

ISO 230-1:2012-03 (E)

Test code for machine tools - Part 1: Geometric accuracy of machines operating under no-load or quasi-static conditions

Contents		Page
Foreword		v
Introduction		vi
1	Scope	1
2	Normative references	1
3	Terms and definitions	2
3.1	General	2
3.2	Terms for machine coordinate system and motion nomenclature	2
3.3	Terms for static compliance and hysteresis	3
3.4	Terms for linear axes	4
3.5	Terms for axes of rotation	12
3.6	Terms for parallelism error and squareness error of axes of motion	19
3.7	Terms for other relationships between axis average lines	25
3.8	Terms for multi-axes motion or kinematic tests	26
3.9	Terms for geometric accuracy of machine functional surfaces, machine tool components and test pieces	30
4	Tolerances	34
4.1	General	34
4.2	Tolerances applicable to machine tool functional surfaces, machine tool components and test pieces	40
4.3	Additional limiting conditions associated with tolerances	40
5	Uncertainty of measurements, test methods and measuring instruments	41
6	Preliminary operations	42
6.1	Installation of the machine before tests	42
6.2	Conditions before machine tests	43
6.3	Test setup and instrumentation	44
7	Machine static compliance and hysteresis tests	45
7.1	General	45
7.2	Tests for machine static compliance and hysteresis by applying force externally	45
7.3	Tests for machine static compliance and hysteresis by applying force internally	47
7.4	Tests for machines with rotary axes	50
8	Geometric accuracy tests of axes of linear motion	52
8.1	General	52
8.2	Straightness error motion tests	53
8.3	Linear positioning error motion tests	58
8.4	Angular error motions tests	60
9	Geometric accuracy tests of axes of rotation	64
9.2	Angular positioning error motion	64
10	Alignment of axes of motion -- Parallelism, squareness, coaxiality and intersection	67
10.1	Parallelism of axes of motion	67
10.2	Coaxiality error of axis average lines	73

10.3	Squareness error of axes of motion	76
10.4	Intersection of axis average lines	83
11	Multi-axes motion (kinematic) tests	85
11.1	General	85
11.2	Linear trajectories	86
11.3	Circular trajectories	87
11.4	Conical (shape) motion	94
11.5	Spherical interpolation test using spherical artefacts and linear displacement sensors ...	95
11.6	Flatness error of a surface generated by two axes of linear motion	96
11.7	Special tests	97
12	Geometric accuracy tests of machine functional surfaces -- Straightness, flatness, perpendicularity and parallelism	100
12.1	Straightness error of machine functional surfaces	100
12.2	Flatness of machine tables	110
12.3	Position and orientation of functional surfaces	118
12.4	Squareness error and perpendicularity error between lines and planes	128
12.5	Run-out of rotational components	132
	Annex A (informative) Machine tool coordinate system and position and orientation errors	134
	Annex B (informative) Test piece measurement	147
	Annex C (informative) Cross-reference	149
	Bibliography	158
	Index Alphabetical index of terms and definitions	159