

TYPE APPROVAL CERTIFICATE

This is to certify:**That the Metallic Expansion Joints**

with type designation(s)

Single axial, Dual lateral

Issued to

Belman A/S**Esbjerg N Syddanmark, Denmark**

is found to comply with

DNV GL rules for classification – Ships Pt.4 Ch.6 Piping systems**DNVGL-OS-D101 – Marine and machinery systems and equipment, Edition July 2015****Application :****Product(s) approved by this certificate is/are accepted for installation on all vessels classed by DNV GL.**

Type:	Temperature range:	Max. working press.:	Sizes:
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 **2017-09-06**for **DNV GL**This Certificate is valid until **2021-12-31**.DNV GL local station: **Fredericia**Approval Engineer: **Mehdi Rowshan****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

Two types of expansion bellows designed according to EJMA 9th edition with various end connections – with or without internal sleeve & collar:

- 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) In addition 8 new single types in drawings 3117-04056-010,-020,-040,-050,-060 & 3117-007048-010,-020,030

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) & 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; JIS B2220

Minimum thickness of internal sleeve: in accordance with EJMA 9th edition Table 4.10.3

Application/Limitation

Expansion bellows covered by this certificate are approved to be installed in exhaust gas systems.

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

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

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 edition table 4.10-1.

Each expansion bellow shall be subjected to minimum hydrostatic test pressure equal to 1.5 times internal design pressure. Bellows installed in piping classes I, II and III, shall be delivered with a product certificate issued by society (ref. to DNV GL ship Rules Pt.4 Ch.6 Sec.1 Table 4). In this case hydrostatic test shall be witnessed by a DNV GL surveyor.

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 GL surveyor.

Welding shall fulfill requirements in DNV GL Rules Pt.2 Ch.4. All welding for piping components for piping classes I and II shall be carried out in an approved welding work shop by DNV GL.

Minimum thickness of pipe (in dual bellows) shall fulfil requirements in DNV GL Ship Rules Pt.4 Ch.6 Sec.9 Table 3 & Table 4.

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).

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 conditions:

- 1- The installation/location of expansion joints is to be approved in each case. Piping system drawings shall be approved by 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.
- 2- 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.

Type Approval documentation

Drawing numbers – all revision 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

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"

Marking of product

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

- Manufacturer's name
- Design pressure & temperature
- Type designation & size
- Arrow pointing to the direction of flow

Job Id: **262.1-013868-5**
Certificate No: **TAP0000115**

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.