# INTERNATIONAL STANDARD 4919

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# Carpets — Determination of tuft withdrawal force

*Tapis-moquettes — Détermination de la force d'arrachement de touffes*

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## FOREWORD

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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.

International Standard ISO 4919 was developed by Technical Committee ISO/TC 38, *Textiles*, and was circulated to the member bodies in September 1977.

It has been approved by the member bodies of the following countries :

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# Carpets — Determination of tuft withdrawal force

## 1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies a method for determination of tuft withdrawal force and is applicable to all carpets with a cut or loop pile yarn structure.

## 2 REFERENCES

ISO 139, *Textiles — Standard atmospheres for conditioning and testing.*

ISO 1957, *Machine-made textile floor coverings — Sampling and cutting specimens for physical tests.*

## 3 DEFINITIONS

For the purposes of this International Standard the following definitions apply :

**3.1 tuft :** A length of yarn, for example I, J, U or W shaped, or length of yarn in the form of a knot, of which the leg or legs form the pile of a carpet.

**3.2 loop :** The continuous length of yarn or fibres between the two successive lowest points of bindings of the pile in the substrate.

NOTE — In certain places in this International Standard, for example in the title, the term "tuft" when used in a general sense implies "and/or loop".

## 4 PRINCIPLE

Gripping of one end of a tuft, or hooking a loop, and recording the maximum force registered during the removal process.

## 5 APPARATUS

**Tensile testing apparatus** with suitable ranges and an accuracy of ± 5 % (normally a range equivalent to 10, 20, 50 or 100 N would be required).

Preferably, the apparatus shall have a constant rate of loading but alternatively constant rate of traverse or extension may be used; in any case the average test time for the achievement of the maximum withdrawal force of the tufts and loops tested should be between 5 and 10 s. This may be achieved in machines which would give very short test times, for example those using load cells, by inserting a spring between the loading mechanism and the specimen.

The apparatus shall have a means of clamping a specimen of carpet to a base plate so that it is flat in a plane perpendicular to the direction of pull upon the tuft or loop. The flat, horizontal part of the clamp which is brought into contact with the specimen during testing shall be at least 60 mm × 60 mm, shall have a circular cut-out of 12 mm radius around the tuft or loop to be withdrawn and shall restrain the specimen outside this cut-out area (see the figure). The cut-out may have a throat to allow easier positioning of the specimen with the tuft grip or hook attached.

For cut pile carpets, a suitable means of selecting and gripping one end of a tuft shall be provided (for example surgical forceps) and for loop pile carpets, a suitable hook (for example a knitting-machine needle) is required. These tuft grips are attached to the upper jaw of the tensile testing apparatus.

The load-sensing mechanism of the machine shall be calibrated with the tuft grip or hook in position.

## 6 ATMOSPHERE FOR CONDITIONING AND TESTING

The conditioning and testing atmosphere shall be the standard atmosphere for testing textiles defined in ISO 139, i.e. an atmosphere of relative humidity 65 ± 2 % and a temperature 20 ± 2 °C.

## 7 TEST SAMPLES AND SPECIMENS

Take samples from at least five places across the width of the carpet selected to be representative of the material under test in accordance with ISO 1957. Condition the samples for not less than 24 h in the standard atmosphere for testing textiles, as defined in clause 6. Cut the specimens (one from each sample) to a size which is convenient for clamping on the testing machine and which will allow for at least 10 tufts to be removed from each. No tufts shall be removed from within 25 mm of the edge of a specimen or of any previously withdrawn tuft.

## 8 PROCEDURE

**8.1** Conduct the test in the standard atmosphere for testing textiles, as defined in clause 6.

**8.2** For **cut pile carpets,** select one end of one tuft and attach the tuft grip. The selection of the tuft is easier if the specimen is bent backwards slightly to open out the tuft structure. Clamp the specimen firmly as described in clause 5, and attach the tuft grip to the upper jaw. Set the machine in motion and withdraw the tuft completely in a direction essentially perpendicular to that of the carpet specimen. Check that only one complete tuft was withdrawn, and record the maximum force. If additional fibres from another tuft were gripped or if only part of the tuft was removed, ignore the result. In certain carpet constructions the selection of one tuft is impracticable; in these cases grip the minimum number of tufts that can be selected, and inspect the withdrawn unit carefully to ensure that the required number of tufts has been isolated.

**8.3** For **loop pile carpets,** select a suitable loop and engage the hook under the top of it. Clamp the specimen firmly as described in clause 5, and attach the hook to the upper jaw. Set the machine in motion to move the hook in a direction essentially perpendicular to that of the carpet specimen, and stop it as soon as slippage occurs in the bonds holding one of the loop sides. Record the maximum force.

**8.4** Where both cut and loop pile are present or where the specimen is composed of yarns of different linear densities, different fibres or different types, these should be tested separately, and care should be taken to ensure that where possible the tufts or loops tested are surrounded by those of the same type. Only completely cut tufts or completely uncut loops should be tested.

**8.5** Repeat the procedure for a minimum of 20 tufts or loops[1], spread evenly through the available samples, taking account of the restriction of at least 25 mm between a previously withdrawn tuft or the edge of the specimens. If the pile yarn breaks without pulling out the tuft or loop, record this result separately, marked "broken". Include this result in the number of valid tests but use it separately in calculations.

## 9 EXPRESSION OF RESULTS

Calculate the mean tuft withdrawal force, in newtons, and the coefficient of variation for all the results, excluding any marked "broken". Calculate the mean of the "broken" results separately. If there is a marked difference between results from different areas, this should be reported.

## 10 TEST REPORT

The test report shall include the following information :

a) that the tests were performed in accordance with this International Standard;

b) the type of tensile testing machine used;

c) the number of tufts or loops tested;

d) the mean tuft withdrawal force and the coefficient of variation and, if applicable, the mean breaking force of the broken tufts, and the differences between different areas and different types (see 8.4);

e) if applicable, a statement that a multiple number of tufts was withdrawn, and a careful description of the unit.

NOTE — The coefficient of variation of tuft withdrawal force is usually fairly large and may be of the order of 20 to 30 %. Assuming these values, if 20 tests are carried out, the 95 % confidence limits of the mean are about ± 9 to 13 % of the mean value.

Greater accuracy may be obtained by testing more tufts; for example, if 50 tufts are tested, the 95 % confidence limits would be ± 6 to 9 % of the mean value.

It would be expected that the tuft withdrawal force for a loop pile carpet is between 1,5 to 2 times that of a cut pile of a similar type.

1) The original five specimens (see clause 7) are cut large enough to allow 10 tufts or loops to be tested from each in case a total of 50 tests should be required (see also the note to clause 10).

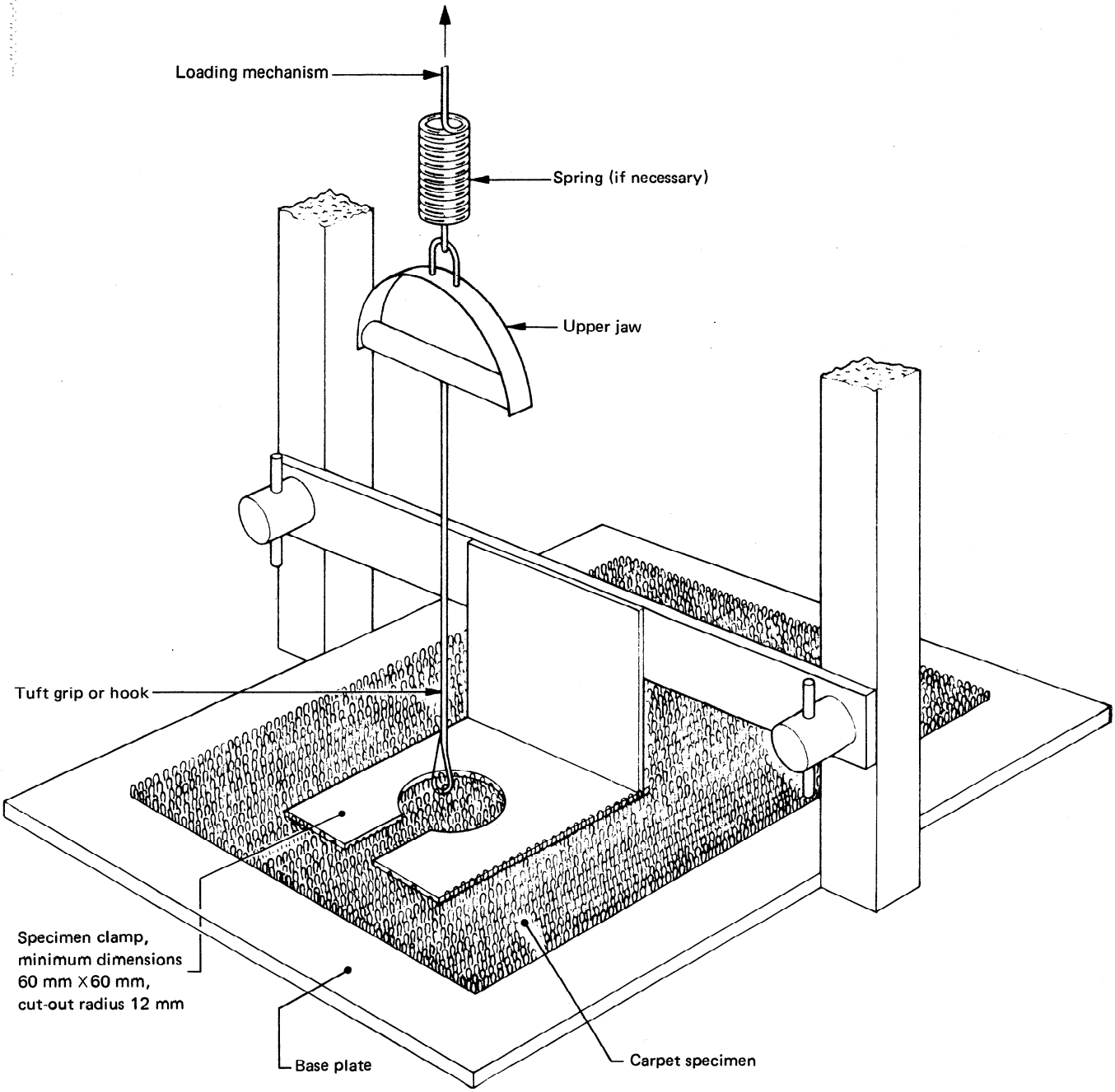


FIGURE – **One possible form of flat horizontal mounting**

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