Certificate No:
TAP00002DY

TYPE APPROVAL CERTIFICATE

This is to certify:

That the Heat Exchanger

with type designation(s)
FG HEATER FL143, FBO Mist Seperator FL 146, HD HEATER FL142, NBO Mist Separator FL 147, FORCING VAPORIZER FL145, Water Aftercooler FL152, Water intercooler FL150, Water intercooler FL151, LNG Vaporizer FL144, SPRAY PIPE FL144, SPRAY PIPE FL145, SPRAY PRE-COOLER FL148

Issued to
chaudriconcept
Brignais, Rhone, France

is found to comply with
DNV rules for classification – Ships Pt.4 Ch.7 Pressure equipment
DNV rules for classification – Ships Pt.5 Ch.7 Liquefied gas tankers

Application :

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

Issued at **Høvik** on
This Certificate is valid until .
DNV local station: **France CMC**

for **DNV**

Approval Engineer: **Sarah Miller**

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

Heat exchangers and Pressure vessels in this certificate are classified as class I as per DNV Ship Rules Pt.4 Ch.7 and they all have corrosion allowance of 0.

Type	Temperature range:	Design pressure:	Operating media:
FG HEATER FL143	Shell -18 to 200°C /Tube -196 to 200°C	Shell 10 BAR/ Tube 21 bar	Shell STEAM/NG
FBO Mist Seperator FL 146	-196°C to 80°C	21 bar	NG
HD HEATER FL142	Shell -18 to 200°c/Tube -196 to 200°c	Shell 10 bar/Tube 10 bar	NG
NBO Mist Separator FL 147	-196 to 80 °c	10 bar	NG (Natural Gas)
FORCING VAPORIZER FL145	Shell -18 to 200°c/Tube -196 to 200°c	Shell 10 bar/Tube 21 bar	Shell: Steam/Tube: NG
Water Aftercooler FL152	Shell -18 to 140°C/ Tube -18 to 140°C	Shell 10 bar/ Tube 21 bar	Shell: Water/ Tube: NG
Water intercooler FL150	Shell -18 to 140°C/ Tube -18 to 140°C	Shell 10 bar/ Tube 17.25 bar	Shell: Water/ Tube: NG
Water intercooler FL151	Shell -18 to 140°C/ Tube -18 to 140°C	Shell 10 bar/ Tube 21 bar	Shell: Water/ Tube: NG
LNG Vaporizer FL144	Shell -18 to 200°C /Tube -196 to 200°C	Shell 10 bar/Tube 10 bar	Shell: STEAM/Tube: LNG
SPRAY PIPE FL144	-196 to 200°c	15 bar	NG (Natural Gas)
SPRAY PIPE FL145	-196 to 200°c	21 bar	LNG
SPRAY PRECOOLER FL148	-196 to 80 °c	10 bar	NBO

Materials:

Type	**Shell**	**End/Dished end**	**Channel**	**Tube sheet**	**Tubes**	**Nozzles**
FG Heater FL143/ HD Heater FL142/ FV FL145/ W.A. FL152/ W.I. FL150/ W.I. FL151/ LNG Vaporizer FL144	SA240 304L	SA240 304L	1.4307 EN10028-7	SA182 F304L	SA213 TP304L	SA 312 TP304L
NBO FL 147 FBO FL 146	SA240 304L	SA240 304L	N/A	N/A	N/A	SA 312 TP304L
Spray Pipe FL144/ Spray Pre-cooler FL148	SA240 304L	N/A	N/A	N/A	N/A	SA-312 TP304L
Spray Pipe FL145	SA312 TP304L	N/A	N/A	N/A	N/A	SA-312 TP304L

Application/Limitation

Heat exchangers covered by this certificate are approved to be used in LNG. Heat exchangers and Pressure vessels in this certificate Backing rings shall be removed in pipes welding joints after welding.

Manufacturing, workmanship, and testing shall be done according to DNV Rules Pt.4 Ch.7

Materials and material protection chosen for the specific system shall be suitable for the intended medium and environmental conditions. Surface in contact with the medium shall be protected from corrosion by considering adequate corrosion allowance, and/or by applying suitable coatings. Surface preparation and coating shall be approved by the Society.
Austenitic stainless steels are not to be used in direct contact with seawater.

Type Approval documentation

Production testing

Each heat exchanger/pressure vessel shall be subjected to hydrostatic pressure test upon completion to at least 1.5 times the design pressure in the presence of a DNV Surveyor.

Certification

Materials for pressure retaining parts are to be delivered with material certificates according to DNV-RU-SHIP Pt. 4 Ch.7 Sec.1 Table 5. Also, relevant requirements in DNV-RU-SHIP Pt.2 Ch.2 shall be fulfilled. Approval of manufacturer is required for VL and W material certificates.

Manufacturer shall have a valid approval of manufacturer certificate issued by DNV as per CP-0261.

Each heat exchanger/pressure vessel shall be certified by a DNV surveyor and to be delivered with a DNV product certificate.

Marking of product

Each heat exchanger/pressure vessel shall be permanently and legibly marked on the pressure part or on a nameplate permanently attached to a principal pressure part to show its identity and origin.
The marking of the heat exchanger shall show at least the following particulars:
manufacturer's name and address
type designation and serial number
year of manufacture
maximum allowable working pressure
hydrostatic test pressure

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.