

TYPE APPROVAL CERTIFICATE

This is to certify:**That the Metallic Expansion Joints**with type designation(s)
TX-20000

Issued to

Tofle Co., Inc.
Hagi Yamaguchi Pref., Japanis found to comply with
DNV GL rules for classification – Ships Pt.4 Ch.6 Piping systems**Application :****Product(s) approved by this certificate is/are accepted for installation on all vessels classed by DNV GL.****Temperature range:** -10°C to 350°C**Max. working press.:** 1 bar**Sizes:** DN 2, 2 1/2, 3, 4, 5, 6, 8, 10, 12, 14This Certificate is valid until **2019-06-30**.Issued at **Høvik** on **2015-12-15**for **DNV GL**DNV GL local station: **Hiroshima**Approval Engineer: **Adel Samiei**

On behalf of 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.

Product description

Single bellows expansion joints. Flanged end connections. Designed according to EJMA 9th edition.

Materials:

- Bellows: SUS304
- Flanges: SS400
- Pipe: SS400

Dimensional and operational data:

Size	2"	2 ½"	3"	4"	5"	6"	8"	10"	12"	14"
Number of convolutions	20	18	18	19	19	17	22	21	18	15
Height of convolution (mm)	8.10	8.55	10.60	11.10	12.05	13.80	14.50	16.40	17.30	34.00
Convolution pitch (mm)	10	11.50	12.00	14.00	14.00	15.00	16.00	16.50	19.00	32.00
Axial movement (±x) (mm)	20.10	21.00	29.30	35.60	34.90	39.60	49.30	46.10	38.70	44.70
Lateral Movement (±y)	21.50	18.90	23.40	27.30	21.80	20.20	26.50	19.80	13.80	16.90
Angular movement (±θ)	0	0	0	0	0	0	0	0	0	0
Life cycles	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Thickness of each ply (mm)	0.40	0.40	0.40	0.40	0.45	0.45	0.50	0.60	0.70	1.00
Mean radius of bellows convolutions (mm)	2.5	2.875	3	3.5	3.5	3.75	4	4.125	4.75	8
Maximum flow velocity (m/s)	2.43	3.04	3.65	4.87	6.09	7.31	7.31	7.31	7.31	7.31
e _c & e _e (calculated) (mm)	2,12	2,45	3,51	4,03	3,94	5,09	4,85	4,72	4,57	5,95
e _c (max) (mm)	4,6	5,35	5,6	6,6	6,55	7,05	7,5	7,65	8,8	15
e _e (max) (mm)	5	5,75	6	7	7	7,5	8	8,25	9,5	16

Application/Limitation

This type approval covers the design of the product with respect to internal pressure. External loading/pipe loads have not been considered.

The installation/location of expansion joints is to be approved in each case. Piping system drawings shall be sent to DNV GL whenever expansion joints are to be installed in a ship classed by the society. The piping system design drawing(s) shall specify the location of all anchors, guides, supports, fixed points and type and location of all expansion joints.

The pipeline in which an expansion bellow shall be fitted, shall be adequately adjusted, aligned and clamped. When found necessary, protection against mechanical damage of the expansion bellows may be required. The pipeline which expansion bellows are to be fitted shall not be subject to ship deformation loads.

Each expansion joints has to be hydraulically tested to 1.5 times the maximum working pressure in presence of DNV GL surveyor and delivered with a DNV GL product certificate when required by DNV Rules or by the purchaser.

Material of bellow shall have material certificates in accordance with DNV GL rules for classification of ships Pt.4 Ch.6 Sec.2 Table 3. All materials delivered with VL or works certificate shall be made at works approved by DNV GL manufacturers (AOM).

Equivalent axial compression per convolution, e_c(rated), shall be greater than e_c(calculated) and less than e_c(max), listed in the above table.

Equivalent axial extension per convolution, e_e(rated), shall be greater than e_e(calculated) and less than e_e(max), listed in the above table.

Job Id: **262.1-001284-5**
Certificate No: **TAP0000079**

Type Approval documentation

- Dwg. EEX-70300-A & EEX-703001B (Type approved)
- Drawing EWE402042-A dated 2006-02-17 (Type approved)
- Strength calculation EEX-70300 dated 2000-12-19 (Used for information)
- Burst pressure test report (3"-6"-8") witnessed by DNV local surveyor, Kobe dated 2002-06-11
- Cyclic loading test report (107 axial + 107 lateral movements) witnessed by DNV local surveyor, Kobe dated 2002-10-18
- Burst pressure test report (12") witnessed by DNV local surveyor, Kobe dated 2006-04-05

Tests carried out

Burst test and cyclic loading test

Marking of product

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

- Manufacturer's name
- Type designation

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.

The main elements of the certificate retention survey are:

- Review of Type Approval documentation
- Review of possible changes in design, materials and performance
- Ensure traceability between manufacturer's product type marking and Type Approval Certificate.