APPROVED BY
Public Company ORLEN Lietuva
Director of Quality, Labor Safety and
Environmental Control
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PUBLIC COMPANY ORLEN LIETUVA
OCCUPATIONAL HEATH AND SAFETY PROCEDURE FOR EMPLOYEES WORKING IN POTENTIALLY EXPLOSIVE ATMOSPHERE BDS-42

Revision 2

1. PURPOSE

Familiarize employees with hazards identification and risk assessment at potentially explosive atmospheres, also with general explosion prevention and protection measures, safety requirements at potentially explosive atmospheres, assuring protection of environment and property as well as occupational health and safety.

2. SCOPE OF APPLICATION

The requirements of the Procedure shall be binding to all the employees of AB ORLEN Lietuva (hereinafter – Company) and, as established in the provisions of certain contracts, to contractors working in those areas of the Company where an explosive atmosphere is likely to form.

3. REFERENCES

3.1. *Safety Regulations for Employees Working in Potentially Explosive Environment* approved by Order No. A1-262 issued by the Minister of Social Security and Labour of the Republic of Lithuania on 30 September 2005.

3.2. Technical Regulation for Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres approved by Order No. 432 of 27 December 1999 issued by the by Minister of Economy of the Republic of Lithuania.

3.3. *Rules for the Installation of Special Purpose Premises and Operating Process Electrical Equipment* approved by Order No. 4-140/D1-232 as of 29 April 2004 by the Minister of Economy and Minister of Environment of the Republic of Lithuania.

3.4. *General Regulations on Usage of Work Equipment* approved by 22/12/99 Order No. 102 of Minister of Social Security and Labor of the Republic of Lithuania.

3.5. *General Regulations on Establishment of Work Places* approved by the Order No. 85/233 of the Ministry of Social Security and Labor of the Republic of Lithuania and the Ministry of Health Care of the Republic of Lithuania as of 5 May 1998.

3.6. 17 August 1998 Recommended Practice for Classification of Locations of Electrical Installations at Petroleum Facilities Classified as Class 1, Zone 0, Zone 1, and Zone 2. First Edition, November 1997 (API Recommended practice 505).

3.7. Directive 94/9/EC of the European Parliament and the Council of 23 March 1994 on the Approximation of the Laws of the Member States Concerning Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres.

3.8. The Communication from the Commission of the European Communities concerning the non-biding guide of good practice for implementation of the Directive 1999/92/EC of the European Parliament and of the Council on Minimum Requirements for Improving the Safety and Health of Workers Potentially at Risk from Explosive Atmospheres, Commission, Brussels, 25 August 2003.

3.9. LST EN 13237:2013 (original reference EN 13237:2012) Potentially explosive atmospheres - Terms and definitions for equipment and protective systems intended for use in potentially explosive atmospheres, issued on 31 January 2013.

3.10. LST EN 60079-10-1:2009 (original reference EN 60079-10-1:2009) Explosive atmospheres - Part 10-1: Classification of areas – Explosive gas atmospheres, issued on 15 May 2009.

3.11. LST EN 60079-10-2:2009 (original reference EN 60079-10-2:2009) Explosive atmospheres - Part 10-2: Classification of areas – Combustible dust atmospheres, issued on 13 November 2009.

3.12. LST EN 60079-20-1:2010 (original reference EN 60079-20-1:2010) Explosive atmospheres - Part 20-1: Material characteristics for gas and vapor classification - Test methods and data, issued on 31 May 2010.

3.13. LST EN 1127-1:2008 (original reference EN 1127-1:2007) Explosive atmospheres - Explosion prevention and protection - Part 1: Basic concepts and methodology, issued on 15 January 2008.

3.14. LST EN 60079-0:2009 (original reference EN 60079-0:2009) Explosive atmospheres - Part 0: Equipment - General requirements, issued on 13 November 2009.

3.15. LST EN ISO 13943:2011 (original reference ISO 13943:2008) Fire Safety. Vocabulary, issued on 14 January 2011.

3.16. Directive 1999/92/EC of the European Parliament and of the Council on the minimum requirements for improving the safety and health protection of workers potentially at risk from explosive atmospheres (15th individual Directive within the meaning of Article 16(1) of Directive 89/391/EEC), issued 16 December 1999.

3.17. *Types of Construction of Oil Refineries, Transportation Entities and Oil Terminals* approved by Order No. 4-283 of Minister of Economy of the Republic of Lithuania as of 16 July 2004.

3.18. *Rules on Installation of Electrical Equipment*, Edition 6 -(ПУЭ - Правила устройства электроустановок)**.**

3.19. National Electric Code ANSI /NEPA (ANSI / NFPA 70 National Electric Code Article 500 & Article 505).

3.20. *Safety Rules for Operation of Refining Equipment* approved with Order No. 4-2734 as of 28 January 2008 by the Minister of Economy of the Republic of Lithuania.

3.21. Operation Manual for Main and Offshore Pipelines Supplying Crude Oil and Petroleum Product, as approved with Order No. 4-207 as of 25 May 2007 by the Minister of Economy of the Republic of Lithuania.

4. KEY TERMS & DEFINITIONS

4.1. Explosion – a sudden reaction of oxidation and decomposition resulting in the increased temperature, pressure or simultaneous increase of both.

4.2. Fire is combustion process releasing heat and combustion products usually followed by smoke, flame, and glow or all together.

4.3. Potentially explosive environment – environment that may become explosive due to certain local or operating conditions. Potentially explosive environment encompasses a term of potentially explosive atmosphere indicated in the standards listed in Chapter 3.

4.4. Explosive gas atmosphere – mixture with air, under atmospheric conditions, of flammable substances in the form of gas, vapor, mist in which, after ignition, combustion spreads throughout the unconsumed mixture.

4.5. Explosive dust atmosphere – mixture with air, under atmospheric conditions, of flammable substances in the form of dust, combustible flyings in which, after ignition, combustion spreads throughout the unconsumed mixture.

4.6. Source of release – point or location from which a highly flammable substances may be released into the atmosphere in such a way that an explosive gas atmosphere could be formed .

4.7. **Flammable substances (gas, vapor, dust and combustible flyings)** – material which, under certain proportions, mixed with air may produce explosive atmosphere. Flammable substance encompasses a term of combustible and explosive substances specified in the standards listed in Chapter 3.

4.8. Combustible dust – finely divided solid particles, 500 μm or less in nominal size, which may be suspended in air, may settle out of the atmosphere under their own weight, may burn or smolder in air, and may form explosive mixtures with air at atmospheric pressure and normal temperature.

4.9. **Combustible flyings** – finely divided solid particles, 500 μm or more in nominal size, which may be suspended in air, may settle out of the atmosphere under their own weight, may burn or smolder in air, and may form explosive mixtures with air at atmospheric pressure and normal temperature.

4.10. Conductive dust – dust or flyings with electrical resistivity equal to or less than 10^3 Ωm.

4.11. Non-conductive dust – dust or flyings with electrical resistivity equal to or less than 10^3 Ωm.

4.12. Explosion protection measures - all and any measures designated to protect against formation of explosive atmosphere, prevent from ignition of explosive atmosphere or minimize the consequences of explosion.

4.13. Equipment – machines, apparatuses, stationary or portable devices, their control systems and measuring instruments as well as sensors/detectors or prevention systems which, either separately or together, are intended to produce, transmit, accumulate, measure, control, transform energy and/or process materials, and which can cause explosion because of ignition sources found in them.

4.14. Category of equipment – classification of equipment as per required safety level.

4.15. Group of equipment – classification of equipment depending on location of installation: Group I: equipment intended for use in the underground parts of mines, and to those parts of surface installations of such mines, likely to become endangered by firedamp and/or combustible dust; Group II: equipment intended for use in other places likely to become endangered by explosive atmospheres.

4.16. Equipment temperature class – classification unit of device, protection system or component operated in potentially explosive atmospheres, determined on the basis of the highest allowable temperature of a surface.

4.17. Gas temperature class – classification unit of gas, vapors or mist determined on the basis of their ignition temperature.

4.18. Dust temperature class – classification unit of dust or flyings determined on the basis of their ignition temperature.

4.19. Lower explosion limit (LEL) – concentration of flammable materials in air, below which the gas atmosphere is not explosive. Lower explosion limit encompasses a term of lower flammable limit indicated in the standards listed in Chapter 3.

4.20. Upper explosion limit (UEL) – concentration of flammable materials in air, above which the gas atmosphere is not explosive. Upper explosion limit encompasses a term of upper flammable limit indicated in the standards listed in Chapter 3.

4.21. Flash point - the lowest temperature of flammable substance at which, under certain standardized conditions, such substance gives off gas and vapor at a rate such as to induce ignition of gas/vapor and air mixture for a short time but not continuously.

4.22. Ignition (auto-ignition) temperature – the lowest temperature at which (auto) ignition (without any source of ignition) of flammable substances may occur.

4.23. Flammability point – the lowest temperature at which the substance emits enough combustible gas or vapor and, ignites immediately if exposed to a source of ignition.

4.24. Maximum experimental safe gap (MESG) – the maximum gap of the joint between the two parts of the interior chamber of a test apparatus which, when the internal gas mixture is ignited and under specified conditions, prevents ignition of the external gas mixture through a 25mm long joint.

4.25. Minimum ignition current (MIC) – the minimum amount of energy required to ignite combustible gas.

4.26. Ignition source – an energy source causing ignition.

4.27. **ATEX (Atmosphere Explosive)** – classification system of potentially explosive atmospheres and equipment regulated by EU Directives (94/9EC and 99/92/EC) and relevant LR legislation and standards.

4.28. **PUE** – Rules on Installation of Electrical Equipment specified in Chapter 3 (3.18). The above rules also contain additional marking types of equipment designed for potentially explosive atmospheres: PIVE and PVRE

5. EXPLOSION HAZARD IDENTIFICATION

5.1. Source of release (Fig. 1) is described as a point or location from which flammable substances may be released into the atmosphere. Source of release by its frequency and duration are classified into:

1) **continuous** (when the concentration of flammable substances in the atmosphere is evidenced 1000 or more hours per year) , e.g.: inside tanks, wells, truck tanks and etc.

2) **primary** (when concentration of flammable substances in the atmosphere lasts from 10 to 1000 hours per year), e.g.: sampling points, tank breathers, ignition spark plugs, drain vents, ducts and etc.

3) **secondary** (when concentration of flammable substances in the atmosphere lasts less than 10 hours per year), e.g.: flanged connections of pipes, tanks.

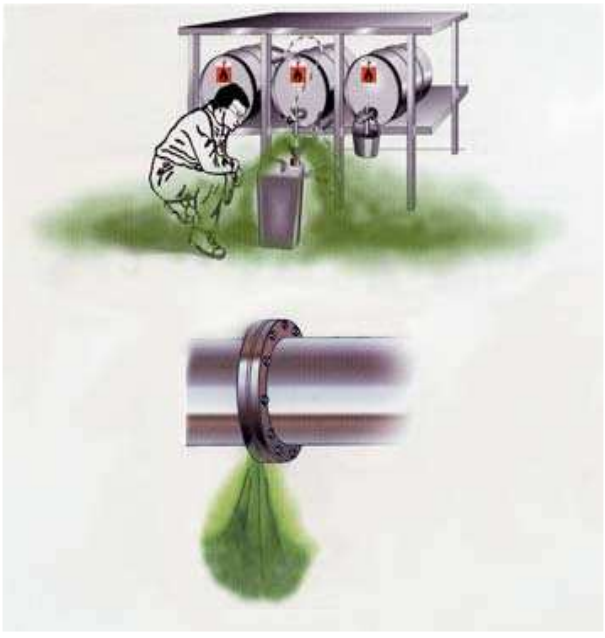


Fig. 1. Typical source of release which may form a potentially explosive atmosphere

5.2. Typical sources of ignition are (Fig. 2 and 3):
1) open flame from burners of process heaters;
2) flares;
3) hot surfaces of pipelines, heat-exchangers and pre-heaters;
4) surfaces of pumps, compressors, turbines, electric motors;
5) lighting installations, circuit-breakers, switches;
6) sparks arising from friction of mechanical parts;
7) electrostatic discharge sparks, short circuit;
8) sparks resulting from the use of diagnostic devices and those providing mobile connection;
9) chemical (exothermic) reactions, self-igniting materials;
10) means of transport (internal combustion engines, batteries, brake drums, exhaust pipes);
11) repair tools, welding equipment;
12) inadequate (negligent) human behavior (smoking in places not designated for smoking, misuse of lighters, matches, mobile phones, photo cameras, etc.)
13) natural phenomena (lightning, exposure to sun rays through a glass lens).

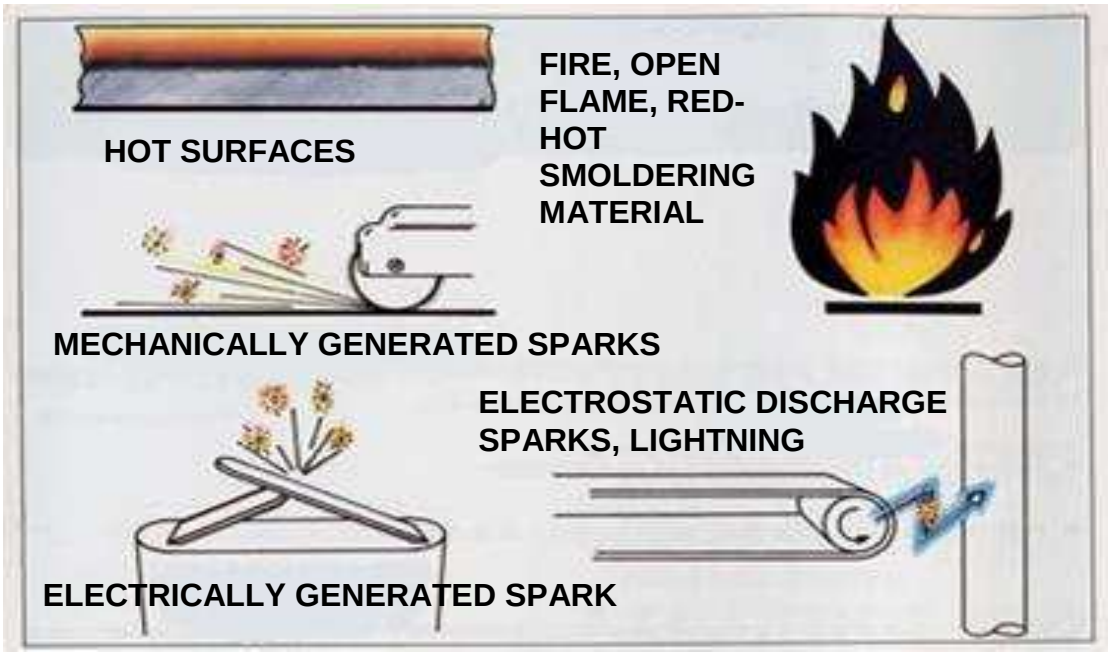


Fig. 2. Examples of sources of ignition.

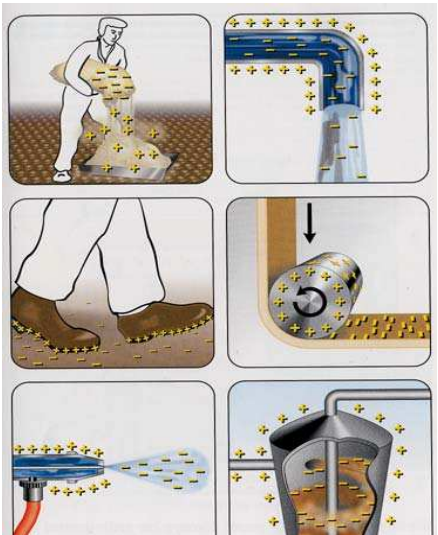


Fig. 3. Typical sources of electrostatic discharge which may cause an explosion when in a potentially explosive atmosphere

5.3. An explosion occurs when the concentration of flammable substance once it is mixed with air (i.e. sufficient amount of oxygen) reaches the lower explosive limit (but does not exceed the upper explosive limit) and when there exists a source of ignition in the environment (Fig. 4).

5.4. In case of explosion employees face the danger of uncontrolled exposure to flame and pressure, radiation of heat, pressure waves, shooting debris, hazardous reaction products and depression of oxygen content in ambient air.

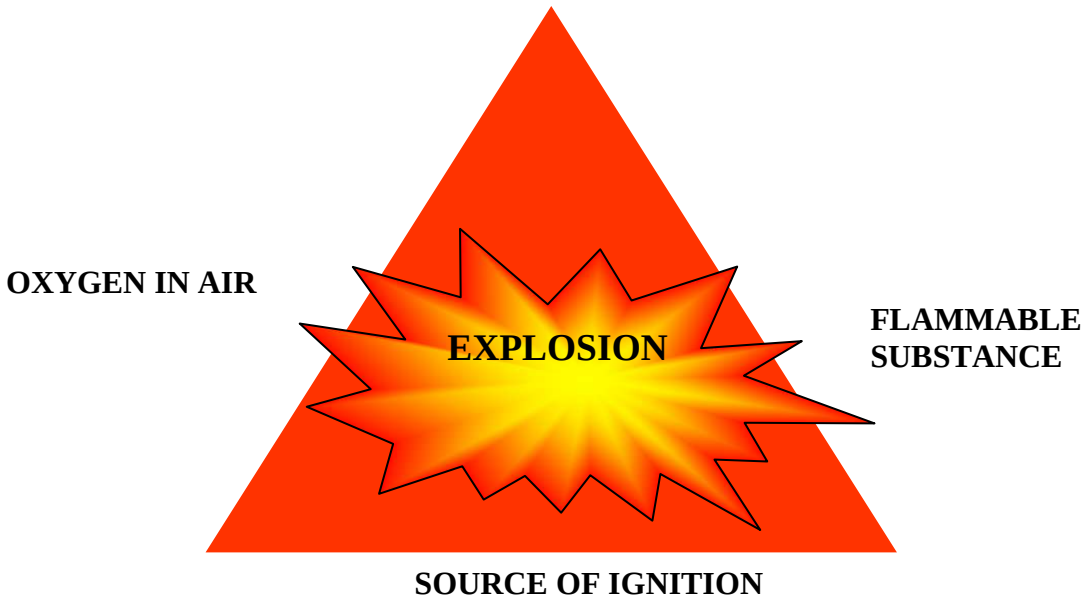


Fig. 4. Explosion triangle – conditions necessary for explosion

6. CRITERIA FOR ASSESSMENT OF RISK OF EXPLOSION

6.1. Assessment of potentiality of explosive atmosphere formation

6.1.1. Explosion hazard shall be subject to further assessment only in case some flammable substances are present.

6.1.2. The below are the substance properties to be taken into consideration when assessing the potentiality of explosive atmosphere formation:

6.1.2.1. Flammable substance lower and upper explosive limits, flashpoint, ignition temperature, operating or ambient temperature, type of flammable liquid handling (jetting, evaporating, condensing and etc.), usage under high pressure, maximum (sometimes minimum) concentration evolved when working with such (Fig. 6);

6.1.2.2. Presence or formation of dust-and-air mixtures or dust drift (e.g. when polishing), their moisture content (Fig. 5).

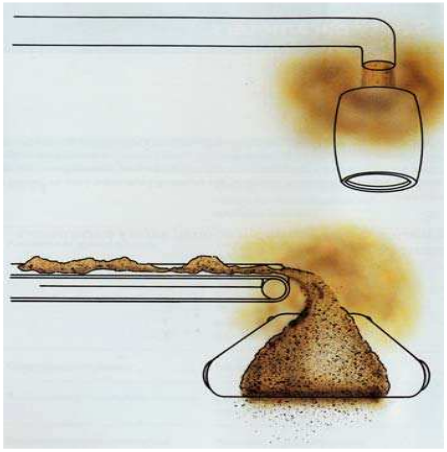


Fig. 5. Examples of dust formation

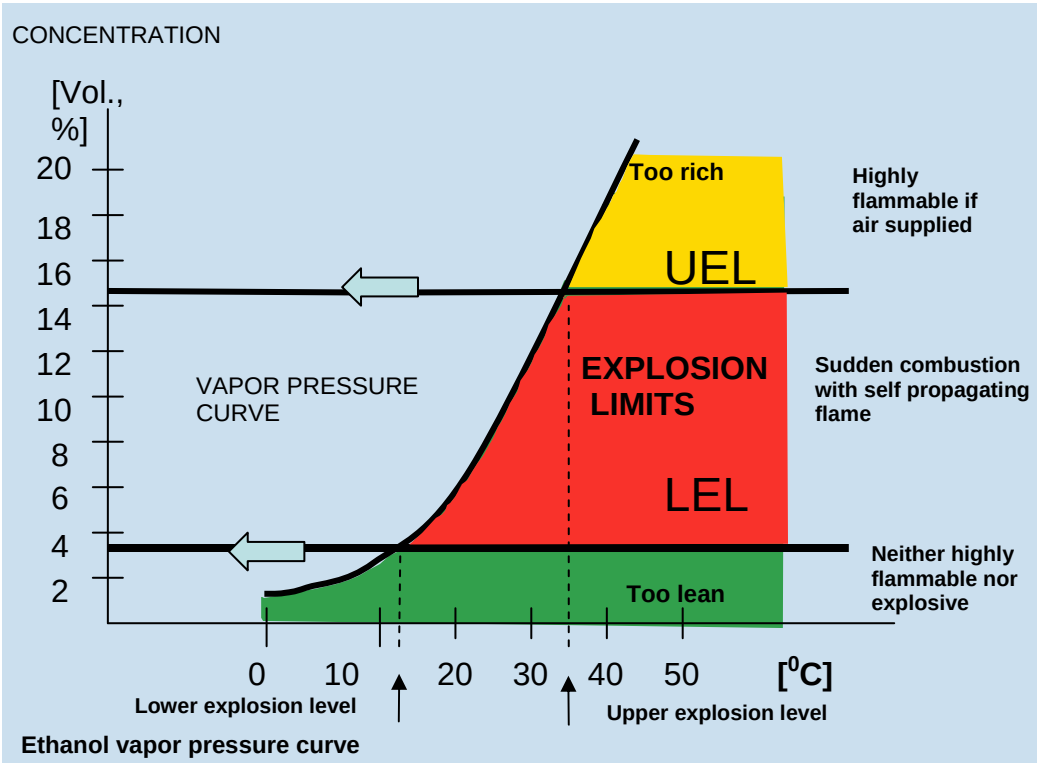


Fig. 6. Explosive limits of ethanol

6.2. Assessment of Work Places with Likely to Form Explosive Atmosphere

6.2.1. When determining potentially explosive atmospheres it is necessary to consider the bellow factors pertaining to materials, facilities, measures applied for process operations as well as environment:

6.2.1.1. Relative density of gas and vapor – the heavier the gas and vapor is, the faster it precipitates, gradually mixes with air and accumulates in hollows, pits, mines, etc. (Fig. 7). Even the slightest air motion (natural draught, people moving around, temperature convection) may accelerate miscibility with air;

Fig. 7. Possible places of accumulation of gases which are heavier than air

6.2.1.2. Evaporation rate of liquids and mist which refers to the quantity of explosive atmosphere which forms under certain temperature, the area of evaporation and operating temperature (e.g. when liquids are sprayed), the increased pressure due to which the sprayed liquid distributes in the air and forms explosive mist (Fig. 8);

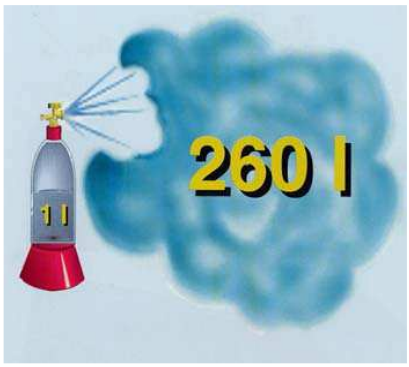


Fig. 8. Once discharged into the atmosphere and turned into gas, one liter of liquefied propane, upon mixing with air up to lower explosion limit (propane LEL - 1,7 % vol), will make 13000 liters of explosive atmosphere

6.2.1.3. The nature of dust production, formation of dust drifts especially on horizontal or only slightly slanted surfaces as well as the size of dust particles (Fig. 9).

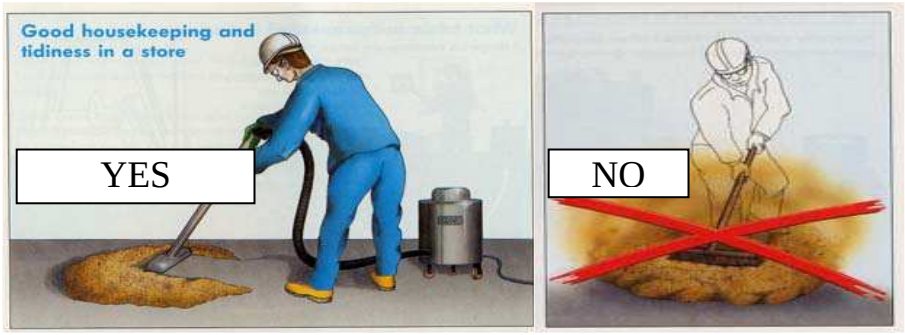


Fig. 9. Appropriate manner of dust handling

7. POTENTIALLY EXPLOSIVE ATMOSPHERE CLASSIFICATION

7.1. Classification of potentially explosive atmospheres is required to identify the size of hazardous areas and hazard level thereof. Classification is executed on the basis of hazard, substances and temperature class.

7.2. Classification by hazards

7.2.1. **Zone 0** a place in which an explosive atmosphere consisting of a mixture with air of flammable substances in the form of gas, vapor or mist is present continuously or for long periods or frequently, e.g. conditions characteristic to this zone typically occur only inside of tanks and installations (reactors, columns, etc.);

7.2.2. **Zone 1** A place in which an explosive atmosphere consisting of a mixture with air of flammable substances in the form of gas, vapor or mist is likely to occur in normal operation occasionally, e.g. sampling points, locations near installation draining systems, breathers, vents, pumps, valve packings, etc.;

7.2.3. **Zone 2** a place in which an explosive atmosphere consisting of a mixture with air of flammable substances in the form of gas, vapor or mist is not likely to occur in normal operation but, if it does occur, will persist for a short period only (areas around Zone 0 and Zone 1);

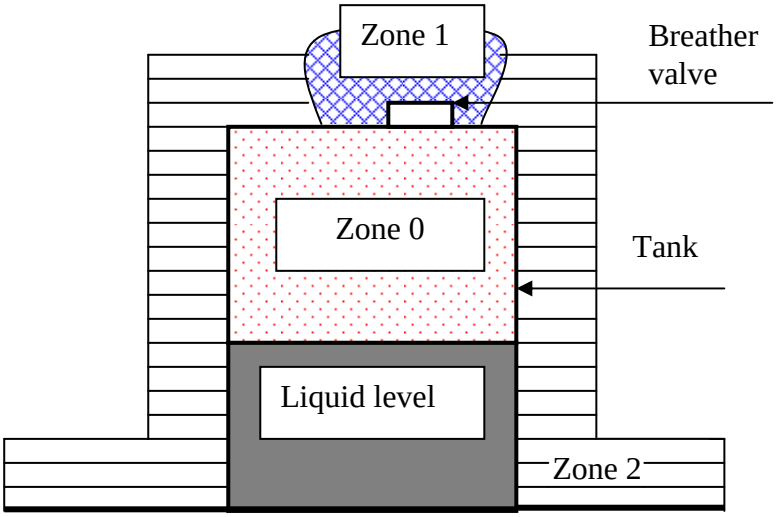


Fig. 10. An example of zoning of a tank with flammable liquid

7.2.4. **Zone 20** a place in which an explosive atmosphere in the form of a cloud of combustible dust or flyings in air is present continuously, or for long periods or frequently;

7.2.5. **Zone 21** a place in which an explosive atmosphere in the form of a cloud of combustible dust or flyings in air is likely to occur in normal operation occasionally;

7.2.6. **Zone 22** a place in which an explosive atmosphere in the form of a cloud of combustible dust or flyings in air is not likely to occur in normal operation but, if it does occur, will persist for a short period only.

7.3. Classification by substances

7.3.1. Group of potentially explosive gas atmosphere is determined on the basis of Maximum Experimental Safe Gap (MESG) and Minimum Igniting Current (MIC). Gas and vapor are devided into three groups.

Table 1

Groups of potentially explosive gas atmosphere

Group of potentially explosive gas atmosphere	ATEX	PUE
IIA	MESG more than 0,9 mm MIC more than 0,80	MESG more than 0,9 mm
IIB	MESG from 0,5 mm to 0,90 mm (inclusively). MIC from 0,45 to 0,8 (inclusive)	MESG from 0,5 mm to 0,90 mm (inclusively).
IIC	MESG less or equal 0,5 mm MIC less or equal 0,45	MESG less or equal 0,5 mm

7.3.2. The above groups are determined on the basis of a size of flammable solids and electric conductivity

Table 2

Groups of potentially explosive dust atmosphere

Group of potentially explosive dust atmosphere	Environment
IIIA	Combustible flyings
IIIB	Non-conductive dust
IIIC	Conductive dust

7.4. Classification by ignition temperature

7.4.1. Class of flammable substances is determined on the basis of (auto) ignition temperature, equipment temperature class is determined on the basis of maximum allowable surface temperature.

7.4.2. Dust temperature class is marked by specifying its (auto) ignition temperature, e.g., T – 135 °C.

7.4.3. Gas, vapor and equipment temperature class is indicated in Table 3. Dust temperature class at both PUE and ATEX cases are determined in the same manner.

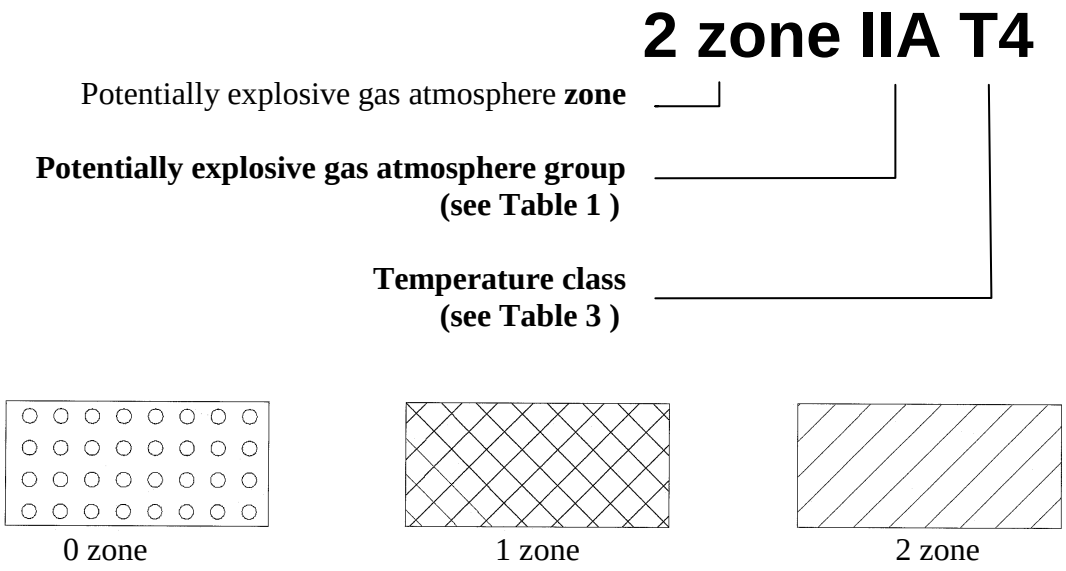
Table 3

Gas and equipment temperature class

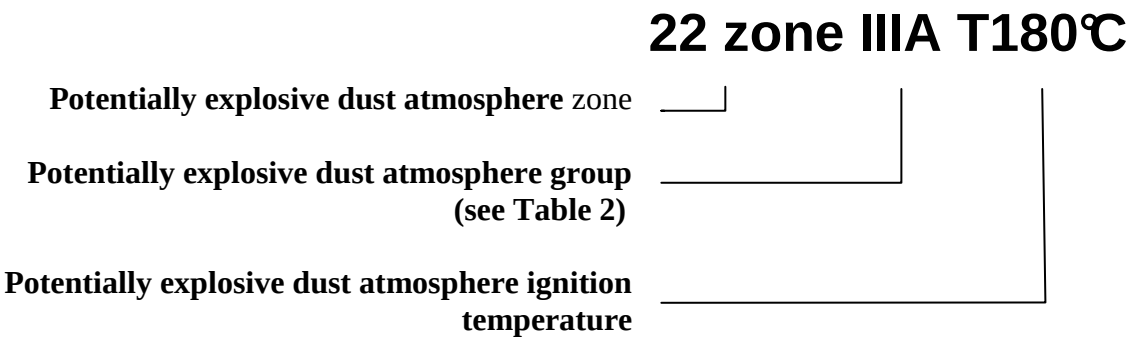
Gas and equipment temperature class	Gas, vapor ignition temperature, °C	Equipment temperature class corresponding gas and vapor temperature class	Equipment max. allowable surface temperature, °C
T1	Above 450	T1–T6	T1 – 450
T2	From 300 to 450	T2–T6	T2 – 300
T3	From 200 to 300	T3–T6	T3 – 200
T4	From 135 to 200	T4–T6	T4 – 135
T5	From 100 to 135	T5–T6	T5 – 100
T6	From 85 to 100	T6	T6 – 85

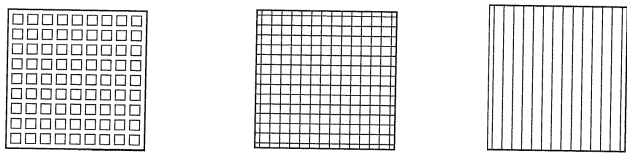
8. POTENTIALLY EXPLOSIVE ATMOSPHERE MARKING

8.1. ATEX marking for potentially explosive gas and vapor atmosphere in the plans



8.2. ATEX marking for potentially explosive dust or combustible flyings atmosphere in the plans




20 zone 21 zone 22 zone

8.3. Potentially explosive atmosphere marking at work places

8.3.1. Entrances to the areas of potentially explosive atmosphere must be marked with the following warning sign:

Warning on potentially explosive atmosphere (equilateral triangle, black letters in yellow background, black rim)

8.3.2. Other data may also be indicated together with the warning sign: nature, frequency, zone type of potentially explosive atmosphere, smoking prohibition and etc.

9. GENERAL TECHNICAL EXPLOSION PROTECTION MEASURES

9.1. Preventive Measures

9.1.1. Usage of flammable substance substitutes

9.1.1.1. Formation of potentially explosive atmosphere may be prevented by rejecting to use or limiting the use of flammable materials. For example, combustible solvents and detergents may be replaced with water solutions.

9.1.1.2. Avoid dust formation; if impossible to avoid, moisture them. Use pasta-type product when possible.

9.1.2. Limiting of Concentration

9.1.2.1. Flammable gas or dust is explosive only in presence of certain concentration of them in the air. Therefore, it is necessary tend to use flammable substances when their explosive mixtures exceed UEL or are lower than LEL

9.1.2.2. Flammable substance may explode only when used above its flash point, therefore, where possible in process operations, the above substance must be used below its flash point.

9.1.2.3. The concentration of explosive atmosphere may be altered by diluting/displacing the explosive mixture by inert gas or water steam. Inert gas is active in confined areas such as the inside of process units. Using of inert gas for expelling the explosive atmospheres from premises is prohibited.

9.1.2.4. Once inside, explosive atmospheres shall be expelled with the help of ventilating installations (Fig. 11). Air intake of supply ventilation cannot be installed in potentially explosive atmosphere.

9.1.2.5. Formation of explosive atmosphere in premises may be prevented by inducing overpressure with the help of air supplied from a non-explosive area. Such system shall be equipped with both blocking and alarm installations necessary for preserving of the certain pressure.

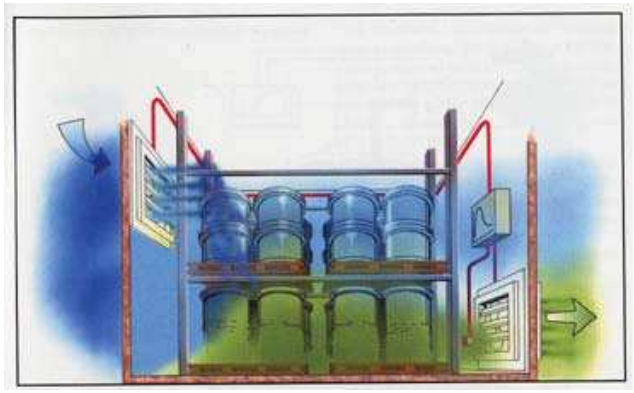


Fig. 11. Concentration of gas, vapor and dust may be reduced by sufficiently ventilating premises

9.1.2.6. Settled dust must be regularly removed to prevent dust explosion.

9.1.2.7. All flammable substances released and/or evolved which are likely to explode must be adequately routed to safe location or eliminated, or, if impossible – collected and disposed in other safe appropriate manner.

9.1.3. Prevention or Limitation of Explosive Atmosphere Formation in the Adjacency of Process Unit

9.1.3.1. Should prevention of flammable substance release is impossible; ventilation must be applied to prevent the formation of explosive atmospheres.

9.1.3.2. Regular in-situ inspection of any concentrations at various locations, at any time and unfavorable operating conditions shall be carried out to avoid explosive mixture formation.

9.1.3.3. Locations involving potentially explosive atmosphere shall be subject to cleaning schedule to prevent dust explosion.

9.1.3.4. Wet cleaning or vacuum-cleaning for combustible non-metallic dust shall be applied to avoid dust concentration increase in atmosphere.

9.1.3.5. Wet cleaning for light metal dust is prohibited (hydrogen is likely to form)

9.1.4. LEL alarm sensor. Main conditions of using the alarm:

9.1.4.1. Sufficient knowledge on what materials are likely to form, places of source of release, maximum capacity of such sources, and conditions for dispersion.

9.1.4.2. The device performance, especially response time, the level and transverse sensitivity of the alarm signal shall comply with the conditions set for its application.

9.1.4.3. Failures of separate alarm system functions shall not induce any emergencies.

9.1.4.4. The number and location of measuring points shall enable prompt and reliable detection of potential mixtures.

9.1.4.5. Awareness of any risks at respective potentially explosive atmospheres and sources of ignition to be avoided therein is necessary prior to introducing protection systems.

9.1.4.6. Protective devices shall ensure reliable warning about formation of explosive atmospheres in adjacent zones, giving of a false alarm shall not induce any other hazards.

9.1.4.7. Alarm system must be installed in the confined spaces containing potentially explosive atmosphere.

9.1.4.8. Alarm system installed for facilities operated outside (not inside) shall correspond to the type and the area of the determined zone the facilities are located at. The places for the above alarm installation are usually determined upon the risk analysis of facilities operation.

9.1.4.9. Gas release alarm applied in potentially explosive atmospheres must be adequately approved and marked, and meet the requirements of the Rules [3.3.]

9.1.5. Avoidance of sources of ignition

9.1.5.1. Sources of ignition of any character must be avoided at potentially explosive atmospheres.

9.1.5.2. Main sources of ignition to be avoided: hot surfaces, flames and hot gas, mechanically generated sparks, electrical devices, alternating current and cathodic protection, el. discharges, lightning, electromagnetic fields, electromagnetic radiation, ionizing radiation, ultrasound, adiabatic compression and knock waves or gas flows, chemical reactions.

9.1.5.3. While implementing ignition hazard prevention measures it is necessary to consider electrostatic discharges at those places where employees or work environment are conductors or sources of electric charge. Employees working at the above places must be furnished with relevant

work clothes made of fabric generating no electrostatic discharges, which might cause ignition of explosive atmosphere.

9.1.6. Extent of protective measures

9.1.6.1. Extent of protective measures depends on type of the zone. Zones 0 or 20 – the highest degree of hazard; Zones 2 or 22 – the lowest degree of hazard.

9.1.6.2. In case several kinds of flammable substances are placed at potentially explosive atmosphere, the preventive measures to eliminate the highest potential risk must be undertaken.

9.1.6.3. Work tools, equipment, devices, protection systems and activation devices at potentially explosive atmosphere may be used only if their operating manuals by manufacturer provide safe usage at explosive atmosphere. The above requirement is applicable to those work tools and activation devices, which by *Technical Regulation of Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres* are not considered work tools, work equipment or protective systems if risk of ignition might occur upon their connection to equipment.

9.2. Mitigation of explosion consequences

9.2.1. Explosion-Proof Equipment. Explosion-proof equipment may be resistant to explosion pressure or explosion shock caused by explosion pressure. Explosion-proof equipment is resistant to anticipated explosion overpressure and, therefore, is not damaged (deformed) irreparably. Explosion pressure shock resistant equipment is designed to resist an overpressure induced impulse in case of internal explosion, however it may be damaged (deformed) irreparably.

9.2.2. Relieving of Explosion. Relieving of the force of explosion embraces all the measures designed to ensure that in case an explosion starts or upon extension of the latter to a certain pre-determined degree, the confined facilities, which the explosion occurs in, should direct the explosion wave in a safe direction for either short or longer period of time until the pressure necessary for activating of an explosion relief device is reached. The purpose of such device is to ensure that the impact of the explosion shock upon the facilities shall not exceed the resistance of the latter. Devices meant to relieve an explosion may be explosion relief disks, doors or vents. Relieving of the force of explosion is not allowed if ventilated products may pose hazard to employees or cause damage to the environment (e.g. evolve toxic compounds).

9.2.3. Suppression of Explosion. Explosion suppression systems are meant to prevent building-up of the maximum explosion pressure: in case of explosion, tanks and facilities are promptly supplied with extinguishing media thereby ensuring that the consequences of the explosion do not transcend the boundaries of the facilities or tank.

9.2.4. Prevention of Spread of Explosion (Explosion Isolation). An explosion having occurred in one part of facilities may spread to either upper or lower parts of the facilities where further explosions may be induced. Built-up explosion pressure may damage certain parts of the facilities even in cases when the structure of such parts are resistant to explosion pressure or pressure shock. Therefore, it is important to limit the spread of potential explosions beyond the area of the certain part of the facilities. The above may be insured with the help of devices designed for explosion isolation. In cases of burning of gas, vapor or mist, flame arresters may be used to isolate the explosion. Flame arresters are mainly designed to:

1) put out fire in narrow openings and channels (e.g. arresters equipped with corrugated metal strips and those from slagged metal);

2) arrest the front line of flame by releasing non-burnt mixtures at a certain speed (high speed valves);

3) arrest the front line of flame with the help of liquid barrier.

9.3. Application of Process Controls

9.3.1. Together with measures specified in clauses 9.1 – 9.2 above, automated process management and control systems are used with the help of which it is possible to timely disconnect dangerous facilities in case an explosive atmosphere forms, to switch on additional ventilation, and to timely signal abnormal modes of equipment operation (temperature increase, depressurization, leakage, etc.).

9.4. Other Measures

9.4.1. In the cases when explosion risk may arise due to el. power supply interruptions, the measures allowing safe usage of equipment, tools, protective systems irrespectively of the above interruptions should be provided.

9.4.2. It is necessary to provide the measures designed for manual disconnection (if safe to do so) of equipment, tools and protection systems applied in automated processes, when their operation do not comply with operating conditions established. Such disconnection operations can be performed by qualified personnel only.

9.4.3. It is necessary to provide the measures designed for prompt and safe dissipation and isolation of energy accumulated during the emergency shutdown in order to eliminate further hazard.

10. POTENTIALLY EXPLOSIVE ATMOSPHERE CLASSIFICATION PLANS

10.1. Each facility containing potentially dangerous zones shall be provided with Plans of Potentially Explosive Atmospheres.

10.2. When implementing changes within the facilities, modifying process variables or replacing process media with others, the potentially explosive atmospheres shall be revised and, in case necessary, changes shall be made in Plans of Potentially Explosive Atmospheres.

11. SAFETY REQUIREMENTS AT POTENTIALLY EXPLOSIVE ATMOSPHERES

11.1. Storage and usage of personal belongings, which are likely to become the sources of ignition or leakage initiating fire or explosion, in the area of production premises and territories shall be prohibited.

11.2. Storing and keeping of containers either empty or filled with flammable substances, rags or other textiles soaked with petroleum products shall be prohibited in the area of production premises and territory, except for places designed for the particular purpose and marked with appropriate warning signs. Such textiles shall be collected into special containers or tanks marked with appropriate inscriptions and handled in accordance with the requirements provided for by legal acts regulating waste disposal.

11.3. In the area of production premises, warehouses, facilities, other environments – places constantly present with employees or designed for work places – chemicals, flammable and combustible materials as well, shall be stored in compliance with the threshold limit value.

Table 4

Threshold limit values upon exceeding which the atmosphere becomes dangerous and has to be classified into potentially explosive atmospheres

	Flammable gas (gas volume calculated per 1 bar pressure)	Liquefied flammable gas	Flammable liquids
Inside	50 liters	5 liters	25 liters
Outside	1000 liters	100 liters	200 liters

11.4. Entrances into premises or buildings where flammable substances are stored shall be provided with a clearly visible list of materials stored, the quantity of such materials and an emergency evacuation plan.

11.5. Prior to using flammable substances, employees shall be familiarized with a safety data sheet of each substance to be used.

11.6. Substances having no certificates or documents of origin, whose explosiveness or combustibility is not known or has not been researched into shall not be used for technological processes and shall not be warehoused together with other materials.

11.7. Employees are to constantly observe the indications of gas detectors - gas alarm systems. The precision of indications provided by the detectors shall be ensured during the entire course of operation. In case a failure of such device is suspected, the failure shall be immediately reported to appropriate repair services.

11.8. Employees shall constantly monitor the indications of process instrumentation because a unit may at any moment start leaking, over-heat, self-ignite or explode.

11.9. Further operation shall be prohibited in case of faulty automatic equipment, deactivated monitoring instruments and safety devices, except for the cases when such devices have been deactivated to undergo certain repairs, or in case of technological necessity upon a written instruction given by a head of the division (shift) and upon additional measures meant to ensure safe operation of the facilities guaranteed.

11.10. Windows, doors of buildings and other structures located in potentially explosive atmospheres shall be tightly closed (unless otherwise specified in technical documentation), and the tightness shall be periodically checked. Self-closing doors shall be in good technical order.

11.11. Reduction of window size or replacement of window glass with pane thicker than that specified in the design, replacement of glass with insulating glass units or other materials (veneer, wood planks, plastic glass, etc.) without a permission given shall be prohibited.

11.12. The area of potentially explosive atmospheres and the surrounding area within the radius of 30 m shall be appropriately and timely cleaned from bushes, trees, mowed grass, soil contaminated with oil products, grease-soaked clothes and other items which may become sources of leakage or combustion of flammable substances.

11.13. Pipelines, process units and containers, containing flammable substances, must be leak-proof. Hot surfaces of pipelines and installations shall be coated with thermal insulation.

11.14. Pursuant to valid technical requirements, pre-treated or impregnated wood or other combustible surfaces, structures and fabrics after the term of their pre-treatment expires or after they are no more fire-resistant due to some other reasons, shall be replaced or appropriately re-treated. Fire resistance of such surfaces shall be checked periodically.

11.15. Wall partitions of buildings and other structures are subject to periodical testing. Upon openings, cavities or leaks noticed in wall seams (connection places), decks and partitions of various engineering process communications, the latter shall be filled-up with construction grouts or other fireproof materials in order to prevent further expansion of potentially explosive atmospheres, to eliminate any possibility for flammable substances to access the buildings.

11.16. When planning or designing buildings, premises and facilities, also when changing their functional purpose or when installing new facilities, the impact of the latter (as regarding explosion-safety) on the existing structures and installations, as well as the influence of the existing objects on the new one shall be assessed.

11.17. It shall be prohibited to change volume and/or area of buildings or other confined objects so that the existing ventilation efficiency and emergency evacuation possibility is preserved. The draw-in – exhaust openings and channels of ventilation shall not be blocked to ensure free air motion which is necessary.

11.18. Production buildings, other structures and objects shall be equipped with emergency lighting so that in case an accident or el. power interruption, employees working in the particular object would be able to emergency-shutdown the operated unit and get evacuated from the building or object.

11.19. During the work shift, a person in charge shall periodically inspect the premises, structures, installations, measures of grounding and lightning protection, gas sensors, and instrumentation. The inspection results shall be recorded to respective logbooks.

11.20. Access to potentially explosive atmosphere and working therein is allowed only in work clothes and footwear adequately certified proving that they do not build electrostatic charge and have no parts or components likely to cause sparkling. Employees shall be informed on the suitability of the acquired clothing and footwear in the respective territory.

11.21. It is prohibited to use mobile el. equipment (e.g. electric tools and devices, cellular phones, photo cameras, etc.) which do not meet the required level of explosion protection, and may become potential source of ignition.

11.22. Hand tools for work at potentially explosive zones shall be selected according to LST EN 1127-1:2008 [3.13] and meet the requirements of OHS Procedures of the Company.

12. SELECTION OF EQUIPMENT FOR WORKPLACES WITH POTENTIALLY EXPLOSIVE ATMOSPHERE

12.1. The equipment and protective systems to be installed in places of potentially explosive atmosphere shall be selected in accordance with the categories established in Technical Regulation of the Equipment and Protective Systems Intended for Use in Potentially Explosive Atmosphere [3.2].

12.2. Equipment used at potentially explosive atmospheres must be marked. Marking examples are provided in Attachment 1.

12.3. Main criteria for selection of equipment intended for use in potentially explosive atmosphere: Type of zone, group and temperature class of potentially explosive atmosphere.

12.4. Equipment categories (Table 5) intended for use in different types of zones:

12.4.1. **Category No.1**: equipment operating according to manufacturer-established operation parameters and ensuring an extremely high level of protection. Applicable in Zones 0, 1, 2;

12.4.2. **Category No.2**: equipment operating according to manufacturer-established operation parameters and ensuring a high level of protection. Applicable in Zones 1 and 2;

12.4.3. **Category No.3**: equipment operating according to manufacturer-established operation parameters and ensuring a normal level of protection. Applicable in Zone 2.

12.5. Selection of equipment based on potentially explosive atmosphere group:

12.5.1. Equipment designed for IIA group is intended for use only in potentially explosive atmospheres marked as IIA group.

12.5.2. Equipment designed for IIB group is intended for use in potentially explosive atmospheres marked as IIA and IIB group.

12.5.3. Equipment designed for IIC group is intended for use in potentially explosive atmospheres marked as IIA, IIB and IIC group.

12.6. Selection of equipment by temperature class of potentially explosive atmosphere is provided in Table 3. If just (auto) ignition temperature is indicated for potentially explosive atmosphere, the **highest surface temperature of the selected equipment must be lower than (auto) ignition temperature of the existing atmosphere**.

12.7. If work equipment is used in different zones, groups of substances or temperature classes, it must comply with the requirements of all zones, groups or temperature classes. E. g.: In case work equipment is used in both Zone 1 and 2, the equipment shall meet the requirements set for Zone 1.

Table 5

Equipment intended for use in various zones

Zone	Category	Purpose
0	1 G	for gas-air mixture, vapor-air mixture and mist
1	1 G or 2 G	for gas-air mixture, vapor-air mixture and mist
2	1 G or 2 G or 3 G	for gas-air mixture, vapor-air mixture and mist
20	1 D	for dust-air mixture
21	1 D or 2 D	for dust-air mixture
22	1 D or 2 D or 3 D	for dust-air mixture

G – Equipment intended for use in potentially explosive atmosphere where gas-air or vapor-air mixtures is likely to be present;

G – Equipment intended for use in potentially explosive atmosphere where dust-air mixture is likely to be present;

13. FINAL PROVISIONS

13.1. Organizational and technical measures (personnel competence and training, work permit system, equipment technical maintenance, supervision and inspection) other than provided herein as well as their procedure of application are regulated by OHS Procedures, Technical Regulations, Rules For Explosion Risk Assessment And Classification Of Potentially Explosive Atmospheres approved in the Company.

13.2. Persons who have failed to meet the requirements specified in the present Procedure shall be liable in accordance with legislation of the Republic of Lithuania, and the rules and procedures of the Company.

14. ATTACHMENTS

Attachment 1. Marking of equipment used at potentially explosive atmospheres.

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