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Textile Test Methods

Dimensional Change in Domestic Laundering of Textiles

ICS 59.080.01

National Standard of Canada

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TEXTILE TEST METHODS

DIMENSIONAL CHANGE IN DOMESTIC LAUNDERING OF TEXTILES

Prepared by the
Canadian General Standards Board 

Approved by the
Standards Council of Canada 

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	Dimensional Change in Domestic Laundering of Textiles	No. 58-2004

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No. 58-M90

FOREWORD

The washing and drying procedures in this method are similar to the International Standard ISO 6330, Textiles — Domestic washing and drying procedures for textile testing using a Type B washer, top-loading, agitator type.

1. PURPOSE AND SCOPE

1.1 This method determines the dimensional change of textile fabrics or garments, likely to occur in domestic laundering procedures. The fabric specimen or garment is subjected to an appropriate combination of specified washing, drying and restoration procedures.¹

1.2 Seven washing, six drying and three restoration procedures are included as follows:

1.2.1 *Washing Procedures*²

I — Low temperature (40°C), low mechanical action, synthetic detergent

II — Medium temperature (50°C), low mechanical action, synthetic detergent

III — Medium temperature (50°C), moderate mechanical action, synthetic detergent

IV — High temperature (70°C), moderate mechanical action, synthetic detergent

V — Cold temperature (20°C), low mechanical action, detergent³

VI — Cool temperature (30°C), low mechanical action, detergent³

VII — Medium-high temperature (60°C), moderate mechanical action, synthetic detergent.

1.2.2 *Drying Procedures*

A — Drip dry

B — Flat-bed press

C — Flat dry

D — Line dry

E — Tumble dry

F — Tumble dry without heat.

1.2.3 *Restoration Procedures*

1 — Tension presser

2 — Knit shrinkage gauge

3 — Hand iron.

¹ Experience has shown that most relaxation shrinkage occurs in the first wash, two additional washes usually being sufficient to effect complete relaxation shrinkage.

² Any other combination of temperature, mechanical action, bleach and detergent may be used, but must be reported.

³ It is recommended that a cold water or liquid detergent be used.

- 1.3 Before using this method, the combination of procedures suitable for the particular item to be tested must be selected to arrive at the appropriate test. A complete test consists of a washing, drying and, if necessary, a restoration procedure. For example, Test IIB1 means that the textile material has been washed at 50°C with low mechanical action, and synthetic detergent, dried by flat-bed press and restored by tension pressing. The final result obtained will, of course, depend upon the choice of test conditions used.
- 1.4 The seven washing tests specified vary in severity of operating conditions and correspond in their essentials to procedures commonly used in home laundering. The six drying procedures specified provide appropriate methods for drying different textile materials. Three procedures are specified for determining the dimensional restorability of materials after washing and drying for those textiles that may be restored by ironing or wearing.
- 1.5 This method is suitable for use with woven or knitted fabrics and also with garments and other made-up textile articles. This method is also applicable to certain nonwoven fabrics. For nonwovens, the principal directions of measurement shall be machine direction and cross direction (perpendicular to the machine direction). Nonwoven fabrics are not usually subjected to restoration procedures. This method may not be suitable for use with certain types of fabrics such as those of open construction or delicate nature. Mechanical action is the factor most responsible for fabric distortion during washing and this must be considered when choosing the procedure to be used. Where the amount of mechanical action is required to be minimal (e.g., as in hand washing), CAN/CGSB-4.2 No. 25.1 should be used for dimensional change.
- 1.6 The testing and evaluation of a product against this method may require the use of materials and/or equipment that could be hazardous. This document does not purport to address all the safety aspects associated with its use. Anyone using this method has the responsibility to consult the appropriate authorities and to establish appropriate health and safety practices in conjunction with any applicable regulatory requirements prior to its use.

2. PRINCIPLE

- 2.1 A garment or fabric specimen is washed in an automatic domestic washing machine. Excess water is removed and the specimen is dried by one of the specified procedures and, where necessary, subjected to a dimensional restoration procedure.
- 2.2 For determining the dimensional change, the reference dimensions marked on the fabric specimens in the length and width directions, or in appropriate locations on garments, are measured before and after laundering, and the percentage dimensional change in each direction is calculated.

3. REFERENCED PUBLICATIONS

- 3.1 The following publications are referenced in this method:

3.1.1 Canadian General Standards Board (CGSB)

CAN/CGSB-4.2 — Textile Test Methods:

No. 1 — Precision and Accuracy of Measurements

No. 2 — Conditioning Textile Materials for Testing

No. 25.1 — Dimensional Change in Wetting.

3.1.2 International Organization for Standardization (ISO)

ISO 6330 — Textiles — Domestic washing and drying procedures for textile testing.

- 3.2 A dated reference in this method is to the issue specified. An undated reference in this method is to the latest issue, unless otherwise specified by the authority applying this method. The sources are given in the Notes section.

4. APPARATUS AND REAGENTS

4.1 Washing Machine.⁴

4.2 **Detergent:** commercially available detergent.^{5 and 6}

4.3 **Loading fabric:** additional undyed fabric may be required to give the specified load for the washer. This ballast shall consist of fabric similar to that being tested and cut into pieces no larger than 1 m square.⁷

4.4 **Dryer.**⁴

4.5 **Hot-head flat-bed press.**⁸

4.6 **Tension presser:**⁹ consisting essentially of the following parts:

4.6.1 **Pressing table, 350 mm square:** with provision for holding two adjacent sides of the specimen in a fixed position and for applying known amounts of tension to the other two sides of the specimen by means of masses acting on movable holding devices, while the specimen is being pressed. The pressing table has a flat upper surface and is rigidly supported so that the surface just makes contact with the specimen when the latter is placed in the apparatus. The surface may be of uncovered nonrusting metal, or other rigid heat-resistant material covered with a flat padding.

4.6.2 **Metal template:** with 250 mm square opening and corners cut away, as shown in Figure 1, for marking out the specimen.

4.6.3 **Holding device:** for the specimen consisting of rigid metal rods (e.g. 5 mm diameter aluminum rod) slipped through 10 mm hems sewn across the end of each flap. The two rods forming the fixed holding devices are held in position between pairs of upright posts fastened to each end of two adjacent sides of the pressing table. The rods forming the two movable holding devices are perforated near each end, or fitted with hooks, to accommodate the cords carrying the tensioning masses. The cords pass over pulleys supported by the framework of the pressing table (Figure 2).

4.6.4 **Nonrusting metal plate, 350 mm square:** perforated with approximately 1.5 mm holes for use in drying the specimen.

4.7 **Knit shrinkage gauge:**⁹ consisting of a set of 20 mounting pins spaced equidistant from one another around the circumference of a circle. The pins are set in guides in radial slots, each pin being attached to a tensioning member that is driven outwardly in the slot. The springs have an extension of 25 mm at 4.5 ± 0.1 N tensions. The tensioning members have a common drive so that the restoration force is applied simultaneously in all directions in the plane of the specimen. The minimum diameter of the pin frame in the collapsed state is 280 mm and the maximum diameter in the freely extended state is 350 mm. The surface of the apparatus in contact with the test specimen is smooth and polished so as to be as friction-free as possible. A marking template is provided.

4.8 **Hand iron.**

4.9 **Measuring scale:** preferably graduated in millimetres.

4.9.1 A premarked device, calibrated to give the percentage of shrinkage or growth, can also be used.

⁴ Contact Standards Division, Canadian General Standards Board, Gatineau, Canada K1A 1G6, fax (819) 956-5740, for information on machine setting conditions and for model number(s) and source(s) of current approved washer(s). Any other washer which is known to give comparable results can be used.

⁵ It is recommended that cold water or a liquid detergent suitable for cold water be used.

⁶ At date of publication, "Original Tide" without bleach meets this method.

⁷ A suitable loading fabric is "Polyester Make-Weights" available from R.B. Atlas Inc., 9 Canso Rd., Rexdale, Ontario, Canada M9W 4L9, telephone (416) 241-4647, fax (416) 241-9008.

⁸ Suitable equipment is available from Calmek Equipment Inc., 6155 Transcanadienne, Saint-Laurent, Quebec, Canada H4T 1S3. Telephone (514) 744-0078. Fax (514) 744-9922.

⁹ Suitable apparatus is available from Testing Machines International of Canada Ltd., 6 Ronald Drive, Montréal, Quebec, Canada H4X 1M8.

5. TEST SPECIMENS

5.1 **Fabrics** — At least two fabric specimens shall be tested.^{10 and 11}

5.1.1 **Tensionless Pressing** — When the specimens are not to be restored by the tension presser or the knit shrinkage gauge, cut each specimen at least 600 × 600 mm from areas free from wrinkles and creases. Place the specimens, conditioned in accordance with CAN/CGSB-4.2 No. 2 on a flat surface. Using a permanent marking medium (e.g. indelible ink, sewing thread), suitably mark on each specimen six accurately measured distances at least 450 mm long, three parallel to each of the two principal directions of the fabric (par. 4.9). The three marked distances shall be at least 75 mm apart; no portion of them shall be closer than 75 mm to the specimen edges. Suitably protect the cut edges of fabrics that are likely to fray during washing.

5.1.2 **Tension Pressing** — When the specimens are to be restored by the tension presser (par. 8.1), prepare them by the following procedure: take two specimens measuring approximately 500 × 500 mm from fabric previously conditioned in accordance with CAN/CGSB-4.2 No. 2. Place the metal template (par. 4.6.2) on the specimens so that adjacent sides of the 250 mm square are parallel to the warp and weft directions, respectively. Mark reference lines on the fabric at the ends and mid-point of each side of the square using indelible ink or sewing with a thread of contrasting colour. Trace the outline of the metal template on the fabric with indelible ink. Mark warp (or wales) direction on the specimens and sew a 10 mm hem on each side of the specimens. Do not cut out the corners of the specimens until after completion of the washing cycle, to prevent distortion or tearing during washing. Measure the distances between the marked lines on the opposite sides of the square before carrying out the test.

5.1.3 **Knit Shrinkage Gauge** — When specimens are to be restored by the knit shrinkage gauge (par. 8.2), prepare them by the following procedure: take two specimens measuring approximately 400 × 400 mm from fabric previously conditioned in accordance with CAN/CGSB-4.2 No. 2. Place the marking template over the centre of the specimens. Trace the 250 mm diameter reference measuring circle and mark the locations of the 20 equidistantly spaced dots, by means of indelible ink.

5.2 **Garments and Other Made-up Articles** — When testing a made-up article where it is undesirable to cut specimens, apply accurately measured markings, as long as possible, at appropriate places on the article. If possible, no portion of the measured distances should be within 50 mm of a seam.^{10 and 12}

6. WASHING PROCEDURES

6.1 Determine the mass of the specimens, and add sufficient loading fabric to obtain a total dry mass of 1.8 kg ± 0.1kg. Alternatively a 3.6 kg load can be used, but must be reported.¹³ Place the specimens and the loading fabric in the machine. Fill the machine with 68 ± 4 L of water. Tables 1 and 2 summarize the washing conditions and machine settings.

¹⁰ If the precision of the results is specified, refer to CAN/CGSB-4.2 No. 1 to determine the number of test specimens required. Otherwise two specimens shall be tested.

¹¹ If the size of the specimen to be tested is smaller than specified to perform the tests, pin the specimen to a piece of similar fabric.

¹² Although this method is not primarily intended to measure shrinkage of seams, it may be applied to this property. An accurately measured distance should be marked along the seam whose dimensional change is to be measured.

¹³ The dimensional change results obtained using a load of 1.8 kg may be different than those obtained with a 3.6 kg load.

TABLE 1
Washing Conditions

PROCEDURE	WASHING TEMPERATURE °C	MACHINE CYCLE
I	40 ± 2	Delicate/Gentle
II	50 ± 2	Delicate/Gentle
III	50 ± 2	Normal
IV	70 ± 2	Normal
V	20 ± 2	Delicate/Gentle
VI	30 ± 2	Delicate/Gentle
VII	60 ± 2	Normal

TABLE 2
Examples of Machine Settings Without Load
(Refer to ISO 6330)

Cycle	Normal	Gentle/Delicate	Permanent Press/Durable Press
Washing Time	12 ± 1 min	8 ± 1 min	10 ± 1 min
Spin Speed	(10.75 ± 0.25) s ⁻¹ (645 ± 15 rpm)	(7.167 ± 0.25) s ⁻¹ (430 ± 15 rpm)	(7.167 ± 0.25) s ⁻¹ (430 ± 15 rpm)
Final Spin Time	6 ± 1 min	6 ± 1 min	4 ± 1 min

Add sufficient detergent to provide good running suds¹⁴ and set the machine to wash for 8 min for delicate or gentle and 12 min for normal cycle. If necessary, advance the operation of the machine manually to begin the rinse cycle after 12 min washing. Cold water shall be used for the rinse cycle. Continue until the end of the final spin cycle, except that if the specimens are to be drip-dried, stop the machine before the final spin and remove them.

- 6.2 Remove the specimens from the machine, taking care that they are neither stretched nor distorted, and dry them by one of the six procedures described in Section 7.

7. DRYING PROCEDURES

7.1 Procedure A — Drip Dry

- 7.1.1 Remove the specimens from the machine and, without extracting the water, suspend them from a line in still air at room temperature, attaching them at two adjacent corners and at the centre of the side, using nonrusting clips, and allow them to dry. The warp or wales direction of the specimens should be vertical. Suspend garments on nonrusting hangers.
- 7.1.2 Place the specimens on a flat surface and condition them in accordance with CAN/CGSB-4.2 No. 2 for at least 4 h.

¹⁴ Approximately 52 g of detergent per 65 L of water has been found to provide a reasonably good suds. However, water hardness will affect the ability to achieve "reasonable goods suds," thus quantity of detergent should be adjusted to suit local conditions.

- 7.1.3 Remeasure the marked distances on the specimens and calculate the average dimensional change for the warp and weft (wales and courses) separately, as a percentage of the original measurements. Average the results for the specimens.
- 7.2 **Procedure B — Flat-bed Press**
- 7.2.1 Unfold each damp specimen and place it on the flat bed of the press. Smooth out heavy wrinkles with the hand and lower the head of the press, which has been set at a suitable temperature¹⁵ according to Table 3 for one or more short periods as required to properly dry the specimen.
- 7.2.2 If a flat-bed press is not available, the damp specimen may be dried by laying it on a padded ironing board and drying it with a hand iron at a suitable temperature.¹⁵ Heavy wrinkles should first be smoothed out by hand and the specimen should be dried by raising and lowering the iron. Do not slide the iron over the specimen, to avoid distorting the fabric.
- 7.2.3 Condition and remeasure the specimen in accordance with par. 7.1.2 and 7.1.3.

TABLE 3
Steam Table Chart

Pressure (kPa)	Temperature °C	Heat kJ/kg
0	100	2677
69	115	2700
138	126	2717
207	135	2728
276	141	2735
345	148	2745
414	153	2749
483	158	2756
552	162	2761
621	166	2763
690	170	2770
758	173	2773
827	177	2775
896	180	2777
965	183	2780
1034	187	2781

¹⁵ The following temperatures may be safely used for ironing fabrics:

<i>Fabric</i>	<i>Temperature °C</i>
<i>Cotton and linen</i>	200
<i>Polyester, rayon, silk, triacetate, wool</i>	150
<i>Acetate, acrylic, modacrylic, nylon, polypropylene, spandex</i>	110

Temperatures can be measured with a surface pyrometer or other appropriate temperature measuring device.

7.3 Procedure C — Flat Dry

- 7.3.1 Spread the specimens on a smooth horizontal surface, remove the wrinkles by hand without stretching or distorting the specimens, and allow them to dry.
- 7.3.2 Condition and remeasure the specimens in accordance with par. 7.1.2 and 7.1.3.

7.4 Procedure D — Line Dry

- 7.4.1 Suspend the extracted specimens from a line to dry according to the procedure described in par. 7.1.1.
- 7.4.2 Condition and remeasure the specimens in accordance with par. 7.1.2 and 7.1.3.

7.5 Procedure E — Tumble Dry

- 7.5.1 Place the specimens and dummy load (if any) in the tumble dryer and set the temperature control to generate the correct exhaust temperature as specified in Table 4. Operate the dryer until the load is dry and continue tumbling, with the heat turned off, for the specified amount of time. Remove the specimens immediately.¹⁶

TABLE 4
Tumble Drying Conditions
(Refer to ISO 6330)

Designation	Exhaust temperature °C	Cool-down
Normal/Cotton sturdy	66 ± 5	5 min
Permanent press	66 ± 5	10 min
Delicate	< 60	5 min

- 7.5.2 Condition and remeasure the specimens in accordance with par. 7.1.2 and 7.1.3.

7.6 Procedure F — Tumble Dry without Heat

- 7.6.1 Place the specimens and dummy load (if any) in the tumble dryer without heat. Operate the dryer until the load is dry. Remove the specimens immediately.
- 7.6.2 Condition and remeasure the specimens in accordance with par. 7.1.2 and 7.1.3.

8. RESTORATION PROCEDURES

8.1 Procedure 1 — Tension Presser

- 8.1.1 This procedure is applicable to woven fabrics but not to garments.
- 8.1.2 If, after the specimen has been dried by the appropriate procedure, excessive shrinkage is found in one or both directions of the fabric, the specimen shall, if required, be subjected to the following tension pressing procedure.
- 8.1.2.1 Cut out the corners of the specimen (par. 5.1.2) and immerse it in water at room temperature until thoroughly wetted. Extract the specimen until its water content is approximately 100% of its dry mass.
- 8.1.2.2 Place the damp specimen on the bed of the tension presser. Mount the two short flaps in the fixed holding devices and the longer flaps in the movable holding devices.

¹⁶ Other drying conditions may be used upon agreement.

- 8.1.2.3 Apply the proper tensioning masses (Table 5) in the warp and weft directions of the fabric. One-half of the total mass should be hung from each pulley and the tension should be applied gradually, the smaller of the two pairs of masses being applied first (Figure 2).

TABLE 5
Masses Applied on Tension Presser

Dimensional Change After Drying Shrinkage %	Total Mass Applied kg
>5	2.0
3.5 to 5	1.5
1.5 to 3	0.5
0 to 1	0.25
Any stretch	0.25

- 8.1.2.4 Dry the specimen while under tension by placing the 350 mm plate (par. 4.6.4) on the portion of the specimen lying on the pressing table and heating the metal plate by placing on it a hand iron having a temperature suitable for the fabric being restored.¹⁵ Release of steam from the specimen is facilitated by the holes in the metal plate.

- 8.1.2.5 When the portion of the specimen on the pressing table is dry, release the tension and remove the specimen. Dry the outer flaps of the specimen by raising and lowering a hand iron (at suitable temperature) on them, taking care not to distort the specimen.

- 8.1.3 Condition and remeasure the specimen in accordance with par. 7.1.2 and 7.1.3.

8.2 Procedure 2 — Knit Shrinkage Gauge

- 8.2.1 This procedure is applicable to some knitted fabrics. It is not suitable for use with fabrics that shrink in one direction and stretch more than 2% in the other direction.

- 8.2.2 After drying the specimen by the appropriate procedure, condition it for at least 4 h in accordance with CAN/CGSB-4.2 No. 2. With the tension on the knit shrinkage gauge fully reduced, mount the specimen on the pins of the gauge, making certain that each pin passes through one of the 20 dots (par. 5.1.3). Operate the hand wheel drive mechanism to bring the tensioning members to their outer extremities at a smooth and uniform rate.

- 8.2.3 Allow the specimen to remain under tension for 2 min. Then, without releasing the tension, measure the diameter of the reference measuring circle. Take the first measurement parallel to the central wale, and the second and third measurements by pivoting around the centre of the specimen approximately 20 mm on either side of the first. Repeat this procedure beginning with the first measurement parallel to the central course, to obtain three measurements in this direction.

- 8.2.4 Calculate the average dimensional change in each direction separately.

8.3 Procedure 3 — Hand Iron

- 8.3.1 This procedure is the least reproducible of the restoration procedures and is intended primarily for use on garments when neither of the other procedures can be used.

- 8.3.2 Place the damp garment on a padded ironing board and press until dry with a hand iron having a temperature suitable for the fabric being pressed.¹⁵ A dry garment may be ironed with a steam iron. During pressing, exert only sufficient tension to reshape and restore the garment to its original dimensions.

- 8.3.3 Condition and remeasure the garment in accordance with par. 7.1.2 and 7.1.3.

9. REPORT

Report the following information:

- 9.1 The complete test procedure used² (Roman numeral for washing procedure, uppercase letter for drying procedure and Arabic numeral for restoration procedure, if used — e.g. Test IIB1).
- 9.2 The average percentage dimensional change for each of the principal directions of the fabric (or garment) to the nearest 0.1% (using a minus sign to indicate shrinkage and a plus sign for stretch), both before and after the restoration procedure where applicable.
- 9.3 The brand name of the detergent used, and whether it contains fluorescent brighteners and/or bleaching agents.
- 9.4 The ironing or pressing temperature, if applicable.
- 9.5 The number of this method: CAN/CGSB-4.2 No. 58-2004.

10. SOURCES OF REFERENCED PUBLICATIONS

The following addresses were valid at the date of publication.

- 10.1 The publications referred to in par. 3.1.1 may be obtained from the Canadian General Standards Board, Sales Centre, Gatineau, Canada K1A 1G6. Telephone (819) 956-0425 or 1-800-665-2472. Fax (819) 956-5644. E-mail ncr.cgsb-ongc@pwgsc.gc.ca. Web site www.ongc-cgsb.gc.ca
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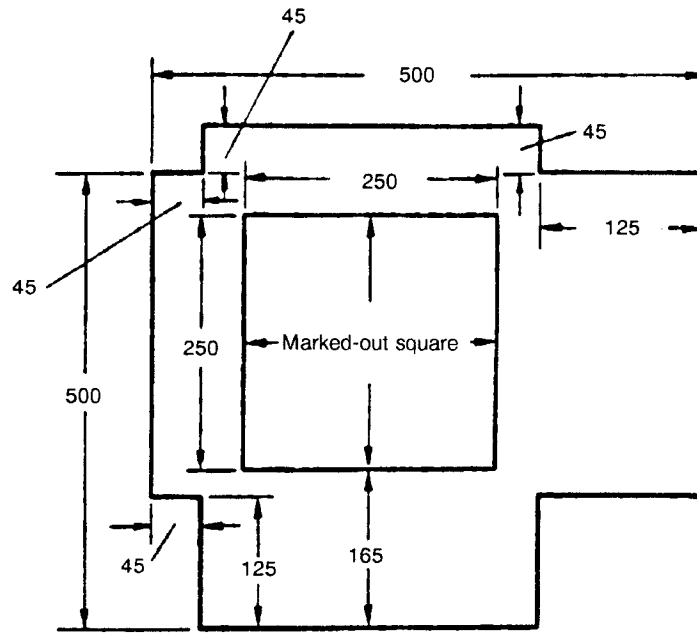


FIGURE 1
Test Specimen

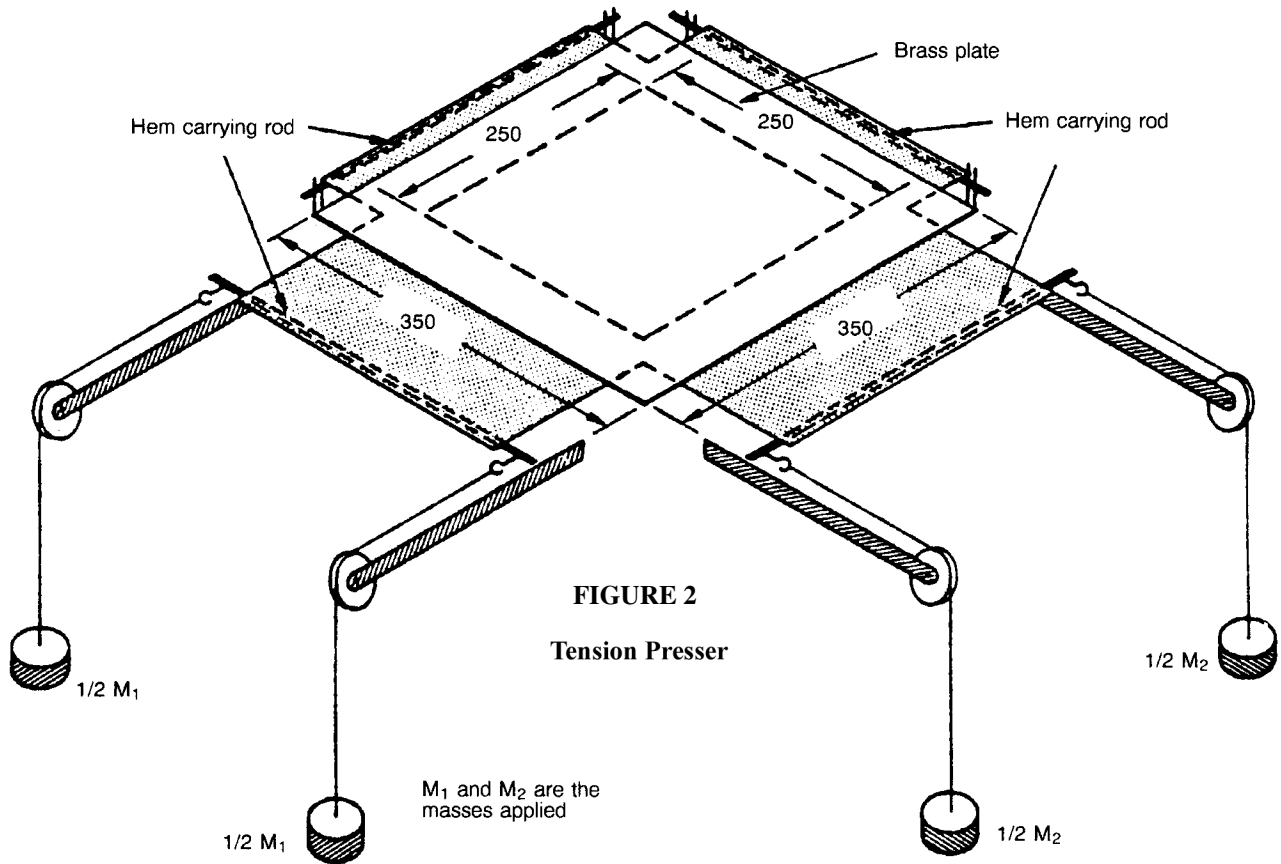


FIGURE 2
Tension Presser

All dimensions are in millimetres.