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EXPLOSION VENTING DEVICES FOR EXHAUST GAS SYSTEM

FDC Co., Ltd.

THE LEADER OF
SAFETY EQUIPMENT

FDC FDC Co., Ltd.

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1. PURPOSE OF INSTALLATION

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The Need for Explosion Venting Device

【 Explosion process inside the exhaust system 】

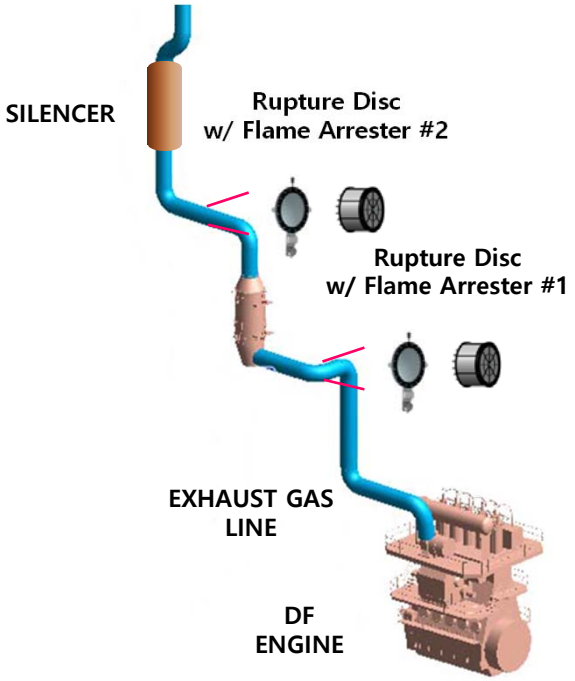
1 Generation of unburned exhaust gas due to misfiring, etc.

2 Remaining exhaust gases in the exhaust system

3 Hot particles entering the exhaust system

4 Contact between hot particles and residual gas

5 Explosion [Exhaust System Damage]



⚠ Installing explosion venting device can help protect your exhaust system from explosions.

2. SHIP CLASSIFICATION REQUIREMENTS

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IACS Requirements (IACS UR M82 : 2023.03)

M82

M82 (Mar 2023) **Type Testing Procedure of Explosion Relief Devices for Combustion Air Inlet and Exhaust Gas Manifolds of I.C. Engines Using Gas as Fuel**

IACS RULE

These are the IACS rules for explosions inside exhaust pipes, the draft data of which is used by each classification company (DNVGL, ABS, LR, etc.) as the only test standard for safety devices against explosions in exhaust pipes.

2021.01 IACS UR M78 DRAFT

The standards for safety devices installed in engine exhaust systems were ambiguous.

This was not a mandatory requirement of the classification society as it only specified safety devices installed on the manifold.

2023.03 IACS UR M82

Details on the safety devices installed in the engine exhaust system have been confirmed.

Safety devices that have received new classification certification must be installed to comply with the revised RULE standards.(Required application for ships Contract from 1 July 2024)

2. SHIP CLASSIFICATION REQUIREMENTS

IACS Requirements (IACS UR M82 : 2023.03)

1 Scope

To specify testing procedure for explosion relief devices for combustion air inlet manifold and exhaust gas manifold of internal combustion engines using gas as fuel.

2 Definitions

Definitions addressing gas as fuel as given in the UR M78, Safety of Internal Combustion Engines Supplied with Low Pressure Gas, apply.

Explosion relief device (ERD) means a device to protect a component against a determined overpressure in the event of a gas explosion. The device is fitted with a flame arrester and may be a valve, a rupture disc or other, as applicable.

3. PRODUCT SPECIFICATIONS AND FEATURES

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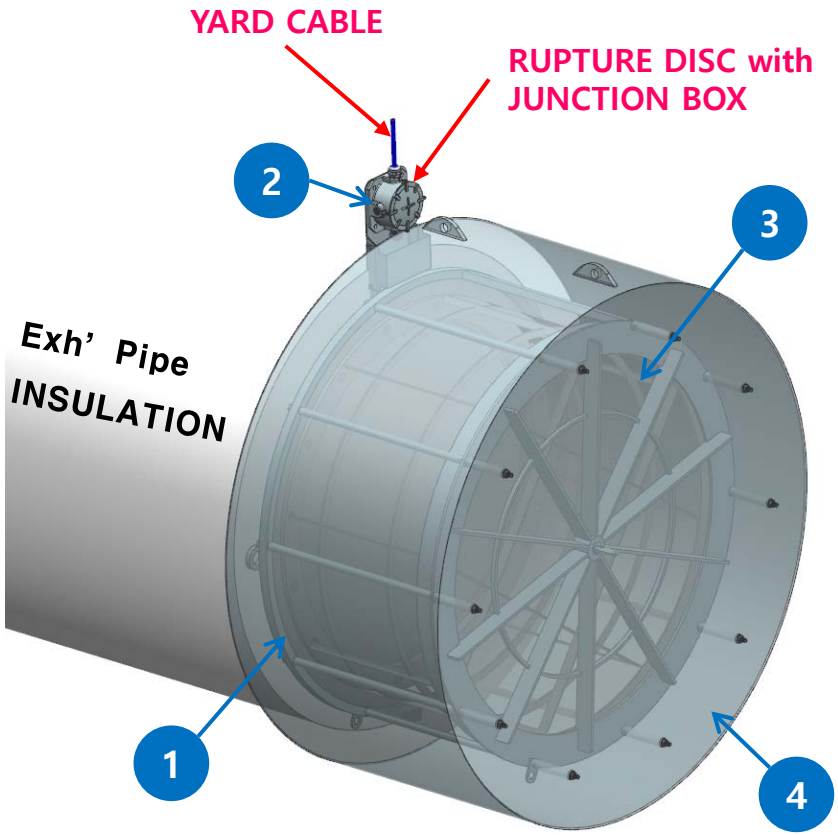
Applicable Size and Part List

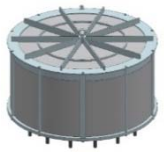
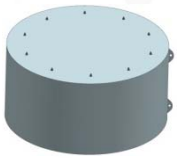


< PRODUCT INSTALLATION REFERENCE >

APPLICABLE SIZE

Exh'GAS PIPE SIZE	RUPTURE DISC SIZE	BURSTING PRESSURE
400A~800A	400A	200mbarg or 500mbarg @ Max. 600℃
850A~1200A	700A	

PART LIST

NO	ITEM NAME	MODEL	IMAGE
01	RUPTURE DISC	KSRPR	
02	BURST SENSOR	KSBS-C-H1	
03	FLAME ARRESTER	KSEVPL	
04	FLAME ARRESTER COVER	A-TYPE	

3. PRODUCT SPECIFICATIONS AND FEATURES

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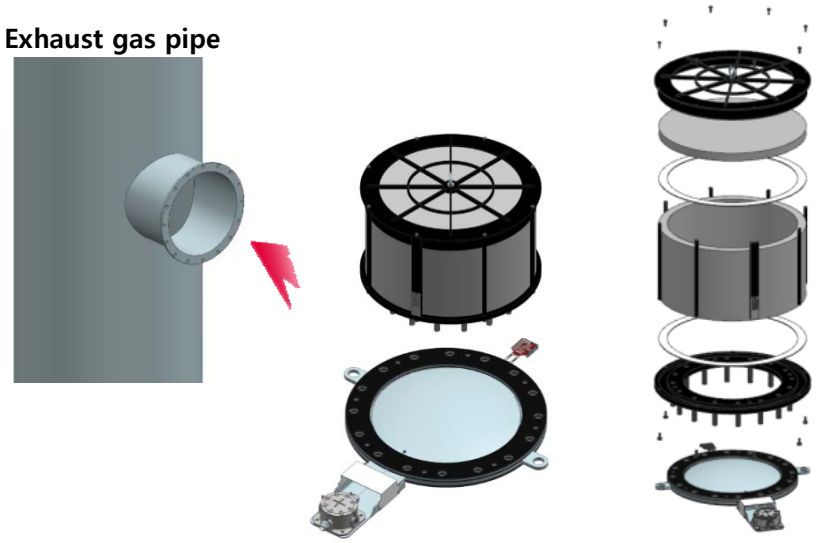
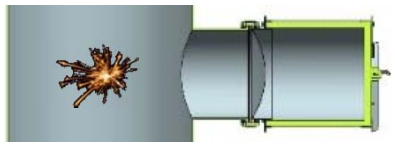
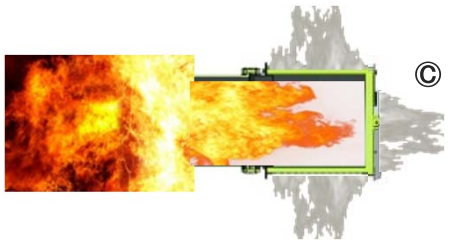
Characteristics of Explosion Venting Device





Ⓐ Ignition of combustible gas in the exhaust system

Ⓑ Spread of explosion flame



Ⓒ Flames are blocked through an anti-flame filter and pressure inside the exhaust system is relieved.

Instant operation and Safe discharge

- The safest explosion protection device that instantly releases the maximum amount of explosive expansion gas and pressure.
- Blocks flame and releases only pressure and smoke

Safe design

- Leak-free and non-fragment design

Temperature shielding structure

- Blocks the temperature inside the exhaust pipe

Cost reduction

- A full opening Rupture disc with Excellent Venting Efficiency allows the only one set of rupture disc is enough per Engine.

Easy to install

- Easy to install and assemble

Live monitoring

- Real-time status monitoring possible by applying an integrated sensor disc

4. PRODUCT COMPARISON DATA

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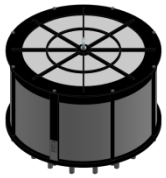
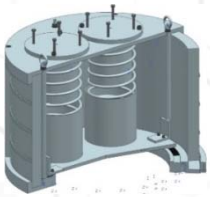
Explosion Venting Device Comparison Table

	RUPTURE DISC	FLAME ARRESTER	EXPLOSION RELIEF VALVE
IMAGE			
LEAKAGE	Zero Leakage. * Confirmed in 450℃ environment	N/A	Zero Leakage. (Applicable only for low pressure operation)
MAINTENANCE	1. Visual inspection 2. Replace with a new product after rupture 3. Burst Sensor can be replaced individually	1. Visual inspection 2. Can be reused (3 times) 3. SPARE PART can be replaced if necessary	1. Visual inspection 2. Self-repair is not possible if problems occur with the sealing or flame filter after an explosion.
REMARK	1. Monitorable sensors 2. Fast pressure release 3. Mechanical integrity 4. Prevention of secondary damage due to addition of flame prevention function 5. Application of temperature shielding structure6. Possible to install in explosion-proof area (Zone 1)	1. Quick pressure release 2. Mechanical integrity 3. Prevent secondary damage due to flame suppression function 4. No need to install additional piping 5. Low maintenance costs as only filter parts can be replaced 6. Possible to install in explosion-proof area (Zone 1)	1. Automatic opening and closing function 2. Flame suppression function prevents secondary damage 3. Continuous exhaust gas emissions occur depending on operating pressure 4. Flame filter cannot be replaced 5. Since there is a possibility of continuous exhaust gas emissions, it is necessary to install a gas detection facility for worker safety.

4. PRODUCT COMPARISON DATA

Dimension Comparison Table-01

	FDC	Company 'F'	Company 'H'
PRODUCT IMAGE 400A	A same scale of actual appearance dimension 		
DIMENSION	MODEL : KSEVPL-400A O.D : Ø 660 H : 390mm WEIGHT(KG) : 45	MODEL : GEX-DN400 PN10 O.D : Ø 565 H : 603mm WEIGHT(KG) : 47.5	MODEL : 565EVM O.D : Ø 735 H : 419mm WEIGHT(KG) : 250

4. PRODUCT COMPARISON DATA

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Dimension Comparison Table-02

	FDC	Company 'F'	Company 'H'
PRODUCT IMAGE 700A	A same scale of actual appearance dimension 		
DIMENSION	MODEL : KSEVPL-700A O.D : Ø 935 H : 495mm WEIGHT(KG) : 92	MODEL : GEX-DN800 PN10 O.D : Ø 1015 H : 1062mm WEIGHT(KG) : 167	MODEL : 735EVM O.D : Ø 910 H : 680mm WEIGHT(KG) : 420

4. PRODUCT COMPARISON DATA

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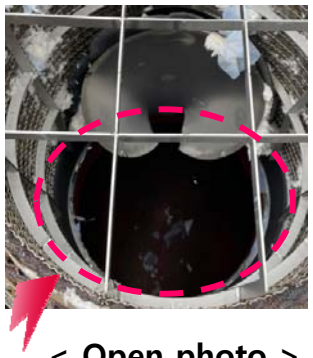
Comparison of Test Results – Appearance after Operation

Rupture Disc + Flame Arrester

< Appearance after explosion >



< Open photo >

Full Open

Fastest Pressure Relief among ERDs

Explosion Relief Valve

< Appearance after explosion >

< Valve structure description >

< Inside the vaLve >

Sealing parts fragments

< Valve internal details >

Sealing parts loss

4. PRODUCT COMPARISON DATA

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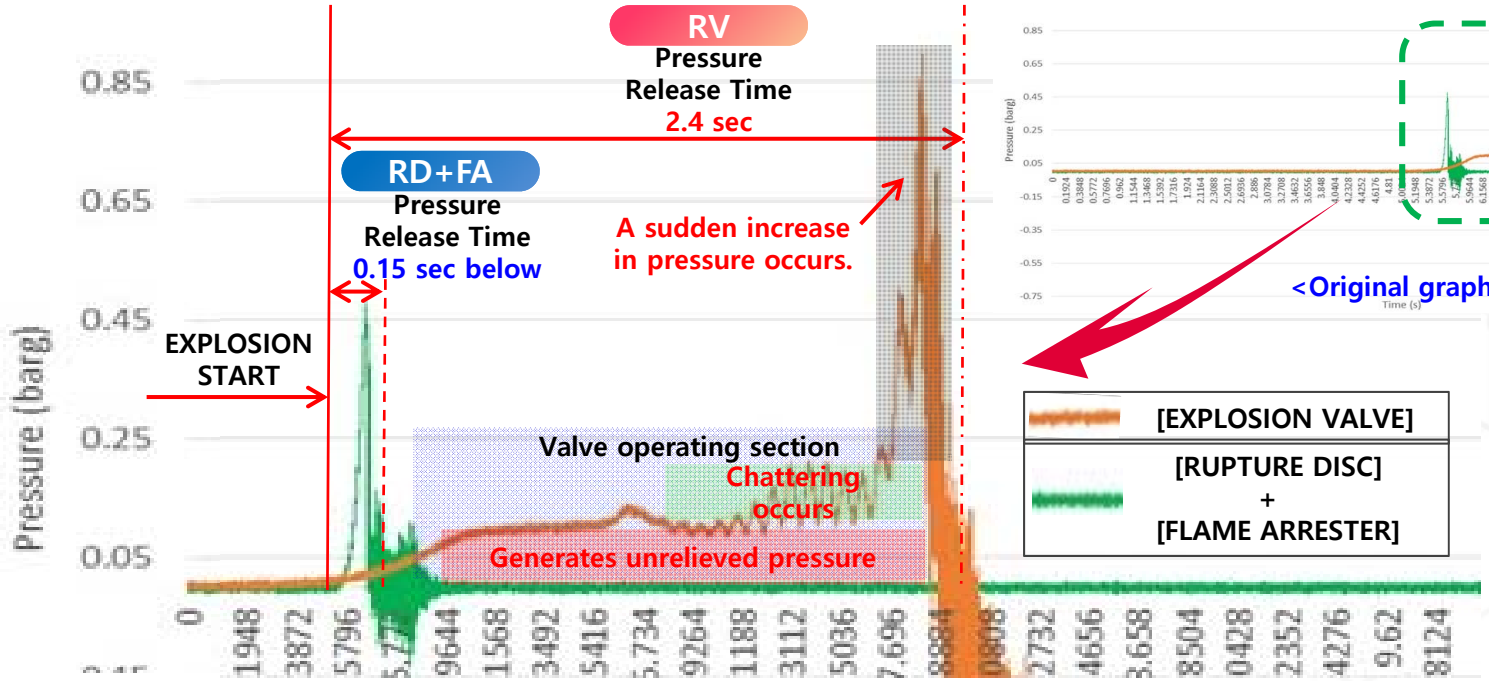
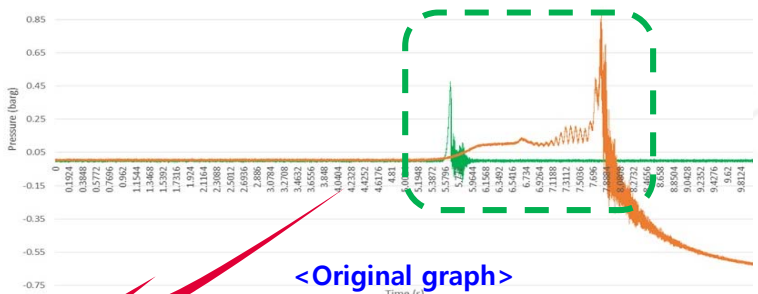
Comparison of Test Results – Pressure graph

Pressure Release Approximately 16 times Faster than RV

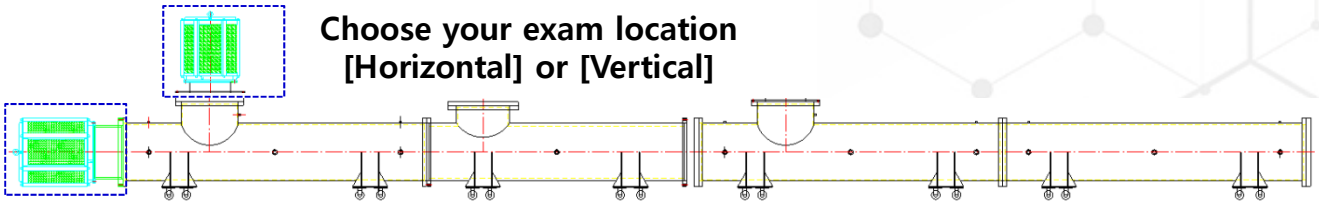


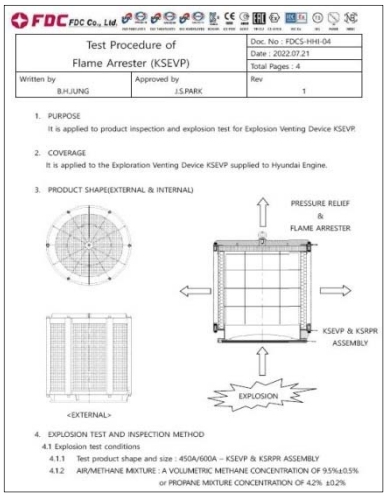


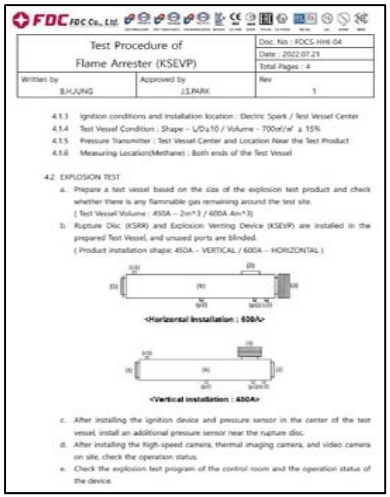
Product	Pressure release time	Max pressure	Note
RUPTURE DISC + FLAME ARRESTER	0.15 sec	0.47 barg	1. The pressure is quickly released 2. Excellent for relieving maximum pressure after explosion
EXPLOSION RELIEF VALVE	2.4 sec	0.9 barg	1. It takes a long time to release the pressure. 2. After explosion, the maximum pressure inside the test pipe becomes very high.

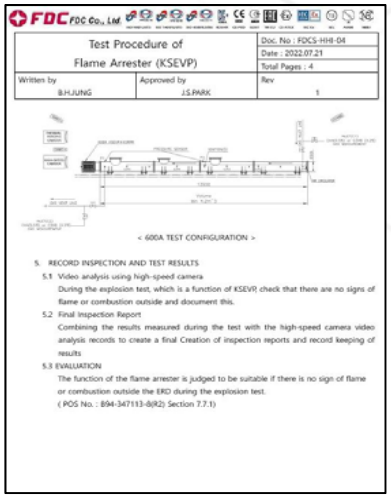
5. FACILITIES STATUS

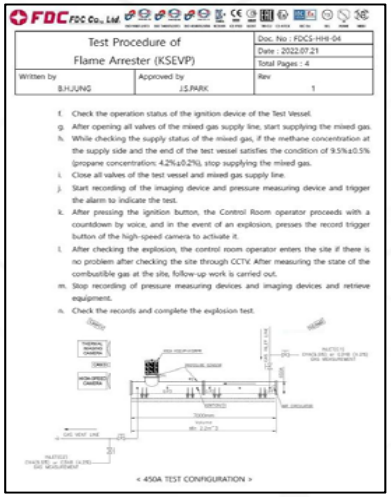
Based IACS UR M82, Explosion Test Facility




Test Procedure of Flame Arrester (KSEVP)


Test Procedure of Flame Arrester (KSEVP)


Test Procedure of Flame Arrester (KSEVP)


Test Procedure of Flame Arrester (KSEVP)

〈 Self-assessment criteria and testing equipment 〉

5. FACILITIES STATUS

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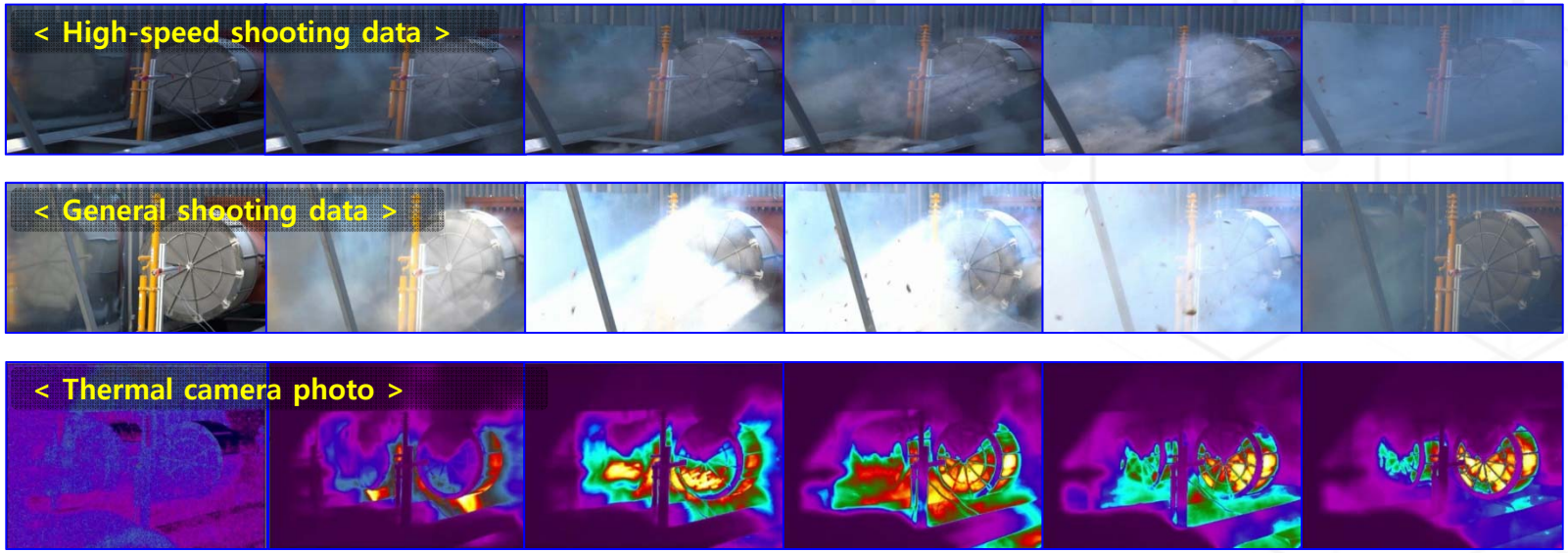
Based IACS UR M82, Explosion Test and Analysis #1



Environmental Measurement Result Data				
1.0m Distance Noise	Front 0.5m Discharge Pressure	Front 1.0m Discharge Pressure	Side 0.5m Discharge Pressure	Side 1.0m Discharge Pressure
126 dB	0.032 barg	0.046barg	0.16 barg	0.058barg

< Results of Explosion test >

1> No flames are generated outside the product

2> No damage to KSEVPL product by opening of Rupture Disc

5. FACILITIES STATUS

Based IACS UR M82, Explosion Test and Analysis #2

Analysis Results

1> As a result of the performance test of KSEVPL anti-inflammatory performance was satisfied.

2> There is no problem with durability even when used with a Rupture Disc at 0.5 barg open conditions.

3> Confirm that KSEVPL satisfies IACS UR M82 requirements.

4> As a result of testing the possibility of casualties when the explosion pressure was released using a mannequin, there was no damage to the mannequin.

< Mannequin photo after test >

6. PRODUCT CERTIFICATE

FDC Co., Ltd.

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Classification

DNV ABS LR BV

< CLASSIFICATION CERTIFICATE >

6. PRODUCT CERTIFICATE

EU-Type Examination Certificate - IBExU GmbH

IBExU Institut für Sicherheitstechnik GmbH
An-Institut der TU Bergakademie Freiberg

[1] EU-TYPE EXAMINATION CERTIFICATE - Translation

[2] Equipment or protective systems intended for use in potentially explosive atmospheres, Directive 2014/34/EU

[3] EU-type examination certificate number **IBExU19ATEX2040 X** | Issue 0

[4] Product: **Flameless venting devices**
Type: KSEVP
Size DN600

[5] Manufacturer: FDC Co., Ltd.

[6] Address: 99, Seobu-ro 1293beon-gil
Juchon-yeon, Gimhae-si
Gyeongsangnam-do
REPUBLIC OF KOREA

IBExU Institut für Sicherheitstechnik GmbH
An-Institut der TU Bergakademie Freiberg

[1] EU-TYPE EXAMINATION CERTIFICATE - Translation

[2] Equipment or protective systems intended for use in potentially explosive atmospheres, Directive 2014/34/EU

[3] EU-type examination certificate number **IBExU19ATEX2041 X** | Issue 0

[4] Product: **bursting discs (explosion panels)**
Type: KSRPR
Size DN600

[5] Manufacturer: FDC Co., Ltd.

[6] Address: 99, Seobu-ro 1293beon-gil
Juchon-yeon, Gimhae-si
Gyeongsangnam-do
REPUBLIC OF KOREA

PASSED

[7] This product and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.

[8] IBExU Institut für Sicherheitstechnik GmbH, notified body number 0637 in accordance with Article 17 of Directive 2014/34/EU of the European Parliament and of the Council, dated 26 February 2014, certifies that this product has been found to comply with the essential health and safety requirements relating to the design and construction of products intended for use in potentially explosive atmospheres given in Annex II to the Directive.

The examination and test results are recorded in the confidential test report IB-18-2-0176.

[9] Compliance with the essential health and safety requirements has been assured by compliance with:
EN 14797:2006
except in respect of those requirements listed at item [18] of the schedule.

[10] If the sign "X" is placed after the certificate number, it indicates that the product is subject to the specific conditions of use specified in the schedule to this certificate.

[11] This EU-type examination certificate relates only to the design and construction of the specified product. Further requirements of the Directive apply to the manufacturing process and supply of this product. These are not covered by this certificate.

[12] The marking of the product shall include the following:

Ex G
$K_G \le 100$ bar*m/s, $p_{red} \le 0.59$ bar

IBExU Institut für Sicherheitstechnik GmbH
Fuchsmühlenweg 7
09599 Freiberg, GERMANY

Tel: + 49 (0) 37 31 / 38 05 0
Fax: + 49 (0) 37 31 / 38 05 10

Certificates without signature and seal are not valid. Certificates may only be duplicated completely and unchanged. In case of dispute, the German text shall prevail.

By order

(Dipl.-Ing. Willamowski)

Seal
(notified body number 0637)

Freiberg, 2019-04-12

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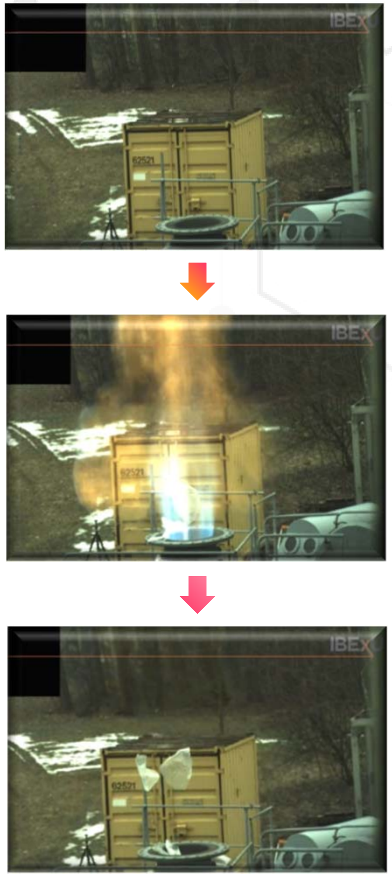
Page 1/2
IBExU19ATEX2041 X | 0

< IBEXU TEST REPORT >



Foil Test

RD+FA Test

6. PRODUCT CERTIFICATE

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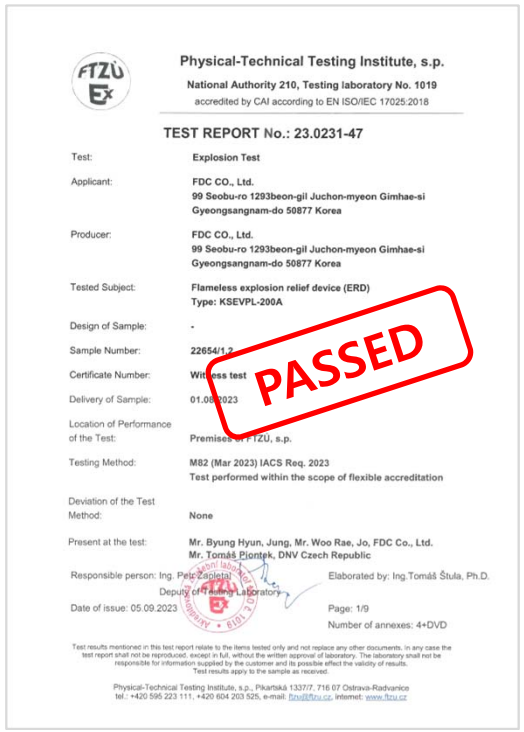
Product Performance Verification Test - Czech FTZU(DNV)



Physical-Technical Testing Institute, s.p.

National Authority 210, Testing laboratory No. 1019

accredited by CAI according to EN ISO/IEC 17025:2018

TEST REPORT No.: 23.0231-47

Test:	Explosion Test
Applicant:	FDC CO., Ltd. 99 Seobu-ro 1293beon-gil Juchon-myeon Gimhae-si Gyeongsangnam-do 50877 Korea
Producer:	FDC CO., Ltd. 99 Seobu-ro 1293beon-gil Juchon-myeon Gimhae-si Gyeongsangnam-do 50877 Korea
Tested Subject:	Flameless explosion relief device (ERD) Type: KSEVPL-200A
Design of Sample:	-
Sample Number:	22654/1,2
Certificate Number:	Witness test
Delivery of Sample:	01.06.2023
Location of Performance of the Test:	Premises of FTZU, s.p.
Testing Method:	M82 (Mar 2023) IACS Req. 2023 Test performed within the scope of flexible accreditation
Deviation of the Test Method:	None
Present at the test:	Mr. Byung Hyun, Jung, Mr. Woo Rae, Jo, FDC Co., Ltd. Mr. Tomáš Piontek, DNV Czech Republic

PASSED

Responsible person: Ing. Petr Zapletal, Deputy of Testing Laboratory

Elaborated by: Ing.Tomáš Štula, Ph.D.

Date of issue: 05.09.2023

Page: 1/9

Number of annexes: 4+DVD

Test results mentioned in this test report relate to the items tested only and not replace any other documents. In any case the test report shall not be reproduced, except in full, without the written approval of laboratory. The laboratory shall not be responsible for information supplied by the customer and its possible effect the validity of results.
Test results apply to the sample as received.

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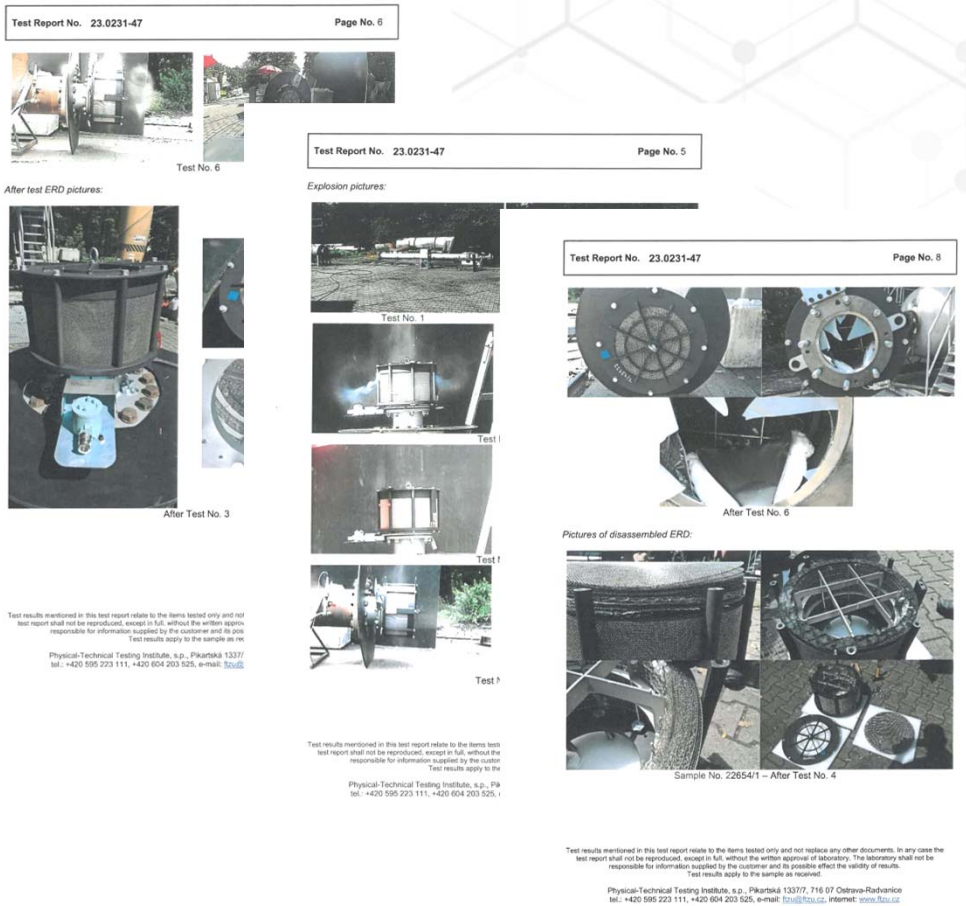
tel.: +420 595 223 111, +420 604 203 525, e-mail: ftzu@ftzu.cz, internet: www.ftzu.cz



Test Report No. 23.0231-47 Page No. 6

Test No. 6

After test ERD pictures:

After Test No. 3

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Test Report No. 23.0231-47 Page No. 5

Explosion pictures:

Test No. 1

Test

Test

Test

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Test Report No. 23.0231-47 Page No. 8

After Test No. 6

Pictures of disassembled ERD:

Sample No. 22654/1 – After Test No. 4

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Test results apply to the sample as received.

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< FTZU TEST REPORT >

6. PRODUCT CERTIFICATE

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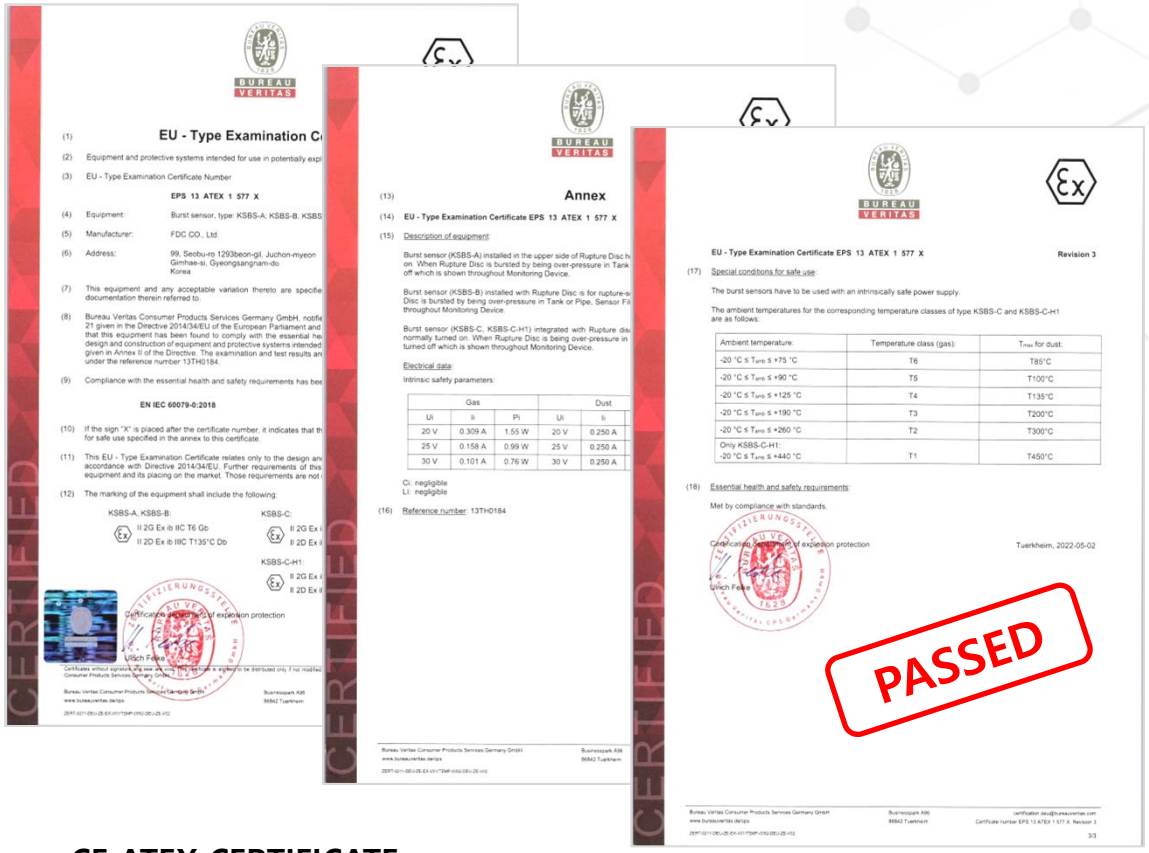
CE-ATEX Certificate



< CE ATEX CERTIFICATE >

사 훈

정직·신뢰

We are making a company of
trust with a unified heart.

FDC Co., Ltd.

Headquarters and 1st factory

129, Golden Route 129beon-gil, Juchon-myeon, Gimhae-si, Gyeongsangnam-do

R&D Insitute and 2nd Factory

199, Seobu-ro 1293beon-gil, Juchon-myeon, Gimhae-si, Gyeongsangnam-do

+82-(0)55-337-0852 +82-(0)55-337-0858 finedisc@finedisc.co.kr www.finedisc.co.kr