DNV·GL

Certificate No:
TAP00001AE

TYPE APPROVAL CERTIFICATE

This is to certify:

That the Heat Exchanger

with type designation(s)
HSET

Issued to
FrioNordica AS
Malmefjorden, Norway

is found to comply with
DNV GL rules for classification – Ships Pt.4 Ch.7 Pressure equipment

Application :

Products approved by this certificate are accepted for installation on vessels classed by DNV GL.

Temperature range:	**Shell side: -20ºC to 43ºC. Tube side: -20ºC to 43ºC**
Design pressure:	**Shell side: 16 bar. Tube side: 6 bar.**
Operating media:	**Shell side: NH3/HFC. Tube side: Water**

Issued at **Høvik** on **2018-03-22**

This Certificate is valid until **2021-12-31**.

DNV GL local station: **Kristiansund N**

Approval Engineer: **Morten Engnestangen**

for **DNV GL**

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.

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Product description

Spray evaporators of type HSET. Shell and tube heat exchangers with fixed tubesheet.

Types: 16-30, 20-30, 24-30, 24-40, 28-30, 32-30, 32-40, 32-50, and 36-30

In accordance with DNVGL Pt.4 Ch.7 Sec.4 [1.1.4] the heat exchangers have been calculated according to EN13445-3.

Materials:

Shell:	P235GH EN10217-2
Water heads/end boxes:	Not covered by approval, refer Limitations
Nozzles:	P235GH EN10216-2
Ellipsoidal head:	P265GH EN10028
Tubesheets:	P265GH EN10028-2 / Ti Grade 2
Heat exchanger tubes:	Titanium Grade 2 ASME SB338

Corrosion allowance:

Carbon steel:	1.0 mm
Titanium:	0 mm

DNVGL pressure vessel class:

Shell side:	Class I
Tube side:	Class III

Application/Limitation

a. Each heat exchanger is to be certified by DNVGL surveyor and is to be delivered with a product certificate.
b. The materials used shall have certificates according to DNVGL Pt.4 Ch.7. Sec.1 Table 5 for class I unit and Table 7 for class III unit.

Table: Certificates for materials

	Pressure vessel class	
	I	III
Plates	MC issued by Society	TR issued by Manufacturer
Pipes (for shell of vessel)		
Flanges and nozzles	MC issued by Manufacturer	
Heat exchanger tubes		
Bolts		
Forging and castings		

c. Manufacturing, workmanship and testing shall be done according to DNVGL Pt.4 Ch.7 Sec.7.
d. Hydraulic pressure testing to 1.5 x design pressure according to DNVGL Pt.4 Ch.7 Sec.7 [4.6].
e. NDT is to be performed according to DNVGL Pt.4 Ch.7 Sec.7 [4.1.1], as for v = 1.
f. In accordance with DNVGL Pt.4 Ch.7 Sec.1 [3.1.4] the water end boxes have not been subject to design approval and certification are to be based on visual inspection, review of material certificates and pressure testing witnessed by DNVGL surveyor.
g. Approval is limited to the pressure envelope and does not include design review of non-pressure retaining parts such as lifting lugs, frame, etc. Evaluation of lifting, installation, effects of environmental loads, fatigue, nozzle loads- and foundation loads are also excluded.
h. The maximum temperature difference between mean shell side metal temperature and mean tube side metal temperature are not to exceed 20degC during operation.
i. The exchangers covered by this certificate are not designed for pressure loss on shell side or on tube side of exchanger while at operating temperature. Reference is made to EN13445-3 Chapter 13.5.4.1.
j. Materials for the pressure retaining components are to have low temperature properties documented by charpy impact testing:

- Plate material: 41J longitudinal and 27J transverse @ test temperature -25ºC
- Tube material with wall thickness above 6mm: 27J @ test temperature -25ºC

Type Approval documentation

Drawing No.	Title:	Revision no.
125-43	Approbation plan, Spray Evaporator, HSET - Gen.dimensions	B
125-05	Welding detail drawing	B
-		-

Marking of product

For identification to this Type Approval the products are to be marked with:

a) the name and domicile of the manufacturer
b) the manufacturer's type designation and serial number
c) the year of manufacture
d) the design pressure
e) the design temperature(s) in °C
f) the hydraulic test pressure
g) DNVGL's identifying mark.

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.