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ISO

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

ISO RECOMMENDATION
R 615

METHODS FOR DETERMINING THE MECHANICAL PROPERTIES OF THE WELD METAL DEPOSITED BY ELECTRODES 3.15 mm OR MORE IN DIAMETER

1st EDITION

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BRIEF HISTORY

The ISO Recommendation R 615, *Methods for Determining the Mechanical Properties of the Weld Metal Deposited by Electrodes 3.15 mm or more in Diameter*, was drawn up by Technical Committee ISO/TC 44, *Welding*, the Secretariat of which is held by the Association Française de Normalisation (AFNOR).

Work on this question by the Technical Committee began in 1955 and led, in 1958, to the adoption of a Draft ISO Recommendation.

In September 1958, this Draft ISO Recommendation (No. 231) was circulated to all the ISO Member Bodies for enquiry. It was approved, subject to a few modifications of an editorial nature, by the following Member Bodies:

Australia	Israel	Spain
Bulgaria	Italy	Sweden
Burma	Japan	Switzerland
Denmark	Norway	
Finland	Poland	
France	Republic of South Africa	
Germany	Romania	
India		

Five Member Bodies opposed the approval of the Draft:

Belgium
Canada
Netherlands
United Kingdom
U.S.S.R.

The Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided, in September 1967, to accept it as an ISO RECOMMENDATION.

ISO Recommendation R 615 September 1967

METHODS FOR DETERMINING THE MECHANICAL PROPERTIES OF THE WELD METAL DEPOSITED BY ELECTRODES 3.15 mm OR MORE IN DIAMETER

FOREWORD

This ISO Recommendation is one of a set which also includes the following:

ISO/R 632, *Methods of Test for Determining whether an Electrode is a Deep Penetration Electrode*,

ISO/R 635, *Code of Symbols for Covered Electrodes for Arc Welding of Mild Steels and Low Alloy High Tensile Steels*,

ISO/R ..., **Special Method of Mechanical Testing to Determine the Coding for Deep Penetration Electrodes.*

1. SCOPE

This ISO Recommendation describes methods for determining the mechanical properties of the weld metal deposited by electrodes 3.15 mm or more in diameter. **

These methods are not valid for electrodes covered by the symbol *P*.

2. TEST ASSEMBLY

2.1 Parent metal

The parent metal, including the backing strip, should be in non-alloyed sound quality steel without important segregations, in accordance with the following specification:

Carbon	0.2 % max.
Manganese	0.7 % max.
Sulphur	0.05 % max.
Phosphorus	0.05 % max.

2.2 Dimensions ***

2.2.1 Figure 1, page 9, shows the dimensions of the cross-section of the test assembly in relation to the diameter of the electrodes.

The plates which constitute the test assembly have a minimum length of

$$L = 200 \text{ mm} + 2\,l$$

where l represents the length of the gripped end of the tensile test piece.

As a guide, the value of l is 35 mm.

The width of the test assembly has a value of

$$2\,B + a$$

* At present Draft ISO Recommendation No. 1040.

** Proposed testing methods for other electrodes will be submitted later.

*** All measurements given in this ISO Recommendation are expressed in millimetres.

where B has the following values:

Diameter of the electrode core	B
mm	mm
3.15 and 4	80 ± 10
5 and 6.3	120 ± 10
8	150 ± 10
10 and 12.5	180 ± 10

Other dimensions (see Fig. 1, page 9):

$S = 10$
$b = 30$
$d = 20$
$\alpha = 10°$
$a = 16$

2.2.2 The bevel angle of 10° is given as a guide, but other angles may be used, provided that it is possible to inscribe within the preparation a circle 20 mm in diameter, as shown in Figure 1, page 9.

2.3 Preparation of test assembly

2.3.1 The test plates and the backing strip should be prepared and assembled as shown in Figure 1, page 9. The bevelling of the plate edges should be done by machining or machine gas-cutting. In the latter case, any remaining scale should be removed from the bevelled edges. The surface of the backing strip should be free from scale or rust.

2.3.2 In order to counteract shrinkage deformation, the test plates should be pre-set when tack-welding the assembly, in such a way as to obtain a level joint after welding.

2.3.3 The particulars given in Figure 2, page 9, are designed to prevent deformation of the test assembly. No pre-setting of the backing strip is required, and before commencing to weld, care should be taken to see that the opening on the upper side of the V-joint is not less than 28 mm.

3. METHOD OF WELDING

3.1 Diameter of electrodes

It is necessary to determine the mechanical properties for each diameter equal to or greater than 3.15 mm in which a given type of electrode is manufactured.

3.2 Nature and value of the welding current

The welding current used may be either alternating current (a.c.) or direct current (d.c.) according to the instructions of the manufacturer. The current value used should always be less than the maximum value given by the manufacturer, but not less than 85% of this upper limit. The open circuit voltage should not be less than that specified by the manufacturer.

3.3 Deposition of runs and layers

3.3.1 Electrodes should be so used that the unused stub does not exceed 50 mm in length. The minimum length of run which is made with a whole electrode should be equal to 0.4 (E — 50) mm, where E is the total length of the electrode in millimetres.

3.3.2 The amount of side-to-side weaving should not exceed five times the electrode core diameter.

3.3.3 The direction of welding should be reversed after each layer. A complete layer may be composed of one or more runs. Deposition should be such that a run does not begin in the operative part of any test piece.

3.3.4 The reinforcement of runs should not generally exceed 3 mm. It can reach 4 mm for electrodes of a diameter equal to or greater than 6 mm.

3.4 Cooling interval

3.4.1 Between the completion of the deposition of one layer and the commencement of the deposition of the next layer, the test assembly should be allowed to cool in still air until the temperature of the joint does not exceed 250 °C.

3.4.2 The temperature should be measured by the use of pyrometers or test colours, or by any other equivalent process.

4. PREPARATION OF TEST PIECES

4.1 Cutting of test assembly

4.1.1 The test assembly should be cut longitudinally and then transversely, as shown in Figure 3, page 10, which gives all necessary particulars concerning the position and cutting of parts for the tensile and impact test pieces.

4.1.2 In Figure 3, lines to be cut are indicated by broken lines.

4.1.3 Cutting along lines shown thus——·——·——·should be done mechanically or by machine gas-cutting. Cutting along longitudinal boundaries of the parts to be machined into impact test pieces, shown thus - - - - -, should only be done mechanically.

4.2 Test pieces

4.2.1 One tensile test piece and three impact test pieces should be cut in accordance with the indications given in Figures 3 and 4, page 10, and Figure 5, page 11, which give the positions of the test pieces in relation to the cut parts and the deposited metal.

Figure 4 gives the position of the tensile test piece.

Figure 5 gives the position of the impact test piece.

4.2.2 All details for the preparation of the impact test piece, in particular the tolerances, are contained in ISO Recommendation R 148, *Beam Impact Test (V-notch) for Steel.*

4.3 Dimensions of test pieces

4.3.1 *Tensile test.* The diameter of the gauge length of the tensile test piece should be 10 mm. This diameter may be gradually reduced to 9.9 mm in the centre portion so that fracture occurs within the gauge length. It should be machined to the measurements given in ISO Recommendation R 82.*

4.3.2 *Impact test.* Test pieces should be machined to the measurements and tolerances given in ISO Recommendation R 148.**

4.4 Heat treatment of the test pieces before testing

4.4.1 *Tensile test.* The tensile test piece should be heat-treated in an electrically heated furnace at 250 °C for a period of not less than 6 hours and not more than 16 hours. The purpose of the heat treatment is to remove any hydrogen from the weld metal.

4.4.2 *Impact test.* The impact test pieces should not be heat-treated.

5. METHODS OF TESTS

5.1 Tensile and impact tests

The tests should be carried out in accordance with ISO Recommendations R 82 and R 148 as regards tensile and impact tests for steel. In particular, the temperature of the test pieces at the time of testing should be 20 ± 2 °C in temperate climates and 27 ± 2 °C in tropical climates.

5.2 Expression of results

5.2.1 *Tensile test.* The results obtained from the tensile test should be used in accordance with the details given in ISO Recommendation R 82.

5.2.2 *Impact test.* The result of the impact test should be expressed as the average value obtained for at least three test pieces.

5.3 Re-tests

Where any test piece fails to satisfy the test requirements, two further sets of test pieces should be prepared (using electrodes from the same batch) and submitted to the test in which failure occurred. Provided that both the additional test pieces are satisfactory in the re-tests, the electrodes may be accepted as having passed that test.

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* ISO Recommendation R 82, *Tensile Testing of Steel.*

** ISO Recommendation R 148, *Beam Impact Test (V-notch) for Steel.*

Dimensions in millimetres

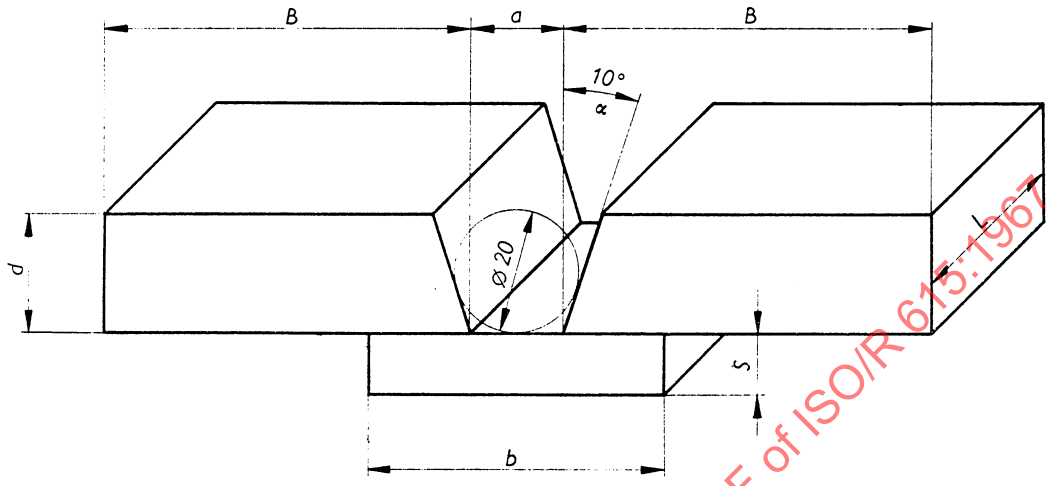

FIG. 1. — **Dimensions of the test assembly**

Dimensions in millimetres

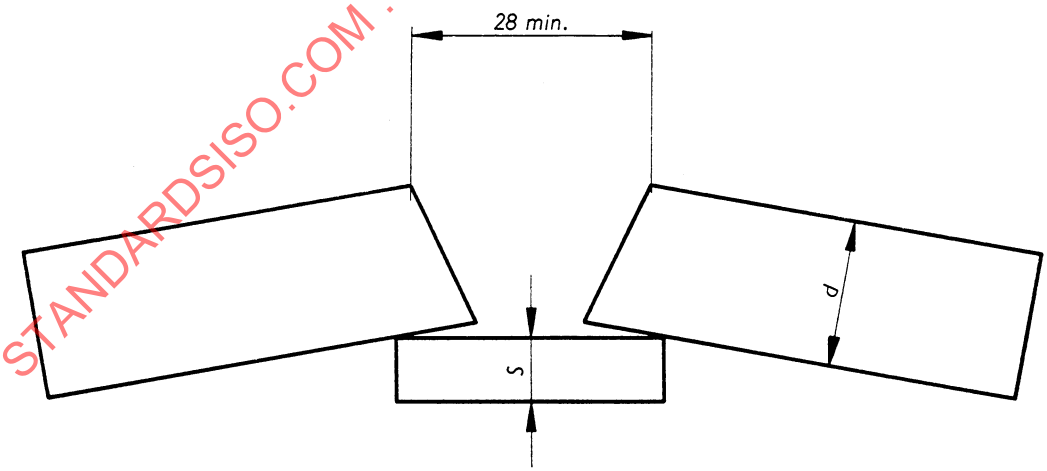

FIG. 2. — **Pre-setting of test plates for tack-welding**