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EN 60079-10-1 ve 2:2015 Standartlarının Zaafiyetleri, Çözüm Önerileri ile 2014/34/EU Direktifi Çerçevesinde Mekanik Ekipman Tutuşturma Risk Değerlendirmesi-MEIRA

Özlem ÖZKILIÇ

Önder Akademi AŞ. Genel Müdür Yrd.
Kimya Yük. Müh. - E. İş Başmüfettişi
A Sınıfı İş Güvenliği Uzmanı - E. İş Teftiş İst. Grp. Bşk. Yrd.

"Geleceği tahmin etmenin en iyi yolu, onu kendi başınıza şekillendirmektir.."

Willy Brandt (1913-1992)
Nobel Peace Prize
Winner

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Patlayıcı Ortam Güvenliği

Tehlikeli kimyasal kullanan ve üreten proseslerde yanıcı ve parlayıcı kimyasallarla ilgili etkili önlemlerin alınamamış olunması sonucunda pek çok iş kazası, yangın ve patlama meydana gelmektedir.

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Patlayıcı Ortam Güvenliği

Günümüzde **yüksek risklere sahip işletmeler için ATEX Direktiflerine uyumun sağlanması kritik önem taşımaktadır.**

Patlayıcı Ortam Güvenliği

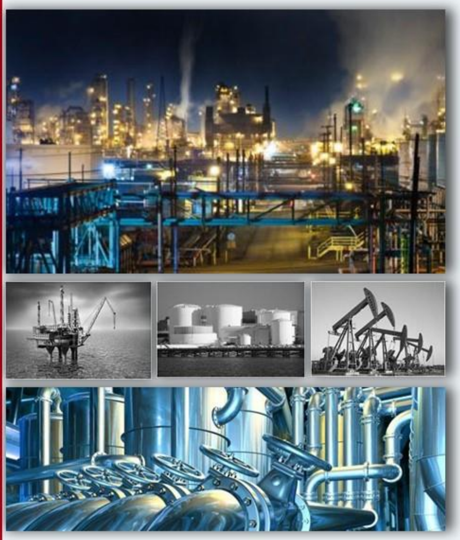
Kimyasal maddelerle çalışan tesislerin patlayıcı ortamlarda **uygun ekipmanı seçebilmesi** için öncelikle **"Tehlikeli Bölge (Zone)"** hesaplaması yapmaları gerekmektedir..

Patlayıcı Ortam Standart Dağılımı

ATEX UL CSA IECEx GOST INMETRO

Dünya'da Patlayıcı Ortam Sınıflandırmasında Kullanılan Çeşitli Standart Mevcuttur!!!

Patlayıcı Ortam – Tehlikeli Bölge Sınıflandırma Standartları



Ülkemizde TSE Tarafından Yayınlanan Standartlar:

TS EN 60079-10-1: 2015 Patlayıcı ortamlar- Bölüm 10-1: Tehlikeli bölgelerin sınıflandırılması-Patlayıcı gaz atmosferler

TS EN 60079-10-2: 2015 Patlayıcı ortamlar- Bölüm 10-2: Tehlikeli bölgelerin sınıflandırılması-Yanıcı toz atmosferler

Patlayıcı Ortam Standart Dağılımı

ATEX UL CSA IECEx GOST INMETRO

Patlayıcı Ortam – Tehlikeli Bölge Sınıflandırma Standartları

2003

EN 60079-10-1: 2003 Gazlar&Sıvılar

2003

EN 60079-10-2: 2003 Tozlar

IEC 60079-10-1/2 Uluslararası Standardları, IEC Teknik Komitesi'nin "Tehlikeli bölgelerin sınıflandırılması ve montaj gereklilikleri" adlı alt-komitesi tarafından ilk defa 2003 yılında hazırlanmıştır.

Ancak ilk yayınlanan versiyon birçok konuda yetersiz ve hesaplamalar açısından muğlak bulunmuştur.

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Patlayıcı Ortam – Tehlikeli Bölge Sınıflandırma Standartları

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hySafe

Hidrojen tesisatları için **tehlikeli alanların belirlenmesi ve EN 60079-10-1** standartının geliştirilmesi için altıncı çerçeve programları çerçevesinde **«hySafe»** AB projesi gerçekleştirilmiştir.

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Patlayıcı Ortam – Tehlikeli Bölge Sınıflandırma Standartları

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HEALTH & SAFETY LABORATORY

2002 yılında İngiltere'de «**Tehlikeli Maddeler ve Patlayıcı Ortamlar Regülasyonu – DSEAR**» yayınlanmıştır.

İngiliz Sağlık ve Güvenlik Laboratuvarı (HSL) tarafından İngiltere'de patlayıcı ortam sınıflandırılması için kullanılan **üç standartın incelenmesi için bir proje gerçekleştirilmiştir.**

Bu standartlar;

- BS EN 60079-10-1: 2009,
- **Güvenli Uygulama Model Kodu, IP 15**, 2005 versiyonu
- **Laboratuvarı Doğal gaz tesisatlarının tehlikeli bölge sınıflandırması, IGEM / SR / 25**, 2010 versiyonudur.

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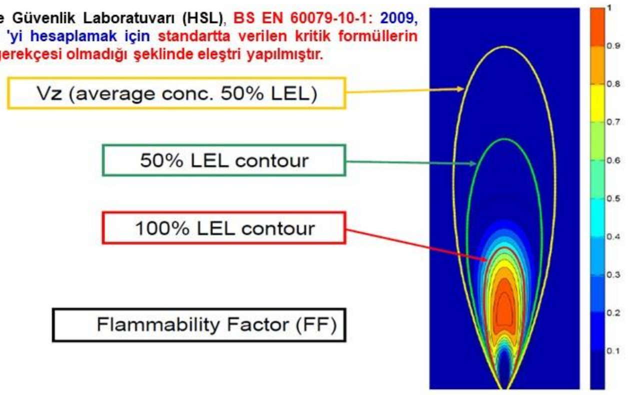
Patlayıcı Ortam – Tehlikeli Bölge Sınıflandırma Standartları

ÖNDER akademi a.ş.

Flammability of Gas Mixtures

HEALTH & SAFETY LABORATORY

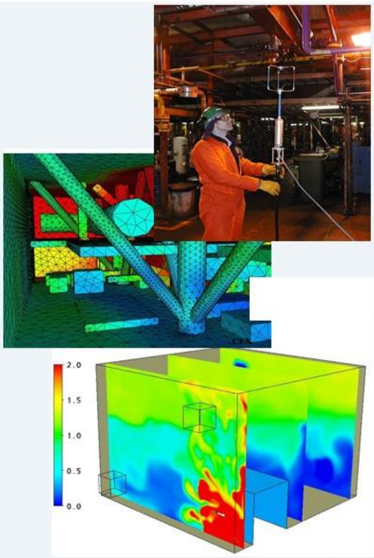
İngiliz Sağlık ve Güvenlik Laboratuvarı (HSL), BS EN 60079-10-1: 2009, standartının Vz 'yi hesaplamak için standartta verilen kritik formüllerin hiçbir bilimsel gerekçesi olmadığı şeklinde eleştri yapılmıştır.



Patlayıcı Ortam – Tehlikeli Bölge Sınıflandırma Standartları

İngiliz Sağlık ve Güvenlik Laboratuvarı (HSL), EN 60079-10-1: 2009 Standartını hazırlayan **Uluslararası Elektrik Komisyonunu "Aşırı Muhafazakar"** olmakla itham etmiştir.

Standartın hesaplama mantığının ve formülasyonlarının değişmesinde eleştirilerin büyük etkisi olmuştur!!!!



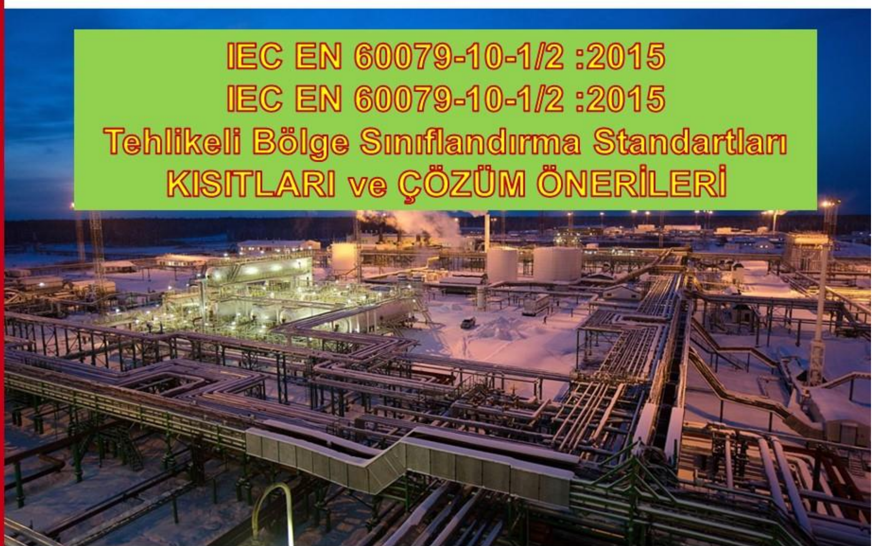
Patlayıcı Ortam – Tehlikeli Bölge Sınıflandırma Standartları

EN 60079-10-1: 2009 Standartına yoğun itirazlar sonucu Uluslararası Elektrik Komisyonu 2015 versiyonunu ilk defa <u>«Çerçeve Standart»</u> olarak yayınlanmıştır.

<u>Standartın kendisinde yoğun eleştirilerden kurtulmak maksadıyla</u> kullanılacak diğer standartlara atıf yapılmakta ve Standartın Kısıtları'na uygun olarak diğer standartların da kullanılmasını <u>şart koşmaktadır.</u>

2003	2009	Taslak 2014	2015
EN 60079-10-2: 2003 Gazlar&Sıvılar	EN 60079-10-2: 2009 Gazlar&Sıvılar	31J/253/FDIS EN 60079-10-2: 2014 Gazlar&Sıvılar	IEC 60079-10-1:2015 Gazlar&Sıvılar

2003	2009	Taslak 2014	2015
EN 60079-10-2: 2003 Tozlar	EN 60079-10-2: 2009 Tozlar	31J/244/FDIS EN 60079-10-2: 2014 Tozlar	IEC 60079-10-2: 2015 Tozlar



IEC EN 60079-10-1:2015
Standartı Kısıtları ve Zaafları

BS EN 60079-10-1:2015

INTERNATIONAL ELECTROTECHNICAL COMMISSION

EXPLOSIVE ATMOSPHERES –

Part 10-1: Classification of areas – Explosive gas atmospheres

FOREWORD

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International Standard IEC 60079-10-1 has been prepared by subcommittee 31J: Classification of hazardous areas and installation requirements, of IEC technical committee 31: Equipment for explosive atmospheres.

This second edition of IEC 60079-10-1 cancels and replaces the first edition, published in 2008, and constitutes a technical revision. The significant technical changes with respect to the previous edition are as follows:

bsi.

Standartın girişinde referanslara dikkat çekilmektedir.

Önsöz 8. madde'de şu uyarı yapılmaktadır:

Bu yayında atıfta bulunulmuş Normatif referanslara dikkat çekilmektedir. Bu yayının doğru şekilde uygulanabilmesi için atıfta bulunulan yayınların kullanılması vazgeçilmezdir/ zorunludur.

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Table K.1 – Examples of codes and standards

Country or Region of Origin	Code or Standard Designation	Title	Developing Body	Application Notes
Australia and New Zealand	AS/NZS (IEC) 60079.10.1	Explosive Atmospheres Part 10-1: Classification of areas – Explosive Gas Atmospheres	Standards Australia/ Standards New Zealand	Introduced in AS/NZS 60079.10.1 as the national Annex
Germany	DGUV-Regel 113-001 "Explosions schutz-Regeln (Rx-RL)"	ExRL "Explosionsschutz- Regeln – Regeln für das Vermeiden der Gefahren durch explosionsfähige Atmosphäre mit Beispielsammlung" ExRL "Explosion Protection- Rules – Rules for avoiding the dangers of explosive atmospheres with examples collection"		
	TRBS 2152	Technischen Regeln für Betriebssicherheitsverordnung Technical Rules for Plant Safety Provisions		
Italy	GUIDA CEI 31-35 & GUIDE CEI 31-35/A	Explosive atmospheres – Guide for classification of hazardous areas for the presence of gas in application of CEI EN 60079-10-1 (CEI 31-87)	CEI – Comitato elettrotecnico italiano CEI – Italian Electrotechnical Commission	Scope of this Guide is the analysis in details of the classification of hazardous areas due to the presence of flammable gases, vapours or mists, according to IEC standard 60079-10-1.
Sweden	Klassning av explosionsfarliga områden	Classification of Hazardous Areas	Svensk Elstandard	Available only in Swedish
Switzerland	SUVA Merkblatt Nr. 2153	Explosionsschutz Grundsätze Mindestvorschriften Zonen Explosion protection Basics Minimal requirements Zones	Schweizerische Unfall- versicher-ungsanstalt	
The Netherlands	NPR 7910-1	Netherlands practical guideline NPR 7910-1, Classification of hazardous areas with respect to explosion hazard – part 1: gas explosion hazard, based on NEN-EN-IEC 60079-10-1	Netherlands Standardization Institute, NEN	
UK	IP15	Model code of safe practice for the petroleum industry, Part 15: Area Classification Code for Petroleum Installations Handling Flammable Liquids.	Energy Institute	IP15 is used as an industry standard in the petro(chem) industry in many countries
	IGEM/SR/25	Hazardous area classification of natural gas installations.	Institution of Gas Engineers and Managers	
USA	API RP 505	Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities classified as Class I, Zone 0, Zone 1 and Zone 2.	American Petroleum Institute (API)	
	NFPA 59A	Standard for the Production, Storage, and Handling of Liquefied Natural Gas.	National Fire Protection Association	
	NFPA 497	Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapours and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas.	National Fire Protection Association	

Standartın KISITLARI olduğunda ne yapılabilir?

5.3. Endüstriyel kuralların ve ulusal standartların kullanımı

Uygulamaya uygun rehber ve standartlar bu standardın genel ilkelerine uygun olarak kullanılabilir.

Ek K örneklerin yanı sıra daha fazla detay sağlayabilen ilgili sanayi kurallarını ve ulusal standartları tanımlamaktadır.

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B.6 Forms of release

Figure B.1 illustrates the general nature of different forms of release.

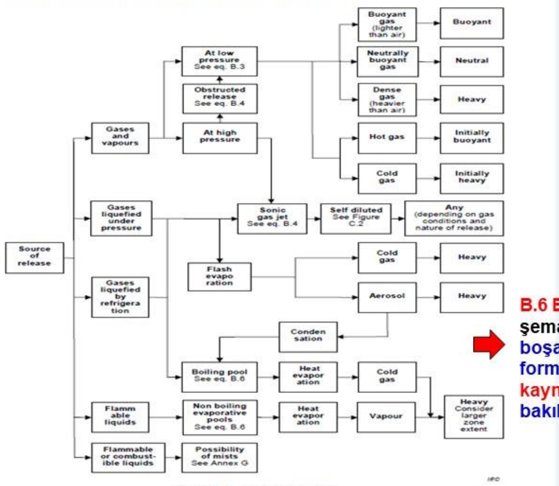

Figure B.1 – Forms of release

B.6 Boşalma şekileri Şekil B.1'de şematik olarak tarif edilmiş, tüm boşalma şekilleri ve koşulları için formüller verilmemiş, referans kaynaklara VE STANDARTLARA bakılması istenilmiştir.

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6.3.2 Gaseous release

A gas release will produce a gas jet or plume at the release source depending on the pressure at the point of release, e.g. pump seal, pipe connection or evaporative pool area. The relative density of the gas, the degree of turbulent mixing and the prevailing air movement will all influence the subsequent movement of any gas cloud.

In calm conditions low velocity releases of a gas that is significantly less dense than air will tend to move upwards, e.g. hydrogen and methane. Conversely, a gas that is significantly denser than air will tend to accumulate at ground level or in any pits or depressions, e.g. butane and propane. Over time, atmospheric turbulence will cause the released gas to mix with air and become neutrally buoyant. A gas or vapour with density that is not significantly different to air is regarded as neutrally buoyant.

Higher pressure releases will initially produce jets of released gas which will mix turbulently with the surrounding air and entrain air in the jet.

At high pressures, a thermodynamic effect due to expansion can come into play. As the gas escapes, it expands and cools down and may initially behave as heavier than air. However the cooling due to the Joule-Thomson effect is eventually offset by the heat supplied by the air. The resulting gas cloud will eventually become neutrally buoyant. The transition from heavier than air to neutrally buoyant behaviour may occur at any time depending on the nature of the release and may occur after the cloud has been diluted to below the *LFL*.

NOTE Hydrogen demonstrates a reverse Joule-Thomson effect, heating up as it expands and so will never exhibit a heavier than air effect.

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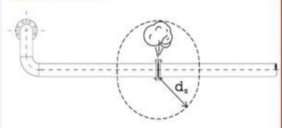
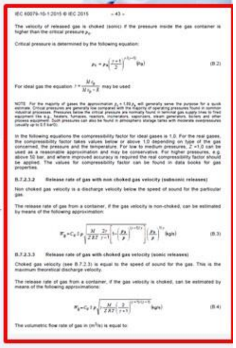
6.3.2 Gaz boşalması

Bir flanş, pompa, boru bağlantısı vb. kaynaktan gaz boşalması koşulları anlatılmış ve B.7.2.3.2'de hesaplama formülleri verilmiştir.

Söz konusu formülün Propan, Bütan, LPG ve LNG, Hidrojen, Amonyak vb. kimyasalların yüksek basınçta boşalması için kısıtı /limiti bulunmaktadır.

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The velocity of released gas is choked (sonic) if the pressure inside the gas container is higher than the critical pressure p_c.

Critical pressure is determined by the following equation:

(B.2)

B.7.2.3.2 Release rate of gas with non choked gas velocity (subsonic releases)

Non choked gas velocity is a discharge velocity below the speed of sound for the particular gas.

The release rate of gas from a container, if the gas velocity is non-choked, can be estimated by means of the following approximation:

(B.3)

B.7.2.3.3 Release rate of gas with choked gas velocity (sonic releases)

Choked gas velocity (see B.7.2.3) is equal to the speed of sound for the gas. This is the maximum theoretical discharge velocity.

The release rate of gas from a container, if the gas velocity is choked, can be estimated by means of the following approximations:

(B.4)

The volumetric flow rate of gas in (m³/s) is equal to:

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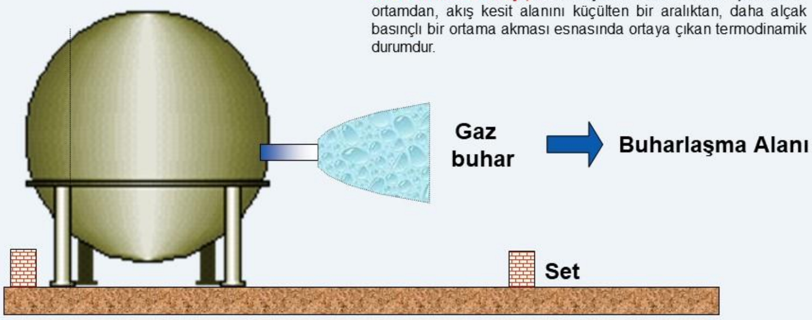
6.3.2 Gaz boşalması

Joule-Thomson olayı; Gaz akışkanın basıncı daha yüksek bir ortamdan, akış kesit alanını küçülten bir aralıktan, daha alçak basınçlı bir ortama akması esnasında ortaya çıkan termodinamik durumdur.



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BS EN 60079-10-1:2015

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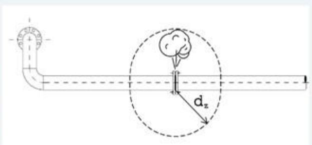

6.3.2 Gaz boşalması

Standart Joule-Thomson kuralı etkisinden bahsetmektedir, bu etkinin değerlendirilmesi gerektiğini söylemekte ancak formül verilmemektedir.

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complex matters with simplified mathematical models. Other calculation methods may also be adopted.

The following equations give the approximate release rates of flammable liquids and gases. Further refinement of release rate estimation would be achieved with consideration of properties of any openings and the viscosity of the liquid or gas. Viscosity may significantly reduce the release rate if the opening, through which the flammable substance is released, is long compared to the width of the opening. These factors are normally considered in the coefficient of discharge ($C_d \leq 1$).

The coefficient of discharge C_d is an empirical value which is obtained through a series of experiments for specific cases of release and for specific orifice details. As a result C_d may take a different value for each particular case of release. A C_d of not less than 0,99 for items with regularly shaped holes, e.g. for vents, and 0,75 for irregular holes can be a reasonably safe approximation if there is no other relevant information upon which to make the assessment.

If C_d is applied to the calculations the value applied should be used by reference to a suitable guide for the application.

B.7.2.2 Release rate of liquids

The release rate of liquid can be estimated by means of the following approximation:

$$W = C_d S \sqrt{2 \rho \Delta p} \text{ (kg/s)} \quad (B.1)$$

The rate of vapourisation of a liquid release is then required to be determined. Liquid releases may take many forms. The nature of the release and how any vapour or gas is generated is also dependant on many variables. Examples of releases include:

a) Two phase release (i.e. combined liquid and gas release)
Liquids such as liquefied petroleum gas (LPG), may include both gas and liquid phases either immediately before the release orifice or after the release orifice through a variety of thermodynamic or mechanical interactions. This may further lead to droplet and/or pool formation which results in further boiling of the liquid contributing to the vapour cloud.

b) Single phase release of a non-flashing liquid
For liquids with higher boiling points (above atmospheric ranges) the release will generally include a significant liquid component which may evaporate near the source of release. The release may also break up into small droplets as a result of a jet action. Vapour released will then depend on any jet formation and vapourisation from the point of release, from any droplets or any subsequent pool formation.

Due to the large number of conditions and variables a methodology for assessing the vapour conditions of a liquid release is not provided in this standard. Users should carefully select a suitable model observing any limitations of the model and/or applying an appropriately conservative approach with any results.

B.7.2.3.1 General

The equations below are considered to provide reasonable estimations of release rate for gases. If the gas density approaches that of liquefied gas then two phase releases may need to be considered as noted in B.7.2.2.

The release rate of gas from a container can be estim… an ideal gas if the pressurized gas density is much lowe…

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6.3.4 Liquefied by refrigeration

Other gases, the so-called permanent gases, … methane and hydrogen. Small leaks of refrigerate… a pool of liquid by drawing heat from the environ… may form.

As the cold liquid pulls energy from the ground a… generating a cold dense gas cloud. As with liqui… or hold the flow of leakages.

NOTE 1 Care needs to be taken when classifying areas … natural gas. Vapours emitted will generally be heavier th… buoyant on approaching ambient temperature.

NOTE 2 Permanent gases have a critical temperature lowe…

6.3.5 Aerosols

An aerosol is not a gas, but consists of small dro… are formed from vapours or gases under cer… evaporation of pressurized liquids. The scatterin… makes the cloud visible to the naked eye. The di… behaviour of a dense gas or a neutrally buoyant… out of the plume or cloud. Aerosols from fla… surrounding environment, evaporate and add to… Annex G).

6.3.6 Vapours

Liquids at equilibrium with their environment w… surface. The pressure this vapour exerts in a clo… which increases in a non-linear function with temp…

The process of evaporation uses energy which… example from the liquid or the surrounding en… decrease the temperature of the liquid and limit t… temperature due to increased evaporation fr… considered too marginal to affect the hazardous… generated vapour is not easy to predict as it is a f… of the liquid and the surrounding air flow.

6.3.7 Liquid releases

The release of flammable liquids will normally form a pool on the ground, with a vapour cloud at the liquid's surface unless the surface is absorbent. The size of the vapour cloud will depend on the properties of the substance and its vapour pressure at the ambient temperature (see B.7.2).

NOTE The vapour pressure is an indication of a liquid's evaporation rate. A substance with a high vapour pressure at normal temperatures is often referred to as volatile. As a general rule, vapour pressure of liquid at ambient temperatures increases with decreasing boiling point. As the temperature rises so does the vapour pressure.

Release may also occur on water. Many flammable liquids are less dense than water and are often not miscible. Such liquids will spread on the surface of water, whether it is on the ground, in plant drains, pipe trenches or on open waters (sea, lake or river), forming a thin film and increasing the evaporation rate due to the increased surface area. In these circumstances the calculations in Annex B are not applicable.

B.7.2.2 Sıvıların Boşalma Hızı

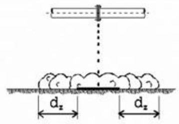
Sıvıların boşalma hızı için formül verilmiştir.

Ancak bir sürü KISIT / LİMİT'i bulunmaktadır.

6.3.7. Sıvı Boşalmaları

Yanıcı sıvılardan boşalma genellikle zeminde bir göllenme oluşturur, yüzey tarafından emilmediği sürece sıvının yüzeyinde bir buhar bulutu oluşur.

Buhar bulutunun büyüklüğü maddenin özelliklerine ve ortam sıcaklığındaki buhar basıncına ve kaynama noktasına bağlıdır.



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Kaynama noktası ve buhar basıncı, sıvıların kolay buharlaşıp buharlaşmadığını gösterir.

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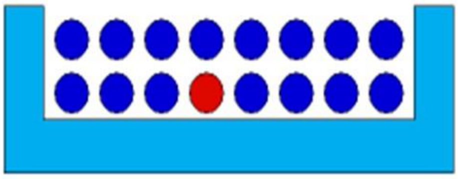
Kaynama noktası düşük
Buhar basıncı yüksek ise;
sıvı kolay buharlaşır.

Kaynama noktası yüksek
Buhar basıncı düşük ise;
sıvı zor buharlaşır.



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B.7.2.2 Release rate of liquids

The release rate of liquid can be estimated by means of the following approximation:

$$W = C_d S \sqrt{2 \rho \Delta p} \text{ (kg/s)} \quad \text{(B.1)}$$

The rate of vapourisation of a liquid release is then required to be determined. Liquid releases may take many forms. The nature of the release and how any vapour or gas is generated is also dependant on many variables. Examples of releases include:

a) Two phase release (i.e. combined liquid and gas release)

Liquids such as liquefied petroleum gas (LPG), may include both gas and liquid phases either immediately before the release orifice or after the release orifice through a variety of thermodynamic or mechanical interactions. This may further lead to droplet and/or pool formation which results in further boiling of the liquid contributing to the vapour cloud.

b) Single phase release of a non-flashing liquid

For liquids with higher boiling points (above atmospheric ranges) the release will generally include a significant liquid component which may evaporate near the source of release. The release may also break up into small droplets as a result of a jet action. Vapour released will then depend on any jet formation and vapourisation from the point of release, from any droplets or any subsequent pool formation.

Due to the large number of conditions and variables a methodology for assessing the vapour conditions of a liquid release is not provided in this standard. Users should carefully select a suitable model observing any limitations of the model and/or applying an appropriately conservative approach with any results.

B.7.2.2 Sıvıların Boşalma Hızı

İki farklı koşuldan bahsedilmektedir ve $W = C_d S \sqrt{2 \rho \Delta p}$ (kg/s) formülünün geçerli olmadığı belirtilmektedir.

a) İki fazlı boşalma (sıvı ve gaz karışımı boşalması)

Propan, LPG, LNG, Amonyak, Hidrojen vb... Kimyasallar için

Aeresoller

Sıvı ve gaz boşalımının aynı anda olması

b) Tek fazlı parlamayan sıvı boşalması

Kaynama Noktası Yüksek, Buhar Basıncı Düşük Sıvılar

Havalandırmanın olduğu ortamda boşalma

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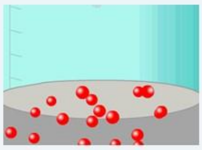
Due to the large number of conditions and variables a methodology fo... the vapour conditions of a liquid release is not provided in this standard. U... carefully select a suitable model observing any limitations of the model and/or... appropriately conservative approach with any results.

B.7.2.2 Sıvıların Boşalma Hızı

$W = C_d S \sqrt{2 \rho \Delta p}$ (kg/s)

İlgili formül bir boşalma kaynağından çıkan sıvının kütlesel debisini hesaplamak için verilmiştir.



Ancak sıvı fazından gaz fazına geçen miktarı yani buhar fazının kütlesel debisinin nasıl hesaplanması gerektiği ile ilgili formüller verilmemiştir.

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a) Two phase release (i.e. cc...

Liquids such as liquefied... either immediately before... of thermodynamic or mect... formation which results in...

b) Single phase release of a...

For liquids with higher boil... include a significant liquid component which may evaporate near the source of release. The release may also break up into small droplets as a result of a jet action. Vapour released will then depend on any jet formation and vapourisation from the point of release, from any droplets or any subsequent pool formation.

Due to the large number of conditions and variables a methodology for assessing the vapour conditions of a liquid release is not provided in this standard. Users should carefully select a suitable model observing any limitations of the model and/or applying an appropriately conservative approach with any results.

Bazı hesaplama yapanlar direk %20 almaktadırlar.

Ancak nedeni nedir.???? Açıklama nedir??????

Wg; gaz fazının kütlesel debisini nasıl hesaplamalıyız?

Standartın B.7.2.2. maddesinin son cümlesinde şu şekilde açıklama yapılmaktadır:

Çok sayıdaki koşullar ve değişkenler nedeniyle bu standartta sıvı boşalmasının buhar koşullarını değerlendirmek için bir metodoloji verilmemiştir.

Kullanıcılar modelin her türlü kısıtlamasını gözlemleyerek ve/veya her sonuç için uygun korumacı bir yaklaşım izleyerek uygun bir model seçmelidir.

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B.7.3 Release rate of evaporative pools

Evaporative pools may be the result of liquid spillage or leakage but also part of a process system where a flammable liquid is stored or handled in an open vessel. The assessment in this section does not apply to thin surface spills since no account is taken for specific factors that may be relevant to such spills e.g. thermodynamic input from the surface on which the liquid is spilt.

The following assumptions are made concerning the assessment below:

- There is no phase change and the plume is at ambient temperature (phase and temperature changes would cause variations in dispersion and evaporation rates).
- The flammable substance released is neutrally buoyant. Heavier than air vapour is treated the same way as neutrally buoyant gases in this analysis which will lead to a comparable assessment.
- A continuous release for catastrophic spillage loss is not considered in this analysis.
- Liquids are instantaneously spilled from containment onto a flat, level surface forming a 1 cm deep pool and are allowed to evaporate at ambient conditions.

Then the evaporation rate could be estimated by using following equation:

$$W_e = \frac{6{,}55 \times 10^{-3} u_w^{0{,}78} A_p p_v M^{0{,}667}}{R \times T} \text{(kg/s)} \quad \text{(B.6)}$$

NOTE 1 The source of this equation is U.S. Environmental Protection Agency, Federal Emergency Management Agency, U.S. Department of Transportation, Technical Guidance for Hazard Analysis – Emergency Planning for Extremely Hazardous Substances, December 1987.

NOTE 2 Vapour pressure can be estimated through various methods, e.g. derived from Antoine's equation.

NOTE 3 It is assumed that the vapour pressure at the boiling temperature is 101,3 kPa.

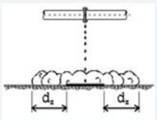
Since the density of the vapour in (kg/m³) is:

$$\rho_g = \frac{p_a M}{R\, T_a} \left(\text{kg/m}^3\right)$$

then, the volumetric evaporation rate in (m³/s) is approximately:

$$Q_g \approx \frac{6{,}5\, u_w^{0{,}78} A_p p_v}{10^5 M^{0{,}333}} \times \frac{T_a}{T} \left(\text{m}^3/\text{s}\right) \quad \text{(B.7)}$$

NOTE 4 Since p_v increases with liquid temperature then the evaporation rate ultimately increases with the rise of T.



B.7.3. Buharlaşan Havuzların Boşalma Hızı

$$W_e = \frac{6{,}55 \times 10^{-3} u_w^{0{,}78} A_p p_v M^{0{,}667}}{R \times T} \text{(kg/s)}$$

Formülün çok fazla kısıtı mevcuttur.
Şu varsayımlar yapılmıştır:

- **Hiçbir faz değişimi yoktur** ve gaz veya buhar bulutu ortam sıcaklığındadır.
- Boşalan yanıcı madde **havadan hafiftir.**
- Analizde yıkıcı dökülme kaybı için sürekli boşalma değerlendirilmemiştir.
- Sıvılar kaplarından düz bir yüzeye dökülmüş ve **1 cm derinliğinde göllenme oluşturmuş** ve ortam kaynama koşullarında buharlaşmasına izin verilmiştir.

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A release of flammable substance above its flashpoint will give rise to a flammable vapour or gas cloud which may initially be less or more dense than the surrounding air or may be neutrally buoyant. The forms of release and the pattern of behaviour at various conditions are displayed as a flow chart in Figure B.1.

Every form of release will eventually end as a gaseous or vapour release and the gas or vapour may appear as buoyant, neutrally buoyant or heavy (see Figure B.1). This characteristics will affect the extent of the zone generated by a particular form of release.

The horizontal extent of the zone at ground level will generally increase with increasing relative density and the vertical extent above the source will generally increase with decreasing relative density.

6.3.2 Gaseous release

A gas release will produce a gas jet or plume at the release source depending on the pressure at the point of release, e.g. pump seal, pipe connection or evaporative pool area. The relative density of the gas, the degree of turbulent mixing and the prevailing air movement will all influence the subsequent movement of any gas cloud.

In calm conditions low velocity releases of a gas that is significantly less dense than air will tend to move upwards, e.g. hydrogen and methane. Conversely, a gas that is significantly denser than air will tend to accumulate at ground level or in any pits or depressions, e.g. butane and propane. Over time, atmospheric turbulence will cause the released gas to mix with air and become neutrally buoyant. A gas or vapour with density that is not significantly different to air is regarded as neutrally buoyant.

Higher pressure releases will initially produce jets of released gas which will mix turbulently with the surrounding air and entrain air in the jet.

At high pressures, a thermodynamic effect due to expansion can come into play. As the gas escapes, it expands and cools down and may initially behave as heavier than air. However, the cooling due to the Joule-Thomson effect is eventually offset by the heat supplied by the air. The resulting gas cloud will eventually become neutrally buoyant. The transition from heavier than air to neutrally buoyant behaviour may occur at any time depending on the nature of the release and may occur after the cloud has been diluted to below the *LFL*.

NOTE Hydrogen demonstrates a reverse Joule-Thomson effect, heating up as it expands and so will never exhibit a heavier than air effect.

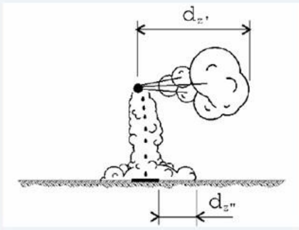
6.3.3 Liquefied under pressure

Some gases can be liquefied by the application of pressure alone, e.g. propane and butane, and are usually stored and transported in this form.

When a pressurized liquefied gas leaks from its containment the most likely scenario is that the substance will escape as a gas from any vapour space or gas lines. The rapid evaporation produces significant cooling at the point of release and icing due to the condensation of water vapour from the atmosphere may occur.

A liquid leak will partially evaporate at the point of release. This is known as flash evaporation. The evaporating liquid pulls energy from itself and the surrounding atmosphere and in turn cools down the leaking fluid. The cooling of the fluid prevents total evaporation and therefore an aerosol is produced. If the leak is large enough then cold pools of fluid can accumulate on the ground which will evaporate over time to add to the gas release.

The cold aerosol cloud will act like a dense gas. A pressurized liquid release can often be seen as the cooling effect of evaporation will condense ambient humidity to produce a visible cloud.



6.3.3. Basınç Altında Sıvılaştırılmış Gazlar

Propan, bütan, LPG vb. bazı gazlar sadece basınç uygulanmasıyla sıvılaştırılabilir ve genellikle bu şekilde depolanır ve nakliye edilirler.

Sıvı bir kaçak boşalma noktasında kısmen buharlaşacaktır. Bu olay flaş (ani) buharlaşma olarak bilinmektedir.

Basınç Altında Sıvılaştırılmış Gazların sıvı fazında boşalması için **HİÇBİR formül** verilmemiştir.

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6.3.4 Liquefied by refrigeration

Other gases, the so-called permanent gases, can only be liquefied by refrigeration e.g. methane and hydrogen. Small leaks of refrigerated gas will evaporate quickly without forming a pool of liquid by drawing heat from the environment. If the leak is large a cold pool of liquid may form.

As the cold liquid pulls energy from the ground and surrounding atmosphere the liquid will boil generating a cold dense gas cloud. As with liquids, dikes or bund walls can be used to direct or hold the flow of leakages.

NOTE 1 Care needs to be taken when classifying areas containing cryogenic flammable gases such as liquefied natural gas. Vapours emitted will generally be heavier than air at low temperatures but will become neutrally buoyant on approaching ambient temperature.

NOTE 2 Permanent gases have a critical temperature lower than –50 °C.

6.3.5 Aerosols

An aerosol is not a gas, but consists of small droplets of liquid suspended in air. The droplets are formed from vapours or gases under certain thermodynamic conditions or by flash evaporation of pressurized liquids. The scattering of light within an aerosol cloud frequently makes the cloud visible to the naked eye. The dispersion of an aerosol may vary between the behaviour of a dense gas or a neutrally buoyant gas. Aerosol droplets can coalesce and rain out of the plume or cloud. Aerosols from flammable liquids may absorb heat from the surrounding environment, evaporate and add to the gas/vapour cloud (for more details see Annex G).

6.3.6 Vapours

Liquids at equilibrium with their environment will generate a layer of vapour above their surface. The pressure this vapour exerts in a closed system is known as the vapour pressure, which increases in a non-linear function with temperature.

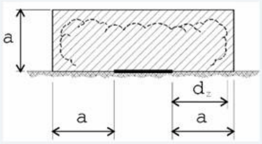
The process of evaporation uses energy which may come from a variety of sources, for example from the liquid or the surrounding environment. The evaporation process may decrease the temperature of the liquid and limit temperature rise. However, changes in liquid temperature due to increased evaporation from normal environmental conditions are considered too marginal to affect the hazardous area classification. The concentration of the generated vapour is not easy to predict as it is a function of the evaporation rate, temperature of the liquid and the surrounding air flow.

6.3.7 Liquid releases

The release of flammable liquids will normally form a pool on the ground, with a vapour cloud at the liquid's surface unless the surface is absorbent. The size of the vapour cloud will depend on the properties of the substance and its vapour pressure at the ambient temperature (see B.7.2).

NOTE The vapour pressure is an indication of a liquid's evaporation rate. A substance with a high vapour pressure at normal temperatures is often referred to as volatile. As a general rule, vapour pressure of liquid at ambient temperatures increases with decreasing boiling point. As the temperature rises so does the vapour pressure.

Release may also occur on water. Many flammable liquids are less dense than water and are often not miscible. Such liquids will spread on the surface of water, whether it is on the ground, in plant drains, pipe trenches or on open waters (sea, lake or river), forming a thin film and increasing the evaporation rate due to the increased surface area. In these circumstances the calculations in Annex B are not applicable.



6.3.4. Soğutma Yoluyla Sıvılaştırılmış Gazlar (Kryojenik Sıvılar)

Metan ve hidrojen gibi gazlar olarak adlandırılan gazlar sadece soğutma yoluyla sıvılaştırılabilir.

Küçük soğutulmuş gaz sızıntıları ortamdan ısı çekerek sıvı göllenmesi oluşturmadan hızlı bir şekilde buharlaşacaktır.

Soğutma Yoluyla Sıvılaştırılmış Gazlar (Kryojenik Sıvılar) sıvı fazında boşalması için **HİÇBİR formül** verilmemiştir.

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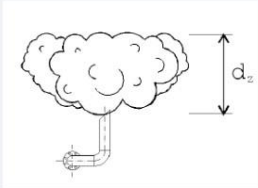

6.3.4. Aerosollar

Aerosol bir gaz değildir ancak havada askıda bulunan küçük sıvı damlacıkları içerir.

Damlacıklar belirli termodinamik koşullar altında buhar veya gazlardan veya basınçlı sıvıların flaş (ani) buharlaşmasından oluşurlar.

Aerosol şeklinde boşalma için formül verilmemiştir.

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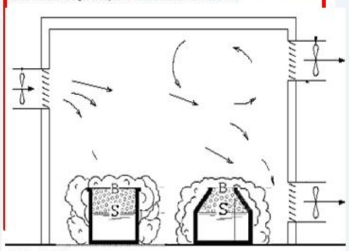
6.4 Ventilation (or air movement) and dilution

Gas or vapour released into the atmosphere may dilute through turbulent mixing with air, and to a lesser extent by diffusion driven by concentration gradients, until the gas disperses completely and the concentration is essentially zero. Air movement due to natural or artificial ventilation will promote dispersion. Increased air movement may also increase the rate of release of vapour due to increased evaporation on an open liquid surface.

Suitable ventilation rates can reduce the persistence time of an explosive gas atmosphere thus influencing the type of zone.

A structure with sufficient openings to allow free passage of air through all parts of the building is considered in many cases to be well ventilated and should be treated as an open air area, e.g. a shelter with open sides and rooftop ventilation openings.

Dispersion or diffusion of a gas or vapour into the atmosphere is a key factor in reducing the concentration of the gas or vapour to below the lower flammable limit.



6.5.1 General

The two types of ventilation are:

a) natural ventilation;

b) artificial (or forced) ventilation, either general to the area or local to the source of release.

6.5.2 Natural ventilation

Natural ventilation in buildings arises from pressure differences induced by the wind and/or by temperature gradients (buoyancy induced ventilation). Natural ventilation may be effective in

6.4. Havalandırma (veya hava hareketi) ve seyrelme

Atmosfere salınan gaz ve buhar, dağılma ve difüzyon yoluyla gaz tamamen dağılıncaya ya da yoğunluğu sıfır oluncaya kadar havada seyrelir.

Doğal veya suni havalandırma kaynaklı hava hareketi dağılmayı teşvik eder.

Artan hava hareketi ayrıca, açık sıvı yüzeyinde artan buharlaşma nedeniyle buhar boşalma hızını da arttırır.

Havalandırma altında bir sıvı birikiminden buharlaşma için HİÇBİR formül verilmemiştir.

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IEC EN 60079-10-1:2015 BAŞVURU Yapılacak Diğer Standartlar

TRBS 2152 Gefährliche explosionsfähige Atmosphäre - Allgemeines: Tesis Güvenliği Sağlama Teknik Kuralları

Almanya

SUVA-Merkblatt 2153 Explosionsschutz - BGLAW: Patlamaya karşı koruma ilkeleri Minimum gereksinimler Bölgeler

İSVİÇRE

AS/NZS (IEC) 60079-10-1: Patlayıcı Ortamlar Bölüm 10-1: Tehlikeli bölgelerin sınıflandırılması- Patlayıcı gaz atmosferler

Avusturya

NPR 7910-1: Hollanda uygulama kılavuzu NPR 7910-1, Patlama riskine gore tehlikeli bölgelerin sınıflandırılması Bölüm 1: Gaz Patlama Riski, NEN-EN-IEC 60079-10-1 Standardını esas almaktadır.

Hollanda

IEC EN 60079-10-1:2015 BAŞVURU Yapılacak Diğer Standartlar

IGEM/SR/25: Doğal Gaz Tesislerinin Tehlikeli Bölge Sınıflandırması

İngiltere

IP15: Petrol Sanayi Güvenli Uygulama Model Kuralı, Bölüm 15: Yanıcı Madde Kullanan Petrol Tesislerinde Sınıflandırma Kuralları

İngiltere

DESAR Regülasyonu 2002 EI15 Klavuzu: Tehlikeli Maddeler ve Patlayıcı Ortamlar Yönetmeliği 2002. Onaylı Uygulama ve Rehberi

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BAŞVURU Yapılacak Diğer Standartlar

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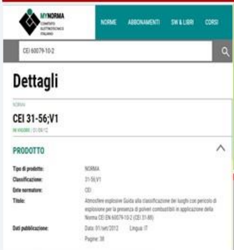
CEI 31-35 Kılavuzu, "Patlayıcı ortamlarda kullanılan elektriksel ekipmanlar. CEI EN 60079-10 Normu (CEI 31-30) uygulama kılavuzu"

IEC - İTALYA

CEI 31-35/A Kılavuzu, "Patlayıcı ortamlarda kullanılan elektriksel ekipmanlar. CEI EN 60079-10 Normu (CEI 31-30) uygulama kılavuzu. Tehlikeli bölgelerin sınıflandırılması, uygulama örnekleri."

IEC - Avrupa



CEI 31-56 (EN 60079-10-2: 2016) Klavuzu
Patlayıcı ortamlar nedeniyle CEI EN 60079-10-2 (CEI 31-88) uyarınca yanıcı tozların bulunduğu için patlama riski taşıyan alanların sınıflandırılması Rehberi

IEC - Avrupa

ÖNDER AKADEMİ AŞ.

IEC EN 60079-10-1:2015
Standartı Kısıtları ve Zaafları

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Çözüm Önerisi

EN 60079-10-1:2015 standartında standartın 2009 versiyonundan sonra nereden çıktı bu kadar formül şeklinde eleştiri gelmemesi için verilmeyen formüller;

İtalyan CEI 31-35 ve CEI 31/35A (EN60079-10-1:2015) standartlarında verilmiştir.

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IEC EN 60079-10-1:2015
BAŞVURU Yapılacak Diğer Standartlar

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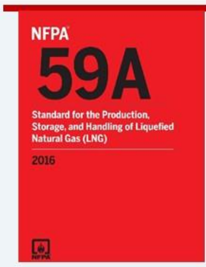
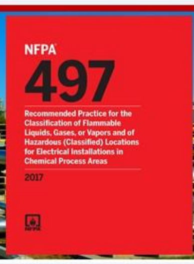
API RP 505: Petrol Tesislerindeki Elektrikli Teçhizatların Bölge 0, Bölge 1 ve Bölge 2 Olarak Sınıflandırılması için Tavsiye Edilen Uygulama

Amerika



NFPA 59A: Sıvılaştırılmış Doğal Gaz Üretim, Depolama ve Kullanım Standardı

Amerika



NFPA 497: Kimyasal Proses Tesislerinde Elektrikli Teçhizatlar için Yanıcı Sıvıların, Gazların, Buharların ve Tehlikeli Yerlerin Sınıflandırılması için Tavsiye Edilen Uygulama

Amerika

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IEC EN 60079-10-1:2015
BAŞVURU Yapılacak Diğer Standartlar

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TS EN 50272-1
Güvenlik kuralları - Sekonder akümülatörler ve akümülatör tesisatları - Bölüm 1: Genel güvenlik bilgisi

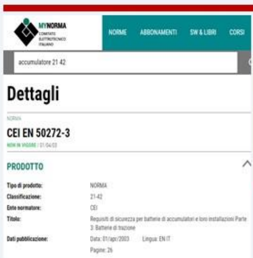
Avrupa

TS EN 50272-2
Güvenlik kuralları- Sekonder bataryalar ve tesisatları için- Bölüm 2: Sabit bataryalar

Avrupa

CEI 21-39
Akümülatör ve kurulumlar için emniyet gerekleri - Bölüm 2: Sabit piller

İtalya



CEI 21-42
Akümülatör ve kurulumlar için emniyet gerekleri - Bölüm 3: Çekiş bataryaları

İtalya

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IEC EN 60079-10-1:2015
Standartı Kısıtları ve Zaafları

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– 26 – IEC 60079-10-1:2015 © IEC 2015

dilution for a given set of ventilation / atmospheric conditions, and a lower ventilation rate corresponds with a lower degree of dilution for a given size of release.

If other forms of ventilation, e.g. cooling fans are taken into account, then care should be exercised as to ventilation availability. Ventilation for other purposes may also affect dilution in either a positive or negative manner.

The degree of dilution will also affect the dilution volume. The dilution volume is mathematically equal to the hazardous volume but the boundary of the hazardous area additionally takes into account other factors such as possible movement of the release due to the direction and velocity of the release and of the surrounding volume of air.

Degrees of dilution depend not only on the ventilation, but also on the nature and the type of the expected release of gas. Some releases, e.g. release with low velocity, will be amenable to mitigation by enhanced ventilation with others much less so, e.g. release with high velocity.

The following three degrees of dilution are recognized:

a) High dilution
The concentration near the source of release reduces quickly and there will be virtually no persistence after the release has stopped.

b) Medium dilution
The concentration is controlled resulting in a stable zone boundary, whilst the release is in progress and the explosive gas atmosphere does not persist unduly after the release has stopped.

c) Low dilution
There is significant concentration whilst release is in progress and/or significant persistence of a flammable atmosphere after the release has stopped.

7 Type of zone

7.1 General

The likelihood of the presence of an explosive gas atmosphere depends mainly on the grade of release and the ventilation. This is identified as a zone. Zones are recognized as: zone 0, zone 1, zone 2 and the non-hazardous area.

Where zones created by adjacent sources of release overlap and are of different zonal classification, the more severe classification criteria will apply in the area of overlap. Where overlapping zones are of the same classification, this common classification will normally apply.

7.2 Influence of grade of the source of release

There are three basic grades of release, as listed below in order of decreasing frequency of occurrence and/or duration of release of flammable substance:

a) continuous grade;
b) primary grade;
c) secondary grade.

A source of release may give rise to any one of these grades of release, or to a combination of more than one.

The grade of release generally determines type of the zone. In an adequately ventilated area (typical open air plant) a continuous grade of release generally leads to a zone 0

Teknik uzmanların en fazla zorlandığı **Tali, Ana, ve Sürekli Boşalma Derecelerinin nasıl değerlendirilmesi gerektiği ile ilgili KURAL formüllize edilerek CEI 31-35 ve CEI 31-35/A rehberinde verilmiştir.**

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IEC EN 60079-10-1:2015
Standartı Kısıtları ve Zaafları

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BS EN 60079-10-1:2015

IEC 60079-10-1:2015 © IEC 2015 – 39 –

Table B.1 – Suggested hole cross sections for secondary grade of releases

Type of item	Item	Leak Considerations: Typical values for the conditions at which the release opening will not expand S (mm²)	Typical values for the conditions at which the release opening may expand, e.g erosion S (mm²)	Typical values for the conditions at which the release opening may expand up to a severe failure, e.g blow out S (mm²)
Sealing elements on fixed parts	Flanges with compressed fibre gasket or similar	≥ 0,025 up to 0,25	> 0,25 up to 2,5	(sector between two bolts) × (gasket thickness) usually ≥ 1 mm
	Flanges with spiral wound gasket or similar	0,025	0,25	(sector between two bolts) × (gasket thickness) usually ≥ 0,5 mm
	Ring type joint connections	0,1	0,25	0,5
	Small bore connections up to 50 mm [a]	≥ 0,025 up to 0,1	> 0,1 up to 0,25	1,0
Sealing elements on moving parts at low speed	Valve stem packings	0,25	2,5	To be defined according to Equipment Manufacturer's Data but not less than 2,5 mm² [d]
	Pressure relief valves [b]	0,1 × (orifice section)	NA	NA
Sealing elements on moving parts at high speed	Pumps and compre-ssors [c]	NA	≥ 1 up to 5	To be defined according to Equipment Manufacturer's Data and/or Process Unit Configuration but not less than 5 mm² [d and e]

[a] Hole cross sections suggested for ring joints, threaded connections, compression joints (e.g.,metallic compression fittings) and rapid joints on small bore piping.

[b] This item does not refer to full opening of the valve but to various leaks due to malfunction of the valve components. Specific applications could require a hole cross section bigger than suggested.

[c] Reciprocating Compressors – The frame of compressor and the cylinders are usually not items that leak but the piston rod packings and various pipe connections in the process system.

[d] Equipment Manufacturer's Data – Cooperation with equipment's manufacturer is required to assess the effects in case of an expected failure (e.g. the availability of a drawing with details relevant to sealing devices).

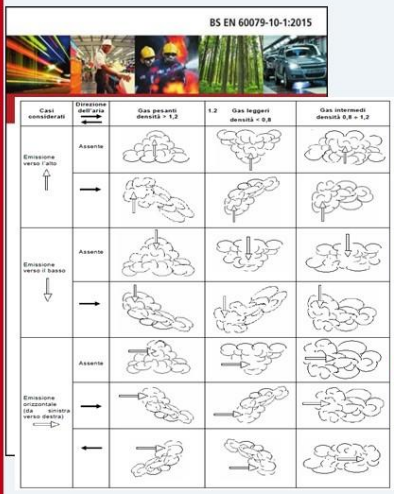
[e] Process Unit Configuration – In certain circumstances (e.g. a preliminary study), an operational analysis to define the maximum accepted release rate of flammable substance may compensate lack of equipment manufacturer's data.

NOTE Other typical values may also be found in national or industry codes relevant to specific applications.

Standartta boşalma hızını hesaplamak için kullanılacak delik kesitleri aralık olarak verilmiştir.

Ancak hangi delik boyutunun hangi durumda kullanılması gerektiği ile ilgili KURAL tek tek ekipmanlar ve koşullar tarif edilerek CEI 31-35 ve CEI 31-35/A rehberinde verilmiştir.

IEC EN 60079-10-1:2015
Standartı Kısıtları ve Zaafları

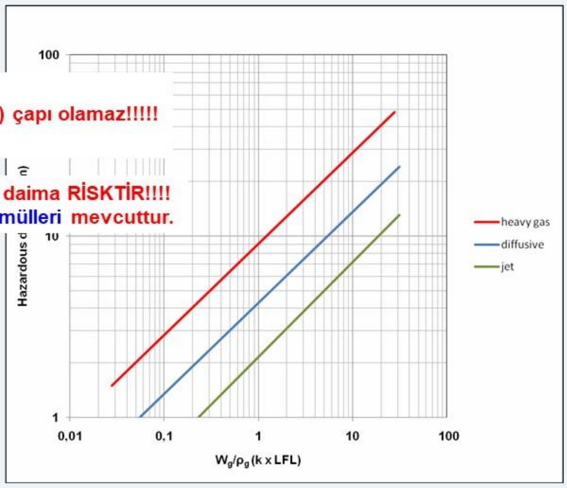


EN 60079-10-1:2015 versiyonunda **kimyasalın buhar yoğunluğu ve havalandırmanın yönüne göre** ZONE(BÖLGE)'nin nasıl değişeceğinin tarifi yapılmamıştır. **İlgili KURAL tek tek ekipmanlar ve koşullar tarif edilerek CEI 31-35 ve CEI 31-35/A rehberinde verilmiştir.**

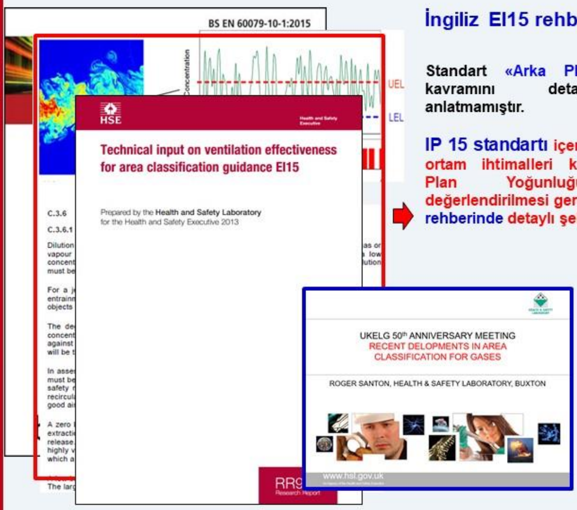
IEC EN 60079-10-1:2015
Standartı Kısıtları ve Zaafları

DİKKAT!!!!
1m 'den küçük ZONE (Bölge) çapı olamaz!!!!!
Ağır gazlarda ise 1.65m….

Logaritmik Tabloları okumak daima RİSKTİR!!!!
CEI 31-35 de tüm eğrilerin formülleri mevcuttur.



IEC EN 60079-10-1:2015
Standartı Kısıtları ve Zaafları



İngiliz EI15 rehberi ve IP 15

Standart «Arka Plan Yoğunluğu» kavramını detaylı şekilde anlatmamıştır.

IP 15 standartı içerisindeki patlayıcı ortam ihtimalleri kullanılarak Arka Plan Yoğunluğu'nun nasıl değerlendirilmesi gerektiği İngiliz EI15 rehberinde detaylı şekilde verilmiştir.

İngiliz Sağlık ve Güvenlik Laboratuvarı (HSL) tarafından «Arka Plan Yoğunluğu» kavramını ve QUADVENT modelini anlatan dokumanlar yayınlanmıştır.

IEC EN 60079-10-2:2015
Tehlikeli Bölge Sınıflandırma Standartı


TÜRK STANDARDI
TURKISH STANDARD

TS EN 60079-10-2

ICS 29.260.20

PATLAYICI ORTAMLAR- BÖLÜM 10-2: TEHLİKELİ BÖLGELERİN SINIFLANDIRILMASI-YANICI TOZ ATMOSFERLER

Explosive atmospheres - Part 10-2: Classification of areas - Explosive dust atmospheres

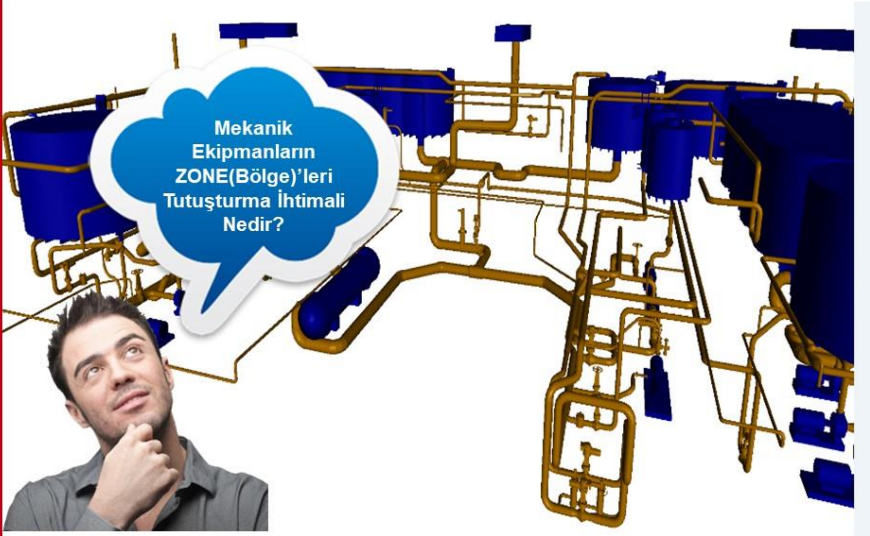
TÜRK STANDARDLARI ENSTİTÜSÜ
Necatibey Caddesi No.112 Bakanlıklar/ANKARA

Tozlar için olan IEC EN 60079-10-2:2015 standartı içerisinde tozlar için patlayıcı ortam ZONE (BÖLGE) (Bölge)'lerinin nasıl hesaplanması gerektiği ile ilgili formül verilmemiştir.

Kişilere göre değişebilecek subjektif değerlendirmeler şeklinde verilmiştir.

Oysaki CEI 31-56 (EN 60079-10-2) ile CEI 31-66 standartlarında tozlar için ZONE (BÖLGE) hesaplama formülleri verilmiştir.

2014/34/EU Gereğince….



EK – 2
ÇALIŞANLARIN SAĞLIK VE GÜVENLİKLERİNİN PATLAYICI ORTAM RİSKLERİNDEN KORUNMASI İÇİN ASGARİ GEREKLER

2.4. Tesis, ekipman, koruyucu sistemler ve bunlarla bağlantılı cihazların **patlayıcı ortamda güvenle kullanılabileceğinin, Patlamadan Korunma Dokümanında belirtilmesi halinde** bunlar hizmete sokulabilir. Bu kural …**ekipman veya koruyucu sistem sayılmayan ancak tesiste yerleştirildikleri yerlerde kendileri bir tutuşturma tehlikesi oluşturan iş ekipmanları ve bağlantı elemanları için de** geçerlidir.

Patlama Riskinin Değerlendirilmesi
MADDE 6

Çalışanların Patlayıcı Ortamların Tehlikelerinden Korunması Hakkında Yönetmelik

30 Nisan 2013 tarih ve 28633 sayılı Resmi Gazetede yayımlanmıştır

1. Patlayıcı ortam oluşma ihtimali ve bu ortamın kalıcılığı,
2. Statik elektrik de dahil tutuşturucu kaynakların bulunma, aktif ve etkili hale gelme ihtimalleri,
3. İşyerinde bulunan tesis, kullanılan maddeler, prosesler ile bunların muhtemel karşılıklı etkileşimleri,
4. Olabilecek patlamanın etkisinin büyüklüğü….

İşverenler, işyerinde **İş Sağlığı ve Güvenliği Risk Değerlendirmesi Yönetmeliğine** uygun risk değerlendirmesi yaparken patlayıcı ortamdan kaynaklanan özel riskleri değerlendirmekle yükümlüdür.

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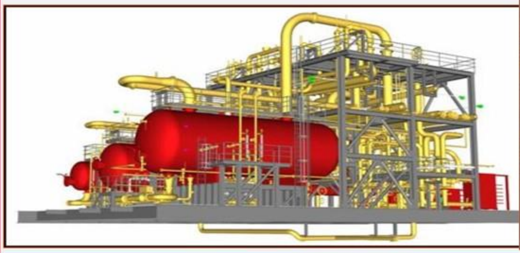
Mekanik Ekipman Tutuşturma Risk Değerlendirmesi- MEIRA

ÖNDER akademi a.ş.

Tehlikeli bölgelerde **"ATEX olmayan" ekipmanı** bulunan işletmelerin mevzuatta belirtilen yükümlülüklerini yerine getirmek için **elektrikli olmayan ekipmanların ateşlenme risklerini değerlendirilmesi** gereklidir.



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Mekanik Ekipman Tutuşturma Risk Değerlendirmesi- MEIRA

ÖNDER akademi a.ş.

Mekanik Ekipman Tutuşturma Risk Değerlendirmesi yalnızca **ekipmanın kaynaklı ateşleme riskini göz önünde bulundurur** ve **diğer ateşleme kaynaklarını** kontrol etmek için yerinde olması gereken **güvenlik yönetim sistemlerinin diğer tehlikelerini** ve **kontrol önlemlerini kapsamaz.**

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Mekanik Ekipman Tutuşturma Risk Değerlendirmesi- MEIRA

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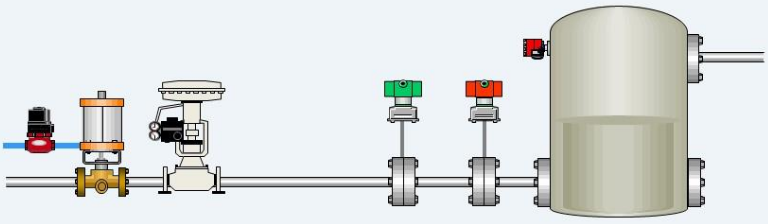
EN 1127 ve EN 13463 gibi mevcut standartlar, patlama riskinin değerlendirmesinde kullanılmaktadır.

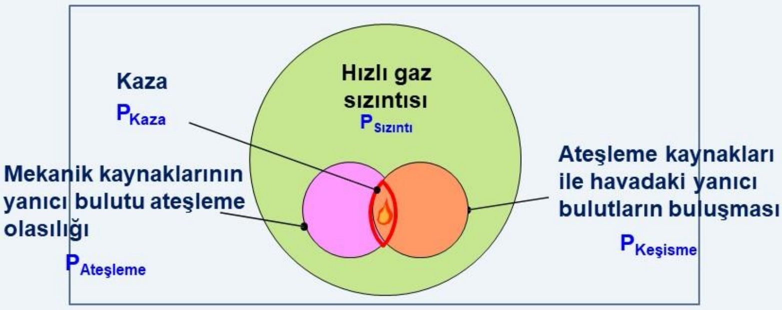
Ancak her iki standart da elektrikli olmayan ekipmanlar için ayrı bir risk değerlendirmesi yapılması gerekliliğinden bahsetmektedir.



Mekanik Ekipman Tutuşturma Risk Değerlendirmesi- MEIRA

$$F_{Kaza} = F_{Sızıntı} \times P_{Ateşleme} \times P_{Keşisme}$$

F_{kaza}	: Patlama olasılığı	zaman/(ünite・yıl)	
$F_{sızıntı}$	: Hızlı gaz sızıntısı olasılığı	zaman/(ünite・yıl)	Generik Data
$P_{Ateşleme}$	: Mekanik kaynaklarının yanıcı bulutu ateşleme olasılığı		
$P_{Keşisme}$	: Ateşleme kaynakları ile yanıcı bulut karşılaşmalarının olasılığı		



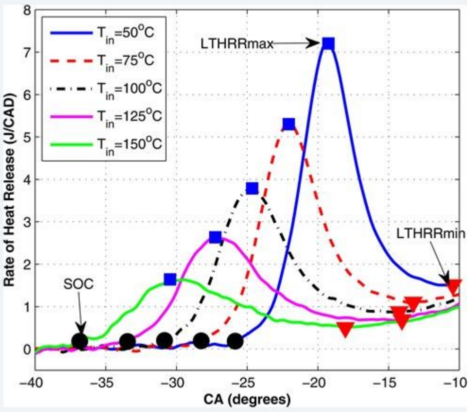
Mekanik Ekipman Tutuşturma Risk Değerlendirmesi- MEIRA

$P_{Ateşleme}$: Mekanik kaynaklarının yanıcı bulutu ateşleme olasılığı

Gaz ve Sıvılar için;
Mekanik ateşleme risk değerlendirmesi için en önemli parametre Kendiliğinden Tutuşma Sıcaklığıdır. (AIT)

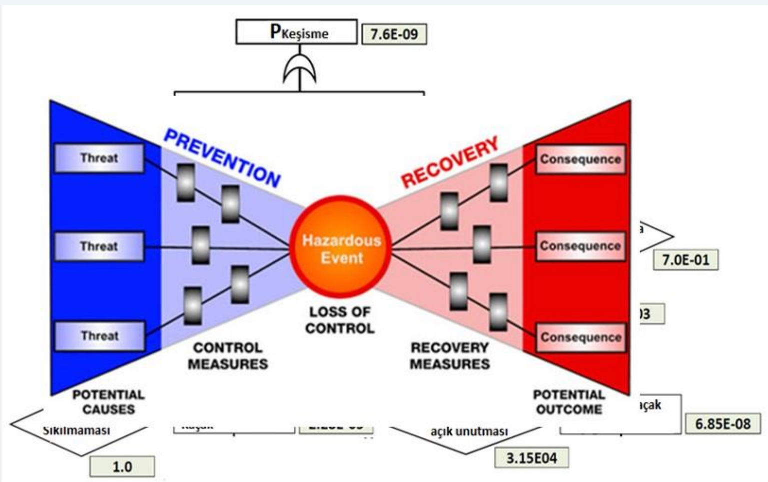
Elektrostatik deşarjdan dolayı riski değerlendirirken Minimum Ateşleme Enerjisi (MIE) önemlidir.

Tozlar için Katman Ateşleme Sıcaklığı (LIT), toz bulutunun Minimum Ateşleme Sıcaklığı (MIT), Minimum Ateşleme Enerjisi (MIE) üzerinden karar verilir..



Mekanik Ekipman Tutuşturma Risk Değerlendirmesi- MEIRA

$P_{Keşisme}$: Ateşleme kaynakları ile yanıcı bulut karşılaşmalarının olasılığı



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Mekanik Ekipman Tutuşturma Risk Değerlendirmesi- MEIRA

Risk değerlendirmesi bir dizi alanı kapsamalıdır:

- Potansiyel olarak yanıcı bir atmosfer oluşturabilecek mevcut tüm materyallerin tehlike tanımlaması
- Potansiyel ateşleme kaynaklarının belirlenmesi
- Hangi seviyede bir koruma tedbirine ihtiyaç var?
- Tasarımda bu istenilen seviye karşılanmış durumda mıdır?

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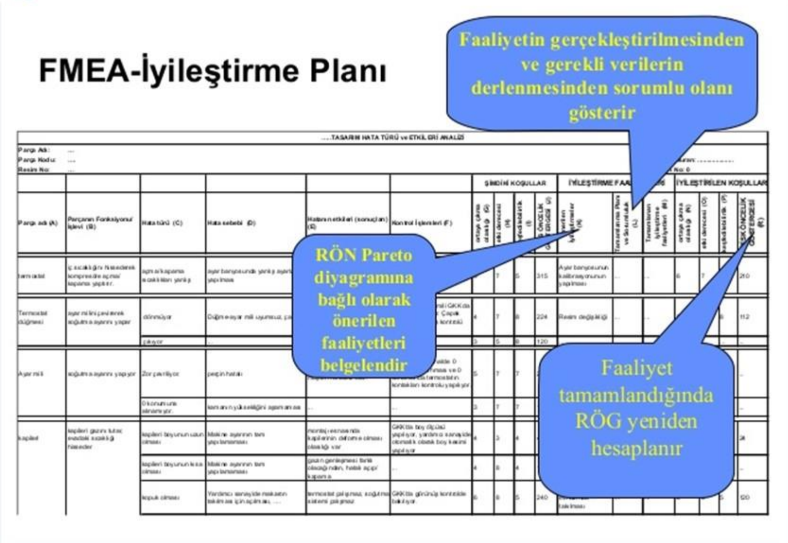
Mekanik Ekipman Tutuşturma Risk Değerlendirmesi- MEIRA



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SONUÇ OLARAK;

Patlayıcı Ortam Hesaplamalarını yapan uzmanların özellikle standartların <u>gelişim evresini incelemesi ve standartların Kısıt ve Limit'lerini</u> iyi incelemeleri gerekmektedir.

Özellikle standartların <u>uygulama rehberlerinin de ayrıntılı olarak incelenerek hesaplama yapılması</u> büyük önem taşımaktadır.

Aksi durumda bir çok koşul için <u>yanlış veya aşırı muhafazakar hesaplama</u> yapılması durumu ile karşı karşıya kalınacaktır.

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SONUÇ OLARAK;

Mekanik Ekipman Tutuşturma Risk Değerlendirmesi – MEIRA" metodolojisinin uygulanmaması durumunda ise patlayıcı alandaki tüm Elektrik/Elektronik/Programlanabilir sistemler Exproof olsa bile halen yüksek oranda risk bulunmaya devam edecektir.

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Teşekkürler!

Özlem ÖZKILIÇ

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ozlem@onderakademi.com