DNV·GL

TYPE APPROVAL CERTIFICATE

Certificate No:
TAP0000143

This is to certify:

That the Pipeline Clamps

with type designation(s)
Clamp

Issued to
Saipem S.p.A.
Marghera, Italy

is found to comply with
DNV-RP-F113 Pipeline Subsea Repair
DNV-OS-F101 Submarine Pipeline Systems
DNV-RP-B401 Cathodic Protection Design

Application :

Intended for diverless installation on submarine pipelines to prevent leaks and/or pipeline defects development.

Issued at **Høvik** on **11th Oct. 2017**

for **DNV GL**

This Certificate is valid until **2022-03-14**.
DNV GL local station: **Milan**

Approval Engineer: **Dag Øyvind Askheim**

Afzal Hussain
Head of Section

This Certificate is subject to terms and conditions overleaf. Any significant change in design or construction may render this Certificate invalid.
The validity date relates to the Type Approval Certificate and not to the approval of equipment/systems installed.

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Job Id: **262.1-014579-3**
Certificate No: **TAP0000143**
Revision No:

Product description

SiRCoS Pipeline Repair Clamps are intended for diverless installation on submarine pipelines to prevent leaks and/or pipeline defects development. A detailed description is given in the:
Sonsub document: no 400246-REL-EQ00-T255 Rev. 2 dated 2008.02.28

Application/Limitation

The clamp limits are given/ depends on the following parameters as follows:

- The pipeline diameters from outer diameter of 450 mm (18") to 1200 mm (48")
- The structural strength utilisation is limited by the allowable material stresses as caused by pressure and bolts pretension.
- The limits for the sealing system using HNBR material gaskets to prevent pipeline leaks are governed by the following parameters.
  - The maximum pipeline fluid temperature limit of 60° C;
  - Pipeline pressure;
  - External pressure caused by the water depth;
  - The pipeline wall thickness;
  - Pipeline material strength;
  - The extent of circumferential seal precompresion;
  - The magnitude of the test pressures for the seal after installation
- The clamp's reinforcement capacity to reduce risk for pipeline crack and buckle development depends on the pipeline hoop stress reduction and the locking of the pipeline's geometry. This is obtained by grout (cement type) injection into the annular space between the clamp and the pipeline The pipeline's hoop stress reduction is governed by:
  - o The pipeline pressure during grout injection (e.g. reduced pipeline pressure);
  - o The pipeline pressure of most concern for damage development (e.g. operating pressure);
  - o The temperature difference during grout injection and the condition of most concern for damage development (e.g. difference between the sea water temperature obtained after shut down and temperature during operation);
  - o The possible remaining void without grout filling in the annulus between the pipeline and the clamp.

Details for calculation of these effects, calibrated by test results are specified in documents referred to in the Sonsub document: no 400246-REL-EQ00-T255 Rev. 2 dated 2008.02.28.

Type Approval documentation

A list of documents forming the basis for the Type Approval is specified in the
Sonsub document: no 400246-REL-EQ00-T255 Rev. 2 dated 2008.02.28

Tests carried out

The DNV engagement in the certification process of the SiRCoS Green Stream pipeline repair clamp represents the basis for this Type Approval. It started in 2003. DNV specialist personnel from DNV Høvik in cooperation with DNV personnel from DNV Milan have performed this work. It includes following up of its development to the final design method. Material tests, small scale seal tests and full scale tests as well as calibration of numeric analytical models were included. It was focusing in particular on both sealing form a leaking pipeline and pipeline strengthening at varying conditions. The final Green Stream functional tests were completed in Trieste during summer 2007.

The results from numerous tests were used for calibration of the numerical analytical design tools. Thereby the sealing capacity and the strength capacity of the clamp with other dimensions than that for the Green Stream could be predicted. This methodology was verified by DNV for compliance with DNV-RP-F113.

Marking of product

For the traceability to this Type Approval the main parts of the SiRCoS Pipeline Clamp System are to be marked with:

- Manufacturers name and trade mark

- Type designation
- Serial no
- Nominal internal and external pressure
- Maximum and minimum working temperature

Periodical assessment

This Type Approval Certificate covers the design and manufacturing methods of SiRCoS Pipeline Repair Clamp within the limitations specified above.
A DNV Product Certificate for the finished connection systems shall be issued for systems covered by this Type Approval Certificate.
The Product Certificate shall verify both that the design complies with the methods referred to in the Type Approval Certificate and that is has been manufactured according to the specifications referred to. Further it shall be traceable to markings made on the finished product.

END OF CERTIFICATE