CERTIFICATES OF COMPETENCY IN THE MERCHANT NAVY - MARINE ENGINEER OFFICER

EXAMINATIONS ADMINISTERED BY THE
SCOTTISH QUALIFICATIONS AUTHORITY
ON BEHALF OF THE
MARITIME AND COASTGUARD AGENCY

STCW 78 as amended MANAGEMENT ENGINEER REG. III/2 (UNLIMITED)

040-36 - ENGINEERING, DRAWING AND SHIP SYSTEMS

WEDNESDAY, 13 DECEMBER 2017

1315 - 1615 hrs

Examination paper inserts:

DRG - 020
DRG - 021
DRG - 022
DRG - 030
DRG - 038

Notes for the guidance of candidates:

1. Non-programmable calculators may be used.

2. All formulae used must be stated and the method of working and ALL intermediate steps must be made clear in the answer.

Materials to be supplied by colleges:

ENGINEERING, DRAWING AND SHIP SYSTEMS

Attempt ALL questions

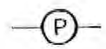
Marks for each part question are shown in brackets

<u>Section A</u>

1. Piping Systems - DRG. 020

   Describe the device, stating its functions for EACH of the following symbols:

   (a)  (2)

   (b)  (2)

   (c)  (2)

   (d)  (2)

   (e)  (2)

2. Mechanical Assembly - DRG 021

   (a) State the device and describe the function of 503; (2)

   (b) State the device and describe the function of 235; (2)

   (c) State the device and describe the function of 020; (2)

   (d) Identify the main casing sections that make up the pump assembly. (4)

[OVER

3. Ship's Construction Drawing - DRG 022

(a) State the frame numbers at which the fore and aft engine room bulkheads are located. (2)

(b) Identify, using frame numbers, the start of the flat bottom of the hull. (2)

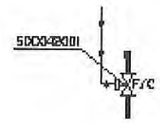
(c) State the depth of the double bottom tanks in the engine room. (2)

(d) State the specification of the main plate sections used on the flat bottom of the hull ford between frame 40 and 54. (2)

(e) State the maximum sounding of the aft peak W.B. tank. (2)

4. Hydraulic and Pneumatic System Drawings - DRG 030

(a) Describe the following device, stating its function: (2)



(b) Describe the location of any pressure alarms on the control air system. (2)

(c) Detail the possible sources of supply for the control air system. (2)

(d) Whilst at sea, the control air pressure low alarm sounds. The fault identified is a leaking safety valve on the control air bottle. Detail the actions required to allow continuous operation of the propulsion plant, whilst repairs are carried out. (4)

5. Electrical Power Systems and Control Drawings - DRG 038

(a) Describe item 'A', identified on the drawing. (2)

(b) State the purpose of air circuit breakers B and C. (2)

(c) On the main and emergency switchboards, both 440 V and 220 V, name the distribution breakers that should remain closed during normal operation, and those that should remain open. (6)

Section B

6. Drawing 022.

On inspection in dry dock, two sections of damage were found on the ship's hull, which have been identified on the shell expansion as 'A' and 'B'.

(a) The first section, 'A', was found to be 300 mm deep.

(i) Using drawing references, identify the location and approximate dimensions of the damaged section. (5)

(ii) State what steels are involved in the repairs, and what complications are evident from the drawing (10)

(b) The second section, 'B', was found to be 200 mm deep.

(i) Using drawing references, identify the location and approximate dimensions of the damaged section. (5)

(ii) State what steels are involved in the repairs, and what complications are evident from the drawing. (5)

7. Drawing 020.

(a) Describe the flow path and valve configuration required to enable all generators to run on HFO. (15)

(b) Describe the procedure, including flow path and change of valve configuration, required to change over No.2 generator to MDO, when all generators are currently set up to run on HFO. (10)

DRG 020

EMERGENCY DIESEL GENERATOR F.O. TANK (0.84m3)
EMERGENCY DIESEL GENERATOR
F.O. LEAK
FV-150-- 25 WIRE TYPE
WIRE
F-221-15-22S
F-222-15-22S
L.O.
CYL. HEAD
ASt
AAI
AAT
IN =0.40MPa OUT=0.05MPa SET=0.35MPa
F-227-40-22S
F-245-40-22S
FV-127-16K-
FV-128-10K-
FV-129-16K-
FV-157-16K-
F-246-40-22S
F-247-40-22S
F-126-50-22S (P.74)
TO H.F.O SERV. TANK
F-248-25-22G
FV-149-16K-
FV-148-16K-
VENTING VALVE FP-55
VENTING UNIT FP-54
F-234-40-512S
FV-147-16K-
H.F.O TANK AIR VENT (P.77)
F-235-40-22S
DIESEL OIL SERV. TANK(9m3)
DIESEL OIL SETT. TANK(6.5m3)
HEAVY F.O. SERV. TANK(22.9m3)
HEAVY F.O. SETT. TANK(22.9m3)
F-122-65-22S (P.74)
F-121-65-22S (P.74)
F-123-50-22S (P.74)
F-504-65-22S
TO PURIFIER(P.78)
F-208-50-22S
TO M/E (P.74)
TO PILOT BURNER (P.76)
F-303-50-22S
TO AUX. BOILER(P.76)
3 0.59MPa ST.
F-200-40-22S
F-100-65-512S (P.74)
F-101-65-22S (P.74)
F-102-65-22S (P.74)
F-500-65-22S
TO PURIFIER(P.78)
TO M/E (P.74)
F-300-50-22S
TO AUX. BOILER (P.76)
F-207-40-22S
FV-109--
FV-100--
FP-51 60 MESH
FP-50 60 MESH
F-244-25-22S
FV-156-16K
F-238-25-512S
PI PAL PR
PT
F.O. OUT.
F.O. IN.
TI
FV-155-16K
F-241-25-512S
FV-145-16K
F-233-25-512S
FV-144-16K
FV-146-16K
7 ORAIN
TI TAH TAL TR
F-223-40-512S
0.59MPa ST.
FV-112--
F-230-25-22S
F-253-25-22S
No.3 GEN. ENGINE
P
F-212-25-22S
FV-160--
F-243-25-22S
FV-154-16K
F-237-25-512S
FV-153-16K
F-240-25-512S
FV-142-16K-
F-232-25-512S
FV-141-16K
FV-143-16K
FV-111--
F-229-25-22S
F-252-25-22S
No.2 GEN. ENGINE
F-213-25-22S
FV-159--
F-242-25-22S
FV-152-16K
F-236-25-512S
FV-151-16K
F-239-25-512S
FV-139-16K-
F-231-25-512S
FV-138-16K
FV-140-16K
FV-110--
F-228-25-22S
F-251-25-22S
No.1 GEN. ENGINE
F-226-25-22S
FV-158--
SEAL POT
IN =0.57MPa
OUT=0.4MPa
SET=0.17MPa
--6-512
FV-130-16K-
FV-132-16K-
FV-131-16K-
F-225-40-512S
FV-133-16K-
F-224-40-512S
F-210-40-22S
4 0.59MPa ST.
FP-53
FV-116--
FV-117--
FIS
FP-52
FV-118--
F-205-32-22S
No. 2 G/E F.O. BOOST. PUMP (0.6m3/h x 40m)
FV-102--
F-201-40-22S
F-202-32-22S
FV-103--
No. 1 G/E F.O. BOOST. PUMP (0.6m3/hx40m)
FV-101--
F-200-40-22S
F-203-32-22S
FV-104--
SEAL POT
IN =0.40MPa
OUT=0.05MPa
SET=0.35MPa
--6-207
FV-106--
FV-108--
FV-107--
FV-105--
F-206-32-22S
F-204-32-22S
35u
10u
DPS DPS
PAH
BY-PASS FILTER
AUTO. BACK WASH FILTER FP-56
TIC
TAH
No. 2 G/E F.O. HEATER
F-220-40-512S
FV-124-16K-
FV-126-16K-
No. 1 G/E F.O. HEATER
F-219-40-512S
FV-123-16K-
FV-125-16K-
F-218-40-512S
RIA
ASt
No. 2 G/E F.O. CIRC. PUMP (1.5m3/h x 50m)
FV-120--SC
F-215-50-22S
FV-216-40-512S
FV-122-16K-
FV-119--SC
F-214-50-22S
F-217-40-512S
FV-121-16K-
No. 1 G/E F.O. CIRC. PUMP (1.5m3/h x 50m)
0.59MPa ST.
TRACING PIPE No. 3 4 5 6 7
F ; 200---253 (209, 211, 249, 250)
FV ; 100---160 (113-115, 134-137)
FP ; 50--- 56

DRG 030

REMARKS:

1. AIR CONNECTIONS IN D.G. ROOM ALSO TO BE USED FOR DRY CLEANING D.G. TURBOCHARGER TURBINE SIDE.

AFT

FOR

ACCOMMODATION

CASING

CASING

WORKING AIR SYSTEM ACCOMMODATION

POS C 032708

POS A 032708

25V657032

25V657033

25V657031

WORKING AIR SYSTEM ACCOMMODATION

POS B 032708

957890

25V020046

1

CONTROL AIR MANIFOLD

SET PRESS. 9.9 BAR

15C716001

TO BILGE

15V020008

016 PI

052 PS

L PA

FIRE FLAPS AIR RECEIVER 052709001 CAP. 1.1 M3

TO FIRE FLAPS

See Diagram 032709 Fire Flaps Air System

25V310010

15A020002

15M043002

TO BILGE

25V020045

UPPER DECK

AIR DRYER SC128

957890

9

CONTROL AIR MANIFOLD PASSAGE WAY SB

POS A 032705

WORKING AIR TO DECK(PASSAGE WAY)

40V310011

DECK 19550

957890

2

CONTROL AIR MANIFOLD

25V020044

POS B 032705

WORKING AIR TO DECK(PASSAGE WAY)

40V310012

051 PS PA

COMPR.ROOM SB.

25V657034

25V657035

25V020041

M.E. T/C CLEANING SEE 032101 POS.A

ECR PI PA PT 076

ICS

CLOSES AT LOW PRESS. 50C042001

F/C

40V511005

25V511002

25C662001

SET PRESS. 9.9 BAR

50V002008

32V020002

15V020007

40VI20022

25VI20011

CONTROL/WORK AIR VESSEL

052702101

CAP. 4 M3

15A020001

15M043001

TO BILGE

TO BILGE

VENT.ROOM PS.

25V657056

M.E. AFT

25V657055

SEPARATOR ROOM

25V657054

25V020049

3

CONTROL AIR MANIFOLD

957890

25V657057

M.E.ROOM

M.E. FORE

25V657072 25V657070 25V657071 25V657041

L2702-056

P130 32

016 PI

15V020005

CONTR.AIR AEROLESCER FILTER 3/4" FEMALE

052702201

1.5"MALE

05270215 CONTR. AIRDRYER FILTER

1.5"MALE

32V020001

32V020004

TO BILGE

25V657037

25V657038

25V657040

25V657036

25V657039

DECK 16788

FUEL VALVE TESTING EQUIPMENT

25V020042

NEAR D.G. NO.3

25V657082

DECK 13255

SET PRESS. 9.9 BAR

25C716001

32V020003

016 PI

NORM. CLOSED

25V020043

15C019001

TO BILGE

FROM START AIR SYSTEM

POS A 032701

F/C

BOSS1/2"BSP

15V020004

25V657042

25V020039

25V020040

25V020081

Sealing air for T/G See 032103

957890

6

CONTROL AIR MANIFOLD FOR T/G

TPI5 TP62

TPI6 TP72

TP46 TP73

TP50 TP86

TP54 TP87

TP58

25V020076

PI TS AFTER COOLER

XA TI

CONTROL/WORK AIR COMPR. 052702001

L.O. SUMP

TI LS

TO BILGE

PI TS AFTER COOLER

XA TI

CONTROL/WORK AIR COMPR. 052702002

L.O. SUMP

TI LS

TO BILGE

CONTROL AIR INLET M.E.

43

15V020006

25V657053

NEAR D.G. NO.2

25V657052

NEAR D.G. NO.1

957890

25V020050

4

25V020053

957890

5

CONTROL AIR MANIFOLD

957890

7

CONTROL AIR MANIFOLD

25V020047

957890

25V020054

8

CONTROL AIR MANIFOLD

SEACHEST

25V657051

25V657050

25V657045

25V657047

SEACHEST

20V654003

PRIMING UNIT S.W. PUMP 052309001

25V657048

HYDROPHORE TANK F.W.

SHAFT TUNNEL

25V657049

25V657046

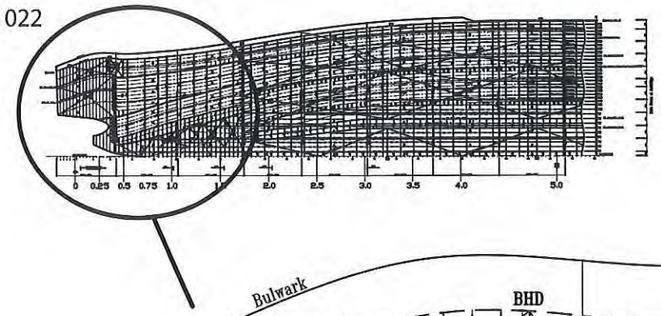
DECK 6950

TANK TOP 2870

PORT

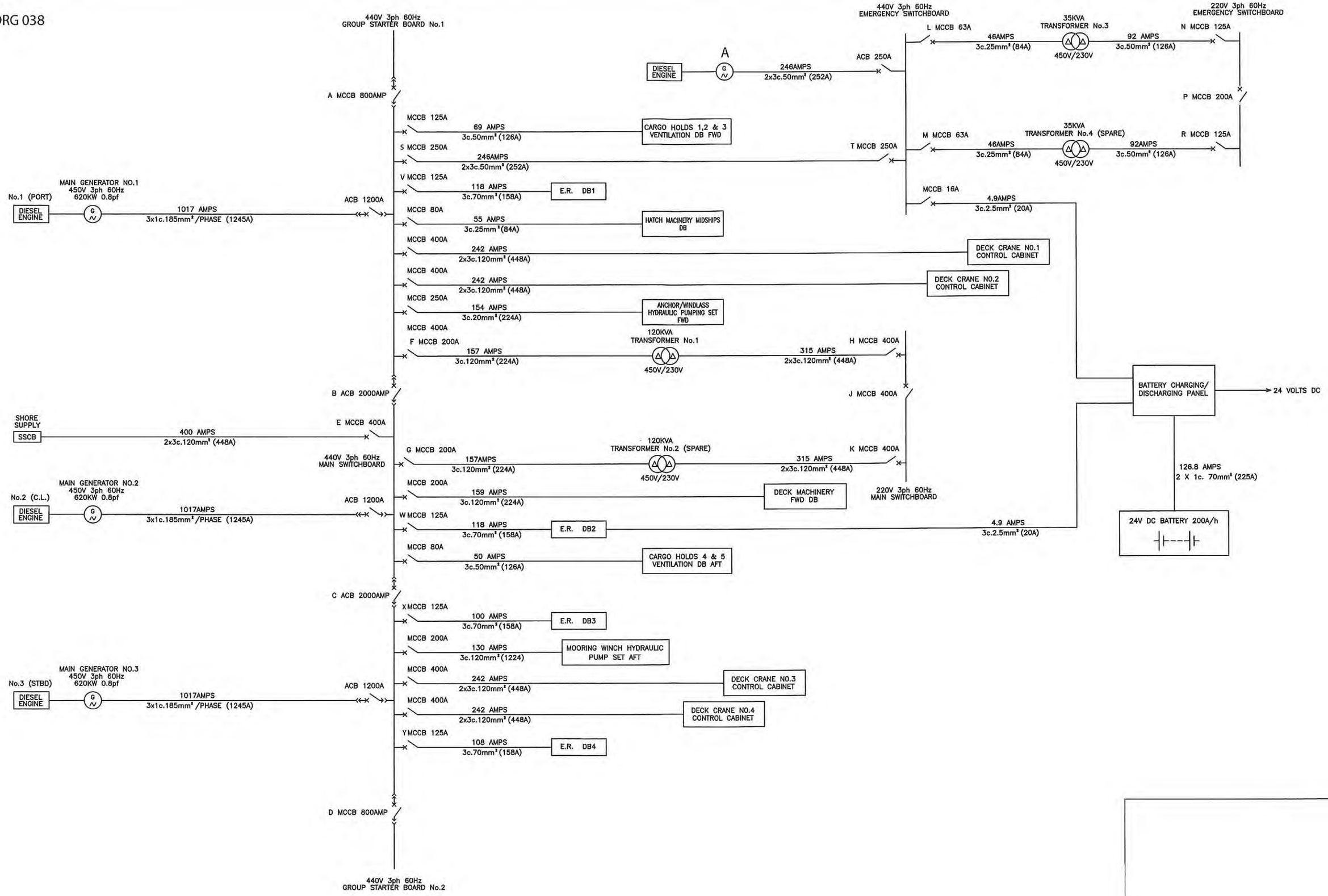
STARBOARD

DRG 022

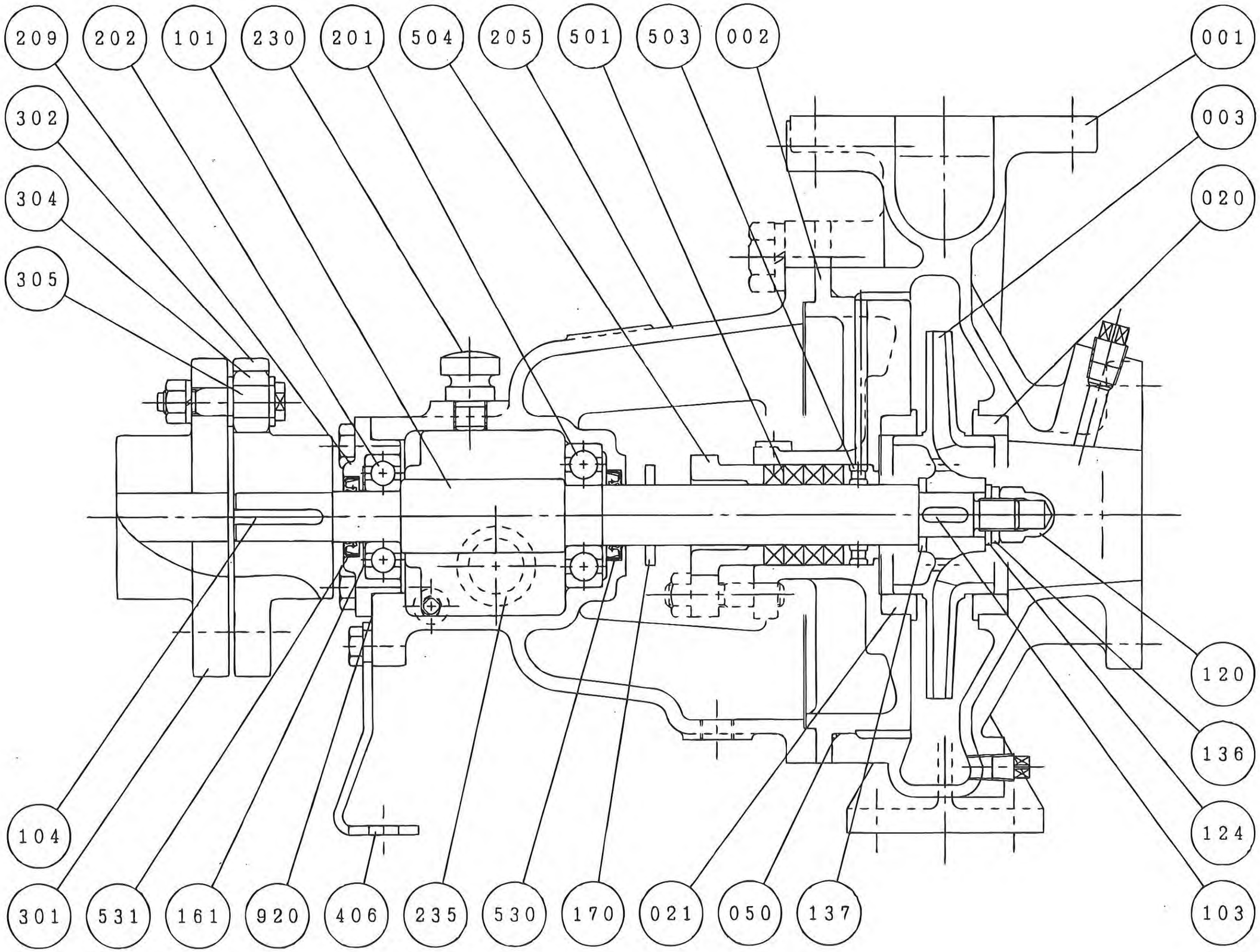


Bulwark
Upper Deck
BHD
Upper Deck
S.G. Flat 12400 A.B.
9900 A.B. Stringer
9900 A.B. Stringer
After Peak W.B. Tank
Sanitary F.W. Tank p&s S.G. Flat
Drinking F.W. Tk.
p&s
Upper E.R. Flat 11850 A.B.
Lower E.R. Flat 7300 a.b.
W.B. TANK
Flat of Bottom
pipe tunnel
E.R. Tank Top 2000 A.B.
Sea Well
D.B. Feed Water Tk.
Fresh Water P.
D.B. F.O. Drain Tk.
Heavy Oil S.
No. 7 D.B. Tank p&s Bilge Water
No. 6 D.B. Tank p&s Diesel Oil
Grey Water Sludge Tank
D.B. BHD
L25 Side Stringer
L24
L23
L22 (4960 A.B.) Top of Double Bottom Wing Tanks
L21
L20
L19
L18
L8 W.T. Girder 800
L7
L6 W.T. Girder 600
L4
L3
L2
L1
Plate Section
2800
2800
900
BASELINE
A.P.
Scantling length 173.000 metres
UNIT 1 = 10834
UNIT 2 = 11200
UNIT 3 = 12000
UNIT 4 = 10400
0.1L
0.15L
0.20L
0 0.25 0.5 0.75 1.0 1.5 2.0

DRG 038


440V 3ph 60Hz
GROUP STARTER BOARD No.1
A MCCB 800AMP
B ACB 2000AMP
C ACB 2000AMP
D MCCB 800AMP
440V 3ph 60Hz
GROUP STARTER BOARD No.2
440V 3ph 60Hz
MAIN SWITCHBOARD
440V 3ph 60Hz
EMERGENCY SWITCHBOARD
220V 3ph 60Hz
EMERGENCY SWITCHBOARD
220V 3ph 60Hz
MAIN SWITCHBOARD
DIESEL ENGINE
A
246AMPS
2x3c.50mm² (252A)
ACB 250A
L MCCB 63A
46AMPS
3c.25mm² (84A)
35KVA
TRANSFORMER No.3
450V/230V
92 AMPS
3c.50mm² (126A)
N MCCB 125A
P MCCB 200A
M MCCB 63A
35KVA
TRANSFORMER No.4 (SPARE)
R MCCB 125A
T MCCB 250A
MCCB 16A
4.9AMPS
3c.2.5mm² (20A)
MAIN GENERATOR NO.1
450V 3ph 60Hz
620KW 0.8pf
No.1 (PORT)
1017 AMPS
3x1c.185mm²/PHASE (1245A)
ACB 1200A
MCCB 125A
69 AMPS
3c.50mm² (126A)
CARGO HOLDS 1,2 & 3
VENTILATION DB FWD
S MCCB 250A
246AMPS
2x3c.50mm² (252A)
V MCCB 125A
118 AMPS
3c.70mm² (158A)
E.R. DB1
MCCB 80A
55 AMPS
3c.25mm² (84A)
HATCH MACINERY MIDSHIPS DB
MCCB 400A
242 AMPS
2x3c.120mm² (448A)
DECK CRANE NO.1
CONTROL CABINET
DECK CRANE NO.2
CONTROL CABINET
MCCB 250A
154 AMPS
3c.20mm² (224A)
ANCHOR/WINDLASS
HYDRAULIC PUMPING SET
FWD
MCCB 400A
F MCCB 200A
157 AMPS
3c.120mm² (224A)
120KVA
TRANSFORMER No.1
450V/230V
315 AMPS
2x3c.120mm² (448A)
H MCCB 400A
J MCCB 400A
BATTERY CHARGING/
DISCHARGING PANEL
24 VOLTS DC
126.8 AMPS
2 X 1c. 70mm² (225A)
24V DC BATTERY 200A/h
SHORE
SUPPLY
SSCB
400 AMPS
2x3c.120mm² (448A)
E MCCB 400A
G MCCB 200A
157AMPS
3c.120mm² (224A)
120KVA
TRANSFORMER No.2 (SPARE)
450V/230V
315 AMPS
2x3c.120mm² (448A)
K MCCB 400A
MAIN GENERATOR NO.2
450V 3ph 60Hz
620KW 0.8pf
No.2 (C.L.)
1017AMPS
3x1c.185mm²/PHASE (1245A)
ACB 1200A
MCCB 200A
159 AMPS
3c.120mm² (224A)
DECK MACHINERY
FWD DB
W MCCB 125A
118 AMPS
3c.70mm² (158A)
E.R. DB2
4.9 AMPS
3c.2.5mm² (20A)
MCCB 80A
50 AMPS
3c.50mm² (126A)
CARGO HOLDS 4 & 5
VENTILATION DB AFT
X MCCB 125A
100 AMPS
3c.70mm² (158A)
E.R. DB3
MCCB 200A
130 AMPS
3c.120mm² (1224)
MOORING WINCH HYDRAULIC
PUMP SET AFT
MAIN GENERATOR NO.3
450V 3ph 60Hz
620KW 0.8pf
No.3 (STBD)
1017AMPS
3x1c.185mm²/PHASE (1245A)
ACB 1200A
MCCB 400A
242 AMPS
2x3c.120mm² (448A)
DECK CRANE NO.3
CONTROL CABINET
MCCB 400A
242 AMPS
2x3c.120mm² (448A)
DECK CRANE NO.4
CONTROL CABINET
Y MCCB 125A
108 AMPS
3c.70mm² (158A)
E.R. DB4

DRG 021


209
202
101
230
201
504
205
501
503
002
001
302
003
304
020
305
120
136
124
104
103
301
531
161
920
406
235
530
170
021
050
137