



The Use of Industry Standards and State-of-the-Art Technologies in the DeltaV Automation System

Plus other helpful information such as a glossary of standards industry terminology, a directory of abbreviations often used in the instrumentation industry, and a primer on using electrical equipment in potentially explosive atmospheres.



© Emerson Process Management 1996—2007 All rights reserved.

DeltaV, the DeltaV design, SureService, the SureService design, SureNet, the SureNet design, and PlantWeb are marks of one of the Emerson Process Management group of companies. All other marks are property of their respective owners. The contents of this publication are presented for informational purposes only, and while every effort has been made to ensure their accuracy, they are not to be construed as warranties or guarantees, express or implied, regarding the products or services described herein or their use or applicability. All sales are governed by our terms and conditions, which are available on request. We reserve the right to modify or improve the design or specification of such products at any time without notice.





Contents

Standards, Technologies, and Guidelines used by the DeltaV System	3
Industry Standards used by the DeltaV System	3
Group 1—Safety	3
Group 2—Environmental	5
Group 3—OEM and Other	7
Technologies Used by the DeltaV System	8
Group 1—Human/Machine Interface (HMI)	8
Group 2—Communications	10
Group 3—Database	11
Industry Guidelines used by the DeltaV System	12
Related information	13
Glossary of Terms	13
Directory of Abbreviations used in the Instrumentation Industry	23
Primer on Using Electrical Equipment in Potentially Explosive Atmospheres	28
Area Classification	28
Gas Groups	29
Apparatus Grouping	29
Temperature	30
Types of Electrical Equipment Suitable for use in Potentially Explosive Atmospheres	32
Notes on Explosion Protection Techniques	33
NEMA and UL Types of Enclosures	35
Ingress Protection: (IP) Codes	36
Selection of Electrical Equipment for Hazardous Areas Equipment Certification Marking:	37
Selection, Installation and Maintenance of Electrical Equipment Intended for Use in Potentially Explosive Atmospheres	38
The Certification Process	39
North American and EU Testing Authorities	39
European Practice—Current—until 30th June 2003	40
European Practice—after July 1, 2003	40
World-wide Certification	41



Standards, Technologies, and Guidelines used by the DeltaV System

The DeltaV system open architecture encompasses industry standards and guidelines and state-of-the-art technology. The first table below describes industry standards, where they are used in the DeltaV system, and the compliance method used to ensure certification. The second table describes various technologies and where they are used in the DeltaV system. Finally, a general list of industry guidelines used by DeltaV developers is presented for review. This information is presented as a summary only. Please refer to actual product specification sheets for up-to-date information.

Industry Standards used by the DeltaV System

Group 1—Safety

(Ordinary location, hazardous area location, PES)

STANDARD	DESCRIPTION	WHERE USED	COMPLIANCE METHOD
CENELEC EN 50021:1999	Hazardous Area Classification For Potentially explosive environments www.cenelec.org	I/O hardware	Nemco agency approval
CENELEC EN 50014:1997 EN 50020:1994	Delta V I/O Nodes with intrinsically safe field terminals www.cenelec.org	I/O hardware	BASEEFA certification report
CENELEC EN 61010-1	Electrical safety www.cenelec.org	Hardware	Certified based on CSA category certification
CAN/CSA-C22.2 No. 1010.1-92 (Reaffirmed 1999)	Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use, www.csa-international.org	All hardware	CSA category certification for Emerson Process Management manufactured hardware; OEM certification for power supplies, workstations and other purchased hardware
73/23/EEC	CE directive for low voltage www.eurocom.com/lvdir.htm	All hardware	3 rd -party tested



<p>FM Class 1, Division 2, Group A, B, C, and D</p>	<p>Hazardous Area designation—Indicates the combustible materials that can be present in the atmosphere where electronic devices are located. Devices marked with this designation work with insufficient energy to ignite the atmosphere.</p> <p>Class 1 = gas or vapor present in the atmosphere</p> <p>Division 2 = ignitable mixture continuously surrounds the device</p> <p>Group A = acetylene is typical of the type of ignitable material that can be present in the atmosphere.</p> <p>www.factorymutual.com</p>	<p>Controller, passthrough power supply, I/O hardware</p>	<p>Certified by Factory Mutual (some restrictions apply)</p>
<p>ISA S12.12</p>	<p>ELECTRICAL EQUIPMENT FOR USE IN CLASS 1, DIVISION 2 HAZARDOUS (CLASSIFIED) LOCATIONS</p> <p>Defines requirements of equipment construction and test criteria related to electrical or thermal ignition of a specified flammable gas or vapor-in-air mixture in its most easily ignitable concentration.</p> <p>www.isa.org/sc/home</p>	<p>Controller, power supply, I/O hardware</p>	<p>Certified by Factory Mutual</p>



Group 2—Environmental

(Temperature, humidity, mechanical influence, corrosive influence, power and grounding, EMC)

STANDARD	DESCRIPTION	WHERE USED	COMPLIANCE METHOD
89/336/EEC	CE directive for electromagnetic compatibility (EMC) www.eurocom.com/emcdir.htm	All hardware	3rd-party tested
CENELEC EN61326 Class A emissions, Annex A immunity	Electrical equipment for measurement, control and laboratory use—EMC requirements. www.cenelec.org	All hardware except ITE equipment	3rd-party tested
CENELEC EN 55022 Class A or B emissions	Information technology equipment—Radio disturbance characteristics—Limits and methods of measurement. www.cenelec.org	Workstations, hubs, operator interface computer and network hardware	3rd-party tested
CENELEC EN55024	Information technology equipment—Immunity characteristics—Limits and methods of measurement. www.cenelec.org	Workstations, hubs, operator interface computer and network hardware	3rd-party tested
NAMUR NE21 18.05.1999	Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment. www.namur.de	Series 2 Hardware	3 rd -party tested
FCC Part 15, Class A	Design standard for digital devices used in commercial or industrial settings to ensure that any radiated radio-frequency energy causes no harmful interference to broadcasting or other radio services. www.fcc.gov	Workstations, hubs	3rd-party tested
ISA S71.01 - G2	ENVIRONMENTAL CONDITIONS FOR PROCESS MEASUREMENT AND CONTROL SYSTEMS Establishes uniform classifications of temperature and humidity conditions for	Controller, power supply, I/O hardware	Self-certified



STANDARD	DESCRIPTION	WHERE USED	COMPLIANCE METHOD
	industrial process measurement and control systems. G1=mild, G2=moderate, G3=harsh www.isa.org/sc/home		
ISA S71.04-1985, G2 and G3	Airborne contaminants www.isa.org/sc/home	Controller, power supply, and I/O modules	Self-certified
MIL-STD-810	ENVIRONMENTAL TEST METHODS AND ENGINEERING GUIDELINES Guidelines for conducting environmental engineering tasks to tailor environmental test to end-item equipment applications.	Controller, power supply, I/O hardware	3rd-party tested



Group 3—OEM and Other

STANDARD	DESCRIPTION	WHERE USED	COMPLIANCE METHOD
ISO-9001	Requirements for an organization whose business processes range from design and development, to production, installation and servicing. www.iso.ch	Processes and procedures in manufacturing	Self-certified based on 3rd-party audit
TCO 91/92	Defines radiation limits from monitors	Workstations	Certified by OEM
UL 478 (Superseded by UL 1950)	INFORMATION-PROCESSING AND BUSINESS EQUIPMENT Covers equipment intended for permanent or cord connection to 600 volt or lower potential branch circuits. www.ul.com	Workstations, hubs	Certified by OEM
UL 1950	SAFETY OF INFORMATION TECHNOLOGY EQUIPMENT INCLUDING ELECTRICAL BUSINESS EQUIPMENT Applicable to equipment designed for and intended to be connected directly to a telecommunications network forming part of a subscriber's installation, regardless of ownership or responsibility for installation and maintenance. www.ul.com	Workstations, hubs	Certified by OEM



Technologies Used by the DeltaV System

Group 1—Human/Machine Interface (HMI)

TECHNOLOGY	DESCRIPTION	WHERE USED
ActiveX	An object model that uses Component Object Model (COM) and Distributed Component Object Model (DCOM) as the key technologies that bind objects together over networks such as the Internet or intranet.	Explorer, Control Studio, Recipe Studio and AMSinside applications run in DeltaV workstations.
EEMUA 191	Alarm systems guidebook for design, management, and procurement.	Operator interface
IEC61131-3	<p><i>Sequential Function Charts</i>—Structures the internal organization of a programmable controller program. SFC elements provide a means of partitioning a controller program into a set of steps and transitions connected by directed links.</p> <p><i>Function Blocks</i>—A controller programming language element consisting of the data definition structure partitioned into input, output, and internal variables and a set of operations to be performed upon the data structure elements when an instance of the function block type is invoked.</p> <p><i>Structured Text</i>—A language to create custom calculations and algorithms. The instruction set uses operands, operators, functions, and constants to create text expressions. Any system parameter may be referenced by these expressions. www.iec.ch</p>	Control languages used for process control.
ISA-S88-01	ISA standards and recommend practices for the design and specification of batch control systems as used in the process control industries. www.isa.org/sc/home	Batch
Microsoft Foundation Classes (MFC)	Software structures in C++, the Windows base classes which can respond to messages, make windows, and from which application specific classes can be derived. www.microsoft.com	All user interface applications run in DeltaV workstations.
NAMUR NE33 31.03.1993	Requirements to be met by systems for recipe-based operations; guidelines for presenting recipes in structured form to help the standardization of designing batch processes. www.namur.de	Recipe Studio and batch applications in DeltaV workstations
OLE	Object Linking and Embedding. In the context of OLE, an object	Explorer, Control



TECHNOLOGY	DESCRIPTION	WHERE USED
	is anything a user can manipulate with a Windows application. Objects are either linked or embedded in a document. An embedded object becomes a physical part of the client application's document. A linked object remains separate from a client application's document.	Studio, Recipe Studio and AMSinside applications run in DeltaV workstations
OPC	OLE for Process Control—A standard set of OLE/COM interface protocols that greatly enhance the interoperability between automation/control applications, field systems/devices, and business/office applications in the process control industry. www.opcfoundation.org	Excel Add-in, Batch Executive, Diagnostics and interface for 3 rd -party applications run in DeltaV work-stations



Group 2—Communications

TECHNOLOGY	DESCRIPTION	WHERE USED
AS-i bus	Actuator Sensor interface bus—replaces conventional actuator and sensor network cabling and uses a single cable to connect devices to a host controller. www.as-interface.com	Sensors and actuators
FOUNDATION Fieldbus 31.25 kbaud Physical Layer Profile Specification, FF-816. IEC 1158-2:1993, ISA-S50.02-1992, dS50.02, Part 2 [Draft Standard] 1995,	The FOUNDATION™ fieldbus is a bi-directional communication protocol used to connect field-level devices to each other and to control systems. It uses ISA SP50/IEC1158. Fieldbus Standard for Use in Industrial Control Systems Part 1 Introduction, Part 2 Physical Layer Specification, Part 3 and 4 Data Link Layer Service and Protocol, Part 5 and 6 Application Layer Service and Protocol, Part 7 System and Network Management Protocol. www.fieldbus.org	H1 Fieldbus I/O interface
HART	Highway Addressable Remote Transducer—A protocol that uses the Bell 202 FSK standard to superimpose digital signals on top of the 4-20mA analog signals of transducers typically used in process control transmitters and final control elements. www.hartcomm.org	4-20 mA I/O Interfaces
ISO 8802/3 IEEE 802.3	INFORMATION TECHNOLOGY—LOCAL AND METROPOLITAN AREA NETWORKS—CARRIER SENSE MULTIPLE ACCESS WITH COLLISION DETECTION (CSMA/CD) ACCESS METHOD AND PHYSICAL LAYER SPECIFICATION This standard specifies the media access control characteristics for the Carrier Sense Multiple Access with Collision Detection (CSMA/CD) access method. It also specifies the media, Medium Attachment Unit (MAU) and physical layer repeater unit for 10 Mb/s baseband systems. www.iso.ch	Workstations, controllers, hubs



Group 3—Database

TECHNOLOGY	DESCRIPTION	WHERE USED
ODBC	A standard for accessing different database systems.	Event Database and Batch Historians that run in DeltaV workstations
ODMG-93	Object Data Management Group standard 93 is a portability standard for software applications. Its use guarantees that a compliant application written on top of compliant system 'A' can be easily ported on top of compliant system 'B'.	Configuration database run in ProfessionalPLUS Station



Industry Guidelines used by the DeltaV System

ANSI/NEMA Mo. ISA 6-78 Industrial Controls and Systems

FDA; 21 CFR Part 11 –Electronic Records; Electronic Signatures. –See Whitepaper: DeltaV Capabilities for Electronic Records Management

FOUNDATION Fieldbus Technical Overview, Revision 1.0, 1996, FD-043.

FOUNDATION Fieldbus 31.25 kbaud Wiring and Installation Guide, FF-140.

FOUNDATION Fieldbus 31.25 kbaud Intrinsically Safe Application Guide, Revision 1.1, 21 September 1995, AG-163.

IEA Pub 297 Rack Mount Dimension Standard

IEC Publication 68 Basic Environment Testing Procedure

IEC Publication 255-4 Single Input Energizing

IEC Publication 546:1976 Controller Performance Evaluation

IEC Publication 770:1984 High Frequency Disturbances

IEC 38, Amendment 1 [1994]

IEEE 518 Installation Guide to Minimize Noise

ISA-RP12.6, Wiring Practices for Hazardous (Classified) Locations Instrumentation
Part I: Intrinsic Safety, Recommended Practice.

ISA S51 ISA Drawing Symbols and S53 Graphics Symbols

NEC 1984 National Electric Code

Section ICS6.110.10 and 11

UL 508 Industrial Control Equipment

UL478 Electronic Data Processing Units and Equipment

UL VWI Cable Flame Test



Related information

Glossary of Terms



AS-Interface (ASi) - AS-interface, the actuator sensor interface (often known as ASi or azzi) offers many of the benefits of more powerful and expensive fieldbuses, but at much lower cost and at much simpler application. Based on digital technology and optimized for binary peripherals, AS-interface networks are simple to design, install, operate and maintain. Conventional sensors and actuators can be easily integrated, resulting in a networking solution of substantial flexibility and rich functionality. It replaces conventional cabling and uses a single cable to connect devices to a host controller. Website is at www.as-interface.com

BVS/DMT – Bergbau-Versuchsstrecke / Deutsche Montan Technologie GmbH. A German national IS testing (BVS) and certifying agency (DMT) mark.



The CE Mark

The CE mark is the official marking required by the European Community for all electric and electronic equipment that will be sold or put into service for the first time, anywhere in the European Community. It proves to the buyer or user that a product fulfills all essential safety and environmental requirements as they are defined in the so-called European Directives. The CE markings directive (93/68/EEC) was adopted on July 7th 1993. It amends 12 other directives that are also part of the EEC.

In return for fulfilling the CE marking requirements, the manufacturer or its agent gets the opportunity to cover the entire European market using only one approval procedure for the topics covered in the miscellaneous directives. The member states of the EC cannot refuse any electronic or electrical product that has been CE marked (unless fraud is suspected) The manufacturer needs, however:

- to be European, or
- to have an official department in the EC, or



- to have an official agent or representative that is willing to take the liability for the CE-marking.

Although one CE mark is sufficient for all EC members, there are some restrictions left over for language variations in user documentation. The major directive that exists for hazardous location equipment is Electrical Safety (Low Voltage Directive)(73/23/EEC) mandatory since January 1, 1997.

CEC—Canadian Electric Code governing Canadian practices for the installation of electrical equipment.



CENELEC—CENELEC is the European Committee for Electrotechnical Standardization. It was set up in 1973 as a non-profit organization under Belgian law. The European Commission in Directive 83/189 EEC officially recognized it as the European standards organization in its field

CENELEC works with 40,000 technical experts from the 19 European Community countries including Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom. CENELEC and the International Electrotechnical Commission (IEC) operate at two different levels, but their actions have a strong mutual impact since they are the most important standardization bodies in the electrotechnical field. Cooperation between CENELEC and the IEC is described in what is known as the Dresden Agreement, since it was approved and signed by both partners in that German city in September 1996. Cenelec's website: www.cenelec.org.

Class—Classification which identifies the hazard type. Examples include gases and vapors, dusts, and fibers and flying articles.





CSA—CSA International, formerly CSA (for Canadian Standards Association) is an independent, not-for-profit organization supported by more than 8,000 members. CSA International has a network of offices, partners, and strategic alliances in Canada, the U.S., and around the world. Established in 1919, CSA International is a leader in the field of standards development and the application of these standards through product certification, management systems registration, and information products. CSA International's website is at www.csa-international.org.

Division—North American hazardous area classification which identifies the probability of a hazard's being present. Division 1 defines a continuous or intermittent hazard. Division 2 identifies a hazard under abnormal conditions. *Division* is similar to the European *Zone* identification.

CUL—The Underwriters Laboratory mark. The appearance of the mark on equipment means that the Underwriters Laboratory has reviewed/tested the equipment to the appropriate standard.

EEC—European Economic Community. The community of European nations that oversees directives such as those for standards involving electrical safety, low voltage, electromagnetic compatibility (EMC), etc.

Euronorm—Standards developed by CENELEC applying to apparatus intended for use in hazardous locations. EN50018 is the EURONORM standard for flameproof equipment.



FCC—The Federal Communications Commission (FCC) is an independent United States government agency, directly responsible to Congress. The FCC was established by the Communications Act of 1934 and is charged with regulating interstate and international communications by radio, television, wire, satellite and cable. FCC jurisdiction covers the 50 states, the District of Columbia, and U.S. possessions. The FCC website is at www.fcc.gov



FDA—The U.S. Food and Drug Administration (FDA) mission is to promote and protect the public health by helping safe and effective products reach the market in a timely way, and monitoring products for continued safety after they are in use. FDA regulated products include everything from the most common food ingredients to complex medical and surgical devices, lifesaving drugs, and radiation-emitting consumer and medical products. The FDA website is at <http://www.fda.gov/>



FM—Factory Mutual Research, a not-for-profit scientific research and testing organization managed by FM Global. Also the mark associated with the certifying agency. Factory Mutual Research tests and approves electrical equipment in accordance with Factory Mutual Research standards and/or American National Standards Institute (ANSI) Standards. Factory Mutual Research also holds interlaboratory testing agreements with labs in Australia, Brazil, Canada, China, France, Germany, the Netherlands, Norway, and the United Kingdom. The Factory Mutual website is at www.factorymutual.com.



Fieldbus Foundation—The Fieldbus Foundation is the leading organization dedicated to a single international, interoperable fieldbus standard. Established in September 1994 by a merger of WorldFIP North America and the Interoperable Systems Project (ISP), the foundation is a not-for-profit corporation that consists of nearly 120 of the world's leading suppliers and end users of process control and manufacturing automation products. Working together, these companies have provided unparalleled support for a worldwide fieldbus protocol, and have made major contributions to the IEC/ISA fieldbus standards development. Fieldbus Foundation has received favorable voting to become an amendment to Euronorm 50170 of CENELEC. This puts Fieldbus Foundation on equal footing with Profibus in Europe. www.fieldbus.org



HART—The HART Communication Foundation is an independent, not-for-profit corporation, specifically organized to coordinate and support the application of HART technology worldwide. Educating the industry on the capabilities and value of this important technology is a key role. Membership and training/support service fees offset operating costs. Membership is open to all suppliers, end users, and others interested in the use of HART technology. The HART website is at www.hartcomm.org



IEC—Founded in 1906, the International Electrotechnical Commission (IEC) is the world organization that prepares and publishes international standards for all electrical, electronic and related technologies. The IEC was founded as a result of a resolution passed at the International Electrical Congress held in St. Louis (USA) in 1904. The organization is constituted as a corporate association with legal entity in accordance with the Swiss Civil Code. Membership consists of more than 50 participating countries, including all the world's major trading nations and a growing number of industrializing countries which collectively represent the 80% of the world's population that produces and consumes some 90% of electrical energy. The object of the Commission is to promote international cooperation on all questions of standardization and related matters in the fields of electrical and electronic engineering, thus promoting international understanding. The IEC website is at www.iec.ch.



IEEE—The IEEE ("eye-triple-E"), The Institute of Electrical and Electronics Engineers, Inc., helps advance global prosperity by promoting the engineering process of creating, developing, integrating, sharing, and applying knowledge about electrical and information



technologies and sciences for the benefit of humanity and the profession. The IEEE's website is at www.ieee.org



ISA—ISA is an international, nonprofit, educational organization. The Society fosters advancement in the theory, design, manufacture, and use of instruments, computers, and systems for measurement and control. ISA is a leading training organization and a respected publisher of books, magazines, and consensus standards. ISA has 47,000 members in 110 countries around the globe, and serves the professional development and credential needs of Control Systems Engineers (CSE), instrument technicians, and others within the field of measurement and control. The ISA website is at www.isa.org.

ORGANISATION
INTERNATIONALE DE
NORMALISATION



INTERNATIONAL
ORGANIZATION FOR
STANDARDIZATION

ISO—The International Organization for Standardization (ISO) is a worldwide federation of national standards bodies from some 130 countries, one from each country. ISO is a non-governmental organization established in 1947. The mission of ISO is to promote the development of standardization and related activities in the world, with a view to facilitating the international exchange of goods and services, and to developing cooperation in the spheres of intellectual, scientific, technological and economic activity. ISO's work results in international agreements which are published as International Standards. One might notice a seeming lack of correspondence between the official title when used in full (International Organization for Standardization) and the short form (ISO). One might think the short form should be "IOS"? Perhaps, if it were an acronym – but it is not. "ISO" is a word, derived from the Greek isos, meaning "equal." Therefore, the prefix "iso" means equal. In addition, the name ISO is used around the world to denote the organization, thus avoiding the plethora of acronyms resulting from the translation of "International Organization for Standardization" into the different national languages of members, e.g. IOS in English, OIN in French (from Organization Internationale de Normalisation). Whatever the country, the short form of the Organization's name is always ISO. The ISO website is at www.iso.ch.





NAMUR—Normen Arbeitsgen Mess Und Regeltechnik. Standards work group for Instrumentation and Controls—Germany. NAMUR was founded at Leverkusen as the body to represent the interests of the users of measurement and control technology in the chemical industry by Dr. Sturm (Bayer), Dr. Hengstenberg (BASF) and Dr. Winkler (Hüls) on November 3, 1949, following the tried and tested traditions of IG-Farbenindustrie (AGEMUR). At the second meeting in December 1949, the founding members of the working group settled the name: Standardization Association for Measurement and Control in Chemical Industries (NAMUR). NAMUR later changed to User Association of Process Control Technology in Chemical and Pharmaceutical Industries. After the war, the main activities of the process measurement department were measurement, control loop analysis, standardization—especially interfaces—4-20 mA signal, proximity switch, as well as exchange of experience of devices. Activities of NAMUR today include measuring, process analytics, open- and closed-loop control automation, communication, operation technology, and process electronics throughout the whole lifecycle from planning, assembly and operation to decommissioning. The NAMUR website is at www.namur.de.

NEC Article 500—National Electric Code governing U.S. installation practices of electrical equipment. Article 500 identifies the Class/Division method of hazardous area classification.

NEC Article 505—National Electric Code governing U.S. installation practices of electrical equipment. Article 505 identifies the newer Class/Zone method of hazardous area classification.



NEMA—The primary reason behind the formation of the National Electrical Manufacturers Association in 1926 was to provide a forum for the standardization of electrical equipment. Then and now, standards enable customers to select from a range of safe, effective, compatible electrical products. They promote fair competition by defining products and processes, leading to economies in product and elimination of misunderstanding. The standardization process also benefits the user by making products that are available globally, delivered locally, competitively priced, able to perform predictably, and are safe and environmentally sound. www.nema.org



OPC—OPC (OLE for Process Control) is an industry standard created through the collaboration of a number leading worldwide automation and hardware software suppliers working in cooperation with Microsoft. The organization that manages this standard is the OPC Foundation. The Foundation has over 220 members from around the world, including nearly all of the world's major providers of control systems, instrumentation, and process control systems.

PIB—Physikalisch-Technische Bundesanstalt. German national IS testing and certifying agency and the mark associated with the agency.



UL—Underwriters Laboratories Inc. (UL) is an independent, not-for-profit product safety testing and certification organization. UL has tested products for public safety for more than a century. Each year, more than 14 billion UL marks are applied to products worldwide. UL has five testing laboratories in the United States and subsidiaries in Mexico, Denmark, England, Italy, India, Singapore, Taiwan, Hong Kong and Japan, plus numerous international, affiliate and representative offices, as well as field representatives located throughout the world. The UL website is at www.ul.com



World Batch Forum—World Batch Forum is a non-profit, professional organization established in 1994 promoting the exchange of information related to the management, operation and automation of batch process manufacturing. The WBF is an association of end-users, vendors, consultants and academics with a strict, non-commercial agenda. In addition to hosting an annual conference with formal presentation and technical papers, the WBF provides organization, management, and structure to facilitate networking among its members and sharing of knowledge and information related to all aspects of



batch processing. WBF supplements the functions of ISA, AIChE, ISPE, CMA, and other related professional organizations by integrating a variety of management and technical disciplines needed to advance batch processing knowledge and technology. The WBF website is at www.wbf.org.



Zone—European and newer North American (via NEC article 505) hazardous area classification which identifies the probability of a hazard's being present. Zone 0 identifies a continuous hazard, Zone 1 identifies an intermittent hazard, and Zone 2 identifies a hazard under abnormal conditions. *Zone* is similar to the older North American *Division* identification.



Directory of Abbreviations used in the Instrumentation Industry

AandT	Automation and Technology Department of ISA
A2LA	American Association for Laboratory Accreditation
AAEE	American Academy of Environmental Engineers
AAMA	American Architectural Manufacturers Association
ABMA	American Boiler Manufacturers Association
ACGIH	American Conference of Governmental Industrial Hygienists
ACI	American Concrete Institute
ACIL	American Council of Independent Laboratories
ACOS	Automatic Control Systems Division of ISA
ACS	American Chemical Society
AD	Analysis Division of ISA
AECL	Atomic Energy Commission Limited
AFT2E	Association of Federal Technology Transfer Executives
AIA	Automated Imaging Association, Analytical Instruments Association
AIAA	American Institute of Aeronautics and Astronautics
AIChE	American Institute of Chemical Engineers
AIHA	American Industrial Hygiene Association
AIS	International Association of the Soap and Detergent Industry
AISC	American Institute of Steel Construction
AISE	Association of Iron and Steel Engineers
AISG	American Insurance Services Group
AISI	American Iron and Steel Institute
ANS	American Nuclear Society
ANSI	American National Standards Institute
API	American Petroleum Institute
APPA	American Public Power Association
APPA	American Public Power Association
AQIRP	Auto/Oil Quality Improvement Research Program
ASAE	American Society of Agricultural Engineers
ASD	Aerospace Industries Division of ISA
ASES	American Solar Energy Society
ASHRAE	American Society of Heating, Refrigerating, and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASMS	American Society for Mass Spectrometry
ASQC	American Society for Quality Control
ASSE	American Society of Sanitary Engineering, American Society of Safety Engineers
ASTM	American Society for Testing and Materials
ATBC	Association of Technology Business Councils



ATP	Advanced Technology Program
AWMA	Air and Waste Management Association
AWS	American Welding Society
BIRA	Belgian Institute for Automatic Control
BOCA	Building Officials and Code Administrators International
BOMA	Building Owners and Managers Association
BSI	British Standards Institute
CAAA	Clean Air Act Amendments (1990)
CANARIE	Canadian Network for the Advancement of Research, Industry, and Education
CANDU	Canada Deuterium Uranium
CCPS	Center for Chemical Process Safety
CEA	Canadian Electrical Association
CEFIC	European Council of Chemical Manufacturer's Federations
CEN	European Standardization Committee
CENELEC	European Committee for Electrotechnical Standardization
CEPP	Chemical Emergency Preparedness and Prevention Office
CHEMPID	Chemical and Petroleum Industries Division of ISA
CIS	Construction Specifications Institute
CLSA	Canadian Laboratory Supplies Association
CMA	Chemical Manufacturers Association
COMPUTEC	Computer Technology Division of ISA
CONDES	Construction and Design Division of ISA
CORM	Council on Optical Radiation Measurement
CPAC	Center for Process Analytical Chemistry
CSA	Canadian Standards Association
DOD	Department of Defense
DOE	Department of Energy
DOT	Department of Transportation
ECNE	Electric Council of New England
EI	Edison Electric Institute
ELEOP	Electro-Optics Division of ISA
EPA	Environmental Protection Agency
EPRI	Electric Power Research Institute
ETL	Electrical Testing Laboratories
FACSS	Federation of Analytical Chemistry and Spectroscopy Societies
FDA	Food and Drug Administration
FIFRA	Federal Insecticide, Fungicide and Rodenticide Act
FM	Factory Mutual
FMRC	Factory Mutual Research Corporation
FPID	Food and Pharmaceutical Industries Division of ISA
FRA	Federal Railroad Administration
FTC	Federal Trade Commission
GandC	Glass and Ceramics Industries Division of ISA



HIMA	Health Industries Manufacturer's Association
HMIP	Her Majesty's Inspectorate of Pollution
landS	Industries and Sciences Department of ISA
IAETL	International Association of Environmental Testing Laboratories
ICAC	Institute of Clean Air Companies
ICBO	International Conference of Building Officials
ICC	International Chamber of Commerce
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronic Engineers
IES	Illuminating Engineering Society
IFAC	International Federation of Automatic Control
IFC	International Fieldbus Consortium
IFPAC	International Forum of Process Analytical Chemistry
IMQ	Italy Standards Organization
INEL	Idaho National Engineering Laboratory
INEM	International Network for Environmental Management
IORC	Inter-Organizational Relations Committee
IPAO	Integrated Process Analytics Organization
ISA	Instrument Society of America
ISAI	Instrument Society of America International
ISASI	Instrument Society of America Services, Inc.
ISC	Intersociety Committee
ISO	International Standards Organization
ISO	OSI International Standards Organization Open Systems Interface
ISP	InterOperable System Project
ISRI	Institute of Scrap Recycling Industries
KEMA	Netherlands Standards Organization
LCIE	France Standards Organization
LEOMA	Laser and Electro-Optics Manufacturer's Association
MandCS	Measurement and Control Society
MandCSI	Measurement and Control Society International
MandS	Marketing and Sales Division of ISA
MAINT	Maintenance Division of ISA
MAN	Management Division of ISA
MID	Metal Industries Division of ISA
MMD	Mining and Metallurgy Division of ISA
MSS	Manufacturers Standardization Society
NACE	North American Commission on the Environment, National Association of Corrosion Engineers
NAIT	Northern Alberta Institute of Technology
NAMUR	Normen Arbeitsgen Mess Und Regeltechnik (Standards work group for Instrumentation and Controls - Germany)
NARUC	National Association of Regulatory Utility Commissioners
NASUCA	National Association of State Utility Consumer Advocates



NCA	National Coal Association
NCCLS	National Committee for Clinical Laboratories Standards
NCMS	National Center for Manufacturing Sciences
NCRT	National Center for Advanced Technology
NEC	National Electrical Code
NELPA	Northwest Electric Light and Power Association
NEMA	National Electrical Manufacturers Association
NESEA	Northeast Sustainable Energy Association
NFC	Norwegian Fieldbus Consortium
NFPA	National Fire Protection Association
NIE	National Institute for the Environment
NIOSH	National Institute for Occupational Health and Safety
NIST	National Institute of Standards and Technology
NRECA	National Rural Electric Cooperative Association
NSF	National Science Foundation, National Sanitation Foundation
NSPE	National Society of Professional Engineers
NSWMA	National Solid Waste Management Association
NTIS	National Technical Information Service
NTTC	National Technology Transfer Center
OECD	Organization for Economic Cooperation and Development
OSHA	Occupational Safety and Health Administration
OSI	Open Systems Interconnection Division of ISA
OWMC	Ontario Waste Management Corporation
PACDM	Process Analyzer Connectivity and Data Management Workgroup
PEA	Pennsylvania Electric Association
PMCD	Process Measurement and Control Division of ISA
POWID	Power Industries Division of ISA
PUPID	Pulp and Paper Industries Division of ISA
ROBEX	Robotics and Expert Systems Division of ISA
RRC	Railroad Commission
RSPA	Research and Special Programs Administration
SAA	Standards Association of Australia
SAE	Society of Automotive Engineers
SAGE	Strategic Advisory Group on the Environment
SAMA	Scientific Apparatus Manufacturers Association
SAS	Society for Applied Spectroscopy
SBCCI	Southern Building Code Congress International
SCS	Society for Computer Simulation
SEC	Securities and Exchange Commission
SEMCO	Sweden Standards Organization
SERC	Science and Engineering Research Council
SETAC	Society of Environmental Toxicology and Chemistry
SIG	Special Interest Group
SIRCH	Scientific Instrumentation and Research Division of ISA



SIRIJ	Semiconductor Industry Research Institute Japan
SP(76)	Standards and Practices (Group of ISA)
SPI	Society of the Plastics Industry
SPIE	The International Society for Optical Engineering
SRC	Semiconductor Research Corporation
SRI	Southern Research Institute
TACB	Texas Air Control Board
TAG	Technical Advisory Group
TAPPI	Technical Association of the Pulp and Paper Industries
TELCOM	Telemetry and Communications Division of ISA
TEMA	Tubular Exchanger Manufacturers Association
TEX	Textile Industries Division of ISA
TMD	Test Measurement Division of ISA
TRP	Technology Reinvestment Project
TWC	Texas Water Commission
TWQB	Texas Water Quality Board
UBC	Uniform Building Code
UCS	Ultra Clean Society
UL	Underwriters Laboratories
UNCSD	United Nations Commission on Sustainable Development
UTC	Utilities Telecommunications Council
VDE	German Standards Organization - Association of German Electrotechnicians
VDI	Society of German Engineers
WAT	Working Party Analytical Techniques
WECA	Western Energy and Communication Association
WWID	Water and Wastewater Industries Division of ISA



Primer on Using Electrical Equipment in Potentially Explosive Atmospheres

Potentially explosive atmospheres, or hazardous areas, exist where there is a risk of explosion due to mixtures of gas/air, vapor/air, dust/air or other flammable combinations. In such areas there is a necessity to eliminate sources of ignition such as sparks, hot surfaces or static electricity, which may ignite these mixtures.

Where electrical equipment has to be used in these areas, it must be designed and constructed so as not to create sources of ignition capable of igniting these mixtures. Before electrical equipment can be used in a potentially explosive atmosphere, a representative sample has to be fully tested and certified by an independent authority such as BASEEFA in the U.K. or UL in the U.S.A.

This information is intended as a guide only. Further expert guidance should be sought before placing into service, maintaining or repairing any item of equipment in a potentially explosive atmosphere. Where comparisons are shown between, for example, European and North American practice, this may be an approximation and individual standards/codes of practice should be consulted for precise details.

Area Classification

Process plants are divided into zones (European and IEC method) or divisions (North American method) and often safety categories, according to the likelihood of a potentially explosive atmosphere's presence.



Definition of zone or division	North American Classification NEC500-503	European and IEC Classification IEC/CENELEC/Europe/NEC505	Safety Categories Vapors	Safety Categories Dusts
An area in which an explosive mixture is continuously present or present for long periods (>100hrs per year) - i.e. continuous hazard	Class 1 Division 1 (gases)	Zone 0 (gases)	G1	-
	Class 2 Division 1 (dusts)	Zone 20 (dusts)	-	D1
An area in which an explosive mixture is likely to occur in normal operation (between 10 and 100 hrs per year) – i.e. intermittent hazard	Class 1 Division 1 (gases)	Zone 1 (gases)	G2	-
	Class 2 Division 1 (dusts)	Zone 21 (dusts)	-	D2
An area in which an explosive mixture is not likely to occur in normal operation and if it occurs it will exist only for a short time (< 10 hrs per year) – i.e. hazard under abnormal conditions	Class 1 Division 2 (gases)	Zone 2 (gases)	G3	-
	Class 2 Division 2 (dusts)	Zone 22 (dusts)	-	D3
	Class 3 Division 1 (fibers)			
	Class 3 Division 2 (fibers)			

Gas Groups

(plus dusts and fibers)

There are two main gas groups, Group I (Mining only) and Group II (Surface Industries). These categories are used in European and I.E.C. groupings. Gas classification and ignition temperatures relate to mixtures of gas and air at ambient temperature and atmospheric pressure.

Apparatus Grouping

Gases are grouped together based on the amount of energy required to ignite the most explosive mixture of gases with air. Equipment is classified into groups according to the gases and vapors for which it is suitable, and it must be selected with a grouping that covers the gases and vapors that will be present where it is to be installed:

Group I	Methane	Ignition energy of 320 Microjoules
Group IIA	Propane	Ignition energy of 300 Microjoules
Group IIB	Ethylene	Ignition energy of 160 Microjoules



Group IIC Hydrogen Ignition energy of 40 Microjoules

Group I is concerned only with underground mining where methane and coal dust are present.

Group II gases occurring in surface industries are sub-grouped according to their volatility. This enables electrical equipment to be designed to less onerous tolerances if it is to be used with the least volatile gases.

Typical gas/material	European/I.E.C. Gas Group	North American Gas Group
	CENELEC EN 50 014 IEC	NEC Article 500
Methane	I	-
Acetylene	IIC	A – class 1 (gases and vapors)
Hydrogen	IIC	B – class 1 (gases and vapors)
Ethylene	IIB	C – class 1 (gases and vapors)
Propane	IIA	D – class 1 (gases and vapors)
Metal dust	-	E—class 2 (dusts)
Coal dust	-	F—class 2 (dusts)
Grain dust	-	G—class 2 (dusts)
Wood, paper or cotton processing	-	No sub group—class 3 (fibers and flyings)

Note : North American legislation now allows zones to be used to classify areas; where this practice is used, it follows the IEC Zone method.

Temperature

Hot surfaces can ignite explosive atmospheres. To guard against this, all electrical equipment intended for use in a potentially explosive atmosphere is classified according to the maximum surface temperature it will reach in service. This temperature is normally based on a surrounding ambient temperature of 40 degrees Centigrade (102 degrees Fahrenheit). This temperature can then be compared to the ignition temperature of the gas(es) which may come into contact with the equipment and a judgement reached as to the suitability of the equipment to be used in that area.



Temperature Classification		
European/I.E.C. IEC79-8 and EN 50 014	North American NEC Table500- 3(d)	Maximum Surface Temperature (° C)
T1	T1	450° C
T2	T2	300° C
	T2A	280° C
	T2B	260° C
	T2C	230° C
	T2D	215° C
T3	T3	200° C
	T3A	180° C
	T3B	165° C
	T3C	160° C
T4	T4	135° C
	T4A	120° C
T5	T5	100° C
T6	T6	85° C

(e.g. butane has an ignition temperature of 365 degrees Centigrade. Equipment used in the vicinity of this gas would need a T rating of T2 or higher.)



Types of Electrical Equipment Suitable for use in Potentially Explosive Atmospheres

<p>Different techniques are used to prevent electrical equipment from igniting explosive atmospheres. There are restrictions on where these different types of equipment can be used as follows: Type of Protection</p>	European - Area of Use Designation Standard	IEC—Area of Use Designation Standard	USA—Area of Use Designation Standard	Code letter IEC Ex... CENELEC Eex...
<p>Flameproof Enclosure—An enclosure used to house electrical equipment, which, when subjected to an internal explosion, will not ignite a surrounding explosive atmosphere.</p>	Zones 1 and 2 EN50018	Zones 1 and 2 IEC60079-1	Class 1 Divisions 1 and 2 UL1203	d
<p>Intrinsic Safety—A technique whereby electrical energy is limited such that any sparks or heat generated by electrical equipment is sufficiently low as to not ignite an explosive atmosphere.</p>	Zones 0, 1 and 2 EN50020	Zones 1 and 2 IEC60079-11	Class 1 Divisions 1 and 2 UL913	i
<p>Increased Safety—Equipment designed so as to eliminate sparks and hot surfaces capable of igniting an explosive atmosphere.</p>	Zones 1 and 2 EN50019	Zones 1 and 2 IEC60079-7	Class 1 Division 2	e
<p>Purged and Pressurized—Electrical equipment is housed in an enclosure which is initially purged to remove any explosive mixture, then pressurized to prevent ingress of the surrounding atmosphere prior to energization.</p>	Zones 1 and 2 EN50016	Zones 1 and 2 IEC60079-2	Class 1 Divisions 1 and 2 NFPA496	p
<p>Encapsulation—A method of exclusion of the explosive atmosphere by fully encapsulating the electrical components in an approved material.</p>	Zones 1 and 2 EN50028	Zones 1 and 2 IEC60079-18	---	m
<p>Oil Immersion—The electrical components are immersed in oil, thus excluding the explosive atmosphere from any sparks or hot surfaces.</p>	Zones 1 and 2 EN50015	Zones 1 and 2 IEC60079-6	Class 1 Division 1 and 2 UL698	o



Powder Filling —Equipment is surrounded with a fine powder, such as quartz, which does not allow the surrounding atmosphere to come into contact with any sparks or hot surfaces.	Zones 1 and 2 EN50017	Zones 1 and 2 IEC60079-5	Class 1 Division 2	q
Non-sparking —Sparking contacts are sealed against ingress of the surrounding atmosphere; hot surfaces are eliminated.	Zone 2 EN50021	Zone 2 IEC60079-15	Class 1 Division 2	n
Special Protection —Equipment is certified for use in a potentially explosive atmosphere but does not conform to a type of protection listed above.	Zones 0, 1 and 2 *	Zones 0, 1 and 2	---	s

*Only national authorities recognize this type of protection; it is not a general European type of protection.

Notes on Explosion Protection Techniques

'd'—Flameproof Enclosure Protection The potentially incandive components are contained within an enclosure into which the flammable atmosphere can enter but which will contain any resultant explosion and prevent its transmission outside the enclosure. This is typically used for switch devices, small breakers, and control enclosures.

Explosion Proof vs. Flameproof Americans refer to “explosion proof”, while the UK and IEC refer to “flameproof” motors or equipment. In IEC definitions, this is an Ex d piece of equipment. Ex d equipment is designed to contain an internal explosion to escape between the “flamepaths”, while cooling any flame in the hot gases so that no flames escape from the enclosure to ignite any external flammable gases—hence “flameproof.” Although Ex e equipment is designed to be used in a Zone 1 area, it cannot be described as explosion proof or flameproof, as it will not contain an explosion if one did occur. Ex e equipment is manufactured to an approved explosion-proof technique.

'i'—Intrinsic Safety Protection The circuit parameters are reliably controlled to reduce potential spark energy to below that which will ignite the specific gas mixture. This includes the occurrence of one (b) or two (a) component faults in the apparatus. It should be noted that this method does not protect entirely against the local overheating of damaged connections or conductors and these should be kept sound and suitably enclosed against damage.

'e'—Increased Safety Protection Normally sparking components are excluded. Other components are designed to reduce substantially the likelihood of the occurrence of fault conditions that could cause ignition. This is done by reducing and controlling working



temperatures, ensuring that the electrical connections are reliable, increasing insulation effectiveness, and reducing the probability of contamination by dirt and moisture.

'p'—Pressurized Apparatus Protection These are system methods. One maintains a positive static pressure inside the apparatus and the other a continuous flow of air or inert gas to neutralize or carry away any flammable mixture entering or being formed within the enclosure. Essential to these methods are monitoring systems and purging schedules to ensure their reliability.

'm'—Encapsulation Protection Potentially incandive components are encapsulated by a method which excludes the flammable atmosphere and controls the surface temperature under normal and fault conditions.

'o'—Oil Immersion Protection This is an old technique, used primarily for switchgear. The spark is formed under oil, and venting is controlled. (The use of hydrocarbon oil has obvious disadvantages and the method of protection is confined to the remotely hazardous area.)

'q'—Powder Filling Protection This involves the mounting of potentially incentive components in an enclosure filled with sand or similar inert powder and having a vent. It is primarily of use where the incandive action is the abnormal release of electrical energy by the rupture of fuses or failure of components such as capacitors. Usually it is used for components inside Ex 'e' or Ex 'N' apparatus and for heavy-duty traction batteries.

'n'—Non-Sparking Protection Precautions are taken with connections and wiring to increase reliability, though not to as high a degree as for Ex 'e'. Where internal surfaces are hotter than the desired T rating, they can be tightly enclosed to prevent the ready access of a flammable atmosphere into the internal parts. This is the "restricted breathing enclosure" technique. Its employment also means that high ingress protection ratings of IP65 and above are built into the design. The Ex 'N' methods are developed around the use of 'N' equipment in the remotely hazardous area commonly referred to as Zone 2.

's'—Special Protection—BASEEFA SFA 3009 This method, being special, has no definite rules. In effect, it is any method that can be shown to be safe in use. Much of the apparatus having 's' protection was designed with encapsulation and this has been superseded by EN50028. In addition, the 's' coding is used when apparatus has been assessed to one of the individual parts of the CENELEC series but does not exactly comply with it. Because 's,' by definition, does not have a set of rules, it will not become part of the harmonized series of standards. Special protection is likely to emerge is some apparatus certified in accordance with the ATEX Directive.



NEMA and UL Types of Enclosures

Type 3 Enclosure

Type 3 enclosures are intended for outdoor use, primarily to provide a degree of protection against windblown dust, rain, sleet and external ice formation.

Type 3R Enclosure

Type 3R enclosures are intended for outdoor use, primarily to provide a degree of protection against falling rain and external ice formation.

Type 3S Enclosure

Type 3S enclosures are intended for outdoor use, primarily to provide a degree of protection against rain, sleet, windblown dust, and to provide for operation of external mechanisms when ice-laden.

Type 4 Enclosure

Type 4 enclosures are intended for indoor or outdoor use, primarily to provide a degree of protection against windblown dust and rain, splashing water, hose-directed water and external ice formation.

Type 4X Enclosure

Type 4X enclosures are intended for indoor or outdoor use primarily to provide a degree of protection against corrosion, windblown dust and rain, splashing water, hose-directed water and external ice formation.

Type 7 Enclosure

Type 7 enclosures are for use indoors in locations classified as Class I, Groups A, B, C or D, as defined in the National Electrical Code®.

Type 9 Enclosure

Type 9 enclosures are for use in indoor locations classified as Class II, Groups E, F or G, as defined in the National Electrical Code®.

Type 12 Enclosure

Type 12 enclosures are intended for indoor use, primarily to provide a degree of protection against dust, falling dirt and dripping noncorrosive liquids.



Ingress Protection: (IP) Codes

Two digits are used to denote the level of ingress protection for a piece of apparatus: (The first digit denotes the level of protection against solid objects and the second against liquids)

Solids		Liquids	
0	No protection.	0	No protection.
1	Protected against solid objects up to 50mm, e.g. hands.	1	Protected against vertically falling drops of water.
2	Protected against solid objects up to 12mm, e.g. fingers.	2	Protected against water spray up to 15 degrees from vertical.
3	Protected against solid objects up to 2.5mm, e.g. tools.	3	Protected against water spray up to 60 degrees from vertical.
4	Protected against solid objects over 1mm, e.g. wires.	4	Protected against water sprays from all directions.
5	Protected against dusts. (No harmful deposits).	5	Protected against water jets from all directions.
6	Totally protected against dust.	6	Protected against strong water jets from all directions, e.g. Offshore.
		7	Protected against immersion between 15cm and 1m in depth.
		8	Protected against long immersion under pressure.



Selection of Electrical Equipment for Hazardous Areas Equipment Certification Marking:

E - European Certification	Ex - Hazardous Area Equipment	d - Protection Method																
IIC - Apparatus Grouping	T6 - Temperature Classification	IP66 - Ingress Protection																
Conversion of Enclosure Type numbers to IEC Classification Designations (Cannot be used to convert IEC Classification Designations to NEMA Type numbers)																		
<table border="0" style="width: 100%;"> <thead> <tr> <th style="width: 50%;">NEMA ENCLOSURE TYPE NUMBER</th> <th style="width: 50%;">IEC ENCLOSURE CLASSIFICATION DESIGNATION</th> </tr> </thead> <tbody> <tr><td style="text-align: center;">3</td><td style="text-align: center;">IP54</td></tr> <tr><td style="text-align: center;">3R</td><td style="text-align: center;">IP54</td></tr> <tr><td style="text-align: center;">3S</td><td style="text-align: center;">IP54</td></tr> <tr><td style="text-align: center;">4 and 4X</td><td style="text-align: center;">IP56</td></tr> <tr><td style="text-align: center;">5</td><td style="text-align: center;">IP52</td></tr> <tr><td style="text-align: center;">6 and 6P</td><td style="text-align: center;">IP67</td></tr> <tr><td style="text-align: center;">12 and 12K</td><td style="text-align: center;">IP52</td></tr> </tbody> </table>			NEMA ENCLOSURE TYPE NUMBER	IEC ENCLOSURE CLASSIFICATION DESIGNATION	3	IP54	3R	IP54	3S	IP54	4 and 4X	IP56	5	IP52	6 and 6P	IP67	12 and 12K	IP52
NEMA ENCLOSURE TYPE NUMBER	IEC ENCLOSURE CLASSIFICATION DESIGNATION																	
3	IP54																	
3R	IP54																	
3S	IP54																	
4 and 4X	IP56																	
5	IP52																	
6 and 6P	IP67																	
12 and 12K	IP52																	



Selection, Installation and Maintenance of Electrical Equipment Intended for Use in Potentially Explosive Atmospheres

Published international and national standards give details of requirements for the safe use of electrical equipment in potentially explosive atmospheres as follows :

	International	U.K.	U.S.A.
General recommendations	IEC60079-14	BS5345: Part 1	N.E.C. Chapter 5
Classification of hazardous areas	IEC60079-10		N.E.C. Chapter 5
Inspection and maintenance of electrical equipment	IEC60079-1		
Requirements for flameproof enclosures	IEC60079-14	BS5345: Part 3	N.E.C. Chapter 5
Requirements for intrinsically safe equipment	IEC60079-14	BS5345: Part 4	N.E.C. Chapter 5
Requirements for increased safety equipment	IEC60079-14	BS5345: Part 6	N.E.C. Chapter 5
Requirements for purged and pressurized Equipment	IEC60079-14	BS5345: Part 5	N.E.C. Chapter 5
Requirements for non-sparking equipment	IEC60079-14	BS5345: Part 7	
Requirements for equipment with special protection	IEC60079-14	BS5345: Part 8	



The Certification Process

All Electrical Equipment, intended for use in a Potentially Explosive Atmosphere, should be certified as suitable for such use. The methods of obtaining certification differ in detail; see below, between each certifying body or group of bodies (e.g. CENELEC). Basically this process consists of supplying a representative sample of the equipment along with a set of drawings to a recognized test/certification body e.g. BASEEFA who in turn test the equipment against a recognized Standard e.g. EN50018 and issue a Certificate. The user of the equipment can then refer to this Certificate to enable him to safely put the item into service in a zone appropriate to the Certification.

North American and EU Testing Authorities

Country	Testing Authority	Country	Testing Authority
USA	Underwriters Laboratories	USA	Factory Mutual
USA	ETL	Canada	CSA
Mexico	ANCE	Austria	TÜV-A
Austria	BVFA	Belgium	ISSEP
Denmark	DEMKO	Finland	VTT
France	INERIS	France	LCIE
Italy	CESI	Netherlands	KEMA
Norway	NEMKO	Spain	LOM
Sweden	SP	United Kingdom	BASEEFA/EECS
United Kingdom	SCS	Germany	PTB
Germany	BVS		



European Practice—Current—until 30th June 2003

The method is basically as above. In addition all electrical equipment intended for use in the European Economic Community (EEC) must comply with Electromagnetic Compatibility (EMC) and Low Voltage (LVD) Directives as applicable - manufacturers must issue Declarations of Conformity showing compliance to the applicable directives. i

When certified, an item of equipment and its certificate carry a code e.g. EExdIIBT4. This can be broken down as follows:

- E European certificate in accordance with harmonized standards
- Ex Explosion-proof electrical equipment
- D flameproof enclosure type of protection
- II Group II surface industries
- B gas group B
- T4 temperature class T4 (135 degrees Centigrade surface temperature).

European Practice—after July 1, 2003

After the above date the **ATEX Directive** comes into force throughout the EEC. This becomes a mandatory requirement for all equipment intended for use in a hazardous area. The fundamental difference between current practice and ATEX certification is that ATEX addresses the essential safety requirements for hazardous area equipment and uses standards as part of the method of conforming to these. Among other documentation required by certifying authorities will be technical manuals to inform users of installation methods.

ALL EQUIPMENT, BOTH ELECTRICAL AND MECHANICAL, INTENDED TO BE PUT INTO SERVICE WITHIN THE EEC AFTER July 1, 2003, WILL HAVE TO BE CERTIFIED IN ACCORDANCE WITH THE ATEX DIRECTIVE.

In practice this means re-certification of all currently certified electrical equipment.

It should be noted also that the ATEX directive covers mechanical equipment, so for the first time items such as gearboxes will have to carry ATEX certification.



The equipment coding will be as the current practice plus an additional code as follows:

ExII2G i.e.:

Ex Explosion proof in accordance with ATEX.
II Group II surface industries.

**2 – category 2 equipment (suitable for use in
Zone 1)**

**Category 1 is suitable for
Zone 0.**

**Category 3 is suitable for
Zone 2.**

G—Suitable for atmospheres containing gas (D is suitable for atmospheres containing dusts).

Equipment will be CE marked when certified to ATEX.

Sample equipment and supporting documentation are submitted to the appropriate authority e.g. .U.L., F.M., C.S.A.,.

The equipment is tested in accordance with relevant standards for explosion protection and also for general electrical requirements, e.g. light fittings.

After successful testing, a listing is issued allowing the manufacturer to place the product on the market.

The product is marked with the certification details such as the gas groups A,B,C,D and the area of use, e.g. Class 1 Division 1.

World-wide Certification

Most countries outside Europe or North America use the IEC standards as a basis for their own national standards.

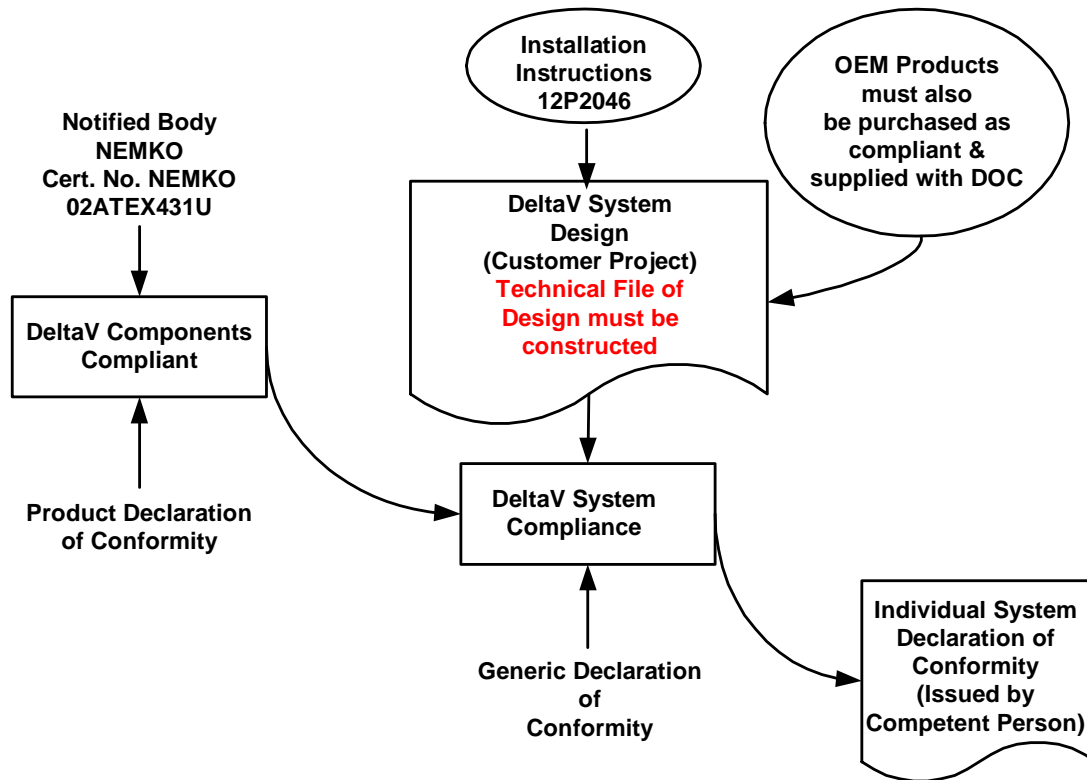
The Russian Federation certifies equipment to **GOST** standards. These closely follow CENELEC practice.

There is a scheme in place, the IEC EX SCHEME, which will, when fully adopted, allow for internationally recognized certification. This uses the IEC standards and IEC-recognized test and certification bodies to issue mutually recognized test reports and certificates. The scheme is in its infancy and its level of success cannot yet be measured.



DeltaV Compliance Methodology (ZONE 2)

DeltaV Mounted
in ZONE 2



**ZONE 2 COMPLIANCE CAN BE SELF-DECLARED
(NO NOTIFIED BODY REQUIRED)**