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, SYSTEMS AND SHIP'S DRAWINGS

WEDNESDAY, 18 OCTOBER 2017

1315 - 1615 hrs

Examination paper inserts:

DRG 006
DRG 007
DRG 009
DRG 008
DRG 005

Notes for the guidance of candidates:

1. Candidates are required to obtain 50% of the total marks allocated to this paper to gain a pass **AND** also obtain a minimum 40% in Sections A and B of the paper.
2. Non-programmable calculators may be used.
3. 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:

Candidate's examination workbook

ENGINEERING, SYSTEMS AND SHIP'S DRAWINGS

Attempt ALL questions

Marks for each part question are shown in brackets

Section A

1. Piping Systems - DRG. 006

   (a) Explain the purpose of item *A* identified on the drawing, stating what is specified about its physical location. (2)

   (b) Explain the meaning of the following symbol, 

   (2)

   (c) Describe the following device, stating its purpose.  (2)

   (d) Whist the vessel is on passage with all engines on HFO, the main engine begins to surge due to fuel starvation.

   State, with reasons, what item may be of concern and what action is required. (4)

2. Mechanical Assembly - DRG. 007

   (a) Describe the type of drive connected to the pump. (2)

   (b) Explain the function of item 210. (2)

   (c) Describe the device and function of assembly 704. (2)

   (d) Describe the procedure for setting up the drive mechanism after the motor has been overhauled. (4)

3. Ship's Construction Drawing - DRG. 009

(a) State the difference between the girders at 6,000 and 8,000 off centre line compared to the other girders, explaining why they are different. (2)

(b) State the extent of the camber on the main deck and at what distance from the centre line it starts. (2)

(c) State the specification of the side longitudinal stiffeners in way of the shear strake. (2)

(d) State the specification of the plate used for deck plating in way of the shear strake. (2)

(e) State the thickness plate used for the tank tops. (2)

4. Hydraulic and Pneumatic System Drawings - DGR. 008

(a) Describe the device and its function.

(2)

(b) State the purpose of valve 10. (2)

(c) Describe in the dual system shown the sequence of events that occur if one side, when in service, develops a leak, including how the isolation valves operate. (6)

5. Electrical Power Systems and Control Drawings - DRG.005

(a) State the purpose of the circuit shown. (2)

(b) State the type of device and its function for EACH of the following:

(i) KM2 (2)

(ii) KM1 (2)

(iii) RL1 (2)

(iv) S2 (2)

Section B

6. Mechanical Assembly Drawing - DRG. 007

The illustrated pump runs, the piston rod can be seen to be reciprocating, but the pump fails to pump fluid.

Describe the inspection procedure required to check the components that may be at fault, including replacement of piston seal rings and liner. (25)

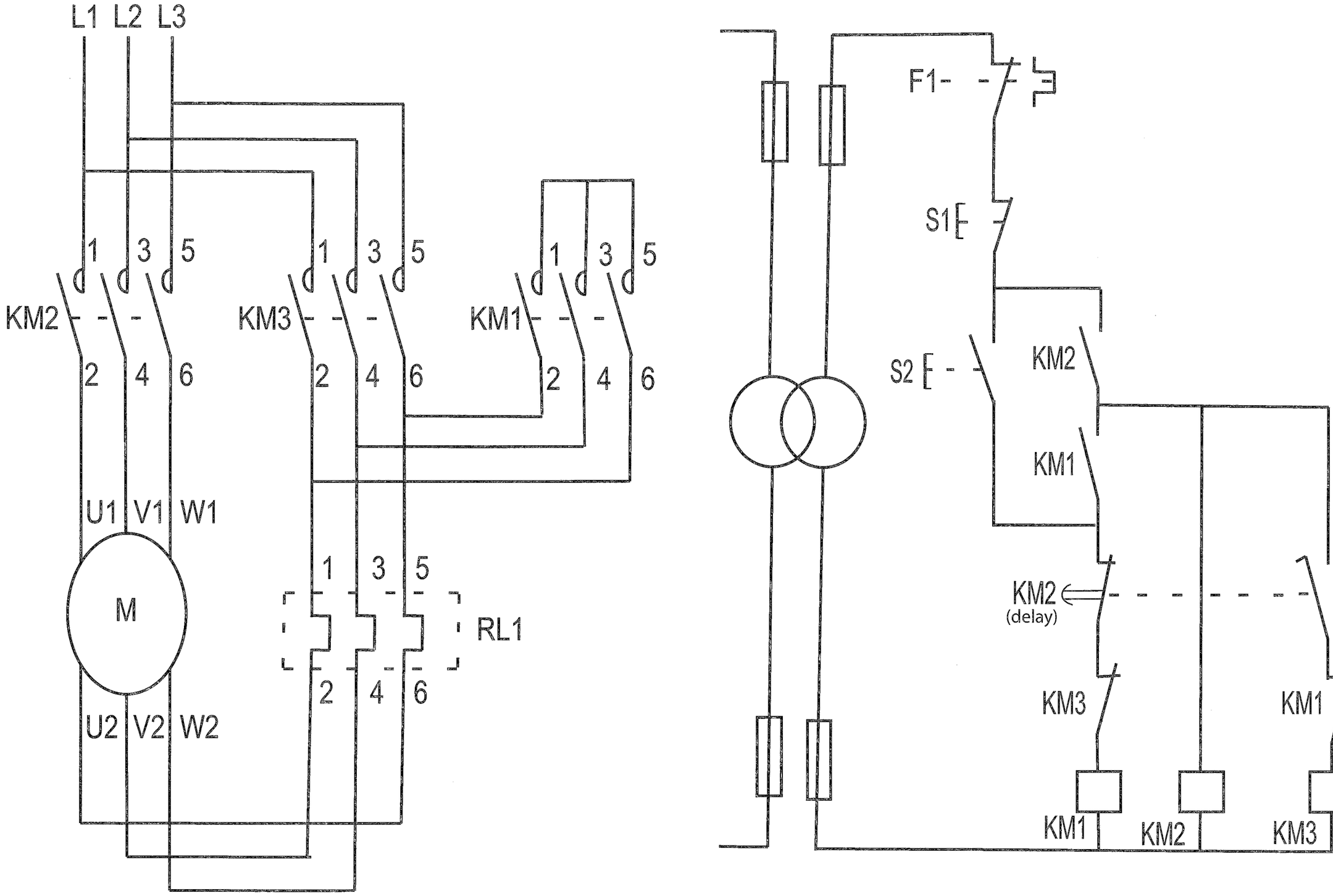
7. Electrical Power Systems and Control Drawings - DRG. 005

The illustrated starter has correct voltage and frequency to main and auxiliary circuits. When the start button is operated a single contactor is heard to operate, but the motor does not turn. When the start button is released, a contactor is heard to move again.

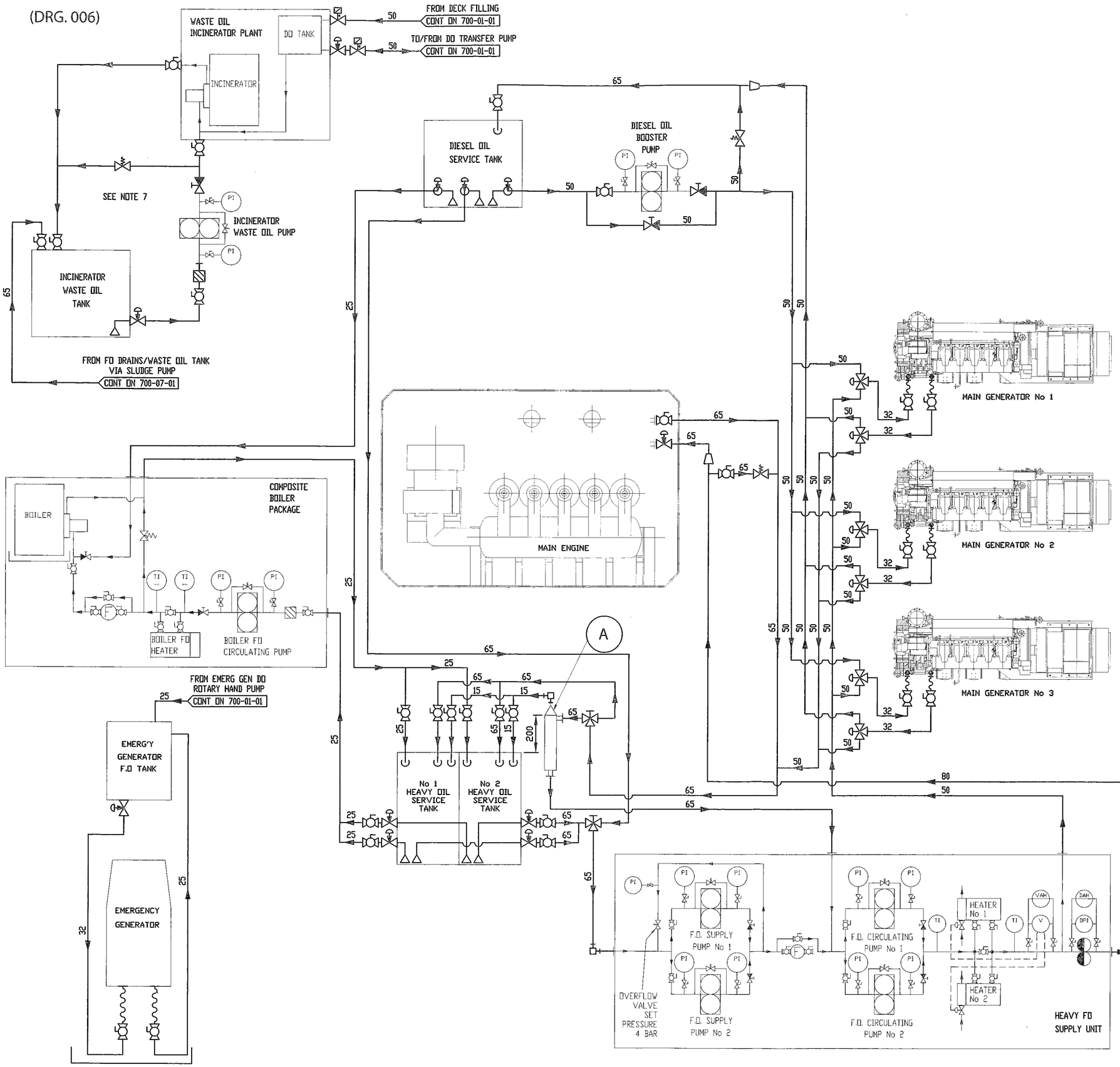
(a) State which contactor operated and which one should have operated. (6)

(b) Explain in detail the location and nature of possible faults. (19)

(DRG. 005)


L1 L2 L3
1 3 5
KM2
2 4 6
KM3
KM1
U1 V1 W1
M
U2 V2 W2
RL1
F1
S1
S2
KM2
KM1
KM2
(delay)
KM3
KM1
KM1 KM2 KM3

(DRG. 006)



Material & size of Piping		
Seamless Copper		
Nominal Diameter (mm)	Outside Diameter (mm)	Wall Thickness (mm)
n/a	8	1.2
n/a	10	1.2
n/a	12	2
Seamless Steel		
Nominal Diameter (mm)	Outside Diameter (mm)	Wall Thickness (mm)
15	22	3
20	27	3
25	34	3.5
32	42	4
40	48	4
50	60	5
65	76	5
80	89	5.5
100	114	6
125	140	7
150	168	7
200	219	9
250	273	9
300	325	10
350	356	10
400	426	10

SYMBOLS	
PI	
TI	
V	
VAH	
DPI	
DAH	
F	

NOTES:-

1- POWER SUPPLY TO ALL INDEPEDENTLY DRIVEN FO PUMPS TO BE CAPABLE OF BEING STOPPED FROM A REMOTE POSITION
2- F.O PUMPS TO BE FITTED WITH RELIEF VALVE IN CLOSE CIRCUIT.
3- TANK GAUGE GLASSES TO BE OF CLASS APPROVED TYPE
4- ALL EQUIPMENT TO BE SUITABLE FOR OPERATING ON DIESEL OIL FUEL
5- FLEXIBLE CONNECTIONS TO BE TYPE APPROVED BY CLASS
6- VALVES TO BE SUPPLIED ACCORDING TO CLASS REQUIREMENTS
7- PIPE SIZES AS PER INCINERATOR PLANT MAKERS RECOMMENDATION.

SYSTEM WORKING PRESSURE= 10 bar
SYSTEM DESIGN PRESSURE= 12 bar
SYSTEM TO BE TESTED TO 1.5 x DESIGN PRESSURE

	MARK	QTY	ITEM	MAKE	DATA	REMARKS
13		1	EMERG GEN FO TANK			
12		1	INCINERATOR WASTE OIL TANK			
11		1	No 2 HO SERVICE TANK			BUILT IN
10		1	No 1 HO SERVICE TANK			BUILT IN
9		1	DIESEL OIL SERVICE TANK			BUILT IN
8		1	COMPOSITE BOILER PACKAGE			
7		1	INCINERATOR WASTE OIL PUMP			
6		1	WASTE OIL INCINERATOR PLANT			
5		1	EMERGENCY GENERATOR			
4		1	DIESEL OIL BOOSTER PUMP			
3		1	HEAVY F.O. SUPPLY UNIT			
2		3	DIESEL GENERATORS			
1		1	MAIN ENGINE			

VER.	
A	
05	
04	
03	
02	

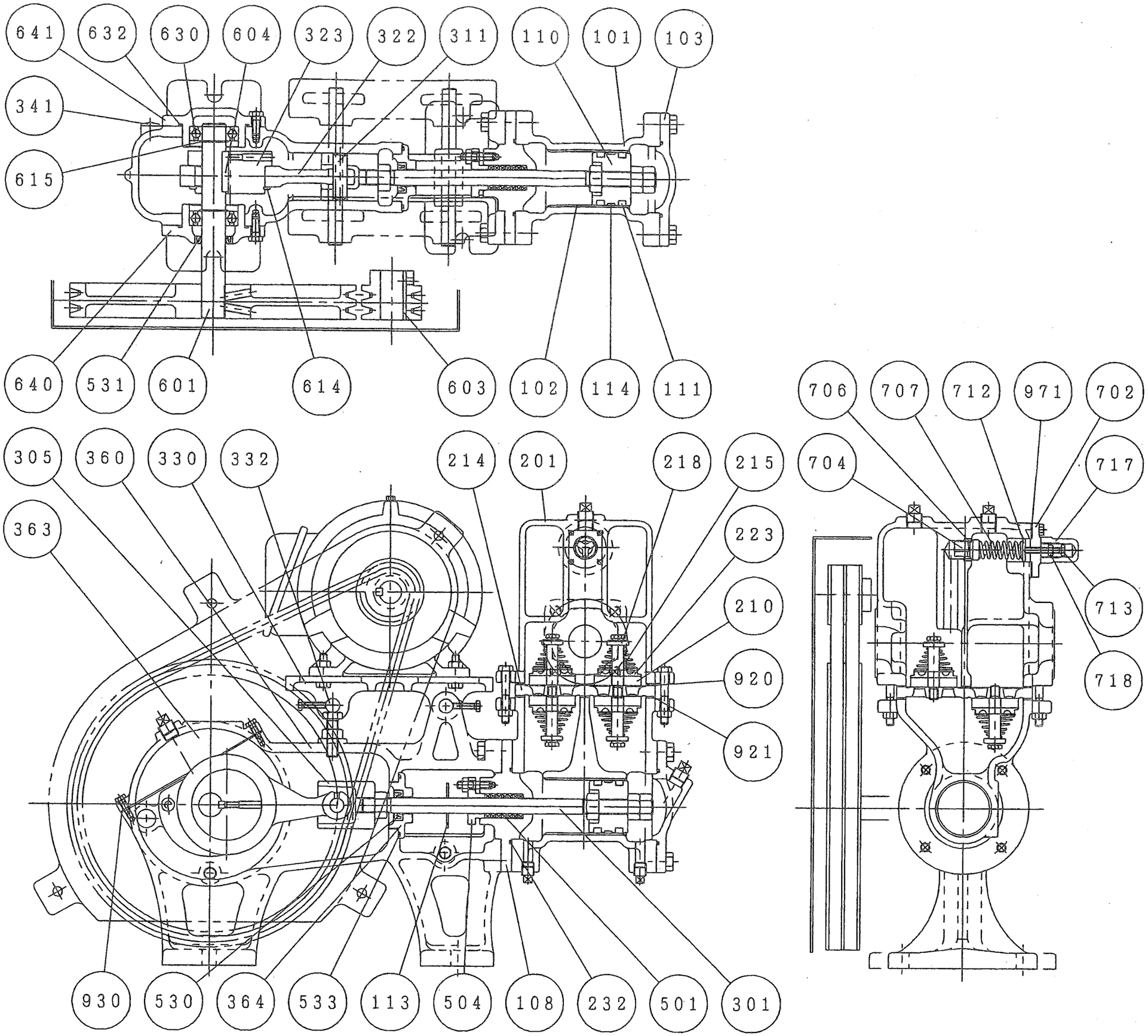
TITLE

FUEL SYSTEM DIAGRAM FUEL OIL SUPPLY

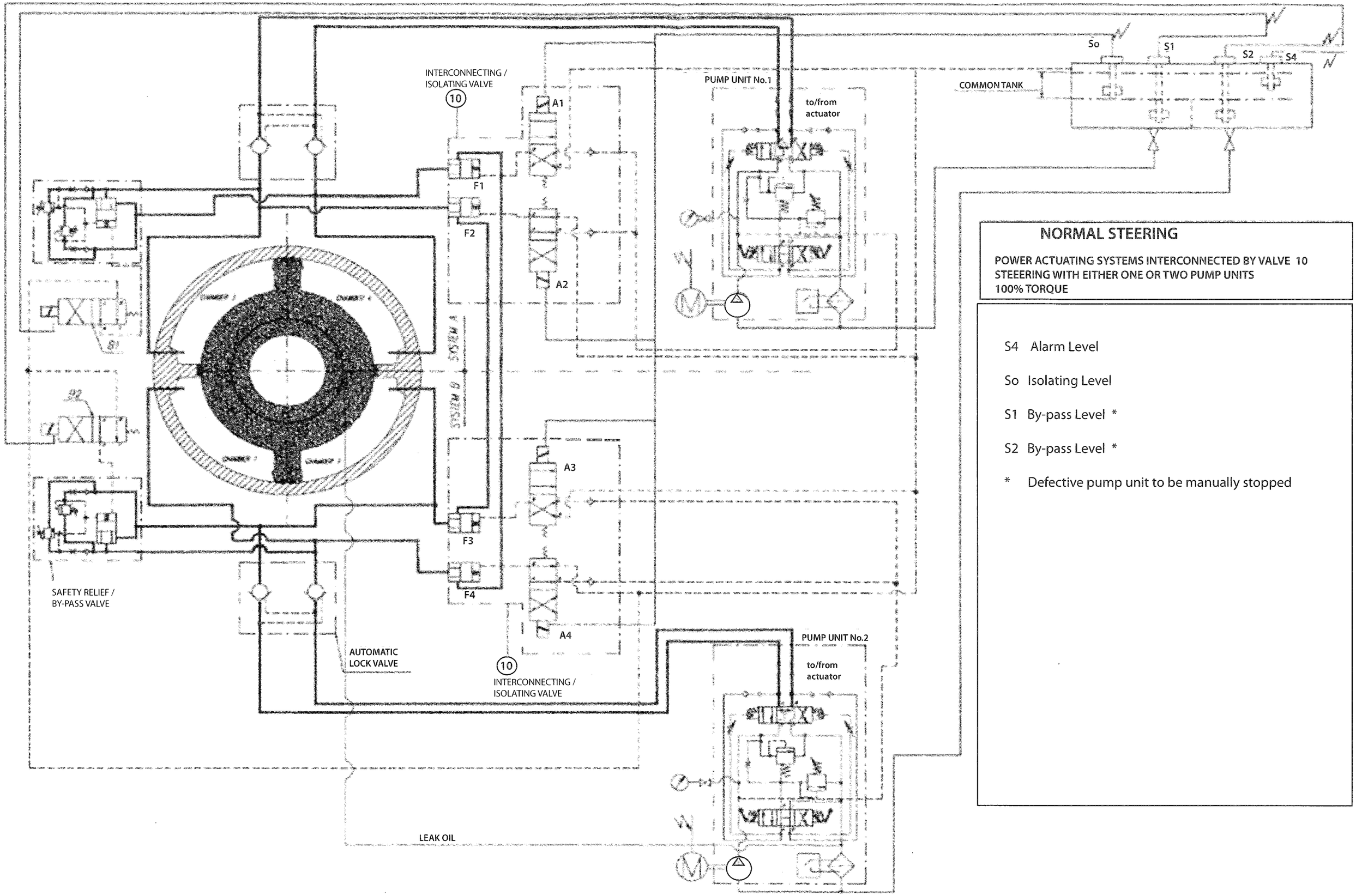
DRAWING No.	SHEET No.	SCALE	VERSION
700-01	02	NTS	A

PAPER SIZE - A1
DIMENSIONS IN MILLIMETRES

(DRG. 007)


641
632
630
604
323
322
311
110
101
103
341
615
640
531
601
614
603
102
114
111
706
707
712
971
702
704
717
305
360
330
332
214
201
218
215
363
223
210
920
921
713
718
930
530
364
533
113
504
108
232
501
301

DRG. 008



NORMAL STEERING

POWER ACTUATING SYSTEMS INTERCONNECTED BY VALVE 10
STEEERING WITH EITHER ONE OR TWO PUMP UNITS
100% TORQUE

S4 Alarm Level

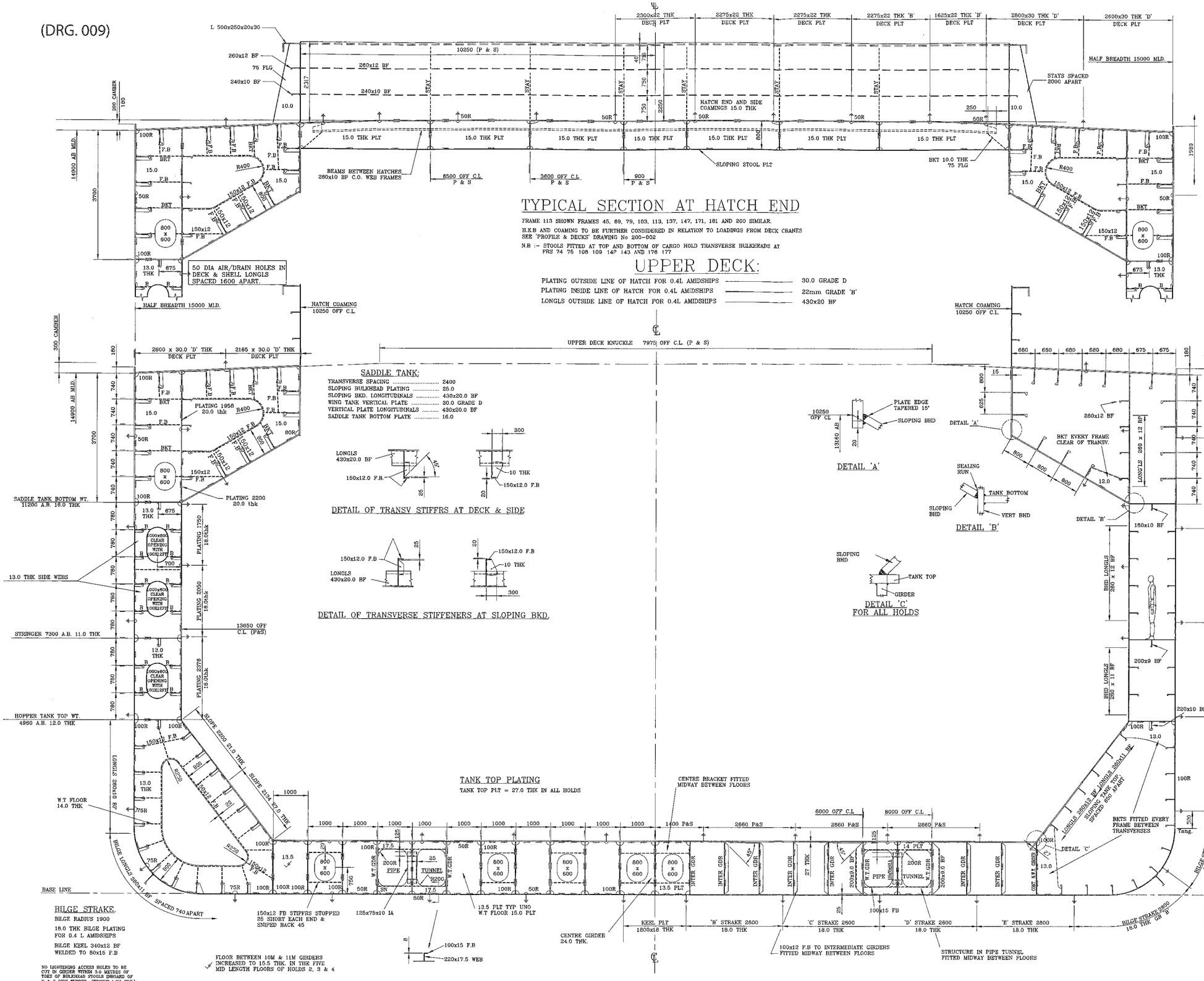
So Isolating Level

S1 By-pass Level *

S2 By-pass Level *

* Defective pump unit to be manually stopped

(DRG. 009)



EQUIPMENT NUMERAL			
HULL	173.000 x 4.400	=	761.2
LOWER BR. DECKHOUSE AFT	6.400 x 2.800	=	17.9
LOWER BR. DECKHOUSE FWD.	15.200 x 2.800	=	42.6
BRIDGE DECKHOUSE AFT	6.400 x 2.500	=	16.0
BRIDGE DECKHOUSE FWD.	15.200 x 2.500	=	38.0
UPPER BR. DECHOUSE	15.200 x 2.500	=	38.0
NAV. BRIDGE DECKHOUSE	15.200 x 2.500	=	38.0
WHEELHOUSE	13.850 x 3.700	=	51.2
FORECASTLE	14.300 x 2.500	=	35.8
CRANEHOUSES	4 x 3.200 x 3.300	=	42.2
HATCH COAMINGS (2-5 HOLDS)	4 x 1.750 x 19.200	=	134.4
HATCH COAMING (No 1 HOLD)	1.750 x 15.200	=	26.6
TOTAL AREA			= 1241.9

EQUIP No. = $DISP^{\frac{2}{3}}$ + 2 B. H. + A/10
= $43912^{\frac{2}{3}}$ + 2 x30.000x17.2 + 1242/10
= 1245 + 1032 + 124

NUMERAL = 2401 LETTER = J (RANGE = 2380 TO 2529)

2 STOCKLESS BOWER ANCHORS 7350kgs. EACH
603M STUD LINK CHAIN CABLE 66mm DIA. (S.Q. GRADE UJ)

DESIGN LOADINGS

WEATHER DECK :- OUTSIDE LINE OF HATCHES SUITABLE FOR 2.50 T/M2
INSIDE LINE OF HATCHES SUITABLE FOR 2.50 T/M2
HATCH COVERS :- SUITABLE FOR 1.75 T/M2
HOLD BOTTOM :- HOLDS Nos.1 – 5 SUITABLE FOR 20.00 T/M2

HOLD	LENGTH (M)	CAPACITY 100% (M3)	HOMOGENEOUS TONNES	HOMOGENEOUS S.G.	ALTERNATIVE HOLDS 1, 3 & 5 TONNES	ALTERNATIVE HOLDS 1, 3 & 5 S.G.
1	24.000	5428	4762	0.741	9282	1.8 / 3.0
2	27.200	9650	7173	0.741	–	–
3	27.200	9815	7273	0.741	12540	1.8 / 3.0
4	27.200	9810	7269	0.741	–	–
5	27.200	9384	6954	0.741	11608	1.8 / 3.0
TOTALS		45115	33431		33430	33469

HOLD	LENGTH (M)	CAPACITY 100% (M3)	ALTERNATIVE HOLDS 1, 2 & 4 TONNES	ALTERNATIVE HOLDS 1, 2 & 4 S.G.	TONNES	S.G.
1	24.000	5428	6111	1.8	8286	3.0
2	27.200	9650	9376	1.8	9167	3.0
3	27.200	9815	–	–	–	–
4	27.200	9810	9376	1.8	9290	3.0
5	27.200	9384	8567	1.8	8887	3.0
TOTALS		45115	33430		33430	

LONGITUDINAL STRENGTH

SCANTLINGS ARE TO BE SUITABLE FOR UNRESTRICTED SEA-GOING SERVICE AND FOR THE MAXIMUM PERMISSIBLE SWBM AND SHEAR FORCE VALUES GIVEN IN THE TABLE BELOW.

THESE VALUES HAVE BEEN DETERMINED FROM A COMPREHENSIVE RANGE OF OPERATING LOADING CONDITIONS AND ALL REQUIRED STATUTORY LOADING CONDITIONS FOR THE VESSEL

FRACTION OF RULE LENGTH	DISTANCE FROM AP (Metres)	DESIGN SWBM POSITIVE (kNm)	DESIGN SWBM NEGATIVE (kNm)	DESIGN SF POSITIVE (kN)	DESIGN SF NEGATIVE (kN)
0.00	2.200	171000	-197000	3217	-3217
0.05	10.650	290266	-334423	17133	-17133
0.10	19.300	409578	-471847	31049	-31049
0.15	27.950	528959	-609270	58880	-58880
0.20	36.600	648145	-746694	58880	-58880
0.25	45.250	767431	-884117	58880	-58880
0.30	53.900	865000	-985000	58880	-58880
0.35	62.550	865000	-985000	51840	-51840
0.40	71.200	865000	-985000	44800	-44800
0.45	79.850	865000	-985000	44800	-44800
0.50	88.500	865000	-985000	44800	-44800
0.55	97.150	865000	-985000	44800	-44800
0.60	105.800	865000	-985000	44800	-44800
0.65	114.450	865000	-985000	51705	-51705
0.70	123.100	821176	-946033	58811	-58811
0.75	131.750	712815	-821194	58811	-58811
0.80	140.400	624451	-696356	58811	-58811
0.85	149.050	495088	-571518	58811	-58811
0.90	157.700	387725	-446678	39074	-39074
0.95	166.350	279363	-321839	19537	-19537
1.00	175.000	171000	-197000	0	0

MAIN PARTICULARS

LENGTH B.P.	175.000 mtrs.
BREADTH MLD.	30.000 mtrs.
DEPTH MLD.	14.900 mtrs.
DRAUGHT EXTREME	10.518 mtrs.
LENGTH ON SUMMER L.W.L.	178.200 mtrs.
LENGTH FOR SCANT.	173.000 mtrs.

LLOYDS ✠ 100 A1, Bulk Carrier, CSR, ESP, BC-A, GRAB(25), (maximum cargo density 3.0 t/m3 ; holds 2 & 4 OR hold 3 may be empty), ✠LMC, UMS, SCM, EP

SCANTLINGS SUITABLE FOR A SUMMER DRAUGHT OF 10.500 mtrs TOP OF KEEL, GIVING A MOULDED DISPLACEMENT OF 43912 TONNES.

Cb Mld. = $\frac{43912}{173.000 \times 30.000 \times 10.500 \times 1.025} = 0.7862$

SERVICE SPEED = 14.5 KNOTS

MINIMUM SCANTLINGS REQUIRED

VER.	DATE	DRAWN BY	CHECKED AUTHORISED	DESCRIPTION OF CHANGES
G				HATCH COAMING THICKNESS AMENDED HATCH COAMING STIFFENERS AMENDED
F				No 3 P.C. INNER BOTTOM TANK REMOVED. UPDATE HATCH COAMING T.T. THICKNESS UPDATED. UPDATE B.M.TABLE
E				SOME SCANTLINGS CHANGED
D				EXTENSION OF LONGL. BHD INTO SADDLE TANK, NEW SWBM & SF, NEW HOLD CAPACITIES
C				LONGL BHD MOVED TO 13650 OFF C.L. - SIDE & BOTTOM ACCESS OPENING CHANGED
B				CHANGED CLASS,SWBM'S AND HOLD LOADINGS UPDATED SOME MINOR STRUCTURAL DETAILS MODIFIED

Prepared By:

CONTRACT No.

DRAWN BY DATE

CHECKED BY DATE

AUTHORISED BY DATE

SHIP/PROJECT: 36000T Bulk carrier

TITLE: MIDSHIP SECTION I.W.O. No. 3 HOLD

DRAWING No.	SHEET No.	SCALE	VERSION
200-01	01	1 : 50	G

PAPER SIZE - A0
DIMENSIONS IN MILLIMETRES