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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 2523-2022

Replacing GB/T 2523-2008

**Measuring methods for the surface roughness, peak count and
waviness of cold-rolled metal sheet and strip**

冷轧金属薄板和薄带表面粗糙度、峰值数和波纹度测量方法

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1 Scope

China's national methods for measuring the surface roughness, peak count and waviness of cold-rolled metal sheet and strip. It specifies the instruments, the conditions, the procedures and the reporting for these three surface characteristics. The surface of a cold-rolled sheet is not incidental - it is transferred from the work rolls, which are deliberately textured, and it is a specified product characteristic because it determines what happens to the sheet afterwards. Roughness governs whether the sheet holds lubricant during forming: a surface that is too smooth allows metal-to-metal contact and galling in the die, while one too rough prints its own texture through a painted finish. Peak count, the number of peaks per unit length above a threshold, is the property that a smooth surface finish on a painted automotive panel actually depends on, because a surface can have the right average roughness with too few, too deep peaks and will not paint out. Waviness is a longer-wavelength deviation that a roughness measurement filters away entirely, and it is what makes a panel look uneven under a gloss finish - it comes from the mill and from the rolls rather than from the texturing, and it is invisible until the paint is on. So all three are measured, and the standard exists because each is meaningless without its measurement

conditions. The result depends on the stylus tip radius and force, the cut-off wavelength and the filter used to separate roughness from waviness, the evaluation length, the traverse direction relative to the rolling direction, and the number and placement of the measurements across a coil that is not uniform. All of that is what the standard fixes. Issued on 11 July 2022 and in force since 1 February 2023, it replaces GB/T 2523-2008.

This document specifies the principle, specimens, measurement requirements, measurement procedures, rounding of measurement values and test reports for surface roughness, peak count and waviness for cold-rolled metal sheet and strip. This document is applicable to the measurement of surface roughness, peak count and waviness for cold-rolled metal sheet and strip. It is also applicable to the cold-rolled metal sheet and strip with surface metal coating.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

GB/T 3505-2009, Geometrical product specifications (GPS) - Surface texture. Profile method - Terms, definitions and surface texture parameters

GB/T 6062-2009, Geometrical product specifications (GPS) - Surface texture. Profile method - Nominal characteristic of contact (stylus) instruments

GB/T 8170, Rules of rounding off for numerical values and expression and judgement of limiting values

JJF 1105, Calibration Specification for Contact (Stylus) Instruments of Surface Roughness Measurement by Profile Method

3 Terms and definitions

For the purposes of this document, the terms and definitions defined in GB/T 3505- 2009 as well as the followings apply.

3.1 roughness average; R_a The arithmetic mean of the absolute value of the ordinate value $Z(x)$ of the roughness profile within a sampling length, see Figure 1.

3.3 peak count level The vertical distance between the upper and lower boundary lines equidistant from the profile midline.

3.4 peak In the profile, a pair of adjacent peaks and valleys beyond the peak count level boundary line.

3.5 peak count; RP_c (or PPI) In the profile, the number of peaks per unit length.

4 Symbols and descriptions

The symbols and corresponding descriptions used in this document are shown in Table 1.

5 Principle

Place a diamond stylus with a certain angle and tip radius vertically on the surface of the specimen with the specified contact force. Move in a straight line at a specified rate. The stylus moves vertically with the profile of the specimen surface.

6 Specimens

6.1 The sampling location shall be in accordance with the relevant product standards or agreements.

6.2 For R_a , R_z , $R_{z1\max}$, RP_c (or PPI), W_a and specimens that do not need to be punched into Marciniak cups to measure W_a

0.8 and W_{sa1-5} , it is recommended to use a square (or circle) with a side length (or diameter) of 100mm.

6.3 When punching into Marciniak cups to measure W_a

0.8 and W_{sa1-5} , the side length of the sample blank shall be at least 220mmx220mm.

6.4 Sample blanks and specimens shall be flat, free from scratches. The surface of the specimen shall be free from rust spots, stains and other surface defects.

6.5 Scrub the measurement area of the specimen with acetone or alcohol before measurement. Immediately measure.

7.1 Instruments

7.1.1 The roughness instrument shall be calibrated in accordance with the requirements of JJF 1105.

7.1.4 See Table 3 for information on the tip radius (r_{tip}) and tolerances of the stylus. The maximum measuring force of the stylus shall not exceed the value shown in Table 3.

7.1.5 When measuring R_a , R_z , $R_{z1\max}$ and RP_c (or PPI), if not otherwise specified, the stylus with a nominal tip angle of 60° shall be used.

7.1.6 When measuring W_a , W_a

0.8 and W_{sa1-5} , it is recommended to use a stylus with a nominal tip angle of 90° and a radius (r_{tip}) of $5\mu\text{m}$. Other styluses with smaller tip angles and radiuses (r_{tip}) may also be used.

7.2 Measurement conditions

7.2.1 Filtering Filtering selection is based on the following.

7.2.2 Roughness and peak count

7.2.3 Waviness The cut-off wavelength, sampling length, assessment length and travel length for measuring the waviness of cold-rolled metal sheet and strip shall comply with the technical characteristic values given in Table 7.

7.2.4 Stylus movement rate During measurement, the movement rate of the stylus shall not be greater than 1mm·s⁻¹.

8 Measurement procedure

8.1 The measurement shall be carried out at a temperature of (20 ± 10)°C, otherwise it shall be noted in the test report.

8.2 The instrument shall be checked with a standard block before measurement. The relative error of the Ra measurement value shall not exceed ±5%.

8.3 The measuring table shall be stable. Measurements shall be carried out in a dry, vibration-free and non-corrosive atmosphere.

8.4 When measuring Ra, Rz, Rz1 max, RPc (or PPI), place the specimen flat on the measuring table. The measuring surface and the stylus travel direction shall be in accordance with the relevant product standards or agreements.

8.6 See Annex C for the measurement of filtered centre line waviness (WCA).

9 Rounding of measurement values

The value of the measurement result shall be rounded up in accordance with the provisions of the relevant product standard or agreement. If not specified, the rounding shall be carried out according to the following requirements. The method of rounding is in accordance with GB/T 8170.

10 Test report

If applicable, the test report shall include at least the following.

Annex A

(normative) Marciniak cup specimen processing A.1 Specimen processing equipment Use sheet forming test equipment. A schematic cross-sectional view of the Marciniak die and test specimen is shown in Figure A.1. A.2 Specimen processing Place a sample blank with