

TYPE APPROVAL CERTIFICATE

This is to certify:**That the Marine Riser Equipment**

with type designation(s)

Diverter II-1 FlexJoint & Diverter II-2 FlexJoint

Issued to

**Oil States Industries Inc.
ARLINGTON TX, United States**

is found to comply with

DNVGL-OS-E101 – Drilling plant, Edition July 2015**DNVGL-SI-0166 – Verification for compliance with Norwegian shelf regulations, Edition July 2015****Application :****See Page 2****** TAD00000DF replaces D-4466**This Certificate is valid until **2021-06-14**.Issued at **Houston** on **2016-06-15**for **DNV GL**DNV GL local station: **Houston - Systems & Components**Approval Engineer: **Mark Miser**

Brandon D. Caraway
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.

Product description

A Marine Drilling Riser FlexJoint is a steel and elastomer assembly having a central through-passage equal to or greater in diameter than the riser bore that may be positioned in the riser string to allow greater angular deflection which reduces local bending stress in the riser string.

Referenced Standards

- API 16F, "Specification for Marine Drilling Riser Equipment", 1st Edition

Application/Limitation

<u>Design Parameter</u>	<u>Value</u>	<u>(Equivalent)</u>
• Rated Axial Tensile Load (Diverter II-1)	: 0.5 x 10 ⁶ lb _f	(2,224.1 kN)
• Rated Axial Tensile Load (Diverter II-2)	: 1.0 x 10 ⁶ lb _f	(4,448.2 kN)
• Rated Axial Compressive Load	: 20,000 lb _f	(89.0 kN)
• Rated Working Pressure	: 500 psi	(34.5 bar)
• Hydrostatic Test Pressure	: 750 psi	(51.7 bar)
• Minimum Design Temperature	: -4°F	(-20 °C)
• Maximum Design Temperature	: 446 °F for 7 days : 77 °F for 300 years	(230 °C for 7 days) (25 °C for 300 years)
• Combined Loading Condition #1	: 500 psi pressure : 10,000 ± 30,000 lb _f tension : ± 15° Conical rotation	(34.5 bar) (44.5 kN ± 133.4 kN) (± 15° Conical rotation)
• Combined Loading Condition #2	: 0 psi pressure : 0.5 x 10 ⁶ lb _f tension (Diverter II-1) : 1.0 x 10 ⁶ lb _f tension (Diverter II-2) : ± 15° Conical rotation	(0 bar) (2,224.1 kN) (4,448.2 kN) (± 10° Conical rotation)
• Hydrostatic Test Loading	: 750 psi pressure : 0 lbf tension : ± 0° Conical rotation	(51.7 bar) (0 kN) (0° Conical rotation)
• Maximum Flex Angle	: ± 15° Conical rotation	
• System, Equipment, Service	: Well Control System, Marine Drilling Riser Equipment, Sour (H ₂ S)	

Design Limitation Note: Customer supplied Riser Couplings shall be provided with DNV GL Product Certification and may reduce the indicated design limitations.

Type Approval documentation

Other part numbers or updated revisions may be acceptable under this Certificate provided critical aspects of the design remain the same. Changes shall be documented and approved (via Engineering Change Notice or similar) by the Manufacturer's Engineering and/or Quality department as appropriate. DNV GL's local surveyor shall verify the change before issuance of Product Certificate.

The following drawings are approved:

<u>Drwg. No.</u>	<u>Rev</u>	<u>Title</u>
PD6087	N/C	Diverter II-1 & Diverter II-2 FlexJoint Assemblies
PD2078	F	Primary Molding
PD2075	K	Primary Nipple
PC2089	A	Primary Reinforcements
PD2073	H	Primary Retainer Flange

Job Id: **262.1-022886-1**
Certificate No: **TAD00000DF**

<u>Drwg. No.</u>	<u>Rev</u>	<u>Title</u>
PD2414	C	Secondary Flex Element Assembly
PD2079	B	Secondary Molding
PD2076	J	Secondary Nipple (Male)
PD2077	J	Secondary Nipple (Female)
PD2090	B	Secondary Reinforcements
PD2080	S	Secondary Retainer
PD2074	L	Housing
PD4857	B	Flange
PB2085	C	Retainer Stud
PB2175	G	Retainer Nut
PB2087	A	Primary Nipple O-Ring
PB2174	B	Primary Nipple Backup Ring
PB7649	A	Secondary Nipple O-Ring
PB2086	B	Secondary Nipple O-Ring

Note : Customer supplied Riser Couplings shall be provided with DNV GL Product Certification.

The following calculations are for information:

<u>Title</u>	<u>Rev</u>	<u>Date</u>
SP1E-22-001, Stress Analysis Report for Diverter II-1 and -2 FlexJoints	B	13 May 09

The following material specifications are presented for information:

<u>Spec.</u>	<u>Rev</u>	<u>Material</u>	<u>Min Yield</u>	<u>Req'd. Charpy</u>
SP 1B-00-002 Gr I-V	U	AISI 4130	80,000 psi	31 ft-lb _f at -25°F (-31.7°C)
Reinforcements		ASTM A36	35,000 psi	N/A
Stud PB7379	A	ASTM A 320 Grade L7	105,000 psi	20 ft-lb _f at -150°F
Nut PB8233	A	ASTM A194 Gr. 7	N/A	N.A.

Prototype Testing

For prototype testing as required by API Specification 16F, see DNV GL reports ANMUS476PP002832emay20110823D, ANMUS476PP002832jdun20110608A, ANMUS476PP002832jdun20110615A and ANMUS476PP002832wdd6july2011A

Marking of product

Marking shall:

1. Be reviewed and approved by the DNV GL local surveyor.
2. Identify and differentiate each production unit <i.e. serial number>.
3. Establish traceability to product design and fabrication documentation.
4. Be in accordance with API 16F (Ref. 1st Edition §8.7).



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Comments

None

Periodical assessment

For retention of the Type Approval, DNV GL's surveyor shall perform a survey every second year in accordance with DNV GL Type Approval Scheme DNVGL-CP-0338, October 2015 Edition.

END OF CERTIFICATE