



# CDY2A-----PC2-5 Type Marine Main Diesel Engine Electric Remote-Control System Instruction

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Controlled Object:

Main Engine: PC 2-5Series diesel engine of electric speed governing type from  
Shanxi diesel engine factory

Gear box: GW Series Gear box from Chongqing gear box factory and Hangzhou  
gear box factory.

Shipowner:

Shipyard:

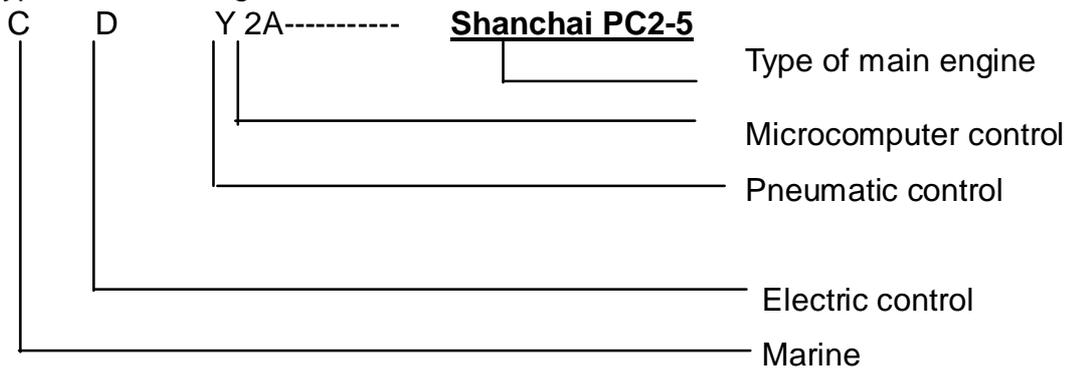
Purpose:

Designed by:Henan Guangcai Electric Co.,Ltd

**A. General:**

1. CDY2A-PC2-5 type marine main diesel engine electric remote-control system is suitable for nonreversible marine main propulsion unit with forward&backward clutch gear box. Shipman may directly operate disengagement, engagement reversing of gear box and speed adjustment of main engine.
2. Characteristic of product: this system is electric-pneumatic mixed type, in electric control part, PLC microcomputer from Japan OMRON Company is adopted as main control unit, and the pneumatic control part is composed of import valve .This system has characteristics as high reliability, handiness, convenient for servicing etc.
3. Main application and range of use  
This system mainly control the basic propulsion system which is composed of **Shanchai** PC2-5 type marine main engine and pneumatic control reversing gearbox, may remote control governing of main engine and reversing of gear box in wheelhouse, and may shut off air source of remote-control system, and manually operate governing of main engine and local change valve of gear box according to main engine telegraph or emergency engine telegraph command.

4. Type and meanings



5. Ambient condition

- a. May normally work within the range 0~+55℃, and won't lapse under 70℃.
- b. This system can be normally work under the following humidity
  - ①. When the temperature reaches +45℃, the relative humidity is 95%±3%;
  - ②. When the temperature reaches +45℃, the relative humidity is 70%±3%.
- c. This system can normally work under the following vibration conditions:

Location	Vibration Parameter	
General Location	2.0HZ~13.2HZ Amplitude±1mm	13.2HZ~100HZ Acceleration±0.7g
Reciprocating machinery and other similar place	2.0HZ~25HZ Amplitude±106mm	25HZ~100HZ Acceleration±4.0g

- d. This system can incline and vibrate for 22.5℃ at each direction ( time of swing is 10S), and may normally work when the linear acceleration at the vertical direction is ±9.8m/S<sup>2</sup>

- e. Protection grade:remote control console IP22,engine room control box, valve box IP22.
6. Safety  
This system conforms with " Steel Sea-going Ship Classification And Construction Rules(2006)"and regulations of overseas classification society.
7. Location
  - a. Remote control console is to be arranged in wheelhouse.
  - b. Air source disposal plant is to be arranged on the bulkhead near the special low pressure air cylinder engine room for engine room remote control.
  - c. Engine room control box, engine room valve box are to be installed near main engine, so as to convenient for observing command meanwhile the operation of main engine won't be affected, and may realize single man operation at engine side.
  - d. Location of each components should strive for concentrated, for the purpose of operation and servicing.
8. Installation requirements
  - a. Earthquake counter measure should be considered for installation of each device, plus 10mm thick rubber blanket or snubber block between common base and device.
  - b. Before the pipe installation is finished and connected with device, sundries inside the pipe should be blown down with high pressure gas, in case of line clogging,and spoiling all sorts of valves.
  - c. After the installation of pipeline, experiment with 1.25 times rating pneumatic pressure, and there shouldn't be gas leakage.
  - d. All pipeline material for remote-control system is  $\Phi 8 \times 1$  copper pipe,bending radius should be greater than 3 times diameter.
  - e. The installation and connection of pipeline are firm, the throughout ship pipe casting is to be equipped at the through location of deck and watertight deck.
  - f. After finishing the installation of each device,cover with flame retardant canvas, in case the scrap iron, welding slag and dust from spoiling the surface of device.

## **B. Function**

1. CDY2A-PC2-5 type marine main diesel engine electric remote-control system is suitable for controlling diesel power plant of gear box (air-control) with reversing clutch, which may realize manoeuvring in wheelhouse(double-wing) , engine control room and local etc. positions.
2. Start and normal shutdown of main diesel engine is to be controlled at local, remote-control system may remote control speed governing, disengagement, coupling and reversing of main engine in wheelhouse.
3. Remote-control system is single handle stepless manoeuvring type, having control function for logic sequence. Setting rotational speed signal of governor may change calmly and slowly at the time of remote manipulation, it won't quickly change as the quickly pull of remote manipulator's handle.
4. Handle of remote manipulator may be directly pulled from ahead to astern,or directly from astern to ahead;
5. When the working air source of remote-control system loses gas, and the set

value of governor's rotational speed will remain constant in a certain time.

6. Remote-control system is equipped with the following indicating lamp : "local ", "WH/C", " ahead ", "stop " and "astern " .
7. Controlling parameter may be adjusted according to real ship's condition.
8. If propulsion unit is controlled in wheelhouse, no matter whether there is someone on duty in machinery space, propulsion system may supply the pre-alarm for the offing deceleration and shut down to duty officer, so that the driver may use safety over control.

### C. Technical Specification

- 1 Type:CDY2A-PC2-5 type
- 2 Form:electric remote control, single handle stepless manoeuvring, logic control, electric signal contact cum indication;  
Speed adjustable range:40%ne~103%ne,divided into ahead 4 steps, neutral, astern 4 steps, altogether 9 steps.
- 3 Power supply:main power: AC220V±10%; standby power supply: DC24V±20%.  
When main power loses voltage, standby power supply will automatically input, power consumption of stand-alone is not greater than 150W; DC24V power supply and 3-power supply for safety, control and measure alarm are independent from each other.
- 4 Temperature: -10°C~+55°C;
- 5 Precision of rotary speed control:<=±1%;
- 6 Setting pneumatic pressure of output rotational speed for remote manipulator: 0.05~0.45MPa;
- 7 Low pressure alarm limit for air source:0.45MPa;
- 8 Insulation resistance:not less than 1 MΩ.
- 9 Reversing time:not more than 15 s.
- 10 Technical Parameter
  - a. Rotary angle for maneuvering handle:±74.5°,among which ± 19.5° is idle speed.
  - b. Stepping motor : 0 \_ 17.5 circles

### D. Matching requirements for main engine and gear box

1. Stepping motor Speed governing device is to be matched with main diesel engine speed governor, namely performer type governor at the input end of Impulse speed governor .
2. Reversing control valve of gear box is required has 3 control orifice. The position of this valve won't change if there is no pneumatic pressure at the control orifice of ahead and astern, or the 3 orifice air source lose air synchronously when " empty" is controlled by air source pneumatic pressure.

### E. System Constituent

CDY2A-PC2-5 type main propulsion unit system is composed of main engine remote control unit(RCU). remote manipulator(MH). remote display control panel(ICP), auxiliary engine telegraph unit(ATE).speed measuring display unit(SM),

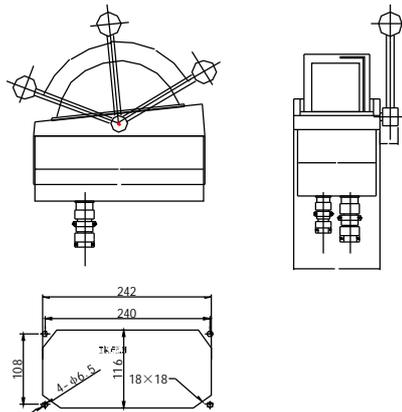
engine room control box, engine room valve box, remote control speed governing device, power supply, double- air source purification plant and oil pressure checkout console for gear box( selective pairing). May compose remote-control system aim at different remotely controlled object according to specifications and requirements of different classification society and special requirements of specific user.

Composition of CDY2A-PC2-5 type main engine remote control system and specific input-output interface is to be referred to CDY2A-PC2-5 type system diagram for remote control unit.

### 1 Remote control unit(RCU)

Core unit of main engine remote control device, PLC microcomputer: used for accepting relative command signal, realizing program governing, reversing and disposal of visual audible and signal for alarm etc., it is the core of this system. Take strict precautions against scrap iron, water, oily soil and impurity from dropping into interior!!

### 2 Remote manipulator(MH)



MH is handle type, having stepless speed regulation form with obvious hand touch, Ingress Protection is IP22.

Main function of MH: sending out command signals for rotational speed and forward, backward of gear box's clutch.

Usually commands output from MH may be divided into the following 9 steps: empty(IDLE), DEAD SLOW, SLOW, HALF and FULL for ahead, DEAD SLOW, SLOW, HALF and FULL for astern. Set value of rotational speed commands for each step may be separately set or modified, but the rotational speed commands between each step will continually change, therefore MH may be used not only according to step mode but also according to stepless mode.

### 3 Remote Display Control Panel

ICP may display maneuvering pattern of remote-control system and actual working state of main propulsion unit at these positions, the specific content is:

- BRIDGE
- LOCAL

- AHEAD
- IDLE
- ASTERN

There are some necessary control button equipped on ICP, specific content is:

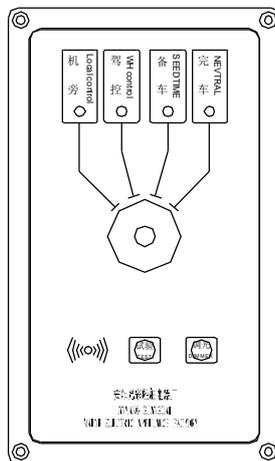
Emergency stop push button with lamp(only equipped in remote control station and centralized control station)

Safety overcontrol push button with lamp(only equipped in remote control station and centralized control station)

Test lamp push button

#### 4 Auxiliary Telegraph Unit

Auxiliary telegraph unit is standard completed unit, used for contact between remote control station, centralized control station and local main propulsion unit.



The content contacted via ATE is: transform for control position between wheelhouse control and local control, request and answer for SBE and FWE.

The ATE which is located at local is provided with a change over switch(WH/C, Local, SBE, FWE), used for ascertaining the two positions for request and answer.

When control at local (change over switch is put at local), ATE in wheelhouse is transmitter, and ATE at local is receiver, at this point ATE in ECR is repeater.

ATE won't directly participate in control process of remote control, its function is only proceed the communication between the above three control position.

#### 5 Speed measuring display unit(SM) (provided by shipyard or Henan Guangcai Electric Co.,LTD)

Tachometry display unit(SM)is divided into 2 parts, respectively used for measuring rotational speed of main engine and stern shaft.

Specific installation elements for speed measuring probe box and speed

measuring fluted disc is referred to in the following drawing:

① SM for measuring rotational speed of main engine is composed of the following components:

2 pieces of speed measuring probe(installed in a junction box)

1 piece of main engine flywheel which may proceed magnetic induction toward speed measuring probe while rotating ( provided by main engine manufactory)

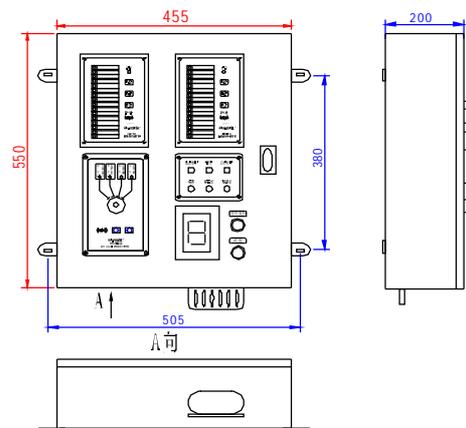
② SM for measuring rotational speed of stern shaft is composed of the following components:

1 piece of speed measuring probe(installed in a junction box)

1 piece of speed measuring fluted disc which may proceed magnetic induction toward speed measuring probe while rotating.

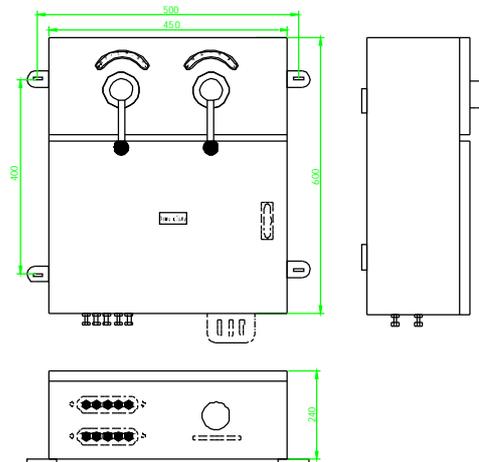
## 6 Engine room control box unit(LC)

Compounding display control panel, auxiliary engine telegraph, local control unit and alarm indicating lamp panel, generally it is fit in the manoeuvring position of main engine. Engine room control box is to be installed near the governing handle of main engine in engine room where is convenient for operation, it may indicate all sorts of operating instruction and operating state of wheelhouse.



## 7 Engine room valve box(LU)

Interior comprises: ahead and astern control solenoid valve, control position transform air valve etc. are to be installed beside engine room control box, local control valves as " remote control -local " " ahead - empty - astern "are to be provided on panel.



## 8 Power Supply

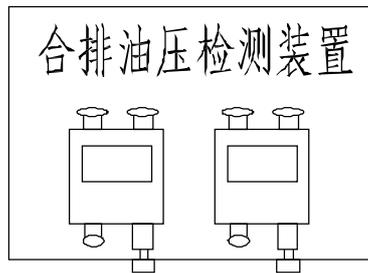
Power supply is assumed 2-route current supply, one is AC220V, adopting unitization switching power supply, AC220V for input, DC24V for output, the other adopting battery DC24V power supply. Power supply can be automatically changed over, and with polarity protection, so as to realize the stabilization of power system.

## 9 Double air source purification plant

Air source disposal plant is a component which may provide clean, steady-going air source for this system, at the time of using it, low pressure air cylinder deployed by shipyard is to input 1MPa compressed, open the switch valve (two-position three-way valve), compressed air is to output 0.6MPa compressed air to engine room valve box after purification via oil mist, reducing valve and filter valve, in order to guarantee the stabilization and cleanness of the air source for the whole remote-control system. Pressure reduction and filtration of air source adopts 2 sets of parallel connection.

10 Speed governing device (stepping motor driving box): to be speed governing execution control box, execution control box may convert to angular displacement for relevant stepping motor according to acceleration or deceleration command of manipulator, thereby control speed governing of main engine. Thus to control rotary speed of main engine.

11 Checkout console for gear box oil pressure: engagement signal for ahead and astern of gear box is to be completed by oil pressure sensor matched with gear box or checkout console for gear box oil pressure (selective pairing) matched with remote-control system.



## F. Operating Instruction

### 1 Controlling means for different control positions

This remote-control system could remote control in two positions as in wheelhouse and at local. On-off disengagement and engagement may be directly operated at local.

Control modes for different control positions as follows:

	Manoeuvring Methods	Control methods for rotary speed	Disengagement and reversing of gear box	Safety system
Wheelhouse	Automatic control with remote manipulator(electric-air control system)	Rotational speed setting signal from governor control of I / P convertor.	Air signal sent out by solenoid valve,control pilot valve which may impulse hydraulic clutch.	Emergency stop Failure shut down Failure slow down
Local	Manually manoeuvre the adjusting knob on air-actuated performer of governor and pull the 3 positions as AH / IDLE / AST on air operated control valve.	Manually adjust the adjusting knob on air-actuated performer of governor,change the position of setting lever for rotational speed of governor.	Manually pull 3 positions as AH / IDLE / AST on air operated control valve, the air generated will impulse control pilot valve of hydraulic clutch.	Emergency stop Failure shut down
Emergency	Manually manoeuvre adjusting knob on air-actuated performer of governor and directly pull handle on control pilot valve.	Manually adjust adjusting knob on air-actuated performer of governor,change the position of setting lever for rotational speed of governor.	Directly pull pilot lever on hydraulic clutch to the required positions as AH.AST or middle IDLE.	Emergency stop Failure shut down

Note a: emergency expresses direct operation under the condition that both air source and power supply of remote-control system are interrupted.

b: Safety system is independent from remote control unit, may be provided by shipyard or separately provided by Henan Guangcai Electric Co.,Ltd additionally.

### 2 Transform of control position

Any transform of control position,must intercommunicate via auxiliary engine telegraph,and won't transform until receiving the confirmation of answer, its preferential principle is the remote manipulation may be released at local;

transfer of control position is to be realized via 2-position transfer air valve equipped on the local display and control unit.

When transfer the different manoeuvring positions, the position of this 2-position transfer air valve and transfer switch as follows:

Control position \ Transfer switch	Position of transfer air valve for "Remote control / Local"
Wheelhouse	Remote Control
Local	Local

At non-remote control status, control command of main engine is to start command and answer via telegraph system which is independent from remote control unit.

### 3 Remote control in Wheelhouse

When pull transfer air valve for 2-position as " Remote Control /local" to " remote control ", switch on the air source lead to remote control part of air logic valve box LU, and switch off the air source lead to transfer air valve for 3-position as local ahead / empty / astern.

#### 3.1. Rotary speed control for main engine

Rotary speed of main engine is to be automatically regulated by and hydraulic governor. Setting value of rotary speed is to be directly sent out from remote manipulator in wheelhouse, the whole rotary speed control is open-loop control, rotary speed of main engine is to increase coming along change for one two, three, four of manipulator.

#### 3.2. Engagement control for gear box

When the handle of remote manipulator is pulled from empty to ahead(or astern),ahead and astern commands are to be sent out from wheelhouse,engage via PLC microcomputer no more than 2 seconds of Max. setting time for engagement, control ahead and astern reversing solenoid valve in engine room valve box,then 3-position 4-way pneumatic control change valve on gear box is to be pulled by 0.6 Mpa compressed air, to realize engagement of gear box.

#### 3.3. Disengagement control of gear box

When the handle of remote manipulator is pulled from ahead(or astern)to empty,empty command is to be sent out from wheelhouse, and disengage in no more than 2 seconds of Max. setting time for engagement via valve box PLC microcomputer, control ahead and astern reversing solenoid valve in engine room valve box, 3-position 4-way pneumatic control change valve on gear box is to be pulled by 0.6 Mpa compressed air, so as to realize disengagement of gear box.

#### 3.4. Reversing and engagement control of gear box

Remote control unit could directly pull the remote manipulator from maximum speed of ahead in harbor to astern (or in opposite direction), while doing this kind of reversing maneuver, within a period that is not

more than Max. setting for reversing and engagement , "rapidly slow down - delay disengagement 2 seconds - neutral position - delay engagement 2 seconds - slowly acceleration " automatic engagement is to be proceeded according to setting logical program of PLC microcomputer. After the receipt of feedback signal for succeed in engagement, slowly increase the rotary speed of main engine to the setting rotary speed of remote manipulator.

### 3.5. Automatically avoiding critical speed

When the rotary speed setting sent out by remote manipulator enters into the range of critical speed for main engine, remote control unit could control the final rotational speed setting output value in the lower limit or high limit of critical speed.

The high limit and lower limit of critical speed are to be modified or set on the spot.

### 3.6. Failure slow down

When some important parameters according to requirements of rules fail, and exceed the preset limit, the safety system which is independent from remote control unit will send out " failure slow down " signal to remote control unit, remote control unit will immediately release the command signal for rotational speed sent by remote manipulator, and replace it with a preset slow speed signal, make the main engine automatically slow down and send out audible and visual alarm. By this time the reset push button indicating lamp on the engine room control box flashes, after the parameters return to normal, press reset after manual acknowledgement, then the rotary speed setting automatically return to the original setting value of remote manipulator, gradually raise to this setting value. Here the reset push button indicating lamp on engine room control box went out.

### 3.7. Failure shut down

When the important parameters according to rules fail, and go beyond the risky limiting value, the safety system which is independent from remote control unit will send out a signal as "failure shut down" to remote control unit, the rotary speed of remote control unit will immediately fall to 0, and main engine will shut down immediately. At the same time, main engine is to be cut off fuel and shut down by the shut down solenoid valve matched with safety system. Here reset push button indicating lamp on engine room control box flashes.

After shut down because of main engine failure, remote control unit won't return to normal until satisfying with the following conditions:

- \* Parameters which cause the failure shut down return to normal
- \* Main engine restart and reach the empty rotary speed
- \* After pressing reset push down via manual acknowledgement

Here the reset push button indicating lamp on engine room control box went out.

### 3.8. Emergency stop

Emergency stop push button is to be fitted both in wheelhouse and engine control room, press this push button while in emergency situation and require for immediately shut down, the rotary speed of remote control unit will fall to 0 immediately, and main engine will immediately shutdown, Meanwhile main engine will be cut off fuel and shut down via shut down solenoid valve matched with safety system. Here push button indicating lamp on engine room control box flashes.

After emergency stop of main engine, remote control unit won't return to normal until satisfying with the following conditions:

- \* Parameters which cause the failure shut down return to normal.
- \* Main engine restart and reach the empty rotary speed
- \* After pressing reset push down via manual acknowledgement

Here the reset push button indicating lamp on engine room control box went out.

### 3.9. Safety over control

When there is slow down and shut down alarm caused by failure of set, and according to navigation conditions, slow down and shut down are not allowed, crew may press over control push button, until navigation conditions allow slow down and shut down, cancel over control function, return to normal slow down, shut down function. After pressing this push button, may release some limit set for protecting main engine, as:

- \* Release failure slow down function at the time of remote control
- \* Release failure shut down function at the time of remote control

### 3.10. Over speed shut down

While controlling in wheelhouse, runaway protection function which is independent from safety system is to be equipped with remote-control system, when the rotary speed of main engine is higher than setting value of overspeed, rotary speed of remote control unit immediately fall to 0, meanwhile send out overspeed shutdown alarm. Here reset push button indicating lamp on engine room control box flashes.

When main engine shutdown as overspeed, remote control unit won't return to normal until satisfying with the following conditions:

- \* Parameters which cause the failure shut down return to normal.
- \* Main engine restart and reach the empty rotary speed
- \* After pressing reset push down via manual acknowledgement

Here the reset push button indicating lamp on engine room control box went out.

3.11 Error direction: turning of screw propeller is not coincident with remote-control command, 15S overtime. Rotary speed of main engine fall to idle speed state automatically.

3.12 Speed governing: speed governing system is air-actuated stepless speed governing, possessing control function for logic sequence, output governing signal to main engine speed governor, make the rotary speed of

main engine smoothly and slowly change, and won't quickly change because of quick pull of maneuvering handle, until rotary speed of main engine is consistent with the remote-control command. Remote manipulation handle could be turned to full astern from Max. forward speed, or directly pull to astern from ahead, all are completed in allowable time of main engine according to automatic sequential operation.

3.13 Test:operate the test push button,check-up whether the indicating lamps and buzzers on control panel are in good condition.

3.14 Mute:operate the mute push button,release the audible and visual alarm signal, and photosignal should remain until the failure is released.

#### 4. Local control

When the transfer air valve for 2-position as remote control /local is pulled to "local "position. Local control is mainly used in test and emergency ,here remote control function is to be released. Engineer may set rotary speed by directly operating the rotary knob on stepping motor performer of hydraulic governor,and control the ahead engagement, astern engagement and disengagement of gear box's clutch via operating the control valve for 3positions as local ahead / empty / astern. Local control unit should be fit near the speed governor, it has to be noted that the speed difference between main engine and stern shaft of screw propeller can not be to large when manual control the engagement under local control. Logical decision need to be completed by the engineer.

#### 5. Indication Instruction

All kinds of indication of display operating panel.

##### 5.1 Control mode:

Expresses the condition under which remote control unit run.

##### I Remote control in wheelhouse

Selector valve for indicating control mode of local display box is to be pulled to " remote control "position, switch valve in engine control room is to be pulled to wheelhouse remote control position, and power plant is under the remote control state by wheelhouse computer.

##### I Local Control

Indicate that the selector valve for control mode on local display box is to be pulled to "local control "position, and remote control unit in under waiting state.

##### 5.2 State of remote manipulator

Indicate to which position is pulled to on remote manipulator in wheelhouse under wheelhouse remote control state. These indications are divided into 3 positions as ahead, astern and empty.

##### 5.3 Control state

##### I Ahead

Indicate that under wheelhouse remote control state, the remote control unit has output a signal to ahead engagement of relay control gear box.

- I Astern  
Indicate that under the remote control state in wheelhouse, the remote control unit has output a signal to astern engagement of relay control gear box.
- 5.4 State of main engine/gear box
  - I Forward of stern shaft  
Indicate that the remote control unit has received a signal ( NO contact) sent by controller for ahead working oil pressure on gear box, and the ahead clutch has been closed.
  - I Error direction  
Indicate that under the remote control state in wheelhouse, Remote control unit distinguishes according to manipulator's order or gear box's feedback and control of remote control unit. If the manipulator's order disaccords with turning of gear box, after 15s'delay,meanwhile shut off speed governing loop, illumine the alarm indicating lamp, delay again and send out alarm sound. Automatically muffle and shut off alarm indicating lamp.
- 5.5 Failure/emergency indication
  - I Emergency shut down  
Indicate that under the remote control state in wheelhouse, remote control unit receives the order to emergency stop push button.
  - I Safety overcontrol  
Indicate that under the remote control state in wheelhouse, remote control unit receives the order to emergency maneuvering push button.
  - I Failure shut down  
Indicate that under the remote control state in wheelhouse, remote control unit receives the signal for main engine failure shut down.
  - I Failure slow down  
Indicate that under the remote control state in wheelhouse, remote control unit receives the signal for main engine failure slow down.
  - I Overspeed  
Indicate that under the remote control state in wheelhouse, send out alarm signal once the rotary speed of main engine exceeds the setting value of overspeed or main engine shut down.

## **G. Operating Procedure**

- 1 Local control
  - 1.1 Ahead and astern control valve on local display box is to be pulled to "empty "position.
  - 1.2 Control mode selector valve on local display box is to be pulled to "local "position.
  - 1.3 Do operation test for emergency telegraph before stand by engine.
  - 1.4 Stand by engine
  - 1.5 Start-up main engine, and adjust the rotary speed to idle speed.

- 1.6 Pull the control mode transfer switch on local display box to "local" position
  - 1.7 Control command is to be sent to "local" via emergency engine telegraph by control staff in wheelhouse, engineer control rotary speed of main engine via knob on diaphragm type performer, and control engagement and disengagement of gear box via ahead and astern operating valve on local display box.
  - 1.8 Before finished with engine, ahead and astern operating valve on local display box should be pulled to "empty" position, and control mode selector valve should be pulled to "local" position, then do the FWE operation.
- 2 Remote control in wheelhouse
    - 2.1 Pull the control mode selector valve on local display box to "local" position, put the handle of remote manipulator to "empty" position, and switch on the remote control power supply.
    - 2.2 Do maneuvering test for emergency telegraph before stand by engine.
    - 2.3 Stand by engine
    - 2.4 Start-up main engine, and adjust the rotary speed to idle speed.
    - 2.5 Pull the control mode selector valve on local display box to "remote control" position, meanwhile select WH/C on wheelhouse control console, and check whether the remote indicating lamps on group lamp panel are normal, operation panel should normally display and no failure indication.
    - 2.6 Control command is to be sent to main control unit directly via remote manipulator, and the rotary speed of main engine and disengagement, engagement and reversing are to be controlled by remote control unit.
    - 2.7 Before finished with engine, put the handle of remote manipulator to "empty" position. Pull the control mode selector valve on local display box to "local" position, then do FWE operation, shut off the remote control power supply.

## H. Installation and Debugging

- 1 Debugging program, methods and matters need attention
  - 1.1 General Inspection

Ordinary examination should be done after finishing the onboard installation of this system.

    - 1.1.1 Open the stop valve of main air source, blow down sundries in each segment of control piping, then check whether there are loose, air leakage with the joints of each pipeline, and if the pipelines have been wrongly connected.
    - 1.1.2 Whether the wire connection is firm, and whether there is loose.
    - 1.1.3 Instruments and devices should be set an operating value as required.
    - 1.1.4 Removable components should be done with manual examination check, their actions are to be flexible.
    - 1.1.5 Check whether the stepping motor has back to origin.
  - 1.2 Functional Check

Input power supply to this system, switch on the power supply

- transfer switch on operating console, if the power indicating lamp flashes, express that the power has been switched on.
- 1.2.1 Test lamp:press push button for test lamp, all indicating lamps on operating console should flash, press push button for test lamp on operating console, all indicating lamps on the panel of this equipment should flash.
  - 1.2.2 Dimmer: rotate the rotary knob for dimmer, brightness of indicating lamp on operating console will change.
  - 1.2.3 Mute:when there is alarm sound, audible signal is to be released by pressing "mute" push button.
- 1.3 Auxiliary telegraph communication:separately operate remote control and local transfer switch on operating console and engine room control box, so as to realize transfer of local remote control.
- 1.3.1 Remote manipulation: pull the remote control, local switch on maneuvering platform to "remote control" position,"remote control" light on control box should flash, accompanied with sound, after engine room receiving the signal, pull the switch on control box and control valve on valve box to "remote control" position,"remote control" light on maneuvering platform flashes, meanwhile the sound disappears,remote control connection is finished.
  - 1.3.2 Local control:put the remote control, local switch on maneuvering platform to "local" position,"local" light on control box should flash, and accompanied with sound, after engine room receiving the signal, put the control valve on switch valve box to "local" position, "local" light on maneuvering platform flashes, meanwhile the sound disappears,then may carry out local control.
- 1.4 Emergency stop: Operate the emergency stop push button ,main engine shutdown valve will shut off air supply or oil supply loop and immediately stop main engine, accompanied with audible and visual alarm ,the sound will disappear after muffling, lamplight won't restore until the emergency stop push button resets.
- 1.5 Emergency communication: Operate the "communicate with ECR" push button on remote control console,"communication" indicating lamp on engine room monitoring console flashes, and accompanied with sound, operate the "communicate with wheel house"push button on the engine room monitoring console, communication lamp on operating console should flash, and accompanied with sound, operating staff may stipulate method and argot for using communication pushbutton.
- 2 System Debugging:
- Debugging of system mainly contains adjustment of reversing program, adjustment of speed adjusting gear and alarm test.
- 2.1 Adjustment of reversing program: reversing program may be adjusted one by one, switch On power supply and air supply. Operate manipulator handle on remote operating console ,and test the reversing time, when pull the handle of operating console from "empty" to "ahead", "empty" light on engine room control box goes out, "ahead" light flashes, here the engine room control box, monitoring console and remote operating console display engine order, gear box correctly reverses, maneuvering handle is to be pulled back from "ahead" to "empty", here "ahead" lamp on engine room control box goes out, gear box disengages after 2 seconds'delay, "empty"

- lamp immediately flashes; adjustment for astern is same as adjustment for ahead. Here ahead lamp on engine room control box goes out, astern lamp flashes, meanwhile simultaneously observe that the time from "astern lamp" flashes to astern coupling of gear case box is 6-8 Seconds;contrarily, the delayed time for directly pulling back the manual control lever from astern to ahead position should also be 6-8 Seconds.
- 2.2 Adjustment of Speed governing device :mainly adjust the angle of stepping motor 's performer . And make the angular displacement synchronous with the speed governing. steps.
- 2.3 Gang adjustment: after separately finishing the adjustment double-engine, then manipulate the handle of double-engine. Make its outer corner basically same as the displacement of Diaphragm actuator ,that is to say the rotary speeds of double engine are basically consistent.
- 2.4 Matters need attention: when adjust the speed governing device ,may shut off power supply ,switch on air supply to adjust. If power on is required, there should be signal output for gear box oil pressure, or else there is no displacement output for diaphragm performer, and the speed of diesel engine can not be increased.
- 2.5 Alarm Test:
- 2.5.1. Air loss: there should be audible and visual alarm when the air supply falls to 0.45Mpa ,press mute push button ,sound disappears, air loss indicating lamp should still have lamplight display, after the air supply source returning to normal, lamplight will disappear of itself .
- 2.5.2. Power failure: shut off main power supply manually, standby power supply will plough into automatically, meanwhile, there should be audible and visual alarm for power failure, and the sound will disappear after pressing mute push button, power failure indicating lamp still has lamplight display, power failure indicating lamp will go out after main power supply restores, then the standby power supply exits automatically.
- 2.5.3. Error direction: manually make the maneuvering handle command disaccord with the action of reversing actuating mechanism, bring about "error direction" after 15S'delay ,meanwhile error direction breaks off speed governing loop . Here pressing the mute push button, then the sound disappears, error direction indicating lamp still has lamplight display, when the maneuvering handle command is synchronous with reversing actuating mechanism, error direction will go out automatically.

## I. Service

### 1. Maintenance and service of PLC

CPM 1A Type microcomputer from Japan OMRON corporation is adopted as main control unit of part remote control for this device, it has advantages as high reliability , low energy consumption, strong interference rejection, and characteristics as compact conformation, strong adaptive capacity to environment , suitable for marine climate, Completely possesses conditions for marine use, and has Japanese Marine Corporation authentication Certificate .

PLC microcomputer software program has been subject to strict

debugging before ex-works. Anybody is disallowed to open or modify the program without agreement of ship owner or equipment manufacturer .

When PLC microcomputer runs abnormally, please contact with manufacturer or OMRON corporation agency nearby in time .

2. Inspection for air supply

Monthly check control air pressure of air supply device, let out impurity and moisture content in filter,filter inside of valve box and cylinder or air container. semiannually check whether the action of each valve is flexible, replace the valve in time once problem appears.

3. Electric Inspection

When start up every time ,check whether remote control panel display is normal, whether there is alarm display .

**J. Other**

- 1 This system is serially ordered, partial components could be ordered separately (as remote manipulator. air source disposal plant. pneumatic setter loop, diaphragm execution air cylinder etc.)
- 2 Sign relative technical agreement or mark type.mode of governing and reversing.quantity etc. for M/E and gearbox in contract at the time of ordering.
- 3 Guarantee period for product :1 year after delivery.
- 4 If user has special requirement,we will specially design and manufacture.
- 5 Spare and spare parts are to satisfy with supply at any moment.
- 6 Welcome to call us for further information.

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