Certificate No:
TAP00002R9

TYPE APPROVAL CERTIFICATE

This is to certify:

That the Metallic Expansion Joints

with type designation(s)
A1F2Y 3F0 PN6, A1F2Y 3F0 PN16, S2F0XV 3FF PN16, S2F0YV 3FF PN16

Issued to
Steelflex S.r.l.
Milano, MI, Italy

is found to comply with
DNV-OS-D101 – Marine and machinery systems and equipment, Edition July 2021
DNV rules for classification – Ships Pt.4 Ch.6 Piping systems

Application :

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

Type:	Temperature range:	Max. working press.:	Sizes:
A1F2Y 3F0 PN6	-10°C to 400°C	See page 2	See page 2
A1F2Y 3F0 PN16	-10°C to 400°C	See page 2	See page 2
S2F0XV 3FF PN16	-10°C to 400°C	See page 2	See page 2
S2F0YV 3FF PN16	-10°C to 400°C	See page 2	See page 2

Issued at **Høvik** on **2023-06-01**
This Certificate is valid until **2028-05-31**.
DNV local unit: **Italy/Malta CMC**

for **DNV**

Approval Engineer: **Thomas Wilhelm Juell**

Zeinab Sharifi
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

Single and universal type metallic expansion bellows with end flanges designed according to EN 14917:

Bellows type	Type	Size (DN)	Inner bellows diameter	Pitch	Height	Ply x thk.	Convolutions
Single	A1F2Y 3F0 PN6	50	58 mm	9.27 mm	8.3 mm	4 x 0.3 mm	13
		65	74 mm	10.08 mm	10.2 mm	3 x 0.4 mm	13
		80	87 mm	11.46 mm	11 mm	3 x 0.4 mm	12
		100[1]	111 mm	12.18 mm	12.1 mm	3 x 0.4 mm	11
		125[2]	136 mm	13.05 mm	13.4 mm	3 x 0.4 mm	10
		150[3]	165 mm	14.0 mm	14.3 mm	3 x 0.4 mm	9
		200[3]	216 mm	16.63 mm	18.0 mm	3 x 0.5 mm	8
		250[3]	270 mm	18.33 mm	21.5 mm	3 x 0.5 mm	6
		300[4]	321 mm	21.2 mm	23.0 mm	4 x 0.5 mm	5
		350	353 mm	21.4 mm	23.3 mm	4 x 0.5 mm	5
		400	403 mm	21.6 mm	23.7 mm	4 x 0.5 mm	5
Single	A1F2Y 3F0 PN16	50	58 mm	9.04 mm	8.3 mm	4 x 0.3 mm	13
		65	74 mm	10.23 mm	10.2 mm	3 x 0.4 mm	13
		80	87 mm	11.13 mm	11.0 mm	3 x 0.4 mm	12
		100	111 mm	11.91 mm	12.1 mm	3 x 0.4 mm	11
		125	136 mm	13.15 mm	13.4 mm	3 x 0.4 mm	10
		150	165 mm	14.22 mm	14.3 mm	3 x 0.4 mm	9
		200[5]	216 mm	16.25 mm	18.0 mm	3 x 0.5 mm	8
		250[6]	270 mm	19.17 mm	21.5 mm	3 x 0.5 mm	6
		300[6]	321 mm	22.0 mm	23.0 mm	4 x 0.5 mm	5
		350	353 mm	21.8 mm	23.3 mm	4 x 0.5 mm	5
		400	403 mm	21.6 mm	23.7 mm	4 x 0.5 mm	5
Universal	S2F0XV 3FF PN16	50	58 mm	9.34 mm	8.3 mm	4 x 0.3 mm	5 + 5
		65	74 mm	10.37 mm	10.2 mm	3 x 0.4 mm	6 + 6
		80	87 mm	11.28 mm	11.0 mm	3 x 0.4 mm	6 + 6
		100	111 mm	12.34 mm	12.1 mm	3 x 0.4 mm	5 + 5
		125	136 mm	13.44 mm	13.4 mm	3 x 0.4 mm	5 + 5
		150	165 mm	13.93 mm	14.3 mm	3 x 0.4 mm	4 + 4
		200[5]	216 mm	16.88 mm	18.0 mm	3 x 0.5 mm	4 + 4
		250[6]	270 mm	18.75 mm	21.5 mm	3 x 0.5 mm	4 + 4
		300[7]	321 mm	22.38 mm	23.0 mm	4 x 0.5 mm	4 + 4
Universal	S2F0YV 3FF PN16	50	58 mm	8.84 mm	8.3 mm	4 x 0.3 mm	5 + 5
		65	74 mm	10.37 mm	10.2 mm	3 x 0.4 mm	6 + 6
		80	87 mm	11.28 mm	11.0 mm	3 x 0.4 mm	6 + 6
		100	111 mm	12.34 mm	12.1 mm	3 x 0.4 mm	5 + 5
		125	136 mm	13.44 mm	13.4 mm	3 x 0.4 mm	5 + 5
		150	165 mm	13.93 mm	14.3 mm	3 x 0.4 mm	4 + 4
		200[5]	216 mm	16.88 mm	18.0 mm	3 x 0.5 mm	4 + 4
		250[6]	270 mm	18.75 mm	21.5 mm	3 x 0.5 mm	4 + 4
		300[7]	321 mm	22.38 mm	23.0 mm	4 x 0.5 mm	4 + 4

[1] with collar – 2 mm thickness and 25 mm length
[2] with collar – 2 mm thickness and 24 mm length
[3] with collar – 2 mm thickness and 28 mm length
[4] with collar – 2 mm thickness and 30 mm length
[5] with collar – 2 mm thickness and 32 mm length
[6] with collar – 2 mm thickness and 36 mm length
[7] with collar – 2 mm thickness and 35 mm length

Materials:

Bellows, collar & Internal sleeve: 1.4541 according to EN 10028-7
Pipe: 1.0425 EN 10216-2 / SA-106 Grade B
Flange: 1.0460 according to EN 1092-1 / SA-516 Grade 60 according to EN 1092-1

Application/Limitation

Expansion bellows covered by this certificate are found to be in compliance with the given design standard.

Bellows	Type	Size	Movement	Life cycles

type		(DN)	Axial	Lateral		Angular	
Single	A1F2Y 3F0 PN6	50	+4/-25 mm	-		-	1000
		65	+5/-27 mm	-		-	1000
		80	+5/-29 mm	-		-	1000
		100	+5/-32 mm	-		-	1000
		125	+6/-35 mm	-		-	1000
		150	+6/-35 mm	-		-	1000
		200	+6/-38 mm	-		-	1000
		250	+6/-39 mm	-		-	1000
		300	+6/-40 mm	-		-	1000
		350	+6/-40 mm	-		-	1000
		400	+6/-40 mm	-		-	1000
Single	A1F2Y 3F0 PN16	50	+4/-24 mm	-		-	1000
		65	+5/-25 mm	-		-	1000
		80	+5/-27 mm	-		-	1000
		100	+5/-30 mm	-		-	1000
		125	+6/-32 mm	-		-	1000
		150	+6/-32 mm	-		-	1000
		200	+6/-35 mm	-		-	1000
		250	+6/-35 mm	-		-	1000
		300	+6/-36 mm	-		-	1000
		350	+6/-36 mm	-		-	1000
		400	+6/-36 mm	-		-	1000
Universal	S2F0XV 3FF PN16	50	-	±32 mm	-64 mm	-	1000
		65	-	±32 mm	-64 mm	-	1000
		80	-	±32 mm	-64 mm	-	1000
		100	-	±28 mm	-56 mm	-	1000
		125	-	±28 mm	-56 mm	-	1000
		150	-	±26 mm	-52 mm	-	1000
		200	-	±26 mm	-52 mm	-	1000
		250	-	±26 mm	-50 mm	-	1000
		300	-	±26 mm	-50 mm	-	1000
Universal	S2F0YV 3FF PN16	50	-	±50 mm	-100 mm	-	1000
		65	-	±50 mm	-100 mm	-	1000
		80	-	±50 mm	-100 mm	-	1000
		100	-	±50 mm	-100 mm	-	1000
		125	-	±45 mm	-90 mm	-	1000
		150	-	±37 mm	-74 mm	-	1000
		200	-	±35 mm	-70 mm	-	1000
		250	-	±35 mm	-70 mm	-	1000
		300	-	±35 mm	-70 mm	-	1000

Maximum design temperature according to design temperature:

	Temperature (°C)	20	50	60	100	150	200	250	300	350	400
Design pressure (bar(g))	A1F2Y 3F0 PN6	6.0	5.8	5.7	5.5	5.2	5.0	4.5	4.1	3.8	3.5
	A1F2Y 3F0 PN16	16.0	15.6	15.4	14.8	14.0	13.3	12.1	11.0	10.2	9.5
	S2F0XV 3FF PN16	16.0	15.6	15.4	14.8	14.0	13.3	12.1	11.0	10.2	9.5
	S2F0YV 3FF PN16	16.0	15.6	15.4	14.8	14.0	13.3	12.1	11.0	10.2	9.5

The expansion bellows may be installed in the following system/media:
A1F2Y 3F0 PN6: Heavy fuel oil / marine gasoil / oil
A1F2Y 3F0 PN16: Heavy fuel oil / marine gasoil / oil / steam and drain condensate / feed water
S2F0XV 3FF PN16: Steam and drain condensate / feed water / fuel oil
S2F0YV 3FF PN16: Steam and drain condensate / feed water / fuel oil

Materials and material protection chosen for the specific system shall be suitable for the intended medium and environmental conditions. Bellows of austenitic stainless steel shall not be used in direct contact with seawater.

Flow velocities in each bellow shall be limited as specified in EN 14917 Table 6.4.3.2-1. When there is no sleeve installed, flow velocities shall not be greater than 8 m/s for liquids and 20 m/s for gases. Minimum thickness of internal sleeve shall be according to EN 14917 Table 6.4.4.2-1.

Production testing
Each expansion bellow shall be subjected to hydrostatic pressure test upon completion to at least 1.5 times the design pressure.

Certification
Whenever the piping system is subject to approval by the society, the below limitations shall be considered:
- Bellows covered by this certificate shall be delivered with test report with reference to this type approval certificate (see to DNV-RU-SHIP Pt.4 Ch.6 Sec.1 Table 3).
- Welding shall fulfill requirements in DNV-RU-SHIP Pt.2 Ch.4.
- Material of bellow shall have material certificates in accordance with DNV-RU-SHIP Pt.4 Ch.6 Sec.2 Table 3. Approval of manufacturer is required for NV or W material certificates.

Type Approval documentation

Marking of product
For traceability to this type approval, the compensators are to be marked with:
- Manufacturer's trademark
- Year of manufacture
- Type designation (as stated in the submitted drawings)
- Size
- Maximum working pressure
- Temperature range
- Nominal movement or specified movement
- The flow direction, if applicable

Periodical assessment
For retention of the Type Approval, a DNV Surveyor shall perform periodical assessment after two years (+/- 90 days) and after 3.5 years (+/- 90 days) to verify that the conditions for the approval are complied with. Reference is made to DNV-CP-0338.