

# TYPE APPROVAL CERTIFICATE

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**This is to certify:**

**That the Metallic Expansion Joints**

with type designation(s)  
**Omega ZH**

Issued to  
**SFZ S.A.S.**  
**CHASSIEU, France**

is found to comply with  
**DNV GL rules for classification – Ships Pt.5 Ch.7 Liquefied gas tankers**

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**Application :**

**Product(s) approved by this certificate is/are accepted for installation on all vessels classed by DNV GL.**

**Temperature range:** -163 °C to 80 °C  
**Max. working press.:** 10 bar  
**Sizes:** 2.5", 5", 6", 8", 10", 12", 14", 16", 18", 20", 22", 24", 28"

This Certificate is valid until **2021-06-30**.

Issued at **Høvik** on **2016-11-30**

DNV GL local station: **Marseille**

for **DNV GL**

Approval Engineer: **Adel Samiei**

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**Marianne Spæren Marveng**  
**Head of Section**

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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

Design:

Omega ZH shaped (universal) double ply metallic expansion bellows with permanently fitted flanges, designed according to EJMA 9<sup>th</sup> edition.

Materials:

Part	Material
Bellows	316L/Inconel 625/Incoloy 825
Tie Rods	316L
Pipes	≤12" A312-TP316L Sch 10S ≥14" A409-TP316L Sch 10S
Flanges	A182 F316L WN 150 lbs RF

## Application/Limitation

This type approval covers the design of the product with respect to internal pressure. External loading/pipe loads have not been considered.

Design data for Omega ZH shaped convolutions in references drawings:

Drawing no	Sizes	Sleeve	Drawing no	Sizes	Sleeve
PC26955_GL_01	6",8",12",20",24"	YES	PC26955_CR_01	5"	NO
PC26955_GL_02	6",8",12"	YES	PC26955_CR_02	6"	NO
PC26955_GL_04	2.5"	NO	PC26955_CR_03	12"	YES
PC26955_GL_05	6",14",22",24"	YES	PC26955_CR_04	12",18",24"	YES
PC26955_GL_06	6",8",12",18"	YES	PC26955_CR_06	8",10",12",16",20"	YES
PC26955_GL_07	6",8",18"	YES	PC26955_CR_07	10"	YES
PC26955_GL_09	24",28"	YES	PC26955_CR_08	10",18"	YES
PC26955_GL_11	6",10"	YES	PC26955_CP_01	16"	NO

The installation/location of expansion joints is to be approved in each case. Piping system drawings shall be sent to 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.

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.

Each expansion joints has to be hydraulically tested to 1.5 times the design pressure in presence of DNV GL surveyor and delivered with a DNV GL product certificate.

Flow velocity in bellows without sleeves is limited as bellow: (Reference to EJMA 9<sup>th</sup> edition Table 4.10-1)

Size	Liquid flow	Gas flow
2.5"	2.1336 m/s	5.1816 m/s
5"	3.6576 m/s	8.6868 m/s
6" & 16"	4.2672 m/s	10.3632 m/s

Material of bellow shall have material certificates in accordance with DNV GL rules for classification of ships Pt.5 Ch.7 Sec.1 Table 8. All materials delivered with VL or works certificate shall be made at works approved by DNV GL manufacturers (AOM).

All expansion bellows covered by this approval are approved for 8000 life cycles (movements as indicated in the product description part) or 2000000 cycles (caused by ship deformation).

Full penetration welds (including longitudinal weld of all plies) are to be subject to 100% X-ray inspection. Bellows weld to pipe are to be subject to 100% dye Penetrant testing

Job Id: **262.1-000073-6**  
Certificate No: **TAP00000MC**

### **Type Approval documentation**

Drawings: PC26955\_GL\_01, PC26955\_GL\_02, PC26955\_GL\_04, PC26955\_GL\_05, PC26955\_GL\_06, PC26955\_GL\_07, PC26955\_GL\_09, PC26955\_GL\_11, PC26955\_CR\_01, PC26955\_CR\_02, PC26955\_CR\_03, PC26955\_CR\_04, PC26955\_CR\_06, PC26955\_CR\_07, PC26955\_CR\_08, PC26955\_CP\_01  
NA\_DNV Revision 0

Manufacturer's calculations No.:

- NC\_24445\_A\_0, NC\_24445\_B\_0, NC\_24445\_C\_0, NC\_24445\_D\_0, NC\_20023\_A\_0 and NC\_20023\_B\_0

apave fatigue life test reports No.:

- 20266222/a DN700, 20266222/b DN250, 20266222/c DN150, 20266222/d DN50

CETIM fatigue life test reports No:

- 5/023496/523/4A and 5/031044/581/4A

### **Tests carried out**

Burst pressure test, hydraulic test, cyclic test and fatigue life test

### **Marking of product**

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

- Manufacturer's name or trade mark
- Type designation
- Arrow to indicate direction of flow on one way flow bellows.
- Additional marking necessary for identification.

### **Periodical assessment**

For retention of the Type Approval, a DNV GL Surveyor shall perform a survey – every second year and before the expiry date of this certificate to verify that the conditions for the type approval are complied with.