

TYPE APPROVAL CERTIFICATE

This is to certify:**That the Pressure Vessel**

with type designation(s)
CAPV 320 bar (300 – 2250L)

Issued to

Umoe Advanced Composites AS
Mandal, Norway

is found to comply with

DNV GL standard DNVGL-ST-C501 – Composite components, August 2017

DNV GL standard DNVGL-ST-0378 – Standard for offshore and platform lifting appliances

DNVGL-OS-E101 – Drilling facilities, Edition January 2018

Application :

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

Max. working temp.: -40 to +55°C

Design pressure: 333 bar

Operating Medium compressed clean air (no oil) or nitrogen

Issued at **Høvik** on **2018-02-21**

This Certificate is valid until **2023-02-20**.

for **DNV GL**

DNV GL local station: **Kristiansand S**

Approval Engineer: **Maheshraja Venkatesan**

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Marianne Spæren Marveng
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.



Product description

A general purpose Composite Air Pressure Vessel (CAPV) designed and constructed in accordance with DNVGL-OS-C501 with the following dimensions:

Inner diameter	:	610 mm (+/- 3 mm)
Outer diameter	:	740 mm (+/- 3 mm)
Internal volume	:	300 to 2250 litres
Nominal length	:	1415 to 8120 mm (+0/ -15 mm)

Material of construction:

The materials used in the pressure vessel are glass fibre epoxy with PE liner (for details see the CAPV Design Report)

Application/Limitation

The composite pressure vessel covered by this certificate are approved to be used:

- as accumulator in heave compensated riser tensioning systems
- as accumulator in offshore crane systems

The CAPV is designed for the following conditions:

Use	:	General purpose pressure vessel containing compressed air or nitrogen
Maximum operating pressure	:	320 bar
Setting of safety valve	:	333 bar (maximum)
Permanent use temperature range	:	-25°C to +55 °C
Extreme temperature range	:	-40 °C to +55°C
Survival wind condition	:	51 m/sec
Internal fluid medium	:	Compressed clean air (no oil) or nitrogen
External medium	:	Air
Fire resistance	:	The vessel shall be installed only in areas where fire resistance is non-critical
External impact	:	The CAPV will be installed in a protected area where it will not be exposed to any impact from operations onboard. Dropped hand tools would not cause significant damage and need not to be considered.
Static safety factor	:	1.7 with additional system factor of 1.1
Lifetime	:	25 years, provided the fatigue load sequence in the below table under 'Load spectrum' is not exceeded

Load Spectrum

The Miner sum damage for any application during the vessels lifetime is not to exceed the Miner sum damage equivalent to the load cycles below, with the appropriate safety factors. All load cycle calculations have to be verified.

Cycles	Operation/Description	Min. P	Max. P
860	Fill cycles to normal working pressure	0.0	251.4
172	Topping up to design pressure	213.3	320.0
43	Filling to PRV set pressure, MAWP	0.0	333.0
215 000	Low pressure - normal working pressure	152.4	228.6
2 064 000	0	303.2	320.0
8 256 000	0	211.8	228.6
6 450 000	0	79.0	95.8
9 718 000	0	91.0	107.8
38 700 000	0	103.0	119.7
38 700 000	0	114.9	131.7
38 700 000	0	126.9	143.7
38 700 000	0	138.9	155.6

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38 700 000	0	150.9	167.6
32 250 000	0	162.8	179.6
32 250 000	0	174.8	191.6
16 168 000	0	186.8	203.5
12 900 000	0	198.7	215.5
1 419 000	0	210.7	227.5
6 450 000	0	222.7	239.5
1 161 000	0	234.7	251.4
322 802 075	Accumulated Cycles		

The items like pressure relief valve, metal end box and a dip-tube which are the components of CAPV system are not covered under the scope of approval.

Type Approval documentation

Tests carried out

Prototype tests carried out as per DNVGL Ship Rules Pt.5 Ch.8 Sec.5 [4]:

Pressure test	2 tests to failure
Pressure fatigue of tank	2 tests to 50x maximum cycles allowed
Stress Rupture tests	2 tests to 1 000 hours

Production testing

Tests to be carried out for each test after production:

Pressure test	Factory acceptance test to 500 bar
System acceptance test	Test to 1.3 times the design pressure for each tank component

Each pressure test shall be witnessed by a surveyor.

Certification

Each accumulator shall be delivered with product certificate issued by the Society if they are to be installed on a DNV GL classed vessel.

Marking of product

The marking shall show at least the following particulars:

- manufacturer's name and address
- type designation and serial number
- year of manufacture
- maximum allowable working pressure

Periodical assessment

For retention of the Type Approval, a DNV GL 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 DNVGL-CP-0338.