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TITLE: CRANES	REVISION NO. 12

1.1 CRANES

1.1.1 Crane Particulars

Crane 40 tonnes, SB

Crane 50 tonnes, PS

Telescopic deck crane, SB forward

Reference is given to PHB's "Operating and Maintenance Instructions" Manual for SB crane, and Liebherr's "Instruction Manual" for the PS crane containing general information, operation, maintenance, main drawings etc of the cranes.

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1.2 SB CRANE 40 TONNES

1.2.1 General

The crane is an electro-hydraulic revolving offshore crane with the following principal utilisation:

- Platform load handling
- Lifts to/from a fixed structure
- Lifts to/from a barge or supply vessel

Maximum capacity is 40 tonnes in main hoist and 5 tonnes in auxiliary hoist.

All working movements can be continuously varied from zero to maximum speed.

1.2.2 Equipment Main Data

Maker/Specification PHB

Representative Service - and Montage - Zentrum Köln,
Widdersdorfer Str 256, D-5000 Köln
Tel: 00949/221 49874-0, Telex: 8882892,
Telefax: 00949/221494883

Electro-hydraulically operated, revolving crane, carrying capacity 40 tonnes.

Work no. 12-16540

1.2.3 Technical Data

General

Boom length (incl whip boom)	46.0 m
Max height above deck	50.0 m
Rear slewing radius	3.8 m
Max wind speed during operation	20 m/s
Design temperature	-20° to +45°

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Main Hoist

Main hoisting gear is equipped with stepless control and automatic power regulation, complete with automatic overload protection.

Capacity at 2-fall operation	Max 40 tonnes from 12 m to 13.5 m 12.5 tonnes at 39.0 m Max 25 tonnes to 24 m, 10 tonnes to 34.5 m at wind speed 25 m/s
Lifting heights	29.5 m above deck, with load 30.0 m below deck, with load
Outreach min	Approx 12 m
Outreach max	Approx 34.5 m
Hoisting speeds	0-40 tonnes 0-10.5 m/min 0-12 tonnes 0-21.0 m/min

Auxiliary Hoist

Auxiliary hoist is equipped with stepless control and automatic power regulation.

Capacity	Max 5 tonnes up to outreach 47 m
Lifting height	30 m above deck, with load 30 m below deck, with load
Outreach min	15.3 m
Outreach max	47 m
Hoisting speed at 1-fall operation	1-100 m/min up to 5 tonnes

Slewing Gear

Stepless controlled and automatic power regulated.

Slewing speed at even keel	0.65 rev/min
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Luffing Gear

Stepless controlled and automatic power regulated.

Speed at full load	Approx 210 s between extreme positions
Speed at empty hook	Approx 210 s between extreme positions

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1.2.4 Technical Description of the Electrical Equipment

Electrical data

Connections

Main feeds 440 V, 60 Hz

Auxiliary feed via transformer
15 kVA for lighting and heating 220 V, 60 Hz

Separate supply from platform for

Helicopter warning light, normal operation 220 V

Helicopter warning light, emergency operation

Emergency lighting for crane 220 V

Hydraulic pump station

Main Pump Units

Two (2) NEBB 36 PC motors type MQU 280 M4A N = 100 kW, 440 V, 60 Hz, Insulation class B, design B3, 1 free shaft n = 1775 rpm, weight 620 kgs/piece, $J_N = 159$ A; $J_A = 1160$ A

Two (2) gears for 2 hydraulic pumps
type BZ690 ADI 60/6000 i = 1,34, weight 87 kgs/piece,
 $n_{a1} = 1775$ rpm, $n_{a2} = 1325$ rpm

Four (4) hydraulic pumps Volvo series V 30 B, nominal size 128,
 $N = 128 \times 1325 =$ abt 170 l/min at abt 200 bars with output regulator and hydraulic adjustment.
Weight abt 100 kgs/unit

Control Oil Pump

One (1) NEBB - AEUB 132 M4 N = 7.5 kW
440 V, 60 Hz, insulation class B, design B3/B5, 1 free shaft,
n = 1740 rpm, weight 48 kgs. $J_N = 14,5$ A; $J_A = 90$ A

One (1) toothed wheel double pump Vickers (Reichert),
type GPC 3 - 32 - 16, N = 55/25 l/min, P 5/60 bars

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Hydraulics

One (1) oil tank with reserve oil tank, oil level indication, limit value transmitter, heating and thermometer

One (1) pressure filter on the control oil pump, 115 l/min, 25 Mu

Two (2) return oil filters on tank, 850 l/min, 25 Mu

One (1) oil air cooler, abt. 15,000 thermal units/hour

Various cocks, valves, base plates and installation material

Standstill Heatings

Voltage	220 V
Frequency	60 Hz
Rating (winch house)	1 x 3 kW
Rating (motor)	Approx 200 W

Lighting and Heating

Voltage	220 V
Frequency	60 Hz
Rating	Approx 10 kW

Cabin Heating

Voltage	220 V
Frequency	60 Hz
Rating	Approx 3 kW

Control

Control circuit voltage	24 V =
DC supply (from 3-phase bridge)	24 V =
Control elements and electronic limit switches	60 V
Electronic stage	24 V =
Duty cycle	S1/100%, S1/100% work.time

1.2.5 SB Crane 40 tonnes - Layout

PHB drawing no. K-OK75-11-8a, titled Layout, 40-ton crane, dated 1979-07-13, reduced to A3 size.

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1.2.6 SB Crane 40 tonnes - Capacity Curves and Load Diagram

Fig. A Table for normal loads and max hook heights above and below Deck, 40-ton crane, File no. K-4K74917

Fig. B Load Curves, File no. K-4K74917

Reading of the Load Curves, 40-ton Crane

The carrying capacity, depending on the outreach, can be read off the load indication.

With this carrying capacity, go down vertically from the normal load curve to the indicated wave height curve.

The admissible carrying capacity can be read on the left-hand side of the horizontal line.

1.2.7 SB Crane 40 tonnes - Reeving Plan

PHB drawing no. K-OK 75072, titled Seilauflegeplan 40 t - Kran, dated 1979-06-06, reduced to A3 size

1.2.8 SB Crane 40 tonnes - General Hydraulics

PHB - Köln/Sperry Vickers

No. 41-79-7046 e, 1

No. 41-79-7046 d, 2

No. 41-79-7046 d, 3

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1.3 PS CRANE BOS 50/1900

1.3.1 General

The crane is an electro-hydraulic offshore crane with the following principal utilisation:

- Platform load handling
- Lifts to/from a fixed structure
- Lifts to/from a barge or supply vessel

All working movements can be continuously varied from zero to maximum speed.

1.3.2 Equipment Main Data

Specification

Electro-hydraulically operated, revolving crane, carrying capacity 50 tonnes on main hoist and 15 tonnes on whip hoist. Type BOS 50/1900.

Basic Design as shown on drawing no. 20626-2.2 (general arrangement of crane)

Certification

Crane	LRS
Pedestal	DNV

Maker

LIEBHERR-Werk Nenzing Ges.m.b.H., A-6710 Nenzing/Austria,
 Tel: 05525/2480-0, Telex: 052141, Telefax: 05525/2480-200

1.3.3 Applicable Codes, Standards and Regulations

The crane is designed and built in accordance with the requirements of the certifying authority and the following statutory requirements, specifications, codes and guidance documents:

- Lloyd's Register of Shipping
 "Code for Lifting Appliances in Marine Environment"
- HSE "Certificate of Fitness"
- Norwegian Maritime Directorate (NMD)
- National Swedish Administration of Shipping and Navigation (SSV)
- DIN Standards
- VDE Regulations
- IEC Regulations
- VDI Regulations

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1.3.4 Environmental Design Criteria

Temperatures

Ambient min/max	- 10° C / + 45° C
Design	- 15° C

Design and Wind Speeds

Operating	25 m/s
Stowed	50 m/s

Heel and Trim

The crane is designed for a max list of +/- 3° in addition to off/side leads .

Hazardous Area Classification

Pedestal adaptor	Safe non-hazardous
Boom	Safe non-hazardous
Machinery house	Safe non-hazardous
Driver's cabin	Safe non-hazardous

1.3.5 Lifting Capacity (LRS-rated) in Tonnes

Radius (m)	Platform lifts	Sea lifts S.W.H. (m)			
		0.5	1.0	2.0	3.0
M/H: 10.5	50.0	50.0	37.0	29.0	25.0
15	50.0	46.2	37.0	29.0	25.0
20	50.0	42.8	37.0	29.0	25.0
25	48.9	40.0	37.0	29.0	25.0
30	41.9	35.7	30.0	23.0	20.0
35	36.0	30.5	25.0	19.0	17.0
40	30.0	25.5	21.0	16.0	14.0
45	25.0	20.5	18.5	14.0	12.0
50	17.0	13.5	12.0	9.5	8.0
W/H: 12	15.0	15.0	12.5	9.5	8.0
57	15.0	15.0	12.5	9.5	8.0
63	14.0	12.3	10.5	8.5	7.5

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Hook Travel

Main hoist (2-fall)	Approx 40,5 m below boom pivot
Whip hoist (1-fall)	80 m below slewing ring

1.3.6 Operating Speeds

Hoisting

Continuously variable hoisting speed from 0 - max speed by means of an electronic power regulator.

Main hoist (M/H) 2-fall operation	Whip Hoist (W/H) 1-fall operation
0 - 20 m/min with 50 tonnes	0 - 70 m/min with 15 tonnes
0 - 23 m/min with 40 tonnes	0 - 93 m/min with 10 tonnes
0 - 29 m/min with 30 tonnes	0 - 128 m/min with 5 tonnes
0 - 36 m/min with 20 tonnes	0 - 140 m/min with empty hook
0 - 38 m/min with 10 tonnes	
0 - 40 m/min with empty hook	Payout mode - whip hoist 150 m/min

Slewing

Continuously variable slewing speed from 0 - max speed by means of an automatic power regulator.

0 - 1,0 rpm with max load even keel
 0 - 0,5 rpm with max load 3° inclination

Luffing

Continuously variable luffing speed from 0 - max speed
 from max to min radius with max load in 210 s
 from max to min radius without load in 120 s

Simultaneous Operation

All three motions can be operated at a time with max load at full speeds.

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1.3.7 Weight

Boom	Approx	42 tonnes
Slewing column	Approx	61 tonnes
Ropes, hooks	<u>Approx</u>	<u>8 tonnes</u>

Weight of the slewing crane Approx 111 tonnes

1.3.8 Prime Movers

Two squirrel cage electric motors

Nominal rating	270 kW each
Mode of operation	S6 - 40% ED
Protection class	IP 54
Insulation class	F / B
Starting method	Star-Delta
Voltage/frequency	440 V, 60 Hz

1.3.9 Winches

Hoist Winch

	M/H	W/H
Drum diameter	800 mm	800 mm
Flange diameter	1100 mm	1070 mm
Drum width	1215 mm	1004 mm
No. of rope layers	2	2
Spooling device	Lebus type groovings	
Drive	Hydraulic	
Brake	Spring-loaded multi-disc	
No. of dead turns	3	

Luffing Hoist Winch

Drum diameter	800 mm
Flange diameter	970 mm
Drum width	2750 mm
No. of rope layers	1
Spooling device	N/A
Drive	Hydraulic
Brake	Spring-loaded multi-disc,
No. of dead turns	3

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1.3.10 Ropes

<u>Load Hoist Rope</u>	M/H	W/H
	PDD 1918z	PDD 1918z
Rope diameter	36 mm	33 mm
Tensile strength	1960 N/mm ²	1766 N/mm ²
Min breaking load	1162 kN	875 kN
No. of load carrying parts	2	1

Luffing Rope

PDPZ 371	
Rope diameter	28 mm
Tensile strength	1960 N/mm ²
Min breaking load	681 kN
No. of load carrying parts	12

1.3.11 Hook/Block

2-fall hook block (main hoist)	S.W.L. 50 tonnes
1-fall hook (whip hoist)	S.W.L. 15 tonnes

1.3.12 Slewing Gear

No. of units	5
Drive	Hydraulic
Brake	Spring-loaded multi-disc

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1.3.13 Slewing Bearing

Manufacturer	Hoesch Rothe Erde
Type	3-row-roller
Nominal bearing diameter	3384 mm
No. of gear teeth	150
Module	20.00 mm
Retention device	None
Materials, Ring	36NiCrMo10V
Rollers	x45Cr13
Bolts	30CrNiMo8V
Bolting - Outer pitch circle dia.	3558 mm
No. of bolts	86
Size	M52
Bolting - Inner pitch circle dia.	3180 mm
No. of bolts	86
Size	M52
Bolt material grade	10,9 DIN/ISO 898
No. of lubrication stations	3
Visual strain indication	None

1.3.14 Hydraulics

Oil tank capacity	1200 l
Oil tank material	Carbon steel painted with an oil resistant paint of 3 x 100 my.
No. of filters in system	4 + 2
Filter mesh size	10 microns absolute
Hydraulic oil heating	Space heaters below tank bottom
Hydraulic piping	Steel braided flexible rubber hoses

1.3.15 Driver's Cabin

Location: Right-hand side to boom direction.

The cabin is equipped with a "Hitachi RA-21-09-CL" 220 V/60 Hz air-conditioning unit.

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1.3.16 Pedestal Adaptor

Conical pedestal adaptor with a height of 7000 mm and a lower outside diameter of approx 3540 mm. The pedestal adaptor is designed with an internal floor, accessible from inside the crane to allow for easy maintenance and inspection of slewing ring, slip-ring collector etc.

1.3.17 Corrosion Protection

The painting system is approved by "International" and used successfully in all fields of maritime activities.

Surface Preparations

According to S.I.S: 05.5900 SA 2,5

Painting: (Products from International Paint Co.)

Primer

Two-pack zinc rich epoxy

n.d.f.t 60 microns

Intermediate

Two-pack epoxy

n.d.f.t. 100 microns

Intermediate

Two-pack epoxy

n.d.f.t 50 microns

Finish

Two-pack epoxy finish

n.d.f.t. 50 microns

Total NMDFT = 310 microns

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1.3.18 Electrical Data

Connections

Main supply	3 x 440 V/PE, 60 Hz
Aux. supply for lighting, heating	220 V/1 Ph, 60 Hz
Emergency supply	1 x 220 V/60 Hz, P max 0,5 kW
UPS - System for helicopter warning lights	220 V/60 Hz
Control voltage lighting and heating	24 V DC
Control voltage "motor start" control	110 V, 60 Hz
Solenoid valves supply	24 V DC
Electronic power supply	+/- 15 V DC

Installed Power Ratings

	<u>Main motor 1 + 11</u>	<u>Oil cooler 1 + 11</u>	<u>Fan</u>
Voltage	3x440 V, 60 Hz	3x440 V, 60 Hz	3x440 V, 60 Hz
Rating	270 kW	1,73 kW	0,28 kW
Nominal current	455 A	3,5 A	0,84 A
Starting current	866 A	21 A	5 A
Operating mode	S6, 40%	S1	S1

Heatings

Crane Heating

Voltage	220 V, 60 Hz
Rating	4 x approx 1,1 kW

Standstill Heating Electric Motors

Voltage	220 V, 60 Hz
Rating	Approx 200 W

Cabin Heating

Voltage	220 V, 60 Hz
Rating	2 x 2,0 kW

Switch Cabinet Heating

Voltage	220 V, 60 Hz
Rating	2 x 45 W (switch cabinet X1)
	2 x 45 W (switch cabinet X2)
	1 x 20 W (switch cabinet X9)

Air-condition

Voltage	220 V, 60 Hz
Rating	1,2 kW

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Lighting

Slewing Column Inside

Voltage 220 V, 60 Hz
Rating 5 x each 2 x 20 W (4 with emergency battery)

Emergency Lights

Voltage 220 V, 60 Hz
Rating 4 x 25 W

Slewing Column Outside

Voltage 220 V, 60 Hz
Rating 5 x each 2 x 20 W

Emergency Lights

Voltage 220 V, 60 Hz
Rating 4 x 60 W

Cabin

Voltage 220 V, 60 Hz
Rating 1 x each 2 x 20 W

Emergency Lights

Voltage 220 V, 60 Hz
Rating 2 x 20 W (switch cabinet X1)
2 x 20 W (switch cabinet X2)
1 x 20 W (switch cabinet X9)
1 x 20 W (switch cabinet X7)

Floodlights

Voltage 220 V, 60 Hz
Rating 2 x 1000 W (boom) (EExd)
2 x 1000 W (slewing column) (EExd)

Helicopter Warning Light

Voltage 220 V, 60 Hz
Rating 2 x 100 W (A-frame top)
2 x 100 W (boom top)
4 x 100 W (boom)

1.3.19 Telecommunications

The crane cab, machinery room, slip-ring unit, etc are fitted with the following systems:

- a) UHF Radio Communication System
- b) Telephone System

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1.3.20 PS Crane BOS 50/1900 - Layout

Liebherr drawing no. 2058-001.00.00.000-000

1.3.21 PS Crane BOS 50/1900 - Capacity Curves

1.3.22 PS Crane BOS 50/1900 - Reeving Plan

Liebherr drawing no. 2058-721.00.00.000-000

1.3.23 PS Crane BOS 50/1900 - General Hydraulics

Liebherr drawing no. 2058-970.00.00.001-001