

# ISO 13041-1:2020-03 (E)

## Test conditions for numerically controlled turning machines and turning centres - Part 1: Geometric tests for machines with horizontal workholding spindle(s)

---

Contents	Page
<b>Foreword .....</b>	<b>iv</b>
<b>Introduction .....</b>	<b>v</b>
<b>1 Scope .....</b>	<b>1</b>
<b>2 Normative references .....</b>	<b>1</b>
<b>3 Terms and definitions .....</b>	<b>1</b>
<b>4 Preliminary remarks .....</b>	<b>2</b>
<b>4.1 Measuring units .....</b>	<b>2</b>
<b>4.2 Reference to ISO 230 .....</b>	<b>2</b>
<b>4.3 Machine levelling .....</b>	<b>2</b>
<b>4.4 Testing sequence .....</b>	<b>2</b>
<b>4.5 Tests to be performed .....</b>	<b>2</b>
<b>4.6 Measuring instruments .....</b>	<b>3</b>
<b>4.7 Diagrams .....</b>	<b>3</b>
<b>4.8 Linear motions .....</b>	<b>3</b>
<b>4.9 Tool turret and tool spindle(s) .....</b>	<b>3</b>
<b>4.10 Machine classifications .....</b>	<b>3</b>
<b>4.11 Software compensation .....</b>	<b>9</b>
<b>4.12 Tolerances .....</b>	<b>10</b>
<b>4.13 Axes not under test .....</b>	<b>10</b>
<b>5 Geometric tests .....</b>	<b>11</b>
<b>5.1 Workholding spindle .....</b>	<b>11</b>
<b>5.2 Straightness of axes of motion .....</b>	<b>13</b>
<b>5.3 Relation between linear motions and/or workholding spindle(s) .....</b>	<b>16</b>
<b>5.4 Angular error of linear axes of motion .....</b>	<b>23</b>
<b>5.5 Tailstock .....</b>	<b>26</b>
<b>5.6 Tool turret and tool spindle .....</b>	<b>30</b>
<b>5.7 Rotary workholding spindle head or tool turret head .....</b>	<b>39</b>
<b>Annex A (informative) Error motions of the axis of rotation of workholding and tool spindles .....</b>	<b>41</b>
<b>Annex B (informative) Terms in non-ISO languages .....</b>	<b>46</b>
<b>Bibliography .....</b>	<b>47</b>