

AUTOMATION 自動控制

報告人：洪維宣
輪機設計課

大綱

- ◎ 前言
- ◎ 規範
- ◎ 儀錶
- ◎ 裝備
- ◎ 系統
- ◎ 應用
- ◎ 問題與討論

➤ 自動控制
Automation



WHY?

航行安全

Safe

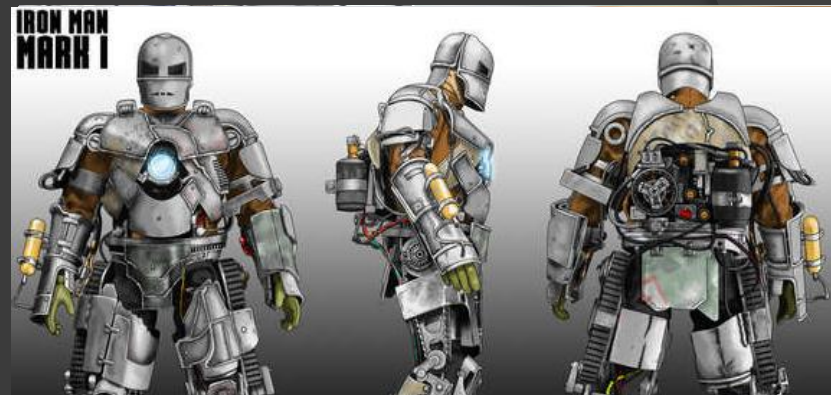
符合環保

Green

操作需求

Operation

法規 / 合約 / 船東額外要求



➤ 法規
Rule





警報
Alarm

監視
Monitoring

控制
Control

➤ 儀錶

Instrumentation



度

Thermometer
°C or °F

直接量測型
Direct Measuring Type

液位

遠端量測型
Remote Measuring Type
ECC儀錶
ICMS圖控
警報提示



直接量測型儀錶
Direct Measuring Type





遠端量測型儀錶
Remote Measuring Type

主機
發電機

轉速

Tachometer



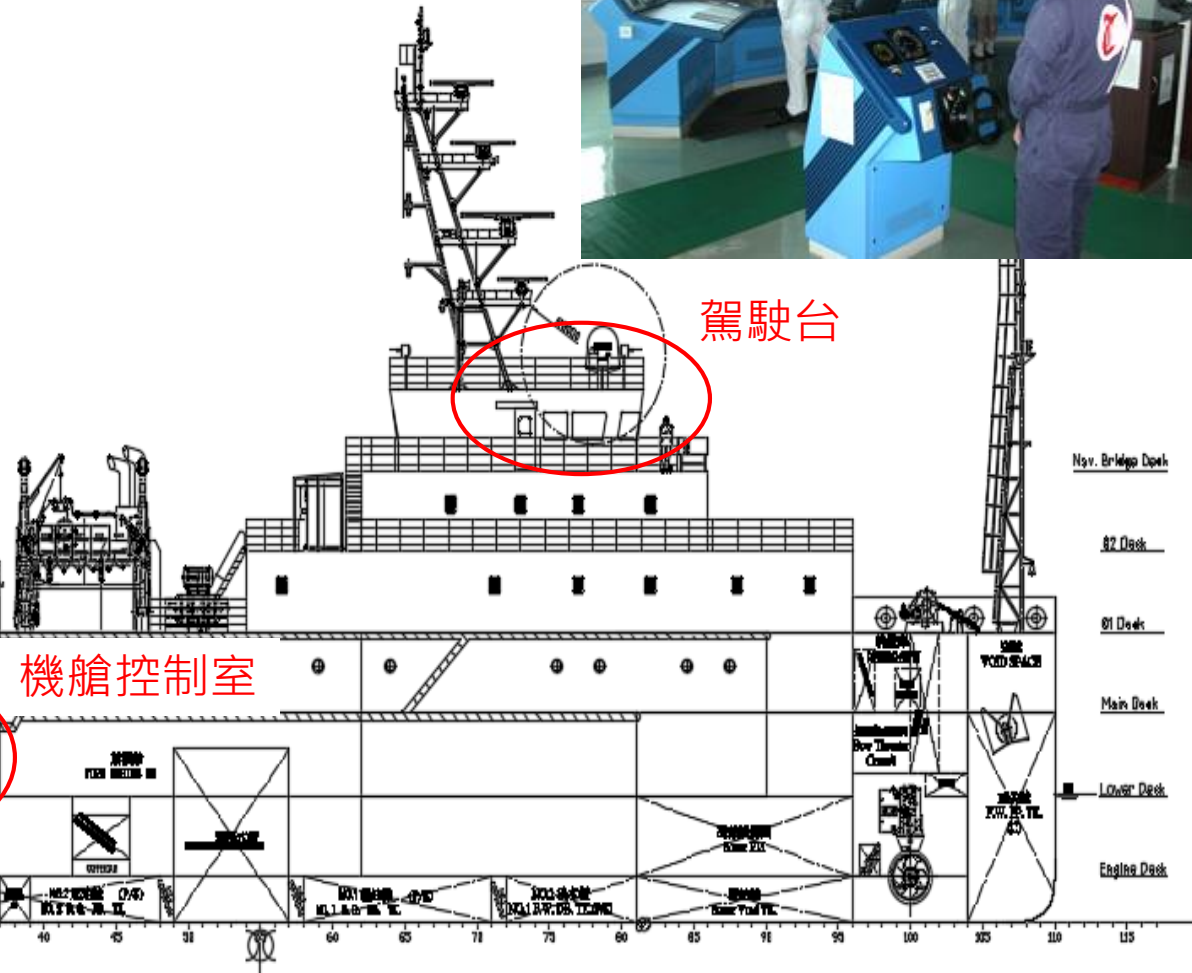
流量

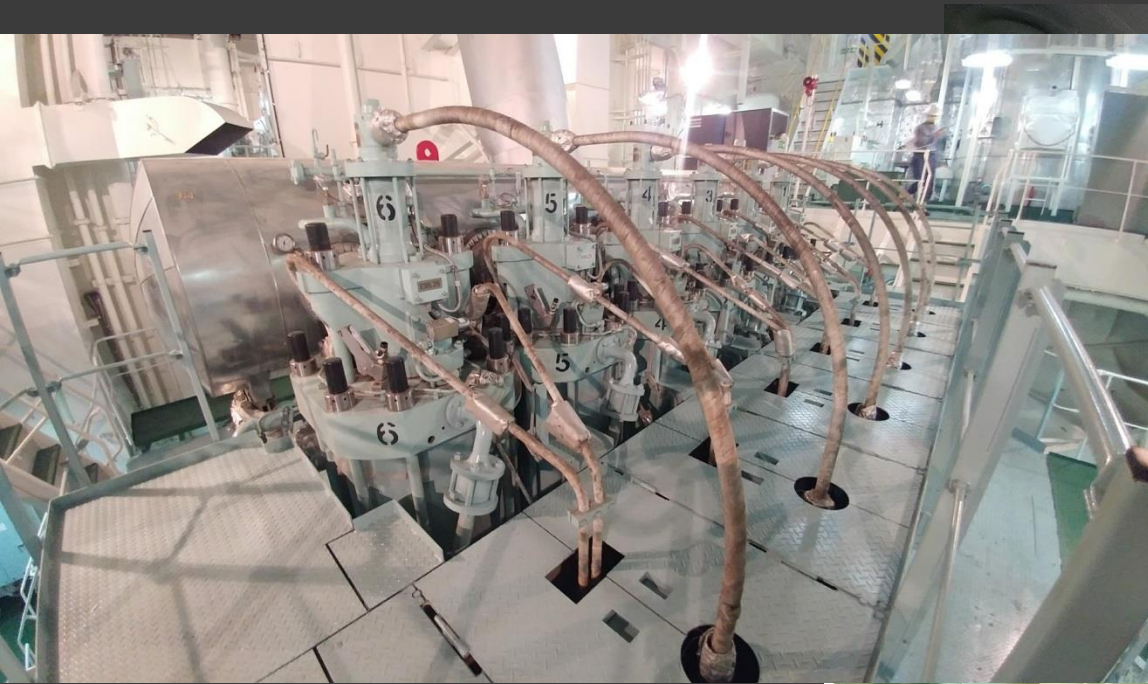


淡水系統

鹽度

WHERE?

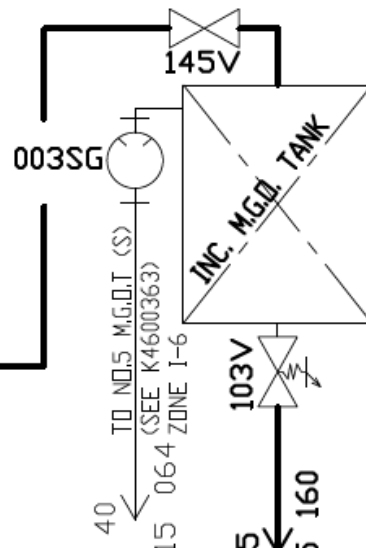




船廠管路系統

FROM M.G.D.
TRANS. PUMP
(SEE K4600363)
ZONE G-4

25
10 010



TO NO.5 M.G.D.T. (S)
(SEE K4600363)
40
15 064 ZONE I-6

25
15 160

80 FROM SLUDGE PUMP
(SEE K4600335)
BS 09 094 ZONE D-6

40
125V
167

15
120V 13 167

15
104V

1017
1006
TIRA
H

1018
1007
TA
H

1018
1007
LA
L

BS104SG

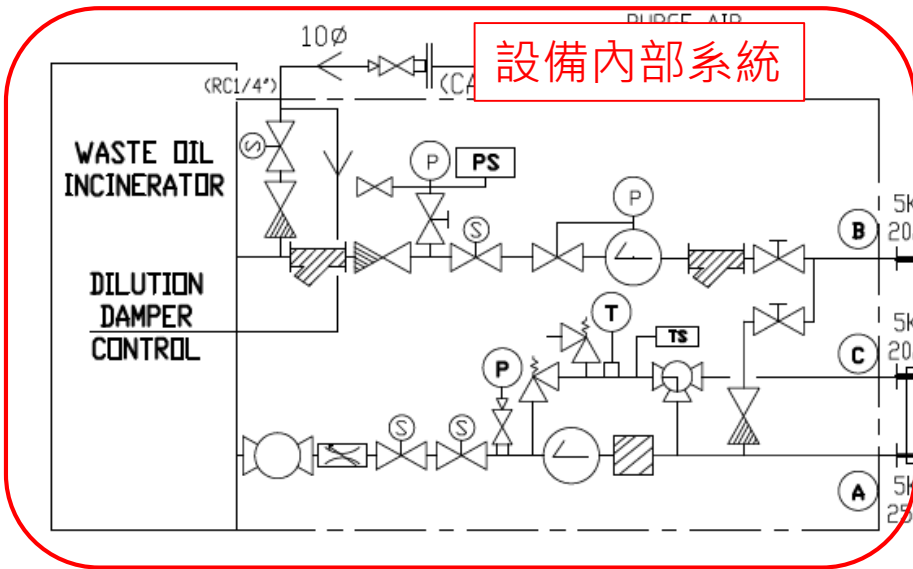
AIR (SEE K4600372)
ZONE C-8
(10K15A)
F0820SH

AIR (SEE K4600372)
ZONE C-8
(10K15A)

FUEL CUT

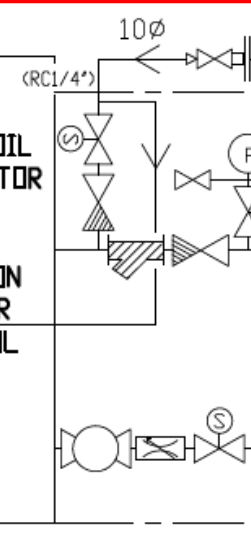
TO SLUDGE COLLECT. TK.
(SEE K4600335)
ZONE E-7

設備內部系統



WASTE OIL
INCINERATOR

DILUTION
DAMPER
CONTROL



20
06 168

25
06 135 130V

25
07 157 171V

5K 20A

5K 20A

5K 20A

25
06 132

25
07 156

104V

BS09 096

BS09 095

BS124V

BS09 094 ZONE D-6

WASTE OIL
SERV. TANK

1017

1006

TIRA

H

1018

1007

TA

H

1018

1007

LA

L

BS104SG

TO SLUDGE COLLECT. TK.
(SEE K4600335)
ZONE E-7

➤ 主機控制

- ⦿ Alarm
- ⦿ Slow Down
- ⦿ Shut Down
- ⦿ Emergency Trip
- ⦿ Turning Gear is Engaged → Do not Running

F.O. Pressure Low

L.O. Pressure Low

L.O. Sump Tank Level Low

Exhaust Temperature High

Cooling F.W. Temperature High

Over Speed



K-Chief 600

Yard: CSBC

Hull no.: 1117

ME Overview

Rev.: 0.0.0

Designed by:

Date: 18-08-2020 22:18 Checked by:

P no.:

Approved by:

T/C system

RPM(X10)

Exh gas in temp

Exh gas out temp

Exh gas turbine bako press

M/E T/C L.O in press SHD

M/E T/C L.O out temp

Safety & Control system

- Starting fail
- S/B Fail
- EMCY SHD Prewarning
- EMCY SHD
- Telegraph system ABN
- Engine not ready
- FWE Fail
- EMCY SLD Prewarning
- Overspeed
- Bridge source fail
- Start blocked
- Critical speed
- SLD Request
- Manual SHD
- Electric shaft system ABN
- Imperfect bridge control
- Wrong way
- Auto EMCY SLD
- Telegraph source fail
- Telegraph logger system ABN
- SHD Cancel
- SLD Cancel
- Control source fail
- Safety source fail

RCS & ECS

- RCS UPS Fail
- RCS Fail
- RCS UPS DC Source fail
- RCS AC Source fail
- RCS DC Source fail
- EICU A power fail
- EICU A common alarm
- EICU B power fail
- EICU B common alarm
- ECS PSU A Controller ABN
- ECS PSU A AC Power fail
- ECS PSU A DC24V Battery mode
- ECS PSU B Controller ABN
- ECS PSU B AC Power fail
- ECS PSU B DC24V Battery mode

C.W system

J.C.F.W inlet temp

J.C.F.W inlet press

J.C.W across cyl. line

J.C.W across cyl. cover&Exh

Air cooler F.W in press

Air cooler F.W in temp

Air cooler F.W out temp

E/R Vent FAN

No.1 Run Fail

No.2 Run Fail

No.3 Run Fail

No.4 Run Fail

Puri room Run Fail

P/P Room Vent FAN

No.1 Supp Run Fail

No.1 Exh Run Fail

No.2 Exh Run Fail

Miscellaneous

- Axial vibration monitor
- Shaft ground voltage
- Axial vibration high
 - Axial vibration system fail
 - HPS Start-up 1 ABN
 - HPS Start-up 2 ABN
 - A/C water mist catcher drain LAH
 - A/C drain TK LAH
 - Deaerating TK vent LAL
 - Hyd.oil TK LAL
 - M/E T/C L.O tank LAL
 - Bearing wear system alarm
 - Bearing wear system fail
 - Crankcase oil mist high
 - Oil mist detector fail
 - No.1 Water in oil alarm high
 - No.1 Water in oil alarm HH
 - No.2 Water in oil alarm high
 - No.2 Water in oil alarm HH
 - No.1 Aux. blower ABN
 - No.2 Aux. blower ABN

Air system

Exh VV spring air press

Scav. air manifold press

Starting air inlet press

Control air inlet press

Scav.air before A/C temp

Scav.air after A/C temp

Scav.air receiver temp

Exh. gas outlet temp

Exh. gas dev.temp

Mean

No.1 No.2 No.3 No.4 No.5 No.6 No.7

Run F.W.E HFO use MGO use

J.C.W Cyl. cover outlet temp

Cyl. J.C.F.W outlet temp

Scav.air trunk temp

F.O system

M/E F.O in press

M/E F.O in temp

M/E F.O in temp(Vis)

M/E CHO viscosity

M/E FO 2nd A/B STR DP

F.O Viscosity control unit fail

M/E F.O leakage

L.O system

M/E L.O in press SHD

M/E L.O in temp

M/E P.C.O In press

Thrust pad temp

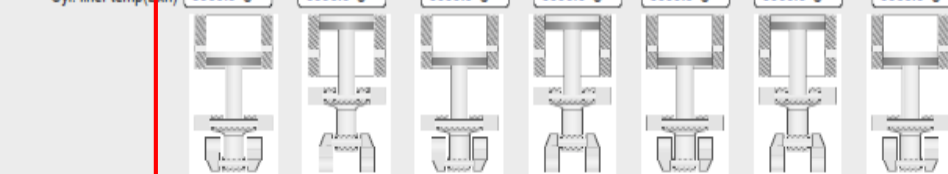
M/E Hyd oil in press

M/E Hyd oil in temp

Hyd oil filter DPAH

Cyl. liner temp(F/P)

Cyl. liner temp(Exh)



Cyl. main bear temp (F)

Cyl. main bear dev temp (A)

(F)

(A)

Mean

P.C.O outlet

NFL NFL NFL NFL NFL NFL NFL

L.O Sump tank

Total Revolution:

Bearing temp

Thrust bearing temp

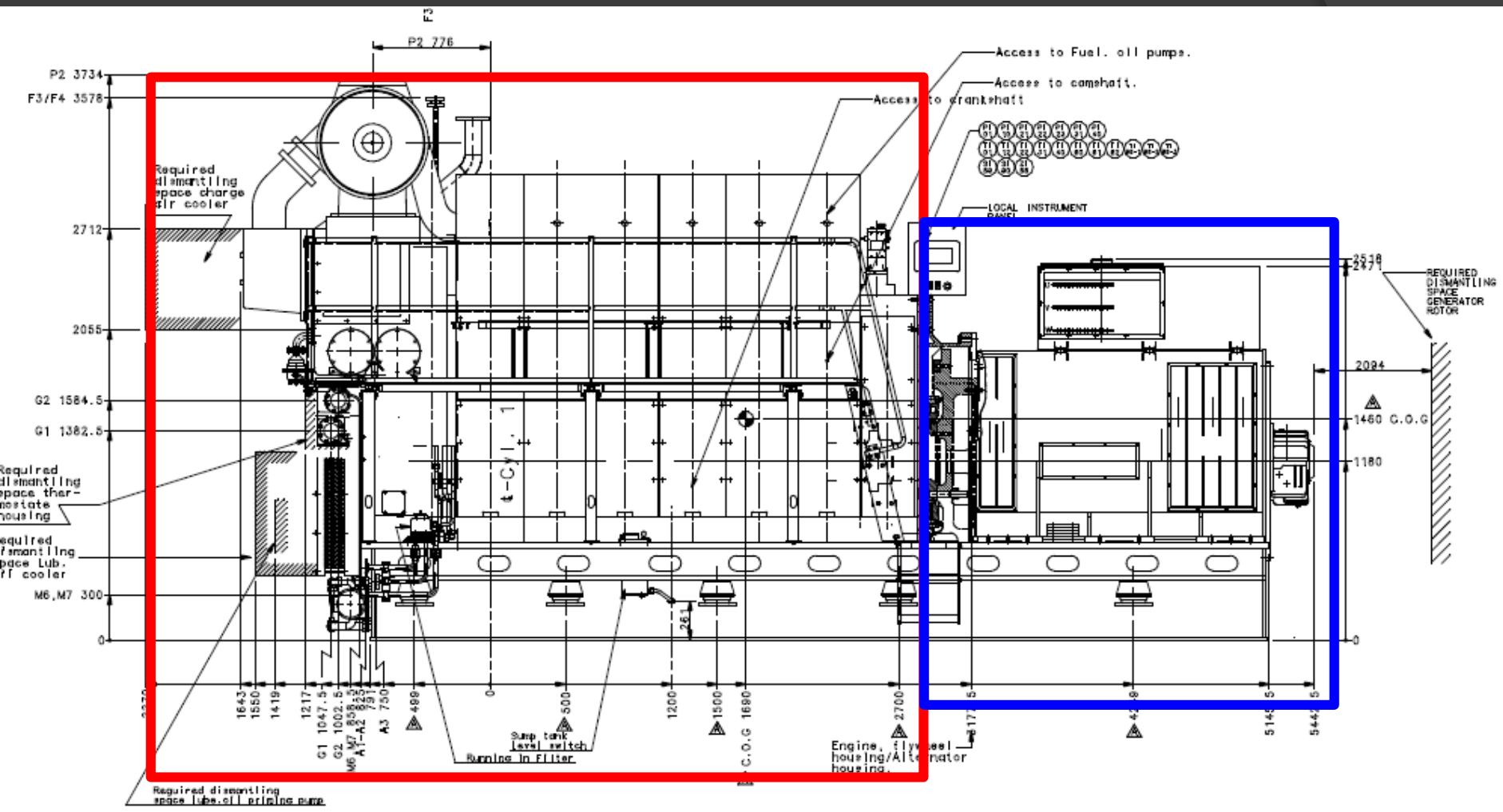
Steady bearing temp

S/T Aft bearin temp(P)

S/T Aft bearin temp(S)

Fwd S/T seal oil temp





發電機引擎部份

- ◎ 啟動/停止控制
- ◎ 燃油
- ◎ 滑油
- ◎ 排氣溫度
- ◎ 冷卻水
- ◎ 緊急停止條件

→ 滑油低壓, 超速, 冷卻水高溫等

發電機電頭部份

- ◎ 發電機運轉/並聯控制
- ◎ 自動同步裝置 Automatic Synchronizing Device
- ◎ 自動負載分佈 Automatic Load Sharing Device
- ◎ 能源管理系統 Power management system
- ◎ 自動順序啟動 Automatic Sequential Start
- ◎ 跳脫保護 Trip → Over Load



K-Chief 600

Yard: CSBC

GE Overview

Rev.: 0.0.0

Designed by:

Date: 03-07-2020 11:03

Checked by:

P no.:

Approved by:

KONGSBERG Hull no.: 1117

L.O system	Value	Alarm	F.O system	Value	Alarm
L.O in.press	00.00 bar		Analogue text	00.00 bar	<input type="radio"/> PAL
L.O filter in.press	00.00 bar	<input type="radio"/> DPAH <input type="radio"/> PAL	Analogue text	00.00 bar	<input type="radio"/> DPAH
L.O in.temp	0000.0 °C	<input type="radio"/> TAH	Analogue text	0000.0 °C	
<input type="radio"/> Pre-L.O PAL			<input type="radio"/> F.O Leak detection		

Air system	Value	Alarm	C.W system	Value	Alarm
CH air CL out temp	0000.0 °C		HT C.W out temp	0000.0 °C	<input type="radio"/> TAH
CH air out press	00.00 bar		HT C.W in temp	0000.0 °C	
Start air press	00.00 bar	<input type="radio"/> PAL	HT C.W in press	00.00 bar	<input type="radio"/> PAL
			LT C.W in temp	0000.0 °C	
			LT C.W in press	00.00 bar	<input type="radio"/> PAL

Generator

Winding temp

R 0000.0 °C TAH

S 0000.0 °C TAH

T 0000.0 °C TAH

Bear temp 0000.0 °C TAH

T/C system	Value	Alarm
Exh gas out temp	0000.0 °C	<input type="radio"/> TAH
Exh gas in temp	0000.0 °C	<input type="radio"/> TAH
RPM(X10)	00000 rpm	
L.O in press	00.00 bar	<input type="radio"/> PAL

Mean 0000.0 °C

Mean	1	2	3	4	5	6
Exh. gas out temp	0000.0 °C	0000.0 °C	0000.0 °C	0000.0 °C	0000.0 °C	0000.0 °C
Exh. gas dev temp	0000.0 °C	0000.0 °C	0000.0 °C	0000.0 °C	0000.0 °C	0000.0 °C

TAH TDAH

Status

Run Stop

Ready to start

RPM 00000 rpm

Shutdown

- HT C.W out temp SHD(CTRL)
- HT C.W out temp SHD(SHD)
- LO Filter out press low SHD(CTRL)
- LO Filter out press low SHD(SHD)
- Overspeed SHD(CTRL)
- Overspeed SHD(SHD)
- Double pick up error SHD
- Stop fail SHD
- EMCY Stop SHD
- Remote SHD

Alarm

- Start fail
- Overspeed
- Run error
- Jet system error
- Turning gear engaged
- Safety system fail
- Safety system power fail
- Control system fail
- T/C Overspeed

LO sump TK LAH LAL

L.O system	Value	Alarm	F.O system	Value	Alarm
L.O in.press	00.00 bar		Analogue text	00.00 bar	<input type="radio"/> PAL
L.O filter in.press	00.00 bar	<input type="radio"/> DPAH <input type="radio"/> PAL	Analogue text	00.00 bar	<input type="radio"/> DPAH
L.O in.temp	0000.0 °C	<input type="radio"/> TAH	Analogue text	0000.0 °C	
<input type="radio"/> Pre-L.O PAL			<input type="radio"/> F.O Leak detection		

Air system	Value	Alarm	C.W system	Value	Alarm
CH air CL out temp	0000.0 °C		HT C.W out temp	0000.0 °C	<input type="radio"/> TAH
CH air out press	00.00 bar		HT C.W in temp	0000.0 °C	
Start air press	00.00 bar	<input type="radio"/> PAL	HT C.W in press	00.00 bar	<input type="radio"/> PAL
			LT C.W in temp	0000.0 °C	
			LT C.W in press	00.00 bar	<input type="radio"/> PAL

Generator

Winding temp

R 0000.0 °C TAH

S 0000.0 °C TAH

T 0000.0 °C TAH

Bear temp 0000.0 °C TAH

T/C system	Value	Alarm
Exh gas out temp	0000.0 °C	<input type="radio"/> TAH
Exh gas in temp	0000.0 °C	<input type="radio"/> TAH
RPM(X10)	00000 rpm	
L.O in press	00.00 bar	<input type="radio"/> PAL

Mean 0000.0 °C

Mean	1	2	3	4	5	6
Exh. gas out temp	0000.0 °C	0000.0 °C	0000.0 °C	0000.0 °C	0000.0 °C	0000.0 °C
Exh. gas dev temp	0000.0 °C	0000.0 °C	0000.0 °C	0000.0 °C	0000.0 °C	0000.0 °C

TAH TDAH

Status

Run Stop

Ready to start

RPM 00000 rpm

Shutdown

- HT C.W out temp SHD(CTRL)
- HT C.W out temp SHD(SHD)
- LO Filter out press low SHD(CTRL)
- LO Filter out press low SHD(SHD)
- Overspeed SHD(CTRL)
- Overspeed SHD(SHD)
- Double pick up error SHD
- Stop fail SHD
- EMCY Stop SHD
- Remote SHD

Alarm

- Start fail
- Overspeed
- Run error
- Jet system error
- Turning gear engaged
- Safety system fail
- Safety system power fail
- Control system fail
- T/C Overspeed

LO sump TK LAH LAL

L.O system	Value	Alarm	F.O system	Value	Alarm
L.O in.press	00.00 bar		Analogue text	00.00 bar	<input type="radio"/> PAL
L.O filter in.press	00.00 bar	<input type="radio"/> DPAH <input type="radio"/> PAL	Analogue text	00.00 bar	<input type="radio"/> DPAH
L.O in.temp	0000.0 °C	<input type="radio"/> TAH	Analogue text	0000.0 °C	
<input type="radio"/> Pre-L.O PAL			<input type="radio"/> F.O Leak detection		

Air system	Value	Alarm	C.W system	Value	Alarm
CH air CL out temp	0000.0 °C		HT C.W out temp	0000.0 °C	<input type="radio"/> TAH
CH air out press	00.00 bar		HT C.W in temp	0000.0 °C	
Start air press	00.00 bar	<input type="radio"/> PAL	HT C.W in press	00.00 bar	<input type="radio"/> PAL
			LT C.W in temp	0000.0 °C	
			LT C.W in press	00.00 bar	<input type="radio"/> PAL

Generator

Winding temp

R 0000.0 °C TAH

S 0000.0 °C TAH

T 0000.0 °C TAH

Bear temp 0000.0 °C TAH

T/C system	Value	Alarm
Exh gas out temp	0000.0 °C	<input type="radio"/> TAH
Exh gas in temp	0000.0 °C	<input type="radio"/> TAH
RPM(X10)	00000 rpm	
L.O in press	00.00 bar	<input type="radio"/> PAL

Mean 0000.0 °C

Mean	1	2	3	4	5	6
Exh. gas out temp	0000.0 °C	0000.0 °C	0000.0 °C	0000.0 °C	0000.0 °C	0000.0 °C
Exh. gas dev temp	0000.0 °C	0000.0 °C	0000.0 °C	0000.0 °C	0000.0 °C	0000.0 °C

TAH TDAH

Status

Run Stop

Ready to start

RPM 00000 rpm

Shutdown

- HT C.W out temp SHD(CTRL)
- HT C.W out temp SHD(SHD)
- LO Filter out press low SHD(CTRL)
- LO Filter out press low SHD(SHD)
- Overspeed SHD(CTRL)
- Overspeed SHD(SHD)
- Double pick up error SHD
- Stop fail SHD
- EMCY Stop SHD
- Remote SHD

Alarm

- Start fail
- Overspeed
- Run error
- Jet system error
- Turning gear engaged
- Safety system fail
- Safety system power fail
- Control system fail
- T/C Overspeed

LO sump TK LAH LAL

緊急發電機

- ◎ 自動啟動 –

Main generator black out

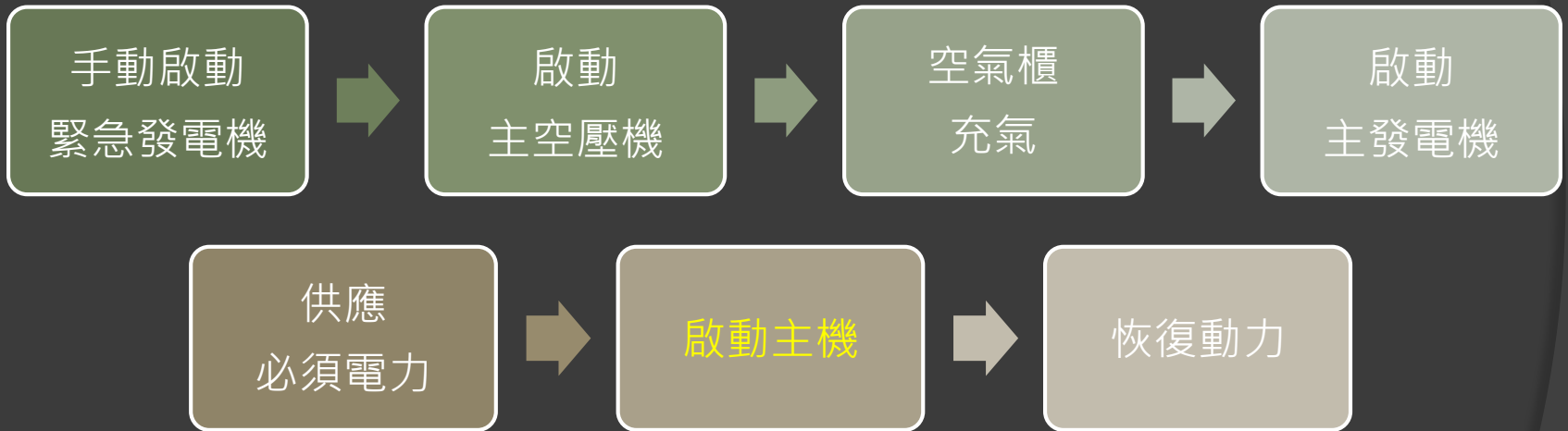
- ◎ 自動停止 –

After 5 min of normal power supply

- ◎ 手動啟動 –

Dead ship initial starting

死船啟動程序



Please refer to K4000310 - DEAD SHIP START ARRANGEMENT

輔鍋爐

- ◎ 自動水位控制(點火、給水)
- ◎ 爐內(蒸氣)壓力控制
- ◎ 安全裝置/安全閥
- ◎ 煙灰清潔裝置



K-Chief 600

Yard: CSBC

ME & boiler FO service

Rev.: 0.0.0

Designed by:

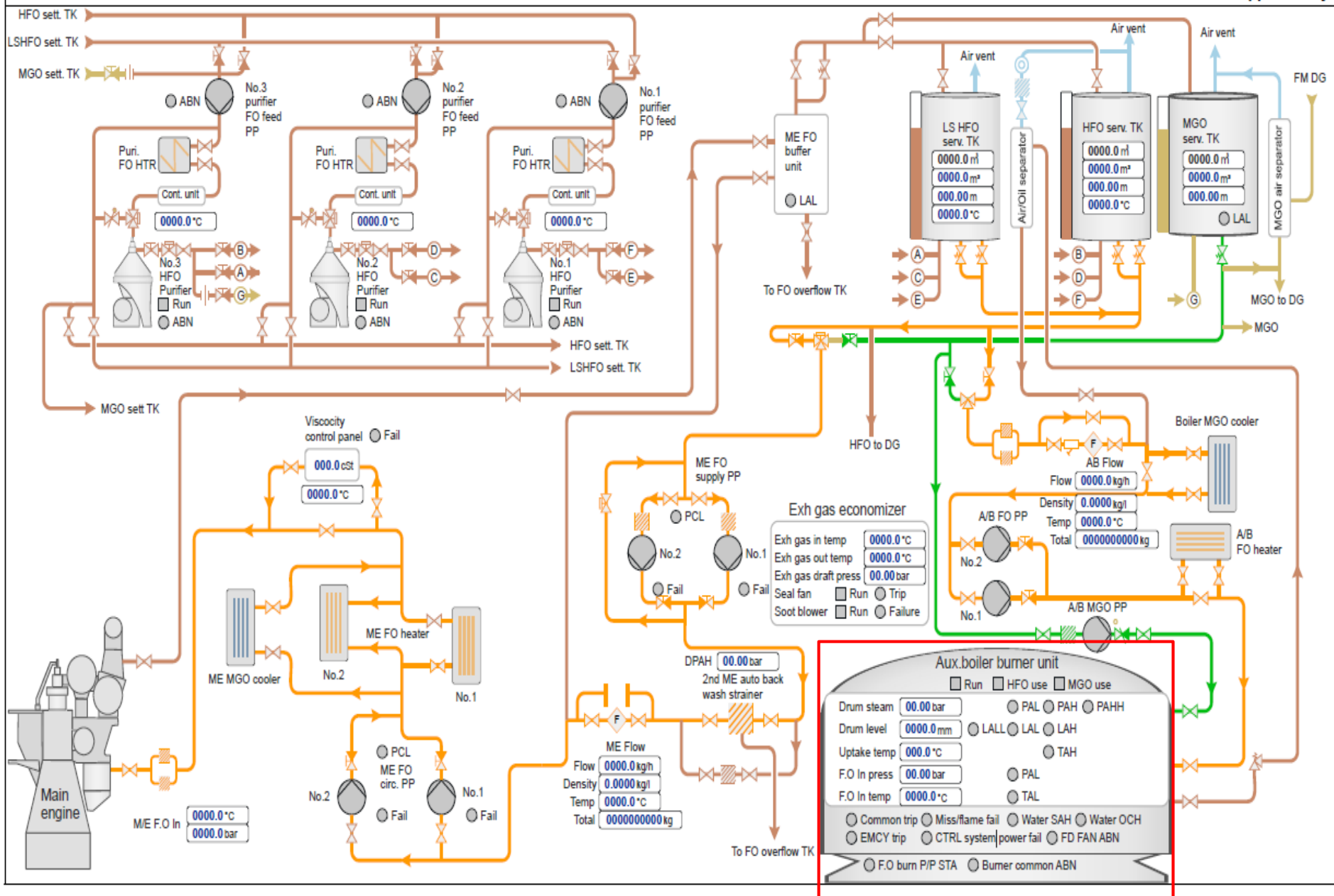
Date: 30-07-2020 15:00

Checked by:

P no.:

Approved by:

KONGSBERG Hull no.: 1117



➤ 輔裝備控制

- ◎ 空壓機
- ◎ 焚化爐
- ◎ 穢水處理裝置
- ◎ 泌水分離器
- ◎ 水霧系統
- ◎ 淨油機

空氣壓縮機

壓力各級壓力

滑油壓力

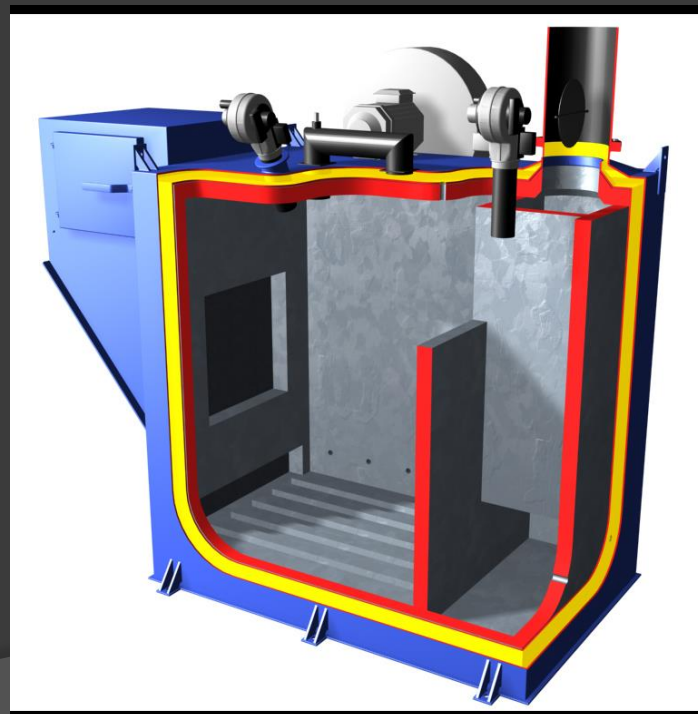
滑油溫度

安全閥



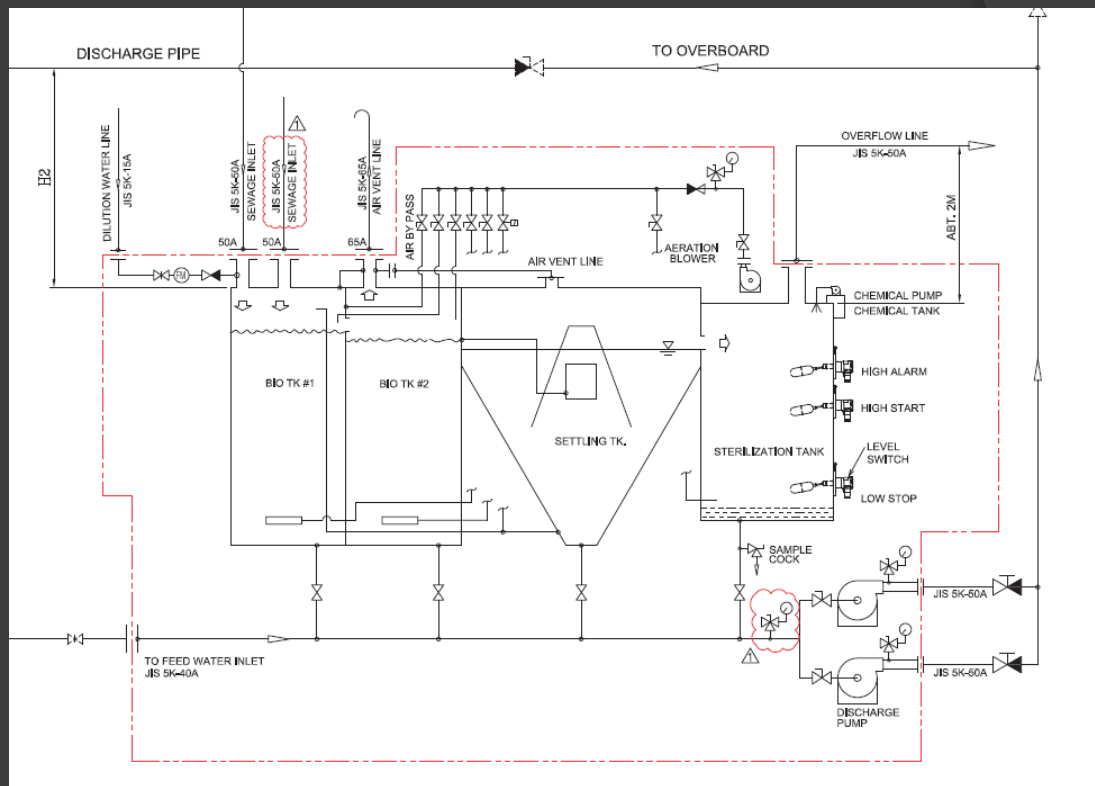
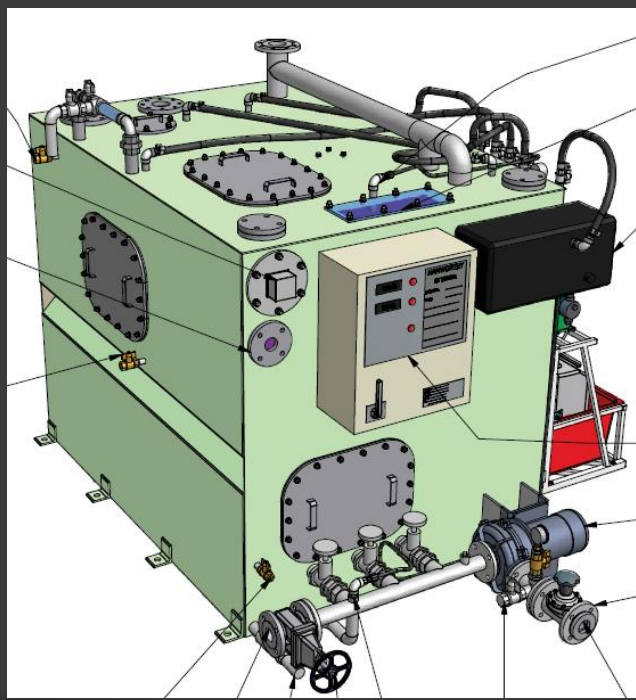
焚化爐

- 廢油高溫及低溫
- 壓縮空氣低壓
- 燃燒器故障及點火失敗
- 爐膛溫度
- 排氣高溫



穢水處理裝置

- ◎ 排出泵自動啟停
- ◎ 高液位警報
- ◎ 溢流裝置



淨油機

- ◎ 加熱器溫度控制
- ◎ 油泥自動排出



泌水分離器

- ◎ 油份偵測
- ◎ 排外偵測

機艙水霧系統

- ◎ 火警自動偵測 – 偵煙 / 偵溫
- ◎ 水霧自動施放系統

➤ 管路系統控制

Control of Piping System

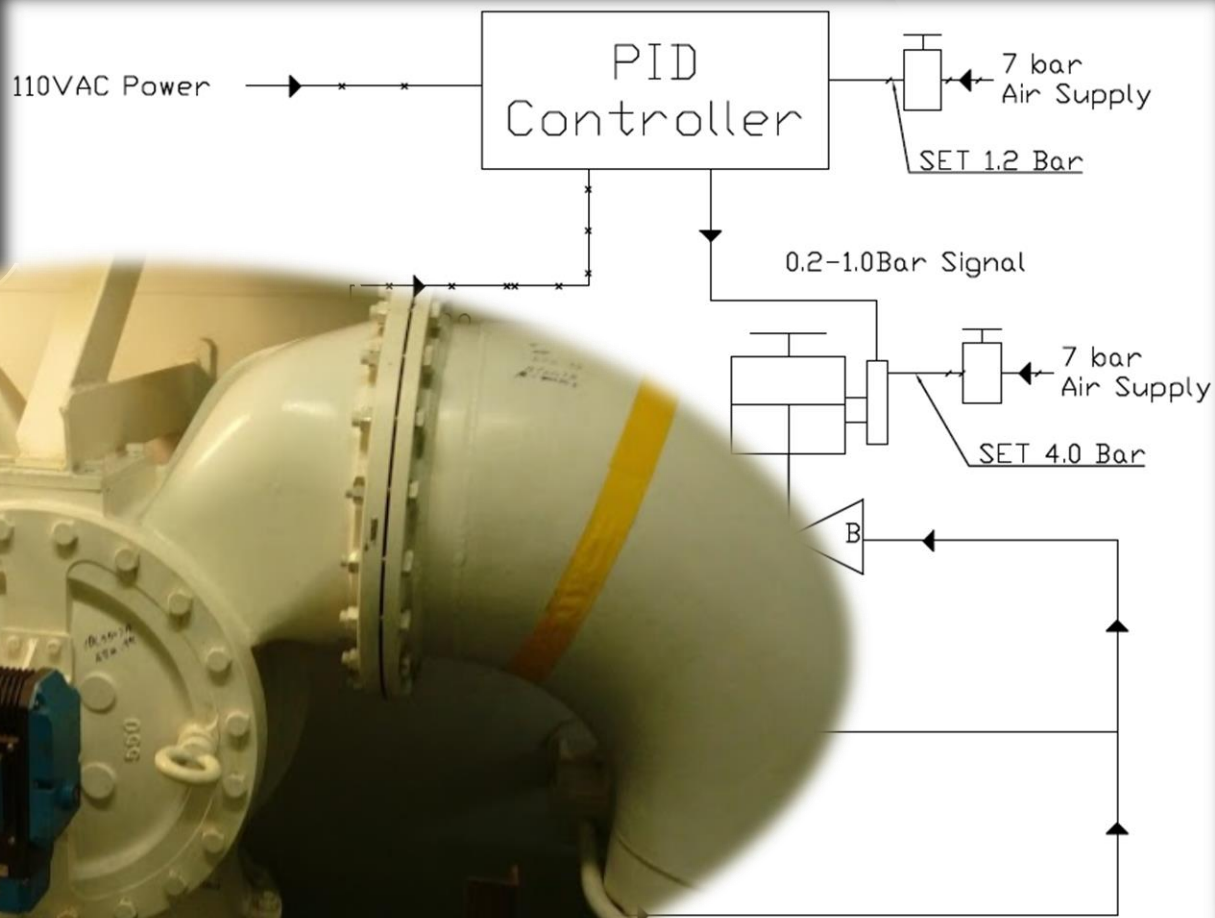
- ◎ 閥、泵
- ◎ 燃油系統
- ◎ 中央冷卻水系統
- ◎ 淡水, 熱水與飲水系統
- ◎ 泌水系統
- ◎ 水霧系統
- ◎ 壓縮空氣系統

泵

- ◎ 自動啟動/停止(液位開關)
- ◎ 自動切換(出口壓力)
- ◎ 進出口壓力監測
- ◎ 運轉及警報監控 → ECR

閥件

- ◎ 溫度控制(中央)
- ◎ 壓力
- ◎



燃油系統(主機/發電機)

- ◎ 流量
- ◎ 系統壓力
- ◎ 過濾器壓差
- ◎ 泵自動控制
- ◎ 冷卻器進出口溫度

淡水, 熱水與飲水系統

- ◎ 造水機(鹽分)
- ◎ 淡水櫃液位
- ◎ 壓力櫃壓力、液位
- ◎ 加熱器溫度
- ◎ 殺菌器
- ◎ 泵自動控制
- ◎ 安全閥

泌水系統

- ◎ 液位監控(汙油櫃、泌水井...)
- ◎ 泵自動啟停
- ◎ 泵進出口壓力監控
- ◎ 油水分離器處理與管理

IMO MEPC.107(49) – Bilge Separator->含油量限制

小於15ppm：可排外

大於15ppm：回流至系統中

水霧系統

- ◎ 火警自動偵測 – 偵煙 / 偵溫
- ◎ 水霧自動施放系統
- ◎ 泵進出口壓力監控
- ◎ 淡水櫃液位

IMO MSC/Circ. 913 : 可連續施放20分鐘

壓縮空氣系統

- ◎ 空氣櫃壓力監控
- ◎ 空壓機自動啟停
- ◎ 系統壓力控制(安全閥、調壓閥)



➤ 查表與應用
Application



母項目說明

子項目說明

HNO.1065-74

K4000300

(34 /)

100 MAIN ENGINE																		
NO.	ITEM	CONTROL					INDICATION, LMP & ALARM										REMARKS	
		AUT	MANUAL				W/H			ECR			LCD OF ICMS			LCL		
			W/H	ECR	ICMS	LCL	IND	LMP	AG	IND	LMP	ALM	IND	LMP	ALM	IND		
MANEUVERING																		
101	ENGINE TELEGRAPH		X			*1		*2								*3	1F	1
102	SUB. TELEGRAPH		X					*5										1
103	TELEGRAPH																	
104	START & STOP					*7	X										*8	1F
105	REVERSING			X		*7	X											
106	SPEED SETTING		X	X		*7	X											
107	PROGRAMMED CONTROL	X						*12										
108	DUTY ENGINEER SELECT.					*13	X											
109	CONTROL POSITION		X	X			X	*15										*16

控制位置
Wheelhouse
E/C/R
ICMS圖控
Local

監控功能
Indication數值顯示
Lamp燈號
Alarm Group
Alarm

警報功能
數字: 警報數量
F: Failure
A: Abnormal
H: High
L: Low

- *1 ACKNOWLEDGE ONLY
- *2 WITH TELEGRAPH SOURCE LAMP
- *3 NO-VOLTAGE ALARM
- *4 WITH S/B BUZZER STOP BUTTON
- *5 F/E, S/B & R/U LAMP WITH PUSH BUTTON
- *7 EMERGENCY OPERATION ONLY
- *8 FAILURE TO START (W/H CONTROL ONLY)
- *9 AHEAD AND ASTERN
- *11 BY-PASS SWITCH
- *12 LOAD UP/DOWN PROGRAM
- *13 DUTY ENGINEER SELECT SWITCH AND E/R UNMANNED SELECT SWITCH (ON ICMS OR CONSOLE)
- *14 DUTY ENGINEER (2/E, 3/E, 4/E, STATE RM1, STATE RM2) AND E/R UNMANNED
- *15 W/H, ECR & LOCAL
- *16 LOCAL & REMOTE

(34 /)

感謝聆聽&指導