

Four Tower Bridge  
200 Barr Harbor Drive  
West Conshohocken, PA 19428  
E-mail: info@amtec-services.com  
Internet: www.amtec-services.com



## Test Report

Customer: Flexitallic L.P.  
6915 Highway 225,  
Deer Park, TX 77536

Project number (amtec): A300 117  
Report number: A300 117 4/-

Test procedure: Fire test API 6FB

Material: Spiral Wound Gasket

Date: 25.07.2014  
Pages: 4  
Appendices: 6

Dipl.-Ing. F. Herkert

**Test results are only relevant to the test objects submitted.**

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## 1. Subject of Investigation

The subject of investigation was a spiral wound gasket manufactured by Flexitallic L.P. which is named

- Spiral Wound Gasket.

The Spiral Wound Gasket, Style CGI, has an inner and outer ring according to ASME B16.20. The material of the outer ring, the inner ring and the metal strip is 316L for all geometries. Flexible graphite (FG-SEL) is the filler material.

## 2. Goal of Investigation

The goal of the investigation was the qualification of the gasket material Spiral Wound Gasket 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 API 6FB is not part of the accreditation.

## 3. Test Specimens

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

Geometry of the gasket:

6" Class 300: 208.1 mm x 182.9 mm x 4.5 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 Spiral Wound Gasket was mounted in a 6" Class 300 flange with hydraulic spanners to a bolt load of 68.5 kN which means a total load of 821 kN and a gasket surface stress of 106 MPa.

After that the flange was pressurized with an internal pressure of 41 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. The system was pressurized with 41 bar during burning and cool-down period.

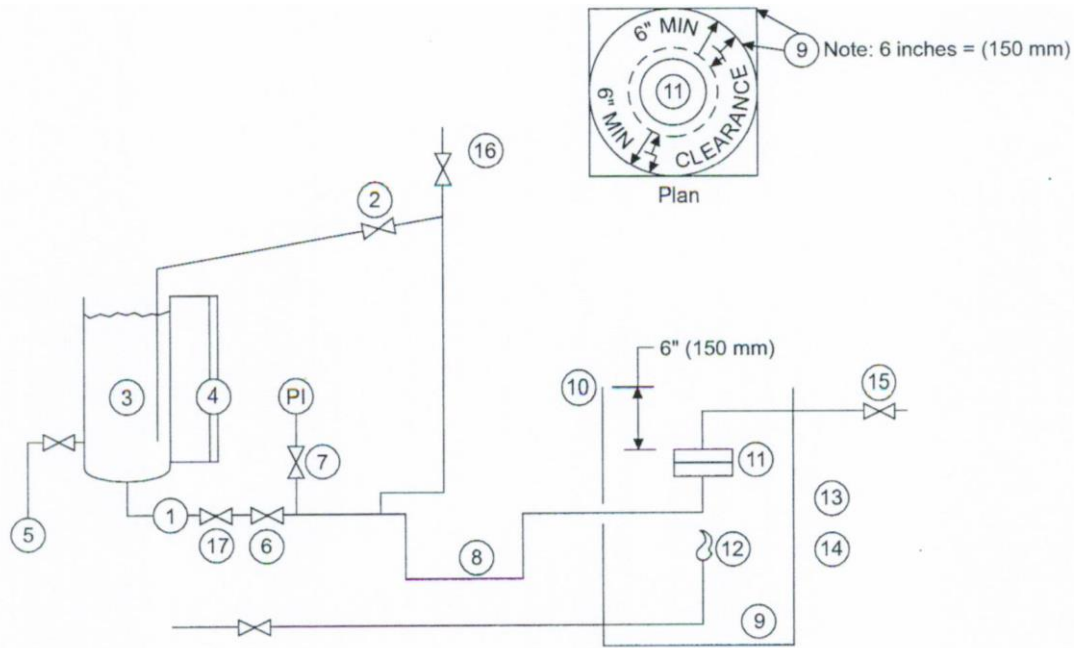
During the complete pressurization with water no significant leakage was measurable. The leak rate is below the allowable leak rate of 1 ml/inch/min and the Spiral Wound Gasket passed the fire test according to API 6FB.

## 7. Photo documentation

In **appendix 6** photos of the tested gasket specimen Spiral Wound Gasket for the fire test are presented.



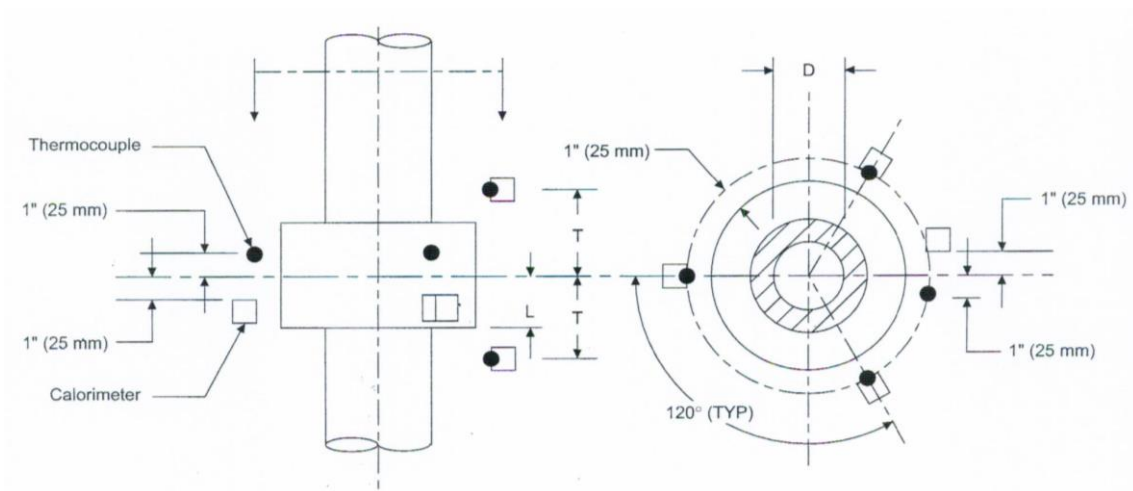
**Fire Safe Testing Device**



**Legend**

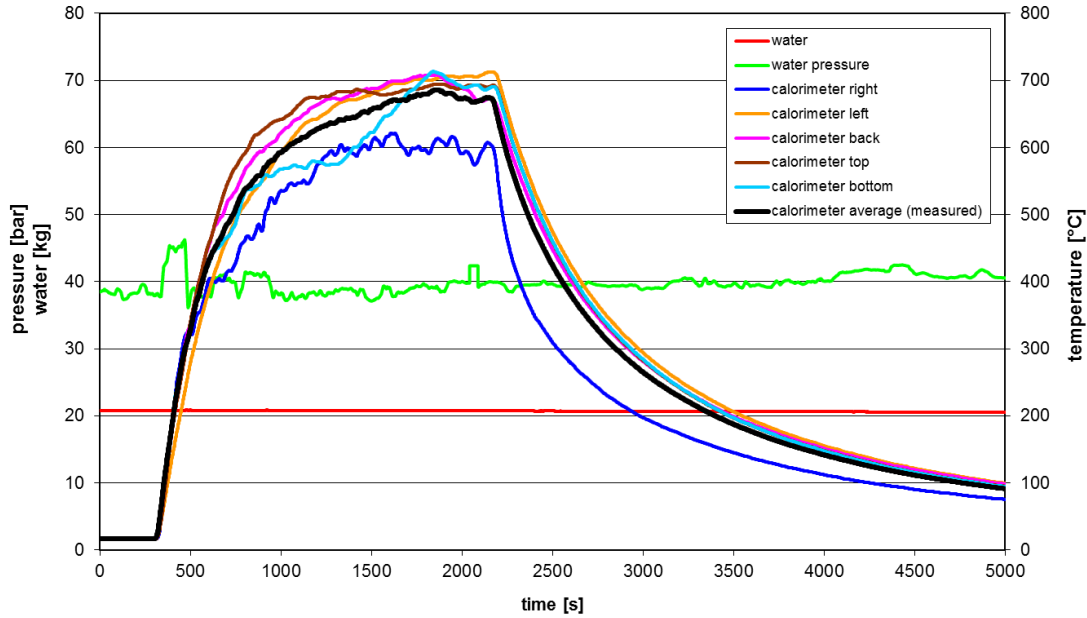
- |   |   |
|---|---|
| 1. Pressure source                        | 10. Minimum height of enclosure shall be 6 inches above the top |
| 2. Pressure regulator and relief          | 11. Test connection mounted horizontally                        |
| 3. Vessel for water                       | 12. Fuel 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**

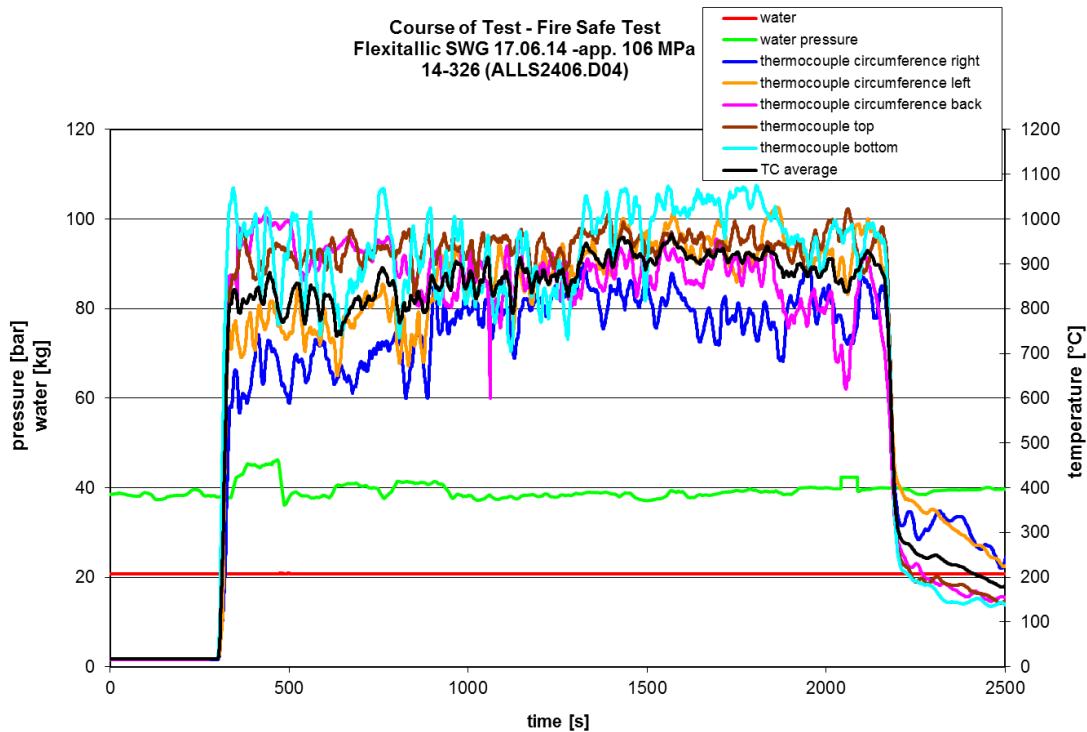


**Location of Thermocouples and Calorimeters – Onshore Condition**

Course of Test - Fire Safe Test  
Flexitallic SWG 17.06.14 -app. 106 MPa  
14-326 (ALLS2406.D04)

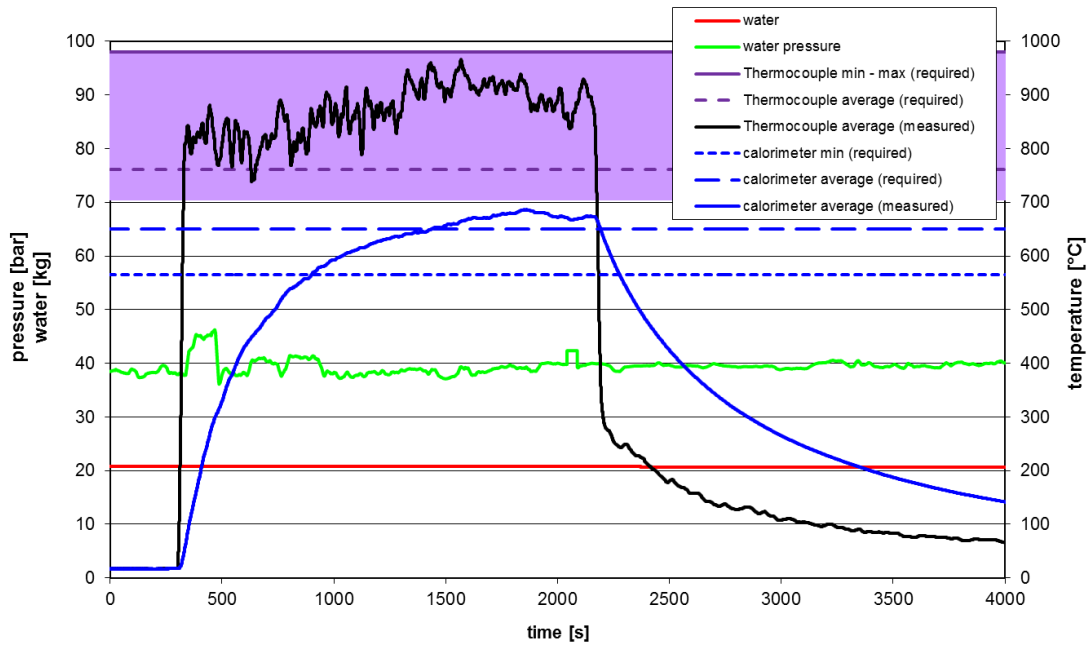


### 3.3.3 Fire test API 6FB - calorimeters



### 3.3.3 Fire test API 6FB – thermocouples

Course of Test - Fire Safe Test  
Flexitallic SWG 17.06.14 -app. 106 MPa  
14-326 (ALLS2406.D04)



### 3.3.3 Fire test API 6FB



## Flexitallic SWG

## A300117

### geometries

bolts	12	-
OD gasket	208.1	mm
ID gasket	182.9	mm
mean gasket circumference	614.2	mm
mean gasket circumference (contact area)	614.2	mm
mean gasket circumference (contact area)	24.18	inch
gasket area	7751.0	mm <sup>2</sup>
gasket contact area	7751.0	mm <sup>2</sup>
OD raised faces flange (6" Class 300)	215	mm

leak rate criteria	1	ml / inch / min
burning period	30	min
<b>maximum allowable leakage during burning period</b>	<b>725.41</b>	<b>ml</b>

### Results

#### calculation of gasket stress

Hydraulic spanners - No.	GS 3/1	-
calibration factor	0.185	kN/bar
pressure	370	bar
force per bolt	68.45	kN
force total	821.4	kN
<b>gasket stress (contact area)</b>	<b>105.97</b>	<b>MPa</b>

#### calculation of leak rate of complete test

start value scale	20.78	kg
end value scale	19.79	kg
leakage (absolute)	990.3	ml
Start test	09:21:18	
End test	12:22:58	
test duration (deci)	0.126157407	
test duration (min)	181.7	min
<b>leak rate</b>	<b>0.23</b>	<b>ml / inch / min</b>

#### calculation of leak rate of burning period

start value scale	20.78	kg
end value scale	20.76	kg
leakage (absolute)	20	ml
Start test	09:21:18	
End test	09:52:23	
test duration (deci)	0.021585648	
test duration (min)	31.1	min
<b>leak rate</b>	<b>0.03</b>	<b>ml / inch / min</b>



**Fire test according to API 6FB (MESC SPE 85/300 - 3.3.3) – 14-326**



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