DNV·GL

Certificate No:
TAP000004Y

TYPE APPROVAL CERTIFICATE

This is to certify:

That the Expansion Joint for Pipe, Slide Type and Flexible Type

with type designation(s)
Axiflex

Issued to
Taylor Kerr (Couplings) Ltd
Milton Keynes, United Kingdom

is found to comply with
DNV GL rules for classification – Ships Pt.4 Ch.6 Piping systems
DNV GL class programme CP-0185 – Type Approval of pipe couplings

Application :

Product(s) approved by this certificate is/are accepted for installation on all vessels classed by DNV GL.

Temperature range:	**-40 to 250 °C (see certificate)**
Max. working press.:	**2.5 to 16 bar (see certificate)**
Sizes:	**DN 50, DN 65, DN 80, DN 100, DN 150, DN 200, DN 250, DN 300, DN 350, DN 400, DN 450, DN 500, DN 600 & DN 700**

This Certificate is valid until **2017-06-30**.

Issued at **Høvik** on **2016-04-22**

for **DNV GL**

DNV GL local station: **Southampton**

Approval Engineer: **Maheshraja Venkatesan**

Marianne Spæren Marveng
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.

Job Id: **262.1-020156-1**
Certificate No: **TAP000004Y**

Product description

Axiflex Types I, II, IV, V & VI:

- Flexible expansion joint – Slip on joint, Slip type
- Flexible expansion joint – Hinged repair type

Sizes:

DN 50, DN 65, DN 80, DN 100, DN 150, DN 200, DN 250, DN 300, DN 350, DN 400, DN 450, DN 500, DN 600 & DN 700

Design:

Single or double plated steel casing with inside rubber sleeve covering the metallic part, tightened with screws. Tightness is obtained by friction between rubber sleeve and pipe surface.

The couplings can be delivered with Axiflex heat shield.

Materials:

TYPE	**I**	**II**	**IV**	**V**	**VI**
Casing	Stainless Steel AISI 304/ DIN 1.4301	Stainless Steel AISI 304/ DIN 1.4301	Stainless Steel AISI 316/ 316L/ DIN 1.4401/ 1.4404	EN 10149-2 grade S550MC	EN 10149-2 grade S550MC
Fasteners	High Tensile Steel (12.9)	Stainless Steel AISI 316/316L DIN 1.4401/ 1.4404	Stainless Steel AISI 316/316L DIN 1.4401/ 1.4404	High Tensile Steel (12.9)	Stainless Steel AISI 316/316L DIN 1.4401/ 1.4404
Gasket/ sealing	EPDM/NBR/ HNBR/VITON	EPDM/NBR/ HNBR/VITON	EPDM/NBR/ HNBR/VITON	EPDM/NBR/ HNBR/VITON	EPDM/NBR/ HNBR/VITON

Maximum working pressure:

	Type I, II, IV		**Type V, VI**		
Size (mm)	**Casing thickness (mm)**	**Max. working pressure (bar)**	**Casing thickness (mm)**		**Max. working pressure (bar)**
50	1	16	1.2		16
65	1	16	1.2		16
80	1	6	1.2		16
	1.2	16	-		-
100	1	2.5	1.2		16
	1.2	10	-		-
	1.5	16	-		-
150	1	2.5	1.2		10
	1.2	10	1.63		16
	2	16	-		-
200	1	2.5	1.2		10
	1.2	6	1.63		16
	1.5	10	-		-
	2.5	16	-		-
250	1.2	6	1.2		6
	2	10	1.63		10
	2.5	12	2.03		16
300	1.2	2.5	110 [1)]	1.2	6
	1.5	6		1.63	10
	2.5	10	140 [1)]	1.2	2.5
	3	13		1.63	10

	-	-		2.64	16
350	1.5	6	1.2		2.5
	2.5	10	1.63		10
	3	12	2.64		16
400	1.5	2.5	1.2		2.5
	2	6	1.63		6
	3	10	2.03		10
450	1.5	2.5	1.2		2.5
	2.5	6	1.63		6
	3	10	2.64		16
500	1.5	2.5	1.2		2.5
	2.5	6	1.63		6
	3	8	2.64		10
	-	-	2.64 + 2.03 [2]		16
600	1.5	2.5	140[1]	1.2	2.5
	2.5	6		1.63	6
	3	7		2.64	10
	-	-		2 x 2.64 [2]	16
	-	-	210[1]	1.63	6
	-	-		2.64	10
	-	-		2 x 3.25 [2]	16
700	2	2.5	140[1]	1.63	2.5
	3	6		2.03	6
	-	-	210[1]	1.63	2.5
	-	-		2.03	6
	-	-		3.25	10

NOTES: 1) Max working pressure depending on coupling width (types V and VI only)
2) Double casing

Application/Limitation

Design temperature is dependent on the gasket materials as below:-

- NBR : -20°C to 80°C
- EPDM : -40°C to 100°C
- VITON : -20°C to 250°C
- HNBR : -40°C to 130°C (160°C short time)

Note: *EPDM material not to be used for hydrocarbon applications*

Rubber elements and other parts subject to wearing are to be replaced by new parts in case of repeated use of the coupling.

The couplings are to be assembled and mounted according to the manufacturer's recommendations.

Couplings with Axiflex heat shield up to DN 600 with EPDM sealing are considered fire safe. Applications of fire safe couplings shall be as specified below.

The slip on joints may be used for piping Class II and III and for the following systems:

- Flammable fluids (flash point ≤ 60°C):
  - Cargo oil lines[5], crude oil washing lines[5], vent lines[3]
- Inert gas
  - Water seal effluent lines, Scrubber effluent lines, Distribution lines[5]
  - Main lines[2] [5]
- Flammable fluids (flash point > 60°C):
  - Cargo oil lines[5],

- Fuel oil lines[2) 3)], Lubricating oil lines[2) 3)], Hydraulic oil[2) 3)], Thermal oil[2) 3)]
- Sea water
  - Fire main and water spray[3)], Foam system[3)], Sprinkler system[3)], Tank cleaning services, Non-essential systems
  - Bilge lines[1)], Ballast system[1)], Cooling water system[1)]
- Fresh water
  - Cooling water system[1)], Condensate return[1)], Non-essential system
- Sanitary/drains/scuppers
  - Deck drains[4)] (internal), Sanitary drains
- Sounding and vent
  - Water tanks/Dry spaces, Oil tanks [2) 3)] (f.p.> 60° C)
- Miscellaneous
  - Service air (non-essential), Brine
  - Steam[6)]

Remarks:

1) Inside machinery spaces of category A - only approved fire resistant types*
2) Not inside machinery spaces of category A or accommodation spaces. May be accepted in other machinery spaces provided the joints are located in easily visible and accessible positions.
3) Approved fire resistant types*
4) Above free board deck only.
5) In pump rooms and open decks*
6) Slip joints allowed; provided that they are restrained on the pipes may be used for pipes on deck with a design pressure of 10 bar or less

* only the couplings with Axiflex heat shield up to size DN 600 with EPDM sealing can be considered to be fire resistant type

Slip-on joints shall not be used in pipelines in cargo holds, tanks, and other spaces which are not easily accessible. Application of these joints inside tanks may be permitted only for the same media that is in the tanks, when approved by DNV GL in each case

Each expansion joint to be hydraulic pressure tested to at least 1.5 times maximum allowable working pressure.

Unrestrained slip-on joints are only to be used in cases where compensation of lateral pipe deformation is necessary. Usage of these joints as the main means of pipe connection is not permitted.

The materials AISI 304, AISI 316/ 316L are not seawater resistant and shall not be used in seawater systems.

Type Approval documentation

- Manufacturer's brochure "TEEKAY Axiflex Pipe Couplings".
- Manufacturers brochure "TEEKAY Small Diameter Pipe Couplings
- General arrangement drawing no. 814, issue 0, dated 2013.04.26.
- Material specification ref.: 8193, issue 00, dated 2015.10.09.
- Vacuum test report no. E78726/1, dated 1986.10.01, from Yarsley.
- Burst test report no. 4510 issue 1, dated 2001.01.07
- Burst test report no. 1282, dated 1996.02.28, from Taylor Kerr Ltd.
- Burst test report no. 4830, dated 2009.03.03, repair coupling burst pressure testing.
- Drawing No. 815, issue 1 dated 2013.10.17 - General arrangement, Teekay hinged/ repair couplings.
- Drawing No. 8187, issue 00 dated 2015.09.02 - General arrangement, Teekay Retro-fit heat shield
- Test report no. 4921-c dated 2011.04.20
- Drawing no. 8170, issue 00 dated 2015.06.18 – G.A.,Teekay Axiflex double lock, type IV, 609.6, 210, EPDM, PN 10.42 with heat shield
- Pressure & fire test report no. 5265-01 & 02 witnessed by DNV GL dated 2015.08.06

- Burst test report no. 5292-1 witnessed by DNV GL dated 2016.02.03
- Vacuum test report no. 5266-01 witnessed by DNV GL dated 2015.08.06
- Type approval assessment report dated 2015.08.05
- Fire test & tightness test report no. 5291 witnessed by DNV GL dated 2016.02.03
- Tightness test reports 5321 dated 2016.03.09 & 5322 dated 2016.03.14

Tests carried out

Tightness test, Burst test, vacuum test, fire test

Marking of product

For traceability to this type approval, each product is at least to be marked clearly with:

- Manufacturer's name or trademark
- Type designation

The identification marking shall be located in low stressed areas.

Periodical assessment

For retention of the Type Approval, a DNV GL Surveyor shall perform a periodical assessment – every second year and before the expiry date of this certificate - to verify that the conditions for the type approval are complied with and to witness burst testing & tightness testing of samples of couplings selected at random from stock or from the running production.