

Machine tools — Environmental evaluation of machine tools — Part 2: Methods for measuring energy supplied to machine tools and machine tool components

Contents

	Foreword
	Introduction
1	Scope
2	Normative references
3	Terms and definitions
4	System and machine tool state description
4.1	General
4.2	Ambient conditions
4.3	Operating states and machine tool activity
4.4	Machine tool activity
5	Test scenarios
5.1	General
5.2	Machine-based test scenario
5.2.1	General
5.2.2	Sample shift regime
5.2.3	Specific shift regime
5.2.3.1	Motivation
5.2.3.2	Clustering of time shares for specific shift regimes
5.2.3.3	Determination of specific shift regimes
5.2.3.4	Reduced shift regimes
5.3	Task-based test scenario
6	System definition for measurement
7	Measuring set up and methodology
7.1	Measuring points selection
7.2	Power measurement and calculation of energy supplied
7.3	Simultaneous measuring
7.4	Quasi-simultaneous measuring
7.5	Measuring equipment
7.5.1	General requirements
7.5.2	Equipment for electrical measurement
7.5.3	Equipment for measuring fluids
7.6	Measurement units
7.7	Measurement period
7.8	Conversion of measured values
7.9	Electrical energy equivalent
7.9.1	Standard conversion rates
7.9.2	Determination of electrical energy equivalent
8	Measurement uncertainty
9	Reporting of results
9.1	Reporting of individual measurement results
9.1.1	System description
9.1.2	Measurement setup description
9.1.3	Measurement result description

9.2	Mapping of measured values and interpretation
9.3	Measurement report
Annex A	(informative) Electrical energy equivalent
A.1	General
A.2	Compressed air
A.3	Contaminated air extraction
Annex B	(informative) Measuring of energy supplies (other than electrical)
B.1	Measuring of pneumatic energy
B.2	Measuring of heat exchange
B.3	Measuring of contaminated air flow and air exchange
Annex C	(informative) Measurement example
C.1	Machine tool description
C.2	Measurement setup description
C.3	Ambient conditions
C.4	Operating states
C.5	Machine tool activity
C.6	Measurement result description
C.7	Results
C.7.1	Definition of relevant operating states
C.7.2	Electrical energy equivalent
C.7.3	Parameters for calculations
C.7.4	Calculation
C.7.5	Estimation of uncertainty
C.7.6	Final result
C.8	Functional description
Annex D	(informative) Equations for the calculation of energy supplied and energy efficiency
Annex E	(informative) Examples of power measurement setup
E.1	Single feeding point electrical power measurement
E.2	Power measurement at electric motors
E.2.1	General
E.2.2	Motor starters
E.2.3	Inverter system with single motor
E.2.4	Inverter system with more than one motor
E.3	Power measurement at hydraulic pump systems
E.4	Power measurement at cylinders and fluid motors
E.4.1	Cylinder with valve control
E.4.2	Cylinder with servo drive units
E.4.3	Fluid motors
E.4.4	Seal and guide friction power
E.5	Mechanical gears
E.6	Pneumatic power

Page count: 51