TYPE APPROVAL CERTIFICATE

Certificate No:
TAP00000NY
Revision No:
1

This is to certify:

That the Metallic Expansion Joints

with type designation(s)
Single (may be subject to combined movement), Single lateral, Single angular, Dual (may be subject to combined movement), Belman Exhaust Bellows (single and dual), Single Axial, Dual Lateral

Issued to
Belman A/S
Esbjerg N, **Denmark**

is found to comply with
DNV rules for classification – Ships Pt.4 Ch.6 Piping systems
DNV-OS-D101 – Marine and machinery systems and equipment, Edition July 2021

Application :

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

Type:	Temperature range:	Max. working press.:	Sizes:
Single (may be subject to combined movement)	**-55°C to 400°C**	**2,5/6/10/16/25/40 bar**	**DN25 to DN2200**
Single lateral	**-55°C to 400°C**	**6/10/16/25/40/63 bar**	**DN50 to DN500**
Single angular	**-55°C to 400°C**	**2,5/6/10/16/25/40/63 bar**	**DN50 to DN2200**
Dual (may be subject to combined movement)	**-55°C to 400°C**	**2,5/6/10/16/25/40/63 bar**	**DN50 to DN2200**
Belman Exhaust Bellows (single and dual)	**-55°C to 550°C (see page 2)**	**1 bar**	**2" to 86" (see page 2)**
Single Axial	**-55°C to 550°C**	**1 bar**	**2" to 86" (25 sizes)**
Dual Lateral	**-55°C to 550°C**	**1 bar**	**2" to 86" (25 sizes)**

Issued at **Høvik** on **2023-04-27**

This Certificate is valid until **2026-12-30**.
DNV local station: **Fredericia Fleet In Service**

Approval Engineer: **Sarah Miller**

for **DNV**

Digitally Signed By: Zeinab, Sharifi
Location: DNV Høvik, Norway

Zeinab Sharifi
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

1) 299 different bellows – 177 single and 122 dual: all dimensional data according to approved dimensional data for:
   - Single axial (4716-10016)
   - Dual lateral (4716-10017)

2) 18 new single types in drawings 3117-07048-010-0, 3117-07048-020-0, 3117-07048-030-0 rev.0 (2017-05-17) / 3117-04056-010-4 rev.4, 3117-04056-040-3 rev.3, 3117-04056-050-1 rev.1, 3117-04056-060-0 rev.0 (2017-05-17) / 3117-04056-020-3 rev.3 (2017-06-06)/ 3117-11072-010-1, 3117-11072-030-1, 3117-11072-050-1, 3117-11072-070-1, 3117-11072-080-1 rev.1 (2018-03-14) / 3117-11072-090-1 rev.1 (2018-03-16) / 3117-11072-020-2, 3117-11072-040-2, 3117-11072-060-2 rev.2 (2018-04-24)/ 4518-10020-010-0 (2018-10-05)

3) Six types of expansion bellows designed accoding to EJMA 9th edition with various end connections – with or without internal sleeve and collar (all dimensional data according to approved dimensional tables):

Type	designation	Total bellows	Pressure (bar)	sizes
Single bellow (may be subject to combined movement)	4716-10012	838	2,5	DN50 to DN2200
			6	DN50 to DN1200
			10	DN25 to DN700
			16	DN25 to DN500
			25	DN50 to DN400
			40	DN50 to DN300
Single lateral	4716-10013	417	6	DN50 to DN500
			10	DN50 to DN500
			16	DN50 to DN450
			25	DN50 to DN350
			40	DN50 to DN250
			63	DN50 to DN200
Single angular	4716-10014	978	2,5	DN400 to DN2200
			6	DN50 to DN2200
			10	DN50 to DN1400
			16	DN50 to DN1000
			25	DN50 to DN700
			40	DN50 to DN500
			63	DN50 to DN400
Dual bellow (may be subject to combined movement)	4716-10015	1066	2,5	DN50 to DN2200
			6	DN50 to DN2000
			10	DN50 to DN1400
			16	DN50 to DN1000
			25	DN50 to DN700
			40	DN50 to DN500
			63	DN50 to DN400
Belman Exhaust Bellows Single bellow	4716-10016	177	1	2" to 86" (25 sizes)
Belman Exhaust Bellows Dual bellow	4716-10017	122	1	2" to 86" (25 sizes)

Material:
- Bellow, sleeve and collar: Stainless Steel 1.4401 (316); 1.4404 (316L);1.4541 (321); 1.4550 (347); 1.4571 (316Ti); 1.4462 (duplex 2205); 1.4547 (SMO 254); 1.4410 (SAF 2507); 1.4501 (super duplex); 2.4856 (Inconel 625); 1.4539 (904L); 2.4605 (Alloy 59) and 2.4858 (Incoloy 825)
- Pipe material: EN10216-[2/3/5]; EN10217-[2/3/7]; EN10028-[2/3/7]; ASTM A240/A516/A106/A312
- Flanges according to EN1092-1;ASME B16.5/B16.47; DIN 86044-1; JIS B2220 (P250GH)
- Minimum thickness of internal sleeve: in accordance with EJMA 9th edition Table 4.10.3
- Material for category 2: according to the approved drawings

Application/Limitation

The approval is valid for ship, machinery & cargo piping systems onboard DNV classed ships and mobile offshore units. Expansion bellows covered by this certificate shall not be used in LNG/LPG applications.

Axial, lateral and angular movements of expansion bellows covered by this certificate are to be in accoradance with approved dimensional tables. If bellows are subject to combined movements, the total equivalent axial movement "eMax" are to be in accordance with approved documents.

All expansion bellows covered by this certificate are approved for 1000 load cycles.

Maximum velocity for bellows without sleeves shall be in accordance with EJMA 9th adition table 4.10-1.

Welding shall fulfill requirements in DNV Rules Pt.2 Ch.4.
All dimensional data, movements and weld details shall be in accordance with approved dimensional tables/drawings.

Minimum thickness of internal sleeve: in accordance with EJMA 9th edition Table 4.10.3
Minimum thickness of pipe (in dual bellows) shall fulfil requirements in DNV Ship Rules Pt.4 Ch.6 Sec.9 Table 3 & Table 4.
For the 299 bellows category, if bellows are subject to combined movements, the total equivalent axial movement "e_{Max}" are to be in accordance with approved documents.

Bellows made of 1.4462 (duplex 2205), 1.4547 (SMO 254), 1.4410 (SAF 2507), 1.4501 (super duplex), 2.4856 (Inconel 625), 1.4539 (904L), 2.4605 (Alloy 59) and 2.4858 (Incoloy 825) may be used in seawater systems. Other materials shall not be used in systems conveying seawater.

Using below materials will limit the maximum design temperature to less than 550°C:

Material designation	Standard	Maximum design temperature
P235GH, P265GH. P295GH, P355GH, 20MnMoNi4-5	EN 10028-2	400°C
18MnMo4-5, 15NiCuMoNb5-6-4, 13CrMoSi5-5+NT, 13CrMoSi5-5 +QT, 12CrMo9-10, 13CrMoV9-10, 2CrMoV12-10,	EN 10028-2	450°C
16Mo3, 13CrMo4-5, 10CrMo9-10, X12CrMo5, X10CrMoVNb9-1	EN 10028-2	500°C
P275NH, P355NH, P460NH	EN 10028-3	400°C
P195GH, 8MoB5-4	EN 10216-2	400°C
P235GH, P265GH, 20MnNb6, 25CrMo4, 15NiCuMoNb5-6-4	EN 10216-2	450°C
16Mo3, 10CrMo5-5, 13CrMo4-5, 10CrMo9-10, 11CrMo9-10, 20CrMoV13-5-5, X11CrMo5+I, X11CrMo5+NT1, X11CrMo5+NT2	EN 10216-2	500°C
P275NL1, P275NL2, P355 NH, P460NH	EN 10216-3	400°C
P620QH, P690QH	EN 10216-3	300°C
P195GH, P235GH, P265GH, 16Mo3	EN 10217-2	400°C
P275NL1, P275NL2, P 355 NH, P 460 NH	EN 10217-3	400°C
SA 240	ASME	325°C
SA 516	ASME	375°C
SA 106	ASME	350°C
SA 312	ASME	450°C

Maximum working pressure at elevated temperature shall be reduced according to manufacturer's correction factors as below:

Temperature °C	20	100	150	200	250	300	350	400
1.4401 & 1.4404	1,00	0,71	0,65	0,59	0,56	0,50	0,48	0,46
1.4541, 1.4550, 1.4571, 1.4539, 1.4547 2.4605, 2.4858 & 2.4856	1,00	0,83	0,78	0,74	0,71	0,67	0,64	0,62
1.4462, 1.4410 & 1.4501	1,00	0,83	0,78	0,74	0,71	Not Applicable		

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 shall fulfil below coniditons:

0- The installation/location of expansion joints is to be approved in each case. Piping system drawings shall be approved by DNV 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.

1- 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.

Production test

Bellows installed in non-class piping systems may be delivered with manufacturer's certificate; in this case production test is not to be witnessed by DNV surveyor.
Each expansion bellow shall be subjected to minimum hydrostatic test pressure equal to 1.5 times internal design pressure.

Certification

Whenever the piping system is subject to approval by the society, the below limitations shall be considered:

- Bellows covered by this certificate shall be delivered with a reference to this type approval certificate (see to DNV-RU-SHIP Pt.4 Ch.6 Sec.1 Table 3).
- Welding shall fulfill requirements in DNV-RU-SHIP Pt.2 Ch.4.
- Material of bellow shall have material certificates in accordance with DNV-RU-SHIP Pt.4 Ch.6 Sec.2 Table 3. All materials delivered with NV or works certificate shall be made at works approved by DNV manufacturers(AoM)
- This type approval covers the design of the product with respect to internal pressure. External loading/pipe loads have not been considered.
- The installation shall be done according to type approval holder's procedures.

Type Approval documentation

Drawing numbers – all revision 0:
4716-10012-010-0, 4716-10012-020-0, 4716-10012-030-0, 4716-10012-040-0, 4716-10012-050-0, 4716-10012-060-0, 4716-10012-070-0, 4716-10012-080-0, 4716-10012-090-0, 4716-10012-100-0,
4716-10012-110-0, 4716-10012-120-0, 4716-10012-130-0, 4716-10012-140-0, 4716-10012-150-0, 4716-10012-160-0, 4716-10012-170-0, 4716-10012-180-0, 4716-10012-190-0, 4716-10012-200-0,
4716-10012-210-0, 4716-10012-220-0, 4716-10012-230-0, 4716-10012-240-0
4716-10013-010-0, 4716-10013-020-0, 4716-10013-030-0, 4716-10013-040-0, 4716-10013-050-0, 4716-10013-060-0, 4716-10013-070-0, 4716-10013-080-0, 4716-10013-090-0, 4716-10013-100-0,
4716-10013-110-0, 4716-10013-120-0, 4716-10013-130-0
4716-10014-010-0, 4716-10014-020-0, 4716-10014-030-0, 4716-10014-040-0, 4716-10014-050-0, 4716-10014-060-0, 4716-10014-070-0, 4716-10014-080-0, 4716-10014-090-0, 4716-10014-100-0,
4716-10014-110-0, 4716-10014-120-0, 4716-10014-130-0, 4716-10014-140-0, 4716-10014-150-0, 4716-10014-160-0, 4716-10014-170-0, 4716-10014-180-0, 4716-10014-190-0, 4716-10014-200-0,
4716-10014-210-0, 4716-10014-220-0, 4716-10014-230-0, 4716-10014-240-0, 4716-10014-300-0
4716-10015-010-0, 4716-10015-020-0, 4716-10015-030-0, 4716-10015-040-0, 4716-10015-050-0, 4716-10015-060-0, 4716-10015-070-0, 4716-10015-080-0, 4716-10015-090-0, 4716-10015-100-0,
4716-10015-110-0, 4716-10015-120-0, 4716-10015-130-0, 4716-10015-140-0, 4716-10015-150-0, 4716-10015-160-0, 4716-10015-170-0, 4716-10015-180-0, 4716-10015-190-0, 4716-10015-200-0,
4716-10015-210-0, 4716-10015-220-0, 4716-10015-230-0, 4716-10015-240-0
4716-10016-010-0, 4716-10016-020-0, 4716-10016-030-0, 4716-10016-040-0, 4716-10016-050-0, 4716-10016-060-0, 4716-10016-070-0, 4716-10016-080-0, 4716-10016-090-0, 4716-10016-100-0,
4716-10016-110-0, 4716-10016-120-0, 4716-10016-130-0, 4716-10016-140-0, 4716-10016-150-0, 4716-10016-160-0, 4716-10016-170-0, 4716-10016-180-0, 4716-10016-190-0, 4716-10016-200-0,
4716-10016-210-0, 4716-10016-220-0, 4716-10016-230-0, 4716-10016-240-0, 4716-10016-300-0
4716-10017-010-0, 4716-10017-020-0, 4716-10017-030-0, 4716-10017-040-0, 4716-10017-050-0, 4716-10017-060-0, 4716-10017-070-0, 4716-10017-080-0, 4716-10017-090-0, 4716-10017-100-0,
4716-10017-110-0, 4716-10017-120-0, 4716-10017-130-0, 4716-10017-140-0, 4716-10017-150-0, 4716-10017-160-0, 4716-10017-170-0, 4716-10017-180-0, 4716-10017-190-0, 4716-10017-200-0,
4716-10017-210-0, 4716-10017-220-0, 4716-10017-230-0, 4716-10017-240-0, 4716-10017-300-0
3117-04056-010-4, 3117-04056-020-3, 3117-04056-040-3, 3117-04056-050-1, 3117-04056-060-0
3117-07048-010-0, 3117-07048-020-0, 3117-07048-030-0
3117-11072-010-1, 3117-11072-030-1, 3117-11072-050-1, 3117-11072-070-1, 3117-11072-080-1 rev.1 (2018-03-14) / 3117-11072-090-1 rev.1 (2018-03-16) / 3117-11072-020-2, 3117-11072-040-2, 3117-11072-060-2 rev.2 (2018-04-24) and calculation report of all 9 sizes
Sleeve welding configurations: 4716-11030-010-0, 4716-11030-020-0, 4716-11030-030-0, 4716-11030-040-0, 4716-11030-050-0
Calculation reports (at maximum design temperature)

Dimensional data as per: “DNV/GL approval-Exhaust_SingleBellow_rev20161213” & “DNV/GL approval-Exhaust_DualBellow_rev20161213”
Drawing number 4518-10020-010-0 rev.0 dated 2018-10-05 and calculation report according to EJMA

18 new single types in drawings 3117-07048-010-0, 3117-07048-020-0, 3117-07048-030-0 rev.0 (2017-05-17) / 3117-04056-010-4 rev.4, 3117-04056-040-3 rev.3, 3117-04056-050-1 rev.1, 3117-04056-060-0 rev.0 (2017-05-17) / 3117-04056-020-3 rev.3 (2017-06-06)/ 3117-11072-010-1, 3117-11072-030-1, 3117-11072-050-1, 3117-11072-070-1, 3117-11072-080-1 rev.1 (2018-03-14) / 3117-11072-090-1 rev.1 (2018-03-16) / 3117-11072-020-2, 3117-11072-040-2, 3117-11072-060-2 rev.2 (2018-04-24)/ 4518-10020-010-0 (2018-10-05)

Sleeve welding configurations: 4716-11030-010-0, 4716-11030-020-0, 4716-11030-030-0, 4716-11030-040-0, 4716-11030-050-0
Calculation reports (at maximum design temperature)
Dimensional data as per: “DNV/GL approval-Exhaust_SingleBellow_rev20161213” & “DNV/GL approval-Exhaust_DualBellow_rev20161213”
Drawing number 4518-10020-010-0 rev.0 dated 2018-10-05 and calculation report according to EJMA

Sleeve welding configurations: 4716-11030-010-0, 4716-11030-020-0, 4716-11030-030-0, 4716-11030-040-0, 4716-11030-050-0

DNV approval - SingleBellows_Angular_rev20161213
DNV approval - SingleBellows_Lateral_rev20161213
DNV approval - SingleBellows_Universal_rev20161213
DNV approval - DualBellows_Universal_rev20161213
Calculation report for all sizes

4716-10016-010-0, 4716-10016-020-0, 4716-10016-030-0, 4716-10016-040-0, 4716-10016-050-0, 4716-10016-060-0, 4716-10016-070-0, 4716-10016-080-0, 4716-10016-090-0, 4716-10016-100-0,
4716-10016-110-0, 4716-10016-120-0, 4716-10016-130-0, 4716-10016-140-0, 4716-10016-150-0, 4716-10016-160-0, 4716-10016-170-0, 4716-10016-180-0, 4716-10016-190-0, 4716-10016-200-0,
4716-10016-210-0, 4716-10016-220-0, 4716-10016-230-0, 4716-10016-240-0, 4716-10016-300-0
4716-10017-010-0, 4716-10017-020-0, 4716-10017-030-0, 4716-10017-040-0, 4716-10017-050-0, 4716-10017-060-0, 4716-10017-070-0, 4716-10017-080-0, 4716-10017-090-0, 4716-10017-100-0,
4716-10017-110-0, 4716-10017-120-0, 4716-10017-130-0, 4716-10017-140-0, 4716-10017-150-0, 4716-10017-160-0, 4716-10017-170-0, 4716-10017-180-0, 4716-10017-190-0, 4716-10017-200-0,
4716-10017-210-0, 4716-10017-220-0, 4716-10017-230-0, 4716-10017-240-0, 4716-10017-300-0
3117-04056-010-4, 3117-04056-020-3, 3117-04056-040-3, 3117-04056-050-1, 3117-04056-060-0
3117-07048-010-0, 3117-07048-020-0, 3117-07048-030-0
3117-11072-010-1, 3117-11072-030-1, 3117-11072-050-1, 3117-11072-070-1, 3117-11072-080-1 rev.1 (2018-03-14) / 3117-11072-090-1 rev.1 (2018-03-16) / 3117-11072-020-2, 3117-11072-040-2, 3117-11072-060-2 rev.2 (2018-04-24) and calculation report of all 9 sizes
Sleeve welding configurations: 4716-11030-010-0, 4716-11030-020-0, 4716-11030-030-0, 4716-11030-040-0, 4716-11030-050-0
Calculation reports (at maximum design temperature)
Dimensional data as per: “DNV approval-Exhaust_SingleBellow_rev20161213” & “DNV approval-Exhaust_DualBellow_rev20161213”
Drawing number 4518-10020-010-0 rev.0 dated 2018-10-05 and calculation report according to EJMA

Marking of product

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

- Manufacturer’s trademark
- Type designation (as stated in the submitted drawings)
- Size
- Maximum working pressure
- Temperature range
- The flow direction, if applicable

Periodical assessment

For retention of the Type Approval, a DNV Surveyor shall perform periodical assessment after two years (+/- 90 days) and after 3.5 years (+/- 90 days) to verify that the conditions for the approval are complied with. Reference is made to DNV-CP-0338.