

## Hazardous Area Competencies - all described in IEC standards

Copyright Material PCIC Europe  
Paper No. PCIC Middle-East ME18\_08

Arpad Veress  
ExNB Certification Institute  
48. Gömb st., 1139 Budapest  
Hungary

### Abstract

Hazardous area industries require competent people being active in all levels. Competency has to be shown both on theoretical and practical level. Competency is not just one-time exercise, it has to be refreshed in every 5 years to comply latest industry regulations and trends. Hazardous area competency (HAC) shall be the basis for both electrical and non-electrical explosion protection. HAC is an add on to one's basic knowledge of being electrician or mechanical fitter (further education).

Units of Ex personnel competencies can be subject of further discussion, but all are related to one's position on site including daily routine duties.

Company shall highlight the definition of competencies related to IEC standards 60079-14, -17 and -19, incl. ISO 80079., using the definition how we can build up inhouse competency systems for improvement of overall safety of hazardous area industries.

### I. INTRODUCTION

The legal way of explosion protection defines the following approach in each case for hazardous area industries:

- **first** – avoid the presence of hazardous material
- **second** – do not ignite if any present / eliminate of all sources of ignition
- **third** – if you can avoid or limit the presence of hazardous material: safety distance, bursting disc, etc.

It can only be done and managed by competent personnel.

### II. Ex COMPETENCY

*In all cases:*

- ex personal competency must be verified and comply with latest IEC versions;

- in many cases ex product certification, guarantee, warranty issues are strongly connected to Ex personnel competency;
- Ex personnel competency itself does not make one be an electrician, mechanic, engineer;
- To practice one's basic education in hazardous environment Ex personnel competency has to be proven.

Ex personnel competency is not only about installation, operation and maintenance - it is about understanding of all possible ignition sources:

- Flames;
- Direct fired space and process heating;
- Use of cigarettes/matches;
- Cutting and welding flames;
- Hot surfaces;
- Heated process vessels such as dryers and furnaces;
- Hot process vessels;
- Space heating equipment;
- Mechanical machinery;
- Electrical equipment and lights
- Spontaneous heating;
- Friction heating or sparks;
- Impact sparks;
- Sparks from electrical equipment;
- Stray currents from electrical equipment;
- Electrostatic discharge sparks;
- Lightning strikes;
- Electromagnetic radiation of different wave lengths and mobiles;
- Vehicles, unless specially designed or modified are likely to contain a range of potential ignition sources.

*The control of source of ignition:*

Sources of ignition should be effectively controlled in all hazardous areas by a combination of design measures, and systems of work:

- I. using electrical equipment and instrumentation classified for the zone in which it is located. New mechanical equipment need to be selected in the same way. (see above);
- II. earthing of all plant/ equipment (see technical measures document on earthing);
- III. elimination of surfaces above auto-ignition temperatures of flammable materials being handled/stored (see above);
- IV. provision of lightning protection;
- V. correct selection of vehicles/internal combustion engines that have to work in the zoned areas (see technical measures document on permit to work systems);
- VI. correct selection of equipment to avoid high intensity electromagnetic radiation sources, e.g. limitations on the power input to fiber optic systems, avoidance of high intensity lasers or sources of infrared radiation;
- VII. prohibition of smoking/use of matches/lighters, mobiles;
- VIII. controls over the use of normal vehicles
- IX. controls over activities that create intermittent hazardous areas, e.g. tanker loading/unloading;
- X. control of maintenance activities that may cause sparks/hot surfaces/naked flames through a permit to work system;
- XI. precautions to control the risk from pyrophoric scale, usually associated with formation of ferrous sulphide inside process equipment

### III. HOW DOES IT WORK?

Company shall apply standards.

Company shall apply to have one personnel competency system

- dedicated for personnel
- and how to integrate this personnel competency on daily level as an engineering lead

The IEC standards describe the various personnel competencies dedicated to different phases of hazardous area industries' operation:

- installation, design;
- maintenance;
- repair.

#### A) Knowledge and skills

Competencies – General: competencies shall apply to each of the explosion protection techniques for which the person is involved.

For example: it is possible for a person to be competent in the field of selection and erection of Ex “i” equipment

only and not be fully competent in the selection and erection of Ex “d” switchgear or Ex “e” motors. In such cases, the person's management shall define this in their documentation system.

#### Responsible persons (supervisor):

Responsible persons who are responsible for the processes involved in the design, selection and erection of explosion protected equipment shall possess, at least, the following:

- a) general understanding of relevant electrical engineering;
- b) understanding and ability to read and assess engineering drawings;
- c) practical understanding of explosion protection principles and techniques;
- d) working knowledge and understanding of relevant standards in explosion protection;
- e) basic knowledge of quality assurance, including the principles of auditing, documentation, traceability of measurement and instrument calibration.

Such persons shall confine their involvement to the management of competent operatives conducting selection and erection duties and not engage themselves directly in the work without ensuring their practical skills at least meet the requirements given – *which means a responsible person (supervisor) is not allowed to open any Ex installation.*

Responsible persons shall be able to demonstrate their competency and provide evidence of attaining the knowledge and skill requirements specified relevant to the types of protection and/or types of equipment involved.

#### Operatives / technicians (selection, erection, inspection):

Operatives / technicians shall possess, to the extent necessary to perform their tasks, the following:

- a) understanding of the general principles of explosion protection;
- b) understanding of the general principles of types of protection and marking;
- c) understanding of those aspects of equipment design which affect the protection concept;
- d) understanding of content of certificates and relevant parts of this standard;
- e) general understanding of inspection and maintenance requirements of IEC 60079-17;
- f) familiarity with the particular techniques to be employed in the selection and erection of equipment referred to in this standard;

g) understanding of the additional importance of permit to work systems and safe isolation in relation to explosion protection.

Operatives/technicians shall be able to demonstrate their competency and provide evidence of attaining the knowledge and skill requirements specified relevant to the types of protection and/or types of equipment involved.

They shall also be able to demonstrate their competency with documentary evidence in the:

- a) use of documentation (VD – Verification Dossier);
- b) production of reports, e.g. inspection reports, to the user as identified in VD;
- c) practical skills necessary for the preparation and installation of relevant concepts of protection;
- d) use and production of installation records as identified in VD.

### **Designers (design and selection)**

Designers shall possess, to the extent necessary to perform their tasks, the following:

- a) detailed knowledge of the general principles of explosion protection;
- b) detailed knowledge of the general principles of types of protection and marking;
- c) detailed knowledge of those aspects of equipment design which affect the protection concept;
- d) detailed knowledge of content of certificates and relevant parts of this standard;
- e) understanding of practical skills for the preparation and installation of relevant concepts of protection;
- f) detailed knowledge of the additional importance of permit to work systems and safe isolation in relation to explosion protection;
- g) detailed knowledge of the particular techniques to be employed in the selection and erection of equipment referred to in this standard;
- h) general understanding of inspection and maintenance requirements of IEC 60079-17.

Designers shall be able to demonstrate their competency and provide evidence of attaining the knowledge and skill requirements specified in relevant to the types of protection and/or types of equipment involved.

They shall also be able to demonstrate their competency with documentary evidence in the:

- a) production of documentation specified in VD;
- b) production of designers certificates to the user as identified in VD;
- c) practical skills necessary for the preparation and compilation of relevant design details for the concepts of protection and systems involved;
- d) updated and production of installation records as identified in VD.

## **B) What VD stands for?**

VD = verification dossier

The IEC standards define the VD as per follows.

It is necessary to ensure that any installation complies with the relevant equipment certificate as well as with this standard and any other requirements specific to the plant on which the installation takes place. To achieve this result, a verification dossier shall be prepared for every installation and shall be either kept on the premises or stored in another location. In the latter case, a document shall be left on the premises indicating who the owner or owners are and where that information is kept, so that when required, copies may be obtained.

*NOTE* The verification dossier can be kept as hard copy or in electronic form. Methods accepted by legislation in each country can have an impact on the form in which the documentation will be legally accepted.

In order to correctly install or extend an existing installation, the following information, additional to that required for non-hazardous areas, is required as part of the verification dossier, where applicable:

### **1) SITE**

- area classification documents (see IEC 60079-10-1 and IEC 60079-10-2) with plans showing the classification and extent of the hazardous areas including the zoning (and maximum permissible dust layer thickness if the hazard is due to dust);
- optional assessment of consequences of ignition;
- where applicable, gas, vapour or dust classification in relation to the group or subgroup of the electrical equipment;
- temperature class or ignition temperature of the gas or vapour involved;
- where applicable, the material characteristics including electrical resistivity, the minimum ignition temperature of the dust cloud, minimum ignition temperature of the dust layer and minimum ignition energy of the dust cloud;
- external influences and ambient temperature.

### **2) EQUIPMENT**

- manufacturer's instructions for selection, installation and initial inspection;
- documents for electrical equipment with conditions of use, e.g. for equipment with certificate numbers which have the suffix "X";
- descriptive system document for the intrinsically safe system;
- details of any relevant calculation, e.g. for purging rates for instruments or analyzer houses;
- manufacturer's/qualified person's declaration.

Considerations should be given to obtaining information for maintenance and repair to meet the requirements of IEC 60079-17 and IEC 60079-19 respectively.

### 3) INSTALLATION

- necessary information to ensure correct installation of the equipment provided in a form which is suitable to the personnel responsible for this activity (see IEC 60079-0, Instructions);
- documentation relating to the suitability of the equipment for the area and environment to which it will be exposed, e.g. temperature ratings, type of protection, IP rating, corrosion resistance;
- the plans showing types and details of wiring systems;
- records of selection criteria for cable entry systems for compliance with the requirements for the particular type of protection;
- drawings and schedules relating to circuit identification;
- records of the initial inspection.
- installer's/qualified person's declaration

*NOTE* Records of inspection for assemblies or pre-installed items can be accepted as part of initial inspection records.

All above means there are many topics which shall be covered by competent hazardous area professionals, which for the company shall train its employees for.

### IV. ASSESSMENT

The competency of responsible persons, operatives and designers shall be verified and attributed, at intervals relevant to national regulations or standards or user requirements, on the basis of sufficient evidence that the person:

- a) has the necessary skills required for the scope of work;
- b) can act competently across the specified range of activities; and
- c) has the relevant knowledge and understanding underpinning competency.

### V. METHODOLOGY

There are several ways to achieve the required level of Ex personnel competency.

All required competencies are described / defined in following IEC standards:

- IEC 60079-14: Electrical installations design, selection and erection
- IEC 60079-17: Electrical installations inspection and maintenance
- IEC 60079-19: Equipment repair, overhaul and reclamation

The Ex training and certification systems shall help us to establish a framework and support the common understanding.

### The formula is simple:

One does have basic skills like electrician, instrumentation, machinery. In order to able to work on a potential hazardous area site (E.g engineering, design, project, commissioning, installation, operation, maintenance, overhaul, repair) and related to hazardous area compliance (E.g HSE, purchasing department, etc) one shall upgrade his/her skills with hazardous area Ex personnel competencies.

This is the best interest of the hazardous area owner, but mandatory too in terms of work safety.

If no further regulation exists, than either the hazardous area owner shall create one InHouse Competency System as a requirement, which both internal and external workforces may comply with, or apply international training and certification packages and act accordingly.

In the followings we assess various Ex training packages (available on the market) and compare them to the minimum level defined by the IEC standard.

*NOTE* any of existing Ex personnel competency systems are applicable, as long as they comply with relevant IEC terms and with the required conformity assessment - general requirements for bodies operating certification of persons (ISO/IEC 17024:2012).

Ex competencies***							
IEC standard	IEC 60079-14			IEC 60079-17		IEC 60079-19	
scope	Electrical installations design, selection and erection – <i>section of realisation</i>			Electrical installations inspection and maintenance – <i>section of operation</i>		Equipment repair, overhaul and reclamation – <i>section of repair</i>	
positions	Responsible persons	Operatives / technicians	Designers	Responsible persons and technical persons with executive function	Operative / technician	Responsible persons	Operatives
description	who are responsible for the processes involved in the design, selection and erection of explosion protected equipment	selection and erection	design and selection	who are responsible for the processes involved in the inspection and maintenance of explosion protected equipment	inspection and maintenance	who are responsible for the processes involved in the overhaul, repair and reclamation of specific types of explosion protection of explosion protected equipment	repair, overhaul
validity / refreshment	5 yrs			5 yrs		3 yrs	
Conformity assessment - General requirements for bodies operating certification of persons (ISO/IEC 17024:2012)							

## VI. CONCLUSIONS

One Ex personnel InHouse competency system in each Company shall exist. Explosion protection shall be the lead of operation, and not a possible follow up action.

The applied 3<sup>rd</sup> party training / certification center shall be according to the conformity assessment - general requirements for bodies operating certification of persons (ISO/IEC 17024:2012).

In any hazardous area environment, the Company shall follow the rule as per one installation (complete system) is not Ex, no installation (system) shall function.

Reasons are many: - life in danger; - the Ex minimum requirements shall be linked to work safety, fire and environmental protection issues.

Company shall have a strategy how they measure personnel competency according to ISO/IEC 17024:2012 focusing on internal (own colleagues) and external (contractors) manpower. It is better to define how and what Company understands as a minimum level of Ex personnel competency and how the Company measures it.

International Ex personnel competency licenses are fine, but Company shall be able to go for interpretation. Available units shall be commented accordingly.

Company shall cover all operations including specification, design, installation, operation, maintenance, repair focusing both electrical and non-electrical explosion protection as per part of the Ex InHouse Competency System.

The simplest way has been described above in the standard, makes sense to follow worldwide. There are few international training personnel training concepts on the market for hazardous area industry owners, whose interest is to have one dedicated for their operation.

NOTE resolution No. (23) for year 2016 Rendered by the Council of Ministers Regarding the UAE Regulation to Control the Electrical Devices Prepared to be used in Potentially Explosive Conditions in UAE has defined:

“3. The entity or the person using the product shall be responsible for the following:

a. All parts of the product shall be assembled and operate duly.

**b. Maintenance operations for the product shall be performed in accordance with the manufacturer or any determined requirements and conditions including the two standard specifications (IEC 60079-14) and (IEC 60079 17).”**

Resolution No. (23) in UAE clearly shows the way in terms of hazardous personnel competency what shall be achieved there by hazardous area owners in UAE.

IEC (see IEC 60079-14/-17 and -19) simply describes the way to follow.

IEC defines the mandatory Ex personnel competencies, how this shall be achieved is in the hand of the hazardous area site owners.

## VII. REFERENCES

- [1] IEC 60079-14:2013
- [2] IEC 60079-17:2013
- [3] IEC 60079-19:2015
- [4] ISO/IEC 17024:2012
- [5] <http://www.iecex.com/publications/operational-od/>
- [6] <https://www.compex.org.uk/>
- [7] <http://www.esma.gov.ae/en-us>

## VIII. VITA

**Mr. Arpad Veress** graduated from the University of Miskolc (Hungary) in 1996. Since 1997 he has been involved in various international projects regarding hazardous area engineering, compliance and Ex personnel compliance. He is a member of the TC31, various standardization working groups and has authored several conference papers. Since 11 January 2017 he is the head of ExNB Certification Institute ([www.exnb.eu](http://www.exnb.eu)).