

**In the event of any doubt arising,
the original Standard in Japanese is to be final authority**

Errata for JIS (English edition) are printed in *Standardization Journal*, published monthly by the Japanese Standards Association.

Errata will be provided upon request, please contact:

**Business Department,
Japanese Standards Association
4-1-24, Akasaka, Minato-ku,
Tokyo, JAPAN 107
TEL. 03-3583-8002
FAX. 03-3583-0462**

Errata are also provided to subscribers of JIS (English edition) in *Monthly Information*.

JAPANESE INDUSTRIAL STANDARD

J I S

Microscopic Testing Method for the
Non-metallic Inclusions in SteelG 0555-1977
(Reaffirmed: 1994)1. Scope

This Japanese Industrial Standard specifies the microscopic testing method to measure the types and the quantity of non-metallic inclusions, hereinafter referred to as the "inclusion", in steel and also to determine the index of cleanliness.

2. Specimen and Test Piece

2.1 Specimen The specimen shall be cut off from rolled or forged steel in a length sufficient for sampling the test piece at right angles with the rolled direction or forged axis.

2.2 Test Piece

2.2.1 The test piece shall be sampled by cutting out the specimen parallel to its rolled direction or forged axis through the centre line of the specimen.

2.2.2 The test piece shall have the test plane of, as a rule, 300 mm² extending from the surface to the centre line of the specimen.

Figures 1 and 2 show the sampling of the test pieces from the round and the square specimens, respectively.

Fig. 1. Sampling of Test Piece
from Round Specimen

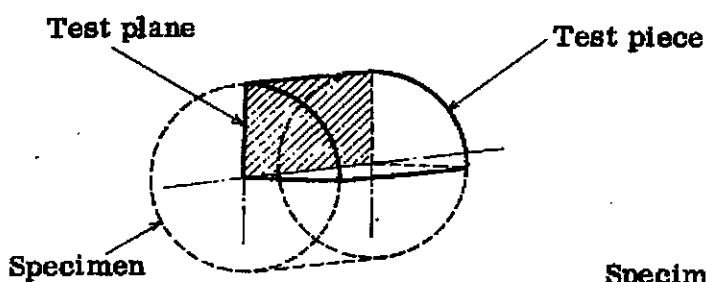
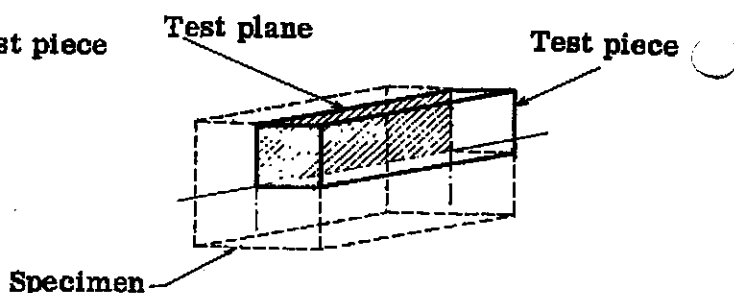


Fig. 2. Sampling of Test Piece
from Square Specimen



2.2.3 For the specimen of 60 mm or larger in thickness, width, diameter, side, or width across flats, it is permitted to take the test piece from the intermediate portion between the surface and the centre axis of the specimen, parallel to the rolled direction or forged axis. In this case, the test plane shall, as a rule, be 15 mm wide and 20 mm high.

Figures 3 and 4 show the sampling of test piece from the round and the square specimens, respectively.

Fig. 3. Sampling of Test Piece from Round Specimen of Diameter 60 mm or More

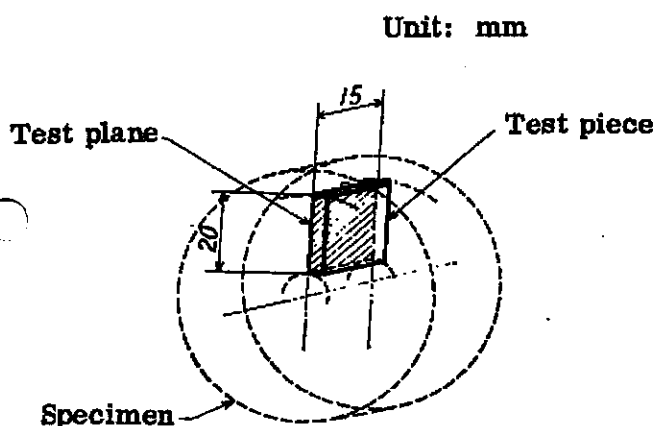
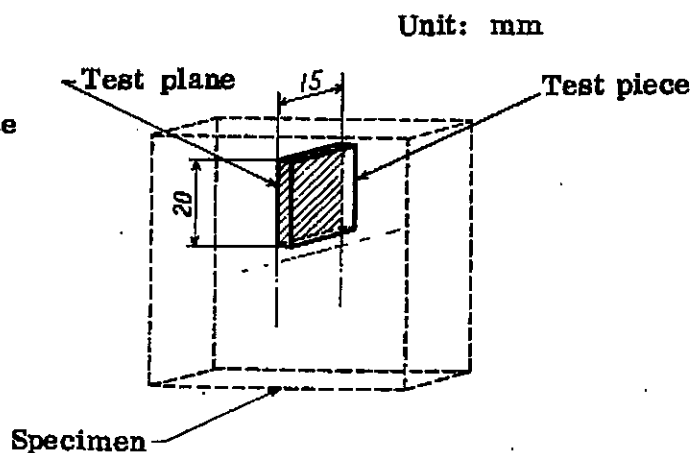


Fig. 4. Sampling of Test Piece from Square Specimen with Thickness, Width, Side or Width across Flats of 60 mm or More



2.2.4 For the specimen of 20 mm or smaller in thickness, width, diameter, side or width across flats, the test plane may be taken along the cross section passing through the centre line. In this case, the area of the test plane shall be predetermined.

Figures 5 and 6 show the sampling of the test piece from the round and the square specimens, respectively.

Fig. 5. Sampling of Test Piece from Round Specimen of a Diameter of 20 mm or Smaller

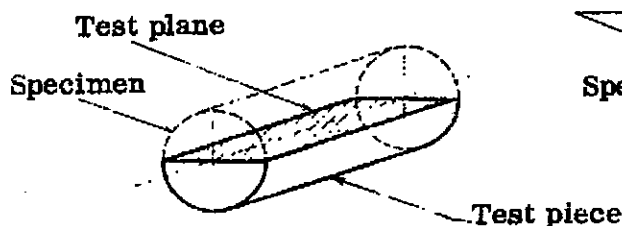
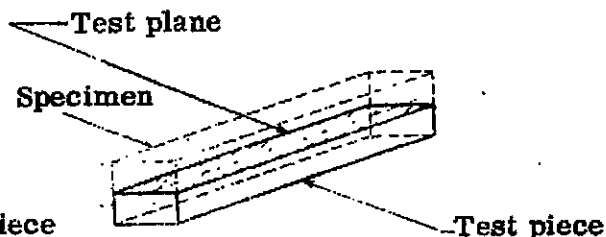


Fig. 6. Sampling of Test Piece from Square Specimen of a Thickness, Width, Side or Width across Flats of 20 mm or Smaller



2.2.5 For the specimens of steel plate, steel pipe, or steel section, the appropriate sampling methods of the test piece shall be subjected to the agreement between the parties concerned.

2.2.6 The sampling position and the area of the test plane of the test piece shall be noted in addition to the test result.

2.2.7 The test plane shall be finished by polishing with the emery paper or the buff after the test piece is hardened or the test plane is hardened by carburizing. In this case, sufficient attentions are necessary not to cause the falling or concealing of the inclusions, pit, scratch, or rust by rough polishing.

3. Classification of Inclusions

Inclusions are classified into following 3 types:

- (1) A Type Inclusion Inclusions formed by viscous deformation during working (sulphides, silicates, etc.). If necessary, they are classified further into sulphides and silicate, and the former shall be called A₁ type inclusion and the latter A₂ type inclusion.
- (2) B Type Inclusion Inclusions formed by granular inclusions discontinuously and collectively disposed in the working direction (alumina, etc.).
As for the steel containing Nb, Ti and Zr, (only one, or more than two thereof), if necessary, inclusions are further classified into oxide such as alumina and carbo-nitride of Nb, Ti, and Zr, and the former shall be called B₁ type inclusion and the latter B₂ type inclusion.
- (3) C Type Inclusion Inclusions formed by irregular dispersion without viscous deformation (granular oxide, etc.).
As for the steel containing Nb, Ti, and Zr, (only one, or more than two thereof), if necessary, inclusions are further classified into oxide and carbo-nitride of Nb, Ti, and Zr, and the former shall be called C₁ type inclusion and the latter C₂ type inclusion.

4. Testing Method

The glass plate having each 20 grating lines, longitudinal and lateral, shall be inserted in the eyepiece of the microscope, and the test plane shall be observed repeatedly at random. The number of grating points occupied by the inclusions shall be counted.

In this case, the number of visual fields shall, as a rule, be 60 and shall be at least 30 and over.

The magnification of microscope shall, as a rule, be 400.

5. Method of Determination

By the total number of grating points found on the glass plate within the visual field, the number of visual field, and the number of grating points occupied by inclusions, the percentage of area occupied by the inclusions shall be calculated from the following formula and the index of cleanliness of the steel (d %) shall be determined.

$$d = \frac{n}{p \times f} \times 100$$

where

p : total number of grating points on the glass plate in the visual field

f : number of the visual fields

n : number of grating points occupied by the inclusions through the visual fields number-
ing f

6. Indication

The results of determination shall be indicated as given below:

Examples 1. d 60 x 400 = 0.34 % (Expressing number of the observed visual fields is 60, the magnification of microscope is 400, and the index of cleanliness is 0.34 %.)

2. d A 60 x 400 = 0.15 %

d B 60 x 400 = 0.02 %

d C 60 x 400 = 0.09 %

... (Expressing number of the observed visual fields is 60, the magnification of microscope is 400, and the index of cleanliness of A, B, and C type inclusions are 0.15 %, 0.02 %, and 0.09 %, respectively.)

G 0555-1977
Edition 4

Japanese Text

Established by Minister of International Trade and Industry

Date of Establishment: 1956-12-15

Date of Revision: 1977-08-01

Date of Reaffirmation: 1994-06-01

Date of Public Notice in Official Gazette: 1994-06-07

Investigated by: Japanese Industrial Standards Committee

Divisional Council on Iron and Steel

**Technical Committee on Testing Methods
for Determination of Steel Properties**

This English translation is published by:

Japanese Standards Association

1-24, Akasaka 4, Minato-ku,

Tokyo 107 Japan

© JSA, 1980

**Printed in Tokyo by
Hohbunsha Co., Ltd.**