

OVERVIEW OF HAZARDOUS AREA SYSTEM

By B K Gupta (Email ID bkgupta5@gmail.com)

ABSTRACT

Petroleum, Chemical & many Industries has presence of flammable liquids, gases, vapours, combustible dust, flying & fibers. Underground coal mines have presence of Firedamp (a naturally occurring mixture of hydrocarbon gases) & combustible coal dust. Open cast coal mines have presence of combustible coal dust. These flammable substances in combination of ambient air form flammable mixture. The area containing such flammable mixture is known as hazardous area. An arc, spark or hot surfaces of equipment can lead to explosion of flammable media causing damages to plant, mines & operating personnel. In serious instances it may lead to consequential damages to surrounding property & population also. To prevent such explosion various safety measures are taken, use of explosion protected (Ex) Electrical & Electronic Equipment is one of these.

KEY WORDS

Hazardous Area, Code, Testing & certification, Conformity Assessment, Acts & Rules.

GENERAL

There are several aspect related to locations having hazardous area & Ex Equipment. This paper is being presented to project overview of explosive atmosphere system. Following are the various parts of this system which are discussed in this paper.

- **Code**
- **Testing & Certification**
- **Conformity Assurance**
- **Area Classification**
- **Selection, Installation & maintenance**
- **Statutory Acts & Rules**

CODE

IEC is the International code laying body. Most of the countries of world are its member. Let us see, what IEC says about importance of International Standards. It says, "IEC's International Standards facilitate world trade by, effectively, removing technical barriers to trade, leading to new markets and economic growth. Put simply, a component or system manufactured to IEC standards and manufactured in country A can be sold & used in countries B through Z."

Almost all member countries of IEC have national standards laying body, which publishes National Standard based on or identical to IEC standards depending on level of harmonization.

EU countries have adopted CENELEC codes, which are identical to IEC as CENELEC & IEC have cooperation agreement for harmonization of standards.

Situation is slightly different in USA, where NEC comes out with code for installation requirements & product codes are formulated by organization like UL, ISA & ANSI. Wide part of world including India accepts these international codes for Ex Equipment of imported origin.

Bureau of Indian Standards (BIS) is the National code laying body in India. All Indian standards except two codes relating to Area Classification and Selection & Installation of Ex equipment are identical to IEC standards. A list of prevailing IS codes & IEC codes are enclosed in Annexure A.

In this era of globalization, no non-tariff barrier is possible under GATT regime and hence sooner or later every country need to adopt international standards (IEC) and international conformity assessment schemes (IECEX).

TESTING & CERTIFICATION

All Ex equipment need to be tested & certified as per related standard before they are put in market. The labs issue a type examination certificate after successful testing, which enables manufacture to assure his customers that the product supplied by him is tested & certified and meets the requirement of related code.

There is a number of labs worldwide, who are recognized by IEC under IECEX scheme as ExTL to for testing & certification of Ex equipment.

There are many notified bodies in Europe undertaking testing & certification of Ex equipment like BASEEFA, SIRA, PTB, DNV etc. UL, FM & CSA are leading certification bodies in USA & Canada.

Almost all countries have their own national labs/ certification bodies to undertake testing & certification of Ex equipment.

India has following labs for testing & certification of Ex equipment:

Central Institute of Mining & Fuel Research (CIMFR) - Dhanbad,

Central Power Research Institute (CPRI) - Bangalore,

Electronics Regional Testing Lab (ERTL) - Kolkata,

Intertek - Delhi

Karandikar Lab - Boisar near Mumbai

IEC gives recognition to Ex Testing Laboratories (Ex TL) for testing & certification of Ex equipment under IEC Ex scheme. This scheme will be dealt in more detail under next heading of product conformity assurance.

Recently Karandikar Lab has been approved as IECEX ExTL as an extension of BASEEFA lab.

CONFORMITY ASSURANCE

The aim of ISO 9000 QMS certification is to make products & services acceptable in all countries on the basis of a single assessment & approval in any one country. ISO 9000 QMS certification creates confidence among potential customers that certified manufacturer could meet their quality requirements. ISO 9000 QMS certification being internationally recognized, the certified firm's product quality has word-wide acceptance. ISO 9000 QMS certification supplemented with EN ISO/IEC 80079-34 is being used for quality control of Ex equipment in EU under ATEX directive. ISO 9000 along with ISO/IEC 80079-34 is used for quality control under IEC Ex scheme.

IEC facilitates the IEC Ex certification scheme for Ex equipment. The objective of the scheme is use of one international certificate & mark accepted by all participating countries. It gives recognition to Accepted Certification Bodies (ACB) who controls use of IEC Ex mark by manufacturers.

Manufacturers in Europe have ATEX approval. Product conformity assurance is an integral part of ATEX approval. ISO 9000 QMS certification supplemented by EN ISO/IEC 80079-34 from notified bodies is one of the options for production control under ATEX directive.

Manufacturers in USA are normally having UL, FM or NRTL mark. UL is an independent body framing product standards, testing & certifying product to these codes and allow manufacturer to use UL mark and ensure

conformity assurance by way of surveillance. FM & other labs also work on similar lines using nationally recognized standards.

Almost all countries have their own national certification bodies to undertake conformity assurance of Ex equipment.

In India, BIS is entrusted with powers to license manufacturers for Quality Mark for Ex equipment and is governed by provisions of the Bureau of Indian Standards Act 1986. However only Ex d, Ex e and Ex i equipment are covered under Quality mark and other type of Ex equipment are not covered under Quality mark scheme by BIS as on date.

India has become member country of IEC Ex through BIS as nodal agency in year 2006 but unfortunately there is no further progress.

AREA CLASSIFICATION

IEC has published

IEC60079-10-1 for area classification of hazardous area having gases & vapours &

IEC 60079-10-2 for area classification of hazardous area having combustible dust.

EU is following these codes as they are published as EN standards but elsewhere harmonization level differs from country to country.

In India, IEC 60079-10-1 has been adopted as IS 5572-2009 with some national differences and IEC 60079-10-2 is under publication.

SELECTION, INSTALLATION & MAINTENANCE

IEC has published following codes:

IEC 60079-14 for selection & installation of Ex equipment,

IEC 60079-17 for Inspection & maintenance of Ex equipment &

IEC 60079-19 for Repair & overhaul of Ex equipment.

EU is following these codes as they are published as EN standards but elsewhere harmonization level differs from country to country.

In India, IEC 60079-14 has been adopted as IS 5571-2009 with some national differences. One of major difference is that Increased Safety Ex equipment is not allowed in Zone1 as done by IEC.

It is matter of great satisfaction that IEC Code for Inspection & Maintenance of Electrical Installation in Explosive Atmospheres has been published as IS/IEC 60079-17: 2007. Similarly IEC Codes for Repair & Overhaul of Ex Equipment has been published as IS/IEC 60079-19: 2006.

STATUTORY ACTS & RULES

These differ from country to country. EU has ATEX directive to regulate use of Ex equipment. USA has NEC, MSHA & OSHA as regulatory bodies. In India, CCOE & DGMS are regulatory bodies.

REFERENCES: The author thankfully acknowledges information available on website, which has been used for compilation of this paper.

LIST OF INDIAN & IEC CODES FOR EXPLOSIVE ATMOSPHERE AS ON 10 April 2013				
IS CODE	TITLE OF INDIAN STANDARD	IEC CODE	TITLE OF IEC STANDARD	STATUS
IS/IEC 60079-0: 2007	Electrical apparatus for explosive gas atmospheres - General Requirements	IEC 60079-0 Ed 6 2011/06	Explosive atmospheres Part 0: Equipment-General Requirements	Latest Version under printing as IS
IS/IEC 60079-1: 2007	Explosive atmospheres Part1- Equipment Protection by Flameproof Enclosures "d"	IEC 60079-1 Ed 6 2007/04	Explosive atmospheres Part1- Equipment Protection by Flameproof Enclosures "d"	Latest Version Printed as IS
IS/IEC 60079-2: 2007	Explosive atmospheres Part 2: Equipment Protection by Pressurized enclosures 'p'	IEC 60079-2 Ed 5 2007/02	Explosive atmospheres Part 2: Equipment Protection by Pressurized enclosures 'p'	Latest Version Printed as IS
IS 11064: 1984	Guide for construction & use of rooms or buildings protected by pressurization for installation of electrical apparatus for explosive gas atmospheres	IEC 60079-13 Ed1 2010/10	Explosive atmospheres - Part 13: Equipment protection by pressurized room "p"	Latest Version under printing as IS
IS/IEC 60079-16 1990	Electrical Apparatus for explosive gas atmospheres Part 16:Artificial Ventilation for the protection of analyzer houses	IEC 60079-16 Ed 1 1990/05	Electrical Apparatus for explosive gas atmospheres Part 16:Artificial Ventilation for the protection of analyzer houses	Latest Version Printed as IS
IS/IEC60079-5: 2007	Explosive Atmospheres Part 5: Equipment Protection by Powder filling 'q'	IEC 60079-5 Ed 3 2007/03	Explosive Atmospheres Part 5: Equipment Protection by Powder filling 'q'	Latest Version Printed as IS
IS/IEC60079-6: 2007	Electrical Apparatus for explosive gas atmospheres - Oil immersion 'o' (First Revision)	IEC 60079-6 Ed 3 2007/03	Explosive atmospheres Part 6: Equipment Protection by Oil immersion 'o'	Latest Version Printed as IS
IS/IEC 60079-7 2006	Explosive atmospheres – Equipment Protection by Increased Safety 'e'	IEC 60079-7 Ed 4 2006/07	Explosive atmospheres – Equipment Protection by Increased Safety 'e'	Latest Version Printed as IS
IS/IEC 60079-11 2006	Electrical Apparatus for explosive gas atmospheres - Intrinsic Safety 'i'	IEC 60079-11 Ed 6 2012/01	Electrical Apparatus for explosive gas atmospheres Part 11: Intrinsic Safety 'i'	Latest Version under printing as IS
IS/IEC 60079-25 2003	Electrical Apparatus for explosive gas atmospheres Part 25: Intrinsically Safe Systems	IEC 60079-25 Ed 2 2010/02	Explosive atmospheres - Part 25: Intrinsically safe electrical systems	Latest Version under printing as IS
IEC 60079-26 2006	Explosive atmospheres Part 26: Equipment with Equipment Protection Level (EPL) Ga	IEC 60079-26 Ed 2 2006/08	Explosive atmospheres Part 26: Equipment with Equipment Protection Level (EPL) Ga	Latest Version Printed as IS
		IEC 60079-27 Ed 2 2008/01	Explosive atmospheres Part 27: Field bus intrinsically safe concept (FISCO)	Latest Version under printing as IS
IEC 60079-28 2006	Explosive atmospheres Part 28: Protection of Equipment & transmission system using optical radiation	IEC 60079-28 Ed 1 2006/08	Explosive atmospheres Part 28: Protection of Equipment & transmission system using optical radiation	Latest Version Printed as IS
IS/IEC 60079-15 2005	Electrical Apparatus for explosive gas atmospheres Part 15: Construction, Test & Marking of Type of protection 'n' Electrical Apparatus	IEC 60079-15 Ed 4 2010/01	Explosive atmospheres - Part 15: Equipment protection by type of protection "n"	Latest Version under printing as IS

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IEC 60079-18 2009	Explosive atmospheres - Part 18: Equipment protection by encapsulation "m"	IEC 60079-18 Ed 3 2009/05	Explosive atmospheres - Part 18: Equipment protection by encapsulation "m"	Latest Version Printed as IS
IS 5572: 2009	Classification of hazardous areas (other than mines) having flammable gases & vapours for electrical installation (Third Revision)	IEC60079-10- 1 Ed 1 2008/12	Explosive atmospheres Part 10-1: Classification of area – Explosive gas atmospheres	Code printed with national differences, under review.
IS/IEC 61241- 10: 2004	Electrical apparatus for use in the presence of combustible dusts: Part 10: Classification of areas where combustible dust may be present	IEC60079-10- 2 Ed 1 2009/04	Explosive atmospheres Part 10-2: Classification of area - Combustible Dust Atmospheres	Latest Version under printing as IS
IS/IEC 60079- 20-1:2010	Explosive atmospheres - Part 20- 1: Material characteristics for gas and vapours classification - Test methods and data	IEC60079-20- 1 Ed1 2010/01	Explosive atmospheres - Part 20- 1: Material characteristics for gas and vapours classification - Test methods and data	Latest Version Printed as IS
IS 5571: 2009	Guide for selection & installation of electrical equipment for hazardous area (other than mines) (Third Revision)	IEC 60079-14 Ed 4 2007/12	Explosive Atmospheres (Other than mines & explosives) Part 14: Electrical installations -Design, Selection & Erection	Code printed with national differences, under review.
IS/IEC 61241- 14 :2004	Electrical apparatus for use in the presence of combustible dusts: Part 14: Selection & Installation		Combined with IEC 60079-14 Ed 4 2007/12	2004 version printed as IS
IS/IEC 60079- 17 2007	Explosive Atmospheres (Other than mines & explosives) Part 17: Electrical Installations - Inspection & Maintenance	IEC 60079-17 Ed 4 2007/08	Explosive Atmospheres (Other than mines & explosives) Part 17: Electrical Installations - Inspection & Maintenance	Latest Version Printed as IS
IS/IEC 60079- 19 2006	Explosive atmospheres Part 19: Equipment Repair, overhaul & reclamation	IEC 60079-19 Ed 3 2010/11	Explosive atmospheres Part 19: Equipment Repair, overhaul & reclamation	Latest Version under printing as IS
IS 5679: 1986	Miners Cap lamp assemblies (incorporating lead acid type batteries) (First Revision)	IEC60079-35- 1 Ed 1 2011/05	Explosives Atmospheres – Part 35-1: Cap lights for use in mines susceptible to firedamp - General requirement- Construction & testing in relation to risk of explosion	To be adopted
		IEC60079-35- 2 Ed 1 2011/12	Explosives Atmospheres – Part 35-2: Cap lights for use in mines susceptible to firedamp - Performance & other safety related matters	To be adopted

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IS CODE	TITLE OF INDIAN STANDARD	IEC CODE	TITLE OF IEC STANDARD	STATUS
IS 9836: 1981	Exploders			
IS 9959: 1980	Guide for selection of electrical & electronic equipment for coal mines			Under Revision
IS 4051: 1967	Code of Practice for installation & maintenance of electrical equipment in mines			Under Revision
IS/IEC60079-29-1: 2007	Explosive Atmospheres Part 29-1: Gas Detectors-Performance requirements of detectors for flammable gases	IEC60079-29-1 Ed 1 2007/08	Explosive Atmospheres Part 29-1: Gas Detectors-Performance requirements of detectors for flammable gases	Latest Version Printed as IS
IS/IEC60079-29-2: 2007	Explosive Atmospheres Part 29-2: Gas Detectors-Selection, installation, use and maintenance of detectors for flammable gases and oxygen	IEC60079-29-2 Ed 1 2007/08	Explosive Atmospheres Part 29-2: Gas Detectors-Selection, installation, use and maintenance of detectors for flammable gases and oxygen	Latest Version Printed as IS
		IEC60079-29-4 Ed 1 2009/11	Explosive atmospheres - Part 29-4: Gas detectors - Performance requirements of open path detectors for flammable gases	Latest Version under printing as IS
IEC60079-30-1 2007	Explosive atmospheres Part 30-1: Electrical resistance trace heating- General & testing requirements	IEC60079-30-1 Ed1 2007/01	Explosive atmospheres Part 30-1: Electrical resistance trace heating- General & testing requirements	Latest Version Printed as IS
IEC60079-30-2 2007	Explosive atmospheres Part 30-2: Electrical resistance trace heating- Application guide for design, installation & maintenance	IEC60079-30-2 Ed 1 2007/01	Explosive atmospheres Part 30-2: Electrical resistance trace heating- Application guide for design, installation & maintenance	Latest Version Printed as IS
IS/ IEC 61241-0:2004	Electrical apparatus for use in combustible dusts: Part 0: General Requirements		Combined with IEC 60079-0 Ed 4 2007/12	2004 Version Printed as IS
IS/IEC 60079-31:2008	Explosive atmospheres: Part 31:Equipment Dust Ignition Protection by enclosure 't'	IEC 60079-31 Ed 1 2008/11	Explosive atmospheres: Part 31:Equipment Dust Ignition Protection by enclosure 't'	Latest Version Printed as IS
IS/IEC 61241-2-1:1994	Electrical apparatus for use in combustible dusts: Part 2: Test methods- Section 1: Method of determining the minimum ignition temperature of dust	IEC 61241-2-1 Ed 1 1994/12	Electrical apparatus for use in combustible dusts: Part 2: Test methods- Section 1: Method of determining the minimum ignition temperature of dust	Latest Version Printed as IS

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IS CODE	TITLE OF INDIAN STANDARD	IEC CODE	TITLE OF IEC STANDARD	STATUS
		IEC/ TS 61241-2-2 Ed 1 1993/08	Electrical apparatus for use in combustible dusts: Part 2: Test methods- Section 2: Method of determining the electrical resistivity of dust in layers	Latest Version under printing as IS
IS IEC 61241- 2-3 : 1994	Electrical apparatus for use in the presence of combustible dusts: Part 2: Test methods- Section 3: Method of determining the minimum ignition energy of dust / air mixture	IEC 61241-2-3 Ed 1 1994/09	Electrical apparatus for use in the presence of combustible dusts: Part 2: Test methods- Section 3: Method of determining the minimum ignition energy of dust / air mixture	Latest Version Printed as IS
IS/IEC 61241- 4: 2001	Electrical apparatus for use in combustible dusts: Part 4: Type of protection 'pD'	IEC 61241-4 Ed 1 2001/03	Electrical apparatus for use in combustible dusts: Part 4: Type of protection 'pD'	Latest Version Printed as IS
IS/IEC 61241- 11 : 2005	Electrical apparatus for use in the presence of combustible dusts: Part 11:Protection by intrinsic safety 'iD'		Combined with IEC 60079-11 Ed 6 2012/01	2005 Version Printed as IS
IS/IEC 61241- 18 : 2004	Electrical apparatus for use in the presence of combustible dusts: Part 18: Protection by encapsulation "mD"		Combined with IEC 60079-18 Ed 3 2009/05.	2004 version printed as IS
IS 15142: 2002	Guide to the use of Electrical Apparatus for potentially explosive atmospheres in the presence of combustible dust			Withdrawn wef 31.03.2014
Email bkgupta5@gmail.com				