

TEST REPORT



FILK
a Subsidiary of KFPA

Report No : G2020-0190

Page(1)/(9)Pages

1030, Gyeongchung-daero, Ganam-eup, Yeosu-si, Gyeonggi-Do, 12661, Korea



1. Client

- Name : KUKIL INNTOT CO., LTD.
- Address : 17, Tapgeol-gil, Ungchon-myeon, Ulju-gun, Ulsan, Republic of Korea
- Date of Receipt : April 07, 2020

2. Test specimen : INNOSILD KN 1(Flat Ring Gasket)

3. Date of Test : April 14, 2020

4. Use of Report : Capability verification

5. Test method used : ISO 19921 and ISO 19922

6. Test Results :

| Specimen | Nominal size | Result | |
|-------------------------------------|---------------|---------------------|----------------------------|
| | | Fire endurance test | Hydrostatic tightness test |
| INNOSILD KN 1 (Flat Ring Gasket) | ASME 150LB 4B | Not leaked | Not leaked |

* The results shown in this test report refer only to the specimen(s) tested unless otherwise stated.

| | | |
|-------------|----------------------------------|----------------------------------|
| Affirmation | Tested by | Technical Manager |
| | Name : Ann, Byung-Ho (Signature) | Name : Jang, Woo-Bin (Signature) |

Fire Insurers Laboratories of Korea

a subsidiary of Korean Fire Protection Association





TEST CONTENTS

1. GENERAL

1.1 Name of test sample : INNOSILD KN 1(Flat Ring Gasket)

1.2 Applicant : KUKIL INNTOT CO., LTD.

17, Tappeol-gil, Ungchon-myeon, Ulju-gun, Ulsan, Republic of Korea

1.3 Manufacturer of the specimen : KUKIL INNTOT CO., LTD.

1.4 Application date : April 07, 2020

1.5 Date of test : April 14, 2020

1.6 Test place : Fire Insurers Laboratories of Korea(FILK)

1.7 Referenced test standard

IACS Req. 2001(Rev.4 2016), Requirements concerning pipes and pressure vessels (P2.11.5.5.6 Fire endurance test). The fire endurance test was to be conducted on the selected test specimens as per the following standards.

(a) ISO 19921:2005(E): Ships and marine technology - Fire resistance of metallic pipe components with resilient and elastomeric seals - Test methods

(b) ISO 19922:2005(E): Ships and marine technology - Fire resistance of metallic pipe components with resilient and elastomeric seals - Requirements imposed on the test bench

1.8 Test result : The specimen showed no leakage during the fire endurance test and the hydrostatic tightness test.

2. TEST SPECIMENS

2.1 Name of test sample : INNOSILD KN 1

2.2 Type of test sample : Flat Ring Gasket

2.3 Nominal size : ASME 150LB 4B, Thickness 1.5 mm

2.4 Maximum working pressure : 0.5 MPa(5 bar)

2.5 Material : Non-Asbestos Sheet

2.6 The number of test sample : 1 unit

2.7 Other details : Refer to the appendix 1. Specifications and drawing of the test specimen





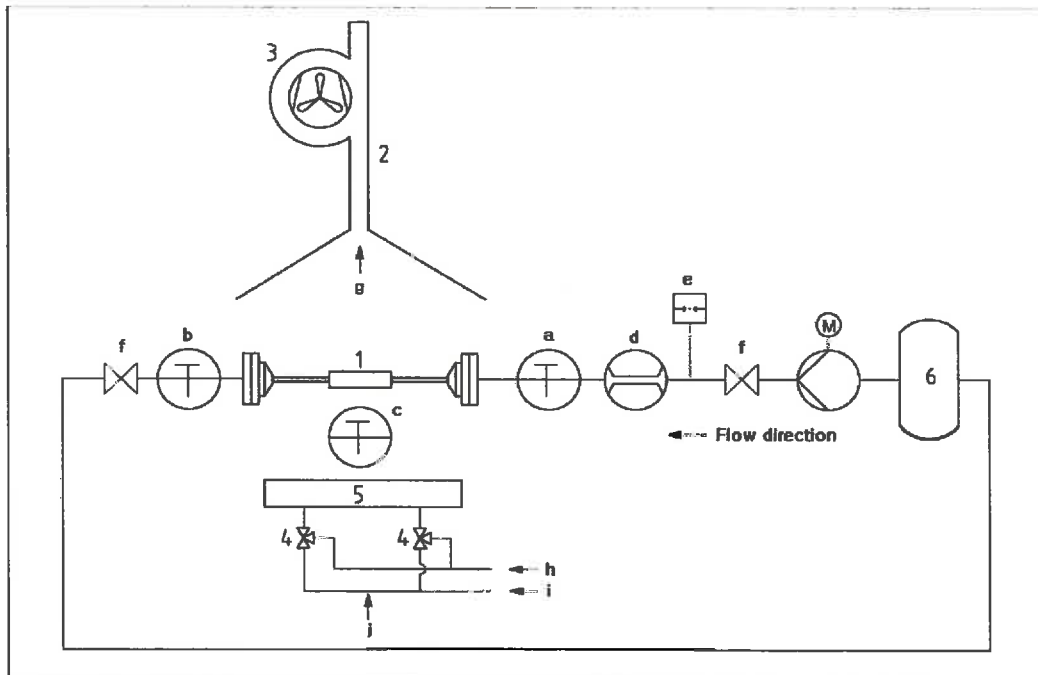
3. PURPOSE OF THE TEST

The purpose of this test is to evaluate the fire resistance performance of the INNOSILD KN 1(Flat Ring Gasket, ASME 150LB 4B) submitted by KUKIL INNTOT CO., LTD. according to the following test methods.

4. TEST METHODS

4.1 Test apparatus

Test rig arrangements for the fire test are to be as indicated in [Figure 1].



| Key | |
|------------------------------------|--|
| 1. test piece | a. Water temperature at test piece, inlet. |
| 2. exhaust gas truck | b. Water temperature at test piece, outlet. |
| 3. exhaust fan | c. Flame temperature below centre of test piece. |
| 4. mixing valve | d. Flow rate of water |
| 5. sectional area burner | e. Working pressure during test |
| 6. water tank with heating/cooling | f. Control valves. |
| | g. Exhaust gas. |
| | h. gas |
| | i. Combustion air. |
| | j. Air supply. |

[Figure 1] Schematic diagram of the test rig arrangements for the fire test

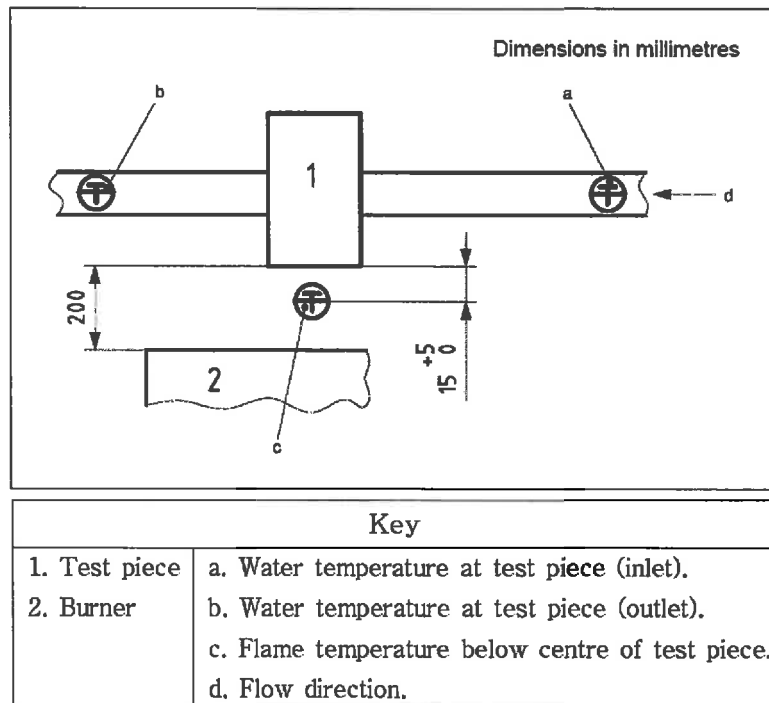




4.2 Test procedures

4.2.1 Fire endurance test

- (1) The test specimen is to be installed on the test rig such that the end of burner extends beyond the mechanical joint by at least 20 mm.



[Figure 2] Temperature measuring points

- (2) After installation, the test specimen is rinsed with the water at the pressure of (500 ± 20) kPa for at least 1 min in order to evacuate as far as possible the air contained in the specimen.
- (3) The specimen is exposed to the flame with the test temperature of at least $925 \text{ }^\circ\text{C}$ for the duration of 30 min at the pressure of (500 ± 20) kPa [(5 ± 2) bar].
- (4) The specimen is to be completely enclosed by the flame.
- (5) The inlet water temperature is maintained at the temperature of $(80 \pm 2) \text{ }^\circ\text{C}$ and the outlet water temperature is to be kept within $85 \text{ }^\circ\text{C}$.

4.2.2 Hydrostatic tightness test

After the fire test, the pressure inside the joint assembly is to be slowly increased to 2.0 times of the working pressure. This test pressure is to be retained for a minimum duration of 5 min.





4.3 Requirements

4.3.1 Fire endurance test

There should be no sign of leakage when the specimen is exposed to the flame for 30 min.

4.3.2 Hydrostatic tightness test

There should be no sign of leakage when the specimen is maintained at the pressure of 2.0 times of the working pressure for 5 min after the fire test.

[NOTE]

For services other than flammable fluids, a leakage rate of not more than 0.2 L/min is considered acceptable.

4.4 Measuring Instrumentation

4.4.1 Thermocouples

(1) K-type thermocouple : 3.2 mm in diameter

4.4.2 Pressure gauge

(1) Bourdon gauge : maximum range of 5.0 MPa(50 bar)

(2) Digital pressure gauge : maximum range of 3.0 MPa(30 bar)

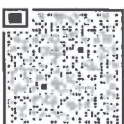
4.4.3 Transmitter for recording the internal pressure.

5. CLASSIFICATION CRITERIA

The test specimen subjected to fire for 30 min at the temperature of at least 800 °C under the test pressure should not show any sign of leakage when subjected to proof pressure(2.0 times of maximum working pressure) after the fire test.

6. TEST RESULTS

| Test specimen | Max. working pressure (MPa) | Fire endurance test | | Hydrostatic tightness test | |
|---|-----------------------------|---------------------|------------|----------------------------|------------|
| | | Test pressure (MPa) | Leakage | Test pressure (MPa) | Leakage |
| INNOSILD KN 1 (Flat Ring Gasket, ASME 150LB 4B) | 0.5 | 0.5 | Not leaked | 1.0 | Not leaked |





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Report No : G2019-0190

Page(6)/(9)Pages

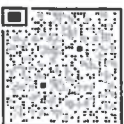
7: CONCLUSION

The INNOSILD KN 1(Flat Ring Gasket, ASME 150LB 4B) submitted by the client, KUKIL INNTOT CO., LTD. satisfied the classification criteria of the marine piping system specified in ISO 19921 and ISO 19922 as required by IACS Req. 2001(Rev.4 2016, Requirements concerning pipes and pressure vessels - P2.11.5.5.6. Fire endurance test).

'D08-10C(2)

210×297(mm)

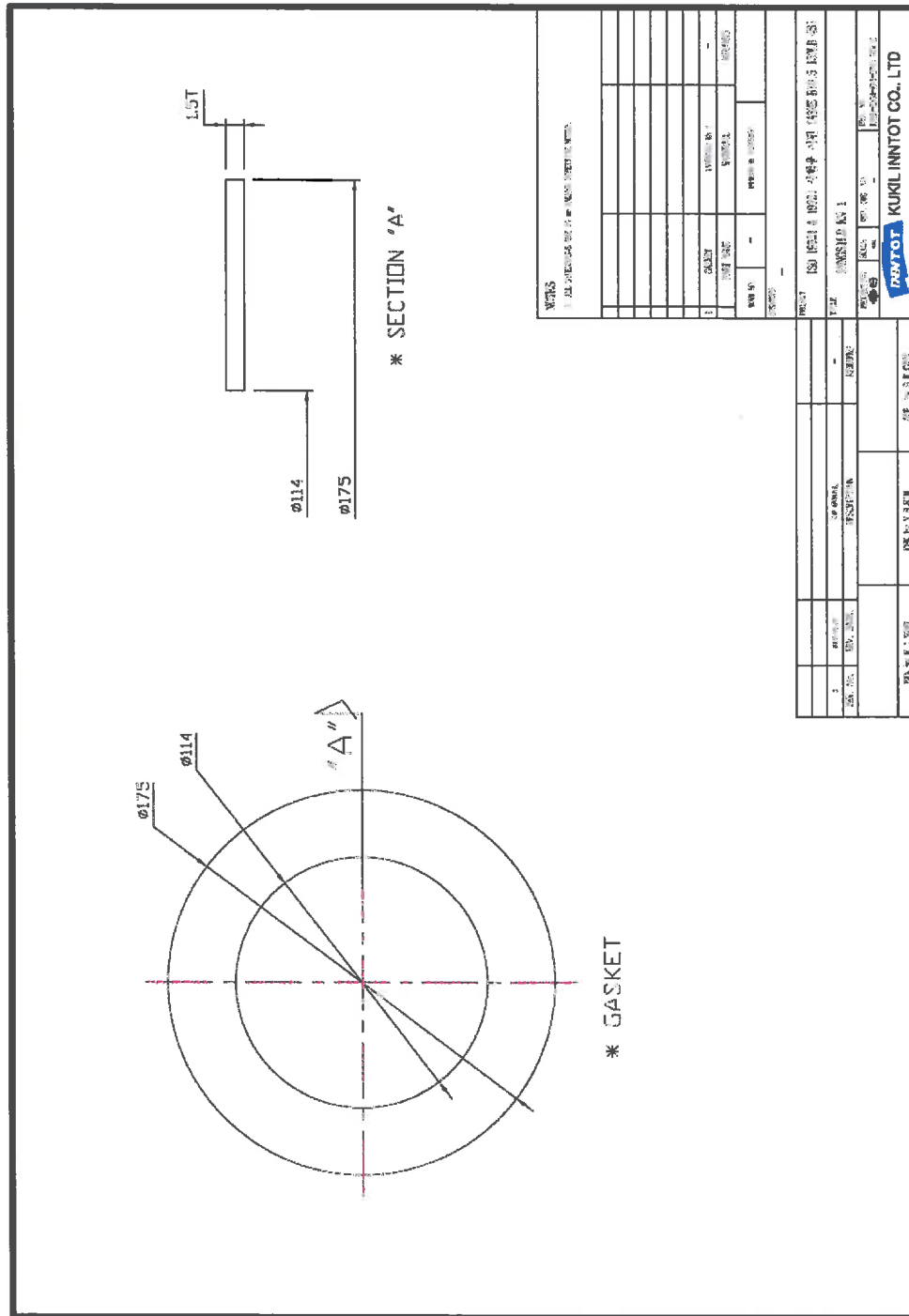
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[APPENDICES]

APPENDIX 1. DRAWING OF THE TEST SPECIMEN

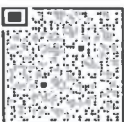


[Figure 1] Drawing of the test specimen

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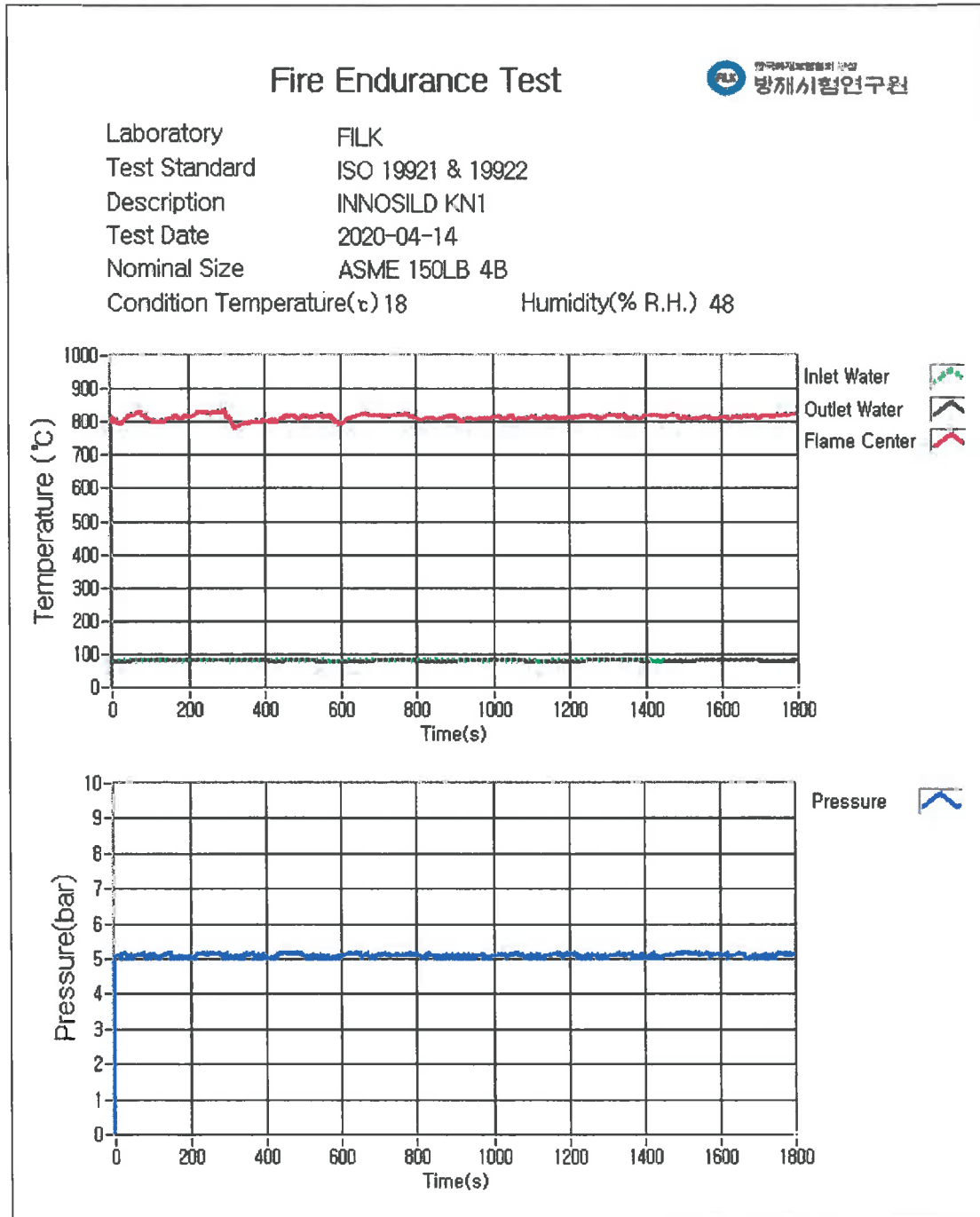
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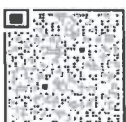




APPENDIX 2. GRAPH OF THE FIRE ENDURANCE TEST



[Figure 2] Graph of the fire endurance test

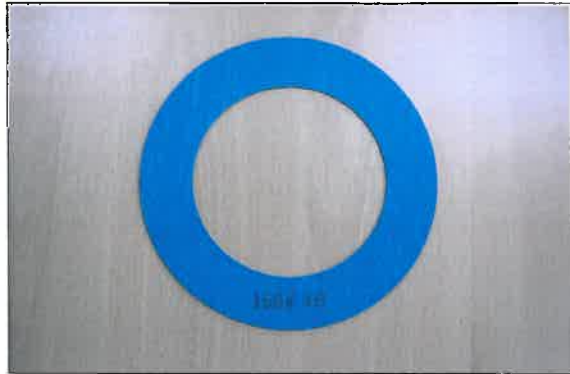




APPENDIX 3. PHOTOGRAPH OF THE TEST SPECIMEN



[Photo 1] Front of test specimen



[Photo 2] Lear of test specimen

APPENDIX 4. PHOTOGRAPH OF THE TEST



[Photo 3] Fire endurance test



[Photo 4] Hydrostatic tightness test

The end of the report.

