Certificate no.:
TAP0000300

TYPE APPROVAL CERTIFICATE

This is to certify:

that the Heat Exchanger

with type designation(s)
TBF 350 HX510 / HX520, TBF 350 HX 200 / HX 300

issued to
A.S.T.R.A. REFRIGERANTI S.r.l.
Galliate, NO, Italy

is found to comply with
DNV rules for classification – Ships Pt.4 Ch.7 Pressure equipment
DNV-OS-D101 – Marine and machinery systems and equipment, Edition July 2021

Application:

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

Type	Temperature range:	Design pressure:	Operating media:
TBF 350 HX510 / HX520	See page 2	See page 2	See page 2
TBF 350 HX 200 / HX 300	See page 2	See page 2	See page 2

Issued at **Høvik** on **2025-03-25**

This Certificate is valid until **2030-03-24**.

for **DNV**

DNV local unit: **Italy/Malta CMC**

Approval Engineer: **Tobias Berntsen**

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 USD 300 000.

Product description

Shell and tube heat exchanger with fixed tubesheet, designed according to DNV-RU-SHIP Pt.4 Ch.7 and ASME VIII Div.1.

Materials:

Type:	TBF 350 HX200 / HX300	TBF 350 HX510 / HX520
Shell:	SA-240 316L	SA-240 316L
Nozzles:	SA-312 TP316L	SA-312 TP316L
Tubesheets:	SA-965 F316L	SA-965 F316L
Heat exchanger tubes:	SA-213 TP316L	SA-213 TP316L
Flanges for nozzle D	SA-182 F316L	SA-182 F316L
Slip-on flange for blind flanges for nozzles A, B, E, I*:	SA-240 316L	SA-240 316L

* Slip-on flanges are included for testing purposes and will be cut of on-site. Nozzles A, B, E, I will be welded to the piping system.

Application/Limitation

TBF 350 HX200 / HX300:

	Shell side	Tube side
Design pressure	9 bar(g)	-1 / 30 bar(g)
Test pressure	13.5 bar(g)	45 bar(g)
Design temperature	-49 /+149 (°C)	-49 /+149 (°C)
Working temp (in/out)	15 / 22 (°C) *	66.4 / 17 (°C) *
Joint efficiency	1	1
DNV vessel class	III	I
Medium	Glycol + water	He-N2
Corrosion allowance	0 mm	0 mm

* Mean metal temperatures applied according to manufacturer's calculations.

TBF 350 HX510 / HX520:

	Shell side	Tube side
Design pressure	-1 / 9 bar(g)	-1 / 30 bar(g)
Test pressure	13.5 bar(g)	45 bar(g)
Design temperature	-196 /+149 (°C)	-196 /+149 (°C)
Working temp (in/out)	15 / 22 (°C) *	66.4 / 17 (°C) *
Joint efficiency	1	1
DNV vessel class	III	I
Medium	Glycol + water	He-N2
Corrosion allowance	0 mm	0 mm

* Mean metal temperatures applied according to manufacturer's calculations.

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 steel not to be used in sweater systems. Reference is made to Pt.4 Ch.6 Sec.2.

Type Approval documentation

Production Testing and Certification

Production Testing and Certification for the actual intended application shall follow the latest applicable edition of the Rules (as mentioned on the front page of this certificate).

Marking of product

Minimum marking requirements shall be as outlined in the edition of the Rules (as mentioned on the front page of this certificate).

Periodical assessment

This certificate is only valid if required periodical assessments are carried out with satisfactory results.

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.

To check the validity of this certificate, please look it up in https://approvalfinder.dnv.com