

TYPE APPROVAL CERTIFICATE

This is to certify:**That the Hydraulic Cylinders**

with type designation(s)

F1

Issued to

Fjero A/S
Skive, Denmark

is found to comply with

**Det Norske Veritas' Rules for Classification of Ships Pt.4, Ch.6 "Piping Systems"
Offshore Standard DNV-OS-D101, Marine and Machinery Systems and Equipment
DNV Standard for Certification 2.9, 5-778.93 Approval of hydraulic cylinders
Standard for Certification 2.22 Lifting Appliances, 2013****Application :****Product(s) approved by this certificate is/are accepted for installation on all vessels classed by DNV GL.****Max work press. push 250 bar**
Max work press. pull 250 bar
Cylinder sizes See certificateThis Certificate is valid until **2019-12-31**.Issued at **Høvik** on **2015-11-25**for **DNV GL**DNV GL local station: **Aalborg**Approval Engineer: **Adel Samiei**

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

59 Types of double acting hydraulic cylinders with spherical bearing in each end

Materials:

- Tube (Barrel): E355+SR according to EN10305-1 or EN10305-2
- Piston Rod: EN 1.4418 / EN 1.4542 / EN 1.5217
- Piston: S355J2 according to EN10025-2
- stuffing box S355J2 according to EN10025-2
- bearing housing: S355J2 according to EN10025-2

Dimensional data of each cylinder (all dimensions in mm):

Cylinder O.D.	Cylinder I.D.	Rod O.D.	Maximum Stroke	Reference drawing
42	32	20	263	59812 - 60816
50	40	20	209	58978 - 59813
50	40	25	327	58979 - 59814 - 60956
60	50	25	260	59815 - 58980
60	50	30	373	58981 - 59816 - 60957
60	50	35	488	58982 - 59817 - 60958
73	63	30	296	58985 - 59818
73	63	40	509	58986 - 59819 - 60959
92	80	40	422	58989 - 59820
92	80	50	637	58990 - 59822
92	80	60	838	58991 - 59823 - 60960
115	100	50	529	58994 - 59824
115	100	65	753	58995
115	100	80	1149	58997 - 59827 - 60963
145	125	65	718	59001 - 59828 - 60964
145	125	80	1056	59002 - 59829 - 60965
145	125	100	1480	60684 - 60866 - 60966
160	140	70	738	59003 - 59830 - 60967
160	140	90	1169	59004 - 59831
185	160	80	853	59005 - 59832
185	160	100	1298	59006 - 59833
205	180	90	957	59007 - 59834
205	180	110	1389	59008 - 59835
230	200	100	1066	59009 - 59836
230	200	125	1619	59010 - 59837

Application/Limitation

The hydraulic cylinders are approved for design pressure equal to 250 bar (both push and pull) and design temperature range between -20°C to 80°C. Corrosion allowance equal to 0.3 mm has been considered.

Hydraulic cylinders are approved for general use. This type approval does not cover the following use of the cylinders:

- Subsea applications
- Steering gear / water jet steering
- Cleating application where the Rules require a mechanical lock of cleats.

If the cylinders are going to be used for above mentioned applications, they are subject to case by case approval.

Materials for the pressure containing parts (cylinder tube, piston rods and end connections) are to meet Charpy V-notch energy values of minimum 27 J at -20°C.

Manufacturing, workmanship and testing of each cylinder shall be done according to DNV type approval programme No. 5-778.93 clause 5.1. Each hydraulic cylinder is to be hydraulically pressure tested to minimum 325 bar before paint or any coating is applied on the cylinders.

Each cylinder is to be certified by DNV GL Surveyor as outlined in Certification Note 2.9 Program No. 5-778.93 "Approval of Hydraulic Cylinders". A product certificate endorsed or issued by the DNV GL Surveyor is to accompany each cylinder/delivery.

Materials for the cylinder tube, piston rods and end connections are to be delivered with material works certificate. All of these materials have to be supplied from an approved manufacturer of DNV GL for the type and grade of steel being supplied and for the relevant steelmaking and processing route.

Type Approval documentation

- General drawings:

Cylinder type	Document no.	Rev.	Date	Status
40/20x100	58978	0	2014-12-22	Type approved
40/25x100	58979	0	2014-12-22	Type approved
50/25x100	58980	0	2014-12-22	Type approved
50/30x100	58981	0	2014-12-22	Type approved
50/35x100	58982	0	2014-12-22	Type approved
63/30x100	58985	0	2014-12-22	Type approved
63/40x100	58986	0	2015-07-02	Type approved
80/40x100	58989	1	2014-12-22	Type approved
80/50x100	58990	1	2014-12-22	Type approved
80/60x100	58991	1	2014-12-22	Type approved
100/50x100	58994	1	2014-12-22	Type approved
100/65x100	58995	1	2014-12-22	Type approved
100/80x100	58997	1	2014-12-22	Type approved
125/65x100	59001	2	2014-12-23	Type approved
125/80x100	59002	2	2014-12-23	Type approved
140/70x100	59003	3	2014-12-23	Type approved
140/90x100	59004	3	2014-12-23	Type approved
160/80x100	59005	2	2014-12-22	Type approved
160/100x100	59006	2	2014-12-23	Type approved
180/90x100	59007	4	2014-12-22	Type approved
180/110x100	59008	2	2014-12-22	Type approved
200/100x100	59009	2	2015-07-02	Type approved
200/125x100	59010	2	2014-12-22	Type approved
32/20x100	59812	0	2015-01-05	Type approved
40/20x100	59813	0	2015-01-05	Type approved
40/25x100	59814	0	2015-01-05	Type approved
50/25x100	59815	0	2015-01-05	Type approved
50/30x100	59816	0	2015-01-05	Type approved
50/35x100	59817	0	2015-01-05	Type approved
63/30x100	59818	0	2015-01-05	Type approved
63/40x100	59819	0	2015-01-05	Type approved
80/40x100	59820	3	2015-01-05	Type approved
80/50x100	59822	1	2015-01-05	Type approved
80/60x100	59823	2	2015-01-05	Type approved
100/50x100	59824	1	2014-12-22	Type approved
100/80x100	59827	1	2014-12-22	Type approved
125/65x100	59828	2	2014-12-22	Type approved
125/80x100	59829	2	2014-12-22	Type approved
140/70x100	59830	3	2014-12-23	Type approved
140/90x100	59831	4	2015-07-02	Type approved

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Certificate No: **TAP0000015**

160/80x100	59832	2	2014-12-23	Type approved
160/100x100	59833	2	2014-12-23	Type approved
180/90x100	59834	3	2014-12-23	Type approved
180/110x100	59835	3	2014-12-23	Type approved
200/100x100	59836	2	2014-12-23	Type approved
200/125x100	59837	1	2015-07-02	Type approved
125/100x100	60684	2	2014-12-23	Type approved
32/20x100	60816	0	2009-03-30	Type approved
125/100x100	60866	2	2014-12-22	Type approved
40/25x100	60956	0	2015-01-05	Type approved
50/30x100	60957	0	2015-01-05	Type approved
50/35x100	60958	0	2015-01-05	Type approved
63/40x100	60959	0	2015-01-05	Type approved
80/60x100	60960	0	2015-01-05	Type approved
100/80x100	60963	0	2014-12-22	Type approved
125/65x100	60964	1	2014-12-22	Type approved
125/80x100	60965	1	2014-12-22	Type approved
125/100x100	60966	1	2014-12-22	Type approved
140/70x100	60967	2	2014-12-22	Type approved

- Strength calculation for each type Used for information

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.

The main elements of the certificate retention survey are:

- Review of Type Approval documentation
- Review of possible changes in design, materials and performance
- Ensure traceability between manufacturer's product type marking and Type Approval Certificate.