



Test Report

Customer: Ferolite Jointings Ltd.
C-178, Site No. 1, B.S.Road Industrial Area
201001 GHAZIABAD
India

Project number (amtec): 303 199
Report number: 303 199 1/-

Test procedure: Fire Test API 6FB

Material: flat gasket – NAM 42GF

Date: July 25th, 2016

Pages: 4

Appendices: 6

Handwritten signature of B. Eng. C. Six in black ink.

B. Eng. C. Six
Test Engineer

Handwritten signature of Dipl. - Ing. F. Herkert in black ink.

Dipl. – Ing. F. Herkert
Head of Laboratory

Test results are only relevant to the test objects submitted.

1. Subject of Investigation

The subject of investigation was a flat gasket manufactured by Ferolite Jointings Ltd. which is named

- NAM 42GF.

The flat gasket is made of fibre material.

2. Goal of Investigation

The goal of the investigation was the qualification of the gasket material NAM 42GF in accordance to the API Specification 6FB (dated December 2008): API Specification for Fire Test for End Connections.

The API Specification 6FB describes the testing procedure and evaluation of the performance of API end connections when exposed to fire.

Fire Test according to API 6FB is not part of the accreditation.

3. Test Specimen

The dimensions of the test specimen was: 6" Class 300

Geometry of the gasket: 251.2 mm x 169.6 mm x 1.4 mm

4. Testing Equipment

The gasket test was carried out on the following testing equipment:

Fire test: Fire Safe Testing device

A photo and the schematic view of the testing equipment are shown in **appendices 1 and 2**.

The fire safe testing device is used to cease a fire for a period of 30 minutes.

Depending on the type of test, different flanges and valves can be tested.

The water pressure is measured by a pressure transducer; the water volume is measured with a scale. The temperature of the fire is measured with 6 different thermocouples and with 5 calorimeters which are shared around the flange or valve. The control of the fire is done manually. Software is used for data logging and online evaluation.

5. Test Procedure

The Fire Test according to API 6FB (dated December 2008) requires that any sealing end connection hold for 30 minutes in a flame condition and hold for a cool down period. After the assembly is cooled down to room temperature the line is depressurized and then re-pressurized. During all facets of the test the gasket must not exceed an API proscribed leak rate.

In the fire test a 6" Class 300 flange is pressurized with a test pressure of 75% of the API rated working pressure. The test pressure is maintained during the burn and cool-down period. After 5 minutes a fire is established and the flame temperature is monitored. The average of the thermocouples must reach 760 °C within 2 minutes and the average of the calorimeter shall reach 650 °C within 15 minutes. The burn period shall last for 30 minutes. After the burn period the connection is air-cooled down to 100 °C or less. After cooling down the flange is depressurized and the pressure is increased again to the test pressure and held for 5 minutes.

The maximum leak rate is 1 ml/inch/min of mean gasket circumference.

6. Results

In the fire test API 6FB the flat gasket NAM 42GF was mounted in a 6" Class 300 flange with hydraulic spanners to a bolt load of 161.0 kN which means a total load of 1931.4 kN and a gasket surface stress of 140.8 MPa.

After that the flange was pressurized with an internal pressure of 40 bar. The test medium was water. After 5 minutes flame impingement starts for a period of 30 minutes, see **appendices 3 to 5**. During burning period the flame temperature was nearly constant. After 30 minutes of burning the flange was cooled down to a temperature less than 100 °C and the system was depressurized and the pressure was increased to 40 bar again.

During burning period a leak rate of 0.01 ml/inch/min could be measured and during complete pressurization with water a leak rate of 0.32 ml/inch/min was measured.

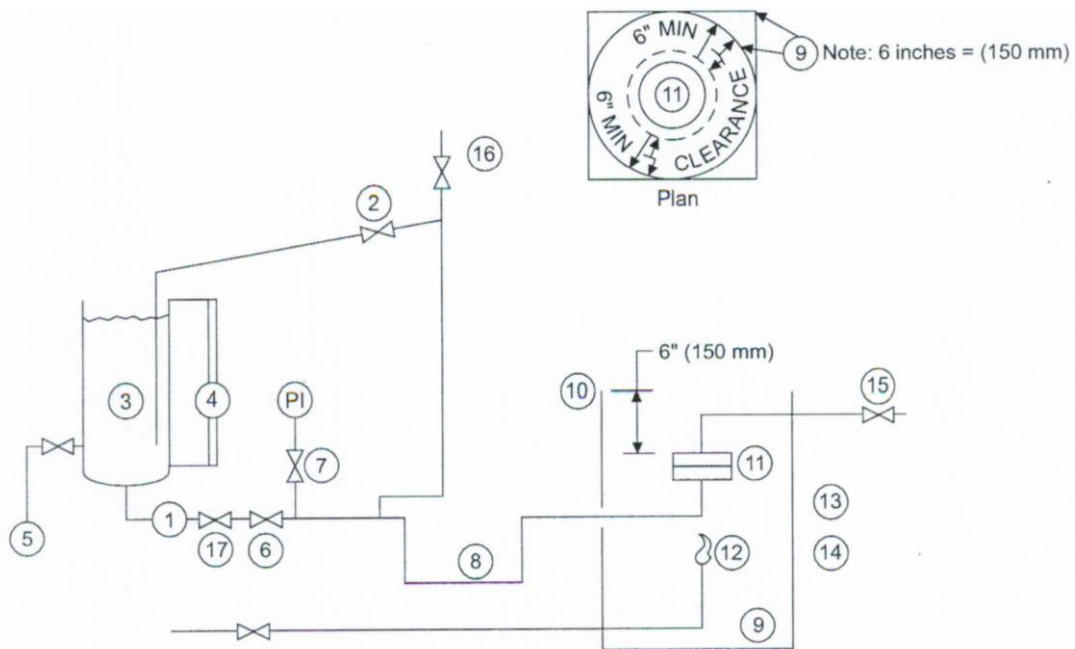
Therefore the leak rate is below the allowable leak rate of 1 ml/inch/min and the flat gasket NAM 42GF passed the fire test according to API 6FB.

7. Photo documentation

In **appendix 6** a photo of the tested gasket specimen NAM 42GF after the fire test is presented.



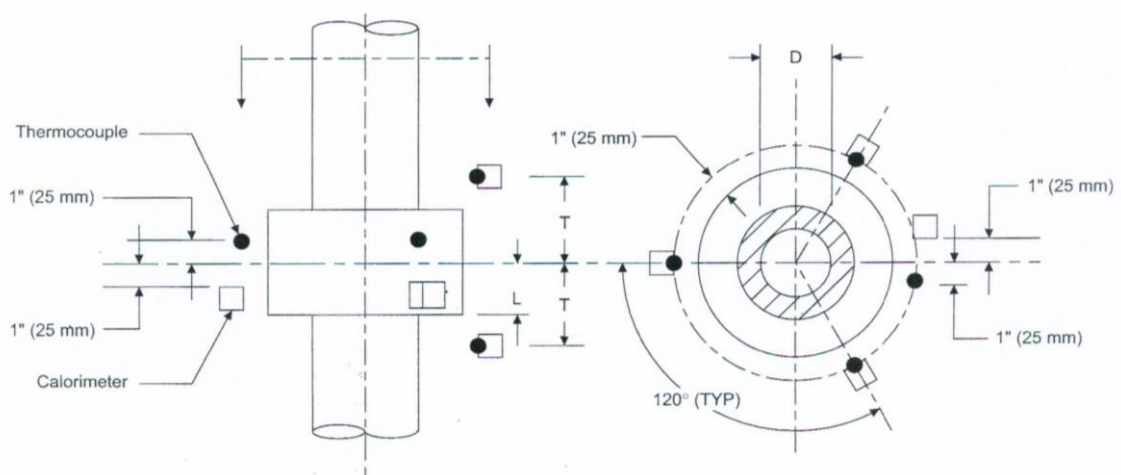
Fire Safe Testing Device



Legend

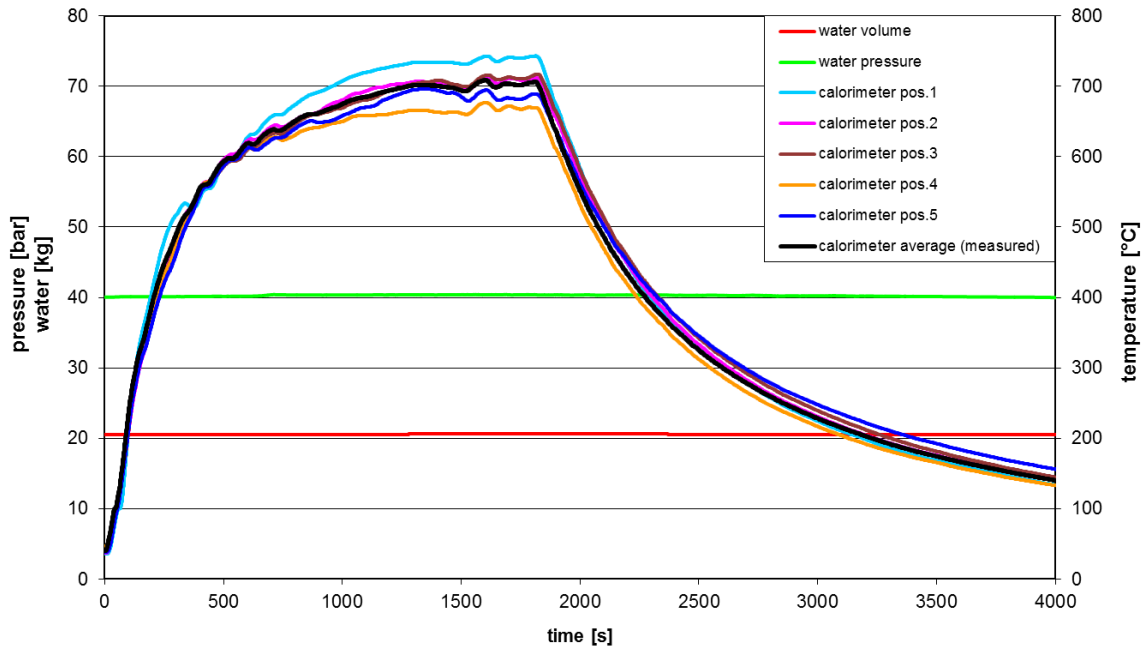
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|---|---|
| 1. Pressure source | 10. Minimum height of enclosure shall be 6 inches above the top |
| 2. Pressure regulator and relief | 11. Test connection mounted horizontally |
| 3. Vessel for water | 12. Fuel gas supply |
| 4. Calibrated sight gauge | 13. Calorimeter cubes |
| 5. Water supply | 14. Flame temperature thermocouple |
| 6. Shutoff valve | 15. Shutoff valve |
| 7. Pressure gauge | 16. Vent valve |
| 8. Piping arranged to provide vapour trap | 17. Check valve |

Schematic System for Fire Testing of End Connections



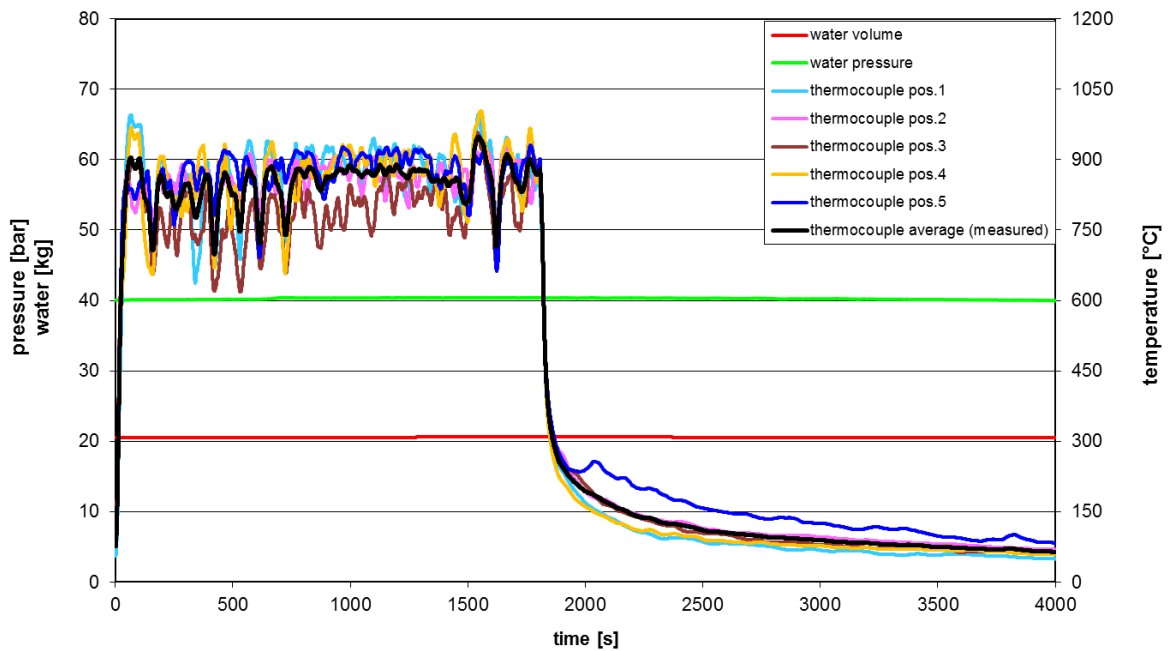
Location of Thermocouples and Calorimeters – Onshore Condition

Course of Test - Fire Safe Test
 Ferolite NAM 42GF 20.07.2016 -app. 140.8 MPa
 16-496



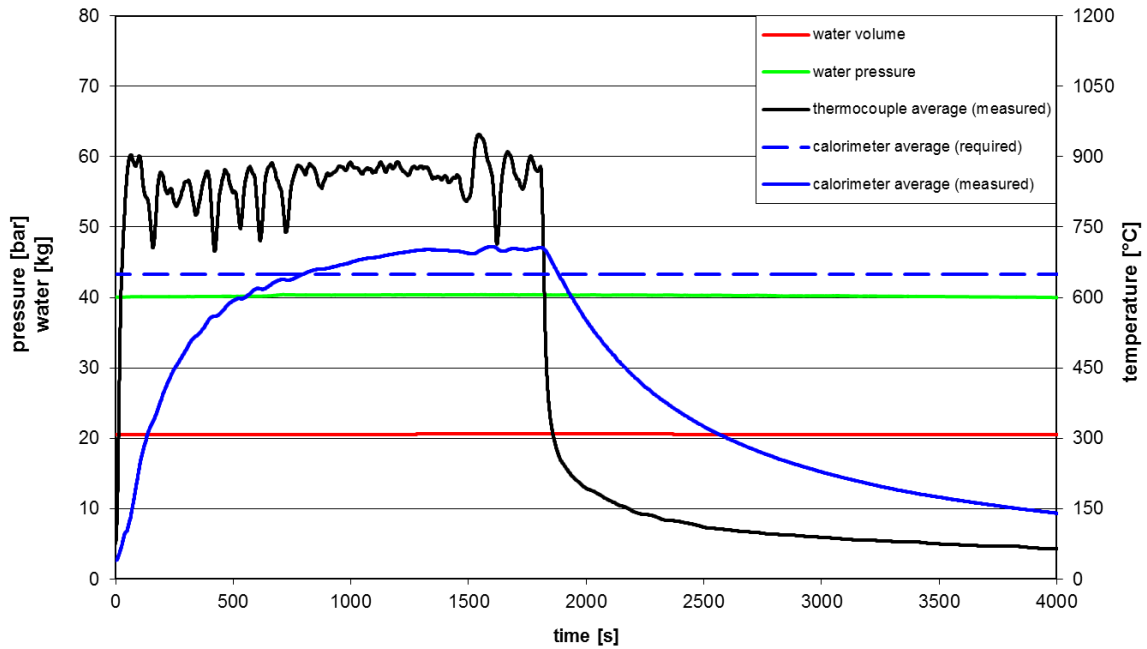
Fire Test API 6FB - calorimeters

Course of Test - Fire Safe Test
 Ferolite NAM 42GF 20.07.2016 -app. 140.8 MPa
 16-496



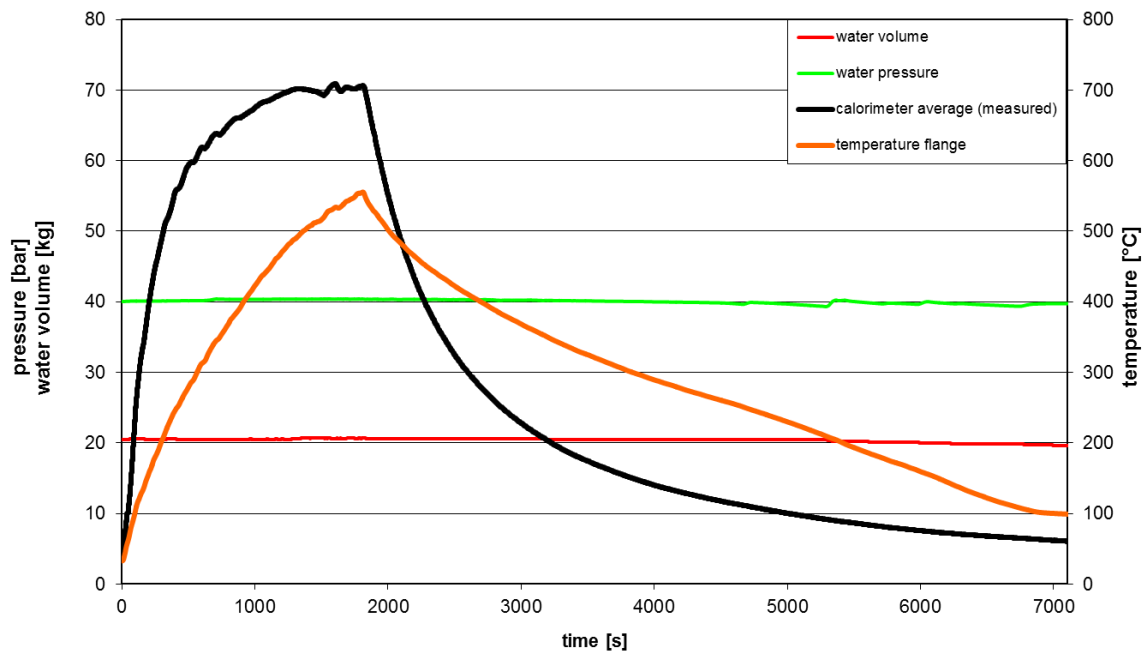
Fire Test API 6FB – thermocouples

Course of Test - Fire Safe Test
 Ferolite NAM 42GF 20.07.2016 -app. 140.8 MPa
 16-496



Fire Test API 6FB

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Fire Test API 6FB - medium

Ferolite Jointings Ltd. – NAM 42GF 303199**geometries**

bolts	12	-
OD gasket	251.2	mm
ID gasket	169.6	mm
mean gasket circumference contact area	604.1	mm
gasket area	26968.4	mm ²
gasket contact area	13713.7	mm ²
OD raised faces flange (6" Class 300)	215	mm
leak rate criteria	1	ml / inch / min
burning period	30	min
maximum allowable leakage during burning period	713.54	ml

calculation of gasket stress

hydraulic spanners - No.	GS 3/1	-
calibration factor	0.19	kN/bar
pressure	870	bar
force per bolt	160.95	kN
force total	1931.40	kN
gasket stress	140.84	MPa

calculation of leak rate of complete test

start value scale	20.56	kg
end value scale	19.66	kg
start test	10:59:18	
end test	12:55:52	
test duration (min)	116.56	min
leakage	899.80	ml
leak rate	0.32	ml / inch / min

calculation of leak rate of burning period

start value scale	20.56	kg
end value scale	20.55	kg
start test	10:59:18	
end test	11:29:18	
test duration (min)	30	min
leakage	9.60	ml
leak rate	0.01	ml / inch / min



Fire test according to API 6FB (16-496)