

TYPE APPROVAL CERTIFICATE

This is to certify:**That the Pumps**

with type designation(s)
ACD Model TC-34

Issued to

ACD, LLC
Santa Ana, CA, USA

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

Application :

Submerged pump to be installed in cargo and fuel tanks for transfer of liquefied nitrogen, liquefied gases including LNG.

Products designed fabricated and tested according to above DNV GL Rules are approved by this certificate and are accepted for installation on all vessels classed by DNV GL.

Issued at **Hamburg** on **2018-10-01**

This Certificate is valid until **2023-09-30**.

DNV GL local station: **Long Beach**

for **DNV GL**

Approval Engineer: **Guido Friederich**

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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.



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 ballanced 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 conditons the pump design may provide one or more impeller stages. The type approval complies the following pump type:

ACD pump type	Design pressure (bar)	Test pressure (bar)	Design temperature (°C)
ACD Model TC-34	20	30	-196° to +40°

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.

Remark:

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

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

- Pressure test

Test pressure in amount of 1,5 times the design pressure

- ACD 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 TC-34 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