Certificate no.:
TAP00002TJ

TYPE APPROVAL CERTIFICATE

This is to certify:

that the Pipeline Repair Connector

with type designation(s)
Saipem Grip & Metal Seal Connector (GMSC) for sour and corrosive service and environment

issued to
Saipem S.p.A.
Marghera, **Italy**

is found to comply with
DNV standard DNV-ST-F101 – Submarine pipeline systems
DNV recommended practice DNV-RP-F113 – Pipeline subsea repair
2021 ASME Boiler and Pressure Vessel Code VIII Div. 2 Rules for Construction of Pressure Vessels
DNV recommended practice DNV-RP-B401 – Cathodic protection design

Application:

For use as pipeline repair connector for Corrosion Resistand Alloy (CRA) clad- or lined submarine pipelines.
Used for replacement of damaged sections of Corrosion Resistance Alloy (CRA) clad- or lined subsea pipelines, 20" to 38", up to 360 bar design pressure, water depth up to 2000 m.
Conditions and limitations are given below and in referenced documents.
Design to follow approved design documentation and test procedures given in the reference documents.

Issued at **Høvik** on **2023-11-16**
This Certificate is valid until **2028-11-15**.
DNV local unit: **Italy/Malta CMC**

for **DNV**

Approval Engineer: **Dag Øyvind Askheim**

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.

LEGAL DISCLAIMER: Unless otherwise stated in the applicable contract with the holder of this document, or following from mandatory law, the liability of DNV AS, its parent companies and their subsidiaries as well as their officers, directors and employees ("DNV") arising from or in connection with the services rendered for the purpose of the issuance of this document or reliance thereon, whether in contract or in tort (including negligence), shall be limited to direct losses and under any circumstance be limited to 300,000 USD.

Product description

The Saipem Grip & Metal Seal Connector (GMSC) is a subsea pipeline repair connector, remote or diver installed, for sour service and corrosive environment on CRA clad or lined pipelines, as further detailed in [1].

Application/Limitation

This Type Approval Certificate (TAC) testifies that the methodology of the presented design documentation meets the requirements given in the specified codes and DNV's engineering judgement. This includes an assessment of possible failure modes, analyses and procedures which reduce the risk of these failures to occur [2].

The Saipem Grip and Metal Seal Connector:

- is used for replacement of damaged sections of Corrosion Resistance Alloy (CRA) clad- or lined subsea pipelines, 20" to 38", up to 360 bar design pressure, water depth up to 2000m.
- can be installed and seal on CRA clad or lined pipelines, able to restore full structural integrity of the pipeline. For application on lined pipelines, acceptable shear resistance between clad layer towards field joint and the carbon steel base material needs to be documented.
- is designed for sweet and sour service according to ISO 15156-2.
- is able to be subsea back seal tested after installation and features reversible installation.

as further detailed in [1].

Design Standards

The governing design standards for the repair coupling are:

1. DNV-ST-F101 "Submarine Pipeline Systems" - providing general requirements related to design, fabrication, installation, commissioning, and operation for the pipeline system.
2. DNV-RP-F113 "Subsea Pipeline Repair", which is harmonized with the requirements given in DNV-ST-F101, covering local pipe wall utilization from coupling interference loads, functional requirements related to gripping capacity and sealing performance.
3. DNV-SE-0284 "Type Approval Scheme – Oil and Gas, specifying the process, conditions, and requirements for issuing the DNV Type Approval Certificate
4. ISO 15156-2 "Materials for use in H_2S-containing environments in oil and gas production — Parts 1, 2, and 3
5. ASME VIII division 2 "ASME Boiler and Pressure Vessel Code", design standard for pressure vessels and pipeline components

Type Approval documentation

#	DOC.NO / UID	REV	TITLE
[1]	109451-C-R-DG00-0024	04	Type Approval Design basis
[2]	2021-0488	04	DNV Technology Qualification status report
[3]	SQT-2021-0488	-	Statement of Qualified Technology
[4]	109451-C-R-DG00-0025	01	Material selection report
[5]	109451-C-G-DG00-0002	01	Type test program
[6]	109451-D-G-DG00-0094	00	GA Type test rig
[7]	109451-C-R-DG00-0026	02	Sonsub pipeline repair connector – corrosion protection report
[8]	109451-C-R-DG00-0020	01	Sonsub Pipeline Repair Connector Design Basis for 38'' ND Pipeline
[9]	109451-C-P-DG05-0301	01	Type test procedure - Clad pipes
[10]	109451-C-R-DG05-0303	01	Detail Design for 26" TA prototype – Clad pipe
[11]	109451-C-R-DG05-0304	01	Detail Design for 26" TA prototype - Clad pipe - Load Cycles

#	DOC.NO / UID	REV	TITLE
[12]	109451-C-R-DG00-0034	00	Type Approval – Design Report 38” Connector for Clad pipes
[13]	109451-C-R-DG00-0039	01	Sonsub Pipeline Repair Connector - Type Approval –Design Report 38” Connector for Clad Pipes – Cyclic loads analysis
[14]	109451-C-R-DG00-0040	01	Sonsub Pipeline Repair Connector - Type Approval –Design Report 20” Connector for Clad Pipes – Cyclic loads analysis
[15]	109451-C-R-DG00-0036	02	Design Basis for 20’’ ND Clad Pipeline
[16]	109451-C-R-DG00-0038	01	Design Report for 20’’ ND Clad Pipeline
[17]	109451-C-R-DG05-0306	01	Type Approval Tests - Clad Pipe Tests Report
[18]	DNV-RP-B401	-	Cathodic Protection Design

Documentation

Documentation for each Grip & Metal Seal Connector size that shall be available at the manufacturer:

- Design premises;
- Description;
- Assembly drawing with parts list;
- Calculations;
- Machine drawings;
- Materials specifications;
- Pipeline exposure from the connector interference loads;
- Inspection and test plan;
- Test reports containing compliance with test procedures.

Conditions

1. The use Saipem Grip & Metal Seal Connector in riser- and topside piping is not covered by this Type Approval Certificate (TAC).
2. The seals shall be replaced by new ones (or re-machined and refurbished metal seals) each time the connectors are activated / de-activated and disassembled.
3. Each connector shall be subjected to hydrostatic pressure test prior to operation (i.e., strength test). The test pressure shall be specified by the relevant design code.
4. Seal test pressure, as defined in the design manual, is to be applied via external ports to the cavity between the test- and the primary sealing elements. Typically, the back-seal test pressure is 1.1 times the local incidental pressure of the pipeline.
5. Extension of the Saipem Grip & Metal Seal Connector design envelope (e.g., pressure, temperature) can be done on a case-by-case basis. Upon successful completion of a case specific study or project, this TAC will be updated accordingly.

This Type Approval covers the design methodology only. Activities related to manufacturing/ fabrication are not covered by this certificate but can be covered by DNV product certification. A DNV Product Certificate can be based on this Type Approval, provided that DNV has been involved in the manufacturing activities as detailed in DNV-SE-0499 “Certification of Pipeline Components” with the requirements as specified in either DNV-ST-F101 “Submarine Pipeline Systems” or DNV-RP-0034 “Steel forgings for subsea applications - technical requirements”.

Tests carried out

The functional performance of the Saipem Grip and Metal Seal Connector are documented through the technology qualification process according to DNV-RP-A203 and the qualification tests, reported in [2].

The following tests on a 26” clad test pipe (OD 668.4mm, WT 38.8mm including Inconel 625 CRA thickness 3mm) are performed for DNV to issue a Type Approval certificate for the connector for the size range 20” – 38”:

Type test program

- Hydrostatic test (FAT)
- Back seal test @ 1.1 x connector design pressure
- Maximum external tensile load
- Maximum external bending load
- Maximum external torsional load
- Operating conditions (shallow/deep water), w/ combined loads
- Dewatering condition @ maximum water depth
- Operating conditions with connector reduced energization.

Marking of product

For traceability to this type approval, the final products are to be marked with:

- Manufacturer's name and trademark
- Type designation
- Serial/ Part No.
- Nominal internal and external pressure
- Maximum and minimum working temperature

Periodical assessment

The scope of the Periodical assessment is to verify that the conditions stipulated for the Type Approval is complied with and that no alterations are made to the product design or choice of materials.

Periodical assessments (for Certificate Retention / Certificate Renewal) shall be performed according to DNV-SE-0284.

This certificate is only valid if required periodical assessments are carried out with satisfactory results. To check the validity of this certificate, please look it up in https://approvalfinder.dnv.com

Product Certificate

Each Grip and Metal Seal Connector produced shall be subject to DNV witness during manufacturing and FAT according to DNV-SE-0499, as well as check of the actual documentation corresponding to the type approved documentation as listed above. This forms the basis for the 'Product Certificate' issued by DNV, including stamping of the product.

Revision Record

- First issue dated 2023.11.16

END OF CERTIFICATE