

Paris, November 10th 2015



Corporate Technology Group

FMI Spa

Via XX Settembre 4
25030 ZOCCO DI ERBUSCO (BS)
ITALY

To the attention of the Quality Control Manager

Subject : Technical approval for flat gasket (MULTIFLEX HPT)

Files n° **J4634**

Dear Sir?

Bearing in mind:

- the domain n° **2082-01-02: Graphite flat gasket**
- the Lacq test report dated June 17, 2013 (60 bar)
- the MUNSTER University test report n° 13101501-1 dated September 23, 2013
- the specification GS GR PVA 202 Rev.00 with following tightness criteria (see attached appendix)

The TOTAL Corporate Technology Group hereby informs you that your gasket **MULTIFLEX HPT** manufactured at **ZOCCO DI ERBUSCO (Italy)** has been granted the "Corporate Technology Group Technical Homologation" for a period of 6 years and only for this site.

This technical approval is valid for a maximum service temperature of **550°C**.

Homologation only valid for our activities in :

Exploration & Production Refining & Chemicals Marketing & Services

Yours faithfully,

General Secretary of the Corporate Technology Group

Annie AUDIBERT-HAYET



TOTAL S.A.
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Monsieur Arnaud ROCH

Comité Technologie Groupe TOTAL

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6.5. Acceptance criteria

a) Flat seals

Seal type	Before ageing	After ageing at temperature of
Fibre-based - Usage limit set at 150°C	$\leq 7 \cdot 10^{-3} \text{ Pa.m}^3.\text{s}^{-1}.\text{m}^{-1}$ under 20 b H _e and 35 MPa	250°C $\leq 1 \cdot 10^{-2} \text{ Pa.m}^3.\text{s}^{-1}.\text{m}^{-1}$ under 10 b H _e and 35 MPa
Reinforced graphite	$\leq 5 \cdot 10^{-3} \text{ Pa.m}^3.\text{s}^{-1}.\text{m}^{-1}$ under 20 b H _e and 55 MPa	400°C $\leq 1 \cdot 10^{-2} \text{ Pa.m}^3.\text{s}^{-1}.\text{m}^{-1}$ under 10 b H _e and 55 MPa
PTFE-based – Usage limit set at 200°C	$\leq 2 \cdot 10^{-4} \text{ Pa.m}^3.\text{s}^{-1}.\text{m}^{-1}$ under 20 b H _e and 35 MPa	225°C $\leq 3 \cdot 10^{-5} \text{ Pa.m}^3.\text{s}^{-1}.\text{m}^{-1}$ under 10 b H _e and 35 MPa
PTFE-based – Usage limit set at 150°C	$\leq 2 \cdot 10^{-4} \text{ Pa.m}^3.\text{s}^{-1}.\text{m}^{-1}$ under 20 b H _e and 35 MPa	180°C $\leq 3 \cdot 10^{-6} \text{ Pa.m}^3.\text{s}^{-1}.\text{m}^{-1}$ under 10 b H _e and 35 MPa
Mica or Vermiculite base	$\leq 5 \cdot 10^{-4} \text{ Pa.m}^3.\text{s}^{-1}.\text{m}^{-1}$ under 5b H _e and 55 MPa	400°C $< 4 \cdot 10^{-3} \text{ Pa.m}^3.\text{s}^{-1}.\text{m}^{-1}$ under 5b H _e and 55 MPa

b) Standard spiral-wound seals

Seal type	Before ageing	After ageing at temperature of
Graphite packing	$\leq 7 \cdot 10^{-5} \text{ Pa.m}^3.\text{s}^{-1}.\text{m}^{-1}$ under 50b H _e and 80 MPa	400°C $\leq 2 \cdot 10^{-4} \text{ Pa.m}^3.\text{s}^{-1}.\text{m}^{-1}$ under 35b H _e and 80 MPa
PTFE packing	$\leq 4 \cdot 10^{-6} \text{ Pa.m}^3.\text{s}^{-1}.\text{m}^{-1}$ under 50b H _e and 70 MPa	200°C $\leq 6 \cdot 10^{-4} \text{ Pa.m}^3.\text{s}^{-1}.\text{m}^{-1}$ under 40b H _e and 70 MPa

c) Seat low pressure spiral-wound seals

Seal type	Before ageing	After ageing at temperature of
Graphite packing	$\leq 3 \cdot 10^{-3} \text{ Pa.m}^3.\text{s}^{-1}.\text{m}^{-1}$ under 20 b H _e and 35 MPa	300°C $\leq 3 \cdot 10^{-4} \text{ Pa.m}^3.\text{s}^{-1}.\text{m}^{-1}$ under 10 b H _e and 35 MPa
PTFE packing	$\leq 8 \cdot 10^{-4} \text{ Pa.m}^3.\text{s}^{-1}.\text{m}^{-1}$ under 20 b H _e and 35 MPa	200°C $\leq 2 \cdot 10^{-4} \text{ Pa.m}^3.\text{s}^{-1}.\text{m}^{-1}$ under 10 b H _e and 35 MPa

Note: the leak is related to the meter of circumference corresponding to the average diameter of the active part of the seal.

