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# International Standard



# 2267

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INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

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## Surface active agents — Evaluation of certain effects of laundering — Methods of preparation and use of unsoiled cotton control cloth

*Agents de surface — Contrôle de certains effets de blanchissage — Méthodes d'élaboration et de mise en œuvre d'un tissu de coton témoin non souillé*

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**Descriptors :** surfactants, tests, washing tests, test specimens, cotton fabrics, specimen preparation, reference sample.

## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 2267 was prepared by Technical Committee ISO/TC 91, *Surface active agents*.

This third edition cancels and replaces the second edition (ISO 2267:1979), of which it constitutes a minor revision.

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

# Surface active agents — Evaluation of certain effects of laundering — Methods of preparation and use of unsoiled cotton control cloth

## 0 Introduction

The quality of laundering for household textile articles may be assessed in two different ways, depending on whether the cleaning effect, or the conservation of the initial characteristics of cloth subjected to repeated laundering, is under consideration.

In the first case, some tests may be carried out on the articles themselves, which may be re-used. However, for measurement of greying and yellowing, it is essential to use unsoiled control cloths. Furthermore, as the measurement of certain characteristics of the household textile articles, particularly their mechanical properties, entails the destruction of samples, it is quite impossible to perform these tests on household textile articles which are in use.

It has therefore been proposed to define the harmlessness of a laundering process on household textile articles by reference to the behaviour of control material treated in the same way at the same time as the cloth washed in the normal manner.

Since the behaviour of household textile articles in use is influenced by many and complex factors, and depends to a large extent on the yarn linear density of the cloth, it is necessary, in order to obtain satisfactory reproducibility of the results, to standardize all matters relating to the preparation of the control cloth, and to its use.

In this International Standard, the characteristics of the control cloth are defined with the greatest possible precision, and its use is standardized.

The test methods to be applied to the control cloth before and after use are described in ISO 4312.

## 1 Scope and field of application

This International Standard specifies the characteristics of a cotton material and the preliminary treatments which are to be applied to it in order to make it an *unsoiled cotton control cloth*<sup>1)</sup> for the testing of certain effects of laundering.

It also defines the conditions of use of this control cloth (in the form of control test pieces) during the laundering processes which are being tested from the point of view of the conservation of the original characteristics of the cloth.

The unsoiled cotton control cloth is primarily intended to enable the laundering of white cloth to be tested. It may be used with all detergents and all types of domestic or industrial machines designed to wash, hydroextract and dry household textile articles.

The unsoiled cotton control cloth may also be used for testing the laundering of other categories of textile articles (coloured, for example).

## 2 References

ISO 2, *Textiles — Designation of the direction of twist in yarns and related products.*

ISO 862, *Surface active agents — Glossary.*

ISO 1144, *Textiles — Universal system for designating linear density (Tex system).*

ISO 1973, *Textile fibres — Determination of linear density — Gravimetric method.*

ISO 2061, *Textiles — Determination of twist in yarns — Direct counting method.*

ISO 2174, *Surface active agents — Preparation of water with known calcium hardness.*

ISO 3801, *Textiles — Woven fabrics — Determination of mass per unit length and mass per unit area.*

ISO 4312, *Surface active agents — Evaluation of certain effects of laundering — Methods of analysis and test of unsoiled cotton control cloth.*

ISO 5081, *Textiles — Woven fabrics — Determination of breaking strength and elongation (Strip method).*

1) The names and addresses of the suppliers of unsoiled cotton control cloth complying with this International Standard may be obtained from the Secretariat of ISO/TC 91 (AFNOR) or from the Central Secretariat.

ISO 7211/2, *Textiles — Woven fabrics — Construction — Method of analysis — Part 2: Determination of number of threads per unit length.*

### 3 Definitions

**3.1 laundering process:** All the operations carried out during laundering. These may comprise

- soaking
- one or more washes
- bleaching
- one or more rinses
- hydroextraction
- drying
- calendering, pressing or ironing.

**3.2 detergent:** A product specially formulated for cleaning through the process of detergency.<sup>1)</sup>

NOTE — A detergent comprises essential components (surface active agents) and, generally, complementary components (builders, etc.).

**3.3 normally soiled household textile articles:** An average sample of the articles which are washed in the usual way and which present an average degree of soiling resulting from normal use.

NOTE — The qualitative and quantitative variability of soiling in household textile articles which have been washed in the normal way, depending on the circumstances of place and time, makes it impossible to define a standard soiled article or cloth which would be suitable in all cases.

This variability, which cannot be avoided, does not, nevertheless, prevent meaningful results being obtained if appropriate statistical methods are used.

Although the nature of the soil affects the behaviour during laundering of the cloth of which the articles are made, the control cloth will be affected in the same way because part of the soil is redeposited on it during washing. As a result, the conclusions arrived at from the application of this International Standard will depend, to some extent, on what constitutes normally soiled articles in the particular circumstances which are of interest to the user of this International Standard.

If it is necessary, for certain tests, to use soiled articles which do not conform to this definition, this shall be specifically mentioned in the test report relating to the methods of test.

**3.4 unprepared control cloth:** Undyed cloth provided by the textile industry for the preparation of the control cloth and having certain specified characteristics, so that it can provide a control conforming to the requirements.

**3.5 control cloth:** Unprepared control cloth which has been subjected to a given number of preparatory treatments under defined conditions in order to bring its essential characteristics to specified initial values.

### 4 Principle

A given number of test pieces of control cloth and machine loads of normally soiled articles are together subjected to a given number of consecutive laundering processes.

After these processes, characteristic properties of the test pieces of control cloth are measured and compared with their initial values.

The changes in these properties during washing should enable the causes of damage in household textile articles in the laundering process to be detected.

### 5 Cotton control cloth

#### 5.1 Characteristics and requirements

The methods of analysis and test to be used to determine the characteristics and requirements and also the designations are described in ISO 2, ISO 1144, ISO 1973, ISO 2061, ISO 3801, ISO 4312, ISO 5081 and ISO 7211/2.

##### 5.1.1 Unprepared control cloth

The cloth provided by the textile industry shall be selected in such a way that, after having been subjected to the preparatory treatments (see 5.2), it has the characteristics defined in 5.1.2.

The unbleached yarn to be used for both warp and weft shall comply with the following requirements:

- nature: pure cotton, minimum commercial length 27 mm (see note 1);
- linear density: single yarn  $30 \pm 2$  tex;
- twist: Z 700  $\pm 25$ .

The width, mass, yarn linear density, and warp strength shall be such that it is possible to obtain the values laid down for the control cloth (5.1.2), allowing for dimensional variations. The latter occur either during any treatment aimed at giving dimensional stability or during preparatory treatment. They are usually of the order of 3 to 8 % in the warp and 1 to 5 % in the weft for stabilized cloth "direct from the loom".

The unprepared control cloth shall also comply with the following requirements:

- it shall have a plain weave;

1) See ISO 862.

— it shall have been completely desized and shall not contain any fluorescent whitening agent revealed by inspection under ultraviolet light;

— it shall have been boiled and laundered in such a way that the fluidity value of the cotton is less than  $50 \text{ (Pa}\cdot\text{s)}^{-1}$  or its degree of polymerization greater than 1 600 (after boiling for 1 h in a 1 % sodium hydroxide solution without being allowed to come into contact with the air);

— it shall have been boiled and laundered in such a way that the degree of radiance (percentage) of the cloth is greater than 86.

#### NOTES

1 It is important to verify that the control cloth consists of cotton only, and contains no other fibre whatsoever. A microscopic examination of the constituent fibres is recommended.

2 It is desirable, but not essential, for the cloth to have a certain number of coloured warp, and possibly also weft, threads, dyed with a fast dye, or white threads of a larger linear mass, or double threads, which indicate:

- the surface area of each test piece (see figure 1);
- within this area, the area of the specimens to be used for the measurement of tensile strength (see figure 2).

This will facilitate the cutting of both test pieces and specimens. Allowance should be made, when determining the dimensions of these, for the dimensional variations envisaged during the preliminary treatments.

It is also desirable for the two selvedges to be different, so that the two sides of the material can be identified.

#### 5.1.2 Control cloth

The unprepared control cloth becomes a control cloth after it has undergone the preparatory treatments (see 5.2), provided that after these treatments it satisfies the following requirements:

- number of threads in warp determined in accordance with ISO 7211/2:  $25 \pm 2$  threads per centimetre;
- number of threads in weft determined in accordance with ISO 7211/2:  $25 \pm 2$  threads per centimetre;
- mass per unit area determined in accordance with ISO 3801:  $170 \pm 10 \text{ g/m}^2$ , after conditioning at  $20 \text{ }^\circ\text{C}$  and 65 % relative humidity;
- width: at least 800 mm;
- breaking strength in warp determined in accordance with ISO 5081: at least 500 N;
- fluidity value determined in accordance with ISO 4312 between 40 and  $50 \text{ (Pa}\cdot\text{s)}^{-1}$ , or degree of polymerization between 1 700 and 1 550;
- degree of radiance (percentage) (measured immediately after the last preparatory treatment) determined in accordance with ISO 4312: greater than 86.

NOTE — The maximum degree of radiance (percentage) that can be obtained on the control cloth depends to some extent on the measuring apparatus used. If the measuring conditions are such that the specular component is excluded (which is the case with the measuring geometry  $45^\circ/\text{normal}$  (45/0), the maximum degree of radiance (percentage) is about 92. If the measuring conditions are such that the specular component is not excluded, or is only partly excluded (measurement in a photometric sphere), the maximum degree of radiance (percentage) may exceed 92 (values related to  $\text{BaSO}_4 = 100$ ).

The above values apply only under measuring conditions which exclude any contribution of the fluorescence.

## 5.2 Preparatory treatments

### 5.2.1 Materials

**5.2.1.1 Water**, of zero hardness corresponding to 0 mg of  $\text{Ca}^{++}$  ions per litre determined in accordance to ISO 2174.

**5.2.1.2 Pure soap flakes**.

Verify that the soap does not contain any fluorescent whitening agent, for example, by examining under ultraviolet light a sample of the same cloth washed with a solution of the soap.

**5.2.1.3 Sodium metasilicate pentahydrate** ( $\text{Na}_2\text{SiO}_3 \cdot 5\text{H}_2\text{O}$ ).

### 5.2.2 Apparatus

**5.2.2.1 Washing machine**, rotating-drum type, diameter of drum greater than 500 mm, made entirely of stainless steel and of a size suitable for the size of the pieces of control cloth to be washed in it.

**5.2.2.2 Conventional hydroextraction, pressing or calendaring equipment**.

### 5.2.3 Preparation of cloth

Cut the unprepared control cloth into a number of pieces corresponding together to the required number of test pieces of the specified dimensions (see 6.2 and figure 1), or, if the pressing or ironing equipment will accommodate them, into a number of pieces each corresponding to several such test pieces, and hem them.

Number the pieces of cloth with indelible ink, so that their original position in the large piece of cloth can be identified (see 6.3). All the numbers shall be put on the same side of the cloth (see 5.2.4.6).

### 5.2.4 Procedure

Apply to the unprepared control cloth, which shall not be used without preparation, five preparatory treatments, under the following conditions:

#### 5.2.4.1 Loading of washing machine

Load the machine with pieces of unprepared control cloth only.

The loading factor (mass, in kilograms, of cloth divided by volume, in cubic decimetres, of inner drum) shall be between  $\frac{1}{13}$  and  $\frac{1}{18}$ .

#### 5.2.4.2 Soaking

For each kilogram of dry cloth, add 5,5 litres of cold water (5.2.1.1) and 1,25 g of pure soap flakes (5.2.1.2). Set the drum in motion. At the same time heat in such a way that the temperature of the soaking water is between 35 and 40 °C at the end of the soaking.

The total time of soaking shall be 5 min and, in the case of domestic machines, it is recommended that the water added shall be preheated to a temperature of 35 to 40 °C.

Empty the machine (see note 1 in 5.2.4.6).

#### 5.2.4.3 Washing

For each kilogram of dry cloth, add 2 litres of water (5.2.1.1) and 12 g of sodium metasilicate (5.2.1.3).

Heat as quickly as possible to a temperature of 80 °C (see note 2 in 5.2.4.6).

If necessary, add a sufficient quantity of soap flakes to maintain a good, but not excessive, lather.

Continue washing for 15 min at a temperature between 80 and 90 °C.

Empty the machine (see note 1 in 5.2.4.6).

#### 5.2.4.4 Rinsing

For each rinse, add 5 litres of cold water (5.2.1.1) per kilogram of dry cloth.

Allow the drum to rotate for 3 min.

Empty the machine (see note 1 in 5.2.4.6).

Repeat this sequence of operations until the alkalinity of the last rinsing water is less than one-fiftieth of that of the washing water, after subtraction of the alkalinity of the softened water used (see note 3 in 5.2.4.6).

#### 5.2.4.5 Hydroextraction

Hydroextract the pieces of cloth after the final rinse until they contain not more than 50 g of water for every 100 g of cloth conditioned.

#### 5.2.4.6 Pressing

Immediately after hydroextraction, press or iron the pieces of cloth so as to avoid the formation of creases.

Depending on the size of the pieces of cloth which have been washed, either a flat press or a calender may be used. In both cases the temperature of the heated part of the machine shall not exceed 170 °C. It is preferable to avoid any pulling of the cloth.

During the final preparatory treatment, the pieces of cloth shall be pressed or ironed with the marked side against the polished part of the equipment.

In no circumstances is air drying permitted (see note 4).

#### NOTES

1 Each emptying operation should be completed in under 1 min.

2 In industrial steam-heated washing machines, it should not take longer than 5 to 10 min to reach a temperature of 80 °C. For machines heated by electricity or gas this time may be considerably longer and, in this case, it is advisable to add preheated water in order to reduce the heating time.

3 If the soft water used has an alkalinity in percentage by mass of sodium hydroxide (NaOH) of more than 0,01 [2,5 ml of hydrochloric acid solution,  $c(\text{HCl}) = 0,1 \text{ mol/l}$ , needed to neutralize 100 ml of water in the presence of methyl orange indicator], the final rinsing water should be acidified with acetic acid.

4 As air drying is usually carried out by hanging the pieces of cloth vertically, because of lack of space for spreading them out flat, the mass of the damp cloth exerts a pull which stretches the material. It has also been proved that air drying produces an additional, irregular, deterioration.

#### 5.3 Evaluation of characteristics, necessary corrections

Determine, within 24 h after the last preparatory treatment, the degree of radiance (percentage) and the degree of yellowing of the pieces of cloth which have been washed. The other characteristics may be determined at a suitable time.

If, after the last preparatory treatment, the fluidity is less than  $40 \text{ (Pa}\cdot\text{s)}^{-1}$  or if the degree of polymerization is greater than 1 700, one or more additional preparatory treatments, including bleaching with sodium hypochlorite (see note below), shall be performed, in order to bring the fluidity to between 40 and  $50 \text{ (Pa}\cdot\text{s)}^{-1}$  or the degree of polymerization to a value between 1 700 and 1 550.

This operation shall be carried out during the final rinse under the following conditions:

- temperature:  $25 \pm 5 \text{ }^\circ\text{C}$ ;
- hypochlorite concentration and duration: determined experimentally in such a way as to give the required result.

Each bleaching operation shall be followed by a cold dechlorinating rinse to which has been added a sufficient quantity of sodium disulphite ( $\text{Na}_2\text{S}_2\text{O}_5$ ) to neutralize the remaining hypochlorite, and by hydroextraction and pressing or ironing as described in 5.2.4.5 and 5.2.4.6.

NOTE — Even if bleaching is not needed to raise the fluidity above  $40 \text{ (Pa}\cdot\text{s)}^{-1}$  or to reduce the degree of polymerization below 1 700, it is useful to include in each preparatory treatment a mild bleaching with hypochlorite, while at the same time keeping the fluidity of the control cloth below  $50 \text{ (Pa}\cdot\text{s)}^{-1}$  or the degree of polymerization above 1 550. Without this treatment, it is difficult to achieve the maximum degree of radiance (percentage).

## 5.4 Storage of control cloth

Store the pieces of control cloth under conditions of the strictest cleanliness, away from light, heat, moisture and acid or alkaline fumes.

## 6 Test pieces

### 6.1 Number of test pieces

For each series of laundering operations forming a test, treat a minimum of three test pieces simultaneously, then compare these test pieces with at least three further test pieces of control cloth which have not undergone the operations of which the test consists.

In cases where test pieces from the same piece of unprepared control cloth are used for several tests carried out simultaneously, it is permissible to use a smaller number of test pieces in determining the initial values, provided that this is mentioned in the test report, and that the choice of the initial number of test pieces is justified by sufficiently detailed statistical calculations to permit the objective evaluation of the accuracy obtained for each characteristic, particularly the tensile strength.

NOTE — By the term "piece of unprepared control cloth" is meant a piece of cloth which is generally between 50 and 100 m long, woven in one operation on one loom.

The determination of the characteristics of the control cloth and the statistical evaluation of the accuracy of each characteristic is valid only for the piece of cloth from which the test pieces of control cloth are taken; in other words, averages may not be determined from measurements made on test pieces of control cloth taken from different pieces of unprepared control cloth.

### 6.2 Selection of test pieces

Cut test pieces 400 mm long from the width (see figure 1) of the control cloth (see 5.1.2).

All the test pieces used during a test shall be taken from the same piece of cloth and shall have undergone the preparatory treatments together, in the same machine.

The six (or more) test pieces necessary for the test shall be cut from the piece of control cloth one after the other. The odd-numbered test pieces (marked I, III, V) shall be included in the washing tests, the others (marked II, IV, VI) shall be used for the determination of the initial values of the characteristics.

### 6.3 Marking of test pieces

In order to avoid any confusion between test pieces which have been used, mark each of them according to a predetermined code, using indelible ink or coloured thread, in a position which will not interfere with the measurement of characteristics.

This marking shall always be on the same side of the cloth (see 5.2.3 and 5.2.4.6).

Similarly, in order to avoid any errors as to the number of laundering operations performed on any one test piece, it is advisable to apply an indelible ink mark after each operation. To make this check still more effective, two differently coloured inks may be used alternately.

## 7 Use of test pieces

### 7.1 Principle

The control test pieces which are to be washed are treated in each laundering operation at the same time as the normally soiled household textile articles (see 3.3) and, together with the latter, undergo all the various procedures: soaking, one or more washes, one or more rinses, bleaching where applicable, hydroextraction, drying, pressing or ironing.

They go through 25 (or 50) laundering cycles, and are then tested.

### 7.2 Preparation of washing equipment

The washing machine used during the control operations shall be thoroughly cleaned.

When the purpose of the test is to study a detergent, this precaution is particularly necessary because of the possible presence of deposits resulting from the hardness of the water or the nature of any products used in previous tests, or oven redeposited soil. The operator should not hesitate, in such a case, to dismantle parts of the machine if necessary, in order to ensure that cleaning is complete.

After the machine has been cleaned, it is advisable to carry out a blank test under the same conditions as the later operations.

NOTE — The blank test consists of treating a batch of normally soiled household textile articles under the actual conditions of the test, before the control test pieces are used. This blank test has the advantage of completing the cleaning of the machine and at the same time putting it into the condition it will be in after the test has started.

If a new washing machine is being used, it should be borne in mind that the internal surfaces may have a certain degree of roughness which will not disappear until after several washing cycles have been performed.

### 7.3 Special recommendations

**7.3.1** Introduce the control test pieces into the washing cycle without their being attached to one another.

**7.3.2** The moisture extraction rate for the household textile articles shall be 40 to 50 %, calculated on the basis of the mass of cloth conditioned in a standard atmosphere. If this requirement cannot be observed, the fact shall be mentioned in the test report on the methods of test, with an indication of the effective extraction rate.

**7.3.3** Subject the control test pieces to all the operations specified for the laundering process which is being investigated, with the exception, however, of some special treatments which may have to be applied to the normally washed household textile articles (special finishes, starching). In this case, the fact shall be mentioned in the test report on the methods of test.

If the method of test includes bleaching, this shall be applied to the control test pieces under the same conditions as for normally soiled cloth; this requirement shall also be mentioned in the test report on the methods of test.

**7.3.4** In certain cases, for example when the effects of two different detergents are to be compared, the normally soiled cloth used for the tests shall be taken from batches washed only and always in the laundry of the test station. It is recommended to make sure that the cloth cannot have been subjected to any washes other those carried out during the tests.

If this requirement cannot be observed, the fact shall be mentioned in the test report on the methods of test.

**7.3.5** Each laundering cycle shall be carried through without interruption.

Generally speaking, 25 cycles are sufficient to produce a significant modification of the characteristics of the control strip. With 50 cycles the result is more accurate, but obviously the duration and cost of the test are increased.

For certain purposes it is permissible to adopt a different number of launderings, for example in order to follow the evolution of a characteristic as a function of the number of cycles.

The 25 (or 50) cycles forming a test shall be carried out wherever possible without interruptions of a prolonged nature (other than those occasioned by normal interruptions in work such as non-working days).

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Dimensions in millimetres

(Dotted lines: weft threads, if any, that are coloured, double, or of a larger linear mass)

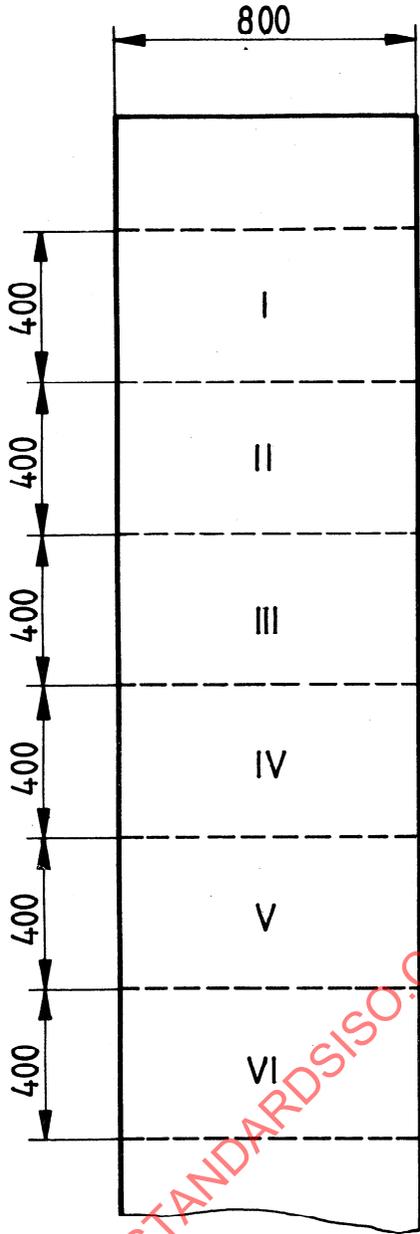


Figure 1 — Method of taking test pieces from the control cloth

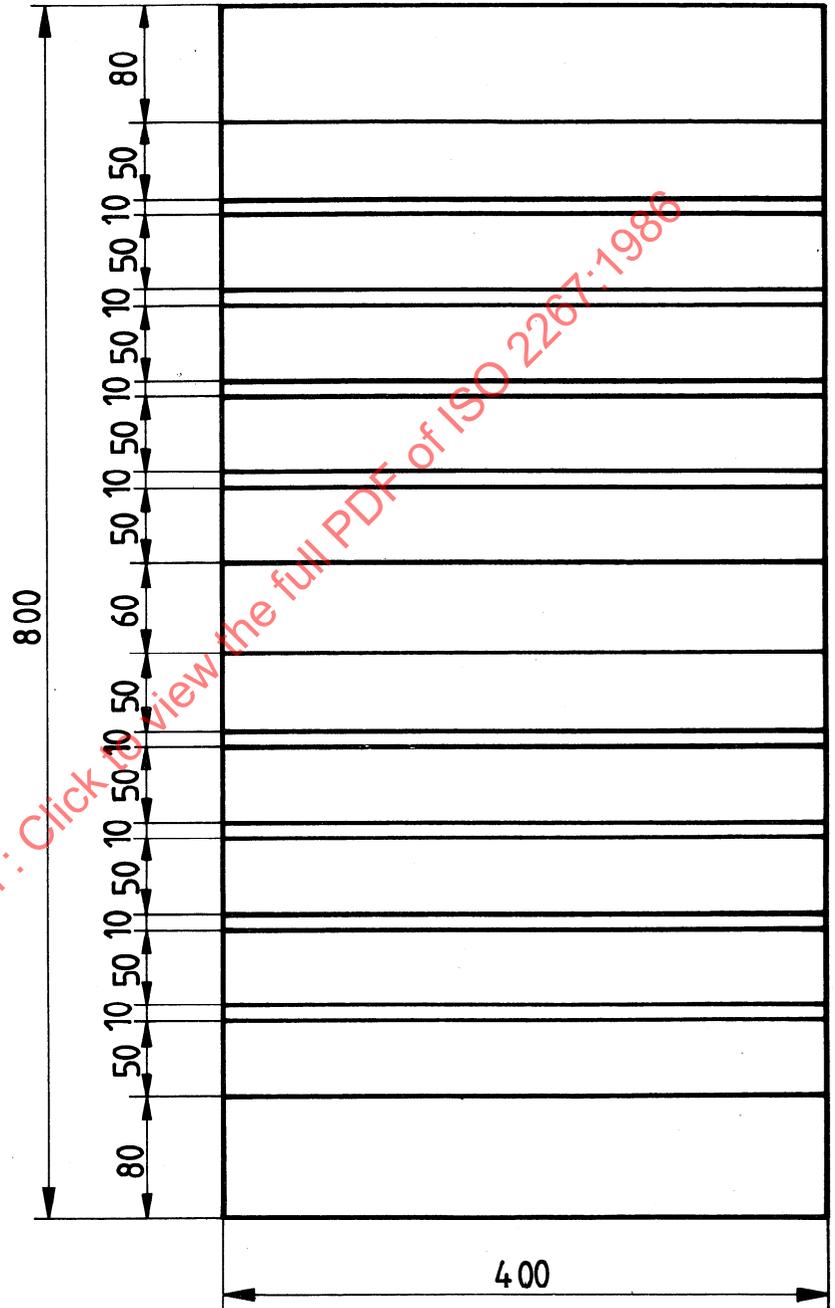


Figure 2 — Method of taking specimens from the test piece (figure 1)