P A L A U

FINISHED PLAN

FOR

MITSUBISHI HYDRAULIC DECK CRANE

HAKODATE DOCK HEAVY INDUSTRIES, LTD. SNo. 789

FINISHED PLAN

MITSUBISHI
HEAVY INDUSTRIES, LTD.

Sheets with cover

DWG. No.	

ITEM No. 82

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HAKODATE DOCK CO.,LTD. SNo.784/5/6/9

MANUFACTURING SPECIFICATION

OF

HYDRAULIC DECK CRANE

(Specification No.DR09113293)

MITSUBISHI HEAVY INDUSTRIES,LTD.

Sheets with cover

DWG. No.	

CONTENTS

* This specification was prepared in accordance with the customer's purchase specification and our standard specification.

* For any item not specified in this specification, re-estimation is to be made by consulting with the customer.

1. Principal particulars and working condition

Item \ Type		30t x 24m (R) Hydraulic deck crane	t x m (R) Hydraulic deck crane
No. of set		4sets per Vessel (No. 1～4 crane)	set per Vessel (No. ～ crane)
Hoisting load		30/12/5 t	/ / t
Hoisting speed		19/38/63 m/min.	/ / m/min.
Lowering speed (at rated load)		63 m/min.	m/min.
Luffing speed		44 sec. (at the working radius 24 - 4.5 m)	sec. (at the working radius - m)
Slewing speed		0.7 rpm	rpm
Working radius		Max. 24 m Min. 4.5 m	Max. m Min. m
Slewing angle		360° endless	° endless
Winding height		35 m (at the minimum working radius)	m (at the minimum working radius)
Hydraulic pump unit		Self-contained	Self-contained
Type of hydraulic actuator	Hoisting	Radial piston motor	Radial piston motor
	Luffing	Axial piston motor	Axial piston motor
	Slewing	Do.	Do.
Electric motor		105kW cont. 240kW ED15%	kW cont. kW ED %
Electric source	Power	AC440V x 60Hz x 3ϕ	
	Lighting & Space heater	AC100V x 60Hz x 1ϕ	
Design condition		Heel Max. 5° + Trim Max. 2°	
Classification		NK	
Total mass		About 39t	About t

Remarks :
- The speed in the above table is on the condition of the working oil viscosity 55×10^{-6} m^2/s (oil temp. about 40℃～50℃).
- Applied Regulations or Rules ; Australian, Indian, Canadian, Pakistan, Newzealand harbour regulation, JIS, the related harbour regulation in U.S.A and Britain, AWWF.
- Gross weight of cargo and grab weight shall be less than 22.5 metric tons when grab handling is carried out in future.
- Allowable speed should be in the range of 95% to 125% of official speed (By regulations of JIS B8801)

2. Construction and main materials

The deck crane is to be designed with the construction and main materials in accordance with the Classification Rule and JIS standards, and to be manufactured in accordance with the approved general assembly drawing.

2-1 Construction

(1) Hoisting and luffing winches

These winch are accommodated in the crane housing with the state of the luffing winch installed over the hoisting winch.

Hoisting winch drum can be driven by the hydraulic motors through one (1) stage reduction gear.

Luffing winch drum can be driven by the hydraulic motor through planetary reduction gear. The reduction gear is in the enclosed casing and lubricated by oil bathing.

Each winch has spherical roller bearing to improve efficiency.

In addition, as the winch drum is grooved, the wire rope can be wound regularly on the drum.

The hoisting winch braking system has two (2) systems, one is hydraulic blocking system (counter balance valve) and the other is hydraulic band braking system.

The band brake is fitted to drum flange, and can be applied by the spring force and released by hydraulic pressure.

The material of the brake lining is of asbestos-free.

Hoisting winch is provided with a pinch roller.

The luffing winch braking system has two (2) systems, one is hydraulic blocking system (counter balance valve) and the other is hydraulic disc braking system.

(2) Slewing device

This crane is installed on the turn table bearing which is subject to the overturning moment and thrusting load at the same time.

The inner race of the turn table bearing is provided with the internal gears and is fixed to the hull post by bolting. Also the outer race is fixed to the crane base by bolting.

The slewing device consists of the hydraulic motor, planetary reduction gear, pinion, hydraulic disc brake and the pinion is engaged with the internal gear of the turn table bearing. The reduction gear is in the enclosed casing and lubricated by oil bathing.

The braking system has two (2) systems, one is hydraulic blocking system (counter balance valve) and the other is hydraulic disc braking system.

The hydraulic disc brake stops the slewing device when the power system is out of operation.

(3) Crane body

The body is of a box type of welded steel and the base is fixed to the turn table bearing by bolting.

(4) Jib

The jib is manufactured of welded steel and has sufficient strength and rigidity for external force.

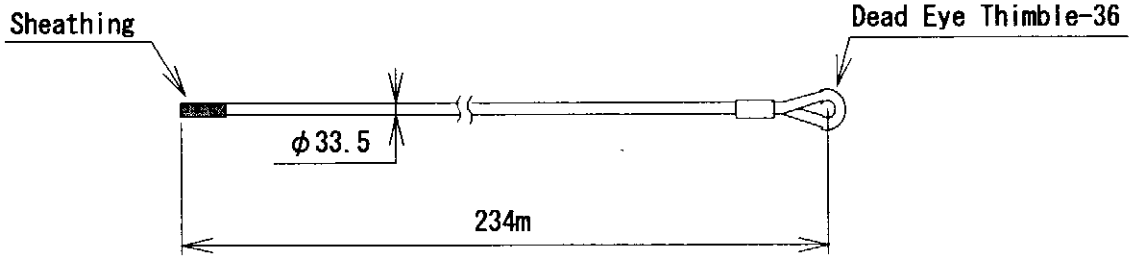
(5) Steel wire rope

The steel wire rope for hoisting is a non-self-rotating rope and that for luffing is of JIS No.18.

These ropes are galvanized.

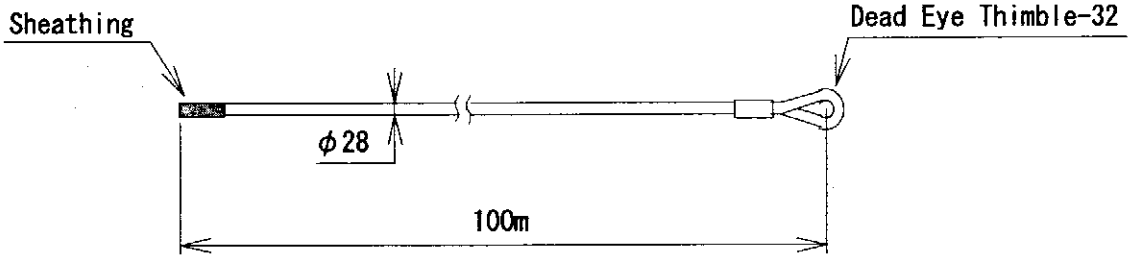
・Hoisting rope(non-rotating rope)

U4 × SeS (39) (SHINKO WIRE CO.,LTD.) Galvanized, Z-lay



・Luffing rope(JIS No.18)

6 x Fi(29) ,class C ,IWRC ,Galvanized ,Z-lay



(6) Operator's cabin

The cabin is completed with heat and sound insulation on the wall.

Two operating handles are arranged in the cabin and each handle in connected to each hydraulic control valves in machine room.

Hoisting handle is easily operated by a right hand, luffing and slewing handle is done by a left hand.

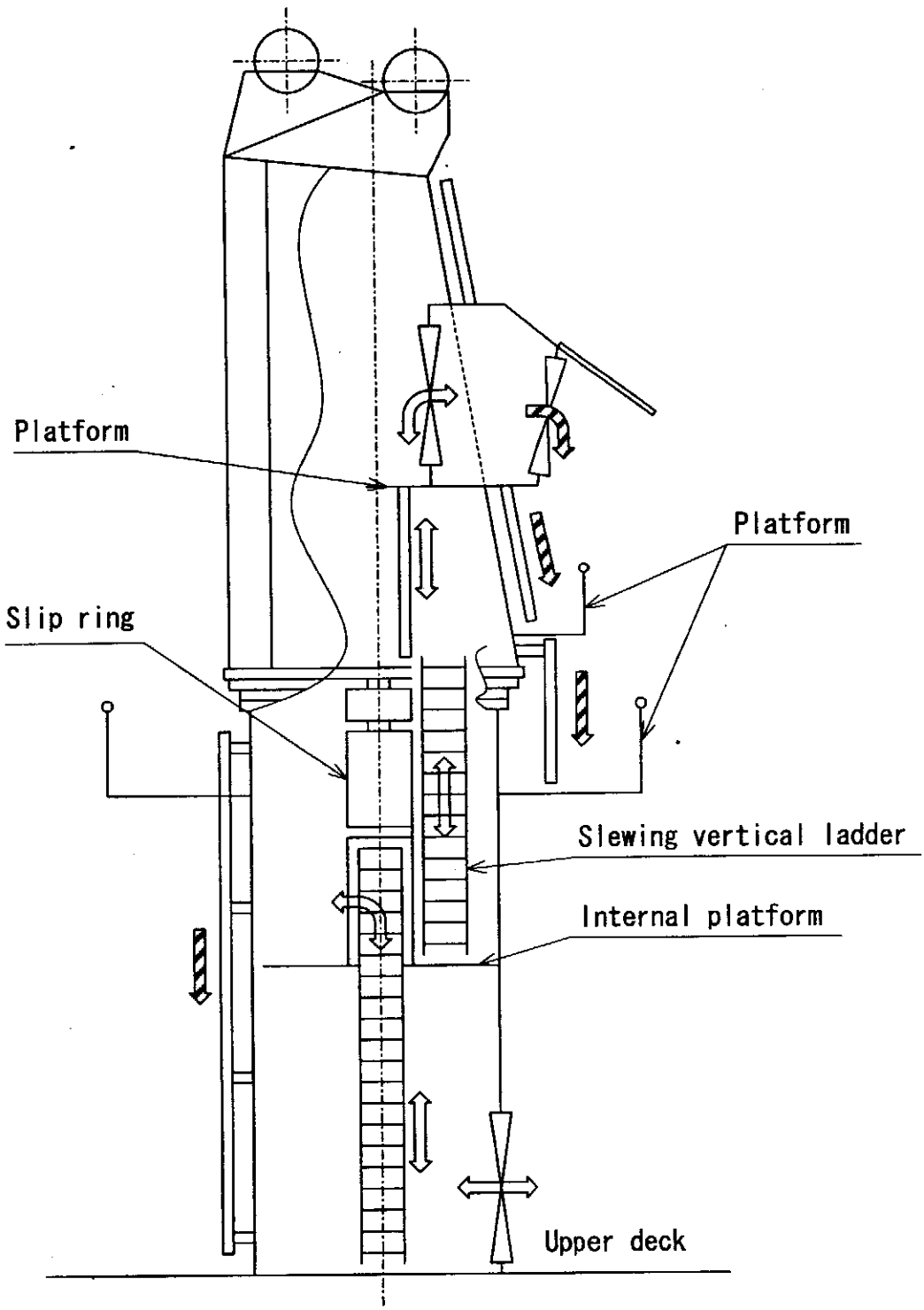
Luffing and slewing handle is adopted the universal controller to operate both action of luffing and slewing.

To raise the efficiency of cargo handling, the three motion at the same time can be carried out with light load.

The noise level in the operator's cabin is less than 85dB(A).

◎ THE ACCESS TO THE OPERATOR'S CAB

・ Outline of access way.

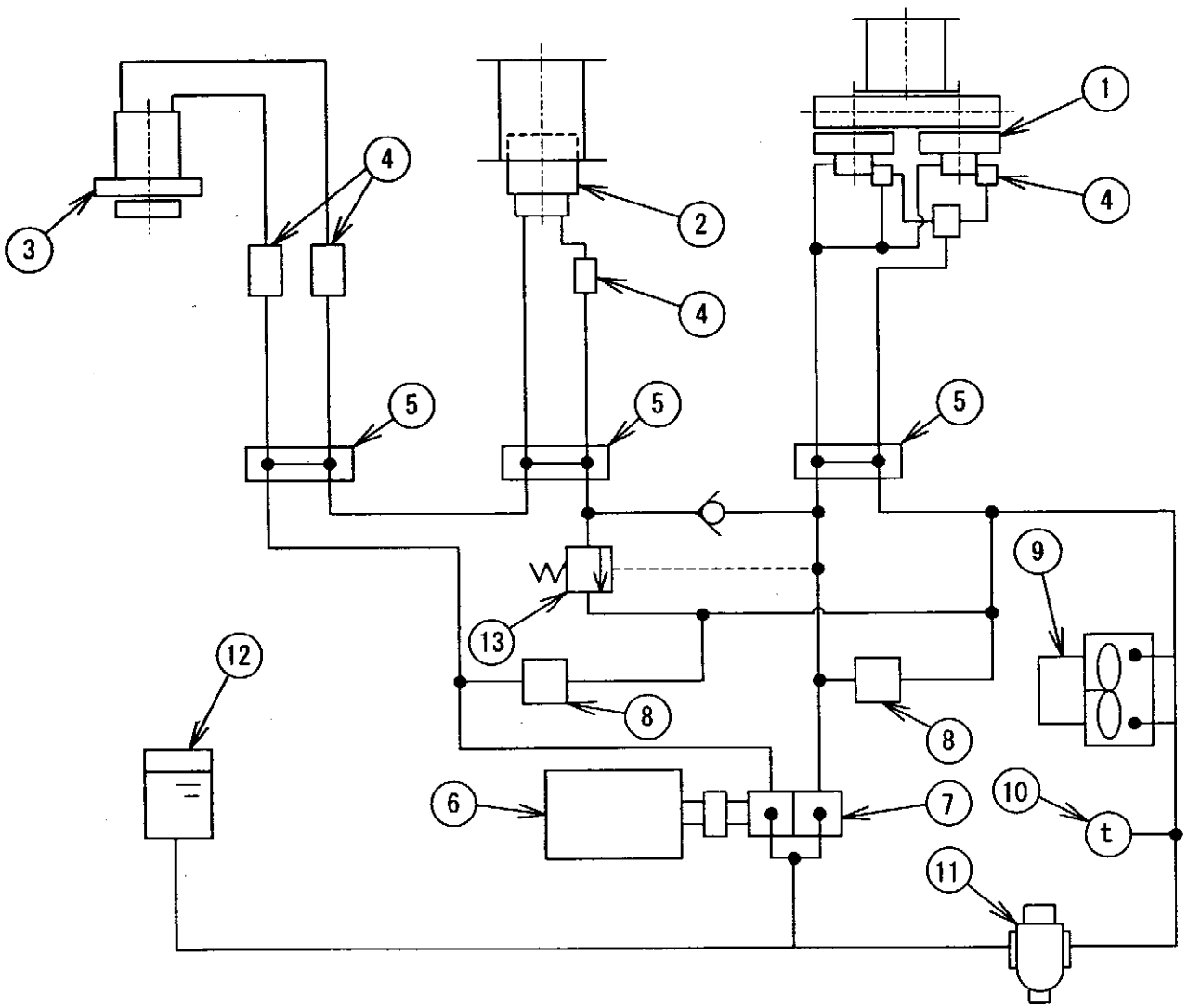


・ Ordinary access ・・・・・・・ Shown with symbol ⟺

・ Emergency access ・・・・・・・ Shown with symbol

Fig. 2-1

SLEWING DEVICE LUFFING WINCH HOISTING WINCH



No.	NAME
1	OIL MOTOR FOR HOISTING WINCH
2	OIL MOTOR FOR LUFFING WINCH
3	OIL MOTOR FOR SLEWING DEVICE
4	COUNTER BALANCE VALVE
5	CONTROL VALVE
6	ELECTRIC MOTOR
7	OIL PUMP
8	RELIEF VALVE
9	OIL COOLER
10	THERMO SWITCH
11	OIL FILTER
12	HEAD TANK
13	UNLOADING VALVE

(7) The hydraulic system (Fig. 2-2)

The hydraulic system for hoisting, luffing and slewing is composed of fixed displacement hydraulic oil pumps, fixed displacement oil motors, control valves, counter balance valves and other accessories.

Of course, the pressure relief valve is fitted in each circuit to prevent the line from over pressure.

The pressure oil delivered from each oil pump driven by an electric motor is regulated by the control valve and is supplied to each oil motor.

So, the speed of each motion can be controlled gradually by controlling the control valve.

The hydraulic system has two (2) circuits, one is for hoisting and the other is for slewing and luffing which line is connected in series.

The return lines of each circuit are connected together.

The oil flows together in return line and flows through air cooled oil cooler which is automatically controlled by a thermo switch and in a 10 micron-oil filter and then, oil gets back to each suction chamber of oil pumps.

Furthermore, a head pipe with head tank connected to the return line gives a little positive pressure and supplies oil in the circuit for developing the sucking performance of oil pumps.

2-2 Electric equipment

(1) General

The main power electric source is connected to the no-fuse-breaker (N.F.B) in the starter panel located in the machine room through cable from slipring of the collector.

The aux. electric source for lighting and heating apparatus is led to the control stand in the cab through cable from the slipring of the collector.

The necessary devices except main switch for operating the deck crane are functionally arranged in the cab.

The switches of space heater for main motor, control stand and starter panel is fitted on the control stand.

(2) Electric source

The following voltage are to be used for the deck crane.

AC440V, 60Hz, 3ϕ.....For main circuit of the electric motor
AC440V, 60Hz, 1ϕ.....For main contact coil of the electric motor for the hydraulic pump & oil cooler
AC110V, 60Hz, 1ϕ.....For control circuit of the solenoid valve
DC24V, ...For other control circuit
AC100V, 60Hz, 1ϕ.....For lighting and heating circuit
Ship supply source.....AC440V, 60Hz, 3ϕ, 225A
AC100V, 60Hz, 1ϕ, 30A

The supply line provided from the ship is connected to the brush of the collector beneath the floor center of the machine room.

(3) Main motor for hydraulic oil pump

The electric motor for the hydraulic pump is to be started by the method (three contactor method) and the starting current is to be decreased in one-third of directly starting.

(a) Three phase induction motor for marine use
(b) Totally enclosed with outside fan squirrel cage rotor equipped with ball bearings
(c) Insulation class F
(d) With space heater & thermal switch
(e) IEC numbers of protection IP55

(4) Motor for oil cooler

The electric motor for oil cooling fan can be automatically operated by the oil temperature while the electric motor for the hydraulic pump is operated. The electro-magnetic switch is actuated by the thermostat for detecting oil temperature which is inserted in the hydraulic piping and causes the motor to operate.

(a) Three phase induction motor for marine use
(b) Totally enclosed with outside fan squirrel cage rotor equipped with shield ball bearings
(c) Insulation class F
(d) Direct start
(e) IEC numbers of protection IP55

(5) Starter panel

Use for starting circuit of main motor for hydraulic oil pump & motor for oil cooler and other.

Including control transformer & diode stack for control circuit, etc.

Constructed by steel plate and drip-proof type (IP22).

Installed in machine room of deck crane.

(6) Control stand for single crane

Control circuit including control switch, indicating lamp and control relays is built in this control stand.

Constructed by steel plate and drip-proof type (IP22).

Installed in cabin of deck crane.

(7) Electric cable

All cables installed throughout the deck crane shall be of Japanese Industrial Standard (JIS) and of 0.6/1kV or 250V grade insulation to meet the voltage to which they are subjected.

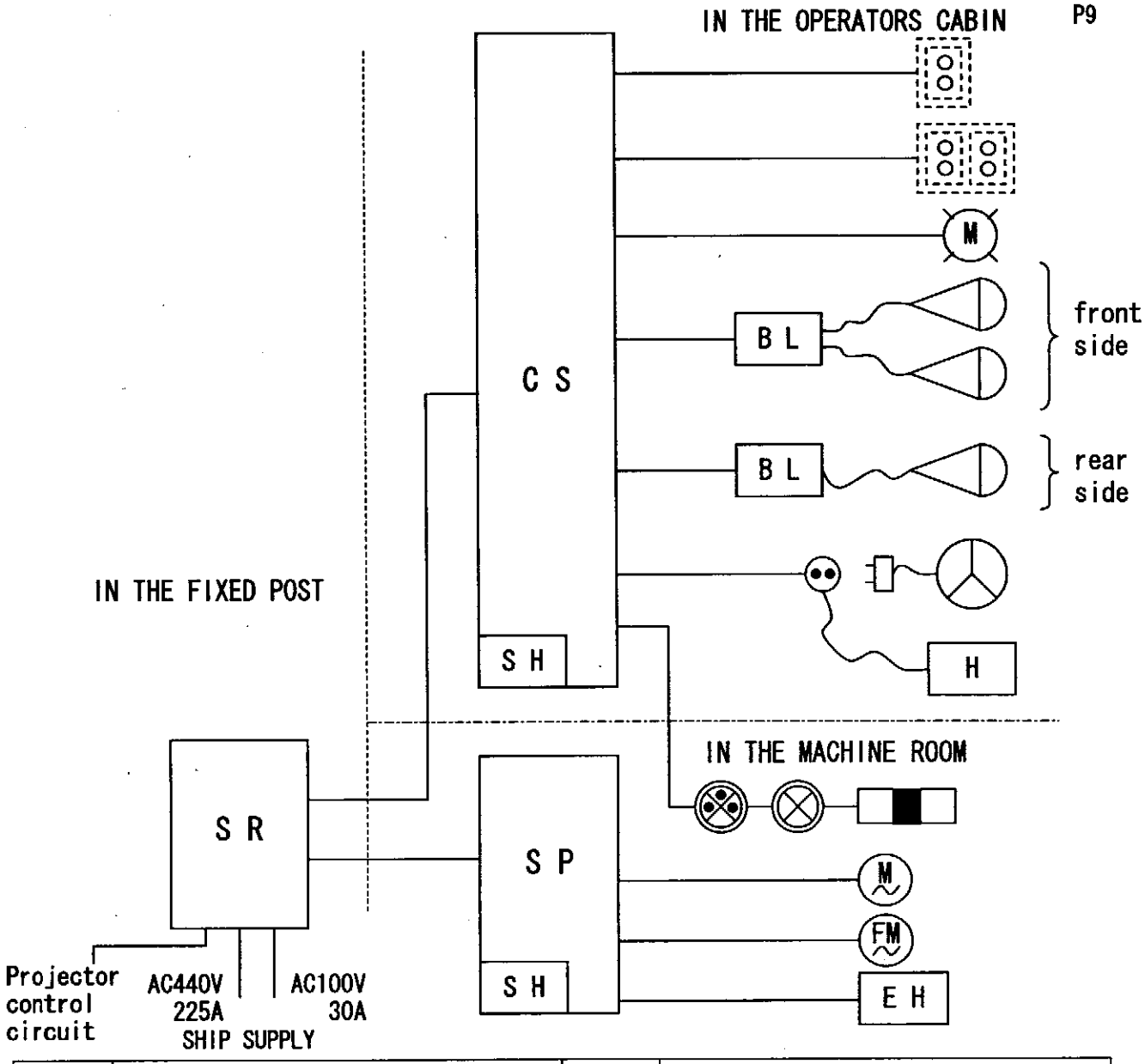
The conductors supplying single load, in general, shall have continuous current carrying capacity equal to 100% of the rating of the connected load.

(8) Slipring

Installed in the fixed post of ship's deck.

Therefore installation and electric wiring of primary and secondary side are worked by shipyard.

(a) Main circuit	AC440V	300A	3 Rings (3ϕ)
		150A	Earth 1 Ring
(b) Lighting & heating circuit	AC100V	30A	2 Rings (1ϕ)
(c) Projection control circuit (Only front side)	AC100V	30A	2 Rings



S R	SLIP RING	H	ROOM HEATER
C S	CONTROL STAND		ELECTRIC FAN
S P	STARTER PANEL	B L	BALLAST
M	HYDRAULIC PUMP MOTOR		MERCURY LAMP
FM	FAN COOLER MOTOR		FLUORESCENT LIGHT
	LIMIT SWITCH FOR HOIST CONTROLLER		RECEPTACLE WITH SWITCH
	LIMIT SWITCH FOR LUFF. & SLEW. CONTROLLER		TUMBLER SWITCH
LSB	LIMIT SWITCH BOX	S H	SPACE HEATER
M	MARINE PENDANT LIGHT		PLUG & RECEPTACLE
E H	ELECTRIC HEATER		

Fig. 2-3

2-3 Main materials

Name	Material
Crane body	Rolled steel for general structure
Jib	Rolled steel for high tensile strength
Winch drum	Rolled steel for general structure
Winch shaft	Carbon steel for machine structural use
Winch gear	Low alloy steel casting
Winch pinion	Chromium molybdenum steel
Sheave	Carbon steel for machine structural use
Gooseneck pin	Carbon steel for machine structural use
Falling block	Rolled steel for general structure

3. Safety device

3-1 The following safety devices are to be provided.

(1) Hoisting upper limit

(2) Hoisting lower limit

※(3) Collision preventing limit between jib tip and falling block

(4) Luffing upper limit(jib)

※(5) Luffing lower limit(jib) 25°

(6) Luffing rest limit

※(7) Loosen detector of hoisting wire rope(against over slack)

(8) Oil level float switch

(9) Temperature detecting device of the working oil
(for stopping and starting the fan cooler)
50 ℃.....Cooler "ON"
35 ℃.....Cooler "OFF"

(10) Upper working oil temperature limit (75 ℃)

(11) Main electric motor overload preventing device

(12) Push button for emergency stop

(13) Handle off-notch interlock

(Note) For the item with marks ※, the by-pass mode of the limit can be produced due to shifting to the by-pass position by means of a by-pass key.

3-2 The procedure for "Restart" after the actuation of each limit or safety protection is as follows.

Safety device	Restart
(1) Hoisting upper limit (2) Hoisting lower limit (3) Collision preventing limit between jib tip and falling block. (4) Luffing upper limit. (5) Luffing lower limit. (6) Loosen detector of hoisting wire rope.	① Reset the control handle at the neutral position. ② Push the buzzer-reset button switch. ③ Push the starting button switch again. ④ Operate the control handle to the reverse direction.
(7) Luffing rest limit.	・Operate the control handle (Luff up) after switching over the by-pass key to "NORMAL" position.
(8) Oil level float switch.	・Fill the working oil in oil tank after removing the cause of oil leakage.
(9) Upper working oil temperature limit.	・Restart E/M in the state that oil temperature goes down 65℃ below after removing the cause of the abnormal rise of oil temperature.
(10) Main electric motor over load preventing device.	There are two cases as follows. ・The thermal relay is actuated (the resetting can be made due to pushing the reset button). ・The thermal switch in the coil of electric motor is actuated. For both cases, first remove the cause of abnormal matter, then, Restart E/M after checking up that "MOTOR OVER LOAD LAMP" on the control stand puts off.

4. Crane equipments

(Quantity shows for one crane)

4-1 Equipment in cabin

Name	Standard	Quantity
Chair	40cm	1
Heater	1kW/100V	1
Electric fan	30cm/100V	1
Wiper	Manual operation	1
Marine pendant light	60W/100V	1 set
Fire extinguisher		1 set
Front openable window	Natural ventilation and emergency escape	1

4-2 Equipment in machinery room

Name	Standard	Quantity
Fluorescent lamp	20W/100V	1
Heater	2kW/440V	1

4-3 External equipment

Name	Standard	Quantity
Mercury lamp	400W/100V(front side)	2
Mercury lamp	400W/100V(rear side)	1
Slip ring	AC440Vx60Hz x 3ϕ, AC100Vx60Hz x 1ϕ,	1 set
Falling block	With hook	Each 1 set
Bolts and washers for fitting the turn table bearing		1 set
Jib angle indicator	On the jib	1 set

4-4 Other equipment

(1) Projector control circuit (front side of crane body)