



**BUREAU
VERITAS**

**CERTIFICATE OF TYPE APPROVAL
E&P/12188I-C-2016-001 Rev.01**

This is to confirm that the general certification procedure described in *Appendix E* has been satisfactorily applied, with respect to conformity of NOV Flexibles non-bonded flexible pipe design, qualification and manufacturing procedures versus API 17J specification 4th ed. (2014), and results successfully evaluated for:

Name of Manufacturer: **National Oilwell Varco Denmark I/S – NOV Flexibles**

Manufacturing Units: **NOV Flexibles – Kalundborg, Denmark
NOV Flexibles – Açú, Brazil**

The range of certification for each Manufacturing Unit capacities is listed on *Appendix A* below.

The validated ranges are based on testing of relevant flexible pipe samples addressing different failure modes (refer to *Appendix B*).

In the process,

- Design rules for flexible pipes and end-fittings have been ascertained (see *Appendix B*),
- The main flexible pipes behaviour prediction and failure modes prediction methodologies, as well as NOV Flexibles in-house software (see *Appendix C*), have been confirmed as being validated through correlation with small and/or full scale tests,
- Raw materials qualification has been confirmed (see *Appendix D*) and methodologies for material selection evaluated (see *Appendix B* and *Appendix C*),
- Fabrication, Repair and Control procedures have been regularly re-assessed, for ability to implement design parameters and maintain Quality with good continuity, (see R1509),
- QA / QC system has been confirmed as independently certified to ISO 9001: 2008.

In particular, NOV Flexibles design and manufacturing procedures have been scrutinized for conformity versus API Specification 17J, 2014.

The results of this evaluation being satisfactory, within the limitations in the Technical Report n°E&P12188I-R-2016-01 / R1509, the present certificate is valid until October 13th, 2020, within the scope of the BUREAU VERITAS General Conditions of Service. In case of any change in the design, manufacturing procedures of the above referenced items, the present Certificate would de facto lose its validity.

This document and its appendices form the entire Certificate.

To whom it may concern,

Neuilly-sur-Seine, December 15th 2016,

For and on behalf of BUREAU VERITAS

**L. MERILLON / A. DAVID
F. MIGEON / T. BREHERET**
Project Engineers



L. VERNEY
SURF & Jacket – Unit Manager

This certificate is delivered within the scope of the BUREAU VERITAS General Conditions of Service.



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Appendix A

**NOV FLEXIBLES
MANUFACTURING UNIT CAPACITIES**

NOV Flexibles Manufacturing Unit Location	Kalundborg, Denmark	Açu, Brazil¹
Product	Non-Bonded Flexible Pipelines Family I: Smooth Bore Pipes with Steel Strips or C-Profile Pressure Wires Family III: Rough Bore Pipes with Steel Strips or C-Profile Pressure Wires	Non-Bonded Flexible Pipelines Family III: Rough Bore Pipes with Steel Strips or C-Profile Pressure Wires
Range of Diameter	Up to 16in ID	4in to 8in ID
Design Pressure	Up to 552 bar (8000 psi)	Up to 345 bar (5000 psi)
Design Temperature	From -50°C to 130 °C depending on steel and plastic materials used.	
Application	Static and Dynamic Flexible Pipelines (Flowlines, Risers & Jumpers) in sweet or sour service.	
Applicable	API Specification 17J, 4 th Edition	API Specification 17J, 3 rd Edition

(1) – Reference is made to BV report R1447, “Incorporation of NOV Açu Plant into NOV Flexibles type approval”.

