

TYPE APPROVAL CERTIFICATE

This is to certify:**That the Metallic Expansion Joints**with type designation(s)
AN, AF, AM, APX, AP, WN, RM

Issued to

**HKS GmbH industrieller Hersteller von Kompensatoren und
Schläuchen****Rostock, Mecklenburg-Vorpommern, Germany**is found to comply with
DNV GL rules for classification – Ships Pt.4 Ch.6 Piping systems**Application :****Products approved by this certificate are accepted for installation on all vessels classed by
DNV GL.****Temperature range: -55°C up to +550°C**
Max. working press.: PN 1, 2.5, 16, 40. Refer to certificate.
Sizes: DN25 up to DN2200. Refer to certificate.This Certificate is valid until **2022-01-15**.Issued at **Hamburg** on **2019-02-01**DNV GL local station: **Rostock**Approval Engineer: **Hagen Markus**for **DNV GL**

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.

Job Id: **262.1-030001-1**
 Certificate No: **TAP00000DU**
 Revision No: **3**

Product description

Expansion bellows (U-Shaped), with welded ends, welding neck / slip on or loose flanges.
 Bellow design according to EJMA, Edition 9.

Bellow type	Compensation Motion	Design details	Remarks
AN	Axial	Single bellow standard	Bellow design type
AF		Single bellow with inner guide tube	AF equal to AN
AM		Double bellow standard (universal type)	Bellow design type AP equal to AM
AP	Double bellow with inner guide tube (universal type)		
RM	Lateral	Double bellow standard	Bellow design type
RP		Double bellow with inner guide tube	RP equal to RM
WN	Angular	Single bellow standard	Bellow design type
WF		Single bellow with inner guide tube	WF equal to WN

Materials

The following materials and its combination are included in this type approval

Bellow Collars	Flanges Pipe studs
1.4571	P235GH
1.4541	S235JR
1.4547	P265GH
1.4435	16Mo3
1.4301	1.4571
1.4306	1.4541
1.4539	1.4547
1.4462	1.4435
	1.4301
	1.4306
	1.4539
	1.4462

Additional material combinations may be approved case by case based on appropriate WPS and tests, if considered necessary.

Requirements according to pipe classes

Depending on pipe class appropriate material certificates for the bellow sheet material and flanges are to be provided.

Refer to:

- DNV GL Rule Pt.4, Ch.6, Sec.1 – Table 1 Pipe classes
- DNV GL Rule Pt.4, Ch.6, Sec.2 – Table 3 Material certificates
- DNV GL Rule Pt.2, Ch.1, Sec.2 - Approval of manufacturers (AoM)

Selection of materials

It shall be noted that the selection of the materials considers the applicable service condition with respect to type of media, flow velocity, media temperature etc. and installation area of the piping system. In particular, the resistance to corrosion, erosion, oxidation and other deterioration during projected service life are to be taken into account.

Reference is made to DNVGL Rules Pt.4, Ch.6 – Section 2 – Materials.

Range of Application / Limitation

Job Id: **262.1-030001-1**
 Certificate No: **TAP00000DU**
 Revision No: **3**

The metallic expansion joint types listed below are type approved for application in pipe class II and III piping systems as follows:

Bellow type	Nominal diameter DN	Nominal pressure PN ¹	Application	Maximum service pressure
AN, AF, AM, AP	1300, 1500, 1600, 1900, 2200	1	Exhaust gas	up to +550°C
AM, AP	100 up to 1200	2.5		
AN, AF	32 up to 1200	2.5		
		6		
WN, WF	100 up to 1200	6		
RM, RP	25 up to 400	6		
AN, AF	32 up to 400	10	Steam, Thermal oil ² Fuel oil, Lubricating oil, Flammable hydraulic oil,	up to +300°C
	32 up to 400	16		
	32 up to 150	25		
	32 up to 150	40		
RM, RP	25 up to 400	10	Other media	up to +150°C
	25 up to 400	16		
WN, WF	100 up to 400	10	Other media	up to + 300°C
	100 up to 400	16		

Notes

¹ Pressure reduction factors for elevated temperatures specified by the manufacturer are to be observed.

Loose flange connections

Expansion joints with loose flanges in combination with flared bellows end are not approved for application in steam, lubricating and fuel oil systems.

For "Other media" and piping systems included in pipe class II this type of flange connection is approved for service temperatures up to + 250°C. For pipe class III applications the temperature range is limited according to the values specified in this type approval certificate.

Refer to DNV GL Rules Pt.4, Ch. 6, Section 9 – 5 Detachable pipe connections, Table 9 – Type F.

Installation in thermal oil systems

The use of expansion bellows in thermal oil system is restricted and based on a case by case approval. Refer to Rules Pt.4, Ch.6, Sec.5 [5.1.4] and Sec. 9 – 5 Thermal-oil installations [5.1.4].

Job Id: **262.1-030001-1**
 Certificate No: **TAP00000DU**
 Revision No: **3**

Expansion bellow design²

This type approval is based on EJMA bellow design calculation with specific service parameters and life cycle expectations and assembly drawings as specified below.

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 Pt.4, Ch.6 – Section 9.

Type	Expansion bellow design calculation ¹	Drawing number
AN	AN0032/016/A012/VV-116	081601-02
	AN0032/040/A010/BsBs-145	--
	AN0040/016/A022/VV - 144	081601-03
	AN0050/016/A022/VV - 190	081601-04
	AN0065/016/A038/VV - 181	081601-05
	AN0080/016/A036/VV - 204	081601-06
	AN0150/040/A034/BsBs	--
	AN0400/016, AN0500/006, AN1200/006	--
	AN1300/001/A130/B/B – 320, 2017-09	
	AN1500/001/A110/B/B – 270, 2017-09	
	AN1600/001/A120/B/B – 270, 2017-09	
	AN1900/001/A110/B/B – 270, 2017-09	
	AN2200/001/A130/B/B – 300, 2017-09	
AF	AF1300/001/A060/B/B - 320, 2017-09	
	AF1500/001/A050/B/B - 270, 2017-09	
	AF1600/001/A050/B/B - 270, 2017-09	
	AF1900/001/A050/B/B - 270, 2017-09	
	AF2200/001/A050/B/B - 300, 2017-09	
AM	AM0100/002.5/A066/BsBs - 500	AM – DN100
	AM0500/002.5/A140-BB - 600	AM – DN500
	AM1400/002.5/A200-BB - 600	AM – DN1400
	AM 1300/001/A230/B/B – 550, 2017-09	
	AM 1500/001/A180/B/B – 480, 2017-09	
	AM 1600/001/A180/B/B – 480, 2017-09	
	AM 1900/001/A170/B/B – 480, 2017-09	
	AM 2200/001/A200/B/B – 520, 2017-09	
	AM0100/002.5/A066/BsBs - 500	AP – DN100
	AM0500/002.5/A140/BB - 600	AP – DN500
AM1400/002.5/A200/BB - 600	AP – DN1400	
AP	AP1300/001/A100/B/B - 550,2017-09	
	AP1500/001/A100/B/B - 480,2017-09	
	AP1600/001/A100/B/B - 480,2017-09	
	AP1900/001/A100/B/B - 480,2017-09	
	AP2200/001/A100/B/B - 520,2017-09	
RM ³	RM0025/016/L240/FF/1100	
	RM0250/016/L200/F/F/1100	
	RM1400/016/L060/RR/1960	
WN ⁴	WN0100/016/W016/BsBs-300	
	WN0500/016/W009/RR-500	
	WN1200/006//W006/FF-1100	

Notes

¹ Type designation refer to HKS code dated 1995-05-23

² EJMA calculation of bellows based on fatigue life of 1.000 cycles. Minimum safety factor 1.

³ Stress calculation of tie rods for RM0025, RM0250 and RM1400

⁴ Stress calculation of angular element for WN0100, WN0500, WN1200

Job Id: **262.1-030001-1**
 Certificate No: **TAP00000DU**
 Revision No: **3**

Production places

Czech Republic	DNV GL Station
HKS - CZ, s.r.o. Mlekojedská 1994/7 412 01 Litomerice	Prague
Manufacturer Certificate (AoM) Welding Shop approval WF 0110001 HH, Rev.4	
Germany	DNV GL Station
HKS GmbH Schonenfahrerstr. 1 18057 Rostock	Rostock
Manufacturer Certificate (AoM) Welding Shop approval WF 1510006 HH, Rev.0	

Responsibilities

The company HKS GmbH, Rostock takes the responsibility that both design and production are in compliance with Rules, Standards and/or Regulations listed on page 1 of this certificate.

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, 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.

Production testing

Each batch of expansion bellow shall be delivered with a copy of the DNVGL Type Approval certificate. Refer to Pt.4, Ch.6 – Section 9, para. 5.3 Expansion bellows.

Materials of bellows included in pipe class 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.

Marking of product

For traceability to this type approval, the final products are to be permanently marked on the flange at least as follows:

Scope of marking	Example
Nominal Pressure, Nominal Diameter	PN2.5 DN1200
Date of production	02/2018
Manufacturer's name, short sign	HKS
Type	AF
Temperature	200°C

Job Id: 262.1-030001-1
Certificate No: TAP00000DU
Revision No: 3

Type tests carried out

Endurance tests, burst tests

Type Approval documentation

- Test reports of pressure and endurance tests
Test report 3837PR05920 dated 2002-10-17
GL Cert.No.: 17483 PRG
HKS reports of pressure tests witnessed by GL surveyor
- Bellow design drawings as listed in certificate
- Bellows design calculation acc. to EJMA Standard: Edition, 9th Edition: 2008.
- Assessment report dated 2016-06-15, HKS-CZ, s.r.o., Mlékojedská 1994/7
- Welding procedure specification WPS
060-141-2.4831-K2-PB-1.4541,1.4571,1.4435,P265GH,16Mo3
061-141-2.4831-K1-PB, 071-141-1.4551-K2-PB, 060-141-2.4831-K2-PB,
058-141-2.4831-K2-PB-1.4541,1.4571,1.4435,P265GH,S235JR
071-141-1.4551-K2-PB-1.4541,1.4301,1.4306
459-141-E-VII-PA-1.4571,1.4541,P235GH,S235JR
461-141-E-VII-PA-1.4571,1.4541, 494-141-E-VII-PA-1.4571,1.4541
692-141-EVII-PA-1.4541,P235GH, 725-141-2.4831-SK3-PB
1231-141-1.4462-IP1,5-PA, 1243-141-1.4462-SK3-PB
1485-142-1.4539-I1-PA-6, 1530-142-1.4462-IO,8-PA-6
- Welding procedure approval test certificate
1489/50/05/AW/IC/W
- Material inspection certificate 17EA-043108, 2017-11-29 issued for UNS S31254

PERIODICAL ASSESSMENT

A condition for retention of the type approval certificate in its validity period is that periodical assessments are successfully carried out. The objective of the periodical assessment is to verify that the conditions for the type approval have not been altered.

For further information refer to DNVGL Class Programme CP-0338.

It is further to be noted that the Society shall be informed in case of :

- Modifications to the product which are liable to affect its characteristics and functions, as originally specified and tested;
- Shifting of the production site and additional production site.

End of certificate