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Small-sized micro indicators

小扭簧比较仪

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Foreword

This standard was proposed by the China Machinery Industry Federation.

This standard is under the jurisdiction of the National Technical Committee on Measuring Tools and Instruments of Standardization Administration of China (SAC/TC 132).

The organization responsible for drafting this standard is Harbin Measuring and Cutting Tool Group Co. Ltd.

The participating drafting organization is the Chengdu Tool Research Institute.

1 Scope

The Chinese national product standard for the small twisted strip comparator, the most sensitive purely mechanical length comparator still in workshop use. Instead of a gear train, a twisted metal strip carries the pointer: a straight-line movement of the measuring spindle untwists the strip, the strip turns the pointer through a large angle across an arc-shaped dial, and because nothing meshes there is no backlash and no gear error to limit the resolution. That is what lets an instrument of this size read to fractions of a micrometre, which is why it is used on comparator stands for gauge block comparison and for checking the form and size of precision parts. This standard specifies the terms and definitions, the types and basic parameters, the requirements, the inspection methods, and the marking and packaging of small twisted strip comparators. It applies to comparators whose clamping sleeve has the diameter stated in the scope. The types and basic parameters clause pairs each scale interval with the indicating range that goes with it. The requirements clause covers the freedom of the measuring surfaces and the clamping sleeve from defects, the smoothness of the measuring mechanism, the zero setting and stroke limiting devices, the geometry of the graduation lines and of the pointer tip, the material and hardness of the measuring head and its surface roughness, and then the metrological requirements proper

- measuring force and its variation, the change of indication under a radial load, the permissible error and repeatability, the swing time of the pointer, the balance of the pointer and the measuring force drop - each of these stated separately for the two accuracy grades. It is used by instrument makers, metrology laboratories and inspection departments.

This standard specifies the terms and definitions, the types and basic parameters, the requirements, the inspection methods, and the marking and packaging of small twisted strip comparators.

This standard applies to small twisted strip comparators whose clamping sleeve has the diameter stated in this clause, hereinafter referred to as comparators.

2 Normative references

The following documents contain provisions which, through reference in this standard, constitute provisions of this standard. For dated references, subsequent amendments (excluding corrections) to, or revisions of, any of these publications do not apply to this standard; however, parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of these documents. For undated references, the latest edition of the document referred to applies.

GB/T 17163 Geometrical product specifications (GPS) - Measuring instruments with the dimension of length - Vocabulary of terms.

3 Terms and definitions

The terms and definitions established in GB/T 17163 and the following apply to this standard.

3.1 micro indicators: a measuring instrument that uses a twisted strip element as the conversion and amplification mechanism, converting the straight-line displacement of the measuring spindle into an angular displacement of the pointer over an arc-shaped dial, and reading the value from that dial.

4 Types and basic parameters

4.1 The scale interval and the indicating range of the comparator are given in Table 1.

Table 1 pairs each of the four scale intervals covered by this standard with the indicating range that belongs to it, the indicating range being stated as a symmetrical span about zero. The units of the table are micrometres.

4.2 The type of the comparator is shown in Figure 1; the figure is for graphical explanation only.

Figure 1 is a schematic drawing of the twisted strip comparator, seen from the front and in part section. It names the pointer, the dial, the case, the zero setting device, the clamping sleeve and the measuring head, and it carries the mounting dimensions of the clamping sleeve, the thread of the measuring head and the minimum lengths available for clamping.

5 Requirements

5.1 There shall be no rust, bruising, scratching or other defect on the measuring surface of the measuring head of the comparator or on the surface of its clamping sleeve which would affect the performance in use.

5.2 The movement of the measuring mechanism of the comparator shall be smooth and free, without sticking, and in the free state the pointer shall return beyond the left-hand graduation line.

5.3 The comparator shall have a zero setting device with an adjusting range of not less than the number of scale divisions stated in this clause, and a stroke limiting device that limits the travel of the measuring spindle.

5.4 The distance between graduation lines and the widths of the pointer tip and of the graduation lines on the dial are fixed by this clause, together with the permitted difference between the width of the pointer tip and the width of a graduation line.

5.5 The pointer tip of the comparator shall cover a stated proportion of the length of the short graduation lines on the dial. At a stated distance from the pointer tip there shall be a round mark of not less than the stated diameter; that mark and the pointer tip shall be painted red, black or another conspicuous colour.

5.6 The distance from the pointer tip of the comparator to the dial shall not be greater than the value stated in this clause.

5.7 The measuring head shall be made of agate, hard alloy or another wear-resistant material; for a steel measuring head, the hardness of the measuring face shall not be lower than the value stated in this clause.

5.8 The maximum permissible value of the surface roughness R_a of the measuring head is given in this clause.

5.9 The measuring force and the variation of the measuring force of the comparator shall comply with the provisions of Table 2. Table 2 gives, for each scale interval, the permitted band of the measuring force and, separately for grade 0 and grade 1 comparators, the permitted variation of the measuring force.

5.10 The change of indication of the comparator under a radial load is specified in Table 3. Table 3 gives, for each scale interval, the radial load to be applied and the change of indication permitted under it, expressed in scale divisions and stated separately for grade 0

and grade 1 comparators.

5.11 The permissible error and the repeatability of the comparator are specified in Table 4. Table 4 gives, for each scale interval, the permissible error at the two checked points on either side of zero and the repeatability, the repeatability being expressed as a fraction of a scale division.

5.12 During measurement, the swing time of the pointer shall not exceed the time stated in this clause.

5.13 The balance of the pointer shall not exceed the fraction of a scale division stated in this clause; for comparators of the finest scale interval, the balance of the pointer shall not exceed the smaller fraction stated there.

5.14 Within the indicating range, the greatest difference in measuring force between the forward and the reverse stroke at any one point is the measuring force drop; the permitted values are stated in this clause for grade 0 and for grade 1 comparators.

6 Inspection methods

6.1 Inspection temperature. This standard prescribes an inspection and measurement temperature, with the tolerance stated in this clause.

6.2 Measuring force, variation of measuring force and measuring force drop. The comparator is reliably mounted on a dedicated measuring force device of the stated scale interval.

6.2.1 Measuring force: the measuring spindle is raised from the starting point until the pointer turns to the maximum of the indicating range; the measuring force shall not exceed the prescribed value.

6.2.2 Variation of measuring force: over the whole indicating range, the difference between the maximum and the minimum measuring force on the forward and the reverse stroke is the variation of the measuring force.

6.3 Change of indication under radial load: the comparator is mounted on a stand of good rigidity so that its measuring head is in vertical contact with a gauge block on the work table, and the pointer is set to the zero of the dial. A specialized force gauge is used to pull on the measuring head, perpendicular to the direction of the spindle. During the measurement the pull is applied in four directions, forward, backward, left and right, and the greatest of the resulting changes of indication is the change of indication under radial load.

6.4 Error of indication: the comparator is reliably mounted on a rigid comparator stand so that the measuring head is in contact with gauge blocks, the pointer is adjusted to the zero position, and the four points on either side of zero named in this clause are taken as the checked points and are checked with gauge blocks. An example of the inspection and