DNV·GL

Certificate No:
TAP00000D6

TYPE APPROVAL CERTIFICATE

This is to certify:

That the Metallic Expansion Joints

with type designation(s)
HYDRA types according to page 2

Issued to
Witzenmann GmbH Metallschlauch-Fabrik
Pforzheim, Germany

is found to comply with
DNV GL offshore standards
DNV GL rules for classification – High speed and light craft
DNV GL rules for classification – Ships

Application :

The products approved by this certificate are accepted for installation on all vessels classed by DNV GL.

Temperature range: **- 55°C up to 720°C (depending on type)**
Max. working press.: **1.0 - 63.0 bar (depending on type)**
Sizes: **DN 15 up to 3000**

This Certificate is valid until **2021-08-02**.

Issued at **Hamburg** on **2016-08-03**

for **DNV GL**

DNV GL local station: **Augsburg**

Approval Engineer: **Hagen Markus**

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.

© DNV GL 2014. DNV GL and the Horizon Graphic are trademarks of DNV GL AS.

Product description

Expension joint types and design acc. to Witzenmann specification TB 600-002

Type	Nominal size
Axial expansion joints for exhaust gas	
ABG/AFG/ARG	DN 15 - 3000
Axial expansion joints	
ARN/ARZ/AFN AFZ/ABN/ABZ ALN/ OZ	DN 15 - 3000 DN 15 - 3000 DN 15 - 3000
ASZ (refer to remarks on page 3)	DN 15 - 3000
Angular expansion joints	
WRN/WRK/WFN WFK/WBN/WBK WBZ	DN 15 - 3000 DN 15 - 3000 DN 15 - 3000
Lateral expansion joints	
LRN/LRK/LRR/LFR LBR/LBS/LFZ	DN 15 - 3000 DN 15 - 3000
Universal expansion joints	
URZ / URN / URG UFZ / UFN / UFG UBZ / UBN / UBG USZ	DN 15 - 3000 DN 15 - 3000 DN 15 – 3000 DN 100

Bellow materials

DIN EN Code	Chemical composition	Temperature range[1]
1.4541	X6CrNiTi 1814	up to 550°C
1.4571	X6CrNiMoTi17-12-2	up to 550°C
1.4301	X5CrNi18-10	up to 550°C
1.4828	X15CrNiSi20-12	up to 900°C[2]
1.4876	X10NiCrAlTi32-21	up to 950°C[2]
1.4404	X2CrNiMo17-12-2	up to 550°C
2.4856	NiCr22Mo9Nb	up to 900°C[2]

Note:
[1] For application below - 55°C additional type tests as specified in the applicable DNVGL Rules are to be carried out.
[2] For application above 720°C EJMA bellow design calculations are to be submitted for approval

Flange, pipe and fitting materials

DIN EN Code	Chemical composition
1.4541	X6CrNiTi 1814
1.4571	X6CrNiMoTi17-12-2
1.4301	X5CrNi18-10
1.4828	X15CrNiSi20-12

Range of Application

Piping systems

The expansion joints of type HYDRA bellows are type approved for application in the following piping systems:
- Fuel oil and lubricating oil*, Exhaust lines from engines
- Steam and condensate*, Compressed air lines *
- Fresh water cooling*, Cargo oil *
- Subordinate piping systems according to pressure and temperature range specified on page 1.

*) - not applicable for ABG, AFG, ARG

Pressure range

Types:	Nominal pressure
ABG, AFG, ARG	PN 1
ARN, ARZ, AFZ, AOZ	PN 1 - 40
AFN, ABN, ALN, ABZ	PN 1 - 40
ASZ	PN 1 – 40
WRN, WRK	PN 1 - 40
WFN, WFK	PN 1 - 25
WBN, WBK	PN 1 - 25
WBZ	PN 1 - 25
LRN, LRR, LRK	PN 1 - 40
LFR, LBR	PN 1 - 40
LBS, URZ, UFZ, UBZ	PN 1 - 40
LFZ	PN 1 - 40
URN, UFN, UBN	PN 1 - 40
URG, UFG, UBG	PN 1

Remarks
The following remarks are to be observed for each specific application.

Working pressure
Maximum working pressures, temperatures, axial stroke, bending angle, displacement and mounting to be in accordance with the manufacturer's instructions except where other limitations are stated.

For service temperatures above 50°C the pressure reduction factors specified by the manufacturer, DNVGL Rules Pt.4,Ch.7 Pressure equipment respectively are to be observed.

For exhaust gas applications above 550°C (high temperature application) the following applies:
- The design principle is to be based on type tested type ASZ
- Bellow design calculation according to EJMA is to be based on proved creep strength values.
- Bellow materials according to table bellow material on page 2 are to be used.
- For selection of pipes, flanges and fittings the Witzenmann specification TB 600-002 is applicable.

Requierements 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)
Welding
Refer to:
DNVGL Rule Pt.4, Ch.6, Sec.10, 1 Welding

Material selection – corrosion and temperature resistance
For selection of the material of media wetted parts, inside and outside of the bellow, the corrosion resistance and high temperature stability is to be observed, e.g. for application in sea water systems or installation on open deck, bellow material with a pitting index PRE >25 is to be used. (PRE=%xCr+3.3x%Mo+16x%N).

Installation on diesel engines
For installation on diesel engines, e.g. on cylinder head, in exhaust gas manifold, the bellow design calculation shall include prove acc. to EJMA 9th Ed., Sec. 4.9- Vibration for each individual application.

Pipe line alignment
The pipeline, in which an expansion bellow is to be fitted, is to be adequately adjusted, aligned and clamped.

Limitation
- Bellows with loose/floating flanges are not to be used in fuel- or lubrication oil systems.
- The bellows must only be fitted in places where they are always accessible.
  Possible exceptions to be considered in each case. For other applications than stated, approval has to be obtained in each case.

Approved Production Places
Witzenmann GmbH
Östliche Karl-Friedrich-Str. 134
75175 Pforzheim, GERMANY

Welding shop approval certificate WWA0000039,Rev.1

Production testing
Each batch of metallic expansion joints are to be hydraulically pressure tested up to 1,5-times the design pressure in the presence of a DNV GL surveyor
For type approved exhaust gas bellows a works certificate issued by the manufacturer is sufficient.

Type Approval documentation
Expansion bellow design drawings
- BAA 0116.0149.06.050.06.0000 - II
- BAA 0268.0319.08.030.03.0000 - AD
- BAA 0502.0572.04.050.03.0000 - AD
- BAA 0502.0574.06.050.03.0000 - AD
- BAA 3016.3103.08.070.03.0000 - II

Expansion bellow design calculation acc. to EJMA 9th Edition
- DN 100 - PN63, T=20°C, Pmax 64,3bar - Typ BAA 0116.0149.06.050.06.0000-II - 2012-11-21
- DN 100 - 02 - PN63, T=100°C, Pmax 55,7bar - Typ BAA 0116.0149.06.050.06.0000-II - 2012-11-21
- DN 250-01- PN16, T=20°C, Pmax 20bar - Typ BAA 0268.0319.08.030.03.0000-AD - 2012-11-21
- DN 250 - PN16, T=200°C, Pmax 15,5bar - Typ BAA 0268.0319.08.030.03.0000-AD - 2012-11-21
- DN 500-01- PN 04 - T 600°C - Pmax=2,3bar - Typ BAA 0502.0572.04.050.03.0000-AD - 2012-11-21
- DN 500-01- PN 04 - T 20°C - Pmax=10,2bar - Typ BAA 0502.0572.04.050.03.0000-AD - 2012-11-26
- DN 3000-02- PN04, T=600°C, Pmax 3,8bar - Typ BAA 3016.3103.08.070.03.0000-II - 2012-11-26
- DN 3000-02- PN04, T=20°C, Pmax 7,1bar - Typ BAA 3016.3103.08.070.03.0000-II - 2012-11-26
- For type ASZ:
  - Witzenmann bellow design calculation acc. to EJMA 9th Ed. dated 18.06.2012
  - Drawings: 1305803:Rev.03, 1305644:Rev.08, 3210697:Rev.0
- For type USZ:
  - Witzenmann bellow design calculation acc. to EJMA 10th Ed. dated 27.07.2016

Test reports
- Test reports dated 1975-04-30, 1978-03-14, 1980-11-18,1980-12-17
- Test reports PR 478 051, 58.34, 580.179
- GL Audit report dated 2012-06-06
- For type ASZ:
    - Witzenmann test reports 512.047_Auftrag 1655219, 120082, 120083
    - GL Approval Ref.No.: 11-149530, 13-011839

Tests carried out
Test according to test sheets: 588.77, 588.83, 588.105, 589.32 589.119
Burst pressure tests, cyclic tests, cyglic fatigue tests

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
- Type designation
- In case of one way flow bellows an arrow to indicate the direction of flow
- Additional marking necessary for identification.

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