



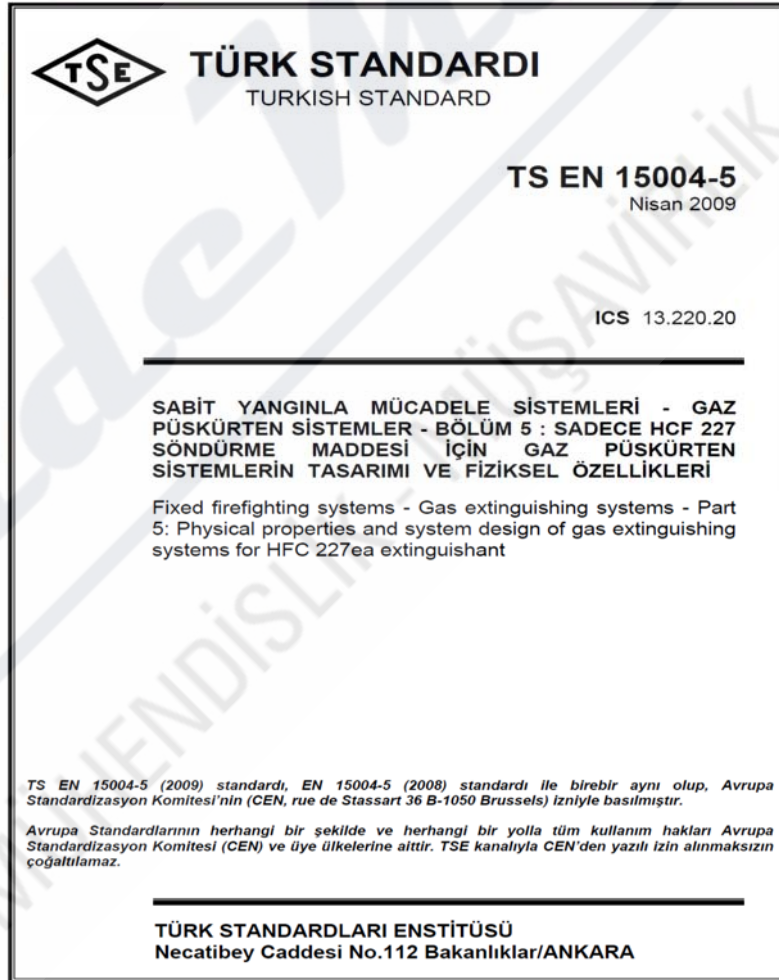
FM-200 GAZLI YANGIN SÖNDÜRME SİSTEMİ SEÇİMİ, TASARIMI VE UYGULAMASINDA DİKKATE ALINMASI GEREKEN HUSUSLAR

1. Nerelerde FM-200 gazlı yangın söndürme sistemi kullanmalıyım?

FM-200 gazlı yangın söndürme sistemi elektronik medyanın ve insanın bulunduğu mahallerde TS EN 15004 standardına bağlı olarak dizayn edildiğinde toksit, boğucu ve korozif etki göstermeyen kimyasal bir söndürücü malzemedir. Bu nedenle bilgi işlem merkezlerinde, veri merkezlerinde, IT odalarında, AG ve OG elektrik odalarında, pano odalarında, müze, arşiv odalarında, radar istasyonlarında, haberleşme merkezlerinde, scada kontrol odaları ve benzeri mahallerde kısaca 7/24 esasına göre çalışması ve/veya korunması gereken mahallerde FM-200 gazlı yangın söndürme sistemi kullanılır.

2. FM-200 gazlı yangın söndürme sistemi dizaynı hangi standarda göre yapılmalıdır?

FM-200 gazlı yangın söndürme sistemi tasarım ve dizaynı yasal ve zorunlu olan TS EN 15004 (Nisan 2009) standardına göre yapılmalıdır.



3. FM-200 tasarımında sıcaklık bir faktör müdür?

Mahal sıcaklığına göre spesifik gaz hacmi değişken olduğu için hesaplamalarda muhakkak mahal sıcaklığı belirtilmeli ve dikkate alınmalıdır.

EN 15004-5:2008 (E)

Table 3 — HFC 227ea total flooding quantity

Temperature <i>T</i> °C	Specific vapour volume <i>S</i> m ³ /kg	HFC 227ea mass requirements per unit volume of protected space, <i>m/V</i> (kg/m ³) This information refers only to the product HFC-227ea, and does not represent any other products containing 1,1,1,2,3,3,3-heptafluoropropane as a component.									
		Design concentration (by volume)									
		6 %	7 %	8 %	9 %	10 %	11 %	12 %	13 %	14 %	15 %
-10	0,1215	0,5254	0,6196	0,7158	0,8142	0,9147	1,0174	1,1225	1,2301	1,3401	1,4527
-5	0,1241	0,5142	0,6064	0,7005	0,7967	0,8951	0,9957	1,0985	1,2038	1,3114	1,4216
0	0,1268	0,5034	0,5936	0,6858	0,7800	0,8763	0,9748	1,0755	1,1785	1,2839	1,3918
5	0,1294	0,4932	0,5816	0,6719	0,7642	0,8586	0,9550	1,0537	1,1546	1,2579	1,3636
10	0,1320	0,4834	0,5700	0,6585	0,7490	0,8414	0,9360	1,0327	1,1316	1,2328	1,3364
15	0,1347	0,4740	0,5589	0,6457	0,7344	0,8251	0,9178	1,0126	1,1096	1,2089	1,3105
20	0,1373	0,4650	0,5483	0,6335	0,7205	0,8094	0,9004	0,9934	1,0886	1,1859	1,2856
25	0,1399	0,4564	0,5382	0,6217	0,7071	0,7944	0,8837	0,9750	1,0684	1,1640	1,2618
30	0,1425	0,4481	0,5284	0,6104	0,6943	0,7800	0,8676	0,9573	1,0490	1,1428	1,2388
35	0,1450	0,4401	0,5190	0,5996	0,6819	0,7661	0,8522	0,9402	1,0303	1,1224	1,2168
40	0,1476	0,4324	0,5099	0,5891	0,6701	0,7528	0,8374	0,9239	1,0124	1,1029	1,1956
45	0,1502	0,4250	0,5012	0,5790	0,6586	0,7399	0,8230	0,9080	0,9950	1,0840	1,1751
50	0,1527	0,4180	0,4929	0,5694	0,6476	0,7276	0,8093	0,8929	0,9784	1,0660	1,1555
55	0,1553	0,4111	0,4847	0,5600	0,6369	0,7156	0,7960	0,8782	0,9623	1,0484	1,1365
60	0,1578	0,4045	0,4770	0,5510	0,6267	0,7041	0,7832	0,8641	0,9469	1,0316	1,1183
65	0,1604	0,3980	0,4694	0,5423	0,6167	0,6929	0,7707	0,8504	0,9318	1,0152	1,1005
70	0,1629	0,3919	0,4621	0,5338	0,6072	0,6821	0,7588	0,8371	0,9173	0,9994	1,0834
75	0,1654	0,3859	0,4550	0,5257	0,5979	0,6717	0,7471	0,8243	0,9033	0,9841	1,0668
80	0,1679	0,3801	0,4482	0,5178	0,5890	0,6617	0,7360	0,8120	0,8898	0,9694	1,0509
85	0,1704	0,3745	0,4416	0,5102	0,5803	0,6519	0,7251	0,8000	0,8767	0,9551	1,0354
90	0,1730	0,3690	0,4351	0,5027	0,5717	0,6423	0,7145	0,7883	0,8638	0,9411	1,0202
95	0,1755	0,3638	0,4290	0,4956	0,5636	0,6332	0,7044	0,7771	0,8516	0,9277	1,0057
100	0,1780	0,3587	0,4229	0,4886	0,5557	0,6243	0,6945	0,7662	0,8396	0,9147	0,9916

m/V is the agent mass requirements (kilogram per cubic metre); i.e. mass, *m*, in kilograms of agent required per cubic metre of protected volume *V* to produce the indicated concentration at the temperature specified.

V is the net volume of hazard (in cubic metre); i.e. the enclosed volume minus the fixed structures impervious to extinguishant.

$$m = \left(\frac{c}{100 - c} \right) \frac{V}{S}$$

T is the temperature (in degree Celsius); i.e. the design temperature in the hazard area.

S is the specific volume (in cubic metre per kilogram); the specific volume of superheated HFC 227ea vapour at a pressure of 1,013 bar may be approximated by the formula:

$$S = k_1 + k_2 T$$

where $k_1 = 0,1269$; $k_2 = 0,000513$.

c is the concentration (in percent); i.e. the volumetric concentration of HFC 227ea in air at the temperature indicated, and a pressure of 1,013 bar absolute.



4. FM-200 sistemleri 25 ve 42 bar haricinde basınçlarda üretilebilir mi?

Hayır, TS EN 15004 'e göre üretim 25 ve 42 bar ile sınırlandırılmış ve tanımlanmıştır. Bu basınç sınıfları dışında tanımlanmış bir üretim standardı mevcut değildir.

5. FM-200 hesaplamalarında gazın boşalması için gerekli kritik süre nedir?

Bu süre 10 sn. 'dir. Tüm söndürücü akışkan 10 sn. içinde ilgili mahale boşalmalıdır. Bir hidrolik hesap programı ile doğrulanmalıdır. Bu değer ancak dizayn sorumlusunun kabulü ile artırılabilir.

EN 15004-1:2008 (E)

ambient enclosure pressure to the standard sea level pressure. Correction factors for gaseous agents are shown in Table 5.

Table 5 — Correction factors

Equivalent altitude m	Correction factor
- 1 000	1,130
0	1,000
1 000	0,885
1 500	0,830
2 000	0,785
2 500	0,735
3 000	0,690
3 500	0,650
4 000	0,610
4 500	0,565

7.8 Duration of protection

7.8.1 It is important that an effective extinguishant concentration not only be achieved, but is maintained for a sufficient period of time to allow effective emergency action. This is equally important in all classes of fires since a persistent ignition source (e.g. an arc, heat source, oxyacetylene torch or "deep-seated" fire) can lead to resurgence of the initial event once the extinguishant has dissipated.

7.8.2 It is essential to determine the likely period during which the extinguishing concentration will be maintained within the protected enclosure. This is known as the hold time. The predicted hold time shall be determined by the door fan test specified in Annex E, or a full discharge test based on the following criteria:

- at the start of the hold time, the concentration throughout the enclosure shall be the design concentration;
- at the end of the hold time, the extinguishant concentration at 10 %, 50 % and 90 % of the enclosure height shall be not less than 85 % of the design concentration;
- the hold time shall be not less than 10 min, unless otherwise specified by the authority.

7.9 System performance

7.9.1 Discharge time

7.9.1.1 Liquefied extinguishant

The liquefied extinguishant discharge shall be completed as quickly as possible to suppress the fire and limit the formation of decomposition products. In no case shall the discharge time required to achieve 95 % of the design concentration exceed 10 s at 20 °C, or as otherwise required by the authority.

The discharge time period is defined as the time required to discharge from the nozzles 95 % of the extinguishant mass required to achieve the design concentration at 20 °C. For liquefied extinguishants, this can be approximated as the interval between the first appearance of liquid at the nozzle and the time when the discharge becomes predominantly gaseous. Flow calculations performed in accordance with 7.3 or with the approved pre-engineered systems instruction manuals shall be used to demonstrate compliance with this clause.

6. FM-200 gazlı yangın söndürme sisteminde dikişli silindir kullanılabilir mi?

Sistem ister 25 ister 42 bar olsun çelik çekme silindir kullanılmalı ve bu silindirlerin test basıncı 250 bar olmalıdır. Dikişli silindirlerde bu değerin yakalanması mümkün değildir. Bu nedenle dikişli (kaynaklı) silindir kullanılamaz.



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BUREAU VERITAS

ATTESTATION DE CONFORMITÉ
CERTIFICATE OF CONFORMITY
selon Module F de la Directive Equipements Sous Pression Transportables
1999/36/CE
as per Module F of Transportable Pressure Equipment Directive
1999/36/EC
N° CE-0062-TPED-F-PTU 008-09-ESP

Fabricant (nom) / Manufacturer (name): PRODUCTOS TUBULARES, S.A.
 Adresse / Address: Carretera Galdino a Ugarte, s/n, 48510 VALLE DE TRAPAGA, VIZCAYA SPAIN

Mandataire (Nom) / Authorized representative (Name): N.A.
 Adresse / Address: N.A.

EQUIPEMENT / EQUIPMENT

Item: STEEL GAS CYLINDER Type B01 109
 Description: 275 Seamless Steel Gas Cylinders. Volume 75l TP 250 BAR. B01 109 08/23/2011
 Attestation d'examen CE de type n° ou agrément CEE n°: EC type-examination certificate n° or EEC pattern approval n°:
 Emise par / Issued by: APRAGAZ (NB N° 0025)
 Valable jusqu'à / Valid until: N.A.
 Attestation d'examen CE de la conception n°: N.A.
 EC design-examination certificate n°: N.A.
 Emise par / Issued by: N.A.

ESSAIS EFFECTUÉS / TESTS CARRIED OUT

Liste des essais / List of tests: - Mechanical/Chemical tests n° 4955-4960 - UT Test certificate n° 2009 08 - Inspection certificate N578596-N578870
 Remarques - Lists des pièces jointes / Remarks - List of enclosures: /

Le présent document est invalide s'il est utilisé ou présenté sans les annexes qu'il mentionne et qui lui sont indissociables. VOID if used or presented without the listed attachment(s) which form(s) part of this document.

INFORMATIONS / INFORMATION

Marquage et emplacement sur l'équipement / Marking and location on the equipment: 2 1/2" 12UN EPT <<R Item>> UT 5,14 MM - KG 75L PH 250BAR TARA-- KG TI 0062 EN 1964-1 F 05 2009/05

Mois et Année de fabrication (Month and Year of manufacture): May-09
 Numéro de série / Serial number: From N578596 to N578870

La présente attestation est présumée nulle et le fabricant supportera seul les conséquences de son utilisation, en cas de modification apportée à l'équipement, susceptible de remettre en cause sa conformité aux exigences essentielles de sécurité ou à ses conditions d'utilisation prévues et, de manière générale, si le fabricant ne respecte pas, notamment, l'une ou l'autre des obligations mises à sa charge par la directive 1999/36/CE du 29 avril 1999 qui ne transposent dans le(s) droit(s) national(aux) applicable(s).

This certificate shall be deemed to be void and the manufacturer shall alone bear any consequences pursuant to its use, in case of modification to the equipment where this may affect conformity with the essential safety requirements or the prescribed conditions for use of the equipment, and generally where the manufacturer fails in particular to comply with any of his obligations under directive 1999/36/EC of 29 April 1999 as transposed in the applicable law(s).

Établi à / Made at	Le (MM/JJ/AAAA) / On (MM/DD/YYYY)	Signé par / Signed by	Signature
BILBAO	05/22/2009	Javier Irigoyen	

Code de conformité / Registration code: 2009/159.15.139/IT

La présente attestation est soumise aux Conditions Générales de Service de Bureau Veritas jointes à la demande. L'intervention signée par le demandeur. This certificate is subject to the terms of Bureau Veritas General Conditions of Service attached to the application signed by the applicant.

Productos Tubulares, s.a.u.

FABRICA DE BOTELLAS

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VAT: ES-A-4532355

DECLARACIÓN DE CONFORMIDAD CE (Directiva Equipos a Presión 99/36/CE)
EC CERTIFICATE OF CONFORMITY (Pressure Equipment Directive 99/36/EC)

El Fabricante: PRODUCTOS TUBULARES, S.A.U. declara bajo su responsabilidad que el equipo a presión:

The Manufacturer declare under his responsibility that the pressure equipment:

Descripción del equipo a presión: BOTELLA PARA GASES COMPRIMIDOS		Modelo: Model		Marca Fab.: Mfg. Mark		PT	
Tipo: 267/755/300-EN 1964-1		Nº de fabricación: N578596-		Nº de Serie o lote: --		Año de fabricación: 2009	
Manufacturing Nr: N578870		Serial number		Manufacturing year			

Presión máxima admisible Permissible maximum pressure:	PW (bar):	Cuerpo (Shell):	N/A
Temperatura mínima/ máxima admisible Permissible minimum and maximum temperature:	T (°C):		
Volumen interno Internal volume:	V (Litro):		75.00
Fluido contenido / grupo: Fluid / group:			
Categoría: Category:			
Presión de prueba Test pressure:	PH (bar):		250
Fluido utilizado para prueba: Testing pressuring fluid:			Agua
Fecha de Prueba: Date of test:			2009 / 05

Cumple la Directiva del Parlamento Europeo y del Consejo, 1999/36/CE, relativa a los equipos a presión.
 Comply with the Pressure Equipment Directive 1999/36/EC

Procedimiento de evaluación de la conformidad utilizado:
 Conformity evaluation procedure

Módulo F

Ref. Certificado de examen CE de: x Tipo - Diseño
 EC Examination certificate ref.:

N/A

Organismo de Control Notificado que ha realizado el control:
 Approved Certification Body who has realized the control

BUREAU VERITAS

Código o norma de diseño aplicado:
 Design Code or standard applied

EN 1964-1:1999

Otras directivas o normas aplicadas:
 Other Directives or standards applied

N/A

Sobre el equipo se ha realizado el marcado (CE) con la identificación:
 The equipment has been marked (EC) with the distinctive mark

π 0062

Nombre / Name: // Firma / Signature: Fernando Itzaguirre
 Cargo / Post: Director Técnico
 Lugar y fecha / Location and date: 04/06/2009 Valle de Trapaga

7. Minimum design konsantrasyonu ne olmalıdır?

Gaz miktarını mahal sıcaklığına bağlı belirleyecek olan minimum dizayn konsantrasyon değeri; Class B için %9, Class A Surface için %7,9, Higher Hazard Class A için %8,5 alınmalıdır.

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Table 4 — HFC 227ea reference extinguishing and design concentrations

Fuel	Extinguishment % by volume	Minimum design % by volume
Class B		
Heptane (cup burner)	6,7	9,0
Heptane (room test)	6,9	
Surface Class A		
Wood crib	4,9	7,9
PMMA	6,1	
PP	6,1	
ABS	6,1	
Higher Hazard Class A	a	8,5
The extinguishment values for the Class B and the Surface Class A fuels are determined by testing in accordance with EN 15004-1:2008, Annexes B and C.		
The minimum design concentration for the Class B fuel is the higher value of the heptane cup burner or room test heptane extinguishment concentration multiplied by 1,3.		
The minimum design concentration for Surface Class A fuel is the highest value of the wood crib, PMMA, PP or ABS extinguishment concentrations multiplied by 1,3. In the absence of any of the 4 extinguishment values, the minimum design concentration for Surface Class A shall be that of Higher Hazard Class A.		
See EN 15004-1:2008, 7.5.1.3, for guidance on Class A fuels.		
The extinguishing and design concentrations for room-scale test fires are for informational purposes only. Lower and higher extinguishing concentrations than those shown for room-scale test fires may be achieved and allowed when validated by test reports from internationally recognized laboratories.		
a The minimum design concentration for Higher Hazard Class A fuels shall be the higher of the Surface Class A or 95 % of the Class B minimum design concentration.		

8. Mahalde asma tavan ve yükseltilmiş döşeme var ise ne yapılmalıdır?

Asma tavan ve yükseltilmiş döşeme hacimleri hesapta dikkate alınmalı, asma tavan ve yükseltilmiş döşemeye ayrıca nozul ilave edilmeli ve bu bölgelere çapraz zon prensibine bağlı yangın dedektörleri yerleştirilmelidir.

9. FM-200 gazlı yangın söndürme sistemi tekliflerinde neye dikkat etmeliyim?

FM-200 gazlı yangın söndürme sistemi teklifi ile birlikte aşağıdaki dokümanları aldığınızdan emin olun;

9.1 Gazlı Söndürme Sistem Tasarımı Mahal Bilgileri,

Örnek: Mahal Bilgi Formu

GAZLI SÖNDÜRME SİSTEMİ SİSTEM TASARIMI MAHAL BİLGİLERİ											
İŞİN ADI : ALAN MENKUL											
NO	ODA ADI	ALAN	Y.D. YÜKS.	ODA YÜKS.	A.T. YÜKS.	TOPLAM YÜKS.	TOPLAM HACİM	GAZ MİKTARI (kg)	NOZUL SAYISI	TOPLAM DEDEKTÖR SAYISI	TÜP KAPASİTESİ (lt.)
1	IT ODASI	31,05	0,11	2,35	0,00	2,46	76,38	51	2	4	67

NOTLAR:

- Teklifimiz hazırlanırken, yukarıdaki tabloda yer alan mahal bilgileri esas alınmıştır.
- Mahal sıcaklığı 20°C olarak kabul edilmiştir.
- Tablolarda yer alan mahal bilgileri, tarafımıza iletilen proje yada keşif listelerindeki bilgilere dayanmaktadır. Mahal bilgilerinde oluşabilecek değişiklikler, teklifimize aynen yansıtılarak, teklifimiz revize edilecektir.
- Gaz konsantrasyonu % 7,9 olarak alınmıştır.

9.2 FM-200 Gazlı Yangın Söndürme Sistemi Hidrolik Analiz Raporu,

Örnek: Hidrolik Analiz Raporu Kapak Sayfası



Pressure Loss Report DuPont™ FM200®

page 1

PROJECT

Reference:
Date:
Altitude:ALAN GAYRIMENKUL
28/05/2015
0 m

PROTECTED ENCLOSURES : IT ROOM

NUM	REFERENCE	VOLUME [m³]	DES. CONC [% VOL.]	DES. TEMP [°C]	GAS [kg]	MAX CONC [% VOL.]
1	ODA İCİ	73.0	7.90	20.0	45.6	7.92
2	YÜKSELTİLMİŞ DOSEME	8.4	7.90	20.0	5.2	7.92

FIRE PROTECTION SYSTEM

Extinguishing Agent:

DuPont™ FM200®

Discharge Time:
Pipe Type:
Connection Type:10.0 s
SCH 40
THREADED (3/8" to 2 1/2" threaded. Bigger than 3"
welded.)

Quantity of Cylinders: 1
Capacity of Cylinders: 67.0 l
System Pressure: 42 bar
Required Amount of Gas: 50.9 kg
Actual Amount of Gas: 51.0 kg
Filling density of the Cylinders: 761.2 kg/m³
Pipework Volume: 2.7 l
Amount of Gas in Pipework: 10.7 % l
Designed according to: UNE EN 15004:2008-2009

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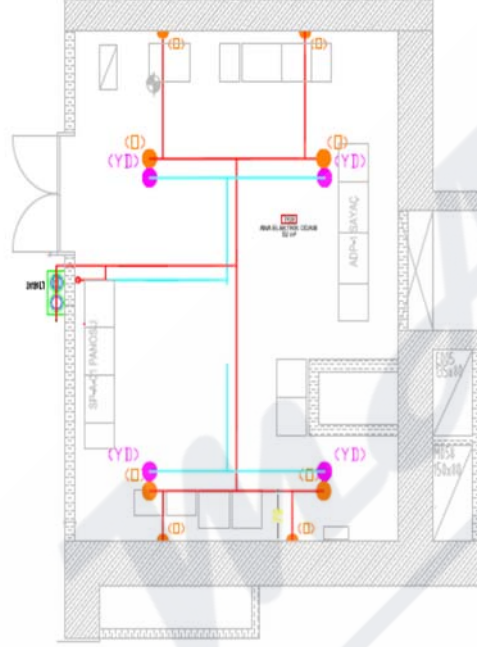
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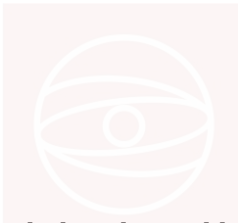


9.4 FM-200 Gazlı Yangın Söndürme Sistemi Plan Çizimleri.

Örnek: Plan Çizimi



ÖLÇEK:1/50



10. Mahal sızdırmazlık testi nedir?

Gazlı söndürme sistemi yapılan tüm mahallerde standartlara uygun sızdırmazlık testleri yapılarak, mahal içinde gaz boşaldıktan sonra gazın kalma süresinin en az 10 dk. olduğu teyit edilmelidir. Aksi takdirde yeniden tutuşma olasılığından dolayı sistem performans göstermeyebilir. Mahal sızdırmazlık testi sistemin öngörülen şekilde çalışıp çalışmayacağını belirler.

Örnek: Mahal Sızdırmazlık Kapak Sayfası

Summary – İT ODASI

retrotec FanTestic Integrity	version: 5.7.24	licensed to: Norm Teknik Malzeme Ticaret İnşaat
Test date: 2015-07-29	By: İlhan yagci	Certification: 1
Location: GAYRETTEPE		Building: ALAN GAYRİMENKUL
Witness: NORM TEKNİK		iyagci@normteknik.com.tr

Enclosure conditions prior to discharge		Extinguishing agent details	
Net protected volume, V [m³]	76,4	Agent	FM200 (ISO) [HFC-227ea]
Max flooded height, H _o [m]	2,35	Quantity [%]	8,5
Required protected height, H _p [m]	2,1	Type	Halocarbon
Design temp, T [C]	20,0	Discharge time, [s]	10
Enclosure pressure limit, [Pa]	500	Mixing during hold time	Yes
Specified Hold Time, [min]	10	Initial concentration, c _i	8,5%
Elevation, [m]	100	Design concentration, c	8,5%
Minimum design humidity	30%	Minimum concentration, c _{min}	7,225%
Maximum design humidity	60%	Bias during Hold, P _{bh} [Pa]	1
Test equipment		Hold time results	
Fan make/model	Retrotec 3000SR	Leakage exponent, n	0,5
Fan serial #	PH002212	Leakage constant, k ₁ [m³/h/Pa ⁿ]	48,20
Fan calibration date	09/12/2019	Total Leakage Area, [cm²]	170
Gauge make/model	DM32	Predicted Hold Time, t [min]	13,8
Gauge serial #	401591		
Gauge calibration date	09/12/2019		

Hold Time compliance based on Annex E of EN15004 (2008 Edition)

Calculations predict that the extinguishing agent concentration will fall from the initial concentration of 8,5% to the minimum concentration of 7,225% in **13,8 minutes**. The enclosure **PASSES** this acceptance procedure because this hold time is greater than the specified minimum of 10 minutes.

Results were calculated based on a user-entered protected height rather than the Standard specified calculated H_e.

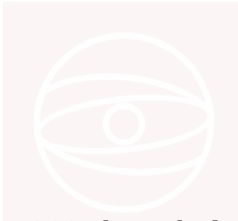
Protected height was entered by user instead of using the Standard specified 90% of flooded height.

Peak Pressure compliance using FSSA equations

Calculations predict a maximum positive peak pressure of **359 Pa**. This pressure is less than the specified maximum enclosure pressure limit of 500 Pa, therefore the enclosure **PASSES** this part of the procedure

Calculations predict a maximum negative peak pressure of **819 Pa**. This pressure is greater than the specified maximum enclosure pressure limit of 500 Pa, therefore the enclosure **FAILS** this part of the procedure.

This enclosure will **require additional PRV area of 144 cm²** that opens under negative pressure to maintain the enclosure's structural integrity and pass the peak pressure procedure in the negative direction.

**11. FM-200 sistemlerinde ne tür boru ve fittings kullanılmalıdır?**

FM-200 gazlı yangın söndürme sisteminde ASTM A53 Gr. B dikişsiz çelik çekme Sch40 boru kullanılmalıdır. 2" ve altındaki borular 3000 lb. dövme çelik dişli fittingslerle, 2½" ve üzerindeki borular Sch40 çelik çekme kaynaklı fittingslerle birleştirilmelidir. Sistemin çalışma basıncı ve güvenlik seviyesi bunu zorunlu kılar.



3000 lb. Dövme Çelik Fittings



Sch40 Çelik Çekme Fittins



Sch40 Çelik Çekme Boru

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