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INTERNATIONAL ELECTROTECHNICAL COMMISSION

IEC TS 60079-44

EXPLOSIVE ATMOSPHERES

Part 44: Personal Competence

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42 Full information on the voting for the approval of this document can be found in the report on
43 voting indicated in the above table.

44 The language used for the development of this document is **English**.

45 This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in
46 accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available
47 at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are
48 described in greater detail at www.iec.ch/standardsdev/publications.

49 The committee has decided that the contents of this publication will remain unchanged until the
50 stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to
51 the specific publication. At this date, the publication will be

52 transformed into an International standard,

53 reconfirmed,

54 withdrawn,

55 replaced by a revised edition, or

56 amended.

57

58 The National Committees are requested to note that for this publication the stability date is

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

61

Introduction

63 The objective of this Document is to minimize the impact on safety and integrity of facilities,
64 where hazardous areas may be present, due to human error that may result from an individual's
65 lack of knowledge, skills, or abilities during the performance of certain activities. This document
66 explains how the minimum requirements for the competence and management of competencies
67 of personnel working in industries where hazardous areas may be present can be achieved.
68 Assurance that individuals who perform such tasks and those individuals responsible for
69 ensuring a qualified workforce are competent according to this document will also support the
70 achievement of the stated objective.

71 Competence depends on knowledge, skill, experience, and training. Verification of competence
72 is a difficult task and requires specific assessment methods based on clear criteria. In
73 establishing these criteria, it is acknowledged that:

- 74 – The competencies for conducting work in facilities where explosive atmospheres may be
75 present are in addition to any competencies which may apply for the specific type of work
76 being undertaken, for example, electrical, mechanical, operations.
- 77 – Competencies for working in hazardous areas vary by the individual roles and tasks
78 performed (see Section 8), and the protection techniques used.
- 79 – As protection techniques adopt quite different and individual design and installation
80 requirements it is common for personnel to be trained and competent either in some or all
81 these techniques.

82 Regarding the assurance of competence, it is recognised that competence evolves with years
83 but can also deteriorate if not applied, and so continued training and assessment to verify
84 competence is necessary. Where training or assessment of competence is required it is
85 expected that those conducting these activities should have at least the same level of
86 competence as those being trained or assessed. These and other specific processes and
87 requirements might also be defined in other publications that are employed in competence
88 certification systems.

90 1 Scope

91 The purpose of this document is to provide guidance to establish recommended minimum
92 criteria to determine roles, establish expectations of the necessary skills and evidence of
93 competence to assess and manage the competence of personnel conducting work in or
94 associated with hazardous areas.

95 This document provides examples and recommendations of minimum levels of competence for
96 typical roles associated with hazardous areas by addressing the knowledge, skills, or abilities
97 that is expected of personnel, and provides examples of the evidence of competence expected
98 for each role.

99 This document is to assist employers in developing a programme to define, assess and manage
100 requirements for competence. Such a programme could be unique to a facility or used in
101 conjunction with other regulatory requirements where they exist. The competencies for
102 conducting work in a hazardous area are in addition to any competencies which may apply for
103 the general type of work being undertaken (for example, professional credentials, electrical,
104 non-electrical, operations, design).

105 This document applies to both electrical and non-electrical applications.

106 2 References

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

- 111 – IEC 60050-426, International Electrotechnical Vocabulary – Part 426: Equipment for
112 explosive atmospheres.
- 113 – IEC 60079-0 Explosive atmospheres - Part 0: Equipment - General requirements
- 114 – IEC 60079-17, Explosive atmospheres – Part 17: Electrical installations, inspection, and
115 maintenance

116 3 Definitions

117 For the purposes of this document, the terms and definitions given in IEC 60079-0 and the
118 following apply.

119 ISO and IEC maintain terminological databases for use in standardization at the following
120 addresses:

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

123 3.1

124 **first-party verification**

125 process where an individual self-declares their credentials and competency.

126 Note 1 to entry: permitting first-party verification for individuals working in hazardous areas could result in liability
127 issues for the employer

128 **3.2**
129 **second-party verification**
130 process where the employer, a person or organization appointed by the employer assesses an
131 individual to a defined set of competency requirements.

132 **3.3**
133 **third-party verification**
134 process where an organization independent of the employer, or its contractors, assesses
135 individuals against a defined set of competency requirements.

136 Note 1 to entry: Third-party verification organizations typically satisfy ISO/IEC17024 requirements and are assessed
137 by a National Accreditation Body.

138 **3.4**
139 **prerequisite qualifications**
140 knowledge, skills, and capabilities required to perform an assigned role or task in non-
141 hazardous areas.

142 Note 1 to entry: Some work roles may require registration or licencing by a local or national authority to verify,
143 approve or endorse specific base knowledge. For example, professional engineer or tradespersons professional
144 registration or licencing.

145 **3.5**
146 **competence**
147 ability to apply knowledge and skills to achieve intended results.

148 [SOURCE: ISO/IEC 17024:2012, 3.6]

149 **3.6**
150 **hazardous area**
151 area in which an explosive atmosphere is present, or can be expected to be present, in
152 quantities such that special precautions for the construction, installation and use of equipment
153 are required.

154 Note 1 to entry: IEC 60079-10-1, Explosive atmospheres – Part 10-1: Classification of areas – Explosive gas
155 atmospheres, gives a classification of hazardous areas containing explosive gas atmospheres (see IEC 426-03-03,
156 IEC 426-03-04 and IEC 426-03-05).

157 Note 2 to entry: IEC 60079-10-2, Explosive atmospheres – Part 10-2: Classification of areas – Explosive dust
158 atmospheres, gives a classification of hazardous areas containing explosive dust atmospheres (see IEC 426-03-23,
159 IEC 426-03-24, and IEC 426-03-25).

160 [SOURCE: IEC 60050 426-03-01]

161 **3.7**
162 **non-hazardous area**
163 area in which an explosive atmosphere is not expected to be present in quantities such as
164 special precautions for the construction, installation and use equipment.

165 [SOURCE: IEC 60050 426-03-02]

166 **3.8**
167 **equipment**
168 apparatus, fittings, devices, components, and the like used as a part of, or in connection with,
169 an installation

170 [SOURCE: IEC 60050 426-01-01]

171 **3.9**
172 **Ex Equipment**
173 explosion-protected equipment

174 Note 1 to entry: Such equipment often includes Ex Components, but additional evaluation is always required as part
175 of their incorporation into equipment.

176 [SOURCE: IEC 60050 426-01-14]

177 **3.10**
178 **qualified assessor**
179 individual with enough knowledge, skills, and experience to undertake assessments
180 Note 1 to entry: This is likely to require on-site experience, understanding, interpreting and applying technical
181 content, such as in IEC 60079-17, along with successful completion of nationally recognized training/assessment
182 courses.

183 **3.11**
184 **role**
185 tasks or responsibilities within the context of an organization that identify the responsibility and
186 authority assigned to specific persons

187 **3.12**
188 **verification**
189 confirmation of truthfulness, through the provision of objective evidence that specified
190 requirements have been fulfilled.

191 [SOURCE: ISO/IEC 17000]

192 Note 1 to entry: Verification can be applied to claims to confirm the information declared with the claim regarding
193 events that have already occurred or results that have already been obtained.

194 **4 General**

195 Competence depends on specific knowledge, skill, and experience. Measurement of
196 competence is a difficult task and requires assessment methods specific to the role being
197 performed. Competence can develop with experience but can also deteriorate over time,
198 therefore continued training or reassessment of competency can be required.

199 Competence assessors should have suitable qualifications for both:

- 200 • the activity being assessed; and
- 201 • the assessment methodologies to be used.

202 **5 Typical evidence of competence**

203 **5.1 General**

204 Individuals should demonstrate they have the knowledge and skills relevant to the Type(s) of
205 Protection, Types of ex Equipment, or safety related requirements necessary to perform their
206 assigned tasks.

207 Evidence that can be used to verify an individual's competence and ability to perform their
208 assigned task includes, but is not limited to:

- 209 – review and confirmation of validity of applicable documentation such as educational records
210 and professional credentials;
- 211 – documentation of experience;
- 212 – practical skills evaluation;
- 213 – theoretical assessment such as exams; and
- 214 – second-party verification or third-party verification of knowledge and skills in accordance
215 with Clause 8.

216 NOTE In many jurisdictions it is the legal responsibility of the owner or operator of a facility to ensure that individuals
217 conducting work have received appropriate training and are competent to complete the tasks assigned to them.

218 **5.2 Prerequisite qualifications**

219 The competence assessment in this document is to assist employers define requirements in
220 addition to any prerequisite qualifications expected of an individual to perform a specific role
221 as required where National requirements are not in place.

222 Some of the roles identified in this document recommend prerequisite qualifications are likely
223 to be necessary to meet the objectives.

224 NOTE 1: Prerequisite qualifications include items such as educational or professional credentials and licences to
225 work required by applicable regulations.

226 NOTE 2 For example, a prerequisite qualification for an installer could be electrician qualifications in addition to
227 being competent to perform other roles identified in this document such as maintenance.

228 **5.3 Recommendations for the verification of Ex competence**

229 Ex competence may be verified through written or verbal tests, by witnessing of work in-
230 process, or assessment of competency verification systems. The results of the verification
231 should be documented, including the verification methodology used and the level of results
232 attained. The verification should be traceable and auditable.

233 Employers should consider including a second-party verification or third-party verification
234 systems in their employment, contract, or procurement processes.

235 First-party verification for individuals working in, or associated with, hazardous areas should
236 not be permitted.

237 NOTE Documents such as ISO/IEC 17024 provide guidance for assessment and certification of competence.

238 **6 Task competency expectations**

239 The level of competence required for specific operations should be determined. This could
240 include assigning a competence level required for certain tasks rather than defining a specific
241 role.

242 Competence expectations should be identified according to the complexity and risk associated
243 with the task and can vary by employer, role, operator, or facility.

244 NOTE For example, the minimum competency expectation for personnel that only install Cable Glands can require
245 different competencies to that of personnel who are expected to install more complex equipment.

246 The skill level of a manufacturer's technician working on their equipment is not expected to be
247 the same as the person carrying out the installation of that equipment.

248 A programme to assess the competence of individuals for specific roles should be established,
249 including pass-fail criteria. (see Clause 9).

250 **7 Party legally responsible for a facility**

251 **7.1 General**

252 The party legally responsible for a facility should ensure the organizational structure and
253 competency of the staff maintains the safety of the facility. The responsibilities and authorities
254 should be clearly defined and communicated within the organization. These should:

255 – be appropriate to the purpose of the organization;

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- 256 – be appropriate to the management structure of the organization;
- 257 – include a commitment to comply with regulatory requirements.
- 258 – be communicated and understood within the organization;
- 259 – be periodically reviewed for continuing suitability; and
- 260 – identify or delegate the responsibility to ensure compliance and maintain the integrity of the
- 261 equipment and facility (see 8.11).

262 **7.2 Internal quality audit of competency management system**

263 **7.2.1 General**

264 Internal auditing of a competency management system to be implanted to assess the
265 effectiveness of the system. The auditing technique can include the interview of selected
266 individuals using an “explain” and “show me” sampling technique.

267 Auditing should be a structured activity based upon a formal programme. Documents such as
268 ISO 19011 provide guidance on the management of an audit programme, its planning and
269 conduct.

270 **7.2.2 Examples of typical auditing tasks**

271 Audits may have a specific focus based on the auditor's prior experience or knowledge of
272 typically weak areas, event history at the facility, management priorities and regulatory
273 requirements.

274 Examples of typical auditing tasks include, but are not limited to, to confirm that:

- 275 – Ex and relevant management processes are appropriate, up to date and available to those
276 who need them;
- 277 – roles and responsibilities are clearly defined and assigned to the appropriate personnel to
278 allow the management processes to be implemented;
- 279 – people clearly understand their duties and are competent to carry them out;
- 280 – Ex Equipment integrity is well managed and documented, and appropriate records are kept
281 of equipment installed, work carried out, inspections performed and findings;
- 282 – records and documentation are kept accurate and current; and
- 283 – management of change procedures relating to hazardous areas and Ex Equipment is in
284 place, and correctly implemented.

285 **7.2.3 Examples of evidence of competence**

286 The auditor should have competence in the audit process, knowledge of the activities to be
287 audited and should be independent of the part of the organization that is being audited.
288 Examples of evidence of competence can include, but are not limited to:

- 289 – having prior experience in the audit process including; plan, conduct, prepare an opening
290 meeting and conduct close out presentations and reports. (ref. ISO 19011); and
- 291 – being experienced in the range of measures required to manage Ex Equipment in hazardous
292 areas including:
 - 293 a) understanding the requirements of the applicable national or international legislation;

- 294 b) being familiar with the legislation governing the management of Ex Equipment;
- 295 c) being able to demonstrate a practical understanding of the requirements for Ex areas,
296 explosion protection principles and installation, maintenance, and repair requirements;
297 and
- 298 d) having prior working experience in various aspects of Ex tasks related to hazardous
299 areas.

300 **8 Roles associated with hazardous areas where competence should be verified**

301 **8.1 General**

302 This section provides examples of roles of individuals working in, or associated with, hazardous
303 areas. Each role is based on the typical tasks performed with examples for the evidence of
304 competence for those tasks.

305 Continuing education or training to maintain the level appropriate of competence for each task
306 associated with a role is advisable.

307 NOTE 1 Assessment of competence is addressed in Clause 9

308 NOTE 2 Reassessment of competence is addressed in Clause 10.

309 NOTE 3 Certain tasks can additionally include the use of a Permit to Work (PTW) management system to ensure
310 that work conducted in a facility is performed safely and efficiently.

311 **8.2 Area Classification**

312 **8.2.1 General**

313 The area classification should be carried out by personnel who understand the relevance and
314 significance of the properties of the flammable substances, sources of release, principles of
315 dispersion, and the potential for an explosive atmosphere to develop. Personnel should be
316 familiar with the activities, process, and the equipment.

317 Area classification typically requires inputs from other disciplines such as electrical, non-
318 electrical, process engineers, plant operations personnel and others as applicable. Personnel
319 involved in area classification should have a broad range of experience and appropriate
320 analytical skills.

321 Competence should be relevant to the nature of the facility and methodology used for carrying
322 out the area classification.

323 **8.2.2 Examples of area classification tasks**

324 Typical area classification tasks include, but are not limited to:

- 325 – area classification involving gathering and analysing of data relative to explosion hazards;
- 326 – identification of the relevant characteristics of the flammable materials;
- 327 – identification of the type and extent of the hazardous area in accordance with the
328 appropriate codes or regulations for the jurisdiction of the facility and material(s) involved;
- 329 – determination of the types and availability of ventilation for gases / vapours and the impact
330 it has on the hazardous area (such as in IEC 60079-10-1);
- 331 – determination of the type dusts involved and the potential for explosive dust atmospheres
332 or dust layering forming (such as in IEC 60079-10-2);

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- 333 – Consideration of any influence due to environmental conditions; and
- 334 – preparation of drawings and documentation to identify the hazardous areas within a facility,
- 335 and the associated risks that occur in those areas;

336 **8.2.3 Examples of evidence of area classification competence**

337 Typical evidence of area classification competence includes, but is not limited to:

- 338 – understanding of the relevant standards and guidance documents applicable to the
- 339 jurisdiction of work and the legal expectations of the local jurisdiction;
- 340 – ability to interpret the input from others as appropriate to understand the processes within
- 341 a facility and the necessary documents required to enable area classification;
- 342 – ability to identify and grade all potential release sources and the impact of ventilation;
- 343 – ability to determine the extent of the zone using appropriate look-up tables, reference
- 344 materials or calculations taking into account their limits of use; and
- 345 – ability to understand the relationship between equipment, processes, and area classification
- 346 where changes or modifications in one area can affect other area(s).

347 NOTE Multiple standards and guidance documents are available and specific to the application and jurisdiction. This
348 document does not attempt to list them. (such as IEC 60079-10-1 and IEC 60079-10-2)
349

350 **8.3 Design of systems or installations for hazardous areas**

351 **8.3.1 General**

352 The design of installations in hazardous areas should be carried out by those who understand
353 the various Types of Protection, installation practices, relevant rules and regulations and the
354 general principles of area classification.

355 A designer needs the ability to design systems for electrical, non-electrical, software, that relate
356 to the operation of a facility in a hazardous area. There are multiple requirements based on the
357 complexity of a facility. This requires that the design start with the objectives and consider the
358 appropriate Ex Equipment that will be able to achieve the process and safety goals.

359 NOTE A designer may be part of a team in which individuals have different competencies necessary to complete the
360 design of a system or installation.

361 **8.3.2 Examples of typical design tasks**

362 Examples of typical design tasks include, but are not limited to:

- 363 – evaluation of local regulatory, legal and facility requirements for an installation in hazardous
- 364 areas;
- 365 – selection of Ex Equipment and interconnecting systems based on the area classification
- 366 using documents such as IEC 60079-14;
- 367 – selection and application of standards, owner specifications and legal requirements relevant
- 368 to the systems being designed and the location;
- 369 – ensure ventilation issues considered during area classification are included in the design
- 370 and installation documents;
- 371 – preparation of construction or installation drawings with supporting detail where required;

- 372 – preparation of specifications for procurement; and
373 – preparation of, or participation in, the verification dossier to support future maintenance,
374 inspection, and repair.

375 **8.3.3 Examples of evidence of design competence**

376 Examples of design competence include, but are not limited to:

- 377 – interpretation and application of requirements from source documents such as functional
378 specifications, area classification drawings;
- 379 – understanding of the area classification and environmental conditions on which to base the
380 design of systems and selection equipment that are appropriate;
- 381 – demonstrating the practical skills necessary for the preparation and compilation of relevant
382 design, procurement, installation, inspection, testing, and maintenance information and
383 documentation for the applicable concepts of protection and systems involved;
- 384 – identification of any ignition sources which shall be properly protected or controlled;
- 385 – understanding the general principles of explosion protection, relevant standards and Ex
386 Equipment marking;
- 387 – understanding the content of instruction manual and Ex Equipment certificates;
- 388 – understanding the specific techniques employed in the selection and erection of Ex
389 Equipment.

390 NOTE The design of systems or installations for hazardous areas typically requires prerequisite competence in other
391 areas such as earthing, electrical systems and lightning protection.

392 **8.4 Installation**

393 **8.4.1 General**

394 Installation of the Ex Equipment includes verification of proper mounting, appropriate electrical
395 and non-electrical interconnection and documentation of the installation while Ensuring the Ex
396 Equipment specifications are appropriate and any Specific Conditions of Use are addressed.

397 Completion an installation can include selection of appropriate materials and tools required for
398 the task.

399 **8.4.2 Examples of typical installation tasks**

400 Examples of typical installation tasks include, but are not limited to:

- 401 – confirmation that Ex Equipment is per specification, or as ordered and is appropriate for the
402 location, including the consideration of any Specific Conditions of Use;
- 403 – selection and installation of various types of equipment not specified in the design that are
404 required for the correct installation of Ex Equipment;
- 405 – handling and installation of Ex Equipment;
- 406 – interconnection of electrical systems, cable termination and the use of supports as required;
- 407 – installation of equipment as per design drawings;
- 408 – working safely in a hazardous area including hazard monitoring, evacuation procedures and
409 the use of permit to work system or safe isolation procedures;

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- 410 – testing of installed cables/circuits to ensure safety where required (this can also be
411 completed in the commissioning process); and
- 412 – documenting the completion of installation as required.

413 **8.4.3 Examples of evidence of installation competence**

414 Installers need to demonstrate competence to the extent necessary to perform their tasks:

415 Examples of evidence of installation competence include, but are not limited to:

- 416 – understanding of installation of and work with Ex Equipment;
- 417 – understanding of the general principles of explosion protection concepts;
- 418 – knowledge of ignition sources
- 419 – understanding of the principles of Types of Protection, marking and appropriate areas of
420 use;
- 421 – understanding of the equipment installation requirements which could affect the protection
422 concept;
- 423 – correct use of instruction manuals, equipment certificates and installation documentation;
- 424 – application of proper installation techniques and correctly select any additional materials
425 when required to complete the task (such as cables, Cable Glands, cable trays, filters, spark
426 arrestors,);
- 427 – raising of technical queries (TQ) (when required) with the appropriate technical authority;
- 428 – application of permit to work systems and comply with any limitations;
- 429 – understanding of installation requirements in the applicable standards or documents;
- 430 – understanding of inspection and maintenance requirements; and
- 431 – correct use and operation of the appropriate testing equipment and consider any impact this
432 may have in the hazardous area.

433 **8.5 Maintenance**

434 **8.5.1 General**

435 Maintenance personnel should have the knowledge and skills required for the relevant Types
436 of Protection and types of Ex Equipment involved.

437 **8.5.2 It is important that any maintenance procedures in hazardous areas ensure the** 438 **explosion-protection features of the Ex Equipment involved is not** 439 **compromised. Examples of typical maintenance tasks**

440 Examples of typical maintenance tasks include, but are not limited to:

- 441 – implementation of maintenance programs and schedules, in relation to Ex Equipment and
442 Specific Conditions of Use;
- 443 – performance of testing as required, fault finding and corrective maintenance;
- 444 – ensuring that the features of each explosion-protection technique are included in the
445 maintenance schedule and tasks;

- 446 – ensuring the maintenance program considers any environmental conditions, such as
447 corrosion, that could require an increased frequency in the maintenance of Ex Equipment;
- 448 – recording of all maintenance conducted and results as appropriate;
- 449 – working safely in a hazardous area including hazard monitoring, evacuation procedures and
450 the use of permit to work system or safe isolation procedures; and
- 451 – interpretation of equipment documentation in relation to maintenance, repair and
452 replacement.

453 **8.5.3 Examples of evidence of maintenance competence**

454 Maintenance personnel need to provide evidence of their maintenance competence to the
455 extent necessary to perform their tasks.

456 Examples of evidence of maintenance competence include, but are not limited to:

- 457 – an understanding of those aspects of equipment which affect the Types of Protection and
458 the related markings;
- 459 – an understanding of the content of Ex Equipment Certificates and Specific Conditions of
460 Use;
- 461 – an understanding and ability to read and assess engineering drawings and identify
462 differences to the condition as installed;
- 463 – understanding of the local regulatory requirements for installations;
- 464 – ability to confirm that the Ex Equipment is fit for purpose, correctly installed and suitable for
465 the location in which it is installed, has not deteriorated or is damaged and has not had any
466 unauthorised modifications;
- 467 – ability to identify Ex Equipment which has deteriorated or is damaged and is no longer in
468 compliance with the Type(s) of Protection;
- 469 – detailed knowledge of the additional importance of permit to work systems and safe isolation
470 in relation to explosion protection;
- 471 – detailed knowledge of the techniques to be employed in the selection and installation of
472 equipment referred to in this document;
- 473 – ability to update or provide the information for the applicable maintenance record,
474 verification dossier, facility drawings,
- 475 – knowledge of the maintenance requirements in the applicable standards or documents for
476 both electrical and non-electrical requirements;
- 477 – knowledge of the overhaul and repair requirements in the applicable standards or
478 documents for both electrical and non-electrical requirements;
- 479 – knowledge of quality assurance, including the principles of auditing, documentation,
480 traceability of measurement and instrument calibration; and
- 481 – knowledge of the correct operation and use of the appropriate testing equipment for use in,
482 or that may impact, the hazardous area;
- 483 – an understanding of the application and limitations of permit to work systems.

484 NOTE The knowledge requirements can vary in respect of:

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485 – the relevant standards specific to legacy installations for example; classification / product / installation/
486 inspection and maintenance.

487 – types of installations including low voltage, high voltage, Types of Protection, engines,

488 **8.6 Overhaul and repair activities within service facilities**

489 **8.6.1 General**

490 Users of Ex Equipment suitable for use in hazardous areas have a duty to ensure equipment
491 remains in compliance with applicable regulations, which can include the need to ensure their
492 equipment is overhauled, repaired and reclaimed and returned to serviceable condition by
493 persons or organizations competent in the application of standards such as IEC 60079-19.

494 Overhaul and repair are typically conducted offsite or outside a hazardous area and therefore
495 the requirements for individuals or organizations involved in those specific tasks need to be
496 verified by the user.

497 Competence should apply to each Type of Protection and Ex Equipment type for which the
498 person is involved. For example: it is possible for a person to be competent in the field of repair
499 and overhaul of Ex “d” electric machines only and not be fully competent in repair of Ex “d”
500 switchgear or Ex “e” electric machines.

501 The responsible person for overhaul and repair activities within the management organization,
502 accepts responsibility and authority for ensuring that the overhauled/repaired equipment
503 complies with the Ex Equipment Certificate or any change in status is agreed to by the user.
504 The person so appointed should have a working knowledge of the appropriate explosion
505 protection standards and an understanding of this document.

506 Repair operators work under the technical authority of the Responsible Person within the site
507 management system.

508 **8.6.2 Examples of typical overhaul and repair tasks – Individual(s) responsible for** 509 **overhaul and repair**

510 Examples of typical overhaul and repair tasks include, but are not limited to:

511 – explaining to user the status of the Ex Equipment after overhaul and repair and obtain
512 acceptance of the resulting status before any repair is undertaken;

513 – obtaining approval from the user on the scope of work involved in the repair or reclamation;

514 – confirming the Ex Equipment is in serviceable condition with sufficient verification of
515 compliance and authorize application of the Ex repair label;

516 – maintaining records such as Ex job records, Type of Protection standards, technical
517 specifications, schedule drawings, operation and maintenance manuals, spare parts list;

518 – verification of the competence of repair operators periodically; and

519 – participation in the Quality Management System review process.

520 **8.6.3 Examples of evidence of overhaul and repair competence – Responsible Person** 521 **for overhaul and repair**

522 Examples of overhaul and repair competence include, but are not limited to:

523 – demonstration of the evidence of competence as detailed in 8.6.5;

- 524 – demonstrating a working knowledge and understanding of the relevant standards in
525 explosion protection field;
- 526 – demonstrating a practical understanding of explosion-protection principles and Types of
527 Protection;
- 528 – demonstrating an understanding and ability to read and assess engineering drawings and
529 identify differences to the as-built condition;
- 530 – demonstrating an understanding of the local regulatory requirements for overhaul and repair
531 applicable for equipment and for the location in which it is installed; and
- 532 – demonstrating a knowledge of quality assurance, including principles of traceability of
533 measurement and instrument calibration.

534 **8.6.4 Examples of typical overhaul and repair tasks - Repair Operator**

535 Examples of typical overhaul and repair tasks include, but are not limited to:

- 536 – identification of the relevant standards from the nameplate or documentation for the
537 equipment and conduct visual inspection and electrical and non-electrical required tests;
- 538 – communication to the responsible person the requirements to return equipment to
539 serviceable condition in accordance with the relevant standards;
- 540 – assessment of equipment condition and that it has not had any unauthorised modifications,
541 completion of approved repairs and provision of inspection and test records, including
542 traceability of instruments used and pass-fail criteria, to the Responsible Person for
543 overhaul and repair; and
- 544 – when authorized by the Responsible Person for overhaul and repair, application of the repair
545 label.

546 **8.6.5 Examples of evidence of competence - Repair Operator**

547 Examples of overhaul and repair competence include, but are not limited to:

- 548 – understanding of the applicable principles of explosion protection, Types of Protection, the
549 content of Ex Equipment Certificates and any Specific Conditions for Use;
- 550 – understanding of nameplate data and marking to accurately identify the relevant standards
551 to be used in assessing equipment condition and conducting overhauls, repairs, and
552 reclamations;
- 553 – ability to evaluate equipment to identify any unauthorised modifications, the equipment
554 condition and any deterioration or damage which may affect the compliance with the Type
555 of Protection;
- 556 – knowledge of the overhaul and repair requirements in the relevant standards or documents
557 such as IEC 60079-19; and
- 558 – ability to update or provide the information for the applicable repair record, job report and
559 Quality Management Systems (QMS) records.

560 **8.7 Inspection**

561 **8.7.1 General**

562 Inspection is the examination of an item or installation to determine the conformity to specific
563 requirements.

564 **8.7.2 Examples of typical inspection tasks**

565 Examples of typical inspection tasks include, but are not limited to:

- 566 – Performance of detailed, close, or visual inspection to confirm compliance with the
567 applicable standards, manufacturers' instructions, and installation requirements and that
568 there is no deterioration of the equipment that could affect the Type of Protection;
- 569 – conduct of testing as required according to Clause 8.10; and
- 570 – recording and retention of the results of all inspections including the extent, type and
571 findings of an inspection and submit the report to management as required.

572 **8.7.3 Examples of evidence of inspection competence**

573 Examples inspection competence include, but are not limited to:

- 574 – ability to obtain the relevant information from the engineering drawings to conduct the
575 inspection;
- 576 – an understanding of those aspects of equipment design which affect the protection concept
577 and ability to identify Ex Equipment which has deteriorated and is no longer in compliance
578 with the Type of Protection concept;
- 579 – an understanding of the content of Ex Equipment Certificates and relevant parts of the
580 applicable standard(s) and to identify that any Specific Conditions of Use are met;
- 581 – understanding of the particular techniques to be employed in the selection and installation;
- 582 – ability to identify differences between the drawings and the condition as installed;
- 583 – an understanding of the local regulatory requirements for installations;
- 584 – knowledge of quality assurance, including the principles of auditing, documentation,
585 traceability of measurement and instrument calibration;
- 586 – knowledge of the correct operation and use of the appropriate testing equipment for use in,
587 or that can impact, the hazardous area;
- 588 – detailed knowledge of the application and limitations of permit to work systems and safe
589 isolation in relation to explosion protection;
- 590 – ability to confirm the equipment is fit for purpose, correctly installed and suitable for the
591 location in which it is installed, and there have not been any unauthorised modifications;
- 592 – understanding of the applicable principles of explosion protection, Types of Protection and
593 marking;
- 594 – ability to accurately and clearly record any defect that has been found in such a manner as
595 to ensure that the repairer can effectively plan and carry out an appropriate repair;
- 596 – knowledge of the inspection and installation requirements in the applicable standards or
597 documents such as IEC 60079-14; and
- 598 – knowledge of the inspection requirements in the applicable standards or documents such
599 as IEC 60079-17.

600 **8.8 Commissioning**

601 **8.8.1 General**

602 Commissioning involves activities undertaken to ensure the verification and functioning of
603 equipment and facilities forming a system or group of sub-systems, by demonstrating and
604 recording its conformance with design parameters, regulation and specified operational
605 requirements, to show that the system is safe and operable.

606 Commissioning can require a combination of some or all the skills including that of inspection,
607 testing, maintenance, and installation

608 These are some of the basic inspection and checks carried out to demonstrate that plant and
609 equipment has been fabricated, constructed, and installed correctly as part of construction, pre-
610 commissioning, and maintenance activities.

611 **8.8.2 Examples of typical commissioning tasks**

612 Examples of typical commissioning tasks include, but are not limited to:

- 613 – testing as required according to 8.10;
- 614 – installation and hook up of equipment;
- 615 – insulation resistance testing of cables and Ex Equipment;
- 616 – high voltage testing of cables where required;
- 617 – cold loop checks (cables continuity tests);
- 618 – performing equipment calibration;
- 619 – performing no-load tests on rotating equipment;
- 620 – energizing electrical switchgear;
- 621 – relay testing and functional testing of electrical interlocks;
- 622 – cause and effect logic testing;
- 623 – load testing;
- 624 – functional testing of instrument loops from field devices to the Human Machine Interfaces
625 and energised functional checks;
- 626 – alignment of rotating equipment couplings;
- 627 – ensuring guards are correctly secured;
- 628 – ensuring lubrication levels are correct;
- 629 – ensuring no visible signs of leakage from pump or gearboxes seals; and
- 630 – recording and retaining the results of checks and inspections.

631 **8.8.3 Examples of evidence of commissioning competence**

632 Examples of commissioning competence include, but are not limited to:

- 633 – Commissioning personnel should demonstrate their competency relevant to the Types of
634 Protection or Ex Equipment involved. ;

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- 635 – understanding, application, and limitations of the permit to work systems; and
- 636 – demonstrating a level of commissioning competency which is related to the tasks being
- 637 performed.

638 **8.9 Facility Operation**

639 **8.9.1 General**

640 Individuals are responsible for the safe the operation of an industrial facility with hazardous
641 areas. This includes but is not limited to the coordination of multiple roles, tasks, work
642 requirements, emergency procedures and management reporting.

643 **8.9.2 Examples of typical facility operation tasks**

644 Examples of typical facility operation tasks include, but are not limited to:

- 645 – operating and monitoring control of equipment, processes, and areas of industrial facilities
- 646 to maintain parameters within prescribed limits during normal and abnormal conditions;
- 647 – initiation of appropriate action when parameters vary outside normal operating limits;
- 648 – managing approval of work, permit to work system or other control procedures of work
- 649 conducted by others in the facility;
- 650 – monitoring and approval of entry of personnel;
- 651 – oversight of the movement, transport, storage of equipment and materials within the facility;
- 652 – initiation, coordination, and execution of emergency response procedures;
- 653 – status reporting to facility managers; and
- 654 – review and approval of management of change requests on behalf of the operations
- 655 department.

656 **8.9.3 Examples of evidence of facility operation competence**

657 Examples of facility operation competence include, but are not limited to:

- 658 – facility operation staff need to demonstrate their abilities which relate to their role and the
- 659 exact nature of the facility:
- 660 – use of information sources to identify the hazardous area classification for a part of a facility
- 661 and identify the potentially flammable materials that may be present;
- 662 – demonstrating the knowledge of the principles of hazardous area classification to identify
- 663 what changes could impact the facility (example of changes: addition of enclosures, change
- 664 of use of pipes, change of pump seal types, increased sample frequency, failure of
- 665 ventilation, lack of cleanliness, leaking joints);
- 666 – showing sufficient understanding of the applicable hazardous area equipment marking to be
- 667 able to establish in which areas equipment may be used, such as gas/dust group and
- 668 temperature class confirm whether the equipment can be used in specific locations of a
- 669 facility;
- 670 – identifying the suitability of personal, portable or transportable equipment to be used in
- 671 various areas of a facility;
- 672 – ascertaining if Ex Equipment is suitable for continued operation (for example understand
- 673 and report alarm status, integrity of enclosures, management of leaks, spills,);

- 674 – understanding the actions to take where equipment and process parameter restrictions are
675 exceeded;
- 676 – understanding emergency response procedures and how to perform required actions;
- 677 – managing / monitoring work at the site to avoid ignitions of a potentially explosive
678 atmosphere. This includes the ability to:
- 679 a) assigning competent personnel appropriate to tasks;
- 680 b) identifying actions at the site that could cause releases of potentially flammable /
681 explosive materials / atmosphere and specify appropriate controls; This may include,
682 but is not limited to:
- 683 c) identifying actions and events that may cause ignition and specify appropriate controls;
- 684 d) understanding the principal sources of ignition (these are identified in documents such
685 as ISO 80079-36) along with the knowledge and experience to understand how these
686 may occur in practice at the place of work;
- 687 NOTE Additional guidance can be found in other documents such as EN 1127-1
- 688 e) originating, verifying, checking, monitoring or controlling measures whether
689 implemented by self or others;
- 690 f) checking selection and use of tools and equipment for the task being performed;
- 691 g) identifying means by which electrostatic charges may be generated and controlled in
692 practice at the place of work (for example, clothing, PPE, splash filling, use of plastics,
693 appropriate hoses, earthing of moveable pumps, pump trucks and persons identified in
694 documents such as IEC TS 60079-32-1 and other relevant documents);
- 695 h) managing / undertaking portable gas testing, if appropriate, including an appreciation of
696 the limitations of this technique;
- 697 i) identifying unacceptable levels of cleanliness in a dust environment, as appropriate; and
- 698 j) confirming that the qualifications of the personnel working in a facility are appropriate
699 for the assigned tasks.

700 **8.10 Testing of installed Ex Equipment**

701 **8.10.1 General**

702 Where there is a requirement for lifecycle integrity testing there should be an understanding of
703 the limitations that exist and the hazards that can be created by the execution of the tests. This
704 is in addition to understanding the Ex Equipment being inspected, requirements for facilities
705 with hazardous areas in relation to permit to work and clearances, hazard monitoring and
706 evacuation procedures, and plant and electrical isolation.

707 **8.10.2 Examples of typical testing of installed Ex Equipment tasks**

708 Examples of typical testing of installed Ex Equipment include, but are not limited to:

- 709 – planning for and conducting testing in a hazardous area:
- 710 – identifying the Occupational Health and Safety (OH&S) procedures to be followed;
- 711 – determining if the area is safe for the tests to be carried out;
- 712 – defining the characteristics, suitability and limitations of the testing equipment being used;
- 713 – defining or identify the appropriate pass-fail criteria for each test procedure;

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- 714 – documentation of results of the installation tests in a verification dossier; and
- 715 – developing procedures and options for dealing with test results that show non-conformance.

716 **8.10.3 Example of evidence of typical testing of installed equipment competence**

717 Examples of testing of installed equipment include, but are not limited to:

- 718 – understanding the aspects of commissioning, maintenance, and inspection; and
- 719 – ability to conduct testing, interpret, record results and report accordingly where corrective
720 action is required for item such as cables, piping (corrosion), ventilation system testing,
721 verification of the direction of rotation of machines.

722 **8.11 Responsibility for specific Ex compliance functions**

723 **8.11.1 General**

724 Organizations may appoint a specific person(s) as responsible for ensuring installations comply
725 with Ex requirements and regulations. Compliance functions can include management,
726 implementation, audit, and analysis.

727 NOTE 1 for example, IEC 60079-14 and IEC 60079-17 have historically used the terms “Responsible Person”,
728 “Operative” and “Technical Person with Executive Function” to describe specific tasks which can be addressed by
729 the roles defined in this document.

730 NOTE 2 Certain tasks require different levels of knowledge, skills, and competencies to enable them to meet the
731 requirements of the relevant standards and legal requirements required in the country of operation.

732 **8.11.2 Examples of typical compliance functions**

733 Examples of compliance functions include, but are not limited to:

- 734 – identification of the applicable legal requirements for safe operation of the facility;
- 735 – ensure an effective Safety Management System (SMS) is in place for the control of ignition
736 sources;
- 737 – establishing an overview of the tasks necessary for Ex compliance;
- 738 – identification of and maintain the content requirements of the verification dossier where
739 required;
- 740 – development, maintenance, and monitoring of an inspection methodology and strategy
741 appropriate for the facility; and
- 742 – monitoring of inspection reports, initiating and prioritizing any remedial actions.

743 **8.11.3 Examples of evidence of compliance function competence**

744 Examples of compliance function competence include, but are not limited to:

- 745 – demonstration of knowledge of the applicable legal requirements for the jurisdiction
746 involved;
- 747 – demonstration of a practical understanding of the requirements for Ex areas, explosion
748 protection principles and installation, maintenance, and repair requirements;
- 749 – demonstration of knowledge of risk evaluation and mitigation methodology;
- 750 – knowledge of the roles, responsibilities of all other (applicable to an Ex facility) tasks;
- 751 – demonstration of a general understanding of engineering and ability to read and assess
752 engineering drawings; and

753 – demonstration of an ability to communicate effectively with plant and engineering
754 management regarding equipment in hazardous areas issues.

755 **8.12 Management (accountable administration)**

756 **8.12.1 General**

757 The term management is here used to define the person(s) or organization given accountability
758 and responsibility on behalf of the owners to ensure that a facility is designed, built,
759 commissioned, safely operated and fulfils all legal requirements.

760 Technical knowledge of the hazardous area operations in a facility is not a prerequisite
761 requirement for management (accountable administration), however this does require they
762 assign key role responsibilities to persons with executive functions with appropriate
763 competence.

764 The management (accountable administration) is expected to read and act upon reports from
765 persons with executive functions when critical safety issues or other important details are
766 identified to protect persons and property where appropriate.

767 **8.12.2 Examples of typical management tasks**

768 Examples of typical management (accountable administration) tasks include ensuring
769 competence persons and systems are in place to address safety critical items, this includes but
770 is not limited to;

771 – persons with knowledge of governing laws, directives and codes are in place in the
772 organization and given responsibility to advise management on issues that may give rise to
773 potential explosions at the facilities under management;

774 – all personnel engaged in activities that may affect the performance of a facility are aware of
775 their roles, have the resources and time to execute these effectively and have sufficient
776 knowledge and experience to undertake these while being able to avoid, mitigate, identify,
777 or manage hazards. Best practice is to maintain evidence of:

778 a) role descriptions / task definitions and verification that these have been
779 communicated to the individuals who hold them;

780 b) competence verification and ongoing training provision, including dates, training
781 objectives, assessment criteria, attainment; and

782 c) periodic staff assessment against defined roles, including feedback from staff.

783 – competent persons are assigned to ensure;

784 ■ all codes and standards used in design, design modifications, installation, testing,
785 commissioning, operation, maintenance are appropriate

786 ■ consultants and contractors appointed have sufficient knowledge / experience;
787 Procedures are in place to ensure evidence of this is provided;

788 ■ key facility documentation (for example area classification drawings, maintenance
789 records, asset registers,) is current and an effective management of change
790 procedure is implemented;

791 ■ inventory of flammable and combustible material used at a site is controlled to be
792 appropriate for the actual throughput of the facility; Records of inventory / throughput
793 are maintained;

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794 ■ facility and equipment are operated and maintained appropriately; roles or positions
795 in the organization that manages the asset are specified such that all
796 accountabilities and responsibilities for all aspects of the management of avoidance
797 of explosions and management of emergency situations are covered and can be
798 traced;

799 ■ up to date guides or procedures are available to staff for the tasks to be safely
800 carried out on explosion protected equipment;

801 ■ records are kept of operational actions taken, work carried out and inspections
802 reports, including corrective actions required and remedial actions performed;

803 ■ procedures are in place to identify, as far as is reasonably practical, where a
804 potential unsafe condition that could give rise to an incident occurring and is
805 communicated to management;

806 ■ any risk ranking procedures in place are appropriate and are formally recorded;

807 ■ effective procedures are in place to control work and personnel (including visitors)
808 entry at site;

809 ■ emergency response procedures appropriate to potential events are in place and
810 proved to be effective by periodic drills or simulations; Records of which are
811 maintained; and

812 ■ defines safe work procedures and authorization requirements (such as a permit to
813 work system in hazardous areas for the various levels of risk involved);

814 – internal audit procedures to verify all the above are in place. Results of audits are recorded,
815 and correction action taken in a timely and appropriate manner.

816 **8.12.3 Examples of evidence of management (accountable administration)** 817 **competence**

818 Examples of management (accountable administration) competence include, but are not limited
819 to:

820 – demonstration of ability to manage an organization where hazardous areas may be present;

821 – demonstration of ability to manage a team of persons experienced with hazardous areas
822 and risk mitigation

823 – demonstration of knowledge of the roles, responsibilities of all other (applicable to an Ex
824 facility) tasks.

825 **8.13 Procurement**

826 **8.13.1 General**

827 When procuring Ex Equipment or services (purchasing, inspection, installation, repair,) or when
828 entering contractual agreements for services of the same, it is important to follow the Ex
829 requirements of the facility.

830 Persons responsible for procurement should have the competence to understand, or obtain, the
831 minimum information required to identify the type of Ex Equipment or services being requested.
832 While it may not be critical for procurement to understand equipment construction requirements,
833 they should be aware the impact of not following the specifications for Ex Equipment. Where
834 an external provider is being evaluated to provide services, the competence of the external
835 provider, including whether their staff has sufficient skills and experience to safely perform the
836 tasks included in the contract, should be confirmed.

837 Procurement should have the competence to understand, or obtain, the minimum information
838 required to identify the type of Ex Equipment or services being requested;

839 While it may not be critical for procurement to understand equipment construction requirements,
840 they should be aware the impact of not following the specifications for Ex Equipment;

841 Where an external provider is being evaluated to provide services, the competence of the
842 external provider, including whether their staff has sufficient skills and experience to safely
843 perform the tasks included in the contract, should be confirmed.

844 NOTE; Where procurement is an automated function, the system data is typically reviewed by persons competent in
845 Ex requirements.

846 **8.13.2 Examples of typical procurement tasks**

847 Examples of procurement tasks include, but are not limited to:

848 – sourcing vendors and purchasing Ex Equipment based on performance specifications,
849 design specifications, description of the product, Ex specifications, a list of acceptable
850 manufacturers, or specific catalogue / part / model number, based on a request from
851 others; and

852 – where a vendor recommends alternatives or substitutions to the original request,
853 procurement should consult with the originator of the request before purchasing;

854 **8.13.3 Examples of evidence of procurement competence**

855 Purchasing/procurement personnel should demonstrate a basic level of competency relevant to
856 the Types of Protection or equipment involved.

857 Examples of procurement competence include, but are not limited to:

858 – completing basic explosion protection awareness training;

859 – demonstrating general awareness of the Ex requirements for the location(s) they are
860 supporting in this role;

861 – demonstrating the ability to be able to identify equipment marking and certificates to be
862 supplied with the equipment ordered;

863 – experience of working to procedures that enable compliance for procurement of Ex
864 Equipment or services.

865 **8.14 Training instructors**

866 **8.14.1 General**

867 Persons involved with the education and training of individuals in developing the necessary
868 skills to meet the competency requirements listed in 8.2 through 8.13 should be competent in
869 the subject material they are dealing with.

870 **8.14.2 Examples of typical training tasks**

871 Examples of typical training tasks include, but are not limited to:

872 – developing task specific training materials; and

873 – presentation of training materials.

874 **8.14.3 Examples of evidence of training competence**

875 Examples of training competence include, but are not limited to:

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- 876 – demonstrating core competence in the subject matter assigned;
- 877 – providing evidence of competence to plan, organise and delivery the training curriculum;
- 878 and
- 879 – demonstrating instruction, communication, and presentation skills.

880 **8.15 Assessors of competence**

881 **8.15.1 General**

882 Assessors should meet the core competence requirements (as applicable) to evaluate the
883 competence of those identified in each role.

884 The assessor can require qualifications for the role and should be appointed or contracted by
885 management. A validation of their competence to conduct assessment may be through a peer
886 or witness assessment process.

887 **8.15.2 Examples of typical assessor tasks**

888 Examples of typical assessor tasks include, but are not limited to:

- 889 – conducting a structured evaluation programme for the role involved;
- 890 – formally recording the results of the assessment; and
- 891 – evaluating the assessment to determine the pass/fail results.

892 **8.15.3 Examples of evidence of assessor competence**

893 Examples of assessor competence include, but are not limited to:

- 894 – demonstrating core competence in the subject matter assigned;
- 895 – providing evidence of competence to conduct an impartial assessment; and
- 896 – demonstrating an understanding of the assessment programme and methods assigned;
- 897 – demonstrating communication skills.

898 **8.16 Other tasks**

899 **8.16.1 General**

900 Other tasks conducted within hazardous areas have the potential to compromise safety or
901 create ignition sources. While personnel should be made aware of the possible hazards, an
902 extensive evaluation of competency might not be required.

903 Other activities include, but are not limited to:

- 904 – housekeeping, catering, paintings, carpentry, civil contracting and other similar activities;
- 905 – tanker loading, material and equipment transfer, storage, logistics, machinery operation and
906 similar activities.

907 **8.16.2 Example of evidence of other competence**

908 An example of evidence of other competence would be completion of training or safety
909 orientation appropriate to the facility.

910 NOTE Facility management can require further assessment such as successful completion of a test.

911 **9 Evaluation Assessment Criteria**

912 **9.1 General**

913 The pass-fail evaluation of the competence assessment system can vary by employer, facility,
914 task or third-party verification, and assessment organization.

915 NOTE 1 The employer can define evaluation, test and pass-fail criteria that meets their specific task requirements.
916 A third-party verification and assessment organization normally defines a pass-fail criterion based to meet their
917 specific competency modules which typically have a broader scope than the employer.

918 Based on assigned tasks as indicated in Clause 6, Ex knowledge required is defined by the
919 facility management or by national regulations.

920 It is recommended that users of this document adopt or develop several versions of the practical
921 and written tests for each task or range of tasks. This process is recommended to facilitate
922 compliance with the requirements of 9.2 and to avoid improprieties.

923 NOTE 2: Documents such as ISO/IEC 17024 can provide guidance for the Evaluation Assessment Criteria.

924 **9.2 Pass-Fail Criteria**

925 The facility management may define or adopt the pass-fail criteria requirements that are most
926 appropriate to their specific operations or the skill level for a certain task as opposed to defining
927 a role.

928 NOTE If there is a need to repeat an assessment, it is common to allow an individual to repeat an assessment twice
929 without evidence of additional training. The questions for each assessment are typically different.

930 **10 Reassessment of competency evaluation**

931 It is important that competency continues to be maintained. It is recommended that the
932 competency of individuals be re-evaluated periodically (typically within a period not exceeding
933 5 years).

934 NOTE Several factors can affect the competency of an individual over time which can include knowledge
935 requirements from both internal and external influences. This can include changes in standards, industry practices
936 or technology, and a change in work role and responsibility, and maintenance of competence through practice.

937

938

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