

TYPE APPROVAL CERTIFICATE

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

with type designation(s)

AN, AF, AT, AM, AP, AMF, AMP, AH, UN, UF, UT, UM, UMF, UMP, UH,

Issued to

**Flexomat GmbH Compensator-Center
Nossen, Germany**

is found to comply with

DNV GL rules for classification – Ships Pt.4 Ch.6 Piping systems**Application :****The expansion bellows are type approved for the use in piping systems of pipe class I, II and III.****Products approved by this certificate are accepted for installation on all vessels classed by DNV GL.****Temperature range:** up to 550°C (refer to certificate)**Max. working press.:** 1 bar up to 40 bar (refer to certificate)**Sizes:** DN 16 up to 5000 (refer to certificate)This Certificate is valid until **2022-03-21**.Issued at **Hamburg** on **2017-03-22**DNV GL local station: **Magdeburg**for **DNV GL**Approval Engineer: **Christian Kaemmer**

**Olaf Drews
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

Expansion bellows (U-Shaped), Axial type with weld ends, welding neck / slip on or loose flanges.
Bellow design according to EJMA.

Bellow Type	Compensation / Motion	Design Details
AN	Axial	One bellow
UN	Axial / Lateral (non-tied)	One bellow with guide tube
AF	Axial	
UF	Axial / Lateral (non-tied)	
AT	Axial	One bellow with telescope guide tube
UT	Axial / Lateral (non-tied)	
AM	Axial	Two bellows with welded intermediate pipe
UM	Axial / Lateral (non-tied)	Two bellows with welded intermediate pipe and guide tube
AMF	Axial	
UMF	Axial / Lateral (non-tied)	Two bellows with welded intermediate pipe and two guide tubes
AMP	Axial	
UMP	Axial / Lateral (non-tied)	Two bellows (axial type) made of one tube
AH	Axial	
UH	Axial / Lateral (non-tied)	Two or more bellows with guide tubes
AP	Axial	

End connection:	Weld-on end, loose and welded flange:		
Size range:	DN 16 to 5000	DN 16 to 500	DN 16 to 500
Pressure range:	PN 1	up to PN 16	up to PN 40

Bellow materials

DIN EN Code	Chemical composition
1.4462	X2CrNiMoN22-5-3
1.4539	X1NiCrMoCu25-20-5
1.4541	X6CrNiTi 18-10
1.4571	X6CrNiMoTi17-12-2
1.4404	X2CrNiMo17-12-2
2.4856	NiCr22Mo9Nb
2.4858	NiCr21Mo

Flange materials

DIN EN Code	Chemical composition
1.0038	S235 JR ¹
1.0425	P265GH ¹
1.0460	P250GH ¹
1.4301	X5CrNi18-9
1.4541	X6CrNiTi 18-10
1.4571	X6CrNiMoTi17-12-2
1.4404	X2CrNiMo17-12-2

Notes

¹ For application above 300°C service temperature the applied welding procedure for bellow – flange welding shall be approved by welding procedure qualification tests (WPQT).

Application/Limitation

Piping systems

The metallic expansion joints are type approved for application in the following piping systems:

- Fuel oil and lubricating oil¹, Exhaust lines of combustion engines^{1,2}
- Steam and condensate¹, Compressed air lines
- Fresh water cooling, Cargo oil¹
- Subordinate piping systems¹

Note

¹ Expansion joints with loose flanges in combination with flared bellows are not approved for application in steam, lubricating and fuel oil systems. For other medias this type of flange connection is approved for service temperatures up to + 250°C.

Refer to DNVGL Rules Pt.4, Ch. 6, Section 9 – 5 Detachable pipe connections.

² The application in exhaust gas systems is limited to installation downstream (after) turbocharger. Installation directly on diesel engines, e.g. cylinder exhaust gas outlet is not included in this type approval and needs to be approved for each installation.

Size and pressure range

Nominal diameter DN [mm]	Nominal pressure PN [bar]	Application
16 – 5000	1.0	Exhaust gas
16 – 500	16	Steam, condensate, thermal oil, cargo oil, fuel oil, fresh water, compressed air
16 – 500	40	

Temperature range

- 55 °C up to + 550 °C

- For service temperatures above 50 °C the pressure is to be reduced in accordance with the manufacturer's specifications. DNVGL Rules Pt.4, Ch.7 (Pressure equipment) respectively are to be observed.
- For application above 425°C the EJMA Requirement S3+(S4/1,25) < Sab in the creep range (T>425°C) is to be observed.

Bellow design depending on service conditions

This type approval is based on EJMA bellow design calculation with specific service parameters and life cycle expectations.

For each application the expansion bellow and flange connection is to be individual designed according to the applicable maximum working pressures, temperatures, media, axial/lateral movement and bending angle according to the EJMA design calculation and DNV GL Rules.

Installation on board ship

The application of metallic expansion joints is to be approved in each case by submitting of piping system drawings specifying the location of all anchors, guides, supports, fixed points and type and location of all expansion joints.

The pipeline, in which an expansion bellow is to be fitted, is to be adequately adjusted, aligned and clamped. Expansion joints shall be fitted in places where they are always accessible.

Expansion joints are not approved in thermal-oil piping systems installed in machinery spaces, except for installation at thermal oil pump. For selection of the material of media wetted parts, e.g. for installation on open deck, the corrosion resistance is to be observed.

Job Id:
Certificate No: **TAP00000R5**

Requirements according to pipe classes:

Material certificates

Refer to:

DNVGL Rule Pt.4, Ch.6, Sec.1 – Table 1 (pipe classes)

DNVGL Rule Pt.4, Ch.6, Sec.2 – Table 3 (material certificates acc. to pipe classes)

DNVGL Rule Pt.2 Ch.1, Sec.2 (Approval of manufacturers)

Material certificates refer to:

- DNVGL Rule Pt.4, Ch.6, Sec.1 – Table 1 (pipe classes)
- DNVGL Rule Pt.4, Ch.6, Sec.2 – Table 3 (material certificates acc. to pipe classes)
- DNVGL Rule Pt.2 Ch.1, Sec.2 (Approval of manufacturers)

Welding process refers to:

- DNVGL Rule Pt.4, Ch.6, Sec.10, 1 Welding

Approved Production Place

Flexomat GmbH

Lindigtstr. 2

01683 Nossen, Germany

Production testing

Each batch of expansion bellow is subject in the manufacturers work shop to a hydraulic pressure test of 1.5 times the PN. The DNV GL Rules "Ships Part 4 Chapter 6 Table 5" are to be observed.

Materials of bellows included in pipe class I and II shall be delivered with works certificates (W) issued by DNV GL approved manufacturers (AoM). For application in pipe class III piping systems, e.g. exhaust gas, a test report (TR) is sufficient.

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Type Approval documentation

Tests carried out

Pressure test, Burst pressure test, Endurance test

Marking of product

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

- Manufacturer's name or trade mark
- Size and nominal pressure PN
- Additional marking necessary for identification.
- In case of one way flow bellows an arrow to indicate the direction of flow, if applicable.

Periodical assessment

For retention of the type approval certificate periodical assessments shall be carried out at production place(s).

The objective of the periodical assessment is to verify that the design and production conditions for the type approval have not been altered.

Main scope of the assessment:

- verification of the production and quality control system
- review of quality control documentation of recent deliveries
- review of the type approval documentation and that this is still the basis for the production
- review of design changes , pre- material and performance of the product
- verification of the product marking

End of Certificate