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TITLE:
Explosive atmospheres - Part 47: Equipment protection by 2-Wire Intrinsically Safe Ethernet concept (2-WISE)

NOTE FROM TC/SC OFFICERS:

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

EXPLOSIVE ATMOSPHERES –**Part 47: Equipment protection by 2-wire intrinsically safe Ethernet concept (2-WISE)**

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- the subject is still under technical development or where, for any other reason, there is the future but no immediate possibility of an agreement on an International Standard.

Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC TS 60079-47, which is a technical specification, has been prepared by subcommittee 31G: Intrinsically-safe apparatus, of IEC technical committee 31: Equipment for explosive atmospheres.

The text of this International Technical Specification is based on the following documents:

DTS	Report on voting
XX/XX/DTS	XX/XX/RVD

88

89 Full information on the voting for the approval of this International Technical Specification can
90 be found in the report on voting indicated in the above table.

91 This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

92 A list of all parts in the IEC 60079 series, published under the general title Explosive
93 atmospheres, can be found on the IEC website.

94 The committee has decided that the contents of this document will remain unchanged until the
95 stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to
96 the specific document. At this date, the document will be

- 97 • transformed into an International standard
- 98 • reconfirmed,
- 99 • withdrawn,
- 100 • replaced by a revised edition, or
- 101 • amended.

102 A bilingual version of this publication may be issued at a later date.

103 The National Committees are requested to note that for this document the stability date
104 is 20XX..

105 THIS TEXT IS INCLUDED FOR THE INFORMATION OF THE NATIONAL COMMITTEES AND WILL BE DELETED
106 AT THE PUBLICATION STAGE.

107

EXPLOSIVE ATMOSPHERES –

Part 47: Equipment protection by 2-wire intrinsically safe Ethernet concept (2-WISE)

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115 **1 Scope**

116 This part of IEC 60079, which is a technical specification, specifies requirements for the
117 construction, marking, and documenting of apparatus, systems and installations for use with
118 the 2-Wire Intrinsically Safe Ethernet concept (2-WISE). The physical layer specification for 2-
119 wire Ethernet 10BASE-T1L is defined in IEEE 802.3cg.

120 2-WISE is the 2-Wire Intrinsically Safe Ethernet concept for advance physical layer (APL),
121 designed to simplify the examination process for components and cable Entity Parameters
122 within APL segments. This is achieved by defining universal Entity Parameter limits for APL
123 ports, according to location and type of hazardous atmosphere, and listing a concise set of
124 rules for the segment setup.

125 The requirements for construction and installation of 2-WISE apparatus and systems are
126 included in IEC 60079-11, IEC 60079-14, and IEC 60079-25, except as modified by this
127 technical specification. Parts of a 2-WISE apparatus may be protected by any Type of Protection
128 listed in IEC 60079-0 appropriate to the EPL for the intended use. In these circumstances, the
129 requirements of this technical specification apply only to intrinsically safe circuits of the
130 apparatus.

131

132 **2 Normative references**

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

137 IEC 60079-0, *Explosive atmospheres – Part 0: Equipment – General requirements*

138 IEC 60079-11, *Explosive atmospheres – Part 11: Equipment protection by intrinsic safety "i"*

139 IEC 60079-14, *Explosive atmospheres – Part 14: Electrical installations design, selection and
140 erection*

141 IEC 60079-25, *Explosive atmospheres – Part 25: Intrinsically safe electrical systems*

142 **IEEE 802.3cg, ...**

143 **3 Terms and definitions**

144 For the purposes of this document, the terms and definitions given in IEC 60079-0, IEC 60079-
145 11, IEC 60079-14, IEC 60079-25 and the following apply.

146 ISO and IEC maintain terminological databases for use in standardization at the following
147 addresses:

- 148 • IEC Electropedia: available at <http://www.electropedia.org/>
- 149 • ISO Online browsing platform: available at <http://www.iso.org/obp>

- 150 **3.1**
151 **APL**
152 **advanced physical layer**
153 10BASE-T1L physical layer specified in IEEE 802.3cg for 10 Mb/s Operation over Single
154 Balanced Twisted-Pair Cabling
- 155 **3.2**
156 **APL segment**
157 interconnection of power source port and power load port or unpowered port within a 2-WISE
158 system
- 159 **3.3**
160 **10BASE-T1L**
161 physical layer standard for 10 Mb/s Ethernet communication on single balanced twisted-pair
162 copper cabling with optional provision of power, standardized in IEEE 802.3cg
- 163 **3.4**
164 **auxiliary device**
165 passive device providing functions other than communication
- 166 Note to entry: This could comprise a power load or introduce communication signal insertion losses, e.g. a surge
167 protector.
- 168 **3.5 Ports**
- 169 **3.5.1**
170 **power source port**
171 port which in addition to communication feeds DC power into an APL segment
- 172 **3.5.2**
173 **power load port**
174 port which in addition to communication consumes DC power from an APL segment
- 175 **3.5.3**
176 **unpowered port**
177 port which provides communication only, but does not supply or consume DC power
- 178 NOTE to entry Definition is under discussion in SC 65C.
- 179 **3.5.4**
180 **auxiliary device port**
181 port of an auxiliary device
- 182 **3.6**
183 **2-WISE**
184 2-Wire Intrinsically Safe Ethernet system
185 intrinsically safe electrical system based on APL with standardised limits for intrinsic safety
186 parameters at each port
- 187 **3.7**
188 **2-WISE apparatus**
189 electrical equipment, either intrinsically safe apparatus or associated apparatus, that provides
190 at least one port according 2-WISE
- 191 **3.8**
192 **2-WISE system**
193 assembly of interconnected items of 2-WISE apparatus, described in a descriptive system
194 document, in which the circuits or parts of circuits, intended to be used in an explosive
195 atmosphere, are intrinsically safe circuits

196 4 Requirements for 2-WISE apparatus

197 4.1 General

198 2-WISE apparatus shall conform to the relevant requirements of IEC 60079-11, except as
199 modified by this technical specification. 2-WISE apparatus shall be suitable for use in a 2-WISE
200 system in accordance with this technical specification.

201 Each port shall conform to the requirements of 4.2, 4.3, 4.4, or 4.5.

202 The terminals of 2-WISE ports shall be capable of withstanding a test voltage to earth in
203 accordance with IEC 60079-11.

204 4.2 2-WISE power source ports

205 Each 2-WISE power source port shall be linear or have a trapezoidal or rectangular output
206 characteristic. The maximum output voltage U_o shall be in the range 14 V to 17,5 V under the
207 conditions specified in IEC 60079-11 for the respective Level of Protection.

208 The maximum unprotected internal capacitance C_i and inductance L_i shall be not greater than
209 5 nF and 10 μ H, respectively.

210 The maximum output current I_o for any 2-WISE power source port shall be determined in
211 accordance with IEC 60079-11 but shall not exceed 380 mA.

212 The maximum output power P_o shall not exceed 5,32 W.

213 NOTE Voltage and current limits for sources with rectangular output characteristic can be found in IEC 60079-11
214 for the Fieldbus Intrinsically Safe Concept (FISCO) – apparatus requirements.

215 The determination of the electrical parameters of the 2-WISE power source port shall take into
216 account the possible opening, shorting and earthing of field wiring connected to the port.

217 4.3 2-WISE Power load ports and 2-WISE auxiliary device ports

218 The following requirements apply to 2-WISE power load ports and 2-WISE auxiliary device ports
219 connected to an intrinsically safe system whether installed inside or outside the hazardous area,
220 in addition to the relevant sections of IEC 60079-11.

221 The electrical parameters for 2-WISE power load ports and 2-WISE auxiliary device ports shall
222 meet the values given in Table 1.

223 **Table 1 - Intrinsically safe parameters for 2-WISE Power load ports and auxiliary device**
224 **ports**

		2-WISE power load port	2-WISE auxiliary device port
Maximum input voltage	U_i	17,5 V	17,5 V
Maximum input current	I_i	380 mA	380 mA
Maximum input power	P_i	5,32 W	5,32 W
Maximum internal capacitance	C_i	5 nF	5 nF
Maximum internal inductance	L_i	10 μ H	200 nH
Maximum leakage current		1 mA	50 μ A
NOTE The values given above apply for all Equipment Groups.			

225

226 Under normal or fault conditions as specified in IEC 60079-11 for the respective Level of
227 Protection, the terminals of 2-WISE load and auxiliary device ports shall not be a source of
228 energy to the system except for a leakage current not exceeding the values given in Table 1.

229 4.4 2-WISE unpowered ports

230 2-WISE unpowered ports shall have a linear output characteristic.

231 The electrical parameters for 2-WISE unpowered ports, connected to an intrinsically safe
232 system, shall meet the values given in Table 2.

233 **Table 2 - Intrinsically safe parameters for 2-WISE unpowered ports**

Maximum output voltage	U_o	9 V
Maximum output current	I_o	112,5 mA
Maximum output power	P_o	254 mW
Maximum input voltage	U_i	17,5 V
Maximum input current	I_i	380 mA
Maximum input power	P_i	5,32 W
Maximum internal capacitance	C_i	5 nF
Maximum internal inductance	L_i	10 μ H

234

235 NOTE The values of U_i , I_i and P_i are defined to prevent unintentional damage of an unpowered port, if being
236 accidentally connected to a powered port.

237 4.5 Simple apparatus

238 A simple apparatus used in an intrinsically safe system shall conform to the relevant
239 requirements of IEC 60079-11.

240 The internal inductance L_i and internal capacitance C_i of each simple apparatus connected to
241 a 2-WISE system shall less than 1 μ H and 1 nF.

242 5 Requirements for 2-WISE systems

243 5.1 General

244 A typical 2-WISE system comprises two 2-WISE ports connected to each end of a cable, with a
245 maximum of two auxiliary devices in between.

246 2-WISE systems are either DC powered or unpowered. In a powered system, the power source
247 port supplies DC power into the system, and the power load port consumes DC power from the
248 system. Auxiliary device ports may also consume DC power from a system. In an unpowered
249 system no DC power is provided to the system and in this case 2-WISE apparatus are always
250 separately powered. An unpowered port shall not be connected to a power source port.

251 Connection facilities and/or electromechanical switches according to IEC 60079-11 may be
252 added to a 2-WISE system without modifying the safety assessment.

253 5.2 Wiring systems

254 The cable used in a 2-WISE system shall comply with the following parameters:

255 cable resistance R_c : 15 Ω /km to 150 Ω /km;

256 cable inductance L_c : 0,4 mH/km to 1 mH/km;

257 cable capacitance C_c : 45 nF/km to 200 nF/km;

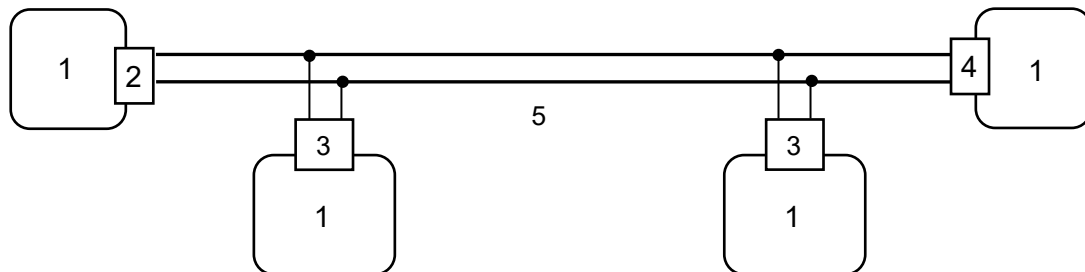
258 NOTE The installation and constructional requirements of individual cables and multi-circuit cables carrying more
259 than one intrinsically safe circuit are contained in IEC 60079-25.

260 5.3 Powered 2-WISE systems

261 A DC powered 2-WISE system shall be considered intrinsically safe if one 2-WISE source port,
262 one 2-WISE load port and up to two 2-WISE auxiliary device ports are connected with a cable,
263 according to the above specification and as shown in Figure 1.

264 A DC powered 2-WISE system comprises:

- 265 – One power source port;
- 266 – One power load port;
- 267 – Up to two auxiliary device ports;
- 268 – A cable with a maximum length of 200 m.



269
270 Key

- 271 1 2-WISE apparatus
- 272 2 2-WISE power source port
- 273 3 2-WISE auxiliary device port
- 274 4 2-WISE power load port
- 275 5 Cable

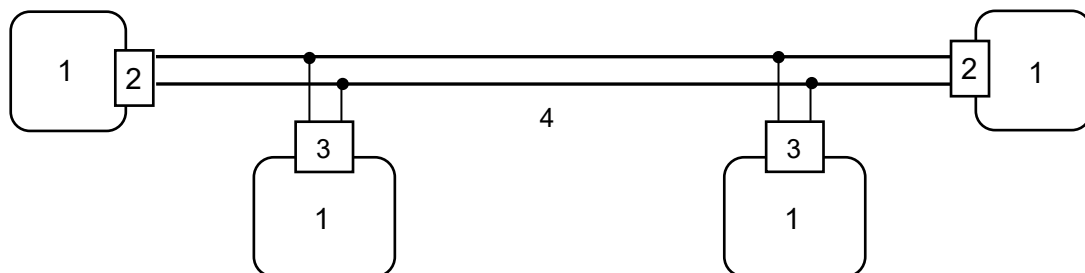
276 **Figure 1 - DC powered 2-WISE system**

277 5.4 Unpowered 2-WISE systems

278 An unpowered 2-WISE system shall be considered intrinsically safe if two 2-WISE unpowered
279 ports and up to two 2-WISE auxiliary device ports are connected with a cable, according to the
280 above specification and as shown in Figure 2.

281 An unpowered 2-WISE system comprises:

- 282 – Two unpowered ports;
- 283 – Up to two auxiliary device ports;
- 284 – A cable with a maximum length of 1000 m.



285
286 Key

- 287 1 2-WISE apparatus
- 288 2 2-WISE unpowered port
- 289 3 2-WISE auxiliary device port
- 290 4 Cable

291 **Figure 2 - Unpowered 2-WISE system**

292

293 5.5 Descriptive system document

294 Each interconnection of 2-WISE ports in a 2-WISE system shall be allocated a Level of
295 Protection ("ia", "ib" or "ic") determined by the 2-WISE port with the lowest Level of Protection.
296 The descriptive system document shall contain the allocated Levels of Protection (refer to
297 IEC 60079-25 for an example of a descriptive document).

298 The descriptive system document shall contain the confirmation that the permitted maximum
299 ambient temperature of each 2-WISE apparatus is suitable for the intended use.

300 The temperature classification of each 2-WISE apparatus shall be determined and recorded in
301 the descriptive system document, if applicable.

302 The descriptive system document shall include the parameters of the cable (see 5.2) to be
303 connected to a 2-WISE port.

304 **6 Instructions / Documentation**

305 The electrical parameters L_i , C_i , L_o and C_o need not be included on the certificate or in the
306 instructions.

307 Instructions shall contain, that a marked '2-WISE unpowered port' shall not be connected to a
308 '2-WISE powered source port'.

309 Instructions shall provide the necessary information to produce the descriptive system
310 document.

311 **7 Marking**

312 **7.1 General**

313 These requirements supplement and modify the marking requirements of IEC 60079-0 and
314 IEC 60079-11.

315 Each 2-WISE apparatus shall be marked '2-WISE'.

316 The type of each port shall be clearly identifiable, as:

- 317 – 2-WISE power source
- 318 – 2-WISE power load
- 319 – 2-WISE auxiliary device
- 320 – 2-WISE unpowered

321 2-WISE ports need not be marked with the intrinsic safety parameters U_i , I_i , C_i , L_i , P_i , U_o , I_o , C_o ,
322 L_o or P_o .

323 **7.2 Examples of marking**

324 a) 2-WISE Apparatus with Power Source Port:

325 Model 123 APL switch
326 ABC Company
327 Ex ec [ia Ga] IIC T4 Gc
328 2-WISE power source
329 $-55\text{ °C} \leq T_a \leq +120\text{ °C}$
330 Serial No. 12345

331

332

333 b) 2-WISE Apparatus with Power Load Port:

334 Model 456
335 ABC Company
336 Ex ib IIC T4 Gb
337 2-WISE power load
338 $-20\text{ °C} \leq T_a \leq +60\text{ °C}$

339 Serial No. 5432

340

341

342 c) 2-WISE Apparatus with Auxiliary Device Port:

343 Model 789

344 ABC Company

345 Ex ic IIA T1 Gc

346 2-WISE auxiliary device

347 $-40\text{ °C} \leq T_a \leq +120\text{ °C}$

348 Serial No. TW342

349

350

351 d) 2-WISE Apparatus with Unpowered Port:

352 Model 1000

353 ABC Company

354 Ex ec [ia] IIC T4 Gc

355 $-55\text{ °C} \leq T_a \leq +85\text{ °C}$

356 2-WISE unpowered

357 Serial No. AB567

358

359

360 e) 2-WISE Apparatus with multiple 2-WISE ports:

361

362 2-WISE Apparatus ABC Company.

363 Ex ec [ia Ga][ib Gb][ic] IIC T4 Gc

364 $-55\text{ °C} \leq T_a \leq +120\text{ °C}$ Serial No. 35594

MNO: 19.0265

PWR = 2-WISE power source [Ex ic Gc] IIC

AUX1 = 2-WISE auxiliary device [Ex ib Gb] IIC

AUX2 = 2-WISE auxiliary device [Ex ia Ga] IIC

Comm1 = 2-WISE unpowered [Ex ia Ga] IIC

PWR

AUX1

AUX2

COMM1

