



SLOVENSKI STANDARD
oSIST prEN 50463-2:2016

01-februar-2016

Železniške naprave - Merjenje energije na vlaku - 2. del: Merjenje energije

Railway applications - Energy measurement on board trains - Part 2: Energy measuring

Bahnanwendungen - Energiemessung auf Bahnfahrzeugen - Teil 2: Energiemessung

Applications ferroviaires - Mesure d'énergie à bord des trains - Partie 2 : Mesure d'énergie

Ta slovenski standard je istoveten z: prEN 50463-2:2015

ICS:

45.060.10

Vlečna vozila

Tractive stock

oSIST prEN 50463-2:2016

en,fr,de

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

DRAFT
prEN 50463-2

November 2015

ICS 45.060.10

Will supersede EN 50463-2:2012

English Version

Railway applications - Energy measurement on board trains - Part 2: Energy measuring

Applications ferroviaires - Mesure d'énergie à bord des
trains - Partie 2 : Mesure d'énergie

Bahnanwendungen - Energiemessung auf Bahnfahrzeugen
- Teil 2: Energiemessung

This draft European Standard is submitted to CENELEC members for enquiry.
Deadline for CENELEC: 2016-02-19.

It has been drawn up by CLC/TC 9X.

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.

This draft European Standard was established by CENELEC 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 CEN-CENELEC Management Centre has the same status as the official versions.

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

Warning : This document is not a European Standard. It is distributed for review and comments. It is subject to change without notice and shall not be referred to as a European Standard.



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

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

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96 **European foreword**

97 This document (prEN 50463-2:2015) has been prepared by CLC/TC 9X “Electrical and electronic
98 applications for railways”.

99 This document is currently submitted to the Enquiry.

100 The following dates are proposed:

- latest date by which the existence of (doa) dor + 6 months
this document has to be announced at national
level
- latest date by which this document has to be (dop) dor + 12 months
implemented at national level by publication of an
identical national standard or by endorsement
- latest date by which the national standards (dow) dor + 36 months
conflicting with this document have to be (to be confirmed or
withdrawn modified when voting)

101

102 This document will supersede EN 50463-2:2012.

103 prEN 50463-2:2015 includes the following significant technical changes with respect to EN 50463-
104 2:2012:

- 105 — updated requirements for events, quality codes, flags and logs (Clause 4);
- 106 — updated for consistency between Table 16 and Figure 6 regarding “Area 2” (Clause 4).

107 This document has been prepared under a mandate given to CENELEC by the European Commission
108 and the European Free Trade Association, and supports essential requirements of EU Directive(s).

109 For the relationship with EU Directive(s) see informative Annex ZZ, which is an integral part of this
110 document.

111 This document is Part 4 of the EN 50463 series which consists of the following parts, under the
112 common title *Railway applications — Energy measurement on board trains*:

- 113 — *Part 1: General*;
- 114 — *Part 2: Energy measuring*;
- 115 — *Part 3: Data handling*;
- 116 — *Part 4: Communication*;
- 117 — *Part 5: Conformity assessment*.

118 This series of European Standards follows the functional guidelines description in
119 EN ISO/IEC 17000:2004, Annex A “Principles of conformity assessment”, tailored to the Energy
120 Measurement System (EMS).

121 The requirements for Energy Measurement Systems in the relevant Technical Specifications for
122 Interoperability are supported by this series of European Standards.

123 Introduction

124 The Energy Measurement System provides measurement and data suitable for billing and may also
125 be used for energy management, e.g. energy saving.

126 This series of European Standards uses the functional approach to describe the Energy Measurement
127 System and on-ground Data Collection Service. These functions are implemented in one or more
128 physical devices. The user of this Series of standards is free to choose the physical implementation
129 arrangements.

130 — Structure and main contents of the EN 50463 series:

131 This series of European Standards is divided into five parts. The titles and brief descriptions of each
132 part are given below:

133 — EN 50463-1 — General:

134 The scope of EN 50463-1 is the Energy Measurement System (EMS)

135 EN 50463-1 provides system level requirements for the complete EMS and common requirements for
136 all devices implementing one or more functions of the EMS.

137 — prEN 50463-2 — Energy measuring:

138 The scope of prEN 50463-2 is the Energy Measurement Function (EMF).

139 The EMF provides measurement of the consumed and regenerated active energy of a traction unit. If
140 the traction unit is designed for use on a.c. traction systems, the EMF also provides measurement of
141 reactive energy. The EMF provides the measured quantities via an interface to the Data Handling
142 System.

143 The EMF consists of the three functions: Voltage Measurement Function, Current Measurement
144 Function and Energy Calculation Function. For each of these functions, accuracy classes are specified
145 and associated reference conditions are defined. This part also defines all specific requirements for all
146 functions of the EMF.

147 The Voltage Measurement Function measures the voltage of the CL system and the Current
148 Measurement Function measures the current taken from and returned to the CL system. These
149 functions provide signal inputs to the Energy Calculation Function.

150 The Energy Calculation Function inputs the signals from the Current and Voltage Measurement
151 Functions and calculates a set of values representing the consumed and regenerated energies. These
152 values are transferred to the Data Handling System and are used in the creation of Compiled Energy
153 Billing Data.

154 The standard has been developed taking into account that in some applications, the EMF may be
155 subjected to legal metrological control. All relevant metrological aspects are covered in this part of
156 EN 50463.

157 prEN 50463-2 also defines the conformity assessment of the EMF.

158 — EN 50463-3 — Data handling:

159 The scope of EN 50463-3 is the Data Handling System (DHS) and the associated requirements of
160 Data Collection Service (DCS).

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161 The on board DHS receives, produces and stores data, ready for transmission to any authorized
 162 receiver of data on board or on ground. The main goal of the DHS is to produce Compiled Energy
 163 Billing Data and transfer it on an interoperable basis to an on-ground Data Collection Service (DCS).
 164 The DHS can support other functionality on board or on-ground with data, as long as this does not
 165 conflict with the main goal.

166 The DCS on-ground receives Compiled Energy Billing Data and transfer it to settlement system.

167 EN 50463-3 also defines the conformity assessment of the DHS and for the transfer of CEBD to an
 168 on-ground Data Collection Service (DCS)

169 — **EN 50463-4 — Communication:**

170 The scope of EN 50463-4 is the communication services.

171 This part of EN 50463 gives requirements and guidance regarding the data communication between
 172 the functions implemented within EMS as well as between such functions and other on board units
 173 where data are exchanged using a communications protocol stack over a dedicated physical interface
 174 or a shared network.

175 It includes the on board to ground communication service and covers the requirements necessary to
 176 support data transfer between DHS and DCS including the transfer of CEBD on an interoperable
 177 basis.

178 EN 50463-4 also defines the conformity assessment of the communications services.

179 — **EN 50463-5 — Conformity assessment:**

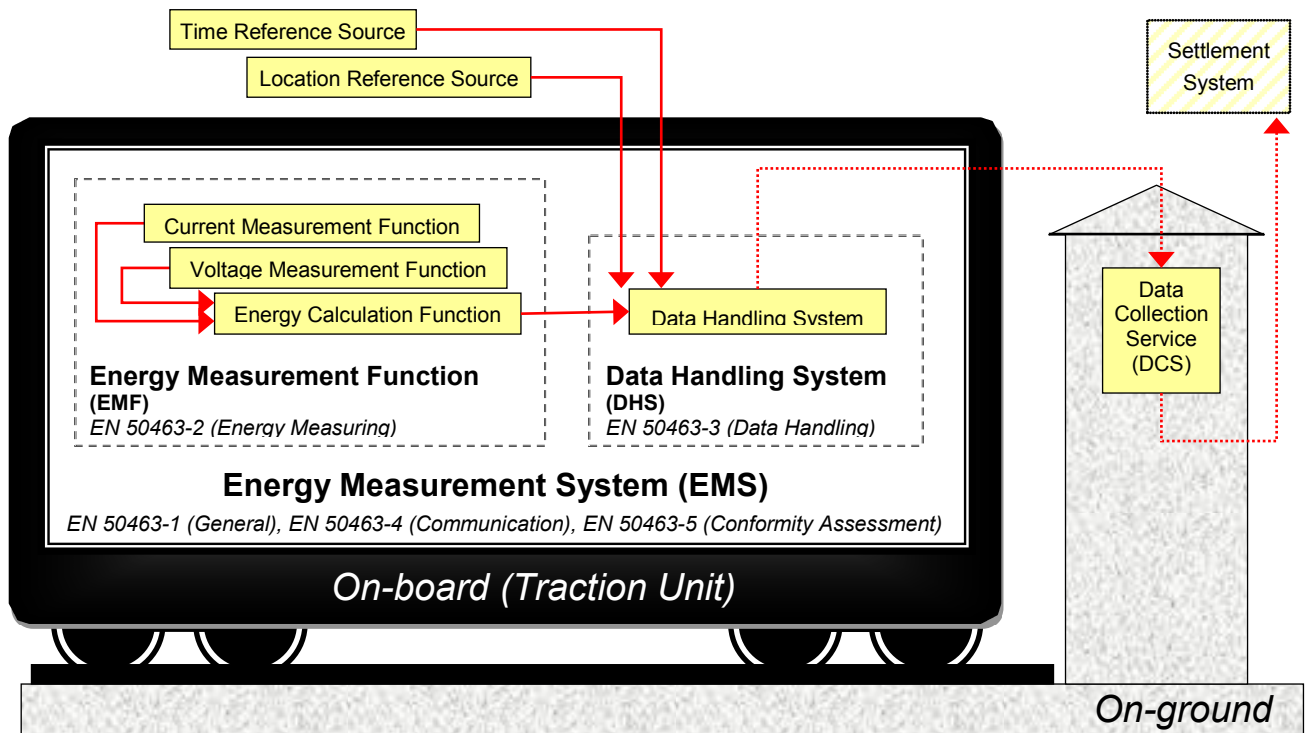
180 The scope of EN 50463-5 is the conformity assessment procedures for the EMS.

181 EN 50463-5 also covers re-verification procedures and conformity assessment in the event of the
 182 replacement of a device of the EMS.

183 — **EMS functional structure and dataflow:**

184 Figure 1 illustrates the functional structure of the EMS, the main sub-functions and the structure of the
 185 dataflow and is informative only. Only the main interfaces required by this standard are displayed by
 186 arrows.

187 Since the communication function is distributed throughout the EMS, it has been omitted for clarity.
 188 Not all interfaces are shown.



189

190

Figure 1 — EMS functional structure and dataflow diagram

iteh Standards
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 Document Preview

SIST EN 50463-2:2018

<https://standards.iteh.ai/catalog/standards/sist/5fac2bc1-25d8-4cc0-a0d2-cf76a90c1e97/sist-en-50463-2-2018>

191 **1 Scope**

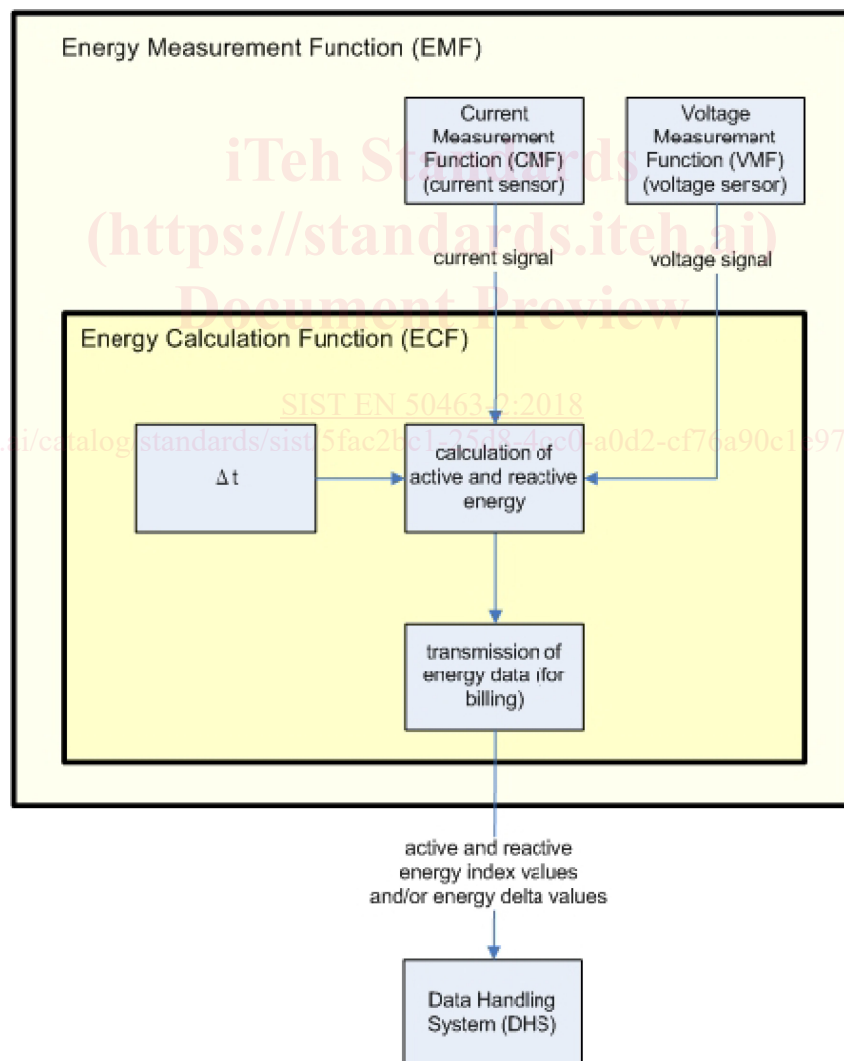
192 This draft European Standard covers the requirements applicable to the Energy Measurement
 193 Function (EMF) of an Energy Measurement System (EMS) for use on board traction units for
 194 measurement of energy supplied directly from/to the Contact Line system.

195 This draft European Standard also gives requirements for the Current Measurement Function (e.g.
 196 current sensor), the Voltage Measurement Function (e.g. voltage sensor) and the Energy Calculation
 197 Function (e.g. energy meter).

198 The Conformity Assessment arrangements for the Voltage Measurement Function, Current
 199 Measurement Function, the Energy Calculation Function and a complete Energy Measurement
 200 Function are also specified in this document.

201 The standard has been developed taking into account that in some applications the EMF may be
 202 subjected to legal metrological control. All relevant metrological aspects are covered in this part.

203 Figure 2 shows the flow between the functional blocks of the EMF. Only connections between the
 204 functional blocks required by this standard are displayed.



205

206

Figure 2 — EMF functional block diagram

207 2 Normative references

208 The following documents, in whole or in part, are normatively referenced in this document and are
 209 indispensable for its application. For dated references, only the edition cited applies. For undated
 210 references, the latest edition of the referenced document (including any amendments) applies.

211 EN 45545-2, *Railway applications — Fire protection on railway vehicles — Part 2: Requirements for*
 212 *fire behavior of materials and components*

213 EN 45545-5, *Railway applications — Fire protection on railway vehicles — Part 5: Fire safety*
 214 *requirements for electrical equipment including that of trolley buses, track guided buses and magnetic*
 215 *levitation vehicles*

216 EN 50121-1, *Railway applications — Electromagnetic compatibility — Part 1: General*

217 EN 50121-3-2:2006, *Railway applications — Electromagnetic compatibility — Part 3-2: Rolling*
 218 *stock — Apparatus*

219 EN 50123-1:2003, *Railway applications — Fixed installations — D.C. switchgear — Part 1: General*

220 EN 50124-1, *Railway applications — Insulation coordination — Part 1: Basic requirements —*
 221 *Clearances and creepage distances for all electrical and electronic equipment*

222 EN 50125-1, *Railway applications — Environmental conditions for equipment — Part 1: Rolling stock*
 223 *and on-board equipment*

224 EN 50155:2007, *Railway applications — Electronic equipment used on rolling stock*

225 EN 50163:2004, *Railway applications — Supply voltages of traction systems (IEC 60850:2000, not*
 226 *equivalent)*

227 EN 50388:2005, *Railway applications — Power supply and rolling stock — Technical criteria for the*
 228 *coordination between power supply (substation) and rolling stock to achieve interoperability*

<https://standards.iteh.ai/catalog/standards/sist/5fac2bc1-25d8-4cc0-a0d2-cf76a90c1e97/sist-en-50463-2-2018>

229 EN 50463-1:2012, *Railway applications — Energy measurement on board trains — Part 1: General*

230 EN 50463-3:2012, *Railway applications — Energy measurement on board trains — Part 3: Data*
 231 *handling*

232 EN 50463-4:2012, *Railway applications — Energy measurement on board trains — Part 4:*
 233 *Communication*

234 EN 50463-5, *Railway applications — Energy measurement on board trains — Part 5: Conformity*
 235 *assessment*

236 EN 60044 (all parts), *Instrument transformers (IEC 60044, all parts)*

237 EN 60044-2:1999, *Instrument transformers — Part 2: Inductive voltage transformers (IEC 60044*
 238 *2:1999, modified)*

239 EN 60044-8:2002, *Instrument transformers — Part 8: Electronic current transformers*
 240 *(IEC 60044-8:2002)*

241 EN 60068-2-1, *Environmental testing — Part 2-1: Tests — Test A: Cold (IEC 60068-2-1)*

242 EN 60068-2-2:2007, *Environmental testing — Part 2-2: Tests — Test B: Dry heat (IEC 60068-2-*
 243 *2:2007)*

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244 EN 60068-2-30, *Environmental testing — Part 2-30: Tests — Test Db: Damp heat, cyclic*
245 *(12 h + 12 h cycle) (IEC 60068-2-30)*

246 EN 60077-4:2003, *Railway applications — Electric equipment for rolling stock — Part 4:*
247 *Electrotechnical components — Rules for AC circuit-breakers (IEC 60077-4:2003)*

248 EN 60085, *Electrical insulation — Thermal evaluation and designation (IEC 60085)*

249 EN 60529, *Degrees of protection provided by enclosures (IP Code) (IEC 60529)*

250 EN 61000 (all parts), *Electromagnetic compatibility (EMC) (IEC 61000, all parts)*

251 EN 61373:2010, *Railway applications — Rolling stock equipment — Shock and vibration tests*
252 *(IEC 61373:2010)*

253 IEC 60028, *International standard of resistance for copper*

254 IEC 60121, *Recommendation for commercial annealed aluminium electrical conductor wire*

255 **3 Terms, definitions, abbreviations and symbols**

256 **3.1 Terms and definitions**

257 For the purposes of this document, the terms and definitions given in EN 50463-1:2012 and the
258 following apply.

259 NOTE When possible, the following definitions have been taken from the relevant chapters of the
260 International Electrotechnical Vocabulary (IEV), IEC 60050–311, IEC 60050–312, IEC 60050–313, IEC 60050–
261 314, IEC 60050–321 and IEC 60050–811. In such cases, the appropriate IEV reference is given. Certain new
262 definitions or modifications of IEV definitions have been added in this standard in order to facilitate understanding.
263 Expression of the performance of electrical and electronic measuring equipment has been taken from EN 60359.

264 **3.1.1**

265 **accuracy class**

266 designation that identifies a set of error limits for measured quantities under reference conditions and
267 the additional percentage errors due to influence quantities

268 Note 1 to entry: An individual accuracy class is associated with each metrological function of the EMF.

269 Note 2 to entry: The suffix “R” is used to differentiate classes according to this standard from other technical
270 standards.

271 **3.1.2**

272 **consumed active energy**

273 active energy taken from the Contact Line by the traction unit on which the EMF is installed

274 **3.1.3**

275 **consumed reactive energy**

276 reactive energy taken from the Contact Line by the traction unit on which the EMF is installed

277 **3.1.4**

278 **electronic sensor**

279 device in which electronic circuits are used to process a measured signal

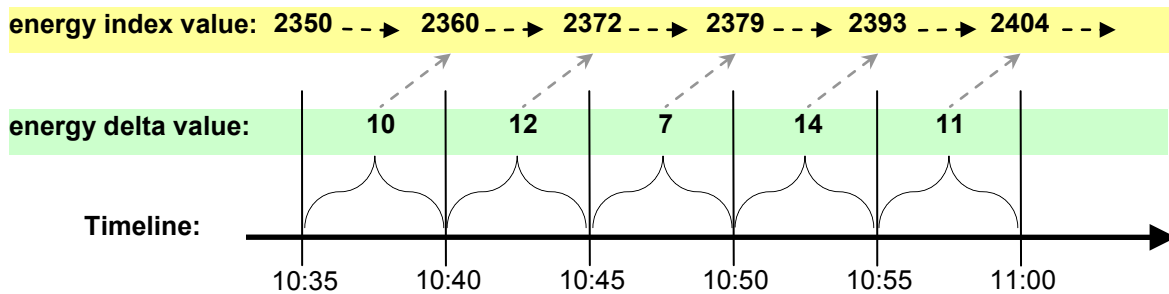
280 Note 1 to entry: Electronic circuits for processing the measurement signal include items such as analogue to
281 digital converters, signal amplifiers, etc.

282 **3.1.5**
 283 **energy delta value**
 284 energy consumed and/or regenerated during a time period

285 Note 1 to entry: See Figure 3 for example.

286 **3.1.6**
 287 **energy index value**
 288 total accumulated energy consumption and/or energy regeneration at the end of a time period

289 Note 1 to entry: See Figure 3 for example.



290

291 **Figure 3 — Example of energy index value**

292 **3.1.7**
 293 **flag**
 294 code indicating information relevant to the functioning of the EMS

295 Note 1 to entry: Examples include operational status, etc.

296 **3.1.8**
 297 **index value overrun**
 298 return to zero of the index value after reaching the maximum value allowed by the register

299 **3.1.9**
 300 **influence quantity**
 301 external condition which affects metrological performance

302 **3.1.10**
 303 **k-factor**
 304 multiplicand necessary to convert a secondary value into a primary value

305 Note 1 to entry: Each Voltage Measurement Function and/or Current Measurement Function can have a
 306 specific k-factor. If the k-factor is applied to Energy Data, this factor is the product of the k-factors of the Voltage
 307 Measurement Function and/or Current Measurement Function used.

308 **3.1.11**
 309 **percentage error**
 310 value given by the following formula:

$$311 \quad \text{Percentage error} = \left| \frac{\text{measured quantity} - \text{true quantity}}{\text{true quantity}} \right| \times 100$$

312 Note 1 to entry: Since the true quantity cannot be determined, it is approximated by a quantity with a stated
 313 uncertainty that can be traced to standards agreed upon between supplier and purchaser or to national standards.

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- 314 **3.1.12**
 315 **phase influence function**
 316 function of the real or apparent phase angle between a measured voltage and a measured current
- 317 Note 1 to entry: Phase influence function expressed as a Power Factor refers to measurements of real and
 318 apparent powers and energies, while $\sin \varphi$ refers to reactive powers and energies.
- 319 Note 2 to entry: For d.c. measurements the requirements for a phase influence function of 1 need to be used.
- 320 **3.1.13**
 321 **Power Factor**
 322 **PF**
 323 ratio of the absolute value of the active power P to the apparent power S
- 324 [SOURCE: IEC 131-11-46, modified]
- 325 **3.1.14**
 326 **primary value**
 327 value referred to the measuring inputs of an EMF
- 328 **3.1.15**
 329 **rated continuous thermal current**
 330 $I_{\text{CMF,cth}}$
 331 value of current which can be permitted to flow continuously into the primary input of a current sensor
- 332 **3.1.16**
 333 **rated dynamic current**
 334 $I_{\text{CMF,dyn}}$
 335 peak value of the primary current which a current sensor will withstand without being damaged
- 336 **3.1.17**
 337 **rated primary current of the EMF**
 338 $I_{\text{n,EMF}}$
 339 value of current which is used to define the relevant performance of the EMF
 340 Note 1 to entry: The term current refers to r.m.s. value for a.c. unless otherwise specified.
- 341 **3.1.18**
 342 **rated primary voltage of the EMF**
 343 $U_{\text{n,EMF}}$
 344 value of voltage which is used to define the relevant performance of the EMF
- 345 Note 1 to entry: The term voltage refers to r.m.s. value for a.c. unless otherwise specified.
- 346 **3.1.19**
 347 **rated short-time thermal current**
 348 $I_{\text{CMF,th}}$
 349 value of the primary current which a current sensor will withstand for a specified time period without
 350 being damaged
- 351 **3.1.20**
 352 **rated traction unit current**
 353 maximum current that the traction unit is designed to draw from the Contact Line when operating
 354 under normal conditions and with a voltage in the range from $U_{\text{min}1}$ to $U_{\text{max}2}$ according to EN 50163
- 355 **3.1.21**
 356 **reference conditions**
 357 set of influence quantities, with reference values and tolerances, with respect to which the error limits
 358 are specified for an input quantity range