



TYPE APPROVAL CERTIFICATE

Certificate no.:
TAP00002B9
Revision No:
2

This is to certify:
that the Pumps

with type designation(s)
MSP-SL

issued to
Nikkiso ACD
Santa Ana, CA, USA

is found to comply with
DNV rules for classification – Ships Pt.5 Ch.7 Liquefied gas tankers
DNV class programme DNV-CP-0505 – Type approval – Pumping units

Application:

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

Max. working press.: 414 bar [6005 psig]
Operating media: Liquefied gases (LNG), liquid ethane, liquefied nitrogen (LIN)
Temperature range: -165°C to + 65°C [-265° F to 149°F]

Issued at **Hamburg** on **2024-11-08**

for **DNV**

This Certificate is valid until **2026-03-10**.

DNV local unit: **Long Beach**

Approval Engineer: **Ana Cristina Do Carmo Insfran**

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

ACD high pressure cryogenic reciprocating pump type MSP-SL consisting of an electric motor¹ driven crankshaft section (hot end) and the direct connected reciprocating cryogenic pump (cold end).

The crankshaft drive section converts 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 cold end pumps may be combined to a pump unit on one crankshaft.

This type approval covers the cold end cryogenic pump only. Documentation of the crankshaft drive section has been reviewed for information.

Design data MSP-SL high pressure pump

Design features	Data (SI)		Data (US imperial)	
Design temperatures ²	-165 to + 65	°C	-265° to 149°	°F
Maximum discharge pressure	414	bar	6005	psig
Speed range	100 to 1000	rpm	100 to 1000	rpm
Piston Diameter	50,8 73	mm	2 2,875	inch

Materials (extraction):

Part	Material specification	Material Certification
Cylinder assembly	ASTM A276 316 SST	DNV MC
Discharge fitting	ASTM A276 316 SST	DNV MC

¹: Electric motors for pump drive including other electrical equipment necessary for pump operation shall be provided with respective DNV (type) approvals for installation on board of DNV classed ships.

²: Test temperature amounts to -196°C, used for test with liquid nitrogen (LIN)

Application

Installation as a cryogenic (LNG) fuel supply pump in gas fuel systems.
 Approved operating media: Liquefied gas, LNG, liquid nitrogen (LIN)

Limitation

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

Modify after sign dated on 2024-11-05

Updated the piston diameter from 2.5 to 2.875 inch, see email from 2024-11-04

- Main assembly drawings, ACD MSP-SL pump type (cold end)
- MSP-SL detailed drawings (cold end) including parts lists
- Drive main assembly drawings, drive assembly MSP-SL (hot end)
- Drive assembly detailed drawings including parts lists
- MSP-SL pump manufacturing data book including material certificates
- Factory acceptance test reports
- Inspection and Test Plan (ITP)
- Type Approval Assessment Report (Audit), dated 2020-12-10

Tests carried out

Test standards: DNV Rules Pt.5 Ch.7 – Liquefied gas tankers DNV CP 0505 – Pumping units for liquids	
Type of Test	Scope of test
Pressure test	Test pressure in amount of 1,5 times the design pressure.
MSP- SL pump performance test. Test medium: Liquid nitrogen Test temperature: -196°C [-321°F] Recorded operating data	Volume flow rate [m3/hr] Pump power input [kW] Pump speed [min -1] Suction pressure (p1) [bar] Discharge pressure (p2) [bar]
Visual inspection of MSP-SL pump	Visual inspection with satisfactory results on accordance with drawings, assembly quality, satisfactory fabrication of single parts. Review of material certificates

Performance and results of tests

All visual inspections and tests witnessed by a DNV Surveyor
 Tests performed with positive results without objections

Marking of product

For traceability to this type approval the ACD MSP-SL pumps are to be marked with:

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

Periodical assessment

For retention of the Type Approval, a DNV Surveyor shall perform periodical assessment to verify that the conditions for the Type Approval are complied with. Refer to the Class Programme DNV-CP-0338, Sec.4.

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

End of certificate