Certificate no.:
TAM00001FS

TYPE APPROVAL CERTIFICATE

This is to certify:

that the Centrifugal Pump

with type designation(s)
ACD Model MSP (TC) 34

issued to
Hangzhou Cryogenic Industries Co., Ltd.
Hangzhou, Zhejiang, China

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:

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

Max. working press.:	**20 [bar]**
Operating media:	**Liquefied gases including LNG, liquefied nitrogen (LIN)**
Temperature range:	**-196°C to -161.5°C +/- 20°C**

Issued at **Hamburg** on **2026-01-30**

This Certificate is valid until **2031-01-29**.

for **DNV**

DNV local unit: **Shanghai**

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

Axial flow pump designed for installation as a submerged motor pump in cargo or fuel tanks for transfer of liquefied gases, such as Liquefied Natural Gas (LNG) and liquid nitrogen (LN2 / LIN).
The pump consists of an integrated motor providing motor bearings lubricated by the liquefied gas which acts also as the cooling medium. The balanced pump rotor assembly consisting of impeller and pump shaft ensures optimized submerged pump performance data within the required performance curve.
Depending on the requested service conditions the pump design may provide one or more impeller stages.

Specification of TC (MSP) 34-2 Stages Pump

		CM59435	**CM54095**
Flow range	gpm	6-119	6-111
	lpm	23-450	23-419
NPSHR	feet	1.5-12	1.5-12
	meter	0.5-4	0.5-4
Differential Head	feet	50-935	50-656
	meter	15-285	15-200
Pump Design Rating	hp	10 up to 44	10 up to 18
	kw	7.5 up to 32	7.5 up to 13.4
RPM Range	rpm	1500-7200	1500-6000

Specifications of TC(MSP) 34-3&4 Stages Pump

		CM54715	
		-5X	**-6X**
Flow range	gpm	6-111	6-111
	lpm	23-419	23-419
NPSHR	feet	1.5-12	1.5-12
	meter	0.5-4	0.5-4
Differential Head	feet	50-1444	50-1263
	meter	15-440	15-385
Pump Design Rating	hp	10 up to 44	10 up to 44
	kw	7.5 up to 32	7.5 up to 32
RPM Range	rpm	1500-6000	1500-6500

ACD Model MSP (TC) 34	**Design pressure [bar]**	**Test pressure [bar]**	**Design temperature [°C]**
	20	30	-196°C to -161.5°C +/- 20°C

Approved TC-34 Design styles	**Nominal Impeller Size**	**Number of Stages**	**TC-34 Pump PN**	**TC-34 Stator PN**
TC-34, 1×2×6-2S	6 inch	2	CM54095	52071-2
TC-34, 1×2×6-2S	6 inch	2	CM59435	54784-2
TC-34, 1×2×6-3S & 4S	6 inch	3 & 4	CM54715	54784-2

Material:

Each submerged centrifugal pump with the submerged electric motor - model of MSP (TC) 34, the housing material made of stainless steel, see below the table.

CM59435-5X HAN's Designed TC(MSP)34-2S, Submerged Centrifugal Pump with the Submerged Electric Motor - Configurations

Parts of the Pump	Material
Suction housing	CF8
Diffuser housing	CF8
Lower discharge manifold	CF8
Upper discharge manifold	CF8
Discharge tube	304L
Stator	-
Shaft	SS17-4PH
Inducer	ZCuSn5Pb5Zn5
Impeller 1st	ZCuSn5Pb5Zn5
Impeller 12st	ZCuSn5Pb5Zn5
Motor housing	CF8
Diffuser 1st	ZCuSn5Pb5Zn5
Diffuser 2st	ZCuSn5Pb5Zn5

CM54095-5X HAN's Designed TC(MSP)34-2S, Submerged Centrifugal Pump with the Submerged Electric Motor - Configurations

Parts of the Pump	Material
Suction housing	CF8
Diffuser housing	CF8
Lower discharge manifold	CF8
Upper discharge manifold	CF8
Discharge tube	304L
Stator	-
Shaft	SS17-4PH
Inducer	ZCuSn5Pb5Zn5
Impeller 1st	ZCuSn5Pb5Zn5
Impeller 12st	ZCuSn5Pb5Zn5
Motor housing	CF8
Diffuser 1st	ZCuSn5Pb5Zn5
Diffuser 2st	ZCuSn5Pb5Zn5

CM54715-5X&6X HAN's Designed TC(MSP)34-4S&3S, Submerged Centrifugal Pump with the Submerged Electric Motor – Configurations

Parts of the Pump	Material
Suction housing	CF8
Diffuser housing	CF8
Lower discharge manifold	CF8
Intermediate discharge manifold	CF8
Upper discharge manifold	CF8
Discharge tube	304L
Discharge tube	304L
Stator	-
Shaft (for -5X only)	SS17-4PH
Shaft (for -6X only)	SS17-4PH
Inducer	ZCuSn5Pb5Zn5
Impeller 1st	ZCuSn5Pb5Zn5
Impeller 2nd (1st for -6X)	ZCuSn5Pb5Zn5
Impeller 3rd (2nd for -6X)	ZCuSn5Pb5Zn5
Impeller 4th (3rd for -6X)	ZCuSn5Pb5Zn5
Motor housing	CF8
Diffuser 1st	ZCuSn5Pb5Zn5
Diffuser 2nd (1st for -6X)	ZCuSn5Pb5Zn5
Diffuser 3rd (2nd for -6X)	ZCuSn5Pb5Zn5
Diffuser 4th (3rd for -6X)	ZCuSn5Pb5Zn5

Application

Installation as a submerged pump in cargo or fuel tanks for liquefied gases, e.g.
Liquefied Natural Gas (LNG), Liquid Nitrogen (LIN).

Limitation

Any electric cable to be connected to the pump for power supply as well as for remote operating and control including additional junction box outside the cargo or fuel tank is excluded from this type approval.

Electric motor, for all models does not exceed 75Kw.

Remark:
If the pump is scheduled for use 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

The following tests have been carried out on the ACD Model MSP (TC) 34 pump type:

- Pressure test
  Test pressure in amount of 1,5 times the design pressure
- ACD Model MSP (TC) 34 pump functional and performance / capacity test.
  Test medium: liquid nitrogen (LIN),
  Test temperature: -196°C
  The following operating data have been recorded during pump performance test:

Volume flow rate	[m3/hr]	
Delivery head	[m]	
Pump power input / output	[kW]	
Speed of rotation	[min -1]	
Suction pressure	(p1)	[bar]
Discharge pressure	(p2)	[bar]

Marking of product

For traceability to this type approval the ACD Model MSP (TC) 34 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 as per DNV-CP-0338, Sec.4 to verify that the conditions for the Type Approval are complied with.
To check the validity of this certificate, please look it up in

END OF CERTIFICATE