Design Appraisal Document

Lloyd's Register EMEA
Engineering Systems
UK&I Technical Support Office, Marine & Offshore
Lloyd's Register Global Technology Centre
Boldrewood Innovation Campus
Southampton SO16 7QF

Date
30 April 2020

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MACHINERY GENERAL DESIGN APPRAISAL

Client: Kobelt Manufacturing Co. Ltd.
Manufacturer: Kobelt Manufacturing Co. Ltd.
Subject: Type Approval of Hydraulic Cylinders in Single and Double Acting Versions (Unbalanced and Balanced)
Models: 2510,2510B, 2512, 2512B, 2514, 2514B, 3512, 3512B, 3515, 3515B, 3518, 3518B, 4516, 4520, 4524

Valid until 29th November 2024

1. The Document(s) listed in paragraph 1 of the appendix have been examined for compliance with the design requirements of Lloyd's Register's Rules and Regulations for the Classification of Ships, Part 5, Chapter 19 & Chapter 11: July 2019; Lloyd's Register's Rules and Regulations for the Classification of Special Service Craft, Part 14, Chapter 1 & Part 15, Chapter 4: July 2019; for the design conditions stated on the plans and are assigned an appraisal status as indicated subject to the following::

2. Cylinder Details

2.1 25 Cylinder

Bore Diameter in inches	2.50
Rod Diameter in inches	1.25
Pin Diameter in inches	1.25
Stroke in inches	10, 12 and 14
Maximum Working Pressure	1600 psi (110.3 bar)
Relief Valve Pressure	2000 psi (137.9 bar)
Test Pressure	3000 psi (206.8 bar)

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2.2 25B Cylinder

Bore Diameter in inches	2.50
Rod Diameter in inches	1.25
Pin Diameter in inches	1.25
Stroke in inches	10, 12 and 14
Maximum Working Pressure	1600 psi (110.3 bar)
Relief Valve Pressure	2000 psi (137.9 bar)
Test Pressure	3000 psi (206.8 bar)

2.3 35 Cylinder

Bore Diameter in inches	3.50
Rod Diameter in inches	1.75
Pin Diameter in inches	1.75
Stroke in inches	12, 15 and 18
Maximum Working Pressure	1600 psi (110.3 bar)
Relief Valve Pressure	2000 psi (137.9 bar)
Test Pressure	3000 psi (206.8 bar)

2.4 35B Cylinder

Bore Diameter in inches	3.50
Rod Diameter in inches	1.75
Pin Diameter in inches	1.75
Stroke in inches	12, 15 and 18
Maximum Working Pressure	1600 psi (110.3 bar)
Relief Valve Pressure	2000 psi (137.9 bar)
Test Pressure	3000 psi (206.8 bar)

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2.5 45 Cylinder

Bore Diameter in inches	4.50
Rod Diameter in inches	2.25
Pin Diameter in inches	2.00
Stroke in inches	16, 20 and 24
Maximum Working Pressure	1600 psi (110.3 bar)
Relief Valve Pressure	2000 psi (137.9 bar)
Test Pressure	3000 psi (206.8 bar)

3. Conditions of Approval

3.1 It is noted that non Lloyd's Register (LR) grade materials are proposed. All pressure retaining materials are to be equivalent to those listed in LR Rules for the Manufacture, Testing and Certification of Materials, be manufactured at works approved by LR for the equivalent grade and be supplied with LR test certificates. AQS

3.2 The following material specification has been used for design appraisal with their corresponding mechanical properties defined by the manufacturer:-

Steel round bar for Head, End, Seal Retainer and Bearing Retainer:
4140 HTSR, ASTM A434, Class BB, BC or BD or 1045 HR ASTM - minimum yield requirement 40 ksi (275.79 MPa) AQS

3.3 Tests and Non-Destructive Examination on the Tube is to be performed in accordance with the requirements of LR Rules for the Manufacture, Testing and Certification of Materials, Chapter 13, Section 4 as agreed by the Manufacturer. AQS

3.4 This approval does not cover additional requirements of Part 5, Chapter 19 Section 8 and 9 for tankers, chemical tankers and gas carriers of 10000 tons GRT and upwards and every other ship of 70000 GRT and upwards. The installation arrangements need to be verified for each application. AQS

3.5 The items referred to in this document are approved for installation in a ship classed by Lloyd's Register subject to the comments made in this design appraisal document. AQS

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4. General Comments

4.1 For actuators intended to be installed on ships, where seals between the piston rod and moving parts are not duplicated, a spare set of seals is to be carried on board.

4.2 The sizing of the tillers, rudder stocks are beyond the scope of this approval and are to be carried out for each individual application. Further review of steering hydraulic, system arrangement aspects are not considered as part of this appraisal. The system arrangement aspect is to be reviewed for each application.

4.3 Where the piston is secured to the piston rod by single nut, the connection is to be secured against inadvertent slackening during vessel operations.

4.4 All front and rear sleeve bearings are to be tight fit.

4.5 Two hydrostatic tests are required at the hydrostatic test pressure (i.e. 1.5 times the design pressure):

a) With no load on the piston rod and pressure applied at the trunnion end.
b) With the rod end and trunnion foot secured so that they are subject to test force with pressure being applied to the trunnion end.
c) The above test conditions are applicable to both balanced and un-balanced versions.

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Appendix

1. The documents listed below have been examined

Document No.	Rev.	Title	Status	Date
7800-0002	**A**	**35 Cylinder Head Sub Assembly**	**SI**	**30/04/2020**
7800-0003	**B**	**35 Rod End Assembly**	**SI**	**30/04/2020**
7800-0005	**A**	**35 Cylinder Seal Retainer Sub-Assembly**	**SI**	**30/04/2020**
7800-0006	**C**	**Cylinder 3512**	**SI**	**30/04/2020**
7800-0008	**C**	**Cylinder 3515**	**SI**	**30/04/2020**
7800-0010	**C**	**Cylinder 3518**	**SI**	**30/04/2020**
7800-0024	**A**	**25 Cylinder Head Sub Assembly**	**SI**	**30/04/2020**
7800-0025	**B**	**25 Rod End Assembly**	**SI**	**30/04/2020**
7800-0027	**A**	**25 Cylinder Seal Retainer Sub- Assembly**	**SI**	**30/04/2020**
7800-0028	**C**	**Cylinder 2510**	**SI**	**30/04/2020**
7800-0030	**C**	**Cylinder 2512**	**SI**	**30/04/2020**
7800-0032	**C**	**Cylinder 2514**	**SI**	**30/04/2020**
7800-0035	**A**	**35 Cylinder End Sub-Ass'y Balance**	**SI**	**30/04/2020**
7800-0037	**A**	**35 Cyl. Seal Retainer Sub Ass'y - Balance**	**SI**	**30/04/2020**
7800-0038	**C**	**35 Cylinder Foot Sub Assembly**	**SI**	**30/04/2020**
7800-0047	**A**	**3512 Piston Rod Sub Assembly Balance**	**SI**	**30/04/2020**
7800-0048	**A**	**Cylinder 3512B**	**SI**	**30/04/2020**
7800-0049	**A**	**3515 Piston Rod Sub Assembly Balance**	**SI**	**30/04/2020**
7800-0050	**A**	**Cylinder 3515B**	**SI**	**30/04/2020**
7800-0051	**A**	**3518 Piston Rod Sub Assembly Balance**	**SI**	**30/04/2020**
7800-0052	**A**	**Cylinder 3518B**	**SI**	**30/04/2020**
7800-0053	**A**	**2510 Piston Rod Sub- Assembly Balance**	**SI**	**30/04/2020**
7800-0054	**A**	**Cylinder 2510B**	**SI**	**30/04/2020**
7800-0055	**A**	**2512 Piston Rod Sub- Assembly Balance**	**SI**	**30/04/2020**
7800-0056	**A**	**Cylinder 2512B**	**SI**	**30/04/2020**
7800-0057	**A**	**2514 Piston Rod Sub- Assembly Balance**	**SI**	**30/04/2020**
7800-0058	**A**	**Cylinder 2514B**	**SI**	**30/04/2020**
7800-0059	**A**	**25 Cylinder End Sub- Assembly Balance**	**SI**	**30/04/2020**
7800-0060	**A**	**25 Cyl. Retainer Sub- Ass'y Balance**	**SI**	**30/04/2020**
7800-0061	**A**	**25 Cylinder Foot Sub- Assembly**	**SI**	**30/04/2020**

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Document No.	Rev.	Title	Status	Date
7801-0002	**C**	**35 Cylinder Head**	**A**	**30/04/2020**
7801-0003	**C**	**35 Cylinder End**	**A**	**30/04/2020**
7801-0004	**A**	**35 Bearing Sleeve**	**A**	**30/04/2020**
7801-0005	**C**	**35 Cylinder Rod End**	**A**	**30/04/2020**
7801-0005-P	**B**	**Profile, Rod End, 35 Cylinder**	**A**	**30/04/2020**
7801-0006	**C**	**35 Seal Retainer**	**A**	**30/04/2020**
7801-0007	**B**	**3512 Tube**	**A**	**30/04/2020**
7801-0008	**A**	**3512 Tie Rod**	**A**	**30/04/2020**
7801-0009	**B**	**3512 Piston Rod**	**A**	**30/04/2020**
7801-0010	**B**	**3515 Tube**	**A**	**30/04/2020**
7801-0011	**A**	**3515 Tie Rod**	**A**	**30/04/2020**
7801-0012	**B**	**3515 Piston Rod**	**A**	**30/04/2020**
7801-0013	**B**	**3518 Tube**	**A**	**30/04/2020**
7801-0014	**A**	**3518 Tie Rod**	**A**	**30/04/2020**
7801-0015	**B**	**3518 Piston Rod**	**A**	**30/04/2020**
7801-0024	**B**	**45 Cylinder Head**	**A**	**30/04/2020**
7801-0025	**D**	**45 Cylinder End**	**A**	**30/04/2020**
7801-0028	**B**	**45 Seal Retainer**	**A**	**30/04/2020**
7801-0029	**B**	**4516 Tube**	**A**	**30/04/2020**
7801-0031	**B**	**4516 Piston Rod**	**A**	**30/04/2020**
7801-0032	**B**	**4520 Tube**	**A**	**30/04/2020**
7801-0034	**B**	**4520 Piston Rod**	**A**	**30/04/2020**
7801-0035	**B**	**4524 Tube**	**A**	**30/04/2020**
7801-0037	**B**	**4524 Piston Rod**	**A**	**30/04/2020**
7801-0046	**C**	**25 Cylinder Head**	**A**	**30/04/2020**
7801-0047	**D**	**25 Cylinder End**	**A**	**30/04/2020**
7801-0048	**A**	**25 Bearing Sleeve**	**A**	**30/04/2020**
7801-0049	**B**	**25 Cylinder Rod End**	**A**	**30/04/2020**
7801-0049-P	**B**	**Profile, Rod End, 25 Cylinder**	**A**	**30/04/2020**
7801-0050	**C**	**25 Seal Retainer**	**A**	**30/04/2020**
7801-0051	**B**	**2510 Tube**	**A**	**30/04/2020**
7801-0052	**A**	**2510 Tie Rod**	**A**	**30/04/2020**

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Document No.	Rev.	Title	Status	Date
7801-0053	**B**	**2510 Piston Rod**	**A**	**30/04/2020**
7801-0054	**B**	**2512 Tube**	**A**	**30/04/2020**
7801-0055	**A**	**2512 Tie Rod**	**A**	**30/04/2020**
7801-0056	**B**	**2512 Piston Rod**	**A**	**30/04/2020**
7801-0057	**B**	**2514 Tube**	**A**	**30/04/2020**
7801-0058	**A**	**2514 Tie Rod**	**A**	**30/04/2020**
7801-0059	**B**	**2514 Piston Rod**	**A**	**30/04/2020**
7801-0069	**D**	**35 Cylinder End - Balance**	**A**	**30/04/2020**
7801-0070	**A**	**35 Cylinder Piston - Balance**	**A**	**30/04/2020**
7801-0072	**C**	**35 Seal Retainer - Balance**	**A**	**30/04/2020**
7801-0073	**B**	**35 Cylinder Foot - Balance**	**A**	**30/04/2020**
7801-0073-P	**A**	**Foot Profile 35 Cylinder Balance**	**A**	**30/04/2020**
7801-0074	**C**	**35 Bearing Retainer**	**A**	**30/04/2020**
7801-0075	**C**	**35 Cylinder Piston Pin**	**A**	**30/04/2020**
7801-0086	**B**	**3512 Piston Rod - Balance**	**A**	**30/04/2020**
7801-0087	**B**	**3515 Piston Rod - Balance**	**A**	**30/04/2020**
7801-0088	**B**	**3518 Piston Rod - Balance**	**A**	**30/04/2020**
7801-0092	**A**	**25 Cylinder Piston - Balance**	**A**	**30/04/2020**
7801-0095	**B**	**25 Cylinder End - Balance**	**A**	**30/04/2020**
7801-0096	**C**	**25 Seal Retainer - Balance**	**A**	**30/04/2020**
7801-0097	**B**	**2510 Piston Rod - Balance**	**A**	**30/04/2020**
7801-0098	**B**	**2512 Piston Rod - Balance**	**A**	**30/04/2020**
7801-0099	**B**	**2514 Piston Rod - Balance**	**A**	**30/04/2020**
7801-0100	**B**	**25 Cylinder Piston Pin**	**A**	**30/04/2020**
7801-0101	**A**	**25 Cylinder Foot - Balance**	**A**	**30/04/2020**
7801-0101-P	**A**	**Foot Profile 25 Cylinder Balance**	**A**	**30/04/2020**
7801-0102	**B**	**25 Bearing Retainer**	**A**	**30/04/2020**
7802-0001	**C**	**35 Cylinder GA**	**SI**	**30/04/2020**
7802-0002	**B**	**45 Cylinder GA**	**SI**	**30/04/2020**
7802-0003	**C**	**25 Cylinder GA**	**SI**	**30/04/2020**
7802-0006	**A**	**3512B Cylinder GA**	**SI**	**30/04/2020**
7802-0007	**A**	**3515B Cylinder GA**	**SI**	**30/04/2020**

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7802-0008	**A**	**3518B Cylinder GA**	**SI**	**30/04/2020**
7802-0009	**A**	**2510B Cylinder GA**	**SI**	**30/04/2020**
7802-0010	**A**	**2512B Cylinder GA**	**SI**	**30/04/2020**
7802-0011	**A**	**2514B Cylinder GA**	**SI**	**30/04/2020**

2. The documents listed below have been considered together with the submitted documents in the appraisal

Document No.	Rev.	Title
-	**A**	**25 Cylinder Design Book**
-	**A**	**25B Cylinder Design Book**
-	**A**	**35 Cylinder Design Book**
-	**A**	**35B Cylinder Design Book**
-	**A**	**45 Cylinder Design Book**

Appraisal Status Key

A Approved - provided the arrangements are to the surveyor's satisfaction