Certificate no.:
TAP00002W6

TYPE APPROVAL CERTIFICATE

This is to certify:

that the Hydraulic Cylinders

with type designation(s)
DVLRS 125/50-500, DVLPRS 100/50-60, DVLPRS 80/40-500, DVLGRS 220/100-1020

issued to
MacArtney Hydraulics A/S
Lemvig, Midtjylland, **Denmark**

is found to comply with
DNV rules for classification – Ships Pt.4 Ch.6 Piping systems
DNV standard DNV-ST-0194 – Hydraulic cylinders
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 vessels classed by DNV.

Type	Design pressure (push)	Design pressure (pull)	Cylinder sizes
DVLRS 125/50-500	50 bar(g)	220 bar(g)	-20°C/+50°C
DVLPRS 100/50-60	250 bar(g)	250 bar(g)	-20°C/+50°C
DVLPRS 80/40-500	165 bar(g)	250 bar(g)	-20°C/+50°C
DVLGRS 220/100-1020	165 bar(g)	250 bar(g)	-20°C/+50°C

Issued at **Høvik** on **2024-06-13**
This Certificate is valid until **2029-06-12**.
DNV local unit: **Denmark CMC**

for **DNV**

Approval Engineer: **Thomas Wilhelm Juell**

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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 300,000 USD.

Product description

Four types of double acting hydraulic cylinders designed according to DNV-ST-0194.

Dimensional data:

Type	Outside diameter	Inside diameter	Piston rod diameter	Stroke
DVLRS 125/50-500	145 mm	125 mm	50 mm	500 mm
DVLPRS 100/50-60	120 mm	100 mm	50 mm	60 mm
DVLPRS 80/40-500	95 mm	80 mm	40 mm	500 mm
DVLGRS 220/100-1020	254 mm	220 mm	100 mm	1020 mm

Materials:

Type	Cylinder tube	Piston rod	Rod eye, Piston & Stuffing box	Tube end	Trunnion
DVLRS 125/50-500	E355+SR (EN10305-1)	1.4418 +QT900 (EN 10088-3)	S355J2+N* (EN10025-2)	S355J2+N*/** (EN10025-2)	N/A
DVLPRS 100/50-60	E355+SR (EN10305-1)	1.4418 +QT900 (EN 10088-3)	S355J2+N* (EN10025-2)	S355J2+N*/** (EN10250-2)	S355J2+N* (EN10025-2)
DVLPRS 80/40-500	E355+SR (EN10305-1)	1.4418 +QT900 (EN 10088-3)	S355J2+N* (EN10025-2)	S355J2+N*/** (EN10250-2)	S355J2+N* (EN10025-2)
DVLGRS 220/100-1020	E355+SR (EN10305-1)	1.4418 +QT900 (EN 10088-3)	S355J2+N* (EN10025-2)	S355J2+N*/** (EN10025-2)	N/A

* The material shall be fine grain treated according to DNV-RU-SHIP Pt.2 Ch.2 Sec.2 [2.6.6], RU-SHIP Pt.2 Ch.2 Sec.3 [1.5.3].
** If the end cover is made from rolled plate it is to be tensile tested in the Z-direction.

Application/Limitation

Design temperature(min/max): -20°/50°C.

Test pressures:

Type	Pull/Push
DVLRS 125/50-500	330 bar
DVLPRS 100/50-60	375 bar
DVLPRS 80/40-500	375 bar
DVLGRS 220/100-1020	375 bar

The following cylinders are limited to the following number of full load cycles over the life span:

Type	Number load cycles
DVLRS 125/50-500	63 700
DVLPRS 100/50-60	19 000
DVLPRS 80/40-500	12 000
DVLGRS 220/100-1020	8 803

The hydraulic cylinders are not intended to operate under emergency conditions.

All welding is to be carried out by qualified welders and according to approved welding procedures. Non-destructive testing of all welds is to be performed according to DNV-ST-0194 [2.3] - Hydraulic Cylinders.

Cylinder tube, piston rod, end covers, and end connections shall be Charpy-V impacted tested at minimum design temperature. Minimum specified average energy value shall be according to DNV-ST-0194 [2.1.2].

Type Approval documentation

Production test and Certification

Each cylinder is to be hydraulically pressure tested to 1.5 times of the design pressure and be delivered with a DNV product certificate. The test pressure is to be applied on both sides of the piston in sequence. Testing are to be in accordance with to DNV standard ST-0194 - Hydraulic Cylinders in presence of DNV surveyor.

Materials for cylinder tube, piston rod, piston, end covers and end eyes shall be delivered with 3.1 material certificates.

Marking of product

Hydraulic cylinders shall be permanently marked in order to enable unique traceability to a product certificate or a type approval certificate. The marking shall at least consist of the following:

- manufacturer's name or trade mark
- design pressure
- type designation
- DNV product certificate number, if applicable
- charge number for the materials used in the cylinder tube and the piston rod.

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.