

TYPE APPROVAL CERTIFICATE

This is to certify:

That the Marine Riser Equipment

with type designation(s)
Diverter II-3 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

**** TAD00000DM replaces D-4503**

This Certificate is valid until **2021-06-15**.

Issued at **Houston** on **2016-06-16**

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

- [1] API 16F, 'Specification for Marine Drilling Riser Equipment' 1st Edition
[2] ASME Boiler & Pressure Vessel Code, Section VIII, Division 2, 2010, "Rules for Construction of Pressure Vessels"

Application/Limitation

Design Parameter	Value	(Equivalent)
• Rated Axial Tensile Load	: 2.0×10^6 lb _f	(8,896.4 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 : $10,000 \pm 30,000$ lbf tension : $\pm 15^\circ$ Conical rotation	(34.5 bar) (44.5 kN) ($\pm 15^\circ$ Conical rotation)
• Combined Loading Condition #2	: 0 psi pressure : 2.0×10^6 lbf tension : $\pm 10^\circ$ Conical rotation	(0 bar) (8,896.4 kN) ($\pm 10^\circ$ Conical rotation)
• Hydrostatic Test Loading	: 750 psi pressure : 0 lbf tension : $\pm 0^\circ$ Conical rotation	(51.7 bar) (0 kN) (0° Conical rotation)
• Maximum Flex Angle	: $\pm 15^\circ$ 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:

Drwg. No.	Rev	Title
PD7722	A	Diverter II-3 FlexJoint Assembly
PD3460	C	Primary Molding
PD3458	J	Primary Nipple
PD3457	A	Primary Reinforcements
PD3459	H	Primary Retainer Flange

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<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
PD3464	G	Housing
PB3462	C	Retainer Stud
PB3463	F	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-22-003, Stress Analysis Report for Diverter II-3 FlexJoints	B	2009

The following material specifications are presented for information:

<u>Component</u>	<u>Material</u>	<u>Minimum Yield</u>	<u>Ave. Charpy</u>
All Nipples, Flanges, Retainers & Body Reinforcements	SP1B-00-002 Gr.IV	60,000 psi	31 ft-lb _f at -40°F (-40°C)
Stud	ASTM A36	36,000 psi	N/A
Nut	ASTM A320 Gr.L7	105,000 psi	20 ft-lb _f @ -150°C
	ASTM A194 Gr. 7	N/A	20 ft-lb _f @ -150°C

Prototype Testing

See DNV reports ANMUS476PP002832emay20110823D, ANMUS476PP002832jdun20110608A, ANMUS476PP002832jdun20110615A and ANMUS476PP002832wdd6july2011A for prototype testing as required by API Specification 16F.

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).

Comments

None



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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