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Indian Standard

METHOD FOR MACROSTREAK FLAW TEST FOR STEEL

(First Revision)

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INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

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Indian Standard

METHOD FOR MACROSTREAK FLAW TEST FOR STEEL

(First Revision)

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Indian Standard

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0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 5 August 1985, after the draft finalized by the Metallography and Heat Treatment Sectional Committee had been approved by the Structural and Metals Division Council.

0.2 The inclusions like oxides, sulphides and silicates, are embedded in steel during the process of steel making and solidification of the material. Undesirable inclusions, if present to a large extent, make the material impure and are detrimental to the serviceability of the steel whereas some important properties like machineability, are favourably influenced by certain intentional inclusions. Hence, it is often necessary to know the amount and distribution of non-metallic inclusions in steel to evaluate its cleanliness and quality.

0.3 There are number of methods to determine the flaws in steel, one of which is macrostreak flaw test used to assess the flaws on the finished surface of steel.

0.4 This standard contains clause **5.1** which permits the purchaser to use his option for selection to suit his requirements.

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1. SCOPE

1.1 This standard prescribes the method for carrying out the macrostreak flaw test for steel. The standard, however, does not lay down or establish limits of acceptability. This test is essentially used for determination of the presence of inclusions above 0·5 mm.

2. PRINCIPLE OF TEST

2.1 The test consists in determining the presence of flaws on machined surface of hot-rolled or forged steel. The test piece shall be machined to specified dimensions and inspected for flaws under good illumination

with unaided eye or with low magnification up to 15 X or with both. In some cases, test pieces may be machined to smaller dimensions for further examination after the original surfaces are inspected.

3. TERMINOLOGY

3.1 For the purpose of this standard the streak flaw shall mean defects arising from non-metallic inclusions, pin holes, blow holes and the streak flaws formed by heterogeneous substances such as sand which can be seen on the finished surface of the test piece. Other irregularities in the metal such as cracks, shrinkage cracks or any other working flaw shall not be considered.

4. SAMPLING

4.1 In determining the inclusion content it is important to realize that whatever method is used, the result actually applies only to the areas of the specimens that are examined. For practical reasons such specimens are relatively small compared to the total amount of steel represented by them. For the inclusion determination to have any value, adequate sampling is just as necessary as a proper method of testing.

4.2 Steel often differs in inclusion content not only from heat to heat, but also from ingot to ingot in the same heat, and even in different portions of the same ingot. It is advisable that the unit lot of steel, the inclusion content of which is to be determined, should not be larger than one heat. Sufficient samples should be selected to adequately represent the lot. The exact sampling procedure should be incorporated in the individual product requirements or specification. The specimens should be selected after the billets have been sufficiently cropped and suitable discards made. If the locations of the different ingots and portions of ingots in the heat cannot be identified in the lot being tested, random sampling should involve a greater number of test specimens for an equivalent weight of steel. A value for the inclusion content of an isolated piece of steel, even if accurately determined, should not be expected to represent the inclusion content of the whole heat.

4.3 The size and shape of steel product tested has a marked influence on the size and shape of the inclusion. During reduction from the ingot by rolling or forging, the shape, size and distribution of the inclusions may be altered. In reporting results, therefore, the size, shape and method of manufacture of the steel from which the specimens have been cut should be stated. For comparing the inclusion contents of different steels they should be rolled or forged as nearly as possible to the same size or shape from ingots of about the same size. Specimens cut lengthwise or parallel to the direction of rolling or forging should be used.

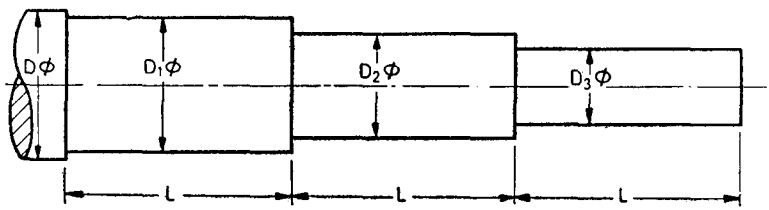
4.4 In order to obtain more readily comparable results, it may be convenient to forge specimens from larger billets. Care shall, however, be taken to crop specimens of sufficient length from the billets for forging and it is desirable to take the specimens from the middle of the forged length. These forged sections may then be sampled in the same way as rolled sections.

5. TEST PIECE

5.1 The test piece (*see* figure in Table 1) shall be machined to the dimensions given in Table 1. The machined surface shall not be rough but shall be fairly smooth. The surface roughness of the test piece shall not exceed 6·3 μm *Ra*. The dimensions may, however, vary for certain classes of steel and for a certain applications subject to mutual agreement between the contracting parties.

TABLE 1 DIMENSIONS OF TEST PIECE

All dimensions in millimetres.



Nominal Diameter	Diameter of the First Step	Diameter of the Second Step	Diamater of the Third Step	Length of Each Step
D	D_1	D_2	D_3	*L*
Below 30	$D - 2$	—	—	64
30 to 75	$D - 4$	$D \times 2/3$	$D \times 1/2$	64
above 75	$D - 6$	$D \times 2/3$	$D \times 1/2$	64

5.1.1 Steel of section other than round shall be forged down to a round section and used as the test piece.

6. TEST PROCEDURE

6.1 The length and the number of streak flaws shall be determined on each step of the machined test piece.

6.2 The length and the number of flaws shall be determined under good

illumination either with an unaided eye or with low magnification up to 15 X or both. Two streak flaws within a distance of 0·5 mm in the longitudinal direction or 0·2 mm in the transverse direction between them shall be counted as one streak flaw.

7. METHOD OF ESTIMATION

7.1 The streak flaw shall be determined by its length and number.

7.1.1 Notations as shown in Table 2 are given for different lengths of streak flaw.

TABLE 2 NOTATION OF STREAK FLAW

Notation of Macrostreak Flaw (1)	Length of Macrostreak Flaw (2)	Notation of Macrostreak Flaw (1)	Length of Macrostreak Flaw (2)
	mm		mm
1	Over 0·5 to 1·0 incl	15	Over 12·0 to 15·0 incl
2	Over 1·0 to 2·0 incl	20	Over 15·0 to 20·0 incl
3	Over 2·0 to 3·0 incl	25	Over 20·0 to 25·0 incl
4	Over 3·0 to 4·0 incl	30	Over 25·0 to 30·0 incl
5	Over 4·0 to 5·0 incl	40	Over 30·0 to 40·0 incl
6	Over 5·0 to 6·0 incl	50	Over 40·0 to 50·0 incl
7	Over 6·0 to 8·0 incl	60	Over 50·0 to 60·0 incl
8	Over 8·0 to 10·0 incl	70	Over 60·0
9	Over 10·0 to 12·0 incl		

7.2 The number of streak flaw shall be given for each step of the specimen by converting the number if streak flaw belonging to the same notation into the number per 100 cm^2 area. This shall be referred to as 'the conversion number'. The conversion number shall always be rounded off to the first figure.

7.3 The total severity of the flaws will be a summation of the product of notation and the conversion numbers.

8. REPORTING OF TEST RESULTS

8.1 Each step shall be examined separately. The streak flaw in each step shall be indicated by its notation, underlined, followed by its equivalent conversion number in bracket as shown in Fig. 1.

8.1.1 Total severity of flaws (*see also* **7.3**) for each step shall also be indicated in the test report.

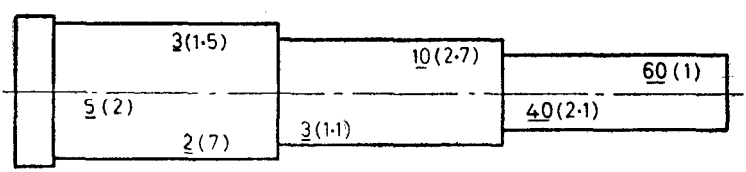


FIG. 1 TEST PIECE INDICATING NOTATIONS

INDIAN STANDARDS INSTITUTION

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002

Telephones : 331 01 31, 331 13 75 Telegrams: Manaksanstha
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