitting.

Susan Ashdown's model was used as point of departure to develop a conceptual framework for this study. The model is complex and this study focuses primarily on design features and fit issues (sections B and D respectively). Understanding design features in terms of the degree of correlation with body types and fit preferences is integral to the improvement of the sizing systems of the SANDF. The relationship between sizing systems, design features and fit issues is presented in Figure 2 below.

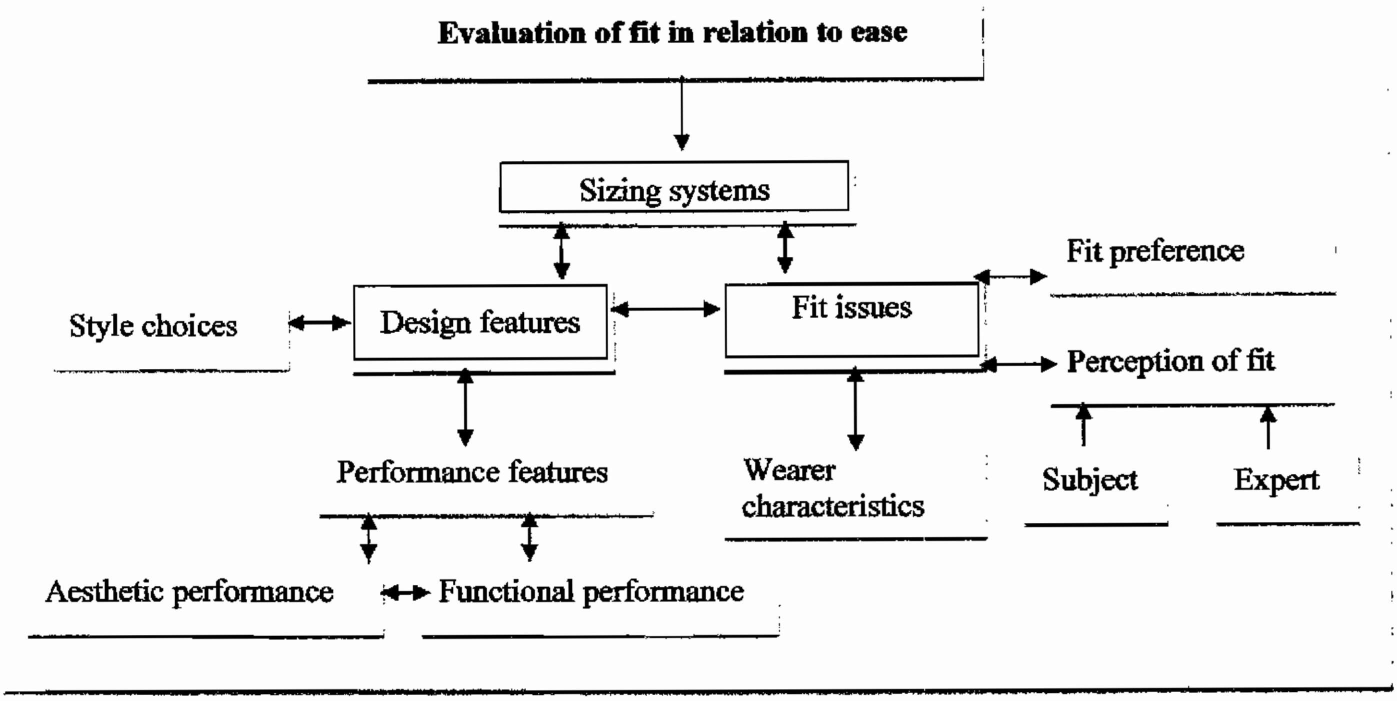


FIGURE 2: Conceptual framework

The conceptual framework focuses on sizing systems, design features and fit issues, particularly in relation to ease. Design features and fit issues are integrated aspects of sizing systems.

In its most simple form a sizing system is a set of predetermined body sizes designated in a standard manner (Winks 1997:24). It is widely accepted within the apparel industry that sizing systems for females are flawed in many ways. In particular the data on which it is based is often very out-dated.

The amount of ease allowed could influence fit in a very positive manner. In general, the sizing system used by a producer will include the ease requirements for each size within the size category (Winks 1997:1). The amount of ease required is calculated during the design phase of the garment and is determined by the functional needs, style choices and materials used. Ease is the difference between the body measurements of the intended wearer and the measurements of the garment (Brown 1992:265). There are three categories of ease, namely

- Design ease;
- movement ease; and
- production ease.

Design ease is the amount of tolerance added to the body dimensions to create a specific style or fit (Alexander, Connell and Presley 2005:53). Movement ease is the amount of tolerance added to the body dimensions to allow for movement and comfort (Brown 1992:265-266, Morris & McCann 1997:21 and Alexander *et al.* 2005:53). Production ease is added to allow for the amount that the fabric shrinks or stretches during the production of the garment. Fabric tests are therefore conducted and the results thereof are used to alter the pattern to ensure good fit. It is essential to thoroughly investigate all three aspects of ease namely design, movement and production ease so that an adequate amount of ease can be incorporated into the garment specifications.

As previously mentioned, the style or the design of a garment will influence the fit. The style of the garment is determined by its silhouette and other describing characteristics. The silhouette of a garment refers to its outline or shape (Brown & Rice 2001:128). The key to identifying the style of a garment is to recognise particular characteristics that make it unique. These characteristics could be the garment design features, functions or intended use or any other specific feature.

The style of a garment plays an important role in prescribing the fit variation for that garment. The garment design may be based on either a tight or a loose fit (Reader's Digest 1977:106). A close fit is indicated by a silhouette that defines the form and, within it, details such as waist seams, darts, curved seams and many other shaping techniques. A loose fit results in a silhouette that camouflages the details beneath. The design of a garment is determined by and dependent on the fit variation selected for each style.

The design features of a garment refer to the basic ingredients, components or media from which design is developed or made. The performance features of a garment directly influence the design features and vice versa. A garment's performance features determine the standards it meets and how it benefits the wearer (Brown & Rice 2001:47-48). Performance features indicate the garment's aesthetic performance and functional performance as discussed below.

❖ Aesthetic performance

The aesthetic performance refers to the attractiveness of the garment. In order to be attractive, the design, material and construction of the garment have to fulfill the wearer's appearance expectations (Brown & Rice 2001:47-48).

❖ Functional performance

The functional performance of the garment refers to performance features other than appearance, namely the garment's utility and durability. Utility may be described as the usefulness of the garment and is dependent on fit and comfort so that the garment can function appropriately for its intended use (Brown & Rice 2001:47-48). Durability refers to the extent to which the garment retains its structure and appearance after wear and care (Brown & Rice 2001:48).

As discussed above, the aesthetic and functional performance of the garment are interdependent aspects that coexist as a function of the design features. Movement ease in relation to fit is an aesthetic feature (attractive fit versus unattractive fit) as well as a functional feature (comfortable fit versus and uncomfortable fit).

In order to fully investigate the concepts of fit, it is essential to understand the issues that constitute good fit. Fit is evaluated according to five classic elements, namely grain, set, line, balance and ease (Brown & Rice 2001:158 and Yu 2004:38). When considering fit, it is also important to establish the overall fit preferences of the population, which simply put is the preferred fit in terms of style and design. An understanding of the fit preference of female wearers could help apparel companies to produce and meet demands for comfortable and well fitting clothes for women (Alexander *et al.* 2005:61).

Fit preferences correspond to the wearer's perceptions and expectations of a garment. Various authors agree that wearers have certain expectations about the product and how the product will function (Foxall & Goldsmith and Schiffmann & Kanuk in Tselepis & de Klerk 2004:86). Expectations arise from needs, normative standards, theoretical knowledge, recommendations by others and personal experience (Tselepis & de Klerk 2004:86). Ultimately, the decision of what constitutes good fit is made by each individual (Ashdown & DeLong 1995: 47). Individual perceptions of fit (which are formed by the wearer or the expert) are mostly subjective and therefore it is necessary to analyze fit in relation to those perceptions.

According to Brown and Rice (2001:153-154) fit problems are often the result of individual characteristics of the wearer. To make good fit an achievable goal, it is necessary for the sizing system to make provision for different body shapes. No two bodies are alike and differences in body shapes and sizes are repeatedly put forward as a main reason why a workable standard sizing system cannot be reached (McVey 1984:24, Price & Zamkoff in Workman 1991:32-34, Winks 1997: 46 and Ashdown, Loker, Cornell & Adelson 2004:1). In addition to the effect of body types, body posture greatly influences the fit of garments. Posture refers to the alignment of the body parts and to the manner in which the body frame is carried (Liechty, Pottberg & Rasband 1992:37). Gender is another wearer characteristic that significantly influences fit. The bodies of males and females differ immensely with regard to body type, posture, body build and tone and average height (Todd, Paquette & Bensel 1996:683). As previously mentioned, female troops have to wear long sleeve combat shirts that were originally designed for male troops.

1.3 GOAL

The goal of this study is to investigate the fit of two styles of upper garments for females namely, the service dress jacket (a closely fitted garment) and the long sleeve combat shirt (a loosely fitted garment) as issued by the SANDF, especially with regard to ease/tolerance allowances for various sizes and body types, design and issue specifications and the validity of sizing charts. Based on the results, recommendations will be made to ensure good fit for an optimum number of consumers with different body types.

1.3.1 Objectives

1. To determine and interpret the amount of tolerance that will:
   - ➢ Comply with the functional requirements related to the activities and comfort of an optimum number of wearers.
   - ➢ Result in an aesthetically acceptable fit.
2. To analyse and interpret the suitability of the key dimensions used to base the current size designation on in terms of especially body shapes and gender.
3. To determine and interpret the relevance and validity of the currently used sizing system with regard to representativeness of the current population's measurements.

The following outcomes are expected for this study:

- ➢ Firstly, the amount of ease allowed for each size in the various size categories may not ensure optimum fit, from both an aesthetic and functional point of view.
- ➢ Secondly, the key dimensions specified in the specifications, may not be adequate to allow for the optimum number of body types of the population.
- ➢ Thirdly, the sizing charts for the dress jacket were last revised in 1989; which is very likely to be inadequate in order to serve the needs of the current population.
- ➢ Fourthly, the loose fitting combat shirt which is based on male sizing charts may not meet the functional and aesthetical needs of female military members.

In conclusion to this introductory chapter, the structure of the remainder of this research report is outlined: Chapter 2 comprises the literature review. The research design is described in Chapter 3, followed by a presentation of the findings in Chapter 4. Chapter 5 comprises the conclusions and recommendations, which are followed by the Bibliography and Annexures.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODCTION

The literature review for this study is based on the conceptual framework described in Chapter 1. The three main focuses of the framework namely, sizing systems, design features and fit issues are the basic concepts fundamental to an understanding of fit and ease/tolerance as an important aspect of fit.

2.2 SIZING SYSTEMS

A sizing system is an established set of body measurements and sizes designated in a standard manner (Winks 1997:24). It is used by manufacturers of mass-produced apparel for sizing, size grading and size marking when prescribing specifications for bulk production. Sizing systems are based on a body of anthropometric data derived from anthropometric surveys conducted on the population for which the garments are intended and designed (McConville, Tibettes & Churchill 1979:102, Ashdown 1998:325, Gupta & Gangadhar 2004:458). Sizing systems should be structured in such a manner that the minimum number of sizes will provide garments that fit the optimum number of members of the population (Ashdown 1998:324, Beazley 1998:277).

2.2.1 The structure of a sizing system

The construction of a sizing system is a complex procedure. In order to fully understand a sizing system it is necessary to understand the components involved, in particular control dimensions, size charts, size rolls, size scales, size ranges, size intervals and size designation systems must be explored. These concepts are subsequently defined and discussed.

2.2.1.1 Control dimensions

The most important step in the construction of a sizing system is dividing the population into subgroups of individuals. These subgroups should have similarities with regard to specified relevant body dimensions, also known as control (key) dimensions. An important characteristic of a control dimension is that it acts as a predictor of other relevant body dimensions (Robinette 1986:573, Chun-Yoon & Jasper 1996:90). Control dimensions are therefore those primary body dimensions according to which the sizing system is built. Control dimensions are fundamental in defining body size, which in turn is used to assign a suitably sized garment to a wearer (Winks 1997:24, Beazley 1998:268). Winks (1997:24) distinguishes between primary, secondary and tertiary control dimensions. Secondary and tertiary dimensions are defined as those body dimensions other than the control dimensions that are required to fully define the body size (Winks 1997:24). Secondary dimensions are helpful to determine the body shape in more detail. Secondary and tertiary dimensions are used in conjunction with the control dimensions by the garment manufacturer in order to prepare the sizing system and size roll (Winks 1997:24).

A size roll is similar to a sizing system. However, a size roll only includes the sizes that are produced by a particular manufacturer.

Research findings indicate that no single body dimension can adequately predict other body dimensions (McConville *et al.* 1979:220, Winks 1997:15). It is widely accepted that at least two control dimensions are required to predict other garment measurements. It is essential that at least one horisontal measurement (i.e. girth, breadth, circumference and depth) and one vertical measurement (i.e. height and length) are used to predict the garment measurements (Robinette 1986:574, Winks 1997:15). These pairs of key dimensions need not correlate well with each other, but should correlate well with other related dimensions (McConville *et al.* 1979:103).

It is indicated by various research studies that two control dimensions might be too few. McConville *et al.* (1979:220) state that two or more dimensions should be selected in such a manner that each will control a different aspect of the body size variability (e.g. linearity or mass). Ashdown (1998:324) proposes redesigning sizing systems in order to optimize fit by using as many variables (body dimensions) as are needed to account for variability within the population. According to McConville *et al.* (1979:220) the selection of key dimensions is of crucial importance, however it is seldom, if ever, clear-cut. Key dimensions should comprise the following characteristics: convenient to measure, an integral part of the garment to be produced, with a high degree of correlation with other dimensions that are important to the design and sizing of the end item (McConville *et al.* 1979:220).

Traditionally, the bust circumference, as a primary control dimension, has been considered to be of major importance for designing upper body garments. The findings of Green (1981:20), however, indicate that the bust measurement failed to predict various measurements for upper torso garments. Green (1981:21) recommends using the width across the shoulders instead of the bust measurement as the primary dimension to design upper torso garments because it is a more useful key dimension than bust circumference. Bust circumference is however a good predictor for the dimensions of a full sized garment (upper and lower body) (Green 1981:24). With reference to the research conducted by the above-mentioned authors it is clear that much work remains to be done regarding identification and the adequate number of key dimensions to be used.

2.2.1.2 Size Charts

A size chart is the result of the artificial division of a range of measurements into a number of sizes that aim to be convenient for wholesale production as well as to satisfy the customer's requirements (Beazley 1999:67). A size chart consists of the group of measurements (including the control dimensions) that represent a specific body size (e.g. size 34) within a sizing system. Multiple types of size charts exist for specific uses. There are charts of body measurements for size ranges related to specific body shapes such as children's, men's or women's body shapes (Beazley 1999:67). A sizing system includes a number of size charts. Designers, patternmakers and graders use these charts when producing mass-produced apparel.

Within a sizing system, size charts are divided according to variables or fixed scales. These scales are based on one body dimension such as the bust dimension (Winks 1997:24, Ashdown 1998:325). Each producer determines the size of the intervals between sizes. The size interval (also known as the 'inter-size' interval, size step or grade) is the incremental difference between adjacent components within the size scale (Winks 1997:24).

A size range is the extent of a size scale, defined by its extreme values (Winks 1997:24). A size range or category contains a range of sizes from small to large (Ashdown 1998:325). A size designation system consists of a system of size labeling for a garment or accessory (Winks 1997:24). It is the designated size shown on the garment label or hang tag (Winks 1997:2). Beazley (1998:261) states that each size has to be labeled so that customers/wearers can recognise that the size will give them a reasonable fit. The purpose of a size designation system is therefore to assist the consumer in selecting the appropriately sized garments, without the inconvenience of trying on various sizes to find an acceptable fit.

Size charts developed for women's wear should be based on control dimensions applicable in describing women's body size and shape. Drop values are used to identify distinct relationships between key dimensions that determine body shape (Beazley 1998:270, Gupta & Gangadhar 2004:464). The drop value is the interval, or the incremental difference between the bust and the hip girths in women's wear, and the chest and the waist measurement in men's wear (Winks 1997:24). Should a woman's bust measurement (e.g. 102 centimeters) be equal to her hip measurement (e.g. 102 centimeters), then she has what is culturally described as an ideal figure. A bust measurement of 92 centimeters and a hip measurement of 107 centimeters (a ratio of 92:107) imply a drop value of 15 centimeters and a triangular body shape.

2.2.2 Process of developing sizing systems

Over the years various researchers have indicated steps according to which sizing systems should be developed. Robinette (1986:573) developed a technique resulting in an anthropometric sizing system that basically involves four steps, namely;

- Selection of one or two dimensions which are key to the end item.
- Division of sample of the user population into subgroups of people according to these dimensions.
- Summarizing the variability in all other relevant dimensions within each of the subgroups, and
- selection of design values for all the dimensions to accommodate the variance for each subgroup (Robinette 1986:573).

Green (1981:16) in her study to develop sizing systems for military women, used steps proposed by the Anthropology Research Project of Ohio, conducted during 1978 for deriving a sizing system from anthropometric data. The steps are outlined below:

- Selection of an appropriate body of data for analysis.
- Selection of the key dimensions.
- Selection of the intervals for key dimensions.
- Development of the body measurements data within each interval or size.
- Conversion of the summarized interval specific data to appropriate design values.
- Derivation of the tariff (number of garments in each size required to outfit the population).

Similarly, Jongsuk and Jasper, cited in Ashdown (1998:325), indicate a four-step process for the development of size charts.

- Dividing the population into different body types based on dimensions such as height or ratios between body measurements.
- Developing sets of size categories, each containing a range of sizes from small to large.
- Basing the size ranges within the size categories on key body dimensions (the sizes are generally evenly distributed from small to large), and
- determining the remaining body dimensions necessary to design the pattern for the garment, once the sizes are identified (Jongsuk and Jasper, cited in Ashdown 1998:325).

Although size charts consist of tables of body measurements for men, women or children in a specific size, size charts also include design values. Design values are determined by the style or fashion and by the amount of ease that needs to be added for movement and design purposes.

Beazley (1999:69-70) identifies three stages in the formulation of size charts, namely:

- Selection of raw data from the survey of body measurements.
- Setting increments between sizes and rounding the increments up or down (to the nearest centimeter or half centimeter), and
- adding required ease allowances.

2.2.2.1 Ease allowance

The size and fit of a garment is influenced by the dimensional clearance/tolerance between the body and the garment. Most garments need to be larger than the body of the wearer in order to allow for movement, expansion and style (Beazley 1999:67). An extra measurement or tolerance, known as movement ease allowance, must therefore be added to the body measurement to ensure the comfortable fit of the garment on the body (Gioello & Berke 1979:7).

Garment manufacturers develop their own fitting tolerance values. These values can vary significantly according to manufacturers (Winks 1997:1). In addition to movement and style ease, fabrics and production techniques will also determine production ease. Another factor to be taken into consideration when determining the ease allowance is the expected performance of a garment. Garments intended to be worn over other garments (such as a jacket or a coat) should include the necessary amounts of ease allowance to make this function possible.

It is crucial to understand the amount and placement of ease allowance to be added to the nude body measurements. Various authors have indicated amounts of ease allowance for specific uses as listed below:

- Reader's Digest (1977:109) quotes wearing ease estimates. These estimates are proposed in consideration of the following exceptions: (1) A pattern designed for a stretchy knit fabric or a strapless styled garment, should provide less wearing ease, and (2) Larger figures may require more than the suggested minimum wearing ease for a truly comfortable fit (Reader's Digest 1977:109).
- Gioello and Berke (1979:16-23) propose specified amounts of ease for both males and females as a guide for developing garment patterns for basic fitted garments of medium weight fabrics.
- Farmer and Gotwals (1982:222-223) specify the minimum amounts of ease required for pattern design. Constructing patterns based on these minimum amounts will result in a fit that is closer to the body than most street/casual wear.
- Haggar (1990:4-8) developed tables of ease allowances required for drafting basic dress and trouser blocks. A block pattern is the pattern for basic garments without any style features added (Beazley 1999:67).

The above-mentioned authors have compiled tables of data concerning the amounts of movement ease allowances. In order to indicate the variance and similarities between these allowances, the four sets of tables are compared to one another. The comparative tables are ordered according to horisontal measurements (Table 1) and vertical measurements (Table 2) and only include the ease allowances for the upper torso. Gioello and Berke (1979:16-23) are the only authors to differentiate between the ease requirements of men and women. The suggested amounts indicate great variations due to the fact that body builds of men are different to those of women.

TABLE 1: COMPARITIVE TABLE OF HORISONTAL MOVEMENT EASE ALLOWANCES

Body area	Recommended ease allowance in millimeters					
	Reader's Digest	Gioello and Berke		Farmer and Gotwals	Haggar	$\bar{x}$
Horisontal measurements	**Women (mm)**	**Men (mm)**	**Women (mm)**	**Women (mm)**	**Women (mm)**	**Women (mm)**
Neck: Total girth	-	6,4	6,4-12	-	-	9,5
Shoulder	-	12	12-25	-	-	19
Chest: Total girth	-	50,8	12,7	-	-	12,7
Bust: Total girth	75	50,8	63,5	50: Bust 60: High bust	100	72
Bust front girth	-	50,8	31,8	-	6	19
Bust back girth	-	50,8	38,3	-	16	24
Total waist girth	20	12,7	25,4	13	40 : bodice 10: skirt 10 : trouser	19,6
Front waist girth	-	12,7	9,5 – 12,7	-	-	11
Back waist girth	-	12,7	12,7 – 25,4	-	-	19
Hip	50	-	-	50	50	50
Top Hip	-	-	-	-	40-50	45
Upper arm	-	76,2 88,9	76,2-101,6	50	50	63
Elbow	-	76,2 (–) 88,9	25,4	-	Minimum 50	38
Forearm	-	-	19,1	-	-	19,1
Wrist	-	-	12,7	-	65	39

(Reader's Digest 1977:109; Gioello & Berke 1979:16-23; Farmer & Gotwals 1982:222-223; Haggar 1990:6-8).

TABLE 2: COMPARITIVE TABLE OF VERTICAL MOVEMENT EASE ALLOWANCES

Body area	Recommended ease allowance in millimeters					
	Reader's Digest	Gioello and Berke		Farmer and Gotwals	Haggar	$\bar{x}$
Vertical measurements	Women (mm)	Men (mm)	Women (mm)	Women (mm)	Women (mm)	Women (mm)
Neck to waist front	-	-	12,7 – 25,4	-	-	19
Neck to waist back	-	--	12,7 – 25,4	-	-	19
Front waist length	-	-	-	13	-	13
Back waist length	-	-	-	13	-	13
Shoulder length	-	22,2	-	-	-	-
Shoulder to waist front and back	-	-	12,7	-	-	12,7
Inseam – from armscye to wrist	-	-	12,7	-	-	12,7
Shoulder to crotch (vertical trunk)	-	31,8-76,2	25,4 – 50,8	-	-	38

(Reader's Digest 1977:109; Gioello & Berke 1979:16-23; Farmer & Gotwals 1982:222-223; Haggar 1990:6-8).

Based on the comparative Tables 1 and 2 presented above it is clear that there is great inconsistency between the proposed ease allowances provided by various authors. The reason can possibly be ascribed to the fact that the authors do not always distinguish between close and loose fitting garments. This complicates the determination of adequate amounts of ease. Table 1 indicates variations concerning the horisontal measurements for both men and women which are presented below:

- A total bust girth that varies from 50 to 100 millimeters.
- A bust front girth that varies from 6 to 50,8 millimeters.
- A bust back girth that varies from 16 to 50,8 millimeters.
- A total waist girth that varies from 10 to 40 millimeters depending on the type of garment.
- An upper arm girth that varies from 50 to 101,6 millimeters, and
- An elbow total girth from 25,4 to 88,9 millimeters.

The only corresponding measurement is the tolerance for the hip measurement, which is constantly given as 50 millimeters.

Due to these inconsistencies, the above data is further compared to the suggested ease allowances presented in Table 3. The pattern drafting guide, as compiled by Muller (1970:2) from the University of Pretoria serves as a practical guide for fashion design and draping for tight, semi-fitting and loose-fitting garments.

TABLE 3: MOVEMENT EASE ALLOWANCE: A PRACTICAL GUIDE FOR DRAFTING PATTERNS

Area on the body of the wearer	Recommended ease allowance for:		
	Tight-fitting garments (Shirt) (mm)	Semi-tight-fitting garments (Jacket) (mm)	Loose-fitting garments (Coat) (mm)
Bust	7 – 75	101,5 – 125	205 +
Waist	N/A	110 – 145	255 +
Hips	N/A	255 +	305 +

(Muller 1970:2)

Table 3 shows that the guide developed by Muller (1970:2) specifies amounts of ease allowance for tight-, semi- and loose- fitting garments. It is important to consider the prescribed fit which stipulates the amount of design and movement ease to be incorporated in order to create a specific style. In addition to the amount of ease allowance, the placement of the suggested ease allowance values must be carefully considered.

Cooklin (1995:30) suggests using a percentage of the applicable girth measurement as ease/tolerance for drafting master patterns for women's outsizes. In the case of a fitted garment as described by Cooklin (1995:30) the style is similar to that of the dress jacket. In the instance of the straight jacket with sleeve as described by Cooklin (1995:16) the style is similar to that of the combat shirt. The ease percentages for the above-mentioned garments are presented in Table 4 overleaf.

TABLE 4: PERCENTAGE VALUES OF EASE ALLOWANCE AS DESCRIBED BY COOKLIN (1995:16, 30)

Location	Value for a fitted jacket with sleeve %	Value for a straight jacket with sleeve %
Bust location	13,8	16,9
Hip location	8,8	14
Waist	5,1	-

(Cooklin 1995:16, 30)

Table 4 shows that the ease percentage is less for a closely fitted garment than for a loosely fitted garment. It is once again important to consider the prescribed fit as it stipulates the amount of design and movement ease to be incorporated in order to create a specific style.

Movement tolerance/ease allowance is a very important function of a sizing system that is frequently underestimated. Additional research is required in order to set standards for:

- The optimum amount of allowable tolerances, and
- specified body measurements where these tolerances should be allocated.

Up to 2005, there has been no research conducted regarding suggested amounts of ease allowance in South Africa (Trollip 2005).

2.2.2.2 Problems with sizing systems and size charts

The difficulty of developing accurate sizing systems for clothing or equipment is often underestimated (Winks 1997:7, Taylor 1998:732). Although it may be the designer's intention that the item should fit a specified range of people, accommodation of that range is not always achieved. Various authors, including Workman (1991:31), Goldsberry, Shim and Reich (1996b:121), Winks (1997:25), Yu (2004:192) and Ashdown *et al.* (2004:2) identify causes for problems within sizing systems which can be reduced to two factors:

- The source of anthropometric data on which the sizing system is based, and
- the representativeness of the size charts.

2.2.2.3 The source of anthropometric data on which the sizing system is based

The sizing standards/systems widely used by manufacturers of women's wear for civilian populations around the world were published in 1958 in the United States of America (Ashdown 1998:326). The anthropometric data was originally derived from a survey conducted on military women in 1941 (Goldsberry, Shim & Reich 1996a:109). According to Goldsberry *et al.* (1996a:109), the 1941 study had very low representation of older women and was biased in favour of young, unmarried, white women. It may be assumed that the current general female population will be less homogeneous and will have greater variability regarding the various body dimensions (Green 1981:17). In addition, the ethnicity, lifestyle and body types of the current population are essential elements to consider when developing sizing systems from anthropometric data.

Green (1981:17) cautions that the data obtained from military populations should not be seen as representative of the civilian population group. As the source of data is from a selected group, it is automatically biased toward a certain segment of the population at the expense of another segment (regarding the ethnicity, age, lifestyle and body type that it favours). Shannon cited in Workman and Lentz (2000:251) reported in 1987 that researchers in Sweden and West Germany found important changes in body measurements when they updated their apparel sizing systems to reflect physical changes that occurred in their populations. Tamburrino in Workman and Lentz (2000:251) argues that increased participation in physical exercise, changes in dietary habits, geographical migrations and other lifestyle factors have produced changes in the anthropometry of populations, subsequently making existing sizing systems obsolete. Various surveys are currently being conducted worldwide using state-of-the-art technologies (digital scanners) that reduce the time and labour involved in the collection of anthropometric data (Yu 2004:179). According to Yu, recent anthropometric studies include the NedScan project conducted in the Netherlands in 2000 and the Size UK project in 2002 that pioneered the largest national survey in the UK since the 1950's (Yu 2004:190). With regard to the clothing and textile industry of South-Africa, Yu (2004:190) has recognised the need for a national anthropometric database that will potentially solve problems that arise in the design and production of well-fitting garments for the diversity of consumers.

2.2.2.4 The representativeness of size charts

The literature review shows that if the anthropometric data on which the sizing system is based is outdated, the related size charts cannot accurately reflect the current population's measurements with regard to ethnicity, age, lifestyle, body type and gender. These concepts are subsequently explained. Aspects such as ethnicity, age, lifestyle, body types and gender will be scrutinised in the following paragraphs, in terms of fit issues as aspects of wearer characteristics.

❖ Ethnicity

The socio-economic group to which people belong, that enables the creation of a unique culture is called an 'ethnos' (Els 1993:6). Coertze cited in Els (1993:6) defines an 'ethnos' as follow:

- A relatively independent and self sufficient, human, social unit.
- The unit is not organized on an *ad hoc* basis but comes into being through a process of growth.
- It consists of a number of people of both sexes and all ages who have lived in a specific geographic area for a number of generations.
- These people have created a unique and distinctive cultural pattern.
- They regard themselves as a separate social unit, and
- they are recognised as such by other groups.

It is widely acknowledged that ethnic groups differ from one another regarding their body shapes. Variations in physical characteristics of human beings are related to the interaction of various factors such as geographic locations, environmental influences, economic circumstances and nutrition (Roach & Eicher 1973:38). Due to the fact that different environments favour different kinds of physical characteristics for survival, genetic differences have developed over many generations and a worldwide diversification of physical types occur (Winks 1997:9).

A comparative study of variations in body size has been conducted by the Center for Ergonomics of Developing Countries (CEDC) in Sweden (Abesekera and Shahnavaz cited in Le Pechoux 2000:4). Their findings indicate variations in almost every part of the human body, resulting in a diversity of body proportions (Le Pechoux 2000:4). The Chamber of Mines of South Africa has conducted anthropometric surveys through mining houses in order to establish the validity of their previously established databases used to design personal protective equipment (Winks 1997:8). The findings of these anthropometric surveys indicate that no substantive changes of functional or ergonomic consequence have occurred in recent years (Winks 1997:8). This contradicts recent testimony by female SANDF members that their upper garment fit is totally unsatisfactory.

In South Africa, anthropometric surveys have shown that the body dimensions of South African black males are in general significantly smaller that those of Caucasian males (Morrison cited in Winks 1997:12). Morrison further states that a study of the data shows that black and white South African males are not proportionately of similar build and that the ratio of sitting height to total height of black males is significantly less than that of white males (Winks 1997:12). Based on the above, Morrison concludes that a proportionately greater leg length for black males is indicated (Winks 1997:12). The findings of Tildesley cited in Winks (1997:12) also indicate that the longitudinal limb measurements of people living in warmer climates tend to be greater in relation to overall height.

Inter-population differences may be ascribed to certain cultural groups being more knowledgeable regarding adequate dieting habits and nutrition. An adequate diet provides sufficient energy as well as essential amino acids, vitamins and minerals to support optimal growth and to maintain and repair body tissues (Shier, Butler & Lewis 2003:426). Malnutrition occurs when the diet lacks essential nutrients or when a person fails to use available foods to best advantage (Shier *et al.* 2003:426). The latter circumstance results in a body type that is smaller, shorter and more petite.

Various ethnic groups have significantly different body types and proportions within the population which must be identified in order to establish the most prominent shapes (Winks 1997:7). In practice, it would be unrealistic to expect a size chart to make provision for all the multiple specific dimensions of several ethnic groups. The developer of the sizing chart should consider the variability between ethic groups and the impact thereof on the fit of garments when trying to provide the majority of the population with well-fitting garments.

❖ Age

As the human body ages, its physical form changes and the clothing worn by the wearer needs to be adapted. The physical changes due to ageing occur gradually in varying degrees and at different stages (Morris & Bader cited in Horridge & Woodson 1988:277). A common body change during ageing is the decrease of stature due to changes in the spine, thinning of weight bearing cartilage and careless posture habits (Horridge & Woodson 1988:277). Weight gain is also associated with the middle years as both men and women tend to enlarge at the waistline (Farmer & Gotwals 1982:10). At a later stage the body becomes thinner as the muscle tone decreases and the arms and legs become less shapely (Farmer & Gotwals 1982:11).

❖ Lifestyle

In addition to the ageing process, there are many other factors that cause changes in body types during the lifespan of a person. Individual body dimensions can vary during one's lifespan, from one person to the next and from one generation to the next (Le Pechoux 2000:2). These body changes occur as a result of individual lifestyle (nutrition, activities, environment, etcetera) that directly affects the person's body fat-versus-muscle content (Le Pechoux 2000:7). Many factors contribute to the change in average body types of an entire population. Some factors include diet, activities, increasing immigration and changes in ideal perceptions of masculinity and femininity (Meek cited in Le Pechoux 2000:7).

❖ Body types

Size charts tend to be biased regarding provision for body types, and frequently do not provide for the full range of body types. Most size charts are based on the principle that body proportions resemble that of the accepted ideal figure. This supposedly perfect or ideal figure comprises proportional areas that are harmonious to look at in length and width as compared to one another (Rasband 1994:9). Ideal figures are expressed in a ratio of 2:3 as the total body height is divided into five equal parts, ideally with two-fifths from the head to waist and three-fifths from the waist to feet (Rasband 1994:9). It is characterised by a proportion of 25-31 centimeters difference between bust and waist and between hip and waist. This ideal figure has shoulders and hips aligned with a naturally indented waistline. In summary, the ideal figure is symmetrical, with an upright stance and aesthetically pleasing body proportions (Armstrong 1995:33). Ironically, only a fraction of the population has what is culturally considered to be a perfectly proportional body.

Many manufacturers select a figure type, often referred to as a "Greek god" or a "Cinderella" or a "perfect ten" to represent the base size (Robinette 1986:570). This (proportional) base form is then graded up and down to create the other sizes. Although this may appear to be a reasonable approach, in reality, people do not come as scaled models of each other (Robinette 1986:570). Daniels, cited in Robinette (1986:570), demonstrates that no two persons are average in every dimension because people come in various shapes that combine certain averages with smaller and larger dimensions. A potential solution to this problem may be to alter the base pattern to accommodate 'disproportional' bodies (Ashdown *et al.* 2004:2). However, due to the variation of body types within the population this would not adequately solve the problem. Adopting the base pattern or shape of the pattern can potentially improve the garment fit for one segment of the population, however this would be at the expense of another segment of the population (Ashdown *et al.* 2004:2).

In addition, cultural ideals change over time and therefore size charts cannot be expected to accurately reflect the body types within the population. Body ideals change as fashion changes and the concept of the ideal female figure has changed vastly over the last 50 years (Kefgen & Touchie-Specht 1981:200). Although the anatomy of the female body remains the same, it is frequently forced into a variety of shapes by the prevailing fashion body ideals of a culture (Kefgen & Touchie-Specht 1981:200). Since 1940, the body ideal of women's body shapes have become rectangular and very slim (Anderson *et al.* 2000:2). From 1940 to 1960 the ideal female figure evolved from a slender and petite body shape to a rounded hourglass figure consisting of wide hips and large bust, frequently characterised by the image of Marilyn Monroe. During the 1970's and 1980's women became more fitness conscious and strived towards more muscular bodies. The 1990's brought about the western ideal that women should be well proportioned with a relatively thin body shape. In recent years, the popularity of sports and general improvement in nutrition, hygiene and living standards have resulted in people becoming healthier, stronger and more slender (Le Pechoux 2000:8). Due to the fitness craze, muscles which were once a symbol of masculinity have become a symbol of fitness, health and sexiness for both sexes (Sproles & Burns 1994:42). Since the year 2000, the ideal body type is recognised as being slender and well toned. An increasing number of women are engaging in weight-training and resistance exercises in their quest for younger, firmer and more vibrant body images. Despite evidence that the ideal body shape has changed over the decades, the size charts and measurements used to represent the current populations may not have changed accordingly.

As previously mentioned, variations of body shapes have frequently been put forward as the primary reason for a workable sizing system not realising (Winks 1997:4). The complexity of this issue arises from body measurements not being the sole indicator of body shape. Women with the same bust, waist and hip measurements may have completely different shapes and sizes, displaying variations in posture, back curvature, hip positions and bust shapes (Tait 1998:22). According to Winks (1997:9) it is obvious that a garment designed for the average person, will not fit and thereby dismiss or disregard large, small, stout or thin people. Winks (1997:7) emphasises the importance of differentiating between various body types and their subsequent effect on fit. Clearly the need exists for research to identify the prominent body types within the population in order to accommodate the majority of the members.

❖ Gender

It is commonly accepted that the bodies of women differ from those of men. In general, adult women tend to have more body fat and less muscle and bone than adult males, who achieve greater stature than adult women (Beachle & Earle 2000:179). Due to these variations, it is expected that women are on average lighter in total body weight than men. Anthropometric measurements of adults indicate that men tend to have broader shoulders relative to their hips; and that women tend to have broader hips relative to their waists and shoulders (Beachle & Earle 2000:179).

An increasing number of women are entering the armed forces and undertaking a wider variety of roles than previously experienced. As the number of women in the military increases, the disparity between male and female dimensions becomes increasingly apparent (Todd *et al.* 1996:683). According to Gordon (1986:581) there is a clear need to provide field clothing that accommodates the body size and more importantly the body proportions of both men and women.

In the past, manufacturers of military garments have attempted to accommodate female wearers by means of gender integrated protective garments. Male garments were simply produced in smaller sizes and made shorter to suit womens' measurements. Gordon (1986:581) ascribes the failure of military garment manufacturers to two practical reasons. First, the scaled-down clothing retained their inherently male proportions and therefore did not fit women well (Gordon 1986:581). Based on proportion variation it is expected that when a military female is issued with a shirt appropriate for her chest size, it will not fit properly over her hips. In contrast, when the garment fits her hips properly, the shoulders will be too big.

The Second shortcoming as stated by Gordon (1986:581) pertains to the fact that the key dimensions that ultimately form the framework of the sizing chart and are used to predict sizes of other parts of the body, differ for men and women. The key dimensions generally used for women's wear are the bust- and -hip circumferences whereas the chest- and -waist measurements are used for men's wear. It is not surprising that women who wear garments intended for male wearers are reported to experience problems with fit. The proper fit of apparel is dependent on the relationship of the size of the garment when compared to the size of the wearer (Huck, Maganga & Kim 1996:45). It is therefore essential to produce women's garments that are based on women's measurements. Sizing charts should distinctly define the specific body characteristics of men and women before it will be possible to satisfy the fit requirements of the population.

In conclusion, a perfect fit for "ready-to-wear" clothing cannot be demanded, nor is it to be expected (Winks 1997:7). Manufacturers should therefore research acceptable solutions which may fall short of the most ideal solutions for accomplishing good fit. It is commonly accepted that it is unrealistic to expect all fashion garments of the same labeled sizes, produced by different sizing charts to be of the exact same measurements. It is however reasonable to expect that the garment will fit the labeled body size (Winks 1997:1).

Although solving problems within sizing systems promises to be a difficult and time-consuming task, accomplishing good fit is of grave importance. An ill-fitting garment results in the customer/wearer being dissatisfied with the garment, irrespective of the fabric quality, workmanship or garment fashion (Winks 1997:1). It therefore follows that by solving problems with sizing charts, garment quality and fit will improve greatly.

Accurate size charts alone are not sufficient to ensure well-fitting garments. It is self-evident that garment fit is influenced by the garment itself. The design features of a garment directly influence the amounts of required ease allowance. Design features include the garment's physical performance features, which reflect its aesthetic and functional performance. It is of vital importance to establish the correct amounts of ease allowance per size due to the fact that too little or too much ease allowance will produce a garment that is aesthetically and functionally unsuccessful with regard to fit.

2.3 DESIGN FEATURES

DeLong (1987:164) defines design as a planning process, which involves the structure of a visual form and as an imaging process. Davis (1996:3) is of the opinion that design comprises two aspects, namely, a process and a product. As a process, design includes planning and organising to meet a goal and carrying out this plan accordingly (Davis 1996:3). As a product, design is an end result; an intended arrangement that is the outcome of a process or plan (Davis 1996:3). Design therefore is a process and a product that includes everything intentionally created for the specified purpose (Davis 1996:3). According to the Southern African Oxford Dictionary (1999:124) design can be defined as a drawing that shows how something is to be made (e.g. a dress design).

Design features (comprising the elements and principles of design) determine the fashion and style of a garment. The style of the garment influences organisational dress (and in particular uniforms) as it prescribes the physical form as well as the fit of the garment. Ultimately all the above-mentioned factors prescribe the quality of any garment and also the performance features.

2.3.1 Design aspects

According to Davis (1996:15) garments are designed in terms of three aspects, namely function, structure and decoration. In order to achieve the design goal the garment should portray these aspects in a manner that appears naturally unified and compliments each aspect (Davis 1996:15). It is important to clearly understand the three aspects of design so that their impact on the fit of garments can be investigated.

❖ Functional design

The main design aspect of a military garment is its functionality. The designer therefore has to set functional goals for a garment, including its physical performance and end use. Davis (1996:17-18) elaborates that the functional requirements of a garment have to comply with the wearer's needs for provision of comfort, freedom of movement, as well as to protect the wearer against the elements to ensure health and safety.

The design and development of protective clothing worn by the military has to address functional challenges as personal protection is needed during normal, combat and emergency survival during peacetime and war (Shanley, Slaten & Shanley 1993:55). According to Cadarette, DeCristofano, Seckman and Sawka (in Shanley *et al.* 1993:56) the majority of available protective garments in the United States Military are not adequate to maintain individual comfort zones during training at high metabolic rates. Shanley *et al.* (1993:57) state that the soldier's activities, which include a wide range of body movements, must not be hampered by his/her clothing. In addition the garments should be properly designed to permit maximum movement.

❖ Structural design

The structural design of a garment should realise the functional criteria set for the garment (Davis 1996:21). Functional criteria include garment construction quality, how and where the garment will open and close, and how the garment will allow for movement ease. According to Shanley *et al.* (1993:57) careful construction and good fit of protective garments are necessary to minimize the effects of heat stress and to facilitate movement and performance. The design and placement of fastening systems are of critical importance for protective gear (Shanley *et al.* 1993:57). Shanley *et al.* (1993:57) state that fasteners must be positioned for comfort, provide unassisted ease of donning and doffing and also offer complete protection from wind, water and chemicals.

Structural design stipulates how the above-mentioned aspects will relate to the body of the wearer and importantly, this design function reveals the garment's style. Garment style stipulates garment fit as the style can range from a very tight, to a very loose fitting garment.

❖ Decorative design

Decorative design is closely related to the appearance of the garment. Decorative aspects should adhere to the aesthetic and functional requirements of the garment. Kefgen and Touchie-Specht (1981:275) explain that decorative design is created after the garment form is completed and is the result of surface enrichment. Although the appearance of any garment is of great importance, it must sustain the main purpose of comfortable fit and function (Davis 1996:23).

Although decorative aspects are not the main feature of military garments, it is of great importance as military organisations are particularly rich in symbolic expressions, which constitute decorative aspects. Horn and Gurel (1981:30) state that a function of decorative design is to identify and distinguish people in various manners. Particular items of clothing can indicate the wearer's status, occupation, religion and group membership (Horn & Gurel 1981:30). This can be accomplished by means of trims, appliqués and/or emblems. Brown and Rice (2001:218) define emblems as pre-embroidered appliqué's, also known as patches, badges or insignia commonly used on military uniforms. Decorative design therefore serves the purpose of revealing status position and identification.

2.3.2 Style

Style is a characteristic of a distinctive form of dress that has certain recognizable qualities or features that distinguish it from other forms (Horn & Gurel 1981:217). According to Horn and Gurel (1981:217), style may be part of the current normative behaviour and therefore be considered fashionable. The latter statement is, however, not applicable to the description of garment styles within military organisations as these styles are not affected by current fashion norms and trends. An appropriate definition is given by Wolfe (1998:22) who states that the style of the garment is determined by the aesthetic features that create its overall appearance. The acceptance of a garment and the satisfaction with that garment is, according to Brown and Rice (2001:128), determined by whether the style exhibits the principles of design. Horn and Gurel (1981: 218) explain that the style of a garment refers to its design or cut, a quality that can be described in terms of line, shape or proportion. Despite the number of possible styles being limitless, all styles may be classified in terms of fit such as very tight fitting, tight-fitting, semi-fitting, loose-fitting and very loose fitting styles.

The garment silhouette may, or may not define the body silhouette. Either the body or the garment's silhouette will be dominant, depending on the closeness or looseness of fit (Liechty *et al.* 1992:4). The categories of fit (very fitted, slightly fitted, slightly loose and very loose), as defined by Liechty *et al.* (1992:4) are presented below.

- A very fitted garment repeats body contours exactly and thereby allows little ease for body movement.
- A slightly fitted garment repeats body contours but provides standard wearing ease. It fits the body without constraining it.
- A slightly loose fitting garment merely suggests body contours and stands slightly away from the body or flows loosely over it.
- A very loose fitting garment does not define body contour at all.

Liechty *et al.* (1992:5) state that improper amounts of ease affect the garment silhouette and that insufficient ease results in lengthwise, crosswise and diagonal wrinkles in strained areas and reveals the body contours beneath. As a result, the garment will bind and pull in fitted areas and normal body movement will be uncomfortable.

2.3.3 Fashion

Fashion can be defined as the style of consumer products or manner of behaviour that is temporarily adopted by a discernible portion of members of a social group because that specific chosen style or behaviour is perceived to be socially appropriate for the time and situation (Sproles & Burns 1994:4). A function of fashion is that it reflects a continuing process of changing styles that are accepted by the majority of a population. Sproles and Burns (1994:7) explain that of all the basic styles that are identifiable, only a small number will be adopted by a discernible number of people at any time. Concepts of fit change as fashions change (Farmer & Gotwals 1982: 8). Fashion does not only prescribe the style of a garment but also the required fit of a specific style.

Within military organisations, garments are not usually susceptible to fashion changes. Military garments look more or less the same over a long period of time. This is due to the fact that the garments must primarily sustain their functional criteria, which is considered more important than changing aesthetical needs. Similarly, fashionable colours do not influence military garments as "soldiers require camouflage prints" (Brown & Rice 2001:139) and more practical colour selections.

2.3.4 Performance features

A garment's performance features determine the standards it meets and how the garment will benefit the wearer (Brown & Rice 2001:47). Performance features include the aesthetic and functional performance. Gersăk (2002:169) states that garment quality is not only defined through its aesthetic and functional properties, but also by the physical and physiological well-being of the wearer. Aesthetic and functional performance is discussed in terms of the physical and psychological affect of the garment on the wearer.

2.3.4.1 Aesthetic performance

Aesthetics have an impact on organisational cultures as the aesthetic appeal can contribute to a sense of competence or incompetence within that organisation. Protective organisations such as the military have a primary function, which is to defend and serve the public (Kaiser 1990:374). Kaiser (1990:374) states that a well-regimented appearance is therefore expected in protective organisations because such an image is viewed as a sign of efficiency and competence.

The wearer's physiological aesthetic needs are co-dependent on his/her physical aesthetic needs. Research has repeatedly found that clothing plays a significant role in social interaction, personal acceptance and perceived sociability (Workman & Johnson 1989a:11). Davis (1996:33) states: "...we want to be wanted, to be accepted by others important to us". A person's appearance influences that acceptance or rejection. Fiore and Kimle (1997:42) are of the opinion that clothing that is beautiful to the consumer can satisfy his/her socio-psychological needs by pleasing him/her on emotional and cognitive levels.

2.3.4.2 Functional Performance

The functional performance of a garment is determined by its intended use. It relates to whether the garment will function in a satisfactory way in terms of what is expected from it (Brown & Rice 2001:48). As utility refers to usefulness, this function entails the garment fit and comfort. It is essential to consider these aspects in the design of the garment, in order to render the garment functionally successful. If a garment binds or restricts the wearer or, conversely, is too large, wearer mobility and the level of protection that the clothing item provides can be adversely affected (Huck *et al.* 1996:45).

The functional performance of a garment has a psychological effect on the wearer as it provides self-presentation. Self-presentation involves the relation of self to actual behaviour in a social situation. Identity is a kind of self-in-context, a self that is embedded in social relations and situations (Kaiser 1990:96). These considerations are influenced by social expectations and cultural symbolism.

Both the aesthetic and functional characteristics of a garment are influenced by the fit of the garment on the body (Shen & Huck 1993:6). Well fitting garments will provide a neat and smooth appearance as well as maximize the comfort and mobility thereof for the wearer. Ultimately, a well fitting garment will be aesthetically and functionally pleasing. Fit therefore determines the success and performance of a garment. The above description of fit may be applied to dress in general. Organisational dress as a particular form of dress has specific characteristics and also communicates non-verbal messages.

2.3.5 Organisational dress

Organisational dress comprises the garments (e.g., jacket, shirt, and pants) and artefacts (e.g., name-tag, emblem) worn by the employees of an organisation. Collectively, group members can express cohesiveness and mutual interest through clothing (Kaiser 1990:351). Uniforms are classified as organisational dress. Joseph (1986:144) states that uniformity of dress (also known as standardised dress) involves a normative pattern of dress arising among members of an occupation due to the fact that they share similar social and physical conditions. Sproles and Burns (1994:157) explain that standardised dress norms have evolved primarily due to the utility and function of the clothing.

2.3.5.1 Characteristics of uniforms

According to Kaiser (1990:374) uniforms are an integral aspect of the organisational culture as it informs priorities, demands compliance for the sake of the public's safety, and creates and maintains a hierarchy. Joseph (1986:66-68) states that uniforms have the following characteristics:

- Serve as an emblem of the organisation.
- Reveal and conceal status position.

- ➢ Certify legitimacy.
- ➢ Suppress individuality.

The characteristics of uniforms portray symbolic significance for the organisation that is represented, and also for the wearer and the viewer. Subsequently, these aspects are discussed below.

❖ Uniforms as an organisational emblem

Joseph (1986:66) underlines the importance of uniforms by explaining the characteristics thereof in relation to the organisation, the wearer and the viewer. The first characteristic of a uniform is that it acts as a group emblem. The uniform depicts the properties of the organisation in a tangible form. The uniform becomes a badge or presentation of the organisation itself (Joseph 1986:66). The uniform is not only an emblem, but also serves as a reminder to the wearer of the appropriate behaviour expected when wearing the uniform. An additional function of the uniform is to facilitate interaction and distinction between the wearer and the viewer. The viewer can immediately identify the wearer as a member of an organisation. Rafaelli and Pratt (1993:42-43) are of the opinion that observations of dress can provide information about the manner in which the organisation is formally structured, the formal division of labour in the organisation and the reporting structure (known as the chain of command in military organisations). Organisational dress can affect employees' compliance with the goals and standards of behaviour inherent to their role. The extent to which employees fulfill role requirements is therefore affected by organisational dress.

❖ Indication of status position

The second characteristic of a uniform is that it reveals and/or conceals status position (Joseph 1986:66). A uniform conceals all identities that the wearer may have with the exception of membership of that organisation. Joseph (1986:66) describes a uniform wearer as "a non-dimensional man who announces only the status he wears on his sleeve". Organisational membership is therefore the single status that is revealed by a uniform and all other statuses may become irrelevant in an organisational context.

❖ Uniforms certify legitimacy

The third characteristic of a uniform it that is certifies legitimacy. The uniform discerns the relationship between the wearer and the organisation (Joseph 1986:66). When a person wears a uniform, the organisation certifies that he or she is representative of the organisation and therefore the organisation will assume responsibility for his or her actions to a certain extent. The uniform thus acts as a symbolic declaration that an individual will adhere to group norms and standardised roles and has mastered the relevant group skills (Joseph 1986:67).

❖ Uniforms suppress individuality

The final characteristic of a uniform is that it suppresses the individuality of the wearer (Joseph 1986:66). The uniform ensures conformity to the organisation which automatically entails a degree of depersonalisation. The individual becomes a member of the organisation and his or her own values become subordinate to organisational values and goals (Kaiser 1990:377).

The characteristics of uniforms (as discussed above) make it clear that uniforms are an important form of organisational dress. Uniforms should not only perform satisfactory psychologically, but physically as well. Each item of specialized clothing or personal protective equipment should be designed to fit and serve its end use successfully within the organisation. These aspects influence the wearer's perception of the quality of the garment (Brown & Rice 2001:47).

4.2 FIT ISSUES

The mass production of 'ready-to-wear' garments has been plagued since problems with sizing systems resulted in poor fit of garments. A study conducted in the USA by Goldsberry *et al.* (1996b:121-132) investigated satisfaction of fit concerning mass produced apparel. This American study was conducted nationwide among 5 912 women aged 55 years and older to examine the factors related to the satisfaction or dissatisfaction of older women with regard to the fit of ready-to-wear clothing (Goldsberry *et al.* 1996b:121). The findings of this study indicated that approximately 70 percent of respondents were dissatisfied with the fit of "ready-to-wear" garments while the remaining 30 percent indicated satisfaction. Many factors contribute to fit problems, including wearer characteristics, fit preferences and fit perception of the wearer and also the expert. The factors that contribute to fit problems will be explored in the following section.

2.4.1 Fit

The definition of fit has varied over time and is dependent on factors such as fashion, culture, industrial norms and individual perceptions of fit (Yu 2004:31). Although definitions of good fit may change, people constantly desire and demand comfort, an attractive appearance and freedom of movement in their clothing (Farmer & Gotwals 1982:5). Various authors define fit from different viewpoints:

Fit refers to the way a garment conforms to, or differs from the body (Workman & Lentz 2000:252). Fit is the relationship between apparel and the body (Ashdown & DeLong 1995:48). Brown and Rice (2001:415) describe fit as the way a garment conforms to the three-dimensional human body form. Garments that fit well provide a neat and smooth appearance and allow maximum comfort and mobility to the wearer (Shen & Huck 1993:6). A garment that fits well, conforms to the human body and has adequate ease for movement, has no wrinkles and has been cut and manipulated in such a way that it appears to be part of the wearer (Chamber & Wiley cited in Fan *et al.* 2004:31). Garment fit is characterised by a garment that follows the shape of the body with no indication of stress or wrinkling (Morris & McCann 1997:7). Erwin, Kinchen and Peters (cited in Yu 2004:31) define fit as a combination of five factors: ease, line, grain, balance and set; these factors are known as the elements of fit.

2.4.2 Elements of fit

The five elements of fit are closely related and describe different but related aspects of fit (Brown & Rice 2001:156). Grain, set, line, balance and ease are subsequently defined and discussed. By implication, problems with the elements of fit are also related to insufficient or excess ease.

2.4.2.1 Grain

Grain is the orientation of the yarns that make up the fabric and refers to the geometry or position of warp (lengthwise) yarns relative to weft (crosswise) yarns in a fabric. Brown and Rice (2001:114) have identified five categories of grain in terms of usage, namely: lengthwise grain, crosswise grain, straight-off grain, bias and true bias and off-grain.

❖ Lengthwise grain

The lengthwise grain or warp yarns run parallel to the salvages, which are the woven edges of the fabric. According to Brown and Rice (2001:114) the warp yarns are the strongest yarns because they have to withstand the tension of the loom during the weaving process. Other characteristics of warp yarns include that they are more stable, less likely to shrink or stretch and therefore are more likely to hang straight than the crosswise yarns.

❖ Crosswise grain

The crosswise grain or weft comprises the yarns woven over and under the lengthwise yarns. Weft yarns interlace the warp yarns at a 90 ° angle to form a woven fabric. Characteristics of the crosswise grain include that it is less strong and has a slight stretch (Brown & Rice 2001:114).

❖ Straight-off grain

The straight-off grain follows the straight grain yarns of the fabric and includes both the lengthwise and crosswise grains (Brown & Rice 2001:115). According to the same authors, a straight-off grain edge creates seams with minimal stretch.

❖ Bias and true bias

The bias and true bias are considered a direction rather than a fabric grain (Brown & Rice 2001:114-115). The same authors state that the true bias is directed at an exact 45 ° angle from both the lengthwise and the crosswise grains in woven fabrics.

❖ Off-grain

According to Brown and Rice (2001:115) garments that are cut moderately off-grain will not hang straight and will affect the overall fit and comfort of the garment with a tendency to pull toward the direction of the lengthwise grain position.

Grain is regarded as a very important indicator of fit in a garment (Orzada 2001:53). Brown and Rice (2001:156) suggest that the position of fabric grain on the body is the primary characteristic to consider when evaluating garment quality and fit. The lengthwise grain or yarns of the fabric need to run parallel to the length of the body at centre front and centre back, down the centre of the arm from shoulder to elbow and down the centre front of each pant leg. The crosswise grain yarns of the fabric should run perpendicular to the length of the body at bust, hip and upper arm at bust level (Brown & Rice 2001:156). This guide is however not applicable for garments deliberately cut on the true bias (also known as cross-grain) to create special effects. On-grain garments contribute to good fit as the garment hangs evenly and appears symmetrical.

Off-grain fabrics cause multiple garment complications. Misuse of fabric grain can cause twisted pant legs, twisted torsos, twisted sleeves, uneven hems and undesirable sagging and wrinkling in fitted garments (Brown & Rice 2001:116). As grain is such an important element of fit it can be expected that off-grain garments will result in fit problems. Correct positioning of the grain lines should be evaluated in order to correct fit problems. General problems caused by off-grain include the following:

- Garments will not hang straight as the seam lines may twist or hang crooked because the fabric on each half of the garment behaves differently (Brown & Rice 2001:156).
- Off-grain fabrics cause problems during production due to reruns or repeating finishing steps, subsequently reducing the fabric or garment quality.
- Garments that are produced from off-grain fabrics do not drape properly or hang evenly and printed designs appear unbalanced.
- In addition to not being aesthetically pleasing, off-grain garments can also adversely affect garment comfort and thereby fit (Orzada 2001:53).

When the lengthwise and crosswise grains of a fabric are not parallel and perpendicular, respectively, to centre front and back of the body, alternative positions should be considered for positioning the pattern pieces. In the instance of upper body garments or 'tops' the pattern positions that must be reconsidered are the upper breasts, shoulder blades and/or breast sides.

Brown and Rice (2001:115) illustrate the correct placement of fabric grain lines on female and male bodies for a basic garment in Figure 3.

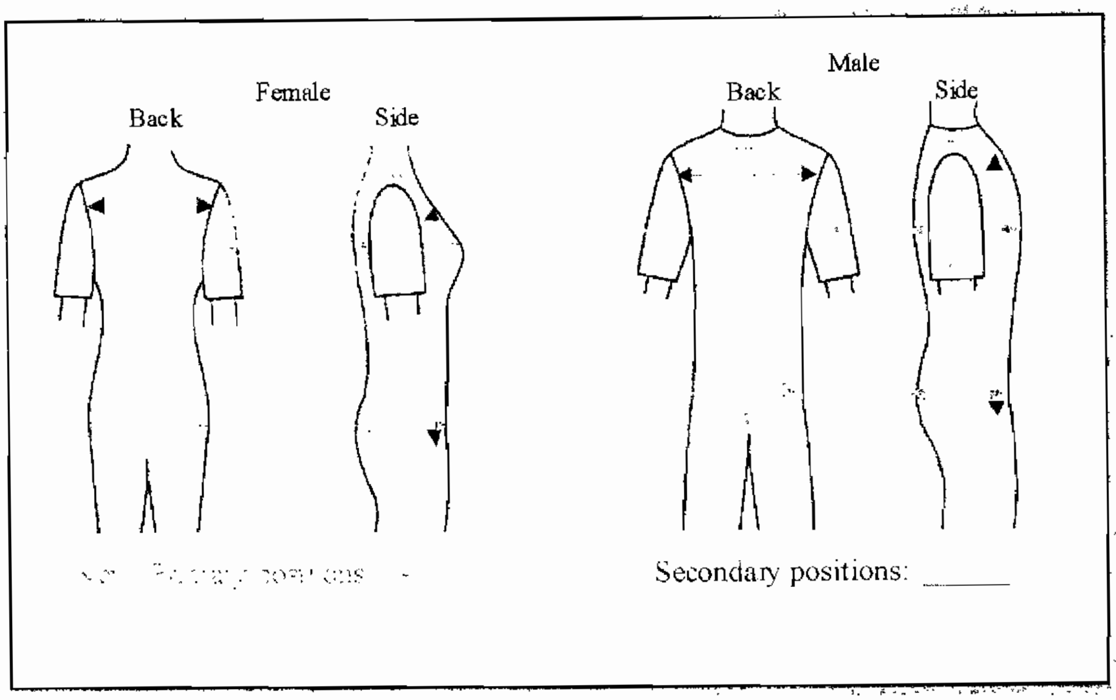


FIGURE 3: Correct positioning of fabric grain on female and male bodies (Brown & Rice 2001:115)

Figure 3 clearly indicates the placement of grain directions. The placement of the pattern's grain line should correspond precisely to (or deliberately deviate from) the fabric's grain line in order to achieve the desired fit and appearance.

2.4.2.2 Set

"Set refers to a smooth fit without undesirable wrinkles" (Brown & Rice 2001:157). Undesirable wrinkles are caused by the improper fit of a garment that is too small or too big for the wearer. The fabric pulls or sags in areas where the garment does not fit. Garment set is an indicator of good/bad set and garment wrinkling, therefore the set of a garment should be closely evaluated in order to correct fit problems.

Brown and Rice (2001:157) identify the cause of fit problems by evaluating wrinkles in a garment that has poor set. The standards for evaluating the position and indication of the wrinkles are presented below (Brown & Rice 2001:157).

- Horisontal wrinkles under tension indicate that the garment is narrower than the body just above or below the wrinkles.
- Loose vertical wrinkles indicate that the garment is too wide in that area.
- Vertical wrinkles under tension form when the garment is too short in that area.
- Loose horisontal folds indicate that the garment is longer than the body.
- Diagonal wrinkles indicate that the garment is too small or lacks sufficient shaping to adequately fit the particular body curve.

2.4.2.3 Line

"Line refers to the alignment of the structural lines of the garments with the natural lines of the body" (Brown & Rice 2001:158). The outline of the garment design is established by the garment edges, which enclose space and define the shape of the body or garment, known as the silhouette (Liechty *et al.* 1992:4). The positions of garment lines provide a good indication of the garment fit. The lines of a garment that is too large or too small will not align satisfactorily.

Brown and Rice (2001:158) recommend the following guide for evaluating line in the good fit of the garment:

- Side seams should hang straight, down the centre of the side of the body and perpendicular to the floor.
- Centre front and centre back lines should fall straight down the centre front and centre back of the body.
- Darts and seams should appear as straight lines that follow the contours of the body parts that they are intended to fit.
- Other lines (such as necklines, armholes and waistlines) should encompass the circumference of the body.

In summary, all garment lines should smoothly follow the lines of the body of the intended wearer.

2.4.2.4 Balance

"Balance occurs when a garment is in equilibrium" (Brown & Rice 2001:158). The front, back and sides of the garments should appear symmetrical at both left and right halves. Unbalanced garments can be caused by uneven construction techniques, excess fabric or strain in particular areas, garments that are cut off-grain and garment lines that do not conform to the lines of the body. Other causes of balance problems may be ascribed to poor posture or lack of symmetry in the wearer's unique figure and should be evaluated and corrected accordingly (Brown & Rice 2001:158).

2.4.2.5 Ease

Ease refers to the amount of extra space or "roominess" in a garment that allows the wearer room for ordinary movement such as walking, sitting, reaching and breathing. Additionally, ease allows extra style fullness for the sake of appearance, giving the garments its style (Brown & Rice 2001:158).

❖ Functions of ease

Ease serves three functions, namely:

- To allow for body movement.
- To allow for expansion of the body.
- To make provision for garment comfort (Beazley 1999:67).

These functions are subsequently defined and discussed.

❖ Freedom of movement

Freedom of movement can be classified as a factor intrinsic to the wearer. Movement is the key to making clothing a "portable" environment (Watkins 1984:144). Ease related to movement allows for the type of movements that the wearer must perform. The success of any type of protective garment depends on how easily an individual can move while wearing it (Watkins 1984:144). A person wearing an active work-wear garment is likely to require more movement ease than a person wearing a garment for a formal occasion which is relatively static and will not require as much ease allowance (Beazley 1999:68). The amount of limb movement, according to Beazley (1999:68), is an important factor related to the activity performed by the wearer. If the activity performed by the wearer requires extended body movement, such as forward arm movement, then the ease allowance should accordingly provide mobility and ease of movement for that specific body part. A troop's forward arm movement when marching in parade or undertaking extensive physical training may require the addition of an extra ease allowance to the sleeve and back width and length of the upper garment to allow for ease of movement. Beazley (1999:68) explains that a high armhole under the arm provides longer underarm seams to both the body of the jacket and the sleeve, which will allow for better arm reach. If the armhole is too high, it can cause discomfort to the wearer, especially when thick garments are worn underneath and if it is too low the arm movement will be restricted (Beazley 1999:68). A loose fitting garment may allow free movement but is not very practical and may even be dangerous in certain occupations (Denton 1972:14). In order to create garments that allow for ease of movement, it is necessary to consider the movements of the body.

❖ Expansion of the body

The position of the body affects the required amounts of ease allowance. Ease allowance should accommodate the body which constantly changes shape while it moves. Muscular expansion and contraction, including the increase and decrease of the chest area during breathing, requires a garment large enough to move with the body of the wearer without restricting body function and movement (Beazley 1999:68). A garment that fits too tightly around the trunk of the body interferes with the movements of deep easy breathing and may injure the wearer's health (Denton 1972:17).

Beazley (1999:68) further advises increasing the amount of ease allowance for larger sizes (by approximately 0, 5 to 1 centimeters) for every third or fourth size within the size range. This is due to the fact that when a person is seated, the hips and buttocks can expand by approximately 4 to 5 centimeters (Beazley 1999:68). The larger the wearer, the more expansion can be expected to take place and therefore the larger sized garments may require more ease allowance than their smaller sized counterparts.

❖ Comfort

Comfort is closely related to the wearer and to the function of the garment (Beazley 1999:68). Heat retention via isolation is an aspect of comfort and it is essential to maintain thermal comfort in order to achieve reductions in energy use (Sontag 1985:10). Ease allows heat retention because the 'air-space' between the layers of fabric within garments traps air and therefore provides warmth when the garment is fastened closely at its openings (Beazley 1999:68). The wearer can feel cooler in tightly fitted garments than in loosely fitting garments. Adequate air space, however, is also required to keep cool as it distances the garment from the body and allows ventilation to take place.

Fashion, style and fabric in relation to ease can be classified as factors extrinsic to the wearer. The style of a garment influences the garment's performance features. These features stipulate the garment's design in terms of protection and/or decoration (Beazley 1999:68). Design ease for the purpose of creating, e.g. darts or flares, can be incorporated into the movement ease when calculating the sum of the required ease allowances. As with style, fashion influences garment comfort as it stipulates the amount of fullness added to the garment. Historic costume shows many examples where fashion prescribed corsetry and tight encasings of the body as well as exaggerated fullness that impeded the body movement (Beazley 1999:68).

The dimensional stability of a fabric is another extrinsic factor to be considered when determining the amount of ease (Beazley 1998:69). Greater ease allowances are required for more stable fabrics as they do not stretch and move with the body. In contrast, a reduction of ease allowance is required for fabrics with high amounts of stretch, which will automatically make provision for body movement. It is therefore necessary to consider the characteristics of each fabric type when calculating and adding required ease allowances to body measurements.

The final aspect of a garment's ease allowance is the manufacturing tolerance (also known as production ease). This tolerance is rarely quoted due to the fact that these tolerances are only calculated when the garments are being prepared for mass production. According to Beazley (1999:72) the manufacturing tolerance is an approximate measurement that can be added to the final garment. This is necessary because it can be difficult for manufacturers to produce garments according to exact measurements due to dimensionally unstable fabrics and complicated construction techniques. Production tolerances make allowance for deviation from the strictly specified measurements, while retaining acceptable sized garments.

An additional extrinsic function of ease is that it allows for a wider variety of body types to be accommodated within the minimum number of sizes. Manufacturers of mass-produced apparel cannot afford to produce 'measurement-specific' or 'custom made to fit' garments to fit individual body types. In direct contrast, the reality is that a limited number of sizes should supply an optimum number of wearers with satisfactorily fitting garments. This underlines the importance of adequate amounts of ease providing a few centimeters smaller or larger at key dimensions within a size category, thereby accommodating a larger variability of body types within a size.

Beazley (1999:70) illustrates the positions for adding ease allowances to the body measurements of women when creating a fitted bodice, a semi-fitted sleeve and a straight skirt. The figure as illustrated by Beazley (1999:70) is presented below.

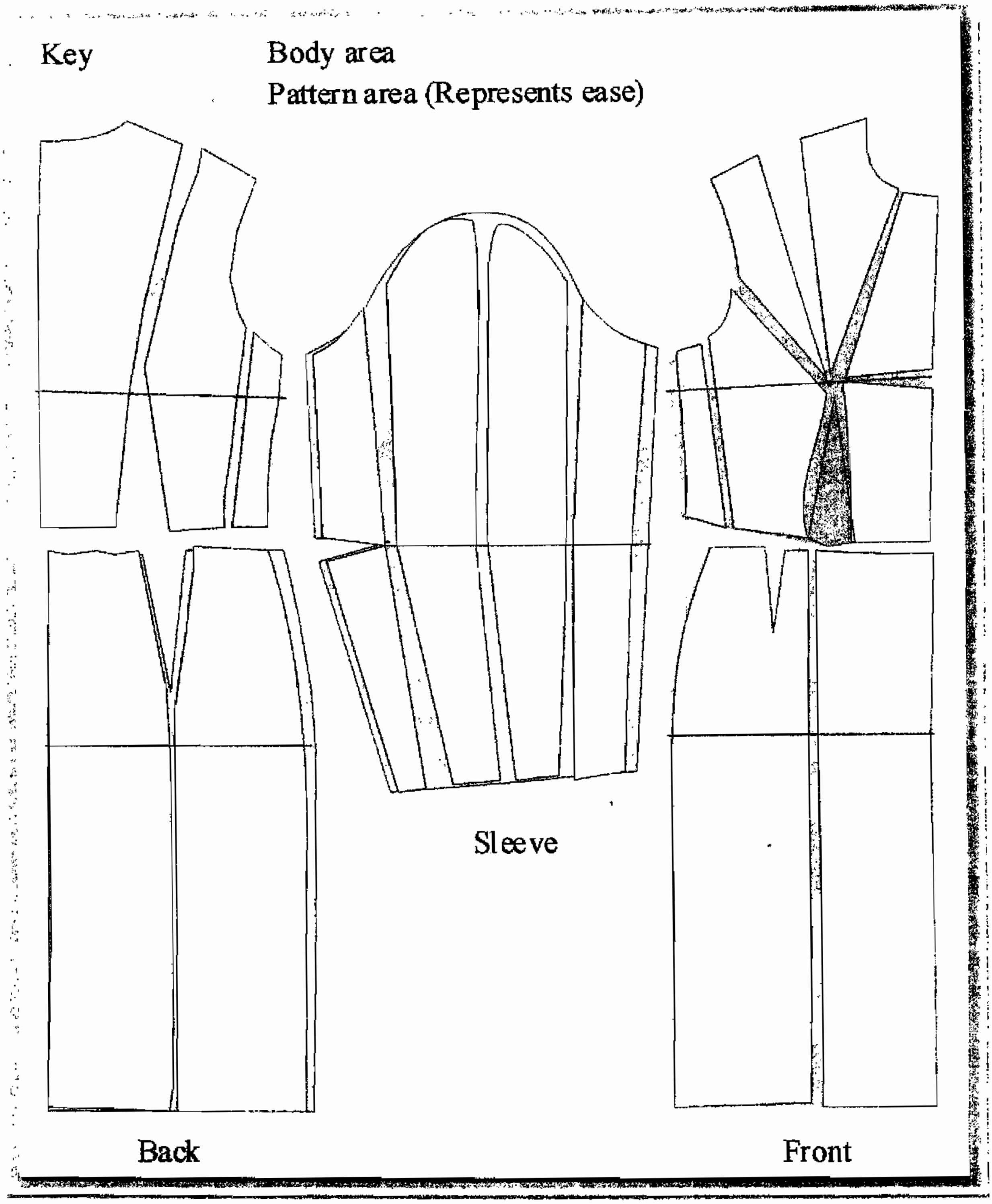


FIGURE 4: Placement of ease (Beazley 1999:70)

Sufficient ease allowance contributes to good fit as the garment can resume its natural position after following body movements, without requiring adjustment (Liechty *et al.*1992:57). Lack of sufficient ease causes poor fit as the garment loses its flow of style lines, appears tight and wrinkled and becomes figure revealing instead of figure flattering (Liechty *et al.* 1992:57).

The elements of fit, namely grain, set, line, balance and ease comprise the fundamental requirements for achieving good fit. By evaluating the elements, deviations in garment fit can be visually observed and thereby corrected.

2.4.3 Evaluating fit

Various authors have compiled standards to guide the evaluation of fit. Rasband (1994:34-35) describes guidelines or standards to evaluate and judge the fit of clothes as well as to set a standard for comparison between actual and ideal fit. These guidelines are presented below:

- Necklines should fit at the base of the neck without cutting into the neck.
- Collars and necklines should fit comfortably around the neck.
- Lapels should lie flat without gaping open.
- Shoulder seams should lie on top of the shoulder and shoulder pads should appear natural.
- Armhole seams should cross the shoulder at the shoulder joint, and may extend 2,5 centimeters beyond the shoulder joint in the case of a jacket.
- Armholes should be large enough to allow for easy movement.
- Upper back areas should lie smoothly without straining at the armhole seam.
- Darts should point toward, and end about 2,5 – 3,7 centimeters from the part of the body curve being fitted.
- The centre front and centre back seam should be centered on the body and fall straight down, perpendicular to the floor.
- Closures should hang smooth and straight without gaping.
- Side seams should hang straight down from the centre of the under arm.
- Sleeves should lie smooth around the arm with about 3,75 centimeters ease.
- Set in sleeve caps should curve smoothly around the armhole and the fullness should be evenly distributed.
- Long sleeves should end on the wrist bone when the arm is bent at the elbow.

- Waistbands should fit comfortably in the natural waistline.
- Jackets should fit loose enough in order to ease comfortably over a shirt or blouse.

When evaluating the standards of fit, it is not only the garment structure that needs to be examined, but also the individual characteristics of the wearer of that garment.

2.4.4 Wearer characteristics

The wearer's body form directly influences the fit of the garment on the body as well as the ease/tolerance necessary at a specific body location. Poor fit may be ascribed to the individual characteristics of the wearer. Wearer characteristics such as body type, posture, age and gender will subsequently be defined and discussed.

2.4.4.1 Body type

Body type refers to size, shape and weight distribution of the various body parts (Rudd & Lennon 1994:163). According to Roach and Eicher (1973:108) body form refers to the independent structure, shape and lines that define the total shape and constituent shapes of the body. Body forms can be divided into parts, proportions and proportional areas.

Proportion is generally defined as the relationship of all parts to one another and of the parts to the whole (Rasband 1994:9). Rasband (1994:9) states that proportional areas of the body are identified by means of break points. The same author defines break points as those points where the body silhouette changes in direction and creates either an inward angle at the narrowest point, or an outward angle at the widest point.

Based on distinct body proportions, Rasband (1994:12-13) differentiates between eight prominent body types, namely: the ideal, the triangular, the inverted triangular, the rectangular, the hourglass, the diamond shaped, the tubular and the rounded figure type. The body types will subsequently be illustrated and discussed.

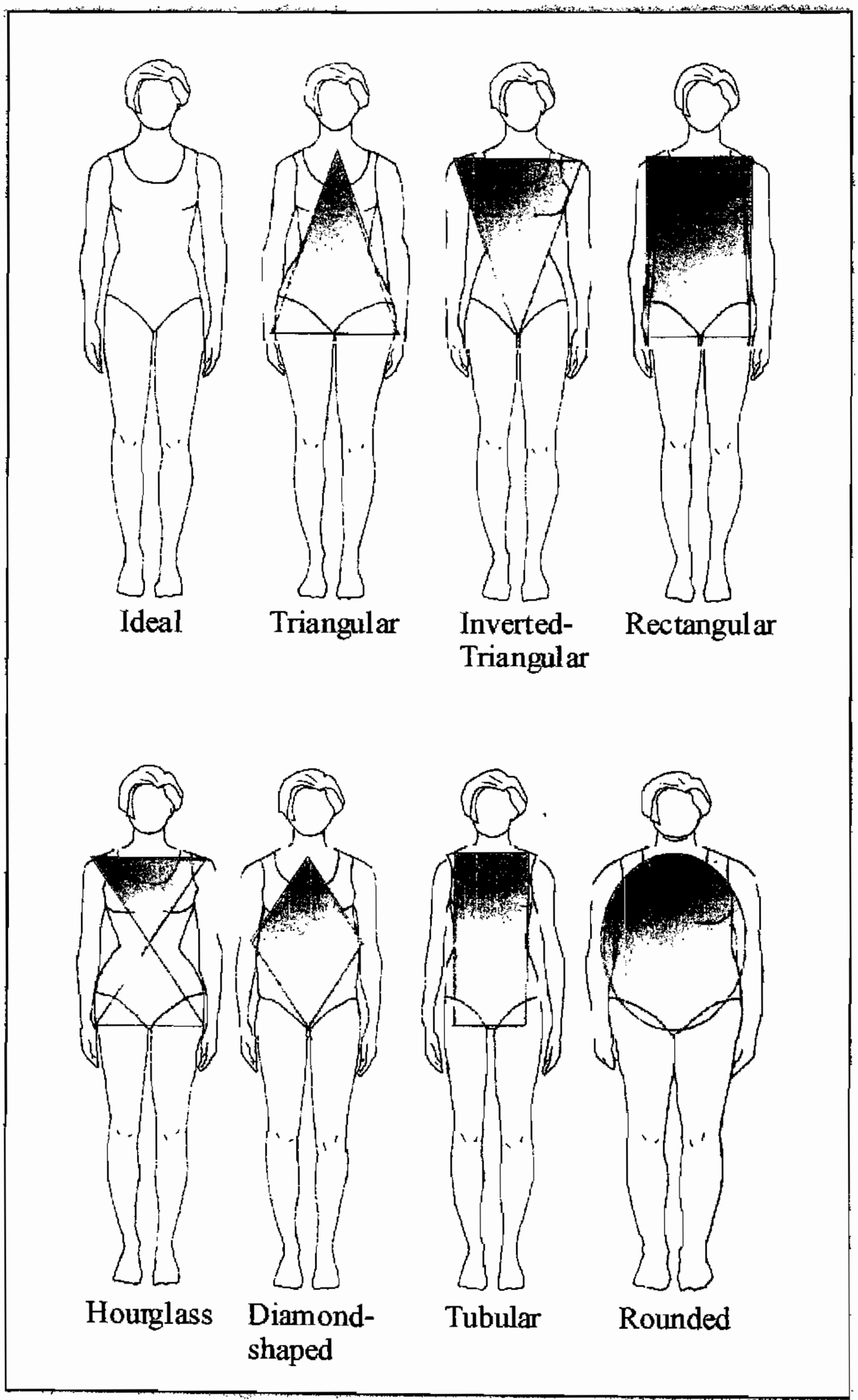


FIGURE 5: The eight prominent body types (Rasband 1994:14-15)

❖ Ideal figure type

The ideal figure is similar in width at the shoulders and hips, with medium bust, small waist, flat to slightly curved abdomen, moderately curved buttocks and slim thighs (Rasband 1994:12). All other figure types are compared to the ideal figure due to the fact that most manufacturers base their pattern design and grading on ideal figure proportions. For that reason, comparative evaluation can present the expected fit problems of various body types.

❖ Triangular figure type

This figure type appears smaller or narrower above the waist, and larger or wider below the waist (Rasband 1994:12). Weight is generally concentrated at the buttocks, hips and thighs. The figure appears unbalanced, top to bottom (Rasband 1994:12). A triangular body shape will have a drop value larger than the ideal figure. It can be expected that when the garment fits the triangular figure's bust, it will be too small over the hips, and when it fits comfortably over the hips, it will be too big in the bust area.

❖ Inverted triangular figure type

This figure type appears larger and wider above the waist and smaller or narrower below the waist (Rasband 1994:12). Weight is concentrated at the upper torso consisting of the shoulders, upper back and bust area. The shoulders are comparatively wider than the hips and therefore the figure appears unbalanced (Rasband 1994:12). It is expected that when the garment fits the inverted triangular figure's bust and shoulders, it will be too big over the waist and hip area.

❖ Rectangular figure type

This figure type appears to be nearly the same width at shoulders, waist and hips, basically straight up and down (Rasband 1994:12). The figure is relatively balanced at the top and bottom but the waist is not noticeably indented at the sides and appears wide in proportion to the hips (Rasband 1994:12). Form fitted garments are shaped at the waistline and therefore it can be expected that this figure will not have sufficient movement ease around the midriff.

❖ Hourglass figure type

According to Rasband (1994:13) this figure type appears equally wide and fully rounded in the bust and hip area, but appears proportionally very small in the waist. Hips and buttocks are rounded and the upper hips taper to a small, well-indented waist (Rasband 1994:13). Although the hourglass figure is proportional at the top and bottom, it is not considered ideal as the very small waist causes the bust and buttocks to appear proportionally larger than they actually are (Rasband 1994:13). Due to the very small waist circumferences it can be expected that the garments will be too large around the waist when fitting well at the shoulders and hips.

❖ Diamond shaped figure type

This figure is typified by comparatively narrow shoulders and hips in combination with a wide midriff and waist (Rasband 1994:13). Instead of tapering inward to the waist, the midriff and hips appear to expand outward to the waist. Mid-body circumference measurements are larger than bust or hip circumferences (Rasband 1994:13). Garments that fit the waist comfortably will be too large at the shoulders and hips. If good fit is desired at shoulders and hips, the garments will not allow comfort of movement at the midriff area.

❖ Tubular figure type

According to Rasband (1994:13) this figure is similar to the rectangular figure. However, the tubular figure type is thinner because weight is considerably below the average range. The same author explains that this figure appears proportional (straight up and down), with a small bust, waist and buttocks. With weight gain within the average range, this figure will appear similar to one of the figures mentioned above (Rasband 1994:13). Due to this figure being skinnier than the ideal figure type, the garment is expected to be too large at all the proportions of the body.

❖ Rounded figure type

A truly rounded figure is named thus because body areas are fully-rounded all over (Rasband 1994:13). With weight reduction to the average range, this figure will appear more similar to one of the figures mentioned above (Rasband 1994:13).

Due to the fact that this figure is stouter than the ideal figure type, it is expected that the garment will be too small in all body proportions. As weight is above average, the upper back, arms, bust, midriff, waist, abdomen, buttocks, hips and upper legs are large and rounded. This figure type is commonly referred to as the 'plus sized' figure. Within the 'plus sized' figure, the body proportions of women can be divided into four major body types. These body types will subsequently be illustrated and discussed.

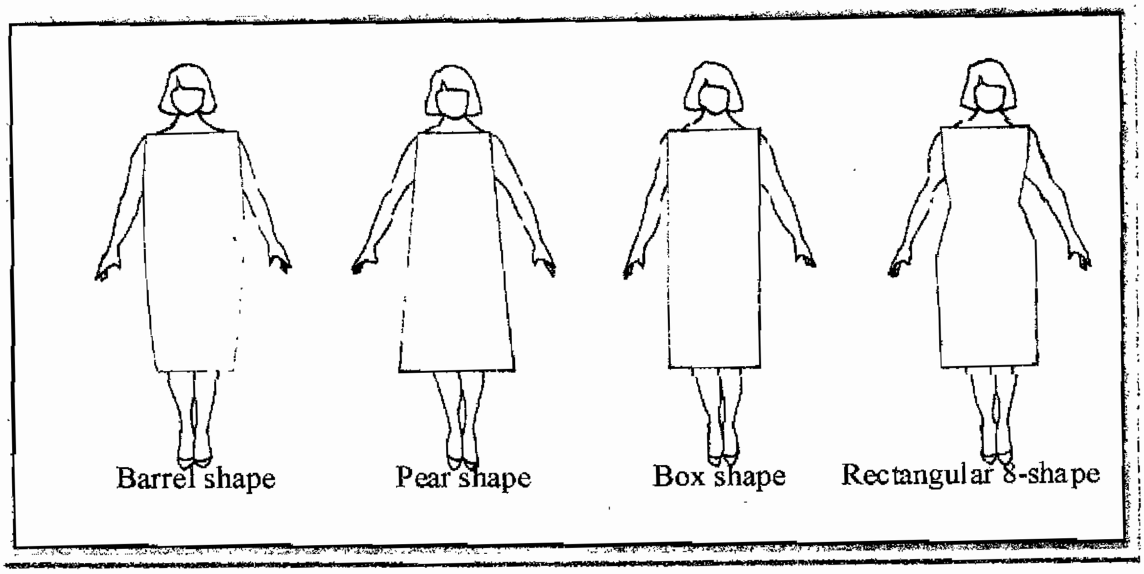


FIGURE 6: Body types within the "plus sized" figure (Zangrillo 1990:4)

❖ The barrel shape

In the instance of the barrel shape, the upper torso appears to be short but broader than the lower torso, which translates into a short-waisted and wide-shouldered figure (Zangrillo 1990:5). The same author states that the term 'barrel-chested' is derived from the profile of this body type, which is profoundly top-heavy. It is expected that fitted garments will fit this body type poorly as the waist is thicker than the hips.

❖ The pear shape

The pear-shaped body type is characterised by a narrow shouldered torso that continues to the waist area where it extends out over round hips or large bulging thighs (Zangrillo 1990:5). Some women with this body type have a thin chest and waist with hips or thighs that curve out abruptly below the small waist. It is very challenging to fit this figure into a hip or low hip-length jacket, because the body proportions of the upper and lower torso differ immensely.

❖ The box shape

This figure is characterised by a thick, short, wide torso, wide hips and long legs with no visible waistline indentation (Zangrillo 1990:5). The same author states that this body type appears to indicate little difference between shoulder, waist and hip measurements. As there are no remarkable body curves, it is expected that any shaped or partially fitted garment would fit this body type poorly.

❖ The rectangular 8-shape

According to Zangrillo (1990:5) this body type is considered to be the most proportional as the well-formed shoulders and curves are in harmonious scale with the rest of the body. A rectangular 8-shape is characterised by shapely shoulders, a full bust, a slightly pinched waistline and proportionally round hips. This body proportion is the most ideal of all the 'plus sized' figure types as the length of the legs are equal to the length of the torso and the arms are rounded but well proportioned (Zangrillo 1990:5).

Recognising overall body contours provides an understanding of how various body types will relate to the ideal figures used in pattern and clothing design and manufacture (Rasband 1994:1). It is important to understand the variations between various figure types as specific figures are more easily fitted and flattered by certain clothing styles. A study conducted by Li *et al.* (2002:1) investigated the fit problems of various figure types and the findings indicated the following:

- Bust tightness was reported by most hourglass figure shapes.
- Hip and thigh tightness were reported by most triangular figure types.
- Waist and abdomen tightness were reported by most rectangular figure types.

The research conducted by Li *et al.* (2002:1) suggests a need for further investigation surrounding issues of fit and the effect of body types.

Goldsberry *et al.* (1996b:131) state that design educators and future apparel designers should focus more on the differences in body types and how patterns can be manipulated to fit various body types. Price and Zamkoff (1990:11) state that each figure type requires a specially developed pattern to accommodate its proportions. When observing various body types it can be expected that standard garments will not provide adequate comfort and ease of movement to suit all the wearers' needs. In addition, these garments cannot provide an aesthetically pleasing fit on the body of the wearer.

2.4.4.2 Posture

Posture refers to the alignment of the body parts and to the manner in which the body frame is carried (Liechty *et al.* 1992:37). According to Rasband (1994:13) posture is possibly the most common figure variation. Perry, cited in Fan *et al.* (2004:197), states that incorrect posture can cause fitting problems. Fitting problems can often be eliminated or greatly improved by improving poor posture. Prior to evaluation of the fit of the garment, the posture of the wearer should be considered. Liechty *et al.* (1992:37-38) differentiate between seven posture variations. These variations are illustrated and described in the section that follows:

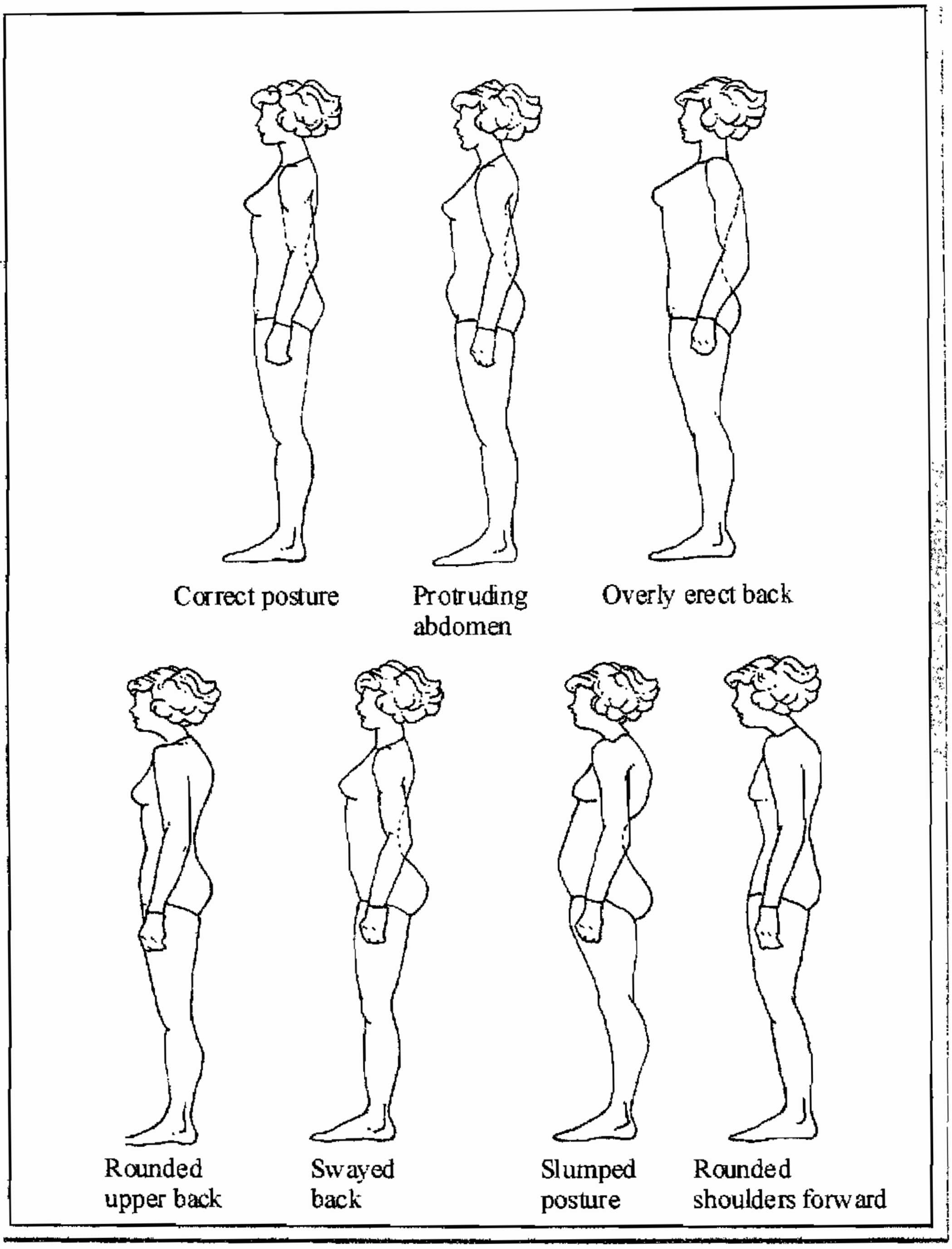


FIGURE 7: The seven prominent posture types (Liechty *et al.* 1992:38)

- Correct posture: When viewed from the side the neck, shoulder joint and elbow are aligned with the back of the wrist joint over the hip joint and knee.
- Protruding abdomen: This posture type is similar to the correct posture except for a forward sway of the lower abdomen.

- Overly erect posture: This posture type is recognised by an exaggerated lift of the chest that in turn creates an arch in the upper back.
- Rounded back posture: This posture type is recognised by an overly curved upper back, a forward curve in the shoulders, a hollow chest and a forward tilted head.
- A sway back: This posture type is recognised by a forward tilt in the pelvis, which results in a prominent abdomen and protruding buttocks.
- A slumped posture: This posture type results in a rounded upper back and shoulders, hollow chest and forward head, in combination with a swayed back and prominent abdomen.
- Rounded shoulders: This posture type, consisting of forward head and backward pelvic tilt is a less common posture variation. It is characterised by rounded back posture in combination with an awkward tilt of the pelvis that pulls the waist area back and thrusts the hip joint and thigh forward. The buttocks are tucked under and the knees may appear in slightly bent position. The individual appears to lead with the hips when walking (Liechty *et al.* 1992:37-39).

Liechty *et al.* (1992:39) state that prolonged bad posture will cause stress and strain on muscles, bones and joints that contribute to fatigue and can cause health problems in later years.

2.4.4.3 Age

Age is an important wearer characteristic to consider when evaluating fit issues. A number of researchers have found that as the body ages, certain predictable physical changes take place (Fan *et al.* 2004:197). A general change includes that the body contour becomes more angular as the body fat moves downward (Farmer & Gotwals 1982:11). Changes in position of body fat subsequently cause posture changes. Shoulders that begin to round can develop a swayback posture. Slouching of the posture and the reduction of cartilage in the spinal column can result in the wearer's total height being reduced as much as 12,5 centimeters with age (Goodrick & Meadors cited in Farmer & Gotwals 1982:11).

According to Farmer and Gotwals (1982:11) the clothing of men and women during the middle and later years of adolesence may require alterations that include:

- Increased fullness in the back armscye, as well as more length in the back bodice.
- As the buttocks flatten, pants are required to be shaped differently if they are to fit correctly.
- Both men and women may need clothing that is longer at the back length area and wider in the back width area.

2.4.4.4 Gender

Gender is a wearer characteristic that is of obvious importance. Gender brings about sex-related differences in physique, body composition, fat deposition and figure types and proportions. These factors greatly affect the fit of garments on the bodies of the wearers. An observation of the processes that occur during the development stages of human beings highlights the differences between men and women.

Beachle and Earle (2000:178-179) describe the body development of males versus females as follows:

- Before puberty there is essentially no difference in height, weight and body size of boys and girls.
- As puberty begins and progresses, differences in these measurements become more evident, primarily due to hormonal changes.
- During puberty, the production of estrogen in girls increases fat deposition and breast development, whereas the testosterone production in boys increases bone formation and protein synthesis.

As adults mature, the body frame and fat deposition of men differ from those of women. Men tend to enlarge at the abdomen and women generally deposit weight in the lower torso, including the hips, buttocks and thighs. The afore-mentioned gender-related physical differences evidently show that the body measurements between men and women differ.

Just as the individual characteristics differ from one person to the next, individual fit preferences are subjective and vary from person to person (Alexander *et al.* 2005:53). Fit preferences should therefore be evaluated when examining fit issues.

2.4.5 Fit preference

Research conducted regarding clothing behaviours has shown that consumers differ in terms of attitudes, values and expectations of clothing (Alexander *et al.* 2005:52). Individual preferences for clothing fit can vary from garments that cling tightly to the body, to garments that barely touch the body. Individuals have apparel fit preferences based upon aesthetic and functional expectations, which have consequences for the volume and proportions that consumers desire in their apparel (Ashdown & DeLong 1995:47).

The snugness or tolerance that the wearer desires from clothing can depend on various aspects. An investigation by Anderson *et al.* (2000:1) regarding the fit preferences of female consumers indicated that it is necessary to understand the consumer's perspectives of physical comfort, psychological comfort and appearance in order to evaluate the wearer's perceived satisfaction with fit. The aspects that contribute to fit preference, namely physical comfort, psychological comfort and appearance are explored in the following paragraphs.

❖ Physical comfort

Horn and Gurel (1981:34) state that physical comfort in clothing is affected by factors that originate inside as well as outside the body. Physical comfort with respect to clothing is a state of mental well-being and expression of satisfaction with the physical attributes of a garment such as air, moisture and heat transfer properties, and mechanical properties including elasticity and flexibility, bulk, texture, weight and construction (Sontag 1985:10).

The above-mentioned physical attributes of a garment are directly affected by garment fit. Garments that are too big or too small exaggerate the negative effects of the afore-mentioned physical and mechanical attributes.

❖ Psychological comfort

Sontag (1985:10) states that psychological comfort with respect to clothing is a state of mental well-being that is expressed through the satisfaction with desired effects such as femininity or sophistication. Psychological comfort can also arise from a sense of being dressed in a manner that is congruent with the self-image of the wearer (Sontag 1985:10). How well the garment fits the body, has an impact on the psychological comfort of the wearer. A poor fitting garment (either too big or too small) can cause the wearer to feel embarrassed. A garment that is too small will accentuate body bulges and figure flaws, leaving the wearer self-conscious. An oversized garment can cause the wearer to look clumsy.

❖ Appearance

Satisfaction or dissatisfaction with the wearer's personal appearance affects his/her social comfort. Social comfort with regard to clothing may be considered to be a mental state of social well-being. Appearance is influenced by the following aspects:

- The appropriateness of the wearer's clothing for a particular occasion.
- The wearer's satisfaction with the impression made on others.
- The degree of desired conformation to the appearance of the wearer's peers (Sontag 1985:10).

Ill-fitting garments may contribute negatively to the image that the wearer intends to project to others. With regard to the adolesent, an ill-fitting appearance is sometimes manipulated to be fashionably in line with the clothing behaviour of peers (Tselepis & de Klerk 2004:84).

2.4.6 Fit perception

Horn and Gurel (1981:177) define perception as the awareness of objects and people through the stimuli received from the senses. The same authors caution that the accuracy of judgments made on the basis of clothing symbols depends on:

- The information presented.
- The way the perceiver receives and interprets the information.
- The perceiver's characteristics.
- The interaction situation (Horn & Gurel 1981:177).

McConville, cited in Ashdown and DeLong (1995:48), states that apparel researchers have developed methods for judging apparel fit based on wearer responses to the look and feel of the garment and on the responses of expert judges to a visual analysis of the garment on the wearer. In another study, Kohn and Ashdown (1998:17) also found that the measures used to assess the quality of fit are the perceptions of the subjects familiar with the performance standards for the apparel item and the subjective observations of expert fit analysts.

In the section that follows, fit perception is discussed in terms of the perspective of the wearer and also the expert.

2.4.6.1 Wearer perceptions of fit

When wearers judge the fit of a garment from a subjective point of view, the verdict is based on both visual and tactile information (Ashdown & DeLong 1995:48). According to Ashdown and DeLong (1995:48), a personal judgment of the way the garment looks on the body is based on visual feedback. In general, the wearer is academically uninformed about what constitutes good fit and may base perceptions on aesthetic appeal only.

Yu (2004:32) state that it is complex to understand fit from a wearer's perspective. Assessments of fit are subjective and can vary from one wearer to the next as well as over a period of time. In a study regarding the expectations of early adolesent girls regarding the fit of their clothes, Tselepis and de Klerk (2004:85) reported that a wearer's understanding includes technical knowledge of the fit of clothing products and previous experience. The existing technical knowledge and previous experiences of people differ and therefore it can be inferred that the wearers' perceptions differ (Tselepis & de Klerk 2004:85).

Differences in subject perceptions may also be ascribed to actual changes in the body that occur over time, or to changes in the manner the wearer perceives the fit of a garment (Ashdown & DeLong 1995:48). Ashdown and DeLong (1995:47) investigated the fit thresholds that are perceived by individual subjects. In their study, each subject received a set of 15 pants, one of which was custom made to fit to represent the correct fit, while the other 14 pants varied from the control by 0,5 – 1,5 centimeters at a single location including the waist, hips and crotch area (Ashdown & DeLong, cited in LePechoux 2000:27). The findings of the study demonstrate the following:

- Fit threshold levels can be established at different areas of the body.
- Perceptible fit variations can be relatively small.
- The tolerances that individuals have for fit variations differ for various locations of the body.

The findings of the study by Ashdown and DeLong (1995:47) indicate that further research and testing is required in order to statistically test and verify fitting preferences, different thresholds and the amount of individual variation among subjects.

2.4.6.2 Expert perceptions of fit

The fit expert may be considered to be an individual who is academically informed, from an objective viewpoint, with regard to the field of clothing fit. As a result of the expert's theoretical background, he/she can holistically perceive and evaluate the fit of a garment. Experts make judgments based on visual observations such as seam placement and the location and orientation of wrinkles (Ashdown & DeLong 1995:48). Theoretical guidelines, such as the elements of fit, garment construction and pattern development are taken into consideration.

The expert's perception of fit and evaluation of actual fit is influenced by the way that a garment fits and wears. Fit experts therefore commonly use wear tests as criteria to evaluate fit.

Wear tests are a means to evaluate the practicality of a garment's fabric and design and require that the garment is worn by a subject while completing an exercise routine/mobility test. A mobility test comprises a range of body motions representing the circumstances where the garment under investigation is worn and stretched (Yu 2004:34). The expert perceiver can then observe and evaluate the garment's responses regarding normal handling, ease of movement, reasonable stretch and tendency to slide down and wrinkle.

In conclusion, the goal of subject and expert assessment methods is to collect information regarding the relationship of a specific garment to the body configuration of an individual subject (Kohn & Ashdown 1998:17).

In summary, the purpose of this literature review was to gain insight in the complexity of fit and specifically the relation of ease/tolerance to fit. The development of an understanding of sizing systems as a primary source of fit problems was therefore an essential point of departure for the literature review. Thereafter, it was important to consider the design features of the particular garment. Lastly, fit issues including movement ease were addressed. Wearer characteristics related to fit and fit perception were addressed in the concluding section of this background study.

This literature review has provided a contextual background for the development of an empirical research strategy and can serve as a guide for the interpretation of the findings of this study. The research design is described in the following chapter.

CHAPTER 3
RESEARCH DESIGN

3.1 INTRODUCTION

Studies that address "real-life" problems are classified as empirical studies by Babbie and Mouton (2001:75). This exploratory and descriptive study in the field of sizing and fit can therefore be classified as an empirical study. The nature of the research problem requires a qualitative research design. The qualitative paradigm stems from an antipositivistic, interpretive approach that is idiographic and thus holistic in nature and aims mainly to understand a phenomenon (Fouche & Delport 2002:79). A multi-method approach was selected as no single method could adequately realise the goals and objectives of this study. The use of multiple methods is termed triangulation. Triangulation, according to Denzin, cited in de Vos (2002:365), aims to increase the reliability of observation. The methods used are the following: focus group interviews, fit sessions, judging sessions, body measuring sessions, somatographs, garment measuring sessions and biographic profiling questionnaire.

3.2 POPULATION AND SAMPLE

The target population was the 15 724 female troops of the SANDF. The sample was selected from the 4 percent operational female troops.

Data gathering occurred at the Uniform Maintenance Center in Valhalla during November 2006 and February 2007. Due to logistic reasons, the sample consisted of 49 members of the logistic group based in the near vicinity of the Uniform Maintenance Centre in Valhalla where data was gathered. The African Warrior Project officer allocated the subjects to the three focus group sessions on different days, namely 19 subjects for day one, seven subjects for day two and 23 subjects for day three. The target sample of 60 persons for the first phase of the study was not reached. The sample should have consisted of 20 subjects for each of the three days.

A non-probability sampling technique was employed to purposively select eight subjects from each focus group session for the second phase of the study. The second phase sample was selected according to the following parameters: age, ethnicity, weight, height and body shape. It was assumed that these parameters all influence the comfort and fit of the dress jacket and combat shirt. In accordance with the African Warrior Project, the target age ranged between 18 and 35 years. Within the second phase sample, 12 of the subjects were in this age category.

Due to the fact that the focus group sample for day two was so small, the entire sample (except one) participated in the second phase of the study, consisting of one-to-one interviews in addition to other data collection methods. One subject was unable to participate further.

In one instance it was obvious that the data gathered was not sufficient. Theoretical sampling was applied to supplement and refine ideas without enlarging the original sample. The data collection process was completed when no new information was gathered any more. The non-probability empirical technique described above is in line with the guidelines for qualitative research provided by Strydom (2002:335).

3.2.1 Description of the first phase sample

The first phase sample consisted of 49 subjects and is described in terms of age, ethnicity and body shape in Table 5. The information from the biographic profile questionnaire was used to describe the sample (see Annexure A for the biographic profile questionnaire). The subjects classified their own body shape according to a key in the biographic profiling questionnaire.

TABLE 5: DESCRIPTION OF THE FIRST PHASE SAMPLE IN TERMS OF AGE, ETHNICITY AND BODY SHAPE

Focus Group	**n**	**Age Group**	**Ethnicity**			**Body shape**						
			Black	White	Coloured	Triangular	Inverted Triangular	Square	Hourglass	Diamond	Oval	Other
1	1	18-21	1			1						
2	0		0	0	0	-	-	-	-	-	-	-
3	2		2			1		1				
1	5	22-25	2	1	2	2		2				1
2	0		0	0	0	-	-	-	-	-	-	-
3	1		1			1						
1	2	26-29			2							2
2	1		1					1				
3	0		0	0	0	-	-	-	-	-	-	-
1	6	30-33	3	3					3	2	1	
2	0		0	0	0	-	-	-	-	-	-	-
3	5		4	1		1			3		1	
1	5	34-37	4		1	1	1			3		
2	2		2						1		1	
3	8		6	2		1	2	1	1	1	2	
1	0	38-41	0	0	0	-	-	-	-	-	-	-
2	1		1								1	
3	3		3					2		1		
1	0	42-45	0	0	0	-	-	-	-	-	-	-
2	1		1						1			
3	1		1					1				
1	0	46-49	0	0	0	-	-	-	-	-	-	-
2	0		0	0	0	-	-	-	-	-	-	-
3	1		1								1	
1	0	50-54	0	0	0	-	-	-	-	-	-	-
2	2		2							1	1	
3	2		1	1				1		1		
Total	49	-	36	8	5	8	3	9	9	9	8	3

Table 5 shows that the majority (73,5 percent) of the focus group subjects were black amounting to 36 subjects. Thirty of the subjects (61,2 percent) were in the age groups 30-41 years. Three subjects were of the opinion that none of the body shape pictograms resembled their own body shapes.

3.2.2 Description of the second phase sample

There were three second phase samples that consisted of a total of 23 subjects who further participated in this study. The second phase participants are described in terms of age, ethnicity, weight, height, body mass index and body shape in Table 6 overleaf. Subjective and objective classifications of body shapes are included in this table. The objective classifications reflect information from the analysis of the somatographs i.e. photographs taken in a standard manner (see Annexure B for examples of the somatographs). The subjective descriptions of body shapes are the personal evaluations of the subjects.

The subjects' body mass index (BMI) values were calculated to further describe the subjects' body forms. The body mass index formula was originally developed by Adolphe Quelet and is a measure of body fat based on height and weight that applies to both adult men and women (http://nhlbisupport.com) and is internationally used as a measure of obesity (http://www.whathealth.com). The formula used to calculate the body mass index is as follows:

$$\text{BMI} = \frac{\text{weight in kilograms}}{\text{height in meters}^2} \ (\text{kg/m}^2)$$

(http://www.whathealth.com).

BMI values that have been calculated can be categorised into the three BMI categories described by the Department of Health and Human Services – National Institute of Health. The key to the BMI values are as follows:

- Normal weight: 18,5 – 24,9
- Overweight: 25 – 29,9
- Obesity: BMI of 30 or greater

The above categories were used to classify the subjects' body mass index values.

TABLE 6: DESCRIPTION OF THE SECOND PHASE SAMPLE IN TERMS OF AGE, ETHNICITY, WEIGHT, HEIGHT, BMI AND BODY SHAPES

Sample	n	Subj. no.	Age (Years)	Ethnicity	Weight (Kg)	Height (m)	BMI	Body shape comparison	
								Body shape (Subjective classification)	Body shape (Objective classification)
1	7	1	36	Black	45	1,510	19,3	Inverted triangle	Inverted Triangular
		3	35	Black	95,5	1,544	40,3	Diamond	Oval
		8	25	Coloured	85	1,714	29,1	Square	Square
		12	27	Coloured	57	1,585	22,8	Other	Triangular
		13	31	Black	58	1,548	24,5	Hourglass	Hourglass
		18	34	Coloured	74	1,646	27,5	Diamond	Triangular
		19	23	White	70	1,766	22,6	Square	Rectangular
2	6	21	37	Black	128	1,645	47,0	Oval	Oval
		22	26	Black	69	1,520	29,9	Square	Triangular
		24	50	Black	94	1,555	39,1	Diamond	Triangular
		25	34	Black	81	1,655	29,8	Hourglass	Hourglass
		26	43	Black	76	1,585	30,4	Hourglass	Square
		27	41	Black	112	1,642	41,6	Oval	Oval
3	10	32	50	Black	90	1,611	34,7	Diamond	Diamond
		33	36	Black	66,5	1,595	26,3	Oval	Triangular
		34	32	Black	104	1,589	41,7	Oval	Oval
		41	53	White	74	1,600	28,9	Square	Square
		42	37	White	93	1,602	36,3	Oval	Diamond
		43	19	Black	73	1,523	34,6	Triangle	Triangle
		49	24	Black	77	1,618	29,7	Triangle	Triangle
		50	38	Black	86	1,610	33,2	Square	Square
		51	35	White	80	1,639	30,1	Square	Square
		52	32	White	60	1,690	21,0	Inverted Triangle	Hourglass
$\bar{x}$			35	-	80,3	1,600	31,3	-	-

Table 6 indicates that the average age of the subjects in the second phase sample was 35 years. The average weight of 80,3 kg and height of 1,600 m reflect that the majority of the subjects could be classified as plus-sized. The findings show that 11 out of 23 subjects had a BMI of 30 + and can be classified as obese. Seven subjects were overweight with a BMI range of 25-29,9 and only five subjects were within the normal weight range of 18,5-24,9. A comparison of subjective and objective evaluations of body shapes indicates that 12 out of the 23 subjects correctly identified their body shape.

The objective evaluations of body types were categorised according to the eight prominent body types as described by Rasband (1994:14-15). These body types are discussed in Chapter 2 and include the ideal, triangular, inverted triangular, rectangular, hourglass, diamond shaped, tubular shaped and the rounded figure.

Zangrillo (1990:4) describes four body types within the plus-sized figure classification (see Figure 6 in Chapter 2). As seven out of 23 subjects were classified as overweight and 11 out of 23 subjects were obese according to BMI values, a total of 18 out of 23 subjects had plus-sized figures. Due to the fact that five out of 23 subjects had normal BMI values, their body shape could not be classified according to Zangrillo's (1990:4) body shape classification. For the purpose of this study, it is assumed that the body shapes described by Rasband (1994:14-15) resemble the body shapes of the plus-sized figure classification described by Zangrillo (1990:4):

- ➢ The rounded body type resembles the barrel body shape.
- ➢ The triangular body type resembles the pear body shape.
- ➢ The rectangular body type resembles the box body shape.
- ➢ The hourglass body type resembles the rectangular-8 body shape.

Within the plus-sized body types as described by Zangrillo (1990:4) there are no body shapes that resemble the inverted triangular body shape, the diamond body shape or the tubular body shape. Kuma (1999:25) investigated the design guidelines for selected plus-sized professional black South African woman. She used the body shape classification developed by Zangrillo (1990:4) for classifying plus-sized figures. In addition to the four shapes described by Zangrillo (1990:4), Kuma added the apple shape. From her description of the apple shape, it is clear that this shape resembles the diamond shape as the body form presents a rounded torso. According to Spillane cited in Kuma (1999:25) the bust of the apple shape is full and the waist may be bigger than the bust and the hips. It can be assumed that this apple shape resembles the diamond figure type described by Rasband (1994:14-15).

A standard body shape classification was used to classify the body shapes of this sample, therefore it was decided to use the body shape classification of Rasband (1994:14-15) as it includes a wider variety of body shapes.

The composition of the second phase sample in terms of age is visually presented in FIGURE 8a below:

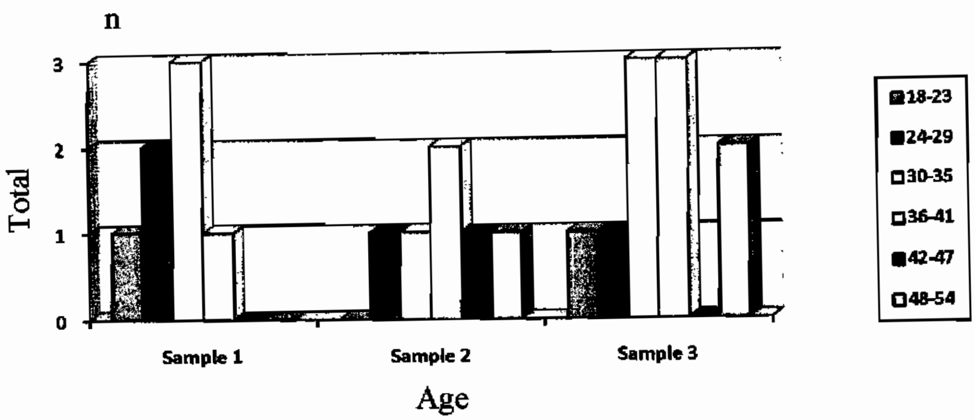


FIGURE 8a: Composition of the second phase samples in terms of age

From Figure 8a regarding the age categories of the subjects in the three samples, it can be seen that:

- One subject from the first sample was between 18 and 23 years old. None of the subjects in the second sample were within this category. One subject from the third sample was within this age range.
- Two subjects from the first sample were between the age of 24 and 29 years old. One subject from the second sample was within this age category and one subject from the third sample was within this age range.
- The majority of the subjects were between the age of 30 and 35 years as three subjects from the first sample, one subject from the second sample and three subjects from the third sample were within this are range.
- One subject from the first sample was between the age of 36 and 41 years while two subjects from sample two were within this category and three subjects from the third sample were within this age range.
- None of the subjects from the first and third samples were within the age category of 42 and 47 years while one subject from the second sample were within this age category.

➢ None of the subjects from the first sample were between the age of 48 and 54 years while one subject from the second sample and two subjects from the third sample were within this age category.

The composition of the second phase sample in terms of ethnicity is visually presented in FIGURE 8b below:

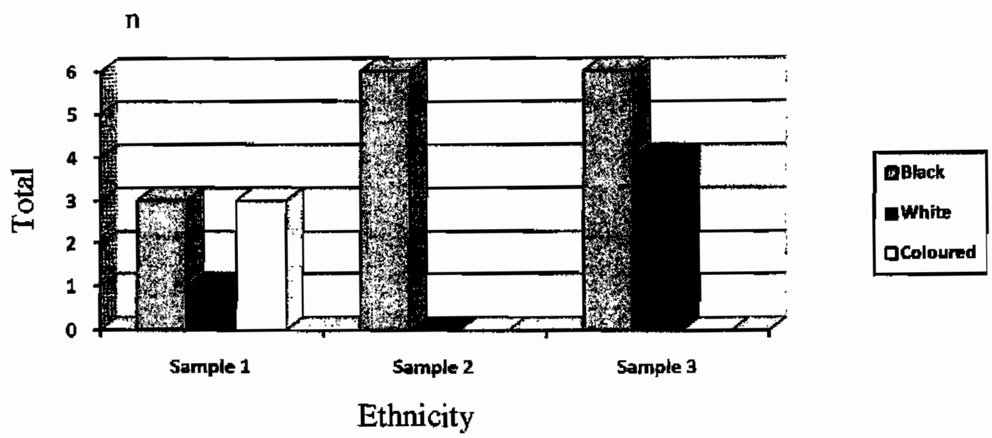


FIGURE 8b: Composition of the second phase samples in terms of ethnicity

From Figure 8b regarding the ethnic composition of the subjects in the three samples, it can be seen that:

➢ From the first sample, three subjects were black, one was white and three were coloured.
➢ All six of the subjects in the second sample were black.
➢ Six of the subjects in the third sample were black while the remaining four subjects were white.

The composition of the second phase sample in terms of BMI is visually presented in FIGURE 8c below:

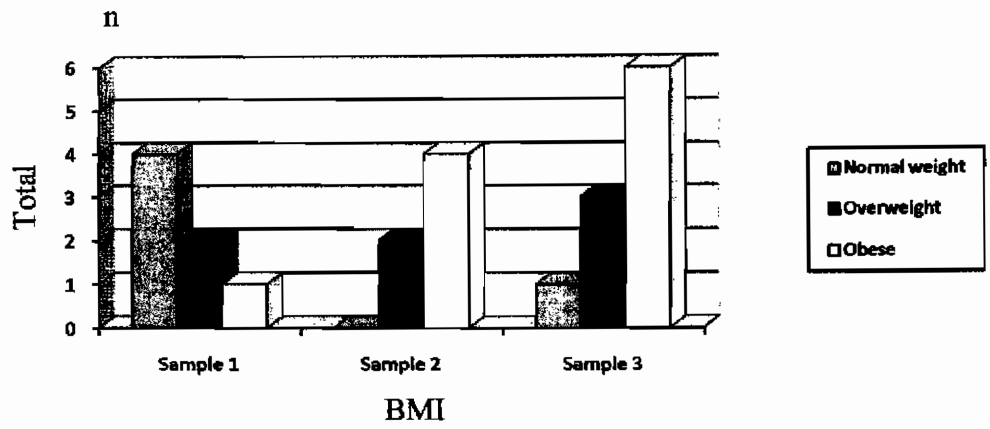


FIGURE 8c: Composition of the second phase samples in terms of BMI values

From Figure 8c regarding BMI categories of the subjects in the three samples, it can be seen that:

- Four of the subjects from the first sample had normal body weight while two were overweight and one was obese.
- Within the second sample, two subjects were overweight and four were obese.
- Only one of the subjects from the third sample had normal weight, while three of the subjects were overweight and six subjects were obese.

The composition of the second phase sample in terms of body shape is visually presented in FIGURE 8d below:

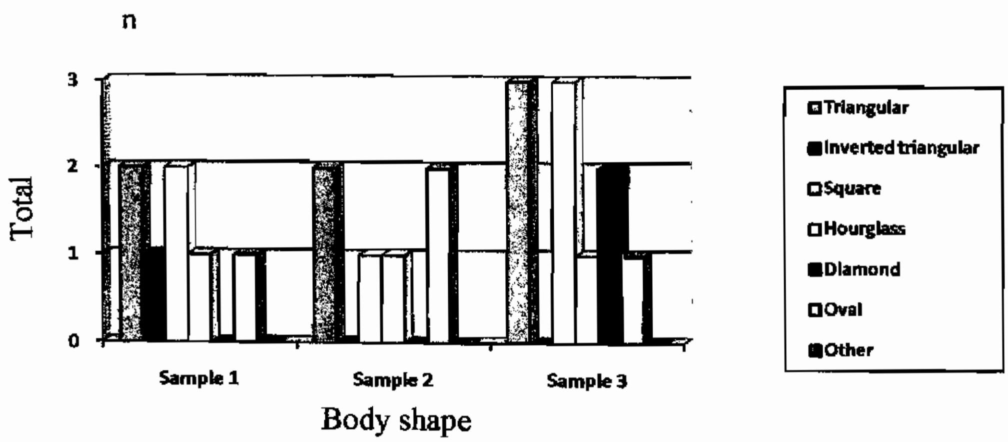


FIGURE 8d: Composition of the second phase samples in terms of body shape

From Figure 8d regarding the body shapes of the subjects in the three samples, it can be seen that:

- Two of the subjects from the first sample had triangular body shapes and two of the subjects had square body shapes. Within this sample, one subject represented the inverted triangular, hourglass and oval body shapes respectively.
- From the second sample, two subjects each had a triangular and an oval body shape while one had a square and one had an hourglass body shape.
- Within the third sample, both the triangular and the square body shape categories were represented by three subjects. One subject had an hourglass body shape, two subjects had diamond body shapes and the remaining subject had an oval body shape.

3.3 METHODS OF DATA COLLECTION

The following predominantly qualitative data gathering methods were employed in the following order: focus group and one-to-one interviews, fit and judging sessions, a motor test, somatographs and body and garment measuring sessions. A thorough study of relevant literature was conducted before and during the field research stage to guide the data collection process and interpret the findings in the light of the background study and research objectives.

A brief biographic profile questionnaire served to describe the samples for the focus group interviews and following methods. The questionnaire was developed in terms of nominal and equal interval levels of measurement according to the guidelines of Delport (2002:169-171, 180).

The subjects were asked to state their date of birth. Closed questions were used to establish the subjects' ethnicity and body shapes. The question regarding body shape included six graphic images resembling body shapes. Each subject was required to select an image that she believed resembled her own body shape. An open block was included so that the respondent could draw her own shape if she was convinced that none of the body types applied to her figure (see Annexure A for the biographic questionnaire).

The biographic questionnaire was administered in the presence of the researcher after the group interview was completed. The five data collection methods mentioned above, namely interviewing, fit checklists, somatographs, motor tests and measuring sessions are defined and discussed in the following section.

3.3.1 Interviewing

In line with the qualitative research strategy, interviewing was used as the primary data collection mode with regard to the first objective of this study. Kvale cited by Greeff in de Vos (2002:292) defines qualitative interviewing as "attempts to understand the world from the participant's point of view, to unfold the meaning of people's experiences and to uncover their lived world prior to scientific explanations". Due to the subjective nature of this study, this definition is interpreted as to describe how the subjects experience the fit of their upper garments with regard to the ease of movement that is provided. Focus group interviews were conducted in addition to one-to-one interviews. This methodology is in line with the research goal, which is exploration and description of the fit of two female SANDF military garments with regard to ease/tolerance allowance.

The communication and interviewing techniques recommended by various authors were applied and practiced during the pilot study sessions (Seidman in de Vos 2002:293-294, Sacks *et al.* quoted by Holstein & Gubrium in de Vos 2002:294-295).

The frame of reference for this study was perceived to be the environment where the subjects would function optimally. The interviews took place in an environment that was familiar to the subjects as their place of work. The venue was suitable for this study because it provided privacy in a comfortable setting that was non-threatening and easily accessible to the subjects. The SANDF granted the subjects the permission to participate in the study. Sufficient time was therefore set aside for the interviews. This is in line with Mouton, Schurink and Puth (1987:79-90) who suggest that all the factors that could negatively influence the interview should be eliminated as far as possible. To ensure that the discussions flowed from the general to more specific topics, the advice of Morgan and Krueger and Morgan and Casey in de Vos (2002:315) was followed.

The one-to-one interviews followed the focus group interviews and allowed the researcher and the subject to explore the research goal and objectives in depth. The above mentioned interview methods are subsequently discussed in further detail.

3.3.1.1 Focus Group interviews

A focus group can be defined as a carefully planned discussion that takes place in a non-threatening environment and that is designed to obtain perceptions on a defined area of interest (Greeff in de Vos 2002:306). The focus groups were conducted mainly to explore and describe the nature of the fit of upper garments, with regard to the way that it provides ease for movement (Greeff in de Vos 2002:307). The aim of conducting focus groups was to form a general concept of the research topic and to identify themes for further discussion in the one-to-one interviews.

Focus group interviews were utilised during the introductory phase of this study for the following reasons:

- To stimulate conversation. It is well known that people are more spontaneous in a group environment. This would simultaneously ensure the participation of the subjects at the following one-to-one interviews.
- To gather a general overview. The researcher wanted to obtain a general idea regarding the satisfaction/dissatisfaction of the fit of the dress jacket and combat shirt. For that reason, only the broad topics of the operational guide were discussed.
- To form a basis (point of departure) to select the sample to take part in the one-to-one interviews.

3.3.1.2 One-to-one interviews

The one-to-one interview is focused on discussing a particular area of interest, while allowing enough room to explore the scope and depth of the research topic (May in de Vos 2002:298). One-to-one interviews were used to explore perceptions of fit regarding the dress jacket and the combat shirt and also to follow up the focus group interviews. Specific topics that were of a more personal nature were selected to be discussed in the one-to-one interviews. In addition certain broad topics mentioned in the focus groups were discussed in greater detail in the one-to-one interviews.

3.3.1.3 Interviewing approach

A general interview guide approach was selected to conduct the focus groups and the one-to-one interviews. These interview guides were developed from an operational plan to assist in the interview process. This plan was developed to realise the goals and objectives of the study and to operationalise the conceptual framework for the study discussed in Chapter 1 (see Annexure C for the operational plan). To ensure that a detailed picture of the participants' experience of and perceptions regarding the tolerance and fit of the garments under investigation was obtained, applicable topics were selected for each type of interview. The guided interview schedules for the respective focus groups and one-to-one interviews were based on these topics.

For the focus group interviews the topics included: overall fit, wearer characteristics, garment design (in relation to both its aesthetic and functional performance) and gender. These topics were viewed to be of general interest to the group and could provide a general overview of the opinions of the subjects regarding the research topic.

Topics selected for the one-to-one interviews included subjective fit issues, personal preferences and experiences as well as the wearers' individual characteristics (body shape, age, ethnicity, weight and height). These topics were of a more personal nature. The above procedure is in line with suggestions made by Greeff in de Vos (2002:302) in order to ensure a detailed understanding of the research problem.

Due to the fact that a general interview guide approach was followed for both types of interviews, the interview questions were developed from checklists based on the operational plan to ensure that all the relevant topics were covered (Greef in de Vos 2002:297). The interviews consisted of open-ended questions to guide rather than dictate the interviews. By following the above procedure, it was ensured that:

- All topics relevant to the investigation were discussed.
- All the subjects were asked more or less the same questions during each interview.
- More efficient time utilization as repetition of previously asked questions was avoided.
- The researcher's thoughts focused on specific topics under discussion while ensuring the consistency and flexibility of the interviewing technique.
- The dross rate, which refers to the amount of irrelevant data collected during the interview was minimized.

An additional function of the general interview guide is that it gives the researcher the opportunity to facilitate description and to define and analyse the findings as the collected data is partly organised under the relevant topics (Greef in de Vos 2002:302).

- Focus group interviewing

One group interview was conducted with three groups, consisting of 19, seven and 23 subjects respectively. This is in contrast with Krueger's advice (cited in de Vos 2002:312) who suggests four meetings with the same group. The reason for conducting only one interview per group was due to the focus group interviewing techniques not being the only means of interviewing in this multi-method study.

The sample size used during the focus group interview was larger than advised by Greeff in de Vos (2002:311) who states that group interviews generally consist of six to ten participants per group. A Participatory Action Research (PAR) approach, using a brainstorming technique was employed to conduct the focus group interviews. This approach makes provision for larger groups. All members of the group were given the opportunity to express themselves in a group dialogue. This is in line with Collins, Schurink and Van Rooyen cited by Strydom (2002:431) who state that the use of this approach enables all members of the group to apply their knowledge, experience and expertise to a specific problem.

The brainstorming procedure followed benefitted the study because it generated ideas in order to gain a broad overview regarding the subjects' perspectives of the problems. This technique allowed anything related to the research topic to come up for discussion, without any criticism. This is in line with the opinion of Collins, Schurink and Van Rooyen cited by Strydom (2002:430).

During the brainstorming procedure all the topics and subtopics raised by the participants were written on large sheets of paper, as they emerged from the discussion. These sheets were pasted against the walls so that the subjects could view them while the interview was taking place. As the discussion evolved, new topics were added if they were found to be important and relevant for later discussions and other focus groups.

A team was involved in the focus group interviewing process. The team consisted of the group facilitator (the researcher) and the assistant (the research assistant). The researcher conducted the interview, while the research assistant wrote the topics and subjects on the sheets of paper. The research assistant also assisted with taking keen observation notes of subject behaviours such as: the subjects' signs of approval/disapproval through comfortable/uncomfortable body language, facial expressions that indicated embarrassment, etc. This is in line with Greeff in de Vos (2002:313) who advises the employment of a team to conduct focus group interviews.

❖ One-to-one interviews

The one-to-one interviews followed the focus group interviews. This sequence of procedure ensured that the subjects could refer back to the discussions held in the focus group interviews and subsequently explore and describe the aspects or topics that they perceived to be important to their individual situations.

During the one-to-one interview procedure the interview schedule was used to guide the discussion. The researcher briefly familiarised the subject with the topics of discussion and thereafter the subject was free to discuss any of these topics that she deemed important (see Annexure D for focus group and one-to-one interview questions/guides). In addition to the interview schedule, the subjects were shown pictograms illustrating common fit problems (see Annexure E1) as well as an illustration of the female figure from front and back (see Annexure E2). These "tools" assisted the participant to recognise specific fit problems at specific body locations as well as to stimulate further discussions.

The above-mentioned procedures conclude interviewing as a data collection method. The following data collection method consisted of a fit and judging session and is subsequently discussed.

3.3.2 Fit checklists

To realise the first objective of this study, fit checklists were designed to assess the fit of the dress jacket and the combat shirt. The checklists were based on relevant theory, applying the principles formulated by Rasband (1994:34-43) and Brown and Rice (2001:159-164) as well as the conceptual framework (see Annexure F1 and F2 for the fit checklists for the dress jacket and combat shirt respectively).

The checklists were structured around the five elements of fit, with special focus on ease allowance. Grain, set, line and balance were included as it indirectly serves as indicators of ease. Questions one to three evaluated fit as it relates to grain. Questions four to ten evaluated fit related to garment set. Questions eleven to sixteen investigated lines as indicators of fit. Question 17 related to balance evaluation. Ease was checked and evaluated in questions 18-26 for the dress jacket and questions 18-27 for the combat shirt. An extra page was allowed for additional comments by the judges.

Fit was evaluated and judged by two trained judges (Bredenkamp & Mac Duff) from ERGOnomics TECHnologies (Ergotech). Ergotech is the organisation that manages the anthropometric database of the SANDF. A training guide was developed according to the fit checklists in order to establish the standards for evaluation and judging (see Annexure G for the training guide). The training guide consisted of definitions and descriptions of the five elements of fit as well as illustrations of the female body form with body landmarks indicating specific areas where fit should be evaluated and judged.

3.3.3 Somatographs

To realise the second objective of this study, somatographs were used to determine the body types of the subjects. Somatometry is a method that has been developed in an attempt to graphically describe the human body shape (Shen & Huck 1993:6). Somotographs (photographs of the body taken in a standardised manner) were used to capture the body types of the subjects in order to obtain an objective view of the body and to allow for objective evaluation of the subject's body type. The standard image capturing procedures as developed by Kohn and Ashdown (1998:17-25) were consulted as general guidelines for developing the method of taking somatographs.

The 23 participating subjects wore two-piece suits (bright red Lycra tops and knee length tights) provided by the researcher. Body suits were available in six sizes (small, medium, medium to large, large, extra-large and extra-extra large). While being photographed, each subject wore a white full-face mask to ensure her anonymity. Each subject's number was attached to her suit in such a way that it was clearly visible in the photograph for the purpose of data analysis.

The photographic procedure was conducted in a private room. The photographs were taken against a light brown screen that provided a neutral background. To maintain standard results, three black vertical lines (50 centimeters apart) were marked on the background to position the subjects. The centre line indicated the subjects' centre front/back positions. Two horisontal lines positioned 70 centimeters apart served as height indicators. These vertical and horisontal lines facilitated the clear identification of the body proportion, curves, irregularities and weight distribution. To ensure that all photographs were taken from the same distance and at similar angles, foot markers (outline silhouettes of feet) were taped onto the floor. The foot markers were positioned 25 centimeters from the screen to indicate standing positions for the front, back and side views.

The digital camera was positioned on a tripod, three meters from the subjects' standing position at a height of 1,11 meters from the floor and in a position perpendicular to the subject's upper body. This arrangement of equipment provided full-length views. A set of photographs consisting of a front, back and side view was taken of each subject.

The front view provided an indication of the subject's proportion, curves, and weight distribution and assisted in figure analysis. The back view defined the general mass and body shape and the side views were used for posture analysis since it produced clear indications of the alignment of the body and posture habits.

To facilitate data analysis, the photographs were analysed according to the method suggested by Kefgen and Touchie-Specht (1981:206-207). The afore-mentioned authors suggest drawing various lines on the figure to determine the shape, symmetry and proportions of the body, which include the following:

- Drawing a vertical line bisecting the body on the front and back view, then comparing differences between left and right sides of the body.
- Drawing a horisontal line across the shoulders, bust, waist, hips and knees on the front and back views, then determining whether these lines are horisontal to each other.

- Drawing a straight line on each side from shoulder/bust to hip on the front and back views, then determining whether these lines taper from shoulder to hip.
- Drawing a vertical line from the ear lobe to ankle on the side view and then establishing the distribution of body weight and posture.

(See Annexure H for the full range of somatographs).

3.3.4 Motor test

The subjects performed a functional movement test using a motor test technique. This test was used to collect data to realise the first objective of this study, namely to determine and interpret the amount of tolerance that will comply with the functional requirements related to the activities and comfort of an optimum number of wearers as well as to result in an aesthetically acceptable fit.

The standardised motor test used by Ergotech was conducted to evaluate the dress jacket and combat shirt (see Annexure I for the motor test). The motor test was refined by Mac Duff, a trained fit judge from Ergotech.

The motor test chosen to establish the functionality of the garments and to approach clothing movement problems was in accordance with mobility tests that have been conducted internationally. During previous studies, researchers such as Crow and Dewar (1986:467-473), Huck (1988:185-190) and Huck *et al.* (1996:45-61) used similar tests to evaluate various aspects of clothing mobility and fit.

During the motor test procedures it was expected of each subject to fit their dress jacket as well as combat shirt while being judged.

3.3.5 Body and garment measuring session

To realise the second objective regarding the suitability of the key dimensions used to base the current size designation on, the size chart specifications used by

Armaments Corporation of South Africa LTD (ARMSCOR) were analysed. These specifications were compiled by the RSA Military Standards Steering Committee (RMSS:1994) and included document number KMG 27/71 (1989) describing the dress jacket (see Annexure J for the document) and RSA-MIL-SPEC-215 (2000) document number 05181-100-017 describing the combat shirt (see Annexure K for the document).

Dress jackets are issued according to key (control) dimensions and also according to secondary dimensions. The bust measurement is used as the key/control dimension. Secondary dimensions include the length of back, width of back and sleeve length. The chest circumference of the intended wearer is the control dimension used to issue the combat shirt. Secondary dimensions include back length, across back width, bottom hem width, sleeve length, scye circumference and cuff circumference.

The above-mentioned measurements were compared to the corresponding body measurements of the subjects and analysed against the background of relevant literature regarding the variations of body types and clothing theory. The list of body measurements was supplemented with ten additional body measurements. Height and weight measures were also added as these influence fit. A total of 18 measurements were identified (see Annexure L for list of body measurements and definitions).

With regard to the third objective, to determine and interpret the relevance and the validity of the currently used sizing system, the issued garment measurements were compared to the subjects' body measurements. This was necessary to calculate the amounts of ease allowance of the garments and evaluate the suitability of the currently used sizing system's ease allowances.

Based on the literature review, the list of garment measurements was supplemented with eight additional measurements relating to the subjects' body dimensions (see Annexure M for the list of garment measurements and definitions).

The additional measurements were deemed necessary because it was suspected that the key dimensions specified in the ARMSCOR specifications would not provide for the optimum number of body types in the population. The ARMSCOR specifications do not, for example include hip circumference, although hip circumference is an important indicator of body type. Secondly, the ARMSCOR specifications required additional measurements in order to define a female's body shape (for example bust and hip circumference) as the combat shirt is based on male size charts and key dimensions.

To ensure complete and accurate body measurements, two trained anthropometrists (Bredenkamp and Mac Duff) from Ergotech measured the subjects at the 18 body locations and recorded their height and weight using standardised measuring procedures as defined by International Organisation for Standardisation (ISO) 8559 (1989) and the RSA Military Standards Steering Committee (RSA-MIL-STD-215, 2000).

The garments resembling the sizes of the garments fitted by the subjects were measured by the researcher and a trained assistant using the applicable Military Specifications (RSA-MIL-SPEC-215, 2000) (see Annexures' M1 & and M2 for the garment measuring positions of the dress jacket and the combat shirt respectively). This was conducted to ensure that the garments complied with the ARMSCOR clothing specifications.

3.4 DATA COLLECTION

Data collection took place over three days at two different locations. For the first two days data was gathered at the Main Ordinance Depot on base 101 in Valhalla. This location was selected as it had a sufficient number of female employees and was within easy reach of the Uniform Maintenance Centre in Valhalla. Subjects that were selected for the motor tests and fit judging were expected to fit a variety of garment sizes at this centre.

For the third day of data gathering, a sample was selected at the JSE Darreson base in Littleton due to the requisite availability of female military employees.

3.5 DATA CAPTURING AND ANALYSIS

Data gathering techniques consisted of field observation notes, tape recordings and transcripts, mind maps as well as written comments, questionnaires, checklists, photographic evidence and tables of measurements. Subsequently the above-mentioned techniques are discussed.

❖ Field and observation notes

As suggested by Judd and Silverman cited in de Vos (2002:285) field notes were taken of relevant observations by the researcher. The researcher made observation notes of how she interpreted the interview, while the research assistant made notes of the subjects' interpretations of the interview and research topic. After the interviews were conducted, the researcher and the assistant researcher compared notes in order to formulate accurate and systematic data. Field notes assisted the research team to obtain a comprehensive account of the subjects themselves, the events that took place, the actual discussions and communications as well as the subjects' perceptions, feelings and attitudes. The above-mentioned procedure is in line with suggestions made by Strydom (2002:287).

❖ Tape recordings and transcribing

With permission from the subjects, the interviews (for both focus groups and one-to-one) were recorded on audiotapes. Smit in de Vos (2002:304) states that the audiotape recordings allow a more complete record than hand-written notes taken during the interview. The researcher could therefore concentrate fully on the interview that was taking place without being distracted by note-taking.

After the interviews were conducted, the tape recordings were transcribed. During transcription, headings and categories were formulated, and comments that emerged from the interviews were accordingly arranged under these headings and categories. Tables were compiled based on the comments under each topic, first as general comments from the focus group interviews and second as detailed discussions from the one-to-one interviews.

❖ Brainstorming technique: Mind maps and written comments

During the focus group interviews all the topics that were raised by the subjects were written on large sheets of paper as the topics emerged from the discussions. The topics and subtopics were used to structure the discussions that took place. The subjects' comments were arranged according to these topics.

❖ Questionnaires

During the initial phase of the study, questionnaires were used to establish the subjects' age, ethnicity and body shape. After the questionnaires were completed, the researcher calculated the subjects' age and arranged the data to be presented in the form of bar graphs and tables.

❖ Checklists

Checklists were used to capture the fit evaluations of the judges while each of the subjects wore the dress jacket and the combat shirt. On the checklists, the expert judges answered 27 questions with regard to the fit of the garments. For each question, the judge was given the opportunity to describe the fit problem.

After the checklists were completed, the researcher categorised the data in typologies, in order to obtain a clear understanding of where and why fit problems occurred.

❖ Photographic evidence

Somatographs were used to capture the subjects' body forms. The somatographs were analysed by means of a method suggested by Kefgen and Touchie-Specht (1981:206-207). Analysis of the vertical and horisontal lines facilitated the objective evaluation of body shapes.

❖ Tables of measurements

Tables of measurements were used to capture the subjects' body measurements as well as the garment measurements. After the tables were completed, comprehensive summative tables could be compiled to facilitate data analysis and comparisons.

3.5.1 Exploration of data capturing

Table 7 summarises the data collection methods, the instruments employed to gather the information as well as the methods and techniques used to capture the data.

TABLE 7: EXPLORATION OF DATA CAPTURING

Objective	Data Collection Method	Instrument	Capturing method.
1, 2, 3 2, 3	Focus group interviews and one-to-one interviews Biographic profiling	Semi-structured interview schedule and audio taping Questionnaire	Field and observation notes Transcripts Questionnaire
1, 2, 3	Fit sessions	Checklists Photographs Motor test schedule	Checklists Photographic evidence Field and Observation notes
1, 2, 3	Judging sessions	Checklists	Checklists and written comments.
1, 2, 3	Body measuring session Body posture and fit session	Measuring specifications including: ARMSCOR specificatious Photographs taken in a standard way	Table of measurements Somatographs
1, 2, 3	Garment measuring session	Measurement specification: SABS	Table of measurements

3.6 DATA ANALYSIS

According to de Vos (2002:340) data analysis can typically be defined in various steps that are in accordance with this study and its objectives. These steps are outlined below:

❖ Collection and recording data

Data analysis in a qualitative inquiry involves a twofold approach. The first approach involves data analysis at the research site during data collection. The second approach involves data analysis away from the site following the period of data collection. As suggested by Erlandson in de Vos (2002:341) the second approach was conducted between site visits prior to, as well as after, completion of data collection.

❖ Managing data

Management of the data comprised the ordering of field notes, observation notes, transcripts and documents according to key words, which related to the theoretical framework and the operational guidelines developed for this study.

❖ Reading, memoing

During the reading phase, in-dept analyses of the transcripts were conducted. At this stage, the researcher recognised that the collected data was sufficient.

❖ Describing, classifying, interpreting

It is typical of the describing phase to look for similarities and differences, internal convergence and external convergence. The researcher developed categories, themes and dimensions of information within the findings.

❖ Representing, visualisation

Where possible, qualitative data was quantified and represented in typologies and figures (bar graphs). Actual statements from interviews were presented in typologies according to similarities and differences.

3.7 HISTORY OF THE STUDY

A team consisting of four members was involved in the data collection process. Each member of the team was assigned specific tasks to complete. Stations were used to organise the data collection procedure. At station one, focus group interviews were conducted and one-to-one interviews were conducted at station number two. Fit and judging sessions took place at station number three and subject body measurements were taken at station number four. Lastly, the somatographs were taken at station number five. Each participating subject moved from the one station to the next and by doing so the data was gathered in an orderly manner.

3.7.1 Pilot study

As a means to ensure the successful collection of data, the interviewing design was pilot tested during a pilot study. Through pilot testing, the researcher refined some practical aspects of establishing access, making contact and conducting the interview as well as to familiarise herself with the required interviewing skills (Greeff in de Vos 2002:300). The practical aspects, in addition to certain technical aspects of the interview design were tested in the pilot study. In particular, time management and the types of questions asked were considered.

❖ Time management

As the interviews should commence and end at a reasonable time, it was important that the time made available to the researcher was used to best advantage. By pilot testing the relevance of the questions in relation to the amount of time allowed for answering them, the most economic use of time was established.

❖ Type of questions

To ensure that all questions were correctly formulated, interpreted and relevant to the context of the study, the questions were refined through pilot testing to ensure relevant data collection. This was conducted to ensure the trustworthiness of the instrument used and to ensure that the collected data is relevant and a useful contribution to the investigation. The above-mentioned aspects applied to both the focus group and one-to-one interviews.

Two pilot tests were conducted. The first pilot-testing sample consisted of five final year students at Vaal University of Technology (VUT). Pilot testing included testing of the following: the interview questions, interview approaches, data capturing methods and potential pitfalls. The second pilot-sample consisted of five second year students at VUT and pilot testing included testing of brainstorming techniques and mind maps. The pilot testing took place at the VUT Vanderbijlpark in available lecturing venues in 2006.

3.8 SOUNDNESS OF THE STUDY

The soundness of the study was enhanced by means of the triangulation of research methods. Lincoln and Guba cited in de Vos (2002:351) propose four alternative constructs that more accurately reflect the assumptions of the qualitative paradigm. These qualitative constructs are as follows:

❖ Credibility

The investigation was conducted in a manner to ensure the correct identification and description of the subjects. In this study the body measurements were taken by experts to ensure that accurate measurements were taken. Photographs of body types were taken in a standardised manner. To ensure that reliable information was collected from the subjects during the interviews, member checks were conducted. This procedure is in line with the opinion of Lincoln and Guba who suggest member checks to enhance credibility (Babbie & Mouton 2001:211). Member checks were conducted during the interview by repeating the responses to the subjects to verify, correct and accurately record responses. Respondents were offered the opportunity to provide additional information by means of the member checks. An audit trail was made possible by keeping records of field notes, audiotapes, written reports and where possible company documents.

❖ Transferability

The researcher continuously referred back to the conceptual framework and relevant concepts to guide the data collection process. Transferability was achieved by comparing the findings of this study to related research conducted by other researchers.

❖ Dependability

The researcher attempted to limit any changing conditions in the interview setting and environment that could in any way negatively influence the data collection process. Gathering the data at a convenient time and place in a favourable environment in which the subjects felt comfortable ensured this. The researcher also ensured that the research procedures were clearly explained to the subjects.

❖ Confirmability

The goals and objectives of this study are related to conceptual and theoretical frameworks, which are linked to research conducted by other researchers in the field related to sizing and fit.

This research design served to describe the population and sample, methods of data collection, data capturing and data analysis and demonstrates the soundness of the study. The findings of the study are presented in the following chapter.

CHAPTER 4
FINDINGS

4.1 INTRODUCTION

In this chapter, the findings of the empirical study are presented in terms of the objectives.

4.2 FINDINGS: OBJECTIVE ONE

To realize the first objective of this study, namely, to determine and interpret the amount of ease that will allow wearers of the garments in question to:

- Comply with the functional requirements related to the activities and comfort of an optimum number of wearers, and
- result in an aesthetically acceptable fit,

the following questions had to be answered regarding the dress jacket and combat shirt respectively:

- What are the fit preferences of the subjects?
- What are the subjective views regarding fit in terms of ease?
- How much ease is allowed at the various garment locations that are important for movement?
- What are the objective opinions regarding fit in terms of ease?
- How much ease would comply with the functional requirements related to the activities and comfort of an optimum number of wearers, and would result in an aesthetically acceptable fit?

To answer the above questions, the findings regarding the dress jacket (closely fitted garment) and the combat shirt (loosely fitted garment) are relevant. The general fit preferences of the subjects are considered as their perspective has implications for the satisfaction with fit and ease allowances. Thereafter the subjective opinions of subjects regarding fit in terms of ease of their dress jackets and combat shirts are considered. To further explore the suitability of the two garments in terms of functionality and an aesthetically acceptable fit, the respective subjective and objective evaluations of the subjects and the fit judges regarding fit in terms of ease are presented, followed by the findings of the motor tests. Thereafter, the findings regarding the fit checklists are used to explore the effects of ease on the aesthetic performance of the garments.

4.2.1 Objective one: Fit preferences

Individual fit preferences influence the amounts of ease that the subject will be satisfied with at various garment locations. This is due to the fact that some persons generally prefer a closer fit and others generally prefer a looser fit.

In Table 8 the fit preferences of the subjects are presented together with selected subjective comments from the one-to-one interviews in the following order: tight fitting, semi-fitting and loose fitting. The objective evaluations of the body shapes of the subjects as well as their BMI values are included to assist in understanding the general fit preferences of the subjects.

TABLE 8: GENERAL FIT PREFERENCES OF THE SUBJECTS

Preferred fit	Subject number	BMI	Body shape	Selected subjective comments
Tight fitting	1	19,3	▼	"For my upper body, it must be fitted"
	22	29,9	▲	"Fitted. All over. I don't feel comfortable in something that is so big"
	52	21,0		"Tight fitting. I don't like oversized garments because of the way it makes me look. I don't think it looks good on me"
Semi-fitting	3	40,3		-
	12	22,8	▲	-
	18	27,5	▲	"Semi-fitted all over. I don't like tight stuff"
	19	22,6	▮	"I must be just a little bit free"
	21	47,0		-
	25	29,8		"At the top, it can be semi-fitted"
	26	30,4	■	-
	33	26,3	▲	"I like semi-fitted. For the upper and the lower body"
	34	41,7		-
	42	36,3		-
	43	34,6	▲	-
	49	29,7	▲	-
Loosely-fitting	1	19,3	▼	-
	25	29,8		"Here (bottom), it must be loose"
	41	28,9	■	"I like wearing baggy clothes, it's comfortable. When my clothes are tight, it puts pressure on my stomach"
	50	33,2	■	"Loose clothes. I like it loose, it must not tighten me"
	51	30,1	■	-
No comment regarding fit preference	8	29,1	■	-
	13	24,5		-
	24	39,1	▲	-
	27	41,6		-
	32	34,7		-

From Table 8 it follows that from the subjects that commented:

- The majority (12 out of 18 subjects) preferred wearing semi-fitting garments.
- Two subjects, (1, 25) had dual fitting preferences as they preferred one type of fit for the upper torso and another for the lower torso.
- Five subjects (1, 25, 41, 50, 51) preferred wearing loosely fitted garments from which two (1, 25) only at the lower body.
- Three subjects (1, 22, 52) preferred wearing tightly fitted garments, of which subject number one preferred tight fit at her upper torso only.

Analysis of the fit preferences of subjects against their BMI values as presented in Table 8 indicates that:

- Four plus-sized subjects (overweight and obese with BMI of 25+) and one subject with normal BMI preferred loosely fitted garments.
- Four out of six subjects within the normal weight category (with BMI values between 18,5 and 24,9) preferred wearing tight and semi-tight fitted clothing.

To further investigate the subjects' preferred fit of clothing, the subjective fit preferences were compared to the body types of the subjects. From Table 8 it follows that:

- One out of the three subjects who preferred wearing a tight fit had an inverted triangle body shape, one had a triangle and one had an hourglass shape.
- From the twelve subjects who favoured a semi-fit, five had triangular body shapes, while three had oval body shapes. One each had a diamond, an hourglass, a tubular and a square shape.
- From the five subjects who preferred a loose fit, three had square body shapes. One subject had an hourglass body shape and one had an inverted triangle body shape.

From Table 8 it can be seen that the majority of subjects with triangle body shapes preferred semi-fitted garments. As described by Rasband (1994:12) this figure is narrower above the waist and wider below the waist with weight generally concentrated in the hips and buttocks. Due to the above, it is not unexpected that the subjects would prefer a semi-fit to accommodate larger hip and buttocks dimensions.

It can be seen from Table 8 that the majority of subjects with square body shapes preferred loosely fitting garments. As described by Rasband (1994:12) the waist dimension of this figure is not indented at the sides and appears wide in proportion to the hip. Semi-fitted garments are tapered to the waist and therefore it can be expected that this body shape would have insufficient movement ease at the waist location. Due to the above, the subjects with squared body shapes could have preferred the loose fit in order to accommodate the larger waistline.

According to Connell, Brannon, Ulrich, Presley, Grasso, Early and Gray (2001:73) fit preferences are related to age and body shape. The same authors state that older and larger women generally prefer more loosely fitted garments and that younger women of average weight and waist, who are rectangular or hourglass shaped will usually prefer a fitted jacket (Connell *et al.* 2001:73). Furthermore, the subjects' self-perception may influence the satisfaction with the fit of the garments. As an example, DeLong, Ashdown, Butterfield and Turnbladh (1993:2) state that an individual may wear a garment that is larger in order to disguise full buttocks if the prevailing ideal body type is less full.

To conclude, it must be stated that the subjective views with regard to the satisfaction with the ease allowance should also be interpreted with fit preferences in mind. Due to this fact, the amounts of ease of the dress jacket (closely fitted garment) and combat shirt (loosely fitted garment) can be experienced by the subjects as adequate even though it might in actuality be insufficient or in excess.

4.3 OBJECTIVE ONE: DRESS JACKET

The findings for the dress jacket (also referred to as the tunic jacket) are presented first, followed by the findings for the combat shirt.

4.3.1 Subjective comments with regard to the functional and aesthetic performance in terms of ease of the dress jacket

With regard to the functional performance of the dress jacket, the focus group and one-to-one interview comments were analysed and categorised in terms of problems experienced. Selected comments from the focus group interviews and the one-to-one interviews are presented in Table 9. The comments from the one-to-one interviews are followed by the number of the particular subject who made the comment.

TABLE 9: SUBJECTIVE COMMENTS REGARDING THE FIT OF THE DRESS JACKET IN TERMS OF FUNCTIONALITY

Functional performance of the garment	Problem	Selected comments
Physical activity	**Sleeves are too short**	"It is uncomfortable because the sleeves are too short. It sometimes happens that the length of the sleeve does not change but now you have an even bigger garment"
		"Dit sit baie styf en dit is baie ongemaklik want die moue is te kort. As jy 'n groter nommer vat dan is dit te groot om die lyf maar niks verander aan die arms nie" (19)
	The sleeves are too tight	"It is too narrow around the arms, the comfort is poor. You cannot lift your arms" (42)
	The jacket is too tight	"It hurts my body. It cramps my body because it is too stiff" (22)
		"It is uncomfortable and it is too tight at the sleeves" (51)
		"It is uncomfortable, very uncomfortable…and the armhole must be bigger" (52)
		"It is definitely too tight, I cannot lift my arms. I can put my ranks on and then it just jumps off. It is totally uncomfortable" (41)
	The jacket is too small	"My jacket is too tight. During the day it tightens me. Maybe it is too small but if I get a bigger one, then it is too big. There must actually be in-between sizes" (3)
	The jacket is uncomfortable	"I cannot drill properly, I cannot salute properly. It is uncomfortable" (51)

The above comments, tabulated in Table 9, provide an overview of the functional fit problems experienced by the subjects with their dress jackets. The most prominent problems include the following:

- The sleeves are too short and too tight.

- The jacket is too tight.
- Some subjects experienced overall poor comfort.

These problems are related to ease/tolerance in terms of the following:

- The amounts of ease at the sleeves are insufficient.
- The amounts of ease are experienced as overall insufficient.
- Insufficient amounts of ease result in discomfort.

During the interviews, some subjects expressed their satisfaction with the functional performance of the dress jacket. Selected comments included:

- "From my side, I don't have a problem, I am comfortable" (Subject number 8).
- "The tunic jacket is comfortable. Mine is the right size. I don't have a problem with it" (Subject number 13).

When analysing the reasons for satisfaction of the above-mentioned subjects against the background of the information presented in Table 6 (description of the 2nd phase sample), the following can be inferred:

- Even though subject number 8 is categorised as overweight according to her BMI value and has a square body shape, she could possibly have been satisfied with the fit of her dress jacket if she was wearing a jacket that was a size too big. If this was the case than the subject could have had excess amounts of ease and therefore experienced comfort.
- In the instance of subject number 13, her satisfaction could be due to her BMI value indicating a normal weight range and that she was issued with and wore the correct size. Furthermore, subject number 13 had an hourglass body shape that is complimented by the style of the dress jacket. It can therefore be inferred that this subject had adequate amounts of ease at most locations.

The comments regarding the aesthetic performance of the jackets were analysed in terms of problems experienced with the fit and the neatness of the dress jackets. Selected examples of subjective comments related to the aesthetic performance are included in Table 10.

TABLE 10: SUBJECTIVE COMMENTS REGARDING THE FIT OF THE DRESS JACKETS IN TERMS OF AESTHETIC PERFORMANCE

Aesthetic performance of the garment	Problems	Selected comments
Fit	**Too tight**	"It does not look neat, it's too tight over my hips"
		"Dit sit baie styf en dit is baie ongemaklik want die moue is te kort. As jy 'n groter nommer vat dan is dit te groot om die lyf maar niks verander aan die arms nie. Dit lyk nie mooi nie" (19)
	Sleeves too short	"The sleeves are too short. You have too take a big size so that the sleeves are long enough but then it is too big other places and then it does not look neat"
Neatness	**Dissatisfied with the style**	"I think the whole thing is not designed correctly. We wear a shirt underneath so maybe they can just let it go a bit, drop the neckline a bit" (52)
		"I am accepting the fact that it is my uniform, it was made like that and there is nothing I can do" (21)

From Table 10 it follows that:

- A jacket that is too tight is aesthetically unpleasing to the subject.
- Sleeves that are too short are aesthetically unpleasing to the subject.
- Overall dissatisfaction with the style of the jacket is experienced by some of the subjects.

The amounts of ease directly impact on the aesthetic performance of the garments because insufficient amounts of ease render a garment aesthetically unpleasing.

During the interviews, some subjects expressed their satisfaction with regard to the aesthetic performance of the dress jacket. Selected comments included:

- "Good, it fits great…because I've got a new one. It fits me well" (Subject number 18).
- "At least it is figure-like, it is shaped" (Subject number 49).

When analysing the reasons for satisfaction in terms of ease, the following can be inferred:

- The above mentioned subjects both wore jackets that are a size too big according to the bust measurement as a key dimension. These subjects were within the overweight range according to their BMI values, therefore they could have been satisfied with the excess amounts of ease provided by the larger garment.

It is clear that the functional performance of a garment has an impact on its aesthetic performance which can be related to ease/tolerance. The dress jacket of subject 19 serves as an example. This subject was dissatisfied with the length and the width of the sleeve of her dress jacket. A larger size garment would accommodate her arm dimension but would be too big at other locations, resulting in an aesthetically unpleasing appearance. In the instance of too little ease the garment would restrict comfortable movement and cause wrinkles that pull. Furthermore, it would render the garment aesthetically unpleasing.

4.3.2 Satisfaction with fit in terms of ease: Dress jacket

Satisfaction with fit is further explored in Tables 11-17. The findings regarding subjective viewpoints are presented in comparison to the objective evaluations of the fit judges in terms of the ease allowance of the dress jackets. The subjective viewpoints regarding ease allowances were investigated during the one-to-one interviews while the judges evaluated the ease allowances during the fit and judging sessions. The ease tables describe the ease allowances at the following body locations: bust circumference, hip circumference, back length, back width, waist circumference, the upper arm circumference and the scye circumference.

4.3.2.1 Bust circumference

In Table 11 the findings are presented against the background of the size designation and nominal garment measurements as included in the ARMSCOR specifications, document number: KMG27/71 (see Annexure J). Comparison of the size designation (according to the bust measurement) in the ARMSCOR specification with the specified nominal finished garment measurement, reveals a difference (100 mm) in the amount of ease allowed in each size category. The bust measurements of the issued garments are also included in the table. When the bust dimensions of the subjects are subtracted from the issued garment measurements in the bust area, the actual amounts of ease available for each subject could be calculated. The subjective and objective opinions of the subjects and the two fit judges are also presented.

To interpret the findings in terms of ease, the norm for ease at the bust area is inferred from pattern design guidelines. For the bust location, an average of 72 mm is accepted as a minimal ease allowance for developing garment patterns for basic fitted garments (see Table 1).

The above-mentioned ease amount of 72 mm is adapted by taking the following factors into account: Firstly, the dress jacket is worn over another garment, therefore additional ease is necessary to accommodate the garment worn underneath. Secondly, larger figures require more than the suggested minimum for a truly comfortable fit (Reader's Digest 1977:109). This is an important aspect due to eleven out of 23 subjects in the sample having a BMI value of 30+ and is therefore classified as obese (see Table 6).

Cooklin (1995:3) refers to larger/obese figures as 'outsize' figures. The same author states that 'outsize' figures are classified as having a hip girth of 1100 mm and larger. According to Cooklin's standard (1995:3), ten out of 23 subjects (21, 24, 25, 27, 32, 34, 41, 42, 43 and 49) of the second sample of this study could be classified as truly outsize. Another three subjects (22, 50, 8) were between 1 mm and 20 mm from being truly outsize. Two subjects (51, 3) had hip girths that were 20 mm to 30 mm smaller than the outsize standard. Subjects 19 and 26 had hip girths that were only 40 mm to 50 mm smaller than the outsize standard. It therefore appears that the majority of the subjects, 17 out of 23 (74 percent) were either truly or very nearly outsized.

Cooklin (1995:30) suggests using a percentage of the applicable girth measurement as ease/tolerance allowance in the instance of a fitted jacket (see Table 4). The suggested ease percentage at the bust dimension is 13,8 percent of the bust girth of the wearer. Although six subjects (1, 12, 13, 18, 33, 52) were neither truly nor nearly outsize, the standard suggested by Cooklin (1995:30) served as a basis to determine a norm for ease at the bust location. Application of Cooklin's (1995:30) standard implies that the subject with the smallest bust needs 112 mm of ease and the subject with the largest bust needs 192 mm ease. To generalise, it was therefore decided to use a norm of 100 mm to 200 mm to interpret the findings in terms of sufficient ease.

TABLE 11: SATISFACTION WITH FIT IN TERMS OF EASE ALLOWANCE FOR THE DRESS JACKET AT THE BUST CIRCUMFERENCE

ARMSCOR Specifications						SUBJECTIVE VIEWS			OBJECTIVE VIEWS					
									Judge 1			Judge 2		
Size designation category	Bust measurement (garment)(mm)	Subject number	Bust measurement (Issued garment) (mm)	Bust measurement (subject) (mm)	Ease allowance per subject (mm)	Adequate ease	Insufficient ease	Excess ease	Adequate ease	Insufficient ease	Excess ease	Adequate ease	Insufficient ease	Excess ease
RR76	860	-	860	-	-	-	-	-	-	-	-	-	-	-
RR81	910	1	900	815	85	✓				✓			✓	
RR87	980	13	940	880	60	✓			✓			✓		
		12		899	41	-	-	-	✓				✓	
RR92	1020	52	1000	895	105	✓			✓			✓		
		33		923	77	✓			✓			✓		
		43		928	72	-	-	-	✓			✓		
RR97	1070	49	1080	925	155				✓			✓		
		41		983	97		✓		✓				✓	
		22		994	86		✓		✓			✓		
RR102	1120	19	1100	928	172	✓					✓			✓
		26		1008	92	-	-	-	✓			✓		
		18		1010	90	✓			✓			✓		
RR107	1170	51	1100	1045	55	✓			✓			✓		
RR112	1220	8	1240	1030	210	✓					✓			✓
		25		1072	168	-	-	-	✓			-	-	-
		3		1085	155		✓			✓		✓		
		24		1106	134	-	-	-		✓		✓		
		42		1140	100	✓			✓			✓		
RR122	1320	50	1290	1126	164	✓					✓			✓
		32		1181	109	-	-	-	✓			✓		
		34		1288	2	✓				✓			✓	
RR132	1420	27	1400	1254	146	-	-	-	✓			✓		
		21		1391	9	✓				✓			✓	

From Table 11 it can be seen that a size designation category includes five bust measurements (bust measurements: 760, 770, 780, 790, 800). Each size category allows 100 mm ease allowance. It means that the smallest bust size (of 760) has 100 mm ease and the bust size of 800 mm, only 60 mm of ease. From the afore-mentioned it becomes evident that as the bust measurements increases, the amount of available ease decreases. This has serious implications for the amounts of ease allowance for the wearer with the largest bust measurement in the size category.

Table 11 presents a comparison of the ARMSCOR specifications (Document number: KMG 27/71) for the bust measurement with the bust measurement of the issued garment. It is indicated in Table 11 that seven out of ten of the issued garments were smaller than specified. For the category RR107, the bust measurement is 70 mm smaller than the specification. Such discrepancies can cause the ease allowance to diminish further.

The ease allowance per subject is presented in Table 11, and indicates that when compared to the norm of 100 mm to 200 mm:

- One subject (8) had more ease than the norm.
- Twelve subjects (1, 13, 12, 33, 43, 41, 22, 26, 18, 51, 34 and 21) had less ease than the norm.
- Ten subjects (52, 49, 19, 25, 3, 24, 42, 50, 32, 27) had adequate amounts of ease in comparison with the norm.

From the subjective views, the following can be inferred:

- If a "no comment" is considered as satisfied/adequate, four subjects (25, 24, 32, 27) were satisfied with an amount within the recommended norm, and three subjects (12, 43, 26) were satisfied with less ease than the recommended norm.
- Thirteen subjects (1, 13, 52, 33, 49, 19, 18, 51, 8, 42, 50, 34, 21) were satisfied with (adequate) amounts of ease ranging between 2 mm and 210 mm.
- Three subjects (41, 22, 3) were dissatisfied with insufficient amounts of ease ranging between 86 mm and 155 mm.

- There were no subjects who expressed dissatisfaction due to excess amounts of ease.

Investigation of the reasons for satisfaction with ease allowances lower or higher than the recommended norm revealed that:

- Subjects 34 and 21 (with 2 mm and 9 mm of ease respectively) wore dress jackets that were too small, based on the bust measurement as key dimension. It is interesting to note that even though subject 21 was of the opinion that the ease was adequate, she mentioned in the one-to-one interview (see Table 10) that she accepts the fact that her uniform was made like that and that there is nothing that she can do about it.
- Subject 51 wore a dress jacket that was one size too large. This may be due to the fact that she is overweight and has a square figure type.
- Subject number 8 was satisfied with excess ease of 210 mm. During the one-to-one interviews the subject commented that she does not have a problem and that she is comfortable when wearing the garment. This subject was wearing a garment two sizes too big. It could therefore be inferred that she prefers wearing a loose fitting garment although she did not comment regarding her fit preference. This may be ascribed to the fact that she is overweight according to her BMI and has a square body shape (see Table 8).

As a result of the above-mentioned discrepancies it seems acceptable to adapt the range for subjective satisfaction from 60 mm to 172 mm.

There was consensus among the judges regarding the following ease ranges:

- Adequate amounts of ease ranged between 55 mm and 155 mm.
- Insufficient amounts of ease ranged between 2 mm and 85 mm.
- In three instances (subjects 8, 19, 50) the judges agreed that the amounts of ease at the bust location were in excess between 164 mm and 210 mm.
- In six instances the evaluation of the judges corresponded with the norm. Although within the norm, they judged two jackets as having insufficient ease.

Comparison of the subjective views to the objective evaluations of the judges reveals that in only six out of 16 instances (13, 33, 49, 18, 51, 42) their opinions corresponded. It was agreed by both parties that adequate ease allowances range between 55 mm and 155 mm.

It is clear that the subjective views differ from the objective views. This is due to the fact that the subjects are uninformed about what constitutes a good fit and solely base their opinions on their experiences. The fit judges had the necessary insight to evaluate garments based on visual interactions such as seam placement and the location and orientation of wrinkles (Ashdown & DeLong 1995:48). The fit judges could therefore holistically perceive and evaluate the fit of the garments.

Viewing the available ease in terms of the subjective and objective satisfaction across size categories it becomes clear that for the smaller sizes (up to and including size RR97), an ease range between 55 mm to 100 mm could be adequate for an optimum number of wearers. In the instance of the larger sizes (from size RR102 to size RR132), 90 mm to 155 mm could be an adequate ease range.

From these results, it can be concluded that:

- Due to the fact that the ease allowance at the bust dimension decreases for the plus-sized wearers within the size categories, these wearers experienced insufficient ease.
- If the issued garments are smaller than specified by the ARMSCOR specifications, then the prescribed ease allowances are even less for the plus-sized wearers.
- The smaller sizes (up to and including size RR97) were satisfied with less ease than sizes above size RR97.
- The ARMSCOR specifications do not provide plus-sized wearers with sufficient ease.

4.3.2.2 Hip circumference

The hip circumference is another important measurement where the correct ease allowances can contribute to the comfort of the garment or vice versa. The findings regarding ease allowance provided in the hip area of the dress jacket are presented in Table 12. The bust measurements and ease allowances of the subjects are also included in the table to assist understanding the differences in ease allowed between the bust and the hip girths.

The findings are presented in the same order as for Table 11 except that the ARMSCOR specifications do not prescribe nominal finished garment measurements for the hip dimension. The ease allowances can therefore not be calculated from the specifications. To determine ease allowance at the hip, the hip dimension of each subject was compared to the measurement in the hip area of the issued garment.

To interpret the findings in terms of ease, the norm for ease at the hip location is inferred from pattern design guidelines as a minimum average of 50 mm (see Comparative table for movement ease allowances in Table 1). It is a general practice in the clothing industry to allow a drop of 50 mm. This implies that the hip measurements of females are 50 mm larger than their bust measurements. For example, if the bust measurement is 920 mm than the hip circumference would be 970 mm. This is in line with Chun in Ashdown (2007:229) who explains that in the instance of a medium bust body, the bust girth is 5 cm smaller than the hip girth. Referring to the above as a point of departure, it can be inferred that if only the bust measurement is known, the garment measurement at the hip area should be at least 100 mm more than the actual bust measurement of the person for a close fit.

To further establish the norm for ease at the hip circumference, the standard developed by Cooklin (1995:30) for an oversized figure is used. This standard prescribes that 8,8 percent of the subject's hip girth should be allowed for ease (see Table 4). According to this principle, it implies that the subject with the smallest hip dimension needs 71 mm of ease while the subject with the largest hip dimension needs 120 mm. Although the dress jacket is a closely fitted garment it is worn on top of other garments. Additional ease at the hip should therefore be allowed.

To consolidate, a norm ranging from 100 mm to 200 mm is used to interpret the findings in terms of ease at the hip circumference.

TABLE 12: SATISFACTION WITH FIT IN TERMS OF EASE ALLOWANCE FOR THE DRESS JACKET AT THE HIP CIRCUMFERENCE

Size designation category	Subject number	Bust location			Hip location			SUBJECTIVE VIEWS			OBJECTIVE VIEWS					
											Judge 1			Judge 2		
		Bust measurement (Issued garment) (mm)	Bust measurement (subject) (mm)	Ease allowance per subject (mm)	Hip measurement (Issued garment) (mm)	Hip measurement (subject) (mm)	Ease allowance per subject (mm)	Adequate ease	Insufficient ease	Excess ease	Adequate ease	Insufficient ease	Excess ease	Adequate ease	Insufficient ease	Excess ease
RR76	-	860	-	-	910	-	-	-	-	-	-	-	-	-	-	-
RR81	1	900	815	85	970	806	164	-	-	-		✓		-	-	-
RR87	13	940	880	60	1030	977	53	-	-	-	✓			✓		
	12		899	41		967	63	-	-	-			✓	✓		
RR92	52	1000	895	105	1080	944	136	✓			✓			✓		
	33		923	77		1075	5	✓				✓			✓	
	43		928	72		1165	-85	-	-	-		✓			✓	
RR97	49	1080	925	155	1120	1190	-70	✓				✓			✓	
	41		983	97		1044	76		✓		✓				✓	
	22		994	86		1080	40		✓			✓			✓	
RR102	19	1100	928	172	1180	1050	130	✓			✓			✓		
	26		1008	92		1045	135	-	-	-		✓			✓	
	18		1010	90		1038	142	✓			✓			✓		
RR107	51	1100	1045	55	1180	1068	112	✓				✓		✓		
RR112	8	1240	1030	210	1280	1098	182	-	-	-	✓			✓		
	25		1072	168		1108	172	-	-	-	✓			✓		
	3		1085	155		1078	202	-	-	-	✓			✓		
	24		1106	134		1316	-36	-	-	-		✓			✓	
	42		1140	100		1184	96	✓				✓		✓		
RR122	50	1290	1126	164	1400	1091	309	✓					✓			✓
	32		1181	109		1225	175	-	-	-		✓		✓		
	34		1288	2		1245	155	✓				✓			✓	
RR132	27	1400	1254	146	1520	1296	224	-	-	-	✓			✓		
	21		1391	9		1358	162	✓				✓			✓	

Comparison of the dimensions of the issued garment bust dimension to that of the garment hip dimension in Table 12 reveals the following:

- Size RR76 allows a garment hip dimension 50 mm larger.
- Size RR81 allows a garment hip dimension 70 mm larger.
- Size RR87 allows a garment hip dimension 90 mm larger.
- Size RR92 allows a garment hip dimension 80 mm larger.
- Size RR97 allows a garment hip dimension 40 mm larger.
- Size RR102 allows a garment hip dimension 80 mm larger.
- Size RR107 allows a garment hip dimension 80 mm larger.
- Size RR112 allows a garment hip dimension 40 mm larger.
- Size RR122 allows a garment hip dimension 110 mm larger.
- Size RR132 allows a garment hip dimension 120 mm larger.

From the above it becomes clear that the manufacturer of the dress jacket compensated for the lack of a specified hip dimension by adding between 40 mm and 120 mm to the bust dimension to accommodate the hip dimension. If a minimum drop of 50 mm is taken into account, the above dimensions show an ease range between 0 mm and 70 mm. This range is not adequate to allow sufficient ease for subjects with larger hip dimensions and different body shapes.

When the bust measurements of the issued sizes are compared to the bust measurements of the subjects against the specification of 100 mm ease at the bust location, it can be seen that nine subjects (13, 12, 33, 43, 49, 41, 22, 24, 42) did not have enough ease over the hips. If the various body shapes of the subjects (such as a triangle) are considered, it is clear that the hip measurement should include additional ease allowance in order to accommodate a variety of body shapes.

When compared to the norm of 100 mm to 200 mm, it follows from Table 12 that:

- Eleven subjects (1, 52, 19, 26, 18, 51, 8, 25, 32, 34, 21) had amounts of ease within the recommended range.
- Nine subjects (13, 12, 33, 43, 49, 41, 22, 24, 42) had less ease than the norm.

- Three subjects (3, 50, 27) had excess amounts of ease when compared to the norm.

The subjective view point presented in Table 12 reveals that:

- Only two subjects (41, 22) mentioned insufficient ease ranging between 40 mm to 76 mm.
- The remaining ten subjects (52, 33, 49, 19, 18, 51, 42, 50, 34, 21), who expressed their satisfaction regarding ease in the hip location were satisfied with ease ranging between 0 mm and 309 mm.
- There were no subjects who experienced the amounts of ease at the hip location as excess.

Investigation of the reasons for the subjective satisfaction with insufficient or excess ease allowance, revealed that:

- Subjects 33 and 49 were satisfied with insufficient ease of 5 mm and -70 mm respectively. This may be due to the fact that these subjects have triangle body shapes and possibly accepted less ease at the hip in order to have satisfactory ease at other body dimensions. In order to accommodate the large hip circumference of subject 49 (that is 265 mm larger than her bust measurement), the subject was wearing a dress jacket that is a size too big. In the one-to-one interview she stated that: "At least it (the dress jacket) is figure-like, it is shaped". The subject's response regarding fit preference in Table 8 indicates that the subject preferred semi-fitting garments and therefore found the shaped style of the dress jacket acceptable.
- In the instance of subject number 42, the subject was satisfied with the provided ease allowance because it was only 4 mm less than the recommended norm.
- Subject number 50, with a dress jacket that was a size too large, was satisfied with ease that exceeds the norm. This can be ascribed to the fact that she had a square body shape, was obese according to her BMI and preferred wearing loose-fitting garments (see Table 8).

Due to the above-mentioned discrepancies the range for subjective satisfaction was adapted from 112 mm to 162 mm in order to satisfy the optimum number of subjects.

From Table 12 it can be seen that the two expert judges agreed on the following:

- In eight instances (13, 52, 19, 18, 8, 25, 3, 27) the judges agreed that adequate amounts of ease ranged between 53 mm and 224 mm. The judges evaluated that the ease was adequate for two subjects (13, 41) even though it was less than the norm (56 mm and 76 mm respectively). Subject 27 was also rated as experiencing adequate ease (of 224 mm) even though the ease exceeded the prescribed norm by 24 mm. This supports the finding that the larger wearers require more ease than the smaller sized wearers.
- In eight instances (33, 43, 49, 22, 26, 24, 34, 21) the judges agreed that insufficient amounts of ease ranged between 5 mm and 162 mm. The ease allowances for subjects 34 and 21 (155 mm and 162 mm respectively) were within the recommended range but the judges agreed that it was insufficient. This reinforces the finding that the larger wearers require more ease allowance.
- For three subjects (43, 49, 24) negative values were calculated and therefore the garment was too tight over the hips.
- Only one subject (50) was considered to have excess ease at the hip (309 mm).

Comparison of the subjective views to the objective evaluations reveals that both parties agreed in three instances (52, 19, 18) that the ease allowances were adequate, ranging from 130 mm to 142 mm.

From the above findings, it can be seen that in contrast to the mostly corresponding subjective and objective views regarding adequate ease in the bust area, the opinions at the hip location corresponded less. The fit preferences of the subjects may have impacted on their satisfaction with the fit. It must be kept in mind that the subjects' opinions differed from the experts' opinions due to the fact that the subjects wear the garments and experience the fit themselves. Expert judges base their opinions on visual interactions such as the seam placement and the location and orientation of wrinkles (Ashdown & DeLong 1995:48).

Viewing the available ease in terms of the subjective and objective satisfaction across size categories it becomes clear that for the smaller sizes (up to and including size RR97) an ease range between 56 mm to 136 mm could be adequate for an optimum number of wearers. In the instance of the larger sizes (from size RR102 and above), 100 mm to 225 mm could be adequate.

From these results it can be concluded that:

- The ARMSCOR specifications do not provide a drop value but it seems as if the manufacturer made provision for a drop between 40 mm and 120 mm.
- The drop differences between 40 mm and 90 mm allowed by the manufacturer still did not accommodate the hip dimensions for all of the subjects.
- Bust dimension as the only key dimension cannot ensure that there will be enough ease in the hip area, or that the jacket will fit satisfactorily.
- The subjects with triangle body shapes in particular had less ease available at the hip location.
- Smaller sizes (up to and including size RR97) were satisfied with less ease than sizes above RR97.

4.3.2.3 Back length

Although back length is not a key dimension, the findings regarding back length are presented because of the implications for ease in the hip area. The differences between the back length dimensions of the body and the garments provide useful information regarding the position of the hemline of the jacket in relation to the hip circumference. If the jacket is shorter, the hemline falls above the fullest part of the hip. If the hemline reaches lower than the buttock line it means that it extends past the fullest part of the hips. The amount of ease allowed is important because it means that the jacket will fold in under the body in a sitting position, requiring more ease.

The back length of the jacket is specified in the ARMSCOR specifications (Document number KMG 27/71) as one of the nominal finished garment measurements and is therefore a secondary dimension. The differences between the back length of the jacket and the back length of the subject (from cervical to waist and waist to buttock) are presented in Table 13. The opinions of the subjects and judges regarding the back length of the jacket are not tabled as the back length dimension is only indirectly involved with ease.

TABLE 13: FIT IN TERMS OF DIFFERENCES IN THE BACK LENGTH OF THE SUBJECT AND THE DRESS JACKET

ARMSCOR Specifications		Subject number	Back length measurement (Issued garment)(mm)	Back length measurement (Subject) (mm)	Difference in length per subject (mm)
Size designation category	Back length measure-ment (Garment) (mm)				
RR76	660	-	640	-	-
RR81	670	1	660	594	66
RR87	680	13	680	642	38
		12		654	26
RR92	690	52	684	696	-12
		33		680	4
		43		723	-39
RR97	700	49	698	735	-37
		41		610	88
		22		618	80
RR102	710	19	700	680	20
		26		668	32
		18		679	21
RR107	720	51	720	687	33
RR112	720	8	700	752	-52
		25		694	6
		3		653	47
		24		674	26
		42		599	101
RR122	-	50	725	715	10
		32		670	55
		34		669	26
RR132	-	27	720	687	33
		21		676	44

From the ARMSCOR specifications in Table 13 it can be seen that the back length dimension increases with 10 mm as the size increases up until size RR107. Between sizes RR107 and size RR112 there is no increase for the back length dimension. The back length dimension of the last two sizes (RR122 and RR132), are not indicated in the ARMSCOR specifications.

Comparison of the issued garment measurements to the ARMSCOR specifications in Table 13 reveals that six out of eight of the issued garment measurements are less than specified. In three instances, for sizes RR76, RR81 and RR112 the issued garments are up to 20 mm shorter than specified at the back length dimension. The jackets would still have reached lower than the broadest part across the hips even if they had been the correct length.

From the difference in length per subject in Table 13, it can be seen that in the instance of 16 subjects (numbers 1, 13, 12, 41, 22, 19, 26, 18, 51, 3, 24, 42, 32, 34, 27, 21) the back lengths of the dress jackets were more than the back length of the subjects by as much as 101 mm (subject 42). It is therefore not surprising that the subjects could have been satisfied in this regard. A longer jacket has a vertical line impact that will result in a slimmer appearance for the wearer as it hides figure flaws such as larger buttocks and broader hips.

Consideration of the findings across the size categories reveals that the back lengths of the garments worn by the subjects wearing the smaller sizes (up to and including size RR97) were less (thereby reaching above the broadest part of the hips) than the back length dimensions of the dress jackets worn by the plus-sized wearers, wearing sizes above size RR97. This has implications for ease at the hip locations for subjects wearing the larger sizes as the dress jacket will reach below the broadest part of the subject's hip dimension.

It can be concluded from the results for back length that:

- The majority of the hemlines of the dress jackets reaches lower than the fullest part of the hips and will impact on the amount of ease in this area.
- For the size categories above size RR97 the back length dimension tends to reach lower than the broadest/fullest part of the hips.

4.3.2.4 Back width

In Table 14, the satisfaction with ease allowance for the back width is presented. The back width of the jacket is specified in the ARMSCOR specifications (Document number KMG 27/71) as one of the nominal finished garment measurements and is therefore a secondary dimension.

To interpret the findings in terms of ease, the norm for ease at the back width location is inferred from pattern design guidelines at a minimum as 24 mm (see Table 1). This amount is inadequate in the instance of a garment that will be worn over another garment. The afore-mentioned is in accordance with Cooklin (1995:7) who states that the back width measurement is mainly a function of the garment type. The function of the garment prescribes the ease required at this location. For example, the back width measurement of a coat would require more ease than the back width of a shirt. This dimension is important for providing sufficient comfort and freedom of movement.

When designing a garment, it is generally accepted that 50 mm is provided in the back width dimension for a closely fitted garment such as the dress jacket. To further investigate the norm for ease at the back width dimension, Cooklin's (1995:30) standard for designing a pattern for a fairly close fitting jacket to be worn by an outsized wearer was consulted. Cooklin (1995:30) prescribes an across back garment measurement of 434 mm for a back width body measurement of 343 mm, thereby allowing 91 mm of ease. The above standard confirms that an initial ease allowance of 24 mm is insufficient in the instance of larger wearers. A norm of 50 mm to 75 mm will therefore be used to interpret the findings in terms of sufficient ease.

The differences between the back width of the jacket and the back width of the subject are presented in Table 14. The subjective opinions of the subjects and objective opinions of the two fit judges are also presented.

TABLE 14: SATISFACTION WITH FIT IN TERMS OF EASE ALLOWANCE FOR THE DRESS JACKET AT THE BACK WIDTH LOCATION

ARMSCOR Specifications		Subject number	Back width measurement (Issued garment) (mm)	Back width Measurement(subject)(mm)	Ease allowance per subject (mm)	SUBJEC-TIVE VIEWS			OBJECTIVE VIEWS					
									Judge 1			Judge 2		
Size designation category	Back width measurement (mm)					Adequate ease	Insufficient ease	Excess ease	Adequate ease	Insufficient ease	Excess ease	Adequate ease	Insufficient ease	Excess ease
RR76	340	-	340	-	-	-	-	-	-	-	-	-	-	-
RR81	350	1	355	290	65	-	-	-		✓			✓	
RR87	360	13	360	345	15	-	-	-	✓			✓		
		12		330	30	-	-	-	✓			✓		
RR92	370	52	370	365	5		✓		✓			✓		
		33		350	20	✓			✓			✓		
		43		370	0	-	-	-	✓			✓		
RR97	380	49	380	330	50		✓		✓			✓		
		41		320	60		✓		✓			✓		
		22		340	40	✓			✓			✓		
RR102	390	19	390	345	45	✓					✓			✓
		26		385	5	-	-	-	✓			✓		
		18		360	30	-	-	-		✓			✓	
RR107	400	51	410	380	30		✓			✓		✓		
RR112	410	8	430	365	65	-	-	-	✓					✓
		25		375	55	-	-	-	✓			✓		
		3		370	60		✓		✓			✓		
		24		380	50	-	-	-	✓			✓		
		42		375	55		✓		✓			✓		
RR122	-	50	450	395	55	✓			✓					✓
		32		375	75	-	-	-		✓		✓		
		34		410	40		✓			✓		✓		
RR132	-	27	470	420	50	✓			✓				✓	
		21		460	70	✓				✓			✓	

From the ARMSCOR specifications in Table 14 it can be seen that the back width dimension increases with 10 mm increments for each size category. The back width of the last two sizes, RR122 and RR132 are not indicated in the specifications. When comparing the issued garment measurements to the ARMSCOR specifications it can be seen that for five out of eight sizes (RR76, RR87, RR92, RR97, RR102) the back width measurements are in accordance with that of the garment specifications. The issued garment back width measurements of garment sizes above RR102 increases with 20 mm increments for each new size.

The ease allowances at the back width range between 0 mm to 75 mm. When compared to the norm of 50 mm to 75 mm, it can be seen that:

- Twelve subjects (1, 49, 41, 8, 25, 3, 24, 42, 50, 32, 27, 21) had adequate ease when compared to the norm.
- Eleven subjects (13, 12, 52, 33, 43, 22, 19, 26, 18, 51, 34) had less ease than the norm available at the back width.
- None of the subjects had ease allowances exceeding the maximum range of the norm of 75 mm.

The subjective viewpoints regarding satisfaction with the ease allowance at the back width, presented in Table 14, revealed the following:

- Six out of 13 subjects that commented (33, 22, 19, 50, 27, 21) were satisfied with ease ranging from 20 mm to 70 mm.
- Seven out of 13 subjects (52, 49, 41, 51, 3, 42, 34) were of the opinion that the amounts of ease were insufficient, ranging between 5 mm and 70 mm.
- None of the subjects were of the opinion that the amounts of ease were in excess.

Table 8 presents subjective fit preferences and reveals reasons for satisfaction with ease allowance that is less than the recommended norm. It is indicated in Table 8 that subjects 33 and 22 (who were satisfied with ease allowance of 20 mm and 40 mm respectively) preferred garments that are tight and semi-fitting. This may be the reason that these subjects did not complain regarding the insufficient ease at this location.

Subject number 19 was satisfied with an ease amount of 45 mm which is only 5 mm less than the recommended norm. It is interesting to note that during the one-to-one interview (see Table 9) this subject commented that: *"Dit sit baie styf en dit is baie ongemaklik"*. The back width location is a very important dimension for providing sufficient comfort, therefore it can be inferred that the subject's overall discomfort with the fit of the dress jacket was the result of insufficient ease at the back width.

Analysis of the reasons for subject dissatisfaction with ease allowance within the norm revealed that:

- Subject 41 may have been dissatisfied with 60 mm of ease due to the fact that she has a square body shape and is overweight according to her BMI. It is an accepted fact that larger wearers require more ease in order to be comfortable. During the one-to-one interview, this subject stated that: "It (dress jacket) is definitely too tight. I cannot lift my arms, it is totally uncomfortable". It can be inferred from this comment that the subject is overall dissatisfied with the comfort of the garment. The back width location is an important dimension for providing sufficient comfort and freedom of movement and therefore it is not unrealistic that the subject's complaint can be related to the back width location. This subject is furthermore dissatisfied with the ease and comfort at her upper arm. Discomfort at this location can impact on the comfort at other locations such as the back width.
- Subject 3 was also dissatisfied with 60 mm of ease at the back width. Dissatisfaction may be ascribed by this subject having an oval body shape (which is full and rounded over the shoulder and back width location) and being categorised as obese according to her BMI value. Even though this subject wore a

garment that was one size too big, she commented during the one-to-one interview that her jacket was too tight. Once again, the overall dissatisfaction with the comfort of the garment would result in dissatisfaction with the ease allowed at the back width location.

Due to the above discrepancies the range of subject satisfaction with back width ease is adapted to 45 mm to 70 mm.

Analysis of the objective views of the judges presented in Table 14 reveals that the judges agreed on the following:

- In the instance of 13 subjects (13, 12, 52, 33, 43, 49, 41, 22, 26, 25, 3, 24, 42) both judges agreed on adequate amounts of ease that ranged between 0 mm and 60 mm.
- In the instance of three subjects (1, 18, 21) insufficient amounts of ease indicated by both judges ranged between 30 mm and 70 mm.
- In one instance (19) both judges agreed on an excess amount of ease namely 45 mm.

The objective evaluation revealed that the judges perceived ease allowances that are far less than the norm as being adequate, such as in the case of subjects 13, 52, 33, 43, 26 with ease allowances of 15 mm, 5 mm, 20 mm, 0 mm and 5 mm respectively. This may be ascribed to sufficient or excess ease allowances at other dimensions (such as the bust and upper arm) that could compensate for ease at the back width dimension. The afore-mentioned may have resulted in the impression that the ease was adequate at the back with. Minimum ease at this dimension may have been evaluated as adequate because it was aesthetically pleasing despite not providing comfortable ease of movement.

Due to the above, it was decided to eliminate the above discrepancies from the judges' satisfaction range in order to satisfy the optimum number of subjects with adequate ease. The objective range was therefore adapted to a range of 30 mm to 60 mm for back width ease.

The subjective and objective findings presented above reveal that the subjective views were not in correspondence with the objective views. In only two instances (22, 33) were both parties in agreement on adequate ease ranging between 20 mm and 40 mm. This may once again be due to the fact that the wearer experiences the comfort herself while the expert judges base their opinions on visual evaluations.

Consideration of the available ease for back width, in terms of the subjective and objective satisfaction across size categories reveals that for the smaller sizes up to and including size RR97 an ease range between 30 mm to 50 mm could be adequate for an optimum number of wearers. In the instance of the larger sizes, 45 mm to 70 mm could be adequate.

It can be concluded from the results for back width that:

- The manufacturer provided dress jackets with broader back widths than specified in the specifications in order to accommodate the larger wearers.
- The plus-sized wearers require more ease at the back width location in order to be comfortable.

4.3.2.5 Waist circumference

Table 15 presents the satisfaction with fit in terms of ease at the waist circumference. It is generally accepted that a minimum of 13 mm to 40 mm is required at the waist location for a fitted garment's block pattern (see Table 1). This amount is inadequate when the garment is intended to be worn over another. Furthermore, the outsized figures have thicker waistlines. Cooklin (1995:30) states that the ease allowed at the waist circumference should comprise 5,1 percent of the waist circumference of the subject (see Table 4). Application of Cooklin's standard (1995:30) indicates that the subject with the smallest waist needs 32 mm ease and the subject with the largest waist needs 62 mm ease for a moderately fitted garment with an indented waistline. Six out of 23 subjects (26 percent) had diamond or oval body shapes with protruding waistlines. Furthermore, seven out of 23 subjects (30 percent) had triangular body types (with a large difference between the waist and hip dimensions). The above factor influences the amount of ease required at the waist dimension as the dress jacket gradually tapers to the waist from the larger hip dimension. Due to the above factors, a range from 70 mm to 150 mm is the norm used to interpret the findings in terms of sufficient ease at the waist circumference. This will not only accommodate the waistline but also facilitate the design of the jacket garment.

TABLE 15: SATISFACTION WITH FIT IN TERMS OF EASE ALLOWENCE FOR THE DRESS JACKET AT THE WAIST CIRCUMFERENCE

Size designation category	Subject number	Waist measurement (Issued garment) (mm)	Waist measurement (Subject) (mm)	Ease allowance per subject (mm)	SUBJECTIVE VIEWS			OBJECTIVE VIEWS					
								Judge 1			Judge 2		
					Adequate ease	Insufficient ease	Excess ease	Adequate ease	Insufficient ease	Excess ease	Adequate ease	Insufficient ease	Excess ease
RR76	-	760	-	-	-	-	-	-	-	-	-	-	-
RR81	1	810	628	182	-	-	-	✓			-	-	-
RR87	13	850	683	167	-	-	-	✓			✓		
	12		745	105	-	-	-			✓	✓		
RR92	52	880	731	149		✓		✓			✓		
	33		745	135	✓			✓			✓		
	43		785	95	✓			✓			✓		
RR97	49	940	733	207	✓			✓			✓		
	41		860	80	✓			✓			✓		
	22		864	76	✓			✓			✓		
RR102	19	1020	815	105	✓					✓			✓
	26		859	161	-	-	-		✓		✓		
	18		861	159	✓					✓	✓		
RR107	51	830	890	-60	✓				✓		✓		
RR112	8	1100	888	212	-	-	-	✓					✓
	25		955	145	-	-	-	✓			✓		
	3		949	151	✓			✓			✓		
	24		1012	88	-	-	-		✓		✓		
	42		1030	70		✓		✓			✓		
RR117	-	-	-	-	-	-	-	-	-	-	-	-	-
RR122	50	1210	912	298	✓					✓			✓
	32		1035	175	-	-	-		✓		✓		
	34		1050	160	✓			✓			✓		
RR132	27	1320	1044	276	-	-	-	✓			✓		
	21		1208	112		✓			✓			✓	

Table 15, presented above, shows that the ARMSCOR specifications do not prescribe nominal finished garment measurements at the waist dimension.

The ease allowance per subject in Table 15 are compared to the norm of 70 mm to 150 mm and reveal the following:

- Eleven subjects (12, 52, 33, 43, 41, 22, 19, 25, 24, 42, 21) had amounts of ease that are within the adequate range.
- Eleven subjects (1, 13, 49, 26, 18, 8, 3, 50, 32, 34, 27) had more ease than the norm at the waist location.
- One subject (51) had insufficient ease.

The subjective evaluations regarding the waist are presented in Table 15 and reveal the following:

- A majority of eleven out of 23 subjects (33, 43, 49, 41, 22, 19, 18, 51, 3, 50, 34) commented that they were satisfied with waist ease.
- These subjects expressed satisfaction with ease allowances ranging between 76 mm and 298 mm.
- Three subjects (52, 42, 21) were of the opinion that their jackets provided insufficient ease (149 mm, 70 mm and 112 mm respectively).
- None of the subjects experienced excess amounts of ease at this location.
- If "no comments" could be interpreted as "satisfied", then three out of nine subjects (12, 25, 24) who did not comment had enough ease while six out of nine subjects (1, 13, 26, 8, 32, 27) who did not comment were satisfied with excess ease.

The overall satisfaction expressed by the subjects regarding ease at the waist may be ascribed to the fact that the majority of the subjects had adequate or excess amounts of ease providing freedom of movement. Excess amounts of ease at the waist could be caused by the necessity to take a larger size in order to accommodate the hip location.

Investigation of the reasons for satisfaction with ease allowances higher or lower than the norm reveals that:

- Subject 49 may have been satisfied with 207 mm of ease at the waist due to the fact that she had a triangle body shape. As previously mentioned, excess ease at the waist location could be the result of accommodating the hip location by wearing a dress jacket that is too big, as in the case of subject 49.
- Subject 18 was satisfied with ease at the waist that was only 9 mm more than the recommended range. During the one-to-one interview, subject 18 stated that: "...it fits great...it fits me well". It can be inferred from this comment that she is overall satisfied with the fit of her dress jacket and thereby also satisfied with the ease allowed at the waist location.
- Subject number 50 was satisfied with 298 mm of ease which is far more than prescribed by the norm. Her satisfaction may be due to the fact that she is obese according to her BMI value and has a square body shape. Due to the afore-mentioned, this subject wears a dress jacket that is one size too big which results in excess ease at the waist location. It is clear from Table 8 that this subject favours loose fitting garments and is subsequently satisfied with excess ease allowance.
- Subject number 51 was satisfied with insufficient ease allowance that is far below the recommended norm. Her satisfaction could be due to the fact that she is already wearing a dress jacket that is a size too big. As a result of this subject's square body shape and the fact that she is obese according to her BMI value, the additional ease provided by the larger garment is insufficient to accommodate her large abdomen.

Investigation of the reasons for dissatisfaction of subject number 21, allows the following to be inferred:

- This subject had an oval body shape which was characterised by a protruding abdomen and thicker waistline and therefore the subject might have required more ease in the waist location. It is not unrealistic for a subject with a plus-sized figure type to experience insufficient amounts of ease at this location.

- The dress jacket is slightly tapered at the waist and therefore a person who prefers to wear loose-fitted garments may experience the amount of ease as insufficient.

Due to the above discrepancies, it was decided to adapt the range of subject satisfaction for the waist circumference to a range of 76 mm to 151 mm.

With regard to the objective evaluation, the following is clear:

- The judges agreed that the jackets of 12 subjects (13, 52, 33, 43, 49, 41, 22, 25, 3, 42, 34, 27) had sufficient ease at the waist. Their opinion corresponded with that of seven subjects (33, 43, 49, 41, 22, 3, 34) and in only four instances differed from the norm.
- The judges agreed with subject 21 that there was insufficient ease at her waist circumference.
- The judges agreed that the ease at the waist of subject 27 was adequate even though it was far more than the norm. This may be ascribed to the fact that subject 27 is a plus-sized wearer with oval body shape and therefore the judges may have inferred that the subject would require additional ease.
- The judges expressed satisfaction with ease allowances ranging between 70 mm and 207 mm and viewed excess ease as ranging between 105 mm and 298 mm.

Comparison of the subjective views to the objective evaluations reveals that both parties agreed in seven instances (33, 43, 49, 41, 22, 3, 34) on adequate ease allowances ranging from 76 mm to 207 mm. Their correspondence regarding adequate ease allowances validates the minimum value of the norm at 70 mm.

Subjective and objective fit preferences and perceptions should once again be kept in mind. Furthermore, satisfaction due to excess amounts of ease at the waist could be related to the functional performance of the garment. The subjects were required to perform certain activities while wearing the garment such as to 'drill' and to 'salute'. The subjects may therefore have preferred excess ease to provide comfortable movement.

Comparison of the waist dimension to the bust dimension reveals that:

- For the smaller sizes (up to and including size RR97) a waist dimension that is between 20 mm and 40 mm smaller than the bust dimension would provide adequate ease of between 80 mm to 150 mm for an optimum number of wearers.
- For the larger sizes (above size RR97), a waist dimension that is between 10 mm and 20 mm smaller than the bust dimension would provide adequate ease between 105 mm to 210 mm.

It can be concluded from the above results for the waist dimensions that:

- The waist dimension is not prescribed in the specification.
- Smaller sizes (up to and including size RR97) need less ease than sizes above RR97.

4.3.2.6 Upper arm circumference

It is important to investigate the satisfaction with fit in terms of ease at the upper arm as the ease allowances at this location impact on the ease at other locations. In the instance of insufficient ease at the upper arm, garment stress is caused which results in discomfort across the back width and the bust location of the garment, as the upper arm and armhole can pull and cause unsightly wrinkles.

In Table 16, the satisfaction with the amounts of ease at the upper arm is presented. When designing a block pattern for the sleeve, a minimum of 30 mm to 50 mm is added to the upper arm to allow for movement. This amount is increased if the garment is to be worn over other garments, as in the case with the dress jacket. It is generally accepted that an absolute minimum of 50 mm of ease is required at this location for a closely fitted garment (see Table 1). It is assumed that this amount can be doubled for a fitted garment which is worn over another.

In order to further investigate the norm for ease at the upper arm, Cooklin's (1995:30) standard was consulted (see Table 4 in Chapter 2). Cooklin (1995:30) recommends a garment bicep girth measurement of 448 mm for an upper arm girth body measurement of 378 mm thereby allowing 70 mm of ease allowance. The norm used to interpret the findings in terms of sufficient ease is therefore between 50 mm and 100 mm.

Table 16, overleaf presents the findings with regard to satisfaction with fit in terms of ease allowance for the dress jacket at the upper arm location.

TABLE 16: SATISFACTION WITH FIT IN TERMS OF EASE ALLOWANCE FOR THE DRESS JACKET AT THE UPPER ARM LOCATION

Size designation category	Subject number	Upper arm measurement (Issued garment) (mm)	Upper arm measurement (subject) (mm)	Ease allowance per subject (mm)	SUBJECTIVE VIEWS			OBJECTIVE VIEWS					
								Judge 1			Judge 2		
					Adequate ease	Insufficient ease	Excess ease	Adequate ease	Insufficient ease	Excess ease	Adequate ease	Insufficient ease	Excess ease
RR76	-	330	-	-	-	-	-	-	-	-	-	-	-
RR81	1	334	277	57	-	-	-	✓			-	-	-
RR87	13	370	272	98	-	-	-	✓			✓		
	12		280	90	-	-	-	✓			✓		
RR92	52	380	372	8	✓			✓			✓		
	33		306	74	✓			✓			✓		
	43		331	49	-	-	-	✓				✓	
RR97	49	380	331	49		✓		✓				✓	
	41		325	55		✓		✓				✓	
	22		329	51	✓				✓		✓		
RR102	19	380	300	80	-	-	-	✓			✓		
	26		335	45	-	-	-	✓			✓		
	18		330	50	✓			✓			✓		
RR107	51	420	334	86		✓			✓		✓		
RR112	8	420	336	84	-	-	-			✓	✓		
	25		341	79	-	-	-	✓			✓		
	3		346	74	✓			✓			✓		
	24		345	75	-	-	-	✓			✓		
	42		329	91		✓		✓			✓		
RR117	-	-	-	-	-	-	-	-	-	-	-	-	-
RR122	50	410	379	31		✓		✓			✓		
	32		365	45	-	-	-		✓			✓	
	34		390	20	✓				✓			✓	
RR132	27	400	410	-10	✓				✓			✓	
	21		465	-65	✓				✓			✓	

The ARMSCOR specifications do not prescribe nominal finished garment measurements for the upper arm location.

Comparison of the garment upper arm measurements to the norm of 50 mm to 100 mm ease allowance presented in Table 16 reveals that:

- Fourteen subjects (1, 13, 12, 33, 41, 22, 19, 18, 51, 8, 25, 3, 24, 42) had ease ranging between the suggested norm of 50 mm to 100 mm.
- Nine subjects (52, 43, 49, 26, 50, 32, 34, 27, 21) had less ease than the norm.
- From the above mentioned nine subjects, four (52, 34, 27, 21) did not have the absolute minimum adequate ease in the upper arm location.

The subjective viewpoints for ease at the upper arm, presented in Table 16 reveal the following:

- Eight out of thirteen subjects who commented regarding their satisfaction with the amounts of ease at the upper arm location were satisfied with ease ranging between -65 mm and 74 mm.
- Of the ten subjects who made no comment, seven subjects (1, 13, 12, 19, 8, 25, 24) had sufficient ease according to the norm while three (43, 26, 32) had slightly less ease (49 mm, 45 mm and 45 mm respectively).
- Five subjects (49, 41, 51, 42, 50) experienced amounts of ease that ranged from 31 mm to 91 mm as being insufficient.
- No subjects were of the opinion that the amounts of ease were in excess.

The above findings regarding the subjects' dissatisfaction due to insufficient ease allowance at the upper arm are supported by the following subjective comments (see Table 9):

- "It is too narrow around the arms, the comfort is poor. You cannot lift your arms" (Subject 42).
- "It is uncomfortable and it is too tight at the sleeves...I cannot drill properly, I cannot salute properly. It is uncomfortable" (Subject 51).
- "It is definitely too tight, I cannot lift my arms" (Subject 41).

Investigation of the reasons for subject satisfaction with ease allowances that were less than the norm revealed that:

- Subject 52 was satisfied with the theoretically insufficient ease at the upper arm location. It is important to note that during the one-to-one interview she stated that: "...the armhole must be bigger" (see Table 9). From the above comment it can be inferred that although the subject experienced discomfort at the armhole this may have been the result of insufficient ease at the upper arm location.
- Subject numbers 34, 27 and 21 were satisfied with ease that was far below the recommended norm. All three of these subjects had oval body shapes and were obese according to their BMI values. In the instance of two subjects (34, 21) insufficient ease may have been the result of wearing a dress jacket that is one size too small. Even though subject 27 wore a size too large, the ease at the upper arm remained insufficient. As previously stated, subject 21 commented that she had merely accepted the fact that the dress jacket is her uniform and that there is nothing that she can do about it. The other two subjects (34, 27) might have agreed.

Due to the above discrepancies it seems acceptable to adapt the ease range of subjective satisfaction to a range of 50 mm to 74 mm.

The objective views of the judges presented in Table 16 indicate that:

- Both judges agreed that the jackets of 12 subjects (13, 12, 52, 33, 19, 26, 18, 25, 3, 24, 42, 50) had sufficient amounts of ease at the upper arm location. Their opinion corresponded with that of four subjects (52, 33, 18, 3).
- The judges expressed satisfaction with ease ranging between 8 mm and 98 mm.
- Both judges agreed that four subjects (32, 34, 27, 21) experienced insufficient ease ranging from -65 mm to 45 mm. This finding supports the minimum range of the recommended norm of 50 mm.
- None of the subjects were evaluated by both judges as experiencing excess amounts of ease at this location.

The objective evaluation by the judges reveals that ease allowance that was less than the norm was perceived as being adequate, as in the case of subjects 52 and 50 with ease allowances of 8 mm and 31 mm respectively. This may be ascribed to sufficient or excess ease allowances at other dimensions (such as the bust and back width) that compensate for ease at the upper arm dimension, resulting in the impression that the ease is adequate at the upper arm. Due to the above, it was decided to eliminate the above discrepancies from the judges' satisfaction range in order to satisfy the optimum number of subjects with adequate ease. The objective range was therefore accepted as a range of 45 mm to 98 mm.

In contrast to the opinions of the judges, three out of four subjects (34, 27, 21) who had insufficient ease according to both judges' evaluation, were satisfied with the ease allowance at the upper arm location. Once again, subjective fit preferences should be taken into consideration as two out of the above-mentioned three subjects preferred wearing a semi-fitting garment.

It is evident from Table 16 that the majority of subjects in the size designation categories RR97 to RR112 have adequate amounts of ease in the upper arm. The last five subjects (50, 32, 34, 27, 21) with the largest sized garments in the size categories have insufficient amounts of ease at the upper arm. Analysis of the issued garment measurements at the upper arm indicated that less upper arm width is provided for sizes RR122 and RR132 (the two largest size categories) than for the previous smaller sizes.

Consideration of the available ease in terms of subjective and objective satisfaction across size categories indicates that for the smaller sizes (up to and including size RR97) an ease range between 45 mm and 75 mm could be adequate for an optimum number of wearers. In the instance of the larger sizes, 75 mm to 100 mm could be adequate.

It may be concluded from these findings that:

- The ease allowance at the upper arm location should be increased for the larger sizes to accommodate the plus sized wearers.
- Subjects wearing smaller sizes (up to and including size RR97) were satisfied with less ease than the subjects wearing the sizes above size RR97.

4.3.2.7 Scye circumference

The scye circumference of a garment could have serious implications for the ease of movement. The scye is commonly known as the armhole dimension and is a location primarily involved in upper torso arm movements. To further investigate the ease of movement at the scye circumference, the ease allowances are presented in Table 17.

It is general practice in industry to add 50 mm to the scye circumference as minimum amount of ease when designing a block pattern. This standard is calculated as follows: 15 mm is added to the front of the armhole and 15 mm to the back. The armhole is further lowered by 10 mm at the front and back to allow for sleeves. The standard for minimal acceptable ease allowance is in line with the principle developed by Joseph-Armstrong (2000:29) who explains that when draping a garment, ease should be added at the curve of the armhole between the mid-armhole and the side-seam. Joseph-Armstrong (2000:29) elaborates that the ease should allow room for the muscle and fleshy connection between the body and the arm when the arm is in forward motion. At the front mid-armhole, 6 mm of ease is added and at the side seams 13 mm (Joseph-Armstrong 2000:29). This 13 mm ease allowance is multiplied by two (26 mm) as it consists of both the front side seams and the back side seams.

If the garment is to be worn over another garment, two to three times more ease is needed. The minimal recommended ease allowance for the jacket scye circumference is therefore 50 mm and the maximum 150 mm. The findings regarding the amount of sufficient ease at the scye circumference will be interpreted against this norm

TABLE 17: FIT IN TERMS OF EASE ALLOWANCE FOR THE DRESS JACKET AT THE SCYE CIRCUMFERENCE

Size designation category	Subject number	Scye circumference measurements (mm)		Ease allowance per subject (mm)
		Issued garment	Subject measurement	
RR76	-	490	-	-
RR81	1	485	430	55
RR87	13	500	395	105
	12		386	114
RR92	52	520	284	236
	33		389	131
	43		399	121
RR97	49	536	462	74
	41		446	90
	22		400	136
RR102	19	570	433	137
	26		420	150
	18		473	97
RR107	51	565	420	145
RR112	8	623	470	153
	25		419	204
	3		470	153
	24		430	193
	42		495	128
RR122	50	635	440	195
	32		448	187
	34		442	193
RR132	27	640	475	165
	21		499	141

The ARMSCOR specifications (Document number KMG 27/71) do not prescribe nominal finished garment measurements for the scye circumference.

Table 17 shows that the amounts of ease in the scye circumferences range from 55 mm to 236 mm. When compared to the norm, the following can be seen from Table 17:

- Fourteen subjects (1, 13, 12, 33, 43, 49, 41, 22, 19, 26, 18, 51, 42, 21) have the recommended amount of ease at the scye circumference.
- The amount of ease for two subjects (8, 3) is almost equal to the norm (153 mm).
- Nine subjects (52, 8, 3, 25, 24, 50, 32, 34, 27) have excess amounts of ease at the scye circumference.

It is important to note that seven out of the nine subjects mentioned above are within the last three size categories. It can therefore be inferred that the larger sizes have deeper armholes.

The length of the scye circumference determines the depth of the armhole. If the armhole is too high it will pull. If the armhole is too deep, it will restrict movement as the sleeve is pulled to the bodice. The wearer will experience strain in the armhole area at the front and back and will experience pulling in the upper arm area. The ease at the scye circumference can therefore cause complications for other garment locations. The above is supported by comments made by subject number 52 (see Tables 9 and 10) who had excess ease of 236 mm: "I think the whole thing (dress jacket) is not designed correctly". This subject furthermore stated that: "It is uncomfortable…and the armhole must be bigger". It is interesting to note that the subject thinks that the armhole is too small due to the fact that it causes restriction. The restriction of movement is actually caused by excess ease at this location.

It can be concluded from the results for scye circumference that:

- Excess ease at this location will cause restriction.
- Insufficient or excess ease at this location is likely to impact on the comfort experienced at other dimensions on the same horisontal level such as the bust, back width and upper arm dimensions.
- Especially the larger sizes provide excess ease at the scye circumference.

In summary, from the findings in the above ease tables (Tables 11 -17) it can be concluded that:

- The amounts of ease allowances for the bust, hip, back width, waist and upper arm dimensions should be increased for the larger sizes in the size chart as it is evident from the findings that the plus-sized wearers require more ease than persons wearing the smaller sizes.
- The issued garments should not deviate from the ARMSCOR specifications as this will have an impact on the ease allowances.
- It is important that the subjects are issued with the correct size dress jacket in order to have adequate ease.
- The bust location as an only key dimension cannot adequately describe the garment dimensions and ease allowance at other locations.
- The style of the dress jacket does not accommodate a variety of body shapes. Dimensions such as the hip location should therefore be considered when designing the jacket.
- The ease allowance at the upper arm and scye circumference should be carefully researched to establish acceptable norms for all sizes.

The above concludes the investigation of the satisfaction of fit in terms of ease allowances. In the next section, functionality of the dress jacket as it is influenced by the ease allowances is further explicated.

4.3.3 Functionality of the dress jacket in terms of ease while completing mobility tests

In addition to the above findings, the results of the motor tests provide in-depth information regarding the functionality of the dress jacket in terms of ease and mobility.

The motor test table is based on the various actions the subjects were required to perform in order to test the functionality of the dress jacket in areas where movement ease is important. Two anthropometrists (also trained to judge fit) evaluated the subjects. The actions were analysed to determine which body areas and corresponding garment positions would be involved during the action. This was done with consideration of the activities that the subjects perform, such as marching in parade which requires ease in the scye and back width locations.

The instructions involved for the seven mobility tests are presented below:

1. Body bends: The instruction requires bending the body sideways and to the front. It is assumed that this type of action will be performed by a person sitting at a desk, turning to reach for an item, answering a telephone, etcetera.
2. Overhead arm extensions: The instruction requires extending the arms overhead and then to bend the elbows. It is assumed that this type of action will be performed when reaching for a file in a high cabinet, etcetera.
3. Trunk twists: The instruction requires the extending of arms perpendicular to the sides of the torso and the twist of the torso to the left and to the right. It is assumed that this type of action will be performed while reaching to pick up an item or turning to reach for an item, etcetera.
4. Cross body arm extensions: The instruction requires the reaching of arms across the chest. It is assumed that this type of action will be performed such as doing administrative work and filing, working in store rooms.
5. Saluting: The instruction requires the subjects to 'Salute' (raising right arm, index finger to touch above eyebrow).
6. Reaching forward: The instruction requires the subjects to sit on a chair and reach forward. This is a very basic action performed by a person completing administrative/office work.
7. Squats: The instruction requires standing upright with feet 'shoulder width' apart and to squat down to a full knee bend. It is essential to easily perform this action, especially in the instance of subjects working in storerooms.

The findings for the mobility tests were summarised and analysed. It was found that the first six tests required upper trunk movements and the comments and opinions of the judges focused on the back width, bust, scye, upper arms as well as elbows. The comments and opinions therefore indicated numerous similarities. The seventh test evaluated the ease of movement of the lower torso and the comments and opinions of the judges focused on the waist and the hip locations.

The results of the seven mobility tests are presented in Table 18. Each of the seven instructions were judged in terms of ease of movement and were evaluated as resulting in: 'no problem', 'uncomfortable, but movement not restricted' or 'movement restricted'. Comments and descriptions that were applicable to the particular test were indicated with a tick (✓). In most instances, the comments of the two judges were similar. In a few instances were the comments of the judges differed, the comments that were most representative of the corresponding evaluation were selected. In a small number of instances were the comments differed but were in both instances representative, both are presented in the table.

The size of the jacket that the subject was issued with and the ease location involved is also presented in Table 18. Ease allowances were read from ease Tables 11-17. To interpret the findings in terms of ease, the previously estimated norms for ease from theory and practice at the various locations are used, namely:

- 100 mm to 200 mm of ease at the bust location
- 100 mm to 200 mm of ease at the hip location
- 50 mm to 75 mm of ease at the back width location
- 70 mm to 150 mm of ease at the waist location
- 50 mm to 100 mm of ease at the upper arm location
- 50 mm to 150 mm of ease at the scye circumference
- 25 mm (the minimum range suggested by Gioello & Berke 1979:16-23) to 50 mm (Haggar 1990:6-8) of ease at the elbow circumference.

The body shapes of the subjects as well as their BMI values were included (see Table 6) in order to assist understanding the ease needs of the subjects.

A total of 161 tests are presented in Table 18 as there were 23 subjects who completed seven tests.

RR107	31	▦	30.1	50	55	145	60	92	112	-60	Movement restricted	✓	✓	✓		✓			Cannot do forward bend, it is restricting	✓						
											Uncomfortable, but movement not restricted				✓		✓		Pulls from armpit over upper arms	✓	✓				✓	
											No problem							✓	Front of armhole cut into upper arm			✓				
																			The subject has to pull up her sleeves before she can salute. Tight over elbow and armholes					✓		
																			Pulls in armpits		✓		✓	✓		
																			Correct							✓
RR112	8	▦	29.1	65	210	153	84	76	182	212	No problem	✓	✓	✓	✓	✓	✓	✓	Correct	✓	✓	✓	✓	✓	✓	✓
	25	⧗	29.8	55	168	204	79	85	172	145	No problem			✓				✓	Pulls under armpits	✓	✓			✓		
											Movement restricted	✓							Pulls from arm holes at shoulder blades				✓			
											Uncomfortable, but movement not restricted		✓		✓	✓	✓		Looks tight at the shoulder blades			✓				
																			Pulls tight at back						✓	
	3	⬮	40.3	60	155	153	74	94	202	151	No problem	✓	✓	✓	✓	✓	✓	✓	Correct	✓	✓	✓	✓	✓	✓	✓
	24	▲	39.1	50	134	193	75	98	-36	88	Uncomfortable, but movement not restricted	✓		✓	✓		✓		Pulls over the back if she bends forward	✓			✓			
											Movement restricted		✓			✓		✓	Jacket too small over waist and hips	✓						
																			Pulls over back and waist		✓	✓				
																			Pulls in front of armpits					✓		
																			The subject cannot button jacket					✓		
	42	◆	36.3	55	100	128	91	60	96	70	Uncomfortable, but movement not restricted	✓		✓					Garment does not drop to natural position		✓					
											No problem		✓					✓	Tight over upper front arm	✓		✓	✓	✓		
											Movement restricted				✓	✓	✓		Tight over hips and stomach						✓	
																			The subject cannot button the jacket							✓
RR122	50	▦	33.2	55	164	195	31	91	309	298	No problem	✓	✓	✓	✓	✓		✓	Correct	✓	✓	✓	✓	✓		✓
											Uncomfortable, but movement not restricted						✓		Pulling over back.						✓	
	32	◆	34.7	75	109	187	45	45	175	175	Uncomfortable, but movement not restricted	✓	✓		✓	✓	✓		Pulling over back, indicates strain over shoulder blades	✓					✓	
											No problem			✓				✓	Pulls uncomfortably under armholes		✓					
																			Pulls higher under arm holes				✓			
																			Tight from elbow and upper arm in sleeve and armhole					✓		
																			Correct			✓				✓
	34	⬮	41.7	40	2	193	20	61	155	160	Movement restricted	✓		✓			✓		Cannot bend forward. Pulls from back at arm holes	✓						
											Uncomfortable, but movement not restricted		✓		✓	✓		✓	Pulls tight			✓				
																			Pulls tight from bottom of armholes		✓					
																			Jacket does not drop back, it pulls on the sides		✓					
																			Tighter on upper arm and in armpits				✓		✓	
																			Pulling over top of arm in sleeves					✓	✓	
RR132	27	⬮	41.6	50	146	165	-10	24	224	276	Uncomfortable, but movement not restricted	✓		✓			✓		Forward bend pulls across back width and arms	✓						
											No problem		✓		✓	✓		✓	Pulls tight on upper arm			✓				
																			Correct				✓			
																			Back of arms pulls tight						✓	
	21	⬮	47	70	9	141	-65	20	162	112	Movement restricted					✓	✓		The subject cannot bend forward	✓						
											Uncomfortable, but movement not restricted	✓	✓	✓	✓			✓	Pulls everywhere	✓	✓	✓	✓		✓	
																			Tight at armholes			✓				
																			Pulls on armhole					✓		
																			The subject cannot complete the test						✓	

																			when arms are dropped							
											No problem			✓		✓			Pulls over back & upper arm – does not drop to natural position		✓					
																			Pulls on arm and back				✓	✓		
																			Correct					✓		
RR107	51	▩	30.1	30	55	145	86	92	112	-60	Movement restricted	✓	✓	✓		✓			Cannot do forward bend, it is restricting	✓						
											Uncomfortable, but movement not restricted				✓		✓		Pulls from armpit over upper arms	✓	✓				✓	
											No problem							✓	Front of armhole cut into upper arm			✓				
																			The subject has to pull up her sleeves before she can salute. Tight over elbow and armholes					✓		
																			Pulls in armpits		✓		✓	✓		
																			Correct							✓
RR112	8	▩	29.1	65	210	153	84	76	182	212	No problem	✓	✓	✓	✓	✓	✓	✓	Correct	✓	✓	✓	✓	✓	✓	✓
	25	⧗	29.8	55	168	204	79	85	172	145	No problem			✓				✓	Pulls under armpits	✓	✓			✓		
											Movement restricted	✓							Pulls from arm holes at shoulder blades				✓			
											Uncomfortable, but movement not restricted		✓		✓	✓	✓		Looks tight at the shoulder blades			✓				
																			Pulls tight at back						✓	
	3	⬮	40.3	60	155	153	74	94	202	151	No problem	✓	✓	✓	✓	✓	✓	✓	Correct	✓	✓	✓	✓	✓	✓	✓
	24	▲	39.1	50	134	193	75	98	-36	88	Uncomfortable, but movement not restricted	✓		✓	✓		✓		Pulls over the back if she bends forward	✓			✓			
											Movement restricted		✓			✓		✓	Jacket too small over waist and hips	✓						
																			Pulls over back and waist		✓	✓				
																			Pulls in front of armpits					✓		
																			The subject cannot button jacket					✓		
	42	◆	36.3	55	100	128	91	60	96	70	Uncomfortable, but movement not restricted	✓		✓					Garment does not drop to natural position		✓					
											No problem		✓					✓	Tight over upper front arm	✓		✓	✓	✓		
											Movement restricted				✓	✓	✓		Tight over hips and stomach						✓	
																			The subject cannot button the jacket							✓
RR122	50	▩	33.2	55	164	195	31	91	309	298	No problem	✓	✓	✓	✓	✓		✓	Correct	✓	✓	✓	✓	✓		✓
											Uncomfortable, but movement not restricted						✓		Pulling over back.						✓	
	32	◆	34.7	75	109	187	45	45	175	175	Uncomfortable, but movement not restricted	✓	✓		✓	✓	✓		Pulling over back, indicates strain over shoulder blades	✓					✓	
											No problem			✓				✓	Pulls uncomfortably under armholes		✓					
																			Pulls higher under arm holes				✓			
																			Tight from elbow and upper arm in sleeve and armhole					✓		
																			Correct			✓				✓
	34	⬮	41.7	40	2	193	20	61	155	160	Movement restricted	✓		✓			✓		Cannot bend forward. Pulls from back at arm holes	✓						
											Uncomfortable, but movement not restricted		✓		✓	✓		✓	Pulls tight			✓				
																			Pulls tight from bottom of armholes		✓					
																			Jacket does not drop back, it pulls on the sides		✓					
																			Tighter on upper arm and in armpits				✓		✓	
																			Pulling over top of arm in sleeves					✓	✓	
RR132	27	⬮	41.6	50	146	165	-10	24	224	276	Uncomfortable, but movement not restricted	✓		✓			✓		Forward bend pulls across back width and arms	✓						
											No problem		✓		✓	✓		✓	Pulls tight on upper arm			✓				
																			Correct				✓			
																			Back of arms pulls tight						✓	
	21	⬮	47	70	9	141	-65	20	162	112	Movement restricted					✓	✓		The subject cannot bend forward	✓						
											Uncomfortable, but movement not restricted	✓	✓	✓	✓			✓	Pulls everywhere	✓	✓	✓	✓		✓	
																			Tight at armholes			✓				
																			Pulls on armhole					✓		
																			The subject cannot complete the test						✓	

From Table 18, it is clear that the following comments were most frequently mentioned by the judges regarding the functionality of the dress jacket for all seven tests:

- No problems (74 out of 161 tests).
- Uncomfortable, but movement not restricted (64 out of 161 tests).
- Movement restricted (23 out of 161 tests).

The evaluation of the judges of 'no problem' was followed by the description 'correct' in eleven instances.

The most frequently mentioned comments of the judges regarding the mobility of all seven tests are presented below:

- The sleeves of the dress jacket are too tight over the upper arm location (23 out of 81 comments).
- The dress jacket pulls at the front or back of the armhole (22 out of 81 comments).
- The dress jacket is too tight over the back and/or the shoulder blades (20 out of 81 comments).
- The dress jacket does not drop back to its natural position over the waist and/or the hips (nine out of 81 comments), the dress jacket is too small over the waist and the hips (twice out of 81 comments) and in two instances the subject cannot button the jacket at the waist and hip dimension.
- Completing forward bends are restricted (four out of 81 comments).
- The dress jacket pulls tight over the elbows (four out of 81 comments).
- The subject cannot lift her arms to shoulder level (once out of 81 comments).

Analysis of the comments and descriptions of the judges in terms of ease provided at each garment location reveals the following:

- Insufficient or excess ease allowances at various locations have an impact on the functional performance of the garment.
- Where ease allowances are less than the minimum requirement in one or more locations, discomfort is experienced, but movement is not restricted. It seems as if sufficient ease in related areas compensates for insufficient ease in one or more

areas. Subject 52, for example had insufficient ease of 5 mm (instead of 50 mm ease) in the back width. However, this is compensated for by 105 mm ease in the bust dimension and excess ease of 236 mm at the scye circumference. This provides ease on the same horisontal level and is part of one circumference dimension including the bust dimension, the scye circumference and the upper arms.

- Insufficient ease at the bust could cause strain in the upper arm area. Subject number 21, for example, could not successfully complete the forward reach. The descriptions of the judges stated that her garment "pulls everywhere" and therefore restricted her movement. It is important to consider the amounts of ease in combination as the dress jacket could restrain movement at the upper arm and back width due to strain in the bust circumference.
- It was previously mentioned that excess ease at the scye circumference could result in a deep scye that can restrict movement. This was probably the case for subjects 25, 32 and 34.
- In the instance of subject 21, insufficient ease in three areas (the bust, upper arm and elbow dimensions) caused discomfort in five out of seven tests; while the other two tests (saluting and reaching forward) indicated restricted movement. With regard to reaching forward, the judges' comment "the subject cannot complete the test" provides valuable insight into the functional problems. It can be concluded that insufficient amounts of ease at multiple locations reduce the functionality of the garment.
- Insufficient ease at the bust and back width dimensions could cause strain in the upper arm area. Subject number 51, for example, could not successfully complete the 'overhead arm extensions'. The judges described her garment as pulling over her upper arm and therefore restricting her movement. It is important to consider the amounts of ease in combination as the dress jacket could restrain movement at the upper arm and back width due to strain in the bust circumference.

Consideration of the motor test results in terms of the body types of subjects revealed the following:

- In the instance of the inverted triangular body type, (subject number 1) it is expected that this subject may experience tightness in her shoulder area. The comments of the judges verify that the jacket is tight over her back and provides insufficient movement ease.
- In the instance of hourglass figure types (subjects 13, 52, 25) no salient fit problems are expected as the design of the dress jacket is slightly tapered at the waist and is most suited for this figure type. Subject 13 had 'no problems' in this regard while subjects 52 and 25 experienced functional problems due to excess ease in the scye area.
- Evaluation of fit for triangular body types, (such as those of subject numbers 12, 33, 43, 49, 22, 18, 24) is expected to reveal fit problems caused by insufficient ease at the hip location as the hips are much broader than the bust. The descriptions of the judges underline the problems experienced by the triangular figures namely: "The jacket does not drop down" to its natural position over the hips in three out of the seven instances (12, 43, 22). Other comments stated that "the jacket is too small over the waist and hips" and that "the subject cannot button the jacket" (subject 24). The above comments indicate that the ease allowance at the hip location is insufficient for triangular figure types.
- It is expected that the five subjects (41, 26, 51, 8, 50) who have square figure types may experience fit problems in terms of ease at the upper body. The descriptions of the judges underline ease problems with regard to upper body fit. Their comments include: "the jacket pulls tight over the back (in two out of four instances, subjects 41, 26), and the "forward bends are restricted" (in two out of four instances, subjects 41, 51).
- Subject 19, the only subject with a rectangular body shape, did not experience any salient fit problems in terms of ease related to fit of the dress jacket in comparison to her body shape. This may be ascribed to the fact that his subject wore a dress jacket that was one size too big.
- It is expected that the four subjects (3, 34, 27, 21) with oval body shapes might experience fit problems in terms of ease at the waist location. The judges

described the problems as follows: The subjects experienced restriction when bending forward (in three out of four instances, subject 34, 27, 21). According to the descriptions of the judges, the subjects experienced "tightness at the back width" area in two out of four instances (subjects 34, 27). The above descriptions verify that ease at the back width, bust and waist locations of these figure types is insufficient to provide ease of movement.

- It is further expected that the two subjects (42, 32) with diamond body shapes would experience fit problems in terms of ease at the waist location. This is due to the diamond figure type having a protruding waistline. The following description by the judges for one of these subjects (number 42) highlights fit problems as a result of a protruding waistline: "garment does not drop down to natural position". For another test, tightness was experienced over the hips and stomach and the judges commented that "the subject cannot button the jacket". The above-mentioned comments by the judges verify that ease at the waist location is insufficient for the diamond figure types.

Within the limitations of this study, it can be concluded that the dress jacket is most suited for the hourglass figure type. This is due to the similar bust and hip dimensions and the tapered waist.

Consideration of the motor test results in terms of the BMI values of the subjects, as presented in Table 18, reveals the following:

- The five subjects (1, 13, 12, 52, 19) with normal BMI values were evaluated in 22 out of 35 tests (five subjects times seven tests per subject) (62,8 percent) as experiencing 'no problems'. In eleven out of 35 tests (31,4 percent) these subjects experienced 'discomfort, but movement not restricted' and for only two tests (5,7 percent) as 'restricted movement'. It is clear from the above that subjects with normal BMI values have overall adequate ease allowance to complete most of the tests without experiencing restricted movement. It must be taken into consideration that three of the above mentioned five subjects (1, 13, 12) wore dress jackets of the correct size, while two out of the five subjects (52, 19) wore dress jackets that were too large (based on the bust measurement as key dimension) and therefore experienced additional ease allowance.

- The seven subjects (33, 49, 41, 22, 18, 8, 25) who were classified as being overweight according to their BMI values were evaluated in 20 out of 49 tests (40,8 percent) as experiencing 'no problem'. In 23 out of 49 tests (46,9 percent), the subjects were 'uncomfortable, but movement was not restricted'. In six out of 49 tests (12,2 percent) 'restricted movement' was experienced.
- The results in Table 18 indicate that the results 'uncomfortable, but movement not restricted' as well as the comment 'movement restricted' increased for the overweight subjects. It can therefore be inferred that the overweight wearers experience more fit and mobility problems in terms of ease allowance.
- There were eleven subjects (43, 26, 51, 3, 24, 42, 50, 32, 34, 27, 21) who were obese according to their BMI values. For these subjects, 32 out of 77 tests (41,5 percent) indicated 'no problem'. It must be considered that seven of the obese subjects (26, 51, 3, 24, 50, 32, 27) wore a larger size garment, possibly to accommodate their weight. During thirty out of 77 tests (38,9 percent) discomfort was experienced but their movement was not restricted. The movements of these subjects were restricted in fifteen tests (19,4 percent). It is evident from these results that obese wearers experienced more problems than their normal and overweight counterparts due to too little movement ease. This may be ascribed to the larger wearers requiring more ease allowance. The ARMSCOR specifications (presented in Table 16) indicate that the ease allowance at the upper arm does not increase for the larger sizes within the size categories. In certain instances, the ease allowance decreased for plus-sized wearers. These findings support the notion that the ease allowance should be increased for larger sizes within the sizing system.

In conclusion, the above findings of the motor tests for functional performance of the dress jacket indicate that:

- Garment dimensions at the same height circumference (e.g. around the upper torso including the bust, back width, upper arm and scye circumferences) with sufficient or excess ease compensate for locations with insufficient ease.

- Insufficient ease in one or two locations will cause discomfort, but not restrict movement.
- Insufficient ease in several areas will restrict movement.
- Excess ease in the scye area is possibly an indication of a deep armhole which restrains upper arm movement.
- The fit of the closely fitted garment does not accommodate a variety of body shapes and subsequently restricts movement.
- The plus-sized subjects require more ease to provide ease of movement.

When considering the findings regarding functionality in terms of problems that are experienced most frequently, it is clear that the following problems regarding fit it terms of ease should be addressed:

- The design of the dress jacket does not promote comfortable movements, as 54 percent (87 out of 161) of the motor tests were evaluated as uncomfortable or movement restricted.
- In order to minimise fit and movement problems, the scye circumference and upper arm location should be adapted. Less ease should be assigned to the scye circumference and more ease should be allocated to the upper arm location.
- The back- and shoulder width of the dress jacket should have more ease.
- The design/style of the dress jacket does not accommodate a variety of body shapes. Ease should therefore be adapted at the bust, waist and hip locations.
- The dress jacket does not accommodate the ease needs of plus-sized wearers (those with obese BMI values of 30+). The size charts should specify additional ease for these wearers.
- It is important to ensure that the subjects are issued with the correct garment size. Wearing incorrect sizes would result in either insufficient or excess ease and cause fit and mobility problems.

The above findings conclude the functional evaluation in relation to the amounts of ease allowance for the dress jacket. In the next section, findings regarding fit in terms of ease as it relates to the aesthetic acceptability of the dress jacket is presented.

4.3.4 Aesthetic performance of the dress jacket in terms of ease

The fit checklists were analysed in terms of the elements of fit, namely grain, set, line and balance in order to further investigate the ease/tolerance in relation to the aesthetic performance of the dress jacket. Branson and Nam (2007:272) conducted research to evaluate the fit of garments in terms of the assessment of ease, line, grain, balance and set requirements. The findings are presented in Table 19. (Ease allowance is the fifth fit element but has been analysed and presented in Tables 11-17). By implication the afore-mentioned elements reflect the ease at a particular location. For example, wrinkles that pull indicate that the ease at that location is insufficient while folds indicate excess ease.

Two trained judges evaluated the aesthetic performance of the dress jackets. In most instances, the evaluations of the two judges were similar. In a small number of instances where the evaluations of the judges differed, the evaluation most representative of the corresponding comment was selected. Where the comments of the judges differed for the same evaluation, both comments are presented in the table.

Similar to the presentation in other tables, the size of the jacket that the subject is issued with is indicated, as well as the ease locations involved. The findings are presented in terms of the previous estimations of ease from theory and practice at the various locations.

The body shapes and BMI values of subjects are included in Table 19 (see Table 6) to enhance understanding the ease needs of the subjects.

The grain lines of the garments were evaluated by means of evaluative questions which included the following:

- Are the grain lines of the garment parallel to the centre front of the body of the subject above as well as below the waist?
- Are the grain lines of the garment parallel to the centre back of the body of the subject above as well as below the waist?

- Are the grain lines of the sleeve perpendicular to the floor?

Where the answer to the above was yes, it is indicated with 'Y'. In instances where the answer was no it is indicated with 'N'. Comments that followed the evaluations are also included.

The set of the garments were evaluated by means of judging wrinkles and/or folds that occurred at the bust, waist, hip and upper arm locations. Where wrinkles or folds were present it is indicated with 'Y' and location and the type of wrinkle or folds is described, such as a vertical wrinkle or a horisontal fold. Where no wrinkles or folds were present it is indicated with 'N'.

The lines of the garments were evaluated by means of the following questions:

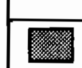
- Do the garment lines follow the natural lines of the body?
- Do the side seams of the garment hang straight?
- Does the centre front seam lie on the centre front of the body of the subject?
- Do the straight seams appear as straight lines on the body of the subject?
- Does the centre front closure form a straight line on the body of the subject?

In instances where the garment lines were correct, it is indicated with 'Y'. Where the garment lines were not correct, it is indicated with 'N'. Comments that were provided are included.

Lastly, the balance of the garment was evaluated. It was important to determine whether the garment appeared balanced at the following locations: front upper torso, front lower torso, back upper torso, back lower torso, right side seam and left side seam. Where the garment appeared to be balanced, it is indicated with 'Y'. Instances where the garment did not appear to be balanced are indicated with 'N'. A description of the problem is included, where provided.

The aesthetic evaluation of the dress jacket is presented in Table 19.

TABLE 19: OBJECTIVE AESTHETIC EVALUATION OF THE DRESS JACKET IN TERMS OF GRAIN, SET, LINE, BALANCE AND EASE

				Ease Allowance (mm)					Aesthetic Evaluation																							
									Grain						Set (Wrinkles and folds)					Line						Balance (Does the garment seem balanced at the following locations)						
									Parallel to C.F		Parallel to C.B.															Front torso		Back torso		Side seams		
Subject number	Size Issued	Body shape	BMI	Bust (mm)	Waist (mm)	Hip (mm)	Back width (mm)	Upper arm (mm)	Above the waist	Below the waist	Above the waist	Below the waist	Sleeve grain perpendicular to the floor	Comments	Bust	Waist	Hips	Upper arms	Comments	Garment lines follow natural body lines	Side seams hang straight	C.F. lines on C.F. of the body	Straight seams as straight lines on the body	C.F. closures form straight line on the body	Comments	Upper	Lower	Upper	Lower	Right	Left	Comments
1	RR81		19.3	85	182	164	65	57	Y	Y	Y	Y	Y	-	N	Y	N	N	Waist: Diagonal wrinkles toward buttocks that protrude at the back	Y	Y	Y	Y	Y	No comments	Y	Y	Y	Y	Y	Y	No comments
13	RR87		24.5	60	167	53	15	98	Y	Y	Y	Y	Y	-	Y	N	N	N	Bust: Horizontal wrinkles as a slight bulge over the bust.	Y	Y	Y	Y	Y	No comments	Y	Y	Y	Y	Y	Y	No comments
12			22.8	41	105	63	30	90	N	N	N	N	N	-	Y	N	N	N	Bust: Diagonal wrinkles form in front . Waist: Slight horizontal folds at the back	Y	Y	Y	Y	Y	At the front hip the garment sticks out from the body.	Y	Y	Y	Y	Y	Y	No comments
52	RR92		21	105	149	136	5	8	Y	Y	Y	Y	Y	-	Y	N	N	Y	Bust: Vertical folds form above the bust and on the sides of the bust. Upper arm: Horizontal wrinkles pull from front of armholes.	Y	Y	Y	Y	Y	No comments	Y	Y	Y	Y	Y	Y	No comments
33			26.3	77	135	5	20	74	Y	Y	Y	Y	Y	-	Y	Y	N	N	Bust: Diagonal wrinkles form from bust towards hips, material pulled tight over the hips, on sides of the hips and side of the back. Waist: Vertical folds cause mild folds from the shoulder blades to the waist. Diagonal wrinkles at the sides front.	N	N	N	Y	Y	The garment lines do not follow the natural body lines because the garment is not wide enough over the hips. Side seams do not hang straight due to folds at the waist. The centre front lines pull towards the buttonhole panel as it pulls out over the hips. The centre front closures pull out over the hips.	Y	Y	Y	Y	Y	Y	No comments
43			34.6	72	95	-85	0	49	Y	Y	Y	Y	Y	-	Y	Y	Y	Y	Bust: Vertical folds form over back below the shoulders. Waist: sever horizontal folds in the waistline at the back and mild folds in the front. Hip: Horizontal wrinkles pull over the buttocks. Upper arm: Horizontal wrinkles pulls tight over the upper arm.	N	N	N	N	N	Garment lines do not follow body lines as the garment is not wide enough over the hips. Side seams are not straight due to folds at the waist and pulling over the hips. Garment centre lines and other straight seams are not on the centre front of the body as it pulls over the hips. The centre front closures pull open to accommodate the hips.	Y	Y	Y	Y	Y	Y	No comments
49	RR97		29.7	155	207	-70	50	49	Y	N	Y	Y	Y	-	Y	Y	Y	N	Bust: Horizontal folds form next to the buttons in front. Waist: vertical folds form from the shoulder blades to the waist level. Diagonal wrinkles pull towards the buttocks. Hips: Diagonal wrinkles pull from the bottom button. The garment pulls tight from the bottom button.	N	N	N	N	N	Garment lines do not follow body lines as the garment is not wide enough over the hips. Side seams are not straight due to the back side seam that pulls backwards over the buttocks. Garment centre lines and other straight seams are not on the centre front of the body due to pulling over the hips. Straight seams are not straight due to pulling at the buttocks. Centre front closures are not straight as it pulls open at the bottom button to accommodate the hips.	Y	Y	Y	Y	Y	Y	No comments
41			28.9	97	80	76	60	55	Y	Y	Y	Y	Y	-	Y	Y	N	Y	Bust: Vertical folds form next to the back of the chest at the armscye. Waist: Horizontal folds form at the back and the garment rides up slightly from the buttocks. Upper arm: Mild horizontal folds form from the upper arm area. Diagonal folds appear in front of the arm.	Y	Y	Y	Y	Y	No comments	Y	Y	Y	Y	Y	Y	No comments
22			29.9	86	76	40	40	51	Y	Y	Y	Y	Y	Cut	Y	Y	N	N	Bust: Slight diagonal wrinkles form over the bust, under the bust and under the armpits. Horizontal folds appear on the sides of the body. Waist: Mild horizontal folds appear in the back waist. Diagonal wrinkles appear in the front.	Y	N	N	N	N	Garment lines do not follow natural body lines as the garment pulls tight over the buttocks. Side seams are not straight due to folds at waist in the sides. Centre front lines are not on the centre front of the body as it flares towards the hips. The centre front closures do not form a straight line over the hip area.	Y	Y	Y	Y	Y	Y	No comments

																									The centre front closures do not form a straight line over the hip area.							
19	RR102		22.6	172	105	130	45	80	Y	Y	Y	Y	Y	-	Y	Y	N	N	Bust: Vertical folds occur as bust does not fill out jacket. Diagonal folds occur from under the armpits. Waist: Vertical folds occur above the waist to the shoulders.	Y	Y	Y	Y	Y	No comments	Y	Y	Y	Y	Y	Y	The garment does not seem balanced because the jacket is too short.
26			30.4	92	161	135	5	45	N	N	Y	Y	N	Due to incorrect cut	Y	Y	Y	Y	Bust: Horizontal folds appear under the bust towards the stomach which protrudes, and under the armpits towards the bust. Diagonal wrinkles occur behind the armpits. Waist: Horizontal folds appear at the back waist. Diagonal wrinkles appear on the front waist and the hips. Hips: Horizontal wrinkles occur over the buttocks. The garment is too tight over the hips. Upper arms: Little horizontal wrinkles appear from the armhole seam above the armhole.	N	N	N	N	N	The garment lines do not follow the natural body lines because the garment does not flair to accommodate the hips. Side seams do not hang straight due to pulling at the waist and over the buttocks. The centre front lines pull over the stomach. The front closures pull over the stomach.	Y	Y	Y	Y	Y	Y	No comments
18			27.5	90	159	142	30	50	Y	Y	Y	Y	Y	-	Y	Y	N	Y	Bust: Horizontal wrinkles form over the bust. Vertical folds occur from the shoulder seam to the scye. Waist: Horizontal folds form at the back. Upper arm: Little horizontal wrinkles appear from the seam on the armhole.	N	Y	Y	Y	Y	The lines of the garment do not follow the natural lines of the body at the shoulder line, armhole or the waist.	Y	Y	Y	Y	Y	Y	No comments
51	RR107		30.1	55	-60	112	30	86	Y	Y	Y	Y	Y	-	Y	Y	N	N	Bust: Vertical folds form over the bust along the middle seam line in the front. Diagonal wrinkles appear over the shoulder blade at the back. Waist: Horizontal folds occur at the front and back of the waist.	Y	Y	Y	Y	Y	No comments	Y	Y	Y	Y	Y	Y	No comments
8	RR112		29.1	210	212	182	65	84	Y	Y	Y	Y	Y	-	Y	Y	N	N	Bust: Vertical folds form from the shoulder over the bust. Diagonal wrinkles occur under the bust, toward the front stomach because the jacket is too big. Toward the armhole at the back it is too big. Waist: Diagonal wrinkles occur at the front and the back of the waist.	Y	Y	Y	Y	Y	No comments	Y	Y	Y	Y	Y	Y	No comments
25			29.8	168	145	172	55	79	N	Y	Y	Y	Y		Y	N	Y	N	Bust: Diagonal wrinkles occur under the back of the armhole and the shoulders. Hips: Diagonal wrinkles make a shirt in the front.	Y	Y	Y	Y	Y	No comments	Y	Y	Y	Y	Y	Y	No comments
3			40.3	155	151	202	60	74	N	N	N	N	N	-	N	Y	Y	N	Waist: Horizontal folds occur at the waist area. Hip: Diagonal wrinkles form towards the buttocks at the back of the hips.	Y	Y	N	Y	Y	The centre front lines curve slightly and the centre front closures (buttons) are not straight,	Y	Y	Y	Y	Y	Y	No comments
24			39.1	134	88	-36	50	75	N	N	Y	Y	Y	-	Y	Y	Y	N	Bust: Diagonal wrinkles form towards the bust and at the back width. Waist: Horizontal folds occur across the waist at the back. Vertical folds form from mid back to the waist. Hip: Diagonal wrinkles occur as the garment rides up over the buttocks and does not close over the hips.	N	N	N	Y	N	The garment does not follow the natural lines of the body as it does not flare at the hips. The side seams are not straight because it pulls towards the buttocks at the hip level. The centre front lines and closures are not straight as it pulls and cannot fasten over the hips.	Y	Y	Y	Y	N	N	The garment does not seem balanced because it pulls to the back over the buttocks.
42			36.6	100	70	96	55	91	Y	Y	Y	Y	Y	-	Y	Y	Y	N	Bust: Diagonal wrinkles from the shoulders outwards (in front). The back pulls diagonally from under the armpit upwards. Waist: horizontal folds occur at the back. Diagonal wrinkles form under the bust in the waist. Hips: Snug at the hips.	Y	Y	Y	Y	Y	No comments	Y	Y	Y	Y	Y	Y	No comments
50	RR122		33.2	164	298	309	55	31	Y	Y	Y	Y	Y	-	Y	N	Y	N	Bust: vertical folds from shoulders to the bust in the front and the back. Diagonal wrinkles occur on sides of bust towards beneath the armhole. Hips: Vertical folds form under the buttocks.	N	Y	Y	Y	Y	Garment lines do not follow natural body lines as there is not enough ease at the waist.	Y	Y	Y	Y	Y	Y	No comments
32			34.7	109	175	175	75	45	Y	Y	Y	Y	Y	-	Y	Y	N	Y	Bust: Diagonal wrinkles towards and under the bust. Vertical folds in front of the shoulders, under the shoulder pads, at the back from the armpits to the sides of the body. Waist: Vertical folds at the back of the waist. Diagonal wrinkles towards the buttocks. Upper arms: Horizontal wrinkles as the upper arms are tight and stretched. Horizontal folds occur next to the shoulders above the deltoid muscles. Vertical folds appear at the armpits.	N	N	Y	N	Y	Garment lines do not follow natural body lines as there is not enough ease at the bust or the buttocks. Side seams and straight seams do not appear as natural lines on the body because the garment pulls back over the buttocks.	Y	Y	Y	Y	Y	Y	No comments
34			41.7	2	160	155	40	20	Y	Y	Y	Y	Y	-	Y	Y	Y	Y	Bust: Diagonal wrinkles form under the bust, towards the bust and from the shoulder seam towards the armhole.	N	N	N	Y	N	The garment lines follow the natural lines of the body but the garment is not fitted well. The straight seams and centre front lines are not	Y	Y	Y	Y	Y	Y	No comments

																			Waist: Diagonal wrinkles occur at the front and the back of the waist.													
25		⧗	29.8	168	145	172	55	79	N	Y	Y	Y	Y		Y	N	Y	N	Bust: Diagonal wrinkles occur under the back of the armhole and the shoulders. Hips: Diagonal wrinkles make a shirt in the front.	Y	Y	Y	Y	Y	No comments	Y	Y	Y	Y	Y	Y	No comments
3		⬮	40.3	155	151	202	60	74	N	N	N	N	N	-	N	Y	Y	N	Waist: Horizontal folds occur at the waist area. Hip: Diagonal wrinkles form towards the buttocks at the back of the hips.	Y	Y	N	Y	Y	The centre front lines curve slightly and the centre front closures (buttons) are not straight,	Y	Y	Y	Y	Y	Y	No comments
24		▲	39.1	134	88	-36	50	75	N	N	Y	Y	Y	-	Y	Y	Y	N	Bust: Diagonal wrinkles form towards the bust and at the back width. Waist: Horizontal folds occur across the waist at the back. Vertical folds form from mid back to the waist. Hip: Diagonal wrinkles occur as the garment rides up over the buttocks and does not close over the hips.	N	N	N	Y	N	The garment does not follow the natural lines of the body as it does not flare at the hips. The side seams are not straight because it pulls towards the buttocks at the hip level. The centre front lines and closures are not straight as it pulls and cannot fasten over the hips.	Y	Y	Y	Y	N	N	The garment does not seem balanced because it pulls to the back over the buttocks.
42		◆	36.6	100	70	96	55	91	Y	Y	Y	Y	Y	-	Y	Y	Y	N	Bust: Diagonal wrinkles from the shoulders outwards (in front). The back pulls diagonally from under the armpit upwards. Waist: horizontal folds occur at the back. Diagonal wrinkles form under the bust in the waist. Hips: Snug at the hips.	Y	Y	Y	Y	Y	No comments	Y	Y	Y	Y	Y	Y	No comments
50	RR122	■	33.2	164	298	309	55	31	Y	Y	Y	Y	Y	-	Y	N	Y	N	Bust: vertical folds from shoulders to the bust in the front and the back. Diagonal wrinkles occur on sides of bust towards beneath the armhole. Hips: Vertical folds form under the buttocks.	N	Y	Y	Y	Y	Garment lines do not follow natural body lines as there is not enough ease at the waist.	Y	Y	Y	Y	Y	Y	No comments
32		◆	34.7	109	175	175	75	45	Y	Y	Y	Y	Y	-	Y	Y	N	Y	Bust: Diagonal wrinkles towards and under the bust. Vertical folds in front of the shoulders, under the shoulder pads, at the back from the armpits to the sides of the body. Waist: Vertical folds at the back of the waist. Diagonal wrinkles towards the buttocks. Upper arms: Horizontal wrinkles as the upper arms are tight and stretched. Horizontal folds occur next to the shoulders above the deltoid muscles. Vertical folds appear at the armpits.	N	N	Y	N	Y	Garment lines do not follow natural body lines as there is not enough ease at the bust or the buttocks. Side seams and straight seams do not appear as natural lines on the body because the garment pulls back over the buttocks.	Y	Y	Y	Y	Y	Y	No comments
34		⬮	41.7	2	160	155	40	20	Y	Y	Y	Y	Y	-	Y	Y	Y	Y	Bust: Diagonal wrinkles form under the bust, towards the bust and from the shoulder seam towards the armhole. Waist: Horizontal folds form at the back as the material rides up over the buttocks. Diagonal wrinkles form on the sides of the waist in the front. Hips: The garment pulls tight over the buttocks. Upper arm: Tight horizontal wrinkles over the upper arm. Vertical wrinkles from the armpit at the back of the upper arm.	N	N	N	Y	N	The garment lines follow the natural lines of the body but the garment is not fitted well. The straight seams and centre front lines are not straight because the garment pulls over the buttocks. The subject has a very curvy body with forward protruding bust and torso. The centre front closures do not form a straight line when fastened because the garment pulls over the subject's bust.	Y	Y	Y	Y	Y	Y	No comments
27	RR132	⬮	41.6	146	276	224	50	-10	Y	Y	Y	Y	N	Offset due to cut	Y	Y	Y	Y	Bust: Horizontal folds occur in front of the shoulders, below the waist. Diagonal wrinkles form under the armpits over the bust. Waist: Diagonal wrinkles occur below the bust and at the back in the sides. Hip: diagonal wrinkles form in the hips. Upper arms: Horizontal folds form from the armhole. Horizontal wrinkles occur in the upper arms and at the elbows.	Y	Y	Y	Y	Y	No comments	Y	Y	Y	Y	Y	Y	No comments
21		⬮	47	9	112	162	70	-65	N	Y	Y	Y	N	-	Y	Y	N	Y	Bust: Diagonal wrinkles form in front of the shoulders, above and below the bust and at the back of the armpits. Horizontal wrinkles form above the waist. Waist: Horizontal folds form at the back of the waist. Upper arms: Horizontal wrinkles at the upper arm causes the material to be under stress. It is definitely too tight over the upper arm.	N	Y	Y	Y	Y	The garment lines do not follow the natural body lines at the waist.	Y	Y	Y	Y	Y	Y	No comments

The findings of the aesthetic evaluation, presented in Table 19, reveal the following regarding the grain lines of the dress jacket:

- The dress jackets of the majority of subjects (15 out of 23, numbers 1, 13, 52, 33, 43, 41, 22 19, 18, 51, 8, 42 50, 32, 34) had grain lines that were parallel to the centre front of the garment, above and below the waist, the centre back of the garment, above and below the waist and the grain lines of the sleeves were perpendicular to the floor.
- The grain lines of the dress jackets of two subjects (12, 3) were off-grain at all five locations. In the instance of subject 12 this was the result of insufficient ease at the bust, hip and back width locations. In the instance of subject 3, grain problems resulted from excess ease at the waist and hip locations. It must be considered that this subject wore a dress jacket one size too big.
- In the instance of four subjects (26, 25, 24, 21) the grain lines of the garments were not perpendicular at the centre front of the garment above the waist. The jacket of subject 26 was off-grain above the waist as a result of insufficient ease (92 mm) at the bust dimension. Even though ease at the hip location was adequate (135 mm) it was in the lower ranges of the norm. This subject is obese according to her BMI value and therefore this amount may not be sufficient.
- In three instances (49, 26, 24) the grain lines were not perpendicular below the waist at centre front. In the instances of subjects 49 and 24 this was caused by insufficient ease at the hip location.
- At the centre back of the garment the grain lines were not perpendicular at both the upper and lower torso for two subjects (12, 3).
- The grain lines of the sleeves of three subjects (26, 27, 21) were not perpendicular to the floor. In the instance of subjects 26, 27, 21 this could have been caused by insufficient ease at the upper arm location.

In conclusion it can be inferred that grain lines that are not in position imply tightness and strain in that particular area, indicating insufficient ease or looseness in an area, indicating excess ease.

From Table 19, the following is clear regarding the set evaluation of the dress jackets:

- The jackets of 21 out of 23 subjects indicated set problems at the bust location. Subject number one did not experience any set problems at the bust of her dress jacket. This may be due to the fact that she had normal body weight and available ease of 85 mm which is only 15 mm less than the recommended norm. Subject three did not experience any set problems at the bust dimension of her dress jacket. This may be ascribed to adequate ease of (155 mm) at the bust location.
- Set problems at the bust location including diagonal and horisontal wrinkles are frequently mentioned (12 out of 23 subjects: 1, 13, 12, 33, 22, 18, 25, 24, 42, 32, 34, 21). These findings revealed tightness/insufficient ease. Vertical and horisontal folds (experienced by ten out of 23 subjects: 52, 43, 49, 41, 19, 26, 51, 8, 50, 27) indicated excessive ease at the bust location, or at a location on the same horisontal level such as the scye circumference.
- The jackets of 18 subjects (33, 43, 49, 41, 22, 19, 26, 18, 51, 8, 3, 24, 42, 32, 34, 1, 27, 21) indicated set problems at the waist location. Fifteen out of 17 subjects (33, 43, 49, 41, 22, 19, 26, 18, 51, 8, 3, 24, 42, 50, 32, 34, 21) had vertical and horisontal folds. This may be ascribed to eight out of 15 subjects (49, 26, 18, 8, 3, 32, 34, 27) having excess ease at the waist location. Three (1, 8, 27) out of 17 subjects showed diagonal wrinkles. All three of the above-mentioned subjects had excess ease of 182 mm, 212 mm and 276 mm respectively. Diagonal wrinkles generally indicate that the garment is too small in the particular location. However, it may also indicate that the garment lacks sufficient shaping to adequately fit the particular body curve. This may have been the case in the instance of subjects 1, 8 and 27 with inverted triangular, square and oval body shapes respectively.
- The jackets of ten subjects (43, 49, 26, 25, 3, 24, 42, 50, 34, 27) had set problems at the hip location. Nine out of ten subjects (43, 49, 26, 25, 3, 24, 42, 34, 27) had horisontal and diagonal wrinkles. Only one (50) was evaluated as experiencing vertical folds. These folds were the result of excessive ease of 309 mm which is 109 mm more than the recommended norm.

- The dress jacket sleeves of nine subjects (52, 43, 51, 26, 18, 32, 34, 27, 21) indicated set problems at the upper arm. In the instance of seven subjects (52, 43, 26, 18, 32, 34, 21) wrinkles appeared, indicating insufficient amounts of ease. Evaluation of the ease column revealed that six subjects (52, 43, 26, 32, 34, 21) had less ease than the norm at the upper arm location. In the instance of two subjects (41, 27), horisontal and diagonal folds formed. Subject 41 had adequate ease of 55 mm. Excess ease at the scye circumference may have contributed to these folds. In the instance of subject number 27, horisontal folds pulled from the armholes but the folds were accompanied by horisontal wrinkles that indicated insufficient ease at this location as this subject had -10 mm of ease at the upper arm dimension.

In conclusion regarding set evaluation, the following may be inferred:

- The majority of subjects were evaluated as experiencing set problems at the bust location.
- Most of the set problems at the waist location were the result of excess ease at this location.
- Most of the set problems at the upper arm location were the result of insufficient ease at this location.

In terms of line evaluation, Table 19 indicates the following:

- According to the judges, the dress jackets of eleven out of 23 subjects had correct line placement.
- In the instance of three subjects (43, 49, 26) the line placements of the dress jackets were completely incorrect. In the instance of subject 49, this may be ascribed to this subject having had excess ease at the waist location (207 mm) and insufficient ease at the hip (-70 mm) and upper arm (49 mm) locations. The ease at the back width was at the minimum of 50 mm. In the instance of subject 26, the set problems could be due to insufficient ease at the bust (92 mm), back width (5 mm) and upper arm (45 mm) locations while the ease at the waist was excessive (161 mm).

- According to the judges' evaluations, the garment seams did not appear as straight lines on the bodies of the wearers for five out of 23 subjects (43, 49, 22, 26, 32). From the above-mentioned subjects, three (43, 49, 22) had insufficient ease at the hip location which could have caused the garment seams to pull skew. Excess ease at the waist location (of 175 mm and 161 mm for subjects 32 and 26 respectively) could have caused the garment seams to deviate from the straight lines on the bodies of the wearers.
- In the instance of six subjects (43, 49, 22, 26, 24, 34), the centre front closures of the dress jackets did not appear as straight lines on the bodies of the subjects. This may be ascribed to insufficient ease at the bust, waist or hip location that causes the openings (buttons) to pull and gape open, as well as distort the shape of the garment so that it does not hang straight. Subjects 43, 49, 22 and 24 had triangular body types and experienced insufficient ease at the hip location (-85 mm, -70 mm, 40 mm and -36 mm respectively) which caused the front closures to pull open. In the instance of subjects 26 and 34, the subjects had a square body shape (26) and an oval body shape (34). Due to the weight distribution of these plus-sized subjects, insufficient ease was experienced at the bust locations (92 mm and 2 mm respectively). Due the above mentioned insufficient ease, the front closures pulled open at the bust location.

In conclusion, it may be inferred regarding line evaluation that insufficient or excess amounts of ease allowance can cause the garment lines to deviate from the intended positions on the body of the wearer.

With regard to balance evaluation, Table 19 reveals the following:

- The dress jackets of the majority of subjects (22 out of 23) appeared balanced at the front torso, back torso and side seams.
- In one instance (subject 24) the garment appeared to be unbalanced. This may be ascribed to insufficient ease at the hip location which caused the garment to ride up over the buttocks. Consequently, the garment appeared to be longer in the front at the hemline than at the back at the hemline.

The findings regarding aesthetic evaluation as described above, allow the following conclusions to be made:

- Insufficient or excess ease at various locations impacts on the aesthetic appearance of the garment as wrinkles or folds are formed.
- The ease at the bust location of the dress jacket causes numerous set problems.
- The ease allowance at the upper arm of the dress jacket is insufficient overall and therefore results in numerous aesthetic problems.
- Ease at the waist dimension of the dress jacket is overall in excess, causing multiple set problems.
- Folds that form at the upper arm and bust locations may be the result of excess ease at the scye circumference which causes the garment to pull from the armhole.
- The variation of body shapes influences the ease allowance at the bust, waist and hip locations and therefore could cause aesthetic problems such as distortion of the garment lines.
- The overweight and obese subjects (with BMI of 25+) experience more aesthetic problems than the subjects with normal weight.

4.3.5 Summary: Objective one for the dress jacket

The findings regarding the amounts of ease that will comply with the functional and aesthetic requirements are presented below. These findings are related to the activities and comfort of an optimum number of wearers in order to result in an acceptable fit of the dress jacket. The findings reveal the following:

- The findings regarding fit preferences indicate that ease preferences impact on subject satisfaction with ease.
- The subjective comments portray general dissatisfaction with the fit and aesthetic appearance of the dress jackets.

The findings regarding ease at the bust indicate the following:

- Firstly, the size categories present a problem. This is due to the smaller sizes in a category having more ease available than the larger sizes with larger bust dimensions.

- Secondly, the bust dimensions of the issued garments are smaller than specified, resulting in even less ease at the bust dimension.
- Thirdly, the subjects wearing the smaller sizes need less ease than the subjects wearing the larger sizes.

The findings of ease at the hip location indicate the following:

- The hip dimension is not indicated in the specifications.
- The manufacturer of the dress jacket incorporated a drop measurement. This value is however inconsistent and inadequate for all the wearers and does not accommodate a variety of body shapes.
- The subjects wearing smaller sizes need less ease than subjects wearing the larger sizes.
- The hip measurement is not included in the specifications, therefore too little ease is assigned over the hip dimension for wearers with larger hip measurements.

The findings regarding the back lengths of the dress jackets indicate that a dress jacket that reaches lower than the broadest part of the subject's hip location has a negative impact on ease at the hip dimension.

The findings for ease at the back width location indicate that:

- The manufacturer of the dress jacket provided back width dimensions that are larger than specified in the specifications. This provides additional ease allowance at the back width location which may serve to accommodate the plus-sized wearers of the dress jackets.
- The subjects wearing smaller sizes need less ease than subjects wearing the larger sizes.

The findings regarding ease at the waist dimension indicate that:

- Garment waist dimensions that are between 20 mm and 40 mm smaller than the bust provide adequate ease for subjects wearing smaller sizes. These subjects were satisfied with less ease than subjects wearing the larger sizes.

- Garment waist dimensions that are between 10 mm and 20 mm smaller than the bust dimension provide adequate ease for subjects wearing larger sizes.

The findings regarding ease allowance at the upper arm location allow the following to be inferred:

- The upper arm circumference is not indicated in the specifications.
- The manufacturer assigned less ease for the larger sizes.
- Plus-sized wearers need more ease in order to be comfortable.

The findings with regard to the ease at the scye circumference indicate that:

- The scye circumference is not indicated in the specifications.
- The manufacturer assigned more ease for the larger sizes categories, resulting in a deep scye.

The findings for the functionality tests indicate that:

- Insufficient or excess ease allowance at one garment location impacts on the ease at other garment locations on the same horisontal height.
- The functional tests revealed that body shape impacts on the amount of ease available and consequently influences the mobility and functionality of the dress jacket.
- The functional tests revealed that subjects with high BMI values experienced more movement restrictions.

The following may be inferred from the aesthetic evaluation:

- Set related problems that are a result of incorrect ease allowance negatively influence the aesthetic appearance of the dress jackets.
- The fit evaluations showed that body shapes determine the amounts of ease available at various garment locations. Consequently, body shape impacts on the aesthetic appearance of the dress jacket.
- The aesthetic evaluation revealed that subjects with high BMI values experienced more aesthetic problems due to overall insufficient ease allowance.

In order to realise the first objective for this research project, the results for the combat shirt are presented in the following section.

4.4 OBJECTIVE ONE: COMBAT SHIRT

In order to explore the ease of a loosely fitting garment, the following findings provide insight regarding ease allowance for the combat shirt and problems related to fit in terms of ease.

4.4.1 Subjective comments with regard to the functional and aesthetic performance of the combat shirt

To investigate the amounts of ease that should be allowed for a loose fitting garment, the findings regarding the combat shirt is presented in a similar order to that of the dress jacket. Table 20 presents the results of the subjective views regarding the functionality in terms of fit of the combat shirt.

TABLE 20: SUBJECTIVE COMMENTS REGARDING FUNCTIONALITY OF THE COMBAT SHIRT

Functional performance of the garment	Problem	Selected comments
Physical activity	**Sleeves are too long and too wide**	"The sleeves are too big" "So it goes *(rubs against)* on top of the boxes and the boxes are dusty"
		"The sleeves are way too long when you are working on the computer" (43)
	The shirt is too short	"If you stretch *(forward)* then everything rides up"
	The shirt is too tight	"It must not be tight when I am drilling or walking. And when I kneel down, my breast must not show" (34 & 49)
	The shirt is uncomfortable	"When I have to drill wearing the 'camo', it is not comfortable for me"
		"I do filing on the top shelves; I have to go *(reach)* up. It is very difficult. That makes us uncomfortable" (33)
		"It is not comfortable, but it is my work dress, this *(combat shirt)* is what you must wear…don't have a choice" (8 & 21)
		"We are in the stores, counting stock (medals, buttons) going up and down *(to upper levels and lower levels and reaching up and down)*… it is so uncomfortable" (8)
	The shirt is too big	"I am working in the stores and it is making my work very difficult, my garment is always dirty…big that it is *(because it is too big it is in the way)*" (21)

The above comments, tabulated in Table 20 provide an overview of the functional problems regarding ease experienced by the subjects. The most salient problems are:

- Sleeves that are too long or too wide cause problems in terms of the physical activities of the subjects.
- A shirt that is too tight is uncomfortable when the subjects drill, walk or kneel down.
- A shirt that is too big proves to be cumbersome.
- Dissatisfaction with the overall comfort of the combat shirt.

The above indicates problems with ease as follow:

- Excess amounts of ease at the sleeve prohibit comfortable movement.
- Insufficient ease restricts movement.
- Excess amounts of ease cause the garment to be cumbersome to the wearer.

- Insufficient or excess ease render a garment uncomfortable.

In summary, the most salient complaints regarding the functionality of the combat shirt included that the subjects did not feel that their uniforms (combat shirts) were suitable for performing their work activities. These problems could be caused by insufficient movement ease in some locations and excess ease in other locations.

In Table 21 selected examples of subjective comments from both the focus group and one-to-one interviews related to the aesthetic performance of the combat shirt are presented. Where subject numbers are indicated, comments are from the one-to-one interviews.

TABLE 21: SUBJECTIVE COMMENTS REGARDING AESTHETIC PERFORMANCE OF THE COMBAT SHIRT

Aesthetic performance of the garment	Problem	Selected comments
Fit	**Too big**	"This big 'slobby' thing *(referring to the combat shirt)*, you do not look neat" (8 & 12)
		"I feel like a gangster, this shirt is too big"
Neatness	**Dissatisfied with the style**	"It feels like you are wearing a dress on top of a trouser, so that makes you uncomfortable"
		We do not look neat in our uniform…it is an overall *(some call it a 'dress' or a 'maternity')*. I do not feel comfortable" (21, 22, 27, 33, 34, 43)"
		It looks very untidy" (27, 33)"
		"It makes your body look worse" *(Does not compliment the figure)* (25)
		"In the field there is no problem *(reason)* why you must look smart because you are in the bush…but because you do office jobs, you want to look nice"
		"We are in a working environment, but we are wearing bush clothes, this *(referring to the combat shirt)* is for the field. In the private sector, you go to work looking nice *(professional)* but now we come to work like this. I feel 'sloppy' *(untidy)* " (12)
	Style of shirt is not professional	"They must give us something that makes us presentable…we are soldiers. I am proud to be a soldier, but I am not proud of what we are wearing" (21 & 27)
	Male image created by wearing male garments	"We are like men, there is no difference"
		"They *(civilians)* see you as imitating a man"
		"They must consider that in the army, whether they like it or not, there are woman and men, so they must differ*(entiate)* for *(between)* us"
		It does not make you feel like a lady…it is not feminine. We are soldiers but we are also woman" (25, 33, 52)
		This is not for ladies, this shape *(style of the combat shirt)* is a men's shape" (8, 12, 13, 21, 33, 34, 41, 42)
		"As a woman, I feel like a tom-boy" (12 & 22)
		"For me, it is nice because I am used to it"

The comments presented in Table 21 provide insight regarding problems experienced by subjects in terms of the aesthetic performance of the combat shirt.

The most salient problems in terms of aesthetic performance of the combat shirt are presented below:

- The subjects do not look and feel neat due to the oversized 'baggy' garments.
- The subjects feel unprofessional when completing their daily activities in an administrative working environment as a result of the poor fit.

- It is the perception of the subjects and civilians that the female soldiers are imitating their male counterparts.

The above-mentioned problems may be related to ease in terms of the following:

- Excess ease results in an oversized and untidy garment.
- A garment with insufficient ease may result in an image that is unprofessional.

The following statement by a supervising Colonel supports the perception of the subjects that the combat shirts do not comply with the functional (and aesthetic) requirements expected by female wearers from their uniforms: *"The fact of the matter is that the camouflage uniform was developed for the field and not for the office or the parade…the camouflage dress was designed for the battle"*.

Similar to the case of the dress jacket, excess or insufficient ease will influence the functional and aesthetic performance of the garments. Excess ease inhibits comfortable movement and causes the fabric to fold and/or pull in areas where ease is in excess. Insufficient ease restrains movement and causes the garment to wrinkle and/or pull in an unsightly manner. The functional performance of the garment therefore directly impacts on its aesthetic appearance.

4.4.2 Satisfaction with fit in terms of ease: Combat shirt

In order to further explore satisfaction with fit in terms of ease of the combat shirts, the findings regarding the subjective viewpoints in comparison to the objective evaluations of the judges are presented in Tables 22-28. As with the dress jacket, subject satisfaction with the ease allowance of the combat shirt was investigated during the one-to-one interviews while the judges evaluated ease allowance during the fit and judging sessions. These ease tables (Tables 22-28) describe ease allowance at the following body locations: chest girth, bottom hem circumference, back length, back width, waist circumference, upper arm circumference and scye circumference. The findings are presented in a similar order to the ease tables for the dress jacket.

The findings are presented against the background of the size designation and finished garment measurements for the male combat shirt in the ARMSCOR specifications, document number: 05181-100-017 (see Annexure K). The size categories are based on the height and chest girth of the intended wearer. For example, 95-90 indicates a regular height and 900 mm chest whereas 99-90 indicates a tall figure and 900 mm chest. These height indicators are not described in the ARMSCOR specifications. According to Aldrich (1997:10-11) the height of a 'regular' figure is between 170 cm and 178 cm and the height of a 'tall' figure is between 178 cm and 186 cm.

One of the subjects (number 52) wore a combat shirt size 92RI. This garment was designated according to a previous size roll and is therefore not stipulated in the ARMSCOR specifications and the issued garment measurements are not available. Due to the above, the ease allowance at various locations could not be calculated for this subject.

The amount of ease at the chest girth will be investigated in the following section.

4.4.2.1 Chest girth/Bust girth

Chest girth is the key dimension used to issue the combat shirts. Due to discrepancies between the bodies of males and females, the chest measurement of a male (relatively flat) does not reflect the bust measurement of a female (relatively rounded) and subsequently it was not possible to compile a bust ease table for the combat shirt.

The bust measurements of the subjects were taken at "maximum quiet respiration with the subject standing upright and the tape measure passed horisontally over the shoulder blades, directly under the armpits and over the bust" (RMSS 1994:168). According to the ARMSCOR specifications (Document number: 05741-100-024) the chest measurement of the combat shirt is taken "across the width of the garment at the base of the scye and is then multiplied by two". Due to gender-specific body proportions this measurement cannot describe or be compared to the bust measurement of the subjects as their higher bust points are level with the middle of the scye of the combat shirt and not at the base of the scye as it would be when worn by male wearers. This causes the neckline to drop down and extend into the bust area.

These findings are supported by the following subjective comments as follows:

- "The neckline opens, it is too low" "About ten centimeters too low".
- " I must wear a *(safety)* pin…otherwise my breasts would show".

It can be inferred from the above comments pertaining to the chest girth that:

- The bust measurements of the subjects are approximately at the height of the collar points of the garment.
- The base of the scye extends below the bust point due to fact that the combat shirt drops down over the upper arms because the female wearers do not have broad shoulders and flat chests. This finding is supported by the following frequently mentioned subjective comment: "They have designed short sleeves *(combat shirts with short sleeves)*, but you can see right through, you can see into the armpit…and the whole cleavage is showing".

It is clear from the above that the bust circumference of the subjects is situated in the middle of the armscye and not 35 mm to 50 mm below the armscye as indicated by the norm for a standard block pattern of a female garment.

Due to the above findings, the bust circumferences of the subjects were compared to a horisontal measurement that extends over the collar point of the garment and includes half of the upper arm circumference. This measurement is multiplied by two in order to obtain a realistic garment measurement (to subtract the bust circumference from) in order to determine actual amount of ease allowed.

Table 22 presents an example of this ease calculation. Only one combat shirt (size 95-110) was available to be analysed. Three subjects were issued with this size. The findings are presented in the following table.

TABLE 22: EASE ALLOWANCE FOR THE COMBAT SHIRT AT THE BUST CIRCUMFERENCE

ARMSCOR specifications		Subject number	Chest Measurement (Issued Garment) (mm)	Horisontal garment measurement over collar point plus half of upper arm multiplied by two to represent bust dimension (mm)	Subject bust measurement (mm)	Ease allowance per subject (mm)
Size designation category	Chest measurement (Nominal finished garment) (mm)					
95-110	1300	51	1266	1400	1045	355
		50			1126	274
		42			1140	260

Table 22 indicates that the range for the ease allowance for a female bust dimension is between 260 mm and 355 mm. This amount of ease in a garment intended for a female, results in too much bulkiness in the upper chest area and a gaping neckline. The above is supported by the following frequently mentioned comment (see Table 21): "This is not for ladies, this shape *(style of the combat shirt)* is a men's shape". Subject number 42, who had an ease allowance of 260 mm agreed with this statement.

It is evident from Table 22 that the issued garment chest measurement is 34 mm smaller than stipulated in the ARMSCOR specifications, assigning 34 mm less ease than prescribed in the specifications.

The ease allowances per subject, presented in Table 22, exceed the prescribed ARMSCOR specifications for males, namely 200 mm of ease at the chest location. It is also more than the norm of ± 205 mm that is indicated for designing loose fitting female garments (Muller 1970:2).

Cooklin (1995:16) suggests using 16,9 percent of the outsized subject's bust girth as ease allowance when designing a straight jacket with sleeve that is similar to the style of the combat shirt (see Table 4). Due to 17 out of 23 subjects being truly or very nearly outsized, this standard was used to establish a norm. According to Cooklin's (1995:16) principle, it is implied that the subject with the smallest bust requires 138 mm of ease and the subject with the largest bust requires an ease allowance of 235 mm. Cooklin's (1995:16) principle supports the opinion that the ease range (260 mm to 355 mm) provided by the combat shirt used as example (size 95-110) is in excess.

In order to further investigate the norm for ease at the chest, the standard for assigning ease allowance for a loose-fitting female garment as developed by Hollen and Kundel (1993:198) was consulted. According to this standard, the ease allowance at the bust of a loose fitting shirt should range between 5 1/8 inches and 8 inches (Hollen & Kundel 1993:198). Converted to millimeters, the range for ease should be between 130 mm and 203 mm (Hollen & Kundel 1993:325).

In consideration of the above factors, it was decided that a norm of 130 mm to 220 mm ease/tolerance would be adequate at the bust location. As it was not possible to compile a bust ease table for the combat shirt, the above norm will be used to interpret the findings in terms of ease in the instance of the other results.

It may be concluded from the above findings for ease at the bust location that:

- The male body measurements are not representative of female body measurements and therefore cannot provide good fit for female wearers.
- The body measurements of males at the chest girth are not taken at the same location as it would be taken for females and therefore the two measurements cannot be compared with one another.
- Male key body measurements cannot be used to issue female wearers with correct sizes.
- Due to the fact that the shoulders of females are not as broad as those of males, the neckline of the combat shirt is too low for female wearers. This can result in

multiple fit problems in terms of both the functional performance and aesthetic appearance of the garment.

- Overall excess ease allowance at the chest location results in too much bulkiness which negatively influences the comfort of the garment.

4.4.2.2 Bottom hem (hip) circumference

The bottom hem circumference is presented in the ARMSCOR specifications (Document number: 05181-100-017) as a secondary dimension. The bottom hems of the combat shirts were compared to the hip measurements of the subjects as the shirts extend over the hipline.

To decide on a norm for ease at the hip location, this range is compared to Cooklin's (1995:16) principle which suggests using 14 percent of the subject's hip girth as ease allowance (see Table 4). According to Cooklin's (1995:16) principle, this would mean that the subject with the smallest hip girth would require 112 mm ease allowance and the subject with the largest hip girth would require 190 mm of ease allowance. It was decided to use a norm of 100 mm to 200 mm to interpret the findings in terms of sufficient ease/tolerance at the hip location.

The findings regarding ease allowance at the bottom hem are presented in Table 23. The subjective and objective comments are also included.

TABLE 23: SATISFACTION WITH FIT IN TERMS OF EASE ALLOWANCE FOR THE COMBAT SHIRT AT THE BOTTOM HEM CIRCUMFERENCE

ARMSCOR specifications		Subject number	Bottom hem measurement (Issued garment) (mm)	Hip measurement (Subject)	Ease allowance per subject (mm)	SUBJECTIVE VIEWS			OBJECTIVE VIEWS					
									Judge 1			Judge 2		
Size designation category	Bottom Hem measurement (Garment)(mm)					Adequate ease	Insufficient ease	Excess ease	Adequate ease	Insufficient ease	Excess ease	Adequate ease	Insufficient ease	Excess ease
95-70	970	22	940	1080	-140	-	-	-		✓			✓	
95-80	1050	12	1070	967	103	-	-	-	✓			✓		
95-90	1120	18	1100	1038	62	✓				✓			✓	
		25		1108	-8		✓			✓			✓	
		26		1045	55	✓				✓			✓	
		49		1190	-90		✓			✓			✓	
95-100	1200	41	1186	1044	142	✓					✓	✓		
95-110	1300	42	1270	1184	86	✓				✓			✓	
		50		1091	179	✓			✓			✓		
		51		1068	202	✓			✓			✓		
95-120	1410	21	1390	1358	32		✓			✓			✓	
95-130	1520	-	1470	-	-	-	-	-		-		-	-	-
99-70	970	1	940	806	134		✓		✓			✓		
		13		977	-37	-	-	-		✓			✓	
99-80	1050	-	990	-	-	-	-	-	-	-	-	-	-	-
99-90	1120	3	1100	1078	22		✓			✓			✓	
		8		1098	2		✓			✓			✓	
		19		1050	50	-	-	-		✓			✓	
		33		1075	25	✓			✓			✓		
		43		1165	-65		✓			✓			✓	
99-100	1200	-	1140	-	-	-	-	-	-	-	-	-	-	-
99-110	1300	24	1274	1316	-42		✓			✓			✓	
		27		1296	-22		✓			✓			✓	
		32		1225	49	-	-	-		✓			✓	
		34		1245	29		✓			✓			✓	
99-120	1410	-	1348	-	-	-	-	-	-	-	-	-	-	-
99-130	1520	-	1520	-	-	-	-	-	-	-	-	-	-	-
92RI	-	52	-	944	-	✓					✓			✓

Comparison of the issued garment bottom hem measurement to the ARMSCOR specifications, presented in Table 23 reveal that the bottom hem dimension of the combat shirt is in most instances less than specified (12 out of 14 sizes). This means that the garments have even less ease at this location.

Compared to the norm of 100 mm to 200 mm, Table 23 shows that:

- Four subjects (12, 41, 50, 1) had adequate ease at the hip location ranging from 103 mm to 179 mm.
- Seventeen subjects (22, 18, 25, 26, 49, 42, 21, 13, 3, 8, 19, 33, 43, 24, 27, 32, 34) had insufficient ease ranging from 0 mm to 86 mm.
- Only one subject, (number 51) had ease of 202 mm, which is 2 mm in excess of the norm.

It is clear from this comparison that the combat shirt does not accommodate the hip dimensions of the majority of the subjects in the sample.

It is clear from the subjective viewpoint that:

- Eight subjects (18, 26, 41, 42, 50, 51, 33, 52) that commented were satisfied with the amount of ease at the bottom hem ranging from 25 mm to 202 mm.
- Ten subjects (25, 49, 21, 1, 3, 8, 43, 24, 27, 34) that commented were of the opinion that they had insufficient amounts of ease allowance between -90 mm and 134 mm.
- None of the subjects experienced the amounts of ease to be excessive.

Investigation of the reasons for satisfaction with ease that is less than the norm, revealed the following:

- Three subjects (18, 26, 33) who had triangle body shapes, had theoretically (according to the suggested norm) insufficient ease of 62 mm, 55 mm and 25 mm respectively. Due to the cut (style) of the combat shirt not being flared at the hip location, it is expected that the larger hip circumference of the triangle body shape is not accommodated by the bottom hem circumference of the garment. The reason for the above-mentioned subjects not complaining could be that these subject accepted less ease at the hip location in order to have adequate ease at other body locations.

- Although ease at the bottom hem circumference was insufficient for a loose-fitting garment, these ease allowances are sufficient for a tight fitting garment. This may be another reason why these subjects did not complain.

Dissatisfaction with insufficient ease allowances is supported by the subjective comments made by subjects 8, 28 and 43: "I need more space *(ease)* at the hips... it opens up *(the buttons gape open)* here at the hips". Insufficient ease at the hip location causes the buttoned openings of the garments to gape open which results in dissatisfaction experienced by the subjects. Subject 25 further stated that: "It (combat shirt) makes your body look worse" (see Table 21). Due to the fact that this subject had insufficient ease of -8 mm, her comment supports the finding that the style of the combat shirt does not accommodate the female body shape and thereby does not compliment the female body form.

Due to the above discrepancies it seemed acceptable to adapt the ease range for subject satisfaction to a range of 86 mm to 202 mm in order to satisfy an optimum number of subjects.

The evaluation of the fit judges in terms of ease at the bottom hem reveals the following:

- The fit judges were of the opinion that in the instance of 16 out of 23 subjects (22, 18, 25, 26, 49, 42, 21, 13, 3, 8, 19, 43, 24, 27, 32, 34) the amount of ease at the bottom hem ranging from 0 mm to 86 mm was insufficient.
- In five instances (12, 50, 51, 1, 33) the judges agreed that the amounts of ease at this location was adequate, ranging from 25 mm to 202 mm. Due to deviations from the recommended norm as a result of body form, the insufficient ease (25 mm) was removed from the satisfaction range. The combat shirt is oversized and bulky overall and the close fit at the hip location may have been preferred. The objective satisfaction range was adapted to a range of 103 mm to 202 mm.

Comparison of the subjective views to the objective evaluations reveals that opinions correspond relatively well. It follows from Table 23 that:

- In three instances (50, 51, 33) it was agreed that ease at the bottom hem ranging from 25 mm to 202 mm was adequate.
- In nine instances (25, 49, 21, 3, 8, 43, 24, 27, 34) it was agreed that ease ranging from 0 mm to 32 mm was insufficient.

Consideration of the subjective and objective satisfaction with ease across size categories reveals the following: for the smaller sizes from size 70 to size 100 (regardless of the height range of '95' or '99') an ease range between 86 mm and 142 mm could be adequate for an optimum number of wearers. In the instance of the larger sizes, from size 110 to size 130 an ease range of 140 mm to 200 mm could be adequate to provide the plus-sized wearers with adequate amounts of ease.

Personal observation revealed that the bottom hem circumferences of the combat shirts do not accommodate the hip measurements and body shapes of the wearers in general. The combat shirt of the majority of the subjects participating in the second phase sample, flared open below the last button. This is due to the strain of the garment on the body of the wearer. Buttoned openings that strain and gape open are uncomfortable for the wearer as well as aesthetically unpleasing.

From these results, it can be concluded that:

- The bottom hem (hip) dimension of the combat shirt does not provide adequate ease allowance for the female hip dimensions of this sample.
- Compared to the ARMSCOR specifications, the bottom hems of the combat shirts had less ease than prescribed in the specification, resulting in even less ease available to the wearer.
- The ease allowance at the bottom hem location does not accommodate a variety of female body shapes such as the wide hip measurement of the triangular body shape.
- Insufficient ease at the hip dimension holds various functional complications as it restricts movement and impacts on the comfort of the garment.

- Insufficient ease at the hip dimension holds various aesthetic complications as buttoned openings that gape open and wrinkles that pull do not contribute to an organisational image.
- Smaller sizes (up to and including size 100) need less ease than sizes above 100.

4.4.2.3 Back length

As with the dress jacket, the findings regarding the back length are presented because of the implications for the amount of ease at the hip area. The back length of the shirt is prescribed in the ARMSCOR specifications (Document number 05181-100-017) as one of the nominal finished garment measurements and is therefore a secondary dimension. The back length of the subjects (cervical to waist and waist to buttock) were subtracted from the back lengths of the combat shirts to determine the differences in lengths allowed for each subject. The opinions of the subjects and judges regarding the back length of the shirts are also included.

TABLE 24: FIT IN TERMS OF DIFFERENCES IN THE BACK LENGTH OF THE SUBJECTS AND THE COMBAT SHIRTS

ARMSCOR specifications						SUBJECTIVE OPINION			OBJECTIVE OPINION					
									Judge 1			Judge 2		
Size designation category	Back length measurement of the garment (mm)	Subject number	Back length measurement (Issued garment)(mm)	Back length body measurement (Subject)(mm)	Differences in length per subject (mm)	Adequate ease	Insufficient ease	Excess ease	Adequate ease	Insufficient ease	Excess ease	Adequate ease	Insufficient ease	Excess ease
95-70	680	22	682	618	64			✓		✓			✓	
95-80	710	12	705	654	51	-	-	-			✓	✓		
95-90	730	18	716	679	37	✓				✓		✓		
		25		694	22			✓		✓		✓		
		26		668	48			✓		✓				✓
		49		735	-19		✓			✓		-	-	-
95-100	750	41	742	610	132	✓	-	-		✓		-	-	-
95-110	770	42	750	599	151	✓				✓		✓		
		50		715	35	-	-	-		✓		✓		
		51		687	63	-	-	-		✓		-	-	-
95-120	800	21	787	676	111	✓				✓		✓		
95-130	830	-	820	-	-	-	-	-	-	-	-	-	-	-
99-70	720	1	710	594	116	✓				✓		✓		
		13		642	68	-	-	-		✓				✓
99-80	750	-	820	-	-	-	-	-	-	-	-	-	-	-
99-90	770	3	755	653	102	-	-	-		✓				✓
		8		752	3		✓			✓				✓
		19		680	75	-	-	-		✓		✓		
		33		680	75	-	-	-		✓		✓		
		43		723	32			✓		✓				✓
99-100	790	-	780	-	-	-	-	-	-	-	-	-	-	-
99-110	810	24	808	674	134			✓		✓				✓
		27		687	121	✓				✓				✓
		32		670	138	-	-	-		✓				✓
		34		669	139	✓				✓		-	-	-
99-120	840	-	818	-	-	-	-	-	-	-	-	-	-	-
99-130	870	-	870	-	-	-	-	-	-	-	-	-	-	-
92RI	-	52	-	696	-	✓				✓		-	-	-

Comparison of the issued garment measurements to the ARMSCOR specifications for nominal finished garment measurements revealed that the measurements correspond relatively well to the specifications as the largest deviation is 20 mm for size 95-110. The specification indicates that as the size of the combat shirt increases, the back length measurement increases with either 20 mm or 30 mm for each new size.

The subjective opinions that are presented in Table 24 indicate that:

- Eight out of the fifteen subjects that commented (18, 41, 42, 21, 1, 27, 34, 52) were satisfied with the lengths of their combat shirts extending 37 mm to 151 mm longer than their back lengths.
- Two subjects (8, 49) were of the opinion that the shirts are too short. The back length dimensions of the combat shirts of these subjects were from 19 mm shorter to 3 mm longer than their back length body dimensions.
- Five subjects (22, 25, 26, 43, 24) commented that they were of the opinion that the shirts are too long with the ease ranging from 22 mm to 134 mm.

The following comment made by subject number 49 illustrates dissatisfaction with the length of the combat shirt: "I am not happy, it *(combat shirt)* is too short. It shows my bottom and I do not like that but I cannot take a longer one because it does not button over my hips". This comment serves to explain the dissatisfaction with the ease allowed as well as the impact of the back length on the hip location.

During the one-to-one interviews, six subjects (22, 21, 33, 43, 27, 34) referred to the combat shirt as a 'dress' (see Table 21). This may be due to the back length of the shirts as the above-mentioned subjects had garments with measurements ranging between 32 mm and 139 mm longer than their back length body measurements. It is interesting to note that only two of the above-mentioned subjects commented that the back length of their garments were too long. The contrasting opinions of the subjects may be ascribed to the vertical line impact created by a longer garment. As previously explained regarding the dress jacket, a longer garment results in a slimmer appearance as it hides figure flaws.

The evaluation of the judges in Table 24 reveals that both judges agreed in only one instance that subject number 22's shirt was too short (this subject had 64 mm ease). It is interesting to note that the subject was of the opinion that her shirt is too long. When investigating the reasons for the difference in satisfaction it can be inferred that:

- Due to the triangular body shape of this subject, the back length measurement of her shirt could impact on the ease allowance at her bottom hem location. The judges agreed (see Table 23) that the ease at the bottom hem location was insufficient (-140 mm).
- The judges may have evaluated the garment length as being too short because it did not cover the wide hips of the subject. It is expected that the garment will ride up over the hips and therefore appear to be too short when in actuality, it is not. This may be the reason for judge number one consistently evaluating the shirts as being too short.

In the majority of cases it appears that plus-sized wearers (wearing sizes 110 to 130) were satisfied with longer back lengths (ease ranging between 111 mm and 151 mm) whereas subjects who wore smaller sizes were dissatisfied. Conversely, subjects who wore the smaller sizes (sizes 70 to 100) were more satisfied with shorter back lengths (ease ranging between 37 mm and 132 mm). Even though many subjects wore combat shirts from the larger height category (the '99' range) their garments did not extend predominantly lower than subjects who wore the '95' range.

The following may be concluded from the results in terms of back length of the combat shirt:

- If the back length measurement is too short, the garment will not cover the subject's hips and buttocks, resulting in wearer dissatisfaction.
- A back length measurement that is too long causes complications at the hip location (as it will extend beyond the fullest part of the hips).

- If the back length measurement is too long, various female body shapes will not be accommodated due to excessive ease at the hip location.
- If the back length measurement extends beyond the fullest part of the hips, additional ease should be added to the hip dimension to accommodate expansion of the hip location when the wearer sits.

4.4.2.4 Back width

In Table 25, the results regarding satisfaction with ease at the back width location are presented. The back width measurement is an important indicator of ease for two reasons. Firstly, this measurement is used in the ARMSCOR specifications (Document number 05181-100-017) to describe nominal finished garment measurements. Secondly, the ease allowance at this location is essential to provide the necessary ease of movement in terms of the functionality of the combat shirt at the back width and bust level.

In order to interpret the findings in terms of ease, it is necessary to determine the norm for ease at the back width location. Gioello & Berke (1979:16-23) suggest a minimum of 38 mm ease at the back width for the block pattern of a female close fitting garment (see Table 1). Cooklin (1995:16) prescribes an across back garment measurement of 440 mm for a back width body measurement of 343 mm, thereby allowing 97 mm of ease allowance at the back width.

This amount of ease was adapted with consideration that the garment is worn over an undershirt. Additional ease is needed to accommodate the fullness of the garment that is worn underneath the combat shirt. The style of the combat shirt has a longer shoulder line and a loose-fitting sleeve. The afore-mentioned factors impact on the ease required at the back width location. Lastly, the intended use of the combat shirt as a battledress uniform must be kept in mind. In consideration of the afore-mentioned factors, it was decided to use a norm of 65 mm to 100 mm for sufficient ease at the back width location.

TABLE 25: SATISFACTION WITH FIT IN TERMS OF EASE ALLOWANCE FOR THE COMBAT SHIRT AT THE BACK WIDTH

ARMSCOR specifications						SUBJECTIVE VIEWS			OBJECTIVE VIEWS					
									Judge 1			Judge 2		
Size designation category	Back width measurement (Garment)	Subject number	Back width measurement (Issued garment)(mm)	Back width measurement Subject (mm)	Ease allowance per subject (mm)	Adequate ease	Insufficient ease	Excess ease	Adequate ease	Insufficient ease	Excess ease	Adequate ease	Insufficient ease	Excess ease
95-70	360	22	350	340	10		✓			✓			✓	
95-80	400	12	395	330	65		✓		✓			-	-	-
95-90	430	18	428	360	68	✓			✓			✓		
		25		375	53	-	-	-		✓			✓	
		26		358	70	-	-	-	✓			✓		
		49		330	98		✓		✓					✓
95-100	460	41	462	320	142	✓			✓					✓
95-110	500	42	500	375	125	✓			✓			✓		
		50		395	105	✓			✓			✓		
		51		380	120	✓			-	-	-			✓
95-120	530	21	525	460	65			✓	✓				✓	
95-130	560	-	565	-	-	-	-	-	-	-	-	-	-	-
99-70	360	1	350	290	60	-	-	-	✓			✓		
		13		345	5	-	-	-	✓				✓	
99-80	400	-	385	-	-	-	-	-	-	-	-	-	-	-
99-90	430	3	422	370	52	-	-	-		✓			✓	
		8		365	57	-	-	-	-	-	-	-	✓	
		19		345	77	-	-	-	✓			✓		
		33		350	72			✓	✓			✓		
		43		370	52		✓		✓			✓		
99-100	460	-	460	-	-	-	-	-	-	-	-	-	-	-
99-110	500	24	497	380	117	✓			✓					✓
		27		420	77		✓			✓		✓		
		32		375	122	-	-	-	✓			✓		
		34		410	87			✓	✓			✓		
99-120	530	-	525	-	-	-	-	-	-	-	-	-	-	-
99-130	560	-	567	-	-	-	-	-	-	-	-	-	-	-
92RI	-	52	-	365	-	✓			✓					✓

Comparison of the ARMSCOR specifications to the issued garment back width measurement in Table 25 reveals that the issued garments correspond relatively well to the specifications. The specification indicates that an increase in the size of the combat shirt is accompanied by an increase in the back width of 30 mm to 40 mm for each size.

Comparison of the norm of 65 mm to 100 mm for ease at the back width to the issued garment measurements presented in Table 25, reveals the following:

- Nine subjects (12, 18, 26, 49, 21, 19, 33, 27, 34) had adequate amounts of ease.
- Seven subjects (22, 25, 1, 13, 3, 8, 43) had insufficient ease.
- Six subjects (41, 42, 50 51, 24, 32) had excess ease.

The subjective opinions of subjects with regard to ease at the back width location, presented in Table 25, indicated that:

- Seven subjects (18, 41, 42, 50, 51, 24, 52) were satisfied with the amount of ease ranging from 68 mm to 142 mm. The satisfaction of these subjects validates the suggested minimum norm of 65 mm.
- Two subjects (41, 42) were satisfied with ease allowance of 142 mm and 125 mm which exceeds the norm. Their satisfaction may be due to the fact that one is overweight (41) and the other obese (42) and that they have square (41) and diamond (42) body shapes respectively, which may result in them preferring looser fitting garments. In terms of subjective fit preferences, Table 8 indicates that subject 41 prefers wearing loose-fitting garments. This subject expressed a preference for baggy clothing and therefore experienced the garment to be comfortable.
- Five subjects (22, 12, 49, 43, 27) expressed dissatisfaction due to insufficient ease ranging from 10 mm to 98 mm. Three of these five subjects (12, 49, 27) had ease allowances within the recommended norm. Two of the afore-mentioned subjects (12, 27) had ease allowance in the lower ranges of the norm. Dissatisfaction with adequate ease at the back width could be influenced by the wearer characteristics as one of the three subjects (27) is obese and another (49) is overweight.

- Three subjects (21, 33, 34) commented that they were dissatisfied due to excess amounts of ease at the back width location ranging between 65 mm and 87 mm. These subjects may have experienced the ease as excess even though it was theoretically adequate due to the fact that excess ease at other locations (such as the bust, upper arm and scye circumferences) could create the impression of excess ease at the back width.

The comment made by subject number 21 supports her dissatisfaction with the excess ease: "At the back, it is not comfortable at all. It is too much". From Table 25 it can be seen that subject 21 had only 65 mm of ease at the back width. This allowance is at the lowest level within the acceptable norm. As previously explained the ease allowance at other locations can impact on the ease at this location and therefore she can experience the ease allowed as too much.

It is interesting to note that the minimum level of ease inferred from the statements of the satisfied subjects is similar to the recommended norm. Most of the subjects are overweight, which may explain their preference for excess ease at the back width.

Due to the above reasons for deviation from the norm, the subject satisfaction range was adapted to a range of 68 mm to 120 mm.

The perceptions of the judges, presented in Table 25, indicate that:

- Both judges agreed that ten subjects (18, 26, 42, 50, 1, 19, 33, 43, 32, 34) had adequate ease ranging from 52 mm to 125 mm. This range is near the suggested norm, thereby validating the norm range of 65 mm to 100 mm.
- Both judges agreed that three subjects (22, 25, 3) had insufficient ease of 10 mm, 53 mm and 52 mm respectively. This supports the minimum ease norm suggested of 65 mm as less than this amount proves to the insufficient.
- In no instance did the judges agree on excess amounts of ease at the back width location.

Comparison of the subjects' satisfaction to the evaluation of the judges in Table 25, indicates that:

- In three instances (18, 42, 50) both parties agreed that adequate ease ranges from 68 mm to 125 mm.
- In one instance (22) both parties agreed that 10 mm ease allowance is insufficient.

Consideration of the available ease for subjective and objective satisfaction across size categories reveals that for the smaller sizes from size 70 to size 100 (regardless of the height range of '95' or '99') an ease range of 52 mm to 77 mm could be adequate for an optimum number of wearers. For the larger sizes (from size 100 to size 130) an ease range of 87 mm to 125 mm could be adequate.

In conclusion it is important to consider the significance of the back width dimension. The ease at this location can impact on the ease of movement at other locations at the same level as the back width.

4.4.2.5 Waist circumference

According to Gioello and Berke (1979:16-23) the recommended ease allowance for a male garment at the waist location is 12 mm and in the instance of a female garment it is 25 mm (see Table 1). It is interesting to note that the above authors suggest double the amount of ease in the instance of a garment intended for females. This is due to the fact that a male figure is generally tapered to the waist as the chest is broader than the hips. In the instance of females, the hips are generally broader than the chest, causing the waist circumference to be larger. Due to this, the female wearers can experience dissatisfaction when wearing male garments. The clothing industry supports the above as it is a general design practice to slightly flare a woman's shirt outwards to the hip in order to accommodate the waistline and hips. This principle was not applied in the design of the combat shirt originally intended to be worn by males only.

To investigate the norm for ease at the waist location, Cooklin's (1995:16) standard was consulted. Cooklin (1995:16) does not prescribe a norm for ease at the waist but it can be inferred that the median (of 15,5 percent) between the bust girth (16,9 percent of the bust circumference) and the hip girth (14 percent of the hip circumference) would be sufficient to determine ease allowance as the shirt has a straight silhouette. Accordingly, the subject with the smallest waist would require 97 mm of ease and the subject with the largest waist would require 187 mm of ease.

To further investigate the norm for ease at the waist dimension, Muller's (1970:2) guide for drafting patterns (see Table 3) was also consulted. The combat shirt is not as loose fitting as a coat, and therefore it can be assumed that the median between a semi-tight fitting garment and a loose-fitting garment can be used as a guide. If this middle-range can be accepted it implies that the ease allowance should range between a minimum of 145 mm and a maximum of 255 mm.

In consideration of the above factors, the norm used to interpret the findings in terms of sufficient ease for the waist location was set between 100 mm and 200 mm. Table 26, overleaf, presents the findings for ease of the combat shirt at the waist dimension.

TABLE 26: SATISFACTION WITH FIT IN TERMS OF EASE ALLOWANCE FOR THE COMBAT SHIRT AT THE WAIST CIRCUMFERENCE

Size designation category	Subject number	Waist measurement (Issued garment) (mm)	Waist circumference (Subject) (mm)	Ease allowance per subject (mm)	SUBJECTIVE VIEWS			OBJECTIVE VIEWS					
								Judge 1			Judge 2		
					Adequate ease	Insufficient ease	Excess ease	Adequate ease	Insufficient ease	Excess ease	Adequate ease	Insufficient ease	Excess ease
95-70	22	864	864	0		✓			✓			✓	
95-80	12	1020	745	275	✓					✓			✓
95-90	18	1050	861	189	-	-	-	✓					✓
	25		955	95	-	-	-		✓		✓		
	26		859	191	✓					✓			✓
	49		733	317			✓	✓					✓
95-100	41	1142	860	282			✓			✓			✓
95-110	42	1210	1030	180			✓		✓		✓		
	50		912	298	✓					✓	✓		
	51		890	320	✓			✓					✓
95-120	21	1330	1208	122	✓			✓			✓		
95-130	-	1450	-	-	-	-	-	-	-	-	-	-	-
99-70	1	860	628	232			✓		✓				✓
	13		683	177	✓			✓					✓
99-80	-	952	-	-	-		-	-	-	-	-	-	-
99-90	3	1040	949	91		✓		✓					✓
	8		888	152	✓			✓					✓
	19		815	225	-	-	-	✓					✓
	33		745	295			✓	✓					✓
	43		785	255	✓			✓			✓		
99-100	-	1130	-	-	-	-		-	-	-	-	-	-
99-110	24	1238	1012	226		✓				✓			✓
	27		1044	194		✓				✓		✓	
	32		1035	203	-	-	-	✓					✓
	34		1050	188	✓				✓			✓	
99-120	-	1330	-	-	-	-	-	-	-	-	-	-	-
99-130	-	1510	-	-	-	-	-	-	-	-	-	-	-
92RI	52	-	731	-			✓			✓		-	-

The ARMSCOR specifications do not prescribe nominal finished garment measurements for the waist location. From the issued garment measurements it can be seen that the waist dimension increases as the size increases but the intervals are inconsistent with a range between 30 mm and 180 mm larger than the preceding size.

Comparison of the waist circumference ease norm of 100 mm to 200 mm to the ease available per subject presented in Table 26 shows that:

- Eight subjects (18, 26, 42, 21, 13, 8, 27, 34) had ease allowance within the recommended range. The above mentioned subjects had ease allowance between 122 mm and 194 mm.
- Three subjects (22, 25, 3) had less ease than the norm (0 mm, 95 mm and 91 mm respectively).
- Eleven subjects (12, 49, 41, 50, 51, 1, 19, 33, 43, 24, 32) had excess amounts of ease (ranging from 203 mm to 320 mm) at this location.

The subjective viewpoints regarding ease at the waist circumference, presented in Table 26, reveal that:

- Nine of the subjects (12, 26, 50, 51, 21, 13, 8, 43, 34) were satisfied with amounts of ease ranging between 122 mm and 320 mm.
- Four of the subjects (22, 3, 24, 27) expressed dissatisfaction with insufficient amounts of ease between 0 mm and 226 mm. The above is supported by a comment made by subject number three as follow: "My stomach is a problem, because this shirt is too tight". This subject had 91 mm of ease at the waist which is below the recommended norm. Furthermore, this subject had an oval body shape which supports the finding that the waist measurement and body shape should be taken into consideration in order to accommodate female body types.
- Six subjects (49, 41, 42, 1, 33, 52) expressed dissatisfaction caused by excess amounts of ease ranging between 180 mm and 317 mm. Subject number one and number 33 commented: "At the waist, it must be tighter". Excess amounts of ease at the waist location could contribute to the dissatisfaction the subjects experienced regarding the aesthetic performance of the garment (see Table 21) where some of the subjects referred to the combat shirt as 'maternity wear'.

Investigation of subject satisfaction with ease that is theoretically (according to the norm) considered to be in excess, revealed the following:

- Contrary to the fact that subject number 12 was satisfied with ease of 275 mm, this subject made the following comments during the one-to-one interview: "This big 'slobby' thing, you do not look neat…I feel sloppy". It may be inferred from the above that the subject experienced the ease as overall excess and therefore her opinion regarding the ease at the waist location will not be included in the subject satisfaction ease range.
- Three subjects (50, 51, 43) were satisfied with ease of 298 mm, 320 mm and 255 mm respectively. Their satisfaction with (theoretically) excess allowance may be ascribed to the fact that they are obese (according to their BMI values). Furthermore, it can be seen from Table 8 regarding fit preferences that two of the above mentioned subjects (50, 51) preferred wearing loose fitting garments. Their fit preferences therefore influenced their perception of the ease allowance at the waist location.

Due to the above discrepancies it seems acceptable to adapt the range of subjective satisfaction with ease to 122 mm to 191 mm.

The evaluation of the fit judges, regarding the waist girths of the combat shirts, presented in Table 26 reveals the following;

- In two instances (21, 43) the two judges agreed that adequate amounts of ease ranged from 122 mm to 255 mm.
- In two instances (22, 34), both judges agreed that insufficient ease ranged from 0 mm to 188 mm.
- In four instances (12, 26, 41, 24) the judges agreed that excess amounts of ease ranged from 191 mm to 282 mm.

The ease range for objective satisfaction is therefore between 122 mm and 255 mm.

Comparison of the subjects' satisfaction with the judges' evaluations in Table 26, indicates the following:

- Both parties agreed in two instances (21, 43) that the ease allowance was adequate between 122 mm and 255 mm.
- In one instance (22) both parties agreed on insufficient ease of 0 mm.
- Both parties agreed that subject 41 had an excess ease allowance of 282 mm, thereby supporting the suggested maximum norm range of 200 mm.

The findings regarding ease at the waist circumference indicated that the majority of the subjects had adequate or excess amounts of ease in general. Excess ease may result from subjects wearing larger sizes to accommodate another body location such as broader hips which in turn, results in excess ease at the waist. Subject number 49, for example, had a triangle body shape with a large hip circumference. The ease allowance at her hip location is -90 mm while she experienced excess ease of 317 mm at the waist location.

The male measurements on which the garments are based are generally larger than those used to design garments for females. This results in excess ease which causes the garment to be bulky at the waist location.

The findings in terms of the subjective and objective satisfaction regarding available ease across size categories indicated that for the smaller sizes (from size 70 to size 100 regardless of the height range of '95' or '99') an ease range between 122 mm to 192 mm could be adequate for an optimum number of wearers. For the larger sizes (size 110 to size 130) an ease range of 180 mm to 255 mm could be adequate.

From these results, it can be concluded that:

- The variety of female body shapes are not accommodated by the waist girths of the combat shirts.
- Excess ease at the waist location is aesthetically unpleasing as it can result in an untidy, oversized and unprofessional image which causes the female wearers of the combat shirt to be dissatisfied.

- The ease allowance at the waist should be increased for the larger sizes in order to accommodate the ease needs of the plus-sized wearers.
- Due to the design of the combat shirt which is not tapered to the waist, the larger hip dimension of females may necessitate the need for a larger size garment, resulting in excess ease at the waist location.
- Subjects wearing smaller sizes (up to and including size 100) were satisfied with less ease than subjects wearing sizes above 100.

4.4.2.6 Upper arm circumference

Another location that impacts on the horisontal measurement used to analyse the bust circumference and the back width location is the upper arm. The satisfaction with the amounts of ease at the upper arm dimension is investigated in the following section.

To investigate the norm for ease at the upper arm location, the standards set by Farmer and Gotwals (1982:222-223) and Haggar (1990:6-8) were consulted. Farmer and Gotwals (1982:222-223) and Haggar (1990:6-8) suggest that the minimum ease allowed at the upper arm should be no less than 50 mm. Gioello and Berke (1979:16-23) recommend a maximum ease amount of 101 mm at the upper arm location. Cooklin (1995:16) suggests a garment measurement of 440 mm at the upper arm location when designing a straight jacket with sleeves for an outsize wearer. When this amount is subtracted from the outsize body upper arm measurement of 378 mm it follows that 62 mm of ease is allowed at the upper arm location (Cooklin 1995:7).

In consideration of the above factors, the norm used to interpret the findings in terms of sufficient ease for the upper arm location was set between 60 mm and 100 mm. The subjective and objective opinions of the subjects and the two fit judges are presented in Table 27 below.

TABLE 27: SATISFACTION WITH FIT IN TERMS OF EASE ALLOWANCE FOR THE COMBAT SHIRT AT THE UPPER ARM LOCATION

Size designation category	Subject number	Upper arm measurement (Issued garment)(mm)	Upper arm measurement (Subject) (mm)	Ease allowance per subject (mm)	SUBJECTIVE VIEWS			OBJECTIVE VIEWS					
								Judge 1			Judge 2		
					Adequate ease	Insufficient ease	Excess ease	Adequate ease	Insufficient ease	Excess ease	Adequate ease	Insufficient ease	Excess ease
95-70	22	434	329	105		✓		✓				✓	
95-80	12	480	280	200	✓					✓			✓
95-90	18	496	330	166	-	-	-	✓			✓		
	25		341	155	✓			✓					✓
	26		335	161			✓		✓				✓
	49		331	165	✓					✓			✓
95-100	41	530	325	205	✓					✓			✓
95-110	42	520	329	191			✓			✓	✓		
	50		379	141		✓				✓	✓		
	51		334	186	✓					✓	✓		
95-120	21	580	465	115	✓			✓					✓
95-130	-	592	-	-	-	-	-	-	-	-	-	-	-
99-70	1	434	277	157	✓					✓			✓
	13		272	162	✓					✓			✓
99-80	-	468	-	-	-	-	-	-	-	-	-	-	-
99-90	3	504	346	158	-	-	-			✓			✓
	8		336	168	-	-	-			✓			✓
	19		300	204			✓			✓			✓
	33		306	198	✓					✓	✓		
	43		331	173	-	-	-			✓	-	-	-
99-100	-	552	-	-	-	-	-	-	-	-	-	-	-
99-110	24	562	345	217			✓			✓			✓
	27		410	152		✓		✓					✓
	32		365	197	-	-	-	✓					✓
	34		390	172			✓		✓		✓		
99-120	-	586	-	-	-	-	-	-	-	-	-	-	-
99-130	-	620	-	-	-	-	-	-	-	-	-	-	-
92Rl	52	-	372	-			✓			✓	-	-	-

The ARMSCOR specifications do not prescribe nominal finished garment measurements for this location. From the issued garment measurements it can be seen that the upper arm dimension increases as the size increases. The intervals are however inconsistent and range from -10 mm smaller to 60 mm larger than the previous size as presented below:

- From size 95-70 to size 95-80, the upper arm circumference increases with 46 mm.
- From size 95-80 to size 95-90, the upper arm circumference increases with 16 mm.
- From size 95-90 to size 95-100, the upper arm circumference increases with 34 mm.
- From size 95-100 to size 95-110, the upper arm circumference decreases with 10 mm.
- From size 95-110 to size 95-120, the upper arm circumference increases with 60 mm.
- From size 95-120 to size 95-130, the upper arm circumference increases with 12 mm.
- From size 99-70 to size 99-80, the upper arm circumference increases with 34 mm.
- From size 99-80 to size 99-90, the upper arm circumference increases with 36 mm.
- From size 99-90 to size 99-100, the upper arm circumference increases with 48 mm.
- From size 99-100 to size 99-110, the upper arm circumference increases with 10 mm.
- From size 99-110 to size 99-120, the upper arm circumference increases with 24 mm.
- From size 99-120 to size 99-130, the upper arm circumference increases with 34 mm.

The combat shirts of all of the subjects had ease allowances ranging between 105 mm and 217 mm which greatly exceed the estimated norm for the upper arm location.

The subjective views for ease at the upper arm location, presented in Table 27 indicate that:

- Nine out of 23 subjects (12, 25, 49, 41, 51, 21, 1, 13, 33) were satisfied with allowances ranging from 115 mm to 205 mm.
- Three subjects (22, 50, 27) experienced insufficient ease ranging from 105 mm to 152 mm. It must be taken into consideration that the subjects may have based their opinions on the ease available when the sleeve is rolled-up.
- Six out of 23 subjects (26, 42, 19, 24, 34, 52) experienced the ease allowances ranging from 161 mm to 217 mm as excess.

The range of subjective satisfaction is between 115 mm and 205 mm.

Subject number 8 commented that she experienced the ease allowance at upper arm area as both insufficient and in excess. She explained that the ease is in excess when the sleeve is not rolled-up but when the sleeve is rolled-up according to the specifications, then the ease is insufficient.

The above comment was supported by subject number 12 who was initially of the opinion that she experienced the ease allowance as adequate, but then stated that: "Because we have to roll-up our sleeves, the arms are fine. But if we did not have to roll it up, I would say less ease here *(upper arm)*. Because it is wide here *(upper arm)* but then it becomes tight when you roll it up. That's why we have a problem in our arm...the problem is the design *(of the sleeve)*. Because they know we must roll up our sleeves. And now they have designed these short sleeves, but you can see right through. You can see the armpit". Although another seven subjects (27, 50, 51, 34, 42, 49) experienced the ease at the upper arm as either adequate, insufficient or excess, they agreed with the above statement.

In response to questions regarding ease at the upper arm, subject 21 commented: "I cut it myself, I made it a short sleeve because it was hurting me. The long sleeve must be big here *(upper arm)* so that it enables me to fold it in summertime and to unfold it when it is wintertime...and in wintertime it is bad because it is becoming too huge". Subjects 18, 25 and 26 also cut off their long sleeves in an attempt to improve on the comfort of the garment. The subjects had ease allowances exceeding the recommended norm at the upper arm but the ease allowances diminished when the sleeve was rolled-up. Subject 25 stated that the 'cut-off' sleeve was now wide enough, while subject 26 was of the opinion that it was too large in the upper arm location.

In terms of the above-mentioned subjective comments, the problems experienced at the upper arm are evident. In this instance, it is the design of the garment which causes the amount of ease to be insufficient. The standard method (dress code) for rolling up the long sleeves requires that the full length sleeve is repeatedly folded in a prescribed manner to fit on the upper arm. The multiple layers of fabric cause the formerly excess ease to be insufficient. Furthermore, subject number 43 stated during the one-to-one interview that her sleeves are too long. The sleeve lengths are another factor to take into consideration when investigating the ease at the upper arm. Based on the dimensions of the male figure, it stands to reason that the sleeve lengths of the combat shirts would be too long for the female wearers, resulting in extra fabric fullness when the sleeve is rolled-up.

From the objective evaluation of the judges, the following can be seen from Table 27:

- The judges agreed in only one instance (subject 18) that the amount of ease was adequate at 166 mm.
- In nine instances (12, 49, 41, 1, 13, 3, 8, 19, 24), the two judges agreed that the amounts of ease were in excess, ranging from 157 mm to 217 mm.

Comparison of the subjects' satisfaction to the judges' evaluation in Table 27 indicates that both parties agreed in two instances (19, 24) on excess ease between 204 mm and 217 mm. The last mentioned amounts are double the suggested maximum norm and therefore their corresponding dissatisfaction supports the maximum ease norm to be 100 mm, as suggested.

Considering the ease range with which the subjects were satisfied (between 115 m and 205 mm) and the amount of ease with which both judges were satisfied (166 mm) across size categories reveals that for the smaller sizes from size 70 to size 100 (regardless of the height range of '95' or '99') an ease range between 115 mm to 165 mm could be adequate for an optimum number of wearers. For the larger sizes, from size 110 to size 130 an ease range of 152 mm to 205 mm could be adequate.

From these results it can be concluded that:

- A garment that is originally designed for males is less suitable for females at the upper arm location.
- The ease at the upper arm is in excess for all of the subjects in this sample.
- Excess ease allowance at the upper arm location results in sleeves that are too bulky. This results in a garment that is both functionally and aesthetically unpleasing.
- When the sleeve is rolled-up, the excess ease allowance diminishes to insufficient amounts of ease.
- The functional performance related to the design of the combat shirt is unsatisfactory due to the 'rolling-up' of the long sleeves which restricts comfortable movement.
- Subjects wearing smaller sizes (up to and including size 100) were satisfied with less ease than the subjects wearing sizes above 100.
- The sleeve of the combat shirt is straight from the armhole down to the cuff width, therefore the findings regarding the amounts of ease also relate to the elbow, forearm and wrist circumferences.

4.4.2.7 Scye circumference

The scye circumference is an important ease indicator for two reasons. Firstly, the scye circumference impacts on the horisontal measurement used to analyse the bust and back width locations which are essential for the provision of the necessary ease of movement. Secondly, the scye circumference of the combat shirt is one of the secondary dimensions specified in the ARMSCOR specifications (Document number 05181-100-017) as a nominal finished garment measurement.

As point of departure, the norm for the scye circumference of the combat shirt is similar to that of the dress jacket, ranging from 50 mm to 150 mm. Once again the norm was in line with the principle developed by Joseph-Armstrong (2000:29) who prescribes 6 mm ease at the front mid-armhole and 26 mm ease at the side seams (13 mm for the front side seam and 13 mm ease for the back side seam). In the instance of a dropped shoulder (such as for the combat shirt) the armhole is dropped with a further 19 mm (Joseph-Armstrong 2000:364). Added together, the minimal ease allowance for the scye circumference is 51 mm, which supports the minimal ease requirement of the norm.

In the instance of a loose fitting garment (such as the combat shirt) this amount can be doubled due to the following: Firstly, many of the subjects wear garments underneath their combat shirts to provide comfort. This additional fullness has to be accommodated. Secondly, the intended use of the combat shirt as a battledress uniform must be considered. Thirdly, it must be kept in mind that the shirt is intended for males and that the longer shoulder dimension results in an armhole seam that extends past the natural shoulder to the top of the upper arm. In consideration of the above factors, the norm used to interpret the findings in terms of sufficient ease is set between 100 mm and 150 mm.

The results for the scye circumference are presented in the following Table. There are no subjective and objective views (as the scye circumference was not commented on).

TABLE 28: FIT IN TERMS OF EASE ALLOWANCE FOR THE COMBAT SHIRT AT THE SCYE CIRCUMFERENCE

ARMSCOR specifications		Subject Number	**Scye circumference (Issued garment) (mm)**	**Scye circumference of the subject (mm)**	**Ease allowance per subject (mm)**
Size designation category	**Scye circumference (Garment) (mm)**				
95-70	510	22	518	400	118
95-80	550	12	558	386	172
95-90	580	18	588	473	115
		25		419	169
		26		420	168
		49		462	126
95-100	610	41	603	446	157
95-110	640	42	625	495	130
		50		440	185
		51		420	205
95-120	660	21	660	499	161
95-130	690	-	690	-	-
99-70	510	1	508	430	78
		13		395	113
99-80	550	-	550	-	-
99-90	580	3	572	470	102
		8		170	402
		19		433	139
		33		389	183
		43		399	173
99-100	610	-	615	-	-
99-110	640	24	637	430	207
		27		475	162
		32		448	189
		34		442	195
99-120	660	-	660	-	-
99-130	690	-	719	-	-
92RI	-	52	-	284	-

Comparison of the issued garment measurements to the ARMSCOR specifications in Table 28 shows that the issued garment measurements correspond relatively well to the specifications as the largest deviation from the standard is 15 mm. According to the specifications, the scye circumference increases with every size increment regardless of the height (whether the garment is intended for a regular height in the 95 range or for a tall figure in the 99 range).

The increase in the scye circumference for the 95 and 99 ranges is discussed below:

- From size 70 to size 80 the scye circumferences increases with 40 mm.
- From sizes 80 to 90, 90 to 100, 100 to 110 and 120 to 130, the scye increases with 30 mm for each new size.
- The circumference increase between sizes 110 and 120 is 20 mm.

It is important to note that two of the larger sizes have smaller scye circumference increases than the smaller sizes.

Comparison of the scye circumference norm of 100 mm to 150 mm to the ease available per subject in Table 28 shows that:

- The combat shirts of seven out of 23 subjects (22, 18, 49, 42, 13, 3, 19) had adequate ease at the scye circumference ranging from 102 mm to 139 mm.
- The combat shirts of fourteen subjects (12, 25, 26, 41, 50, 51, 21, 8, 33, 43, 24, 27, 32, 34) had excess ease at the scye circumference, ranging from 157 mm to 402 mm.
- One of the subjects (number 1) had 78 mm ease which is less than the recommended norm for ease at the scye circumference.

In conclusion it is clear that ease/tolerance in the scye area, is in most instances adequate or in excess. Excess ease results in a deep armhole which will restrain movement by pulling the sleeve towards the body. It should be emphasized that, similar to the findings for the dress jacket, a scye circumference that is too large will restrict the movement of the wearer. This finding is supported by the following subjective comments (see Table 20):

- "I have to go *(reach)* up. It is very difficult. It makes us uncomfortable" (subject 33). This subject had excess ease of 183 mm which caused restriction of movement while she was completing her work activities.
- "We are in the stores, counting stock (medals, buttons) going up and down *(reaching up and down)*...it is so uncomfortable" (subject 8). This subject had excess ease of 402 mm which is more than double the amount recommended in the norm. It may be inferred that the discomfort experienced by the subject is caused by excess ease at the scye circumference.
- "This big 'slobby' thing, you do not look neat "(subjects 8 and 12; see Table 21) and "It looks very untidy" (subjects 27 and 33; see Table 21). These four subjects (8, 12, 27, 33) had excess ease at the upper arm and scye circumferences which resulted in an oversized and baggy garment. Last mentioned impacts negatively on the aesthetic appearance of the garment.

From these results it can be concluded that:

- The deep scye combined with wide sleeves results in excess ease and bulkiness in the upper torso area that can restrict movement.
- A garment that is originally designed for males, is less suitable for females at the scye circumference.
- The deep scye circumference can impact on the upper arm location and contribute to fit and ease problems experienced when the sleeve is rolled-up.

From the findings in the above ease tables (Tables 22-28), it can be concluded that:

- The amounts of ease in the combat shirts are not suitable to accommodate the body measurements of the female soldiers. The broader shoulder and upper chest measurements result in a low dropped shoulder line, sleeves that are too long and upper arms and cuff areas that are too wide. The larger upper chest measurements result in gaping necklines due to too much ease/tolerance in the upper chest area. These problems render the garments cumbersome to wear and inhibit easy movement. The hip dimension of the combat shirt does not provide adequate ease for female hip dimensions.

- It is not only the amounts of ease that are incorrect but also the positions where these ease amounts are added. The afore-mentioned ease problems can be ascribed to the fact that the shirt is originally designed to fit male bodies. A typical male figure has a flat chest and narrow hips with no protruding buttocks. The typical female figure has curves at the bust, hips and buttocks. From a design viewpoint it cannot be expected to accommodate the majority of women with a garment developed from male body measurements and key dimensions. Due to physical discrepancies between male and female body proportions, the necessary ease is not in the right locations.
- Incorrect amounts of ease at incorrect garment locations cause the subjects to experience the fit of the combat shirts as oversized and restraining movement.

4.4.3 Functionality of the combat shirt in terms of ease while completing mobility tests

To further explore ease allowances in the combat shirt, the results of the motor tests provide additional information regarding the functionality in terms of ease and mobility.

In Table 29 the results of the mobility tests are presented. This table is similar to the motor test table of the dress jacket except that it does not include the test 'saluting'. The size of the shirt that the subject was issued with is indicated, as well as the ease locations involved. Ease allowances were read from Tables 22-28. To interpret the findings in terms of ease, the previous estimations for ease from theory and practice at the various locations are used, namely:

- 100 mm to 200 mm of ease at the bottom hem (hip) location.
- 65 mm to 100 mm of ease at the back width location.
- 100 mm to 200 mm of ease at the waist location.
- 60 mm to 100 mm of ease at the upper arm location.
- 100 mm to 150 mm of ease at the scye circumference.

- ➢ 25 mm (the minimum range suggested by Gioello & Berke 1979:16-23) to 50 mm (the ease range suggested by Haggar 1990:6-8) of ease at the elbow circumference.

The comments of the judges as well as their descriptions of the problems are included. As with the motor test table for the dress jacket, the comments of the two judges were similar in most instances. Where the comments differed, but were representative of the evaluation, both were included in the table. The comments and descriptions applicable to the particular test were indicated with a tick (✓). The body shapes as well as BMI values of the subjects were included to assist in understanding the ease requirements of the subjects.

In Table 29, observations regarding the following instructions are presented: body bends, overhead arm extensions, trunk twists, cross body arm extensions, reaching forward and squats (see page 146 for descriptions of the instructions). A total of 138 tests were completed as every one of the 23 subjects performed six tests.

From Table 29 it is clear that the following comments were also most frequently mentioned regarding the fit and functionality of the combat shirt.

- No problem (85 times out of 138 tests).
- Uncomfortable, but movement not restricted (51 times out of 138 tests).
- Movement restricted (twice out of 138 tests).

In comparison with the motor test findings of the dress jacket, the movement was a lot less restricted for the combat shirt. This may be due to the loose fitting style of the combat shirt which can accommodate more figure types than a fitted garment such as the dress jacket. The combat shirt is not tapered to the waist, therefore this style may be more accommodating for figure types such as the oval and diamond shapes.

The evaluation 'no problem' was usually followed by no description or by the description 'correct', meaning that the test was executed correctly. In some instances, the fit judges evaluated the test as 'no problem' but described that:

- The combat shirt does not drop down to natural position" (eight times). This is an indication of insufficient ease in the hip location.
- The combat shirt pulls slightly over the shoulder blades, at the back of the sleeves and over the back (six times).
- The forward bends are restricted when the sleeve is rolled-up (three times).
- The shirt stays pulled-up over the chest and the waist (once).
- The subject cannot fasten the buttons at the hip as the shirt is too tight (once).
- The shirt pulls and gapes open (once) and the shirt pulls tight over the hips and buttocks (once).

Consideration of the descriptions following the comment 'uncomfortable, but movement not restricted', reveals that the following problems were experienced during movement:

- Tightness over the back width and shoulders due to insufficient ease allowances (eight out of 67 comments).
- The shirt does not drop down to the natural position when the subject returns standing (six out of 67 comments).
- Tightness and discomfort at the back of the upper arm when sleeve is rolled (five out of 67 comments).
- Correct (three out of 67 comments).
- The shirt pulls tight over the hips and buttocks (two out of 67 comments).
- The garment pulls at the armholes (once out of 118 comments).
- The garment gapes at the bust location (once out of 118 comments).

Consideration of the descriptions following the comment 'movement restricted', reveals that the following problems were experienced during movement:

- The garment does not drop back to the natural position when the arms are dropped (once out of 67 comments).
- The garment pulls from the bottom of the armhole (once out of 67 comments).
- The combat shirt pulls tight across the buttocks (once out of 67 comments).
- The subject cannot lift her arms completely (once out of 67 comments).
- The shirt pulls tight at the waist and the hips (once out of 67 comments).

Analysis of the comments and descriptions of the judges in terms of the ease provided in each garment location, indicates the following:

- Insufficient ease in one area is compensated for by sufficient ease in all the other related areas, e.g. subject 13 had 5 mm of ease at the back width instead of 65 mm to 100 mm, but sufficient or excess ease in the bust and excess ease at the upper arm dimension provided ease of mobility at those locations (It was previously argued that the male shirts provide excess ease for females in the upper chest area). Subject 22 had only 10 mm of ease in the back width location instead of 65 mm to 100 mm. Insufficient ease was compensated for by excess amounts of ease at the upper arm (105 mm) as well as possible excess ease at the bust location.

The insufficient amounts of ease at the back rendered the garment uncomfortable, but movement was not restricted.

- Even though it seems that in the instance of all of the subjects, excess ease was allowed in the upper arm, the sleeves did not provide adequate ease allowance when rolled-up. A frequently mentioned comment stated that the upper arm dimensions were uncomfortable when the long sleeves were rolled up. Even though the amounts of ease at the upper arm seemed adequate, this was misleading. As previously mentioned, the subjects had to roll up their sleeves according to a standard procedure. The sleeves were in some instances very long. This caused a lot of fabric fullness at the upper arm location when rolled up. Several plies (layers) of fabric caused the ease at the upper arm dimension to diminish, resulting in insufficient amounts of ease and restricted movement. Furthermore, restriction in this location impacted on the amounts of ease in other locations.
- Insufficient ease at the hip area caused strain at the bottom hem of the garments. This resulted in buttons that gaped open at that hip dimension. When the wearer moved, the shirt could ride up above the broadest part of the hips and may not have dropped down onto the intended hip dimension when the wearer returned to standing (stationary) position.
- Discomfort was noted at the back width and upper arm locations. When analysing the ease column, it can be seen that subject 22 had too little ease at the back width, causing discomfort. In contrast, subject number 32 had too much ease at the back width, also causing discomfort. This supports the finding that either insufficient or excess ease can be restricting to the wearer.

When considering the results of the motor tests in terms of the body types of the subjects, the following becomes evident:

- In the instance of the inverted triangular body type (subject number 1), it was expected that the garment would fit well over the shoulder location due to the fact that an inverted triangular shape is broader across the shoulder location than at the waist and the hips. The combat shirt is designed for males with broader shoulders than females. According to the evaluation of the judges, the shirt did not look comfortable. This may be ascribed to the fact that the subject had insufficient ease at the back width location which is an important ease location in terms of the overall comfort of the garment. Even though the shirt had excess ease at the waist location, the ease allowance at the hip was within the lower ranges of the norm. Due to the above, the shirt did not drop back over the buttocks when the subject stood upright.

- Considering of the hourglass figure types (subjects 25, 13, 52), it was expected to show that the combat shirt may fit tightly over the hip locations as this location is broader than the waist. In the instance of two subjects, numbers 25 and 13, the shirt did not drop back over the hips and buttocks when the subjects completed their tests. Referring to the amounts of ease at the hip location, it can be seen that these subjects had far less ease at the hip location than was specified by the norm.
- Evaluation of the fit for the triangle body types (such as those of subject numbers 22, 12, 18, 49, 33, 43, 24), was expected to show that these subjects experience fit problems caused by insufficient ease at the hip location as the combat shirt (intended for male wearers) would not accommodate the larger hip dimension of female wearers. The description of the judges supported the expectation for triangular figures by the following description: "The jacket does not drop down to its natural position over the hips" in four (22, 12, 43, 24) of the seven instances. Three of these four subjects had insufficient ease of -140 mm, -65 mm and -42 mm respectively while one subject (12) had the minimum amount within the norm of 103 mm. The above indicate that the ease allowance at the hip location is insufficient for the triangular figure types.
- It was expected that the five subjects (26, 41, 50, 51, 8) who had square figure types may have experienced fit problems in terms of ease at the upper body. The descriptions of the judges underlined the ease problems with the following comments: "Forward bends pulls tight at the rolled-up sleeve'" (subject 51) and "the shirt pulls tightly over the back and the arms" and "the shirt pulls tight over the shoulders" (subject 8). Last mentioned may be ascribed to the fact that the subject had insufficient ease of 57 mm at the back width location.
- The only subject (number 19) with a rectangular body shape did not experience any salient fit problems in terms of ease related to the fit of her combat shirt

compared to her figure type. This may have been due to the silhouette of this body shape being similar to the style (silhouette) of the combat shirt. The comments of the judges stated that the shirt does not drop back to the natural position as it pulls over the hips and the buttocks. This was due to the fact that the ease allowance at her hip location was less than the norm (50 mm). The above indicates that the combat shirt does not provide sufficient ease at the hip location, even for a figure that does not have a prominently large hip circumference.

- Four subjects (21, 3, 27, 34) with oval body shapes were expected to experience fit problems in terms of ease at the waist and other upper torso locations. The judges described the problems as follows: "The garment pulls tight at the armholes" (four times), "at the shoulder blades" (once), "at the back of the sleeves" (once) and "over the back" (twice). In the instance of subject number three, the shirt stayed pulled over the chest and the waist. In the instance of subject number 27, the openings of the combat shirt gaped open at the bust. Movement was restricted for subject number 21 when she reached forward, even though she had excess ease at the scye and upper arm locations and adequate ease at the back width and the waist locations. The above-mentioned descriptions support the finding that excess ease can be as restricting as insufficient ease. The judges commented that in the instance of three out of these four subjects (21, 3, 27) the garment did not drop back to the natural position over the abdomen and the hips. In terms of amounts of ease at the hip location it can be seen that all four subjects with oval body shapes had insufficient ease at the hip location.
- The two subjects (42, 32) with diamond body shapes were expected to experience fit problems in terms of ease at the waist location due to the fact that the diamond figure type has a protruding waistline. In the instance of subject number 42, the judges commented that the shirt does not drop down to its natural position and that the buttons come undone. Even though the subject had adequate ease at the waist location (of 180 mm) according to the norm, the combat shirt may not provide sufficient movement ease for the diamond body shape.

Within the limitations of these findings, it can be concluded that the combat shirt is most suited for the inverted triangular and rectangular figure types. This is due to the straight and narrow body silhouette which is more similar to the male form intended to wear the combat shirt.

Consideration of the motor test results in terms of the BMI values of the subjects indicated the following:

- The five subjects (12, 1, 13, 19, 52) with normal BMI values were evaluated in 28 out of 30 tests (five subjects times six tests per subject) (93,3 percent of the total tests) as experiencing 'no problems'. In two of the 30 tests (6,6 percent) discomfort was experienced but movement was not restricted. From the above it is clear that the subjects with normal BMI values had overall adequate movement ease to complete most of the tests without experiencing movement and functional problems. Due to the fact that the combat shirt is a loose fitting garment designed for male wearers, it results in an oversized garment with excess room for movement.
- The seven subjects (22, 18, 25, 49, 41, 8, 33) who were classified as overweight according to their BMI values were evaluated in 25 out of 42 tests (59,9 percent) as experiencing 'no problem'. In 17 out of 42 tests (40,4 percent), the subjects were 'uncomfortable, but their movement was not restricted'. It can be seen that the result 'no problem' decreased and the result 'uncomfortable, but movement not restricted' increased for the overweight subjects. It can therefore be inferred that the overweight wearers experienced more fit problems in terms of movement ease than their normal weight counterparts.
- From the eleven subjects (43, 26, 51, 3, 24, 42, 50, 32, 34, 27, 21) who were obese according to their BMI values, 32 out of the 66 tests (48,4 percent) indicated 'no problem'. An equal number of 32 out of 66 tests (48,4 percent) indicated 'discomfort but did not restrict movement'. In the instance of two tests (3 percent), the movements of the subjects were 'restricted'. It is therefore clear that obese wearers experienced more discomfort and movement problems than their normal and overweight counterparts. This may be ascribed to the fact that the plus-sized wearers require more ease. This finding supports the fact that the ease allowance should be increased for the larger sizes within the sizing system.

It can be seen that the subjects experienced less movement problems with the combat shirts than they did with the dress jacket. This may be due to the loose-fitting style of the combat shirt and male body dimensions that are overall larger than female body dimensions such as the back width and the upper arm locations.

From these results it can be concluded that:

- The amounts of ease in the combat shirt are not adequate to accommodate the hip and buttock measurements of the female wearers. This problem has the following consequences: the shirt does not drop back to the intended position on the hips, the shirt can ride up as the wearer walks and the lower buttons of the shirt can pull or the opening can gape open in an unsightly manner.
- Excess ease allowance at locations such as the bust/chest, scye and upper arm does not ensure comfort of movement. In contrast, it can restrict comfortable movement.

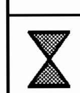
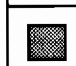
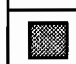
The above findings conclude the functional evaluation in relation to the amounts of ease allowance for the combat shirt. In the next section, the findings regarding fit in terms of ease as it relates to the aesthetic acceptability of the combat shirt is presented.

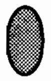
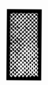
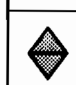
4.4.4 Aesthetic performance of the combat shirt in terms of ease

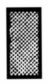
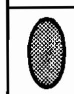
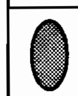
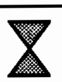
To further investigate the ease/tolerance in relation to the aesthetic performance of the combat shirt, the fit checklists were analysed in terms of the elements of fit, namely, grain, set, line, balance and ease. Ease allowance (the fifth fit element) has already been analysed and discussed in Tables 22-28. The findings are presented in Table 30. The table is similar to the table used to present the findings of the dress jacket and the same format was used to present the evaluative questions, comments and description of the judges. Once again, the evaluations of the two judges corresponded in most instances. In a small number of instances where the comments differed for the same evaluation, both comments are presented in the table.

Similar to the other tables, the size of the shirt that the subject is issued with is indicated, as well as the ease location involved. To interpret the findings in terms of ease, the previous estimations of ease from theory and practice at the various locations are used. The subjects' body shapes as well as BMI values were included (see Table 6) to assist in understanding the ease needs of the subjects.

TABLE 30: OBJECTIVE AESTHETIC EVALUATION OF THE COMBAT SHIRT IN TERMS OF GRAIN, SET, LINE, BALANCE AND EASE

Subject number	Size Issued	Body shape	BMI	Ease Allowance (mm): Bust (mm)	Waist (mm)	Hip (mm)	Back width (mm)	Upper arm (mm)	Aesthetic Evaluation – Grain: Parallel to C.F: Above the waist	Parallel to C.F: Below the waist	Parallel to C.B: Above the waist	Parallel to C.B: Below the waist	Sleeve grain perpendicular to the	Comments	Set (do any wrinkles and/or folds occur in the following areas): Bust	Waist	Hips	Upper arms	Comments	Line: Garment lines follow natural body lines	Side seams hang straight	C.F. lines on C.F. of the body	Straight seams as straight lines on the body	C.F. closures form straight line on the body	Comments	Balance (Does the garment seem balanced at the following locations): Front torso: Upper	Front torso: Lower	Back torso: Upper	Back torso: Lower	Side seams: Right	Side seams: Left	Comments
22	95-70		29.9	n/a	0	-140	10	105	Y	Y	Y	Y	Y	No comment	Y	Y	N	N	Bust: Horizontal wrinkles form above and below the bust. Diagonal wrinkles pull from the bust. Waist: Horizontal wrinkles form as the garment is too tight over the torso.	N	N	Y	Y	N	Side seams do not hang straight as the garment pulls towards the back over the buttocks. The centre front closures pull open at the waist. The subjects cannot fasten the lowest button.	Y	Y	Y	Y	N	N	On the side seams it pulls back over the buttocks.
12	95-80		22.8	n/a	275	103	65	200	Y	Y	Y	Y	Y	No comment	N	Y	N	Y	Waist: Horizontal folds form at the waist and at the buttocks. Upper arm: Vertical folds form due to excess material in the wide sleeve.	N	Y	Y	Y	Y	The garment lines do not follow the natural body lines as the garment is too loose.	Y	Y	Y	Y	Y	Y	No comment
18	95-90		27.5	n/a	189	62	68	166	Y	Y	Y	Y	Y	No comment	N	N	N	N	No comment	Y	Y	Y	Y	N	The centre front buttons pull and the closure gapes slightly over the hips below the lowest button.	Y	Y	Y	Y	Y	Y	No comment
25			29.8	n/a	95	-8	53	155	Y	Y	Y	Y	Y	No comment	Y	Y	Y	N	Bust: Diagonal wrinkles pull towards the bust. Waist: Horizontal folds form at the back of the waist. Hip: Diagonal wrinkles pull towards the hips.	N	N	Y	Y	N	The side seams do not hang straight as the shirt pulls to the back over the buttocks. The centre front closures gape at the hip level below the lowest button.	Y	Y	Y	Y	N	N	On the side seams it pulls back over the buttocks.
26			30.4	n/a	191	55	70	161	Y	Y	Y	Y	Y	No comment	Y	Y	Y	N	Bust: Diagonal wrinkles form at the sides of the bust and under the bust. Waist: Diagonal wrinkles occur at the back and the front of the waist. Hip: Diagonal wrinkles occur in the front hip area.	N	N	Y	Y	N	The garment lines do not follow natural body lines at the waist or flares out at the hip as needed. Side seams do not hang straight due to folds at the waist. The centre front closures pull below bottom button as the shirt is tight over the buttocks.	Y	Y	Y	Y	N	N	Side seams are not straight as it rides up over the buttocks.
49			29.7	n/a	317	-90	98	165	Y	Y	Y	Y	Y	No comment	Y	Y	Y	Y	Bust: Horizontal folds form under the bust below the pockets. Vertical folds form from the shoulder down. Waist: Horizontal folds form at the waist back as the garment rides up from the buttocks. Hip: The shirt is too tight over the buttocks. Upper arm: Vertical folds are formed due to excess material in the upper arm area.	N	N	Y	Y	N	Garment lines do not follow natural body lines as the shirt does not go into the wais or flare out at the hips. The side seams are not straight due to folds at the waist as the shirt pulls to the back over the buttocks. The centre front closures pull outwards from the waist to accommodate the hips.	Y	N	Y	N	Y	Y	No comment
41	95-100		28.9	n/a	282	142	142	205	Y	Y	Y	Y	Y	No comment	Y	N	Y	Y	Bust: Vertical folds are formed from the back of the shoulder seam to the armholes. Diagonal wrinkles pull from the bust to the waist. Hips: Vertical folds form as the shirt makes a 'skirt' in front. Upper arm: Vertical folds are formed due to excess material in the upper arm.	N	Y	Y	Y	Y	The garment lines do not follow the natural lines of the body as the garment is too wide.	Y	Y	Y	Y	Y	Y	No comment
42	95-110		36.3	n/a	180	86	125	191	Y	Y	Y	Y	Y	No comment	Y	N	N	Y	Bust: Diagonal wrinkles form towards the bust. Hip: Horizontal folds form at the back of the hip. Upper arm: Vertical folds form due to excess material in the upper arm area.	N	Y	Y	N	Y	Straight seams do not appear as straight lines on the body as the garment pulls up at the back over the buttocks.	Y	Y	Y	Y	Y	Y	No comment
50			33.2	n/a	298	179	105	141	Y	Y	Y	Y	Y	No comment	Y	N	N	Y	Bust: Vertical folds form between the armholes and the bust on either side. Upper arm: Folds form due to excess material in this area.	N	Y	Y	Y	Y	The garment lines do not follow the natural lines of the body as the garment has no shape.	Y	Y	Y	Y	Y	Y	No comment
51			30.1	n/a	320	202	120	186	Y	Y	Y	Y	Y	No comment	Y	N	N	Y	Bust: Vertical folds form along the armholes in the front. Upper arm: Vertical folds form due to excess material in the upper arm area.	N	Y	Y	Y	Y	The garment lines do not follow the natural lines of the body due to the cut/shape of the shirt.	Y	Y	Y	Y	Y	Y	No comment
21	95-120		47	n/a	122	32	65	115	N	N	Y	Y	Y	No comment	Y	Y	Y	N	Bust: Horizontal wrinkles and folds form over the bust. Diagonal wrinkles occur under the arms. Waist: Horizontal folds form at the back in the waist.	N	Y	N	Y	N	The garment lines do not follow the natural lines of the body as the shirt does not accommodate the bust and thick trunk. Straight seams and centre front closures are not straight due to tight	Y	Y	Y	N	Y	Y	The shirt rides up from the buttocks.

																			bust. Diagonal wrinkles occur under the arms. Waist: Horizontal folds form at the back in the waist. Hips: Horizontal wrinkles occur on the sides of the hips.						... of the body ... the bust and thick trunk. Straight seams and centre front closures are not straight due to tight pulling on buttons over the bust and the stomach. This causes the garment to pull open at the bottom of the shirt.							
1	99-70		19.3		232	134	60	157	Y	Y	Y	Y	Y	No comment	N	Y	Y	Y	Waist and hips: Horizontal folds across the waist and diagonal folds across the buttocks. Upper arm: Vertical folds due to extra material in the sleeve.	N	N	Y	Y	Y	The garment lines do not follow the natural lines of the body at the waist location. The side seams are not straight as they pull slightly forward .	Y	Y	Y	N	Y	Y	Unbalances due to folds at waist as the material rides up over the buttocks.
13			24.5	n/a	177	-37	5	162	Y	N	Y	N	Y	No comment	N	Y	Y	Y	Waist: Horizontal folds form as the hips are big in relation to the waist. Hip: Horizontal wrinkles pull tight across the hips. Upper arm: Vertical folds form as the sleeve is too wide.	Y	N	N	Y	Y	Side seams are not straight as they pull to the back over the buttocks. The centre front seam pulls open in front from under the waist. The centre front closures cannot close over the hip area.	Y	Y	Y	Y	Y	Y	No comment
3	99-90		40.3	n/a	91	22	52	158	N	N	N	N	N	No comment	Y	Y	N	N	Bust: Horizontal wrinkles pull tight across bust and waist. Horizontal folds form across top of chest to armholes. Waist: Horizontal wrinkles pull tight at the waist, diagonal wrinkles pull tight in the abdomen.	Y	Y	N	N	N	Side seams are not straight as they pull to the back over the buttocks. The centre front seam pulls open as the shirt is too tight over the abdomen. The centre front closures cannot close over the bust and stomach areas.	Y	Y	Y	Y	Y	Y	No comment
8			29.1	n/a	152	2	57	168	Y	N	Y	Y	Y	No comment	N	Y	Y	Y	Waist: Folds occur across waist as the garment rides up from hips and buttocks. Hips: Wrinkles pull towards stomach, the shirt is too tight over the hips. Upper arm: Folds form due to excess material in the arm and in the sleeve.	N	N	N	Y	N	The garment lines do not follow the natural lines of the body as the shirt does not fit into the waist. The shirt is too loose in the waist and too tight over the hips. Side seams are not straight due to folds at the back. The centre front lines and closures are not straight due to pulling over the hips from the waist button downwards.	Y	Y	Y	N	N	Y	The garment lifts up over the buttocks and causes folds at the waist.
19			22.6	n/a	225	50	77	204	Y	Y	Y	Y	Y	No comment	Y	Y	N	Y	Bust: vertical folds form from the shoulder seam down to the outside of the bust. Diagonal wrinkles form towards the bust. Waist: Vertical folds form on the sides of the waist. Upper arm: Vertical folds occur due to excess material at the upper arm.	N	N	N	Y	N	The side seams are not straight as they pull slightly to the back over the buttocks. Centre front lines and closures are not straight as the shirt pulls open at waist level and below lowest button.	Y	Y	Y	Y	Y	Y	No comment
33			26.3	n/a	295	25	72	198	Y	Y	Y	Y	Y	No comment	Y	Y	N	Y	Bust: Horizontal folds form along bust and along top pocket. Waist: Vertical folds form from the shoulder to the waist location. Upper arm: Vertical folds are caused due to excess material.	N	Y	Y	Y	Y	No comments.	Y	Y	Y	Y	Y	Y	No comment
43			34.6	n/a	255	-65	52	173	Y	Y	Y	Y	Y	No comment	Y	Y	Y	Y	Bust: Vertical folds form from shoulder seams to top pockets. Diagonal wrinkles appear from armholes towards stomach (under bust). Waist: Horizontal folds occurs at the back of the waist. Hip: Diagonal wrinkles pull towards the buttocks. Upper arm: Vertical folds are caused by excess material in the upper arm.	N	N	N	N	N	The garment lines do not follow the natural lines of the body due to the cut/shape of the shirt. The side seams are not straight due to folds at the waist that pull to the back. Centre front lines and closures are not straight as the shirt pulls open at the hips and pulls to the sides. Straight seams are not straight as the shirt pulls to the back to accommodate the hips and the buttocks.	Y	Y	Y	N	Y	Y	No comment
24	99-110		39.1	n/a	226	-42	117	217	N	N	N	N	Y	No comment	Y	Y	Y	Y	Bust:Horizontal folds form at the sides of the bust and under the arms. Waist: Horizontal folds occur at the back waist and diagonal wrinkles on the sides of the waist. Hip: Diagonal wrinkles pull on the sides and the fronts of the hips. Upper arm: Horizontal wrinkles pull from the armholes.	N	Y	N	Y	N	The garment lines do not follow the natural lines of the body as it doesn't fit into the waist area because it rides up from the buttocks. The centre front closures do not form a straight line and cannot button from below the waist, at the hip level.	Y	Y	Y	N	N	N	The garment pulls up at the back over the buttocks. The side seams (left and right) hang higher at back than at front.
27			41.6	n/a	194	-22	77	152	Y	Y	Y	Y	Y	No comment	Y	Y	Y	Y	Bust: Vertical folds at the bust in the front, back and sides. Waist: Horizontal folds form in the front and the back. Hip: Diagonal wrinkles form on the sides and the front of the hips. Upper arms: Horizontal wrinkles pull from the armholes.	Y	Y	N	N	Y	The garment lines do not follow the natural lines of the body as the shirt doesn't fit into the waist and is too tight over the buttocks. The side seams are not straight as it pulls back over the buttocks and makes a fold at the waist. Centre front closures do not form a straight line as the shirt pulls open from the last button.	Y	Y	Y	N	N	N	The garment rides up from the buttocks. The side seams pull to the back as the back hem is higher than the front.
32			34.7	n/a	203	49	122	197	Y	Y	Y	Y	N	No comment	Y	Y	Y	Y	Bust: Vertical folds from the shoulder seams to above the pockets on the bust. Waist: Horizontal folds form across the waist at the back. Diagonal wrinkles pull towards the buttocks. Hip: The shirt is snug over the hips. Upper arm: Vertical folds form over the upper arm.	N	N	Y	Y	N	The garment lines do not follow the natural lines of the body due to the cut of the shirt that does not go in at the waist. Side seams are not straight as the shirt pulls slightly over the buttocks. The centre front closures do not form a straight line as the shirt pulls slightly at the stomach and the hips.	Y	Y	Y	Y	Y	Y	No comment

8			29.1	n/a	152	2	57	168	Y	N	Y	Y	Y	No comment	N	Y	Y	Y	Waist: Folds occur across waist as the garment rides up from hips and buttocks. Hips: Wrinkles pull towards stomach, the shirt is too tight over the hips. Upper arm: Folds form due to excess material in the arm and in the sleeve.	N	N	N	Y	N	The garment lines do not follow the natural lines of the body as the shirt does not fit into the waist. The shirt is too loose in the waist and too tight over the hips. Side seams are not straight due to folds at the back. The centre front lines and closures are not straight due to pulling over the hips from the waist button downwards.	Y	Y	Y	N	N	Y	The garment lifts up over the buttocks and causes folds at the waist.
19			22.6	n/a	225	50	77	204	Y	Y	Y	Y	Y	No comment	Y	Y	N	Y	Bust: vertical folds form from the shoulder seam down to the outside of the bust. Diagonal wrinkles form towards the bust. Waist: Vertical folds form on the sides of the waist. Upper arm: Vertical folds occur due to excess material at the upper arm.	N	N	N	Y	N	The side seams are not straight as they pull slightly to the back over the buttocks. Centre front lines and closures are not straight as the shirt pulls open at waist level and below lowest button.	Y	Y	Y	Y	Y	Y	No comment
33			26.3	n/a	295	25	72	198	Y	Y	Y	Y	Y	No comment	Y	Y	N	Y	Bust: Horizontal folds form along bust and along top pocket. Waist: Vertical folds form from the shoulder to the waist location. Upper arm: Vertical folds are caused due to excess material.	N	Y	Y	Y	Y	No comments.	Y	Y	Y	Y	Y	Y	No comment
43			34.6	n/a	255	-65	52	173	Y	Y	Y	Y	Y	No comment	Y	Y	Y	Y	Bust: Vertical folds form from shoulder seams to top pockets. Diagonal wrinkles appear from armholes towards stomach (under bust). Waist: Horizontal folds occurs at the back of the waist. Hip: Diagonal wrinkles pull towards the buttocks. Upper arm: Vertical folds are caused by excess material in the upper arm.	N	N	N	N	N	The garment lines do not follow the natural lines of the body due to the cut/shape of the shirt. The side seams are not straight due to folds at the waist that pull to the back. Centre front lines and closures are not straight as the shirt pulls open at the hips and pulls to the sides. Straight seams are not straight as the shirt pulls to the back to accommodate the hips and the buttocks.	Y	Y	Y	N	Y	Y	No comment
24	99-110		39.1	n/a	226	-42	117	217	N	N	N	N	Y	No comment	Y	Y	Y	Y	Bust:Horizontal folds form at the sides of the bust and under the arms. Waist: Horizontal folds occur at the back waist and diagonal wrinkles on the sides of the waist. Hip: Diagonal wrinkles pull on the sides and the fronts of the hips. Upper arm: Horizontal wrinkles pull from the armholes.	N	Y	N	Y	N	The garment lines do not follow the natural lines of the body as it doesn't fit into the waist area because it rides up from the buttocks. The centre front closures do not form a straight line and cannot button from below the waist, at the hip level.	Y	Y	Y	N	N	N	The garment pulls up at the back over the buttocks. The side seams (left and right) hang higher at back than at front.
27			41.6	n/a	194	-22	77	152	Y	Y	Y	Y	Y	No comment	Y	Y	Y	Y	Bust: Vertical folds at the bust in the front, back and sides. Waist: Horizontal folds form in the front and the back. Hip: Diagonal wrinkles form on the sides and the front of the hips. Upper arms: Horizontal wrinkles pull from the armholes.	Y	Y	N	N	Y	The garment lines do not follow the natural lines of the body as the shirt doesn't fit into the waist and is too tight over the buttocks. The side seams are not straight as it pulls back over the buttocks and makes a fold at the waist. Centre front closures do not form a straight line as the shirt pulls open from the last button.	Y	Y	Y	N	N	N	The garment rides up from the buttocks. The side seams pull to the back as the back hem is higher than the front.
32			34.7	n/a	203	49	122	197	Y	Y	Y	Y	N	No comment	Y	Y	Y	Y	Bust: Vertical folds from the shoulder seams to above the pockets on the bust. Waist: Horizontal folds form across the waist at the back. Diagonal wrinkles pull towards the buttocks. Hip: The shirt is snug over the hips. Upper arm: Vertical folds form over the upper arm.	N	N	Y	Y	N	The garment lines do not follow the natural lines of the body due to the cut of the shirt that does not go in at the waist. Side seams are not straight as the shirt pulls slightly over the buttocks. The centre front closures do not form a straight line as the shirt pulls slightly at the stomach and the hips.	Y	Y	Y	Y	Y	Y	No comment
34			41.7	n/a	188	29	87	172	Y	Y	Y	Y	Y	No comment	Y	Y	Y	Y	Bust: Vertical folds from the shoulder seams down to top of the bust. Waist: Horizontal folds at the back as the material is tight over the buttocks. Hip: The shirt is snug over the hips. Upper arm: Vertical folds as the sleeve folds from the shoulder to the armholes due to excess material.	N	N	Y	Y	N	The garment lines do not follow the natural body lines as the shirt does not shape into the waist. The side seams are not straight as they pull to the back over the buttocks. The centre front lines are not straight as the shirt pulls outward from the bottom button to provide more ease over the buttocks.	Y	Y	Y	Y	Y	Y	No comment
52	92RI		21	n/a	n/a	n/a	n/a	n/a	Y	Y	Y	Y	Y	No comment	Y	N	N	Y	Bust: Diagonal wrinkles pull towards bust from the top pockets. Upper arm: Vertical folds form due to excess material.	N	Y	Y	Y	Y	The garment lines do not follow the natural lines of the body as the shirt hangs straight down due because it is too big.	Y	Y	Y	Y	Y	Y	No comment

From Table 30 the following is clear regarding the grain lines of the combat shirts:

- The combat shirts of most of the subjects (17 out of 23, numbers 22, 12, 18, 25, 26, 49, 41, 42, 50, 51, 1, 19, 33, 43, 27, 34, 52) had grain lines that were parallel to the centre front of the garment, above and below the waist, the centre back of the garment, above and below the waist and the grain lines of the sleeves were perpendicular to the floor.
- In three instances (21, 24, 3) the grain lines of the garments were not perpendicular at the centre front of the garment above the waist. In five instances (21, 13, 3, 8, 24) the grain lines were not perpendicular below the waist. At the centre back of the garment the grain lines were not perpendicular at the upper torso for two subjects (3, 24) and at the lower torso for three subjects (13, 3, 24). The grain lines of the sleeves of two subjects (3, 32) were not perpendicular to the floor. This was caused by excess ease at the upper arm of 158 mm and 197 mm respectively.

Comparison of the grain evaluations of the combat shirts by the judges to the ease at the particular locations, indicates that:

- The judges evaluated subject number 21 as experiencing grain problems at the front of the combat shirt, above and below the waist. This was due to the fact that this subject had a minimum level of ease (122 mm) at the waist location and insufficient ease (32 mm) at the hip location.
- The judges evaluated the grain lines of the combat shirt of subject 13 as being off-grain below the waist dimension at the front and the back. This was caused by insufficient ease (-37 mm) at the hip location.
- At all five locations, the grain lines of the combat shirt of subject number 3 were evaluated as incorrect. This may be ascribed to the fact that this subject had insufficient ease at three out of four locations (at the waist, hip and back width dimensions) and excess ease at the upper arm dimension.
- In the instance of subject number eight, the grain lines were not parallel to centre front below the waist, due to insufficient ease at the hip location of 2 mm.

- The grain lines of the combat shirt of subject number 24 were off-grain above the waist due to excess ease at the back width and upper arm locations and off-grain below the waist due to insufficient ease at the hip location (-42 mm).
- The grain lines of the sleeve of subject number 32 were not perpendicular to the floor due to excess ease of 152 mm at the upper arm location.

In conclusion, it can be inferred that grain lines that are not in position imply tightness and strain in a particular area, indicating insufficient ease. Conversely, grain lines that are not in position may also imply looseness, which is an indicator of excess ease.

From Table 30, the following is clear regarding the set evaluation of the combat shirts:

- Eighteen (22, 25, 26, 49, 41, 42, 50, 51, 21, 3, 19, 33, 43, 24, 27, 32, 34, 52) out of 23 subjects were evaluated as experiencing set problems at the bust location. Frequently mentioned set problems at this location were diagonal and horisontal wrinkles (in seven instances) that indicate restriction; and vertical and horisontal folds (in eleven instances) that indicated excess ease.
- Seventeen subjects (22, 12, 25, 26, 49, 21, 1, 13, 3, 8, 19, 33, 43, 24, 27, 32, 34) were evaluated as experiencing set problems at the waist location. The most frequently mentioned set problem included vertical and horisontal folds indicating excess ease at the waist location. In the instance of diagonal wrinkles, insufficient amounts of ease were caused by a body bulge.
- At the hip location, 13 (25, 26, 49, 41, 21, 1, 13, 8, 43, 24, 27, 32, 34) subjects were evaluated as experiencing set problems. The most prominent set problems included diagonal wrinkles which indicated that the shirt was too tight over the hip location. Due to the above it could be inferred that the set and therefore aesthetic problems at the hip were caused by insufficient rather than excess amounts of ease.
- At the upper arm location, 17 subjects (12, 49, 41, 42, 50, 51, 1, 13, 8, 19, 33, 43, 24, 27, 32, 34, 52) were evaluated as experiencing set problems. In the instance of 15 subjects, vertical folds appeared which indicated excess amounts of ease at

the upper arm. For two subjects (24, 27) horisontal wrinkles that pulled from the armhole indicated restriction as a result of excess ease at the upper arm and scye circumferences.

Comparison of the set evaluations of the combat shirts by the judges to the ease at the particular locations shows that:

- Eight of the 17 subjects (12, 49, 19, 33, 24, 32) who experienced set problems at the waist location had excess amounts of ease, six subjects (26, 21, 13, 8, 27, 34) had correct amounts of ease in relation to the norm and three (22, 25, 3) had insufficient amounts of ease.
- From the 13 subjects who experienced set problems with their combat shirts at the hip location, ten subjects (25, 26, 49, 13, 8, 43, 24, 27, 32, 34) had insufficient ease while only three (41, 21, 1) had adequate ease allowances.
- All 17 subjects (12, 49, 41, 42, 50, 51, 1, 13, 8, 19, 33, 43, 24, 27, 32, 34, 52) who experienced set problems with their combat shirts at the upper arm location had excess amounts of ease at this location.
- Even though 18 out of 23 subjects experienced set problems with their combat shirts at the bust location, this finding could not be related to the ease allowance as it was not possible to calculate ease values.

In conclusion, it can be inferred from the above that overall excess ease at the waist and upper arm locations cause set problems while overall insufficient ease is the cause of set problems at the hip location.

From Table 30 regarding line evaluation of the combat shirts, it follows that:

- The combat shirts of none of the subjects had correct line placement.
- In the instance of one subject (number 43) the garment lines of her combat shirt were completely incorrect. The garment lines did not conform to the natural lines of the body, the side seams did not hang straight and the centre front closures were not in a straight line on the centre front of the subject's body.
- The judges evaluated that the garment seams did not appear as straight lines on the bodies of four subjects (42, 3, 43, 27).

- In the instance of thirteen subjects (22, 18, 25, 26, 49, 21, 3, 8, 19, 43, 24, 32, 34) the centre front closures did not appear as straight lines on the bodies of the subjects. This may have been due to insufficient ease at the bust, waist or hip dimensions that caused the buttons at the centre front openings to pull and the buttoned openings to gape open, as well as distort the shape of the garment so that it did not hang straight.

Comparison of the line evaluations of the combat shirts by the judges to the ease at the particular locations shows that:

- In the instance of subject number 43, the line placement of the combat shirt was completely incorrect due to excess ease at the waist (255 mm) and upper arm (173 mm) locations and insufficient ease at the hip (-65 mm) and back width (52 mm) locations. These deviations from the ease norms caused the garment to pull in some areas and to 'sag' in other areas.
- In the instance of four subjects (42, 3, 43, 27) the garments' seams did not appear as straight lines on the bodies of the wearers. All four of the above-mentioned subjects had insufficient ease at the hip locations of 86 mm, 22 mm, -65 mm and -22 mm respectively. Insufficient ease at the hip could have caused the garment lines to pull (skew).

Comparison of the judges' balance evaluations to the ease at the particular locations in Table 30 shows:

- The combat shirts of 13 out of 23 subjects appeared balanced at the front torso, the back torso and the side seams.
- In only one instance (subject number 49), the garment seemed unbalanced at the lower torso. This may be ascribed to the fact that the subject had insufficient ease of -90 mm at the hip location which caused the garment to pull at the lower torso.
- In seven instances (49, 21, 1, 8, 43, 24, 27) the garments appeared unbalanced at the back lower torso. In the instance of six subjects (49, 21, 8, 43, 24, 27) this was due to insufficient ease at the hip location which caused the garments to ride up over the buttocks.

- In six instances, the right or left side seams seemed unbalanced. This may have been ascribed to insufficient ease at the hip location which caused the garments to ride up over the buttocks, resulting in an uneven bottom hem.

In view of the above findings regarding the aesthetic performance of the combat shirt, the following problems regarding fit in terms of ease should be addressed:

- Insufficient ease at various locations impacts on the aesthetic appearance of the garment as it causes wrinkles to form.
- Excess ease at various locations impacts on the aesthetic appearance of the garment as it causes folds to form.
- The plus-sized (obese) subjects experience more aesthetic problems than the subjects with BMI values within the normal weight range.

4.4.5 Summary: Objective one for the combat shirt

From the above findings regarding the amounts of ease that will comply with the functional and aesthetic requirements (related to the activities and comfort of an optimum number of wearers) to result in an acceptable fit of the combat shirt, it becomes clear that:

- The subjective comments portray overall dissatisfaction with the functional and aesthetic appearance of the combat shirts.

The findings regarding ease at the chest location indicate that:

- Male dimensions cannot provide female wearers with well-fitting garments.
- The male chest girth cannot be compared to the bust dimension of female wearers.
- Garment locations of the combat shirt do not correspond to the intended body location on female wearers.
- Gender related body differences result in excess ease for female wearers.
- Not only are the amounts of ease incorrect, but also the locations where the ease allowances are assigned.

The findings for ease at the hip location indicate that:

- The bottom hem measurement does not accommodate the hip dimensions of female wearers.
- The bottom hem dimensions of issued garments are less than specified, resulting in even less ease.
- The subjects wearing smaller sizes need less ease than the subjects wearing larger sizes.

The findings regarding the back lengths of the combat shirts indicate that a back length that reaches lower than the broadest part of the subject's hip location has an impact on ease at the hip dimension.

The findings for ease at the back width location indicate that:

- The back width dimensions of the garments are less than specified, resulting in even less ease.
- The subjects wearing the smaller sizes need less ease than the subjects wearing the larger sizes.

The findings regarding ease at the waist dimension indicate that:

- Due to the overall larger male dimensions, most subjects have excess ease at the waist location.
- The subjects wearing larger sizes were satisfied with more ease at this location than the subjects wearing the smaller sizes.
- The plus-sized wearers need more ease.

In terms of ease allowance at the upper arm it can be inferred that:

- Excess ease is available in the upper arm location.
- The excess ease results in multiple fit problems.
- The design of the combat shirt causes ease related problems in terms of the functional and aesthetic performance of the garment.
- Plus-sized wearers need more ease in order to be comfortable.

- Subjects wearing smaller sizes were satisfied with less ease than subjects wearing larger sizes.

With regard to the ease at the scye circumference, the findings indicate that:

- Larger male body dimensions result in a scye circumference that is too large for female wearers.
- This contributes to the bulky, oversized appearance of the garments.

The findings of the functionality tests indicate that:

- Ease allowance that is insufficient or excessive influences ease at garment locations on the same horisontal level.
- A garment that is originally intended for males does not provide adequate ease for female wearers to function optimally.
- The functional tests showed that female body shapes influence the amounts of ease available and consequently impact on the mobility of the subjects.
- The functional tests showed that the subjects with high BMI values experience more movement restrictions.

It is clear from the aesthetic evaluation that:

- Due to gender-related differences, overall excess ease at the chest, waist, upper arm and scye circumference and insufficient ease at the hip location impact on the set and distortion of the grain, balance and line of the garments.
- Set related problems as a result of incorrect amounts of ease allowance negatively impact on the aesthetic appearance of the combat shirts.
- The fact that female body shapes are not accommodated well by the combat shirt, negatively influences the aesthetic appearance of the garments.
- The plus-sized wearers experience more aesthetic problems than the subjects wearing the smaller sizes.

In the following section, the conclusive summary for the dress jacket and the combat shirt to realise objective one is presented.

4.4.6 Objective one: Summary and conclusive discussion

In this section, the conclusions for the findings of objective one for the dress jacket (closely fitted garment) and the combat shirt (loosely fitted garment) are presented. The conclusions are presented according to the subjective fit preferences, different ease values for different size categories, revision of the ARMSOR specifications, ease allowance at various garment locations, objective evaluations of ease in terms of the functional and aesthetic performance of the garments and conclusions regarding ease ranges.

4.4.6.1 Conclusions in terms of the subjective fit preferences

The findings regarding the dress jacket and the combat shirt indicated that subjective fit preferences vary and therefore impact on the satisfaction with fit and ease allowance. The subjective fit preferences should therefore be taken into consideration. This is in line with Branson and Nam (2007:264) who state that the amount of ease that a wearer desires in a garment is influenced by personal preference. Ashdown and DeLong (1995:47) state that "...ultimately, the decision of what constitutes good fit is made by each individual". DeLong *et al.* (1993:7) recommend that individual ease preferences need to be accommodated. In addition, the subjective comments portrayed overall dissatisfaction with the fit of the dress jacket and the combat shirt and this should be attended to.

4.4.6.2 Larger sizes need more ease

With regard to ease/tolerance the findings indicated that the subjects wearing smaller sizes were satisfied with less ease than plus-sized subjects wearing larger sizes. This was the case for both the dress jacket and the combat shirt at the hip, back width, waist and upper arm locations as well as at the bust location in the instance of the dress jacket.

A solution to this problem would be to revise the specification and to assign less ease for the smaller sizes (RR76 to RR97 in the instance of the dress jacket and sizes 70 to 100 in the instance of the combat shirt) and more ease allowance to the larger sizes in the size range (sizes above RR97 in the instance of the dress jacket and sizes above 100 in the instance of the combat shirt). This is in line with the opinion of Petrova (2007:73) namely that the tolerance/ease amounts should adapt with the size. It is suggested that larger size steps are assigned for the larger dimensions and smaller size steps for the smaller dimensions (Petrova 2007:73).

4.4.6.3 Revision of the ARMSCOR specifications

In the instance of the dress jacket, the hip, waist and upper arm dimensions are not included in the ARMSCOR specifications. It is recommended that these dimensions be incorporated in order to ensure adequate amounts of ease allowance for an optimum number of wearers with variations of body shapes. The upper arm proved to be problematic and therefore the inclusion of this dimension is also recommended.

In the instance of the combat shirt, the garment dimensions should be adapted to dimensions appropriate to represent female body dimensions in order to ensure good fit, in particular at the bust, hip, upper arm and scye locations.

4.4.6.4 Conclusions regarding ease allowance at various garment locations

The findings regarding ease allowance for the dress jacket and the combat shirt, allow the following conclusions to be made in terms of the various body dimensions:

❖ Conclusions with regard to the amounts of ease at the bust/chest location

For the dress jacket it can be seen that within a particular size category, the amount of ease decreases as the bust measurement increases, causing the larger wearers to have insufficient ease allowance. The ARMSCOR specifications prescribe ease of 100 mm for each size category. This is however only the case for the person with the smallest bust dimension in the category. This amount diminishes to 40 mm for the wearer with the largest bust measurement within that size. This is problematic as the larger the body dimension, the more ease is required at that area. The afore-mentioned is especially applicable in the case of closely fitted garments.

The findings of the mobility test showed that insufficient ease at the bust caused problems with functionality and aesthetics. When ease allowances at this dimension were sufficient according to the norm, but equal to the minimum amounts, the plus-sized wearers in particular experienced discomfort and restricted movement. The most salient set problems included wrinkles as a result of restriction at the bust location as well as folds as a result of excess ease. This may be ascribed to the fact that the smaller wearers may have the maximum amounts of ease while the larger wearers may have only the minimum amounts of ease.

In the instance of the combat shirt, the male chest dimension is used to represent the female bust dimension. The chest dimension of a male cannot be compared to the bust dimension of a female due to obvious differences between male and female body forms. As a result, the amounts of ease allowance intended for male wearers are excessive for female wearers. These discrepancies result in multiple fit problems (such as gaping necklines) as gender related differences have implications for the amounts of ease allowance but also for the locations of the ease allowed on the bodies of female wearers. It is recommended to use dimensions appropriate to female body dimensions to ensure good fit for female wearers. This is in line with the opinion of various authors, e.g. Gordon (1986:581).

❖ Conclusions with regard to the amounts of ease at the hip/bottom hem location

For both the dress jackets and combat shirts, several subjects experienced insufficient ease. In the instance of the combat shirts, the ease allowance assigned to the hip dimension is intended for a male hip measurement and is insufficient for female wearers because male dimensions are not representative of female hip and buttock dimensions.

The ease amounts are insufficient due to the variations of body shapes. It was found that especially in the case of the triangle body shape, restriction as a result of insufficient ease caused tightness over the hip location. The results of the motor tests confirmed that in numerous instances, the ease allowances were insufficient as the most salient comment stated that the jacket or shirt does not drop to the natural position over the hip location. The aesthetic evaluation confirmed that the ease was overall insufficient as numerous subjects experienced wrinkles that caused the garment to pull over the hip location in an unsightly manner.

In the instance of the dress jacket, it is further recommended to incorporate the hip dimension in the size specifications. In doing so, the manufacturer can revise and incorporate a drop value in order to accommodate the body shapes of an optimum number of subjects.

In the instance of the combat shirt, it was found that the female hip dimension is not accommodated. This is congruent with the findings of Todd in Ashdown (2007:290) who states that the hip dimensions of male garments are extremely tight on the bodies of female wearers as women are larger in this dimension than men. Due to the fact that the ease allowances specified in the specifications are not adequate to accommodate the larger female hip dimensions this results in insufficient amounts of ease. To counter this problem, a measurement representative of the female hip dimension should be considered in the design of the combat shirts in order to comply with the functional requirements of the garment as well as to provide an aesthetically acceptable fit. Furthermore, in certain instances it was found that the issued garments were smaller than specified in the nominal finished garment specifications. This has implications for ease allowance and should be addressed.

- Conclusions with regard to the back length dimensions of both the dress jackets and the combat shirts

For both the dress jacket and the combat shirt, the back length dimensions of the majority of the garments extended below the fullest part of the subjects' hip dimensions. This had implications for the ease allowance at the hip dimension. This was confirmed by the mobility tests which showed that the garments tend to 'ride up' in order to fit above the fullest part of the hips. In cases where the jackets and shirt did not drop down to the intended position on the hips, this proved insufficient wearing ease. Subject dissatisfaction can be experienced if the back length of the combat shirt does not extend below their hips and buttocks as wearers may want to conceal their figures over the hip and buttock dimensions. A longer garment creates a vertical line impact which results in a slimmer appearance.

The varieties of body shapes were not accommodated due to the ease implications caused by the (longer) back length of the garments. Furthermore, if the garment folds under the wearer in a seated position, the amount of ease will be affected as the hips and buttocks expand as the wearer sits. This finding is in line with the opinion of Bray in Beazley (1999:68) who states that the larger the wearer, the more hip and buttocks expansions take place and therefore more ease allowance is required.

In the instance of the dress jacket, it can be inferred that the implications for ease at the hip location would decrease if the garment style and length is adapted. In the instance of the combat shirt, the garment is produced in two height categories labeled as the '95' range (for a regular height) and the '99' range (for a tall figure). Due to the above, the subjects' back length measurements should be better accommodated. Despite the afore-mentioned, it is not unrealistic to assume that the back lengths would nonetheless be too long due to proportional differences in males and females. The findings of the study conducted by Todd *et al.* (1996:687) confirmed that female troops 5'2" (1,57 m) and shorter were not accommodated by male based garments due to gender related disparities in stature.

Due to the implications of the ease at the hip dimension, it is recommended that the back length dimensions for both the dress jacket and the combat shirt should be carefully reconsidered.

❖ Conclusions with regard to the amounts of ease at the back width location

For both the dress jacket and the combat shirt, the ease allowance at the back width location tends to be insufficient when analysed in terms of the satisfaction of the subjects. This may be ascribed to the fact that when the subjects experience the comfort of the garments as poor, they will consequently be dissatisfied with the back width dimensions as this dimension is important for providing garment comfort. Furthermore, the mobility tests showed that the ease allowance at this location impacts on the ease at other locations and therefore overall comfort.

It is recommended that the ease allowances at the back width dimension of the larger sizes should be increased in order to provide plus-sized wearers with adequate amounts of ease for comfort. This finding is in line with the advice of Beazley (1999:68) who suggests increasing the amount of ease allowance for the larger sizes by 10 mm every third or fourth size.

❖ Conclusions with regard to the amounts of ease at the waist location

For both the dress jacket and the combat shirt it may be inferred that the provided ease allowances do not adequately accommodate different body shapes. Insufficient ease at the waist may be due to the fact that body shapes such as the diamond have a protruding waistline. Furthermore, many of the plus-sized wearers may have excess weight distribution at the abdomen.

In the instance of the combat shirt, ease related problems at the waist (both functional as well as aesthetic) may be the result of the oversized loose fitting garments. Excess ease at the waist may be caused by the necessity to wear combat shirts that are too large in order to accommodate another body dimension such as the hip dimension previously discussed.

It is recommended that the waist dimension of these plus-sized wearers should be accommodated in order to provide an optimum number of wearers with sufficient ease at this location. This is in line with DeLong *et al.* (1993:7) who state that ease amounts should be slightly increased for larger wearers.

❖ Conclusions with regard to the amounts of ease at the upper arm location are presented below

Adequate ease allowances at the upper arm location are essential in order to ensure the overall comfort and movement of the closely fitted dress jacket as well as the loosely fitted combat shirt.

For the dress jackets, the amounts of ease at the upper arm of the issued garments decrease for the larger and plus-size wearers. This is problematic as the larger the body dimension, the more ease is required at that area to accommodate body expansion. This was confirmed by the results of the motor tests that indicated that sleeves that were too tight over the upper arm location were the most salient fit problem. Furthermore, the findings of the motor tests showed that the ease at this location impacts on the ease at other locations. Due to the afore-mentioned it is especially important to have adequate ease at the upper arm dimension. The problems related to insufficient ease at the upper arm dimension were further confirmed by the results of the aesthetic evaluations where the most salient set problems included wrinkles at the upper arm location as a result of insufficient ease at this location. Insufficient ease at the upper arm does therefore not only cause discomfort but also an unattractive appearance.

For the combat shirt, it was found that most of the subjects experienced the ease at the upper arm location to be excessive. This may be ascribed to the fact that the upper arm dimension of male wearers does not represent the upper arm dimension of female wearers.

The above-mentioned conclusion is confirmed by the findings of the aesthetic evaluation as numerous subjects experienced folds that formed due to excess ease. When the sleeve was in a rolled-up position, the ease was insufficient. In this instance it is the design of the combat shirt (with duel function as long or short sleeve) which impacts on the ease and comfort of movement. As a result, multiple functional problems arise as either insufficient or excess ease prohibits comfortable movement.

In the instance of the dress jacket it is recommended to include the upper arm dimension in the size specifications to better accommodate the ease needs of the subjects. In the instance of the combat shirt it is recommended to use an upper arm dimension which is representative of a female upper arm dimension. Furthermore, the design of the sleeve causes various functional problems and should be carefully considered.

For both the dress jacket and the combat shirt it is further recommended to revise the size specifications to assign different ease ranges for the smaller and the larger sizes in order to provide the plus-sized wearers with adequate amounts of ease. This is congruent with the findings of the study conducted by Strydom (2006:235) who states that the bicep girth is especially important when manufacturing garments for the plus-sized figure. The same author further explains that the upper arm is a problem area due to the fact that little information is available regarding accurate measurements at this dimension.

❖ Conclusions with regard to the amounts of ease at the scye circumference:
In the instance of both the dress jacket and the combat shirt, excess ease at the scye circumference resulted in a deep scye that restrained comfortable movement. In this instance, excess movement ease does not result in additional freedom of movement.

In the instance of the dress jacket, the three largest sizes in the size roll provided overall excess ease. The ease allowance for these sizes should decrease in order to provide the wearers with adequate rather than excess amounts of ease. In the instance of the combat shirt, gender-related differences in body dimensions resulted in a deep scye because the scye circumference of male wearers is not representative of the scye circumference of female wearers.

The findings of the motor tests showed that ease allowance at this dimension impacts on the ease at other dimensions. If the armhole is too deep it will pull at the bust, back width and upper arm dimensions, causing movement problems at these locations. Multiple fit and ease problems resulted from the combination of excess ease at the scye circumference and insufficient ease at the upper arm dimension. This aggravates the problem with ease at this location. It is therefore essential to have adequate ease allowance at the scye circumference.

In consideration of the above it is recommended to revise the garment specifications. The ease at the scye circumference should be carefully considered as either insufficient or excess ease will restrain comfortable movement. This is congruent with the opinion of Beazley (1999:68) that in the instance of a significantly lowered (deep) underarm seam, the arm movement will be restricted.

- Conclusions with regard to the functional and aesthetic performance in terms of ease:

For both the dress jacket and the combat shirt it was found in the mobility tests that ease allowance on the same horisontal level (including the bust, back width, scye and upper arm dimensions) compensated for either insufficient or excess ease at other locations. The mobility tests also proved that the body shapes of the subjects impacted on the ease allowed and that the plus-sized subjects need more ease allowance than subjects wearing smaller sizes. In the instance of the dress jacket, it is recommended to adapt the ease ranges in order to provide adequate ease for movement. In the instance of the combat shirt, garment dimensions that resemble female body dimensions should be used in order to ensure a good fit. Ease ranges should be established accordingly.

From these findings it is clear that both insufficient as well as excess amounts of ease will restrict movement and hinder the comfort of the garment. Daanen and Reffeltrath in Ashdown (2007:203) emphasised that it is important for wearers to be able to function and move unrestrictedly in clothing systems.

The findings of the mobility tests also reflected in the aesthetic evaluation. The aesthetic tests confirmed that in the instance of both garments, the plus-sized wearers of larger sizes required more ease allowance in order to achieve an aesthetically acceptable appearance. Petrova (2007:81) also confirmed that garment fit is dependent on the amounts of ease added above and beyond the body measurements for comfort and style.

In conclusion, it can be inferred that in order to comply with the functional requirements related to the activities and comfort of the wearers as well as to result in an aesthetically acceptable fit, it is recommended that the amounts of ease should be carefully reconsidered. This is in line with the opinion of Beazley (1999:79) who stated that understanding the amount and placement of ease allowances to be added to the body measurement is crucial.

In the instance of the combat shirt, most salient fit and movement problems were caused by excess ease. This is in line with the opinion of Beazley (1999:68) who states that excessive fabric in very loose fitting garments can be cumbersome. Wheat and Dickson (1999:9) in their study investigating uniforms for college female golfers also found that problems with wearing large, bulky and ill-fitting garments were often discussed as hindering physical performance. The findings of this study are congruent with the findings of the study conducted by Wheat and Dickson (1999:9) which concluded that female golfers were dissatisfied with male golf uniforms.

In consideration of the afore mentioned findings it is clear that determining the amounts of ease and ease ranges to comply with the functional and aesthetic requirements is not an easy task. This is in agreement with Branson and Nam (2007:264) that it is an important and difficult issue to determine what are appropriate amounts of ease in order to assert fit. According to Strydom (2006:23) fit is a complicated concept because every individual has his/her own perception of what good fit entails. This is in accordance with the opinion of Bougourd in Ashdown (2007:130) that analysis of fit remains a challenge.

It was found that in certain instances, the subjective views regarding adequate ease differed from the objective evaluations. Fan, Yu and Hunter cited by Bougourd in Ashdown (2007:130) stated that subjective assessment and objective evaluation of clothing fit is a complex but critical issue. In order to evaluate ease allowances and ease ranges in perspective, it is important to consider both viewpoints. According to Ashdown and DeLong (cited by Branson & Nam 2007:272) subjective fit judged by the wearer is based on appearance as well as perception of comfort. Conversely, fit researchers use a variety of resources to objectively evaluate fit, such as fabric properties, ease, line, grain, set and balance (Branson & Nam 2007:272).

The value of the subjective views is that according to Daanen and Reffeltrath (in Ashdown 2007:203) good fit is only achieved when the subject feels comfortable in the clothing. This is in line with the opinion of Strydom (2006:23) that objective evaluations cannot address the interactions that occur on the clothed body that the wearer experiences. Strydom (2006:23) further stated that it is also crucial to have a comprehensive and objective understanding of what good fit entails. From the above, it can be inferred that many factors contribute to determining and interpreting adequate amounts of ease allowance.

4.4.6.5 Conclusions regarding ease norms for the dress jacket and the combat shirt

To realise objective one, namely to determine and interpret the amount of ease that will comply with the functional and aesthetic requirements of an optimal number of wearers of the dress jacket (closely fitting garment) and the combat shirt (loosely fitting garment) the amounts of ease were investigated.

After consideration of the objectives and findings it is clear that in order to realise objective one, the amounts of ease that impact on the functional and aesthetic requirements of the garments (both the dress jacket and the combat shirt) need to be addressed.

It was found that the subjects wearing smaller sizes were satisfied with less ease than the plus-sized wearers wearing the larger sizes. Due to the above, the estimated ease ranges were adapted to accommodate different size categories. By ensuring that subjects wearing smaller sizes have ease in the lower ranges and the subjects wearing larger sizes have ease within the higher ranges, the ease requirements of an optimal number of subjects should be better accommodated. In consideration of the above factors, the ease norms differ for the size categories for the smaller sizes (from size RR76 up to size RR97 for the dress jacket; and sizes 70 to 100 for the combat shirt) to the larger sizes (from size RR102 to size RR132 for the dress jacket and above size 100 for the combat shirt).

In order to establish ease ranges for the various sizes, the following factors were taken into consideration:

- Firstly, the norms from theory and practice. These norms were initially used as parameters to interpret the findings in terms of ease.
- Secondly, the ease ranges with which the subjects were satisfied. It was previously motivated that the subjective views are important and should be considered.
- Thirdly, the ease ranges with which the judges were satisfied were considered, as this is a crucial aspect of fit analysis.

In consideration of the above factors, the satisfaction range was adjusted and extended. This range was inferred from both the subjective and objective satisfaction with ease from the smallest to the largest acceptable amount of ease allowance. Through extending the ease range, a larger number of wearers should be satisfied and accommodated. Finally, the extended ease range was divided into two ranges, assigning lower ease values to the smaller sizes and allocating larger amounts of ease to the larger sizes in the size categories.

The ease ranges for the dress jacket and the combat shirt differ due to the fit, functionality and intended use of the garments. The dress jacket is a service dress uniform worn at parades and other functions. It is a styled garment which creates a professional appearance. The combat shirt is part of the battledress uniform that should be functional in a battle environment. Therefore, as the garments have different end-uses, the ease ranges should be adapted to suit these specific needs.
In consideration of the above, Tables 31 and 32 are compiled for the dress jacket and the combat shirt respectively. These tables propose the ease norms for the bust (in

the instance of the dress jacket) and the ease norms for the hip, back width, waist and the upper arm locations for the dress jacket and the combat shirt.

(The conclusive ease range values were rounded to the nearest 5 mm). The table for the dress jacket is presented below.

TABLE 31: CONCLUSIVE EASE NORMS FOR THE DRESS JACKET

Dimension	**Inferred norm (mm)**	**Sub-jective ease range (mm)**	**Objective ease range (mm)**	**Extended ease range (mm)**	**Suggested ease per size group (mm)**	
					RR76-RR97	**RR102-RR132**
Bust	100 – 200	60 – 172	55 – 155	55 - 170	60-100	90-170
Hip	100 – 200	112-162	56 – 224	55 – 225	55-140	100-225
Back width	50-75	45-70	30 – 60	30 – 70	30-50	45-70
Waist	70 - 150	76-151	76 – 160	76 – 207	80-150	105-210
Upper arm	50 – 100	50-74	45 – 98	45 - 100	45-75	75-100

The following table presents the conclusive ease ranges for the combat shirt. The objective ease range for the upper arm dimension stipulates one dimension only. This is due to the fact that the judges were in only one instance satisfied with the amount of ease allowance.

TABLE 32: CONCLUSIVE EASE NORMS FOR THE COMBAT SHIRT

Dimension	**Inferred norm (mm)**	**Sub-jective ease range (mm)**	**Objective ease range (mm)**	**Expanded ease range (mm)**	**Suggested ease per size group (mm)**	
					70 - 100	**110 - 130**
Hip/bottom hem	100 – 200	86- 202	103 – 202	85 – 200	85 - 140	140 - 200
Back width	65 - 100	68 - 120	52 – 125	50 – 125	52 - 77	87 – 125
Waist	100 - 200	122-191	122 – 255	120 – 255	122 - 192	180 – 255
Upper arm	60 – 100	115-205	165	115 - 205	115 - 165	152 - 205

The findings for objective two are presented in the following section.

4.5 FINDINGS: OBJECTIVE TWO

To realise the second objective of this study, namely to analyse and interpret the suitability of the key dimensions used to base the current size designation on, particularly in terms of body shape and gender, the following questions had to be answered for the dress jacket:

- Is the bust dimension as key dimension for the closely fitted dress jacket sufficient to predict other dimensions in order to ensure good fit?
- Does the use of the bust dimension as only key dimension for the dress jacket affect fit in terms for ease of the close fitting dress jacket?
- How does body shape influence the fit of the dress jacket?
- What are the implications of body shape on the key dimensions of the dress jacket and therefore, for fit in terms of ease?
- If the currently used key dimensions are not adequate, which key dimensions should be used?

The following questions had to be answered for the combat shirt:

- Are the chest girth and height dimensions as key dimensions of the loose fitting combat shirt sufficient to predict other dimensions in order to ensure good fit?
- Does the use of the chest and height as the only key dimensions for the combat shirt affect the fit of the loosely fitting combat shirt?
- How does body shape and gender influence the fit of the combat shirt?
- What are the implications of body shape and gender for the key dimensions of the combat shirt and therefore for fit in terms of ease?
- If the currently used key dimensions are not adequate, which key dimensions should be used?

The findings for the dress jacket are presented below, followed by the findings for the combat shirt.

4.5.1 Objective two: Dress jacket

To establish whether the bust dimensions as only key dimension for the dress jacket is sufficient to predict other dimensions to ensure good fit, the bust, waist and hip dimensions of the garments and the subjects are compared in Table 33. The ease available at the various body locations is used as a respective parameter to interpret the findings. The final ease ranges established for objective one were used.

In Table 33 the ease allowances for the bust, waist and hip dimensions from the ease Tables 11, 12 and 15 are summarised. The findings are presented against the background of the size designation and nominal garment measurements as included in the ARMSCOR specifications, document number KMG27/71 (see Annexure J). Pictograms of the body shapes of the subjects are included to establish the effect thereof on the ease available at various body locations. The size designation RR76 is omitted from this table, because none of the sample subjects wore this size.

TABLE 33: A COMPARISON OF THE BUST, WAIST AND HIP DIMENSIONS OF THE DRESS JACKETS TO THOSE OF THE SUBJECTS

ARMSCOR Specifications			Dimensions at bust location (mm)			Dimensions at waist location (mm)			Dimensions at hip location (mm)			
Size designation category	Nominal finished garment bust measurement	Subject number	Issued garment	Subject	Ease Allowance	Issued garment	Subject	Ease Allowance	Issued garment	Subject	Ease Allowance	Body shape of the subjects
RR81	910	1	900	815	85	810	628	182	970	806	164	▼
RR87	970	13	940	880	60	850	683	167	1030	977	53	
		12		899	41		745	105		967	63	▲
RR92	1020	52	1000	895	105	880	731	149	1080	944	136	
		33		923	77		745	135		1075	5	▲
		43		928	72		785	95		1165	-85	▲
RR97	1070	49	1080	925	155	940	733	207	1120	1190	-70	▲
		41		983	97		860	80		1044	76	■
		22		994	86		864	76		1080	40	▲
RR102	1120	19	1100	928	172	1020	815	105	1180	1050	130	▮
		26		1008	92		859	161		1045	135	■
		18		1010	90		861	159		1038	142	▲
RR107	1170	51	1100	1045	55	830	890	-60	1180	1068	112	■
RR112	1220	8	1240	1030	210	1100	888	212	1280	1098	182	■
		25		1072	168		955	145		1108	172	
		3		1085	155		949	151		1078	202	
		24		1106	134		1012	88		1316	-36	▲
		42		1140	100		1030	70		1184	96	
RR122	1320	50	1290	1126	164	1210	912	298	1400	1091	309	■
		32		1181	109		1035	175		1225	175	
		34		1288	2		1050	160		1245	155	
RR132	1420	27	1400	1254	146	1320	1044	276	1520	1296	224	
		21		1391	9		1208	112		1358	162	

Consideration of the ease norms for the bust (60 mm to 100 mm), waist (75 mm to 150 mm) and hip (55 mm to 135 mm) for sizes RR76 to RR97, Table 33 shows that:

- Six subjects (1, 13, 33, 43, 41, 22) have adequate ease at the bust.
- Only one subject (number 41) has adequate ease at all three locations.
- In four of six instances (33, 43, 49, 22) the bust dimensions are sufficient to ensure sufficient ease at the waist dimension but not sufficient to ensure adequate ease at the hips for the triangle body shapes.

Consideration of the ease norms for the bust (90 mm to 170 mm), waist (105 mm to 210 mm) and hip (100 mm to 225 mm) for sizes RR102 to RR132, Table 33 shows that:

- Nine out of 14 subjects (26, 18, 25, 3, 24, 42, 50, 32, 27) have adequate ease at the bust.
- Five subjects (number 26, 18, 25, 3, 32) have adequate ease at all three locations.
- In three instances (24, 42, 50) the ease at the bust dimensions were sufficient but did not ensure sufficient ease at the waist and hip dimensions.

From the above it can be inferred that the bust as only key dimension is not sufficient to predict the waist and hip dimensions. The ease allowance at these locations will therefore not be sufficient.

In order to determine whether body shape affects the fit of the dress jackets, the suitability of the bust dimension as key dimension was analysed in comparison to the waist and hip dimensions of the subjects. The findings are analysed in terms of the ease ranges at the bust (60 mm to 100 mm for the smaller size categories and 90 mm to 170 mm for the larger size categories), waist (75 mm to 150 mm for the smaller size categories and 105 mm to 210 mm for the larger size categories) and hips (55 mm to 135 mm for the smaller size categories and 100 mm to 225 mm for the larger size categories).

From Table 33 it follows that:

- One subject had an inverted triangular body shape (1) and experienced adequate ease at the bust and waist locations but excess ease at the hip location.
- All three subjects (13, 52, 25) who had hourglass body shapes had adequate amounts of ease at the hip locations.
- From the seven subjects (12, 33, 43, 49, 22, 18, 24) who had triangle body shapes, it is important to note that five (33, 43, 49, 18, 24) had insufficient ease at the hip location.
- Out of five subjects (41, 26, 51, 8, 50) with square body shapes, three (41, 26, 50) had adequate ease at the bust dimension. Three subjects (41, 26, 8) had adequate ease at the waist. Four subjects (41, 26, 51, 8) had adequate ease at the hip location.
- The only subject with a rectangle body shape had excess ease at the bust but adequate ease at the waist and hip dimensions.
- Four subjects (3, 34, 27, 21) had oval body shapes, and two of these subjects (3, 27) had adequate ease at the bust dimensions while the other two (34, 21) had insufficient ease at the bust. Three out of four subjects (3, 34, 21) had excess ease at the waist dimension.
- One of the subjects with a diamond shape (32) had adequate ease at the bust and hip dimensions, whereas the other (subject 42) had insufficient ease at the waist and hip dimensions.

From the above findings it can be inferred that not all body shapes are accommodated. The bust dimension as only key dimension is not sufficient to predict the dimensions for the waist and hip locations. Consequently, body shapes are not adequately defined.

In the next section, the findings for the combat shirt are presented.

4.5.2 Objective two: Combat shirt

In order to determine the suitability of the chest and height as key dimensions for the fit of the combat shirt, the findings presented in Table 34 are relevant. This table is similar to Table 33 presenting the findings for the close fitting dress jacket.

In Table 34 the ease allowances for the waist and hip dimensions from ease Tables 24 and 27 are summarised. The nominal finished garment chest measurements described in document number: 05181-100-017 are included (see Annexure K). Pictograms of the body shapes of the subjects are included in order to establish the effect of body shape on the ease of the loose-fitting combat shirts.

The final ease ranges from objective one for the combat shirt were used as parameters to interpret the findings in terms of ease.

TABLE 34: COMPARISON OF THE WAIST AND HIP DIMENSIONS OF THE COMBAT SHIRTS TO THOSE OF THE SUBJECTS

ARMSCOR specifications		Subject number	Issued garment: chest measurement (mm)	Bust circumference: Subject (mm)	Ease allowance (mm)	Issued garment: waist measurement (mm)	Waist circumference Subject (mm)	Ease allowance (mm)	Issued garment: bottom hem measurement (mm)	Hip measurement: Subject (mm)	Ease allowance (mm)	Subject body shape
Size designation category	Nominal finished garment chest measurement (mm)											
95-70	360	22	-	-	-	864	864	0	940	1080	-140	▲
95-80	400	12	-	-	-	1020	745	275	1070	967	103	▲
95-90	430	18	-	-	-	1050	861	189	1100	1038	62	▲
		25		-	-		955	95		1108	-8	
		26		-	-		859	191		1045	55	■
		49		-	-		733	317		1190	-90	▲
95-100	460	41	-	-		1142	860	282	1186	1044	142	■
95-110	500	42	1266	1140	260	1210	1030	180	1270	1184	86	◆
		50		1126	274		912	298		1091	179	■
		51		1045	355		890	320		1068	202	■
95-120	530	21	-	-	-	1330	1208	122	1390	1358	32	●
99-70	360	1	-	-	-	860	628	232	940	806	134	▼
		13					683	177		977	-37	
99-90	430	3	-	-	-	1040	949	91	1100	1078	22	●
		8		-	-		888	152		1098	2	■
		19		-	-		815	225		1050	50	▮
		33		-	-		745	295		1075	25	▲
		43		-	-		785	255		1165	-65	▲

ARMSCOR specifications		Subject number	Issued garment: chest measurement (mm)	Bust circumference: Subject (mm)	Ease allowance (mm)	Issued garment: waist measurement (mm)	Waist circumference Snbject (mm)	Ease allowance (mm)	Issued garment: bottom hem measurement (mm)	Hip measurement: Subject (mm)	Ease allowance (mm)	Subject body shape
Size designation category	Nominal finished garment chest measurement (mm)											
99-110	500	24	-	-	-	1238	1012	226	1274	1316	-42	▲
		27		-	-		1044	194		1296	-22	
		32		-	-		1035	203		1225	49	
		34		-	-		1050	188		1245	29	
92Rl	-	52	-	-	-	-	731	-	-	944	-	

As previously established for objective one (see Table 22), the chest girth as key dimension of the combat shirt is not adequate to represent the bust girths of female wearers. Due to the fact that a male chest girth cannot be compared to a female bust measurement, this key dimension cannot be used as a predictor for other female dimensions to ensure well fitting garments for female wearers.

With the ease norms for the waist (120 mm to 190 mm) and hip (85 mm to 140 mm) for sizes 70 to 100 in mind, Table 34 shows that:

- None of the 14 subjects who wore the smaller sizes had insufficient ease at either the waist or hip dimensions.
- Four out of 14 subjects (18, 26, 13, 8) had adequate ease at the waist location.
- Only three subjects (12, 41, 1) out of 14 had adequate ease at the hips.

With the ease norms for the waist (180 mm to 225 mm) and hip (140 mm to 200 mm) for the sizes 100 to 130 in mind, Table 34 shows that:

- None of the eight subjects had adequate ease at either the waist or hip dimensions.
- Five subjects (42, 24, 27, 32, 34) had adequate ease at the waist.
- Only two subjects (50, 51) had adequate ease at the hip dimensions.

From the above it can be concluded that the male chest dimension is not sufficient to predict the waist and hip dimension of female wearers.

The second key dimension of the combat shirt is the height of the intended wearer. As previously mentioned, the combat shirt is produced according to two size ranges, namely, the '95' range (describing a regular height) and the '99' range (describing a tall figure). Referring to the back length table of the combat shirt (see Table 24) for objective one, it was found that the majority of the combat shirts extended beyond the fullest part of the hips of the subjects. It is therefore important to include the hip dimension in conjunction with the height dimension as key dimensions. The findings of a study conducted by Chatterman and Rudd (2006:58) found that individuals with a larger body size showed a preference for greater body coverage. It can therefore be inferred that some of the subjects will prefer wearing a longer combat shirt in order to feel comfortable.

From the available ease allowance shown in Table 34, it can be concluded that if only the chest and height are used as key dimensions, the following consequences for the fit of the combat shirt are found:

- The loose fitting combat shirts are too large at the bust location for female wearers.
- The use of male chest measurements as key dimensions for female wearers results in too much bulkiness at the bust location.
- The above mentioned results in fit problems such as gaping necklines.
- The combat shirts are too large at the waist location but too small at the hip location.

As an example, the body dimensions of subject number three will be compared to the dress jacket and the combat shirt. Referring to Table 11 for ease at the bust circumference of the dress jacket, it can be seen that subject number three wears a size RR112 dress jacket. This size garment is the third largest in the size chart. When subject number three wears a combat shirt, she wears a size 99-90 (which is the third smallest size in the size chart) as her bust dimension of 112 mm is accommodated by the third smallest chest dimension. To further support this finding the ease at the hip is investigated. Referring to Table 12 for the ease at the hip dimension, it was found that the dress jacket provided subject number three with 202 mm ease allowance and the combat shirt provided 55 mm. Even though last mentioned is the absolute minimum amount, the male dimensions did provide ease in this instance.

From the above it can be concluded that the combat shirt is oversized for female wearers and that the garment dimensions used should represent that of female body dimensions in order to ensure good fit for female wearers.

In order to interpret whether body shape affects the fit of the loose fitting combat shirt, the available ease allowance at the waist and hip locations were analysed in terms of the final ease ranges established for objective one. From Table 34 it follows that:

- From the seven subjects (22, 12, 18, 49, 33, 43, 24) who had triangle body shapes, six (22, 18, 49, 33, 43, 24) had insufficient ease at the hip location.
- Both subjects (25, 13) who had an hourglass body shape had insufficient ease at the hip dimension.
- Three (41, 50, 51) out of five subjects (26, 41, 50, 51, 8) who had a square body shape had excess ease at the waist dimension.
- Both subjects (42, 23) who had diamond body shapes and all four of the subjects (21, 3, 27, 34) who had oval body shapes had insufficient ease at the hip dimension.
- In the instance of the rectangular body shape (19) the ease at the hip dimension was insufficient even though this body shape is not characterised by wide hips. It can therefore be concluded that the hip dimension of the combat shirt does not accommodate the larger hip dimension of the female wearers, regardless of their body shape.

From the above findings it can be inferred that the combat shirt does not accommodate female body shapes. The male chest dimension as key dimension is not sufficient to predict the dimensions for the female waist and hip locations in order to define body shapes.

4.5.3 Summary: Objective two for the dress jacket and combat shirt

From the above findings regarding the suitability of the key dimensions used to base the current size designation on, especially in terms of body shape and gender, it can be inferred that:

- In the instance of the dress jacket, the bust as only key dimension is not sufficient to predict other body dimensions.
- In the instance of the combat shirt, the male chest dimension is not suitable to represent the female bust dimension.
- For both garments, the key dimensions did not adequately predict other body dimensions such as the waist and hip locations.
- Due to the above, variations of body shapes were not accommodated.
- Male body dimensions as key dimensions of the combat shirts result in 'oversized/baggy' garments for female wearers.

4.5.4 Objective two: Summary and conclusive discussion

In the next section, the conclusions and recommendations of objective two for the dress jacket and the combat shirt are presented and discussed. The conclusions are presented according to the suitability of the key dimensions used to base the current size designation on. In the instance of the dress jacket, the key dimensions are discussed in particular in terms of body shape and for the combat shirt, the suitability of the key dimensions focus on gender.

4.5.4.1 Conclusions with regard to the suitability of the bust dimension as only key dimension for size designation of the dress jacket

If the size designation is based on the bust dimension as only key dimension, size allocation will not ensure that wearers receive garments that provide good fit at the hip and waist locations. The findings of various studies indicate that the bust proved to be inadequate as key/control dimension. The results of a study conducted by Green (1981:21) indicated that the bust circumference (which is traditionally considered to be of major importance) failed in predicting various measurements for upper torso garments. Winks (1997:15) states that it is unrealistic to assume that a single set of measurements (such as the bust) can predict a range of body measurements. The same author explains that this is due to the fact that the girth dimensions are not directly proportional. Claims of predictability are therefore based on the false premise that all subjects within the population have the same body shape (Winks 1997:15).

From the functional viewpoint (see Table 18 in objective one) it was confirmed that the bust dimension failed to adequately predict the waist and hip dimensions resulting in tightness (due to too little ease) or bulkiness (due to too much ease) and consequently, discomfort with and restriction of movement. In some instances, the garments had the tendency to 'ride up' over the hip. The inadequacy of bust as a key dimension was further confirmed by the aesthetic evaluations (see Table 19). Unsightly wrinkles and folds indicated either too little or too much ease as a result of dimensions that could not adequately be predicted.

It is recommended to include the waist and hip dimensions as key dimensions in the size designation for the dress jacket in order ensure good fit for an optimum number of wearers. This is in accordance with the findings of Chun-Yoon and Jasper (1996:89) that most body measurement tables describe each size code with three body measurements which include the bust, waist and hip dimensions. According to Pertova (in Ashdown 2007:66) the International Organisation for Standardisation recommends the use of three control dimensions, namely the bust girth, the hip girth and height for upper-body garments. The findings of Strydom (2006:234) support the fact that the waist and hip circumferences are required to manufacture tight (close) fitting garments for ladies wear.

Winks (1997:15) suggests that if only one dimension is used as key, it should rather be the hip dimension as the bust location is known to change in girth and shape over the years while the hips are generally larger in girth and are more static. Koblyakova cited by Petrova (2007:66) is also of the opinion that the control dimension must have the largest value in order to be representative of the basic shape of the body. As the hip dimension is generally larger than the bust, the above strengthens the point to include the hip dimension as key dimension.

By including hip dimensions in different drops, a variety of body shapes can be accommodated by the sizing system. The recommendation to include additional key dimensions, such as the waist and hip dimensions, is in line with the opinions of various authors (Petrova 2007:66; Salusso-Deonier, DeLong, Martin & Krohn 1985:38).

Within the sample of this study it was found that the largest body shape group (consisting of black plus sized females) was the triangle, namely seven out of 23 subjects (30,4 percent). This finding is in line with other studies conducted in South Africa (Kuma 1999:14; Ergotech 1994). Referring to Table 13 for the back length dimension of the dress jackets, it can be seen that the majority of the dress jackets' back lengths extended beyond the broadest part of the subjects' hip locations. It could be inferred that the hip dimensions of body shapes such as the triangle are directly affected. Due to the fact that the back length dimension is a secondary dimension, it is further recommended to incorporate the hip dimension as key dimension in order to accommodate the body shapes.

Even though the shoulder dimension as a possible key dimension for the upper garments was not investigated in this study, the findings of other studies recommend the use of this dimension as key dimension when designing upper torso garments (Green 1981:21, Strydom 2006:235). Strydom (2006:235) explains that if the shoulder seams do not fit properly it causes a garment to appear too small or too large, regardless of whether the bust dimension is correct. It is recommended that the adequacy of this measurement (from the side of the neck to the shoulder) as key dimension of upper torso garments is investigated in future studies.

4.5.4.2 Conclusions with regard to the suitability of the male chest dimension as key dimension to issue combat shirts to female soldiers

The male chest dimension is not suitable as key dimension to issue combat shirts to female wearers. The male chest girths are not comparable to female bust dimensions. This finding is similar to the findings of another study where Todd *et al.* (1996:683) found that as the number of women in the army increased, the disparity between male and female dimensions became increasingly apparent.

The findings of objective one indicated that the use of chest as key dimension resulted in oversized garments in the upper torso location that are functionally as well as aesthetically unpleasing. On the other hand, the garments did not provide sufficient ease at the hip location which resulted in restriction and strain at the front shirt opening of the garment. The shirts have a tendency to ride up over the hip line where there is not an adequate amount of movement ease. From the aesthetic evaluation it was clear that the above mentioned functional problems also resulted in aesthetic problems.

It was furthermore found that it is not only the amounts of ease allowances that are incorrect, but the ease is also provided at incorrect locations. This is congruent with the findings of Gordon (1986:581) that downsizing male garment patterns to fit female wearers has accentuated the fitting problems caused by gender related body proportions.

From the above findings, it is recommended that garment dimensions appropriate to female body dimensions should be used as key dimensions in the size designation in order to provide well-fitting garments for female wearers. This is in line with the opinions of other researchers. The findings of the study by Gordon (1986:581) also indicated that female body measurements must be considered in the design and sizing of army field clothing. The findings of the study conducted by Todd *et al.* (1996:683) indicates (through an anthropometric comparison between male and female soldiers' stature) that due to the disparity in body proportion, 65 percent of the Army female population is likely to be outside the typical design envelope for many Army systems. Schafer and Bates (cited by Todd in Ashdown 2007:290) also found that the differences between male and female body proportions were too great to fit both males and females in the same sizing system.

Crist (cited by Todd in Ashdown 2007:290) suggested the development of a separate woman's sizing system as it would be easier to grade and easier to develop. However, Todd (in Ashdown 2007:290) was of the opinion that creating a complete set of female specific sizes in addition to male stock will create concerns in manufacturing, stocking and distribution costs.

In consideration of the above it becomes clear that providing good fit for females from male size charts and key dimensions proves to be a challenging undertaking.

The above findings are not only relevant for objective two, but also for objective three.

4.6 FINDINGS: OBJECTIVE THREE

To realise the third objective, namely to determine and interpret the relevance and the validity of the currently used sizing system with regard to the representativeness of the current population's measurements, the following questions had to be answered regarding the close fitting dress jacket as well as the loose fitting combat shirt:

- Is the sizing system representative the current population's measurements?
- Are the sizes in the size categories and the intervals between sizes applicable for the intended population?
- Does the sizing system accommodate the variety of body sizes and shapes of ethnic groups in the population?

4.6.1 Objective three: Dress jacket and the combat shirt

In the next section, the findings regarding objective three for the dress jacket as well as the combat shirt are presented. The findings are presented in the order of the questions asked to realise the objective.

4.6.1.1 The representativeness of the sizing system

Sizing systems are based on anthropometric data for which the sizing system is intended and therefore, the representativeness of the database determines the success of the sizing system.

In the instance of both the dress jacket and the combat shirt the origin of the database on which the system is based is unclear. The size chart specifications were consulted and during an informal interview with one of the managers of the anthropometric database from Ergotech, it was found that:

- The origin of the anthropometric data on which the size charts are based, could have been derived from the SABS (South African Bureau for Standardization) as the SABS assisted in the drafting of the SANDF specifications.
- The size chart specifications for the dress jacket were last revised during 1989. It is unsure when the size chart specifications for the combat shirt were last revised.
- There is more current anthropometric data available on the current population of the SANDF. Ergotech collects anthropometric data on about 480 soldiers (240 male and 240 female) every year. But it is unclear whether the size specifications have been updated accordingly. This is due to the fact that there is no formal process in place for updating the current sizing systems with current

anthropometric data. Ergotech could conduct an analysis during which they compare the nominal finished garment (NFG) measurements to the most recent anthropometric data in order to verify whether the NFG measurements would mathematically "fit" the current SANDF population. They could then report discrepancies between garment measurements and the measurements of the population. The SANDF logistics office could then support the appropriate action to rectify the discrepancies (by means of new designs, alterations, etcetera).

It can be concluded that if the anthropometric data is not current, it is not representative of the body measurements of the intended population.

4.6.1.2 Size ranges and intervals between sizes

The number of sizes which comprise the size chart should accommodate the intended wearers. From the above findings in objective one, it was found that the number of sizes is not sufficient to accommodate the current population.

In the instance of the dress jacket, the following findings from objective one and two are relevant:

- Referring to Table 11 (for the ease at the bust dimension) it was found that the size categories of the dress jacket include too many sizes. This has serious implications for the wearers with the largest bust measurements in each size.
- The intervals between sizes should increase in order to accommodate the plus-sized wearers wearing the larger sizes.
- The number of sizes does not accommodate all the wearers. In the instance of the bust and upper arm dimensions there were subjects outside the sizing system as their body dimensions were larger than the largest garment dimension in the size range.

In the instance of the combat shirt, the following findings from objective one are relevant:

- Female body dimensions are not accommodated by male size charts.
- The intervals between sizes should increase in order to accommodate the plus-sized wearers of the larger sizes.
- It can be speculated that there may be female wearers with body dimensions smaller than the garment dimensions provided due to the oversized garments and size ranges of the combat shirts.

When referring to the ease tables for both the dress jackets and the combat shirt it was found that for most of the garment sizes, the issued garments were smaller than prescribed in the specifications. This causes the ease allowances to diminish which directly impacts on the fit and comfort of the garments.

4.6.1.3 Accommodation of body sizes and shapes

From findings of objective 1 and 2 for the dress jacket and combat shirt it was found that body size (BMI) and variations of body shapes need to be accommodated within sizing systems. Variations in body size and shape may be related to differences between ethnic groups. Different body shapes and proportions should be addressed. The results of the functional and aesthetic evaluations confirmed that the above mentioned factors impact on the ease allowance and consequently the fit of the garments.

4.6.2 Summary: Objective three for the dress jacket and the combat shirt

From the above findings regarding the relevance and validity of the currently used sizing system it can be inferred that:

- It is unclear whether the anthropometric data on which the sizing system is based is current and consequently, representative of the population's measurements.
- The size categories include too many sizes.
- The intervals between sizes are too small to accommodate the plus-sized wearers.
- Not all of the subjects are accommodated by the size charts.

- The size specifications and the male sizing system for combat shirts do not accommodate female wearers of the combat shirt.
- The size charts do not accommodate variations in body size and body shapes of different ethnic groups.
- The issued garment sizes are smaller than prescribed in the specifications.

4.6.3 Objective three: Summary and conclusive discussions

In the next section, the conclusions and recommendations of objective three for the dress jacket and the combat shirt are presented and discussed. The conclusions are presented according to the representativeness of the sizing systems, the male garment sizes, the number of garment sizes, the intervals between sizes, the issued garments and body sizes and shapes.

4.6.3.1 Conclusions with regard to the representativeness of the sizing systems

It is unsure whether the sizing systems are current and therefore representative. It can be inferred that the sizing system does not represent the measurements of this sample and probably also not the current population's measurements. This is in line with the findings of Labat (in Ashdown 2007:94) that most sizing systems available today are based on out-dated databases. Currently used sizing systems are therefore not representative of the current population. The findings of the study by Strydom (2006:30) indicate that the source of anthropometric data on which the South African sizing systems are based is vague.

The representativeness of the size charts should be addressed. A solution to this problem would be to update the current sizing system by means of an anthropometric survey (in conjunction with three-dimensional body scanning technology) to ensure the representativeness of the current population's measurements. This is in line with Susan Ashdown's framework (2000) which illustrates that the effectiveness of a sizing system is determined by the population's measurements on which it is based.

McConville *et al.* (1979:102), Brunn (1983:98), Workman (1991:31), Ashdown (1998:325), Gupta and Gangadar (2004:458), Strydom (2006:16), Chun (in Ashdown 2007:238), Petrova (2007:80) agree that up-to-date anthropometric data should form the basis of a sizing system in order to provide the best fit for the largest number of people in the population.

The three-dimensional body scanner is widely recommended as a means to collect anthropometric data (Ratnapharki, Ratnapharki & Robinette 1992:181, DesMarteau 2000:42, Le Pechoux 2000:13, Yu 2004:174, Ashdown & Dunne 2006:121, Ashdown & O'Connell 2006:139, Griffey & Ashdown 2006:112, Bougourd in Ashdown 2007:108, Branson & Nam 2007: 272, Ashdown, Loker, Schoenfelder & Lyman-Clarke, Connell, Ulrich, Knox, Hutton, Woronka & Ashdown & Simmons, Istook & Devarajan cited by Petrova 2007:83).

Until recently, advanced computer based techniques for collecting and analysing large volumes of anthropometric data have not been available. In recent years, measuring technology has advanced to the state that it is now possible to digitise the surface of body forms faster and in much finer detail than previously possible (Ratnapharki *et al.* 1992:181). The three-dimensional scanner is the latest and most objective method of collecting anthropometric data (Le Pechoux 2000:13).

The advantages of this data collection method include that it is a non-contact method and provides information about the contours and the measurements of a person's body through a 3D virtual model (Staples, Pargas & Davis in Griffey & Ashdown 2006:113). Another important aspect of the three-dimensional scanner is that the body shape of the target market can be captured (Bougourd in Ashdown 2007:108). The entire process takes five to fifteen seconds depending on the type of scanner and the set of body measurements can be generated from the scan in less than a minute (Petrova 2007:83).

4.6.3.2 Conclusions with regard to male garment sizes for the combat shirt used to accommodate female wearers

It was found that male size charts and size ranges are not suitable to accommodate the female wearers of the combat shirts. As previously discussed in objectives two and three, it is recommended to use body dimensions representative of female body dimensions for the sizing of the combat shirts.

4.6.3.3 Conclusions with regard to the number of garment sizes

It was found that the number of sizes within the size categories proved to be problematic. This is in line with Petrova's statement (2007:57) that deciding how many size groups should be developed is a major dilemma. According to Chun in Ashdown (2007:233) a closely fitting garment requires a larger number of sizes to fit the full range of wearers' body dimensions and body types, while a loose-fitting garment for the same population could fit consumers satisfactorily with fewer numbers of sizes.

It is recommended to reduce the number of sizes in a size category by increasing the number of categories, thereby creating more garment sizes. Petrova (2007:57) is of the opinion that a large number of size groups will have fewer individuals within each group but these individuals will be provided with a very well fitting garment. Furthermore, the problem with the group of individuals who are left out of the sizing system because they have some control dimension that is either too low or too high will be addressed (Petrova 2007:78). This is in accordance with Daanen and Reffeltrath (in Ashdown 2007:202) that one way to deal with the variability in male and female bodies in military clothing systems is to make clothing in several sizes in an attempt to satisfy both male and female wearers. Conversely, a large number of sizes is countered by increased production costs (Petrova 2007:57). Furthermore, it is in contradiction with the aim of a sizing system which is to accommodate the largest number of wearers with the smallest number of sizes (Salusso-Deonier *et al.*

1985:39, Ashdown 1998:324-325, Beazley 1998:227, Daanen & Reffeltrath in Ashdown 2007:202).

4.6.3.4 Conclusions with regard to the intervals between sizes

It was found that the intervals between sizes were not suitable to accommodate the ranges of sizes. It is recommended that the intervals between sizes should be increased for the larger garment sizes. This is in line with the opinion of Petrova (2007:72) that the intervals between sizes will be larger for larger body dimensions (such as the hip) than for smaller body dimensions.

4.6.3.5 Conclusions with regard to the issued garments

It was found that the issued garment measurements deviated from the specifications. Stricter control of issued garments is recommended to ensure correspondence with the AMSCOR specifications. This finding is in line with the opinion of Petrova (2007:81) that even though it may be suggested that a sizing system is flawed, poor fit may very well be a consequence of an irrelevant sizing system and can also be due to problems with garment construction.

4.6.3.6 Conclusions with regard to body size and shapes

It can be inferred from the findings of objective two and three that body shape and size is an aspect that must be addressed. Variations of body shapes and sizes are constantly put forward as the primary reason why a workable sizing system is not achieved (McVey 1984:24, Salusso-Deonier *et al.* 1985:39, Price & Zamkoff in Workman 1991:32-34, Winks 1997:46, Ashdown *et al.* 2004:1, Le Pechoux in Strydom 2006:27).

If the sample considered in this study represents the total population, it can be inferred that a large segment of the total population is plus-sized. It is recommended that the size charts are adapted to accommodate the variety of body shapes and sizes.

This is in line with the opinion of Petrova (2007:57) that the wide variation in body dimensions in the population inevitably raises the necessity of garment and body sizing. Incongruously, very few sizing systems accommodate variations in body proportions as a result of body weight (Winks 1997:4).

The design of the garments, as well as the dimensions used to base the sizes on, need to be adapted to accommodate plus-sized figures. Winks (1997:7) suggests that various ethnic groups within the population should be identified in order to establish the most prominent body shapes. Manufacturers of military garments should endeavour to accommodate larger wearers with variations of body shapes.

This is congruent with the findings of Chun (in Ashdown 2007:236) who states that apparel manufacturers and designers need to pay attention to the needs of larger sized women who constitute a noteworthy and substantial target market.

In order to accommodate variations of body shapes, additional key dimensions should be included to describe and predict the variations of body shapes. The findings of the study conducted by Strydom (2006:214) indicate that South African sizing systems are not as sophisticated as international systems due to the fact that none of the South African apparel manufacturing companies that participated used drop value to define different body shapes. The findings by Strydom (2006:214) are congruent with the findings of this study as the hip dimension is not considered as key and therefore, the variations of body shapes in the sample cannot be accommodated.

Various garment styles to accommodate body shapes based on the silhouette of the triangle, oval and square shapes would assist the provision of better fitting garments. Alternatively, the styles of the dress jacket and combat shirt can be altered by the addition of pleats at the side seams or a box pleat at the back in order to provide better fit.

These findings, conclusions and recommendations served to realise the objectives of this study.

In Chapter 5 an overview of the study follows. The methods used are evaluated, followed by recommendations for future studies.

CHAPTER 5
CONCLUSIONS

5.1 INTRODUCTION

The contents of this chapter is presented in the following order:

- An overview of the study in terms of the goal and objectives of the study, the conceptual framework, methods employed, the soundness of the study.
- The limitations of the study are discussed in terms of the sample, the ease calculations and the data collection methods.
- Conclusive comments for the objectives of the study.
- The value of the study.
- Recommendations for future studies.

5.2 OVERVIEW OF THE STUDY

❖ The goal and objectives

The goal of this study was to investigate the fit in terms of ease of two styles of upper garments for females namely, the service dress jacket (a closely fitted garment) and the long sleeve combat shirt (a loosely fitted garment) as issued by the SANDF. The objectives of this study were threefold: The first objective was to determine and interpret the amount of ease that will comply with the functional and aesthetic requirements related to the activities and comfort of an optimum number of wearers. Second, to analyse and interpret the suitability of the key dimensions (used for size designation) in terms of body shapes and gender. The third objective of this study was to determine and interpret the relevance and the validity of the sizing system that is currently used by the SANDF.

❖ The conceptual framework of the study

In order to realise the goals and objectives of this study, it was necessary to conduct a relevant literature study with the aid of a conceptual framework. Susan Ashdown's model (2000) was used as point of departure to develop the conceptual framework. The conceptual framework focused on three aspects namely sizing systems, design features and fit issues, the latter especially in relation to ease/tolerance.

The conceptual framework served as an ordering structure for the literature study. An operational plan was developed from the conceptual framework to assist in the selection of appropriate methods to cover all relevant concepts and realise the objectives of the study.

❖ The methods of the study

In order to realise the objectives of this study, a multi-method approach was employed in line with the qualitative research strategy selected. The use of multiple methods ensured triangulation of results and contributed to the validity of the findings. The data collection methods included: a biographic profiling questionnaire, focus group and one-to-one interviews, fit and judging sessions, motor tests, somatographs, and body and garment measuring sessions.

The information from the biographic profiling questionnaire was used to describe the demographics of the sample in terms of age, ethnicity and body shape. Focus group and one-to-one interviews assisted in exploring and describing the subjective viewpoints with regard to ease/tolerance in terms of the functional and aesthetic performance of the garments. Two trained judges evaluated the fit of the garments in order to provide an objective viewpoint regarding fit. Mobility tests provided information regarding the functional performance of the garments. Somatographs captured the body shapes of the subjects in order to realise the second objective. Two anthropometrists conducted body measuring sessions. Body measurements were used to calculate ease values as well as to determine the garment size allocations. The weight and the height of the subjects were applied to calculate the BMI values of the subjects.

The researcher measured the garments in accordance with the garment measuring specifications prescribed by ARMSCOR (Document number 05741-100-024). Garment measurements were used to calculate ease values as well as to determine whether the issued garments complied with the nominal finished garment measurements prescribed in the ARMSCOR specifications (Document number KMG27/71 for the dress jacket and document number 05181-100-017 for the combat shirt respectively).

❖ The soundness of the study

Lincoln and Guba (in de Vos 2002:351) propose four alternative constructs, namely credibility, transferability, dependability and confirmability, to enhance the soundness and accurately reflect the assumptions of the qualitative paradigm. Multiple measures such as triangulation, member checks, extensive field notes and audit trails were employed to ensure the trustworthiness of the study.

With regard to credibility, the data collection procedures were conducted in a manner that would ensure accurate identification and description of the subjects. To ensure that the body measurements taken of the subjects were correct, the measures were taken by trained anthropometrists. The somatographs were taken in a standard and prescribed manner in order to ensure consistency and reliability. Member checks were taken as a means to ensure that reliable information was collected from the subjects during the interviews. To enhance transferability the researcher constantly referred to the conceptual framework and relevant concepts to guide the data collection and interpretation process. Additionally, the operational plan was followed to ensure that all relevant aspects were explored and described.

Dependability was achieved by means of an ideal working environment for the research team as well as the participating subjects. Data gathering took place at a convenient time and place, in a work environment where the subjects felt comfortable. The data collection venue provided privacy (for dressing and undressing), clarity of sound, adequate lighting to assist the photographic procedures and prevented external interferences. As far as possible, any changing conditions in the interview setting and environment that could negatively influence the data collection process were eliminated.

With regard to confirmability, the findings of this study were compared to the findings of other studies conducted by other researchers in the field of sizing and fit as presented in Chapter 4.

❖ The limitations of the study

The limitations of the study are discussed in terms of the sample, the ease calculations and the data collection methods.

➢ Limitations regarding the sample: The sample of this study was negatively influenced by the following aspects:

Representativeness of the sample: In line with a qualitative research strategy, the sample was small and therefore not representative of the total population. Due to the sample size, the findings of the study cannot be generalised to represent the total female population of the SANDF. Furthermore, the sample was selected from only one section (the logistics department) on two military bases situated in the same geographical area namely, Lyttleton and Thabatswane in Pretoria, Gauteng.

Parameters of the second phase sample: The initial sample for the first phase of the study was smaller than planned, therefore it was not possible to fully control the variables to apply the parameters to ensure that the second phase sample was balanced in terms of age, ethnicity and body shape.

Subject participation: Twenty subjects per day were requested for participation in data collection. On the second day of data collection, only seven subjects were available, including one subject who was not available for the whole day.

- Limitations regarding ease calculations: Ease calculations were negatively influenced by the following factors:

Availability of garments: The subjects were requested to bring their dress jackets and combat shirts on the day of data collection for the purpose of garment measuring. Most of the subjects failed to do so. Due to the above, as well as time constraints, it was not possible in all instances to measure the actual garments that the subjects wore and were issued with during one day. Subjects could also only be visited once. As an alternative, garment sizes from the store rooms and the range of sample sizes from ARMSCOR were measured. It is possible that these sample garment measurements could have deviated from the actual garments that the subjects wore.

Availability of sizes: In one instance, the researcher was not able to calculate ease values for a subject, who wore an old combat shirt from a previous size roll. The dimensions for her garment size (Rl92) were not included in the ARMSCOR specifications.

Garment dimensions of issued garments: The garment dimensions of the issued garments did not in all instances resemble that of the nominal finished garment measurements of the ARMSCOR specifications.

Incorrect size distribution: Size distribution also presented a problem. It was found that in some instances, the subjects wore garments a size that were either too big or too small.

Limited stock: It was initially planned to evaluate three sizes of dress jackets for each subject, namely a jacket from the size category that the subject should be issued with based on the bust measurement as key dimension, a jacket from the size category smaller and a jacket from the size category larger. Due to the limited availability of garment sizes (as well as time constraints as each of the subjects would have been evaluated three times), it was not possible to employ this method.

Limited time: It was not possible to re-access the garments after the initial data collection process. This was a disadvantage as the researcher could not return to re-measure the combat shirts after it was found that the garment measurements initially taken at the chest dimension did not correspond to the body measurements of the subjects. Due to the above, ease values for the chest dimension versus the bust dimension of the combat shirt could not be calculated.

- Limitations in terms of the data collection methods: The data collection methods were negatively influenced by the following aspects:

Logistical problems: A logistical problem prevented the return to the military bases for follow-up interviews in order to clarify uncertainties and to refine ideas as is in line with a qualitative design strategy.

Tedious data collection methods: Though completing and analysing the fit checklists and judging sessions proved to be tedious, the findings thereof provided valuable information regarding fit and ease.

Against the limitations of this study the summary of conclusions are presented in terms of the objectives in the following section.

5.3 SUMMARY OF THE CONCLUSIONS IN TERMS OF THE OBJECTIVES

The conclusive comments for objective one, two and three are presented in the next section.

- Conclusive comments for objective one

The amounts of ease necessary to comply with the functional and aesthetic requirements of the garments were investigated.

The subjective comments regarding satisfaction with ease ranges were not in consensus due to fit preferences. The subjects were however in agreement regarding general dissatisfaction with both the dress jacket and the combat shirt in terms of functional as well as aesthetic performance of the garments. The objective views varied from the subjective evaluations due to the fact that the judges visually evaluated the fit of the garments while the subjects experienced the fit and comfort of movement of the garments themselves.

From the findings regarding available ease when analysed against the specifications it was found that especially the plus-sized wearers were dissatisfied with fit in terms of ease. From the ease evaluations it became clear that the plus-sized subjects wearing the larger sized garments required larger amounts of ease than their smaller counterparts in order to be comfortable.

The amounts of ease at various body dimensions such as the waist, hips and upper arm of the dress jacket were not adequate for all of the subjects. In the instance of the waist and hip locations, this was due to variations of body shapes which were not accommodated. For example, the triangle body shape had insufficient ease at the hip location and the diamond body shape had insufficient ease at the waist location due to a protruding abdomen. The plus-sized subjects had insufficient ease at the upper arm location. Apart from the bust dimension as only key dimension of the dress jacket, the ease prescribed by the ARMSCOR specifications at other body dimensions such as the waist, hip, upper arm, scye and back width locations are unclear.

The mobility tests supported the fact that functional problems were caused by inadequate amounts of ease. This was in some instances the result of variations of body shapes. The overweight and obese subjects experienced more functional problems due to inadequate amounts of ease. The findings of the aesthetic evaluations indicated that incorrect amounts of ease resulted in poor aesthetic appearance.

In the instance of the combat shirts, the amounts of ease that were either insufficient or excessive resulted in poor fit. Furthermore, it was found that it was not only the amounts of ease that were incorrect but also the locations of ease on the bodies of the female wearers.

The majority of the subjects experienced insufficient ease at the hip location of both the dress jackets and the combat shirts. The most ease problems occurred at this garment location. This was due to the fact that the hip dimension (and consequently, the body shape) was not considered in the design of the dress jacket. In the instance of the combat shirt, insufficient ease at the hip dimension occurred due to the fact that the combat shirt does not accommodate female body shapes.

From this study it was found that garment locations at the same height circumference (e.g. around the upper torso including the bust, back width, upper arm and scye circumferences) with sufficient or excessive ease compensated for locations with insufficient ease. Consequently, inadequate amounts of ease at one location also caused ease problems at other garment locations.

It was found that the subjects wearing the smaller sizes were satisfied with less ease than the plus-sized wearers wearing the larger sizes. Due to the above, two separate ease ranges were recommended in order to accommodate the optimum number of subjects in the population. By doing so the subjects wearing the smaller sizes in the smaller size categories were assigned less ease and the subjects wearing the larger sizes in the larger size categories were allocated with ease values in the higher ranges.

❖ Conclusive comments for objective two

The findings of objective two indicated that the use of the bust/chest dimension as key dimension for the dress jackets and the combat shirts was not adequate to designate a suitably sized garment to the wearer. In the instance of the dress jacket, the bust dimension as only key dimension did not predict the body shapes of the subjects. Due to the above, adequate ease at other dimensions (such as the hip) cannot be ensured.

In the instance of the combat shirt the situation is exacerbated. It was found that the male key dimensions (chest girth and the height) were not suitable to represent the body dimensions of female wearers. Due to gender related differences in body proportions, the chest dimension of a male cannot be compared to the bust dimension of a female. Body dimensions representative of female wearers (such as the waist and hip dimensions) should be incorporated as key dimensions (or in some instances, secondary dimensions). It is recommended to incorporate the waist and the hip dimensions as key dimensions in the size designation to assist with size distribution that would ensure that an optimum number of wearers receive garments that fit well. This will furthermore make provision for different drop values in the size specifications to accommodate more than one body shape, especially the triangle body shape as it seems as if this shape was most prominent.

❖ Conclusive comments for objective three

The findings of objective three indicated that the currently used size charts are not representative of the current population's measurements. This was due to the following factors: (i) The origin of the anthropometric database is unclear, (ii) the size specifications for the dress jacket was last revised during 1989, and (iii) it is unsure when the size specifications for the combat shirt was last revised. Due to the above, the database used to construct the size charts are outdated and therefore does not represent the body dimensions and body shapes of the current population.

Other aspects regarding the structure of the sizing system such as the number of sizes in each category and intervals between sizes also caused ease related problems. Furthermore, some of the plus-sized subjects were not accommodated by the size chart, indicating that it does not reflect the body dimensions of the current population. In the instance of the combat shirts, the body dimensions of the female wearers were not accommodated by the male dimensions on which sizing is based.

The problems within the sizing system can be countered by implementing the following aspects, namely: (i) A current and representative anthropometric database should be used as the basis of the sizing system. (ii) Suitable key dimensions should be used in order to base size designation on as well as to make provision for various body shapes by means of drop values. (iii) The intervals between sizes should increase for the larger sizes to accommodate the plus-sized wearers. (iv) Appropriate body measurements for the dimensions other than the key and secondary dimensions (such as back width, scye circumference etcetera) should be assigned for each size, and (v) an appropriate number of garments for each size category should be manufactured to outfit the population.

5.4 THE VALUE OF THE STUDY

This study contributes to a small but growing body of knowledge regarding satisfaction with the amounts of ease allowance and acceptable ease ranges. The findings provided valuable information regarding the implications of ease on the functional and aesthetic properties of the dress jackets and the combat shirts. Furthermore, valuable findings regarding the implications for ease/tolerance in the instance of females wearing garments intended for male wearers were established.

Although a small sample was used for this study, the manufacturers of military garments can benefit from the findings regarding the ease needs of female military members wearing uniforms intended for males.

By means of a multi-method approach it was possible to acquire various viewpoints. The subjective viewpoints provided valuable information regarding personal experiences with regard to the fit and the comfort of the garments. The objective viewpoints provided valuable information regarding the functionality and aesthetic appearance of the garments in terms of mobility and aesthetic acceptability.

This study can serve as a pilot study to test methods for more comprehensive studies. The methods used are acknowledged data collection methods in the field of sizing and fit. The employed methods proved to be successful as they were adequate to explore the goals and objectives of this study.

In line with a qualitative research strategy, this exploratory and descriptive study uncovered a relatively unexploited area in the field of sizing and fit. Therefore, this study could serve as point of departure for future studies regarding the investigation of ease and the suitability of ease ranges for different size categories.

5.5 RECOMMENDATIONS FOR FUTURE STUDIES

It is recommended that future studies in this study field select a sample that is representative of the total population. Better representation of the total population can be achieved through control over the variables of the study. Consequently, the findings can be generalised to represent the optimum number of wearers.

It is recommended that a comprehensive anthropometric study is undertaken in order to obtain current and representative anthropometric data by means of three-dimensional body scanning technology to update the outdated sizing systems.

It is recommended that the ease ranges established in this study are further investigated by means of fit and wear testing on a large sample size in terms of three aspects: Firstly, the satisfaction of the ease ranges developed for the smaller and larger size categories. Secondly, the suitability of the ease ranges in terms of functionality and aesthetic acceptability. Thirdly, the development of ease ranges at other garment/body locations.

Aspects regarding fit and sizing of military garments that could be addressed in future studies include the following:

- To investigate reasons for poor fit and dissatisfaction experienced by female wearers of the combat trousers that is originally intended for male wearers.
- To determine causes of discomfort with garment fabric properties.
- To investigate causes of poor fit of shoes.
- To investigate the fit in terms of ease of other female military garments such as undergarments and overalls.
- To determine the problems that arise regarding the availability of garment sizes.

- To research better quality control for the issuing procedures.

This study investigated a relatively unexplored area in the field of sizing and fit relating to the amounts of ease allowance that would ensure good fit. In the course of the last ten years, an increasing number of clothing specialists became involved in research aimed at solving fit problems. This is due to three reasons: Firstly, the needs of the discriminative wearer must be met. Secondly, the clothing industry can benefit from increased sales. Thirdly, corporate organisations such as the SANDF can save millions of rands as stock that does not fit anyone can be eliminated. In addition, a more professional and efficient corporate image will be projected if the wearers are issued with well-fitting garments. Within the above context lies the substantial contribution of this study.

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ANNEXURE A: Biographic profile questionnaire

For office use only.

Session: ____________________ Subject number: ______________

Date: ______________________ Size of issued garments: _______

This questionnaire is aimed at determining your opinion regarding the fit of your uniform. You are requested to answer each question.

Indicate your choice by marking the appropriate block with an "X".

For example:

Male	1	
Female	2	X

The questionnaire is completed anonymously and will take approximately 3 minutes of your time.

Thank you kindly for your cooperation.

Please state your:

1. Date of birth:

Year	Month	Day

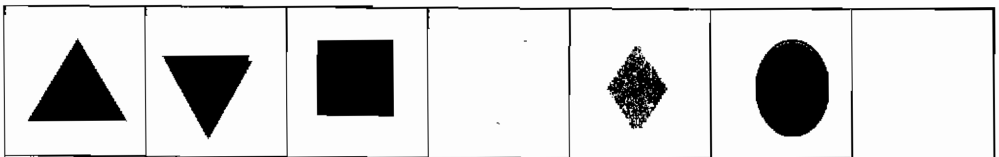
2. Ethnicity:

Black	1	
White	2	
Colored	3	
Asian	4	

3. Consider the following body type images.

Tick the block that you consider an appropriate description of your own body type:

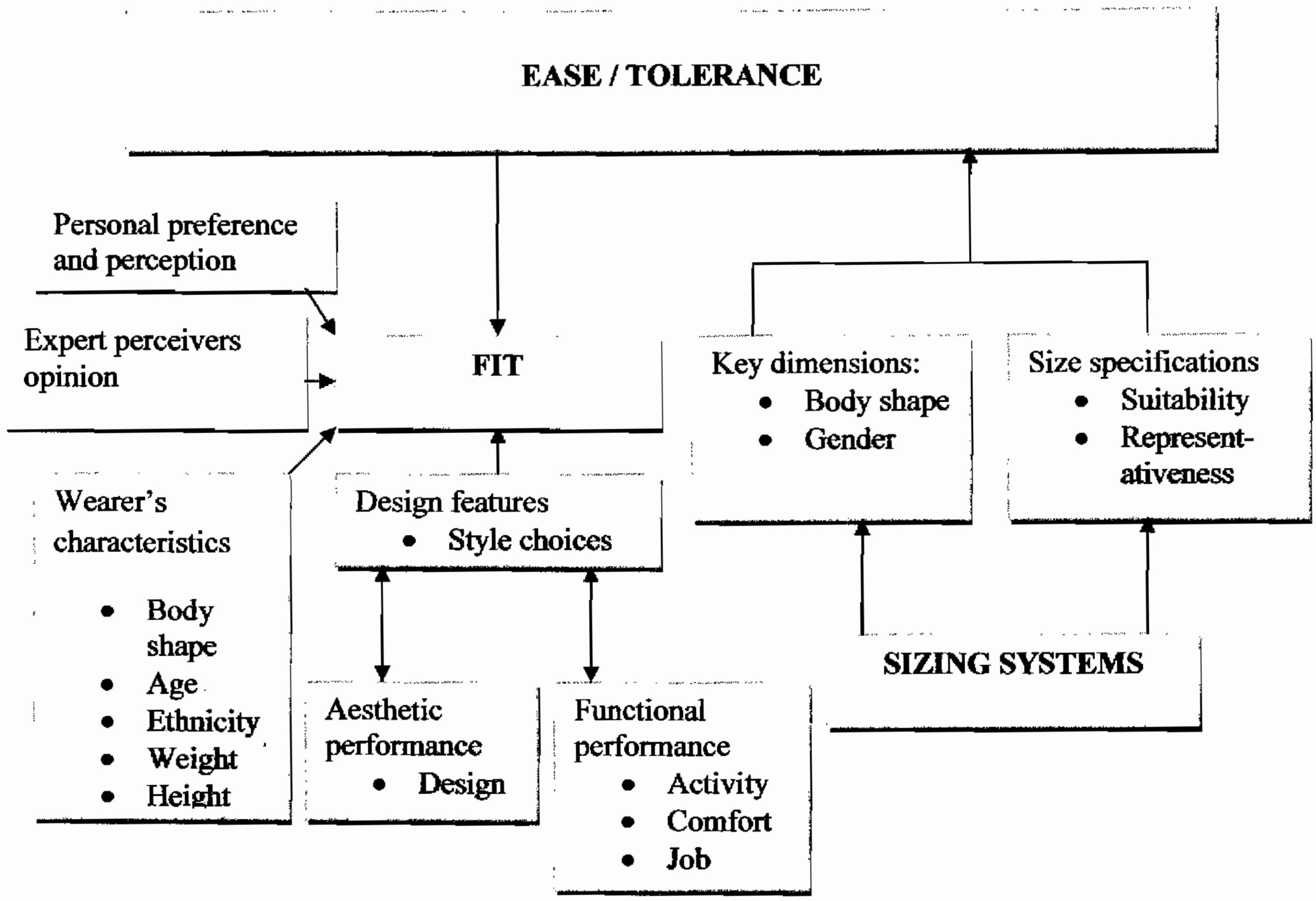
Triangular	Inverted Triangular	Square	Hourglass	Diamond	Oval	Other (Draw)



1		2		3		4		5		6		7	

ANNEXURE B: Example of somatographs

ANNEXURE C: Operational plan



ANNEXURE D: Focus group and one-to-one interviews questions/guides

Introduction: "Good morning/afternoon. My name is Nicolene and I am the researcher conducting this study. Meet my research assistant Angelica. She will be assisting me during this procedure. Your participation and comments are very important to us, so please answer the questions honestly and freely."

Before we can get started, we have to settle two technical aspects:
Firstly, I want to ask you to complete the informed consent form in front of you. This form states that you are voluntarily participating in this procedure.
Your participation will be required for two days, from 08:00 in the mornings to 16:30 in the afternoons. Depending on the outcome of the collected data, we may need to see you again at a later stage.

Secondly, you will notice that you have each been assigned a subject number, (e.g.: 1-20, 21-40, 41-60). Please insert your force number on the card provided. This is essential if we need to contact you at a later stage.
We are here today to investigate the fit of two styles of upper garments, namely: the dress jacket & the combat shirt, especially with regard to ease.

At last, we can begin:
As a starting point, I want you to evaluate the fit of the jacket of the person sitting next to you.

- *Compliment a strong point: where does it look/seem comfortable?*
- *Criticize a weak point: where does it look/seem uncomfortable?*

Now let's take a vote:

- Who here feels that they are completely satisfied with the fit of their jackets?
    - Please raise your hands.
- Who here feels that they are dissatisfied with the fit of their jackets?
    - Please raise your hands.

For those of you who voted satisfied, why do you think the dress jacket fits you so well?

Is your body in good shape/does the style flatter your figure?

For those of you who are dissatisfied, why are you unhappy with the fit of your dress jacket?

As mentioned earlier: The purpose of this study is to investigate fit, especially with regard to ease.

Some of you may ask: "What is ease and how does this affect me?"

We can answer this question with a simple practical exercise:

- Stretch forward with your arms to the front as far as possible, - does the jacket feel as if it might rip over your back?
- Fasten all your buttons at center front, - does the jacket pull tightly over your hips, or do the buttons pull open?
- Lastly, put your hand on your chest and breathe deeply. Can you feel your chest expanding?

This exercise demonstrates that every garment must provide adequate movement space (i.e. ease) in order to fit well and to be comfortable.

In order to provide adequate movement space, ease allowances are incorporated into your garment at these locations:

(Researcher shows A2 illustration/poster of ease placements) [Beazley]

The pink area indicates body size while the blue area shows added ease allowances.

Now that you understand the importance of ease, please take a good look at your jackets and answer the following questions:

OVERALL FIT

1. Describe the fit of your dress jacket/combat shirt.

   I want to hear every-one's opinion.

- Where does it fit well? (With ease in mind)

  ...Why does it fit well in area X?

- With which area are you dissatisfied? (With ease in mind)

  ...Why do you think you are dissatisfied with fit in area X?

- Describe specific problems that you have experienced...

  ...What could possible causes of these problems be?

2. How do fit problems relate to comfort of movement/physical comfort?

- When you are moving around?
- When you are walking around?
- Or only when you are sitting down / standing up?

3. At which areas do you experience garment stress?

- If you think back to the practical exercise, where did you experience garment stress?

  At your back, waist or hips?

- At which areas do you require more movement ease?

4. If you look at your colleagues, do you think they experience the same problems that you are experiencing?

   Describe instances where you have noticed dissatisfaction.

WEARER CHARACTERISTICS (AND EASE)

The following question concentrates on how the dress jacket / combat shirt fits individual bodies.

5. To what extent would you say that your own body determines the fit of the dress jacket in relation to ease?

- The human body changes with age, how does this influence the fit?

- Does the garment fit a short person or a tall person better?
- Is the dress jacket better suited for a slimmer figure or for a fuller figure?
- Do you think that body shape can influence the amount of ease that should be allowed at different body locations?

  Please motivate your answer.

SIZE DESIGNATION

6. Motivate whether the garments are available in a size suitable for your body:

- In terms or body shape...
- In terms of gender...

7. With regard to the SANDF issuing procedures:

- How is it decided what size you receive?

  ...Are you measured?

- What is the exchange policy for the garments that do not fit?
- If you are dissatisfied with the garment you received; can you exchange it for a more comfortable size?
- In general, how does the issued garments fit and wear?

DESIGN / STYLE

8. In terms of ease, how does the style/design of the garment influence comfort?

- What would you change about the style to make it more comfortable?
- What is your opinion regarding the attractiveness of the garment, bearing in mind the amount of ease.

  ...Is the garment neat?

  ...Do you look and feel professional wearing the garment?

- In terms of ease, what is your opinion regarding the functionality of the garment

- Does the garment have a practical style/design for performing your daily tasks?
- Has the garment ever hindered your work performance?

THAT CONCLUDES OUR QUESTIONS FOR THE FOCUS GROUP

PLEASE COMPLETE THE QUESTIONNAIRE

THANK YOU FOR YOUR PARTICIPATION

Open-ended questions for the one-to-one interviews:

Based on the focus group interviews, I have realized that there are general problems with the fit of your uniforms:

1. I would now like to hear your personal perception regarding the fit of your uniform (dress jacket/combat shirt).
2. How would you describe a well fitting garment? (With regard to ease)

- How would you describe a poor fitting garment? (With regard to ease)
- What criteria do you use to purchase a garment?
- Which aspects / garment characteristics (such as fit, style or fabric) are most important? Please rank these aspects in order of importance.

3. Do you prefer a fitted, semi fitted or loose fitting garment?

- Which fit do you prefer at different body locations (upper torso/ /lower torso or all over)?
- Describe why?

4. What is your opinion regarding the various areas where ease allowances are added? ...Shoulder, bust, waist, hips, upper and fore arm, ect.

- Do you experience the amounts of ease as too little? ...Where?
- Do you experience the amounts of ease as too much? ...Where?
- How do you think this influences the fit of your jacket?

5. Think of a comfortable garment that you own.

- Why do you like this garment so much? (With ease in mind)

…What makes it so comfortable? List the criteria: 2 fingers at the waist / 4 fingers at the waist?

6. With the comfort of a garment that you own in mind, please answer the following:

- Describe the comfort ability of your dress jacket with regard to ease.
- Describe the comfort ability of your combat shirt with regard to ease.

7. How do you think the jackets fit your individual body type?

- Describe how the fit is influenced by your:
    - Age
    - Weight
    - Height
    - Ethnicity / Body type

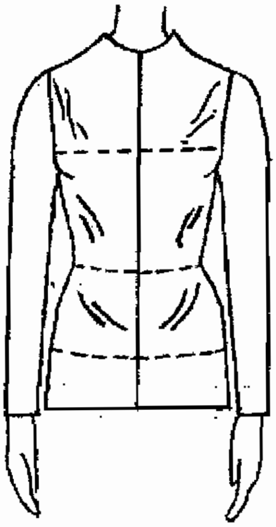
Note: Visual material is available to stimulate the subjects' thoughts where required.

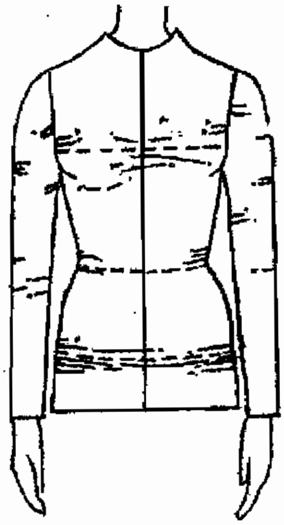
- *Visual material A: Illustration of female figure & landmarks*
- *Visual material B: Illustration of adequate, sufficient and insufficient amounts of ease allowance.*
- *Visual material C: Illustration of various fit problems.*
- *Visual material D: Illustration of the 8 prominent body types.*

ANNEXURE E1: Illustration of common fit problems

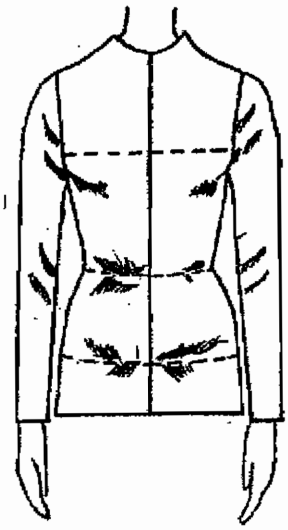
Which of the following fit problems (if any) do you experience?

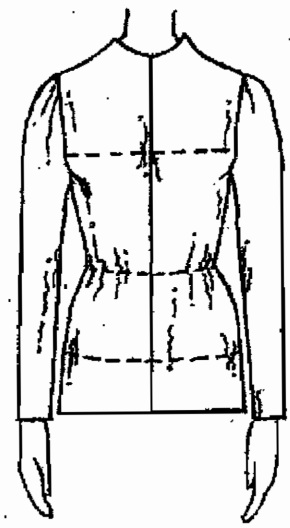
Diagonal folds.



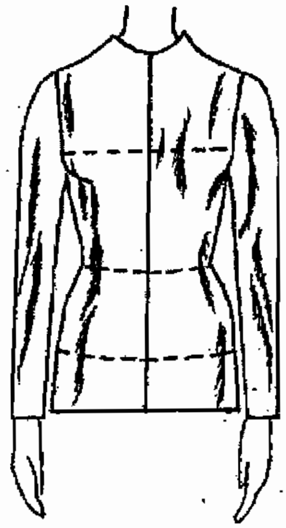


Horizontal wrinkles or folds

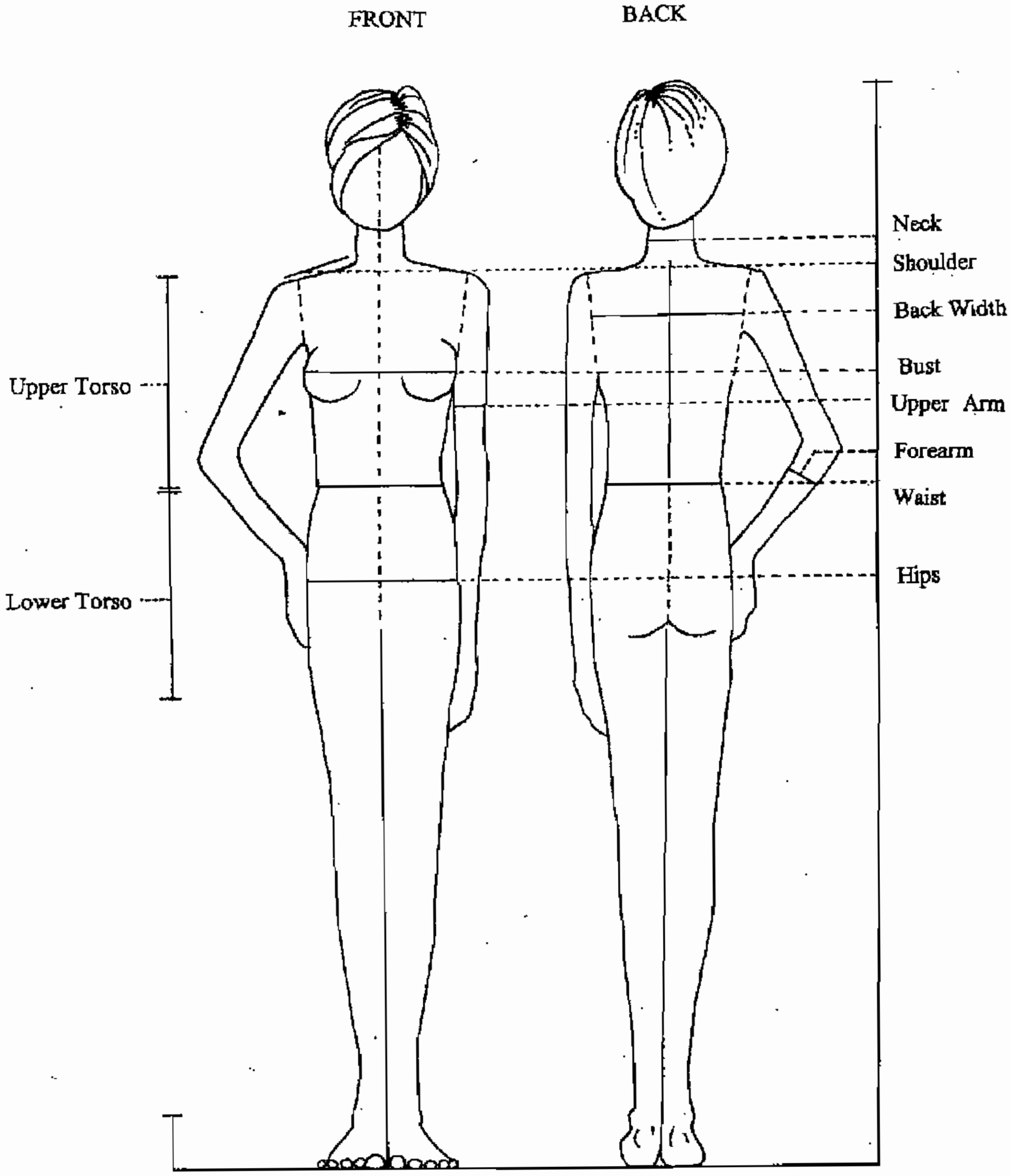




Vertical wrinkles or folds



ANNEXURE E2: Female figure from front and back



ANNEXURE F1: Fit checklist for the dress jacket

Session: ____________________ Subject number: ____________________

Date: ____________________ Size of issued garment: ____________________

Size fitted: ____________________

Tick 'yes' or 'no' to the following questions. In the instance of a problem, please describe it accordingly.

Evaluative questions					
No.	**Area description**	**Yes**	**No**	**Description of the problem**	**For office use**
1.	Are the grain lines of the garment fabric parallel to the centre front of the body:				
1.2	Above the waist				
1.2	Below the waist				
2.	Are the grain lines of the garment fabric parallel to the centre back of the body:				
2.1	Above the waist				
2.2	Below the waist				
3	Are the grain lines of the sleeve fabric perpendicular to the floor?				
4	Do any of the following wrinkles occur in the **bust** area:				
4.1	Horizontal wrinkles				
4.2	Horizontal folds				

No.	Area description	Yes	No	Description of the problem	For office use
4.3.	Vertical folds				
4.4.	Vertical wrinkles				
4.5.	Diagonal wrinkles that point to a body bulge				
5	Do any of the following wrinkles occur in the **waist** area:				
5.1	Horizontal wrinkles				
5.2	Horizontal folds				
5.3.	Vertical folds				
5.4.	Vertical wrinkles				
5.5.	Diagonal wrinkles that point to a body bulge				
6.	Do any of the following wrinkles occur in the **hip** area:				
6.1	Horizontal wrinkles				
6.2	Horizontal folds				
6.3.	Vertical folds				
6.4.	Vertical wrinkles				
6.5.	Diagonal wrinkles that point to a body bulge				

No.	Area description	Yes	No	Description of the problem	For office use
7	Do any of the following wrinkles occur in the **upper arm** area at the sleeve:				
7.1	Horizontal wrinkles				
7.2	Horizontal folds				
7.3.	Vertical folds				
7.4.	Vertical wrinkles				
8.	Does the garment fit smoothly over the shoulders?				
9.	Does the garment's waist fall in the natural waist or desired waist level?				
10	Do long sleeves hit the wrist bone when the arm is bent slightly? (At 120°)				
11	Do the lines of the garment follow the natural lines of the body?				
12	Do the side seams hang straight?				
13	Do the centre front lines fall straight down the centre front of the body?				
14	Do straight seams appear as straight lines on the body?				
15	Does the shoulder seam lie on top of the wearer's shoulder?				

No.	Area description	Yes	No	Description of the problem	For office use
16	Do the closures at centre front form a straight line when fastened. If not, indicate where.				
17	Do the right and the left halves of the garment appear **balanced**/ symmetrical on the body when viewed from the:				
17.1	Front upper torso				
17.2	Front lower torso				
17.3.	Back upper torso				
17.4	Back lower torso				
17.5.	Left side seams				
17.6	Right side seams				
18	How does the amount of **ease** at the indicated body locations seem, when the body is not in motion:				

Location		Adequate	Insufficient	Excess		
18.1	Chest width					
18.2	Bust circumference					
18.3	Back width					
18.4	Nape to waist length					
18.5	Waist circumference					

Location		Adequate	Insufficient	Excess	Description of the problem	For office use
18.6	Hip circumference					
18.7	Top hip circumference					
18.8	Top arm circumference					
18.9	Elbow circumference					
18.10	Wrist circumference					

No.	Area description	Yes	No	Description of the problem	For office use
19.	Does the garment fit comfortably over the shoulders?				
20.	Does the fabric look strained or pulled across the back of the jacket, as if it might rip?				
21.	Is the armhole cut full enough without straining the seams?				
22.	Does the neckline fit the curve around the wearer's neck, not gaping or cutting in uncomfortably?				
23.	Does the collar fit the curve around the wearer's neck, not gaping or cutting in uncomfortably?				
24.	Does the armscye fit without chafing?				

No.	Area description	Yes	No	Description of the problem	For office use
25.	Do the sleeves hang naturally from the armholes?				
26.	Are the armholes too big?				

Area described Number:	Description of the problem:

ANNEXURE F2: Fit checklist for the combat shirt

Session: ____________________ Subject number: ____________________

Date: ____________________ Size of issued garment: ____________________

Size fitted: ____________________

Tick 'yes' or 'no' to the following questions. In the instance of a problem, please describe it accordingly.

Evaluative questions					
No.	**Area description**	**Yes**	**No**	**Description of the problem**	**For office use**
1	Are the grain lines of the garment fabric parallel to the centre front of the body:				
1.1	Above the waist				
1.2	Below the waist				
2	Are the grain lines of the garment fabric parallel to the centre back of the body:				
2.1	Above the waist				
2.2	Below the waist				
3	Are the grain lines of the sleeve fabric perpendicular to the floor?				
4	Do any of the following wrinkles occur in the **bust** area:				
4.1	Horizontal wrinkles				
4.2	Horizontal folds				

No.	Area description	Yes	No	Description of the problem	For office use
4.3.	Vertical folds				
4.4.	Vertical wrinkles				
4.5.	Diagonal wrinkles that point to a body bulge				
5	Do any of the following wrinkles occur in the **waist** area:				
5.1	Horizontal wrinkles				
5.2	Horizontal folds				
5.3.	Vertical folds				
5.4.	Vertical wrinkles				
5.5.	Diagonal wrinkles that point to a body bulge				
6.	Do any of the following wrinkles occur in the **hip** area:				
6.1	Horizontal wrinkles				
6.2	Horizontal folds				
6.3.	Vertical folds				
6.4.	Vertical wrinkles				
6.5.	Diagonal wrinkles that point to a body bulge				

No.	Area description	Yes	No	Description of the problem	For office use
7.	Do any of the following wrinkles occur in the **upper arm** area at the sleeve:				
7.1	Horizontal wrinkles				
7.2	Horizontal folds				
7.3.	Vertical folds				
7.4.	Vertical wrinkles				
8.	Does the garment fit smoothly over the shoulders?				
9.	Do long sleeves hit the wrist bone when the arm is bent slightly? (At 120°)				
10.	Do the lines of the garment follow the natural lines of the body?				
11.	Do the side seams hang straight?				
12.	Do the centre front lines fall straight down centre front of the body?				
13.	Do straight seams appear as straight lines on the body?				
14.	Does the shoulder seam lie on top of the shoulder?				
15.	Do the closures at centre front form a straight line when fastened. If not, indicate where.				

No.	Area description	Yes	No	Description of the problem	For office use
16.	Does the right and the left halves of the garment appear **balanced** /symmetrical on the body when viewed from the:				
16.1	Front upper torso				
16.2	Front lower torso				
16.3.	Back upper torso				
16.4	Back lower torso				
16.5.	Left side seams				
16.6	Right side seams				
17	How does the amount of ease at the indicated body locations appear when the body is not in motion:				

Location		Adequate	Insufficient	Excess		
17.1	Chest width					
17.2	Bust circumference					
17.3	Back width					
17.4	Nape to waist length					
17.5	Waist circumference					
17.6	Hip circumference					

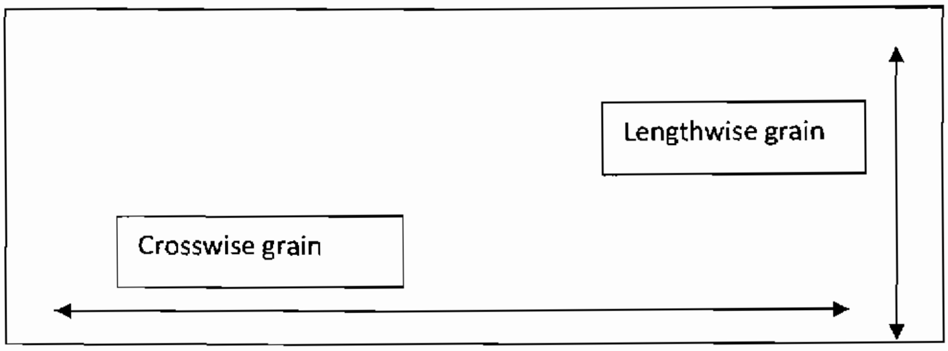
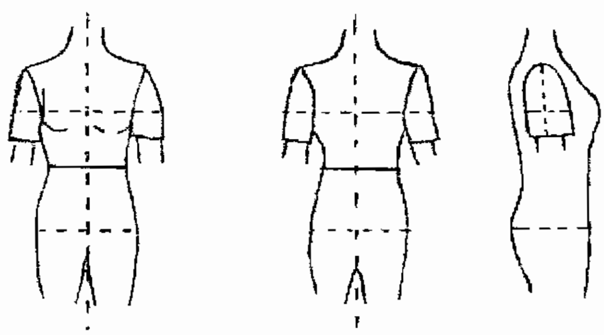
Location		Adequate	Insufficient	Excess	Description of the problem	For office use
17.7	Top hip circumference					
17.8	Top arm circumference					
17.9	Elbow circumference					
17.10	Wrist circumference					

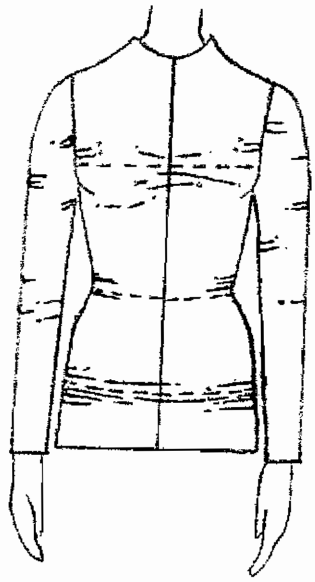
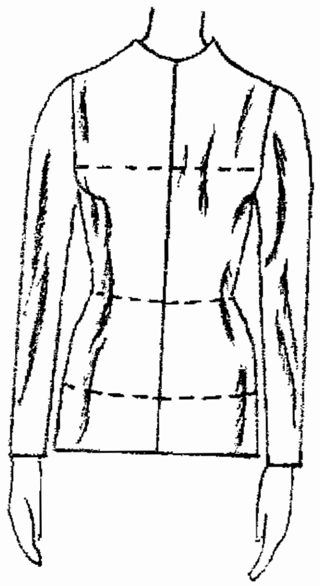
No.	Area description	Yes	No	Description of the problem	For office use
18.	Does the garment fit comfortably over the shoulders?				
19.	Does the fabric look strained or pulled across the back of the shirt, as if it might rip?				
20.	Is the armhole cut fully enough without straining the seams?				
21.	Does the neckline fit the curve around the neck, not gaping or cutting in uncomfortably?				
22.	Does the collar fit the curve around the neck, not gaping or cutting in uncomfortably?				
23.	Does the armscye fit without chafing?				
24.	Do the sleeves hang naturally from the armholes?				

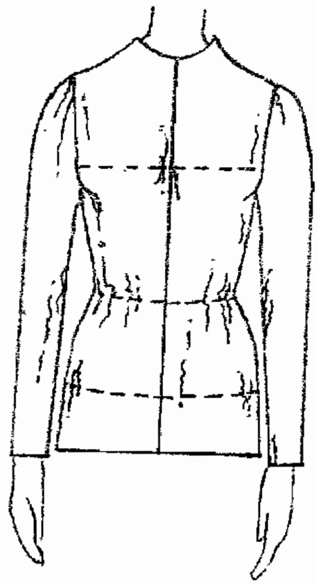
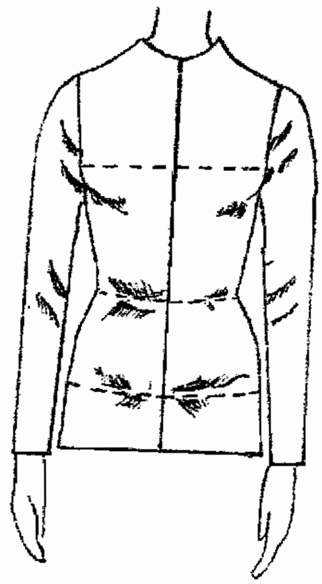
No.	Area description	Yes	No	Description of the problem	For office use
25.	Are the rolled-up sleeves loose enough to slip your fingers easily between the fabric and the wearer's arm?				
26.	Does the amount of ease seem cumbersome to the wearer?				
27.	Are the armholes too big?				

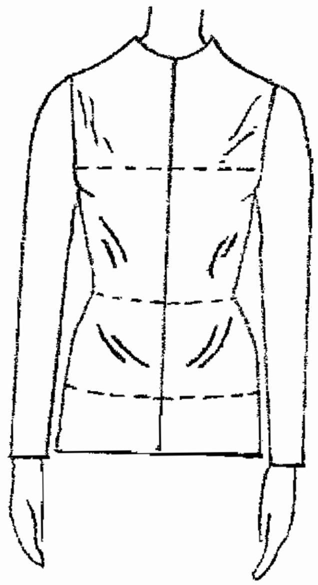
Area described Number:	Description of the problem

ANNEXURE G: Training guide

GRAIN	
Definition	Grain is the orientations of the yarns of which the fabric consists and thereby refers to the position of warp (lengthwise) yarns relative to weft (crosswise) yarns in a fabric. 
Description	The grain lines of the garment fabric should run parallel and perpendicular respectively, to the centre front and centre back of the body of the wearer, both above and below the waist. The warp grain lines of the sleeve fabric should hang perpendicular to the floor. During fit, the grain should be checked for distortions such as bending, twisting, sagging or wrinkling. These distortions will indicate the direction of the fit problem and will identify incorrect amounts of ease.
Illustration	Front Back Side 

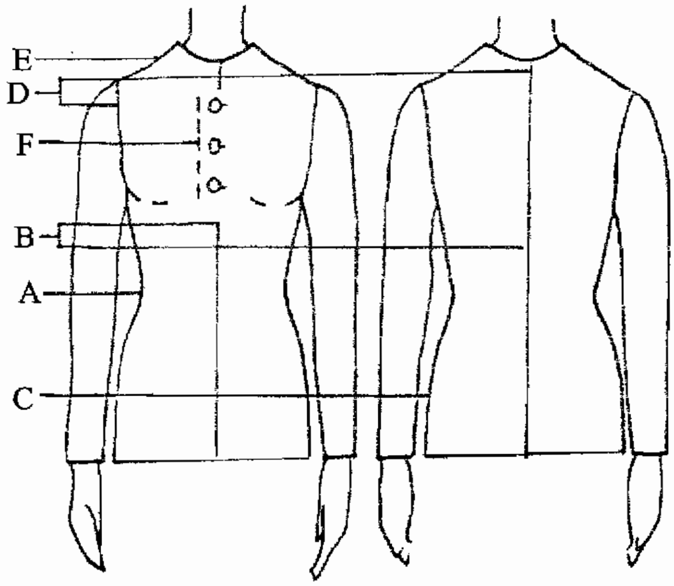
<table>
<tr><th colspan="3">SET</th></tr>
<tr><td rowspan="3">Set refers to a garment that is either too big or too small.</td><td colspan="2">In the case of wrinkles, the garment will pull uncomfortably and minimize the wearer's ease of movement. The standards for evaluating the position and indication of the wrinkles are as follow:</td></tr>
<tr><td>Horizontal wrinkles under tension indicate that the garment is narrower than the body just above or below the wrinkles.</td><td></td></tr>
<tr><td>Loose vertical wrinkles indicate that the garment is too wide in that area.</td><td></td></tr>
</table>

	Vertical wrinkles form under tension when the garment is too small/short in that area.	
	Loose horizontal folds indicate that the garment is larger/longer than the body in that area.	

	Diagonal wrinkles point to a particular body curve and indicate that the garment is too small or lacks sufficient shaping to adequately fit the particular body curve.	
	Other set evaluations include: ➢ That the garment should fit smoothly over the shoulder. ➢ The waist level of the garment should fall within the intended/desired waist level. ➢ Long sleeves should reach the wrist bone when the arm is bent.	

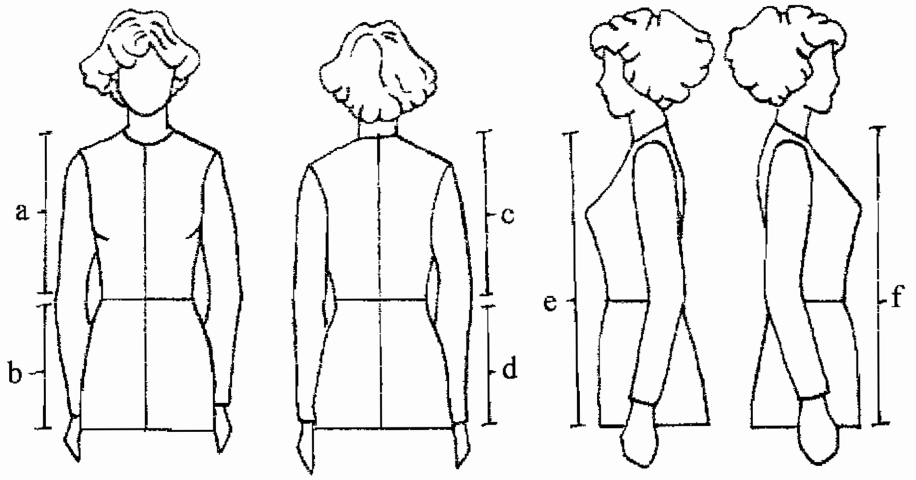
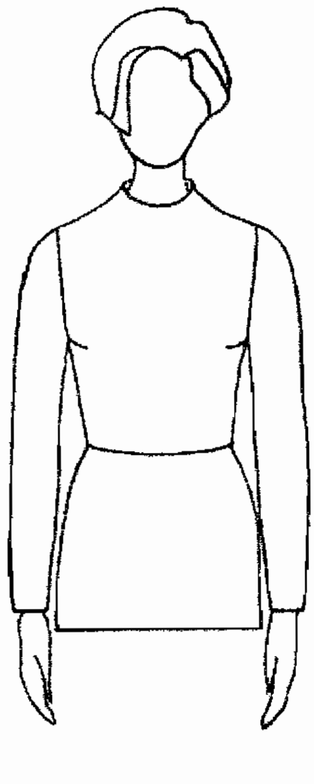
LINE

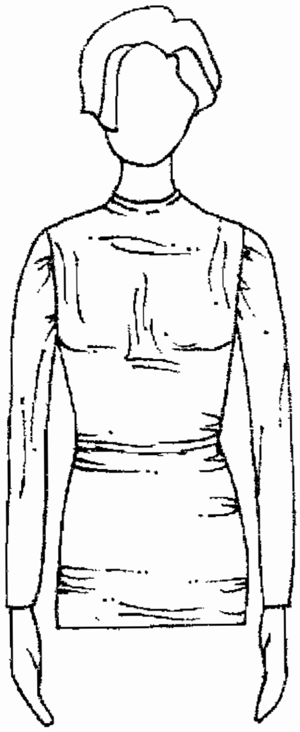
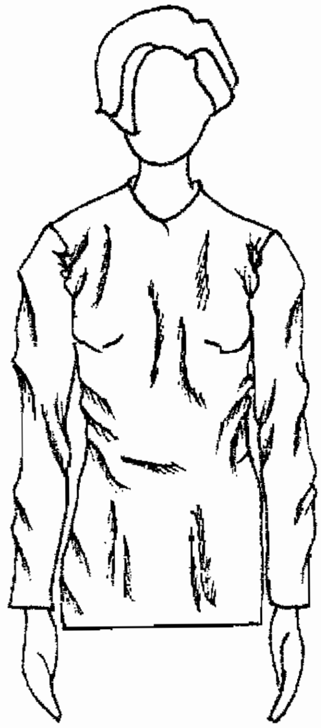
Line refers to the alignment of the structural lines of the garments with the natural lines of the body.	Line may be evaluated as follow: A: Side seams should hang straight, down the centre of the side of the body, perpendicular to the floor. B: Centre front and centre back lines should fall straight down the centre front and centre back of the body. C: Darts and seams should appear as straight lines that follow the body parts that it is intended to fit. D: Other lines (such as necklines, armholes and waistlines) should encompass the circumference of the body. E: The shoulder seam should lie on top of the wearer's shoulder F: The closures at centre front should form a straight line when fastened and should not shift/pull to the left or right.

<table>
<tr><td>Illustration indicates the six points on a garment where line should be evaluated.</td><td>Line evaluation points

</td></tr>
<tr><td colspan="2">BALANCE</td></tr>
<tr><td>Definition</td><td>Description</td></tr>
<tr><td>The front, back and sides of the garments should appear symmetrical at both left and right halves.</td><td>Unbalanced garments are garments that do not conform to the lines of the wearer's body. Various balance problems are caused by poor posture or lack of symmetry in the unique figure of the wearer. Balance contributes to the fit of a garment and an unbalanced garment will 'pull' or 'ride-up' causing discomfort and lack of mobility.

The garment should be balanced on the body when viewed from the:

a. Front upper torso
b. Front lower torso
c. Back upper torso
d. Back lower torso
e. Left side seam
f. Right side seam</td></tr>
<tr><td>Illustration indicates the areas on the body where the garment should be balanced.</td><td>Body areas where the garment should be balanced</td></tr>
</table>

<table>
<tr><td></td><td colspan="2">
</td></tr>
<tr><td colspan="3">EASE</td></tr>
<tr><td>Ease is defined as the dimensional clearance/tolerance between the body and the garment.</td><td>Adequate ease: The garment should have extra fabric to accommodate normal body movements such as breathing, walking, sitting and raising and swinging arms. Sufficient ease allowance provides mobility as the garment can resume its natural position after following body movements, without needing adjustment.</td><td></td></tr>
</table>

	Insufficient ease: Lack of sufficient ease causes the garment to lose its flow of style lines. The garment appears tight and wrinkled. Insufficient ease results in lengthwise, crosswise or diagonal wrinkles in strained areas and reveals the body contours beneath. The garments will bind/pull in fitted areas and normal body movement will be uncomfortable.	
	Excess ease: Excess ease will cause the fabric to sag, puff or form vertical folds. The fabric will pull or sag downwards over an area where the body contour is too small or shallow.	

	Other ease evaluations include: g. The garments should fit comfortably over the shoulders. h. The fabric should not strain or pull across the back of the garment. i. The armhole should not strain the seams or chafe the wearer's scye. j. The neckline and collar should not gape or cut in uncomfortably. k. The sleeves should hang naturally from the armholes.

ANNEXURE I: Motor tests

Session: ____________________ Subject number: ____________________

Date: ______________________ Motor test judge title and name: ____________________

Garment: ____________________ Size fitted: ____________________

Instruction to the subjects:

➢ Instruction 1: Body Bends.
Stand upright with arms at the side. Bend body to the left and return, bend body forward and return, bend body right and return.

Comments:

____

____

➢ Instruction 2: Overhead arm extensions.
Stand upright. Extend arms overhead, and then bend elbows.

Comments:

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➢ Instruction 3: Trunk twists.
Stand upright. Extend arms perpendicular to the sides of the torso. Twist torso left and return, twist torso right and return.

Comments:

____

____

➢ Instruction 4: Cross body arm extensions.
Stand upright. Reach arms across chest to opposite side.

Comments:

____

____

➢ Instruction 5: Sit on chair and reach forward.
Comments:

____

____

➢ Instruction 6: Squats.
Stand upright with feet shoulder width apart and squat down to a full knee bend and reach forward, return to standing.

Comments:

____

____

ANNEXURE J: Document number KMG27/71

Document number		KMG 27/71				
Issue		Revised May 1989				
Jacket women						
TABLE 1 -SIZE RANGE FOR JACKETS,SERVICE DRESS						
Arm of service	Item control number	Size designation	Nominal finished garment measurements, cm.			
			Bust	Length of back	Width of back	Length of sleeve +
SA Army	8410-18-409-8919	RR76	86	66	34	72
SAAF	-8990					
SA Navy	-8948					
SAMS	-8392					
SA Army	8410-18-409-8923	RR81	91	67	35	73
SAAF	-8894					
SA Navy	-8952					
SAMS	-8396					
SA Army	8410-18-409-8927	RR87	97	68	36	74
SAAF	-8898					
SA Navy	-8956					
SAMS	-8400					
SA Army	8410-18-409-8931	RR92	102	69	37	75
SAAF	-8902					
SA Navy	-8404					
SAMS	8410-18-409-8933					
SA Army	-8904	RR97	107	70	38	76
SAAF	-8962					
SA Navy	-8406					
SAMS	8410-18-409-8936					
SA Army	-8907	RR102	112	71	39	77
SAAF	-8965					
SA Navy	-8409					
SAMS	8410-18-409-8939					
SA Army	-8910	RR107	117	72	40	78
SAAF	-8968					
SA Navy	-8412					
SAMS						
SA Army	8410-18-409-8942	RR112	122	72	41	79
SAAF	-8913					
SA Navy	-8971					
SAMS	-8415					
SA Army	8410-18-422-4697	RR117	127	73	42	80
SAAF	-4698					

SA Navy	-4699					
SAMS	-4700					
From collar seam to lower edge of finished hem.						
+ From centre back, over elbow, to lower edge of finished sleeve hem.						

ANNEXURE K: Document number 05181-100-017

Table 1 – Size range for shirts, combat

1	2	3	4	5	6	7	8	9
Size designation[1)]	To fit chest size	Nominal finished garment measurement cm						
		Back length	Cross back width	Chest circumference	Bottom hem	Sleeve length[2)]	Scye circumference	Cuff circumference
95-70	63-72	68	36	90	97	56	51	31
95-80	73-82	71	40	100	105	58	55	32
95-90	83-92	73	43	110	112	61	58	34
95-100	93-102	75	46	120	120	63	61	35
95-110	103-	77	50	130	130	63	64	36
95-120	112	80	53	140	141	64	66	37
95-130	113-	83	56	150	152	64	69	37
	122							
99-70	123-	72	36	90	97	60	51	31
99-80	132	75	40	100	105	62	55	32
99-90		77	43	110	112	65	58	34
	63-72							
99-100	73-82	79	46	120	120	67	61	35
99-110	83-92	81	50	130	130	67	64	36
99-120		84	53	140	141	68	66	37
99-130	93-102	87	56	150	152	68	69	37
	103-							
	112							
	113-							
	122							
	123-							
	132							

1) The size designation indicates the height and chest girth of the intended wearer e.g.
95-90 indicates regular height and 90 cm chest;
99-90 indicates tall figure and 90 cm chest

2) Measured from top of crown to the outer edge of the cuff.

ANNEXURE L: Body measurements and definitions

No.	Key dimension	Definition/Description
	Horizontal measurements	
1	Chest circumference	Maximum horizontal circumference at fullest part of breast measured at maximum quit respiration. The subject stands erect, with the arms raised slightly out from the body (RMSS 1994:166).
2	Bust circumference	The circumference measured at maximum quit respiration with the subject standing upright and the tape measure passed horizontally over the shoulder blades (scapulae), directly under the armpits (axillae) and over the bust. Females only (RMSS 1994:168).
3	Back width	The horizontal distance across the back measured half-way between the upper and lower scye levels (RMSS 1994:48).
4	Waist circumference	The circumference at level of natural indentation (RMSS 1994:172).
5	Hip circumference (maximum)	The circumference at the point where the hips are the widest (RMSS 1994:176).
6	Shoulder length.	The surface distance between the trapezius landmark at the base of the side of the neck and the acromion landmark on the tip of the right shoulder. The subject stands looking straight ahead. The shoulders and upper extremities are relaxed (RMSS 1994:68).
7	Upper arm circumference	The maximum circumference of the upper arm at lowest scye level, measured with the subject standing upright with the arms hanging naturally (RMSS 1994:171).
8	Elbow circumference	The circumference of the elbow measured with the subject standing upright, the arm bent at approximately 90 degrees, and the hand and fingers facing forward (RMSS 1994:174).
9	Forearm max contraction	The maximum circumference of the widest part of the forearm, measured with the subject standing upright and elbow bend at 90 degrees (RMSS 1994:185).
10	Wrist circumference	The circumference over the wrist-bone measured with the arms hanging naturally (RMSS 1994:175).

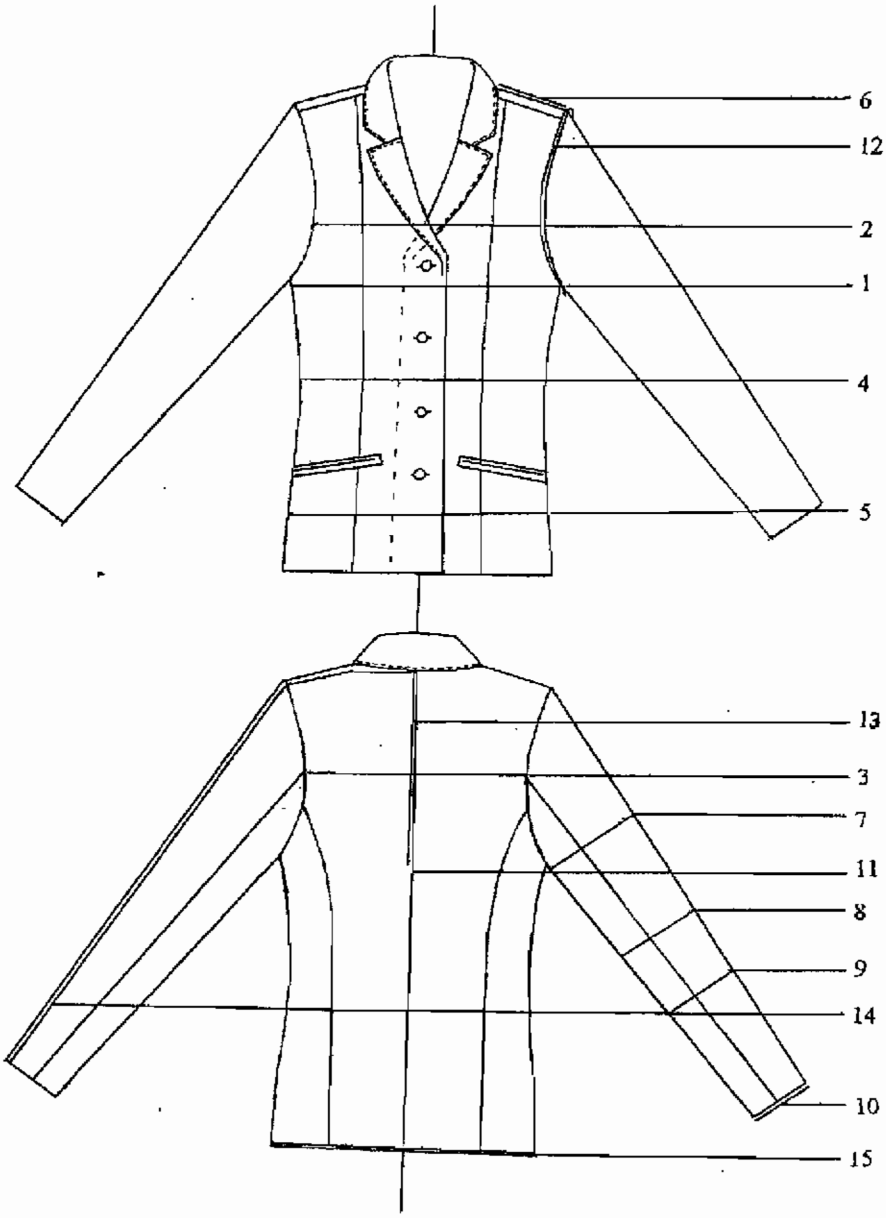
Vertical measurements		
11	Cervical to waist length (posterior)	The distance from the 7^{th} cervical vertebra, vertically down the back to the waist at the natural indentation level (RMSS 1994:64).
12	Armscye circumference	The circumference of the armscye measured through the under-arm midpoint and vertically over the shoulder, with the subject standing upright with the arm hanging naturally (RMSS 1994:170).
13	Scye depth	The distance, measured vertically on the body, from the 7^{th} cervical vertebra to the upper edge of the measuring tape, which is passed horizontally under the armpits (RMSS 1994:63).
14	7^{th} Cervical to wrist length	The distance between the 7^{th} cervical vertebra (nape) to the wrist bone measured on the body using the tape-measure passed over the top of the shoulder (acromion) and along the arm bent at 90 degrees in a horizontal position (RMSS 1994:59).
15	Stature (Height)	The vertical distance from a standing surface to the top of the head. The subject stands erect with the head in the Frankfort plane. The heals are together with the weight distributed equally on both feet. The shoulders and upper extremities are relaxed (RMSS 1994:33).
Seated measurements		
16	Sitting hip width	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 degrees (RMSS 1994:106).
17	Cervical height (sitting)	Vertical distance from a horizontal sitting surface to the cervical (ISO 1996:7).
Mass measurements		
(18)	Weight	The subject stands on the platform of a scale. Subject is weighed wearing under garments only. The mass of the subject is taken to the nearest tenth of a kilogram (RMSS 1994:32).

ANNEXURE M: Garment measurements and definitions

No.	Garment location	Definition/Description
1	Chest circumference	Measure across the width of the garment at the base of the scye and multiply by two.
2	Bust	Measure the garment in the widest point in the bust area.
3	Back width	Measure across the width of the back from sleeve seam to sleeve seam.
4	Waist girth	Measure across the width of the garment at its intended waistline and multiply by two.
5	Hip circumference	Measure across the width of the garment at intended hipline and multiply by two.
6	Shoulder length	Measure the length of the shoulder seam from the edge of the armhole to the neckline seam.
7	Sleeve circumference: Upper arm girth	Measure from the bottom of the scye, across the width of the sleeve and multiply by two.
8	Elbow girth	Measure across the intended elbow line midpoint of the sleeve length, across the width of the sleeve and multiply by two.
9	Forearm max circumference	Measure across the intended forearm line 1/3 of the sleeve length from the cuff, across the width of the sleeve and multiply by two.
10	Cuff circumference	Measure across the width at the bottom edge of the cuff (with the button fastened) and multiply by two.
11	Back length	Measure from the centre back neck seam to the bottom edge of the hem.
12	Armhole circumference	Measure from the bottom of the scye, along the armhole seam, to the bottom of the scye.
13	Scye depth	Measure the length of the garment from the center back neck point to the height under the armholes.
14	Sleeve length	Measure from the centre of the back neck, along the shoulder, and down to the outer edge of the cuff.
15	Bottom hem	Measure across the bottom hem of the garment (back) from side-seam to side-seam and multiply by two.

ANNEXURE M1: Garment measuring positions for the dress jacket

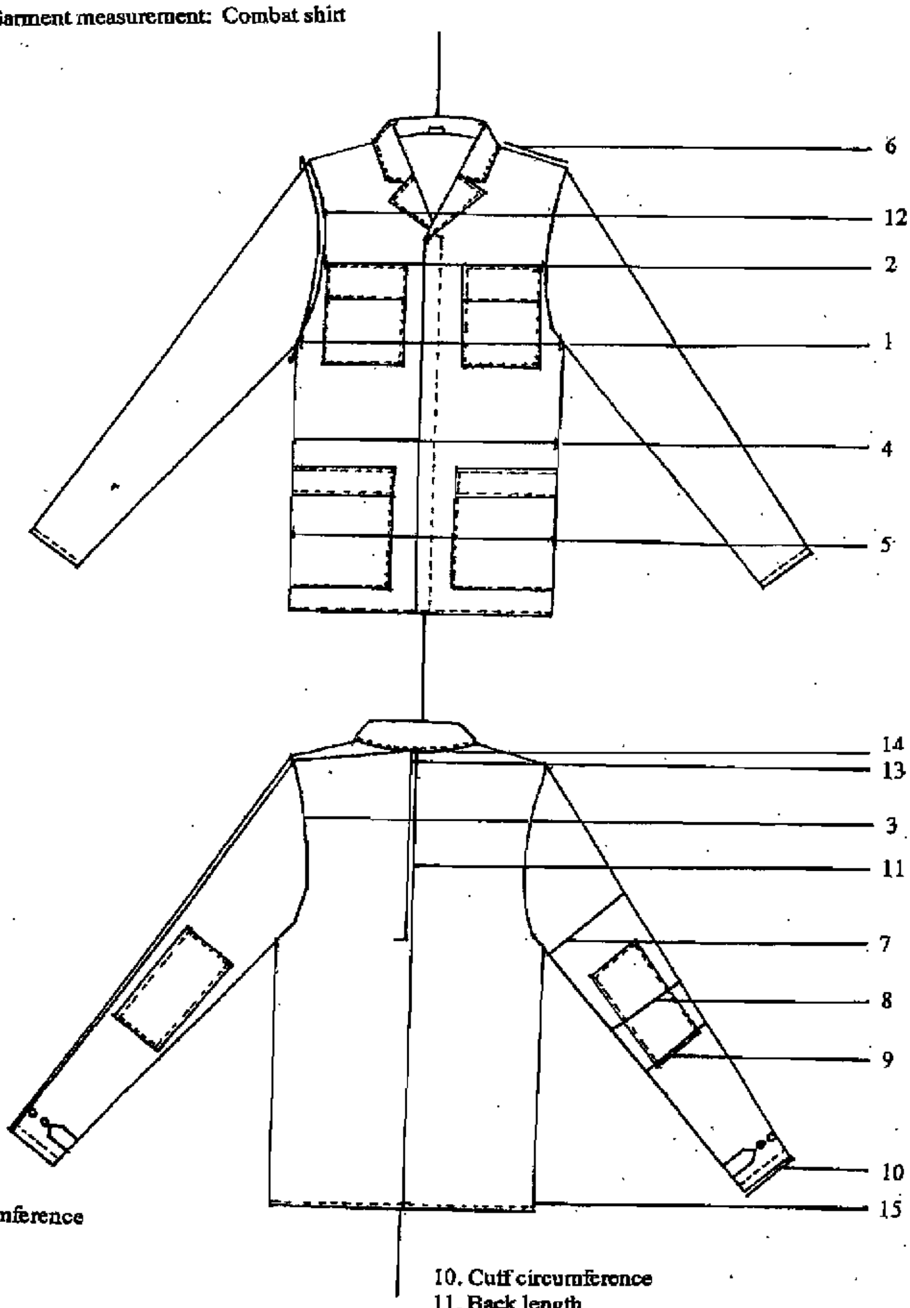
Garment measurement: Dress jacket



1. Chest circumference
2. Bust
3. Back width
4. Waist girth
5. Hip circumference
6. Shoulder length
7. Sleeve circumference: upper arm girth
8. Elbow girth
9. Fore arm girth
10. Cuff circumference
11. Back length
12. Armhole circumference
13. Scye depth
14. Sleeve length
15. Bottom hem

ANNEXURE M2: Garment measuring positions for the combat shirt

Garment measurement: Combat shirt



1. Chest circumference
2. Bust
3. Back width
4. Waist girth
5. Hip circumference
6. Shoulder length
7. Sleeve circumference: upper arm girth
8. Elbow girth
9. Fore arm girth
10. Cuff circumference
11. Back length
12. Armhole circumference
13. Scye depth
14. Sleeve length
15. Bottom hem

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29 November 2007

To Whom It May Concern:

This is to certify that I have acted as language editor for the dissertation titled

"Ease allowance and fit of selected female military garments"

by Nicolene Smit submitted in fulfilment of the requirements for the degree Magister Technlogiae: Fashion in the Department of Visual Arts and Design, Faculty of Humanities, Vaal University of Technology.

I have reviewed the printed manuscript and made the necessary corrections; I trust that these changes have been effected on the final document. My best wishes accompany this promising researcher.

Yours sincerely,

AEngelbrecht

ANTOINETTE ENGELBRECHT BA Communications (RAU), BA Honours (RAU), A+ MCSE (Prometric)