INTERNATIONAL STANDARD

ISO 10321

First edition
1992-12-01

Geotextiles — Tensile test for joints/seams by wide-width method

Géotextiles — Essai de traction pour joints/coutures par la méthode de la bande large

Reference number
ISO 10321:1992(E)

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. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 10321 was prepared by Technical Committee ISO/TC 38, *Textiles*, Sub-Committee SC 21, *Geotextiles*.

International Organization for Standardization
Case Postale 56 • CH-1211 Genève 20 • Switzerland

Printed in Switzerland

Geotextiles — Tensile test for joints/seams by wide-width method

1 Scope

This International Standard specifies an index test method for determination of the tensile properties of joints and seams in geotextiles and related products, using a wide-width strip. The method is applicable to most geotextiles and geotextile-related products. It is also applicable to geogrids, but the specimen dimensions may need to be altered.

This method quantifies the tensile strength of a joint or seam between geotextiles or related products. It can provide data to indicate the joint or seam tensile strength which can be achieved.

A joint or seam efficiency can be calculated by comparison of the joint/seam tensile strength with the tensile strength of the unjointed material as determined by ISO 10319.

Procedures for measuring the tensile properties of both conditioned and wet specimens are included.

Some modification of techniques may be necessary for particular geotextiles, e.g. strong geotextiles, meshes or geotextiles made from glass fibre, to prevent them from slipping in the jaws or being damaged as a result of being gripped in the jaws.

The basic test for joints or seams in all kinds of geotextiles or related products uses test specimens of 200 mm width, with the provision for the seam or joint to extend for 25 mm on each side in order to provide joint or seam stability during the test (see figure 2).

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 554:1976, *Standard atmospheres for conditioning and/or testing — Specifications.*

ISO 3696:1987, *Water for analytical laboratory use — Specification and test methods.*

ISO 7500-1:1986, *Metallic materials — Verification of static uniaxial testing machines — Part 1: Tensile testing machines.*

ISO 9862:1990, *Geotextiles — Sampling and preparation of test specimens.*

ISO 10319:—[1], *Geotextiles — Wide-width tensile test.*

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1 seam: Series of stitches joining two or more separate pieces of a material or materials of planar structure, e.g. geotextiles or related products.

3.2 joint: The junction at which two or more separate pieces of a geotextile or related product are joined by a method other than stitching.

3.3 joint/seam strength (for geotextiles and related products): The maximum tensile resistance, measured in kilonewtons per metre, of the junction formed by stitching or joining two or more planar structures.

1) To be published.

3.4 joint/seam efficiency: The ratio, expressed as a percentage, of joint/seam strength to the geotextile strength evaluated in the same direction.

4 Principle

A geotextile specimen, 200 mm wide and containing a joint/seam, is gripped across its entire width in the clamps of a tensile testing machine, operated at a prescribed rate of extension, and subjected to a longitudinal force (perpendicular to the seam axis) until the joint/seam of the geotextile or related product ruptures.

5 Apparatus and materials

5.1 Tensile testing machine, constant rate of extension type, complying with ISO 7500-1, in which the rate of increase of specimen length is uniform with time.

5.2 Jaws, which are sufficiently wide to hold the entire width of the specimen and with appropriate means to limit slippage or damage. Each jaw shall have faces measuring at least the width of the specimen, i.e. 200 mm.

NOTE 1 It is stressed that it is essential to choose jaw faces that limit slippage of the geotextile that may occur, especially for stronger geotextiles. Examples of types of jaw face, which have been found satisfactory, are given in figure 1.

5.3 Water (for wet specimens only), purity grade 3 as defined in ISO 3696.

5.4 Non-ionic wetting agent (for wet specimens only).

6 Test specimens

6.1 Number of test specimens

Cut at least five test specimens, each of which includes the seam or joint.

6.2 Selection of test specimens

Select specimens in accordance with ISO 9862.

6.3 Dimensions of test specimens

6.3.1 Prepare test specimens from the jointed or seamed specimen, each of sufficient length to ensure an initial jaw separation of 100 mm plus the joint or seam width b (see figure 3) and with the seam or joint located along the centre-line of the specimen, perpendicular to the direction of the applied load.

Cut each specimen, as shown in figure 2, to achieve a final specimen width of 200 mm. When removing the shaded area from a specimen, as shown in figure 2, the angles between the 25-mm extensions, which are parallel to the seam or joint, and that section of the specimen having a finished width of 200 mm shall be 90°.

6.3.2 For woven geotextiles (see ISO 10319), make 25-mm-long cuts at a distance of 25 mm plus $b/2$ from the centre-line of the specimen, to facilitate the removal of the edge yarns in attaining the nominal width of 200 mm.

6.3.3 For geogrids, prepare jointed specimens at least 200 mm wide and sufficiently long to ensure a clamp separation of at least 100 mm plus the joint width, measured to $\pm$ 3 mm. The jointed test specimen shall contain at least five tensile elements within the width of the test specimen and at least one row of nodes or cross-members on either side of the joint, excluding those by which the test specimen is held in the jaws or from which the joint is to be made. Cut all ribs or cross-members at least 10 mm from any node (see figure 4).

The cross-members, from which the joint is to be made, shall be extended, by at least one pitch beyond the tensile elements to be tested, on both sides of the specimen, in order to facilitate the formation of the joint.

6.3.4 For knitted geotextiles, geocomposites or others in which preparing the specimen by cutting with a knife or scissors may affect the geotextile structure, thermal cutting can be used, taking care to avoid damaging the specimen during the cutting operation, particularly at the point labelled "A" in figure 2. This shall be reported in the test report [clause 10, b)].

6.3.5 If wet testing is also required, cut an additional five specimens.

6.4 Index characterisation

For index characterisation of the seam/joint, the two elements seamed/jointed together shall be orientated in the same direction (warp or weft, machine or cross-machine direction) and aligned perpendicular to the seam/joint and parallel to the applied load axis.

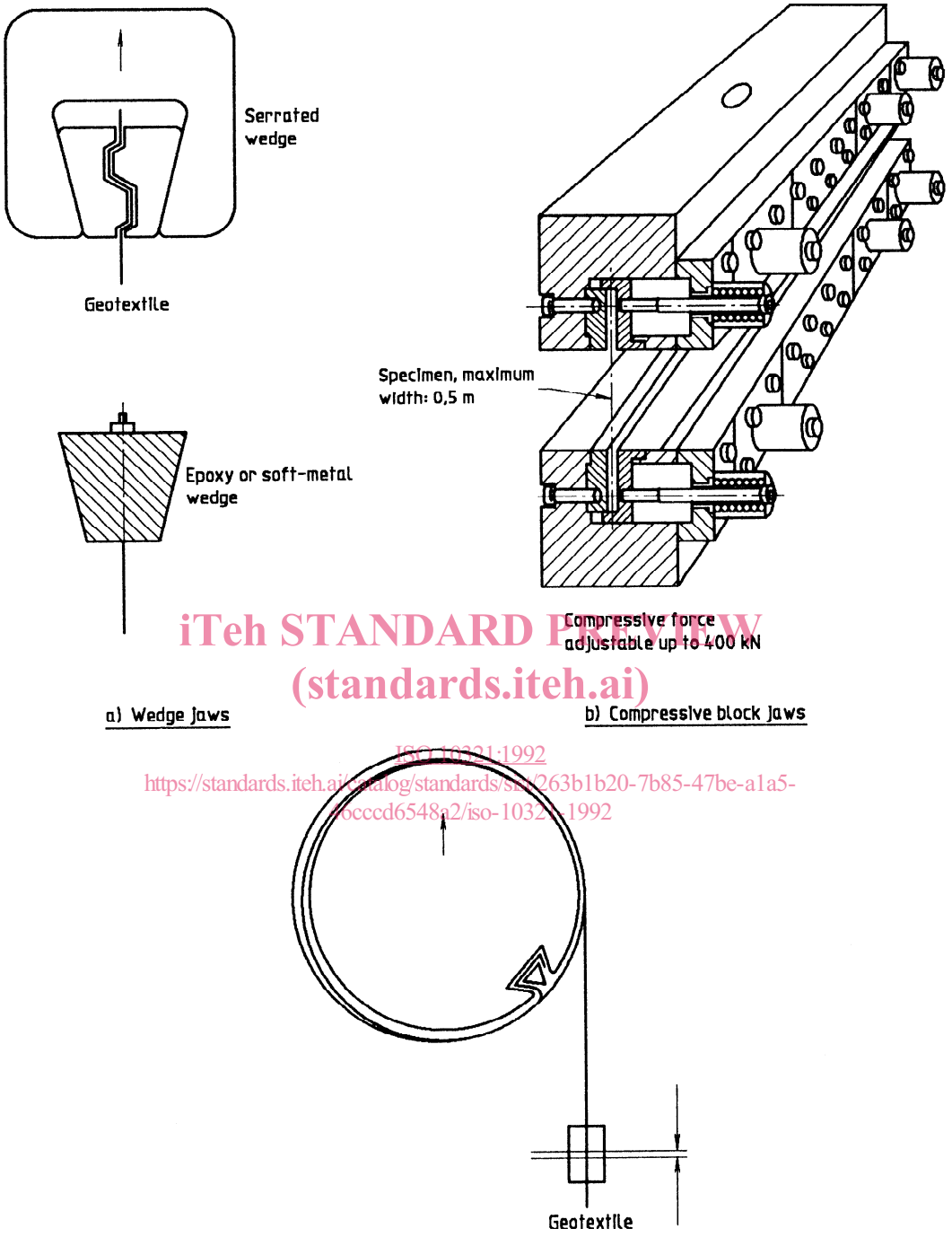

Figure 1 — Examples of jaw faces for testing geotextiles

Dimensions in millimetres

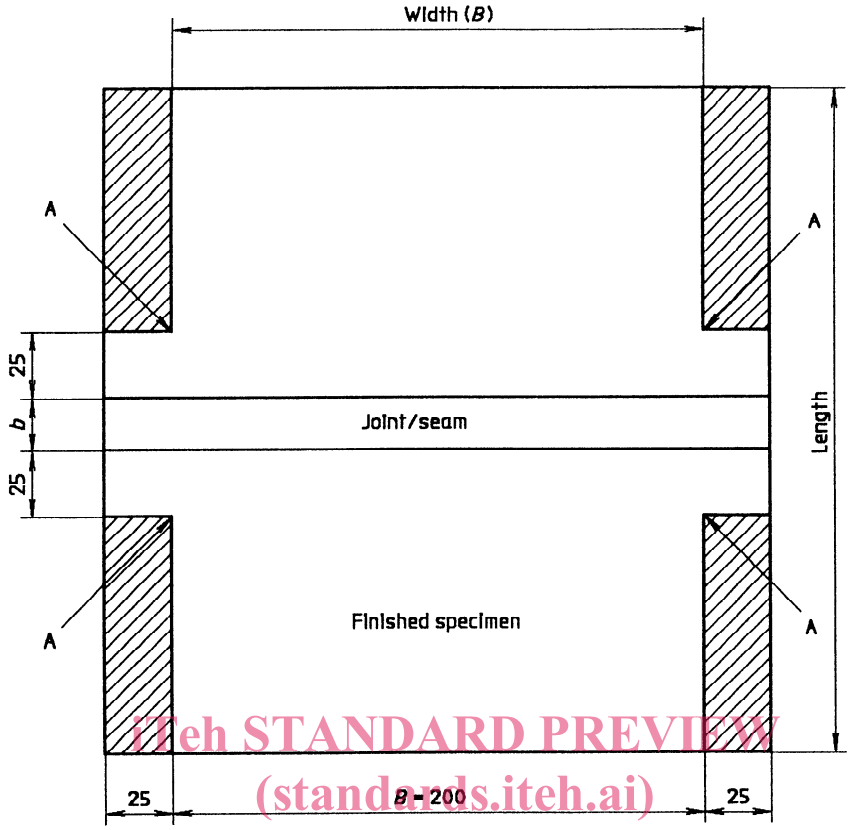

Figure 2 — Test specimen preparation

Dimensions in millimetres

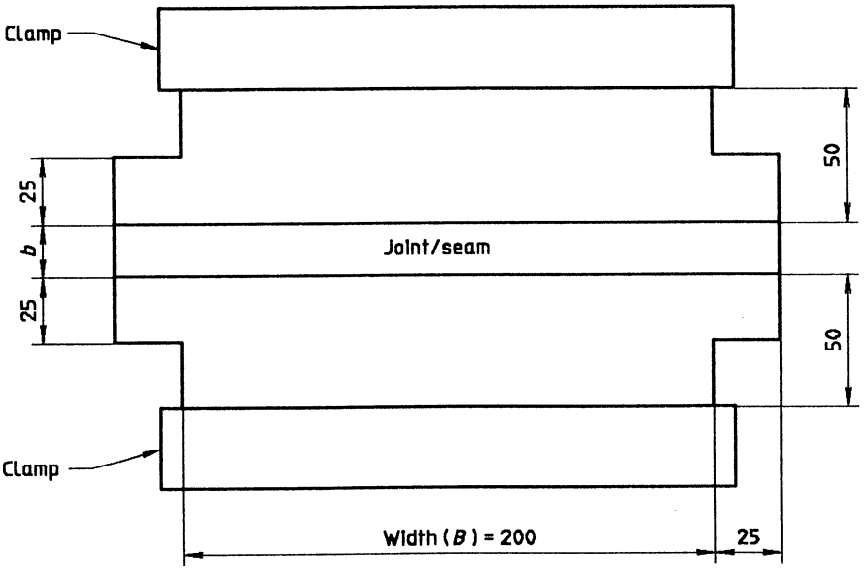

Figure 3 — Example of seam/joint specimen placed in compressive clamps

Dimensions in millimetres

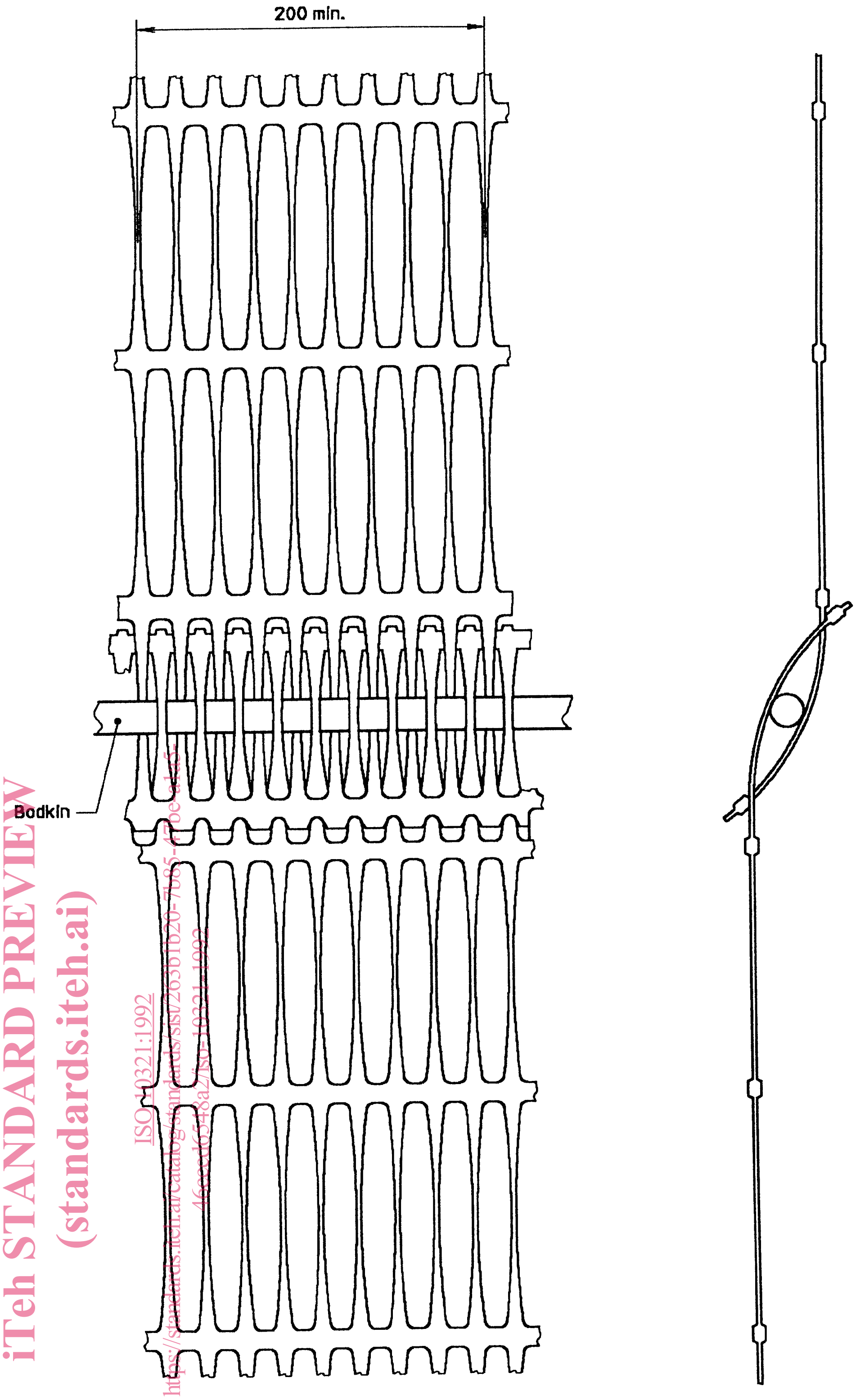

Figure 4 — Example of geogrid seam/joint specimen

7 Conditioning atmosphere

The test specimens shall be conditioned and the test conducted in one of the standard atmospheres defined in ISO 554, i.e. at a relative humidity of (65 ± 2) % and a temperature of (20 ± 2) °C [or (50 ± 2) % R.H. and (23 ± 2) °C, or (65 ± 2) % R.H. and (27 ± 2) °C], until constant mass is achieved.

NOTES

2 The test specimens can be considered to have been conditioned when the change in mass of the test specimen in successive weighings, made at intervals of not less than 2 h, does not exceed 0,25 % of the mass of the test specimen.

3 Conditioning and/or testing at a specified relative humidity may be omitted if it can be shown that the results are not affected.

Specimens to be tested in the wet condition shall be immersed in water (5.3) maintained at a temperature of (20 ± 2) °C [or (23 ± 2) °C or (27 ± 2) °C]. The time of immersion shall be sufficient to wet out the test specimens thoroughly, as indicated by no significant change in maximum load or strain following a longer period of immersion, and at least 24 h. To obtain thorough wetting, it may be necessary to add not more than 0,05 % of a non-ionic neutral wetting agent (5.4) to the water.

8 Procedure

8.1 Setting up of machine

Adjust the distance between the jaws at the start of the test, to give a length of 100 mm plus the seam or joint width, measured to ± 3 mm, except for geogrids and for geotextiles when using capstan grips.

Select the force range of the testing machine such that the break occurs between 30 % and 90 % of full-scale force. Set the machine so as to induce a strain rate of (20 ± 5) %/min in the distance between the jaws.

Test conditioned specimens in an atmosphere specified in clause 7. For wet test specimens, perform the test within 3 min of removal from the water.

8.2 Insertion of test specimen in jaws

Mount the test specimen centrally in the jaws, taking care that the specimen length is parallel to the direction of application of force. Where appropriate, after mounting, draw a line on the specimen parallel and adjacent to each jaw face in order to observe any jaw slippage during testing.

8.3 Measurement of tensile seam/joint strength

Start the tensile testing machine and continue the procedure until the joint, the seam or the material itself ruptures. Stop the machine and reset to the initial gauge position. Record and report the maximum force, as read directly from the testing machine, to an accuracy of 0,2 % of the full scale. Observe and record whether the rupture is caused by:

a) material rupture;

b) sewing thread rupture;

c) material slippage relative to the joint/seam;

d) tear-type geotextile yarn rupture;

e) joint failure;

f) a combination of two or more of the foregoing.

Also note any other comment on the failure mode.

8.4 Discard criteria

Discard any individual test result and test a further specimen where one or more of the following occurs:

a) a single determination is more than 3 standard deviations below the mean of the five results, and the reason for the premature failure is clearly due to faulty specimen preparation;

b) the specimen failure is initiated from any of the points labelled "A" in figure 2;

c) jaw slippage is observed, and this clearly initiates a premature failure of the seam/joint.

9 Expression of results

9.1 Seam/joint strength

Using equation (1), calculate the mean maximum joint or seam strength (S_f) of individual specimens having a similar seam assembly, i.e. the force, in kilonewtons per metre, at which the specimen ruptures, as read directly from the testing machine.

$$S_f = F_f \times c \qquad \ldots (1)$$

where

S_f is the joint or seam strength, expressed in kilonewtons per metre;

F_f is the recorded maximum force, expressed in kilonewtons;

c is obtained from equation (2) or (3) as appropriate.

Either, for geononwovens or closely woven geotextiles or similar open-structure materials:

$$c = \frac{1}{B} \quad \ldots (2)$$

where B is the specimen width in metres (usually 0,2 m, see figures 2 and 3).

Or, for coarse geowovens, geomeshes, geogrids or similar materials:

$$c = \frac{N_m}{N_s} \quad \ldots (3)$$

where

N_m is the minimum number of tensile elements within 1 m width of the product being tested;

N_s is the number of tensile elements within the test specimen.

9.2 Seam/joint efficiency

If requested, determine the seam/joint efficiency (E) using equation (4) when the strength of the unjointed/unseamed material ($\bar{\alpha}_f$) has been determined by the wide-strip tensile test method (ISO 10319) in the same direction as it was for the joint/seam strength test.

$$E = 100 \times \frac{\bar{S}_f}{\bar{\alpha}_f} \quad \ldots (4)$$

where

E is the seam/joint efficiency, expressed as a percentage;

$\bar{S}_f$ is the mean seam/joint strength, expressed in kilonewtons per metre;

$\bar{\alpha}_f$ is the mean tensile strength of the unseamed/unjointed material, expressed in kilonewtons per metre.

10 Test report

The test report shall include the following information:

a) the number and year of publication of this International Standard (ISO 10321:1992);

b) identification and description of the material, the product seam or joint method used, the method of sampling used, where relevant, the direction of the joined parts of the specimen and whether the specimens were prepared using thermal cutting techniques;

c) the condition of the test specimens, i.e. wet or dry;

d) the number of test specimens tested;

e) the manufacturer and model of the testing machine;

f) the type of jaw, including the jaw dimensions, and the type of jaw face;

g) the standard atmosphere used;

h) the joint or seam strength, in kilonewtons per metre, for each specimen tested and the average of those results, and the standard deviation or coefficient of variation, or both, of the seam/joint strength;

i) the type of failure for each test specimen (the material itself, joint/seam or other failure for each specimen);

j) if requested, the seam efficiency, as a percentage.