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TECHNICAL REPORT
NATICK/TR-77/021

ANTHROPOMETRY OF WOMEN OF THE U.S. ARMY-1977

Report No. 1 - Methodology and Survey Plan

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UNITED STATES ARMY
NATICK RESEARCH and DEVELOPMENT COMMAND
NATICK, MASSACHUSETTS 01760

Clothing, Equipment & Materials Engineering Laboratory

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This report, on the methodology and survey plan, is the first of a series. Subsequent reports will present univariate statistics, bivariate frequency tables, statistical summaries by subgroups and for computed variables and indices, and comparative data for U. S. Army men.

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

An anthropometric survey of U. S. Army women was conducted during the winter of 1976-1977--the first such survey in 30 years. The survey was planned and carried out in response to the need for current and comprehensive body size and strength data for the women who make up an increasingly large part of the U. S. Army. The main purpose of the survey was to obtain and develop statistical data on body size, workspace parameters, and static muscle strength of U. S. Army women. During the survey, data were obtained on 128 conventional body size dimensions, 14 workspace dimensions, and 9 static strength

20. ABSTRACT (continued)

measurements. Many of the measurements made had not been previously reported for any large-scale survey of women, military or civilian. Other measurements were selected to supplement and complement data already available to provide up-to-date information for use in the design of clothing, protective equipment, workspace and industrial equipment which women in the Army wear, use, operate, or within which they work.

This, the first of a series of reports dealing with this survey, describes the methodology used in the conduct of the survey. Included here are an outline of the survey design, a listing of the landmarks used in defining the dimensions to be measured, and detailed descriptions of the procedures used in making each measurement.

Measurement techniques used in previous large-scale anthropometric surveys of women also are listed here. Thus this report, in addition to reporting the methodology of the present survey, constitutes a comprehensive source book of anthropometric techniques for use with women.

PREFACE

The design and conduct of any large survey requires the cooperation and participation of many people and the present survey was no exception. This survey was initiated by Robert M. White of the U. S. Army Natick Research and Development Command, and conducted by the Anthropology Research Project of Webb Associates, Yellow Springs, Ohio, under contract DAAG17-76-C-0010 with Edmund Churchill as senior investigator. As Project Officer, Mr. White played an active, substantial, and continuing role in the planning and organization of the survey.

Success for the survey would have been impossible without the administrative support provided to the project at the four measuring sites. At Fort Sam Houston, Colonel Maurice H. Hensley, Colonel George Kreuger, Lieutenant Colonel Robert H. Willis, Captain Dale Coburn, and First Lieutenant Shirley Bolton provided essential aid and coordination. Captain Cheryl Crawford and Second Lieutenant Winifred Petterson provided similar support and assistance at Fort McClellan. At Walter Reed Medical Center, Major Rose Weddell served as Project Officer, coordinating the survey's activities with skill and thoroughness. Assistance in both the planning and the day-to-day operation of the survey was provided at Fort Jackson by Lieutenant Colonel Robert D. Martin and Mr. Gordon Wingard. In addition to these individuals, a sizable number of other people, both military and civilian, contributed to the success of the project. Particularly worthy of mention are Mr. Dennis, director of the Walter Reed Inn, in which the Washington portion of the survey was conducted, and his staff, and SP/4 Frances Moyer who welcomed the survey into her training-aids space at Fort Jackson with a friendliness which will long be remembered. The authors of this report are pleased to have this opportunity to thank each of these men and women and to acknowledge the survey's considerable debt to them.

The measuring team, under the direction of Pat Reese, consisted of Becca Fenton, Jay Frost, Linda Gronwoldt (during the second half of the survey), Leslie Metcalf, Diann O'Daniel, Becky Sikes, and Liz Wheeler, all of whom performed their tasks competently and cooperatively.

Typing and many other aspects of the preparation of this report have been skillfully taken care of by Ms. Jane Reese; the drawings included here are the work of Mrs. Kay Downing. Ms. Ilse Tebbetts edited the final version of this report and supervised its completion.

Thanks are also due, of course, to all the women who served, occasionally reluctantly but far more often with cheerful cooperation, as subjects. Without them, there would have been no survey.

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ANTHROPOMETRY OF WOMEN OF THE U. S. ARMY--1977
REPORT NO. 1 - METHODOLOGY AND SURVEY PLAN

INTRODUCTION

The present anthropometric survey has been designed and carried out as a response to the need for current and comprehensive body size and strength data for the women who make up an increasingly large part of the United States Army.

The reasons for this need are, in the main, twofold. One reason is the drastic increase in the numbers and types of occupational roles which women are now filling in the Army. While formerly women served in the Army almost exclusively in nursing and other health related professions or in clerical positions, today some 400 of the Army's approximately 500 military assignments are open to and filled by women. In many of these jobs women will have to function in workspaces originally designed to accommodate men and to operate equipment planned for use by men. Data on the size and strength of Army women are clearly needed to evaluate the appropriateness of these designs and to provide, where necessary, the basis for new designs which will provide the maximum utility for use by both male and female members of the Army. A substantial amount of the information needed for this purpose has never been collected on any sizable group of uniformed women.

The second major reason is the lack of contemporary body size data on Army women for the traditional use of such data in the design and sizing of clothing and other personal equipment. The last, in fact the only other, major anthropometric survey of Army women was made at separation centers at the end of World War II. The data from that survey are more than 30 years old, and were gathered under military circumstances so drastically different from those of the present time as to cause serious doubts as to their present relevancy. More recent data are available, it is true, for women of the Air Force, but even these data are almost a decade old, and this has been a decade of major change in the role of women within the military services. The only major survey of American civilian women, made in 1939-1940, substantially predates both military surveys.

In this survey, conducted at Fort Sam Houston, Texas; Fort McClellan, Alabama; Walter Reed Medical Center, the District of Columbia; and Fort Jackson, South Carolina, during the winter of 1976-1977, a sizable series of conventional anthropometric measurements and small subseries of head and face, workspace, and static

strength measurements were made on a sample of women representing wide spectrums of rank, age, and occupation.

The methodology and statistical results of this survey will be presented in a series of survey reports of which this is the first. As is appropriate, this first report will be concerned with the design and anthropometric methodology of the survey. In large part, this report is a slightly revised form of the manual which was prepared for use in training the survey's measuring team.

Chapter I

THE DESIGN OF THE SURVEY

Basic planning of this survey was a cooperative effort of Robert M. White of the U. S. Army Natick Research and Development Command and Lloyd Laubach, John McConville, and Edmund Churchill of Webb Associates. The final plan represents, of course, a series of compromises of the desires for large numbers of measurements to be made on large numbers of subjects at large numbers of military installations throughout the country with a recognition of what was possible--and what would be profitable--with the limited resources available for the conduct of the survey.

Subseries Design

A major element in the design of this survey was the division of the total series of measurements into five separate groups. The first series of measurements--the core group--was to be made on every subject; in addition, each of the remaining four series of measurements was to be made on approximately one-quarter of the subjects. The core series consisted entirely of conventional body size measurements, 69 in number. Subseries 1 included about two dozen other conventional measurements plus several skinfold measurements. Subseries 2 consisted of 14 workspace measurements; subseries 3 was made up of 31 head and face measurements; and subseries 4 consisted of 9 strength measurements. The contents of each series are shown in Figures 1 through 5, which show the several data blanks used in the survey. It was assumed that each subseries would be measured on 250-350 subjects and that in the final data analysis the subseries data would be tied in to those for the total series.*

Target Population

The population to be sampled was deemed to be all female personnel of the U. S. Army, from basic trainees to senior commissioned officers and NCO's. Particular efforts were to be made to include as many NCO's beyond their early twenties and as many commissioned officers who were not nurses as possible, although the difficulties involved in getting large numbers of such subjects were recognized. Practical considerations dictated that the survey would have to be

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* The decision to use this type of design was prompted, in part, by the discussions of sample size and of adjusting small sample data to correspond to data from large groups which appeared in Sampling and Data Gathering Strategies for Future USAF Anthropometry, by Edmund Churchill and John McConville (AMRL-TR-74-102, Wright-Patterson Air Force Base, Ohio, 1976).

WOMEN'S ARMY CORPS ANTHROPOMETRIC SURVEY BLANK - 1976/1977

(Please print all requested information)

Subject No._____

Name_____ Date_____
(Last) (First) (Middle)

Rank_____ Location_____

Social Security No._____ MOS: Primary_____ Secondary_____

Length of Service_____ What is your primary duty, nurse, cook, typist, etc._____
(years) (months)

Age at Last Birthday_____ Command_____

Birthdate_____ Handedness: R L A
(year) (month) (day) (circle appropriate symbol)

Place of Birth_____ Estimated Nude Height_____ (inches)
State (country if other than USA)

Estimated Nude Weight_____ (pounds)

GROUP I

(Standing)

1. Stature_____
2. Acromiale Height_____
3. Axilla Ht_____
4. Bustpoint Ht_____
5. Waist Height_____
6. Crotch Ht_____
7. Buttock Ht_____
8. Chest Breadth_____
9. Waist Breadth_____
10. Hip Breadth_____
11. Bust Depth_____
12. Waist Depth_____

(Seated on Table)

13. Sitting Ht_____
14. Eye Height_____
15. Knee Height_____
16. Popliteal Ht_____
17. Shoulder-Elbow Lgth_____
18. Elbow-Fingertip Lgth_____
19. Bideltoid Breadth_____
20. Buttock-Knee Length_____

GROUP II

(Seated on Chair)

21. Head Circumference_____
22. Neck Circumference_____
23. Head Length_____
24. Head Breadth_____
25. Hand Circumference_____
26. Hand Breadth_____
27. Hand Length_____
28. Palm Length_____

(Standing on Table)

29. Hip Circumference_____
30. Upper Thigh Circ_____
31. Knee Circ_____
32. Calf Circ_____
33. Ankle Circ_____
34. Heel-Ankle Circ_____
35. Instep Circ_____
36. Foot Circ_____
37. Heel Breadth_____
38. Knee Height_____
39. Calf Height_____
40. Ankle Height_____
41. Sphyrion Ht_____
42. Foot Length_____
43. Instep Length_____
44. Foot Breadth_____

GROUP III

45. Weight_____
46. Arm Circ at Scye_____
47. Biceps Circ, Flexed_____
48. Elbow Circ, Flexed_____
49. Forearm Circ, Flexed_____
50. Wrist Circumference_____
51. Shoulder Length_____
52. Neck to Bustpoint_____
53. Sleeve Inseam_____
54. Sleeve Outseam_____
55. Axilla to Waist Level_____
56. Shoulder Circ_____
57. Chest Circ at Scye_____
58. Bust Circ_____
59. Chest Circ Below Bust_____
60. Waist Circumference_____
61. Interscye Front_____
62. Waist Front_____
63. Interscye Back_____
64. Waist Back_____
65. Back Curvature, Bust Level_____
66. Back Curvature, Waist Level_____
67. Back Curvature, Hip Level_____
68. Vertical Trunk Circ_____
69. Crotch Length_____

Figure 1. The survey blank: the core measurements.

WOMEN'S ARMY CORPS ANTHROPOMETRIC SURVEY BLANK - 1976/1977

(Please print all requested information)

Subject No._____ Social Security No. _____

Name_____ Location_____
(Last) (First) (Middle)

Sub-Series #1

Traditional Anthropometry

GROUP I

(Standing)

1. Cervicale Height_____
2. Suprasternale Ht_____
3. Substernale Ht_____
4. Elbow Height_____
5. Acromion-Radiale Length_____
6. Radiale-Stylion Length_____

(Seated on Table)

7. Elbow to Center of Grip_____
8. Elbow Rest Height_____
9. Thigh Clearance Ht_____
10. Biacromial Breadth_____

GROUP II

(Seated on Table)

11. Abdominal-Extension Depth_____
12. Abdominal-Extension Breadth_____
13. Thigh-to-Thigh Breadth_____

(Standing on Table)

14. Bispinous Breadth_____
15. Knuckle Height_____
16. Gluteal Furrow Ht_____
17. Trochanteric Ht_____
18. Tibiale Ht_____

GROUP III

19. Axillary Arm Circ_____
20. Biceps Circ, Relaxed_____
21. Forearm Circ, Relaxed_____
22. Waist Circ (Omphalion)_____
23. Vertical Trunk Circ (Seated)_____
24. Hip Circ (Seated)_____
25. SKF: Triceps_____
26. SKF: Biceps_____
27. SKF: Subscapular_____
28. SKF: Suprailiac_____

Figure 2. The survey blank: traditional anthropometry subseries.

WOMEN'S ARMY CORPS ANTHROPOMETRIC SURVEY BLANK - 1976/1977

(Please print all requested information)

Subject No._____ Social Security No._____

Name_____ Location_____
(Last) (First) (Middle)

Shoes_____

Boots_____

Sub-Series #2

Anthropometry of Working Positions

1. Weight_____			
2. Stature_____			
3. Functional Reach_____			
4. Functional Reach, Extended_____			
5. Overhead Reach Height_____			
6. Overhead Reach Breadth_____			
7. Bent Torso Height_____			
8. Bent Torso Breadth_____			
9. Overhead Reach, Sitting_____			
10. Functional Leg Length_____			
11. Kneeling Height_____			
12. Kneeling Leg Length_____			
13. Bent Knee Height, Supine_____			
14. Horizontal Length, Knees Bent_____			

15._____			
16._____			
17._____			
18._____			

Figure 3. The survey blank: workspace subseries.

WOMEN'S ARMY CORPS ANTHROPOMETRIC SURVEY BLANK - 1976/1977

(Please print all requested information)

Subject No._____ Social Security No._____

Name_____ Location_____
(Last) (First) (Middle)

Sub-Series #3

Head and Face

(Headboard)
1. Menton to Wall_____
2. Stomion to Wall_____
3. Subnasale to Wall_____
4. Pronasale to Wall_____
5. Sellion to Wall_____
6. Glabella to Wall_____
7. Ectocanthus to Wall_____
8. Tragion to Wall_____

9. Menton to Vertex_____
10. Stomion to Vertex_____
11. Subnasale to Vertex_____
12. Pronasale to Vertex_____
13. Sellion to Vertex_____
14. Glabella to Vertex_____
15. Ectocanthus to Vertex_____
16. Tragion to Vertex_____

17. Crinion-Menton_____
18. Sellion-Menton_____
19. Sellion-Subnasale_____
20. Biocular Breadth_____
21. Interpupillary Distance_____
22. Mouth Breadth, Smiling_____
23. Nose Breadth_____
24. Face Breadth_____
25. Bitragion Breadth_____
26. Minimum-Frontal Br_____
27. Sagittal Arc_____
28. Bitragion-Coronal Arc_____
29. Bitragion-Frontal Arc_____
30. Bitragion-Menton Arc_____
31. Bitragion-Submandibular Arc_____

Figure 4. The survey blank: head and face subseries.

WOMEN'S ARMY CORPS ANTHROPOMETRIC SURVEY BLANK - 1976/1977

(Please print all requested information)

Subject No._____ Social Security No._____

Name_____ Location_____
(Last) (First) (Middle)

Handedness R L A
(circle appropriate symbol)

Skirt ____ Slacks ____

Sub-Series #4

Static Muscle Strength (lbs of force)

		T_1	T_2
1. Standing Two-Handed Lift 38 cm Above Floor Long Handle (Bent Knee)	Average Peak		
2. Standing Two-Handed Lift 50 cm Above Floor Long Handle (Straight Knee)	Average Peak		
3. Standing Two-Handed Lift 100 cm Above Floor Long Handle	Average Peak		
4. Standing Two-Handed Lift 150 cm Above Floor Long Handle	Average Peak		
5. Standing One-Handed Lift 100 cm Above Floor "D" Ring Dominant Hand	Average Peak		
6. Seated One-Handed Pull Centerline of Seat 45 cm Above Floor "D" Ring	Average Peak		

Figure 5a. The survey blank: static muscle strength subseries.

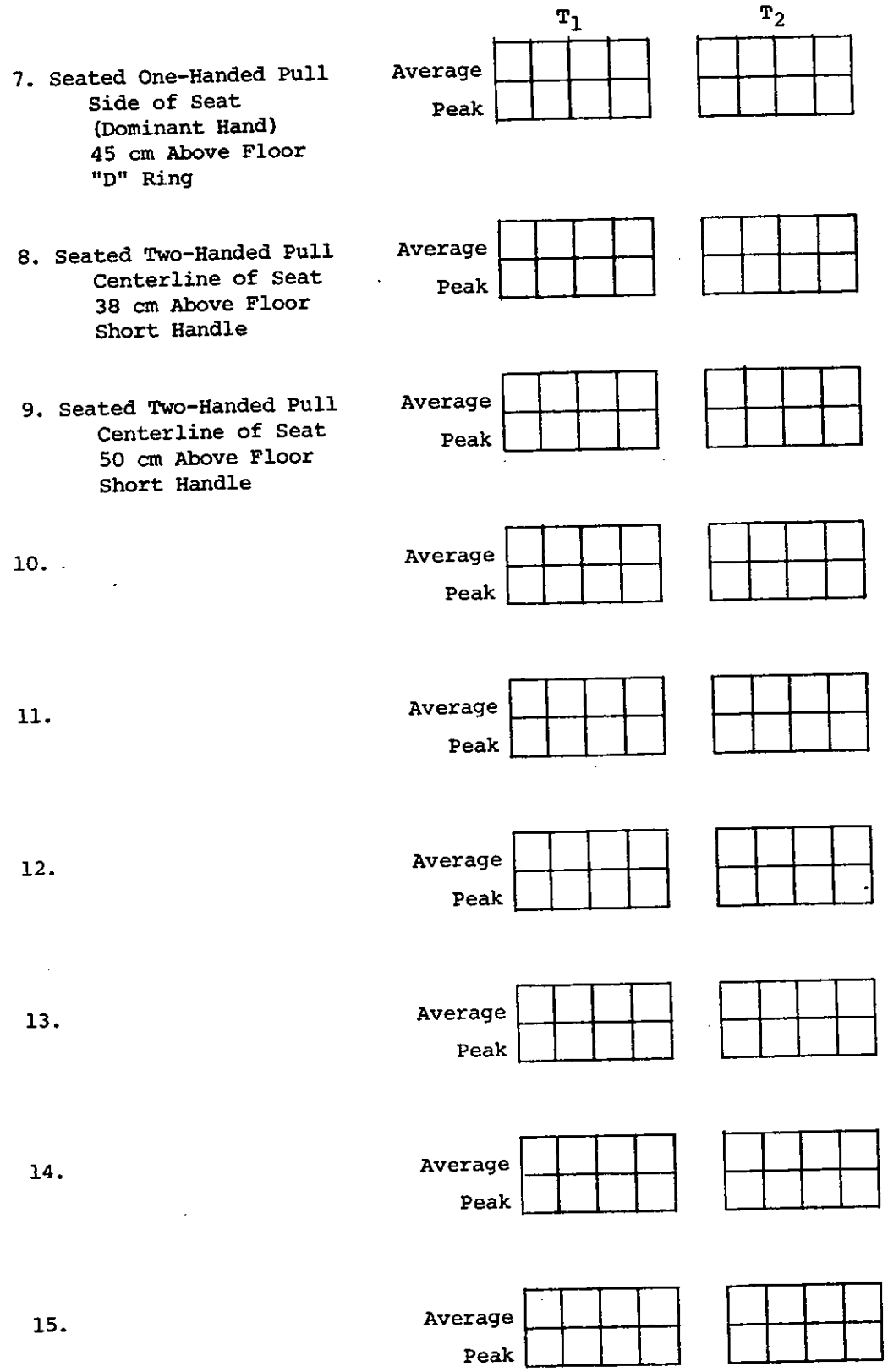

Figure 5b. The survey blank: static muscle strength subseries.

conducted at a small number of installations at which there would be large pools of prospective subjects. The final decision was to conduct the survey at Forts Sam Houston, McClellan, and Jackson and at the Walter Reed Medical Center, spending two to three weeks at each measuring site.

Selection of the Measurements

The choice of measurements to be made in this survey constituted, as is the case with most surveys, a serious problem. The number of possible measurements far exceeds the number that would be either prudent or possible. A recent check of major military and civilian surveys, for example, has provided a list of some 350 measurements which have been made in one or more of these surveys, and even this list is by no means exhaustive.

The practical considerations of the number of measurements a team of three measurement-recorder pairs could be expected to make and the period of time which we could impose on our subjects' often hurried work days were a major consideration. It was decided that each measuring pair would make a total of 20 to 25 measurements in the core series--those measurements to be made on all subjects. In selecting these measurements, the major goal was to choose a set which would include:

a. a basic series of measurements providing a solid anthropometric description of women in the Army at the time of the survey;

b. those measurements specifically requested by the Army clothing design staff;

c. a group of measurements which would make possible statistical interactions with data from other women's surveys:

   i. in the area of studying change and growth and the prediction of future changes in the size of Army women, and,

   ii. in the area of providing the incremental and correlational statistics which would facilitate the use of data from the other surveys to supplement the data from this survey;

d. measurements which had not been included in the 1968 survey of Air Force women, but which the Air Force anthropologists, working on problems similar to those of the Army, had found substantial need for, and for which the Army would in all likelihood find a similar need;

e. measurements which would facilitate the evaluation of equipment and workspace units, originally designed for use by male soldiers, as to their suitability for use by women;

f. measurements which would provide a tie-in of data from the subseries to the sample as a whole, and

g. measurements which USAF anthropologists wished for use in the development of a female equivalent of COMBIMAN (COMputerized BIomechanical MAN model).

Clearly, there is substantial overlap between these several groups of measurements and each group makes a substantial contribution to the overall purpose of providing the data necessary for designing the clothing women in the Army will wear and equipment which they will operate. A total of 69 measurements was chosen as most important: weight, 15 height measurements, 8 torso (including neck) circumferences, 4 torso breadths, 2 torso depths, 4 arm lengths, 5 arm circumferences, 3 head measurements, 4 hand measurements, 7 foot measurements, 4 leg circumferences, 11 torso surface measurements, and buttock-knee length; these are listed in the first measurement blank (Figure 1). Of these 69, 25 were measurements not made in the Air Force Women's survey, several had not been measured in either the AFW survey or the 1946 Army survey, and some had not been measured in any of the major women's surveys.

The first subseries--traditional anthropometry--consisted initially of 28 measurements, all but four of which (a set of skinfold measurements) were of the same general type as those in the core series; many were runners-up for the core list. Several of the subseries measurements were essentially the same as certain of the core measurements except for differences in the position of the body or the definition of the relevant landmarks.

The second subseries--the workspace measurements--would appear to represent the first major effort to obtain data of this type on military women. Considerable guidance in the selection of the measurements was obtained from earlier USAF studies of male personnel. Eight of the 12 measurements (excluding clothed stature and weight) included in this subseries are essentially the same as measurements made by Alexander and Clauser in their 1965 study (The Anthropometry of Common Working Positions, by Milton Alexander and Charles E. Clauser, AMRL-TR-65-73, Wright-Patterson Air Force Base, Ohio, 1965).

The third subseries--head and face--consisted of 31 measurements. With the three basic head measurements included in the core series, this provides a series of 34 head and face measurements--the most comprehensive set of head and face measurements of any major women's survey. Twelve of these measurements were not taken in the AFW survey, most were not taken in the Army 1946 survey, and none were taken in

the Department of Agriculture study. So large a series of head and face measurements was included because of an increasing need for data for the design of masks, respirators, and similar equipment for women--a need intensified by the movement of women into high-hazard jobs in both civilian and military areas. Guidance in the selection of these measurements was obtained from Anthropometry for Respirator Sizing by John T. McConville, Edmund Churchill, Lloyd L. Laubach and Milton Alexander, Final Report, HEW Contract HMS 099-71-11, Webb Associates, Yellow Springs, Ohio, 1972.

The final subseries--the strength measurements--like the previous one had no antecedents in previous major anthropometric surveys of women. The considerable time required to make even a short series of measurements on a single subject, the importance of at least duplicate measurements, and the desire to avoid problems of fatigue severely limited the number of measurements and, to some extent, affected the way the measurements were to be made. As in most similar studies, the selection of measuring equipment, in this case the University of Michigan Department of Industrial and Operations Engineering's strength monitor, played a major role in determining which measurements were to be made. The final choice was a list of 9 measurements, each to be made twice; the list is shown in the last of the measurement blanks (Figure 5a and 5b). The data recorded for each measurement were the subject's maximum pull over a three-second interval and the average of her pull.

Background Information

Earlier military surveys have usually requested substantial amounts of personal and socio-military background information from each subject. For this survey, the amount of such information was reduced to a bare minimum. This was done in large measure because of current laws and Defense Department regulations which require that the need for and the prospective use of any such information be explained and justified to each prospective subject, and the consequences of the failure to provide the information be spelled out. A copy of the statement, prepared by the legal staff of the Natick Research and Development Command, which was shown to each subject, appears as Appendix A. As this statement makes clear, each subject was free not only to refuse to provide any personal information but also to decline to participate in the survey at all.* Under these circumstances, the

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* Surprisingly enough, only a handful of prospective subjects on being shown the statement elected to exercise their right to non-participation.

decision was made to ask only a few questions of clear-cut relevancy: basically age, state or country of birth, military occupational specialty (MOS), handedness, and the subject's estimate of her height and weight. As the data form indicates, each subject was also asked her name and, initially, her social security number. Subjects were informed that they were perfectly free to omit this information and that no use could be made of it; in the latter stages of the survey, the question about the social security number was crossed out.

Staffing and Training of the Survey Team

Staffing of the survey team, it was agreed, would follow the pattern of the survey of U. S. Army aviators conducted in 1970. Six civilian women, without prior training in anthropometry, were employed to carry out the bulk of the measuring and recording of the data. Prior to the beginning of the survey, these women underwent a week and a half of intensive training under the direction of Drs. Laubach and McConville, with the assistance of Milton Alexander of the U. S. Air Force Aerospace Medical Research Laboratory, in the area of the head and face measurements.

The training program began with a general introduction to anthropometric methods and instruments and to the entire series of measurements planned for the survey. Following this, the six women were paired off and each pair assigned responsibility for approximately one-third of the measurements in the core series and in the traditional anthropometry and head and face subseries. For the remainder of the training period, each pair was trained exclusively in the group of measurements assigned it, and throughout the survey, each pair--alternating between the roles of measurer and recorder as they wished--made the measurements in which they had been especially trained.* Each measurer was provided a copy of the training manual which, in slightly revised form, constitutes the next chapter of this report.

The team was directed during the first half of the survey by Dr. Laubach as field supervisor and Ms. Patricia Reese as team supervisor; Dr. Laubach and Ms. Reese also carried out the workspace and strength measurements. During the second half of the survey, Ms. Reese carried full responsibility for the direction of the team's activities and, with the assistance of a recorder, made all the workspace and most of the strength measurements.

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* On the fortunately rare occasions when a member of the team was ill, the other member of her pair did all the measuring.

Timing of the Survey

The timing of the survey was, in no sense, ideal. Technical problems caused a number of postponements in the start of the field work. When these problems were resolved, it was already too late to complete the survey prior to the 1976-1977 holiday season;* to delay the start of the survey until after the holidays would create additional and undesirable delays in the availability of the data and would carry the preparation period for the final reports past the planned retirement of Mr. Churchill, the senior investigator on the contract. Reluctantly, the decision was made to divide the survey into two parts--Fort Sam Houston and Fort McClellan in November and early December, Walter Reed Medical Center and Fort Jackson from mid-January to early February. Field work began at Fort Sam Houston on November 1, 1976. The team moved to Fort McClellan November 15 and completed work there on December 3. Measuring resumed at Walter Reed on January 10, 1977. The team moved to its final site, Fort Jackson, on January 23 and completed its activities on February 11.

Survey Equipment

The measuring equipment for all but the workspace and strength measurements consisted of the following:

anthropometers, Siber Hegner #101
sliding calipers, Siber Hegner #104
spreading calipers, Siber Hegner #106
2-meter steel tapes, K&E Tip-Top Wyteface
headboard and special gauge
footboard and block
medical scales
Lange skinfold calipers

All of these instruments are fairly standard for large anthropometric surveys and, except for a slightly different measuring tape, were used in recent surveys of Army aviators and Air Force women. The headboard and the footboard, constructed locally for an earlier survey, are illustrated in Figure 6.

The anthropometer, whole and in parts, constitutes a basic tool of the anthropometrist. The complete anthropometer and its lower half, as is appropriate, is used to measure all the heights, except

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* The contractor was advised that an adequate number of subjects simply could not be assured at any of the measurement sites from about the middle of December until the second week of January.

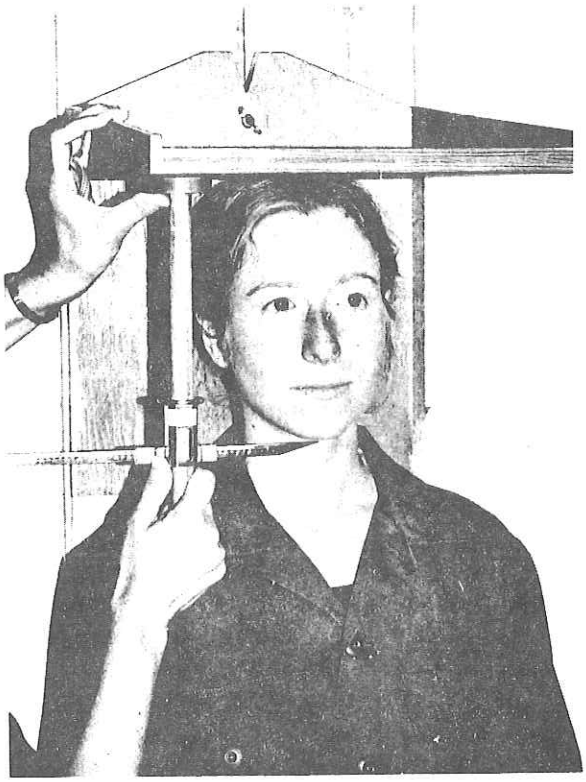


Figure 6a. Headboard.

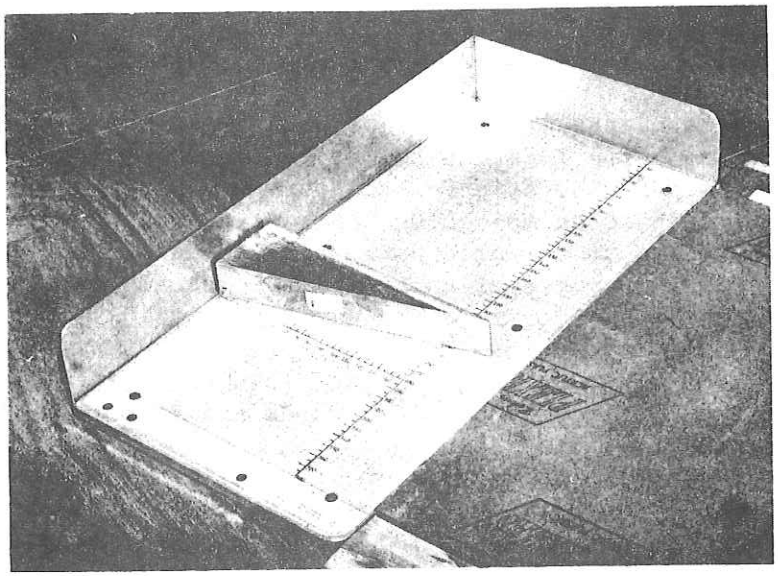


Figure 6b. Footboard.

sphyrion. The detached upper half forms a beam caliper and is used to measure most of the larger breadths, depths, and segment lengths.

The smaller sliding (maximum opening: 25 cm) and spreading (maximum opening: 30 cm) calipers are used primarily for point-to-point measurements of the head, hands, and feet. The steel tape is used for circumferences, arcs, and other surface measurements.

The headboard is used to locate tragion and points on the profile of the face relative to the horizontal plane tangent to the top of the head and to the vertical plane tangent to the back of the head. The footboard and its block are used to measure foot and instep lengths, instep breadth, and sphyrion height.

The workspace subseries of measurements made considerable use of graph paper mounted on the floor (or a piece of plywood) and on a vertical wall. This graph paper was covered with a layer of clear acetate. For several measurements, the relevant points are marked on the acetate with a felt tip pen while the subject maintains a specified posture. After the subject has moved away, the locations of these marks are noted and the marks wiped off the acetate. Other equipment used for this subseries included an anthropometer, complete and as a beam caliper, a 30°-60°-90° plastic triangle for adjusting the angle of the subject's knees, an anthropometer with metal base for making the buttock-heel measurement, and the same medical scales used in the core measurements sequence.

The strength subseries measurements are made using an "Employee Strength Measurement Monitor" built by Industrial and Operations Engineering, University of Michigan and the associated steel platform, approximately 90 centimeters square, to which the load cell is anchored, and three handles: a D-ring for one-handed pulls, and long (45 centimeters) and short (15 centimeters) handles for two-handed pulls.

The data blanks, Figures 1-5, were typed and duplicated on an office reproducer. This method of preparation represented a change from that used in the Army aviator survey. For that survey, the forms were printed on so-called "carbonless carbon paper" so that normal recording of the data would provide duplicate copies. The existence of two copies of each data record made it possible to ship the data from the field for early processing without the danger of irreparable loss. For the present survey, it was felt that it would be more convenient and less expensive to use blanks reproduced on plain, but heavier, paper and to obtain the duplicate copies of the completed form by the same method of reproduction. This procedure, in addition, made it possible to delay the final arrangement of measurements on the blanks until almost the end of the training period. Except for the blanks for the strength and

workspace subseries, the blanks provided three squares following each measurement name in which to record the numbers which were to be punched. As shall be explained in the report describing the statistical procedures, punching of the 1000's digit was not necessary; omitting it made it practical to punch all values, from smallest to largest, in the same form. The blanks for the other two subseries contained, for each measurement, an appropriate set of four squares.

Chapter II

THE MEASURING TECHNIQUES

A training manual consisting of drawings and descriptions of each measurement, written descriptions and illustrations of landmarks used in the measuring, and a glossary of anatomical and anthropometric terms was prepared prior to the conduct of the survey. This manual provided the written basis for the training of the measuring team; a copy for each member of the team was deemed an important part of the survey equipment.

This section of the report consists of a slightly revised version of this manual. In the main, revisions reflect minor changes in the wording made in consultation with the team supervisor after the completion of the field work to insure that the descriptions accurately indicated the procedures actually used.

The descriptions of measurements made on the side of the body do not, as a rule, state on which side the measurement is to be made since the technique is the same whether the measurement is made on the left or the right. All unilateral measurements in this survey were made on the right side except the one-handed strength measurements which were made using the subject's "preferred" hand.

The list of landmarks, the glossary, the illustrations of landmarks, anatomical points and skeletal segments, Figure 7, and those of the major anatomical planes, Figure 8, were also part of the training manual.

DEFINITIONS OF LANDMARKS

ABDOMINAL EXTENSION: the most forward point of the abdomen in the midsagittal plane.

ANKLE LEVEL: the level of the minimum circumference of the ankle above the projections of the ankle bones (the malleoli) as established by measurement.

AXILLA: points, anterior and posterior, on the axillary skinfolds at the inferior edge of the armpit determined by placing a straight edge horizontally and as high as possible into the axilla without compression of the soft tissue and marking the front and rear points of contact of this straight edge.

BICEPS BRACHII: the point of maximum protuberance of the biceps muscle as established by visual inspection when the arm is bent and the biceps strongly contracted.

BUSTPOINT: the most anterior protrusion of the bra cup.

BUTTOCK, MAXIMAL PROTRUSION: the level of the maximum posterior protrusion of the buttocks.

CALF, MAXIMAL CIRCUMFERENCE: the level of the maximum circumference of the calf as determined by measurement.

CERVICALE: the tip of the spinous process of the seventh cervical vertebra as determined by palpation. Often it is most easily located when the subject's head is bent forward.

CHEILION: a corner of the mouth formed by the juncture of the lips.

CRINION: the point in the midsagittal plane where the hairline meets the forehead.

DACTYLION: the tip of the third finger.

DELTOID: the most lateral protrusion of the deltoid muscle as determined by visual inspection.

ECTOCANTHUS: the external corner of the eye, the angle formed by the juncture of the upper and lower eyelid.

FOREARM, MAXIMAL CIRCUMFERENCE: the level of maximum circumference of the forearm.

GLABELLA: the most anterior point in the midsagittal plane on the forehead between the eyebrows as determined by palpation and visual inspection.

GLUTEAL FURROW: the crease formed on the back of the thigh at its juncture with the buttock.

HIPS, MAXIMAL PROTRUSION: the points of maximum lateral protrusion of the hip bones.

ILIAC CREST: the highest point of the ilium, the hip bone, in the midaxillary plane.

ILIAC SPINES, ANTERIOR-SUPERIOR: the bony protrusion on the anterior edge of the iliac crest of the pelvis.

MENTON: a point in the midsagittal plane on the curvature of the lower jaw approximately 45° from the vertical as determined by palpation and visual inspection.

METACARPALE III: the most prominent point of the knuckle where the third finger joins the palm.

METACARPAL-PHALANGEAL JOINTS II & V: the most lateral points of the knuckles where the second and fifth fingers join the palm.

METATARSAL-CUNEIFORM JOINT: the medial line of the juncture of the first metatarsal bone with the first cuneiform bone of the foot.

METATARSAL-PHALANGEAL I AND V: the most medial point of the knuckle where the big toe joins the instep; the most lateral point of the knuckle where the fifth toe joins the instep.

MIDAXILLARY LINE-BUSTPOINT LEVEL: the points in the right and left midaxillary lines at the level of the right bustpoint.

MIDAXILLARY LINE-BUTTOCKS MAXIMAL PROTRUSION LEVEL: the points in the right and left midaxillary lines at the level of the most posterior protrusion of the right buttock.

MIDSCYE, ANTERIOR: the point located halfway between the anterior scye landmark and acromiale.

MIDSCYE, POSTERIOR: the point located halfway between the posterior scye landmark and acromiale.

MIDPATELLA: the point halfway between the superior and inferior margins of the kneecap.

MIDSHOULDER: the point on the upper surface of the shoulder midway between the lateral neck and acromial landmarks as determined by visual inspection.

NECK: a circle is established by placing a loop over the subject's head and tightening it around the neck at the neck-shoulder juncture. The loop is not perpendicular to the long axis of the neck and is usually higher on the posterior neck surface than on the anterior neck surface. Points are marked at the intersections of this circle with the midsagittal plane and at the neck-shoulder junctures.

NUCHALE: the lowest point on the occiput in the midsagittal plane that can be palpated among the muscles in the posterior-superior part of the neck. This point is often visually obscured by hair.

OCCIPUT: the most posterior point of the skull.

OLECRANON: the proximal end of the ulna, the bone on the little finger side of the forearm.

OLECRANON PROCESS, INFERIOR TIP: the lowest point of the proximal end of the ulna when the upper arm hangs relaxed and the forearm is extended horizontally.

OLECRANON PROCESS, POSTERIOR TIP: the most posterior point of the proximal end of the ulna when the upper arm hangs relaxed and the forearm is extended horizontally.

OMPHALION: the midpoint of the navel.

PALM-FINGER CREASE III: the skin crease at the base of the middle finger.

PRONASALE: the most anterior tip of the nose.

RADIAL-STYLION: bony protrusion on the distal end of the radius, the forearm bone on the thumb side of the arm.

RADIALE: the uppermost point on the lateral margin of the head of the radius, the forearm bone on the thumb side of the arm.

SCAPULA, INFERIOR ANGLE: the inferior angle of the shoulder blade.

SELLION: the point of maximum indentation where the bridge of the nose meets the forehead; the deepest point of the nasal root depression.

SPHYRION: the level of the most distal extension of the tibia on the medial side of the foot.

STOMION: the point of contact in the midsagittal plane of the upper and lower lips.

STYLION: the most distal point on the styloid process of the radius, a thick pointed projection on the lateral side of the lower extremity of the radius.

SUBMANDIBULAR: the juncture, in the midsagittal plane, of the jaw and the neck.

SUBNASALE: the point where the base of the nasal septum meets the philtrum (the groove in the upper lip).

SUBSTERNALE: the inferior end of the sternum (xiphoid process).

SUPRAPATELLA: the midpoint of the upper edge of the kneecap.

SUPRASTERNALE: the lowest point of the jugular notch on the sternum as determined by palpation.

TEMPORAL CRESTS OF THE FRONTAL BONE, GREATEST INDENTATION: the points of maximum indentation in the narrow, bony ridge running along the side of the head, curving up from the upper lateral margin of the frontal bone.

TIBIALE: the uppermost point of the medial margin of the tibia (shin bone).

TRAGION: the deepest point of the notch just above the tragus of each ear as determined by visual inspection.

TRICEPS: a point on the back of the arm which, when the elbow is flexed 90°, is halfway between acromion and the tip of the elbow.

TROCHANTERION: the tip of the bony lateral protrusion of the proximal end of the femur (thigh bone).

ULNAR STYLION: the distal end of the ulna, the forearm bone on the little finger side of the hand.

WAIST LEVEL: the level established by the subject placing an elastic tape around her "natural waist." This level is marked anteriorly and posteriorly in the midsagittal plane and on the midaxillary lines.

WRIST CREASE: the most distal point on the transverse skin crease where the palm joins the wrist.

GLOSSARY

ABDOMINAL: pertaining to the abdomen, particularly the region below the rib cage and above the pelvis.

ACROMION: the most lateral point on the acromial process of the scapula.

ANKLE LEVEL: the level of the smallest girth of the right ankle above the protuberances of the ankle bones (malleoli).

ANTERIOR: pertaining to the front of the body, as opposed to posterior.

AXILLA: the armpit; axillary, pertaining to the armpit.

AXILLARY FOLD, POSTERIOR: the furrow formed by the juncture of the upper arm and the back.

BASE OF HAND: the line of demarcation drawn between the hand and the lower arm. This line coincides with the distal skin crease at the proximal edge of the palm.

BICEPS BRACHII: the large protruding muscle mass on the anterior surface of the upper arm.

BROW RIDGES: the bony elevations, just above the orbits, on the frontal bone of the skull.

BUTTOCK LEVEL: the level of the maximum posterior protrusion of the right buttock.

CALCANEUS: the heel bone.

CALF HEIGHT: the level of the maximum circumference of the right calf.

CANTHUS: corner of the eye formed by the meeting of the eyelids.

CERVICALE: the protrusion of the spinal column at the base of the neck, caused by the tip of the spine of the 7th cervical vertebra.

CHEILION: a corner of the mouth.

CORONAL PLANE: a vertical plane which divides the body into anterior and posterior sections; a vertical plane perpendicular to a sagittal plane.

CRINION: the hairline above the forehead.

DACTYLION: the point at the distal tip of the middle finger.

DELTOID MUSCLE: the large muscle on the lateral border of the upper arm in the shoulder region.

DISTAL: the end of a body segment farthest from the head or area of attachment; opposed to proximal.

ECTOCANTHUS: an external corner of the eye.

EXTERNAL: away from the midplane of the body; lateral; opposed to medial or internal.

FEMUR: the thigh bone.

FIBULA: the bone on the lateral side of the lower leg.

FRANKFORT PLANE: the standard horizontal plane of orientation of the head, containing tragion and the lowest point of the orbit. This plane is closely approximated when the subject looks directly forward with her line of vision horizontal.

GLABELLA: the most anterior point of the forehead between the brow ridges, in the midsagittal plane.

GLUTEAL FURROW: the furrow formed by the junction of the buttock with the back of the leg.

HUMERUS: the upper arm bone.

ILIUM: the hip bone.

INFERIOR (INFRA): lower edge (below), as opposed to superior (supra).

INSEAM: a tailoring term indicating the inside length of sleeve or trouser, measured on the medial side of arm or leg.

INSTEP THROAT: the anterior juncture of the ankle with the right foot.

INTERNAL: near the midplane of the body, as opposed to external.

LATERAL: lying toward the sides of the body; opposed to medial.

LOWER ARM CIRCUMFERENCE LEVEL: the level of maximum protrusion of the brachioradialis muscle when the arm is flexed, and the subject is making a fist.

MALLEOLUS: the bony protrusion, either lateral or medial, of the ankle.

MEDIAL: lying near the midsagittal plane of the body; opposed to lateral.

MENTON: the lowest point of the tip of the chin in the midsagittal plane.

METACARPAL BONE: a bone of the palm of the hand.

METACARPALE: the point of juncture of a bone of the palm (metacarpal) with the first bone (phalanx) of the finger.

METATARSAL: a bone of the instep of the foot.

MIDAXILLARY PLANE: the vertical plane passing through the centers of the armpits; midaxillary lines--the intersection of the torso and the midaxillary plane.

MIDSAGITTAL PLANE: the vertical plane which divides the body into essentially equal right and left sections.

MIDSHOULDER: the point on the superior border of the shoulder midway between acromion and the juncture of the neck and shoulder.

NASAL ROOT DEPRESSION: the area of greatest indentation where the bridge of the nose meets the forehead.

NASAL SEPTUM: the cartilaginous wall separating the right nostril from the left.

NAVICULAR BONE: the small bone of the hand just distal to the bend of the wrist or the base of the thumb.

NECK POINT: the point marking the intersection of the right side of the neck with the trapezius muscle of the right shoulder.

NUCHALE: the lowest point in the midsagittal plane of the occiput that can be palpated among the nuchal muscles. This point is often visually obscured by hair.

OCCIPUT: the bone at the back of the skull; the region of the back of the head.

OCULAR: of or pertaining to the eyes.

OLECRANON: the proximal (upper) end of the ulna (the medial forearm bone).

OMPHALION: the midpoint of the umbilicus or navel.

PATELLA: the kneecap.

PHALANGES: the bones of the fingers and the toes; phalangeal--referring to these bones.

POPLITEAL: the hollowed-out region of the leg directly behind the bent knee, involving both the bottom of the thigh and the top of the calf.

POSTERIOR: pertaining to the back of the body, as opposed to anterior.

PRONASALE: the anterior tip of the nose.

PROXIMAL: the end of a body segment nearest the head; opposed to distal.

PUPILLARY: pertaining to the pupil of the eye.

RADIALE: the highest point on the proximal head of the radius, near the midpoint of the elbow joint on the posterior side of the arm.

RADIUS: the bone of the lower arm which extends from the lateral side of the elbow to the wrist at the base of the thumb; radial, pertaining to radius.

SAGITTAL PLANE: any plane parallel to the midsagittal plane, or equivalently any vertical plane perpendicular to the coronal or midaxillary plane.

SCYE: a tailoring term used to designate the armhole of a garment. Here it is used to refer to a point on either side of the body marking the upper end of the posterior axillary fold.

SELLION: the point of greatest indentation of the nasal root depression.

SITS ERECT: subject sits on a flat horizontal surface with her head in the Frankfort plane, weight distributed equally, her back held in, her shoulders held back, and her thighs parallel. This position requires holding the torso straight, but not rigid.

SPHYRION: the most distal point of the tibia; it lies at the tip of the malleolar process.

STANDS ERECT: subject stands on a flat surface, with her head in the Frankfort plane, her weight distributed equally, her back held in and

her shoulders held back, and her legs fully straightened. This position requires holding the body straight but not rigid.

STOMION: the point of contact in the midsagittal plane between the upper and lower lips.

STYLION: the point in the wrist region at the distal end of the radius.

SUB (INFRA): lower edge (below), as opposed to supra.

SUBMANDIBULAR: pertaining to the region under the mandible or lower jaw.

SUBNASALE: the point where the base of the nasal septum meets the philtrum (groove in the upper lip).

SUBSCAPULAR: inferior edge of the shoulder blade.

SUBSTERNALE: inferior edge of the sternum (breast bone).

SUPERIOR (SUPRA): upper edge (above), as opposed to sub or inferior.

SUPRAILIAC: superior edge of the pelvis in the midaxillary plane.

SUPRASTERNALE: the lowest point in the notch in the upper edge of the breast bone.

TEMPORAL CREST (LINE): a narrow, bony ridge running along the side of the head, curving up from the upper lateral margin of the eye socket, above and past the ear and downward, ending behind the ear. This serves as the area of attachment for the temporal muscles.

TEMPORAL REGION: the area on the side of the head between and above the eyes and ears.

TIBIALE: the uppermost point on the medial superior surface of the tibia.

TRAGION: the point located at the notch just above the tragus of the ear. This point corresponds approximately to the upper edge of the ear hole.

TRAGUS: the small cartilaginous flap of flesh in front of the ear hole.

TRANSVERSE PLANE: any horizontal plane through the body.

TROCHANTERION: the top of the bony lateral protrusion of the proximal end of the femur (thigh bone).

ULNA: the bone of the lower arm which runs from the tip of the elbow to the wrist on the same side as the little finger.

VERTEX: the top of the head in the midsagittal plane when the head is held in the Frankfort plane.

WAIST LEVEL: as used in this study, the height of the horizontal plane at the "natural" waist level. Certain measurements were made at the level of the center of the navel and are identified by the inclusion of the word "omphalion" in their names.

ZYGOMATIC ARCH: the bony arch extending horizontally along the side of the head from the cheekbone (malar) nearly to the external ear.

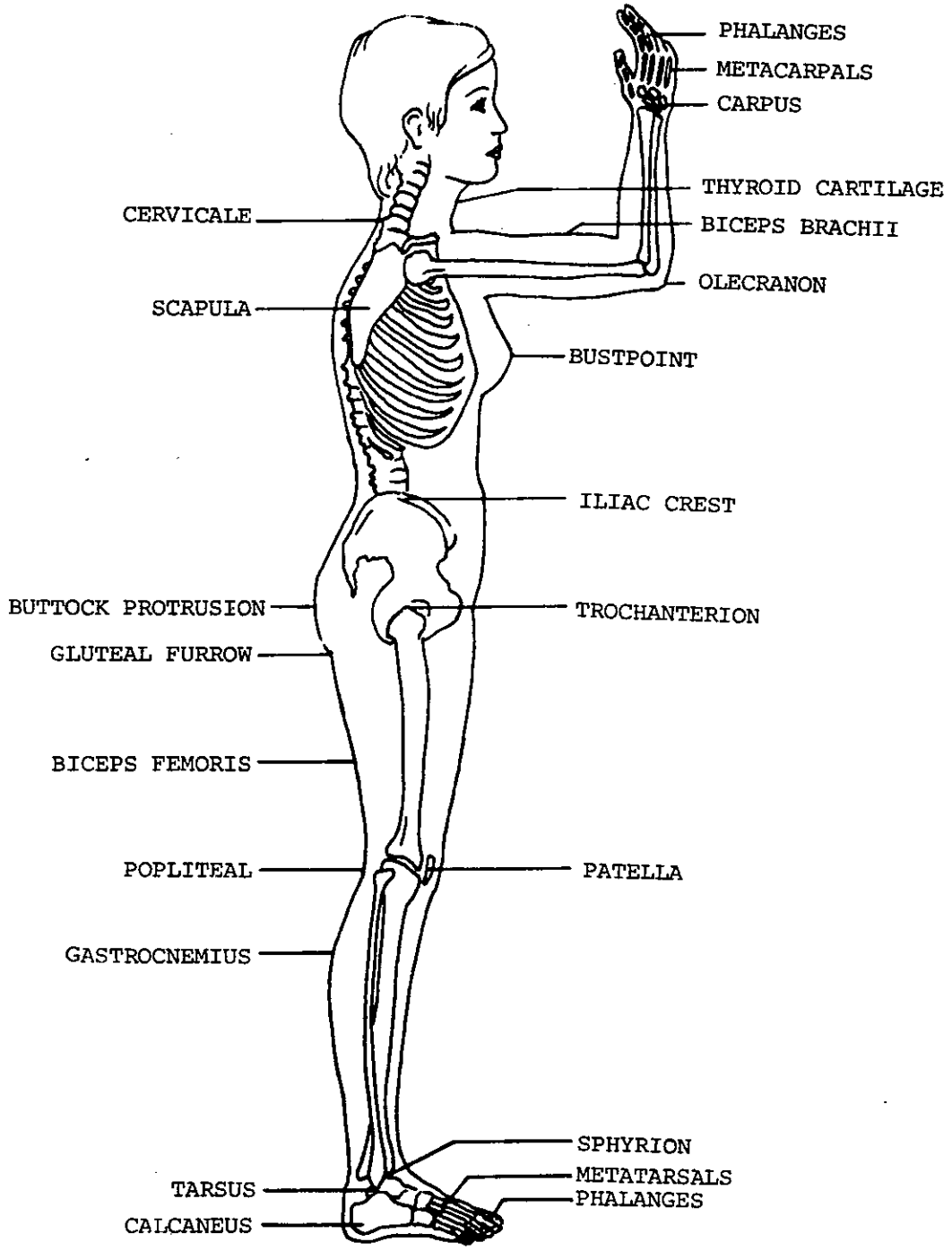


Figure 7a. Landmarks, anatomical points, and skeletal segments, Survey of Army Women, 1976/77.

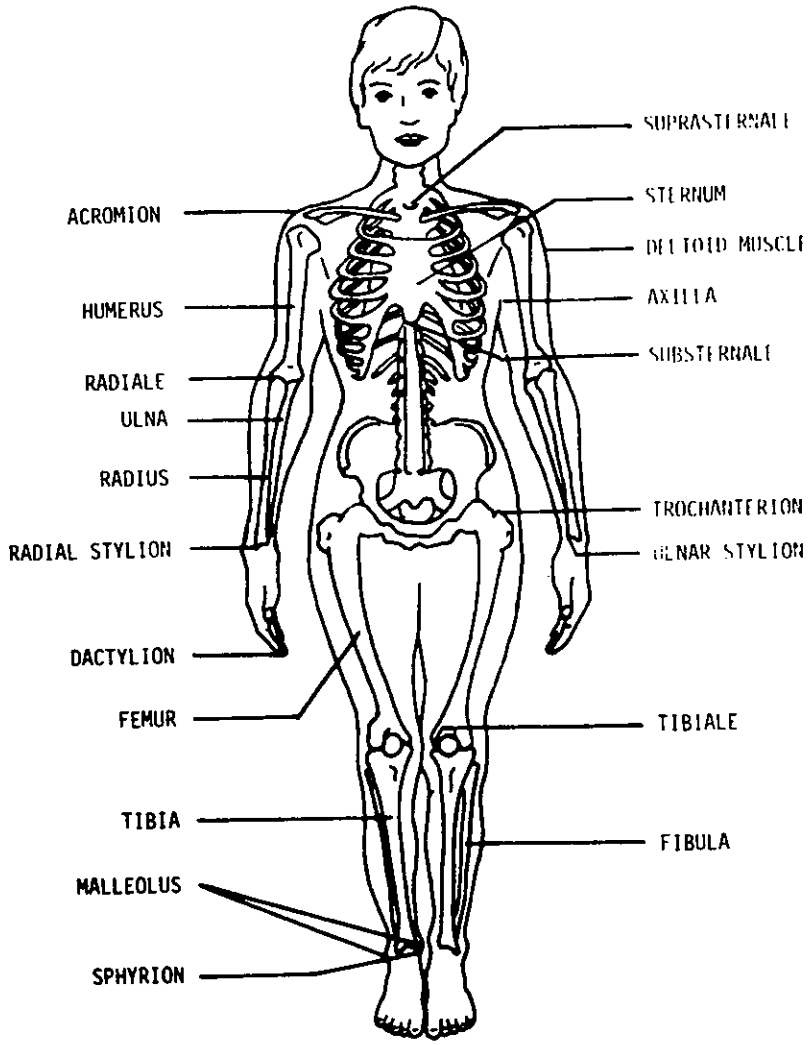


Figure 7b. Landmarks, anatomical points, and skeletal segments, Survey of Army Women, 1976/77.

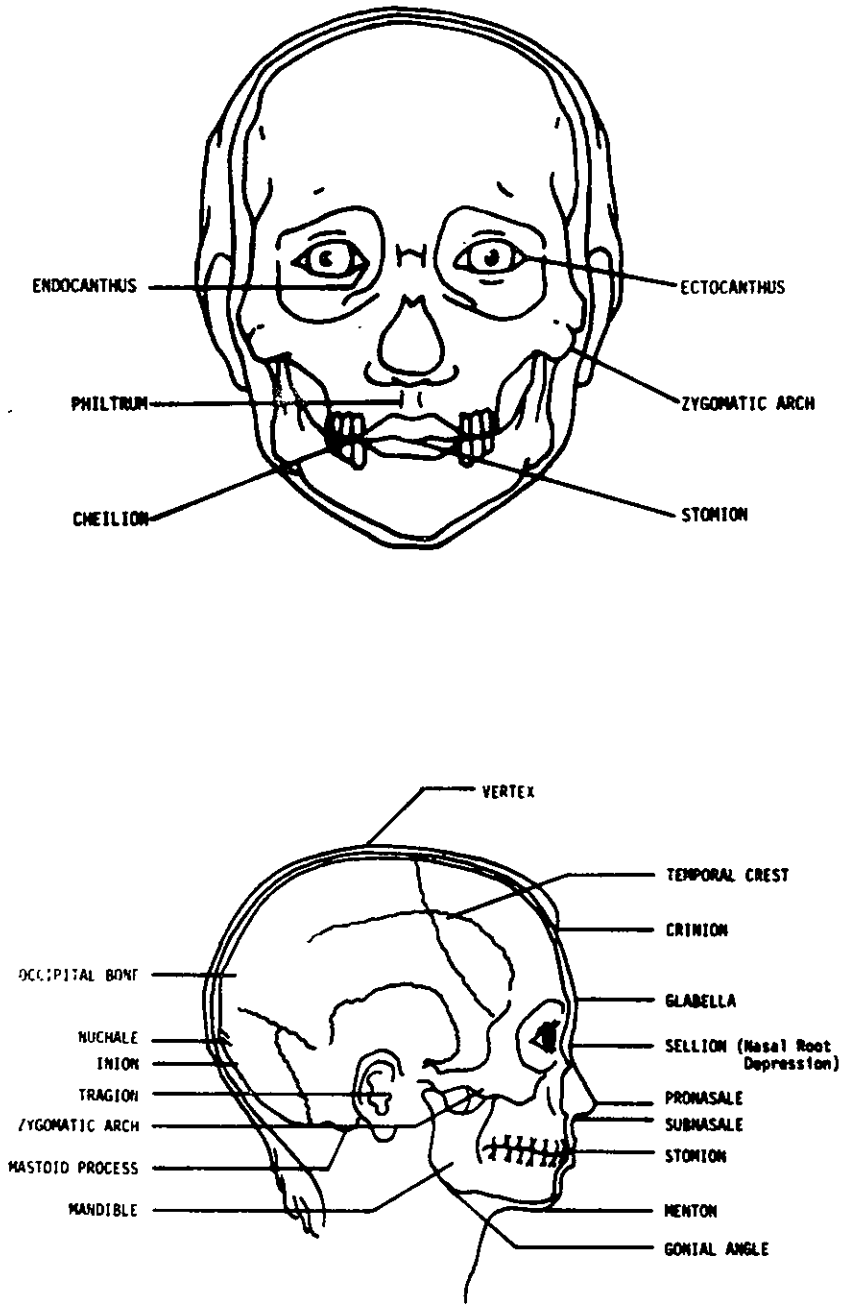


Figure 7c. Landmarks, anatomical points, and skeletal segments, Survey of Army Women, 1976/77.

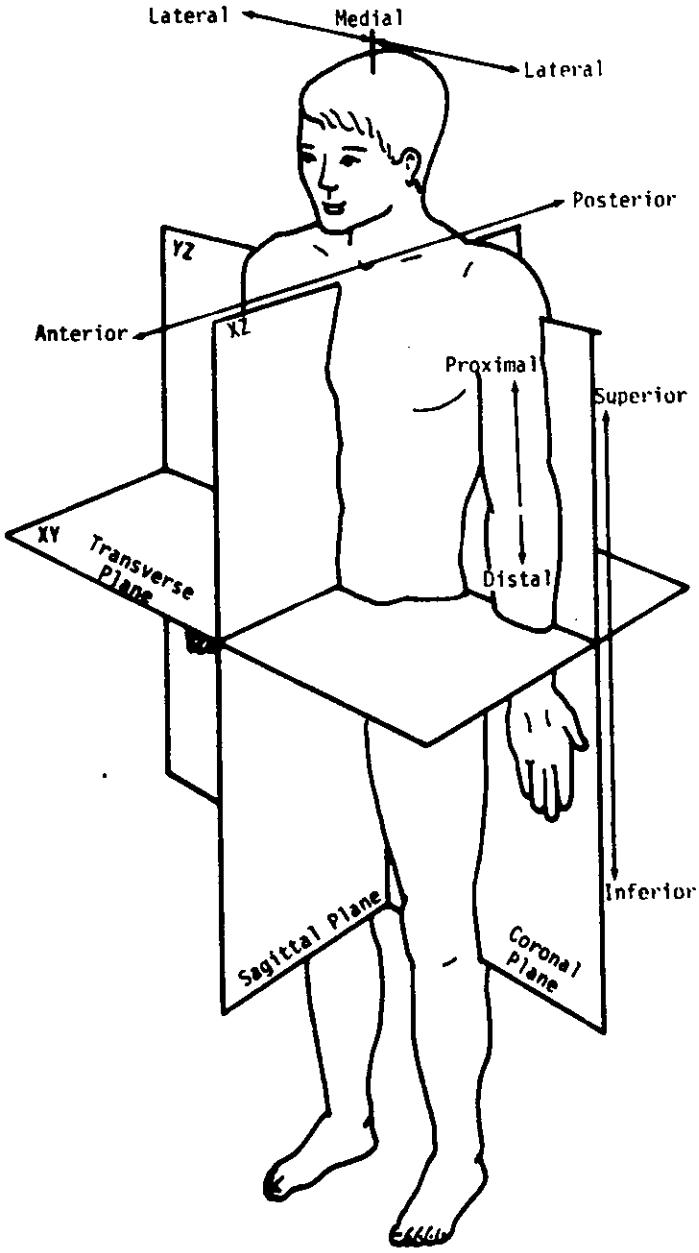
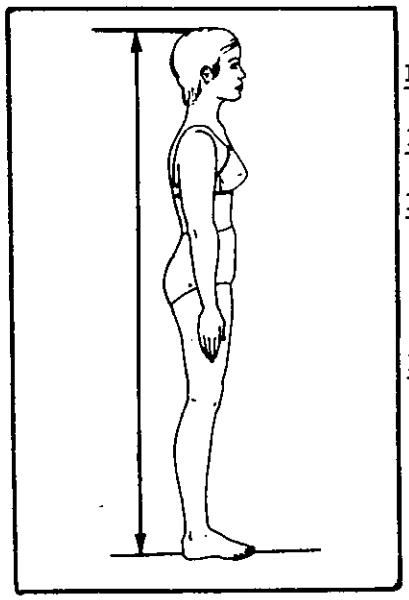


Figure 8. Major anatomical planes.

THE CORE MEASUREMENTS



1. STATURE

Landmark: None.

Instrument: Anthropometer.

Position of Subject: Subject stands erect, looking straight ahead, heels together, and weight distributed equally on both feet.

Procedure: With the arm of the anthropometer firmly touching the scalp, measure the vertical distance from the standing surface to the top of the head.

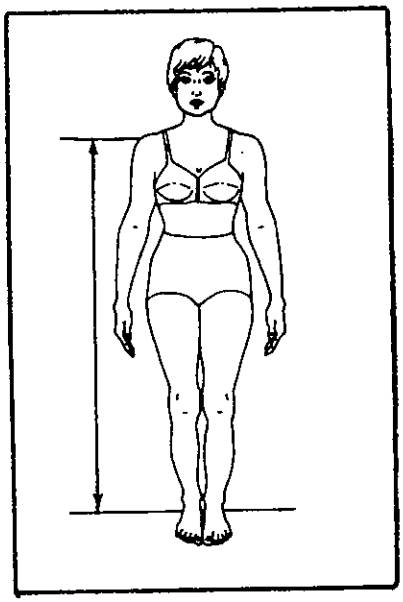
2. SHOULDER (ACROMIALE) HEIGHT

Landmark: Acromiale.

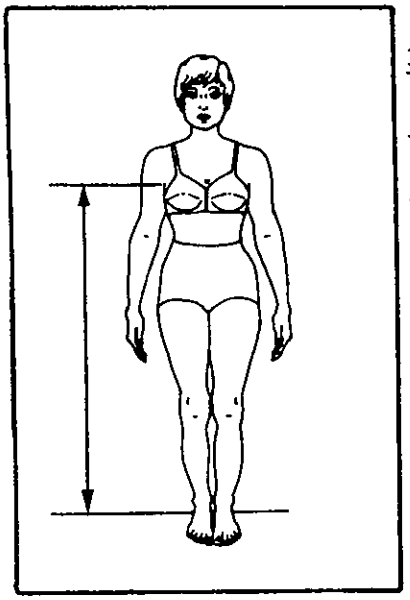
Instrument: Anthropometer.

Position of Subject: Subject stands erect, looking straight ahead, heels together, and weight distributed equally on both feet.

Procedure: With an anthropometer, measure the vertical distance from the standing surface to the acromial landmark.



3. AXILLA HEIGHT



Landmark: Axilla, anterior.

Instrument: Anthropometer.

Position of Subject: Subject stands erect, looking straight ahead, heels together, and weight distributed equally on both feet.

Procedure: With an anthropometer, measure the vertical distance from the standing surface to the anterior axillary fold.

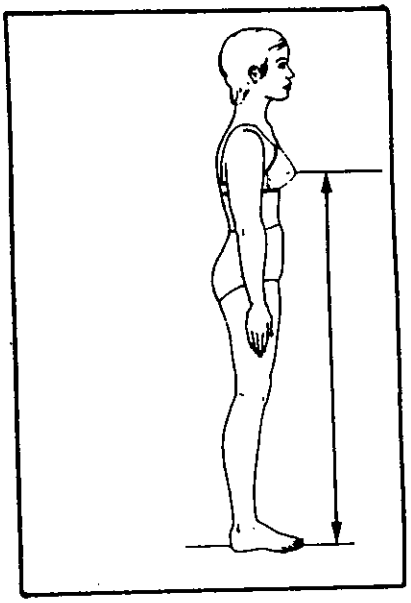
4. BUSTPOINT HEIGHT

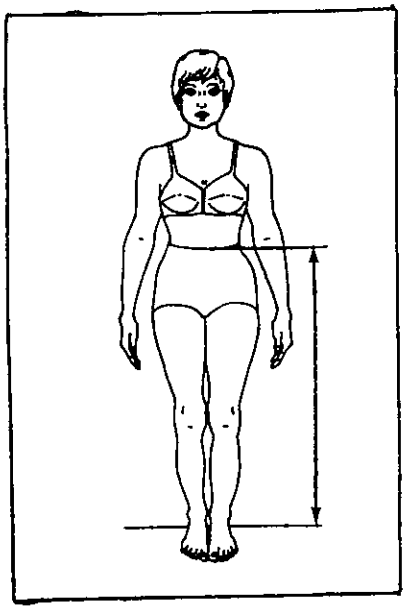
Landmark: Bustpoint.

Instrument: Anthropometer.

Position of Subject: Subject stands erect, looking straight ahead, heels together, and weight distributed equally on both feet.

Procedure: With an anthropometer, measure the vertical distance from the standing surface to the bustpoint landmark.





5. WAIST HEIGHT

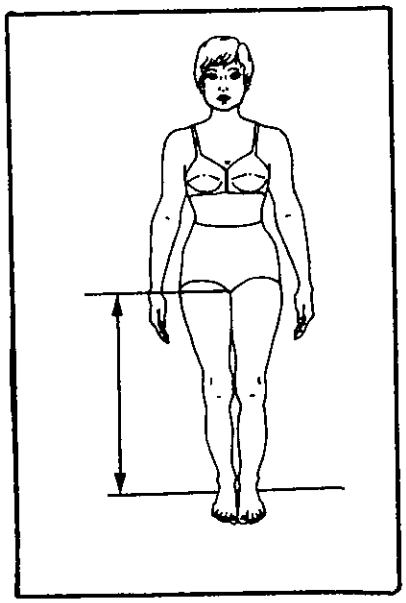
Landmark: Waist, anterior.

Instrument: Anthropometer.

Position of Subject: Subject stands erect, looking straight ahead, heels together, and weight distributed equally on both feet.

Procedure: With an anthropometer, measure the vertical distance from the standing surface to the anterior waist landmark.

6. CROTCH HEIGHT



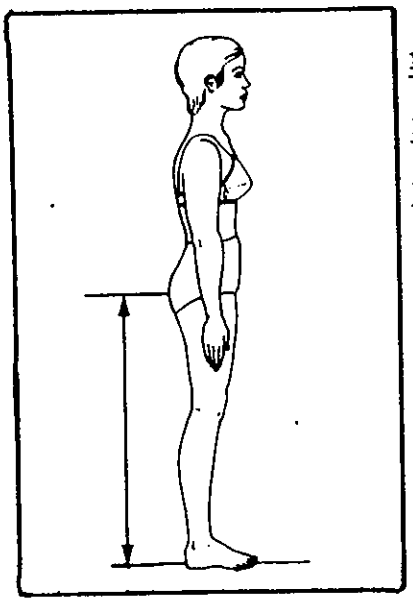
Landmark: None.

Instrument: Anthropometer.

Initial Position of Subject: Subject stands erect, looking straight ahead, heels approximately 10 cm apart, and weight distributed equally on both feet.

Procedure: Hold the anthropometer in front of the subject and raise the arm of the anthropometer up into the crotch until contact is made. Request the subject to bring her heels together while maintaining the contact of the anthropometer arm in the crotch. Record the reading of the anthropometer. During the statistical computations, 1 cm, the width of the blade of the anthropometer, will be added to the recorded value since it represents the height of the blade's lower edge.

7. BUTTOCK HEIGHT



Landmark: Buttock, maximal protrusion.

Instrument: Anthropometer.

Position of Subject: Subject stands erect, looking straight ahead, heels together, and weight distributed equally on both feet.

Procedure: With an anthropometer, measure the vertical distance from the standing surface to the buttock landmark.

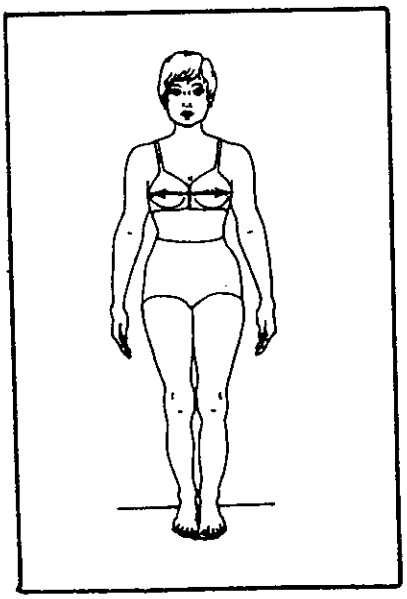
8. CHEST BREADTH

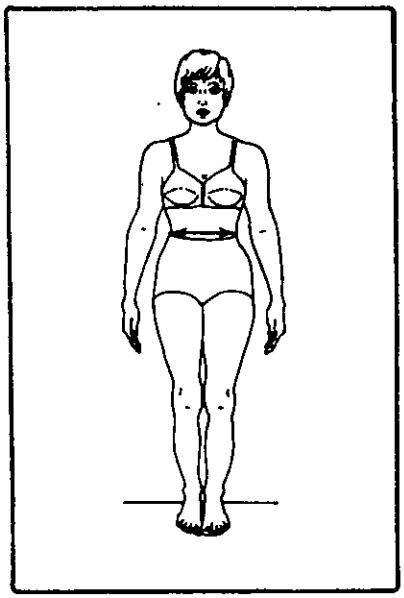
Landmarks: Bustpoints.

Instrument: Beam caliper.

Position of Subject: Subject stands erect, looking straight ahead, with heels together and arms slightly abducted.

Procedure: With a beam caliper, measure the horizontal distance across the torso at the level of the bustpoint landmarks.





9. WAIST BREADTH

Landmarks: Waist level, midaxillary line.

Instrument: Beam caliper.

Position of Subject: Subject stands erect, looking straight ahead, with heels together and arms slightly abducted.

Procedure: With a beam caliper, measure the horizontal breadth across the torso at the level of the waist landmarks.

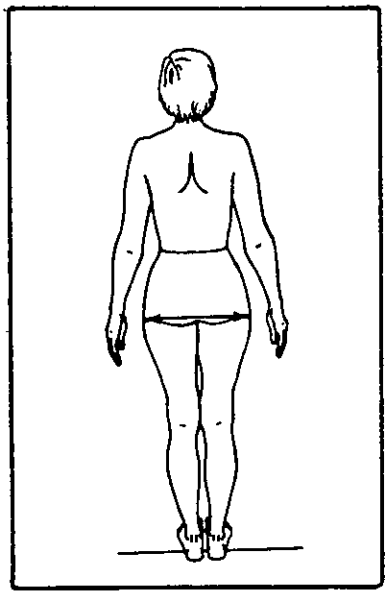
10. HIP BREADTH

Landmarks: Hips, maximal protrusions.

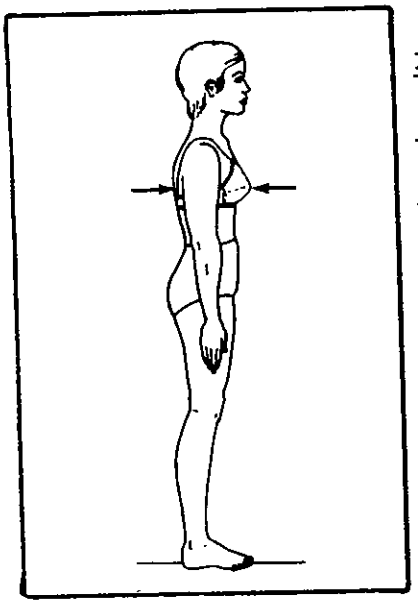
Instrument: Beam caliper.

Position of Subject: Subject stands erect, heels together, and weight distributed equally on both feet.

Procedure: With a beam caliper, measure the maximum horizontal breadth of the hips.



11. BUST DEPTH



Landmark: Bustpoint.

Instrument: Beam caliper.

Position of Subject: Subject stands erect, looking straight ahead, heels together, and weight distributed equally on both feet.

Procedure: With a beam caliper, measure the horizontal distance from the plane of the bustpoints to that of the back. The reading is made at the point of maximum quiet respiration.

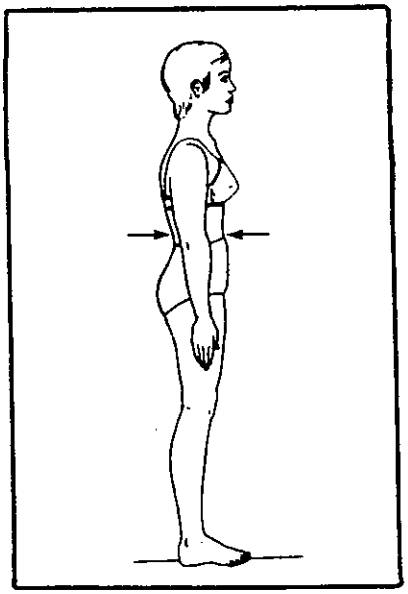
12. WAIST DEPTH

Landmarks: Waist level, anterior and posterior.

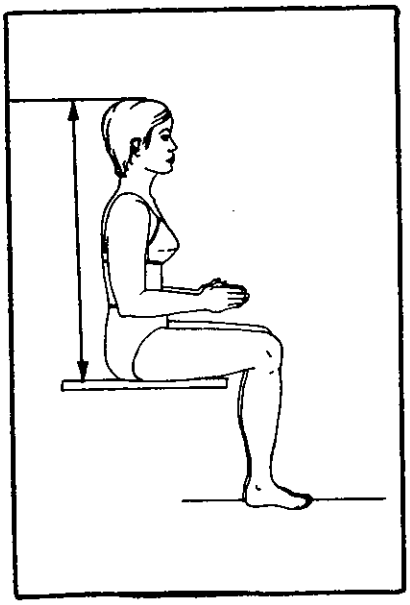
Instrument: Beam caliper.

Position of Subject: Subject stands erect, looking straight ahead, arms at sides, heels together, and weight distributed equally on both feet.

Procedure: With a beam caliper, measure the depth of the torso between the anterior and posterior waist landmarks. The reading is made at the point of maximum quiet respiration.



13. SITTING HEIGHT



Landmark: None.

Instrument: Anthropometer.

Position of Subject: Subject sits erect with her head in the Frankfort plane.

Procedure: With the anthropometer arm firmly touching the scalp, measure the vertical distance from the sitting surface to the top of the head.

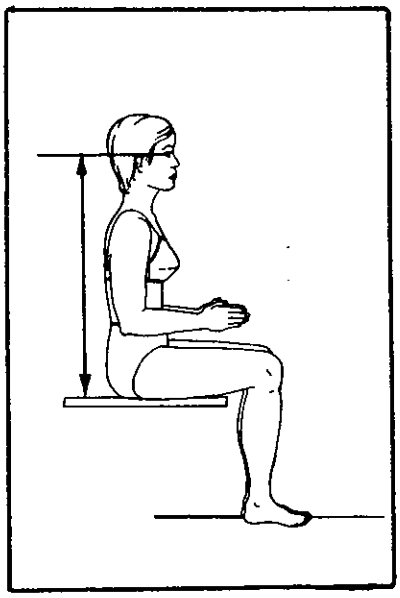
14. EYE HEIGHT, SITTING

Landmark: Ectocanthus.

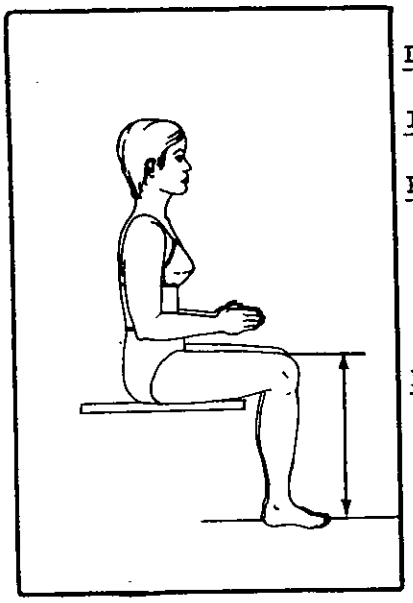
Instrument: Anthropometer.

Position of Subject: Subject sits erect with her head in the Frankfort plane and her eyes closed.

Procedure: With an anthropometer, measure the vertical distance from the sitting surface to the right ectocanthus.



15. KNEE HEIGHT, SITTING



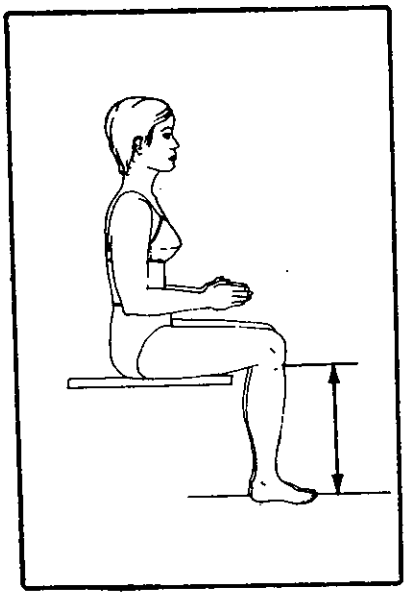
Landmark: None.

Instrument: Anthropometer.

Position of Subject: Subject sits erect on a flat surface, looking straight ahead, feet on a platform which is adjusted so that the knees are flexed 90°, and the thighs parallel.

Procedure: With an anthropometer, measure the vertical distance from the platform surface to the top of the knee at a point 5 cm proximal to the anterior surface of the patella.

16. POPLITEAL HEIGHT

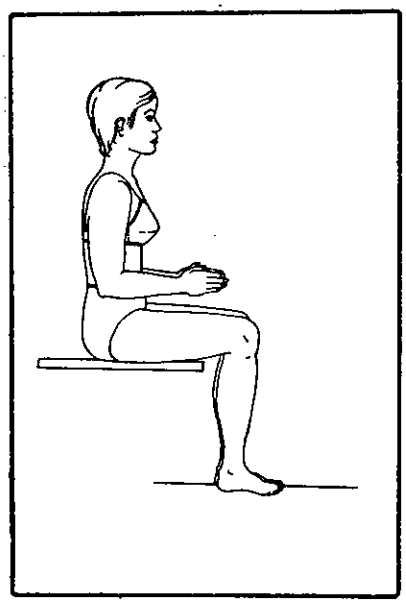


Landmark: None.

Instrument: Anthropometer.

Position of Subject: Subject sits erect on a flat surface, looking straight ahead, feet on a platform which is adjusted so that the knees are flexed 90°, and the thighs parallel.

Procedure: Raise the blade of a vertical anthropometer until it makes firm contact with the lateral underside of the thigh at a point contiguous to where the tendon of the biceps femoris muscle joins the lower leg and record the indicated height. One centimeter, the width of the blade, is added during the statistical analysis to the recorded value.



17. SHOULDER-ELBOW LENGTH

Landmarks: Acromiale and olecranon, inferior tip.

Instrument: Beam caliper.

Position of Subject: Subject sits erect, looking straight ahead, upper arms hanging relaxed, forearms and hands extended forward horizontally.

Procedure: With a beam caliper, measure the vertical distance of the long axis of the upper arm from acromion to the inferior tip of the olecranon process of the elbow.

18. ELBOW-FINGERTIP LENGTH

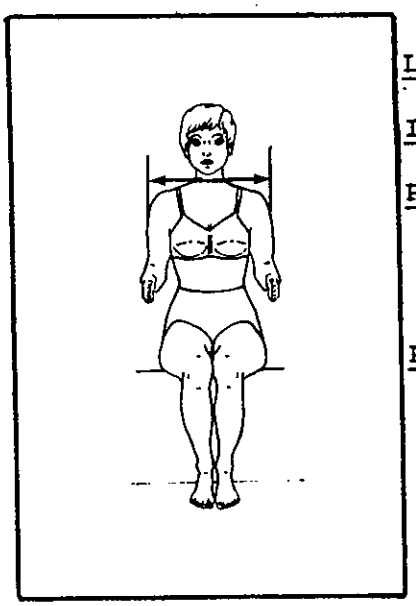
Landmarks: Olecranon, posterior tip and dactylion.

Instrument: Beam caliper.

Position of Subject: Subject sits erect, looking straight ahead, upper arms hanging relaxed, forearms and hands extended forward horizontally.

Procedure: With a beam caliper, measure the horizontal distance along the long axis of the forearm and hand from the posterior tip of the olecranon process to dactylion.

19. SHOULDER (BIDELTOID) BREADTH



Landmarks: Deltoids, right and left.

Instrument: Beam caliper.

Position of Subject: Subject sits erect, looking straight ahead, upper arms hanging relaxed, forearms and hands extended forward horizontally.

Procedure: With a beam caliper, measure the distance across the body at the level of the deltoid landmarks.

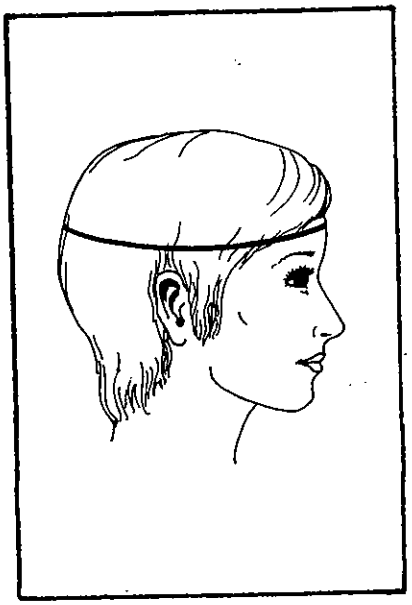
20. BUTTOCK-KNEE LENGTH

Landmark: Buttock, maximum protrusion.

Instrument: Beam caliper.

Position of Subject: Subject sits erect on a flat surface, looking straight ahead, feet on a platform which is adjusted so that the knees are together and flexed 90°.

Procedure: With a beam caliper held parallel to the long axis of the thigh, measure the horizontal distance from the most posterior aspect of the right buttock to the most anterior aspect of the right knee.



21. HEAD CIRCUMFERENCE

Landmarks: Brow ridges and nuchale.

Instrument: Tape.

Position of Subject: Subject sits.

Procedure: With a tape passing above the brow ridges and nuchale, measure the maximum circumference of the head.

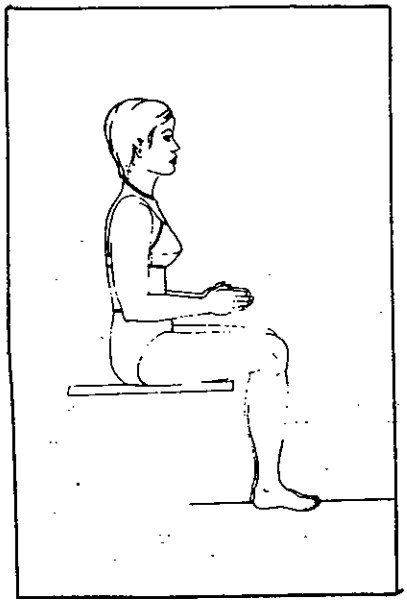
22. NECK CIRCUMFERENCE

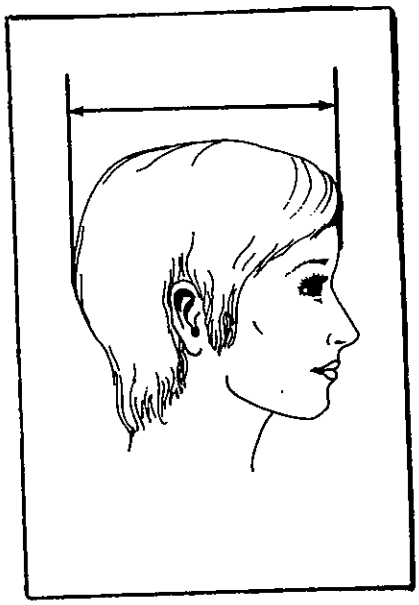
Landmarks: Neck marks.

Instrument: Tape.

Position of Subject: Subject sits erect, head in the Frankfort plane.

Procedure: Measure the circumference of the neck with a tape which is placed around the neck so that it passes over the neck marks. Note that the plane of this circumference is not perpendicular to the long axis of the neck.





23. HEAD LENGTH

Landmarks: Glabella and occiput.

Instrument: Spreading caliper.

Position of Subject: Subject sits erect.

Procedure: With a spreading caliper, measure in the midsagittal plane the maximum length of the head between the glabella landmark and the occiput.

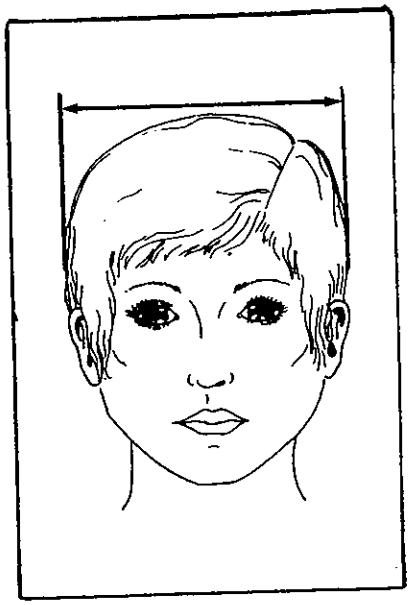
24. HEAD BREADTH

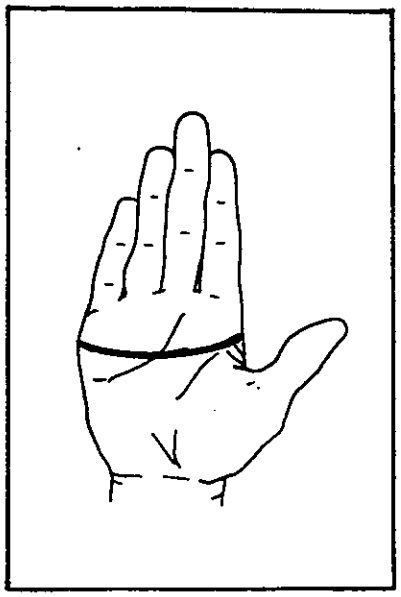
Landmark: None.

Instrument: Spreading caliper.

Position of Subject: Subject sits erect.

Procedure: With a spreading caliper, measure the maximum horizontal breadth of the head above the level of the ears.





25. HAND CIRCUMFERENCE

Landmarks: Metacarpal-phalangeal joints II and V.

Instrument: Tape.

Position of Subject: Subject sits, right hand flat on a table, palm down, with fingers extended and thumb abducted.

Procedure: With a tape measure passing over the metacarpal-phalangeal joints at II and V, measure the circumference of the hand.

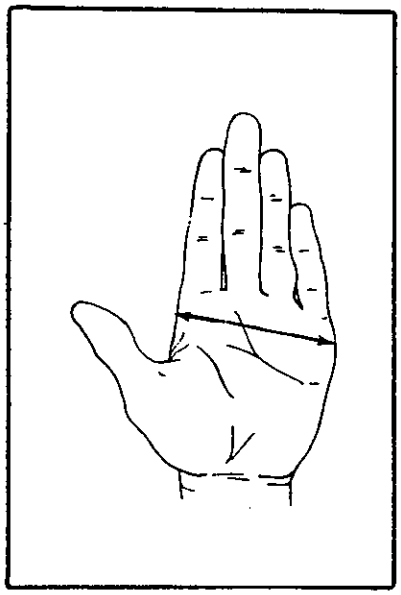
26. HAND BREADTH

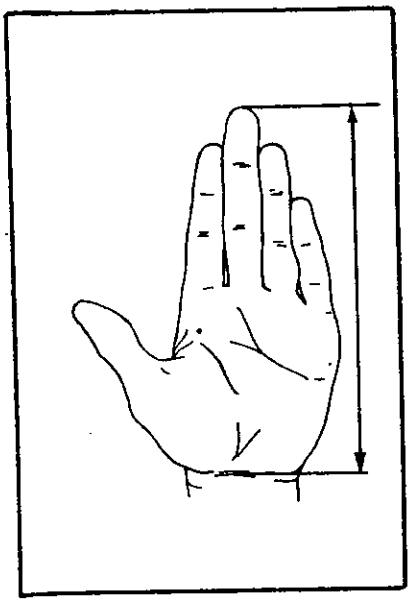
Landmarks: Metacarpal-phalangeal joints II and V.

Instrument: Sliding caliper.

Position of Subject: Subject sits, hand flat on a table, palm down. The fingers are together and straight but not hyper-extended.

Procedure: With a sliding caliper, measure the breadth of the hand between metacarpal-phalangeal joints II and V.





27. HAND LENGTH

Landmarks: Wrist crease and dactylion.

Instrument: Sliding caliper.

Position of Subject: Subject sits, hand flat on a table, palm up. The fingers are together and straight but not hyper-extended.

Procedure: With the bar of a sliding caliper parallel to the long axis of the hand, measure the distance from the wrist crease to dactylion.

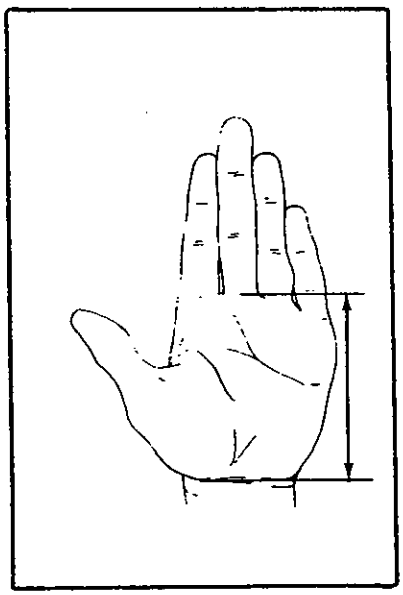
28. PALM LENGTH

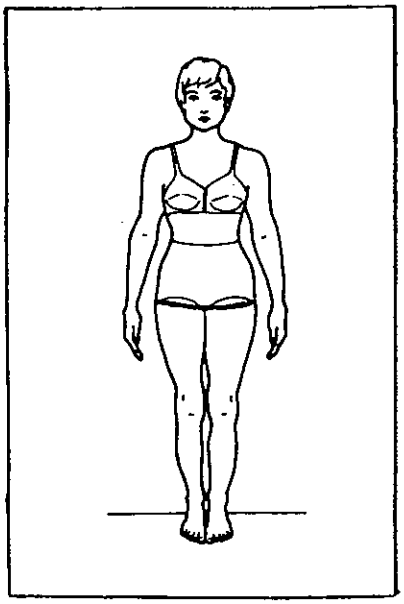
Landmarks: Wrist crease and palm-finger crease III.

Instrument: Sliding caliper.

Position of Subject: Subject sits, hand flat on a table, palm up. The fingers are together but not hyper-extended.

Procedure: With the bar of the sliding caliper parallel to the long axis of the hand, measure the distance from the wrist crease to the skin crease at the base of the middle finger.





29. HIP CIRCUMFERENCE

Landmark: Buttock.

Instrument: Tape.

Position of Subject: Subject stands erect, looking straight ahead, heels together, and weight distributed equally on both feet.

Procedure: A tape is passed around the hips without constriction, at the level of the maximum posterior protrusion of the buttocks, with the plane of the girth at a right angle to the long axis of the trunk. Measure the maximum circumference of the hips at this level.

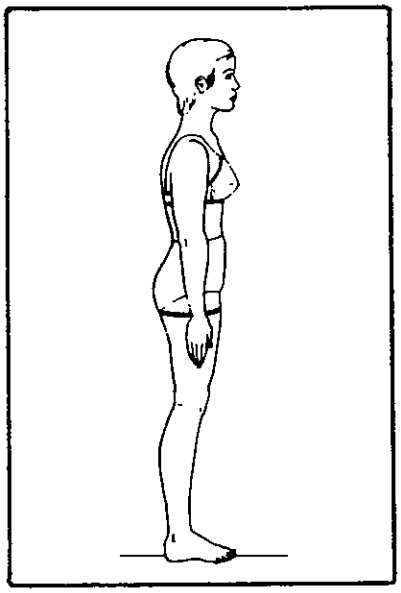
30. UPPER THIGH CIRCUMFERENCE

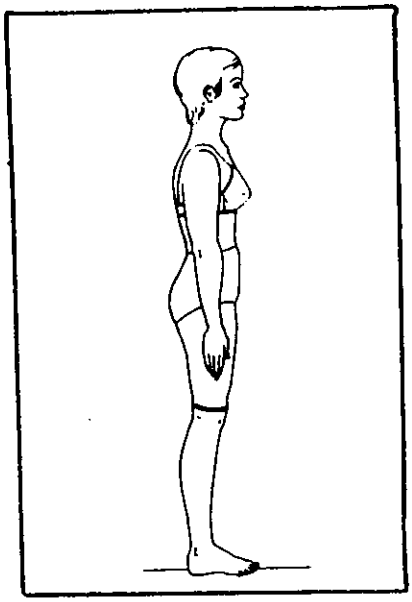
Landmark: Gluteal furrow.

Instrument: Tape.

Position of Subject: Subject stands erect, looking straight ahead, heels together, and weight distributed equally on both feet.

Procedure: With a tape held in a plane perpendicular to the long axis of the thigh, measure the circumference of the thigh at the level of the lowest point on the gluteal furrow. Where the furrow is deeply indented, the measurement is made just distal to the furrow.





31. KNEE CIRCUMFERENCE

Landmark: Midpatella level.

Instrument: Tape.

Position of Subject: Subject stands erect, looking straight ahead, heels approximately 10 cm apart, and weight distributed equally on both feet.

Procedure: With a tape held in a plane perpendicular to the long axis of the leg, measure the circumference of the knee at the level of the midpatella landmark. The subject must not tense her knee during the measurement.

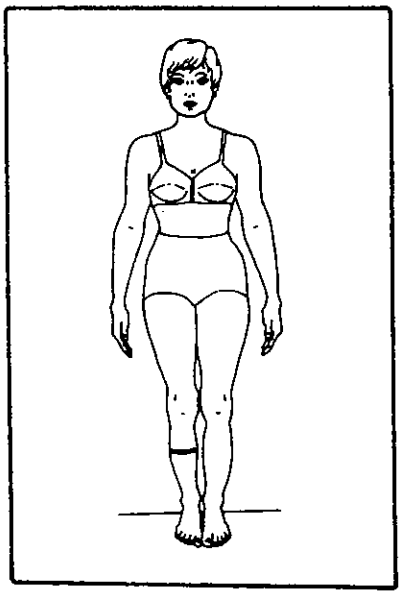
32. CALF CIRCUMFERENCE

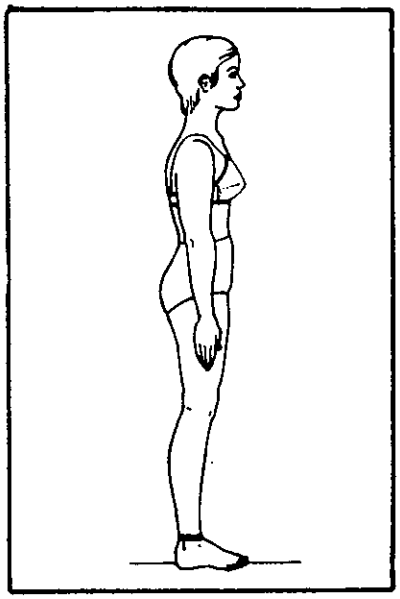
Landmark: Calf, maximal circumference.

Instrument: Tape.

Position of Subject: Subject stands erect, heels approximately 10 cm apart, and weight distributed equally on both feet.

Procedure: With a tape held in a plane perpendicular to the long axis of the lower leg, measure the circumference of the calf at the level of the calf landmark.





33. ANKLE CIRCUMFERENCE

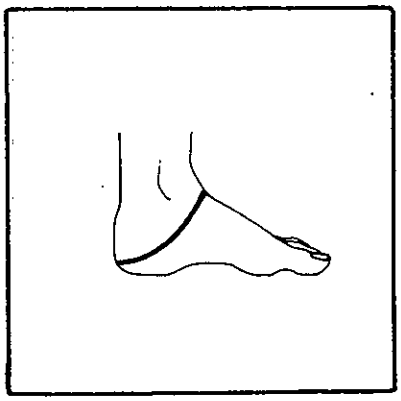
Landmark: Ankle, minimal circumference.

Instrument: Tape.

Position of Subject: Subject stands erect with weight distributed equally on both feet.

Procedure: With a tape held in a plane perpendicular to the long axis of the lower leg, measure the circumference of the leg at the level of the ankle landmark.

34. HEEL-ANKLE CIRCUMFERENCE



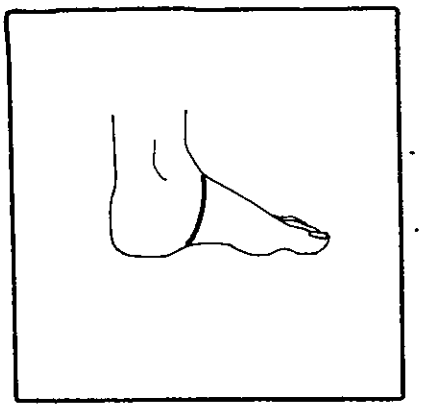
Landmark: None.

Instrument: Tape.

Position of Subject: Subject stands erect, feet slightly apart, and weight distributed equally on both feet.

Procedure: Measure the diagonal circumference of the foot with the tape passing over the throat of the foot and around the base of the heel.

35. INSTEP CIRCUMFERENCE



Landmark: Metatarsal-cuneiform joint.

Instrument: Tape.

Position of Subject: Subject stands, feet slightly apart, and weight distributed equally on both feet.

Procedure: With a tape, measure the circumference of the foot in a plane perpendicular to the long axis of the foot at the mid-instep level. This level is determined from the mid-arch of the foot as viewed from the medial aspect and should coincide with the metatarsal-cuneiform joint.

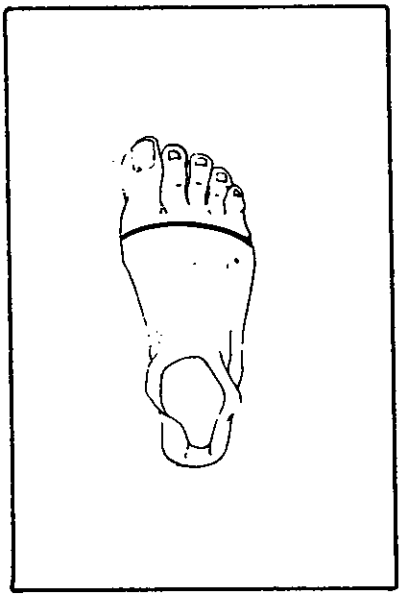
36. FOOT CIRCUMFERENCE

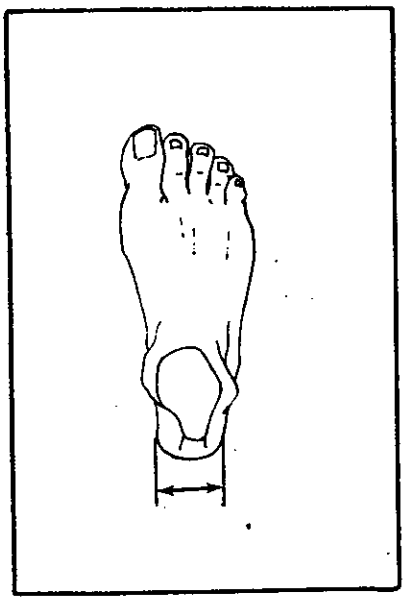
Landmarks: Metatarsal-phalangeal I and V.

Instrument: Tape.

Position of Subject: Subject stands erect, feet slightly apart, and weight distributed equally on both feet.

Procedure: With a tape, measure the circumference of the foot over the distal ends of the metatarsal bones. The measurement is in a plane oblique to the long axis of the foot.





37. HEEL BREADTH

Landmark: None.

Instrument: Sliding caliper.

Position of Subject: Subject stands erect, feet slightly apart, and weight distributed equally on both feet.

Procedure: With a sliding caliper, measure the maximum horizontal breadth of the calcaneus.

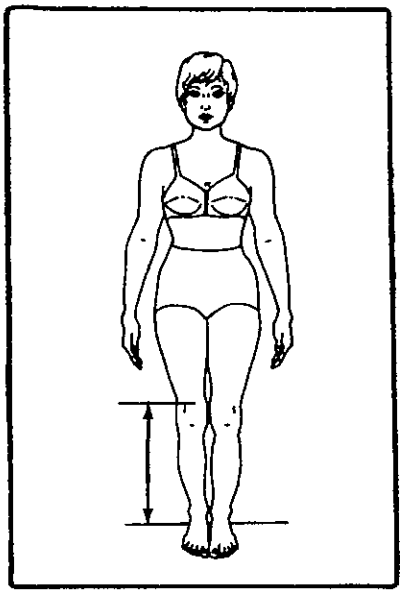
38. KNEECAP HEIGHT

Landmark: Suprapatella.

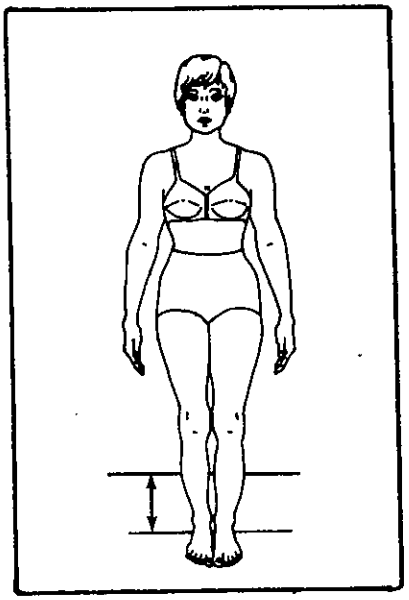
Instrument: Anthropometer.

Position of Subject: Subject stands erect, heels together, and weight distributed equally on both feet.

Procedure: With an anthropometer, measure the vertical distance from the standing surface to the suprapatella landmark on the leg.



39. CALF HEIGHT



Landmark: Calf, maximal circumference.

Instrument: Anthropometer.

Position of Subject: Subject stands erect, heels together, and weight distributed equally on both feet.

Procedure: With an anthropometer, measure the vertical distance from the standing surface to the calf landmark on the leg.

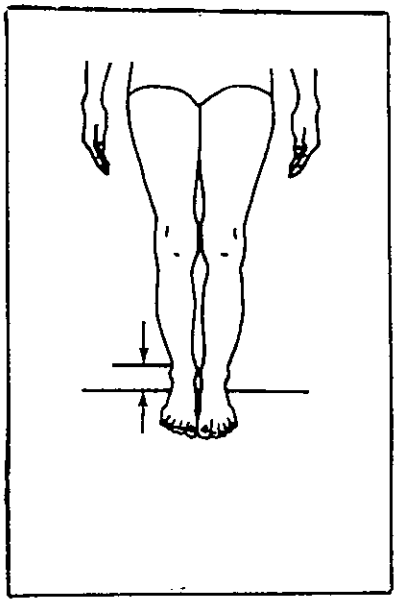
40. ANKLE HEIGHT

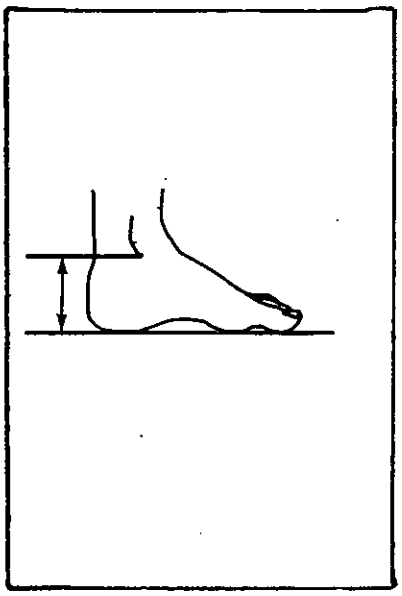
Landmark: Ankle, minimal circumference.

Instrument: Anthropometer.

Position of Subject: Subject stands with weight distributed equally on both feet.

Procedure: With an anthropometer, measure the vertical distance from the standing surface to the ankle landmark on the leg.





41. SPHYRION HEIGHT

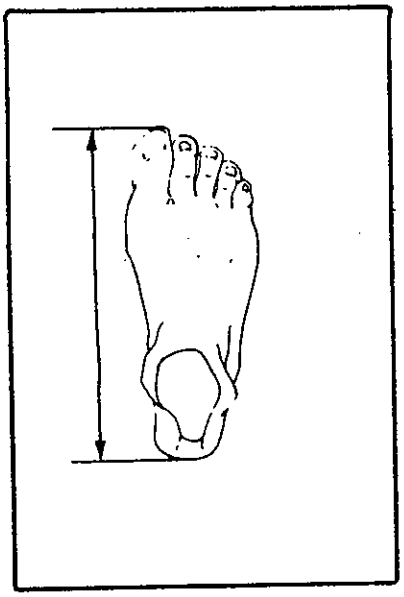
Landmark: Sphyrion.

Instrument: Measuring block.

Position of Subject: Subject stands with weight distributed equally on both feet.

Procedure: With the special measuring block, measure the vertical distance from the standing surface to the sphyrion landmark on the right leg.

42. FOOT LENGTH

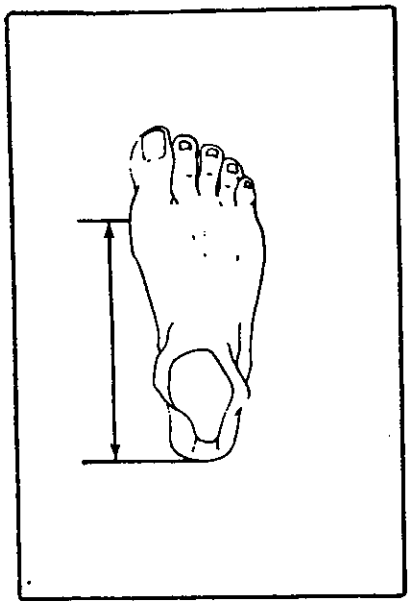


Landmark: None.

Instrument: Footboard and block.

Position of Subject: Subject stands erect, right foot in the measuring box, left foot on a board of equal height, and weight distributed equally. The right foot is positioned so that its long axis is parallel to the side of the box, the heel touches the rear of the box and the lateral metatarsal-phalangeal joint touches the side of the box.

Procedure: With the measuring block touching the tip of the most protruding toe, measure on the scale of the box the length of the foot.



43. INSTEP LENGTH

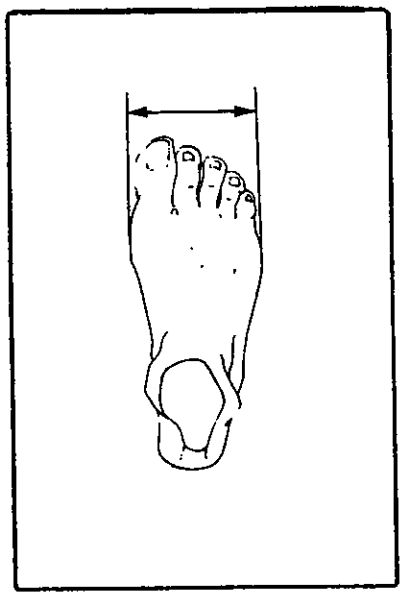
Landmark: Metatarsal-phalangeal I.

Instrument: Footboard and block.

Position of Subject: Subject stands erect, right foot in the measuring box, left foot on a board of equal height, and weight distributed equally. The right foot is positioned so that the heel touches the rear of the box and the lateral metatarsal-phalangeal joint touches its side.

Procedure: With the measuring block touching the metatarsal-phalangeal joint I, measure on the scale of the box the length of the foot from heel to instep.

44. FOOT BREADTH



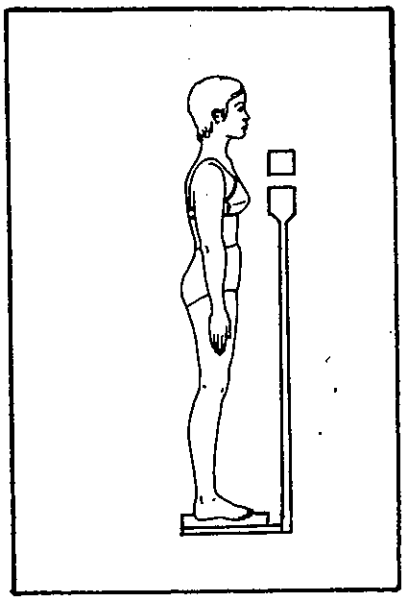
Landmarks: Metatarsal-phalangeal I and V.

Instrument: Footboard and block.

Position of Subject: Subject stands erect, right foot in the measuring box, left foot on a board of equal height, and weight distributed equally. The right foot is positioned so that its long axis is parallel to the side of the box, the heel touches the rear of the box, and the lateral metatarsal-phalangeal joint touches the side of the box.

Procedure: With the measuring block touching the widest part of the foot, measure on the scale of the box the breadth of the foot.

45. WEIGHT



Landmark: None.

Instrument: Balance type scales.

Position of Subject: Subject stands on center of scale platform wearing panties and bra.

Procedure: Adjust balance to within one-quarter of a pound and record.

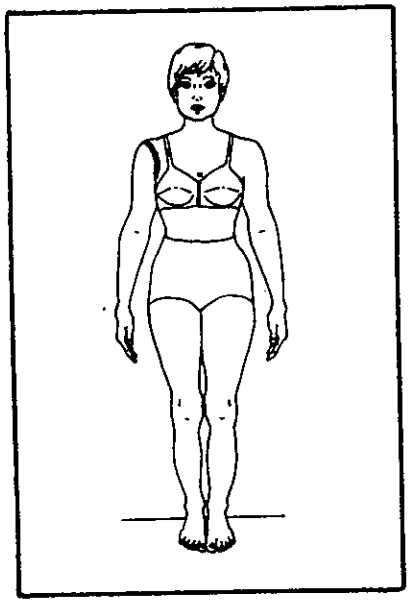
46. ARM SCYE CIRCUMFERENCE

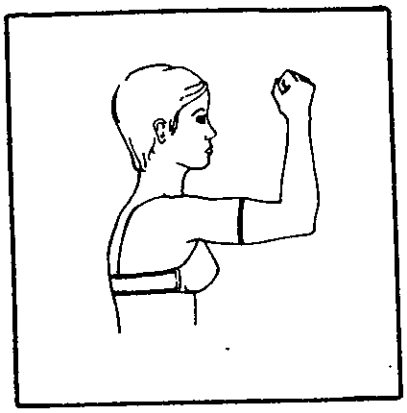
Landmark: Acromiale.

Instrument: Tape.

Position of Subject: Subject stands with shoulder relaxed and her right arm abducted sufficiently to allow clearance of a tape between the arm and trunk.

Procedure: With a tape passing through the axilla and over the right acromial landmark, measure the circumference of the scye. The axillary tissue is not compressed.





47. BICEPS CIRCUMFERENCE, FLEXED

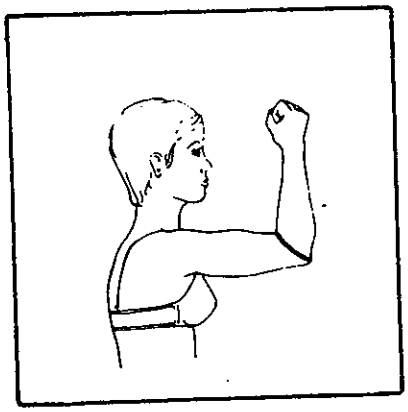
Landmark: Biceps brachii.

Instrument: Tape.

Position of Subject: Subject stands, upper arm raised so that its long axis is horizontal, elbow flexed 90°, biceps strongly contracted, and fist tightly clenched.

Procedure: With a tape held in a plane perpendicular to the long axis of the upper arm, measure the circumference of the arm at the level of the biceps landmark.

48. ELBOW CIRCUMFERENCE, FLEXED

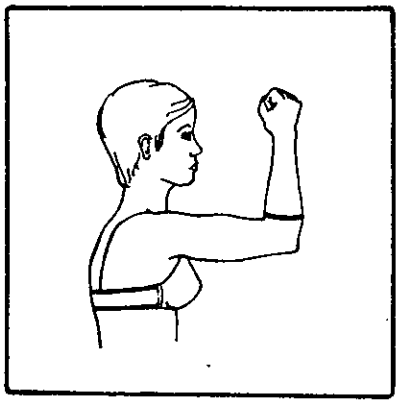


Landmark: Olecranon.

Instrument: Tape.

Position of Subject: Subject stands, upper arm raised so that its long axis is horizontal, elbow flexed 90°, fist tightly clenched and biceps strongly contracted.

Procedure: With a tape passing over the tip and through the crotch of the elbow, measure the circumference of the elbow.



49. FOREARM CIRCUMFERENCE, FLEXED

Landmark: Forearm, maximal circumference.

Instrument: Tape.

Position of Subject: Subject stands, right upper arm raised so that its long axis is horizontal, elbow flexed 90°, and fist tightly clenched.

Procedure: With a tape held in a plane at right angles to the long axis of the lower arm, measure the girth of the lower arm at the level of maximum forearm circumference.

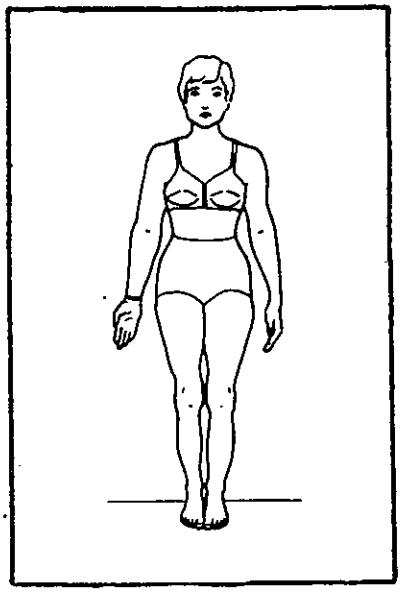
50. WRIST CIRCUMFERENCE

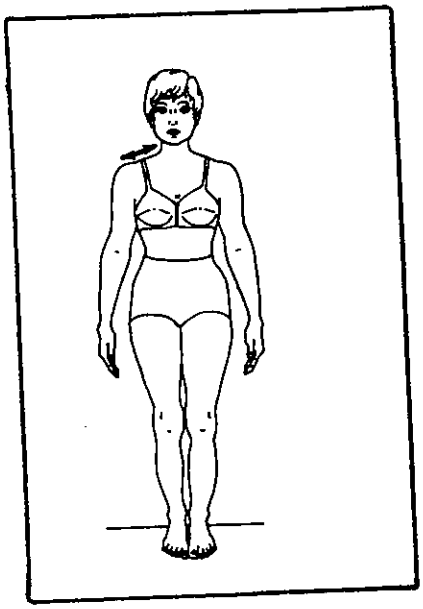
Landmark: Stylion.

Instrument: Tape.

Position of Subject: Subject stands with arm slightly abducted and the hand extended.

Procedure: With a tape held in a plane perpendicular to the long axis of the right forearm and hand, measure the circumference of the wrist at the level of the stylion landmark.





51. SHOULDER LENGTH

Landmarks: Neck, lateral and acromiale.

Instrument: Tape.

Position of Subject: Subject stands erect with the head in the Frankfort plane.

Procedure: With a tape, measure the surface distance along the top of the shoulder from the lateral neck landmark to the acromial landmark.

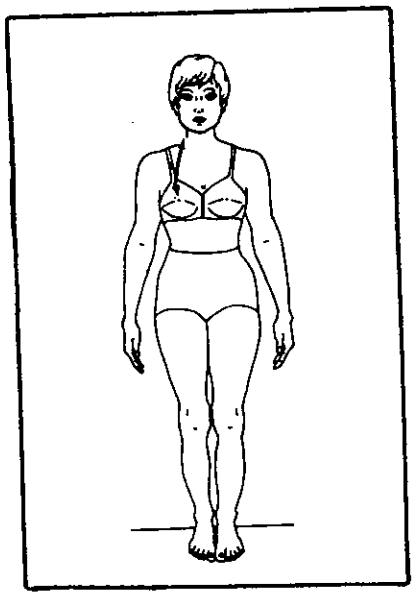
52. NECK TO BUSTPOINT

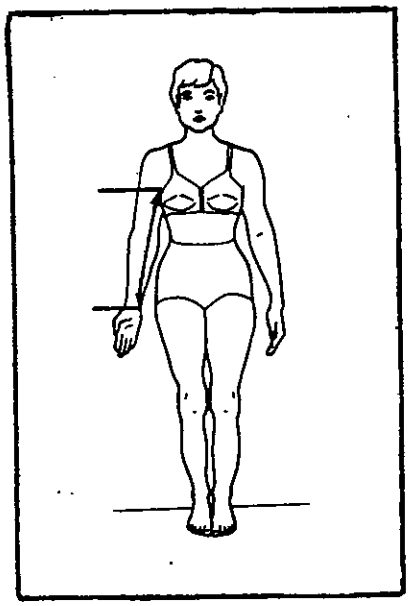
Landmarks: Neck, lateral and bustpoint.

Instrument: Tape.

Position of Subject: Subject stands erect looking straight ahead.

Procedure: With a tape, measure the straight line distance from the lateral neck landmark to the bustpoint landmark. The tape is held tense and does not follow the surface contour of the body.





53. SLEEVE INSEAM LENGTH

Landmarks: Scye, anterior and wrist.

Instrument: Tape.

Position of Subject: Subject stands, right arm slightly abducted and palm forward.

Procedure: With a tape, measure the distance from the anterior scye-point landmark to the ulnar side of the wrist landmark. The tape is held tense and does not follow the surface contour of the arm.

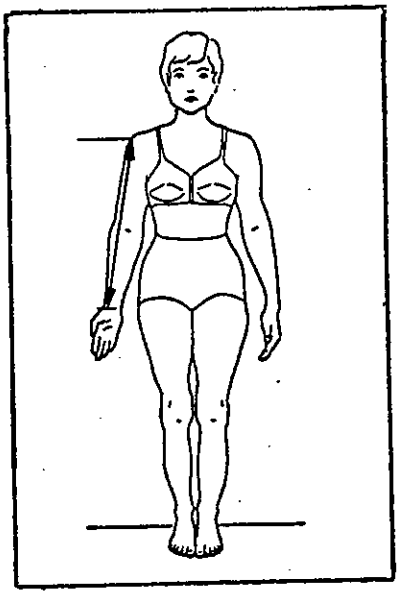
54. SLEEVE OUTSEAM LENGTH

Landmarks: Acromiale and wrist.

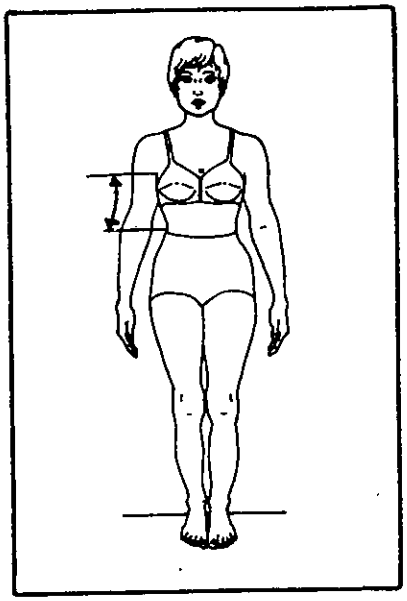
Instrument: Tape.

Position of Subject: Subject stands, right arm slightly abducted and palm forward.

Procedure: With a tape, measure the distance from the acromial landmark to the radial side of the wrist landmark. The tape is held tense and does not follow the surface contour of the arm.



55. AXILLA TO WAIST LEVEL



Landmarks: Axilla fold at midaxillary line and waist level at midaxillary line.

Instrument: Tape.

Position of Subject: Subject stands erect with the arm slightly abducted.

Procedure: With a tape, measure the surface distance in the midaxillary line from the axillary landmark to the waist level.

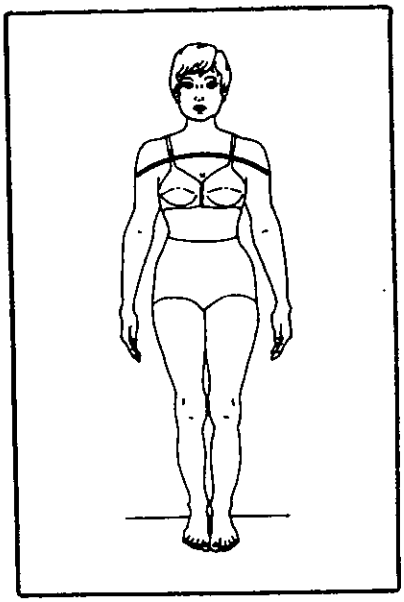
56. SHOULDER CIRCUMFERENCE

Landmark: Deltoid.

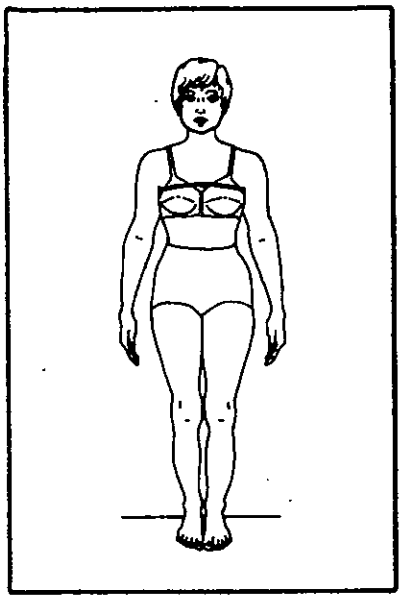
Instrument: Tape.

Position of Subject: Subject stands erect, looking straight ahead, arms relaxed at sides, heels together, and weight distributed equally on both feet.

Procedure: With a tape held in a horizontal plane, measure the circumference of the body at the level of the right deltoid landmark.



57. CHEST CIRCUMFERENCE AT SCYE



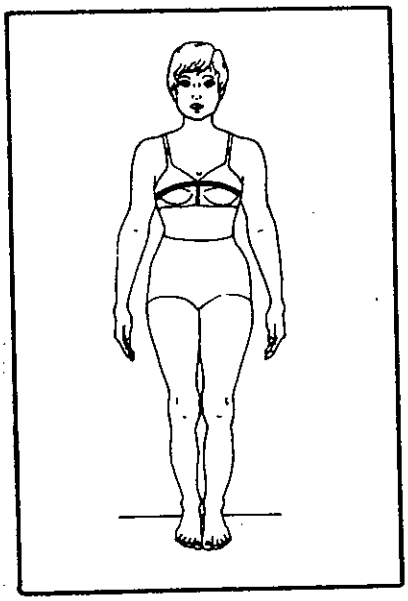
Landmark: Scye.

Instrument: Tape.

Position of Subject: Subject stands erect, looking straight ahead, heels together, weight distributed equally on both feet, shoulders relaxed, and arms abducted sufficiently to allow passage of a tape between arms and trunk.

Procedure: With a tape, measure the circumference of the trunk at the level of the horizontal scye landmark. The reading is made at the point of maximum quiet respiration.

58. BUST CIRCUMFERENCE

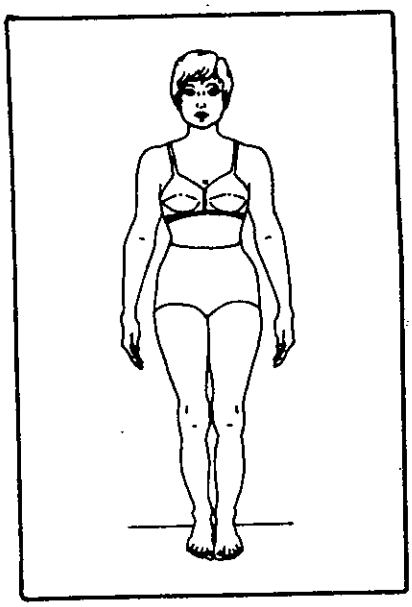


Landmarks: Bust point level.

Instrument: Tape.

Position of Subject: Subject stands erect, looking straight ahead, heels together, and weight distributed equally on both feet. The arms are abducted sufficiently to allow clearance of a tape between the arms and trunk.

Procedure: With a tape passing over the bustpoint, measure the circumference of the trunk. The reading is made at the point of maximum quiet respiration.



59. CHEST CIRCUMFERENCE BELOW BUST

Landmark: None.

Instrument: Tape.

Position of Subject: Subject stands erect, looking straight ahead, heels together, and weight distributed equally on both feet. The arms are abducted sufficiently to allow clearance of a tape between the arms and trunk.

Procedure: With a tape held in a horizontal plane, measure the circumference of the trunk at a level just below the cups of the bra. The reading is made at the point of maximum quiet respiration.

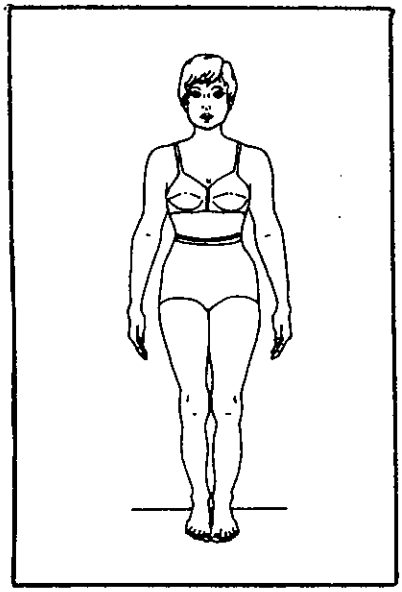
60. WAIST CIRCUMFERENCE

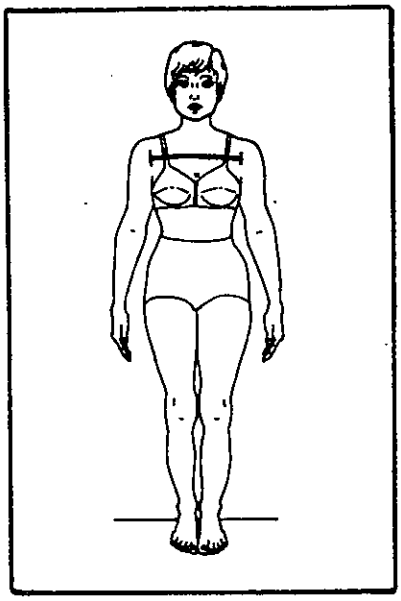
Landmark: Waist level.

Instrument: Tape.

Position of Subject: Subject stands erect, looking straight ahead, heels together, and weight distributed equally on both feet.

Procedure: With a tape passing over the waist landmarks, measure the circumference of the trunk. The reading is made at the point of maximum quiet respiration.





61. INTERSCYE FRONT

Landmarks: Mid-scye, right and left anterior.

Instrument: Tape.

Position of Subject: Subject stands erect, looking straight ahead, arms at side.

Procedure: With a tape, measure the surface distance across the chest between the right and left mid-scye landmarks.

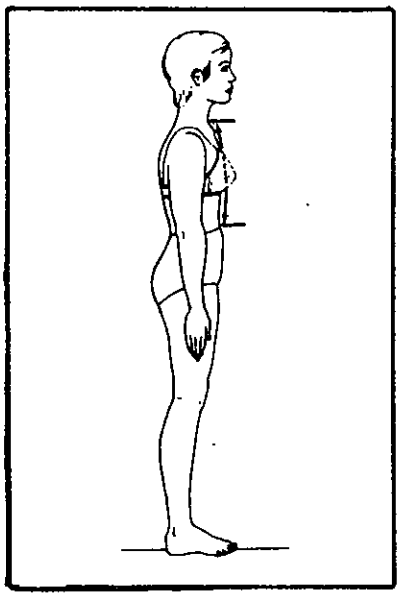
62. WAIST FRONT LENGTH

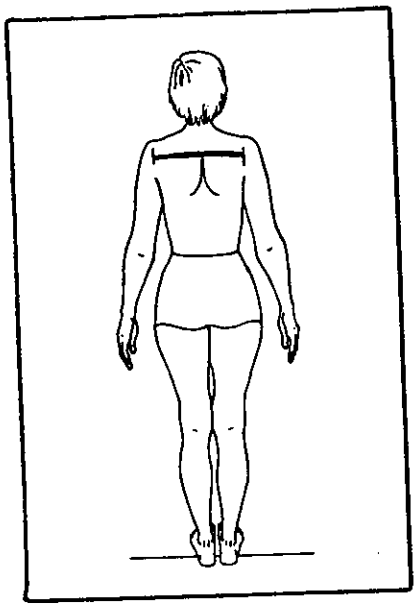
Landmarks: Neck landmark, anterior and waist landmark, anterior.

Instrument: Tape.

Position of Subject: Subject stands erect, looking straight ahead.

Procedure: With a tape, measure the surface distance from the anterior neck landmark to the anterior waist landmark.





63. INTERSCYE BACK

Landmarks: Mid-scye, posterior.

Instrument: Tape.

Position of Subject: Subject stands erect, looking straight ahead, arms at side.

Procedure: With a tape, measure the surface distance across the back between the right and left mid-scye, posterior, landmarks.

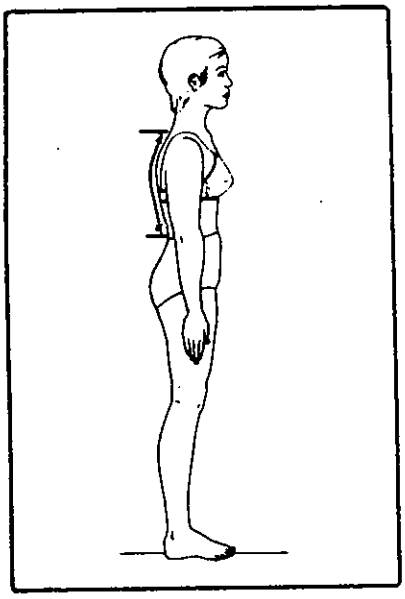
64. WAIST BACK LENGTH

Landmarks: Cervicale and waist, posterior.

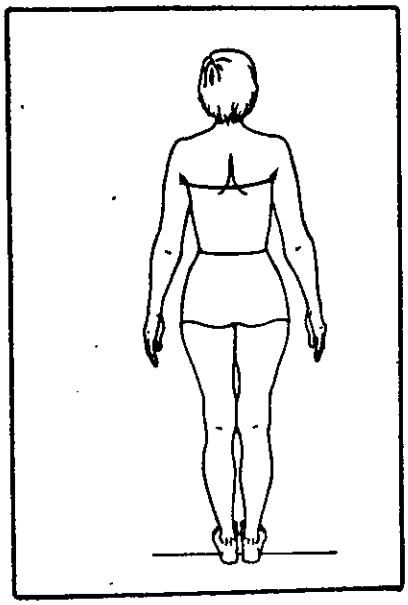
Instrument: Tape.

Position of Subject: Subject stands erect with head in the Frankfort plane.

Procedure: With a tape, measure the surface distance along the spine from the cervicale landmark to the posterior waist landmark.



65. BACK CURVATURE, BUST LEVEL



Landmarks: Midaxillary line and bustpoint level, right and left.

Instrument: Tape.

Position of Subject: Subject stands erect with arms slightly abducted.

Procedure: With a tape, measure the surface distance across the back between the midaxillary landmarks at the level of the bustpoint landmarks.

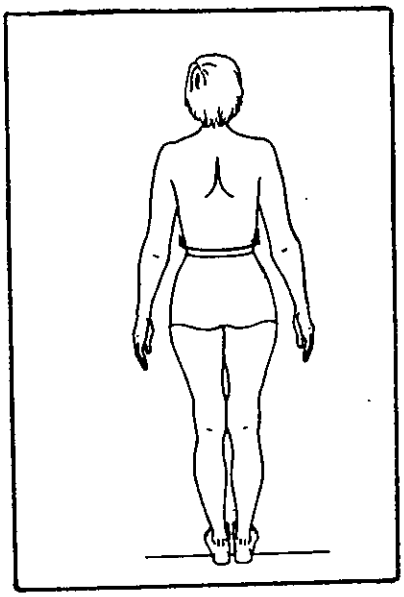
66. BACK CURVATURE, WAIST LEVEL

Landmarks: Waist level, midaxillary line.

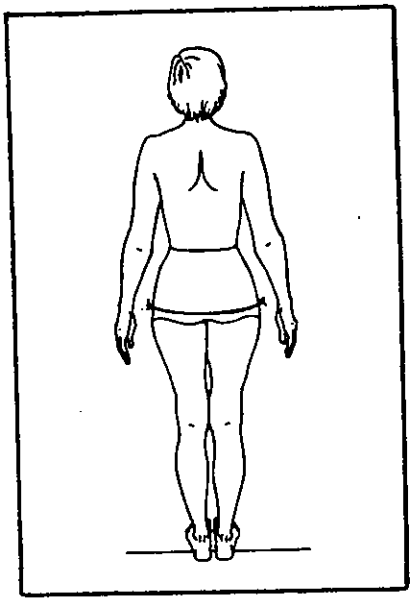
Instrument: Tape.

Position of Subject: Subject stands erect with her arms slightly abducted.

Procedure: With a tape, measure the surface distance across the back between the midaxillary landmarks at the level of the waist landmarks.



67. BACK CURVATURE, HIP LEVEL



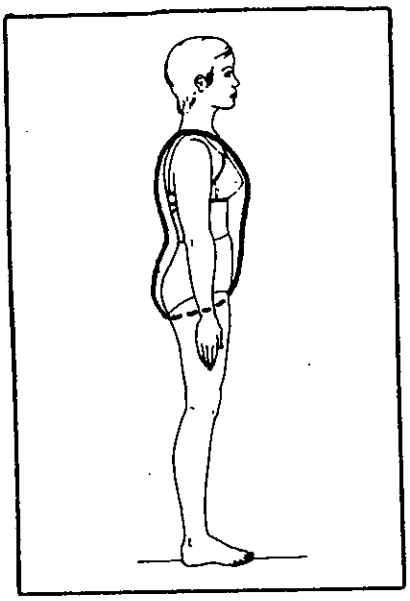
Landmarks: Midaxillary line and buttocks, right and left maximal protrusion.

Instrument: Tape.

Position of Subject: Subject stands erect, arms slightly abducted.

Procedure: With a tape, measure the surface distance across the back between the midaxillary landmarks at the level of the maximum protrusion of the buttocks.

68. VERTICAL TRUNK CIRCUMFERENCE, STANDING



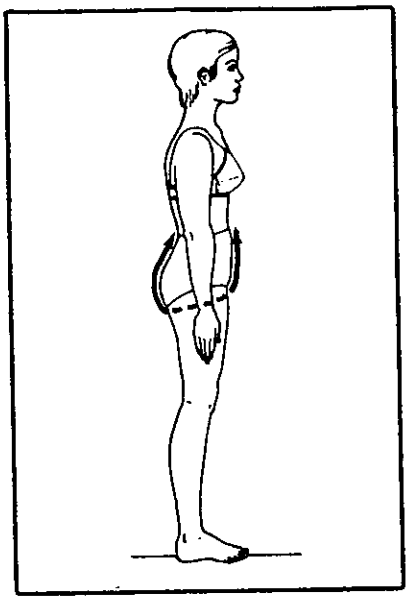
Landmarks: Midshoulder, bustpoint, and buttock, maximal protrusion.

Instrument: Tape.

Initial Position of Subject: Subject stands with legs slightly apart.

Procedure: Pass a length of tape between the legs, over the protrusion of the right buttock, and up the back to lie over the midshoulder landmark. Bring other end of the tape up over the right bustpoint landmark to the midshoulder landmark, completing the circumference. Ask the subject to bring her heels together, maintaining the contact of the tape in the crotch. Holding the tape into the concavity of the back to insure that it follows the posterior body contour, measure the circumference of the trunk. (The tape does not follow the anterior body contour.) The measurement is made at the point of maximum quiet respiration.

69. CROTCH LENGTH



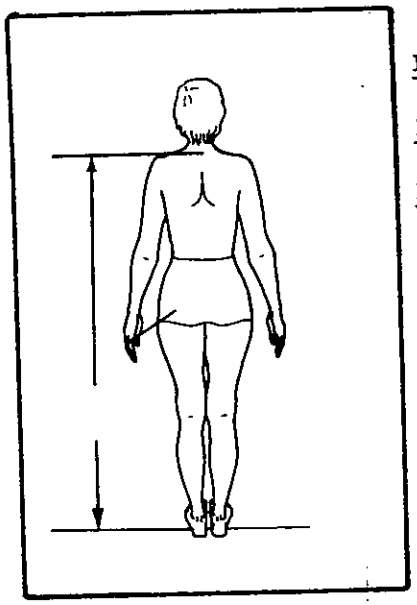
Landmarks: Waist, posterior and anterior and buttock.

Instrument: Tape.

Initial Position of Subject: Subject stands erect, heels approximately 10 centimeters apart, and weight distributed equally on both feet.

Procedure: With a tape, measure the surface distance from the waist level directly above the protuberance of the buttock, across the buttock, through the crotch, and up to the anterior waist landmark after the subject has brought her heels together. Maintain the contact of the tape in the crotch. The tape follows the posterior and anterior body contour.

THE TRADITIONAL ANTHROPOMETRY SUBSERIES



1. CERVICALE HEIGHT

Landmark: Cervicale.

Instrument: Anthropometer.

Position of Subject: Subject stands erect, looking straight ahead, heels together, and weight distributed equally on both feet.

Procedure: With an anthropometer, measure the vertical distance from the standing surface to the cervicale landmark.

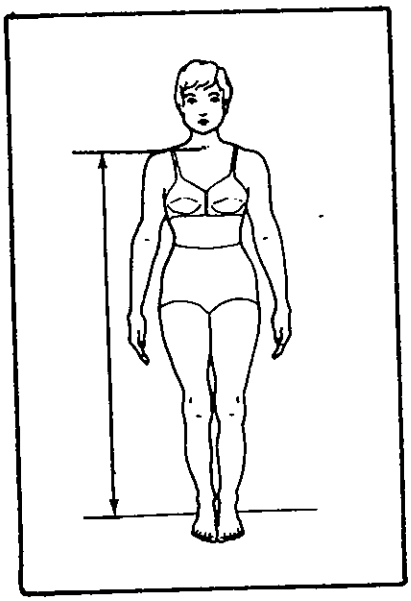
2. SUPRASTERNALE HEIGHT

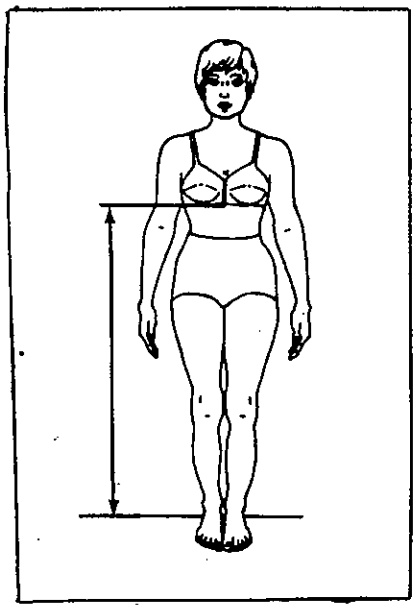
Landmark: Suprasternale.

Instrument: Anthropometer.

Position of Subject: Subject stands erect, looking straight ahead, heels together, and weight distributed equally on both feet.

Procedure: With an anthropometer, measure the vertical distance from the standing surface to the suprasternale landmark.





3. SUBSTERNALE HEIGHT

Landmark: Substernale.

Instrument: Anthropometer.

Position of Subject: Subject stands erect, looking straight ahead, heels together, and weight distributed equally on both feet.

Procedure: With an anthropometer, measure the vertical distance from the standing surface to the substernale landmark.

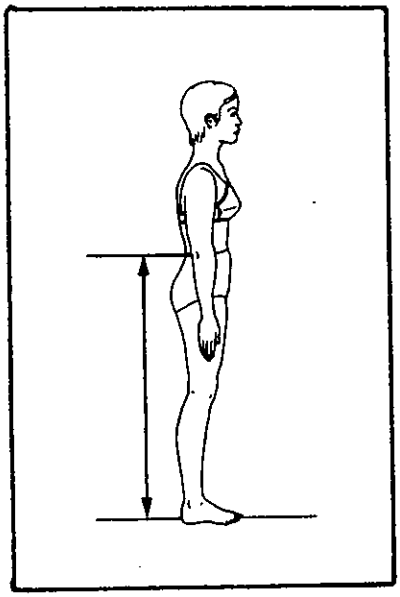
4. ELBOW (RADIALE) HEIGHT

Landmark: Radiale.

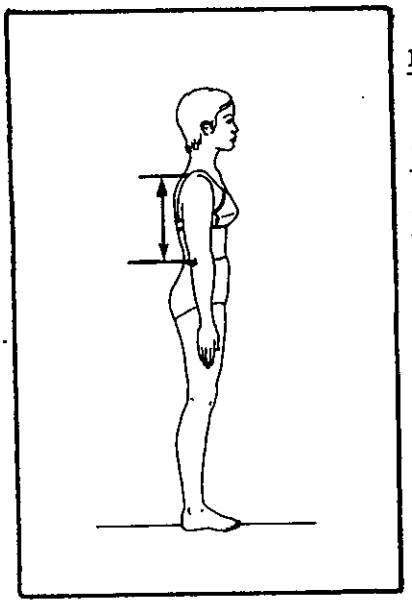
Instrument: Anthropometer.

Position of Subject: Subject stands erect, looking straight ahead, heels together and arms hanging naturally at her sides.

Procedure: With an anthropometer, measure the vertical distance from the floor to the depression between the humerus and the radius of the right arm.



5. ACROMIALE-RADIALE LENGTH



Landmarks: Acromiale and radiale.

Instrument: Beam caliper.

Position of Subject: Subject stands erect, looking straight ahead, with arms relaxed.

Procedure: With a beam caliper held parallel to the long axis of the right upper arm, measure the distance from the acromial landmark to the radial landmark.

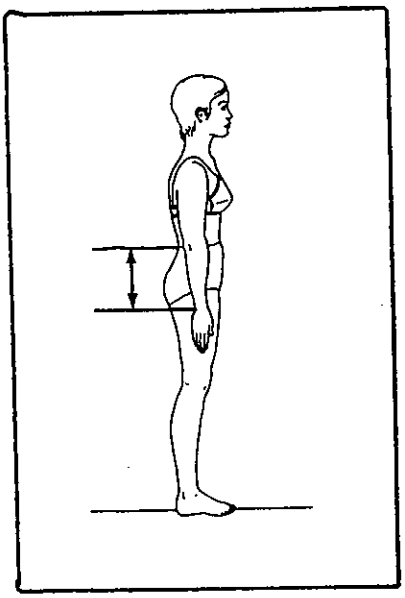
6. RADIALE-STYLION LENGTH

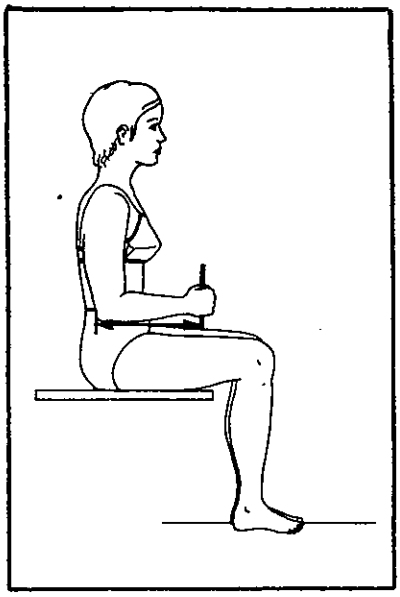
Landmarks: Radiale and radial stylion.

Instrument: Beam caliper.

Position of Subject: Subject stands erect, looking straight ahead, with arms relaxed.

Procedure: With a beam caliper held parallel to the long axis of the right forearm, measure the distance from the radial landmark to the radial stylion landmark.





7. ELBOW-GRIP LENGTH

Landmark: Olecranon process, posterior tip.

Instrument: Beam caliper.

Position of Subject: Subject sits erect, looking straight ahead, her upper arm hanging relaxed, her forearm and hand extended forward horizontally, holding the movable slide of a beam caliper vertically in her fist.

Procedure: Hold the beam caliper so that its axis is parallel to the long axis of the forearm and adjust the fixed slide so that it is in contact with the posterior tip of the olecranon process. Record the indicated opening of the caliper. During the statistical analysis 0.5 cm, half the width of the slide, is added to the recorded value to obtain the distance from the tip of the elbow to the middle of the slide.

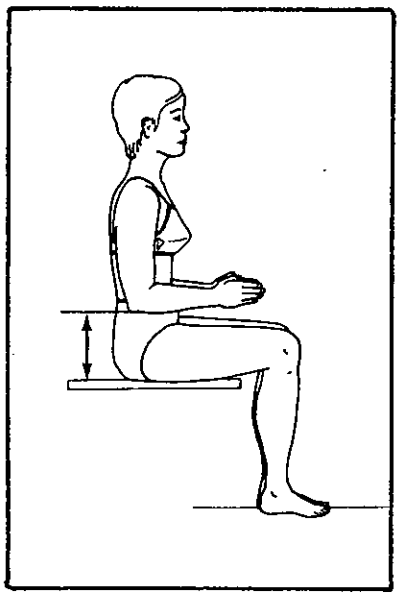
8. ELBOW-REST HEIGHT

Landmark: None.

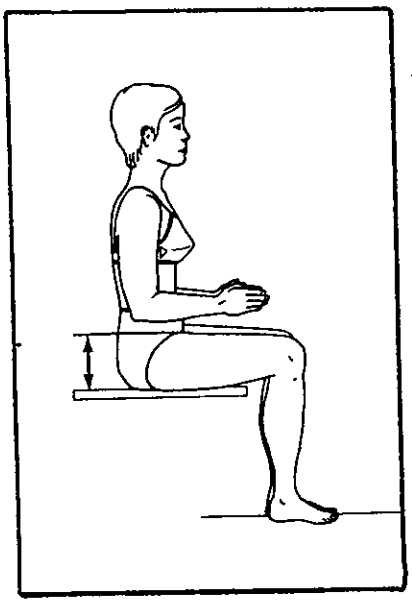
Instrument: Anthropometer.

Position of Subject: Subject sits erect, looking straight ahead, upper arms hanging relaxed, forearms and hands extended forward horizontally.

Procedure: With an anthropometer, measure the vertical distance from the sitting surface to the bottom of the right elbow.



9. THIGH CLEARANCE



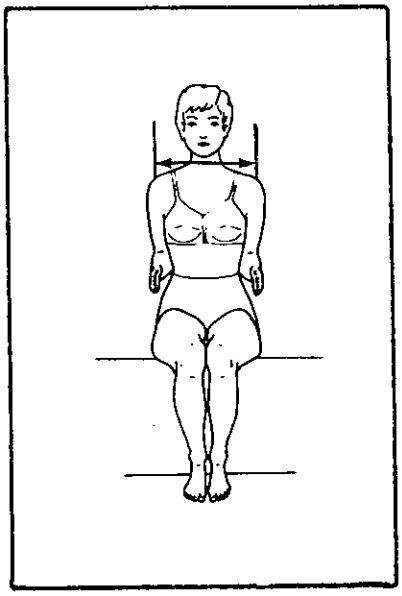
Landmark: None.

Instrument: Anthropometer.

Position of Subject: Subject sits erect on a flat surface, feet on a platform which is adjusted so that the knees are flexed 90°.

Procedure: With an anthropometer, measure the vertical distance from the sitting surface to the highest point on the right thigh.

10. BIACROMIAL BREADTH

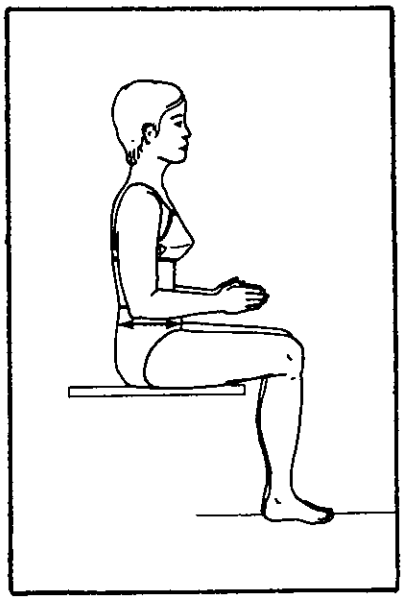


Landmarks: Acromiale, right and left.

Instrument: Beam caliper.

Position of Subject: Subject sits erect, looking straight ahead, upper arms hanging relaxed, forearms and hands extended forward horizontally.

Procedure: With a beam caliper, measure the distance between the acromial landmarks.



11. ABDOMINAL EXTENSION DEPTH, SITTING

Landmark: Abdominal extension.

Instrument: Beam caliper.

Position of Subject: Subject sits erect on a flat surface, looking straight ahead, feet on the adjustable platform, and knees flexed 90°.

Procedure: With a beam caliper, measure the horizontal depth of the trunk at the level of the maximum anterior protrusion of the abdomen. The reading is made at the point of maximum quiet respiration. The subject must not pull in her abdomen.

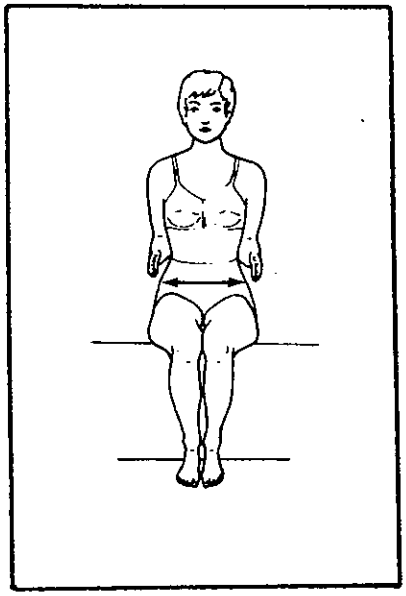
12. ABDOMINAL EXTENSION BREADTH, SITTING

Landmark: Abdominal extension.

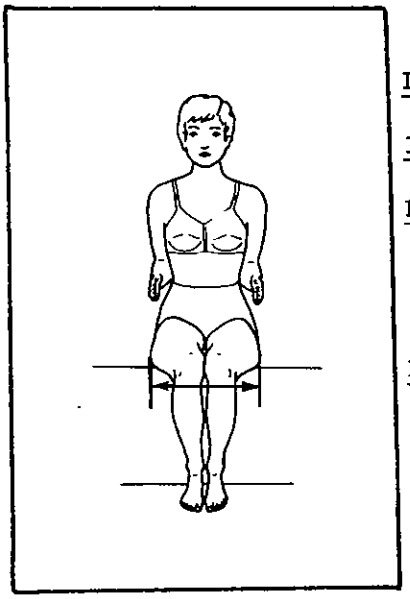
Instrument: Beam caliper.

Position of Subject: Subject sits erect on a flat surface, looking straight ahead, feet on the adjustable platform, and knees flexed at 90°.

Procedure: With a beam caliper, measure the horizontal breadth of the trunk at the level of the maximum anterior protrusion of the abdomen.



13. THIGH-TO-THIGH BREADTH, SEATED



Landmark: None.

Instrument: Beam caliper.

Position of Subject: Subject sits erect, looking straight ahead, thighs completely supported by the sitting surface, and knees together.

Procedure: With a beam caliper, measure the maximum horizontal distance across the thighs.

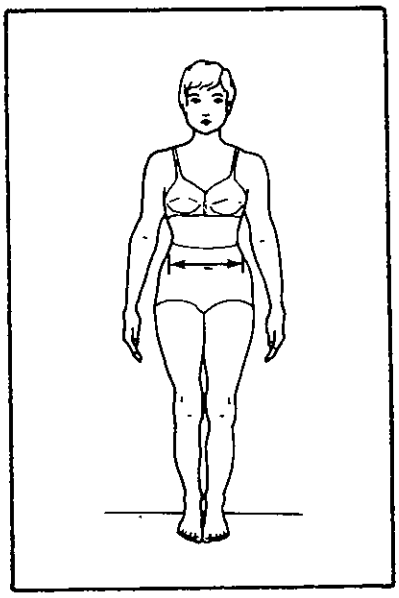
14. BISPINOUS BREADTH

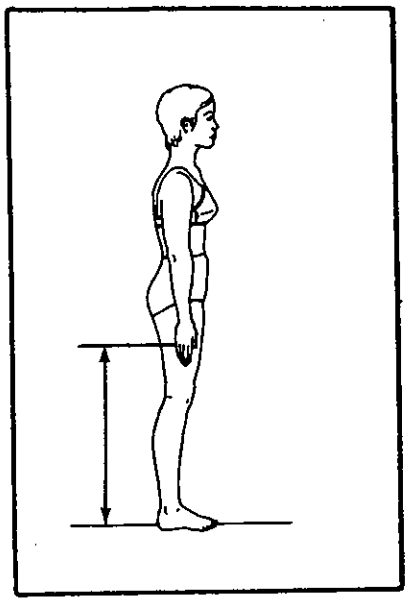
Landmarks: Iliac spines, anterior-superior.

Instrument: Beam caliper.

Position of Subject: Subject stands erect, looking straight ahead, heels together and weight distributed equally on both feet.

Procedure: With a beam caliper, measure the horizontal distance between the anterior-superior iliac spines.





15. KNUCKLE HEIGHT

Landmark: Metacarpale-III.

Instrument: Anthropometer.

Position of Subject: Subject stands erect, looking straight ahead, heels together, and arms hanging naturally at her sides.

Procedure: With an anthropometer, measure the vertical distance from the floor to the knuckle of the right hand where the first phalanx of the middle finger joins the corresponding bone of the palm (third metacarpal).

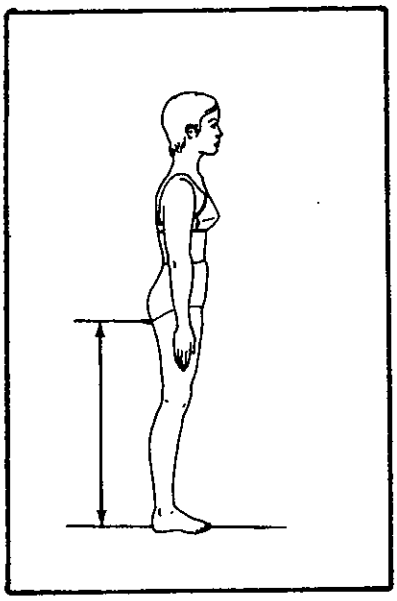
16. GLUTEAL FURROW HEIGHT

Landmark: Gluteal furrow.

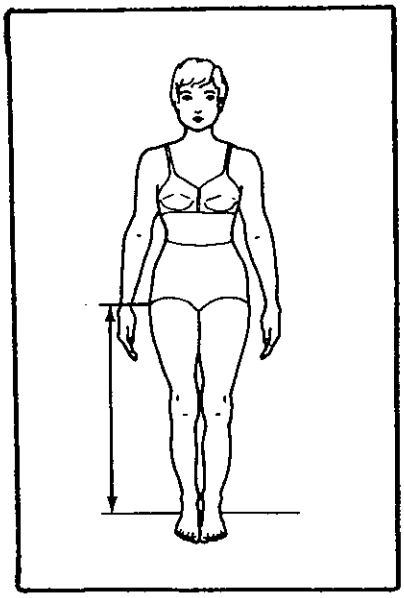
Instrument: Anthropometer.

Position of Subject: Subject stands erect, looking straight ahead, heels together, and weight distributed equally on both feet.

Procedure: With an anthropometer, measure the vertical distance from the standing surface to the lowest point on the right gluteal furrow.



17. HIP (TROCHANTERIC) HEIGHT



Landmark: Trochanterion.

Instrument: Anthropometer.

Position of Subject: Subject stands erect, looking straight ahead, heels together, and weight distributed equally on both feet.

Procedure: With an anthropometer, measure the vertical distance from the standing surface to the right trochanteric landmark.

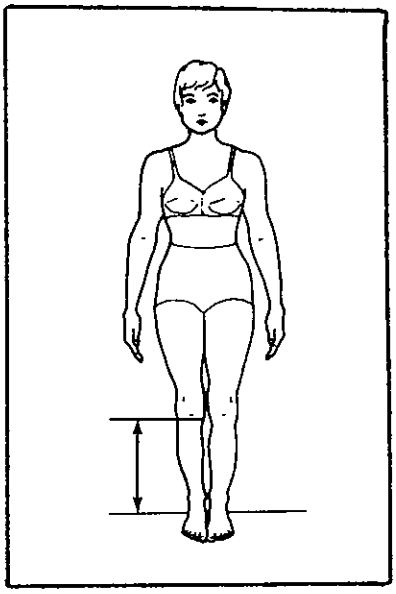
18. TIBIALE HEIGHT

Landmark: Tibiale.

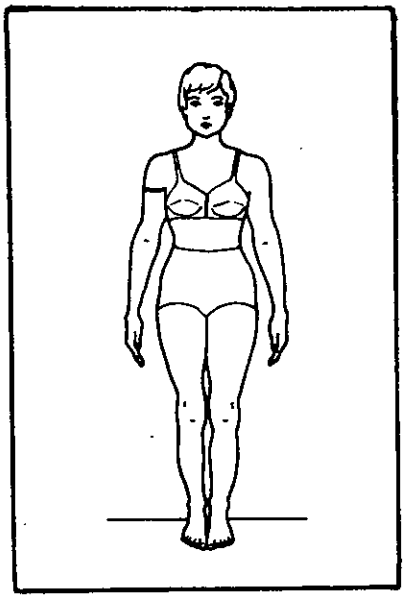
Instrument: Anthropometer,

Position of Subject: Subject stands erect, heels together, and weight distributed equally on both feet.

Procedure: With an anthropometer, measure the vertical distance from the standing surface to the tibial landmark mark on the right leg.



19. AXILLARY ARM CIRCUMFERENCE



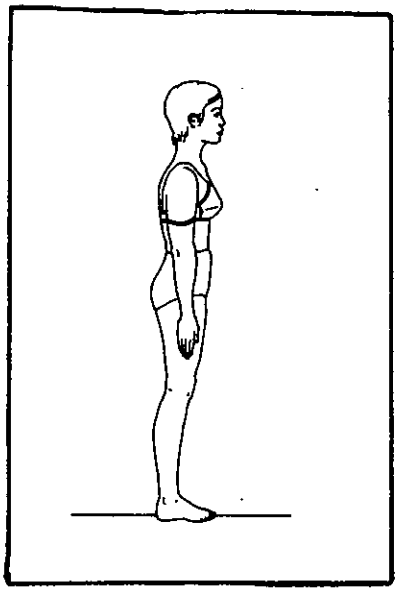
Landmark: Axilla level.

Instrument: Tape.

Position of Subject: Subject stands with right arm abducted sufficiently to allow clearance of a tape between the arm and trunk.

Procedure: With a tape held in a plane perpendicular to the long axis of the upper arm, measure the circumference of the arm at the level of the bottom of the axilla landmark. The axillary tissue is not compressed.

20. BICEPS CIRCUMFERENCE, RELAXED

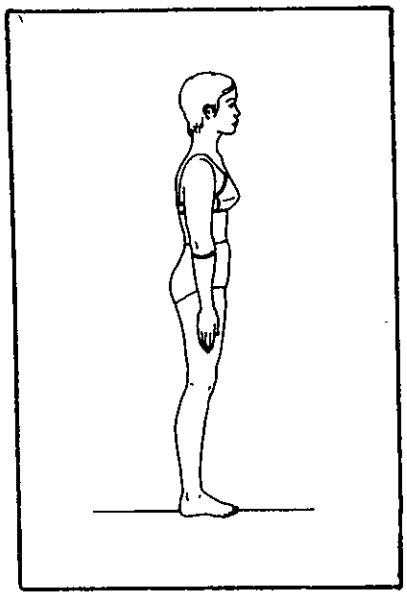


Landmark: Biceps.

Instrument: Tape.

Position of Subject: Subject stands with right arm slightly abducted.

Procedure: With a tape held in a plane perpendicular to the long axis of the upper arm, measure the circumference of the arm at the level of the biceps landmark.



21. FOREARM CIRCUMFERENCE, RELAXED

Landmark: Forearm, maximal circumference.

Instrument: Tape.

Position of Subject: Subject stands with right arm slightly abducted.

Procedure: With a tape held in a plane perpendicular to the long axis of the lower arm, measure the circumference of the lower arm at the level of maximum forearm girth.

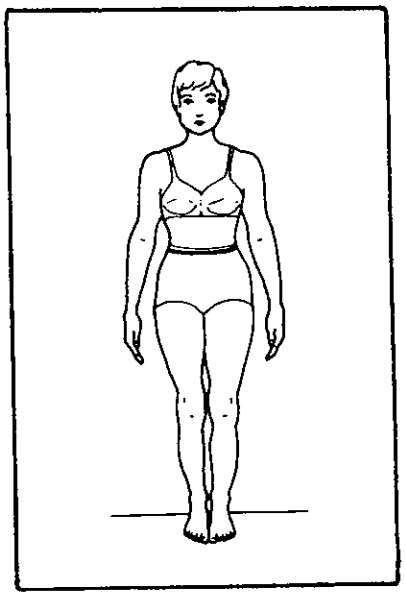
22. WAIST CIRCUMFERENCE, OMPHALION

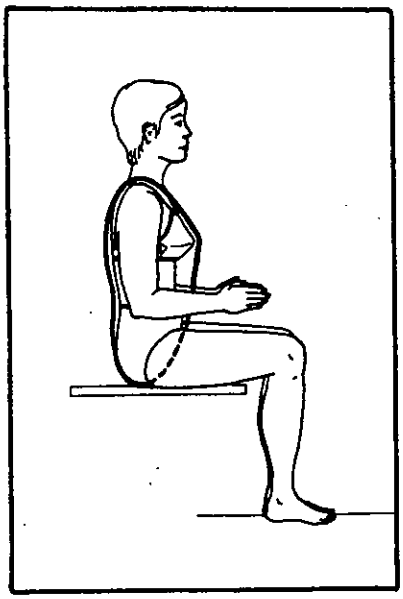
Landmark: Omphalion.

Instrument: Tape.

Position of Subject: Subject stands erect, looking straight ahead, heels together, and weight distributed equally on both feet.

Procedure: With a tape held in a horizontal plane, measure the circumference of the trunk at the level of omphalion. The reading is made at the mid-point of quiet respiration.





23. VERTICAL TRUNK CIRCUMFERENCE, SITTING

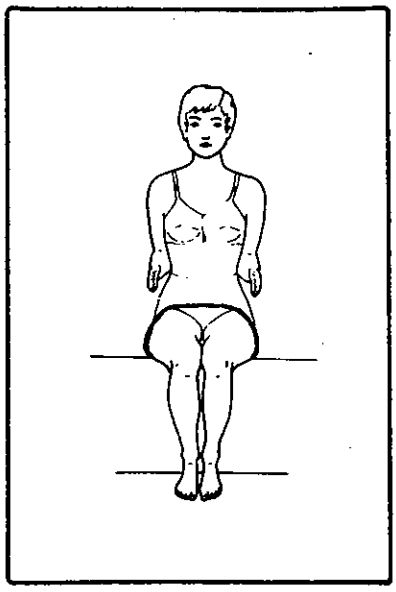
Landmarks: Midshoulder, bustpoint and buttock, maximal protrusion.

Instrument: Tape.

Initial Position of Subject: Subject stands with legs slightly apart.

Procedure: A length of tape is passed between the legs, over the protrusion of the right buttock, and up the back to lie over the midshoulder landmark. Keeping the tape in place, the subject then sits, her trunk erect and arms relaxed. The other end of the tape is brought over the right bustpoint landmark to the midshoulder landmark completing the circumference. The subject brings her legs together maintaining the contact of the tape in the crotch. The measurer holds the tape into the concavity of the back to insure that it follows the posterior body contour. (The tape does not follow the anterior body contour.) Measure the circumference of the torso at the point of maximum quiet inspiration.

24. HIP CIRCUMFERENCE, SITTING



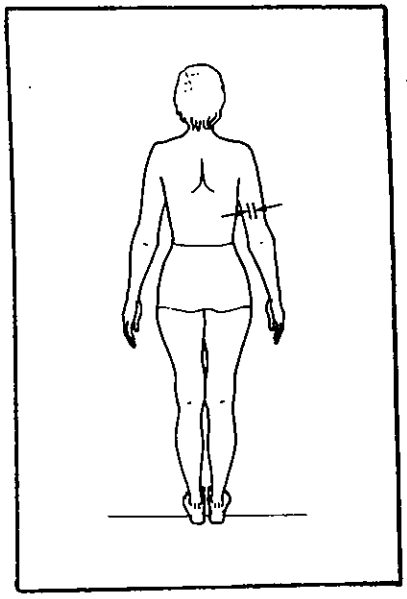
Landmark: None.

Instrument: Tape.

Position of Subject: Subject sits erect on a flat surface, looking straight ahead, thighs parallel, upper arms hanging relaxed, forearms and hands extended forward horizontally.

Procedure: Drawing a tape as far forward as freely possible under the subject's buttocks and bringing it upward and diagonally across her lap at the level of the thigh-trunk intersection, measure the circumference of the buttocks.

25. TRICEPS SKINFOLD



Landmark: Triceps.

Instrument: Lange skinfold caliper.

Initial Position of Subject: Subject stands with right elbow flexed 90°.

Procedure: Locate the level on the back of the upper arm halfway between acromion and the tip of the elbow and then have the subject relax her arm at her side. At the level previously located, pick up a skinfold parallel to the long axis of the upper arm. Using a Lange skinfold caliper, measure the thickness of the fold.

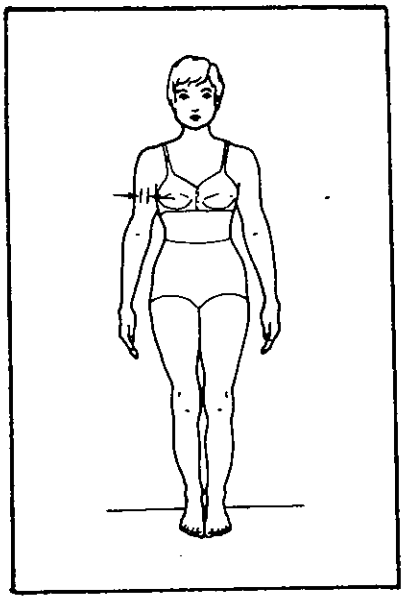
26. BICEPS SKINFOLD

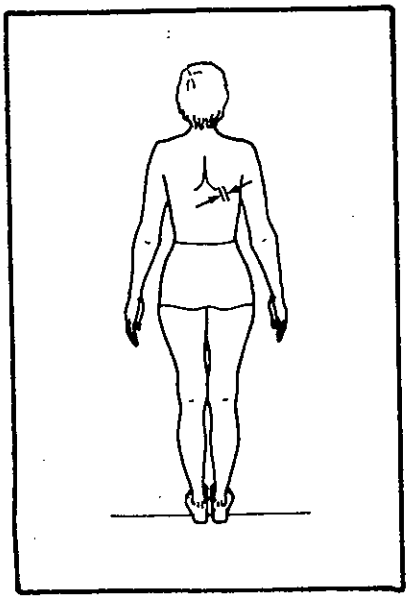
Landmark: Biceps brachii.

Instrument: Lange skinfold caliper.

Position of Subject: Subject stands with right arm slightly abducted.

Procedure: At the level of the biceps circumference, pick up a skinfold parallel to the long axis of the upper arm. Using a Lange skinfold caliper, measure the thickness of the fold.





27. SUBSCAPULAR SKINFOLD

Landmark: Scapula, inferior angle.

Instrument: Lange skinfold caliper.

Position of Subject: Subject stands relaxed.

Procedure: Pick up a skinfold just below the inferior angle of the right scapula and parallel to the tension lines of the skin. Using a Lange skinfold caliper, measure the thickness of the fold.

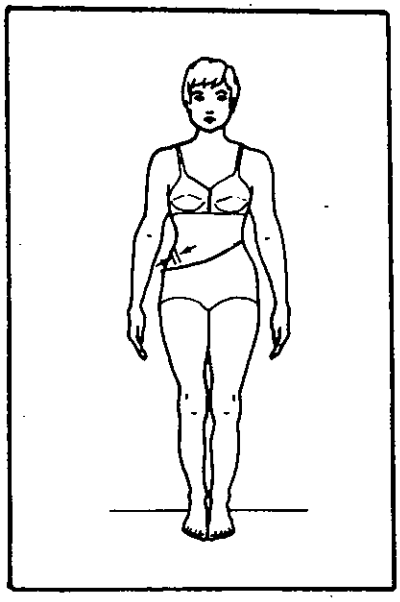
28. SUPRAILIAC SKINFOLD

Landmark: Iliac crest.

Instrument: Lange skinfold caliper.

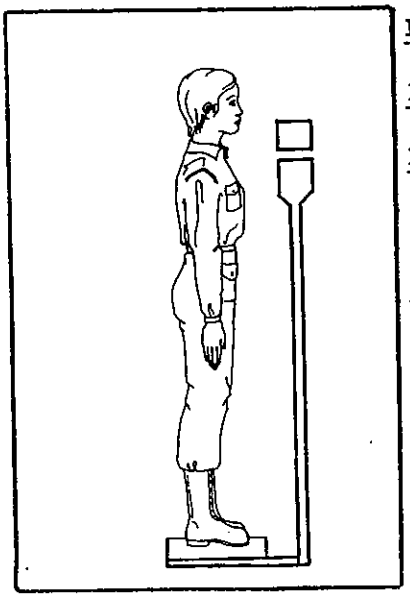
Position of Subject: Subject stands relaxed.

Procedure: Pick up a skinfold in the right midaxillary line at the level of the crest of the ilium and following the border of the crest. Using a Lange skinfold caliper, measure the thickness of the fold.



THE WORKSPACE SUBSERIES

1. WEIGHT (Dressed)



Landmark: None.

Instrument: Balance type scales.

Position of Subject: Subject stands on center of scale platform wearing fatigues and combat boots.

Procedure: Adjust balance to within one-quarter of a pound and record.

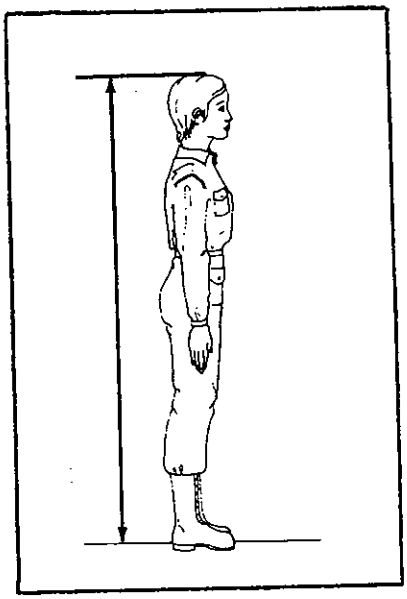
2. STATURE (Dressed)

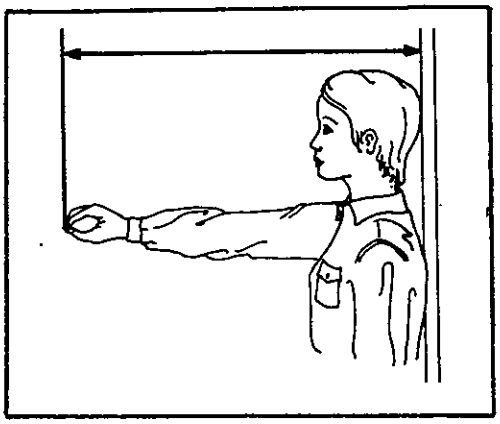
Landmark: None.

Instrument: Anthropometer.

Position of Subject: Subject, dressed in fatigues and combat boots, stands erect, head in the Frankfort plane, heels together, and weight distributed equally on both feet.

Procedure: With the arm of the anthropometer firmly touching the scalp, measure the vertical distance from the floor to the top of the head.





3. FUNCTIONAL REACH

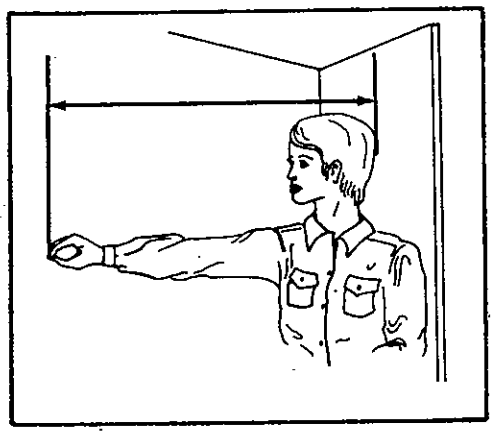
Landmark: None.

Instruments: Wall-mounted graph paper and measuring block.

Position of Subject: Subject stands erect in a corner looking straight ahead, both shoulders against the back wall, her right arm horizontal and held against the scale mounted on the side wall. The thumb is extended parallel to the long axis of the arm. The tip of her index finger touches the pad of the extended thumb.

Procedure: Mark the location of the tip of the thumb on the acetate covering the graph paper and record the distance from the back of the wall to this mark.

4. FUNCTIONAL REACH, EXTENDED



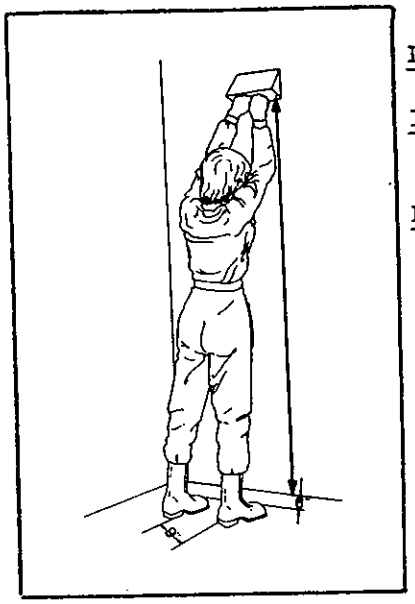
Landmark: None.

Instruments: Wall-mounted graph paper and measuring block.

Position of Subject: Subject stands erect in a corner looking straight ahead, right shoulder extended as far forward as possible while keeping the back of the left shoulder firmly against the back wall, the right arm is horizontal and held against the scale mounted on the side wall. The thumb is extended parallel to the long axis of the arm. The tip of the index finger touches the pad of the extended thumb.

Procedure: Mark the location of the tip of the thumb on the acetate covering the graph paper and record the distance from the back of the wall to this mark.

5. OVERHEAD REACH HEIGHT



Landmark: None.

Instrument: Wall-mounted graph paper and measuring block.

Position of Subject: The subject stands with her heels 23 centimeters apart and her toes 15 centimeters from the wall. Her arms are extended overhead, fists touching and against the wall, with the first phalanges horizontal.

Procedure: Mark the highest point on the first phalanges as indicated by the measuring block on the acetate covering the graph paper, and then record the height of the mark.

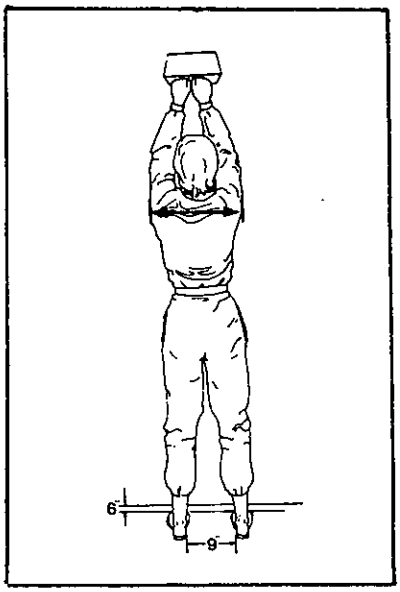
6. OVERHEAD REACH BREADTH

Landmark: None.

Instrument: Beam caliper.

Position of Subject: The subject stands with her heels 23 centimeters apart and her toes 15 centimeters from the wall. Her arms are extended overhead, fists together and against the wall, with the first phalanges horizontal.

Procedure: With a beam caliper, measure the maximum horizontal distance across the arms or shoulders, whichever is the wider.



7. BENT TORSO HEIGHT

Landmark: None.

Instrument: Anthropometer.

Position of Subject: The subject stands with feet 30 centimeters apart. She bends over and places the palms of her hands on her kneecaps. The elbows and knees are locked. She looks forward, her head tilted as far back as possible.

Procedure: Using an anthropometer, measure the vertical distance from the floor to the top of the head.

8. BENT TORSO BREADTH

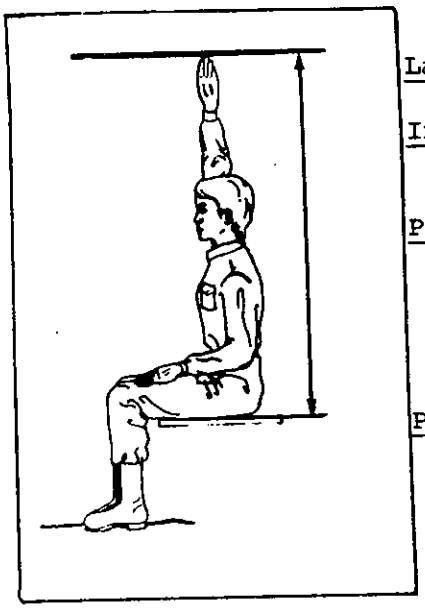
Landmark: None.

Instrument: Beam caliper.

Position of Subject: The subject stands with her feet 30 centimeters apart. She bends over and places the palms of her hands on her kneecaps. The elbows and knees are locked. She looks forward, her head tilted as far back as possible.

Procedure: With a beam caliper, measure the maximum horizontal distance across the shoulders.

9. OVERHEAD REACH, SITTING



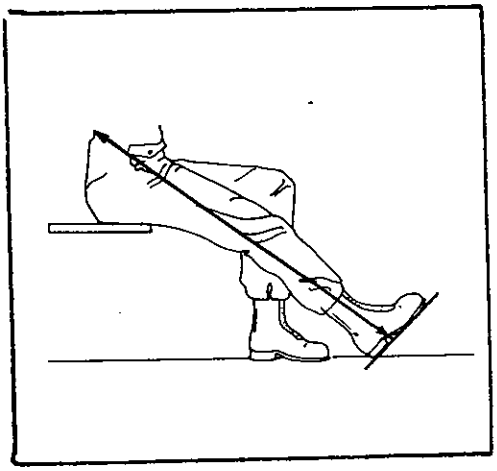
Landmark: Dactylion.

Instruments: Wall-mounted graph paper and measuring block.

Position of Subject: Subject sits erect, right side against a wall, left hand in lap, right arm extended upward with the palm of her hand flat against the wall and fingers extended.

Procedure: Place the block at the level of the tip of the middle finger, mark this level on the acetate covering the graph paper and then record the height of this mark above the sitting surface.

10. FUNCTIONAL LEG LENGTH (BUTTOCK-HEEL)



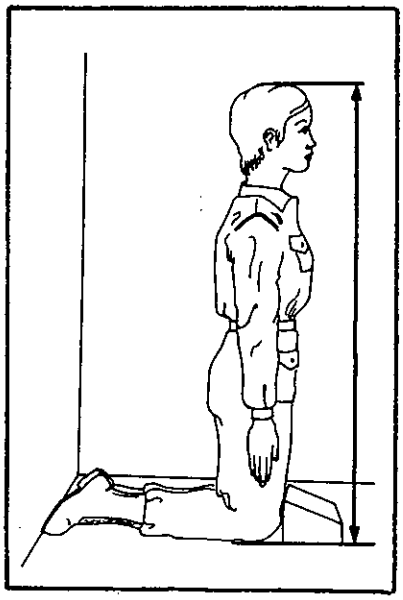
Landmark: None.

Instrument: Anthropometer

Position of Subject: Subject sits erect on the edge of a chair, right leg is extended forward with knee straightened.

Procedure: With the base of the modified anthropometer firmly in contact with the plantar surface of the foot, measure from the sole of the foot, along the axis of the leg, to the posterior waist.

11. KNEELING HEIGHT



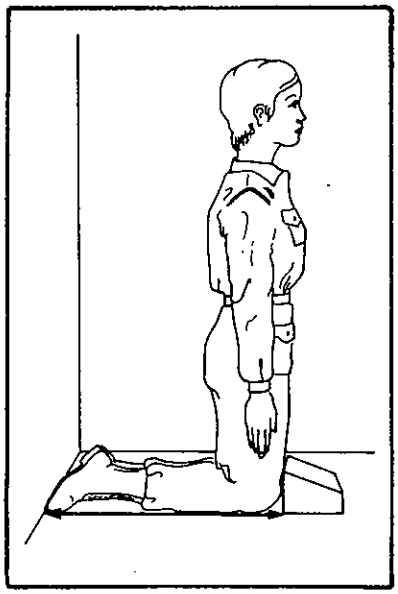
Landmark: None.

Instruments: Floor-mounted graph paper and anthropometer.

Position of Subject: The subject kneels on the floor-mounted graph paper with her toes extended and lightly touching the rear wall. The torso is erect with the arms hanging loosely at the sides. The head is in a Frankfort plane.

Procedure: With an anthropometer, measure the vertical distance from the floor to the top of the head.

12. KNEELING LEG LENGTH



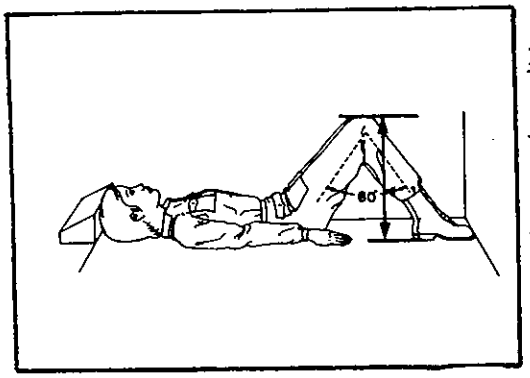
Landmark: None.

Instruments: Floor-mounted graph paper and measuring block.

Position of Subject: The subject kneels on the floor-mounted graph paper with her toes extended and lightly touching the rear wall. The torso is erect with the arms hanging loosely at the sides. The head is in a Frankfort plane.

Procedure: Place the block in contact with the knee and mark on the acetate covering the graph paper the location of the contact edge of the block. Record the distance of this mark from the wall.

13. BENT KNEE HEIGHT, SUPINE



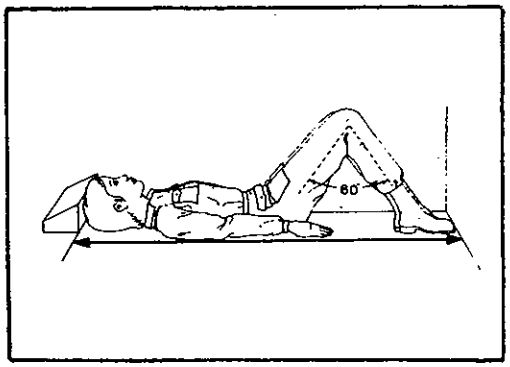
Landmark: None.

Instruments: Anthropometer and 60° triangle.

Position of Subject: The subject lies supine on the floor-mounted graph paper, looking directly upward. The measurer adjusts the subject's knees so that the angle between the upper and lower legs approximates 60°. The toes are lightly touching the wall.

Procedure: Using an anthropometer, measure the maximum vertical distance from the floor-mounted graph paper to the highest point on the knee.

14. HORIZONTAL LENGTH, KNEES BENT



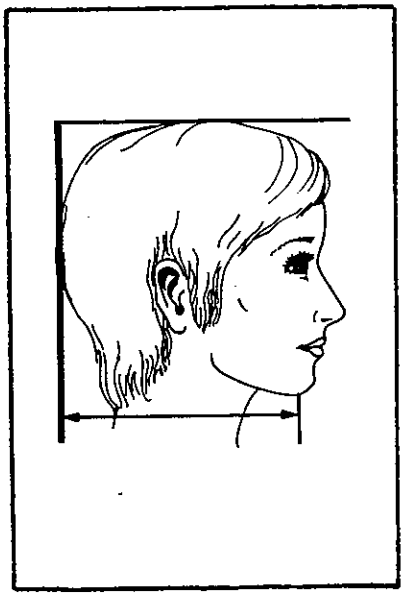
Landmark: None.

Instruments: Floor-mounted graph paper and measuring block.

Position of Subject: The subject lies supine on the floor-mounted graph paper, looking directly upward. The measurer adjusts the subject's knees so that the angle between the upper and lower legs approximates 60°. The toes are lightly touching the wall.

Procedure: Place the measuring block in firm contact with the top of the head and mark the location of the contact edge of the block. Record the distance of this mark from the wall after the subject has stood up.

THE HEAD AND FACE SUBSERIES



1. MENTON TO WALL

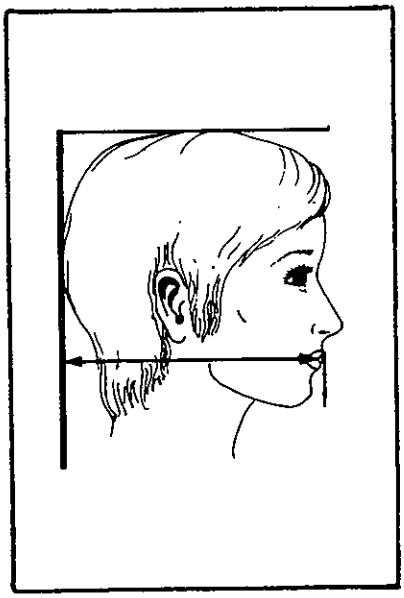
Landmark: Menton.

Instrument: Special gauge.

Position of Subject: Subject stands under the headboard looking straight ahead, her teeth and lips together but not compressed. The headboard is adjusted so that its vertical and horizontal planes are in firm contact with the back and the top of the head. The head is then readjusted so that it is oriented in the Frankfort plane.

Procedure: Using the special gauge, measure the horizontal distance from the vertical plane to the menton landmark.

2. LIPS (STOMION) TO WALL



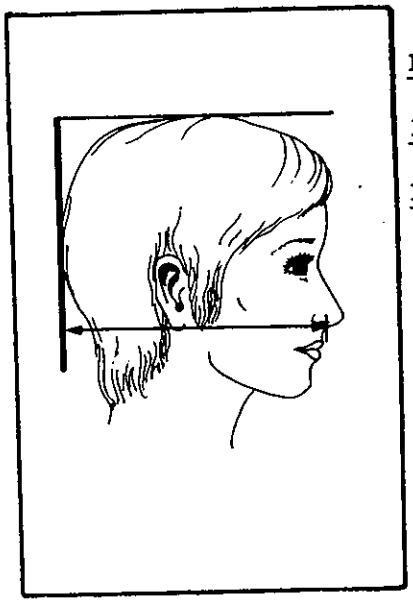
Landmark: None.

Instrument: Special gauge.

Position of Subject: Subject stands under the headboard looking straight ahead, her teeth and lips together but not compressed. The headboard is adjusted so that its vertical and horizontal planes are in firm contact with the back and the top of the head. The head is then readjusted so that it is oriented in the Frankfort plane.

Procedure: Using the special gauge, measure the horizontal distance from the vertical plane to the most anterior point in the midsagittal plane of either the upper or lower lip.

3. SUBNASALE TO WALL



Landmark: Subnasale.

Instrument: Special gauge.

Position of Subject: Subject stands under the headboard looking straight ahead, her teeth and lips together but not compressed. The headboard is adjusted so that its vertical and horizontal planes are in firm contact with the back and the top of the head. The head is then readjusted so that it is oriented in the Frankfort plane.

Procedure: Using the special gauge, measure the horizontal distance from the vertical plane to subnasale.

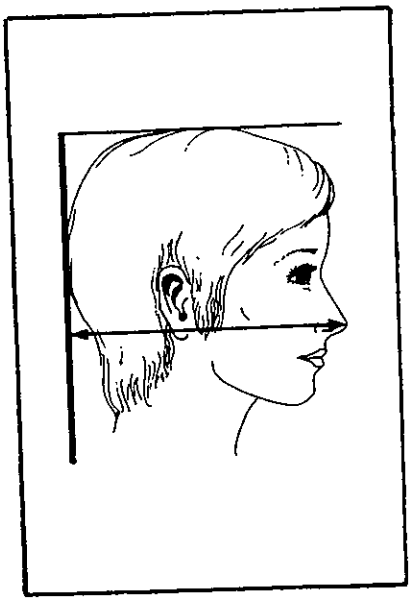
4. PRONASALE TO WALL

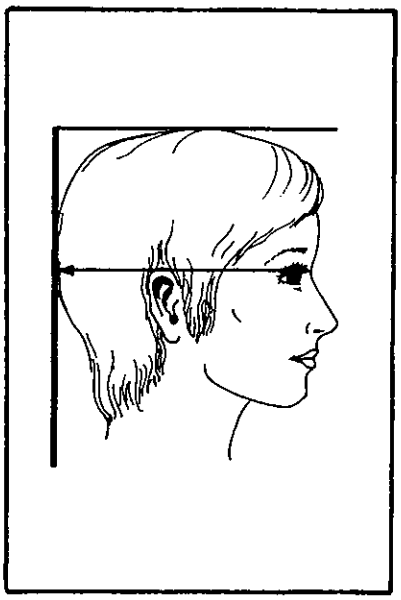
Landmark: Pronasale.

Instrument: Special gauge.

Position of Subject: Subject stands under the headboard looking straight ahead, her teeth and lips together but not compressed. The headboard is adjusted so that its vertical and horizontal planes are in firm contact with the back and the top of the head. The head is then readjusted so that it is oriented in the Frankfort plane.

Procedure: Using the special gauge, measure the horizontal distance from the vertical plane to pronasale.





5. SELLION TO WALL

Landmark: Sellion.

Instrument: Special gauge.

Position of Subject: Subject stands under the headboard looking straight ahead, her teeth and lips together but not compressed. The headboard is adjusted so that its vertical and horizontal planes are in firm contact with the back and the top of the head. The head is then readjusted so that it is oriented in the Frankfort plane.

Procedure: Using the special gauge, measure the horizontal distance from the vertical plane to the deepest point in the nasal root depression.

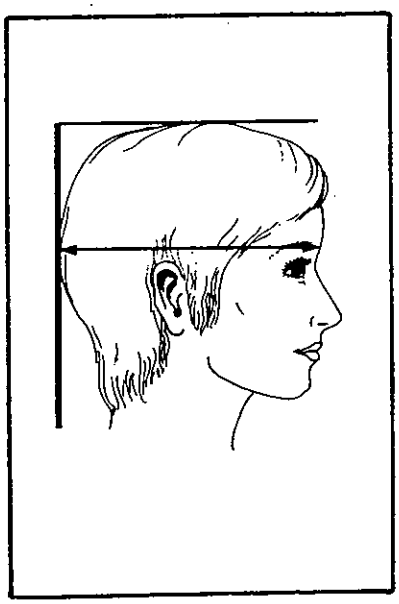
6. GLABELLA TO WALL

Landmark: Glabella.

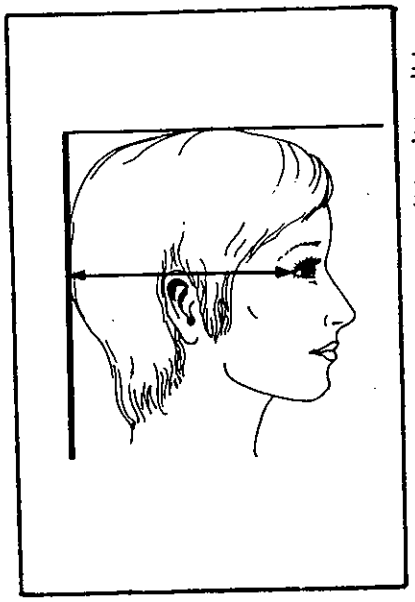
Instrument: Special gauge.

Position of Subject: Subject stands under the headboard looking straight ahead, her teeth and lips together but not compressed. The headboard is adjusted so that its vertical and horizontal planes are in firm contact with the back and the top of the head. The head is then readjusted so that it is oriented in the Frankfort plane.

Procedure: Using the special gauge, measure the horizontal distance from the vertical plane to the glabella landmark.



7. ECTOCANTHUS TO WALL



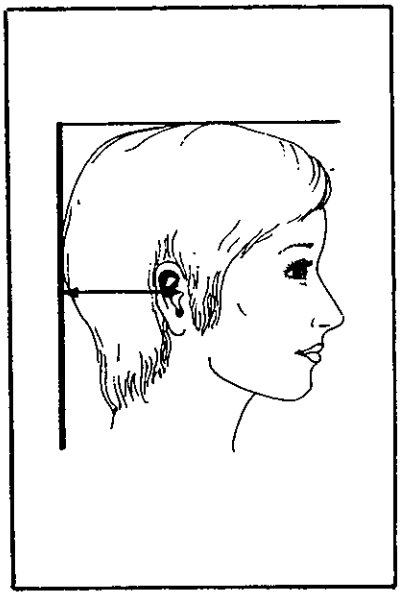
Landmark: Ectocanthus.

Instrument: Special gauge.

Position of Subject: Subject stands under the headboard looking straight ahead, her teeth and lips together but not compressed. The headboard is adjusted so that its vertical and horizontal planes are in firm contact with the back and the top of the head. The head is then readjusted so that it is oriented in the Frankfort plane.

Procedure: Ask the subject to close her eyes and then with the special gauge measure the horizontal distance from the vertical plane to the right ectocanthus.

8. TRAGION TO WALL



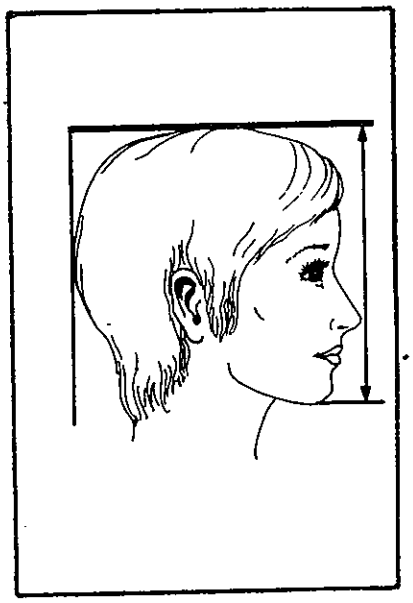
Landmark: Tragion.

Instrument: Special gauge.

Position of Subject: Subject stands under the headboard looking straight ahead, her teeth and lips together but not compressed. The headboard is adjusted so that its vertical and horizontal planes are in firm contact with the back and the top of the head. The head is then readjusted so that it is oriented in the Frankfort plane.

Procedure: Using the special gauge, measure the horizontal distance from the vertical plane to the right tragion landmark.

9. MENTON TO VERTEX



Landmark: Menton.

Instrument: Special gauge.

Position of Subject: Subject stands under the headboard looking straight ahead, her teeth and lips together but not compressed. The headboard is adjusted so that its vertical and horizontal planes are in firm contact with the back and the top of the head. The head is then readjusted so that it is oriented in the Frankfort plane.

Procedure: Using the special gauge, measure the vertical distance from the horizontal plane to the menton landmark.

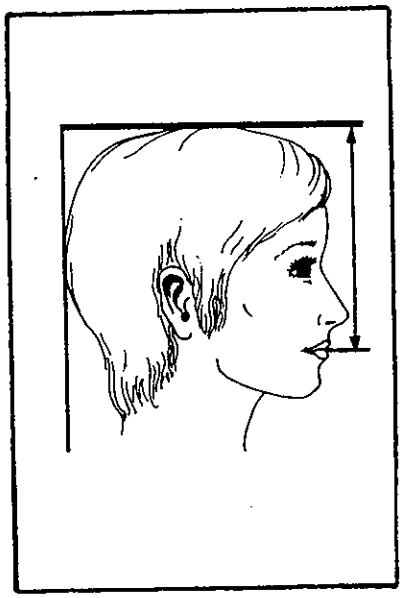
10. STOMION TO VERTEX

Landmark: Stomion.

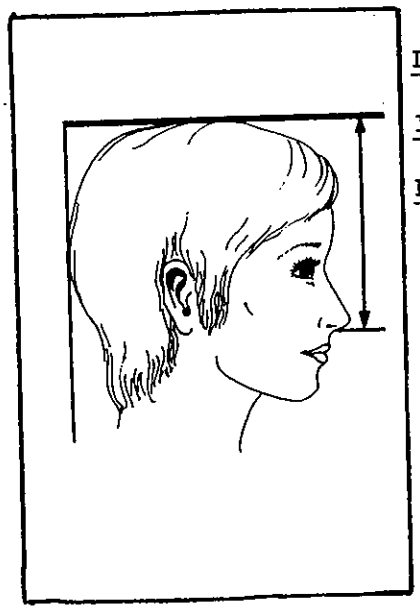
Instrument: Special gauge.

Position of Subject: Subject stands under the headboard looking straight ahead, her teeth and lips together but not compressed. The headboard is adjusted so that its vertical and horizontal planes are in firm contact with the back and the top of the head. The head is then readjusted so that it is oriented in the Frankfort plane.

Procedure: Using the special gauge, measure the vertical distance from the horizontal plane to stomion.



11. SUBNASALE TO VERTEX



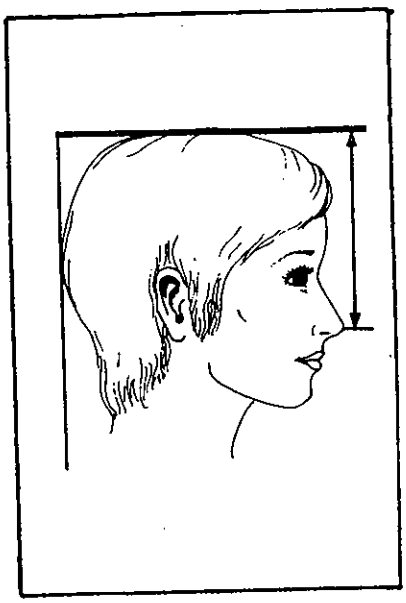
Landmark: Subnasale.

Instrument: Special gauge.

Position of Subject: Subject stands under the headboard looking straight ahead, her teeth and lips together but not compressed. The headboard is adjusted so that its vertical and horizontal planes are in firm contact with the back and the top of the head. The head is then readjusted so that it is oriented in the Frankfort plane.

Procedure: Using the special gauge, measure the vertical distance from the horizontal plane to subnasale.

12. PRONASALE TO VERTEX



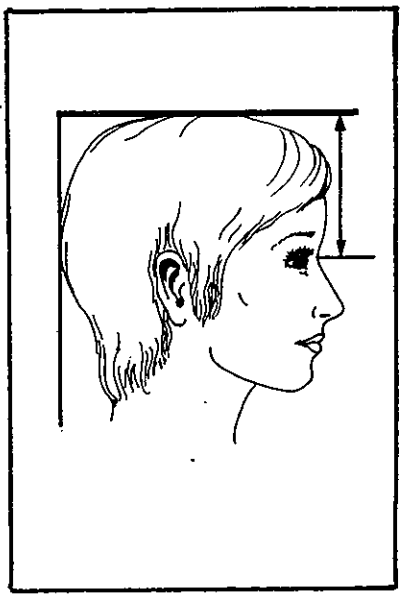
Landmark: Pronasale.

Instrument: Special gauge.

Position of Subject: Subject stands under the headboard looking straight ahead, her teeth and lips together but not compressed. The headboard is adjusted so that its vertical and horizontal planes are in firm contact with the back and the top of the head. The head is then readjusted so that it is oriented in the Frankfort plane.

Procedure: Using the special gauge, measure the vertical distance from the horizontal plane to pronasale.

13. SELLION TO VERTEX



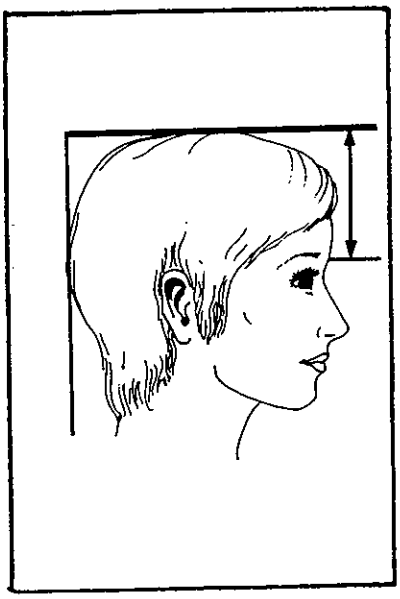
Landmark: Sellion.

Instrument: Special gauge.

Position of Subject: Subject stands under the headboard looking straight ahead, her teeth and lips together but not compressed. The headboard is adjusted so that its vertical and horizontal planes are in firm contact with the back and the top of the head. The head is then readjusted so that it is oriented in the Frankfort plane.

Procedure: Using the special gauge, measure the vertical distance from the horizontal plane to the deepest point of the nasal root depression.

14. GLABELLA TO VERTEX



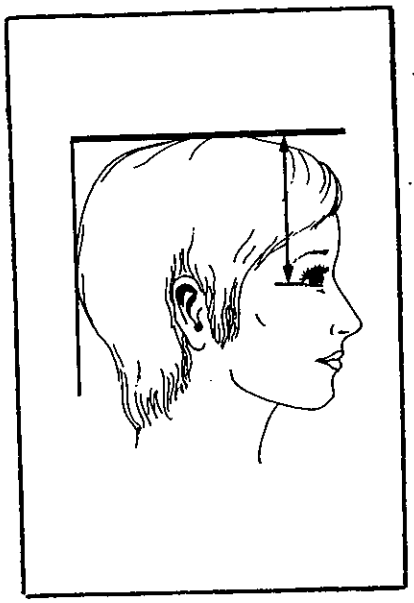
Landmark: Glabella.

Instrument: Special gauge.

Position of Subject: Subject stands under the headboard looking straight ahead, her teeth and lips together but not compressed. The headboard is adjusted so that its vertical and horizontal planes are in firm contact with the back and the top of the head. The head is then readjusted so that it is oriented in the Frankfort plane.

Procedure: Using the special gauge, measure the vertical distance from the horizontal plane to the glabella landmark.

15. ECTOCANTHUS TO VERTEX



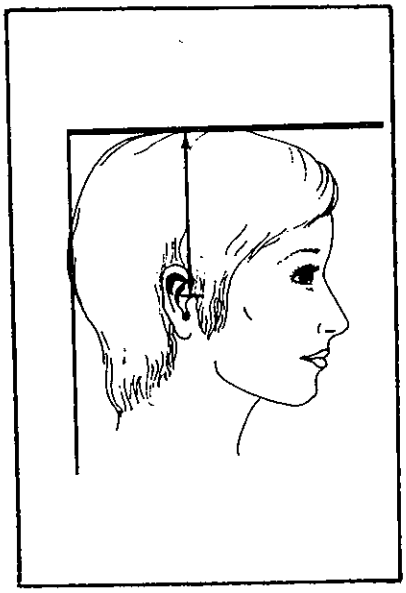
Landmark: Ectocanthus.

Instrument: Special gauge.

Position of Subject: Subject stands under the headboard looking straight ahead, her teeth and lips together but not compressed. The headboard is adjusted so that its vertical and horizontal planes are in firm contact with the back and the top of the head. The head is then readjusted so that it is oriented in the Frankfort plane.

Procedure: Ask the subject to close her eyes and then with the special gauge measure the vertical distance from the horizontal plane to the right ectocanthus.

16. HEAD HEIGHT (TRAGION TO VERTEX)



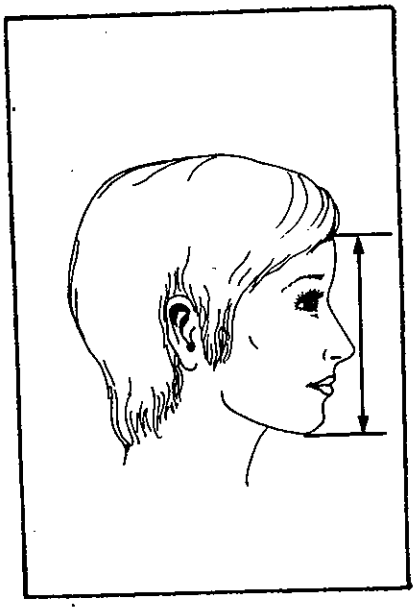
Landmark: Tragion.

Instrument: Special gauge.

Position of Subject: Subject stands under the headboard looking straight ahead, her teeth and lips together but not compressed. The headboard is adjusted so that its vertical and horizontal planes are in firm contact with the back and the top of the head. The head is then readjusted so that it is oriented in the Frankfort plane.

Procedure: Using the special gauge, measure the vertical distance from the horizontal plane to the right tragion landmark.

17. CRINION-MENTON



Landmarks: Crinion and menton.

Instrument: Sliding caliper.

Position of Subject: Subject sits with facial muscles relaxed and jaws closed.

Procedure: Using the sliding caliper, measure the straight line distance from the menton landmark to crinion.

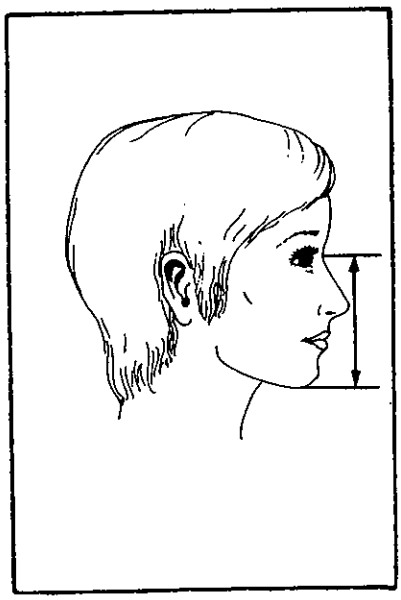
18. FACE LENGTH (SELLION-MENTON)

Landmarks: Sellion and menton.

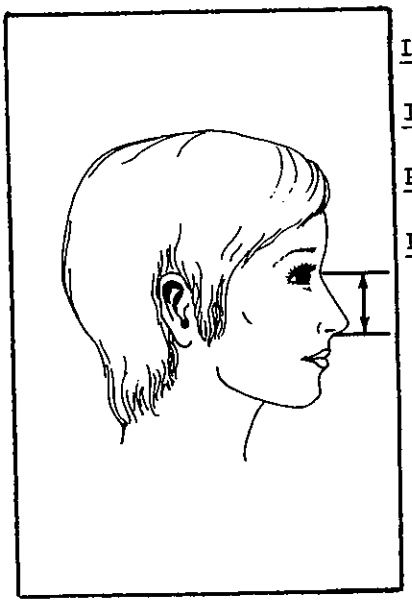
Instrument: Sliding caliper.

Position of Subject: Subject sits with mouth closed and jaw relaxed.

Procedure: With a sliding caliper, measure the straight line distance from the menton landmark to the deepest point in the nasal root depression.



19. NOSE LENGTH (SELLION-SUBNASALE)



Landmarks: Sellion and subnasale.

Instrument: Sliding caliper.

Position of Subject: Subject sits.

Procedure: With a sliding caliper, measure the straight line distance from subnasale to the deepest point in the nasal root depression.

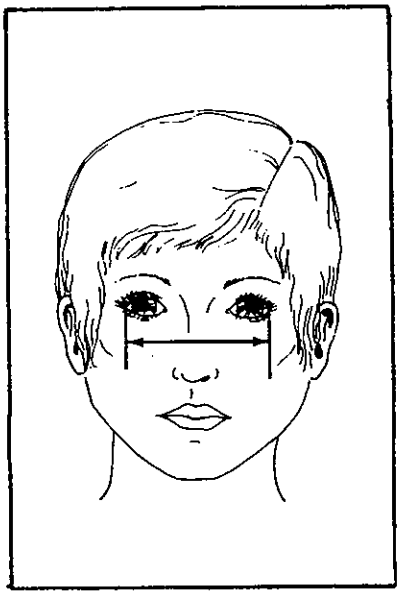
20. BIOCULAR BREADTH

Landmarks: Ectocanthi, right and left.

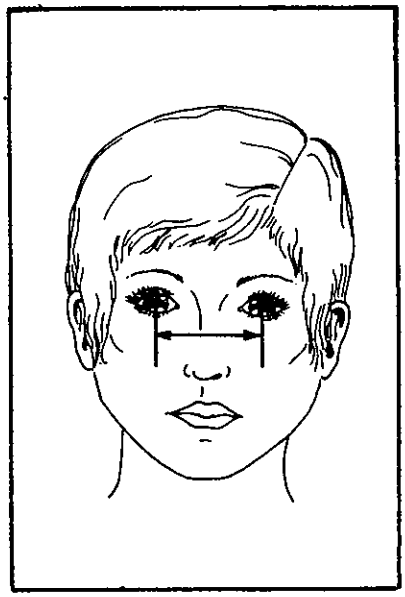
Instrument: Sliding caliper.

Position of Subject: Subject sits.

Procedure: With a sliding caliper, measure the breadth of the face between the right and left ectocanthi.



21. INTERPUPILLARY DISTANCE



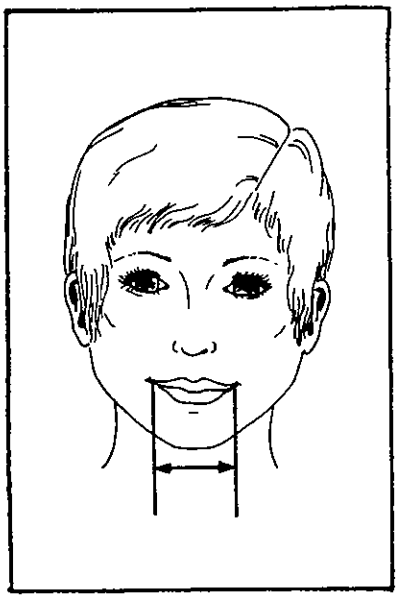
Landmark: None.

Instrument: Sliding caliper.

Position of Subject: Subject sits.

Procedure: With a sliding caliper, measure the horizontal distance from the center of the right pupil to the center of the left pupil.

22. MOUTH BREADTH, SMILING



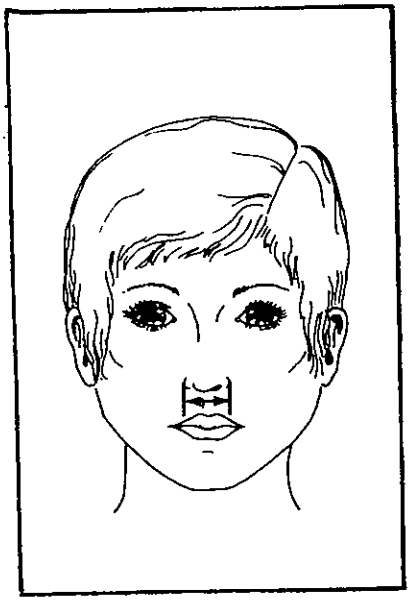
Landmark: Cheilion.

Instrument: Sliding caliper.

Position of Subject: Subject sits with teeth and lips together but not compressed. She is instructed by the measurer to smile broadly.

Procedure: With the sliding caliper, measure the maximum distance between the corners of the mouth.

23. NOSE BREADTH



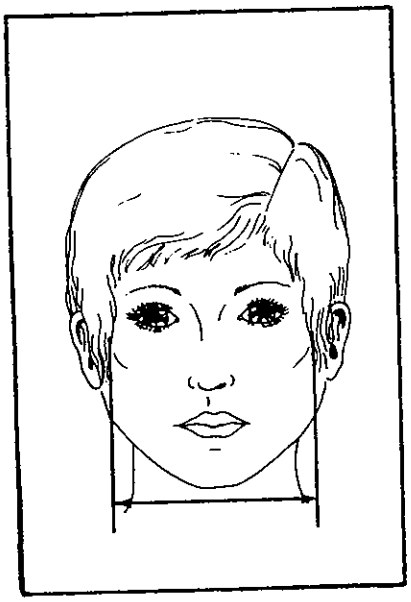
Landmark: None.

Instrument: Sliding caliper.

Position of Subject: Subject sits.

Procedure: With a sliding caliper, measure the maximum horizontal breadth of the nose.

24. FACE BREADTH (BIZYGOMATIC)



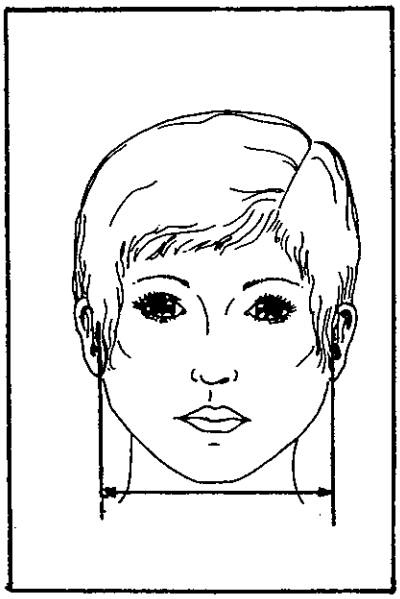
Landmark: None.

Instrument: Spreading caliper.

Position of Subject: Subject sits.

Procedure: With a spreading caliper, measure the maximum horizontal breadth of the face between the zygomatic arches.

25. BITRAGION BREADTH



Landmarks: Tragion, right and left.

Instrument: Spreading caliper.

Position of Subject: Subject sits.

Procedure: With a spreading caliper, measure the breadth of the head between the right and left tragion.

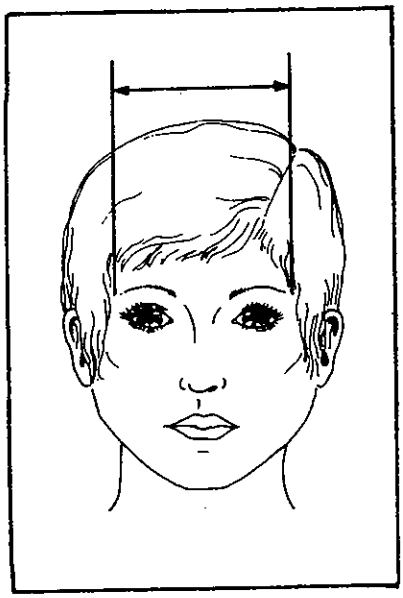
26. MINIMUM FRONTAL BREADTH

Landmarks: Temporal crests of the frontal bone, greatest indentation.

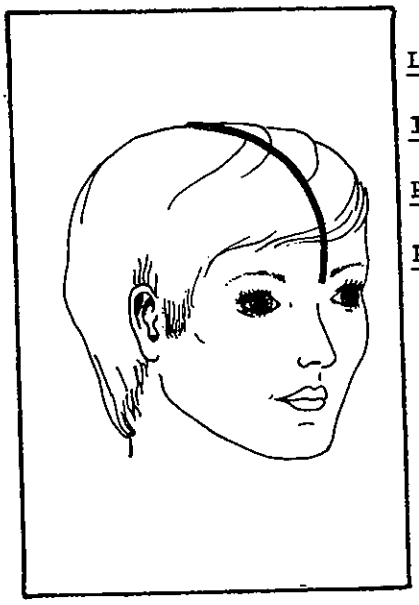
Instrument: Spreading caliper.

Position of Subject: Subject sits.

Procedure: Holding the spreading caliper near the tips, measure the horizontal distance between the landmarks indicating the greatest indentation of the temporal crests.



27. SAGITTAL ARC



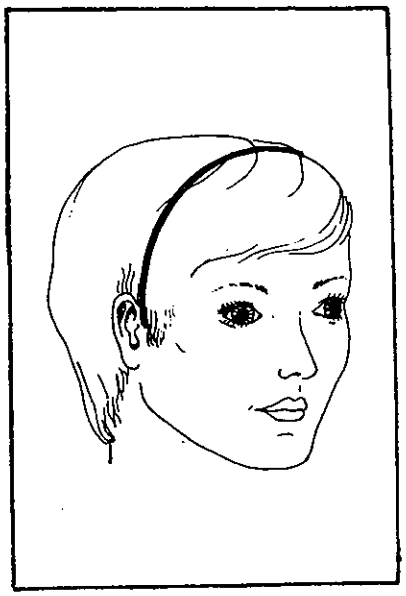
Landmarks: Glabella and nuchale.

Instrument: Tape.

Position of Subject: Subject sits.

Procedure: With a tape held as close to the scalp as possible, measure the surface distance in the midsagittal plane from the glabella to nuchale.

28. BITRAGION-CORONAL ARC



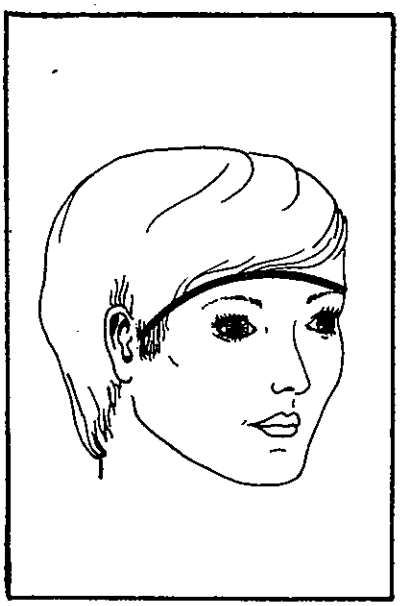
Landmarks: Tragion, right and left.

Instrument: Tape.

Position of Subject: Subject sits.

Procedure: With a tape held as close to the scalp as possible, measure the surface distance in a coronal plane from the left to the right tragion.

29. BITRAGION-FRONTAL ARC



Landmarks: Tragion, right and left and temporal crests, greatest indentation.

Instrument: Tape.

Position of Subject: Subject sits.

Procedure: With the tape passing over the temporal crest landmarks, measure the surface distance from right tragion to left tragion.

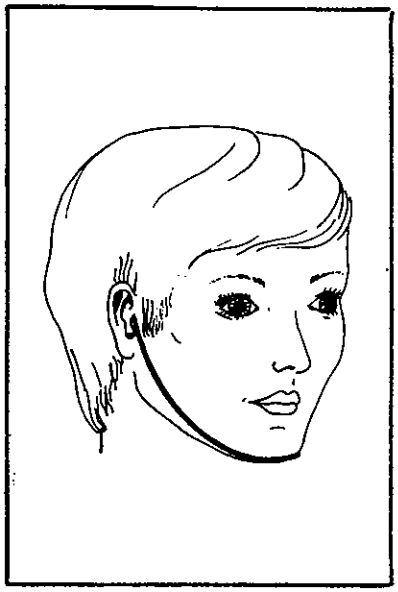
30. BITRAGION-MENTON ARC

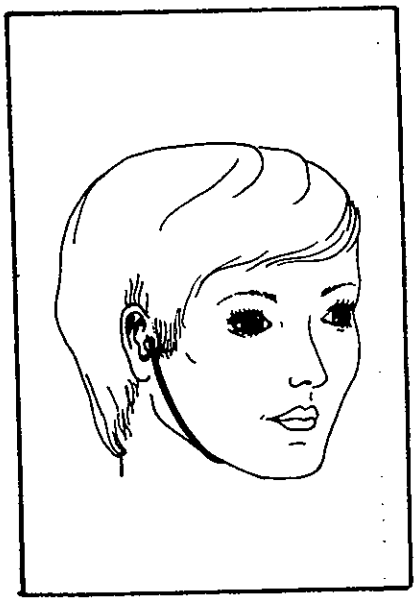
Landmarks: Tragion, right and left and menton.

Instrument: Tape.

Position of Subject: Subject sits with teeth and lips together but not compressed.

Procedure: With the tape passing over the menton landmark on the chin, measure the surface distance from right tragion to left tragion.





31. BITRAGION-SUBMANDIBULAR ARC

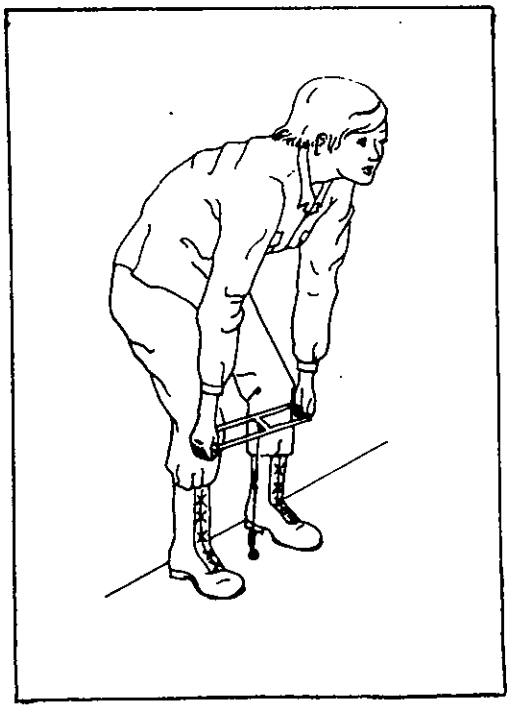
Landmarks: Tragion, right and left and submandibular.

Instrument: Tape.

Position of Subject: Subject sits with teeth and lips together but not compressed.

Procedure: With the tape passing under the gonial angles of the jaw and over the landmark indicating the juncture of the jaw and neck, measure the surface distance from right tragion to left tragion.

THE STATIC STRENGTH SUBSERIES

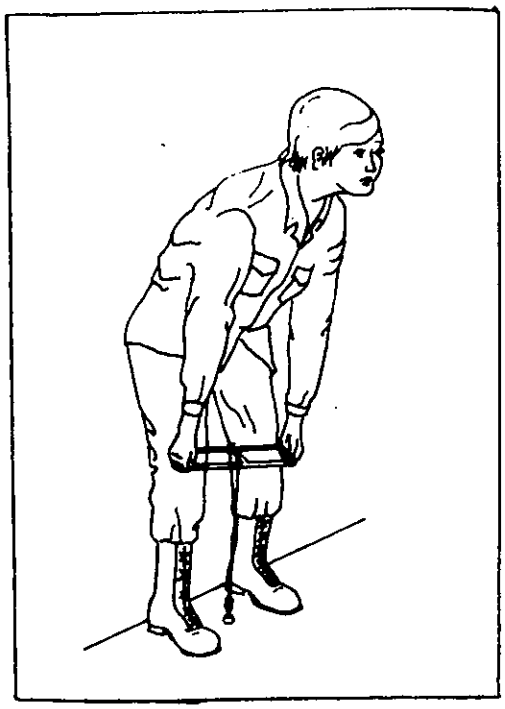


1. STANDING TWO-HANDED PULL
   38 Centimeters Above Platform
   Long Handle
   (Bent Knee)

Equipment: Long handle, force monitor, and platform. The long handle is adjusted to 38 centimeters above the platform.

Position of Subject: The subject stands with her feet 45 centimeters apart and her knees bent. She bends at the waist and grasps both sides of the long handle.

Procedure: The subject is instructed to minimize pull with the back to lessen the chance of injury. She bends the knees, bends at the waist and, using the arms and shoulders, attempts to pull the handle. In doing this she also uses her legs by extending them upward while pulling.

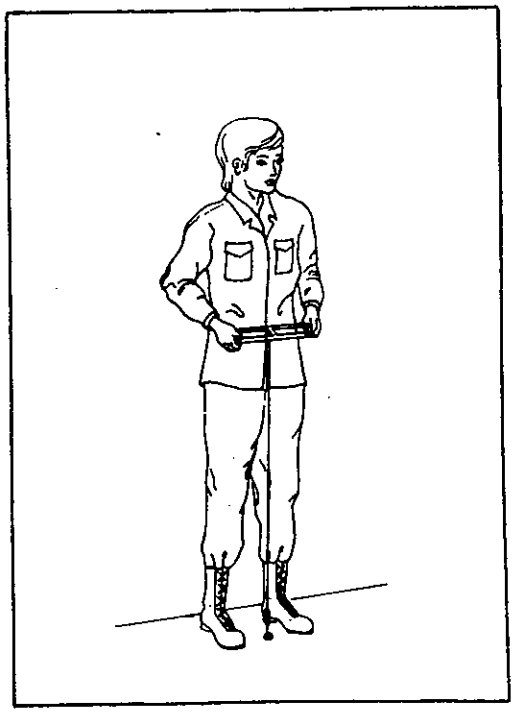


2. STANDING TWO-HANDED PULL
   50 Centimeters Above Platform
   Long Handle
   (Straight Knee)

Equipment: Long handle, force monitor, and platform. The long handle is adjusted to 50 centimeters above the platform.

Position of Subject: The subject stands with her feet 45 centimeters apart and knees straight. She bends at the waist and grasps both sides of the long handle.

Procedure: The subject is instructed to minimize pull with the back to lessen the chance of injury. She bends at the waist and, using the arms and shoulders, attempts to pull the handle. In doing this she also uses her legs by extending them upward while pulling.



3. STANDING TWO-HANDED PULL
   100 Centimeters Above Platform
   Long Handle

Equipment: Long handle, force monitor, and platform. The long handle is adjusted to 100 centimeters above the platform.

Position of Subject: The subject stands erect with her feet 45 centimeters apart. She grasps both sides of the long handle.

Procedure: The subject attempts to pull the handle using her arms, keeping her knees straight, and her feet firmly planted on the platform.

4. STANDING TWO-HANDED PUSH
   150 Centimeters Above Platform
   Long Handle

Equipment: Long handle, force monitor, and platform. The long handle is adjusted to 150 centimeters above the platform.

Position of Subject: The subject stands erect with her feet 45 centimeters apart. She grasps the long handle from below with both hands.

Procedure: The subject attempts to push the handle straight up, using her arms and shoulders, keeping her knees straight, and her feet firmly planted on the platform.

5. STANDING ONE-HANDED PULL
   100 Centimeters Above Platform
   "D" Ring

Equipment: "D" ring, force monitor, and platform. The "D" ring is adjusted to 100 centimeters above the platform.

Position of Subject: The subject stands erect with her feet 15 centimeters apart and flat on the platform. She stands to one side of the hook so that when she grasps the "D" ring from underneath, with her dominant hand, the rope is parallel to the long axis of the adjacent leg. Her other arm is relaxed at her side.

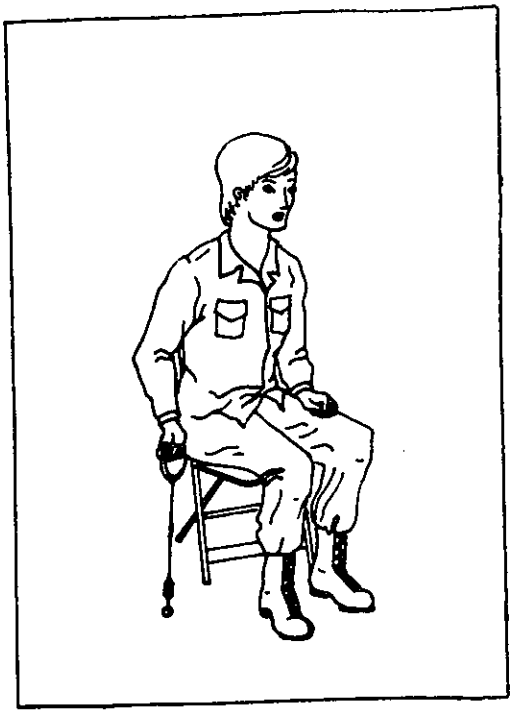
Procedure: The subject attempts to pull the "D" ring, primarily using her arm while keeping her shoulders square, knees straight and her feet firmly planted on the platform.

6. SEATED ONE-HANDED PULL
   Centerline of Seat
   45 Centimeters Above Platform
   "D" Ring

Equipment: "D" ring, force monitor, platform, and chair. The "D" ring is adjusted to 45 centimeters above the platform just forward of the seat and in the centerline.

Position of Subject: The subject sits erect with her feet 55 centimeters apart and flat on the platform. The chair is positioned behind the platform hook so that the rope attached to the "D" ring is vertical when it is pulled. She grasps the "D" ring from the underside with her dominant hand without bracing her arm on her thigh. Her other hand rests in her lap.

Procedure: The subject attempts to pull the "D" ring, using her dominant hand while keeping her shoulders square, her feet firmly planted on the platform. Her other hand rests in her lap and should not grasp the underneath side of the chair.

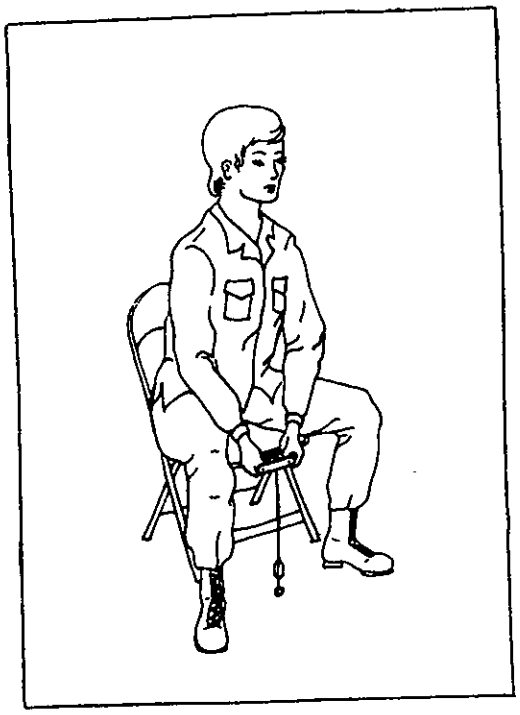


7. SEATED ONE-HANDED PULL
   Side of Seat (Dominant Hand)
   45 Centimeters Above Platform
   "D" Ring

Equipment: "D" ring, force monitor, platform, and chair. The "D" ring is adjusted to 45 centimeters above the platform.

Position of Subject: The subject sits erect with her feet 55 centimeters apart and flat on the platform. The chair is positioned so that the platform hook is a short distance to the right (or left, if that is the dominant hand) of a point midway between the maximal protrusion of the buttock and the knee. The subject grasps the "D" ring with her dominant hand from the underside.

Procedure: The subject attempts to pull the "D" ring using her dominant hand while keeping her shoulders square. Her other hand rests in her lap and her feet remain firmly planted on the platform.



8. SEATED TWO-HANDED PULL
   Centerline of Seat
   38 Centimeters Above Platform
   Short Handle

Equipment: Short handle, force monitor, platform, and chair. The short handle is adjusted to 38 centimeters above the platform.

Position of Subject: The subject sits erect with her feet 55 centimeters apart and flat on the platform. The chair is positioned behind the platform hook so that the short handle rope is vertical when it is pulled. The subject bends slightly at the waist and grasps both sides of the short handle with her hands.

Procedure: The subject attempts to lift the short handle, primarily using her arms and shoulders while keeping her arms off her thighs.

9. SEATED TWO-HANDED PULL
   Centerline of Seat
   50 Centimeters Above Platform
   Short Handle

Equipment: Short handle, force monitor, platform, and chair. The short handle is adjusted to 50 centimeters above the platform.

Position of Subject: The subject sits erect with her feet 55 centimeters apart and flat on the platform. The chair is positioned behind the platform hook so that the short handle rope is vertical when it is pulled. The subject bends slightly at the waist and grasps both sides of the short handle with her hands.

Procedure: The subject attempts to pull the short handle, primarily using her arms and shoulder while keeping her arms off her thighs.

Chapter III

TECHNIQUES USED IN OTHER MAJOR ANTHROPOMETRIC SURVEYS OF AMERICAN WOMEN

The number of large-scale anthropometric surveys of American women is small. In addition to the present survey, there have been only three surveys in which large numbers of body size measurements have been made on large numbers of American women:

1. a survey of 1,905 Air Force women made in 1968 (136 measurements);

2. a survey of 8,859 Army women made in 1946 at the end of World War II (64 measurements); and,

3. a survey of 14,698 civilian women made under the direction of the U. S. Department of Agriculture in 1939 and 1940 (59 measurements).

We are reprinting here the descriptions--as furnished in the reports of these surveys--of the measurement techniques used in these three surveys. There are two main reasons for doing this. The first of these is that the reports for all three surveys are out of print and, except for the first of them, are often difficult to locate. The second reason is that by including these descriptions in this report we have assembled in one place descriptions of all the techniques used in major anthropometric surveys of American women. Thus, we hope, we are providing a useful resource for both users and collectors of anthropometric data of adult females.*

Both variable names and descriptions are given here exactly as they appeared in the original reports. The variety of names sometimes associated with a single measurement technique and the variety of techniques sometimes associated with the same measurement name do, in truth, call out for a serious effort to standardize names and techniques, but we have not undertaken that awesome task here. Measurements are listed in the order in which they appear in the original reports; an alphabetic listing of measurement names for these earlier surveys and the present one appears in Appendix B. In each, a number of landmarks were defined, often marked, and used in the definitions of the measurements. We have included here the definitions of these landmarks as given in each report.

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* Brief summaries of the data from the three surveys will be included in a subsequent report.

While we limit ourselves here to these three surveys, it may be appropriate to note briefly a few other women's surveys which, while not "large-scale" by our criteria of at least 50 measurements on 1,000 or more women, are still of some present or prior importance. Listed in chronological order, these are:

a. Army Air Force Women, 1942. Thirty-one anthropometric measurements were made on 444 women pilot trainees and 152 flying nurses. Data and brief descriptions of measuring procedures are given in: F. E. Randall, A. Damon, R. S. Benton and D. I. Patt. 1946. Human Body Size in Military Aircraft and Personal Equipment, AAF Technical Report No. 5501, Air Materiel Command, Wright Field, Dayton, Ohio. (ATI 24519)

b. USAF Basic Trainees, 1952. Sixty-three measurements were made on 852 women, 65% of whom were under 20 years of age. Descriptions and univariate statistics are given in: G. S. Daniels, H. C. Meyers, Jr. and Sheryl H. Worrall. 1953. Anthropometry of WAF Basic Trainees, WADC TR 53-12, Wright Air Development Center, Wright-Patterson Air Force Base, Ohio. (AD 20542); correlational statistics are presented in: E. Churchill and K. Bernhardi. 1957. WAF Trainee Body Dimensions: A Correlation Matrix, WADC TR 57-197, Wright Air Development Center, Wright-Patterson Air Force Base, Ohio. (AD 118 161)

c. National Health Examination civilian survey, 1959-1962. Eighteen measurements were made on a sample of 3,581 women. The results of this survey are of considerable significance because they were based on a scientifically selected sample of non-institutional adults. More recent data have been collected but have not, as yet, been reported in detail. Descriptions of this survey and its results are to be found in: T. Gordon and H. Miller. 1964. Cycle I of the Health Examination Survey: Sample and Response, United States, 1960-1962, Public Health Service Publication No. 1000, Series 11, No. 1, U. S. Government Printing Office, Washington, D. C.; H. W. Stoudt, A. Damon, R. McFarland and J. Roberts. 1965. Weight, Height, and Selected Body Dimensions of Adults, United States, 1960-1962, Public Health Service Publication No. 1000, Series 11, No. 8, U. S. Government Printing Office, Washington, D. C.; and H. W. Stoudt, A. Damon, R. McFarland and J. Roberts. 1970. Skinfolds, Body Girths, Biacromial Diameter and Selected Anthropometric Indices of Adults, United States, 1960-1962, Public Health Service Publication No. 1000, Series 11, No. 35, U. S. Government Printing Office, Washington, D. C.

d. Airline Stewardesses, 1971. Seventy-two measurements were made on 423 stewardess trainees of American Airlines. The conduct and results of the survey are reported in: C. C. Snow, H. M. Reynolds and M. A. Allgood. 1975. Anthropometry of Airline Stewardesses, Department

of Transportation Report No. FAA-AM-75-2, FAA Office of Aviation Medicine, Civil Aeromedical Institute, Oklahoma City, Oklahoma.

Major anthropometric surveys of women in other countries have been quite rare. The following surveys are worthy of mention:

Slovakian women--12 measurements. Number of subjects varies from 360 to 1,500, reported in: M. Prokopec. 1969. "Dimensional Characteristics of Men and Women in Czechoslovakia for the Purposes of Industry," in Ergonomics in Machine Design, Volume I, International Labour Office, Geneva, Switzerland, pp. 575-593.

Dutch women--15 measurements on 5,001 department store customers, reported with a highly sophisticated analysis of the use of such data for sizing purposes in: J. Sittig and H. Freudenthal. 1951. De Juiste Maat (in Dutch with English summary). N. V. Magazijn "Die Beijenkorf," Uitgegeven Big L. Stafleu, Uitgever Te Leiden, The Netherlands.

German office workers--10 measurements, plus some duplicates on the opposite side of unilateral measurements, on 1,166 office workers, reported in: Von T. Peters. 1969. "Anthropometrische and Physiologische Grundlagen zur Gestaltung von Buroarbeitssitzen" (in German), Ergonomics, 12 (2): 162-170.

English women--37 measurements on a sample of 4,995 women, reported in: W. F. F. Kemsley. 1957. Women's Measurements and Sizes, Cheltenham Press Ltd., Cheltenham, England.

Swedish women--54 measurements on 216 women, reported in: B. E. Ingelmark and T. Lewin. 1968. "Anthropometrical Studies on Swedish Women," Acta Morphologica, Neerlando-Scandinavica, III (2): 145-166; and 37 measurements on 77 women, reported in: T. Lewin. 1969. "Anthropometric Studies on Swedish Industrial Workers When Standing and Sitting," Ergonomics, 12 (6): 883-902.

Australian pilots--17 measurements on 75 women, reported in: M. I. Bullock and M. A. Steinberg. 1973. Arm Reach Boundaries for Cockpit Control Operation, Aviation Medicine Memorandum No. 31, Aviation Medicine Branch, Department of Civil Aviation, Melbourne, Victoria 3001, Australia.

Japanese women--41 measurements on approximately 9,000 women, reported in: S. Yanagisawa. 1974. About Japanese Physique and Body Girth (in Japanese), Department of Home Economics, Ochanomizu Institute, Women's University, Bunkyo-Ku, Tokyo, Japan.

The 1968 Survey of Air Force Women

Measurement techniques as well as statistical material for this survey have been published in Anthropometry of Air Force Women by C. E. Clauser et al., 1972, AMRL-TR-70-5, Wright-Patterson Air Force Base, Ohio (AD 743 113). Descriptions are given below for variables 2-124; variable 1 was age, variable 125 was grip strength, and variables 126-138 were measurements made over foundation garments using the same techniques as were used for the corresponding measurements made over panties.

The landmarks marked on each subject are illustrated in Figure 9 (Figure 1 of Anthropometry of Air Force Women) and were described as follows:

ABDOMINAL EXTENSION: Subject stands erect with abdomen relaxed. The level of the maximum anterior protrusion of the abdomen is determined by visual inspection and marked with a short horizontal line. A short horizontal line is also drawn on the back at this level.

ACROMIALE, RIGHT AND LEFT: Subject stands with arms relaxed at sides. The most lateral margin of each acromial process is determined by palpation and marked with a short horizontal line.

ANKLE: The level of the minimum circumference of the right ankle is determined with a measuring tape and marked on the medial surface with a short horizontal line.

BICEPS, RIGHT AND LEFT: Subject's upper arm is horizontal, elbow flexed 90 degrees and fist tightly clenched. The point of maximum protrusion of the strongly contracted biceps brachii muscle is determined by visual inspection and marked with a short horizontal line.

BUST, RIGHT AND LEFT: The point of the maximum anterior protrusion of each bra cup is determined by visual inspection. Short horizontal and vertical lines are drawn through these points.

BUSTPOINT, RIGHT AND LEFT: The intersections of the horizontal and vertical bust landmarks are the bustpoint landmarks.

BUTTOCK: Subject stands. The level of the maximum protrusion of the right buttock is determined by visual inspection and marked with a short horizontal line.

CALF, RIGHT AND LEFT: Subject stands. The level of the maximum circumference of each calf is determined with a measuring tape and marked on the medial surface with a short horizontal line.

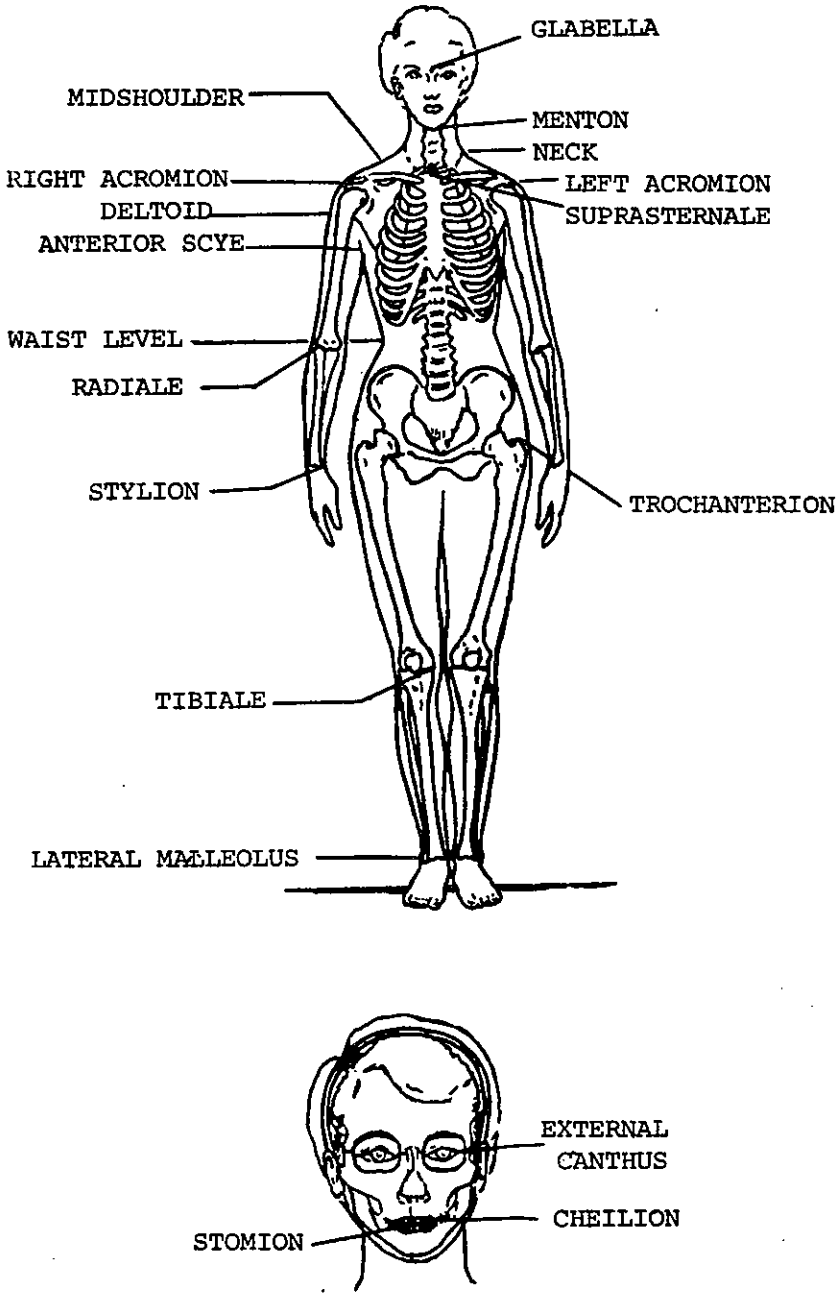

Figure 9a. Locations of landmarks, 1968 Survey of Air Force Women.

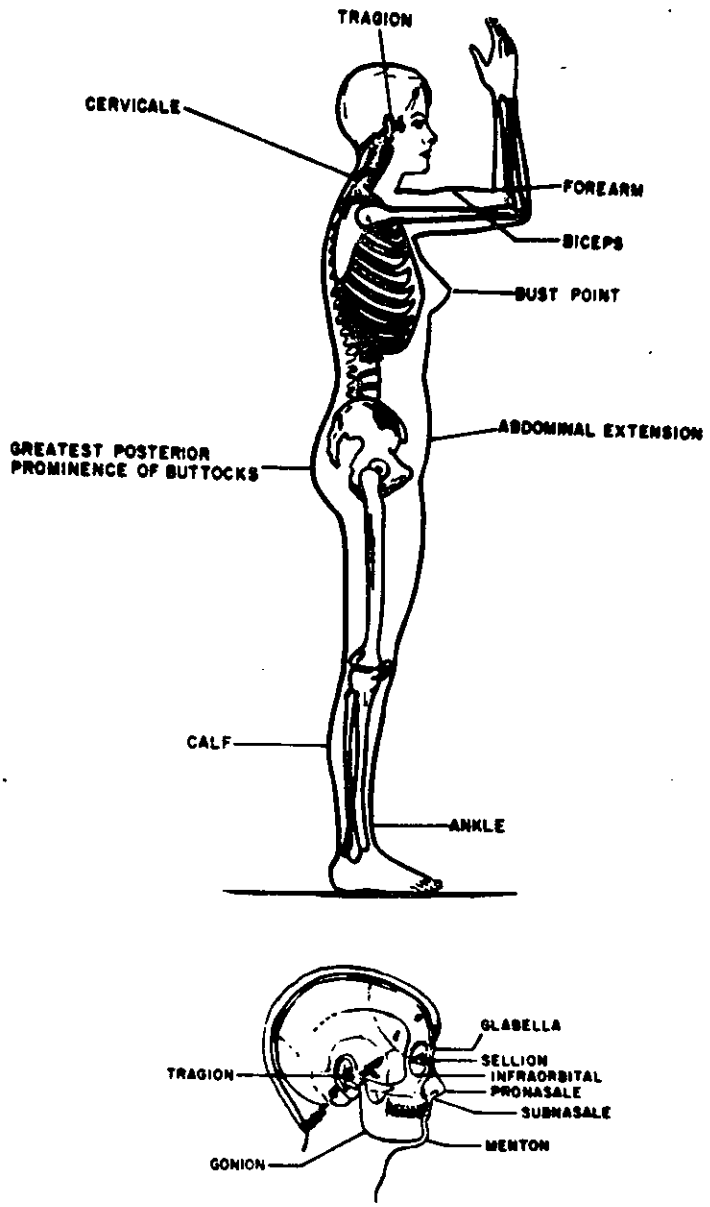

Figure 9b. Locations of landmarks, 1968 Survey of Air Force Women.

CERVICALE: Subject stands with head in the Frankfort plane. The tip of the spinous process of the 7th cervical vertebra is determined by palpation and marked with a short horizontal line.

DELTOID: Subject stands with arms relaxed at sides. The most lateral protrusion of the right deltoid muscle is determined by visual inspection and marked with a dot.

FOREARM: Subject's upper arm is horizontal, elbow flexed 90 degrees, and fist tightly clenched. A short horizontal line is drawn one tape width (6 mm) distal to the crotch of the elbow.

GLABELLA: The most anterior point in the midsagittal plane on the forehead between the brow ridges is determined by palpation and visual inspection and marked with a dot.

HIP--7 INCH: A short horizontal line is drawn on the right hip 7 inches, as measured over the body surface with a tape, below the right waist landmark. The process is repeated on the left side.

HIP--9 INCH: A short horizontal line is drawn on the right hip 9 inches, as measured over the body surface with a tape, below the right waist landmark. The process is repeated on the left side.

INFRA-ORBITAL: The lowest point on the inferior border of the right orbit is determined by palpation and marked with a dot. This landmark, in conjunction with the right tragion landmark, facilitates the positioning of the subject's head in the Frankfort plane.

KNEE: The upper and lower borders of the patella are located by palpation and the horizontal midpoint between the borders is determined visually and marked with a short horizontal line. The subject's knee is straight but care is taken to insure that it is not locked.

LATERAL MALLEOLUS: The maximum protrusion of the right lateral malleolus is determined by palpation and marked with a short horizontal line.

MENTON: A point in the midsagittal plane on the curvature of the lower jaw, on a line approximating 45 degrees from vertical and perpendicular to a tangent of the curvature, is determined by palpation and marked with a dot.

MID-AXILLARY LINE: A vertical line originating at the center of the axillary space.

MID-SHOULDER: The point on the upper surface of the right shoulder midway between the lateral neck landmark and the acromial landmark is determined by visual inspection and marked with a short line.

NECK: Subject stands with head in the Frankfort plane. A circle is established by placing a loop over the subject's head and tightening it around the neck at the neck-shoulder juncture. The loop is adjusted so that the plane formed is perpendicular to the long axis of the neck. Anterior, right and left lateral, and posterior lines are drawn along the top edge of the loop. A vertical line is drawn to mark the right mid-lateral neck landmark.

RADIALE: The highest palpable point on the head of the right radius is determined and marked with a short horizontal line.

SCYE, RIGHT AND LEFT: These are a series of marks drawn at the axillary folds formed by the juncture of the arms and trunk. Subject stands and initially abducts slightly her right arm; a straight edge is placed horizontally under the armpit so that the top of the straight edge touches, without compressing the tissue, the inferior point of the axillary fold. The subject then relaxes her arm and short horizontal lines are drawn at the level of the top of the straight edge on the anterior and posterior surfaces of the arms and torso. On the posterior surface, a line is also drawn upward following the fold towards the acromial landmark. The process is repeated on the left side of the body.

SCYE POINT, RIGHT AND LEFT: The intersections of the posterior horizontal scye landmarks and the lines following the axillary folds are the scye point landmarks.

STYLION: The tip of the styloid process of the right radius is determined by palpation and marked with a short horizontal line. The landmark is extended along the anterior and posterior aspects of the wrist perpendicular to the long axis of the forearm.

SUPRASTERNALE: The lowest point of the jugular notch on the superior margin of the sternum is determined by palpation and marked with a short horizontal line.

TIBIALE: Subject stands. The level of the proximal medial margin of the right tibia is located by palpation and marked with a short horizontal line.

TRAGION, RIGHT AND LEFT: The deepest point of the notch just above the tragus of each ear is determined by visual inspection and marked with a dot.

TROCHANTERIC, RIGHT AND LEFT: Subject stands. The superior point of the greater trochanter of each femur is determined by palpation and marked with a short horizontal line.

WAIST: Subject stands. The level of the waist is established using a quarter-inch elastic belt. The subject is asked to place the belt at her "normal" waist level and fasten it with minimum constriction. The belt is then adjusted, if necessary, to lie in a horizontal plane. Short lines are drawn along the top of the belt on the front, back and at both sides of the waist.

The descriptions of the measuring techniques for variables 2 - 124 are the following;

2. WEIGHT:
Using a balance type scale, subject (wearing panties and bra) stands on center of scale platform. Balance is adjusted to within 0.25 pound.

3. TRICEPS SKINFOLD:
Subject stands with right elbow flexed 90 degrees. Locate the level on the back of the upper arm halfway between acromion and the tip of the elbow and then have the subject relax her arm at her side. At the level previously located, pick up a skinfold parallel to the long axis of the upper arm. Using a Harpenden skinfold caliper, measure the thickness of the fold.

4. SUBSCAPULAR SKINFOLD:
Subject stands relaxed. Pick up a skinfold just below the inferior angle of the right scapula and parallel to the tension lines of the skin. Using a Harpenden skinfold caliper, measure the thickness of the fold.

5. SUPRAILIAC SKINFOLD:
Subject stands relaxed. Pick up a skinfold in the right mid-axillary line at the level of the crest of the ilium and following the border of the crest. Using a Harpenden skinfold caliper, measure the thickness of the fold.

6. MEDIAL CALF SKINFOLD:
Subject stands with right foot resting on a platform so that right hip and knee are flexed about 90 degrees. Pick up a skinfold parallel to the long axis of the lower leg at the right calf landmark. Using a Harpenden skinfold caliper, measure the thickness of the fold.

7. STATURE:
Subject stands erect, head in the Frankfort plane, heels together, and weight distributed equally on both feet. With the arm of the anthropometer firmly touching the scalp, measure the vertical distance from the standing surface to the top of the head.

8. STATURE, MAXIMUM:
Subject stands erect, head in the Frankfort plane, heels together, and weight distributed equally on both feet. While taking a deep breath, subject stretches to maximum stature, maintaining head in the Frankfort plane and feet flat on the floor. With the arm of the anthropometer firmly touching the scalp, measure the vertical distance from the standing surface to the top of the head.

9. CERVICALE HEIGHT:
Subject stands erect, head in the Frankfort plane, heels together, and weight distributed equally on both feet. With an anthropometer, measure the vertical distance from the standing surface to the cervicale landmark.

10. ACROMIAL HEIGHT:
Subject stands erect looking straight ahead, heels together, and weight distributed equally on both feet. With an anthropometer, measure the vertical distance from the standing surface to the right acromial landmark.

11. SUPRASTERNALE HEIGHT:
Subject stands erect looking straight ahead, heels together, and weight distributed equally on both feet. With an anthropometer, measure the vertical distance from the standing surface to the suprasternale landmark.

12. BUSTPOINT HEIGHT:
Subject stands erect looking straight ahead, heels together, and weight distributed equally on both feet. With an anthropometer, measure the vertical distance from the standing surface to the right bustpoint landmark.

13. WAIST HEIGHT:
Subject stands erect looking straight ahead, heels together, and weight distributed equally on both feet. With an anthropometer, measure the vertical distance from the standing surface to the anterior waist landmark.

14. ABDOMINAL EXTENSION HEIGHT:
Subject stands erect looking straight ahead, heels together, and weight distributed equally on both feet. With an anthropometer, measure the vertical distance from the standing surface to the abdominal extension landmark.

15. TROCHANTERIC HEIGHT:
Subject stands erect looking straight ahead, heels together, and weight distributed equally on both feet. With an anthropometer, measure the vertical distance from the standing surface to the right trochanteric landmark.

16. BUTTOCK HEIGHT:
Subject stands erect looking straight ahead, heels together, and weight distributed equally on both feet. With an anthropometer, measure the vertical distance from the standing surface to the buttock landmark.

17. GLUTEAL FURROW HEIGHT:
Subject stands erect looking straight ahead, heels together, and weight distributed equally on both feet. With an anthropometer, measure the vertical distance from the standing surface to the lowest point on the right gluteal furrow.

18. TIBIALE HEIGHT:
Subject stands erect, heels together, and weight distributed equally on both feet. With an anthropometer, measure the vertical distance from the standing surface to the tibiale landmark on the right leg.

19. CROTCH HEIGHT:
Subject stands erect looking straight ahead, heels approximately 10 cm apart, and weight distributed equally on both feet. The measurer holds the anthropometer in front of the subject and requests her to raise the arm of the anthropometer up into the crotch until contact is made. The vertical distance from the standing surface to that level is then recorded.

20. ANKLE HEIGHT:
Subject stands with weight distributed equally on both feet. With the special measuring block, measure the vertical distance from the standing surface to the ankle landmark on the right leg.

21. LATERAL MALLEOLUS HEIGHT:
Subject stands with weight distributed equally on both feet. With the special measuring block, measure the vertical distance from the standing surface to the lateral malleolus landmark on the right leg.

22. SITTING HEIGHT, RELAXED:
Subject sits relaxed with head in the Frankfort plane. With the arm of the anthropometer firmly touching the scalp, measure the vertical distance from the sitting surface to the top of the head.

23. SITTING HEIGHT:
Subject sits erect, head in the Frankfort plane, upper arms hanging relaxed, forearms and hands extended forward horizontally. With the anthropometer arm firmly touching the scalp, measure the vertical distance from the sitting surface to the top of the head.

24. EYE HEIGHT, SITTING:
Subject sits erect, head in the Frankfort plane, upper arms hanging relaxed, forearms and hands extended forward horizontally. With an anthropometer, measure the vertical distance from the sitting surface to the right ectocanthus.

25. MID-SHOULDER HEIGHT, SITTING:
Subject sits erect looking straight ahead, upper arms hanging relaxed, forearms and hands extended forward horizontally. With an anthropometer, measure the vertical distance from the sitting surface to the right mid-shoulder landmark.

26. WAIST HEIGHT, SITTING:
Subject sits erect looking straight ahead, upper arms hanging relaxed, forearms and hands extended forward horizontally. With an anthropometer, measure the vertical distance from the sitting surface to the right lateral-waist landmark.

27. ELBOW REST HEIGHT:
Subject sits erect looking straight ahead, upper arms hanging relaxed, forearms and hands extended forward horizontally. With an anthropometer, measure the vertical distance from the sitting surface to the bottom of the right elbow.

28. POPLITEAL HEIGHT:
Subject sits erect, feet on the adjustable platform, knees flexed 90 degrees, and thighs parallel. With an anthropometer, measure the vertical distance from the surface of the platform to the lateral underside of the thigh at a point contiguous to where the tendon of the biceps femoris muscle joins the lower leg.

29. BUTTOCK-POPLITEAL LENGTH:
Subject sits erect on a table, on the top of which is affixed a measuring scale with its origin at the edge of table. The feet are supported by the adjustable platform, knees flexed 90 degrees, thighs parallel, with the posterior surface of the right knee touching the front edge of the table. With a block held against the most posterior aspect of the right buttock, measure on the table scale the horizontal distance from the edge of the table to the buttock.

30. BUTTOCK-KNEE LENGTH:
Subject sits erect, feet on the adjustable platform, knees flexed 90 degrees, and thighs parallel. With a beam caliper held parallel to the long axis of the thigh, measure the horizontal distance from the most posterior aspect of the right buttock to the most anterior aspect of the right knee.

31. ACROMION-RADIALE LENGTH:
Subject stands erect looking straight ahead and with arms relaxed. With a beam caliper held parallel to the long axis of the right upper arm, measure the distance from the acromial landmark to the radiale landmark.

32. RADIALE-STYLION LENGTH:
Subject stands erect with arms relaxed. With a beam caliper held parallel to the long axis of the right forearm, measure the distance from the radiale landmark to the stylion landmark.

33. THUMB-TIP REACH:
Subject stands erect in a corner looking straight ahead, both shoulders against the back wall, right arm horizontal and held against the scale mounted on the side wall. The thumb is extended and parallel to the long axis of the arm. The tip of the index finger touches the pad of the extended thumb. With the block, measure on the wall scale the horizontal distance from the back wall to the tip of the thumb.

34. THUMB-TIP REACH, EXTENDED:
Subject stands erect in a corner looking straight ahead, right shoulder extended as far forward as possible while keeping the back of the left shoulder firmly against the back wall, the right arm is horizontal and held against the scale mounted on the side wall. The thumb is extended and parallel to the long axis of the arm. The tip of the index finger touches the pad of the extended thumb. With a block, measure on the wall scale the horizontal distance from the back wall to the tip of the thumb.

35. OVERHEAD REACH:
Subject stands erect looking straight ahead, along side of, but not touching, the wall mounted scale. Holding the special pointer in her right fist, she raises the pointer as high as possible while keeping her feet flat on the floor and both the pointer and the proximal phalanges horizontal. Measure on the wall scale the vertical distance from the floor to the tip of the pointer.

36. NECK CIRCUMFERENCE:
Subject sits erect, head in the Frankfort plane. A piece of dental tape is placed around the neck, passing over all four neck landmarks. The measurer marks off with her thumbnail a length of tape corresponding to the subject's neck circumference, and then measures this tape segment with a standard tape.

37. SHOULDER CIRCUMFERENCE:
Subject stands erect looking straight ahead, arms relaxed at sides, heels together, and weight distributed equally on both feet. With a tape held in a horizontal plane, measure the circumference of the body at the level of the deltoid landmark.

38. CHEST CIRCUMFERENCE AT SCYE:
Subject stands erect looking straight ahead, heels together, weight distributed equally on both feet, and arms abducted sufficiently to allow passage of a tape between arms and trunk. With a tape held in a horizontal plane, measure the circumference of the trunk at the level of the horizontal scye landmarks. The reading is made at the point of maximum quiet inspiration.

39. BUST CIRCUMFERENCE:
Subject stands erect looking straight ahead, heels together, weight distributed equally on both feet, and arms abducted sufficiently to allow passage of a tape between arms and trunk. With a tape held in a horizontal plane, measure the circumference of the trunk at the level of the bustpoint landmarks. The reading is made at the point of maximum quiet inspiration.

40. CHEST CIRCUMFERENCE, BELOW BUST:
Subject stands erect looking straight ahead, heels together, and weight distributed equally on both feet. The arms are abducted sufficiently to allow clearance of a tape between the arms and trunk. With a tape held in a horizontal plane, measure the circumference of the trunk at a level just below the cups of the bra. The reading is made at the point of maximum quiet inspiration.

41. WAIST CIRCUMFERENCE:
Subject stands erect looking straight ahead, heels together, and weight distributed equally on both feet. With a tape held in a horizontal plane, measure the circumference of the trunk at the level of the waist landmarks. The reading is made at the point of maximum quiet inspiration. The subject must not pull in her stomach.

42. ABDOMINAL EXTENSION CIRCUMFERENCE:
Subject stands erect looking straight ahead, heels together, and weight distributed equally on both feet. With a tape held in a horizontal plane, measure the circumference of the trunk at the level of the abdominal extension landmark. The reading is made at the point of maximum quiet inspiration. The subject must not pull in her stomach.

43. HIP CIRCUMFERENCE - seven inches below waist level:
Subject stands erect looking straight ahead, heels together, and weight distributed equally on both feet. With a tape held in a horizontal plane, measure the circumference of the trunk at the level of the 7-inch hip landmarks. The reading is made at the point of maximum quiet inspiration. The subject must not pull in her stomach.

44. HIP CIRCUMFERENCE - nine inches below waist level:
Subject stands erect looking straight ahead, heels together, and weight distributed equally on both feet. With a tape held in a horizontal plane, measure the circumference of the trunk at the level of the 9-inch hip landmarks.

45. UPPER THIGH CIRCUMFERENCE:
Subject stands erect, heels approximately 10 cm apart, and weight distributed equally on both feet. With a tape held in a plane perpendicular to the long axis of the right thigh, measure the circumference of the thigh at the level of the lowest point on the gluteal furrow. Where the furrow is deeply indented, the measurement is made just distal to the furrow.

46. KNEE CIRCUMFERENCE:
Subject stands erect, heels approximately 10 cm apart, and weight distributed equally on both feet. With a tape held in a plane perpendicular to the long axis of the right leg, measure the circumference of the knee at the level of the midpatella landmark. The subject must not tense her knee during the measurement.

47. CALF CIRCUMFERENCE, RIGHT:
Subject stands erect, heels approximately 10 cm apart, and weight distributed equally on both feet. With a tape held in a plane perpendicular to the long axis of the right lower leg, measure the circumference of the calf at the level of the calf landmark.

48. CALF CIRCUMFERENCE, LEFT:
Subject stands erect, heels approximately 10 cm apart, and weight distributed equally on both feet. With a tape held in a plane perpendicular to the long axis of the left lower leg, measure the circumference of the calf at the level of the calf landmark.

49. ANKLE CIRCUMFERENCE:
Subject stands erect with weight distributed equally on both feet. With a tape held in a plane perpendicular to the long axis of the right lower leg, measure the circumference of the leg at the level of the ankle landmark.

50. VERTICAL TRUNK CIRCUMFERENCE:
Subject stands with legs slightly apart. A length of tape is passed between the legs, over the protrusion of the right buttock, and up the back to lie over the mid-shoulder landmark. The other end of the tape is brought up over the right bustpoint landmark to the mid-shoulder landmark completing the circumference. The measurer holds the tape into the concavity of the back to insure that it follows the posterior body contour. (The tape does not follow the anterior body contour.) The measurement is made at the point of maximum quiet inspiration.

51. VERTICAL TRUNK CIRCUMFERENCE, SITTING:
Subject stands with legs slightly apart. A length of tape is passed between the legs, over the protrusion of the right buttock, and up the back to lie over the mid-shoulder landmark. Keeping the tape in place, the subject then sits, her trunk erect and arms relaxed. The other end of the tape is brought over the right bustpoint landmark to the mid-shoulder landmark completing the circumference. The measurer holds the tape into the concavity of the back to insure that it follows the posterior body contour. (The tape does not follow the anterior body contour.) The measurement is made at the point of maximum quiet inspiration.

52. BUTTOCK CIRCUMFERENCE, SITTING:
Subject sits erect on a flat surface, thighs parallel, and arms folded across chest. Drawing a tape as far forward as freely possible under the subject's buttocks and bringing it upward and diagonally across her lap at the level of the thigh-trunk intersection, measure the circumference of the buttocks.

53. SCYE CIRCUMFERENCE:
Subject stands erect looking straight ahead. The right arm is abducted sufficiently to allow placement of a tape into the axilla. With a tape passing through the axilla over the anterior and posterior-vertical scye landmarks and over the right acromial landmark, measure the circumference of the scye. The axillary tissue is not compressed.

54. AXILLARY ARM CIRCUMFERENCE:
Subject stands with right arm abducted sufficiently to allow clearance of a tape between the arm and trunk. With a tape held in a plane perpendicular to the long axis of the upper arm, measure the circumference of the arm at the level of the anterior arm-scye landmark. The axillary tissue is not compressed.

55. BICEPS CIRCUMFERENCE, RELAXED, RIGHT:
Subject stands with right arm slightly abducted. With a tape held in a plane perpendicular to the long axis of the upper arm, measure the circumference of the arm at the level of the biceps landmark.

56. BICEPS CIRCUMFERENCE, FLEXED, RIGHT:
Subject stands, right upper arm raised so that its long axis is horizontal, elbow flexed 90 degrees, biceps strongly contracted, and fist tightly clenched. With a tape held in a plane perpendicular to the long axis of the upper arm, measure the circumference of the arm at the level of the biceps landmark.

57. BICEPS CIRCUMFERENCE, RELAXED, LEFT:
Subject stands with left arm slightly abducted. With a tape held in a plane perpendicular to the long axis of the upper arm, measure the circumference of the arm at the level of the biceps landmark.

58. BICEPS CIRCUMFERENCE, FLEXED, LEFT:
Subject stands, left upper arm raised so that its long axis is horizontal, elbow flexed 90 degrees, biceps strongly contracted, and fist tightly clenched. With a tape held in a plane perpendicular to the long axis of the upper arm, measure the circumference of the arm at the level of the biceps landmark.

59. ELBOW CIRCUMFERENCE, FLEXED:
Subject stands, right upper arm raised so that its long axis is horizontal, elbow flexed 90 degrees, fist tightly clenched and biceps strongly contracted. With a tape passing over the tip and through the crotch of the elbow, measure the circumference of the elbow.

60. FOREARM CIRCUMFERENCE, RELAXED:
Subject stands erect with right arm slightly abducted and hand relaxed. With a tape held in a plane perpendicular to the long axis of the forearm, measure the circumference of the arm at the level of the forearm landmark.

61. FOREARM CIRCUMFERENCE, FLEXED:
Subject stands, right upper arm raised so that its long axis is horizontal, elbow flexed 90 degrees, and fist tightly clenched. With a tape held in a plane perpendicular to the long axis of the forearm, measure the circumference of the arm at the level of the forearm landmark.

62. WRIST CIRCUMFERENCE:
Subject stands with right arm slightly abducted. With a tape held in a plane perpendicular to the long axis of the forearm and hand, measure the circumference of the wrist at the level of the stylion landmark.

63. BIACROMIAL BREADTH:
Subject sits erect looking straight ahead, upper arms hanging relaxed, forearms and hands extended forward horizontally. With a beam caliper, measure the distance between the acromial landmarks.

64. BIDELTOID BREADTH:
Subject sits erect looking straight ahead, upper arms hanging relaxed, forearms and hands extended forward horizontally. With a beam caliper, measure the horizontal distance across the body at the level of the deltoid landmarks.

65. CHEST BREADTH:
Subject stands erect looking straight ahead with arms slightly abducted. With a beam caliper, measure the horizontal distance across the trunk at the level of the bustpoint landmarks.

66. BUSTPOINT-TO-BUSTPOINT BREADTH:
Subject stands erect looking straight ahead. With a beam caliper, measure the horizontal distance between the bustpoint landmarks.

67. WAIST BREADTH:
Subject stands erect looking straight ahead with arms slightly abducted. With a beam caliper, measure the horizontal breadth across the trunk at the level of the waist landmarks.

68. HIP BREADTH:
Subject stands erect, heels together and weight distributed equally on both feet. With a beam caliper, measure the maximum horizontal breadth of the hips.

69. THIGH-TO-THIGH BREADTH, SITTING:
Subject sits erect, thighs parallel and completely supported by the sitting surface. With a beam caliper, measure the maximum horizontal distance across the thighs.

70. HUMERAL BREADTH, RIGHT:
Subject sits, right upper arm abducted, and elbow flexed. With a sliding caliper and using firm pressure, measure the maximum distance between the epicondyles of the humerus.

71. HUMERAL BREADTH, LEFT:
Subject sits, left upper arm abducted, and elbow flexed. With a sliding caliper and using firm pressure, measure the maximum distance between the epicondyles of the humerus.

72. FEMORAL BREADTH, RIGHT:
Subject sits on a table, lower legs hanging over its side, and feet unsupported. With a spreading caliper and using firm pressure, measure the maximum distance between the epicondyles of the right femur.

73. FEMORAL BREADTH, LEFT:
Subject sits on a table, lower legs hanging over its side, and feet unsupported. With a spreading caliper and using firm pressure, measure the maximum distance between the epicondyles of the left femur.

74. CHEST DEPTH:
Subject stands erect looking straight ahead, heels together, and weight distributed equally on both feet. With a beam caliper, measure the horizontal depth of the trunk at the level of the bustpoint landmarks. The reading is made at the point of maximum quiet inspiration.

75. WAIST DEPTH:
Subject stands erect looking straight ahead, arms at sides, heels together, and weight distributed equally on both feet. With a beam caliper, measure the horizontal depth of the trunk at the level of the waist landmarks. The reading is made at the point of maximum quiet inspiration. The subject must not pull in her stomach.

76. ABDOMINAL EXTENSION DEPTH:
Subject stands erect looking straight ahead, arms at sides, heels together, and weight distributed equally on both feet. With a beam caliper, measure the horizontal depth of the trunk at the level of the abdominal extension landmark. The reading is made at the point of maximum quiet inspiration. The subject must not pull in her stomach.

77. BUTTOCK DEPTH:
Subject stands erect, heels together and weight distributed equally on both feet. With a beam caliper, measure the horizontal depth of the trunk at the level of the buttock landmark.

78. THIGH CLEARANCE:
Subject sits erect on a flat surface, feet on the adjustable platform, and knees flexed 90 degrees. With an anthropometer, measure the vertical distance from the sitting surface to the highest point on the right thigh.

79. SHOULDER LENGTH:
Subject stands erect with the head in the Frankfort plane. With a tape, measure the surface distance along the top of the shoulder from the right lateral-neck landmark to the right acromial landmark.

80. NECK-TO-BUSTPOINT LENGTH:
Subject stands erect looking straight ahead. With a tape, measure the straight line distance from the right lateral-neck landmark to the right bustpoint landmark. The tape is held tense and does not follow the surface contour of the body.

81. STRAP LENGTH:
Subject stands erect with head in the Frankfort plane. With a tape, measure the distance from the right bustpoint landmark across the posterior neck landmark to the left bustpoint landmark. The tape is held tense and does not follow the curvature of the front of the body.

82. INTERSCYE CURVATURE:
Subject stands erect with arms relaxed. With a tape held in a horizontal plane, measure the distance across the back between the posterior scye-point landmarks.

83. INTERSCYE CURVATURE, MAXIMUM:
Subject stands, torso bent forward from the waist at an angle of about 90 degrees and arms hanging relaxed. With a tape, measure the surface distance across the back between the posterior scye-point landmarks.

84. BACK CURVATURE:
Subject stands erect with hands on hips. With a tape held in a horizontal plane, measure the distance across the back between the mid-axillary landmarks at the level of the bustpoint landmarks.

85. WAIST BACK:
Subject stands erect with head in the Frankfort plane. With a tape, measure the surface distance along the spine from the cervicale landmark to the posterior waist landmark.

86. ANTERIOR WAIST LENGTH:
Subject stands erect looking straight ahead. With a tape, measure the surface distance from the anterior neck landmark to the anterior waist landmark.

87. SLEEVE INSEAM:
Subject stands, right arm slightly abducted and palm forward. With a tape, measure the distance from the right anterior, scye-point landmark to the ulnar side of the right wrist landmark. The tape is held tense and does not follow the surface contour of the arm.

88. SPINE-TO-SCYE LENGTH (SLEEVE LENGTH SEGMENT):
Subject stands, arms horizontal, elbows flexed about 60 degrees, fists clenched and touching. A tape with its zero point on the midline of the spine is passed horizontally around the right shoulder and over the tip of the elbow to the wrist landmark. Measure the surface distance from the spine to the posterior vertical-scye landmark.

89. SPINE-TO-ELBOW LENGTH (SLEEVE LENGTH SEGMENT):
Subject stands, arms horizontal, elbows flexed about 60 degrees, and fists clenched and touching. A tape with its zero point on the midline of the spine is passed horizontally around the right shoulder and over the tip of the elbow to the wrist landmark. Measure the surface distance from the spine to the tip of the elbow.

90. SPINE-TO-WRIST LENGTH (SLEEVE LENGTH):
Subject stands, arms horizontal, elbow flexed about 60 degrees, and fists clenched and touching. A tape with its zero point on the midline of the spine is passed horizontally around the right shoulder and over the tip of the elbow to the wrist landmark. Measure the surface distance from the spine to the wrist landmark.

91. HAND LENGTH:
Subject sits, right forearm and hand raised with palm up. The fingers are together and straight but not hyper-extended. With the bar of a sliding caliper parallel to the long axis of the hand, measure the distance from the wrist landmark to dactylion.

92. HAND BREADTH:
Subject sits, right forearm and hand raised with palm down. The fingers are together and straight but not hyper-extended. With a sliding caliper, measure the breadth of the hand between metacarpal-phalangeal joints II and V.

93. HAND CIRCUMFERENCE:
Subject stands with right hand and fingers extended and thumb abducted. With a tape passing over metacarpal-phalangeal joints II and V, measure the circumference of the hand.

94. FOOT LENGTH:
Subject stands erect, right foot in the measuring box, left foot on a board of equal height, and weight distributed equally. The right foot is positioned so that its long axis is parallel to the side of the box, the heel touches the rear of the box and the medial metatarsal-phalangeal joint touches the side of the box. With the measuring block touching the tip of the most protruding toe, measure on the scale of the box the length of the foot.

95. FOOT BREADTH:
Subject stands erect, right foot in the measuring box, left foot on a board of equal height, and weight distributed equally. The right foot is positioned so that its long axis is parallel to the side of the box, the heel touches the rear of the box, and the medial metatarsal-phalangeal joint touches the side of the box. With the measuring block touching the widest part of the foot, measure on the scale of the box the breadth of the foot.

96. HEAD LENGTH:
Subject sits. With a spreading caliper, measure in the mid-sagittal plane the maximum length of the head between the glabella landmark and the occiput.

97. HEAD BREADTH:
Subject sits. With a spreading caliper, measure the maximum horizontal breadth of the head above the level of the ears.

98. HEAD CIRCUMFERENCE:
Subject sits. With a tape passing above the brow ridges and nuchale, measure the maximum circumference of the head.

99. TRAGION TO TOP OF HEAD:
Subject stands under the headboard looking straight ahead. The headboard is adjusted so that its vertical and horizontal planes are in firm contact with the back and the top of the head. Positioning the head in the Frankfort plane and using the special gauge, measure the vertical distance from the horizontal plane to the right tragion landmark.

100. ECTOCANTHUS TO TOP OF HEAD:
Subject stands under the headboard looking straight ahead. The headboard is adjusted so that its vertical and horizontal planes are in firm contact with the back and the top of the head. Positioning the head in the Frankfort plane and using the special gauge, measure the vertical distance from the horizontal plane to the right ectocanthus.

101. PRONASALE TO TOP OF HEAD:
Subject stands under the headboard looking straight ahead. The headboard is adjusted so that its vertical and horizontal planes are in firm contact with the back and the top of the head. Positioning the head in the Frankfort plane and using the special gauge, measure the vertical distance from the horizontal plane to pronasale.

102. SUBNASALE TO TOP OF HEAD:
Subject stands under the headboard looking straight ahead. The headboard is adjusted so that its vertical and horizontal planes are in firm contact with the back and the top of the head. Positioning the head in the Frankfort plane and using the special gauge, measure the vertical distance from the horizontal plane to subnasale.

103. STOMION TO TOP OF HEAD:
Subject stands under the headboard looking straight ahead. The headboard is adjusted so that its vertical and horizontal planes are in firm contact with the back and the top of the head. Positioning the head in the Frankfort plane and using the special gauge, measure the vertical distance from the horizontal plane to stomion.

104. MENTON TO TOP OF HEAD:
Subject stands under the headboard looking straight ahead. The headboard is adjusted so that its vertical and horizontal planes are in firm contact with the back and the top of the head. Positioning the head in the Frankfort plane and using the special gauge, measure the vertical distance from the horizontal plane to the menton landmark.

105. TRAGION TO WALL:
Subject stands under the headboard looking straight ahead. The headboard is adjusted so that its vertical and horizontal planes are in firm contact with the back and the top of the head. Positioning the head in the Frankfort plane and using the special gauge, measure the horizontal distance from the vertical plane to the right tragion landmark.

106. ECTOCANTHUS TO WALL:
Subject stands under the headboard looking straight ahead. The headboard is adjusted so that its vertical and horizontal planes are in firm contact with the back and the top of the head. Positioning the head in the Frankfort plane and using the special gauge, measure the horizontal distance from the vertical plane to the right ectocanthus.

107. PRONASALE TO WALL:
Subject stands under the headboard looking straight ahead. The headboard is adjusted so that its vertical and horizontal planes are in firm contact with the back and the top of the head. Positioning the head in the Frankfort plane and using the special gauge, measure the horizontal distance from the vertical plane to pronasale.

108. SUBNASALE TO WALL:
Subject stands under the headboard looking straight ahead. The headboard is adjusted so that its vertical and horizontal planes are in firm contact with the back and the top of the head. Positioning the head in the Frankfort plane and using the special gauge, measure the horizontal distance from the vertical plane to subnasale.

109. LIP PROTRUSION TO WALL:
Subject stands under the headboard looking straight ahead. The headboard is adjusted so that its vertical and horizontal planes are in firm contact with the back and the top of the head. Positioning the head in the Frankfort plane and using the special gauge, measure the horizontal distance from the wall to the point of greatest anterior lip protrusion.

110. MENTON TO WALL:
Subject stands under the headboard looking straight ahead. The headboard is adjusted so that its vertical and horizontal planes are in firm contact with the back and the top of the head. Positioning the head in the Frankfort plane and using the special gauge, measure the horizontal distance from the vertical plane to the menton landmark.

111. SAGITTAL CURVATURE:
Subject sits. With a tape held as close to the scalp as possible, measure the surface distance in the midsagittal plane from the glabella landmark to nuchale.

112. BITRAGION-CORONAL CURVATURE:
Subject sits. With a tape held as close to the scalp as possible, measure the surface distance in a coronal plane from the left to the right tragion landmark.

113. BIOCULAR BREADTH:
Subject sits. With a sliding caliper, measure the breadth of the face between the right and left ectocanthi.

114. BIAURICULAR BREADTH:
Subject sits. With a spreading caliper, measure the distance from the most lateral point of the right ear to the corresponding point of the left ear. Use minimum pressure in applying the caliper.

115. BITRAGION BREADTH:
Subject sits. With a spreading caliper, measure the breadth of the head between the right and left tragion landmarks.

116. BIZYGOMATIC BREADTH:
Subject sits. With a spreading caliper, measure the maximum horizontal breadth of the face between the zygomatic arches.

117. BIGONIAL BREADTH:
Subject sits. With a spreading caliper, measure the maximum horizontal breadth of the jaw between the right and left gonial angles. Use minimum pressure in applying the caliper.

118. NASAL BREADTH:
Subject sits. With a sliding caliper, measure the maximum horizontal breadth of the nose.

119. LIP LENGTH:
Subject sits with mouth closed and jaw relaxed. With a sliding caliper, measure the horizontal distance from the right to the left cheilion.

120. MENTON-SUBNASALE LENGTH:
Subjects sits with mouth closed and jaw relaxed. With a sliding caliper, measure the straight-line distance from the menton landmark to subnasale.

121. MENTON-SELLION LENGTH:
Subject sits with mouth closed and jaw relaxed. With a sliding caliper, measure the straight-line distance from the menton landmark to sellion.

122. SUBNASALE-SELLION LENGTH:
Subject sits. With a sliding caliper, measure the straight line distance from subnasale to sellion.

123. EAR LENGTH:
Subject sits. With a sliding caliper, measure the maximum length of the right ear along its major axis.

124. EAR BREADTH:
Subject sits. With a sliding caliper, measure the maximum breadth of the right ear in a plane perpendicular to its major axis.

The 1946 Survey of Army Women

Sixty-four measurements (numbered 16 through 80, omitting 23) were made on about 9,000 women at the time of their separation from military service at the end of World War II. Landmarks and measuring techniques are described in F. E. Randall, 1947, Survey of Body Size of Army Personnel, Male and Female: Project No. E-59-46, Phase 4, Report No. 1 - Methodology and General Considerations (Female), Report No. 123, U. S. Army Quartermaster Climatic Research Laboratory, Lawrence, Massachusetts (AD 209 809).

This report lists the following landmarks. Apparently only a few of them (nasion, cervicale, acromion, waist points, glabella, lateral neck point, and trochanterion) were routinely marked.

VERTEX: The highest point in the midsagittal plane of the head when the head is held normally, eyes directed straight ahead.

APEX: That point on the superior surface of the head in the midsagittal plane vertically above tragion.

GLABELLA: The point where a line drawn tangential to the superior border of the eyebrows crosses the midsagittal plane of the head.

NASION: The point where the inter-nasal suture meets the naso-frontal suture. In practice this point usually is taken as the intersection of a line drawn up the crest of the nose with the transverse line at the deepest part of the nasal root.

SUBNASALE: That point where the inferior border of the nasal septum meets the upper lip. Where the junction is a curved line, the point is taken midway along the curve.

GNATHION: The most inferior point on the anterior portion of the mandible.

FRONTO-TEMPORALE: The most medial point on the temporal crest just superior to the lateral end of the eyebrows.

ZYGION: The most lateral point on the zygomatic arch.

CERVICALE: The most dorsally protruding point on the spine of the 7th cervical vertebra.

ACROMIALE: The most lateral point on the superior surface of the acromial process.

SUPRASPINALE: The most anterior point on the anterior, superior iliac spine.

LATERAL NECK POINT: That point at which the lateral line of the neck meets the superior surface of the shoulder.

a. Method of Location. The assistant observer places a small link chain around the subject's neck. The chain is held in front at the superior edge of the manubrium, crossing cervicale in the back. The chain is held tightly enough to follow the contour of the neck. The subject is asked to turn her head as far to the left as possible. The observer then runs her finger medially along the superior border of the left trapezius muscle until it touches the chain. This point is then marked.

TROCHANTERION: The most lateral point on the greater trochanter of the femur.

WAIST POINT:

a. Anterior. That point in the midsagittal plane at waist level on the anterior surface of the body.

b. Posterior. That point in the midsagittal plane at waist level on the posterior surface of the body.

c. Lateral. The most lateral point on the body at waist level.

d. Method of Location. The tape is placed horizontally around the body at the minimal circumference between the iliac crests and the 12th rib. The points are marked where the tape crosses the midsagittal plane anteriorly, posteriorly, and at the most lateral points, right and left.

STERNALE: The most anterior, superior point in the suprasternal notch.

TRAGION: The medial point, in the superior-inferior direction, on the tragus.

ALARE: The most lateral point on the wing of the nose.

OUTER CANTHUS: That point on the outer corner of the eye where the upper and lower lids meet and just lateral to the mucus membrane.

INNER CANTHUS: That point on the inner corner of the eye where the upper and lower lids of the eye meet.

OTOBASION SUPERIOR: The most superior point where the helix of the ear joins the head.

DACTYLION: The most distal point of the third finger.

The measuring techniques were described as follows:

16. WEIGHT:
Taken on physician's scales with subject wearing either panties or girdle (not both) and a hospital gown. Twenty gowns were weighed and found to have an average weight of one pound. This was subtracted from the weight before recording. The weight was then recorded to the nearest quarter pound reduced to a decimal.

At Fort Dix and for the first few weeks at Fort Sheridan, the weights were given to the survey by the Medical Department.

17. STATURE (floor to vertex):
Subject stood erect without stretching, eyes on an imaginary horizon, wearing either panties or a girdle. Anthropometer held vertically in rear of subject without touching. Combs and rolls had been previously removed from hair.

18. CERVICALE HEIGHT:
Subject stood as for #17. Measurement taken from floor vertically to cervicale.

19. ACROMION HEIGHT:
Subject stood as for #17. Measurement taken from floor vertically to left acromiale.

20. WAIST HEIGHT:
Subject stood as for #17. Measurement taken from floor vertically to left lateral waist point.

21. HIP HEIGHT:
Subject stood as for #17. Measurement taken vertically to left trochanterion.

22. INSEAM:
Subject, clothed as for #17, stood on left foot with right foot placed on a stool directly to the front. Measurer stood to rear of subject, anthropometer placed to subject's right, and held vertically. Measurement taken from floor to highest point in the crotch, midway between anterior and posterior surface of thigh. Contact.

24. ARM LENGTH:
Subject stood as for #17. Measurement taken vertically from floor to left dactylion. To get arm length, this measurement must be subtracted from #19.

25. FOOT LENGTH:
Subject stood as for #22. Anthropometer held lateral to the foot and parallel to its anterior-posterior axis. Measurement taken from the most posterior point on the heel to the most anterior point on the longest toe of the left foot.

26. FOOT BREADTH:
Subject stood as for #22. Anthropometer held parallel to the floor. Measurement taken as the maximum breadth across the metatarsal-phalangeal joints of the left foot.

27. INSTEP LENGTH:
Subject stood as for #22. Anthropometer held medial to the left foot and parallel to the anterior-posterior axis. Measurement taken from the most posterior point on the heel to the most medially projecting point on the metatarsal-phalangeal joint.

28. HEEL BREADTH:
Subject stood as for #22. Anthropometer held parallel to the floor and perpendicular to the anterior-posterior axis of the left foot. The needles of the anthropometer were directed downward at approximately a 45-degree angle. Measurement taken as the maximum width of the heel posterior to the malleoli.

29. SITTING HEIGHT:
Subject clothed as for #17. Subject either sat on a stool, non-adjustable, with feet on floor, or on table with feet on stool, non-adjustable. Subject sat erect with eyes on imaginary horizon. Anthropometer held vertically in rear of subject with stationary arm end on the table or stool top. The body of anthropometer held in contact with spine between the shoulder blades. The measurement taken from the table or stool top to vertex.

30. TRUNK HEIGHT:
Subject sat as for #29. Anthropometer held vertically in front, and to the left, of the subject. Measurement taken from table or stool top to sternale.

31. PATELLA HEIGHT:
Subject sat as for #29, with lower leg vertical. Anthropometer held vertically to left of foot with needle perpendicular to the lower leg. Measurement taken from floor or stool to the most superior point on the patella.

32. BUTTOCK-KNEE:
Subject sat as for #31, with knees together. Anthropometer held to the left of the subject, parallel to the floor, and parallel to the line of contact between the thighs. Measurement taken from the most posterior point on the buttocks, below the hips, and the most anterior point on the patella.

33. HEAD HEIGHT:
Subject sat as for #29, eyes on imaginary horizon, and head level. Anthropometer held vertically to left of subject. Measurement taken from apex to the center of the tragus. Left side only.

34. SHOULDER-ELBOW:
Subject sat as for #29 with upper arm parallel to the body and forearm at a right angle to it. Anthropometer held vertically a little anterior to the upper arm. Measurement taken from left acromion to the most inferior point on the olecranon process.

35. FOREARM-HAND LENGTH:
Subject sat as for #34, fingers extended. Anthropometer held as for #32. Measurement taken from the most posterior point on the left olecranon process to dactylion.

36. NIPPLE-NIPPLE:
Subject sat as for #29. Measurement taken from center of the left nipple to the center of the right nipple.

37. HIP BREADTH:
Subject sat as for #29 with both upper arms parallel to the body and both forearms extending forward at right angles to the upper arms. Anthropometer held parallel to the floor to the rear of the subject. The needles point downward at a 45-degree angle. Measurement taken as the maximum breadth below the hips.

38. ELBOW BREADTH:
Subject sat as for #37. Anthropometer held as for #37. Measurement taken as the maximum breadth between the most lateral points on the lateral epicondyles of the humeri.

39. BIDELTOID:
Subject sat as for #29, upper arm parallel to the body and the hands clasped in lap. Anthropometer held in rear of subject and parallel to the floor. Measurement taken as the maximum breadth across the deltoid muscles. Enough pressure applied to dent the skin.

40. CHEST BREADTH:
Subject stood as for #17 with arms extended horizontally to the side. Anthropometer held in front of subject and parallel to the floor. The needles extend downward and backward through and as high in the axilla as possible without exerting pressure. Measurement taken as the maximum breadth without denting the skin.

41. BI-ILIAC:
Subject stood as for #17. Anthropometer held in front of subject and parallel to the floor. Subject was asked to place her fingers on the anterior superior iliac spines. Using these as guides the measurement was taken between the two supra-spinales.

42. CHEST DEPTH:
Subject stood as for #17 with the left arm extended forward horizontally. Anthropometer held horizontally and as high in the axilla as possible without exerting pressure. Measurement taken as the maximum anterior-posterior diameter of the chest. No pressure.

43. TRUNK DEPTH:
Subject stood as for #42. Anthropometer held horizontally at the subject's left. Measurement taken as the maximum anterior-posterior diameter of the thorax or abdomen, whichever is greater, below the breasts.

44. HEAD LENGTH:
Subject sat erect with eyes on an imaginary horizon. Measurement taken as the maximum head length from glabella to the occiput in the midsagittal plane.

45. HEAD BREADTH:
Subject sat as for #44. Measurer stood to rear of subject. Measurement taken as the maximum head breadth perpendicular to #44.

46. BIZYGOMATIC:
Subject sat as for #44. Measurement taken from left to right zygion.

47. FACE LENGTH:
Subject sat as for #44. Subject was asked to put her molars together. Measurement taken from nasion to gnathion. Pressure applied to gnathion.

48. NOSE LENGTH:
Subject sat as for #44. Measurement taken from nasion to subnasale.

49. NOSE BREADTH:
Subject sat as for #44. Measurement taken from left to right alare. Light contact.

50. NASAL ROOT BREADTH:
Subject sat as for #44 with eyes closed. Measurement taken as the minimum diameter between the naso-maxillary sutures. Presure applied.

51. MINIMUM FRONTAL:
Subject sat as for #44. Measurement taken from left to right fronto-temporale.

52. BIOCULAR:
Subject sat as for #44 and was asked to look toward ceiling. Measurement taken from left to right outer canthus.

53. INTEROCULAR:
Subject sat as for #44 with eyes closed. Measurement taken from left to right inner canthus.

54. HAND LENGTH:
Subject sat as for #44 and was asked to extend left hand, palm up and fingers extended. Measurement taken from the most distal crease on the wrist to dactylion.

55. HAND BREADTH:
Subject sat as for #54. Calipers were held above the hand with points extending downward. Measurement taken as maximum breadth across the metacarpal-phalangeal joints (2nd to 5th).

56. OUTER CANTHUS-OTOBASION SUPERIOR:
Subject sat as for #44. Measurement taken from the left outer canthus to left otobasion superior.

57. HEAD CIRCUMFERENCE:
Subject sat as for #44. Measurement taken as the maximum circumference of the head when the lower edge of the tape passes just above glabella. Not necessarily horizontal. Enough pressure exerted to compress the hair. Taken once.

58. NECK CIRCUMFERENCE:
Subject sat as for #44. Measurement taken as the maximum circumference with tape held horizontally just below the voice box.

59. BREAST CIRCUMFERENCE:
Subject stood as for #17. The arms were raised while the tape was being adjusted and then lowered for the measurement. Measurer stood to rear of subject and assistant stood in front to adjust tape. Measurement taken horizontally with tape passing over both nipples.

60. CHEST CIRCUMFERENCE:
Subject stood as for #59. Assistant adjusted tape in front and measurer stood behind. Measurement taken horizontally just below the breasts. Normal breathing.

61. WAIST CIRCUMFERENCE:
Subject stood as for #59. Measurement taken as the minimum circumference, horizontal, between the superior borders of the hips and the inferior borders of the ribs. The tape rests just above the dots previously marked.

62. HIP CIRCUMFERENCE:
Subject stands as for #59. Assistant measurer adjusted tape in front and measurer stood behind. Measurement taken as the circumference when the tape is placed horizontally and passed over the two trochanterions.

63. HALFWAY TO HIP CIRCUMFERENCE:
Subject stands as for #59. Measurement taken when tape is passed around body midway between #61 and #62.

64. UPPER ARM CIRCUMFERENCE:
Subject stood as for #17. Measurement taken horizontally midway between the shoulder and elbow. Left arm only.

65. FOREARM CIRCUMFERENCE:
Subject stood as for #17. Measurement taken as the maximum horizontal circumference of the forearm. Left side only.

66. WRIST CIRCUMFERENCE:
Subject stood as for #17. Measurement taken as the minimum circumference between the styloid processes of the radius and ulna and the carpals. Left side only.

67. VERTICAL TRUNK CIRCUMFERENCE:
Subject stood as for #17 but with feet slightly apart. Measurement taken from left shoulder through crotch and back to shoulder point.

68. TOTAL CROTCH LENGTH:
Subject stood as for #67. Measurement taken from anterior waist point to posterior waist point through crotch.

69. THIGH CIRCUMFERENCE AT CROTCH:
Subject stood as for #67. Measurement taken horizontally as high as possible in the gluteal fold. Left side only.

70. MID-THIGH CIRCUMFERENCE:
Subject stood as for #67. Measurement taken horizontally midway between crotch and knee. Left side only.

71. ARM SCYE:
Subject stood as for #67. The arm was raised high enough to permit passage of tape and then lowered for measurement. Measurement taken as circumference from acromiale through the axilla and back to acromiale. Left side only.

72. CROSS BACK WIDTH:
Subject stood as for #67 with back to measurer. With the lower edge of tape resting on the most superior point of the axillary fold the measurement is taken from the left to the right axillary fold.

73. BACK WAIST LENGTH:
Subject stood as for #72. Measurement taken from cervicale to posterior waist point.

74. ARMPIT WAIST:
Subject stood as for #17. Subject raised left arm and end of tape was placed as high in the axillary fossa as possible. The arm was then lowered. Measurement taken from that point to left lateral waist point.

75. SHOULDER LENGTH:
Subject stood as for #17. With tape in contact with the skin the measurement was taken from the left neck point to acromion. Read to nearest 5 millimeter mark.

76. NIPPLE TO NIPPLE OVER CERVICALE:
Subject stood as for #17. An assistant measurer stood in front to adjust tape. Measurement taken from the right nipple to the left nipple with the lower edge of the tape crossing cervicale. Tape held tight.

77. FRONT WAIST LENGTH:
Subject stood as in #17 facing measurer. Measurement taken from sternale to anterior waist point. Read to nearest 5 millimeter mark.

78. LATERAL NECK POINT WAIST:
Subject stood as for #17. Measurement taken from left lateral neck point vertically down to the level of the anterior waist point.

79. CERVICALE-LATERAL NECK POINT:
Subject stood as for #17. Measurer stood in rear of subject. Measurement taken from left lateral neck point to cervicale. Tape kept in contact with the skin.

80. BALL CIRCUMFERENCE:
Subject stood as for #17. Measurement taken with the tape passing around the metatarsal-phalangeal joints. The subject was asked to raise the anterior part of her foot so that the ball of the foot was off the floor. The tape was adjusted and the subject asked to place all her weight on it. Measurement was then read.

The Department of Agriculture Survey, 1939-1940

A total of 59 measurements, including 4 made over foundation garments, were made on a sample of almost 15,000 civilian women in a survey sponsored and supervised by the Bureau of Home Economics under a grant of the Works Project Administration. Statistical summaries and measurement descriptions were published in Women's Measurements for Garment and Pattern Construction by Ruth O'Brien and W. C. Shelton, 1941, U. S. Department of Agriculture Miscellaneous Publication No. 454, U. S. Government Printing Office, Washington, D. C.

The landmarks used were illustrated in three figures (Figures 10a, b, and c here) and described as follows:

LANDMARKS OF THE NECK

The Neck Base: The curve of the neck base was determined by first placing three landmarks, one each on the cervicale and upper borders of the medial extremities of the right and left clavicles. The neck chain was then placed around the neck so that it passed over the cervicale and touched the two anterior landmarks. While the chain was in place, its position was marked in the center front and over the trapezius muscle on the right side. A short vertical line intersecting the neck base at the center front was drawn in the median sagittal plane. The cross at the cervicale was placed in the center of the spinous process of the seventh cervical vertebra. This is usually most prominent when the head is dropped forward. It was, therefore, palpated when the head was in this position, but the landmark was marked when the skin was in its normal position with the head erect.

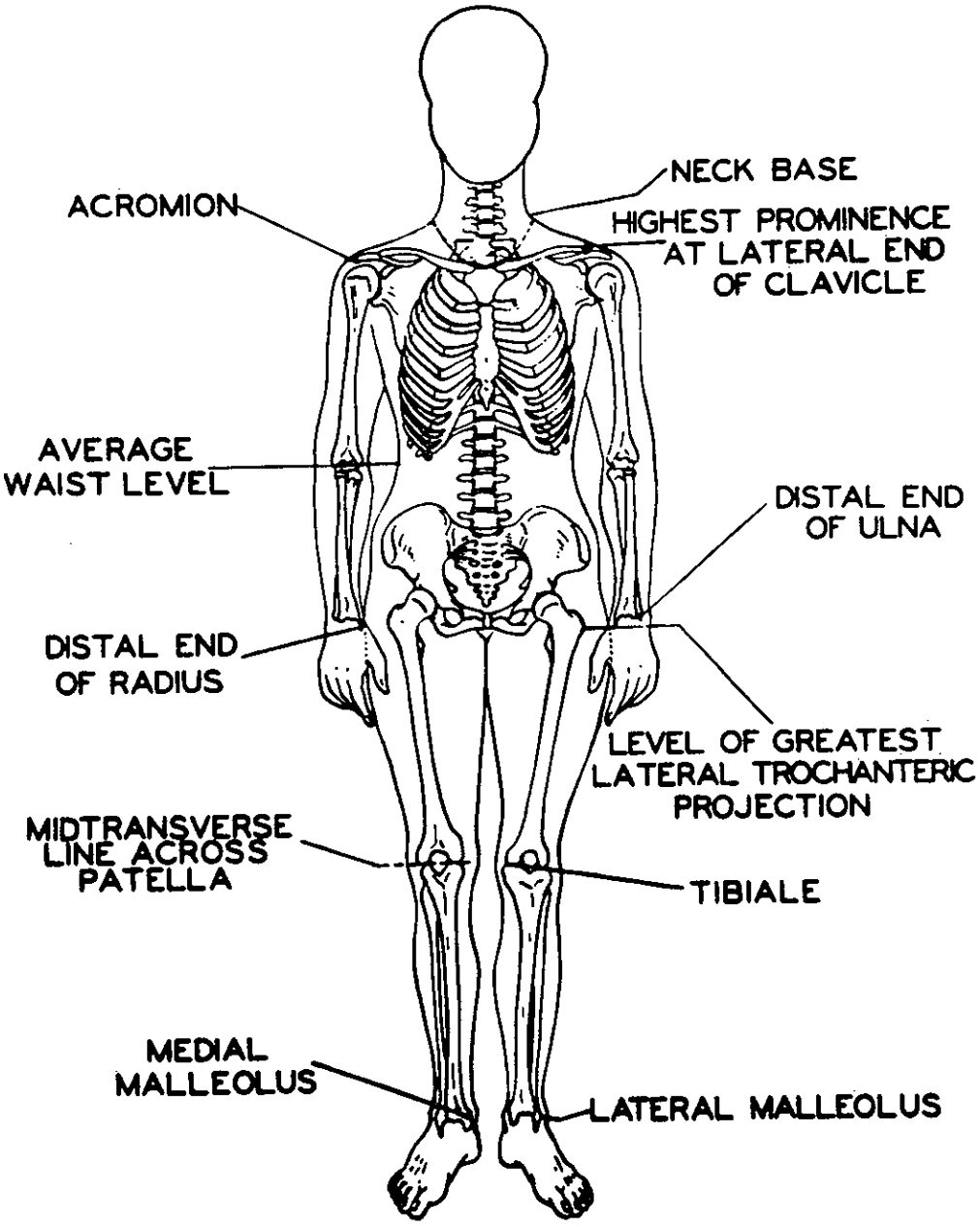

Figure 10a. Locations of landmarks, Department of Agriculture Survey.

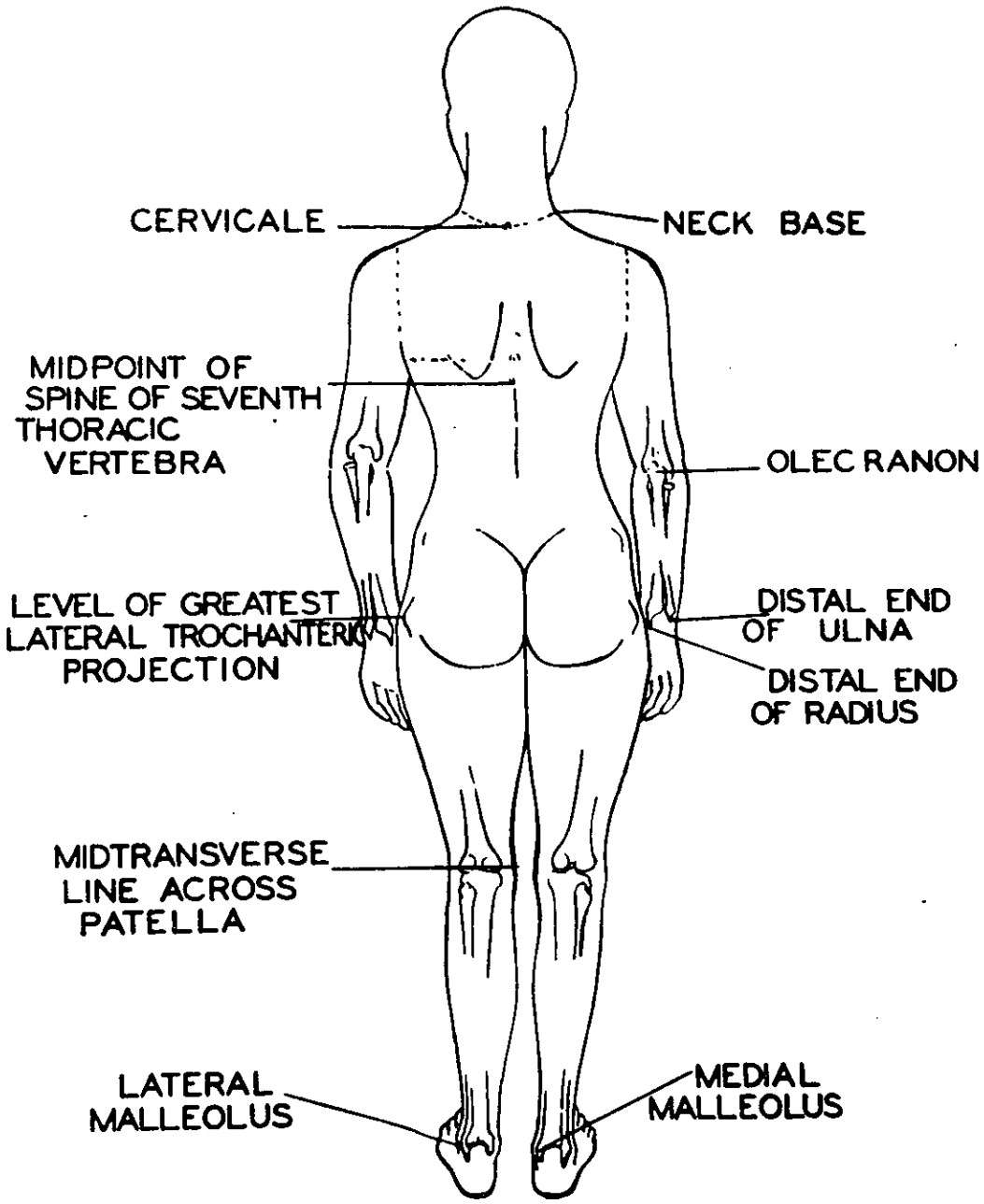

Figure 10b. Locations of landmarks, Department of Agriculture Survey.

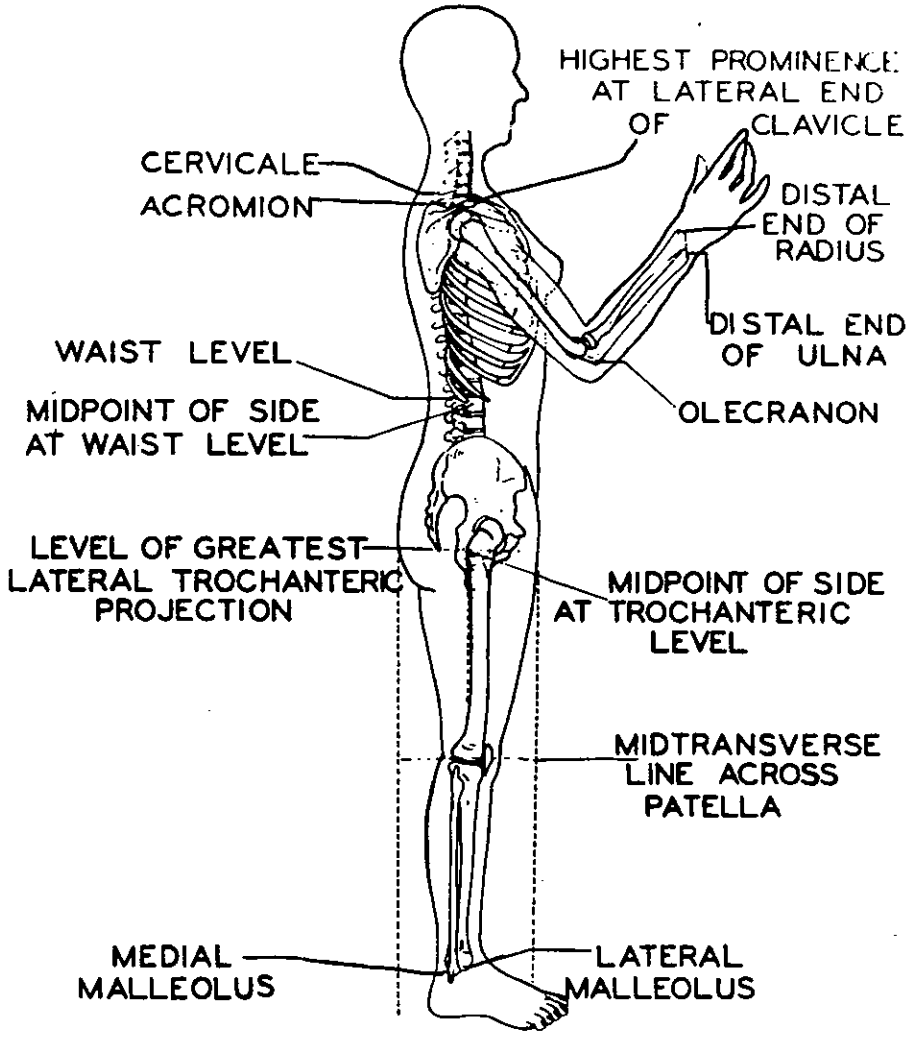

Figure 10c. Locations of landmarks, Department of Agriculture Survey.

LANDMARKS OF THE TRUNK

The Armscye: The armscye, the line followed by the seam of a typical set-in sleeve, is an important line in clothing construction. It was marked by four landmarks, i.e., the shoulder point, the armscye anterior and posterior, and underarm midpoint. The procedure described here for the right side only was identical for the right and left sides.

The shoulder point used was midway between the acromion and the highest point at the lateral end of the clavicle. The acromion as defined for this purpose was a point on the side of the acromial process midway between a point in front of the angle of the process and a point at the center of the shoulder as judged by sighting. The first step in establishing it was to outline the side of the acromial process. Points were then placed on the outline at the angle of the process and at the sighted center of the shoulder. A line intersecting the outline of the process was placed midway between these two points and the intersection marked as the acromion. This use of the midpoint between two easily located limits made it easier to find the most lateral point of the process.

The highest point at the lateral end of the clavicle was then located and marked. The point midway between this and the acromion was marked as the shoulder point of the armscye.

The armscye anterior and posterior were traced with the aid of a small string covered with carpenter's chalk. The center of the string was placed under the arm when the arm was raised about 30 degrees from the trunk. The ends of the string were brought up and crossed over the shoulder point, thus indicating the direction of the armscye at the front and back as well as under the arm. The chalked path of the string was marked using short, thin, sloping lines. The lines were placed on the front and back of each shoulder and on the top of the right shoulder but not under the arm. On the front and back they were located so as to serve as zero and reading points at the level of the fourth thoracic vertebra and the level of the mid-armscye region, respectively.

The underarm midpoint was placed with reference to the natural folds in the armpit and the total width of the shoulder. The height of the midpoint in the armpit was decided on the basis of the size and position of the folds. The measurer sat in front of the subject and studied the formation of the folds on the right and left sides as the arms were raised to about 45 degrees and gradually lowered to meet the trunk. Usually the folds of one armpit are more clearly defined than those of the other. The level of the midpoint was set with respect to the more clearly defined folds and a corresponding level marked off in the pit of the arm on the opposite side. A short, thin line on the trunk marked the underarmscye level.

A vertical line indicating half of the total width of the shoulder was drawn through this to give the underarm midpoint of the trunk. This bisection of the shoulder was made with a small caliper. The subject's arm was raised to the side at an angle of approximately 90 degrees with as little elevation of the shoulder as possible. The upper edge of the shaft of the caliper was held against the trunk at the level of the armscye, the shaft horizontal, and the jaws in a vertical position, touching the shoulder at the back and front without constricting it. The midpoint of the total width was then marked with the skin pencil.

The underarm midpoint on the arm was placed so that it fell upon the midpoint of the trunk when the arm was lowered to the side. This was determined by trial placements and readjustments when the arm was alternately raised and lowered.

The position of these underarm midpoints on the trunk and arm took clothing construction into account. The measurer had to decide to what height under the arm the blouse could extend without forming an uncomfortable surplus of fabric when the arm was lowered. This depended upon the position of the armpit folds on the subject being measured.

The Shoulder Line: A line was marked corresponding to the customary shoulder seam of a garment. It was located with reference to the trapezius muscle and the acromion, intersecting the neck base and the armscye at the shoulder. By palpation at the neck base, it was possible to find the border of the upper fibers of the trapezius which pass forward and downward to become inserted in the acromial end of the clavicle. The intersection of the shoulder line with the neck base was placed at this front border of the trapezius. The other end of the shoulder line was directed by the acromion, although the intersection of the shoulder line was actually with the armscye. The steel guide rod was used to guide the measurer so that the neck base and armscye intersections could be readily placed with respect to the trapezius border and the acromion.

Level for the Measurement of Waist Girth: The waist level used lies at the lower edge of the lowest rib and was found by palpating the sides of the body in the midaxillary line. This waist level corresponds very closely to the natural waist which can be seen when the side profiles of the body are slightly concave.

To locate the waist level, the measurer sat in front of the subject and felt the right and left sides simultaneously, using the index fingers to press against the sides in line with the armpits. The hands were held with the palms directed toward the floor and the fingers extended and together. The

thumb side of the middle joint of the index finger was placed against the subject. When the lower edge of the lowest rib was felt on the back surface of the index finger, the level of the midline of the index finger was taken as the waist level. Without displacing the skin, the level was marked with a dot in line with the armpit on the right and left sides in turn. The waist levels of the right and left sides frequently differ. The average height from the floor of the two sides was therefore considered the waist level. The anthropometer was set at this height and landmarks for the average waist level placed at the center front, at the center back, and in line with the greatest prominence of the right breast.

The finished landmarks of the waist were five in number; center back, center front, each side, and the right side of the front. Small crosses were used at center back, front, and sides, composed of two short, straight, thin lines at right angles, similar to those at neck base and cervicale. The horizontal branches indicated average height of waist. At center back and front the vertical intersecting lines were in the median sagittal plane. The vertical intersecting line at the side was a projection of a bisection at hip level of an imaginary "panel" defined by the buttocks and the thigh.

Level for the Measurement of the Greatest Abdominal Extension Below the Waist: The region of the abdomen below the waist was viewed from the side and a landmark placed at the level of greatest protuberence. The height of this landmark from the floor was measured with the anthropometer and additional landmarks placed at this level on both sides and at the center back.

Level for the Measurement of Width of Chest: Short, straight, thin lines were used to mark on the back and chest the levels at which the widths between the armscyes were to be measured. On the back the landmark was placed in the center on the prominence of the spinous process of the seventh thoracic vertebra. The landmark on the chest was placed at a level midway between that of the shoulder point of the armscye and the level of the lowest visible point of the armscye. The latter point was indicated by placing a pencil under the arm so that the blunt end was visible at the juncture of the arm and trunk.

Level for the Measurement of Maximum Bust Girth: To guide the measurer in placing her tape at the level at which the girth of bust appeared to be greatest, landmarks were placed at this level after consideration of the contour of the bust. The region of the bust was viewed from one side and a preliminary landmark was placed at the level at which it appeared that the girth would be the greatest. Similarly a preliminary

landmark was placed when the subject was viewed from the opposite side. The average height of the two preliminary landmarks was taken as the level of maximum bust girth. The final landmarks were placed at the center front, center back, and the right and left sides.

LANDMARKS OF THE UPPER EXTREMITY

Bisection of Upper Arm: The length of the upper section of the arm from the shoulder to a point on a level with the armscye is used in sleeve construction (the sleeve cap). The width of the upper arm was bisected, by sighting between the guide rod and a pencil held at armscye level at the front and back of the arm perpendicular to the floor. A short line was drawn indicating this bisection approximately at armscye level.

Elbow, Right: The length of the upper segment of the arm was measured from the armscye-shoulder line intersection to the elbow. In order to provide a landmark at the elbow, the closed fist of the subject was rested against the waist with the back of the hand facing forward; the most lateral point of the olecranon was then located and marked.

Wrist, Right: The total length of the arm was measured from the armscye-shoulder line intersection over the elbow to the farther (distal) end of the ulna at the wrist. To locate the end of the ulna, the flat of the thumb nail of the measurer was pushed up against the end of the ulna on the same side as the little finger, and its distal end indicated by a short line drawn perpendicular to the long axis of the ulna. An intersecting line was placed at right angles to this in the middle of the side of the wrist corresponding to the little finger.

Midanterior Wrist Point: The reading point for the measurement of the anterior length of the arm was placed on the anterior or volar surface of the wrist. This was a sighted projection of the distal end of the ulna.

LANDMARKS OF THE LOWER EXTREMITIES

Level for the Measurement of Hip Girth: The level of the hip was placed at the most prominent bony point in the region of the trochanter major. The level was determined independently for the right and left sides and the average of the two taken as the hip level. The preliminary landmarks were corrected to correspond with the average if the difference between the two sides exceeded 4 millimeters.

The extended index and middle fingers of the measurer's right hand were used to palpate the region of the trochanter. This was done while the measurer squatted with her eyes

approximately at the level of the trochanter. The direction of the palpation was from below upward. On well-developed, muscular women or on those with excessive fat pads, it took some time to find the proper level. It was often necessary to ask the subject to bend slightly forward or rotate the femur by turning the toes laterally and by pivoting on the heel. A rounded region was thus located, the midpoint of which was marked with a preliminary dot to indicate the hip level. The average hip level was later marked with a short horizontal line.

A point was determined on this line, corresponding to the location of the side seam of a garment. The measurer located the point by squatting at the side of the subject with eyes at the hip level and holding the guide rod and skin pencil tangent to the buttocks and thigh profiles, respectively, at their most projected parts. The midpoint between these two was sighted and marked on the hip-level line. The measurer was helped by thinking of this as bisecting a hypothetical vertical "panel," the posterior limit of which was tangent to the most posterior projection of the buttocks and the anterior limit of which was tangent to the most anterior projection of the thigh. When this point was set, the steel guide rod was held vertically and used as a ruler to extend the line from this point to the waist level (see "Level for the Measurement of Waist Girth"). The point where it met the waist level was marked. By this means a line was produced following the usual direction of the side hip seams of clothing.

Level for the Measurement of Sitting Spread: The level of sitting spread was defined as the most lateral extension of the thighs when the subject sat relaxed on a table with knees snug against the edge and the feet hanging. The trunk was kept at right angles to the table. Preliminary landmarks on the side of each thigh were sighted and placed. The subject was then asked to stand, and the anthropometer was used to check the two levels from the floor. If the difference between the two sides exceeded 4 millimeters the landmarks were corrected to correspond to the average.

Crotch Center: This landmark corresponds to the intersection of the inside seams of trouser legs with the crotch seams. The subject rested her left foot on a chair while the landmark was placed. The measurer squatted at the side of the subject with her eyes at the level of the gluteal fold and directly in front of the inner surface of the right thigh. The subject's right foot was directed straight forward. The middle line of the inner surface of the right thigh was sighted and marked with a thin vertical line extending downward from the perineum. If the lower borders of the measuring suit obscured the region, the subject was asked to draw them up by lifting the suit by the waist band.

Tibiale, Right: The tibiale was taken as the highest point on the margin of the glenoid of the tibia when the subject stood erect. The medial "cleft" of articulation between the condyles of the femur and the upper end of the tibia was used as a guide in locating this. It was palpated by grasping the knee firmly while it was alternately flexed and extended and by moving the index finger or thumb in the region of the "cleft" until the ends of the bones were located. The tibiale was marked by a dot at the level of the cleft.

Median Line of Kneecap (Patella) With Knee Bent: A horizontal line was placed midway between the upper and lower borders of the patella. This landmark was located while the knee formed a right angle.

Ankle Point (Malleolus Medialis): The ankle point is the middle point of the malleolus medialis at the lower extremity of the tibia. It is most prominent on the inner side of the ankle and is easily identified by palpation.

LANDMARKS OVER FOUNDATION GARMENT

After the body measurements were taken, the subject put on the foundation garment she had worn to the measuring center. The landmarks listed below were marked on the garment by pins.

Level for the Measurement of Bust Girth Over Foundation Garment: The movable arm of the anthropometer was set at the average bust height as determined by measurement No. 4. With the anthropometer perpendicular to the floor, landmarks were indicated by placing pins on the foundation garment, marking back, front, and right and left sides at the previously determined bust level.

Level for the Measurement of Waist Girth Over Foundation Garment: The movable arm of the anthropometer was set at the average waist height as determined by measurement No. 5. With the anthropometer perpendicular to the floor, landmarks were indicated by placing pins on the foundation garment, marking the back, front, and right and left sides at the previously determined average waist level.

Level for the Measurement of Maximum Abdominal Extension Girth Over Foundation Garment: The movable arm of the anthropometer was set at the average height of the greatest abdominal extension below the waist as determined by measurement No. 6. With the anthropometer perpendicular to the floor, landmarks were indicated by placing pins on the foundation garment, marking the back, front, and right and left sides at the previously determined average abdominal extension level.

Level for the Measurement of Hip Girth Over Foundation Garment: The movable arm of the anthropometer was set at the average height of hip as determined by measurement No. 7. With the anthropometer perpendicular to the floor, landmarks were indicated by placing pins on the foundation garment, marking the right and left sides at the previously determined average hip level.

The measurement descriptions are given as follows:

1. WEIGHT

Instrument: Portable scales.

Position of Subject: The subject was asked to stand quietly on the center of the platform of the scales.

Procedure: The dial indicator was set at zero before the subject stepped on the scales. The subject was instructed not to shift her weight while the reading was made.

2. STATURE

Instruments: Anthropometer. A leveling platform was used if the floor was not level. A perpendicular wallboard was also used when a suitable wall, free of baseboard and paneling, was not available in the workroom.

Position of Subject: The subject stood erect with feet as close together as was comfortable and with the palms of the hands on the thighs. The eyes were directed forward. Reid's base line (the line from just above the tragus to the base line of the eye socket) was held parallel to the floor while, with the weight well over the feet, the subject stepped slowly backward until some part of her body touched the wall. She remained in this position while the measurement was being taken.

Position of Measurer: The measurer stood at the subject's right side.

Procedure: The anthropometer was held and balanced in a vertical position in the measurer's right hand. The left hand located the vertex of the head while the right hand slid the moving arm of the anthropometer down to rest there. The hair texture was taken into consideration when exploring the top of the head, and sufficient pressure was used to bring the brass point piece of the anthropometer to the level of the vertex. The anthropometer was then carefully removed from the subject and read with the eyes on the level of the reading.

3. CERVICALE HEIGHT

Landmark: Cervicale.

Instruments: Anthropometer. The leveling platform was used if the floor of the workroom was not level.

Position of Subject: The position of the subject was normal, nonfatigue, away from the wall so that the anthropometer could be placed back of her. The eyes were directed forward and the head held erect. The palms of the hands were placed on the thighs.

Position of Measurer: The measurer stood back of the subject, slightly to her left side.

Procedure: The anthropometer was held vertical in the right hand in line with the center back. The straight edge of the brass point piece was directed toward the floor. The point was lowered to the cervicale.

4. BUST HEIGHT

This measurement was the average height of the preliminary landmarks placed on the bust. It was recorded when the preliminary landmarks were measured preparatory to placement of the four landmarks of average bust level described under Landmarks of the Trunk.

Instruments: Anthropometer. The leveling platform was used if the floor of the workroom was not level.

Position of Subject: The subject stood erect.

Position of Measurer: The measurer stood in front of the subject.

Procedure: The anthropometer was held vertical in the right hand and the moving arm lowered with the left until the brass point was on the landmark.

5. WAIST HEIGHT

This measurement was the average height of the preliminary landmarks on the right and left sides of the waist in the midaxillary region at the margin of the lowest rib. It was recorded when the preliminary landmarks were measured preparatory to placing the five landmarks of the average waist level described under Landmarks of the Trunk.

Instruments: Anthropometer. The leveling platform was used if the floor of the workroom was not level.

Position of Subject: The subject stood erect. She was cautioned against shifting her weight from one foot to the other and from heels to toes. Her arms hung loosely at the sides, slightly to the back.

Position of Measurer: The measurer stood facing each landmark as placed.

Procedure: The anthropometer was held vertical in the right hand and the moving arm lowered with the left until the brass point rested on the landmark.

6. ABDOMINAL EXTENSION HEIGHT

This measurement was taken when the appropriate landmarks were placed (see Landmarks of the Trunk).

Instruments: Anthropometer. The leveling platform was used when the floor was not level.

Position of Subject: The subject stood erect, the palms of the hands at the thighs, with her weight evenly distributed on her feet.

Position of Measurer: The measurer sat in front of the subject.

Procedure: The anthropometer was held vertical in the right hand and the movable arm raised with the left until the brass point rested on the landmark.

7. HIP HEIGHT

The average height of the preliminary landmarks placed on the right and the left sides in the region of the trochanters was recorded as the height of hips.

Instruments: Anthropometer. The leveling platform was used if the floor of the workroom was not level.

Position of Subject: The subject stood erect, with her hands on her hips and her weight evenly distributed on her feet.

Position of Measurer: The measurer usually found it most convenient to sit in front of the subject.

Procedure: The anthropometer was held in the right hand, and the movable arm raised with the left until the brass point rested on the landmark.

8. SITTING-SPREAD HEIGHT

The average height of the preliminary landmarks indicating the greatest extension of the thighs, right and left, when the subject was sitting, was recorded.

Instruments: Anthropometer. The leveling platform was used when the floor was not level.

Position of Subject: The subject stood erect, with hands on her hips and her weight evenly distributed on her feet. She was cautioned against shifting her weight from one foot to the other or from heels to toes.

Position of Measurer: The measurer sat in front of the subject.

Procedure: The anthropometer was held in the right hand and the movable arm raised with the left until the brass point rested on the landmark.

9. CROTCH HEIGHT

Landmark: Crotch center.

Instruments: Anthropometer. The leveling platform was used if the workroom floor was not level.

Position of Subject: The subject stood erect in a normal, nonfatigue position.

Position of Measurer: The measurer squatted directly back of the subject with her eyes at the level of the gluteal fold.

Procedure: The subject was asked to pull on the measuring suit by the waist band. The anthropometer was held in the right hand and the movable arm raised with the left until the brass point rested on the landmark.

10. TIBIALE HEIGHT

Landmark: Tibiale.

Instruments: Anthropometer. The leveling platform was used when the floor of the workroom was not level.

Position of Subject: The subject placed her left foot on a chair, which raised it to the level of the mid-region of the patella. She was asked to keep her weight distributed as evenly as possible on her feet, and the main axis of her right leg perpendicular to the floor. The right foot was directed straight forward.

Position of Measurer: The measurer squatted at the subject's left side, with her eyes at the knee level of the subject.

Procedure: The anthropometer was held in the right hand and its movable arm raised until the brass point rested upon the landmark. This height was then marked with the skin pencil on the lateral surface of the right knee for use in taking measurement No. 35.

11. ANKLE HEIGHT

Landmark: Most medial point of the malleolus medialis.

Instruments: Sliding caliper. The leveling platform was used when the floor was not level.

Position of Subject: The subject stood in a normal, nonfatigue position with her feet 6 to 8 inches apart and her weight evenly distributed on them.

Position of Measurer: The measurer knelt or squatted on the side of the subject, getting the eyes as near the level of the ankle as possible.

Procedure: The sliding caliper was placed between the feet of the subject with its shaft vertical and resting on its fixed arm. The movable arm was raised until the lower edge touched the landmark. The reading was taken on the lower hairline and recorded with the notation "plus 1.8." This correction (later made during the editing of the schedules) was necessitated by the lack of calibration on the fixed arm.

12. TOTAL POSTERIOR ARM LENGTH

Landmarks: Armscye-shoulder line intersection, olecranon, and the distal limit of the ulna.

Instrument: Tape.

Position of Subject: The subject stood with normal, erect posture, feet together. Her clenched right fist was placed on her hip with the back side of the hand to the front. The arm was not flexed at the wrist.

Position of Measurer: The measurer stood on the right side, slightly back of the subject. When reading the tape, the measurer bent down under the point at the wrist so that the reading was made in the direct line of vision.

Procedure: The zero point of the tape was placed at the armscye-shoulder line intersection. The tape was passed over the olecranon to the landmark at the distal limit of the ulna. The measurement was taken with sufficient tension to prevent the tape from slipping off the olecranon.

13. UPPER POSTERIOR ARM LENGTH, RIGHT

Landmarks: Armscye-shoulder line intersection and the olecranon.

Instrument: Tape.

Position of Subject: Identical to that assumed for measurement No. 12.

Position of Measurer: The measurer stood back of the subject's right arm.

Procedure: The zero point of the tape was held at the armscye-shoulder line intersection. The reading was made at the olecranon.

14. ANTERIOR ARM LENGTH

Landmarks: Underarm midpoint on the arm and the mid-anterior wrist point.

Instrument: Tape.

Position of Subject: The subject assumed her normal erect posture with feet together. Her right arm was raised laterally about 30 degrees without elevating the shoulder. The fingers were extended and the palm of the hand directed toward her thigh.

Position of Measurer: The measurer sat at the right side of the subject so that both landmarks could be observed.

Procedure: The zero point of the tape was placed at the underarm midpoint on the arm. The reading was made at the midanterior wrist point.

15. SITTING HEIGHT (Note: this should be "Cervicale Height, Sitting".)

Landmark: Cervicale.

Instrument: Anthropometer.

Position of Subject: The subject sat erect on a table with her knees snug against the edge and her hands in her lap.

Position of Measurer: The measurer stood at the left side of the subject.

Procedure: The anthropometer was held perpendicular to the table, at the center back of the subject. The movable arm was raised to the cervicale and the measurement read.

16. VERTICAL TRUNK GIRTH

Landmark: Center of right shoulder, midway between the intersections of the neck base and the armscye with the shoulder line.

Instrument: Tape.

Position of Subject: The subject stood in her normal erect position with her feet a few inches apart so that

the tape could pass freely between the thighs. She was asked to pull the measuring garment up snugly by the waist band.

Position of Measurer: The measurer stood in front of the subject with her eyes at bust level.

Procedure: The tape was drawn out about 1 meter. The zero end was passed between the ankles and brought up over the right shoulder to meet the other tape end which was brought up from the crotch over the largest projection of the right breast. On the shoulder, the tape lay midway between the neck base and the armscye. Posteriorly, at the crotch, the tape passed between the buttocks; anteriorly, it passed centrally over the genitals without constriction. The feet were placed together after the tape was set. Since the breathing of the subject affected the measurement, the middle value between the largest and smallest reading was recorded.

17. CERVICALE TO WAIST, ANTERIOR

Landmarks: Cervicale, average waist level at center front and intersection of shoulder line and neck base.

Instrument: Tape.

Position of Subject: The subject stood in her normal, erect position.

Position of Measurer: The measurer stood to the right side of the front of the subject.

Procedure: The zero point of the tape was placed on the cervicale. The tape was then guided along the right side of the neck base to the shoulder-line intersection. From this point it was allowed to follow the contour of the body to the waist level at center front, where the reading was taken.

18. ANTERIOR WAIST LENGTH

Landmarks: Neck base and average waist level at center front.

Instrument: Tape.

Position of Subject: The subject was asked to assume the same position as when her stature was measured (measurement No. 2) and maintain it while this measurement, as well as measurements No. 21, No. 48, and No. 50 were taken successively. Special care was taken that the subject's posture did not change during these four measurements.

Position of Measurer: The measurer stood in front of the subject, slightly to her right side.

Procedure: The zero point of the tape was held at the neck base in the center front and the reading made at the average waist level. The subject was cautioned not to raise the chin when the zero point of the tape was placed at the neck base.

19. SHOULDER TO WAIST

Landmarks: Shoulder line, level of greatest prominence of the bust, and average waist level.

Instrument: Tape.

Position of Subject: The subject stood normally with head erect.

Position of Measurer: The measurer stood in front of the subject, slightly to her right.

Procedure: The zero point of the tape was placed at the average waist level on the right side of the subject. The tape was extended over the greatest prominence of the bust to the shoulder line, where the reading was made. The tape was held perpendicular to the floor. While the tape was held in this position, a dot was placed at the point where the tape passed over the top of the curved outline of the bust. A corresponding mark was placed on the left side, providing landmarks for measurement No. 49, highest bust-level width.

20. NECK TO BUST, RIGHT

Landmarks: Bust level and intersection of shoulder line and neck base.

Instrument: Tape.

Position of Subject: Identical to that assumed for measurement No. 19.

Position of Measurer: The measurer stood in front of the subject, slightly to her right side.

Procedure: The zero point of the tape was placed at the intersection of the right shoulder line with the neck base. The reading was made at the greatest prominence of the bust.

21. POSTERIOR WAIST LENGTH

Landmarks: Cervicale and the average waist level at the center back.

Instrument: Tape.

Position of Subject: See measurement No. 18.

Position of Measurer: The measurer stood back of the subject, slightly to her left.

Procedure: The zero point of the tape was placed at the cervicale. The subject was cautioned against dropping the head forward. The tape was allowed to follow the contour of the back without constriction. The reading was made at the average waist level, center back.

22. SCYE DEPTH

Landmarks: Cervicale and level of underarm midpoint marked in the median sagittal plane.

Instrument: Tape.

Position of Subject: The subject stood with head erect and eyes directed forward.

Position of Measurer: Identical to that assumed for measurement No. 34.

Procedure: The zero point of the tape was placed at cervicale, the subject being cautioned not to lower the head. The reading was made at the point in the median sagittal plane which indicated the position of the upper border of the tape when it was placed for the measurement of girth of chest at armscye (see measurement No. 28).

23. TRUNK-LINE, RIGHT

Landmarks: Right underarm midpoint and average waist level at the right side.

Instrument: Tape.

Position of Subject: The subject stood normally, with head erect.

Position of Measurer: The measurer sat at the right side of the subject.

Procedure: The zero point of the tape was placed at the right underarm midpoint. After the subject lowered the arm, allowing it to hang relaxed at her side, the tape was passed directly to the average waist level marked on the right side and the reading was taken.

24. ARM LENGTH, SHOULDER TO SCYE

Landmarks: Shoulder point and intersection of upper arm bisection with the armscye level placed after taking measurement No. 43.

Instrument: Tape.

Position of Subject: The subject stood erect, arms hanging at her sides.

Position of Measurer: The measurer stood at the right of the subject.

Procedure: The zero point of the tape was placed at the shoulder point and the tape extended to the armscye level, the reading being taken at the intersection of the armscye level and the bisecting line of the upper arm.

25. WAIST TO HIPS, RIGHT

Landmarks: Average waist level and average hip level, both on the right side.

Instrument: Tape.

Position of Subject: The subject stood erect with arms folded across her chest.

Position of Measurer: The measurer sat to the right of the subject.

Procedure: The zero point of the tape was placed at the average waist level on the right side. The reading was made at the average hip level, the tape passing over the measuring garment.

26. TOTAL CROTCH LENGTH

Landmarks: Average waist levels, center front and back.

Instrument: Tape.

Position of Subject: After pulling up the measuring suit by the waist band to insure a snug adjustment at the crotch, the subject placed her left foot on a stool or other steady object which elevated the left foot to the midlevel of the patella of the right leg. Her weight was evenly distributed on her feet, the long axis of the right leg being held approximately perpendicular and the principal transverse axis of the pelvis approximately horizontal to the floor. The right foot was directed straight forward and the left hand rested on the left thigh. The head and trunk were erect.

Position of Measurer: The measurer sat at the left side of the subject while placing the zero point, and was at the center back with her eyes at the average waist level when the reading was made.

Procedure: After the measurer placed the zero point of the tape at the average waist level in center front,

the subject held it in position flat against the abdomen with two fingers spread so that the position of the zero point could be checked without moving her fingers. The measurer passed the tape centrally over the genitourinary space and the perineum to the average waist level at center back. The reading was made with the tension of the tape approximately that provided by the weight of the tape case.

27. ANTERIOR CROTCH LENGTH

Landmarks: Average waist level, anterior, and crotch center.

Instrument: Tape.

Position of Subject: Same as measurement No. 26.

Position of Measurer: The measurer squatted at the subject's left side with eyes at crotch level.

Procedure: The zero point of the tape was placed at the average waist level in the center front and held by the subject while measurement No. 26 was taken. The measurer then dropped the tape from the average waist level in the center back to the crotch level. There the tape was supported on the measurer's left index finger while the tape case hung free, thus providing the tension on the tape which was desired for this measurement. The tape was lowered from the perineum by the width of the tip of the measurer's index finger so that the measurer could grasp the tape between the index finger and thumb at the medial landmark of the thigh. This landmark was the reading point for the measurement. The reading was taken while the tape was held at a distance equal to the width of the index finger below the perineum.

28. CHEST GIRTH AT ARMSCYE

Landmarks: The underarm midpoints on the right and left sides.

Instrument: Tape.

Position of the Subject: The subject stood erect. Care was taken that the shoulders were relaxed.

Position of Measurer: The measurer stood back of the subject.

Procedure: The tape was placed around the trunk without constriction with the zero point at the center back. The upper border of the tape rested under the arms at the level

of the armscye of the trunk and passed through the underarm midpoints of the right and left armscye. When the tape was satisfactorily placed, the measurer passed around to the side of the subject to check the relative positions of the anterior and posterior arcs of the girth and to be sure they lay in the same horizontal plane. The reading was made at the midpoint of respiration. Before removing the tape, the level of its upper border was marked posteriorly by a dot in the median sagittal plane, providing a reading point for measurement No. 22.

29. BUST GIRTH

Landmarks: Level of maximum bust girth, posterior and anterior.

Instrument: Tape.

Position of Subject: The subject's position was her normal, erect posture with feet together.

Position of Measurer: The measurer stood at the center front of the subject.

Procedure: The tape was passed around the chest so that the upper border was at the level indicated for the measurement of the maximum girth, and the zero point was at the center front. The anterior and posterior arcs of the girth lay in the same horizontal plane. The girth was measured without constriction of the musculature and mammary glands and the reading was made at the midpoint of respiration.

30. WAIST GIRTH

Landmarks: Average waist level, anterior, posterior, and lateral.

Instrument: Tape.

Position of Subject: Identical with that assumed for measurement No. 29.

Position of Measurer: The measurer sat in front of the subject.

Procedure: The tape was passed around the body at waist level with the upper border of the tape resting on the landmarks and the zero point at the center front. The measurement was taken without constriction and the reading made when the breathing was normal at the midpoint of respiration.

31. ABDOMINAL EXTENSION GIRTH

Landmarks: Level of abdominal extension, posterior, anterior and lateral.

Instrument: Tape.

Position of Subject: The subject stood erect with her hands folded across her chest.

Position of Measurer: The measurer stood to the right of the subject.

Procedure: The tape was passed around the body so that the upper border of the tape was at the level previously marked as the greatest extension of the abdomen. The zero point was placed on the right side of the subject and the measurement taken without constriction.

32. HIP GIRTH

Landmarks: Average hip level, right and left sides.

Instrument: Tape.

Position of Subject: The subject's position was her normal, erect posture with feet together and hands on her hips.

Position of Measurer: The measurer sat at the right side of the subject and made the reading with her eyes at the subject's hip level.

Procedure: The tape was placed around the body so that the upper border rested on the landmarks and the zero point was at the hip level on the right side. The plane of the girth was horizontal and the measurement was taken without constriction.

33. SITTING-SPREAD GIRTH

Landmarks: Average level on the right and left sides of the greatest extension of the thighs when the subject was sitting.

Instrument: Tape.

Position of Subject: With the tape under the thighs, the subject sat erect on a table which was too high for her feet to reach the floor. The bend of her knees touched the edge of the table. Her hands were folded across her chest and her thighs relaxed.

Position of Measurer: The measurer stood in front of the subject.

Procedure: The recorder or aide assisted the measurer in placing the upper border of the tape on the landmarks so that the plane of the girth was vertical and the tape was snug but not tight. On very heavy women, the tape crossed part of the lower abdomen.

34. MAXIMUM THIGH GIRTH

Landmark: None.

Instrument: Tape.

Position of Subject: The subject's position was her normal erect posture with her hands away from her hips. The feet were parted a few centimeters to permit the tape to pass freely between the medial surfaces of the thighs.

Position of the Measurer: The measurer squatted back of the subject with her eyes on the level of the gluteal fold.

Procedure: The tape was placed around the largest part of the thigh girth without constriction. The zero point of the tape was directly in front of the measurer.

35. MIDWAY THIGH GIRTH

Landmark: Midway between average hip level and tibiale.

Instrument: Tape.

Position of Subject: Same as for measurement No. 34.

Position of Measurer: The measurer squatted at the subject's right side.

Procedure: The distance between the average hip level and tibiale was measured and a landmark indicated halfway between these points. The tape was then placed around the thigh at this midpoint level without constriction. The plane of the girth was kept parallel with the floor.

36. BENT KNEE GIRTH

Landmark: Midpoint of patella.

Instrument: Tape.

Position of Subject: The subject sat on a table with the feet placed in a chair high enough to form a right angle at the knee.

Position of Measurer: The measurer sat in front of the subject.

Procedure: The tape was placed around the knee without constriction, the zero point of the tape at the center

front and the upper border at the level of the midpoint of the patella.

37. KNEE GIRTH AT TIBIALE

Landmark: Tibiale.

Instrument: Tape.

Position of Subject: Same as for measurement No. 34.

Position of Measurer: The measurer squatted in front of the subject with her eyes at the level of tibiale.

Procedure: The tape was placed around the knee without constriction, with the upper border of the tape at the level of tibiale and the zero point at center front. The plane of the girth was horizontal.

38. MAXIMUM CALF GIRTH

Landmarks: None.

Instrument: Tape.

Position of Subject: Same as for measurement No. 34.

Position of Measurer: The measurer squatted at the right side of the subject with her eyes at the midlevel of the tibia.

Procedure: The tape was placed around the calf where the measurer, by inspection of the posterior profile, judged the girth to be maximum. The plane of the girth was kept parallel with the floor.

39. MINIMUM LEG GIRTH

Landmark: None.

Instrument: Tape.

Position of Subject: Same as for measurement No. 36.

Position of Measurer: Same as for measurement No. 36.

Procedure: The tape was placed without constriction above the lateral and the medial malleoli at the minimum girth.

40. ANKLE GIRTH

Landmark: Medial point of malleolus medialis.

Instrument: Tape.

Position of Subject: Same as for measurement No. 36.

Position of Measurer: The measurer squatted in front of the subject.

Procedure: The tape was placed around the ankle so that the upper border passed through the landmark with the zero point in the center front. It was held with sufficient tension to maintain it in position at the landmark and over the irregular contours of the ankle.

41. NECK-BASE GIRTH

Landmarks: Cervicale and the lateral and the anterior landmarks on the base of the neck.

Instrument: Fine-gauge, flexible-link chain and anthropometer.

Position of Subject: The subject sat erect with her arms dropped at her sides.

Position of Measurer: The measurer stood back of the subject, slightly to her right side.

Procedure: When the neck chain was adjusted at the neck base, and the landmarks of the neck located, the points at which the chain crossed the cervicale were pinched between the thumb and index finger of each hand, the chain removed from the neck and this distance measured by placing the chain along the anthropometer.

42. ARMSCYE GIRTH

Landmarks: Underarm midpoint, armscye anterior and posterior, and armscye-shoulder line intersection.

Instrument: Tape.

Position of Subject: The subject's position was her normal posture with feet together and arms relaxed at her sides.

Position of Measurer: The measurer stood back of the subject, slightly to the right side.

Procedure: The subject's right arm was raised sufficiently to permit the measurer to place the tape under it with the thin edge of the tape passed through the underarm midpoint and the zero point falling just below the armscye at the back. The case end of the tape was brought up over the shoulder and the case allowed to drop down over the back, thus providing the tension for this measurement. The anterior folds at the axillary fossa of the arm were eased under the tape. The lateral margin of the tape was fitted to the armscye, anterior and posterior, as well as to the armscye-shoulder line intersection. The loop of the tape was raised without unduly binding the posterior folds at the axillary fossa. The zero point of the tape was placed laterally with respect to the case end of the tape and the measurement was read.

43. UPPER-ARM GIRTH, RIGHT

Landmark: Armscye level on the trunk and upper arm bisection.

Instrument: Tape.

Position of Subject: Identical with position assumed for measurement No. 42.

Position of Measurer: The measurer stood at the right side of the subject with her eyes at the level of measurement.

Procedure: The tape was passed around the upper arm with the zero point at the upper arm bisection and the upper border in line with the armscye level of the trunk. The plane of the girth was horizontal when the arm hung relaxed so that the principal long axis was approximately perpendicular to the floor. Before the tape was removed, the level of its upper border was marked at the zero point by a small line. Thus a reading point was provided for measurement No. 24.

44. ELBOW GIRTH, RIGHT

Landmark: Olecranon.

Instrument: Tape.

Position of Subject: The subject stood in a normal, erect position, her right arm flexed approximately 90 degrees at the elbow and the hand and fingers extended anteriorly. The upper arm was directed downward perpendicularly to the floor.

Position of the Measurer: The measurer stood at the right side of the subject with her eyes at the level of the measurement.

Procedure: The tape, with zero point in front of measurer, was placed around the elbow so that it passed without constriction over the landmark on the olecranon and bisected the angle of the bent elbow.

45. FOREARM GIRTH

Landmark: None.

Instrument: Tape.

Position of Subject: Same as for measurement No. 44.

Position of Measurer: Same as for measurement No. 44.

Procedure: The tape, with the zero point directly in front of the measurer was placed without constriction

around the arm at the angle formed when the forearm was flexed at a 90 degree angle to the upper arm. The plane of the girth was perpendicular to the floor. The tape case provided the tension.

46. WRIST GIRTH

Landmarks: Distal limit of the ulna and the radius midanterior wrist point.

Instrument: Tape.

Position of Subject: The subject stood with the forearm extended anteriorly and the palm directed upward.

Position of Measurer. The measurer stood in front of the subject.

Procedure: The zero point of the tape was placed at the midanterior wrist point and the tape passed without constriction over the landmarks at the extremity of the ulna and the radius.

47. SHOULDER LENGTH

Landmarks: The intersections of the shoulder line with the neck base and the armscye.

Instrument: Tape.

Position of Subject: The subject's position was her normal, erect posture with feet together and her arms relaxed at her sides.

Position of Measurer: The measurer stood back of the subject's right shoulder.

Procedure: The zero point of the tape was located at the intersection of the neck base with the shoulder line, the anterior border placed along the shoulder line, and the reading taken at the intersection of the armscye with the shoulder line. The subject was cautioned against lowering the shoulder or drawing the head away from the tape.

48. ANTERIOR CHEST WIDTH

Landmarks: Armscyes, anterior, right and left, and the level for the width of chest, anterior.

Instrument: Tape.

Position of Subject: Same as for measurement No. 21.

Position of Measurer: The measurer stood in front of the subject with her eyes at the level of measurement.

Procedure: The subject was informed that this measurement as well as measurements Nos. 18, 21, and 50 were

to be made while she stood in the same position and that it was important that she maintain the same posture as when her stature was measured. The upper border of the tape was placed horizontally, without constriction, at the level of the anterior landmark with the zero point at the right armscye. The reading was taken on the armscye of the left arm.

49. HIGHEST BUST-LEVEL WIDTH

Landmarks: Those placed when measurement No. 19 was taken.

Instrument: Tape.

Position of Subject: Same as for measurement No. 48.

Position of Measurer: The measurer stood in front of the subject.

Procedure: The zero end of the tape was placed on the landmark above the right bust, the tape passed across the chest parallel to the floor and read at the landmark above the left bust.

50. POSTERIOR CHEST WIDTH

Landmarks: Armscyes, posterior, right and left, and the level for the width of chest, posterior.

Instrument: Tape.

Position of Subject: Same as for measurement No. 18.

Position of Measurer: The measurer was back of the subject, with her eyes at the level of measurement.

Procedure: The upper border of the tape was passed horizontally, without constriction, at the level of the spinous process of the seventh thoracic vertebra with the zero point placed at the left armscye. The reading was taken at the right armscye.

51. ANTERIOR BUST ARC

Landmarks: Average bust level, right and left sides.

Instrument: Tape.

Position of Subject: The subject's position was her normal, erect posture.

Position of Measurer: The measurer sat in front of subject with her eyes at the level of measurement.

Procedure: The zero point of the tape was placed at the average bust level on the subject's right side, the tape passed across the largest part of the bust, and the reading taken at the corresponding level on the left side. Care was exercised not to constrict the musculature and the mammary glands. The reading was taken at the mid-point of respiration.

52. ANTERIOR WAIST ARC

Landmarks: Average waist level, center front, and right and left sides.

Instrument: Tape.

Position of Subject: Same as for measurement No. 30.

Position of Measurer: Same as for measurement No. 30.

Procedure: The zero point of the tape was placed at the average waist level on the subject's right side and the tape passed without constriction across the waist at the average waist level in the center front. The reading was taken at the corresponding level on the left side.

53. ABDOMINAL-EXTENSION ARC

Landmarks: Levels of the abdominal extension at right and left sides and at center front.

Instrument: Tape.

Position of Subject: Same as for measurement No. 31.

Position of Measurer: The measurer sat in front of the subject.

Procedure: The zero point of the tape was placed at the landmark on the right side which indicated the level of the greatest abdominal extension. The tape was then passed without constriction across to the corresponding level on the left side, where the reading was taken. The upper border rested on the front landmark.

54. POSTERIOR HIP ARC

Landmarks: Average hip level at the right and left sides.

Instrument: Tape.

Position of Subject: The subject stood erect with feet together, her weight evenly distributed on her feet and her hands folded across her chest.

Position of Measurer: The measurer squatted back of the subject with her eyes at hip level.

Procedure: The zero point of the tape was placed at the average hip level on the left side, the tape passed without constriction across the hips parallel to the floor. The reading was made on the right thigh at hip level.

55. through 58. Bust, waist, abdominal-extension and hip girths over foundation garments are based on the same procedures as measurements 29 through 32.

59. SHOULDER SLOPE

Landmarks: Intersections of shoulder line with neck base and armscye.

Instrument: Protractor.

Position of Subject: The subject sat erect, well back on a chair, with her arms hanging at her sides.

Position of Measurer: The measurer stood at the right side of the subject.

Procedure: The wooden blade of the protractor was rested on the intersections of the shoulder line with the neck base and with the right armscye. The subject was asked to carry the weight of the instrument on her shoulder without altering the position of the shoulder. In placing the protractor, the intersection of the shoulder line and the armscye was used as the pivotal point and the opposite end of the wooden blade was lowered to the intersection of the shoulder line and neck base where it was rested lightly without depressing the skin surface. The instrument was balanced on the landmarks, straddled by the right hand, while the thumb and index finger of the left hand adjusted the spirit level to the horizontal position. When the protractor could not be brought to rest on the intersections of the shoulder line with the neck base and armscye, due to interference with higher points, the blade was poised on the highest point but its direction kept in that of the shoulder line.

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Appendix A

PRIVACY ACT STATEMENT

SUBJECT: Privacy Act Statement for the Anthropometric Survey of U. S. Army Women.

1. Authority: The Anthropometric Survey of U. S. Army Women is being conducted under the authority of Section 3012 of Title 10 of U. S. Code.

2. Purpose: To obtain statistical data on body size, workspace parameters, and static muscle strength of U. S. Army women.

3. Routine uses: Information obtained in the survey will be used by the Army to develop statistical analyses of body size, of workspace requirements, and of strength capabilities of Army women; and the results of the survey will be published in reports of these analyses. The reports will be used by Army clothing and equipment designers to design, size, and supply clothing and equipment for Army women. Individual participants in the survey will not be identified.

4. Mandatory or voluntary disclosure: Participation in the survey and the furnishing of any information requested during the survey is voluntary on your part. Your refusal to participate will have no effect on you personally but could definitely have an adverse effect on the results of the survey, making it more difficult to provide properly sized and fitting clothing and equipment for Army women.

Appendix B

INDEX OF MEASUREMENT TECHNIQUES

This index lists all measurements included in the four lists of measuring techniques. Names are those used in the survey reports. The same name has, on occasion, been used for rather different measurements and, conversely, different names have occasionally been given to quite similar measurements; the descriptions of the measurements given in the body of this report are the prime source of evidence as to the equivalence of names and techniques. We have here equated the word *girth*, as used in the Department of Agriculture survey, with the word *circumference* as used in the other surveys; the word *curvature*, as used in the AFW survey, with *arc* as used in the Department of Agriculture survey and the Army women's surveys; and the word *acromial* with the word *acromion*.

The table headings are as follows:

ARMY 1977--the present U. S. Army women's survey;
USAF 1968--the 1968 survey of the Air Force women;
ARMY 1946--the 1946 survey of Army separatees;
DEPT AGRI--the Department of Agriculture survey.

Entries in the first column followed by C refer to the core measurements; those followed by T to the traditional anthropometry subseries; those followed by H to the head and face subseries; those followed by W to the workspace subseries.

APPENDIX E

INDEX OF MEASUREMENT TECHNIQUES

A LIST OF ALL MEASUREMENTS WITH THEIR SURVEY NUMBERS

ARMY 1977	USAF 1968	ARMY 1946	DEPT AGRI	
			53	ABDOMINAL-EXTENSION ARC
12T				ABDOMINAL EXTENSION BREADTH, SITTING
	42		31	ABDOMINAL EXTENSION CIRCUMFERENCE/GIRTH
	129		57	ABDOMINAL EXTENSION CIRCUMFERENCE/GIRTH O.F.G.
	76			ABDOMINAL EXTENSION DEPTH
11T				ABDOMINAL EXTENSION DEPTH, SITTING
	135			ABDOMINAL EXTENSION DEPTH O.F.G.
	127		6	ABDOMINAL EXTENSION HEIGHT O.F.G.
	10	19		ACROMIAL (ACROMION) HEIGHT
5T	31			ACROMION-RADIALE LENGTH
33C	49		41	ANKLE CIRCUMFERENCE/GIRTH
40C	20		11	ANKLE HEIGHT
			14	ANTERIOR ARM LENGTH
			51	ANTERIOR BUST ARC
			48	ANTERIOR CHEST WIDTH
			27	ANTERIOR CROTCH LENGTH
			52	ANTERIOR WAIST ARC
	86		18	ANTERIOR WAIST LENGTH
		24		ARM LENGTH
			24	ARM LENGTH, SHOULDER TO SCYE
		74		ARM PIT WAIST
		71		ARM SCYE
			42	ARMSCYE GIRTH
46C				ARM SCYE CIRCUMFERENCE
3C				AXILLA HEIGHT
19T	54			AXILLARY ARM CIRCUMFERENCE
55C				AXILLA TO WAIST LEVEL
	84			BACK CURVATURE
65C				BACK CURVATURE, BUST LEVEL
67C				BACK CURVATURE, HIP LEVEL
66C				BACK CURVATURE, WAIST LEVEL
		73		BACK WAIST LENGTH
		60		BALL CIRCUMFERENCE
			36	BENT KNEE GIRTH
13W				BENT KNEE HEIGHT, SUPINE
8W				BENT TORSO BREADTH
7W				BENT TORSO HEIGHT
10T	63			BIACROMIAL BREADTH
	114			BIAURICULAR BREADTH
47C	56			BICEPS CIRCUMFERENCE, FLEXED
	58			BICEPS CIRCUMFERENCE, FLEXED, LEFT
20T	55			BICEPS CIRCUMFERENCE, RELAXED
	57			BICEPS CIRCUMFERENCE, RELAXED, LEFT
26T				BICEPS SKINFOLD

C=CORE, T=TRACIONAL, W=WORKSPACE, H=HEAD & FACE

APPENDIX B

INDEX OF MEASUREMENT TECHNIQUES

A LIST OF ALL MEASUREMENTS WITH THEIR SURVEY NUMBERS

ARMY 1977	USAF 1968	ARMY 1946	CEPT AGRI	
	64	39		BIDELTOID BREADTH
	117			BIGONIAL BREADTH
		41		BI-ILIAC
20H	113	52		BIOCULAR BREADTH
14T				BISPINOUS BREADTH
25H	115			BITRAGION BREADTH
28H	112			BITRAGION-CORONAL ARC/CURVATURE
29H				BITRAGION-FRONTAL ARC
30H				BITRAGION-MENTON ARC
31H				BITRAGION-SUBMANDIBULAR ARC
	116	46		BIZYGOMATIC BREADTH
		59		BREAST CIRCUMFERENCE
58C	39		29	BUST CIRCUMFERENCE/GIRTH
11C				BUST DEPTH
			55	BUST GIRTH OVER FOUNDATION GARMENT
			4	BUST HEIGHT
				BUSTPOINT HEIGHT
40	12			BUSTPOINT-TO-BUSTPOINT BREADTH
	66			BUTTOCK CIRCUMFERENCE, SITTING
	52			BUTTOCK CIRCUMFERENCE, SITTING O.F.G.
	137			
	136			BUTTOCK DEPTH C.F.G.
10M				BUTTOCK-HEEL LENGTH
70	16			BUTTOCK HEIGHT
200	30	32		BUTTOCK-KNEE LENGTH
	29			BUTTOCK-POPLITEAL LENGTH
320	47			CALF CIRCUMFERENCE
	48			CALF CIRCUMFERENCE, LEFT
390				CALF HEIGHT
1T	9	18	3	CERVICALE HEIGHT
		79		CERVICALE-LATERAL NECK POINT
			17	CERVICALE TO WAIST ANTERIOR
8C	65	40		CHEST BREADTH
		60		CHEST CIRCUMFERENCE
57C	38			CHEST CIRCUMFERENCE AT SCYE
590	40			CHEST CIRCUMFERENCE BELOW BUST
	74	42		CHEST DEPTH
			28	CHEST GIRTH AT ARMSCYE
17H				CRINION-MENTON
		72		CROSS BACK WIDTH
80	19		9	CROTCH HEIGHT
690				CROTCH LENGTH
	124			EAR BREADTH
	123			EAR LENGTH
	100			ECTOCANTHUS TO TOP OF HEAD

C=CORE, T=TRADITIONAL, W=WORKSPACE, H=HEAD & FACE

APPENDIX B

INDEX OF MEASUREMENT TECHNIQUES

A LIST OF ALL MEASUREMENTS WITH THEIR SURVEY NUMBERS

ARMY 1977	USAF 1968	ARMY 1946	DEFT AGRI	
15H				ECTOCANTHUS TC VERTEX
7H	106			ECTOCANTHUS TC WALL
		38		ELBOW BREADTH
480	59			ELBOW CIRCUMFERENCE, FLEXED
18C				ELBOW-FINGERTIP LENGTH
			44	ELBOW GIRTH
7T				ELBOW-GRIP LENGTH
4T				ELBOW (RADIALE) HEIGHT,STANDING
8T	27			ELBOW REST HEIGHT
140	24			EYE HEIGHT, SITTING
24H				FACE BREADTH (BIZYGOMATIC)
		47		FACE LENGTH
18H				FACE LENGTH (SELLION-MENTON)
	72			FEMORAL BREADTH
	73			FEMORAL BREADTH, LEFT
440	95	26		FOOT BREADTH
360				FOOT CIRCUMFERENCE
420	94	25		FOOT LENGTH
		65	45	FOREARM CIRCUMFERENCE/GIRTH
490	61			FOREARM CIRCUMFERENCE, FLEXED
21T	60			FOREARM CIRCUMFERENCE, RELAXED
		35		FOREARM-HAND LENGTH
		77		FRONT WAIST LENGTH
3H				FUNCTIONAL REACH
4H				FUNCTIONAL REACH, EXTENDED
14H				GLABELLA TO VERTEX
6H				GLABELLA TO WALL
16T	17			GLUTEAL FURROW HEIGHT
		63		HALFWAY TO HIP CIRCUMFERENCE
26C	92	55		HAND BREADTH
25C	93			HAND CIRCUMFERENCE
27C	91	54		HAND LENGTH
24C	97	45		HEAD BREADTH
21C	98	57		HEAD CIRCUMFERENCE
		33		HEAD HEIGHT
16H				HEAD HEIGHT (TRAGION-VERTEX)
23C	96	44		HEAD LENGTH
34C				HEEL-ANKLE CIRCUMFERENCE
370		28		HEEL BREADTH
			49	HIGHEST BUST-LEVEL WIDTH
100	68	37		HIP BREADTH
	133			HIP BREADTH O.F.G.
290		62	32	HIP CIRCUMFERENCE/GIRTH
	130			HIP CIRCUMFERENCE 7" BELOW WAIST O.F.G.

C=CORE, T=TRADIONAL, W=WORKSPACE, H=HEAD & FACE

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INDEX OF MEASUREMENT TECHNIQUES

A LIST OF ALL MEASUREMENTS WITH THEIR SURVEY NUMBERS

ARMY 1977	USAF 1968	ARMY 1946	DEPT AGRI	
	43			HIP CIRCUMFERENCE 7" BELOW WAIST
	131			HIP CIRCUMFERENCE 9" BELOW WAIST O.F.G.
	44			HIP CIRCUMFERENCE 9" BELOW WAIST
24T				HIP CIRCUMFERENCE, SITTING
			58	HIP GIRTH OVER FOUNDATION GARMENT
		21	7	HIP HEIGHT
17T				HIP (TROCHANTERIC) HEIGHT
14W				HORIZONTAL LENGTH, KNEES BENT
	70			HUMERAL BREADTH
	71			HUMERAL BREADTH, LEFT
		22		INSEAM
				INSTEP CIRCUMFERENCE
35C				INSTEP LENGTH
43C		27		INTERCOLAR BREADTH
		53		INTERPUPILLARY DISTANCE
21H				INTERSCYE, BACK
63C				INTERSCYE CURVATURE
	82			INTERSCYE CURVATURE, MAXIMUM
	83			INTERSCYE, FRONT
61O				KNEE CIRCUMFERENCE
31O	46			
			37	KNEE GIRTH AT TIBIALE
38O				KNEECAP HEIGHT
15O				KNEE HEIGHT, SITTING
11W				KNEELING HEIGHT
12W				KNEELING LEG LENGTH
15T				KNUCKLE HEIGHT
	21			LATERAL MALLEOLUS HEIGHT
		78		LATERAL NECK POINT WAIST
	119			LIP LENGTH
2W	109			LIP PROTRUSION TO WALL
			36	MAXIMUM CALF GIRTH
			34	MAXIMUM THIGH GIRTH
				MEDIAL CALF SKINFOLD
	6			MENTON-SELLION LENGTH
	121			MENTON-SUBNASALE LENGTH
	120			MENTON TO TOP OF HEAD
	104			MENTON TO VERTEX
9H				MENTON TO WALL
1H	110			MIDSHOULDER HEIGHT, SITTING
	25			MID-THIGH CIRCUMFERENCE
		70		
			35	MIDWAY THIGH GIRTH
26H		51		MINIMUM FRONTAL BREADTH
			39	MINIMUM LEG GIRTH
22H				MOUTH BREADTH, SMILING

C=CORE, T=TRADIONAL, W=WORKSPACE, H=HEAD & FACE

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INDEX OF MEASUREMENT TECHNIQUES

A LIST OF ALL MEASUREMENTS WITH THEIR SURVEY NUMBERS

ARMY 1977	USAF 1968	ARMY 1946	DEPT AGRI	
	118			NASAL BREADTH
		50		NASAL ROOT BREADTH
			41	NECK-BASE GIRTH
22C	36			NECK CIRCUMFERENCE
			2C	NECK TO BUST
52C				NECK TO BUSTPOINT
				NECK-TO-BUSTPOINT LENGTH
		36		NIPPLE-NIPPLE
		76		NIPPLE TO NIPPLE OVER CERVICALE
23H		49		NOSE BREADTH
		48		NOSE LENGTH
19H				NOSE LENGTH (SELLION-SUBNASALE)
		56		OUTER CANTHUS-CTOBASION SUPERIOR
6H				OVERHEAD REACH BREADTH
9W	35			OVERHEAD REACH HEIGHT
9H				OVERHEAD REACH, SITTING
28C				PALM LENGTH
		31		PATELLA HEIGHT
16C	28			POPLITEAL HEIGHT
			5C	POSTERIOR CHEST WIDTH *
			54	POSTERIOR HIP ARC
			21	POSTERIOR WAIST LENGTH
	101			PRONASALE TO TOP OF HEAD
12H				PRONASALE TO VERTEX
4H	107			PRONASALE TO WALL
6T	32			RADIALE-STYLION LENGTH
27H	111			SAGITTAL CURVATURE/ARC
	53			SCYE CIRCUMFERENCE
			22	SCYE DEPTH
13H				SELLION TO VERTEX
5W				SELLION TO WALL
19C				SHOULDER (BIDELTOID) BREADTH
56C	37			SHOULDER CIRCUMFERENCE
2 C				SHOULDER (ACROMIALE) HEIGHT
17C		54		SHOULDER-ELBOW LENGTH
51C	79	75	47	SHOULDER LENGTH
			59	SHOULDER SLOPE
			19	SHOULDER TO WAIST
13C	23	29	15	SITTING HEIGHT
	22			SITTING HEIGHT, RELAXED
			33	SITTING-SPREAD GIRTH
			8	SITTING-SPREAD HEIGHT
	87			SLEEVE INSEAM
53C				SLEEVE INSEAM LENGTH

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INDEX OF MEASUREMENT TECHNIQUES

A LIST OF ALL MEASUREMENTS WITH THEIR SURVEY NUMBERS

ARMY 1977	USAF 1968	ARMY 1946	DEFT AGRI	
540				SLEEVE OUTSEAM LENGTH
410				SPHYRION HEIGHT
	89			SPINE-TO-ELBOW LENGTH
	88			SPINE-TO-SCYE LENGTH
	90			SPINE-TO-WRIST LENGTH
10	7	17	2	STATURE
2W				STATURE (CLOTHED)
	8			STATURE, MAXIMUM
	103			STOMION TO TOP OF HEAD
10W				STOMION TO VERTEX
	81			STRAP LENGTH
	122			SUBNASALE-SELLION LENGTH
	102			SUBNASALE TO TOP OF HEAD
11W				SUBNASALE TO VERTEX
3W	108			SUBNASALE TO WALL
27T	4			SUBSCAPULAR SKINFOLD
3T				SUBSTERNALE HEIGHT
28T	5			SUPRAILIAC SKINFOLD
2T	11			SUPRASTERNALE HEIGHT
		69		THIGH CIRCUMFERENCE AT CROTCH
9T	78			THIGH CLEARANCE
13T	69			THIGH-TO-THIGH BREADTH, SITTING
	138			THIGH-TO-THIGH BREADTH, SITTING O.F.G.
	33			THUMB-TIP REACH
	34			THUMB-TIP REACH, EXTENDED
18T	18		10	TIBIALE HEIGHT
		68	26	TOTAL CROTCH LENGTH
			12	TOTAL POSTERIOR ARM LENGTH
	99			TRAGION TO TOP OF HEAD
8W	105			TRAGION TO WALL
25T	3			TRICEPS SKINFOLD
	15			TROCHANTERIC HEIGHT
		43		TRUNK DEPTH
		30		TRUNK HEIGHT
			23	TRUNK LINE
		64	43	UPPER ARM CIRCUMFERENCE/GIRTH
			13	UPPER POSTERIOR ARM LENGTH
30C	45			UPPER THIGH CIRCUMFERENCE
69C	50	67	16	VERTICAL TRUNK CIRCUMFERENCE/GIRTH
23T	51			VERTICAL TRUNK CIRCUMFERENCE, SITTING
	85			WAIST BACK
6AC				WAIST BACK LENGTH
9C	67			WAIST BREADTH
6CC	41	61	3C	WAIST CIRCUMFERENCE/GIRTH

C=CORE, T=TRADITIONAL, W=WORKSPACE, H=HEAD & FACE

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INDEX OF MEASUREMENT TECHNIQUES

A LIST OF ALL MEASUREMENTS WITH THEIR SURVEY NUMBERS

ARMY 1977	USAF 1968	ARMY 1946	DEPT AGRI	
221				WAIST CIRCUMFERENCE, OMPHALION
120	75			WAIST DEPTH
	134			WAIST DEPTH O.F.G.
62C				WAIST FRONT LENGTH
			56	WAIST GIRTH OVER FOUNDATION GARMENT
5C	13	20	5	WAIST HEIGHT
	126			WAIST HEIGHT C.F.G.
29T				WAIST HEIGHT, OMPHALION
	26			WAIST HEIGHT, SITTING
			25	WAIST TO HIP
45C	2	16	1	WEIGHT
1W				WEIGHT (CLOTHED)
500	62	66	46	WRIST CIRCUMFERENCE/GIRTH

C=CORE, T=TRADICNAL, W=WORKSPACE, H=HEAD & FACE