
Electromagnetic compatibility (EMC) - Product family standard for machine tools -
Part 2: Immunity

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EUROPEAN STANDARD

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NORME EUROPÉENNE

EUROPÄISCHE NORM

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English version

**Electromagnetic compatibility (EMC) -
Product family standard for machine tools
Part 2: Immunity**

Compatibilité électromagnétique (CEM) -
Norme de famille de produits
pour les machines-outils
Partie 2: Immunité

Elektromagnetische Verträglichkeit (EMV) -
Produktfamilienorm für
Werkzeugmaschinen
Teil 2: Störfestigkeit

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This European Standard was approved by CENELEC on 2002-11-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

This European Standard was prepared by the Technical Committee CENELEC TC 210, Electromagnetic compatibility (EMC).

The text of the draft was submitted to the formal vote and was approved by CENELEC as EN 50370-2 on 2002-11-01.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2003-11-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2005-11-01

This standard is intended for publication in the Official Journal of the European Communities as harmonized standard for the assessment of conformity with the protection requirements of the Electromagnetic Compatibility Directive (89/336/EEC).

The purpose of this product family standard is

- to establish uniform requirements for the electromagnetic immunity of the machine tools contained in the scope,
- to fix test specifications of immunity,
- to refer to basic standards for methods of testing,
- to standardise conditions during the tests, performance criteria and test report format for the assessment of conformity.

Annexes designated "normative" are part of the body of the standard.

Annexes designated "informative" are given for information only.

In this standard, Annexes A, B and C are normative and Annexes D and E are informative.

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1 Scope

This standard deals with the electromagnetic immunity of machine tools designed exclusively for industrial and similar purposes that use electricity, the rated voltage of the machine tool not exceeding 1 000 V a.c. or 1 500 V d.c. between lines.

Machine tools may incorporate motors, heating elements or their combination, may contain electric or electronic circuitry, and may be powered by the mains, or any other electrical power source.

This immunity standard may also be used for assessment of equipment used in other environments, which require less stringent immunity levels (residential, light industry...) than the industrial environment.

This standard is not intended for the EMC conformity assessment of modules to be placed on the market separately.

This standard is not intended for complying with Machinery Directive 98/37/EC. Hence safety considerations are not covered by this standard.

This standard does not cover fixed installations as defined in the Guide to the Application of Directive 89/336/EEC, published by the European Commission.

This standard does not apply to apparatus intended to be used in locations where special electromagnetic conditions prevail, such as the presence of high electromagnetic fields (e.g. in the vicinity of a broadcast transmitting station) or where high pulses occur on the power network (e.g. in a power generator station). In these instances special mitigation measures may have to be employed.

Immunity requirements in the frequency range 0 Hz to 400 GHz are covered. No measurements need to be performed at frequencies where no requirements are specified.

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2 References

2.1 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 61000-4-2	Electromagnetic compatibility (EMC) — Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test (IEC 61000-4-2)
EN 61000-4-3	Electromagnetic compatibility (EMC) — Part 4-3: Testing and measurement techniques – Radiated, radio-frequency electromagnetic field immunity test (IEC 61000-4-3)
EN 61000-4-4	Electromagnetic compatibility (EMC) — Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test (IEC 61000-4-4)
EN 61000-4-5	Electromagnetic compatibility (EMC) — Part 4-5: Testing and measurement techniques – Surge immunity test (IEC 61000-4-5)

EN 61000-4-6 ¹⁾	Electromagnetic compatibility (EMC) — Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields (IEC 61000-4-6)
EN 61000-4-8	Electromagnetic compatibility (EMC) — Part 4-8: Testing and measurement techniques – Power frequency magnetic field immunity test (IEC 61000-4-8)
EN 61000-4-11	Electromagnetic compatibility (EMC) — Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests (IEC 61000-4-11)
IEC 60050	International Electrotechnical Vocabulary (IEV)

2.2 Other references

ISBN 92-828-0762-2	1997	Electromagnetic Compatibility (EMC) - Guide to the application of Directive 89/336/EEC
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3 Terms, definitions and abbreviations

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3.1 Terms and definitions

3.1.1

machine tool (MT)

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machine, not portable as a whole during its operation, driven by an external electrical energy source and intended to work typically metal products in the solid state, with material removal (cutting processes as turning, milling, grinding, drilling, machining...) or without material removal (forming processes as bending, forging...)

The machine tool is normally equipped with a power supply, an electrical and electronic assembly for power and control and one or more power drive systems for the movement of mobile elements or parts

3.1.2

module

unit consisting of mechanical, pneumatic, hydraulic, electrical and/or electronic parts (examples: machine bed, tool holder, sensor, spindle unit, cabinet including NC-controller and human-machine-interface, programmable logic controller - PLC, power drive...), intended exclusively for an industrial assembly operation for incorporation in an apparatus or system. A component can be considered as a module

3.1.3

electromagnetically relevant component/module

an electromagnetically relevant component or module for immunity aspects is defined as one that, due to its electromagnetic characteristics, is liable to have its performance degraded by electromagnetic disturbances such that it will influence the EMC characteristics or the intended operation of typical assemblies into which it may be incorporated

¹⁾ At draft stage.

3.1.4**port**

particular boundary of the specified machine tool or module with the electromagnetic environment of the process (IEV 131-02-21 modified)

NOTE By boundary is meant the physical limits of the complete machine tool or module.

3.1.5**signal interface**

input/output (I/O) connection for a line connecting the supervision, control and/or protection module(s) to other parts or modules of the machine tool

3.1.6**power interface**

connections needed for the distribution of electrical power within the machine tool

NOTE A port of a module may be connected to a port of the machine tool, or may form an interface to another module within the machine tool.

3.1.7**entire electrical set**

assembly of all electro-magnetic relevant modules separated from the mechanical structure of the machine tool allowing the assembly to be tested in a reference test site

3.1.8**type test**

test of one or more devices made to a certain design to show that the design meets certain specifications (IEV 151-04-15)

3.1.9**equipment**

generic term, referring to the entire machine tool, the entire electrical set or an electrical/electromechanical module

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3.2 Abbreviations

NOTE Only the abbreviations used in the English version of this part of EN 50370 are mentioned in this subclause. The German and French versions of this part may use other abbreviations. Refer to 3.2 of each language version for details.

a.c.	alternating current
AM	amplitude modulation
CRT	cathode ray tube
d.c.	direct current
EDM	electrical discharge machining
EM	electromagnetic
EFT	electrical fast transient
EMC	electromagnetic compatibility
ESD	electrostatic discharge
EUT	equipment under test
I/O	input/output
LED	light emitting diode
MT	machine tool
PLC	programmable logic controller

r.m.s.	root mean square
T_h	hold time
T_r	rise time

4 System configuration

A basic configuration may consist of (see Figure 1)

- an electrical feeding section,
- control and protection circuits and equipment,
- one or more basic power conditioning units (example: drive modules) performing control and/or conversion of electrical energy,
- one or more actuators and their associated transducers,
- control and sequencing systems such as NC-controllers, programmable controllers and their associated peripherals, programming and debugging tools, test equipment and human-machine interfaces,
- peripherals (transducer(s), operator station, emergency stop devices, etc.),
- the structure and the moving parts driven by the actuator(s).

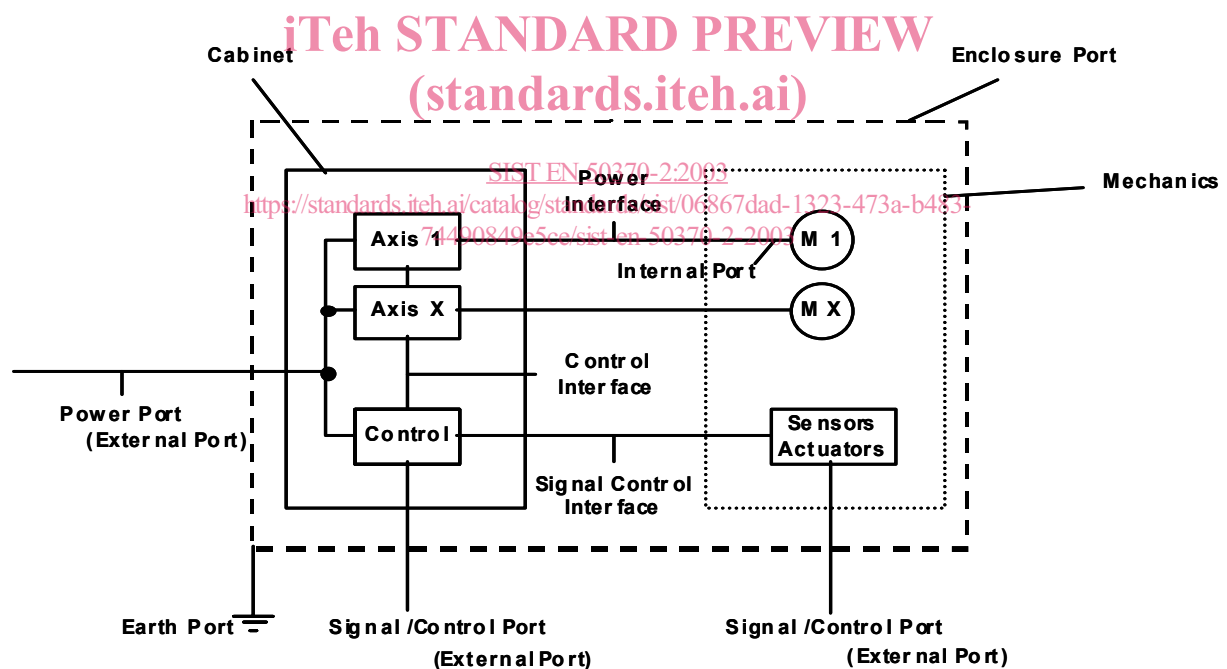


Figure 1 – System configuration and example of ports

4.1 Test approach

Type testing of a finished product is the normal method for conformity assessment, but complete testing of an entire machine tool at a conventional EMC test site is only technically possible and economically feasible for a limited number of machines. A distinction shall be drawn between type-testable machines and machines which, because of the weight, dimensions, operation or unreasonable testing costs and testing delay, cannot be type-tested as a whole at a conventional EMC test site.

Furthermore, it is necessary to take into account single-piece production and the multitude of types as well as expansions and modifications.

Distinctions shall be drawn between the following cases and shall be taken into account:

- type-testable machines;
- machines which are not type-testable;
- multitude of types;
- modifications, additions and expansions.

Each assessment of conformity could be based on one or a combination of various tests:

- type test at the EMC test site;
- visual inspection of entire machine tools;
- additional tests on entire machine tools at manufacturers premises.

4.2 Void

5 Immunity tests

5.1 Classification and testing procedures

The immunity testing procedures are described in the following paragraphs. A flow chart providing an overview of the test procedures is included in the informative Annex E.

5.1.1 Machine tool containing no electromagnetically relevant components

If the machine tool contains no electromagnetically relevant components, no tests have to be carried out.

EXAMPLES Machine tools containing only components such as electric motors, electromechanical switches, thermostats, (rechargeable) batteries etc.

5.1.2 Machine tool containing electromagnetically relevant components

If the machine tool contains electromagnetically relevant components such as electronic control and power parts (sub-assemblies, sub-systems, etc.), one of the procedures laid down in Table 1 shall be carried out. The test procedure is chosen by the manufacturer based on the characteristics of the machine tool.

Table 1 – Test procedures

Test Procedure	Procedure A (Applicable for the entire MT)	Procedure B (Applicable for the entire electrical set)	Procedure C (Applicable for electrical or electromechanical modules)
Type test	Required	Required	Required
Visual inspection of entire MT	Not required	Optional (see note)	Required
Additional tests on entire MT at manufacturers premises	Not required	Optional (see note)	Required

NOTE Visual inspection or additional tests as decided by the manufacturer.

5.1.2.1 Test procedure A

The machine tool shall be tested according to the immunity requirements laid down in this standard (see 5.2 to 5.6 and Annex A).

For tests, the machine tool shall operate as specified by the manufacturer.

The performance criteria (Table 2) shall be used to check the performance of a machine tool before, during and after each immunity test.

5.1.2.2 Test procedure B

The entire electrical set of the machine tool shall be tested according to the specific immunity requirements laid down in this standard (see 5.2 to 5.6 and Annexes A and B) while simulating specific functions to be specified by the manufacturer.

The performance criteria (Table 2) shall be used to check the performance of a machine tool before, during and after each immunity test.

5.1.2.3 Test procedure C

The machine tool shall be divided into modules by the manufacturer in any appropriate fashion to enable the procedure C to be carried out.

After having divided a machine tool into modules, the manufacturer shall classify each module as electromagnetically relevant or irrelevant concerning the immunity of the machine tool.

Electromagnetically irrelevant modules need not be tested.

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Electromagnetically relevant modules shall be subjected to the following steps.

- 1) determine which ports of the machine tool are electrically connected to which port or interfaces of the module (see Annex C, Table C.1);
- 2) the tests shall be applied to all ports of the module which will be used as external ports in the complete machine tool;
- 3) the enclosure ports of all modules are considered to be connected to the enclosure port of the machine tool;
- 4) the module shall be tested according to the immunity requirements laid down in this standard (see 5.2 to 5.6 and Annexes A and C) or according to a harmonised European generic, product family or product immunity standard for the industrial environment.

NOTE The machine tool builder does not need to repeat tests on an EMC compliant module as declared by its manufacturer.

5.2 Test arrangements

Tests shall be applied to the relevant ports of the machine tool or the modules as specified in 5.1.2.1 to 5.1.2.3 and the respective annexes.

However, if several process measurement and control ports or signal interfaces have the same physical configuration (layout) it is sufficient to test one port or interface of that type.

The tests shall be carried out as single tests in sequence. The sequence of testing is optional.

These tests shall be performed normally in the test conditions as specified in the basic immunity standards (these test conditions may include in situ testing, as long as they are specified in the basic immunity standards).