

# TYPE APPROVAL CERTIFICATE

Certificate No:  
**TAP00000DU**  
Revision No:  
**4**

## This is to certify:

**That the Metallic Expansion Joints**

with type designation(s)  
**AN/AF/AM/APX/AP/WN/RM, AN-DNV-SHIP-6-2-6 LFL**

Issued to

**HKS GmbH industrieller Hersteller von Kompensatoren und  
Schläuchen  
Rostock, Germany**

is found to comply with

**DNV rules for classification – Ships Pt.4 Ch.6 Piping systems  
DNV rules for classification – Ships Pt.6 Ch.2 Sec.6 Low flashpoint liquid fuelled engines – LFL fuelled**

## Application :

**Products approved by this certificate are accepted for installation on all vessels classed by DNV.**

<b>Type:</b>	<b>Temperature range:</b>	<b>Max. working press.:</b>	<b>Sizes:</b>
<b>AN/AF/AM/APX/AP/WN/RM</b>	<b>-55°C up to +550°C</b>	<b>1, 2.5, 16, 40 bar</b>	<b>DN25 up to DN2200</b>
<b>AN-DNV-SHIP-6-2-6 LFL</b>	<b>+5°C up to +200°C</b>	<b>16bar</b>	<b>DN25 up to DN400</b>

Issued at **Hamburg** on **2024-04-03**

for **DNV**

This Certificate is valid until **2029-04-02**.

DNV local unit: **Rostock**

Approval Engineer: **Hagen Markus**

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**Sven Klinger**  
**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.

LEGAL DISCLAIMER: Unless otherwise stated in the applicable contract with the holder of this document, or following from mandatory law, the liability of DNV AS, its parent companies and their subsidiaries as well as their officers, directors and employees ("DNV") arising from or in connection with the services rendered for the purpose of the issuance of this document or reliance thereon, whether in contract or in tort (including negligence), shall be limited to direct losses and under any circumstance be limited to 300,000 USD.



## Product description

Metallic expansion joints of axial, lateral and angular type made of U-Shaped bellows with different types of flanges or welding ends. Bellows design according to EJMA, Edition 9<sup>th</sup> and 10<sup>th</sup> Edition.

HKS bellows type	Compensation motion	Expansion joint design
AN	Axial	Single bellows standard
AF		Type AN bellows with inner guide tube
AM	Axial universal type	Double bellows standard
AP		Type AM bellows with inner guide tube
APX		Type AM bellows with special parts
RM	Lateral	Double bellows standard with tie rods
RP		Type RM bellows with inner guide tube
WN	Angular	Single bellows standard with angular elements
WF		Type WN bellows with inner guide tube

## Bellows end pipe connection types

Reference: HKS product catalogue "Expansion joints and hoses"

Pipe connection type <sup>2</sup>	DNV Flange type <sup>3</sup>	Axial	Universal	Lateral	Angular
		HKS pipe connection type			
Loose plate flange with pressed collar	F	B-B	B-B	B-B	n.a.
Plate flange (standard)	E	F-F	n.a.	F-F	F-F
Weld neck flanges	A	V-V	n.a.	n.a.	n.a.
Loose plate flange with welded collar	B	D-D	n.a.	n.a.	n.a.
Plate flange (Methanol)	B	F-F	n.a.	n.a.	n.a.
Weld end	n.a.	R-R	R-R	R-R	R-R
Custom made flange	Acc. to Pt.4 Ch.6 Table 7	S			

### Note

<sup>1</sup> The above table specifies for each expansion joint type the standard HKS pipe connection type. The other types may also be applied on request.

<sup>2</sup> Acc. to ISO 1092

<sup>3</sup> Refer to DNV-RU-Ship Pt.4 Ch.6 Sec. 9 – Figure 4 and table 7

## Materials

Bellows and collars materials		Flange materials	
DIN EN Code	Chemical composition	Material group ISO/TR20172	Material group
1.4541	X6CrNiTi 1814	1.1, 1.2	Carbon steel
1.4571	X6CrNiMoTi17-12-2		
1.4301	X5CrNi18-10		
1.4404	X2CrNiMo17-12-2	5.1, 5.2	Heat resistance steel
1.4306	X2CrNi19-11	7.1	Ferritic stainless steel
1.4435	X2CrNiMo18-14-3		
1.4462	X2CrNiMoN22-5-3	8.1, 8.2	Low temperature stainless steel
1.4547	X1CrNiMoCuN20-18-7		
1.4539	X1NiCrMoCu25-20-5		
2.4605	NiCr23Mo16Al	43	Nickel and nickel alloys
2.4856	NiCr22Mo9Nb		
2.4858	NiCr21Mo	45	

Additional material combinations may be approved case by case, based on appropriate WPS and WPQR.

**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 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 considered.

**Sea water application**

The term sea water application includes piping systems conveying sea water and piping systems installed on the open deck.

The stainless-steel materials 1.4435, 1.4462, 1.4547, 1.4539 are approved for sea water application.

Even the stainless-steel grade specified above cannot be considered immune to attack under all situations, avoidance of stagnant seawater conditions and removal of welding oxides after welding are some of the important factors to the successful use in piping systems for sea water and installation on open deck.

**Bellows materials with limitation**

The bellows materials listed in the table below are considered not suitable for:

- application in unprotected installation areas subject to sea water spray or green sea, e.g. open deck.
- in wet exhaust gas respectively exhaust gas scrubber systems and similar application with high corrosive media. This is also applicable to combination of carbon steel flanges with any bellows material.

DIN EN Code	Chemical composition
1.4541	X6CrNiTi 1814
1.4571	X6CrNiMoTi17-12-2
1.4301	X5CrNi18-10
1.4306	X2CrNi19-11
1.4404	X2CrNiMo17-12-2

Reference: DNV Rules Pt.4 Ch.6 – Section 2 – Materials

**Requirements on materials certification according to pipe classes**

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

Refer to DNV-RU-Ship:

- Pt.4 Ch.6, Sec.1 - Table 1 Classes of piping systems
- Pt.4 Ch.6, Sec.2 - Table 3 Material certificates
- Pt.2 Ch.1, Sec.1 - Table 4 Materials manufacturers

### Range of Application / Limitation

The metallic expansion joint types listed below are type approved for application in pipe class II and III piping systems for compensation of thermal movements and relative movements of components and machinery.

#### DNV-RU-SHIP Pt.4 Ch.6 Piping Systems

Bellows type	Nominal diameter DN	Nominal pressure PN <sup>1</sup>	Max. service temperature	Piping system	Pipe class <sup>3</sup>	Standard Bellows end connection <sup>4</sup>
AN, AF	32 up to 1200	2.5	≤ 550°C	Other Media such as Open ended pipes Exhaust gas	III	B-B F-F
		6				
AM, AP	100 up to 1200	2.5				
AN, AF, AM, AP	1300, 1500, 1600, 1900, 2200	1				
WN, WF	100 up to 1200	6				
RM, RP	25 up to 400	6				
AN, AF	32 up to 400	6	≤ 170°C	Steam	III	F-F
	32 up to 400	6	≤ 150°C	Fuel oil, Lubricating oil, Flammable hydraulic oil	III	F-F
AN, AF	32 up to 400	10, 16	≤ 300°C	Steam	II	V-V D-D R-R
WN, WF	100 up to 400	10, 16				
AN, AF	32 up to 150	16	≤ 150°C	Fuel oil, Lubricating oil, Flammable hydraulic oil	II	V-V D-D R-R
WN, WF	100 up to 400	10, 16				
AN, AF	32 up to 150	25, 40	or >300°C	Steam	I	V-V D-D R-R
	32 up to 150	25, 40	or >150°C	Fuel oil, Lubricating oil, Flammable hydraulic oil	I	
	32 up to 150	25, 40	≤ 300°C	Other Media	II	
RM, RP	25 up to 400	6	≤ 170°C	Steam	III	F-F
	25 up to 400	6	≤ 60°C	Fuel oil, Lubricating oil, Flammable hydraulic oil	III	F-F
	25 up to 400	10,16	≤ 300°C	Steam	II	V-V D-D R-R
		10, 16	≤ 150°C	Fuel oil, Lubricating oil, Flammable hydraulic oil	II	
RM, RP	25 up to 400	16	≤ 200°C	Other media	III	F-F
WN, WF	100 up to 400	10, 16	≤ 200°C			

#### DNV RU SHIP Pt.6 Ch.2 Sec. 6 LFL fuels

AN, AF	25 up to 400	16	-55°C up to +150°C	Methyl/Ethyl (Methanol) liquid and gaseous phase, including vacuum.	II	F-F V-V D-D R-R
			> 150°C ≤200°C		I	

#### Notes

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

<sup>2</sup> For installation in exhaust gas lines on diesel engines, e.g., on cylinder head or in exhaust gas manifold, the bellows design calculation shall include prove acc. to EMA 9th Ed., Sec. 4.9- Vibration for each individual application.

<sup>3</sup> DNV-RU- SHIPS Pt.4 Ch.6 Piping Systems, Section 1 Table 2 Classes of piping systems

<sup>4</sup> HKS product catalogue "Expansion joints and hoses"

#### Limitation thermal oil pipe system application

The use of expansion joints in thermal oil system is restricted.

Approval may be given based on a case-by-case approval.

Refer to Pt.4 Ch.6, Sec.5 [5.1.4] and Sec. 9 – 5 Thermal-oil installations [5.1.4].

### **Bellows pipe end connections**

For selection of flange types DNV RU Ship Pt.4 Ch.6, Sec. 9 – Table 7 Type of flange connections are to be observed.

### **Loose plate flange with pressed collar HKS Flange connection B**

Expansion joints with loose plate in combination with pressed collar bellows end are not approved for application in steam, lubricating, fuel oil and Methyl/Ethyl (Methanol) systems.

For “Other medias” 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 RU SHIP Rules Pt.4 Ch. 6, Section 9 – 5 Detachable pipe connections, Figure 4 and Table 7 – Type F.

### **Expansion bellows design**

The lifetime of expansion bellows depends on the service conditions, such as working pressure, axial and lateral stroke and bending angle.

Accordingly, for each application the bellows design shall be based on the applicable service condition and lifetime. This is to be documented by dedicated EJMA bellows calculation and in the expansion joint design drawing for each delivery.

### **Application DNV-RU-SHIP Pt. 4 Ch.6 Piping systems.**

For application in machinery piping systems the approval is based on bellows design calculations acc. to EJMA, Edition 9<sup>th</sup> and 10<sup>th</sup>, minimum life cycle of 1000 and safety factor  $f_c$  of 1.

### **Application DNV-RU-SHIP Pt.6 Ch.2 Section 6 LFL Fuels - Methyl/Ethyl (Methanol)**

For application of types AN sizes AN 0025 up to AN400 for application in methanol fuel piping systems, bellows design calculation is based on EJMA, Edition 10<sup>th</sup>, minimum life cycle of 7000 and safety factor  $f_c$  of 0.85.

### **Approved design drawings for application methanol**

Type DD Flange: AN 0025/16/A008/DD-192, AN 0100/16/A019/DD-250 and AN 0400/16/A052/DD-468

Type FF Flange: AN 0050/016/A010/FF-244, AF 0250/016/A042/FF-392

Other sizes with same flange welds may be used.

### **Production places**

HKS GmbH, Schonenfaherstr. 1, 18057 Rostock, Germany  
Welding Shop approval WWA0000150, Rev.2

HKS - CZ, s.r.o., Mlekojedska 1994/7, 412 01 Litomerice, Czech Republic  
Welding Shop approval WWA00000XD, Rev.2

### **Responsibilities**

The company HKS GmbH, Rostock takes the responsibility for the design and the production procedures with relation to ensuring continued consistent production of the type approved products.

Reference DNV CP-0338 Type approval scheme, Section 4.

### **Installation**

#### **General**

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.

#### **Alternative fuel - Methanol**

Depending on the installation location, splash protection may need to be provided so that no methanol hits hot surfaces in the event of a leak.

### Production testing

Each metallic expansion joints included in pipe class I and II are to be pressure tested up to 1.5 / 2.0 times the design pressure. Non-destructive testing of welding according to HKS work instruction "AA\_8312, Rev. 1.2".

As part of the delivery documentation, a works certificate together with a copy of this type approval certificate may be enclosed to each delivery.

### 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	02/2024
Manufacturer's name, short sign	HKS
Type	AF
Temperature	200°C

### Type tests carried out

Endurance tests, burst tests, vacuum resistance calculation acc. to EJMA, Edition 10:2015

### Type Approval documentation

TAP00000DU, Revision 4

Work scope: Renewal and technical modification. Including expansion joints for use in low flash point fuel systems acc. to Pt.6 Ch.2, Sec. 6

#### Documents

Drawings expansion joints with flange connection application Methanol

Drawing	Flange type	Issue date
AN 0025/16/A008/DD-192	D-D	14.06.2023
AN 0100/16/A019/DD-250		
AN 0400/16/A052/DD-468		
AN 0050/016/A010/FF-244	F-F	
AF 0250/016/A042/FF-392		

Approved design drawings for application methanol

Type DD Flange: AN 0025/16/A008/DD-192, AN 0100/16/A019/DD-250 and AN 0400/16/A052/DD-468

Type FF Flange: AF 0250/016/A042/FF-392

Other sizes with same flange welds are included.

Bellows design calculation acc. to EJMA, Edition 10:2015

Type/sizes	Service condition
AN 0025/0032/0040/0050/0065/0080/ 0100/0125/0150/AN0200/AN0250/AN0300/AN0350/AN400	Vacuum -1 bar min., +200°C, fc 0.85.
	Vacuum -0.5bar min, 16bar max, + 200°C, fc 0.85

#### Test reports

HKS Certificate	Test specimen drawing	Test location
2023/0764	AN 0025/016/A008/D/D-192	Rostock-2023-09-14
2023/0764/1	AN 0050/016/A010/F/F-244	
13867	AN0100/016/A019/D/D-250	Litomerice-2023-09-01
13868	AN0250/016/A042/F/F -392	
13881	AN0400/016/A052/D/D/-468	



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**Miscellaneous documents**

- Welding procedure specifications WPS - EN ISO 15609-1 for Nickel base alloys
- HKS works instruction "AA\_8312-Metallische Kompensatoren und Schlauchleitungen mit Endabnahme durch Benannte Stellen", Revision 1.2

**Periodical assessment**

For retention of the Type Approval, a DNV Surveyor shall perform periodical assessment to verify that the conditions for the Type Approval are complied with. Refer to the Class Programme DNV-CP-0338, Sec.4.

To check the validity of this certificate, please look it up in <https://approvalfinder.dnv.com>

**End of certificate**