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Ročna oprema za elektrostatično brizganje - Varnostne zahteve - Ročna oprema za brizganje nevnetljivih premazov

Electrostatic hand-held spraying equipment - Safety requirements - Hand-held spraying equipment for non-ignitable coating materials

Elektrostatische Handsprüheinrichtungen - Sicherheitsanforderungen - Handsprüheinrichtungen für nichtentzündbare Beschichtungsstoffe

Équipement manuel de projection électrostatique - Exigences de sécurité - Equipement manuel de projection de revêtement ininflammable

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87.100	Oprema za nanašanje premazov	Paint coating equipment
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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

DRAFT
prEN 50059

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ICS 87.100

Will supersede EN 50059:1990

English version

**Electrostatic hand-held spraying equipment -
Safety requirements -
Hand-held spraying equipment for non-ignitable coating materials**

Équipement manuel de projection
électrostatique - Exigences de sécurité -
Équipement manuel de projection
de revêtement ininflammable

Elektrostatische Handsprüheinrichtungen -
Sicherheitsanforderungen -
Handsprüheinrichtungen für
nichtentzündbare Beschichtungsstoffe

This draft European Standard is submitted to CENELEC members for CENELEC enquiry.
Deadline for CENELEC: 2011-10-28.

It has been drawn up by CLC/TC 204.

If this draft becomes a European Standard, 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.

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CENELEC

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

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1

Foreword

2 This draft European Standard was prepared by the Technical Committee CENELEC TC 204, Safety of
3 electrostatic painting and finishing equipment. It is submitted to the CENELEC enquiry.

4 This document will supersede EN 50059:1990.

5 The significant changes with respect to EN 50059:1990 are as listed below:

- 6 – modification of the title of the standard;
- 7 – extension of introduction;
- 8 – extension of normative references;
- 9 – extension of terms and definitions;
- 10 – new arrangement and extension of the requirements for hand-held spraying equipment for non-ignitable
11 liquid coating materials;
- 12 – definition of requirements for safety functions;
- 13 – new arrangement and extension of tests for hand-held spraying equipment for non-ignitable liquid coating
14 materials;
- 15 – new arrangement and extension of the information for use;
- 16 – definition of requirements for repeated tests;
- 17 – introduction of the normative Annex A "Test of the transferred charge using a shunt and an oscilloscope";
- 18 – introduction of the informative Annex B "Ignitability of water-based paints";
- 19 – introduction of the informative Annex ZZ "Coverage of Essential Requirements of EC directives".
- 20

21 This draft European Standard has been prepared under a mandate given to CENELEC by the European
22 Commission and the European Free Trade Association and covers essential requirements of EC Directive
23 MD (2006/42/EC). See Annex ZZ.

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57 0 Introduction

58 0.1 Process

59 During the electrostatic coating process the non-flammable coating material is transported from a reservoir to
60 an applicator where it is atomised by mechanical forces and by the influence of an electric field. During this
61 atomising process the parts/droplets are charged by high voltage of some 10 kV and a spray cloud is
62 generated. The charged parts/droplets of the coating materials are attracted by and applied to the earthed
63 workpiece.

64 Parts/droplets of the coating material, which are not applied to the workpiece (overspray) are removed by a
65 suction device or by other means.

66 After the coating process the coated workpieces are introduced into a dryer or oven where a dry film of
67 coating material is generated.

68 0.2 Fire hazards

69 **0.2.1** Fire hazards can be caused by deposits of coating materials inside the spray booth, exhaust air
70 ducts, the recovery system for coating materials, and filters. During operation, malfunctions or electrical
71 faults may cause ignition of these residues. This is especially true for spray booths where electrostatic
72 coating takes place. The fast propagation of the fire leads to hazards also in adjacent areas.

73 **0.2.2** Particular attention should be paid to the prevention of electrostatic charges on different surfaces,
74 which are in the vicinity of the spray cloud. This could apply to workpieces during the coating process or the
75 reciprocating devices and the mounting parts of the spraying system, etc.

76 **0.2.3** When spraying non-ignitable coating material, the formation of an explosive atmosphere is not likely
77 to occur. Electrostatic application equipment for ignitable coating materials are covered by EN 50050-1,
78 EN 50050-2, and EN 50050-3.

79 0.3 Electric hazards

80 **0.3.1** Electric shock (by direct or indirect contact) can be generated, for instance, by contact with

- 81 – live parts, which are not insulated for operational reasons,
- 82 – conductive parts, which are not connected to dangerous voltage during normal operation, but only in case
83 of failure,
- 84 – insulated live parts with insufficient or damaged insulation due to external impact.

85 **0.3.2** Inadequate earthing may occur, for instance, due to

- 86 – faulty connections to the protective earthing system,
- 87 – a too high resistance to earth (e. g. contamination by coating materials).

88 **0.3.3** Hazards could occur, for instance, if hazardous malfunctions (e.g. shortcut of electronic safety
89 circuits) occur due to interferences of the electrostatic high voltage equipment and the components of the
90 control and safety systems.

91 **0.3.4** Hazardous electrostatic discharges could be generated, for instance, by non-earthed conductive
92 components or by large insulating surfaces, especially if they are backed with conductive material.

93 1 Scope

94 **1.1** This European Standard specifies the requirements for hand-held or hand-operated electrostatic
95 spraying equipment for non-ignitable coating materials which do not generate an explosive atmosphere
96 inside the spraying area.

97 This European Standard deals with all hazards significant for the electrostatic spraying of non-ignitable
98 coating materials, which could also contain small quantities of added metal particles, if the work is carried out
99 under conditions recommended by the manufacturer.

100 This European Standard specifies the design-related and test requirements for electrostatic spraying
101 equipment of type A-NL according to Table 1 of EN 50348:2010.

102
103
104 **1.2** In addition to the requirements above, the requirements of EN 1953 apply with regard to all other
105 significant hazards relevant for applicators (e.g. ejection of fluids, mechanical strength, electrical (apart from
106 the electrostatic), noise, explosion, contact with or inhalation of dangerous substances, ergonomics).

107 **1.3** Additional requirements may be applicable to equipment designed for use in food and pharmaceutical
108 industry.

109 **1.4** This European Standard does not apply to

110 — cleaning of spraying areas, see instruction manual of the spraying booth,

111 — fire prevention and protection [for instance fire hazards due to other sources; see EN 12215, EN 12981],

112 — requirements for machinery for the supply and recirculation of coating material under pressure
113 [see EN 12621].

114 The requirements of EN 12621 apply for specific requirements for machinery for the supply and recirculation
115 of coating materials under pressure.

116 2 Normative references

117 The following referenced documents are indispensable for the application of this document. For dated
118 references, only the edition cited applies. For undated references, the latest edition of the referenced
119 document (including any amendments) applies.

EN 1149-5		Protective clothing – Electrostatic properties – Part 5: Performance requirements
EN 1953		Atomising and spraying equipment for coating materials – Safety requirements
EN 12215		Coating plants – Spray booths for application of organic liquid coating materials – Safety requirements
EN 60079-7	2007	Explosive atmospheres – Part 7: Equipment protection by increased safety "e"
EN 60204-1		Safety of machinery – Electrical equipment of machines – Part 1: General requirements (IEC 60204-1)
EN 60529		Degrees of protection provided by enclosures (IP code)(IEC 60529)
EN 62061		Safety of machinery – Functional safety of safety-related electrical, electronic and programmable electronic control systems (IEC 62061)
EN ISO 12100		Safety of machinery - General principles for design - Risk assessment and risk reduction (ISO 12100)
EN ISO 13849-1		Safety of machinery – Safety-related parts of control systems - Part 1: General principles for design (ISO 13849-1)
EN ISO 20344		Personal protective equipment – Test methods for footwear (ISO 20344)

120 3 Terms and definitions

121 For the purposes of this document, the following terms and definitions apply.

122 3.1

123 **hand-held spraying equipment**

124 hand-held or hand-operated equipment for electrostatic coating using non-ignitable coating materials,
125 generally comprising the following parts:

126 — applicator;

127 — coating material supply system;

128 — control device;

129 — high voltage supply system;

130 — connecting cable

131 3.2

132 **connecting cable**

133 electric cable to the applicator

134 3.3

135 **earthing device**

136 device for earthing the electrostatic hand-held spraying equipment permanently

137 3.4

138 **spraying device**

139 outlet opening for the coating materials

140 3.5

141 **high voltage electrode**

142 conductive part of the applicator which is at high voltage and serves to directly or indirectly charging of the
143 coating material

144 3.6

145 **control device**

146 device generally having the following functions:

147 — control of, for instance, the coating material supply system and the control air

148 NOTE A combination of the control device and the high voltage supply according to 3.8 is possible.

149 3.7

150 **applicator**

151 equipment for application of coating materials that comprises the following parts in general:

152 — high voltage electrode;

153 — high voltage supply (as far as integrated into the applicator);

154 — housing;

155 — spraying device;

156 — exchangeable attachment parts (e.g. nozzles, extensions, angular pieces, etc.);

157 — if applicable, battery unit (integrated fixedly, or attached)

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- 158 **3.8**
 159 **high voltage supply for applicators**
 160 high voltage supply comprising the following parts in general:
- 161 — low voltage section with devices for switching on and off the hand-held spraying equipment and for
 - 162 adjustment, control, regulation, limitation and monitoring of current and voltage, as well as the required
 - 163 connecting cables;
 - 164 — high voltage generator
- 165 **3.9**
 166 **spraying area**
 167 area, closed or not, in which the coating material is applied to the workpiece by the hand-held spraying
- 168 equipment

169 **3.10**
 170 **dangerous discharge**
 171 discharge which generates a fire hazard and/or a hazard of electric shock

172 **3.11**
 173 **coating material supply system**
 174 coating material supply system that comprises the following in general:

 - 175 — reservoir for coating materials;
 - 176 — dosing and mixing devices for coating materials;
 - 177 — supply lines for coating materials;
 - 178 — devices for drive, control and monitoring supply of coating materials

179 **3.12**
 180 **workpiece**
 181 article to which the coating material is applied

182 **3.13**
 183 **non-ignitable coating materials (coating material)**
 184 liquids or powders, especially varnishes and inorganic coating powders which cannot be ignited by an
- 185 effective ignition source during spraying

186 NOTE 1 A formula for the estimation of ignitability of liquid paints and varnishes on the basis of the composition of the

187 coating material is given in Annex B. Liquids the composition of which does not fall in scope of the formula, e.g.

188 chlorinated liquids, have to be tested experimentally.

189 NOTE 2 Inorganic powders, except for metal powders, do not form an explosive atmosphere of powders in air.

190 **3.14**
 191 **discharge energy**
 192 energy discharged from a conductive part of the installation in form of a spark which could cause both
- 193 electric shock to a person and an ignition of an explosive atmosphere

194 **3.15**
 195 **antistatic footwear**
 196 footwear that has a resistance to earth via its sole, which is low enough to prevent the build-up of
- 197 electrostatic charges capable to produce an incendive discharge

198 NOTE 1 See EN ISO 20344.

199 NOTE 2 A required electric insulating resistance to prevent electric shocks is not contradictory to this definition.

200 **3.16**
 201 **antistatic clothes**
 202 clothes that have a resistance to earth, which is low enough to prevent the build-up of electrostatic charges
- 203 capable of an incendive discharge

204 NOTE 1 See EN 1149-5.

205 NOTE 2 A required electric insulating resistance to prevent electric shocks is not contradictory to this definition.

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- 206 **3.17**
 207 **antistatic floor**
 208 floor that has a resistance to earth, which is low enough to prevent the build-up of electrostatic charges
 209 capable to produce an incendive discharge
- 210 **3.18**
 211 **accessories**
 212 accessories are all devices, components and other equipment, except for 3.7 of this standard
- 213 **3.19**
 214 U_{\max}
 215 maximum output voltage of the high-voltage generator
- 216 **3.20**
 217 I_{\max}
 218 maximum output current of the high-voltage generator
- 219 **3.21**
 220 **repeated test**
 221 test of the hand-held spraying equipment, including all accessories, to be carried out at regular intervals
- 222 **4 Requirements for hand-held spraying equipment for non-ignitable coating**
 223 **materials**
- 224 **4.1 General requirements**
- 225 **4.1.1** Hand-held spraying equipment shall be designed and constructed to prevent exceeding of a
 226 maximum discharge energy of 350 mJ, or a maximum transferred charge of 50 μC .
- 227 **4.1.2** All conductive parts of the hand-held spraying equipment which are not at high voltage potential shall
 228 be earthed. Earthing of conductive parts inside the hand-held spraying equipment can be neglected if
 229 hazardous discharges have been prevented by design. Conductive parts connected to measuring and
 230 control circuits shall be earthed with a resistance of $\leq 100 \text{ M}\Omega$. Parts which are at high voltage for operational
 231 reasons shall be bonded to each other in a conductive way.
- 232 **4.1.3** Applicators shall meet the requirements of EN 1953.
- 233 **4.1.4** Electrical connecting cables shall be connected with the applicator in a safe and permanent way.
- 234 **4.1.5** The handle of the applicator shall have a contact surface area of conductive material of at least
 235 20 cm^2 . This contact surface area shall be earthed, and the resistance to earth shall not exceed $1 \text{ M}\Omega$.
- 236 **4.1.6** Operating triggers of applicators shall be dissipative and shall automatically take the OFF-position. In
 237 this position, the high voltage supply shall be cut-off immediately, and the coating material supply system
 238 shall be cut-off within 2 s. For high voltage supplies having several outputs, the cut-off function shall be
 239 ensured for each output/applicator individually.
- 240 **4.1.7** Applicators shall have an earth connection. The resistance to earth shall not exceed $1 \text{ M}\Omega$. The
 241 connection shall be designed in accordance with 4.2.1 of EN 60079-7:2007.
- 242 **4.1.8** Components on which safety in respect of persons depends shall be designed, arranged and built in
 243 to not impair the safety of the electrostatic hand-held spraying equipment. Examples of components on
 244 which safety in respect of persons depends are spray nozzles, cables of the earthing system, resistances
 245 and other electronic components.
- 246 **4.1.9** The electric equipment not connected to the high voltage system shall comply with EN 60204-1.
- 247 **4.1.10** If energy limiting electric components (e.g. resistances) are used, they shall be designed in such a
 248 way that they are protected from damage. This can be fulfilled by switching off the applicator automatically.
 249 As an alternative all components shall withstand a short circuit between the high voltage electrode and earth
 250 for 5 min. Furthermore, the degree of protection shall remain unchanged.

251 **4.1.11** Applicators, except for the spraying device, shall be at least of degree of protection IP54 according
252 to EN 60529.

253 **4.1.12** Electrical cables connected to the applicator shall have an earthed shielding which is protected
254 against mechanical damage (e.g. by insulation).

255 **4.1.13** Safety related functions of the hand-held spraying equipment shall function independent of the
256 measurement and control devices required for the coating process. This can be satisfied by compliance with
257 the requirements for safety integrity level 2 (e.g. according to EN 62061) or PL d (e.g. according to
258 EN ISO 13849-1).

259 In general, the fail-safe principle shall be applied.

260 In case of failure of the safety functions the hand-held spraying equipment shall be led in a safe state.

261 If the safety related functions of the hand-held spraying equipment depend on software, hazards due to
262 program errors shall be considered in particular.

263 **4.2 Requirements for the accessories**

264 **4.2.1** Accessories to be used in spraying areas shall at least comply with the requirements of degree of
265 protection IP54 according to EN 60529.

266 **4.2.2** Control devices shall have an earth connection. The resistance to earth shall not exceed 1 M Ω .

267 **4.2.3** The operating parameters relevant for safety, operational voltage, operational current and short
268 circuit current, shall not be set to values deviating from the checked limit values defined in 5.4.1.1 to 5.4.1.3.

269 **4.2.4** Detachable earth connections shall be marked clearly.

270 **4.2.5** In case conductive parts are used for coating material supply system, these parts shall be earthed
271 according to 4.2.2, or shall be connected to the high voltage supply in such a way that their potential is
272 permanently identical with that of the applicator. The equipotential bonding shall be done by means of a
273 discrete electronic conductor. The discharge energy shall be limited according to 4.1.1.

274 **4.2.6** All parts of the coating material supply system made of non-conducting material shall pass the high-
275 voltage test according to 5.4.2.1, with the coating material at high voltage potential during normal operation.
276 The discharge energy shall be limited according to 4.1.1.

277 **5 Tests**

278 **5.1 General**

279 All tests described in 5.2, 5.3, 5.4 and 5.5 shall be carried out with two applicators according to the following
280 order: cable pull test, impact test, drop test, test of electrical safety and test of the transferred charge.

281 All tests described in 5.2, 5.3, 5.4 and 5.5 shall be carried out with cleaned applicators.

282 The value of the output high voltage and output current shall be set to the maximum value during the tests
283 according to 5.4.1.1 to 5.4.1.3 and 5.5. The manufacturer shall indicate the required relevant operational
284 parameters (e.g. supply voltage).

285 **5.2 General tests**

286 **5.2.1 Test of earth connections**

287 It shall be tested that the hand-held spraying equipment has an earth connection complying with 4.1.7, 4.1.9
288 and 4.2.2.