DET NORSKE VERITAS

TYPE APPROVAL CERTIFICATE

CERTIFICATE NO. **P-13684**

This is to certify that the
Pressure Vessel

with type designation(s)
CAPV 300 - 2250 L

Manufactured by
Umoe Advanced Composites AS
MANDAL, Norway

is found to comply with
Det Norske Veritas' Offshore Standard DNV-OS-C501, Composite Components, January 2003
Rules for Classification of Ships Pt.5 Ch.15, CNG Carriers, Scantlings and Testing of Composite Type Cargo Tanks, 2006

Application
To be used as a general purpose pressure vessel, in accordance with application limitations.

Max. working temp.:	**-40 to +70 °C**
Design pressure:	**210 bar (see Application Limitations)**
Operating Medium	**Compressed clean air (no oil) or nitrogen**

Høvik, 2010-12-15
for **Det Norske Veritas AS**

Per Esvall
Head of Section

DNV local office:
Kristiansand S

This Certificate is valid until
2014-12-31

Ulf-Gunnar Mikalsen
Surveyor

Product description

A composite pressure vessel to be used as a general purpose pressure vessel. Typical applications are:

- Accumulator in riser tensioning systems
- Accumulator in active heave compensated crane/winch systems

Application/Limitation

Use:	General purpose vessel for compressed air or nitrogen.
Maximum use temperature:	+70°C internal and external (This is the material temperature, which may be higher than the surrounding air temperature, if the tank is exposed to direct sunlight.)
Minimum use temperature:	-40°C internal and external.
Maximum continuous use temperature:	+70°C internal and external
Minimum continuous use temperature:	-25°C internal and external
Survival wind condition:	51 m/sec
Internal media:	Compressed clean air or nitrogen
External medium:	Air
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.
Lifetime:	25 years.

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.

No. Of Cycles	Min. Pressure	Max. Pressure
500	0	210
2,000	140	210
20,000	127	191
240,000	199	210
960,000	136	191
750,000	51	80
1,130,000	58	90
4,500,000	66	100
4,500,000	74	110
4,500,000	81	120
4,500,000	89	130
4,500,000	97	140
3,750,000	104	150
3,750,000	112	160
1,880,000	120	170
1,500,000	127	180
165,000	135	190
750,000	143	200
135,000	150	210
37,532,500	Accumulated Cycles	

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

Type Approval documentation

Design Report 210bar CAPV, Harald Fernández Cuesta, Umoe Advanced Composites, R-CAPV-0197, Rev. B, 27.10.2010

Pressure Vessel Layout: Drawing T-CAPV-0003, Rev. D, 27.10.2010
Pressure Vessel End Boss: Drawing T-CAPV-0004, Rev.K, 09.08.2010.

Production Report: Manufacturing of Composite Pressure Vessel, Harald Fernández Cuesta, Umoe Advanced Composites, R-CAPV-0196, Rev. C, 13.10.2010

Design Verification of 210bar Composite Pressure Vessel, A. Echtermeyer, DNV Technical Report No. 2010-3548, Rev.14.12.2010

Tests carried out

Tests carried out in the design phase

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

Tests carried out for each pressure vessel after production

Pressure test	Factory acceptance test to 315 bar.
System acceptance test	Test to 1.3 times the design pressure for each tank component

Each pressure test shall be witnessed by a DNV surveyor.

Marking of product

For traceability the following marking is to be carried out on each product:
- Part No.
- Serial No.
- Design Pressure
- Manufacturers Name or Mark

Certificate Retention Survey

For retention of the type approval, DNV Surveyor shall perform a survey – every year or every 1000 tanks, whichever comes first, and before the expiration date of this certificate – to verify that the conditions for the type approval are complied with.

END OF CERTIFICATE