



SLOVENSKI STANDARD
oSIST prEN IEC 62822-3:2022
01-julij-2022

Električna varilna oprema - Ocenjevanje omejitev z vidika izpostavljenosti ljudi elektromagnetnim poljem (od 0 Hz do 300 Hz) - 3. del: Oprema za uporovno varjenje

Electric welding equipment - Assessment of restrictions related to human exposure to electromagnetic fields (0 Hz to 300 Hz) - Part 3: Resistance welding equipment

**iTeh STANDARD
PREVIEW**

Matériels de soudage électrique - Évaluation des restrictions relatives à l'exposition humaine aux champs électromagnétiques (0 Hz à 300 GHz) - Partie 3: Matériels de soudage par résistance

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13.280	Varstvo pred sevanjem	Radiation protection
25.160.30	Varilna oprema	Welding equipment

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26/732/CDV

COMMITTEE DRAFT FOR VOTE (CDV)

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26/729/CD, 26/731/CC

IEC TC 26 : ELECTRIC WELDING	
SECRETARIAT: Austria	SECRETARY: Mr Josef Feichtinger
OF INTEREST TO THE FOLLOWING COMMITTEES:	PROPOSED HORIZONTAL STANDARD: <input type="checkbox"/>
Other TC/SCs are requested to indicate their interest, if any, in this CDV to the secretary.	
FUNCTIONS CONCERNED: <input type="checkbox"/> EMC <input type="checkbox"/> ENVIRONMENT <input type="checkbox"/> QUALITY ASSURANCE <input checked="" type="checkbox"/> SAFETY	
<input checked="" type="checkbox"/> SUBMITTED FOR CENELEC PARALLEL VOTING	<input type="checkbox"/> NOT SUBMITTED FOR CENELEC PARALLEL VOTING
<p>Attention IEC-CENELEC parallel voting</p> <p>The attention of IEC National Committees, members of CENELEC, is drawn to the fact that this Committee Draft for Vote (CDV) is submitted for parallel voting.</p> <p>The CENELEC members are invited to vote through the CENELEC online voting system.</p>	

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Recipients of this document are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

TITLE:

Electric welding equipment - Assessment of restrictions related to human exposure to electromagnetic fields (0 Hz to 300 Hz) - Part 3: Resistance welding equipment

PROPOSED STABILITY DATE: 2025

NOTE FROM TC/SC OFFICERS:

CONTENTS

2		
3		
4		
5	FOREWORD.....	6
6	1 Scope.....	8
7	2 Normative references	8
8	3 Terms, definitions, quantities, units and constants.....	9
9	3.1 Terms and definitions.....	9
10	3.2 Quantities and units	11
11	3.3 Constants	11
12	3.4 Symbols.....	11
13	4 Requirements	12
14	5 Assessment methods.....	12
15	5.1 General.....	12
16	5.2 Methods based on external magnetic fields.....	13
17	5.2.1 General	13
18	5.2.2 Assessment based on measured magnetic field.....	14
19	5.2.3 Assessment based on calculated magnetic field	16
20	5.3 Methods based on assessment of corporal quantities (basic restrictions).....	18
21	5.3.1 General	18
22	5.3.2 Method based on coupling coefficients	18
23	5.3.3 Method based on correction factor.....	20
24	5.3.4 Method based on human model simulation	21
25	5.3.5 Result comparison	23
26	6 Measurement considerations.....	23
27	6.1 Measurement instruments for magnetic fields or exposure levels.....	23
28	6.1.1 General.....	23
29	6.1.2 Probe(s)	23
30	6.1.3 Handheld field meter	24
31	6.1.4 Measurement system with separate elements	24
32	6.2 Instruments for recording	25
33	6.2.1 Welding current recording.....	25
34	6.2.2 Magnetic field recording	25
35	6.3 Signal processing (applicable on any welding current waveform)	25
36	6.3.1 General	25
37	6.3.2 Application of the weighted peak method in the time domain	26
38	6.3.3 Spatial averaging.....	26
39	6.3.4 Time averaging.....	26
40	6.4 Uncertainty of assessment.....	26
41	7 Computational assessment methods.....	26
42	7.1 General.....	26
43	7.2 Quasi-static approximation.....	27
44	7.3 Human body models for numerical simulation	27
45	7.4 Computational assessment against the basic restrictions.....	28
46	8 Source model	29
47	8.1 General.....	29
48	8.2 Source model example.....	29
49	9 EMF data sheet and assessment report.....	30

50	Annex A (informative) Example of assessment based on the individual components	32
51	A.1 Introduction	32
52	A.2 Welding current generator	32
53	A.3 Coupling coefficient of welding circuit	34
54	A.4 Welding-system	36
55	Annex B (informative) Data sheets	38
56	B.1 Current generator datasheet	38
57	B.2 Data sheet of the welding circuit	39
58	B.3 Data sheet of equipment assembly	40
59	Annex C (informative) Coupling coefficient method	43
60	C.1 Principle	43
61	C.2 Validation of this method	43
62	C.2.1 Context	43
63	C.2.2 Basic restriction against health effects	44
64	C.2.3 Basic restriction against sensory effects	44
65	C.3 Conclusion	45
66	Annex D (informative) Correction factor method	46
67	D.1 General	46
68	D.2 Principle	46
69	D.3 Example of correction factor finding	46
70	D.3.1 Context	46
71	D.3.2 Exposure index factor for the trunk and limbs	47
72	D.3.3 Exposure index factor for the head	47
73	D.4 Conclusion	48
74	Annex E (informative) Example of exposure assessments on a welding machine	49
75	E.1 Description of the spot welding workstation	49
76	E.2 Exposure conditions	49
77	E.3 Main simulation parameters and results	51
78	E.3.1 Main simulation parameters	51
79	E.3.2 Simulation results	51
80	E.4 Exposure assessments	51
81	E.4.1 Method based on magnetic field calculation (see § 5.2.3)	52
82	E.4.2 Method based on coupling coefficients (see § 5.3.2)	52
83	E.4.3 Method based on the correction factor (see § 5.3.3)	52
84	E.4.4 Method based on human model (see § 5.3.4)	53
85	E.5 Conclusion	53
86	Annex F (informative) Numerical simulation methods	54
87	F.1 General	54
88	F.2 SPFD method	54
89	F.3 Quasi-static – finite element method	54
90	F.4 Impedance method	55
91	F.5 Hybrid technique of FEM and SPFD method	56
92	F.6 Computation of the magnetic vector potential	56
93	Annex G (informative) Averaging algorithms	58
94	G.1 Current density averaging over an area	58
95	G.1.1 General	58
96	G.1.2 Calculation of the current density in a Cartesian voxel	58
97	G.1.3 Calculation of the current density in a tetrahedron	59

98	G.1.4	Calculation of J_{avg}	59
99	G.2	E-field averaging in a cubical volume	59
100	G.3	E-field averaging along an averaging distance	60
101	G.3.1	General	60
102	G.3.2	Algorithm to construct the integration path.....	61
103	Annex H (informative)	Correspondence table between time domain and frequency	
104		domain	62
105	Bibliography.....		63
106			
107			
108	Figure 1 – Flowchart for the assessment procedure		13
109	Figure 2 – Exposure measurement at head position.....		15
110	Figure 3 – Exposure measurement at trunk position.....		15
111	Figure 4 – Exposure measurement at limb positions (hands and thigh)		16
112	Figure 5 – Compliance perimeters according reference levels (Action levels).....		17
113	Figure 6 – Compliance perimeters according basic restrictions (Exposure Limit Values)		20
114	Figure 7 – Magnetic field around the human body obtained by source modelling.....		21
115	Figure 8 – Example of induced electric field in a human body exposed to a welding gun		
116	($I = 1\text{ kA} - 50\text{ Hz}$)		23
117	Figure 9 – Welding current flowing in an ($a \times b$) rectangular loop configuration		29
118	Figure A.1 – Assessment of a complete welding system		32
119	Figure A.2 – Typical component based assessment.....		32
120	Figure A.3 – LF-AC (left) and MF-DC (right) current waveforms		33
121	Figure A.4 – Combined ELV for the sensory and health effects applicable for the head.....		33
122	Figure A.5 – Current exposure indices over the time for 2 welding technologies		34
123	Figure A.6 – Geometry of the stationary spot-welding gun		35
124	Figure A.7 – Welding electric circuit model (m) and 1 point of interest along x axis		35
125	Figure A.8 – Coupling coefficient CC_{BI} along x axis		36
126	Figure A.9 – Exposure index (AL) along x axis		36
127	Figure A.10 – Exposure index (ELV) along x axis		37
128	Figure B.1 – Datasheet of the power source		38
129	Figure B.2 – Datasheet of the electrode assembly		39
130	Figure B.3 – Datasheet of the welding system		40
131	Figure B.4 – Datasheet of the welding system (continuation)		41
132	Figure B.5 – Datasheet of the welding system (continuation)		42
133	Figure C.1 – Distribution of human to disk model exposure index ratios (health effects		
134	ELV on trunk and hands)		44
135	Figure C.2 – Distribution of human to disk model exposure index ratios (sensory and		
136	health effects ELV on the head)		44
137	Figure D.1 – Distribution of correction factor k_{E} for health effects on trunk and hands		47
138	Figure D.2 – Distribution of correction factor k_{E} for the head (sensory and health)		
139	effects		47
140	Figure E.1 – welding gun and its electric circuit model (yellow dash segments).....		49
141	Figure E.2 – Magnetic field distribution around the exposed body		50

142	Figure E.3 – Configuration and electric field distribution on the exposed body (per 1kA	
143	at f = 50 Hz).....	50
144	Figure E.4 – Electric field distribution on hands (per 1kA at f = 50 Hz).....	51
145	Figure G.1 – Field components on voxel edges.....	59
146		
147		
148	Table 1 – Examples of human models to determine induced electric fields in low	
149	frequency range.....	27
150	Table A.1 – Current exposure index for AC-LF technology ($I_{rms} = 11,4$ kA).....	34
151	Table A.2 – GP current exposure index for AC-LF technology ($I_{rms} = 11,4$ kA).....	34
152	Table C.1 – Representative disk radius (geometric model).....	43
153	Table C.2 – Coupling coefficients.....	45
154	Table E.1 – Coupling coefficients for the magnetic field and on human model.....	51
155	Table E.2 – Results based on magnetic field calculation.....	52
156	Table E.3 – Results based on coupling coefficients.....	52
157	Table E.4 – Results based on the correction factor.....	52
158	Table E.5 – Results based on human model.....	53
159	Table H.1 – Transcription of relationships.....	62
160		

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTRIC WELDING EQUIPMENT – ASSESSMENT OF RESTRICTIONS RELATED TO HUMAN EXPOSURE TO ELECTROMAGNETIC FIELDS (0 HZ TO 300 GHZ)

Part 3: Resistance welding equipment

FOREWORD

- 173 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising
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204 International Standard IEC 62822-3 has been prepared by IEC technical committee 26: Electric
205 welding.

206 This second edition cancels and replaces the first edition published in 2017. This edition
207 constitutes a technical revision. This edition includes the following significant technical changes
208 with respect to the previous edition:

- 209 a) Including the uncertainties in the results of assessment
210 b) Simplifying methods of exposure assessment

211 The text of this International Standard in CD version is based on the following documents:

Draft	Report on voting
WG5_367_INF	WG5_364_RM

212
213 Full information on the voting for its approval can be found in the report on voting indicated in
214 the above table.

215 The language used for the development of this International Standard is English.

216 This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in
217 accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available
218 at https://www.iec.ch/members_experts/refdocs. The main document types developed by IEC
219 are described in greater detail at <https://www.iec.ch/standardsdev/publications>.

220 The committee has decided that the contents of this document will remain unchanged until the
221 stability date indicated on the IEC website under webstore.iec.ch in the data related to the
222 specific document. At this date, the document will be

- 223 • reconfirmed,
- 224 • withdrawn,
- 225 • replaced by a revised edition, or
- 226 • amended.

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227 **ELECTRIC WELDING EQUIPMENT – ASSESSMENT OF**
228 **RESTRICTIONS RELATED TO HUMAN EXPOSURE TO**
229 **ELECTROMAGNETIC FIELDS (0 HZ TO 300 GHZ)**

230
231 **Part 3: Resistance welding equipment**
232

233 **1 Scope**

234 This part of IEC 62822 applies to equipment for resistance welding and allied processes
235 designed for occupational use by professionals and for use by laymen.

236 More generally, this document covers equipment for which the welding current flows in an
237 electrical circuit whose geometry cannot be changed and regardless of the technology of the
238 current generator (for example LF-AC, MF-DC for spot or seam welding or capacitive discharge
239 used for stud welding).

240 NOTE 1 Allied processes as resistance hard and soft soldering or resistance heating achieved by means
241 comparable to resistance welding equipment are included as well.

242 This document specifies procedures for the assessment of human exposure to magnetic fields
243 produced by resistance welding equipment. It covers non-thermal biological effects in the
244 frequency range from 0 Hz to 10 MHz and defines standardized test scenarios.

245 NOTE 2 The general term “field” is used throughout this document for “magnetic field”.

246 NOTE 3 For the assessment of exposure to electric fields and thermal effects, the methods specified in the Generic
247 Standard IEC 62311 or relevant basic standards apply.

248 This document aims to propose methods for providing EMF exposure data that can be used to
249 assist in the assessment of the workplace, especially when the conditions of use of the
250 equipment are not known. When these are technically constrained (for example, a double hand
251 control imposes the position and posture of the user), the data can be directly exploitable if they
252 fall within the scope specified by the manufacturer or the integrator.

253 Other standards can apply to products covered by this document. In particular this document
254 cannot be used to demonstrate electromagnetic compatibility with other equipment. It does not
255 specify any product safety requirements other than those specifically related to human exposure
256 to electromagnetic fields.

257 This document proposed several methods to assess the exposure to EMF from simple to
258 sophisticated. In return, the last is also the most precise.

259 **2 Normative references**

260 The following documents are referred to in the text in such a way that some or all of their content
261 constitutes requirements of this document. For dated references, only the edition cited applies.
262 For undated references, the latest edition of the referenced document (including any
263 amendments) applies.

264 IEC 61786-1, *Measurement of DC magnetic, AC magnetic and AC electric fields from 1 Hz to*
265 *100 kHz with regard to exposure of human beings – Part 1: Requirements for measuring*
266 *instruments*

267 IEC 61786-2, *Measurement of DC magnetic, AC magnetic and AC electric fields from 1 Hz to*
268 *100 kHz with regard to exposure of human beings – Part 2: Basic standard for measurements*

269 IEC 62226-2-1, *Exposure to electric or magnetic fields in the low and intermediate frequency*
 270 *range – Methods for calculating the current density and internal electric field induced in the*
 271 *human body – Part 2-1: Exposure to magnetic fields – 2D models*

272 IEC 62311, *Assessment of electronic and electrical equipment related to human exposure*
 273 *restrictions for electromagnetic fields (0 Hz – 300 GHz)*

274 IEC 62233, *Measurement methods for electromagnetic fields of household appliances and*
 275 *similar apparatus with regard to human exposure*

276 IEC 62822-1, *Electric welding equipment – Assessment of restrictions related to human*
 277 *exposure to electromagnetic fields (0 Hz to 300 GHz) – Part 1: Product family standard*

278 EN 50527-1-1:2017: *Procedure for the assessment of the exposure to electromagnetic fields of*
 279 *workers bearing active implantable medical devices - Part 1: general*

280 EN 50527-2-1:2016: *Procedure for the assessment of the exposure to electromagnetic fields of*
 281 *workers bearing active implantable medical devices - Part 2-1: Specific assessment for workers*
 282 *with cardiac pacemakers*

283 EN 50527-2-2:2018: *Procedure for the assessment of the exposure to electromagnetic fields of*
 284 *workers bearing active implantable medical devices – Part 2-2: Specific assessment for workers*
 285 *with cardioverter defibrillators (ICDs)*

286 **3 Terms, definitions, quantities, units and constants**

287 **3.1 Terms and definitions**

288 For the purposes of this document, the terms and definitions given in IEC 60050-851, IEC
 289 60974-1, IEC 60974-6, and the following apply.

290 ISO and IEC maintain terminological databases for use in standardization at the following
 291 addresses:

- 292 • IEC Electropedia: available at <https://www.electropedia.org/>
- 293 • ISO Online browsing platform: available at <https://www.iso.org/obp>

294 **3.1.1**

295 **basic restrictions**

296 restrictions on exposure to electric, magnetic and electromagnetic fields that are based directly
 297 on established health effects and biological considerations. Basic restrictions are also named
 298 dosimetric reference limits (DRLs) and exposure limit values (ELVs).

299 **3.1.2**

300 **coupling-coefficient**

301 coupling-coefficient CC_{YX} establishes relation allowing to estimate Y from X. For example, CC_{EI}
 302 gives the maximum induced electric field inside a region of the human body according a unit
 303 welding current.

304 Note 1 to entry: Keeping in mind that the electric conductivity can be frequency dependent, a conversion between
 305 CC_{JI} and CC_{EI} or CC_{JB} and CC_{EB} is possible with the relation given in Formula (1)

$$J(j\omega) = \sigma(j\omega) \cdot E(j\omega) \quad (1)$$

306 where

307 σ is the conductivity, expressed in siemens per meter;

308 E is the electric field strength, expressed in volt per meter

309 ω is equal to $2\pi f$

310 **3.1.3**

311 **exposure index**

312 EI

313 result of the evaluation of exposure to (both sinusoidal and non-sinusoidal) EMF, expressed as
314 a fraction or percentage of the permissible values.

315 Note 1 to entry: Fractions higher than 1 (100 %) exceed the permissible values.

316 **3.1.4**

317 **general public**

318 individuals of all ages and of varying health conditions

319 **3.1.5**

320 **intracorporeal**

321 situated or occurring within the body

322 **3.1.6**

323 **layman**

324 operator who does not weld in the performance of his profession and may have little or no
325 formal instruction in welding

326 [SOURCE: IEC 60050-851, 851-11-14, modified – "Arc welding" was replaced by "welding".]

327 **3.1.7**

328 **non-thermal effect**

329 stimulation of muscles, nerves or sensory organs as a result of human exposure to EMF

330 **3.1.8**

331 **occupational exposure**

332 exposure of workers to EMF at their workplaces, generally under known conditions, and as a
333 result of performing their regular or assigned job activities

334 Note 1 to entry: A worker is any person employed by an employer, including trainees and apprentices

335 **3.1.9**

336 **reference level**

337 directly measurable quantity, derived from basic restrictions, provided for practical exposure
338 assessment purposes. Reference levels are also named exposure reference levels (ERLs) and
339 action levels (ALs).

340 Note 1 to entry: Respect of the reference levels will ensure respect of the relevant basic restriction. If the reference
341 levels are exceeded, it does not necessarily follow that the basic restriction will be exceeded.

342 **3.1.10**

343 **resistance welding system**

344 a combination of power source, transformer, cabling and welding circuit

345 **3.1.11**

346 **sensory effect**

347 transient disturbed sensory perceptions and minor change in brain functions as a result of
348 human exposure to EMF

349 **3.1.12**

350 **standardized configuration**

351 configuration reflecting the normal operator positions

352 **3.1.13**353 **standardized distance**

354 distance from the axis of a part of the welding circuit to the closest surface of the body in
355 standardized configurations

356 **3.1.14**357 **welding circuit**

358 conductive material through which the welding current is intended to flow

359 Note 1 to entry: In resistance welding, the workpieces are not part of the welding circuit for the purposes of this
360 document

361 [SOURCE: IEC 60050-851, 851-14-10, modified – The two notes to entry have been deleted,
362 and a new note to entry has been added.]

363 **3.2 Quantities and units**

364 The internationally accepted SI units are used throughout this document.

365 Symbols throughout this document set in bold type are vector quantities.

Physical quantity	Symbol	Unit	Dimension
Electric conductivity	σ	siemens per metre	$S \cdot m^{-1}$
Electric current	I	ampere	A
Electric current density	J	ampere per square metre	$A \cdot m^{-2}$
Electric field strength	E	volt per metre	$V \cdot m^{-1}$
Frequency	f	hertz	Hz
Magnetic flux density	B	tesla	T ($V \cdot s/m^2$)
Magnetic permeability	μ	henry per metre	$H \cdot m^{-1}$
Wavelength	λ	metre	m

366

367 **3.3 Constants**

Physical constant	Symbol	Magnitude	Dimension
Permeability of free space	μ_0	$4 \times \pi \times 10^{-7}$	$H \cdot m^{-1}$

368

369 **3.4 Symbols**

370 Symbols used in this document are expanded hereafter.

Symbols	Meaning
*	Convolution product i.e. $B(t) * WL(t)$ means filtering $B(t)$ by $WL(t)$
t	Time
f	Frequency of a single frequency signal
$B(t)$	Magnetic flux density (magnetic field) in time domain
$B(f)$	Magnetic flux density (magnetic field) in frequency domain
$B_{RL}(f)$	B reference level at f
$W_{RL}(t)$	Time (impulse) response of the weighted filter according reference level
$W_{RL}(f)$	Frequency response of the weighted function according reference level
EI_{RL}	Exposure index according reference level
$I(t) / I$	Welding current in time domain/frequency domain
CC_{BI}	Coupling coefficient from I to B (frequency independent)

\mathcal{F}^{-1}	Inverse Fourier transform
dB/dt	Time derivate of the magnetic flux density
R	Disk radius of 2D geometric model
E_i	Induced or internal electric field
dI/dt	Time derivate of the welding current
$W_{BR}(t)$	Time (impulse) response of the weighted filter according the basic restriction
$W_{BR}(f)$	Frequency response of the weighted function according the basic restriction
$CC_{EB/2D}$	Coupling coefficient from B to E_i with geometric model
$CC_{EI/HM}$	Coupling coefficient from I to E_i with human model
EI_{BR}	Exposure index according exposure limit value (basic restriction)
k_E	Exposure index coefficient
CEI_{BR}	Current exposure index according basic restrictions

371

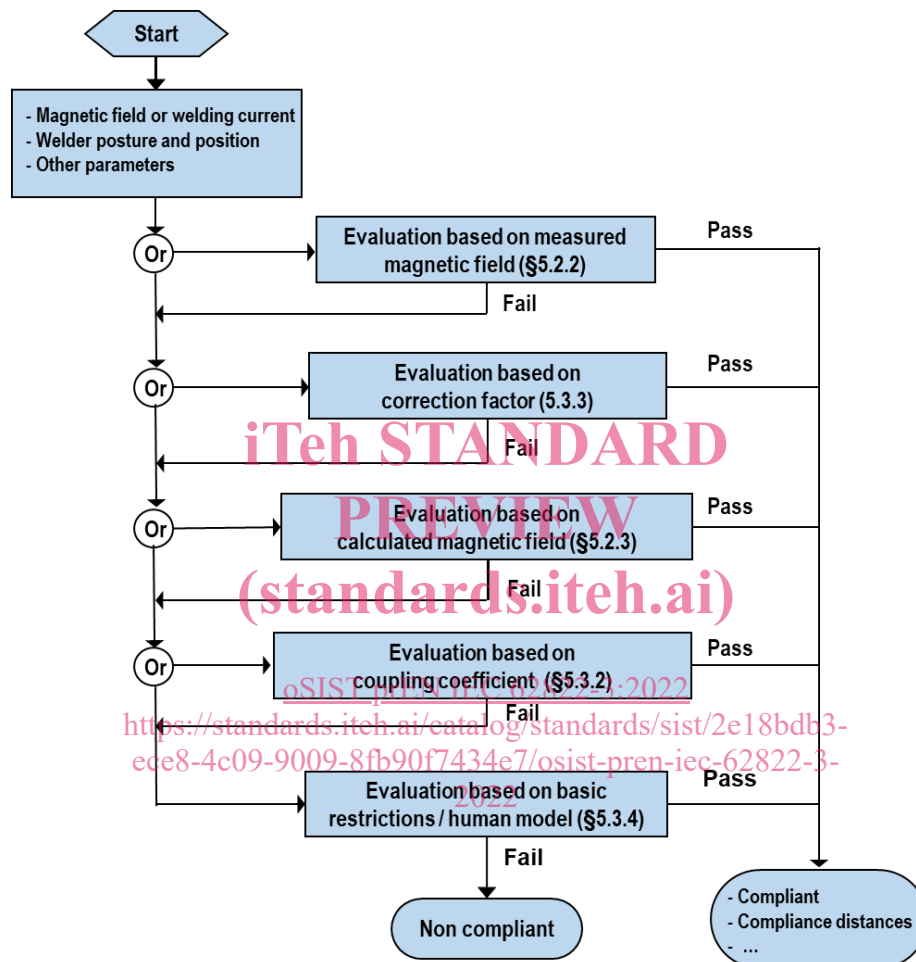
372 **4 Requirements**

373 Equipment shall be assessed as defined in Clause 5.

374 If the assessment is conducted using measured or calculated external field levels, Clause 5.2
375 shall be applied in conjunction with Clause 6.376 If the assessment is conducted using corporal quantities, Clause 5.3 shall be applied in
377 conjunction with Clause 6 if measurements are performed and in conjunction of Clause 7 if a
378 human model is applied379 The results shall be reported as specified in Clause 9.
<https://standards.iteh.ai/catalog/standards/sist/2e18bdb3-ece8-4c09-9009-8fb90f7434e7/osist-pren-iec-62822-3-2022>380 **5 Assessment methods**381 **5.1 General**382 This clause provides basic assessment methods considering the direct effects of
383 electromagnetic fields [2], [3], [4], [5], [6], [7], [8]. Evaluations are made either against basic
384 restrictions or against derived reference levels. In the international guidelines, different limits
385 on basic restrictions and reference levels are defined for stimulation effects which are
386 considered for exposure to low frequency magnetic fields.387 There are five methods as described in Figure 1 to assess the welding equipment exposure and
388 to demonstrate conformity or give enough information to do it with the reference levels and/or
389 basic restrictions. Any of the five methods can be selected, depending on which is the most
390 relevant for the exposure assessment. If one of the first 4 methods does not lead to compliance,
391 another can be chosen. The ultimate method is the fifth (dosimetry with human model).392 While the evaluation based on measuring incident magnetic fields against reference levels is
393 the easiest method (§5.2.2), the evaluation based on computed magnetic field from the welding
394 current can predict the exposure and it does not require a field meter (§5.2.3). Those methods
395 are necessarily conservative than the assessment of exposure according to induced quantities
396 against basic restrictions.397 Thus, the evaluation of internal (or induced) E-field and/or current density against basic
398 restrictions (5.3) is performed with more realistic exposure conditions considering mainly the
399 heterogeneity of magnetic field.

400 Evaluations of induced fields against basic restrictions using simple (geometric) models are
 401 methods of intermediate complexity (§5.3.2 and §5.3.3). As these methods must cover a large
 402 number of situations, they are conservative most of the time and in extreme cases, they become
 403 right.

404 Lastly, evaluation of induced fields against basic restrictions with an electrical representative
 405 human body is the most rigorous and reduces uncertainties. It requires numerical simulation
 406 after a faithful modelling of the environment (§5.3.4).



407

408

Figure 1 – Flowchart for the assessment procedure

409 5.2 Methods based on external magnetic fields

410 5.2.1 General

411 The assessments are based on external (incident) magnetic field against reference levels.

412 Reference levels have been derived from the basic restrictions considering the conditions which
 413 maximized the exposure (whole body exposure to a uniform field). Such an assessment is
 414 conservative under all non-uniform and local exposure conditions, which is the case in most
 415 occupational exposure situations. Therefore, this method is simple but it overestimates
 416 exposure to welding equipment most of the time.

417 The exposure level is determined by a comparison of the magnetic field and the relevant
 418 exposure limits applicable to the affected regions of the body.