DNV·GL

Certificate No:
TAP00001MB

TYPE APPROVAL CERTIFICATE

This is to certify:

That the Pumps

with type designation(s)
HPP 65

Issued to
Cryostar S.A.S.
HESINGUE, France

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

Application :

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

Max. working press.:	**620 bar**
Operating media:	**Liquefied gases, in particular LNG, LIN**
Temperature range:	**-196°C to +65°C**

Issued at **Hamburg** on **2018-11-23**

This Certificate is valid until **2023-11-22**.

DNV GL local station: **Paris CMC / VMC**

Approval Engineer: **Guido Friederich**

for **DNV GL**

Olaf Drews
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

High pressure cryogenic reciprocating pump consisting of electric motor driven crankshaft section (hot end) and the direct connected reciprocating cryogenic pump (cold end).
The drive section consists of the electric motor directly connected to a crankshaft converting the rotatory drive motion into the stroke actuation for the reciprocating pump.
Depending on the required amount of cryogenic fuel supply one, two or three pumps (cold ends) may be combined to a pump unit on one crankshaft.
Design features of the high pressure pump are the vacuum jacketed pump cylinders for reduced heat transfer and the integrated balanced low and high pressure chambers for the cryogenic fuel (LNG) suction and discharge.

This type approval includes the cryogenic pump section (cold end) only. The additional documentation of the drive section has been reviewed and filed for information.

Pump type	Design pressure (bar)	Test pressure (bar)	Design temperature (°C)	Stroke (mm)
HPP 65 / 90	620	930	-196° to +65°	90
HPP 65 / 110	620	930	-196° to +65°	110
HPP 65 / 120	620	930	-196° to +65°	120

Application

Installation as a cryogenic (LNG) fuel supply pump in gas fuel systems of two-stroke engines. The pumps are arranged on a single rigid pump skid piped with a pulsation damper.
Operating media: Liquefied gas, LNG, liquid nitrogen (LIN)

Limitation

The present Non-Return Valve design fitted on the HPP 65 pump for cryogenic liquefied gas (LNG) discharge into the connected piping system is limited to a design pressure of 450 bar.

Remark:
Electric motors for pump drive including other electrical equipment necessary for pump operation shall be provided with respective DNV GL (type) approvals for installation on board of DNV GL classed ships.
If the pump is used on board of a vessel with a cargo temperature below -165°C, the requirements for design temperatures below -165°C shall be specially agreed with the flag state administration.

Type Approval documentation

Tests carried out

- Pressure test, Test pressure in amount of 1,5 times the design pressure.
- HPP 65 pump performance / capacity test. Test medium: liquid nitrogen (LIN)
- Number of test specimes: Two pump units type HPP65/90 GL3 (GL3 - Gear drive section), each pump unit consisting of three single pumps (cold ends)
  The following operating data have been recorded during pump performance test:

Volume flow rate	[m3/hr]
Pump power input	[kW]
Speed of rotation	[min -1]
Suction pressure	(p1) [bar]
Discharge pressure	(p2) [bar]
Inlet and outlet temperature	(°C) / Test fluid liquid nitrogen

Marking of product

For traceability to this type approval the HPP pumps are to be marked with:

- Manufacturers name or trade mark
- Pump type designation
- Size
- Design pressure and temperature

Periodical assessment

A condition for retention of the Type Approval Certificate in its validity period is that periodical assessments are successfully carried out.

The objective of the periodical assessment is to verify that the conditions for the type approval have not been altered.

The main scope of the periodical assessment will normally include:
- Verification of the TA applicant's production and quality system w.r.t ensuring continued consistent production of the type approved products at the TA applicant's own premises and at other companies that are given the responsibility for manufacturing of the products.
- Review of the TA documentation and that this is still used as a basis for the production
- Review of possible changes to the design, the material and the performance of the product
- Verification of the product marking

END OF CERTIFICATE