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JAPANESE INDUSTRIAL STANDARD

Methods of measuring case depth for steel hardened by flame or induction hardening process

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1. Scope This Japanese Industrial Standard specifies the methods of measuring the case depth for steel hardened (hereafter referred to as "case depth") by flame or induction hardening process.

Remarks: 1 The standards cited in this Standard are given in the following:

JIS B 0601	Surface roughness – Definitions and designation
JIS G 0201	Glossary of terms used in iron and steel (heat treatment)
JIS G 0202	Glossary of terms used in iron and steel (testing)
JIS Z 2244	Method of Vickers hardness test
JIS Z 2245	Method of Rockwell and Rockwell superficial hardness test

2. The International Standard corresponding to this Standard is given in the following:

ISO 3754: 1976	Steel—Determination of effective depth of hardening after flame or induction hardening

3. The hardness limit and its expression in measuring the effective case depth by hardness testing shall be as given in Annex.

2. Definitions The principal terms used in this Standard are as defined in the following, and for the rest of terms, definitions laid down in JIS G 0201 and JIS G 0202 apply.

(1) effective case depth The distance from the surface of the hardened case under as-quenched or as-tempered conditions to the position of the hardness limit specified in Table 1. When agreed between the purchaser and supplier, however, other hardness limit values than those given in Table 1 may be designated, or the values specified in 1. (Hardness limit) of Annex may be used, taking into account the field of application.

Table 1. Hardness limit for effective case depth

Carbon content of steel(1) %	Vickers hardness HV	Rockwell C hardness HRC	Rockwell superficial hardness		
			HR15N	HR30N	HR45N
0.23 and over, up to 0.33	350	36	78	56	38
0.33 and over, up to 0.43	400	41	81	60	44
0.43 and over, up to 0.53	450	45	83	64	49
0.53 and over	500	49	85	68	54

Note (1) The carbon content of steel apply to the midpoint of the range specified for the steel grade to be tested.

(2) Total case depth The distance from the surface of the hardened case to a point where the difference in physical or chemical properties between the hardened case and the core material is no longer identifiable.

Remarks: Physical properties shall be determined by the hardness and chemical properties by the macrostructure.

(3) Hardness transition curve A curve presenting the relationship between the vertical distance from the surface of the hardened case and the hardness.

3. Classification of measuring methods

(1) Measuring method by hardness test A method where the case depth is determined by measuring the hardness on the cross-section of the specimen.

(2) Measuring method by macrostructure test A method where the case depth is determined by observing the etched cross-section of the specimen with a low power magnifying glass.

Remarks: Determination of the case depth is usually made by the measuring method by means of the hardness test, but when a more simple method is necessary, the measuring method by means of the macrostructure test is used.

4. Specimen In general, for the specimen, the product itself shall be used. If this is impracticable, the steel product of the same profile, dimensions and steel grade as the hardened part of the product may be used when treated under the same conditions applied to the product.

5. Measuring method by hardness test

5.1 The specimen shall be cut at a right angle to the face of hardened case, and the cut surface shall be finished by polishing for testing. In cutting or polishing, sufficient care shall be paid so that these processes do not affect the hardness and do not blunt the edges of the surface to be tested.

5.2 The Vickers hardness test specified in JIS Z 2244 or the Rockwell C or Rockwell superficial hardness test specified in JIS Z 2245 shall be carried out onto the test surface, and a hardness transition curve shall be drawn, then the effective or total case depth shall be determined therefrom. In this case, the Vickers hardness test force shall be 0.98 to 98.1 N.

5.3 The hardness transition curve shall be prepared as follows:

(1) The hardness transition curve shall be drawn by measuring hardness at the positions to be measured in the order along the straight line normal to the test surface. If necessary, after selecting 2 to 5 points within a 1.5 mm span on the surface, one hardness transition curve shall be drawn by measuring the hardness on each point along the straight line normal to the surface (see Fig. 1).