DNV·GL

Certificate No:
TAD00000DJ

TYPE APPROVAL CERTIFICATE

This is to certify:

That the Marine Riser Equipment

with type designation(s)
Intermediate-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

**** TAD00000DJ replaces D-4612**

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.

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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

Design Parameter	Value	(Equivalent)
Rated Axial Tensile Load	: 2.6 x 10^6 lb_f	(11,565.4 kN)
Rated Axial Compression Load	: 0 lb_f	(0 kN)
Rated Working Pressure	: 2,500 psi	(172.4 bar)
Hydrostatic Test Pressure	: 3,750 psi	(258.6 bar)
Minimum Design Temperature	: -4 °F	(-20 °C)
Maximum Design Temperature	: 446 °F for 7 days	(230 °C for 7 days)
	: 77°F for 300 years	(25 °C for 300 years)
Combined Loading Condition #1	: 2,500 psi	(172.4 bar)
	: 1,000,000 lb_f tension	(4,448.2 kN)
	: ± 20° conical rotation	
Combined Loading Condition #2	: 500 psi	(34.5 bar)
	: 2,000,000 lb_f tension	(8,896.4 kN)
	: ± 20° conical rotation	
Combined Loading Condition #3	: 0 psi	(0 bar)
	: 2,600,000 lb_f tension	(11,565.4 kN)
	: ± 20º conical rotation	
Hydrostatic Test Loading	: 3,750 psi	(258.6 bar)
	: 0 lb_f tension	(0 kN)
	: ± 0° conical rotation	
Maximum Flex Angle	: ± 20 ° Conical Rotation	
System, Equipment, Service	: Well Control System, Marine Drilling Riser Equipment, Sour (H2S)	

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
PD8182	N/C	Intermediate -2 FlexJoint Assembly
PD7896	A	Molded Assembly
PD7897	B	Nipple
PC1874	A	Renforcements
PD2263	J	Back Flange
PD4270	E	Retainer Flange

Drwg. No.	Rev	Title
PD7894	B	Housing
PD4768	B	Center Wear Ring
PB2266	F	Retainer Stud
PB2265	F	Retainer Nut
PB0977	A	Flex Element O-Ring
PB0849	E	Anti-rotation Pin
PB1147	C	Test Port Plug
PD3620	E	Urethane Debris Shield
PC3621	C	Debris Shield Bolting Plates

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

The following calculations are for information:

Doc. No.	Rev.	Description
SP1E-23-108	A	Stress Analysis Report for Intermediate -2 FlexJoint
SP1E-24-001	N/C	Design, Manufacture and Quality Control of Oilfield FlexJoints and Bearings

The following material specifications are presented for information:

Component	Material	Minimum Yield	Average Charpy
Nipple	SP1B-00-002	60 ksi	31 ft-lb_f at -25°F
Reinforcements	ASTM A-36	36 ksi	N/A
Back Flange	SP1B-00-002	60 ksi	31 ft-lb_f at -25°F
Retainer Flange	SP1B-00-002	60 ksi	31 ft-lb_f at -25°F
Housing	SP1B-00-002	60 ksi	31 ft-lb_f at -25°F
Stud	ASTM A320 Gr.L7	105 ksi	20 ft-lb_f at -50°F
	or ASTM A193 Gr. B7	105 ksi	20 ft-lb_f at -50°F
Nut	ASTM A194 Gr.7	N/A	N/A

Prototype Testing

For prototype testing as required by API Specification 16F. See DNV 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).

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