

# TYPE APPROVAL CERTIFICATE

**This is to certify:****That the Hydraulic Cylinders**with type designation(s)  
**Hydraulic cylinder**

Issued to

**Servi Cylinderservice AS  
RISSA, Norway**

is found to comply with

**DNV GL rules for classification – Ships Pt.4 Ch.6 Piping systems  
DNVGL-OS-D101 – Marine and machinery systems and equipment, Edition July 2015  
DNV Standard for Certification 2.9, 5-778.93 Approval of hydraulic cylinders****Application :****Max work press. push 0 - 700 bar  
Max work press. pull 0 - 700 bar  
Cylinder sizes 32 - 700 inner tube diameter**This Certificate is valid until **2019-10-22**.Issued at **Høvik** on **2015-12-16**DNV GL local station: **Trondheim**Approval Engineer: **Tom Berg-Nielsen**for **DNV GL**

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**Marianne Spæren Marveng  
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

Hydraulic cylinders for general applications. Consisting of cylindrical shell, piston, piston rod, stuffing box and end connections. End connections are pinned (spherical end eyes), flanged or trunnioned. Piston and stuffing box are threaded. Piston rod end connection is threaded or welded. The cylinders may be fitted with certain non-loadbearing components (instrumentation, brackets welded on shell to support piping etc.) within limitations as given in this certificates. Other types of attachments may be allowed after special evaluation in each case.

## Application/Limitation

### a. Main dimensions and design limitations

Cylinder tube inner diameter	32 - 700 mm
Design pressure	0 - 700 bar
Design temperature	- 40°C / + 80°C
Piston rod diameter	0 - 600 mm

### b. Allowable materials\*

Material designation/grade/no.	Standard	SMYS (Mpa)	Tensile strength (MPa)	Young's modulus (MPa)
S355K2	EN 10025-2	355	510	206 000
S355J2H	EN 10210-1	355	510	206 000
S355J2+N	EN 10025-2			
E355+N	EN 10305-1			
E355+SR	EN 10305-1			
1.4418	EN 10088-3	660	830	206 000
1.4404	EN 10088-3	210	490	200 000
1.4404	EN 10272			
1.4404	EN 10216-5			
UNS J92800	ASTM SA-351			
UNS J92900	ASTM SA-351	460	620	200 000
AISI 329 (1.4460)	EN 10088-3			
1.4462	EN 10088-3	460	640	200 000
1.4462	EN 10272			
1.4462	EN 10216-5			
UNS S31803	ASTM SA-789			
UNS S31803	ASTM SA-790			
UNS S31803	ASTM SA-276			
UNS J92205	ASTM SA-890			
UNS J92205	ASTM SA-995			
Sanmac 2205	Sandvik, 13.04.2011	530	730	200 000
1.4410	EN 10088-3			
1.4410	EN 10272			
UNS S32750	ASTM SA-182			
UNS S32750	ASTM SA-479			
UNS J93404	ASTM SA-890			
UNS J93404	ASTM SA-995			
SAF 2507	Sandvik, 13.04.2011			

Job Id: **262.1-010538-2**  
Certificate No: **TAP0000056**

Cromax 280X		440	550	206 000
JM7-15	EN 1982	280	650	-
OM7-15	EN 1982			
JM3-15	EN 1982	150	280	-
OM3-15	EN 1982			
8.8	ISO 898-1	640	800	
10.9	ISO 898-1	940	1040	
A4-80	ISO 3506-1	600	800	

\* Requirement: Documented Charpy V-notch value of 27 J @ min. design temp. (average of 3 tests. No single value below 19 J). Min elongation 12 % and delivered with inspection certificates 3.1 according to EN 10204.

#### c. Hydraulic oil

- Mineral oils
- Synthetic oils
- Water glycol based fluids
- Water
- Ester based fluids

#### d. Other limitations

This type approval does not cover the following use of the cylinders:

- direct tensioning of marine risers and drill strings
- main jacking cylinders for self-elevating units
- subsea applications
- steering gear / water jet steering

If the cylinders are going to be used for above mentioned applications, they are subject to case-by-case approval, taking into consideration selection of materials, relevant loads etc.

In addition, cylinders subject to significant bending moments are excluded from this type approval and are subject to case-by-case approval.

For cylinder rod that are joined together by welding to create the desired length (see documentation package for weld detail), the number of load cycles shall be limited by FAT 71 curve as given in IIW (*International Institute of Welding*) document *IIW-1823-07 ex XIII-2151r4-07/XV-1254r4-07, December 2008 "Recommendation for fatigue design of welded joints and components"*, Fig. (3.2)-2: "Fatigue resistance S-N curves for steel, normal stress very high cycles applications".

#### Documentation to follow individual products:

- Each product shall be certified by a DNVGL Surveyor or a representative from the QA department when an MSA is established. A product certificate shall be issued in either case.
- Assembly drawing
- Detail drawings
- Strength calculations according to documentation package no. B1098 Ref F dated 2011-11-08
- Excel spread sheet for buckling analysis. File "B1100.xls" revision dated 2011-11-08
- Material certificates

## **Type Approval documentation**

### **Approved design documentation**

Documentation package no. B1098 Rev. F dated 2011-11-08. 174 pages including appendixes A – J. The index of the package are as follows:

- 1 – Tube dimensions
- 2 – Rod dimensions
- 3 – End bottom
- 4 – Welded end connection
- 5 – Threaded connections
- 6 – Pinned end connections
- 7 – Bolts
- 8 – Trunnion mounted connection
- 9 – Flanges
- 10 – Welded trunnion and flanges

- Appendix A – Approved materials
- Appendix B – Forces
- Appendix C – Allowable equipment
- Appendix D – Weld between bottom and barrel
- Appendix E – Weld between connection and barrel
- Appendix F – Ration on ears
- Appendix G – Ratio on flanges
- Appendix H – Slicing of rod and barrel
- Appendix I – Cylinder suspensions
- Appendix J – Rod suspensions

### **Marking of product**

For traceability to this type approval the cylinders are to be permanently marked with:

- Manufacturer's name or trade mark
- Type designation

### **Periodical assessment**

For retention of the Type Approval, a DNV GL Surveyor shall perform periodical assessment every second year and before the expiry date of this certificate. The scope of the periodical assessment survey is to verify that the conditions stipulated for the Type Approval is complied with and that no alterations are made to the product design or choice of materials.