Certificate No:
TAP00002DW

TYPE APPROVAL CERTIFICATE

This is to certify:

That the Hydraulic Cylinders

with type designation(s)
06453, 08883, D007871, D007041, D014570, 04413D, D018636, 06452D, D014688, D007042, D008565, D002772

Issued to
Servi AS
RISSA, **Norway**

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

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
06453	250 bar	250 bar	100/50x140mm
08883	149 bar	250 bar	110/70x2711mm
D007871	250 bar	250 bar	160/100x3516mm
D007041	200 bar	200 bar	160/80x200mm
D014570	250 bar	250 bar	180/90x265mm
04413D	250 bar	250 bar	110/70x2298mm
D018636	160 bar	160 bar	50/25x65mm
06452D	250 bar	250 bar	110/90x2467mm
D014688	250 bar	250 bar	250/150x4275mm
D007042	160 bar	160 bar	100/50x140mm
D008565	137 bar	250 bar	110/70x2910mm
D002772	238 bar	238 bar	250/125x3660mm

Issued at **Høvik** on **2021-09-03**
This Certificate is valid until **2026-09-02**.
DNV local station: **Norway CMC, Mid-North**

Approval Engineer: **Renata Rossi**

for **DNV**

Zeinab Sharifi
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.

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

12 types of double acting hydraulic cylinders intended for lifting thrusters.

Dimensional data:

Type	Outside diameter	Inside diameter	Piston rod diameter	Stroke	Rod end connection
06453	120 mm	100 mm	50 mm	140 mm	Threaded (fixed)
08883	150 mm	110 mm	70 mm	2711 mm	Threaded (fixed)
D007871	220 mm	160 mm	100 mm	3516 mm	Threaded (fixed)
D007041	185 mm	160 mm	80 mm	200 mm	End eye
D014570	210 mm	180 mm	90 mm	265 mm	End eye
04413D	150 mm	110 mm	70 mm	2298 mm	Threaded (fixed)
D018636	60 mm	50 mm	25 mm	65 mm	End eye
06452D	150 mm	110 mm	90 mm	2467 mm	Threaded (fixed)
D014688	325 mm	250 mm	150 mm	4275 mm	Threaded (fixed)
D007042	120 mm	100 mm	50 mm	140 mm	End eye
D008565	150 mm	110 mm	70 mm	2910 mm	Threaded (fixed)
D002772	325 mm	250 mm	125 mm	3660 mm	Threaded (fixed)

Materials:

Type	Cylinder tube	Piston rod	Piston	End connection	End cover */**	Stuffing box *
06453	E355+SR (EN 10305-1) or S355NH/S355NLH (EN10210-1) or S355J2H+N (EN10219-1)	1.4418+QT900 (EN 10088-3)	S355J2+N (EN 10025-2)	S355J2+N (EN 10025-2)	S355J2+N (EN 10025-2)	S355J2+N (EN 10025-2)
08883	1.4460 (EN 10088-3)	S355J2+N (EN 10025-2)	S355J2+N (EN 10025-2)	S355J2+N (EN 10025-2)	1.4460 (EN 10088-3)	S355J2+N (EN 10025-2)
D007871	S355NH/S355NLH (EN10210-1) or S355J2H+N (EN10219-1)	S355J2+N (EN 10025-2)	S355J2+N (EN 10025-2)	S355J2+N (EN 10025-2)	S355J2+N (EN 10025-2)	S355J2+N (EN 10025-2)
D007041	S355NH/S355NLH (EN10210-1) or S355J2H+N (EN10219-1)	1.4418+QT900 (EN 10088-3)	S355J2+N (EN 10025-2)	S355J2+N (EN 10025-2)	S355J2+N (EN 10025-2)	S355J2+N (EN 10025-2)
D014570	S355NH/S355NLH (EN10210-1) or S355J2H+N (EN10219-1)	1.4418+QT900 (EN 10088-3)	S355J2+N (EN 10025-2)	S355J2+N (EN 10025-2)	S355J2+N (EN 10025-2)	S355J2+N (EN 10025-2)
04413D	1.4460 (EN 10088-3)	S355J2+N (EN 10025-2)	S355J2+N (EN 10025-2)	S355J2+N (EN 10025-2)	1.4460 (EN 10088-3)	S355J2+N (EN 10025-2)
D018636	S355NH/S355NLH (EN10210-1) or S355J2H+N (EN10219-1)	1.4418+QT900 (EN 10088-3)	S355J2+N (EN 10025-2)	S355J2+N (EN 10025-2)	S355J2+N (EN 10025-2)	S355J2+N (EN 10025-2)
06452D	1.4460 (EN 10088-3)	S355J2+N (EN 10025-2)	S355J2H+N (EN 10210-1)	S355J2+N (EN 10025-2)	1.4460 (EN 10088-3)	S355J2+N (EN 10025-2)
D014688	1.4404 (EN 10088-3)	S355J2+N (EN 10025-2)	S355J2+N (EN 10025-2)	S355J2+N (EN 10025-2)	1.4404 (EN 10088-3)	S355J2+N (EN 10025-2)
D007042	S355NH/S355NLH (EN10210-1) or S355J2H+N (EN10219-1)	1.4418+QT900 (EN 10088-3)	S355J2+N (EN 10025-2)	S355J2+N (EN 10025-2)	S355J2+N (EN 10025-2)	S355J2+N (EN 10025-2)

D008565	S355NH/S355NLH (EN10210-1) or S355J2H+N (EN10219-1)	S355J2+N (EN 10025-2)	S355J2+N (EN 10025-2)	S355J2+N (EN 10025-2)	S355J2+N (EN 10025-2)	S355J2+N (EN 10025-2)
D002772	1.4404 (EN 10088-3)	S355J2+N (EN 10025-2) 1.4418+QT900 (EN 10088-3)	S355J2+N (EN 10025-2)	S355J2+N (EN 10025-2)	1.4404 (EN 10088-3)	S355J2+N (EN 10025-2)

* The material shall be fine grain treated according to 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° to +80°C

Test pressures:

Type	Pull	Push
06453	375 bar	375 bar
08883	375 bar	375 bar
D007871	375 bar	375 bar
D007041	300 bar	300 bar
D014570	375 bar	375 bar
04413D	375 bar	375 bar
D018636	240 bar	240 bar
06452D	375 bar	375 bar
D014688	375 bar	375 bar
D007042	240 bar	240 bar
D008565	375 bar	375 bar
D002772	357 bar	357 bar

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

Type	Number load cycles
06453	15 000
D007041	15 000
D014570	15 000
D018636	15 000
D007042	15 000

When the stud is welded on top of the circumferential weld for the end cover, NDE is to be done for each weld and for each cylinder. Surveyor shall review relevant reports.

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 DNVGL-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 DNVGL-ST-0194 [2.1.1].

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, 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:

- Manufacturers name or trade mark
- Type designation
- DNV product certificate number

- Charge number for the materials used in the cylinder tube and the piston rod.

Periodical assessment

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 DNVGL-CP-0338.