

Enclosure Integrity Test Report



Tested Building: **SOCAR**

Tested Enclosure: **UPS ODASI**

Building Address: **İSTANBUL**


Performed for: **DOĞUŞ ELEKTRİK ELEKTRONİK ve BİLGİSAYAR ALT YAPI HİZMETLERİ SAN. TİC. LTD. ŞTİ.**

Performed by: **Serdar GÜNEY**

Test date: **07-05-2019**

*Yangın Güvenlik Sistemleri
ve İnş. San. Tic. Ltd. Şti.*

Summary

 FanTestic Integrity	version: 2.2.0.19	Witness: Suat POLAT
Test date: 07-05-2019	By: Serdar GÜNEY	Location: UPS ODASI
Building: SOCAR		

Enclosure conditions prior to discharge		Extinguishing agent details	
Net protected volume, V	133.92 m³	Agent	HFC 227ea (FM 200)
Max flooded height, H _o	3.17 m	Quantity [kg]	110
Design temp, T [°C]	20	Mixing during hold time	Yes
Inside temp, T [°C]	20	Initial concentration, c _i	10.125
Outside temp, T [°C]	20	Design concentration, c	7.9
Specified Hold Time, [min]	10	Minimum concentration, c _{min}	6.715
Elevation, [m]	0	Bias during Hold, P _{bh} [Pa]	0.2
		Passing discharge rate	Continuous Mixing
Test equipment		Hold time results	
Fan make/model	Retrotec 6000	Lower leakage fraction, F	0.5
Fan serial #	3PH600666	Leakage exponent, n	0.5970
Fan calibration date	14/08/2017	Leakage constant k ₁ [m ³ /(h.Pa ⁿ)]	160.0
Gauge make/model	DM32	Equivalent Leakage Area ,	707
Gauge serial #	407717	Max Allowable Leakage Area,	954
Gauge calibration date	14/08/2017	Predicted Hold Time, t [min]	13.5

Hold Time compliance based on ISO 14520 (2015 edition)

The lower leakage fraction F was determined to be 0.50 which gives a calculated hold time of **13.5** minutes. The calculated hold time of 13.5 minutes is greater than the required 10 minutes, therefore the enclosure **PASSES** the hold time requirement.

Peak Pressure compliance using FSSA equations

Positive Pressure Result: Venting Calculated **PASSES** – ELA for enclosure and vent of 903 cm² exceeds the minimum required ELA of 190 cm² and the peak pressure of 149 Pa is less than the enclosure pressure limit of 500 Pa.

Negative Pressure Result: Venting Calculated **PASSES** – ELA for enclosure and vent of 903 cm² exceeds the minimum required ELA of 657 cm² and the peak pressure of 334 Pa is less than the enclosure pressure limit of 500 Pa.

Enclosure Integrity (hold time)

The enclosure was tested in compliance with ISO 14520 (2015 edition) Integrity Procedure. These tests only address potential failures in maintaining extinguishing agent concentration due to excessive enclosure leakage. The following assumptions were made:

- The initial extinguishing agent concentration as indicated in the test report will be achieved.
- Ductwork connected to air-handling systems that are outside this enclosure will be either isolated with dampers or will be shut down during the hold time.
- If air handlers are used to provide continuous mixing, they will be dedicated to this enclosure and will not create significant flows across the enclosure boundaries.
- An adequate return path for the air flow was provided during the enclosure integrity door fan tests.
- All intentional openings will be sealed during the enclosure leakage for hold time tests.
- Settling rate of particles is much longer than hold time.
- All other non-integrity tests, as outlined in the ISO standard, will be satisfactorily completed.

Enclosure Construction Data

The maximum flooded height used in the calculations is 3.17 m. The equipment was installed in the room, and the top of the rack was measured to be 3.17 was taken as the minimum height for protection. Net protected volume used is 133.92m³. Building elevation used is 0, and the elevation correction factor used in the calculations is 1.

Total Enclosure Leakage test data

Based on **measured** values, the enclosure alone has an equivalent leakage area of 707 cm² at a reference pressure of 10 Pa.

Note: The enclosure was previously tested, tested leakage area was entered.

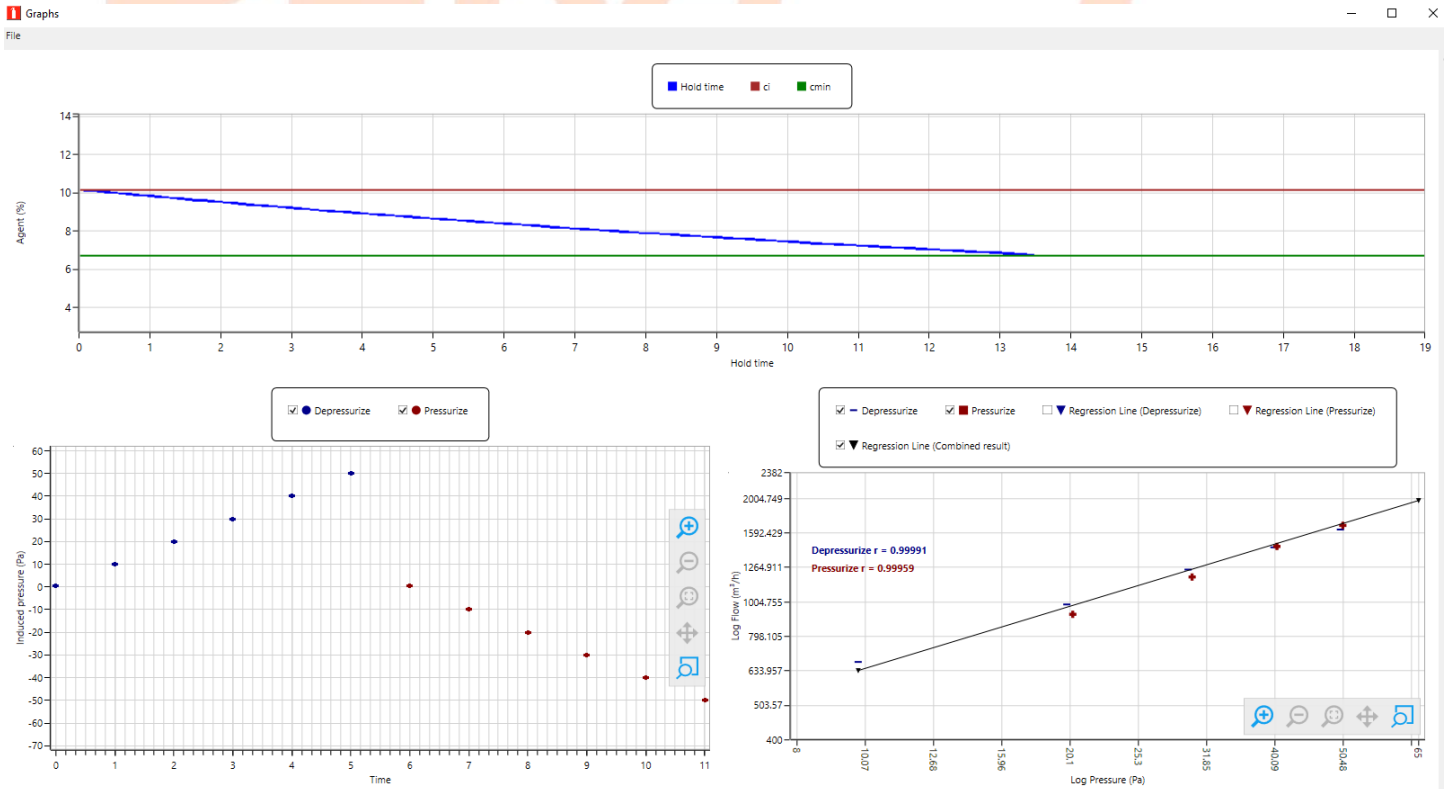
The following table represents the results from the enclosure integrity procedure carried out on the whole enclosure, with all intentional openings sealed.

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Test conditions

Test date	07-05-2019	Inside temperature, T_e [°C]	20°C
Test time		Outside temperature, T_o [°C]	20°C
Operator location	Outside	Bias pressure, P_{bt} [Pa]	0.2

		Pressurize Data					Depressurize Data					
Induced pressure [Pa]		-10	-20	-30	-40	-50		10	20	30	40	50
FAN #1- RANGE B4	Fan Pressure [Pa]	38.7	86.1	135.5	196.5	257.5	{ FAN #1- RANGE B4	54.7	116	176.5	233	293
	Flow [m]	753	1,069	1,352	1,552	1,727			870	1,090	1,300	1,481
Leakage exponent, n		0.656						0.545				
Leakage characteristic, k ₁ [m ³ /(h.Pa ⁿ)]		127.69						195.99				
Leakage area at 10 Pa [cm ²]		646.29						767.88				
Correlation, r		0.99959						0.99991				



Venting data for no pressure relief vent

Positive direction data

The positive free vent area provided by the enclosure and vent is 903 cm² is greater than 190 cm² and there is no need for additional vent area. The Enclosure Positive Peak Pressure is 149 Pa under 500 Pa.

Negative direction data

The negative free vent area provided by the enclosure and vent is 903 cm² is less than 657 cm² and there is no need for additional vent area. The Enclosure Negative Peak Pressure is 334 Pa under 500 Pa.

The following dataset expresses values for the enclosure integrity test performed under positive and negative pressures. All intentional openings were set to the operating condition expected during the agent discharge for positive and negative peak pressure relief.

Design details	
Enclosure pressure limit, [Pa]:	500
Discharge time, [s]:	10
Pressure relief vent type:	No pressure relief vent
Peak Pressure relief using:	Enclosure

Peak Positive Pressure	
Peak positive pressure, [Pa]	149
Leak to volume ratio, LVR _{pos} [cm ² /m ³]	6.75

Venting summary – Positive Direction	
Minimum required leakage, [cm ²]	190
Venting area used, [cm ²], (describes enclosure and vent)	903
Additional PRV area needed, [cm ²]	0

Peak Negative Pressure	
Peak negative pressure, [Pa]	334
Leak to volume ratio, LVR _{pos} [cm ² /m ³]	6.75

Venting summary – Negative Direction	
Minimum required leakage, [cm ²]	657
Venting area used, [cm ²], (describes enclosure and vent)	903
Additional PRV area needed, [cm ²]	0

