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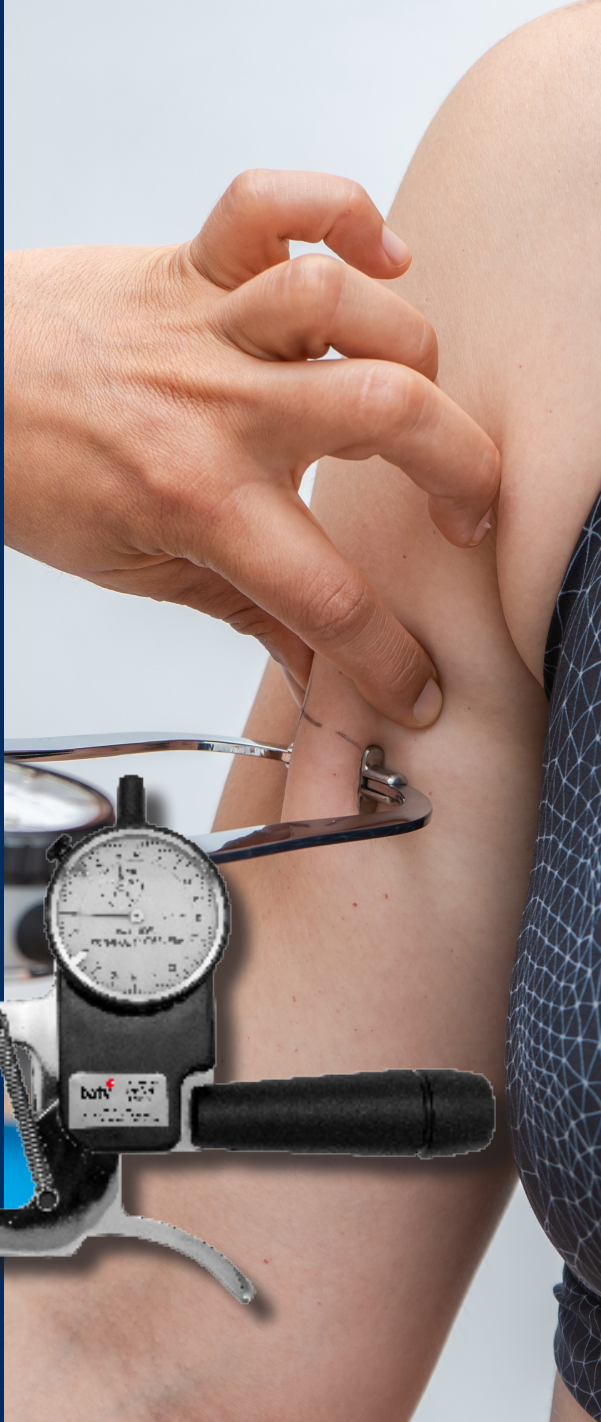
How To Use Your Harpenden Skinfold Caliper



THE HARPENDEN SKINFOLD CALIPER HSB-BI BY BOWERS GROUP

Thank you for purchasing our product. We are confident that you have chosen one of the most up to date and versatile Skinfold Calipers on the market.

Used correctly it will give good service and reliable results for many years and, in order that optimum results are obtained, we suggest strongly that you read your manual thoroughly even if experienced in the use of this type of equipment.

The Harpenden Skinfold Caliper is NOT intended for use in the diagnosis of disease or other conditions, or in the cure, mitigation, treatment, or prevention of disease, in man or other animals.

Details of our related products may be obtained directly from Bowers Group (address on last page) or from one of our selected distributors.

The carry case should contain one Harpenden Skinfold Caliper Instrument and one copy of this handbook.

CONTENTS

1 BODY COMPOSITION – EVALUATION AND MEANING

The most accurate estimation of body composition is achieved by use of the underwater or hydrostatic weighing technique. Obviously, this method places severe restrictions on both practicality and convenience, and the alternative basis of skinfold thickness measurements is therefore used in all but the most stringent of requirements.

The use of skinfold calipers in the performance of skinfold thickness measurements (from which are derived the estimates of body fat) has been well established and documented over the last 40 years, references to which can be found in the Bibliography section of this manual.

These thickness measurements do not measure overall body fat mass or its percentage directly but rely on validated equations that describe the relationship between measures of skinfold fat as well as other body dimensions and the measured body density. Body fat percentage is determined from the estimate of body density.

Various experimenters have put forward equations that are used with either skinfold thickness alone or in conjunction with other measurements such as body circumference or limb lengths. Two of the most common sets of equations used are attributable to Durnin & Womersley (skinfolds alone), and to Jackson & Pollock (skinfolds and body measurements). The results obtained from the equations (that of body fat density) are subsequently used in the Siri equation to calculate the body fat.

Tables are included that show the fat percentage based on the Durnin & Womersley system. Values are shown for both males and females across the whole age range based on the sum of 4 skinfold measurements, and the results shown for each 2 millimetre increment of skinfold thickness.

Skinfold measurements, when properly taken, correlate very highly (0.83 to 0.89) with hydrostatic weighing, with a standard error of only about 3 or 4%. In comparison, the correlation of height and weight charts is much lower at about 0.60.

The explanation of the use of skinfold thickness measurement in the derivation of body fat data has been simplified enormously, and can never detract from the tremendous volume of research and scientific ability in the fields of both nutrition and fitness. We all owe much respect and our considerable thanks to the specialists responsible for guiding us towards a healthier life worldwide.

2 SETTING AND USING THE HARPENDEN SKINFOLD CALIPER

2.1 CARE AND USE

a) Ensure that your Caliper are clean and open freely and smoothly.

Always clean the Caliper before and after use on a test subject.

b) Open the Caliper to approximately 20mm and allow it to close several times.

c) Check for repeatability of the zero reading within one division (0.2mm)

d) **Do not open and shut the Caliper rapidly or allow the Caliper to snap shut.**

This can cause damage to the Indicator mechanism.

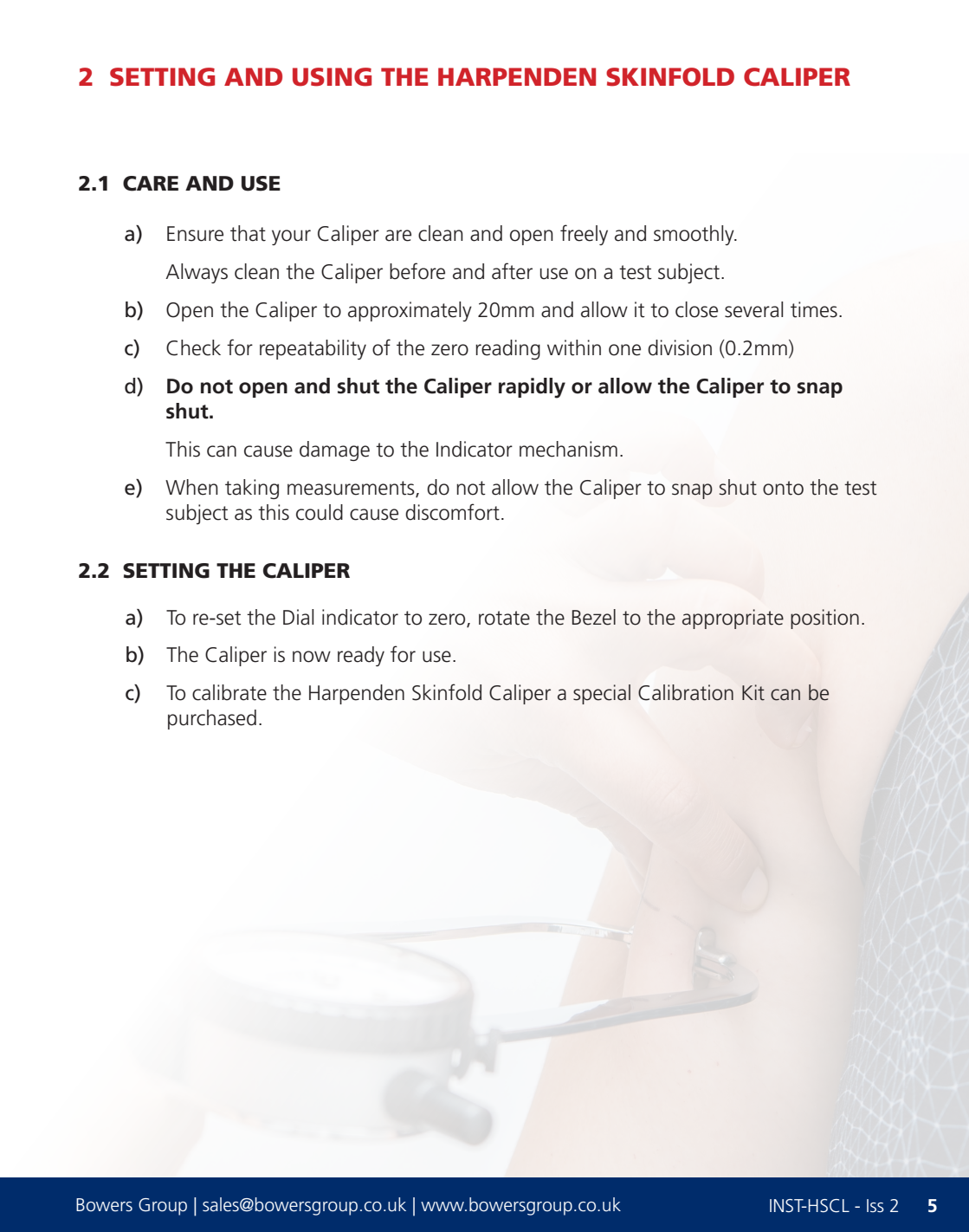
e) When taking measurements, do not allow the Caliper to snap shut onto the test subject as this could cause discomfort.

2.2 SETTING THE CALIPER

a) To re-set the Dial indicator to zero, rotate the Bezel to the appropriate position.

b) The Caliper is now ready for use.

c) To calibrate the Harpenden Skinfold Caliper a special Calibration Kit can be purchased.



3 TAKING THE SKINFOLD MEASUREMENTS

The accuracy of measurement is, as one would expect, dependent upon the accuracy of the equipment being used, the correct selection and location of the skinfold sites, the proper technique in taking the measurements and the experience of the user.

3.1 EQUIPMENT REQUIRED

- **A Tape Measure** - To assist in locating the correct site.
- **Skinfold Caliper** - Accurately calibrated and with a constant spring pressure of 10g/mm2 throughout its entire range. Your Harpenden Caliper has been calibrated to this performance prior to dispatch from the factory.

3.2 CORRECT TECHNIQUE

Essential for accurate and repeatable tests, specific guidelines for taking skinfold measurements have been established. Following a standard method of assessment helps ensure accuracy and repeatability on future testing.

a) Measurement should be taken on healthy, undamaged and uninfected dry skin. Moist skin is harder to grasp and can influence the measurement. Do not use the Caliper on broken or infected skin.

b) Instruct the test subject to keep the muscles relaxed during the test.

c) Take all measurements on the right side of the body. An exception might be where a deformity or missing limb would necessitate using the left side.

d) Mark the skinfold site (see pages 5-7) using a pen with water soluble ink. Use a tape measure to accurately find the mid-points.

e) The skinfold should be firmly grasped by the thumb and index finger, using the pads at the tip of the thumb and finger. Gently pull the skinfold away from the body.

f) The Caliper should be placed perpendicular to the fold, on the site marked, dialup, at approximately 1cm below the finger and thumb. While maintaining the grasp of the skinfold, allow the Caliper to be released so that full tension is placed on the skinfold. The dial should be read to the nearest 0.50mm, 1 to 2 seconds after the grip has been fully released.

g) The Caliper should not be placed too close to the body or too far away on the tip of the skinfold. Try to visualise the location of a true double fold of skin thickness, and place the Caliper there.

h) A minimum of two measurements should be taken at each site. If repeated tests vary by more than 1mm, repeat the measurement. If consecutive measurements become increasingly smaller, the fat is being compressed. Go to another site and come back a little later and recheck the problem site.

i) The final value recorded should be the average of the two that seems best to represent the skinfold fat site.

j) Record each skinfold as you measure it. It is easy to forget the first measurement if you try to keep it all in your head.

k) Experience is necessary to grasp the same size skinfold in the same location consistently. Practice these techniques until you get consistent results.

4 SITE SELECTION

Site selection is very important and frequently a source of error in skinfold testing. The sites selected must match the particular protocol being used.

There are two protocols usually involved, the 4-site system being the most commonly used. This system is the same for male and female subjects and has been used as the basis for the correlations in this manual.

The second system uses 3 sites, the sites differing for either male or female subjects, and are used in conjunction with the Body Density formulae (Jackson & Pollock) given on page 12 of the manual.

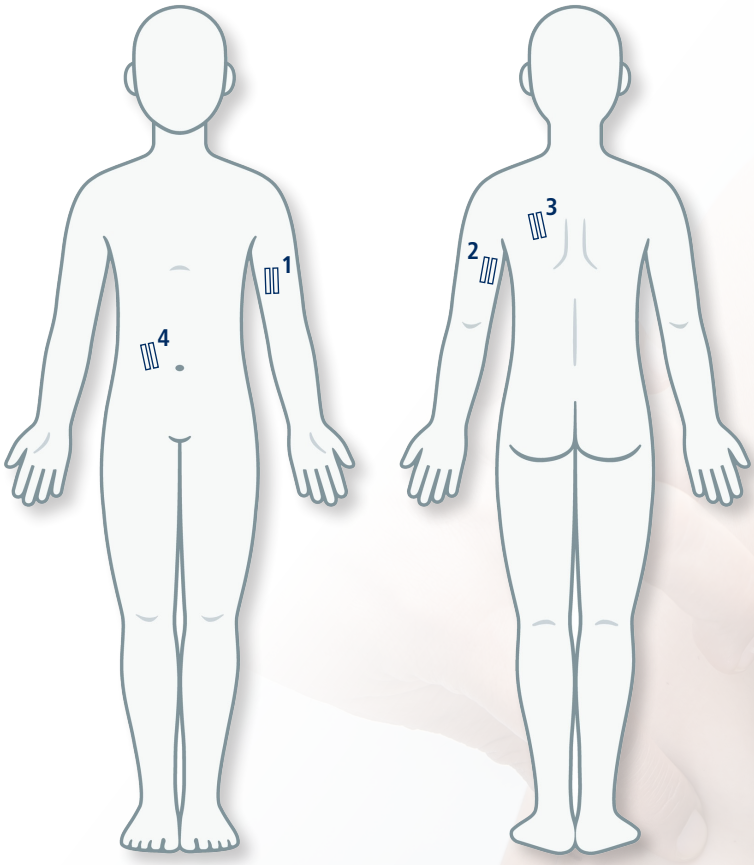
4.1 THE 4 SITE SYSTEM FOR MALE AND FEMALE SUBJECTS

Site 1) Biceps
The anterior surface of the biceps midway between the anterior fold and the antecubital fossa.

Site 2) Triceps
A Vertical fold on the posterior midline of the upper arm, over the triceps muscle, halfway between the acromion process (bony process on top of the shoulder) and olecranon process (bony process on elbow). The elbow should be extended and the arm relaxed.

Site 3) Subscapular
The fold is taken on the diagonal line coming from the vertebral border to between 1 and 2cm from the inferior angle of the scapulae. (A diagonal fold about 1 to 2cm below the point of the shoulder blade and 1-2cm toward the arm).

Site 4) Suprailiac
A diagonal fold above the crest of the ilium at the spot where an imaginary line would come down from the anterior auxiliary line just above the hipbone and 2-3cm forward.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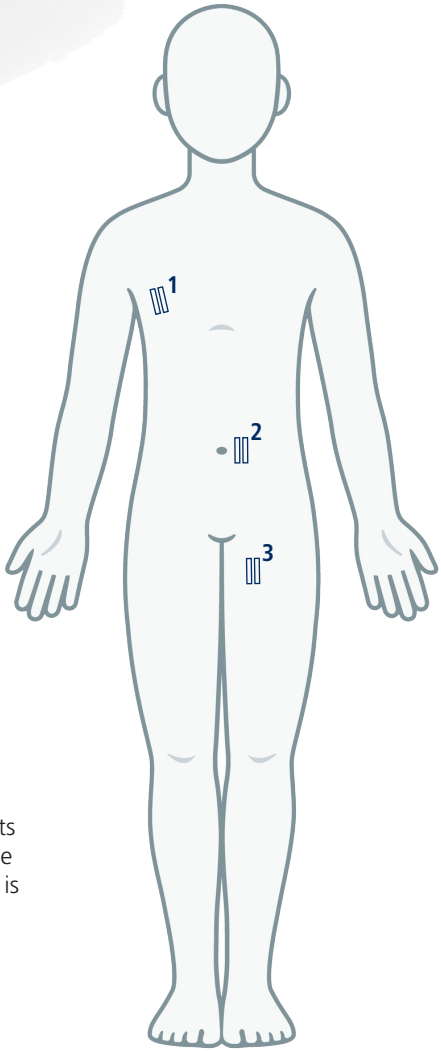
4.2 THE 3 SITE SYSTEM FOR MALE SUBJECTS

Site 1) Chest (Juxta-Nipples)

A diagonal fold taken one half of the distance between the anterior auxiliary line and the nipple.

(The anterior auxiliary line is the crease where the top of the arm, when hanging down, meets the chest).



Site 2) Abdominal

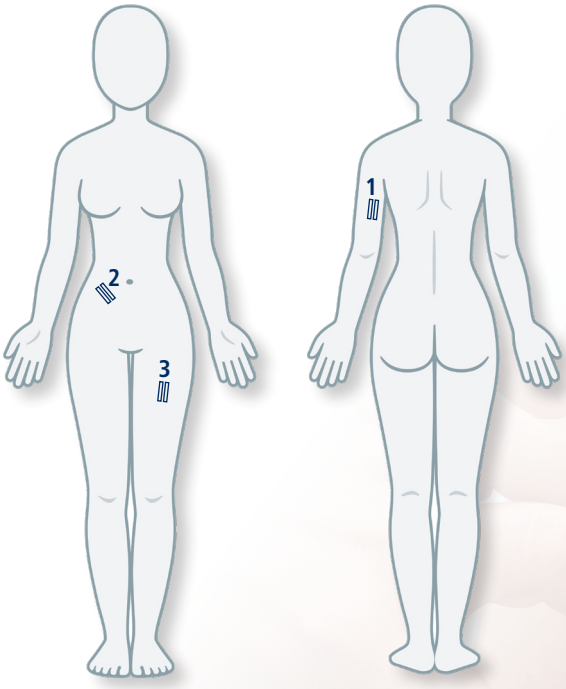
The vertical fold taken at the lateral distance of approximately 2cm from the umbilicus (2cm to the side of the umbilicus).

Site 3) Thigh

A vertical fold on the anterior aspect of the thigh, midway between the hip and knee joints (on the front of the thigh halfway between the hip joint, where the leg bends when the knee is lifted, and the middle of the knee cap).

The leg should be straight and relaxed.

4.3 THE 3 SITE SYSTEM FOR FEMALE SUBJECTS



Site 1) Triceps

A Vertical fold on the posterior midline of the upper arm, over the triceps muscle, halfway between the acromion process (bony process on top of the shoulder) and olecranon process (bony process on elbow). The elbow should be extended and the arm relaxed.

Site 2) Suprailiac

A diagonal fold above the crest of the ilium at the spot where an imaginary line would come down from the anterior auxiliary line just above the hipbone and 2-3cm forward.

Site 3) Thigh

A vertical fold on the anterior aspect of the thigh, midway between the hip and knee joints (on the front of the thigh halfway between the hip joint, where the leg bends when the knee is lifted, and the middle of the knee cap). The leg should be straight and relaxed.

5 MAXIMUM DESIRABLE FAT PERCENTAGE – PREFERRED LEVELS AND NORMALITY

5.1 MALE SUBJECTS

The levels recommended are based on a recent population survey of 9000 individuals performed by Durnin et al (1985), as well as the consensus of previous opinion (Katch & McArdle (1973); Durnin & Rahaman (1967); and Royal College of Physicians (1983). The maximum levels are age and sex dependent, reflecting an increased risk of morbidity and heart disease in males if they are fat and young (Van Itallie (1979), but allowing for a greater fat mass (25%) as the age of men increases to 40 years and beyond. A more preferable level would be 4 to 5% lower (i.e. 20%) and this should be sought. Younger men of less than 20 should have a preferred value of 15% or lower and there is a sliding scale of maximum fatness from the early twenties to forties and beyond.

Maximum Preferred or Desirable Fatness Levels for Ages	
UP TO 24 YEARS	15%
25 – 27 YEARS	17%
28 – 29 YEARS	18%
30 – 32 YEARS	19%
33 – 39 YEARS	20%
OVER 40 YEARS	21%

5.2 FEMALE SUBJECTS

The average fat content for females is between 24 and 26%, dependent upon country of residence, although from a health point of view, a maximum desirable level of 30% (young) and 35% (older), may pose no threat. This level of moderate obesity would not satisfy the desirable shape or quirks of contemporary fashion. The fashion model type of body composition reflects a fat percentage of 15% or less, female gymnasts as low as 8% and distance runners down to 6%. The maximum desirable level suggested is based on the work of Katch & McArdle (1973), Pollock et al (1975) and Brown & Jones (1977) and is 25% for women of 30 years and over, but starts at 20% for those less than 20 years old. Again there is a sliding scale reflecting advancing years and a reduction in health risk.

Contemporary fashion would indicate a preferred female level of perhaps 3% lower than these values.

Maximum Preferred or Desirable Fatness Levels for Ages	
UP TO 20 YEARS	17%
20 – 22 YEARS	18%
23 – 25 YEARS	19%
25 – 29 YEARS	20%
OVER 30 YEARS	22%

TABLE 1 – BODY FAT % VERSUS SKINFOLD THICKNESS – MALE SUBJECTS

Skinfold Thickness	Age 17-19	Age 20-29	Age 30-39	Age 40-49	Age 50+
10mm	**0.41**	**0.04**	**5.05**	**3.30**	**2.63**
12mm	2.46	2.10	6.86	5.61	5.20
14mm	4.21	3.85	8.40	7.58	7.39
16mm	5.74	5.38	9.74	9.31	9.31
18mm	7.10	6.74	10.93	10.84	11.02
20mm	8.32	7.96	12.00	12.22	12.55
22mm	9.43	9.07	12.98	13.47	13.95
24mm	10.45	10.09	13.87	14.62	15.23
26mm	11.39	11.03	14.69	15.68	16.42
28mm	12.26	11.91	15.46	16.67	17.53
30mm	13.07	12.73	16.17	17.60	18.56
32mm	13.84	13.49	16.84	18.47	19.53
34mm	14.56	14.22	17.47	19.28	20.44
36mm	15.25	14.90	18.07	20.06	21.31
38mm	15.89	15.55	18.63	20.79	22.13
40mm	16.51	16.17	19.17	21.49	22.92
42mm	17.10	16.76	19.69	22.16	23.66
44mm	17.66	17.32	20.18	22.80	24.38
46mm	18.20	17.86	20.65	23.41	25.06
48mm	18.71	18.37	21.10	24.00	25.72
50mm	19.21	18.87	21.53	24.56	26.35
52mm	19.69	19.35	21.95	25.10	26.96
54mm	20.15	19.81	22.35	25.63	27.55
56mm	20.59	20.26	20.73	26.13	28.11
58mm	21.02	20.69	23.11	26.62	28.66
60mm	21.44	21.11	23.47	27.09	29.20
62mm	21.84	21.51	23.82	27.55	29.71
64mm	22.23	21.90	24.16	28.00	30.21
66mm	22.61	22.28	24.49	28.43	30.70
68mm	22.98	22.65	24.81	28.85	31.17
70mm	23.34	23.01	25.13	29.26	31.63
72mm	23.69	23.36	25.43	29.66	32.07
74mm	24.03	23.70	25.73	30.04	32.51
76mm	24.36	24.03	26.01	30.42	32.93
78mm	24.68	24.36	26.30	30.79	33.35
80mm	25.00	24.67	26.57	31.15	33.75

TABLE 2 – BODY FAT % VERSUS SKINFOLD THICKNESS – FEMALE SUBJECTS

Skinfold Thickness	Age 17-19	Age 20-29	Age 30-39	Age 40-49	Age 50+
10mm	5.34	4.88	8.72	11.71	12.88
12mm	7.6	7.27	10.85	13.81	15.1
14mm	9.53	9.3	12.68	15.59	16.99
16mm	11.21	11.08	14.27	17.15	18.65
18mm	12.71	12.66	15.68	18.54	20.11
20mm	14.05	14.08	16.95	19.78	21.44
22mm	15.28	15.36	18.1	20.92	22.64
24mm	16.4	16.57	19.16	21.95	23.74
26mm	17.44	17.67	20.14	22.91	24.76
28mm	18.4	18.69	21.05	23.8	25.71
30mm	19.3	19.64	21.9	24.64	26.59
32mm	20.15	20.54	22.7	25.42	27.42
34mm	20.95	21.39	23.45	26.16	28.21
36mm	21.71	22.19	24.16	26.85	28.95
38mm	22.42	22.95	24.84	27.51	29.65
40mm	23.1	23.67	25.48	28.14	30.32
42mm	23.76	24.36	26.09	28.74	30.96
44mm	24.38	25.02	26.68	29.32	31.57
46mm	24.97	25.65	27.24	29.87	32.15
48mm	25.54	26.26	27.78	30.39	32.71
50mm	26.09	26.84	28.3	30.9	33.25
52mm	26.62	27.4	28.79	31.39	33.77
54mm	27.13	27.94	29.27	31.86	34.27
56mm	27.63	28.47	29.74	32.31	34.75
58mm	28.1	28.97	30.19	32.75	35.22
60mm	28.57	29.46	30.62	33.17	35.67
62mm	29.01	29.94	31.04	33.58	36.11
64mm	29.45	30.4	31.45	33.98	36.53
66mm	29.87	30.84	31.84	34.37	36.95
68mm	30.28	31.28	32.23	34.75	37.35
70mm	30.67	31.7	32.6	35.11	37.74
72mm	31.06	32.11	32.97	35.47	38.12
74mm	31.44	32.51	33.32	35.82	38.49
76mm	31.81	32.91	33.67	36.15	38.85
78mm	32.17	33.29	34	36.48	39.2
80mm	32.52	33.66	34.33	36.81	39.54

6 BODY DENSITY EQUATIONS

LINEAR REGRESSION EQUATIONS (DURNIN & WOMERSLEY)

BODY DENSITY = C - [M (LOG 10 SUM OF ALL FOUR SKINFOLDS)]

Male	Age 17-19	Age 20-29	Age 30-39	Age 40-49	Age 50+
C	1.1620	1.1631	1.1422	1.1620	1.1715
M	0.0630	0.0632	0.0544	0.0700	0.0779

Female	Age 16-19	Age 20-29	Age 30-39	Age 40-49	Age 50+
C	1.1549	1.1599	1.1423	1.1333	1.1339
M	0.0678	0.0717	0.0632	0.0612	0.0645

THE SIRI EQUATION

$$FAT\ \% = \left[\left(\frac{4.95}{BD} \right) - 4.5 \right] \times 100$$

BODY DENSITY EQUATIONS (JACKSON & POLLOCK)

MALE BD = $1.0990750 - 0.0008209\ (X_2) + 0.0000026\ (X_2)^2 - 0.0002017\ (X_3) - 0.005675\ (X_4) + 0.018586\ (X_5)$

Where
- X_2 = sum of the chest, abdomen and thigh skinfolds in mm
- X_3 = age in years
- X_4 = waist circumference in m
- X_5 = forearm circumference in m

FEMALE BD = $1.1470292 - 0.0009376\ (X_3) + 0.0000030\ (X_3)^2 - 0.0001156\ (X_4) - 0.005839\ (X_5)$

Where
- X_3 = sum of the triceps, thigh and suprailiac skinfolds in mm
- X_4 = age in years
- X_5 = gluteal circumference in cm

7 BIBLIOGRAPHY

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8 LIMIT OF LIABILITY

8.1 All information of a medical nature contained in this manual is based upon the documents cited in the Bibliography and is offered in good faith for convenience of the user. The manufacturer or supplier of this instrument does not however accept any liability for conclusions drawn, diagnosis, estimates of state-of-health, treatments or any other medical assessment whatsoever based upon the measurements taken using this instrument.

8.2 The certification of this instrument will be void if the instrument is dismantled, reassembled or altered in any way by anyone other than Bowers Group or those agents who have specific approval for recalibration.

8.3 Bowers Group reserve the right to change the information in this document without notice in line with the policy of continued product improvement and development. The information contained in this document is considered to be correct at the time of printing. It is supplied without liability for errors or omissions.

9 TECHNICAL INFORMATION

RANGE	RESOLUTION	REPEATABILITY	ACCURACY
80.00mm	0.20mm	0.20mm	99.00%

NOTE

Resolution is defined as the minimum graduation of the instrument and is not the same as the expected accuracy.

10 MAINTENANCE AND REPAIR

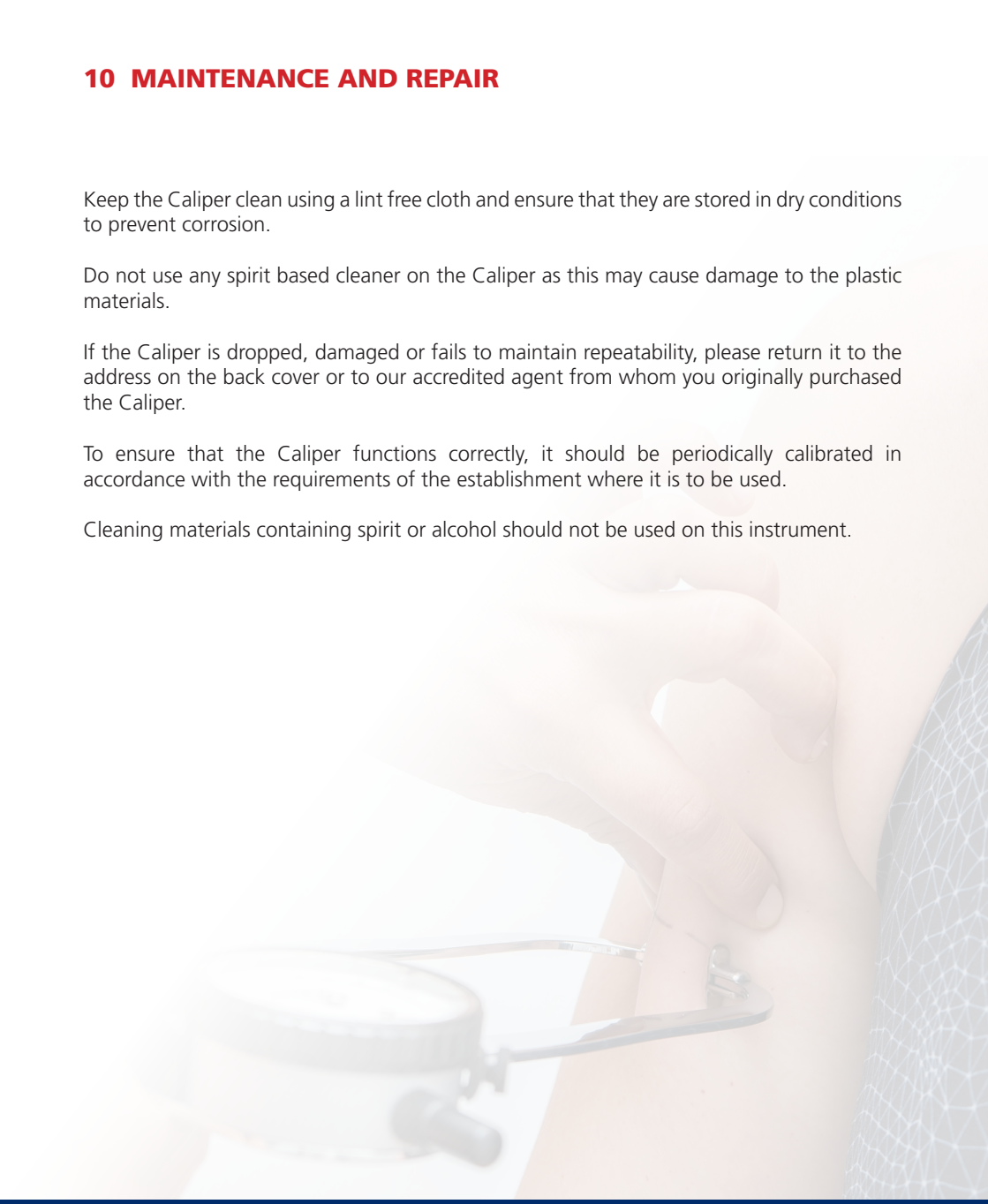
Keep the Caliper clean using a lint free cloth and ensure that they are stored in dry conditions to prevent corrosion.

Do not use any spirit based cleaner on the Caliper as this may cause damage to the plastic materials.

If the Caliper is dropped, damaged or fails to maintain repeatability, please return it to the address on the back cover or to our accredited agent from whom you originally purchased the Caliper.

To ensure that the Caliper functions correctly, it should be periodically calibrated in accordance with the requirements of the establishment where it is to be used.

Cleaning materials containing spirit or alcohol should not be used on this instrument.



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