



Certificate No:
TAP00002CR

TYPE APPROVAL CERTIFICATE

This is to certify:

That the Hydraulic Cylinders

with type designation(s)

D003469, 605-21, 605-20, 03536, 03472, 643-68, 605-19, 534-88, 590-54, 536-05, 654-03, 02973, 03843, 643-70, D004567, 654-05

Issued to

Servi AS
RISSA, Norway

is found to comply with

DNV GL standard DNVGL-ST-0194 – Hydraulic cylinders

DNV GL rules for classification – Ships Pt.4 Ch.6 Piping systems

DNVGL-OS-D101 – Marine and machinery systems and equipment, Edition January 2018

Application :

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

Issued at **Høvik** on **2021-07-13**

This Certificate is valid until **2026-07-12**.

for **DNV**

DNV local station: **Norway CMC, Mid-North**

Approval Engineer: **Sarah Miller**

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.



Form code: TA 251

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Product description

16 types of double acting hydraulic cylinders intended for general machinery use application.

Dimensional data:

Type	Cylinder's Outside diameter	Cylinder's Inside diameter	Piston rod outside diameter	Piston rod inside diameter	Stroke
D003469	343 mm	300 mm	160 mm	0 mm	385 mm
605-21	145 mm	125 mm	63 mm	0 mm	100 mm
605-20	145 mm	125 mm	63 mm	0 mm	85 mm
03536	165 mm	140 mm	63 mm	16 mm	165 mm
03472	120 mm	100 mm	63 mm	10 mm	420 mm
643-68	160mm	140mm	63 mm	0 mm	65 mm
605-19	160 mm	140 mm	63 mm	0 mm	165 mm
534-88	110 mm	90 mm	56 mm	0 mm	430 mm
590-54	200 mm	160 mm	100 mm	0 mm	925 mm
536-05	170 mm	140 mm	90 mm	0 mm	1143 mm
654-03	95 mm	80 mm	32 mm	15 mm	190 mm
02973	73 mm	63 mm	40 mm	0 mm	355 mm
03843	298 mm	250 mm	160 mm	0 mm	1773 mm
643-70	105 mm	90 mm	56 mm	10 mm	150 mm
D004567	170 mm	150 mm	90 mm	0 mm	1143 mm
654-05	120 mm	100 mm	63 mm	10 mm	660 mm

Materials:

Type	Cylinder tube	Piston rod	Piston	End eye	End cover	Stuffing box
D003469	E355+SR (EN10305-1)	1.4418+QT900 (EN 10088-3)	S355J2+N* (EN10025-2)	S355J2+N * (EN10025-2)	S355J2+N*/** (EN10025-2)	S355J2+N* (EN10025-2)
605-21	E355+SR (EN10305-1) /S355J2H+N (EN 10210-1/ EN 10219-1)	1.4418+QT900 (EN 10088-3)	S355J2+N* (EN10025-2)	S355J2+N* (EN10025-2)	S355J2+N*/** (EN10025-2)	S355J2+N* (EN10025-2)
605-20	E355+SR (EN10305-1) /S355J2H+N (EN 10210-1/ EN 10219-1)	1.4418+QT900 (EN10088-3)	S355J2+N* (EN10025-2)	S355J2+N* (EN10025-2)	S355J2+N*/** (EN10025-2)	S355J2+N* (EN10025-2)
03536	E355+SR (EN10305-1) /S355J2H+N (EN 10210-1/ EN 10219-1)	1.4418+QT900 (EN10088-3)	S355J2+N* (EN10025-2)	S355J2+N* (EN10025-2)	S355J2+N*/** (EN10025-2)	S355J2+N* (EN10025-2)
03472	E355+SR (EN10305-1) /S355J2H+N (EN 10210-1/ EN 10219-1)	1.4418+QT900 (EN10088-3)	S355J2+N* (EN10025-2)	S355J2+N* (EN10025-2)	S355J2+N*/** (EN10025-2)	S355J2+N* (EN10025-2)
643-68	E355+SR (EN10305-1)	1.4418+QT900 (EN 10088-3)	S355J2+N* (EN10025-2)	S355J2+N* (EN10025-2)	S355J2+N*/** (EN10025-2)	S355J2+N* (EN10025-2)
605-19	E355+SR (EN10305-1) /S355J2H+N (EN 10210-1/ EN 10219-1)	1.4418+QT900 (EN 10088-3)	S355J2+N* (EN10025-2)	S355J2+N* (EN10025-2)	S355J2+N*/** (EN10025-2)	S355J2+N* (EN10025-2)
534-88	E355+SR (EN10305-1) /S355J2H+N (EN 10210-1/ EN 10219-1)	1.4418+QT900 (EN 10088-3)	S355J2+N* (EN10025-2)	S355J2+N* (EN10025-2)	S355J2+N*/** (EN10025-2)	S355J2+N* (EN10025-2)
590-54	E355+SR (EN10305-1) /S355J2H+N	1.4418+QT900 (EN 10088-3)	S355J2+N* (EN10025-2)	S355J2+N* (EN10025-2)	S355J2+N*/** (EN10025-2)	S355J2+N* (EN10025-2)

	(EN 10210-1/ EN 10219-1)					
536-05	E355+SR (EN10305-1) /S355J2H+N (EN 10210-1/ EN 10219-1)	1.4418+QT900 (EN 10088-3)	S355J2+N* (EN10025-2)	S355J2+N* (EN10025-2)	S355J2+N*/** (EN10025-2)	S355J2+N* (EN10025-2)
654-03	E355+SR (EN10305-1) /S355J2H+N (EN 10210-1/ EN 10219-1)	1.4418+QT900 (EN 10088-3)	S355J2+N* (EN10025-2)	S355J2+N* (EN10025-2)	S355J2+N*/** (EN10025-2)	S355J2+N* (EN10025-2)
02973	S355J2H+N (EN 10210-1/ EN 10219-1)	1.4418+QT900 (EN 10088-3)	S355J2+N* (EN10025-2)	S355J2+N* (EN10025-2)	S355J2+N */** (EN10025-2)	S355J2+N* (EN10025-2)
03843	E355+SR (EN10305-1) /S355J2H+N (EN 10210-1/ EN 10219-1)	1.4418+QT900 (EN 10088-3)	S355J2+N* (EN10025-2)	S355J2+N* (EN10025-2)	S355J2+N*/** (EN10025-2)	S355J2+N* (EN10025-2)
643-70	S355J2H+N (EN 10210-1/ EN 10219-1)	1.4418+QT900 (EN 10088-3)	S355J2+N* (EN10025-2)	S355J2+N* (EN10025-2)	S355J2+N*/** (EN10025-2)	S355J2+N* (EN10025-2)
D004567	E355+SR (EN10305-1) /S355J2H+N (EN 10210-1/ EN 10219-1)	1.4418+QT900 (EN 10088-3)	S355J2+N* (EN10025-2)	S355J2+N* (EN10025-2)	S355J2+N*/** (EN10025-2)	S355J2+N* (EN10025-2)
654-05	S355J2H+N (EN 10210-1/ EN 10219-1)	1.4418+QT900 (EN 10088-3)	S355J2+N* (EN10025-2)	S355J2+N* (EN10025-2)	S355J2+N*/** (EN10025-2)	S355J2+N* (EN10025-2)

* 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°/80°C

Design/Test pressures:

Type	Design Pull Pressure	Design Push Pressure	Test Pull Pressure	Test Push Pressure
D003469	240 bar	240 bar	360 bar	360 bar
605-21	210 bar	210 bar	315 bar	315 bar
605-20	210 bar	210 bar	315 bar	315 bar
03536	210 bar	210 bar	315 bar	315 bar
03472	210 bar	210 bar	315 bar	315 bar
643-68	210 bar	210 bar	315 bar	315 bar
605-19	210 bar	210 bar	315 bar	315 bar
534-88	210 bar	210 bar	315 bar	315 bar
590-54	210 bar	210 bar	315 bar	315 bar
536-05	210 bar	210 bar	315 bar	315 bar
654-03	210 bar	210 bar	315 bar	315 bar
02973	250 bar	250 bar	375 bar	375 bar
03843	250 bar	250 bar	375 bar	375 bar
643-70	80 bar	210 bar	315 bar	315 bar
D004567	210 bar	210 bar	315 bar	315 bar
654-05	210 bar	210 bar	315 bar	315 bar

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

Type	Number load cycles
D003469	15000
605-21	15000

605-20	15000
03536	15000
03472	unlimited
643-68	15000
605-19	unlimited
534-88	18000
590-54	15000
536-05	15000
654-03	15000
02973	15000
03843	12343
643-70	15000
D004567	15000
654-05	15000

In cases where 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.

When having designs that the material used for the cylinder tube is E355+SR, 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 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, if applicable
- 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.