4º VOLUME

2001

TRIBUNAL MARÍTIMO

Anexo I
Processo 19489/01 - P 36
MANUAL DE OPERAÇÃO II

Representado(s): _____

_____

_____

_____

AUTUAÇÃO

Aos 09 de Agosto de dois mil e 01

na Secretaria do Tribunal Marítimo autuo os presentes autos.

Do que fiz este termo

_____

Diretor - Geral da Secretaria

1441.B

CERTIDÃO

CERTIFICO que, nesta data foi encaminhado o 4º Aditamento ao Contrato 049891/05 – 3.36.

O referido é verdade e dou fé.

Aos 11 **de** abril **de 200**7.

É CÓPIA FIEL DO DOCUMENTO ORIGINAL

JOSÉ CARLOS DE MENEZES QUEIROZ
MATRÍCULA
DIVISÃO DE SERVIÇOS CARTORIAIS

INDICE

943

JOSÉ CARLOS FANTINEL CURSÃO
DIRETOR
DIVISÃO DE SERVIÇOS CARTORIAIS

MD.119

PETROBRAS
E&P-BC/GETRAN

SITM - Gestão de Demanda
Manifesto de Carga

14/02/2001 10:00
IMPSOL-CONV / Pag 1

GEM

Cód. Solic.
1015985

Embarcação	PO	Classe Oper.	Data Atendimento
		SUPRIM. CONVES	Mais cedo : 13/02/2001 Mais tarde : 21/02/2001

Origem: P-36 Destino: MCAE Repasse carga:

Empresa: PETROBRAS No Contrato: 0

Orgão Requisitante: NUPRO-AE/GP-36 Apoio: MCAE

Destinatário: SOP-OM/ATREX Peso Tot.(Kg): 3000

It	Qtd	Descrição da Carga Dimensões Local	Valor(R$) Lacre	Peso(Kg) Eslinga	Doc Número
01	1	CONTAINER RENAVI-53 CONT. MATERIAIS. 03,50x02,40x02,40 P-36	90000,00 5518985	3000	

DUTC: 123024912 01 CONTAINER RENAVI-53 CONT. MATERIAIS.

CONFERIDO
Weld Services Serv. de Apoio e Logística Ltda.

Observações:
BOMBA DO TQ. DE ESTOCAGEM PARA DRENO FECHADO-BE.
TAG.V533604-A
0100 41 45 OK A/ MOTOR

GETRAN / GTC
ETROPORTO
EM: 21/2/01
NOME: Adriana Silva Mat.: 139457-0 Técnico Setorial de Operações de Cargas
MAT.

ORIGEM: P36	REBOCADOR	GETRAN	GESER/GSI
DATA: 14/2/01	DATA: 18/02/01	DATA: / /	PLACA:
HORA: 11:00	HORA:	HORA:	MOT:
RAMAL: 962 3650		RAMAL:	RG: /
			DATA: / /
			HORA:
ASSINATURA	ASSINATURA	ASSINATURA	ASSINATURA

Paulo Roberto Vieira
Matr.: 139377-9
Coordenador de Plataforma P-36

É CÓPIA FIEL DO DOCUMENTO ORIGINAL
JOSÉ CARLOS PINHEIRO PITOMBO
DIVISÃO DE SERVIÇOS CARTORIAIS

Page: 1 Document Name: untitled

Sol: 1004145 Registro: 14/02/01 - 11:06 h GRP-GP36

!Nome: JACINTHO
!Emitente: UN-RIO/ATP-RO/OP-P36 P47
!Tipo Servico: 2401 - SOP/OM - SERVICO ONSHORE
!Data Requerida Inicio: 16 / 02 / 01
!Data Previsao Inicio: / /
!Data Conclusao: 16 / 05 / 01

Ramal: 8616805

Prioridade: B
Fim: 28 / 02 / 01
Fim: / /
Assunto: Manutencao

Manut: B Perda => Oleo(m3/d): Gas(m3/d): SOT Assoc.:

Bomba do tanque de drenagem V-533604-A boreste

---------- Status: DEV ----------

ENTER ==> Continuar PF03 ==> Retornar

Date: 22/05/ 1 Time: 09:57:32

Page: 1 Document Name: untitled

Codigo da SOT: 01004145 Status: DEV Executante: SOP/OM / ATREX
CAC: D3272-4 CAD: D9038-3 CNE: TAC
Fabricante: Modelo: Doc - Tipo: duto Numero: 121024912
WI: 36.Z K.036 Loc.Equipamento: A/MOTOR Planejador: 9
Ativ.: GMAN Plat.: P-36 Sonda: BRANCO Ot: G1132 Uo/Ui: A12124
Sintomas: Problemas mecanicos

FMKE	P-36	14.02.2001	11:11	Bomba essencial para sistema de seguranca de drenagem de emergencia da plataforma.
FMG2	GRP-G	22.02.2001	08:52	ALTERADO PARA:SEG
DMT3	ATREX	22.02.2001	09:44	AG. TRIAGEM PB.
DMT3	ATREX	23.02.2001	16:02	MATERIAL RECEBIDO EM 23/02/2001. OBS: RECEBEMOS BOMBA, FAB.SHANLEY PUMP; MOD.SHP 11502; NS.31688/3; TAG.B-533604A, C/ ACOPLAMENTO. SEGUE AVULSO CX.DE TRANSMIS SAO C/ ACOPLAMENTO.
JMJP	PGOFI	23.02.2001	16:50	AG.PLANEJ.GG.
JMJP	PGOFI	01.03.2001	13:57	LIBERADA PARA EXECUCAO.

Enter ==> Continua PF7 ==> Inicio PF8 ==> Avanco PF3 ==> Retorna

Date: 22/05/ 1 Time: 09:57:43

Page: 1 Document Name: untitled

```
!Codigo da SOT: 01004145   Status: DEV   Executante:   SOP/OM / ATREX
!CAC: D3272-4   CAD: D9038-3   CNE:                    TAG
!Fabricante:       Modelo:       Doc - Tipo: dutc  Numero: 121024912
!WI: 36.Z   K.036  Loc.Equipamento: A/MOTOR          Planejador: 9
!Ativ.: GMAN   Plat.: P-36       Sonda: BRANCO     Ot: G1132   Uo/Ul: A12124
!Sintomas: Problemas mecanicos
!
!-------------------------------------------------------------------------
! KMQ0  PQS    05.03.2001  09:12  recebido para execucao. Att. Ailton r. 1283
!                                  7.
! LMOT  PQS    07.05.2001  14:46  ESTAMOS DEVOLVENDO A SOT PARA DEFINIÇÃO DO
!                                  CLIENTE (NILTON) QUANTO A EXECUCAO OU NAO D
!                                  O REPARO.
! JMJP  PGOFI  07.05.2001  15:34  AG.PLANEJ.C.
! LMP2  PGOFI  11.05.2001  13:41  Solicitamos ao Niltom r.13211 um correio in
!                                  formando as razões para suspender contrata
!                                  ção dos serviços referente a P-36 desde o
!                                  dia 07/05 para devolvermos as sot,s.
! JMJP  PGOFI  14.05.2001  08:56  DEVOLVER P/CLIENTE CONF.ANDAMENTO EFETIVADO
!
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Enter ==> Continua PF7 ==> Inicio PF8 ==> Avanco PF3 ==> Retorna

Page: 1 Document Name: untitled

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!Codigo da SOT: 01004145   Status: DEV   Executante:   SOP/OM / ATREX
!CAC: D3272-4   CAD: D9038-3   CNE:                    TAG
 Fabricante:       Modelo:       Doc - Tipo: dutc  Numero: 121024912
!WI: 36.Z   K.036  Loc.Equipamento: A/MOTOR          Planejador: 9
!Ativ.: GMAN   Plat.: P-36       Sonda: BRANCO     Ot: G1132   Uo/Ul: A12124
!Sintomas: Problemas mecanicos
!
!-------------------------------------------------------------------------
!                                  EM 07/05/2001.SOLICITADO POR NILTON R-13211
! RMVI  ATREX  14.05.2001  10:16  AG. EXPEDICAO F-1
! DMT3  ATREX  16.05.2001  08:00  CONFORME SOLICITACAO DE EDUARDO ENTREGAR
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Page: 1 Document Name: untitled

```
!Codigo da SOT: 01004145    Status: DEV    Executante:   SOP/OM / ATREX
!CAC: D3272-4    CAD: D9038-3    CNE:                    TAC
!Fabricante:          Modelo:          Doc - Tipo: dutc  Numero: 121024912
!WI: 36.Z    K.036  Loc.Equipamento: A/MOTOR             Planejador: 9
!Ativ.: GMAN    Plat.: P-36          Sonda: BRANCO        Ot: G1132   Uo/Ui: A12124
!Sintomas: Problemas mecanicos
!
!-------------------------------------------------------------------------------
!                                                EM 07/05/2001.SOLICITADO POR NILTON R-13211
!
! EMVI  ATREX  14.05.2001  10:16  AG. EXPEDICAO F-1
! DMT3  ATREX  16.05.2001  08:00  CONFORME SOLICITACAO DE EDUARDO ENTREGAR
!                                 MATERIAL NO GALPAO DE MARLIN-BOX P-36.
!                                 MATERIAL ENVIADO P/ DUTC:121076307.
!                                 DE 15/05/01. QUITAR SOT.
!
! EMG2  GRP-G  16.05.2001  08:11  SOT DEVOLVIDA PARA ATREX A PEDIDO DA EUNICE
! DMT3  ATREX  16.05.2001  08:18  FAVOR DESCONSIDERAR ANDAMENTO ACIMA.
!                                 MATERIAL ENVIADO P/ GEMAT AL-10 (BOX-P36)
!                                 P/ DUTC:121076247.
!
!
!
!-------------------------------------------------------------------------------
 ** FIM DOS DADOS **
Enter ==> Continua      PF7 ==> Inicio      PF8 ==> Avanco      PF3 ==> Retorna
```

				MATERIAL ENVIADO P/ DUTC:121076307.
				DE 15/05/01. QUITAR SOT.
EMG2	GRP-G	16.05.2001	08:11	SOT DEVOLVIDA PARA ATREX A PEDIDO DA EUNICE
DMT3	ATREX	16.05.2001	08:18	FAVOR DESCONSIDERAR ANDAMENTO ACIMA.
				MATERIAL ENVIADO P/ GEMAT AL-10 (BOX-P36)
				P/ DUTC:121076247.

** FIM DOS DADOS **
Enter ==> Continua PF7 ==> Inicio PF8 ==> Avanco PF3 ==> Retorna

* Material enviado p/ Gemat AL-10 BOX P36

Date: 22/05/ 1 Time: 09:58:02

BOLETIM de PRODUÇÃO
CAMPO DE RONCADOR P - 36

DATA : 14/03/01

Número: 302

Dados de óleo

Pr o Bruta Medidor		14249
Fator de Correção		0,94
BSW de Transferência %		0,3
Produção de Água		40
Produção Líquida Óleo		13354
Pressão dos Oleodutos (bar g)	A	43
	B	43
	C	0
Silicone Separadores A / B		148 148
Silicone Separador de teste		0

Movimentação de Gás (Mm3/dia)

Gás Produzido	1632	Perda total	116
Gás Exportado A.P.	1337	Queima operacional	3
Gas Combust. P-47	0	Queima aguard. obra	112
Gás Lift	470	Queima aguard. Proj.	0
Gás Importado	0		
Consumo de gás	85		
Gás do Surge	112	Gás separado	
Condensado	95	Separador A	713
P.Gasoduto PNA-1	133	Separador B	1276
P.Gasoduto P-47	0	Sep. Teste	0

Compressores

	TC-A	TC-B	TC-C	MC
Horimetro	3068	2501	89	0
Partidas	131	132	15	0
Operando	8	16	0	0
Recirc.	0	0	0	0
Parado	16	8	24	0

Dados do Processo

	Trem A	Trem B	Consumo
Temp. Separação (°C)	62	61	de Diesel
Pressão Sep. (bar g)	8,4	8,5	62

DADOS dos POÇOS

Poço	PDG - P (bar g)	PDG - T °C	TPT - P (bar g)	TPT - T °C	P. mont. (bar g)	T. mont. °C	P.revest (bar g)	Horas Prod	Rateio (m^3/d)	Pot (m^3/d)	BSWmédio (%)
RO-08	223,6	69,0	124,5	59,8	15,6	15,1	166,9	24	2025	2051	1,90
RO-09	204,0	69,5	100,2	54,2	17,0	12,6	149,1	24	1568	1588	0,00
RO-12	254,3	69,1	136,6	#N/A	15,9	21,8	155,8	24	2698	2731	0,00
RO-14	0,0	0,0	136,7	58,2	17,0	21,4	165,7	24	2814	2850	0,00
RO	203,4	68,2	84,9	#N/A	15,3	12,7	122,4	24	1724	1746	0,00
	221,5	67,0	93,8	60,8	12,5	26,3	#N/A	24	2527	2560	0,60

TESTES dos POÇOS

Poço	Q. Óleo (m3/d)	RGLi (m^3/m^3)	RGOf (m^3/m^3)	BSW (%)	Data Último Teste
RO-08	1892	15	104	0,8	09/03/01
RO-09	1579	66	110	0	10/03/01
RO-12	2611	40	96	0	05/03/01
RO-14	2884	37	117	0	11/03/01
RO	1667	62	109	0	09/03/01
	2555	0	108	0	03/03/01

.encial: 13.528 m3/d | Perda 172 | Rateio 13354 m3/d | Total TP 13188 m3/d | Eficiência Operac. 98,7%

Poços	Perda	Descrição suscinta:	Início	Término	Motivo	Sistema	Componente	Causa	Providencia	Responsavel
Todos	172	Poços produzindo abaixo do potencial.	17:00	17:00	FU	SS	SC	NI	OP AOA	P-36

Observações

01) TC-A :Stand by TC-B : Em operação. TC-C : ABS não liberou operação da maquina devido falta de sensores de gás no hood. Sendo providenciado pela Pignone

02) **Queima de gás LP**: Devido falta do Compressor Booster. Previsão de partida do MC até meados de março.

03) **Balanço de gás**: Medição de exportação operacional, EM TESTE

04) **Unidade de Glicol** :Em operação. Teor de umidade = 1,0 lb/MMscf

05) **SAS**: Estamos sem comunicação do SAS com a Bailey. Aguardando protocolo de comunicação que o CENPES ficou de nos fornecer.

06) **RO-19**: Condição de alinhamento na ANM através da CO (travada aberta, sem controle pela plataforma), W2, PXO, conforme solicitação do GP-36, até que se resolva o problema de vazamento pela W1 (quando na condição aberta). Solicitadas inspeções periodicas para atestar ausência de vazamentos na W1.
Atentar para o aumento constante do BSW no RO-19.

07) **Potencial:** Alterado o potencial dos poços RO-14 e RO-19, faltando os demais em função dos novos testes de produção realizados.

08) **Vent atmosferico**: Estamos tendo pressurização no sistema de vent da plataforma. Provável causa é o entupimento do abafador de chamas. Estamos especificando-o para compra. Será necessário parada de produção para substituição do mesmo, visto estar bem proximo dos queimadores de gás na torre de flare.

COPLAT: Viana SUPROD: Tião SOS: Amazon River

BOLETIM de PRODUÇÃO
CAMPO DE RONCADOR P - 36

DATA : 13/03/01

Número: 301

Dados de óleo

Produ ruta Medidor		14291
Fator de Correção		0,94
BSW de Transferência %		0,26
Produção de Água		34
Produção Líquida Óleo		13400
Pressão dos Oleodutos (bar g)	A	44
	B	44
	C	0
Silicone Separadores A / B		120 / 120
Silicone Separador de teste		0

Movimentação de Gás (Mm3/dia)

Gás Produzido	1662	Perda total	115
Gás Exportado A.P.	1389	Queima operacional	2
Gas Combust. P-47	0	Queima aguard. obra	112
Gás Lift	469	Queima aguard. Proj.	0
Gás Importado	0		
Consumo de gás	62		
Gás do Surge	112	Gás separado	
Condensado	96	Separador A	732
P.Gasoduto PNA-1	135	Separador B	1286
P.Gasoduto P-47	0	Sep. Teste	0

Compressores

	TC-A	TC-B	TC-C	MC
Horímetro	3040	2485	89	0
Partidas	130	131	15	0
Operando	0	24	0	0
Recirc.	0	0	0	0
Parado	24	0	24	0

Dados do Processo

	Trem A	Trem B	Consumo
Temp. Separação (°C)	64	63	de Diesel
Pressão Sep. (bar g)	8,4	8,5	52

DADOS dos POÇOS

Poço	PDG - P (bar g)	PDG - T °C	TPT - P (bar g)	TPT - T °C	P. mont. (bar g)	T. mont. °C	P.revest (bar g)	Horas Prod	Rateio (m^3/d)	Pot (m^3/d)	BSWmédio (%)
RO-08	223,8	69,0	124,7	59,8	15,5	15,0	166,8	24	2032	2051	1,00
RO-09	203,6	69,5	100,5	53,9	16,8	12,5	154,9	24	1573	1588	0,00
RO-12	254,6	69,1	136,3	#N/A	15,8	22,1	154,7	24	2705	2731	0,00
RO-14	0,0	0,0	136,8	56,2	17,0	21,3	168,3	24	2823	2850	0,00
RO-15	203,4	68,2	85,0	#N/A	15,3	12,8	123,2	24	1730	1746	0,00
9	222,2	67,1	84,0	60,8	12,5	26,4	#N/A	24	2538	2560	0,45

TESTES dos POÇOS

Poço	Q. Óleo (m3/d)	RGLi (m^3/m^3)	RGOf (m^3/m^3)	BSW (%)	Data Último Teste
RO-08	1892	15	104	0,8	09/03/01
RO-09	1579	66	110	0	10/03/01
RO-12	2811	40	98	0	05/03/01
RO-14	2884	37	117	0	11/03/01
RO-15	1687	62	109	0	09/03/01
9	2555	0	108	0	03/03/01

ncial: 13.526 m3/d | Perda 126 | Rateio 13400 m3/d | Total TP 1 m3/d | Eficiência Operac. 99,1%

Poços	Perda	Descrição suscinta:	Início	Término	Motivo	Sistema	Componente	Causa	Providencia	Responsavel
Todos	126	Poços produzindo abaixo do potencial.	17:00	17:00	FU	SS	SC	NI	OP AOA	P-36

Observações

01) TC-A :Stand by TC-B : Em operação. TC-C : ABS não liberou operação da maquina devido falta de sensores de gás no hood. Sendo providenciado pela Pignone

02) **Queima de gás LP**: Devido falta do **Compressor Booster**. Previsão de partida do MC até meados de março.

03) **Balanço de gás**: Medição de exportação operacional, EM TESTE

04) **Unidade de Glicol** :Em operação. Teor de umidade = 3,0 lb/MMscf

05) **SAS**: Estamos sem comunicação do SAS com a Bailey. Aguardando protocolo de comunicação que o CENPES ficou de nos fornecer.

06) **RO-19**: Condição de alinhamento na ANM através da CO (travada aberta, sem controle pela plataforma), W2, PXO, conforme solicitação do GP-36, até que se resolva o problema de vazamento pela W1 (quando na condição aberta). Solicitadas inspeções periodicas para atestar ausência de vazamentos na W1.
Atentar para o aumento constante do BSW no RO-19.

07) **Potencial:** Alterado o potencial dos poços RO-14 e RO-19, faltando os demais em função dos novos testes de produção realizados.

08) **Vent atmosferico**: Estamos tendo pressurização no sistema de vent da plataforma. Provável causa é o entupimento do abafador de chamas. Estamos especificando-o para compra. Será necessário parada de produção para substituição do mesmo, visto estar bem proximo dos queimadores de gás na torre de flare.

COPLAT: Galvão SUPROD: Tião SOS: Amazon Rivers IAL

BOLETIM de PRODUÇÃO
CAMPO DE RONCADOR P - 36

DATA : 12/03/01
Número: 300

Dados de óleo

Produ ruta Medidor		14310	
Fator de Correção		0,94	
BSW de Transferência %		0,1	
Produção de Água		13	
Produção Líquida Óleo		13438	
Pressão dos Oleodutos (bar g)	A	41	
	B	41	
	C	0	
Silicone Separadores A / B		120	120
Silicone Separador de teste		0	

Movimentação de Gás (Mm3/dia)

Gás Produzido	1654	Perda total	137
Gás Exportado A.P.	1316	Queima operacional	24
Gas Combust. P-47	0	Queima aguard. obra	113
Gás Lift	487	Queima aguard. Proj.	0
Gás Importado	0		
Consumo de gás	107	Consumo de diesel	63
Gás do Surge	113	Gás separado	
Condensado	94	Separador A	730
P.Gasoduto PNA-1	136	Separador B	1278
P.Gasoduto P-47	0	Sep. Teste	0

Compressores

	TC-A	TC-B	TC-C	MC
Horímetro	3040	2461	89	0
Partidas	130	131	16	0
Operando	24	24	0	0
Recirc.	0	0	0	0
Parado	0	0	0	0

Dados do Processo

	Trem A	Trem B
Temp. Separação (°C)	64	63
Pressão Sep. (bar g)	8,4	8,5

DADOS dos POÇOS

Poço	PDG - P (bar g)	PDG - T °C	TPT - P (bar g)	TPT - T °C	P. mont. (bar g)	T. mont. °C	P.revest (bar g)	Horas Prod	Rateio (m^3/d)	Pot (m^3/d)	Q. Óleo (m3/d)
RO-08	223,9	69,0	124,8	59,8	15,8	15,0	166,7	24	1991	2051	1892
RO-09	203,8	69,5	101,2	53,8	18,5	12,5	156,1	24	1542	1588	1579
RO-12	254,7	69,6	136,2	#N/A	15,7	22,2	153,9	24	2652	2731	2611
RO-14	#N/A	#N/A	136,9	56,2	17,0	21,3	166,3	24	2947	3035	2884
RO-16	203,6	68,2	85,0	#N/A	15,3	12,8	122,9	24	1695	1746	1667
,9	223,3	67,1	94,3	60,9	12,5	26,4	#N/A	24	2812	2890	2555

TESTES dos POÇOS

Poço	P.mont (bar g)	RGLi (m^3/m^3)	RGOf (m^3/m^3)	BSW (%)	Último Teste
RO-08	16,6	15	104	0,8	09/03/01
RO-09	16,7	68	110	0	10/03/01
RO-12	18,1	40	98	0	05/03/01
RO-14	15,8	37	117	0	11/03/01
RO-16	16,2	62	109	0	09/03/01
	14,85	0	108	0	03/03/01

ıncial: 13.841 m3/d | Perda 403 | Rateio 13438 m3/d | Total TP 13188 m3/d | Eficiência Operac. 97,1%

Poços	Perda	Descrição suscinta:	Início	Término	Motivo	Sistema	Componente	Causa	Providencia	Responsavel
Todos	403	Poços produzindo abaixo do potencial.	17:00	17:00	FU	SS	SC	NI	OP AOA	P-36

Observações

01) **TC-A** : em operação. **TC-B** : stand by. TC-C : ABS não liberou operação da maquina devido falta de sensores de gás no hood. Sendo providenciado pela Pignone
02) **Queima de gás I.P**: Devido falta do **Compressor Booster**. Previsão de partida do MC até meados de março.
03) **Balanço de gás**: Medição de exportação operacional, EM TESTE
04) **Unidade de Glicol** :Em operação. Teor de umidade = 2,5 lb/MMscf
05) **SAS**: Estamos sem comunicação do SAS com a Bailey. Aguardando protocolo de comunicação que o CENPES ficou de nos fornecer.
06) **Análise de BSW** : RO-08=1,0%. RO-09/12/14/16= Zero. RO-19=0,5% ,DUTO= 0,1%
07) **RO-19**: Condição de alinhamento na ANM através da CO (travada aberta, sem controle pela plataforma), W2, PXO, conforme solicitação do GP-36, até que se resolva o problema de vazamento pela W1 (quando na condição aberta). Solicitadas Inspeções periodicas para atestar ausência de vazamentos na W1.
Atentar para o aumento constante do BSW no RO-19.
08) **Potencial:** Necessário alterar o potencial em função dos novos testes de produção realizados.
09) **Vent atmosferico**: Estamos tendo pressurização no sistema de vent da plataforma. Provavel causa é o entupimento do abafador de chamas. Estamos especificando-o para compra. Será necessário parada de produção para substituição do mesmo, visto estar bem proximo dos queimadores de gás na torre de flare.

COPLAT: Galvão SUPROD: Tião SOS: Amazon River

OPERATING MANUAL

14.0 Closed Drains

Contents

14.1 System Overview

Process drainage on the Spirit of Columbus is provided by three separate systems, closed drains, hazardous open drains, and non-hazardous open drains, designed to provide segregation of pressurised and atmospheric hazardous fluids and non-hazardous fluids.

The closed drains system is used for draining pressurised process systems during normal operation and for maintenance. The system consists of three sub-systems:

- the normal closed drains
- the oil storage
- the tank top sump

The drained liquid and any flash vapour generated by the reduction in pressure is collected by the closed drains piping system which feeds the Closed Drains Drum, V-45002, on the tank top aft extension. The flash vapour vents to the LP Flare system. The liquid separated in the drum is pumped by the Closed Drains Pumps, B-533603A/B, to the oil separation trains, upstream of the Oil/Produced Water Exchangers. If the pumps fail, the liquid is drained to the Port and Starboard Drains Storage Tanks, V-533604A/B.

Maintenance drainage of large process equipment, e.g. Atmospheric Separators, which require a greater holding capacity than that available in the Closed Drains Drum is directed to the Drains Storage Tanks, V-533604A/B. The structural tanks are located in the port-aft and starboard-aft columns. The tanks vent to the Atmospheric Vent. The liquid is pumped by the Port and Starboard Drains Storage Pumps, B-533604A/B, to the oil separation trains, upstream of the Oil/Produced Water Exchangers.

Closed drains from equipment on the tank top which are too low to flow into the Closed Drains Drum are routed to the Tank Top Deck Sump, V-533605, located between structural beams in the tank top deck. The tank is fitted with a local atmospheric vent. The liquids drained into the sump are normally crude oil with little flash vapour. Liquid from the tank is pumped by The Tank Top Deck Sump Pump, B-533605, to the closed drains header.

14.2 System Description

The closed drains system is used for draining pressurised process systems during normal operation and for maintenance. Some equipment continuously discharge fluids into the system under level control. The system consists of three separate sub-systems. The normal closed drains system, which handles most of the process equipment drains, the oil storage system, which is used to hold large volumes of oil, and the tank top deck sump system, which is used for equipment too low for the normal closed drain system.

Normal Closed Drains System

Liquids from equipment are drained to the closed drains system continuously under level control or intermittently by hand control for start-up or maintenance.

The liquid drained and any flash vapour generated by the reduction in pressure is collected by the closed piping system which feeds the Closed Drains Drum, V-45001, on the tank top. The continuous feed from the oil production hydrocyclones which contains oil with produced water is routed separately to near the drum inlet in plastic pipe (FRP).

The Closed Drains Drum is a horizontal vessel designed for 10 barg, -20/85°C. The flash vapour from the drum vents to the LP Flare header.

The liquids separated in the drum are pumped by the Closed Drains Pumps, B-533603A/B under on-off level control on the drum, to the production separation trains, at the inlet to the Oil/Produced Water Heat Exchangers. The Closed Drains Pumps have a capacity of 20 m³/h with a differential of 16 bars.

When the inflow to the drum exceeds the capacity of one pump, the second pump starts, and if the pumps fail to start, the dump valve XV53360102 opens and liquids are discharged under on-off level control to the Drains Storage Tanks, V-533604A/B.

Oil Storage System

The oil storage system is used to collect liquids drained for maintenance or an emergency from equipment with a capacity too large for the Closed Drains Drum.

The Atmospheric Separators can be drained directly to the storage system with XV53360022 at the Crude Oil Booster Pumps suction manifold. The other production separation vessels can be drained to the system via the Produced Water Degasser. The Closed Drains Drum discharges to the system under level control if its pumps fail. Liquids from the HP and LP Flare Drum Pumps, Matrix Separator Oil Pump, and Closed Drains Pumps which normally go to the inlet of the production trains can also be directed to the system for a limited period if a problem occurs in the oil separation trains.

The oil storage system collects liquids in a header which runs down to the bottom of the Port and Starboard Drains Storage Tanks, V-533604A/B. The structural tanks are located in the port-aft and starboard-aft columns, have a capacity of 450 m³ each, and vent to the Atmospheric Vent. The tanks are purge by a small flow of nitrogen

through a dip pipe which also gives an indication of level.

The tanks are provided with the Port and Starboard Drains Storage Pumps, B-533604A/B, which transfer the liquid back to the oil separation trains upstream of the Oil/Produced Water Exchangers trains or to the

Production Caisson. The vertical screw type pumps have a capacity of 60 m³/h and a differential of 19 bar.

Tank Top Deck Sump System

Closed drains from equipment on the tank top which are too low to flow into the Closed Drains Drum are routed to the Tank Top Deck Sump, V-533605, located between structural beams supporting the tank top aft deck extension. The atmospheric sump has a capacity of 16 m³.

Manual drains from the oil export pig launchers, oil export pumps and fuel gas filters are piped to the sump. The sump is also used to collect hazardous open drains from skids for the oil export pig launchers, oil export pumps, drains drums, and fuel gas treatment. The open drains and the closed drains systems are segregated by discharging into the vessel via separate dip pipes to provide a liquid seal. The sump is purge by a small flow of nitrogen through a dip pipe which also gives an indication of level. The Tank Top Deck Sump is fitted with a blow-off cover and a local atmospheric vent with a flame arrestor .

The liquid drained into the sump is normally crude oil with little flash vapour. Liquid from the sump is pumped by the Tank Top Deck Sump Pump, B-533605, to the closed drains header. The horizontal screw pump has a capacity of 5 m³/h with a differential of 1 bar.

The system collects drains from the equipment in Table 1 below:

Table 1

Equipment Tag No	Description (P&ID)
Closed Drains System	
LP-121002A-F,N,P-Y	Paraffin Removal Pig Launchers (-138)
LP-121003	Subsea Lift Gas Manifold Pig Launcher (-124)
RP-121001A/B	Paraffin Removal Pig Receivers (-135/136)
RP-121001A/B	Pig Receiver Barred-Ts (-135/136)
LP-122302	Gas Export Pig Launcher (-273)
LP-513501	Fuel Gas Export Pig Launcher (-318)
UQ-121001-01	Production and Test Manifolds (-142)
P-122300A/B	Oil/Produced Water Exchangers (-151/161)
P-122302A/B	Production Heaters (-152/162)
SG-122301A/B	Production Separators (-153/163)
TO-122301A/B	Oil Electrostatic Dehydrators (-154/164)
SG-122303A/B	Atmospheric Separators (-155/165)
P-122303	Test Heater (-171)
SG-122302	Test Separator (-172)
B-122303A/B	Test Separator Crude Pump (-173)
CI-533601 A/B	Production Separator Hydrocyclones (-322/323) *
CI-533603 A/B	Oil Dehydrator Hydrocyclones (-325/326) *
CI-533602	Test Separator Hydrocyclone (-324)
CI-533602	Test Separator Hydrocyclone recovered oil (-324)
V-533601	Produced Water Degasser (-327)
V-533601	Produced Water Degasser condensate (-327) *
V-43001	HP Flare Drum (-402)
V-541202	LP Flare Drum (-404)
T-123301A/B	TEG Contactors (-262/263)
V-123301	Glycol Flash Tank condensate (-303) *
V-UC-122301A/B/C-01	1st Stage Suction KO Drums (-211/231/251)
V-UC-122301A/B/C-02	2nd Stage Suction KO Drums (-213/233/253)
V-UC-122301A/B/C-03	3rd Stage Suction KO Drums (-215/235/255)
UQ-122304/6/8	Compressors Casings (-218/238/258)
V-30001	Gas Booster Suction KO Drum (-202) *
E-30001	Gas Booster Interstage Cooler (-204)
V-30002	Gas Booster Interstage KO Drum (-205)
E-30002	Gas Booster Outlet Cooler (-207)
K-30002A/B	Gas Booster Compressors Casings (-208)
V-122301	Safety Gas KO Drum (-209) *
B-533606A/B	Production Caisson Skim Oil Pumps (-397) *
-	Riser ESDVs (-121/141)
B-533605	Tank Top Deck Sump Pump (-393)

Equipment Tag No	Description (P&ID)
Oil Storage System	
SG-122303A/B	Atmospheric Separators (-181)
V-533601	Produced Water Degasser (-327/397)
V-45002	Closed Drains Drum (-392)
-	Flare Drums and Drains recycle manifold (-402)
Tank Top Drains	
LP-122301A/B/C	Crude Export Pig Launchers (-183/184/185)
B-122302A/B/C	Crude Oil Pipeline Pumps (-182)
UQ-122312-02	Crude Oil Pipeline Pumps Manifold (-182)
B-122301A/B/C	Crude Oil Booster Pumps (-181)
V-513501	Fuel Gas KO Drum drain (-313)
FT-513501A/B	Fuel Gas Filters drain (-314)

* Items discharge into the closed drains system under normal operation

14.3 Equipment Summary

Closed Drains Drum, V-45002

Size	2135mm ID x 3150mm T/T
DP/ DT	10 barg/ 85/-20°C

Closed Drains Pump, B-533603A/B

Capacity	20 m³/h
Head	16 bar
Manufacturer	Flowtronex Int.
Type	Screw
Motor Rating/Speed	21.3 kW / 1750 rpm
Manufacturer	Siemens

Port and Starboard Drains Storage Tank, V-533604A/B

Size	10670mm high structural tank
DP/ DT	Atmos. / Amb.

Port and Starboard Drains Storage Pump, B-533604A/B

Capacity	60 m³/h
Head	18.1 bar
Manufacturer	Flowtronex
Type	Vertical Screw
Motor Rating/Speed	53 kW / 1750 rpm
Manufacturer	Siemens

Tank Top Deck Sump, V-533605

Size	1180mm x 8806mm x 2600mm high structural tank
Capacity	16 m³
DP/ DT	Atmos. / Amb.

Tank Top Deck Sump Pump, B-533605 (was P-45001A)

Capacity	5 m³/h
Head	1 bar
Manufacturer	Mono Merlin.
Type	Screw
Motor Rating/Speed	0.75 kW / 1750 rpm
Manufacturer	Brook-Crompton

14.4 Relief Valve Schedule

Tag No.	P&ID No.	Equip't./ Pkg No.	Service Description	Set Press.
PSV 5336 0014	398	B-533604A	Port Drains Storage Pump	19.0
PSV 5336 0024	398	B-533604B	Starboard Drains Storage Pump	19.0
PSV 5336 0033	393	B-533605	Tank Top Deck Sump Pump (was P45001A)	4.5
PSV 5336 0103	392	B-533603A	Closed Drains Pump	17.0
PSV 5336 0113	392	B-533603B	Closed Drains Pump	17.0
PSV 6825 1122	421.01	B-UQ-682503-01B	Gas Hydrate Inhibitor Pump	293.0

14.5 Alarm & Trip Schedule

Below are the normal operating, alarm and trip set points of the Closed Drains system.

Tag No.	Description	System	Units	Control Set Point	Alarm		Trip	
					Lo	Hi	Lo	Hi
Drains								
LI53360104	Closed Drains Drum Level	ECOS	% / mm	Pump on 600 / off 300	5	95	-	-
LSH53360102	Closed Drains Drum Level	ECOS	mm	-	-		-	1070
LSHH45511	Closed Drains Drum Level	ESD	mm	-	-	-	-	1500
LSLL45514	Closed Drains Drum Level	ESD	mm	-	-	-	200	-
PSL53360007	Closed Drains Pumps Discharge Pressure	ECOS	barg	-	14	-	-	-
LI53360013	Port Drains Storage Tank 'A' Level	ECOS	mm	-	2.5			
LSH65001A	Port Drains Storage Tank 'A' Level	ECOS	mm	-	-	10388	-	-
LSLL65001B	Port Drains Storage Tank 'A' Level	ESD	mm	-	-	-	200 *	-
LI53360023	St bd Drains Storage Tank 'B' Level	ECOS	mm	-	2.5	-	-	-
LSH65002A	St bd Drains Storage Tank 'B' Level	ECOS	mm	-	-	10388	-	-
LSLL65002B	St bd Drains Storage Tank 'B' Level	ESD	mm	-	-	-	200 *	-
LI53360031	Tank Top Deck Sump Level	ECOS	mm	Pump on 750 / off 300	20	80	-	-
LSLL53360032	Tank Top Deck Sump Level	ESD	mm	-	-	-	200	-
PSHH53360031	Tank Top Deck Sump Pump Press.	ESD	barg	-	-	-	-	4

14.6 Reference Documents

Closed Drains System UFD / P&ID List

Equipment	P&ID/UFD
Drainage System Utility Flow Diagram	033
Closed Drains Collection	391
Closed Drains Drum	392
Tank Top Deck Sump	393
Drains Storage Tanks	398

Supplementary Documentation (not included as part of Operating Manual)

Basis of Design : ET-3010.38-1200-941-AMK-921
Drains System Design Philosophy : ET-3010.38-5336-941-AMK-906
Instrument ESD Cause and Effect Chart : DE-3010.38-5400-840-AMK-621 to 643
Electrical One Line Diagrams : DE-3010.38-946-AMK-001-01
Operations Manual : DE-3010.38-1320-915-NDB-909

14.7 Operating Procedures

Systems Required For Start-Up

The following systems must be in operation and available before Start-Up of the closed drains system can begin:

System Description
Open Drains
Instrument Air
Nitrogen Generation
Main power
Firewater and F&G System
Control and ESD System

Start-Up Assumptions

It is assumed that the closed drains system has been purged with nitrogen and is liquid free.

The following procedures assume that the system is mechanically complete, tested, pre-commissioned, purged with nitrogen and with all main isolation, vent and drain valves closed and instrument isolation valves open. The position of spades, spectacle blinds and valve locks should be as shown on the P&IDs.

14.7.1 Initial Start-Up

As part of the purging of the plant the system is left full of nitrogen with the Closed Drains Drum venting to the LP Flare header and the nitrogen purge gas flow established to the Port and Starboard Drains Storage Tanks and the Tank Top Deck Sump. Unless the vessel have been left with sufficient liquid inside, the low level alarms and trips will be activated.

As the low level trips only prevent the pumps from running, the system can be started by waiting for normal levels to be established during normal operation before resetting the low level ESD trips. Alternativelly, a level is established manually at the beginning and the pumps prepared so that the pumps will start automatically when the level increases in the vessels. The second method is used in this procedure.

Establish Liquid Levels

Fresh water is used to fill the Closed Drains Drum, Drains Storage Tanks and the Tank Top Deck Sump just above the LSLL trip level.

Connect a hose to the fresh water or potable water supply and discharge the water into the drains treatment skid floor drain which drains into the Tank Top Deck Sump.

Monitor the level in the Sump and when the level rises above the trip setting reset ESD for LSLL53360032.

Check that the Tank Top Deck Sump Pump discharge valve V-523 is open and then start the pump locally with HS53360010A to start filling the Closed Drains Drum.

Check that the level in the sump is maintained by LT53360031 on ECOS stopping and starting the pump while continuing to discharge water to the skid floor drain.

Monitor the level rising in the Closed Drains Drum and when the level rises above the trip setting reset ESD for LSLL45514.

Check that the Port Drains Storage Tank A liquid inlet valve V-534 is open and V-535 on the B tank is closed. Open XV53360004 in the line to the storage tanks. Maintain the level in the Closed Drains Drum just above the low level trip by opening the bypass on XV53360102 to direct water to the Port Drains Storage Tank.

Monitor the level rising in the Port Drains Storage Tank and when the level rises above the trip setting reset ESD for LSLL65001B.

Open V-535 on the Starboard Drains Storage Tank and close V-534 on the A tank. Monitor the level rising in the Starboard Drains Storage Tank and when the level rises above the trip setting reset ESD for LSLL65002B.

Close the bypass on XV53360102. Close XV53360004 in the line to the storage tanks. Open V-534 and lock open V-534 and 535 on the Drains Storage Tanks.

Stop discharging water to the drains treatment skid floor drain.

The Closed Drains Pumps and the Drains Storage Pumps are now prepared for start. The Tank Top Deck Sump Pump is already operational.

Prepare Closed Drains Pumps for Start-Up

With the liquid level above the minimum in the Closed Drains Drum, fill the Closed Drains Pumps as follows.

Check that the pumps suction and discharge valves V-473,474,476,477 and 479 are open.

Check that the valves V-493, and 494 in the line to the production trains are open (P&ID 402).

Force the pumps suction XV53360101 open by putting instrument air onto the actuator. Vent any trapped gas in the suction line with the drain valves V-475 and 478. Close XV53360101 by reinstating its normal air supply.

Check that a production separation train is available to receive liquids from the Closed Drains Pumps and the isolation valves SDV12230111, 12230211 and V-089A/B are open. Select one of the Closed Drains Pumps for 'Duty' with HS53360105. The pumps are now ready to start under level control.

Prepare Drains Storage Pumps for Start-Up

With the liquid level above the minimum in the Drains Storage Tanks, fill the Drains Storage Pumps as follows.

Open the pumps suction XV65002 and 65004 with PB65002 and 65004. Vent any trapped gas in the suction line with the drain valves. Close XV65002 and 65004 with PB65002 and 65004.

The pumps are ready to start under manual control when required.

General

The closed drains system is now ready to receive liquids from the process or for maintenance.

When oil production starts, the following equipment will start to discharge oily water to the Closed Drains Drum:

- Separators and Dehydrators hydrocyclones oil stream
- Produced Water Degasser separated oil
- Safety Gas KO Drum liquids
- Gas Booster Suction KO Drum liquid

Liquids from the Tank Top Deck Sump will be transferred to the closed drains when the level rises due to drainage of the oil export pig launchers and from open drains on the tank top.

Check that when the level in the Closed Drains Drum rises to the high level, the duty Closed Drains Pump starts automatically on level control and discharges to a production train.

Check that the pump stops on low level.

The Drains Storage Tanks and Pumps are not normally in use and are not operated until a problem occurs with the Closed Drains Pumps or production trains, or oil needs to be drained from the oil separators. The tanks are used to store large volumes of oil in an emergency or for maintenance of the oil handling equipment. The oil is returned to the production trains when normal production resumes by manually starting the Drains Storage Pumps as described in section "Manual Operation" below.

14.7.2 Normal Start-Up

A normal start-up for the closed drains systems can be from a full process plant shutdown (ESD2) or partial shutdown due to a local trip of the pumps in the system.

Pump trips can be caused by a power failure or low level in the suction vessel. In either case, the cause of the trip is corrected and the ESD reset to re-establish automatic operation of the pumps and associated XVs.

Start-Up from ESD2 Shutdown Status

If the shutdown has been initiated by an ESD2 trip, the Closed Drains Pumps, Tank Top Deck Sump Pump, and the Drains Storage Pumps will be tripped and the following valves in the drains system will be closed:

- XV-53360101 Closed Drains Drum liquid outlet to pump
- XV-53360102 Closed Drains Drum outlet to Drains Storage Tanks
- XV-65001,2,3,,4 Drains Storage Pumps isolation

The cause of the shutdown has to be rectified and the ESD reset to allow the system to start.

Check that at least one production train is ready to receive liquids from the drains system with SDV12230111/12230211 at the inlet to the Oil/Produced Water Exchanger open.

Check that the controls for the Closed Drains Pumps are switched to ECOS control with the 'B' pumps selected as the stand-by.

Reset HS53360101, HS53360102, and the MCC for the pumps

Check that the HP and LP Flare Pumps, Drains Storage Tank Pumps, and Matrix Separator Oil Pump are operational or isolated from the common liquid recycle line to the production trains.

The Closed Drains Drum Pumps will start when required by the level control on the drum.

The Tank Top Deck Sump Pump is reinstated by resetting the ESD trip to the MCC for the pump. The pump will start when required by the level control on the tank.

The Drains Storage Pumps are reinstated by resetting the ESD trip to the MCC for the pumps. The pumps are started manually when required.

14.7.3 Normal Operation

The closed drains system requires little supervision under normal operating conditions.
The following checks are required on a regular basis at a frequency which will be dictated by operating experience.

The following checks should be performed at regular intervals:

- Performance of pumps
- Liquid level in the drum is maintained within the normal range
- The pressure in the drum and tanks

The Drains Storage Pumps are provided with suction strainers which require inspection and cleaning periodically.

Check that a small flow of nitrogen is maintained to the Deck Sump and the Drains Storage Tanks for level measurement.

The Closed Drains Drum liquid outlet line is provided with corrosion and microbiological monitoring devices which are inspected periodically.

Control Set Points

Refer to section 14.5 for the normal operating, alarm and trip set points of the Lift Gas system.

14.7.4 Abnormal Conditions

The system is provided with pre-alarms for pressure and level to give early indication of operating faults. If the faults escalate, the ESD trips will be initiated to protect the equipment.

Low Level

LSLL-45514 on the Closed Drains Drum will stop the pumps, B-533603A/B, and close XV53360101 and 53360102 on the drum liquid outlet upon detection of low level in the drum.

LSLL-53360032 on the Tank Top Deck Sump will stop the pump, B-533605, upon detection of low level in the sump.

LSLL-65001B and 65002B on the Drains Storage Tanks will stop the respective pump, B-533604A or B, upon detection of low level in the tank.

High Level

LSHH-45511 on the Closed Drains Drum will initiate an ESD Level 2, and stop the pumps B-533603A/B, and close XV53360101 and 53360102 on the drum liquid outlet upon detection of high level in the drum.

LAH53360102 on the Closed Drains Drum will open XV53360102 if the pumps, B-533603A/B have not started on high level.

High Pressure

PSHH53360031 on the discharge of the Tank Top Deck Sump Pump will stop the pump, B-533605, upon detection of high pressure.

General

A high level in the Tank Top Deck Sump can be caused by a failure of the level controls or pump. This requires inflow to the sump to be stopped by closing the manual drain valves on equipment feeding the sump.

If the oil in a production train has to be drained due to a leak or for maintenance, the oil is transferred to the Drains Storage Tanks. Oil from the Atmospheric Separators is drained by opening XV53360022 at the Crude Oil Booster Pumps suction manifold. The other vessels are drained to the Drains Storage Tanks via their associated hydrocyclones and the Produced Water Degasser by opening XV53360020 and closing XV53360021 in the line to the Production caisson.

If both production trains are shutdown with XV12230111/12230211 closed, liquids collected in the Closed Drains Drum can be pumped to one of the Drains Storage Tanks by opening XV53360004.

14.7.5 Normal Shutdown

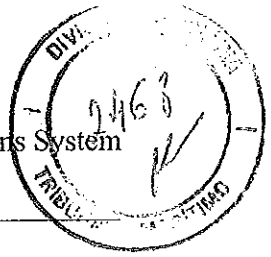
The closed drains system is not normally shutdown with the process as drainage can continue to occur from utilities. The system is only shutdown if the whole platform is shutdown and all liquids prevented from draining into the system. This may be required for major maintenance of the plant.

The pumps in the system will stop automatically on low level in the drains drum and tanks. The Closed Drains Pumps can be prevented from running with the stop hand switches HS53360103B and 53360113B on ECOS.

The Tank Top Deck Sump Pump can be prevented from running with the local stop hand switch HS53360010B.

The Drains Storage Pumps can be prevented from running with their local stop push buttons.

If both production trains are shutdown and XV12230111/12230211 closed, liquids collected in the Closed Drains Drum can be pumped to one of the Drains Storage Tanks by opening XV53360004.



14.7.6 Emergency Shutdown

The closed drains system is not normally shutdown with the process.

A high level in the Closed Drains Drum will initiate an ESD level 2 shutdown.

ESD functions are automatic and covered above under Abnormal Conditions. An ESD level 2 will stop all the drains pumps and close the associated XVs.

For an emergency detected by the operator, the pumps can be stopped with their hand switches on ECOS or local to the pumps. If necessary the system is shutdown by using the ESD2 push-button.

When both production trains are shutdown and XV12230111/12230211 are closed, open XV53360004 to direct liquids pumped from the Closed Drains Drum to one of the Drains Storage Tanks.

14.7.7 Restart from Emergency Shutdown

The status after an emergency shutdown will depend on the trip initiated.

The cause of the trip is rectified and the ESD reset.

The system is restarted as described above under Normal Start-Up.

14.7.8 Preparation for Maintenance

The equipment which can be serviced while the system is in operation are the Closed Drains Pumps and the Drains Storage Pumps which are provided with a standby/spare.
The pump requiring maintenance is switched to standby duty where applicable and electrically isolated at the MCC. The suction and discharge isolation valves are locked closed and the drain valve opened. The pump discharge is depressurised with the vent on the pressure gauge. The suction and discharge piping spools can be remove for access to the pump.

XV53360102 on the Closed Drains Drum can be manually bypassed, isolated and removed for servicing.

14.7.8 Manual Operation

Control Failure

The level in the Closed Drains Drum and Deck Sump can be maintained manually by switching the pump control to local and starting and stopping the pumps with the local push buttons and monitoring the level on the local gauges.

If the Closed Drains Pumps and the XV53360102 have failed to control the level in the Closed Drains Drum, the level can be maintained with the bypass valve on XV53360102 and monitoring the level gauge.

The operation of the Drains Storage Tanks and Pumps is manual. Apart from the Closed Drains Drum high level dump via XV53360102, all filling operations are manual. Liquids normally pumped to the production trains, can be directed to one of the Drains Storage Tanks by opening XV53360004.

Drains Storage Pumps Operation

The Drains Storage Pumps, B-533604A/B, are started manually when required. The oil is pumped to the production trains for reprocessing. The procedure below is for operating B-533604A which is typical for either pump.
Check that a production train is lined up to receive liquids from the drains recycle manifold
Close V-534 and 535 in both tanks inlet line
Open XV53360004 in the line to the drains recycle manifold
Open the pump suction and discharge valves XV65002 and 65001 with PB65002 and 65001
Check the valve status on ECOS with ZLOC65002 and 65001
Start B-533604A with the local start push button
Check the operation of the pump with the discharge pressure gauge PI53360017
Monitor the level in the tank and when the level reaches close to the low level trip, stop the pump with the local stop push button
Close the pump suction and discharge valves XV65002 and 65001 with PB65002 and 65001
Close XV53360004 in the line to the drains recycle manifold
Open V-534 in the tank inlet line

If the liquid in the Drains Storage Tanks, consists of a large volume of produced water, the liquid is pumped directly to the Production Caisson for disposal to sea. For this operation, V-533 is opened instead of XV53360004. The pumped liquid is sampled frequently to prevent the transfer of oil to the caisson.

4.3 PLATFORM SERVICE SYSTEMS

All systems described in this section are designed to operate under the following conditions.

1. Roll 22,50
2. Pitch 22,50
3. Period 12 sec
4. List 15°
5. Trim 15°
6. Ambient temperature inside 0° to +50°C
   outside -20° to +50°C

4.3.1 Ballast System

Ref: DE-3010.38-5334-944-AMK-543 to 546: P&ID Ballast System, and
Fig. 4.3.1: Ballast System Diagram.

40 ballast tanks, inside the pontoons and columns, ensure a proper ballast service for the FPU.

In the fore and aft end of each pontoon two pump rooms are provided connected to each other by a crossover pipeline.

Another crossover pipeline ensures the connection between the aft pump rooms of each pontoon (this line runs through the aft horizontal bracing).

One ballast pump (XA/414 A-D) is arranged in each pump room complete with remote control and monitoring both from ECOS and BMP (Ballast Mimic Panel). Four ECM's (Emergency Control Mimic) ensure the possibility of emergency operations. Double level transmitters arranged on board give remote level indication of each ballast tank.

In order to prevent water hammer damages, an automatic valves sequence is used by ECOS.

Table 4.3.1.1 - Ballast Pumps Main Characteristics

Equipment No.		**XA414 A-D**
Manufacturer		Garbarino
Model		MU 200/500
Capacity	m^3/hr	590
T.M.H.	m	30
Speed	rpm	1750
Electric Motor Power	kW	90

4.3.1.1 Ballast Plant Start

1) The operator chooses and opens the relevant sea chest on duty valves.
2) The operator starts the pump which does not run until pump suction side valve is opened.
3) About 8-10 sec. after starting the pump, the throttling type delivery valve slowly opens.

4.3.1.2 Ballast Plant Stop

1) The operator stops the pump and at the same time, the suction line valve closes.
2) About 8-10 sec. after stopping the pump, the throttling type delivery valve slowly closes.

In each pump room suction and delivery pipes are connected to seawater circulating pipes and relevant seawater pumps (XA/039 A-D) in order to ensure emergency ballast operations by sea water system.

4.3.1.3 Control Mode Philosophy

1) Keyboard

From this position it is possible to operate the valves individually putting the auto-manual software selector in manual position, without any interlock.

2) BMP

From this position the pump starting is interlocked with the suction and delivery valves only. No individual control of the above valves is possible.

3) ECM

No automatic sequence is provided for operations from this PNL.

4.3.1.4 Electrical Supply

Electrical power supply to ballast pumps and to seawater/ballast pumps is shown on diagram of Fig. 4.3.2.

Note that the electrical power supply system is designed to ensure ballast system operation at the following inclinations:

- 22.5° for the main power supply
- 35° for the emergency power supply

4.3.2 Bilge System

Ref: Doc Title: Bilge Piping System
Doc. No: DE-3010.38-5331-944-AMK-540-01 to 07

The bilge system is shown in Fig. 4.3.3: Bilge System Diagram.

Two bilge systems are provided:

- Automatic bilge (automatic operation).
- Rule bilge (manual operation).

Table 4.3.2.1 - Bilge Pumps Main Characteristics

Equipment No.		XA411 A-H	XA412 A-D	XAI49A-B
Manufacturer		Garbarino	Garbarino	Garbarino
Model		MU40/250LMP	MU80/315	
Capacity	m^3/hr	27,6	90	4,97
T.M.H.	m	30	35	40
Speed	rpm	1750	1750	1750
Electric Motor Power	kW	6,7	18,5	3,5

4.3.2.1 Automatic Bilge

An automatic bilge system is provided for each thruster room and each pump room.

Each space has a high capacity bilge well which collects the bilge water.

From each bilge well an automatic bilge pump (XA/411 A-H) takes suction.

Each bilge well is provided with a 3-contact type level switch for the automatic operations as follows:

HH (High-High Level)	- Alarm in ECOS (1).
H (High Level)	- Automatic bilge pump starting. - Valve (SE*003 VD) on the delivery line opened. - Valve (SE*012VX) to the bilge holding tank opened. - Valve (SE*017 VF) to the separator tank closed. - Valve (SE*033 VF) for O.B. discharge closed (see rule bilge operation).
L (Low Level)	Automatic bilge pump stopping. - Valve (SE*030 VD) on the delivery line closed.

The water collected by the automatic bilge system is discharged into the bilge holding tank (one for each pontoon, arranged in the aft pump room double bottom).

Each bilge holding tank is provided with a 3-contact type level switch for the following automatic operations.

HH (High-High Level)	- Alarm in ECOS
H (High Level)	- XA/411 automatic bilge pump stopping.
L (Low Level)	XA/412 rule bilge pump stopping when used for bilge holding tank discharge (to shore or to the separator tank)

An "excessive running" alarm in ECOS is provided for each automatic bilge pump (XA/411).

Each automatic bilge sump well in thruster room is provided (as per Classification Soc. request) with a separate level switch for HH alarm in ECOS.

The above level switch for the pump rooms is located close to separate bilge suction.

The above mentioned operations are classified as "automatic bilge".

Fore and aft thruster-pump rooms are connected by cross-over pipes either for suction and discharge lines.

Two O.B. discharge lines are arranged on the delivery cross-over for each pontoon.

This configuration gives the possibility to take suction from aft to fwd and vice-versa.

When automatic or rule bilge pump is started, ECOS opens the SE*034 VF valve arranged between the aft and fore sides of the delivery crossover pipe to allow the above operation.

4.3.2.2 Rule Bilge

Bilge wells, with H (high) level alarm switch, are provided inside pontoon spaces where bilge suction is required.

No automatic operation is foreseen.

The operator, after the H level alarm acknowledgement, can remotely start the bilge pump (XA/412 A-D) and open the relevant suction valve on the suction manifold.

Four bilge pumps (one for each pump room) are provided.

When the bilge pump is started, ECOS provides for the following automatic valve sequence:

- Bilge holding tank valve (SE*012 VX) closed.
- Valve to separator tank opened (SE*E017 VD).

The bilge holding tank, which is part of the automatic bilge system, is in this case cut-off.

The delivery line of each XA/412 bilge pump is provided with an oil detector connected to ECOS.

If the oil content in bilge water (when the pump starts, oil detection starts) is above 15 p.p.m., the O.B. discharge valves are kept in closed position (to prevent oily water O.B. discharge) and the bilge water is led into the separator tank (one port and one stbd arranged inside the platform inner bottom).

If the oil content in bilge water is below 15 p.p.m., ECOS closes the valves (SE*017 VD) to the separator tank and opens the O.B. discharge valve. In this case the (clean) bilge water is discharged into the sea.

In presence of "excessive running" alarm for the automatic bilge pumps, or HH (high-high) alarm in thruster or pump room automatic bilge sump wells, the operator can manually and remotely start the XA/4 12 bilge pump. This pump directly takes suction from the above bilge wells (also automatic bilge pump can be started-stopped remotely).

In this case the valve sequence is the same as described above.

4.3.2.3 Oily Bilge Water Treatment

The bilge water of the bilge holding tank can be discharged into the separator tank using the bilge pump XA/412 for the oil separation service.

With the waste oil pump, the oily water can be discharged to the shore through the relevant station on main deck.

Each separator tank is connected to a separator (XA/428 AA-BA), complete with pump (XD/428 AB-BB) and oil detector unit.

The separator tank is provided with a double level transmitter (redundancy) for the following automatic operations:

Remote Level Indication

HH (High-High Level)	Alarm in ECOS
H (High Level)	Starting of the separator pump (treatment in progress)
L (Low Level)	Stopping of the separator pump (treatment stop)
LL (Low Low Level)	XA/149 waste oil pump. Stopping when used for discharging bilge water to the shore

The cleaned water from the separator is directly discharged outboard into the sea if the oil detector measures an oil content below 15 p.p.m. Otherwise, in case of oil content above 15 p.p.m., the oil detector, by means of a 3-way valve, passes the oily water back into the separator tank giving an alarm to ECOS.

The dirty oil from separator is discharged into a waste oil tank (one for each separator) provided with two separated level switches for the following operations:

HH (High-High Level)	Alarm in ECOS
H (High Level)	Starting of the separator pump (treatment in progress)
L (Low Level)	Waste oil pump XA/149 stopping when used for dirty oil discharge to shore, to the sludge tank or to the incinerator plant.
LL (Low Low Level)	XA/149 waste oil pump. Stopping when used for discharging bilge water to the shore

The upper-hull double bottom is provided with a separate bilge system.

Suction is taken by some ejectors fed with seawater (from SW circulation) and connected to the SW ring by a flexible hose during the bilge operation.

The valves on the ejectors are hand-operated only. Ejector for bilge suction, and H level alarm switches, are provided for bilge service inside low spaces of central caisson; valves on bilge wells are remote controlled.

4.3.2.4 Leakage Detection for Bracings

In case of presence of water inside the bracings, the water will flow through the relevant pipes to roper receivers arranged above the cut-off valve (which is always kept in closed position). On the receiver there is a level switch which detects the water presence giving an alarm in ECOS. Opening the a.m. cut-off valve, the water flows to the pump room bilge well (connected to the automatic bilge system).

4.3.2.5 Leakage Detection for Voids

Leakage of water into the voids is detected by their respective high level alarm switches or by sounding pipes. The water collects in sumps built into the void floor. The sumps are provided with drain lines with remotely (ECOS) operated valves to drain the water to the bilge sumps in the thruster room or pump rooms.

4.3.3 Diesel Oil System

Ref: Doc Title: *P&ID Diesel System*
Doc. No: *DE-3010.38-5133-944-AMK-525-01 to 05*
DE-3010.38-5133-944-AMK-521 to 524-01
DE-3010.38-5133-944-AMK-475

Diesel oil system is shown also in simplified form on Fig. 4.3.4.

Diesel oil is carried in tanks located in the port and starboard hulls. Each pump room is provided with one pump to enable transfer between hulls and discharge to the service header, deck fill connections and storage and day tanks.

Table 4.3.3.1 - Diesel Oil Transfer Pump Main Characteristics

Equipment No.		**XA/148 A-D**
Manufacturer		Garbarino
Model		MU40/250LMP
Capacity	m^3/hr	37,6
T.M.H.	m	50
Speed	rpm	3470
Electric Motor Power	kW	8,5

The diesel oil transfer pumps (XA/148 A-D) are operated remotely from the ballast control console along with all valves indicated as being power operated.

Diesel oil tanks in the lower hulls have remote level indication displayed on the ballast control console. The diesel oil day tank and settling tank are provided with high-low level alarms arranged to sound and display in the ballast control room.

4.3.4 Lube Oil System

Ref: Doc Title: P&ID Lube Oil Piping System
Doc. No: DE-3010.38-5250-944-AMK-532-01 to.06 (Fincantieri drawing)
DE-3010.38-5133-944-AMK-521 to 524-01

The lube oil system includes lube oil piping and storage tanks. A simplified diagram of the system is shown on Fig. 4.3.5.

Storage tanks are listed in the following table.

4.3.4.1 Lube Oil Tanks List

Equipment No.	Service	Capacity [litres]	Location
XA214	Air compressors	900	Second deck
XA216	Gas turbine	900	Main deck
XA230	Daily service	700	Drill floor
XA231 A	Mooring windlass	300	Second deck
XA231 B	Mooring windlass	300	Second deck
XA231 C	Mooring windlass	300	Second deck
XA231 D	Mooring windlass	300	Second deck
XA233	Emergency generator	600	
XA243 A	Injection water	900	Lower Hull
XA243 B	Injection water	900	Lower Hull

The main gas turbine engines are arranged for gravity filling from drums that are located and stored on the main deck.

Drain oil from the gas turbine engines and the emergency diesel generator is piped to the waste oil tank.

Fill lines are installed for the lube oil tanks terminating on the main deck near machinery spaces arranged for a hose connection and/or funnel for dumping in drums of oil.

The oil storage tanks are fitted with level gauge and trays for filling hand oilers. Bolted oil tight access plates are provided for cleaning the inside of tanks.

A motor driven waste oil pump is provided to facilitate emptying the sludge tank. The discharge from the dirty oil pump is led to a deck connection for discharge to barges or drums.

4.3.5 Seawater / Freshwater System

Ref: Doc Title: *Seawater / Freshwater System*

Doc. No: *DE-3010.38-5111-944-AMK-516-01 to 07*

DE-3010.38-5111-944-AMK-331 to 339

Doc. Title: *Freshwater/Process Cooling Piping System*

DE-3010.38-5120-944-AMK-517-01 to 04

DE-3010.38-5111-944-AMK-341-343,345-348

Refer to Process Operating Manual for detailed description and operation.

Table 4.3.5.1 - Seawater / Freshwater Pumps Main Characteristics

		Seawater		Freshwater/Process Cooling	
Equipment No.		XA039 A-D	B-511102A-C	XA054 A-B	B-512401A-C
Manufacturer		Garbarino	Frank Mohn	Garbarino	Ahlstrom
Model		QVK 18/320	SE300H	MU250/400	APT54-16
Capacity	m^3/hr	1550/590	1642	1150	2500
T.M.H.	m	75/34	64.4	55	44.3
Speed	rpm	1750/1150	1770	1750	1200
Electric Motor Power	kW	520-130	600	290	450

4.3.5.1 Seawater Service System

(See Fig. 4.3.6)

The seawater service requirements of the vessel are supplied by the seawater service pumps (XA/039 A-D), located in each of the pump rooms in the lower hulls and by the Seawater Supply Caisson Pumps (B-511102A-C) in the central caisson.

The pumps are capable of supplying the complete system plus stand-by requirements with further stand-by, at reduced capacity, furnished by the ballast water pumps

The seawater service pumps (XA/039 A-D) may run in high or low speed conditions. They take water from the four low sea chests or the four high sea chests dosed with hypochlorite and pump to a common ring main located in the inner bottom.

The seawater service system supplies cooling water to freshwater cooling system plate coolers and various services including the following: watermakers, air compressors, sanitary system pressure set, diving equipment, and washdown outlets. Some of the water rises to the main deck to join the water from the caisson pumps. The water header on the main deck serves the process cooling water system plate exchangers, riser pull-in winches, gas booster compressor auxiliaries and hose stations.

In addition to satisfying the cooling and service water requirements of the vessel the seawater service system is actuated as a booster supply, providing water to the fire pumps. Two of the seawater service pumps are always available to operate with two of the four fire pumps for fire service.

The seawater service pumps and their related valves in the lower hull pump room are remote operated from the ballast control console. The caisson pumps are remote operated from ECOS and have automatic discharge valves and anti-biofoulant dosing valves opening on pump start and closing on pump stop.

For the seawater service pumps, the operator will decide how many pumps to set on duty (2 or 3) and which one will be the stand-by (in case of three pumps on duty the remaining one will be automatically the stand-by). ECOS system will supervise that this condition is always true and starts the stand-by unit in case of any of the following conditions:

- On duty pump tripped
- Main ring low pressure
- On duty pump delivery pressure low

The pumps could also be individually controlled by setting the manual-automatic software change over to manual.

Each of the four pumps when running sends via ECOS a signal to the chlorinator unit, that will dose the hypochlorite according with the pump speed.

Some interlocks are provided in the pump starting sequence, either in automatic or manual control.

In case of fire the control of the pumps and of the relevant valves is taken over by the fire fighting control system by inhibiting the control from ECOS.

The seawater pumps electric motors are powered from 440V main switch boards and from emergency switchboards as shown on Fig. 4.3.2.

The starboard fwd seawater service pump (XA/039C) and port aft pump (XA/039B) are connected to the emergency switchboard. These pumps also serve as emergency ballast pumps.

The seawater system has been enlarged by the addition of the three seawater supply caisson pumps (B-511101A-C) to satisfy the additional cooling required by the process plant.

The caisson pumps are of the vertical submerged motor type in caissons inside the central caisson. The pumps lift water from the caisson to the manifold on the tank top. The discharge manifold feeds the seawater distribution header on the main deck which is also fed from the seawater service pumps ring main. The seawater passes through the Central Process Cooling Exchangers (P-512401A-D) and discharges to the sea via the Seawater Coolant Dump Caisson (TD-511103) on the starboard side.

The seawater is dosed with copper and aluminium ions by the anti-biofouling unit (UE-512101) which is regulated by the pump status logic in ECOS.

4.3.5.2 Freshwater System

Ref: Fig. 4.3.7

Two separate freshwater systems are provided: the freshwater service system and the process cooling system.

Freshwater Service System

The purpose of the freshwater service system is to circulate fresh cooling water in a closed circuit to the cooling systems of the various platform facilities i.e. air conditioning, winches, turbo-generators.

Two Freshwater Pumps (XA/054 A-B) are provided; one on duty and one on stand-by.

The stand-by pump starts automatically if the first pump is tripped or by the low pressure alarm in the upper ring.

Freshwater is circulated from the common manifold through a F.W. cooler and pumped by one of two pumps to a common outlet manifold where all the users are directly connected via manual valves. The circuit is provided with F.W. expansion tank (XA/076) and chemical dosing tank (XA/072) located on the derrick structure.

The cooler is provided with a three-way thermostatic by-pass valve, set at 36°C. Temperature transmitters are arranged, giving an alarm at 40°C.

By means of ECOS the Operator is able to control the main pumps and monitor the pressure and temperature by the above listed transmitters.

Process Cooling System

The process cooling system on the main deck is provided for cooling the compressor discharge gas and the compressor and oil pumps auxiliaries.

Water is circulated by 2 of 3 Process Cooling Circulation Pumps (B-512401A-C) through the Central Process Cooling Exchangers (P-512401A-D). The water is cooled from 45 to 32°C and distributed to the users.

The circuit is provided with an expansion vessel (V-512401) on the derrick structure. The system shares a make-up and chemical dosing facility with the heating medium system.

4.3.6 Exhausts and Inlets

The 3 main generator gas turbine air inlet and exhaust systems are led vertically through the main deck, the exhaust outlets being direct outboard.

Both the ventilation and combustion air systems are provided with filters and silencers.

Waste heat recovery units (WHRU) are installed on two generators (XA/275A and C). All exhaust and inlets are provided with sufficient flexible connections and are adequately supported.

The three compressor gas turbines on the main deck draw air horizontally through filters and silencers from the aft end and discharge the exhaust gas vertically. All three compressor turbines are provided with WHRU.

4.3.7 Steam, Condensate and Feed System

The system has been removed from the vessel.

4.3.8 Potable Water System

Ref: Doc Title: Potable Water Piping System Diagram
Doc. No: DE-3010.38-5130-944-AMK-518-01 to 06 (Fincantieri drawing)

The potable water system is shown in the simplified diagram of Fig. 4.3.9.

The potable water system provides water for all plumbing fixtures throughout the vessel, excluding flushing for all toilets and urinals, which use seawater from sanitary pressure set.

The non-chlorinated cold water supply provides make-up for diving area and other machinery services as required. A branch from the water supply is provided to the fuel oil purifiers for priming.

Potable water is also used for make up of the freshwater cooling and heating medium systems and for supplying the high pressure cleaning system (see below).

Washdown outlets are provided in the galley and on the house sides port and starboard in the accommodation area.

The two potable water transfer pumps (XA/103 A-B), one in the port and one in the starboard aft columns are used to discharge water from the columns to the independent potable water tank in the upper hull. The system has provisions for transfer between port and starboard column potable water tanks.

The potable water service pumps (XA/461 A-B) take suction from the independent potable water tank and discharge to the various fixtures and services throughout the vessel. Pressure in the system is maintained by the pressure set (XA/461). Start and stop of the pumps are controlled by pressure switches.

The controls are arranged such that under normal conditions only one pump is in operation. The potable water may also be produced from seawater by the water maker units (XA/107 A-B).

The hot water from each deck is piped back to the hot water circulating pump (XA/445 A-B) and each return is fitted with a balancing cock. An ultra-violet sterilizer unit (see para. 4.8.3) and a chlorinating unit (XA/727) are installed in the potable water supply header.

HP Cleaning System

Ref: Doc. No.: P&ID DE-3010.38-5128-944-AMK-453

The system provides hot or cold high-pressure water to seven (7) washdown hose stations. Potable water is fed via an electric heater to the reservoir. The water is maintained at 77°C by circulating the water through the temperature-controlled heater. The water is pumped from the reservoir to the distribution header at 207 barg by the double headed HP feed pump.

Table 4.3.8.1 - Potable Water /Hot Water Pumps Main Characteristics

Equipment No.		**XA103 A-B**	**XA461 A-B**	**XA445 A-B**
Manufacturer		Garbarino	Garbarino	Garbarino
Model		MU32/160M	MU32/I60ME	MU25/160M
Capacity	m^3/hr	13.8	20	2,4
T.M.H.	m	40	42	10
Speed	rpm	3500	3500	1750
Electric Motor Power	kW	6.7	6.7	0.67

4.3.9 Tank Level and Draft Indicating System and Tank Soundings

One complete independent tank level indicating system, with sensors installed inside each tank is provided on board.

This system is the electronic type. Tank level transmitters are installed in all ballast tanks, drill water tanks, diesel oil storage hull tanks, potable water tanks, separator tanks, oil overflow tank and draft gauges. The analog output signal from these gauging devices is transmitted to ECOS and displayed on the CCR consoles.

Level and draft indications are displayed on the console in the Central Control Room. Draft sensors are located in separate compartments in the lower hulls. (See also para. 4.6.7.7 - Tank gauging system).

4.3.10 Compressed Air System

Ref: Doc Nos: DE-3010.38-5134-944-AMK-526, -527, 528-01 to 07
DE-3010.38-5134-944-AMK-484-01 to 02
DE-3010.38-5000-944-AMK-452

See also simplified schematic diagram Fig. 4.3.10.

The compressed air system is supplied by three screw type compressors, each one with a power of 155HP.

The three air compressor units are arranged in a skid together with the seawater cooled air coolers, filters, dehumidifiers, wet air receiver, control panel and all the relevant accessories.

A second skid contains one horizontal 10m³ dry air receiver.

From the dry air receiver, two headers are provided to supply utility air and instrument air.

The pressure of the instrument air header is regulated at 7.6 barg. The utility air header operates at the same pressure as the receiver and is shut off if the receiver pressure falls below 6 barg.

The utility air header supplies the following users:

- production plant users
- emergency diesel generator (starting)
- mooring windlasses
- pneumatic whistle
- incinerator (sludge atomizing)
- generator waste heat recovery units

- air winches
- helicopter transportable refuelling system
- fire dampers control
- deluge tank

NOTE: The emergency diesel generator is normally started by using the compressed air supplied by the main compressed air header; a dedicated air compressor has been provided for the "cold" starting of the emergency diesel generator.

Table 4.3.10.1 - Air Compressors Main Characteristics

Manufacturer	Ingersoll-Rand
Type	Rotary screw, single stage
Model	S970 HH
Inlet Pressure	ambient
Capacity	1260 m^3/h
Discharge Pressure	10 barg
Driver Type	electric motor
Driver Power	155 kW
Driver Speed	1785 rpm
Operating Ambient Temperature	0 to 50°C

4.3.11 Open Drains

The Open Drains system is shown on drawings:

- Exterior Deck Drain Piping System:	*DE-3010.38-5336-944-AMK-547-01 to -07*
- Interior Deck Drain Piping System:	*DE-3010.38-5336-944-AMK-549-01 to -07*
- Gravity Drainage Piping System:	*DE-3010.38-5336-944-AMK-548-01 to -04*
- Skim Pile:	*DE-3010.38-5336-944-AMK-390*
- Tank Top Deck Sump:	*DE-3010.38-5336-944-AMK-393*
- Hazardous Open Drains:	*DE-3010.38-5336-944-AMK-394, -395*
- Production Caisson:	*DE-3010.38-5336-944-AMK-397*
- Deluge Drains Collection:	*DE-3010.38-5336-944-AMK-399*

Refer to Operating Manual for detailed description and operation.

A. WATER AND INTERIOR

Drains are provided in all spaces and on all decks where water or oil can accumulate. The drains are divided into two categories, clean and contaminated, which are each divided into two systems, hazardous and non-hazardous. Clean drains are piped overboard and contaminated drains are piped to the contaminated drain-collecting tank.

Deck drains are fitted with a removable strainer plate.

Clean drains are those such as quarters deck, house top and interior quarters deck drains other than W.C. spaces, etc. These may be connected into the clean plumbing deck drains and piped overboard. Weather deck drains are piped into a lower deck drain and not spilled on deck. Drains are provided at all exterior doors and vestibules.

Helicopter deck has a separate drain overboard.

Deck drains from flats in the caissons are led overboard via reach-rod operated stop check valves.

Special deck drains are installed in areas which were to be subject to mud spillage prior to the removal of the drilling equipment, such as the sack storage area and mud processing pump areas.

B. CONTAMINATED DRAINS

(See Fig. 4.3.11)

The contaminated deck drain system is provided to eliminate the overboard discharge of oily water and other contaminants from spaces such as the interior of all machinery coamings (generators, hydraulic units, watermakers, etc.), generator rooms, machine shop, drill floor, main deck below drill floor and pipe rack, etc.

Contaminated drains are piped to skim pile (YD/73 1A).

A pneumatic pump (YD/731C) is provided to pump the separated oily water from the skim pile to the matrix separator (YD/731B). Water from the separator is drained overboard and oil is piped to the waste oil holding tank for pumping by YD/731E to the production plant.

Open drains in the processing on the main deck are routed to the Hazardous Open Drains Drum (V-45001) and pumped by P-45002A-B to the produced water degasser.

Process skids provided with deluge water have drains which are routed to the Production Caisson (TD-533601). Oil is separated with floatation gas and the clean water with <20ppm oil discharges to the sea. The oil is removed under level control by pump B-533606A-B to the closed drains system.

Open drains from the tank top aft extension which are too low to enter the hazardous open drains header, are collected in the Tank Top Deck Sump tank (V-533605) and pumped by pump B-533605 to the closed drains system.

C. PLUMBING & SEWAGE PLANT

Plumbing drains are divided into two categories: clean and soil. Clean drains are all interior drains other than soil. Soil drains are those from toilets., toilet space deck drains, urinals and hospital lavatory, and hospital shower.

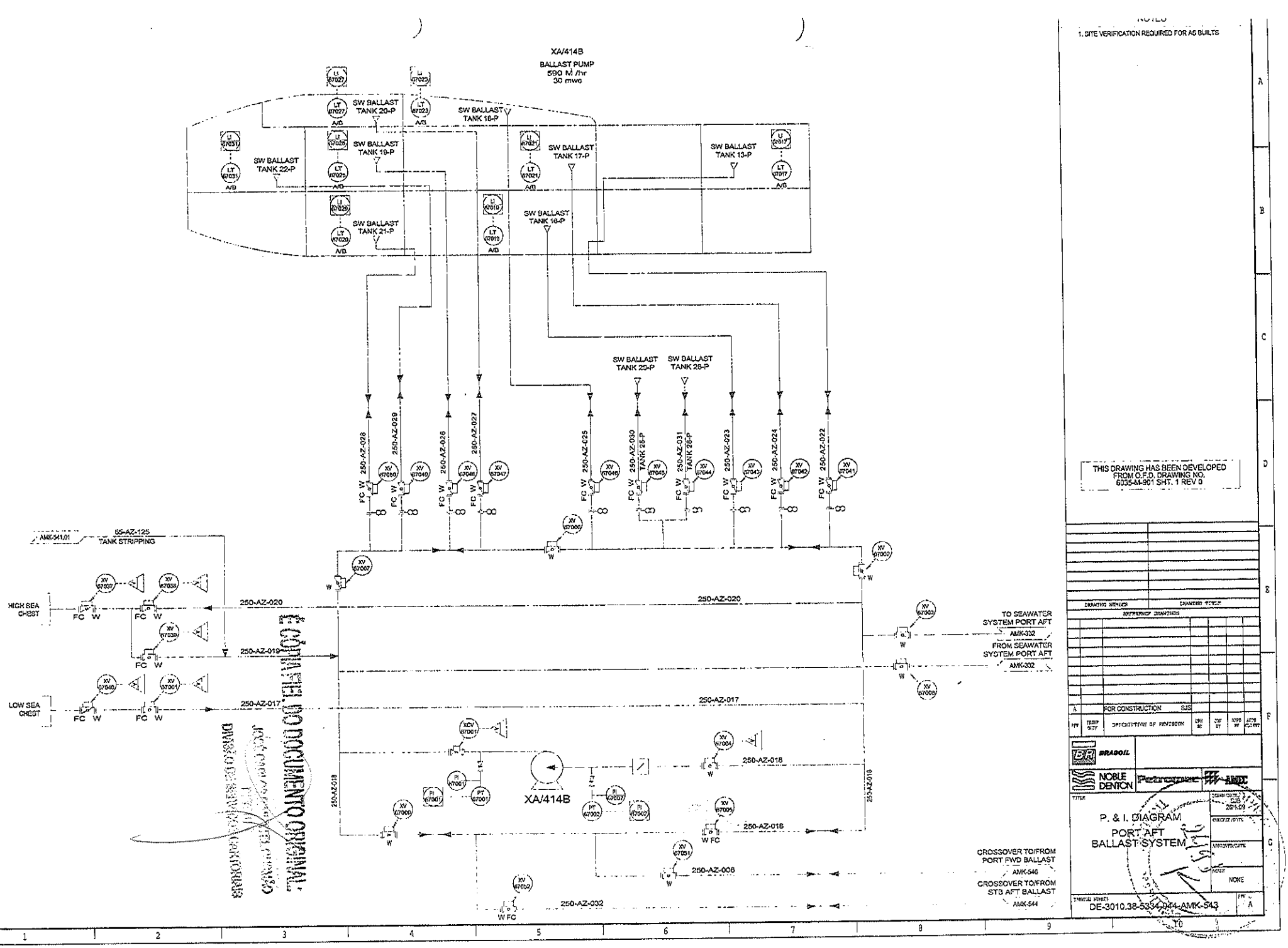
Clean drains are discharged overboard. Soil drains are piped to the sewage treatment plant.

All drains piped to the sewage treatment plants are capable of being led overboard directly.

Two 50% capacity sewage treatment plants, suitable for a complement of 130 men, are provided on board.

4.3.12 Swimming Pool

The swimming pool is located on the main deck in the accommodation area. The water is seawater, supplied by manually controlling the mixing of warm seawater from the process cooling water exchangers with cold seawater to give the required temperature. The water from the swimming pool overflows to the sea.



NOTES

1. SITE VERIFICATION REQUIRED FOR AS BUILTS

THIS DRAWING HAS BEEN DEVELOPED FROM O.E.D. DRAWING NO. 6035-M-901 SHT. 1 REV 0

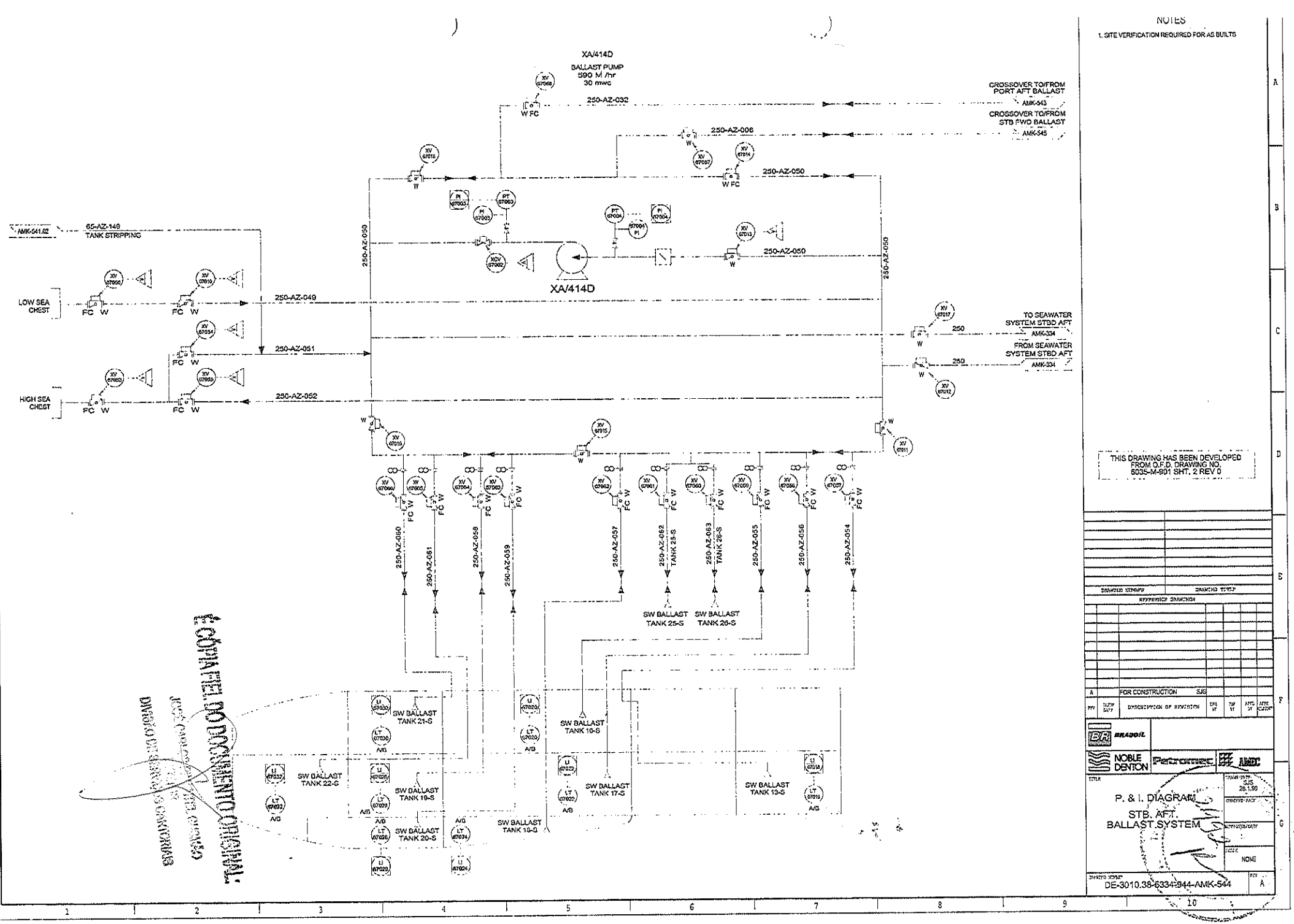
REV	DESCRIPTION OF REVISION
A	FOR CONSTRUCTION

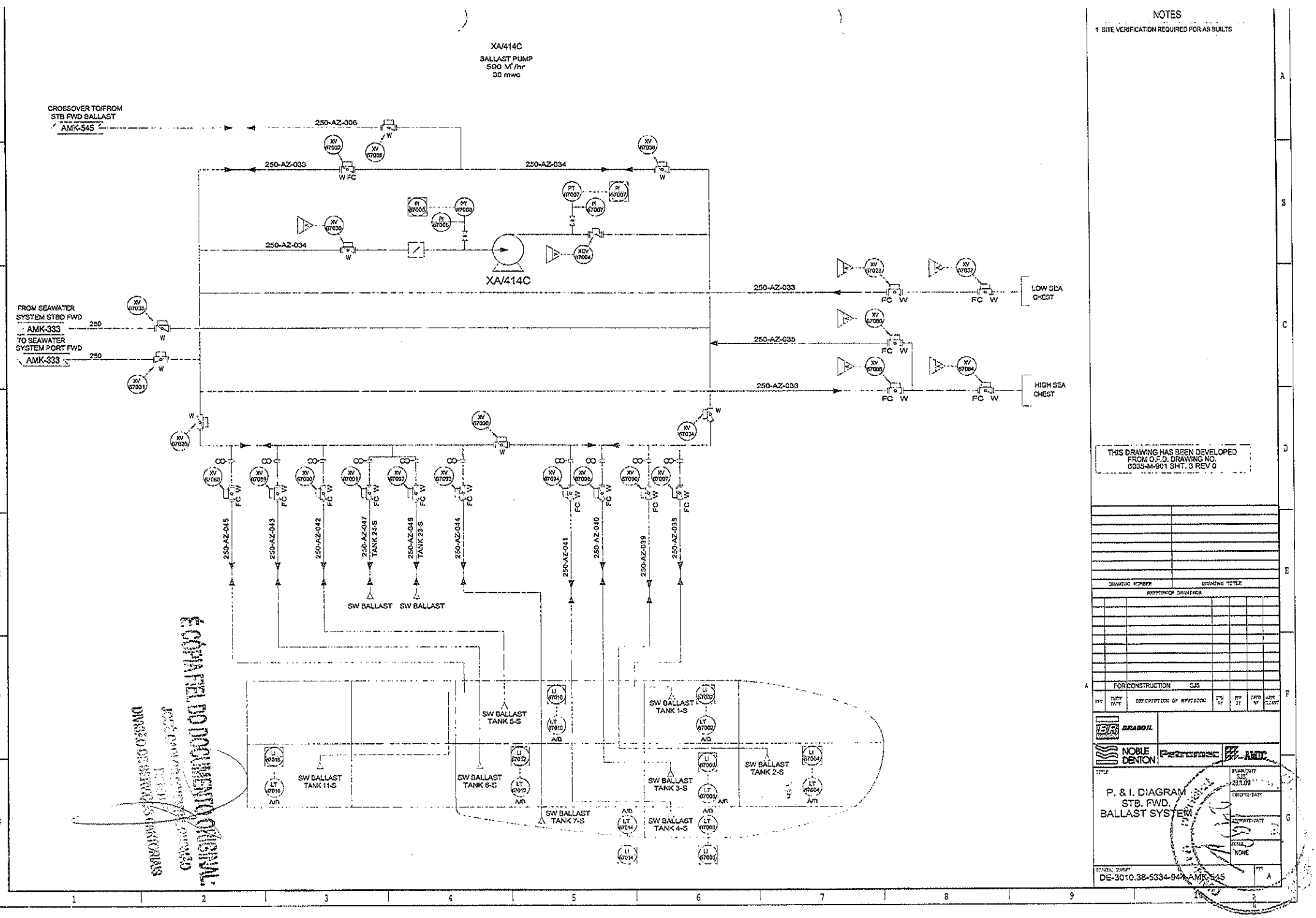
BRASOIL

NOBLE DENTON | Petrocomec | AMEC

P. & I. DIAGRAM
PORT AFT
BALLAST SYSTEM

DE-3010.38-5334-044-AMK-543 A


NOTES
1. SITE VERIFICATION REQUIRED FOR AS BUILTS
XA/414D
BALLAST PUMP
590 M /hr
30 mwc
CROSSOVER TO/FROM PORT AFT BALLAST
AMK-543
CROSSOVER TO/FROM STB FWD BALLAST
AMK-545
250-AZ-032
250-AZ-006
250-AZ-050
AMK-041.02
65-AZ-149
TANK STRIPPING
LOW SEA CHEST
HIGH SEA CHEST
250-AZ-049
250-AZ-051
250-AZ-052
TO SEAWATER SYSTEM STBD AFT
AMK-334
FROM SEAWATER SYSTEM STBD AFT
AMK-334
250
250-AZ-060
250-AZ-061
250-AZ-058
250-AZ-059
250-AZ-057
250-AZ-062
TANK 25-S
250-AZ-063
TANK 26-S
250-AZ-055
250-AZ-056
250-AZ-054
SW BALLAST TANK 25-S
SW BALLAST TANK 26-S
SW BALLAST TANK 21-S
SW BALLAST TANK 22-S
SW BALLAST TANK 19-S
SW BALLAST TANK 20-S
SW BALLAST TANK 18-S
SW BALLAST TANK 10-S
SW BALLAST TANK 17-S
SW BALLAST TANK 13-S
THIS DRAWING HAS BEEN DEVELOPED FROM O.F.D. DRAWING NO. 6035-M-801 SHT. 2 REV 0
FOR CONSTRUCTION
P. & I. DIAGRAM
STB. AFT. BALLAST SYSTEM
NONE
DE-3010.38-6334-944-AMK-544
REV A



NOTES

1 SITE VERIFICATION REQUIRED POR AS BUILTS

THIS DRAWING HAS BEEN DEVELOPED FROM O.F.D. DRAWING NO. 6035-M-901 SHT. 3 REV 0

DRAWING NUMBER	DRAWING TITLE
REFERENCE DRAWINGS	

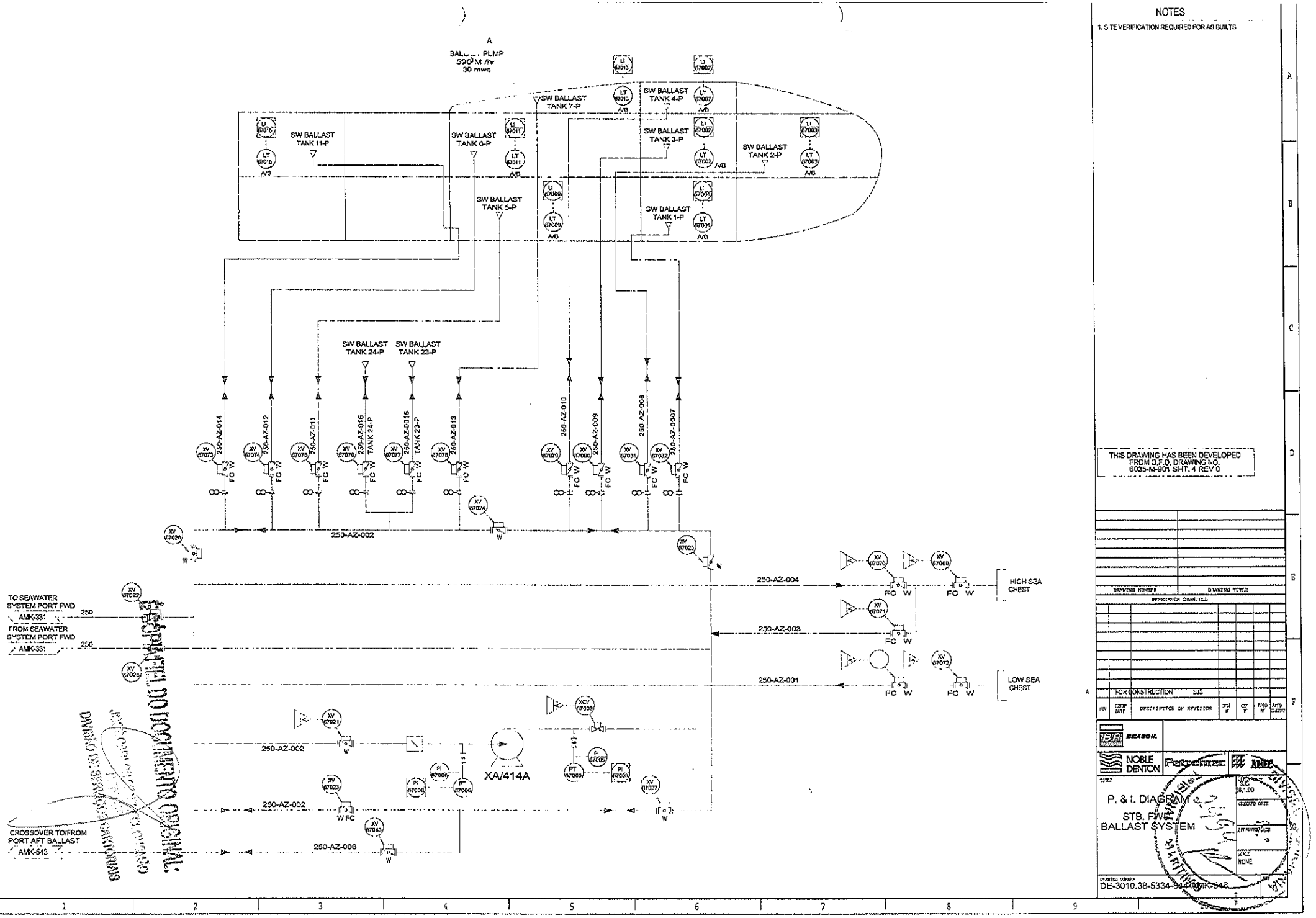
REV	DATE	DESCRIPTION OF REVISION	CHK BY	APP BY	APP'D W/ COMM
A		FOR CONSTRUCTION SJS			

BRASOIL | NOBLE DENTON | Petromec | AMEC

TITLE: P. & I. DIAGRAM STB. FWD. BALLAST SYSTEM

DRAWN/DATE SJS 28.1.09
CHECKED/DATE
APPROVE/DATE
SCALE NONE

CONTROL NUMBER DE-3010.38-5334-944-AMK-545 REV A



NOTES

1. SITE VERIFICATION REQUIRED FOR AS BUILTS

THIS DRAWING HAS BEEN DEVELOPED FROM O.F.D. DRAWING NO. 6035-M-901 SHT. 4 REV 0

REV	ISSUE DATE	DESCRIPTION OF REVISION	DRN BY	CHK BY	APPD BY	APPD CLIENT
		FOR CONSTRUCTION	SJD			

BRAGOIL

NOBLE DENTON | Petromec | ARDE

P. & I. DIAGRAM
STB. FWD. BALLAST SYSTEM

DATE 28.1.99
DRAWN DATE
APPROVED DATE
SCALE NONE

DRAWING NUMBER DE-3010.38-5334-944-AMK-546

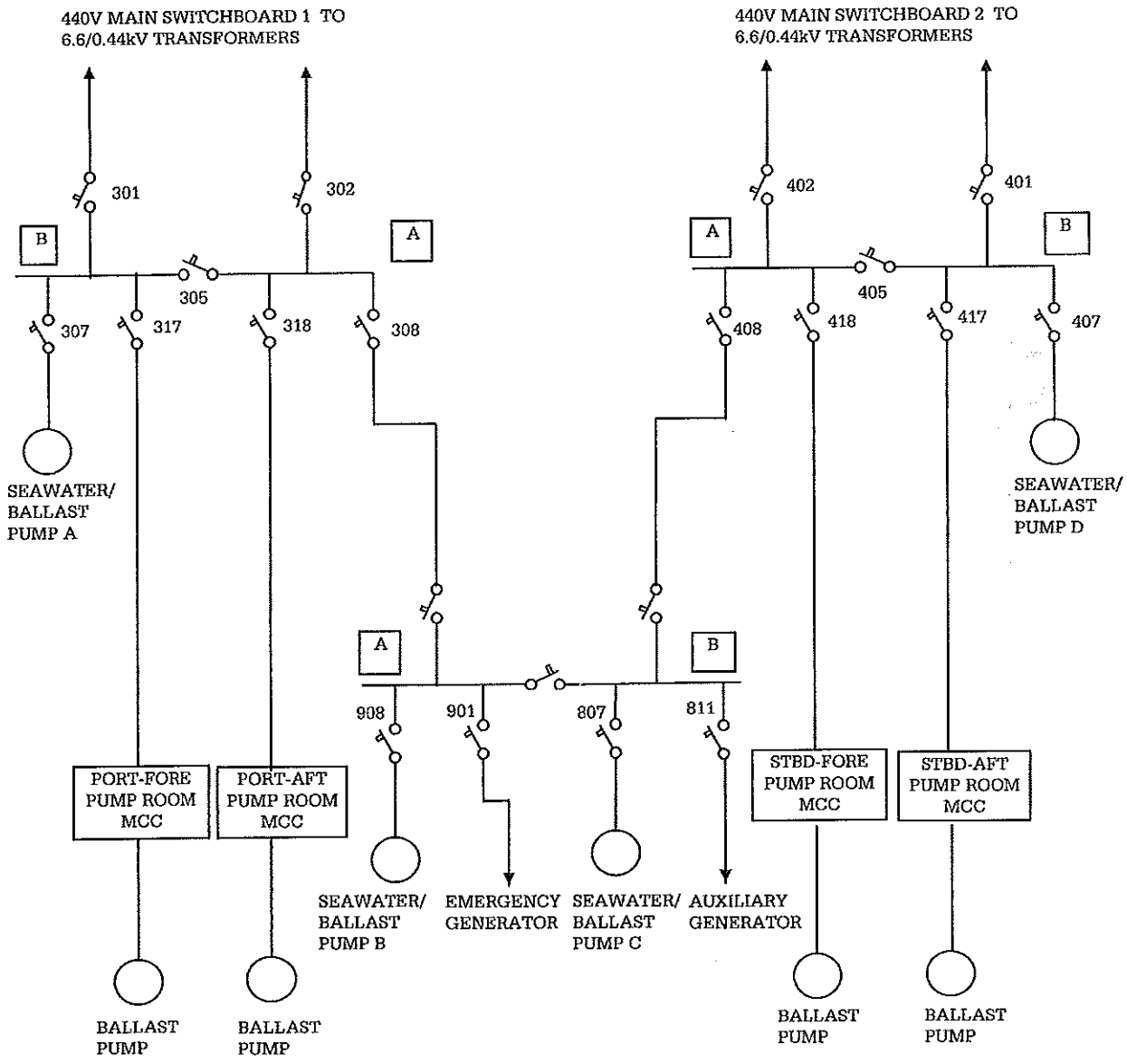


Fig. 4.3.2
Ballast & Seawater Pumps
Electrical Simplified Diagram

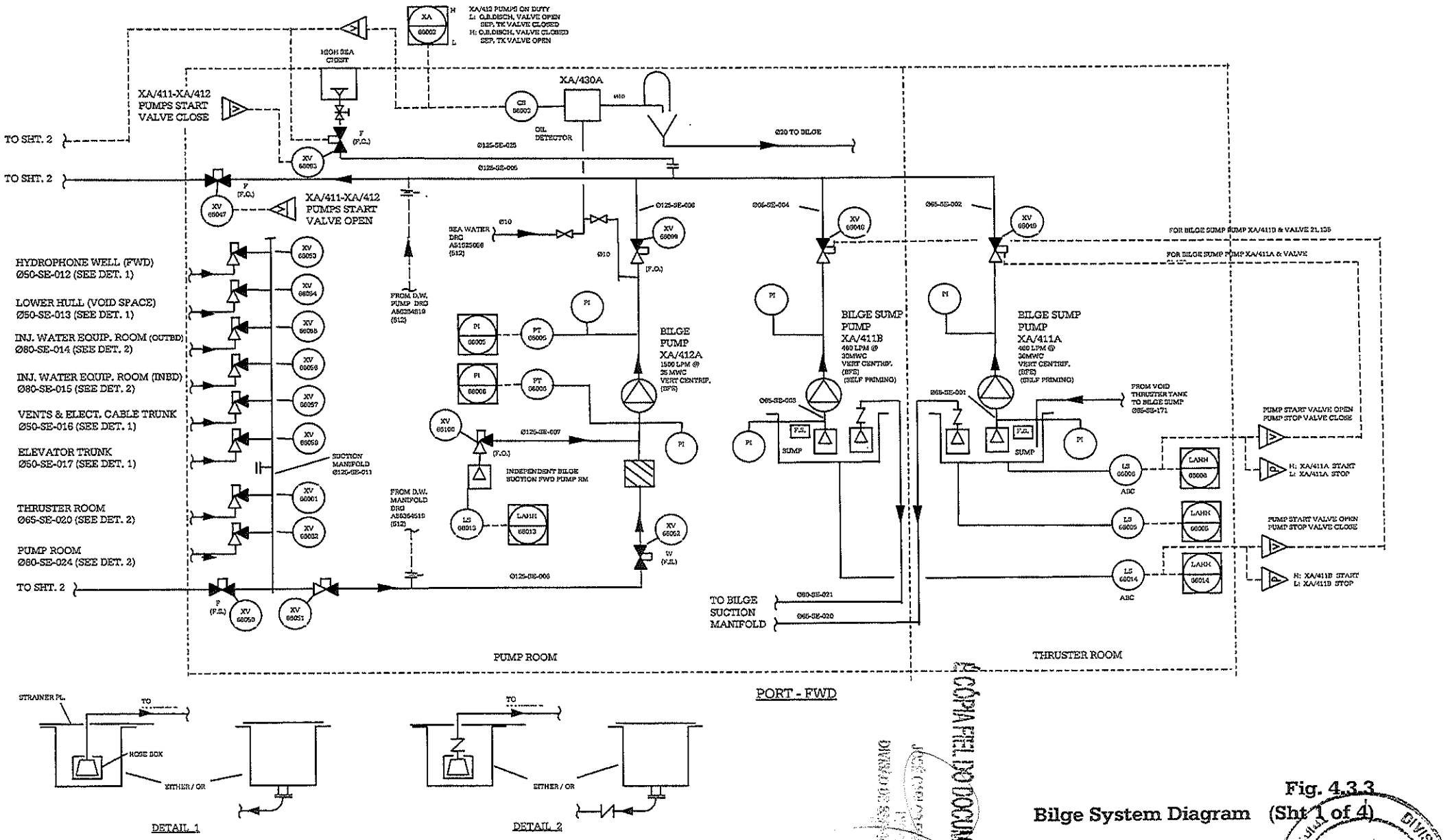


Fig. 4.3.3
Bilge System Diagram (Sht 1 of 4)

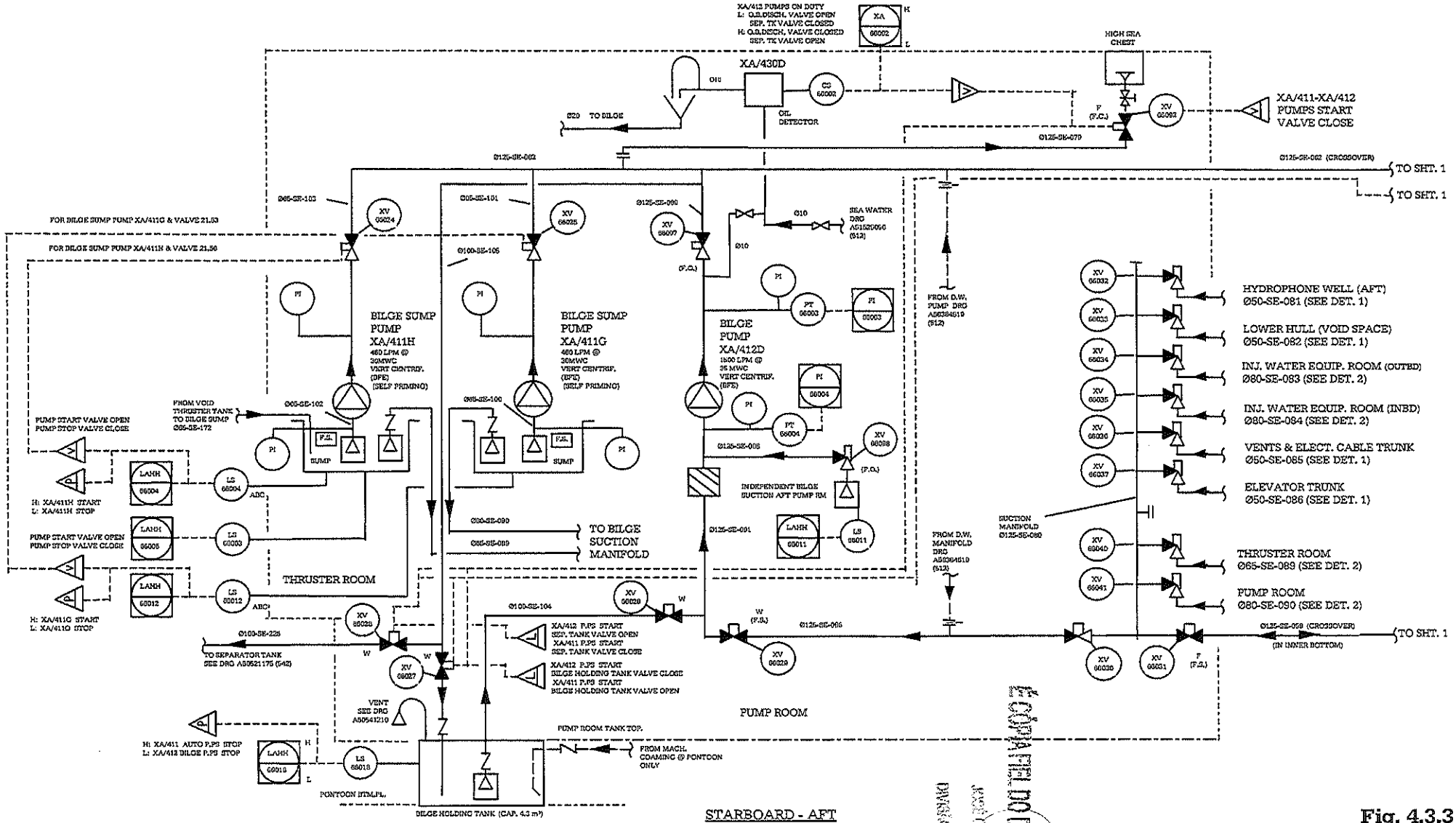


Fig. 4.3.3
Bilge System Diagram (Sht 2 of 4)

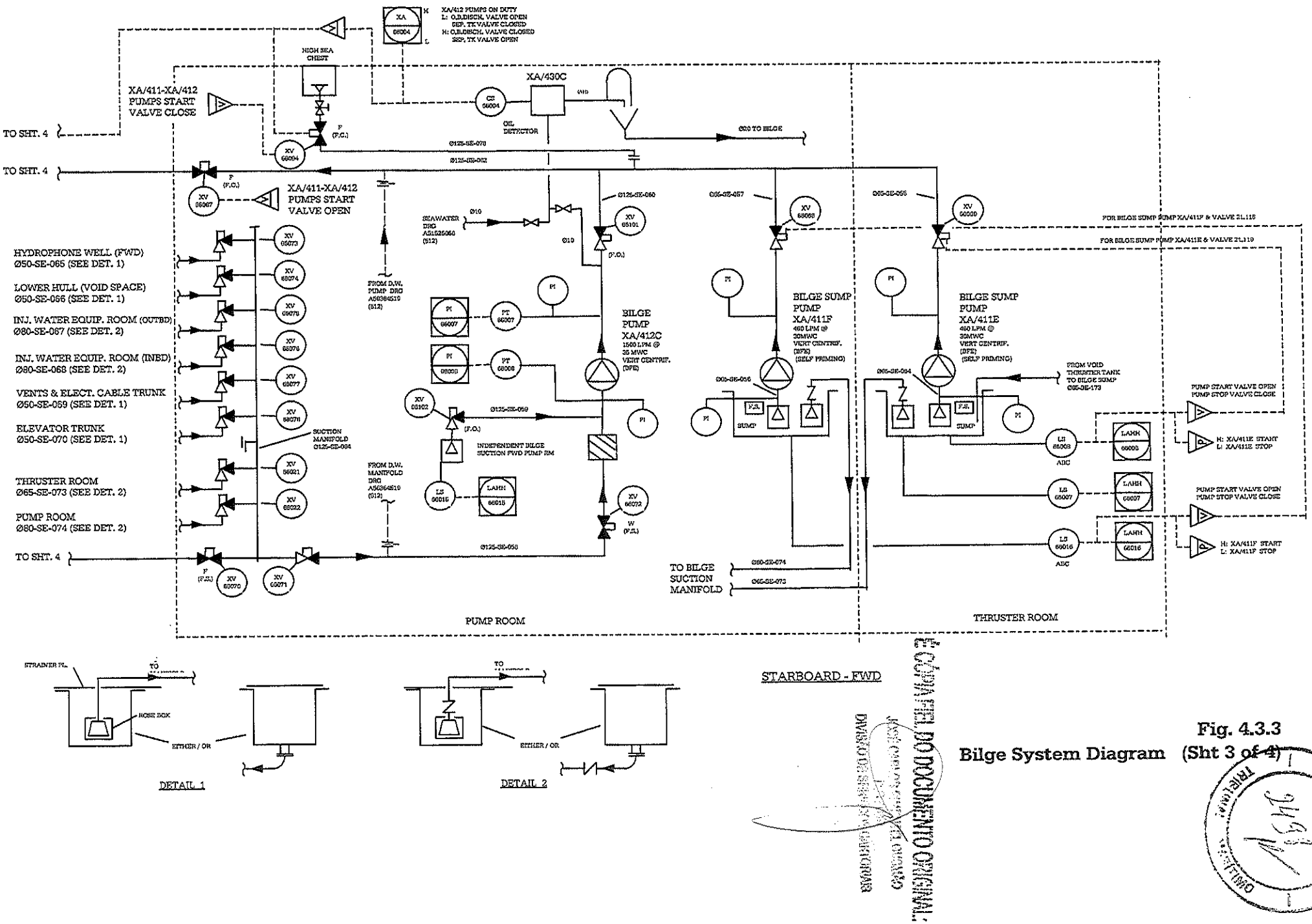


Fig. 4.3.3
Bilge System Diagram (Sht 3 of 4)

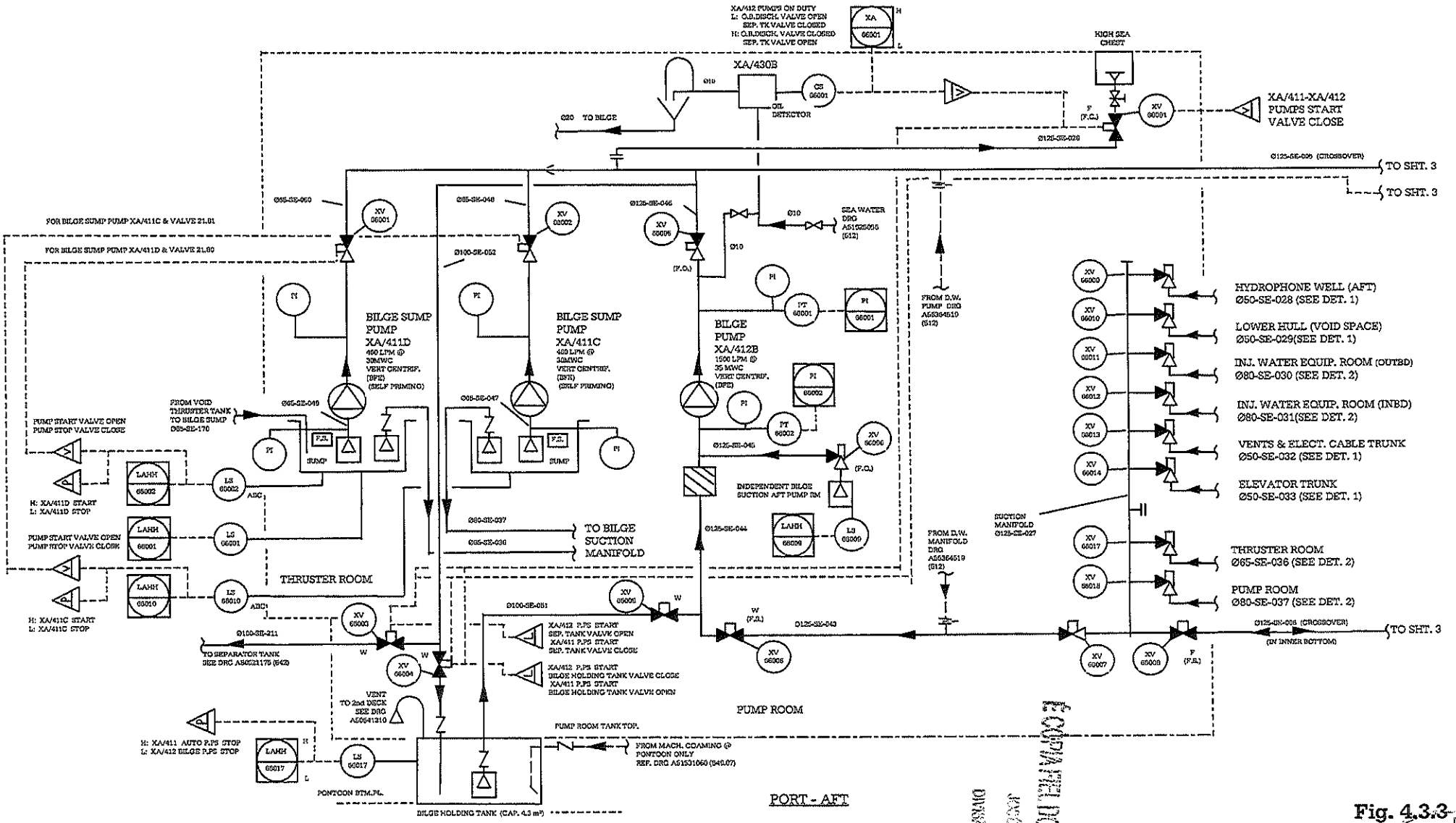


Fig. 4.3.3
Bilge System Diagram (Sht 4 of 4)

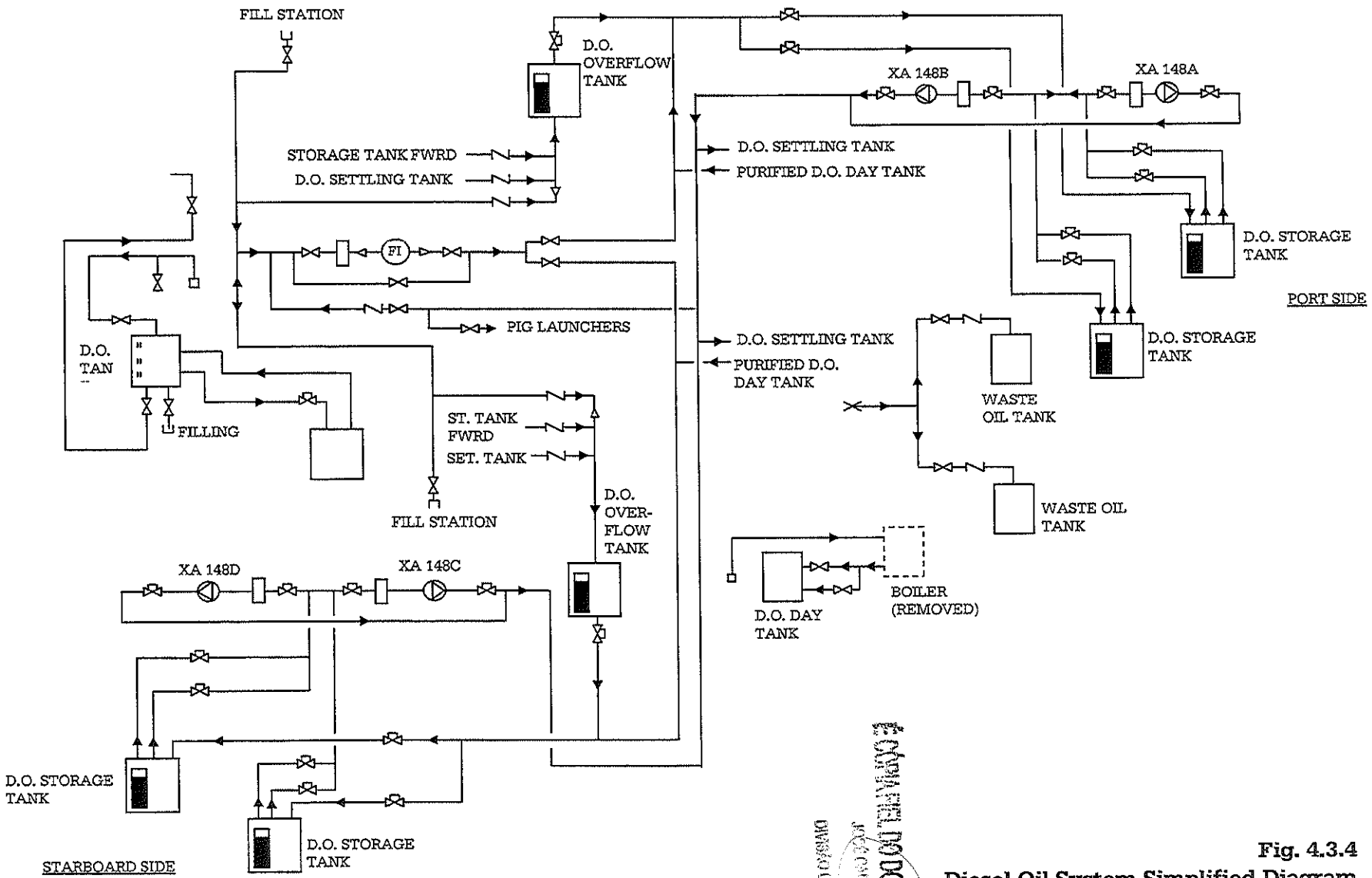
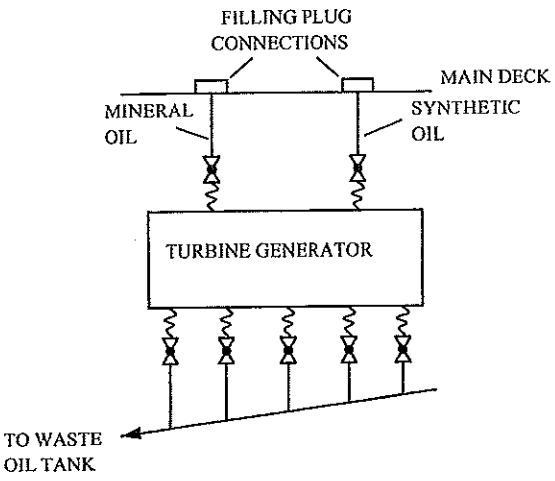
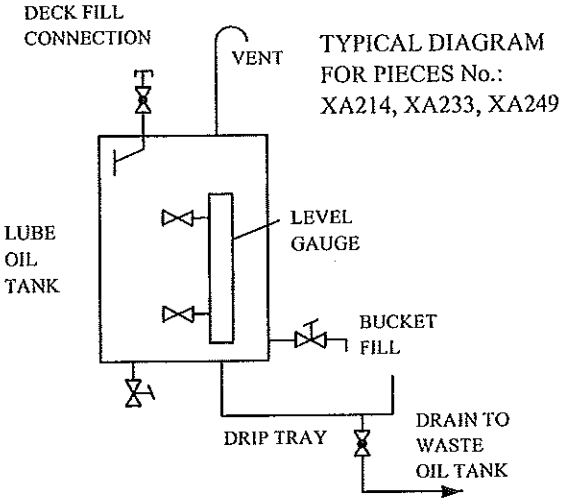
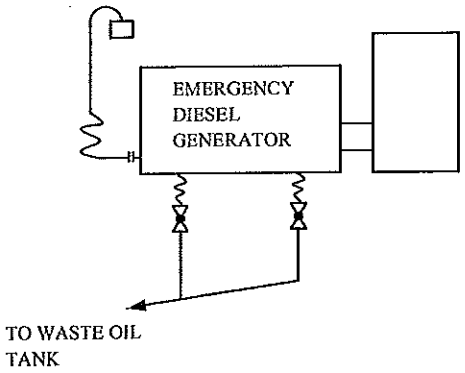


Fig. 4.3.4
Diesel Oil System Simplified Diagram







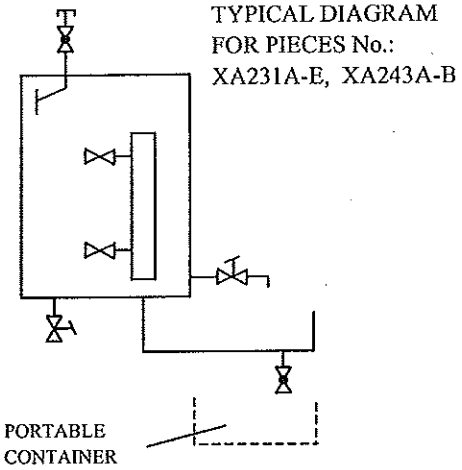


Fig. 4.3.5
Lube Oil Tanks and Piping

B-511102A/B/C
SEAWATER SUPPLY CAISSON PUMPS (NEW)

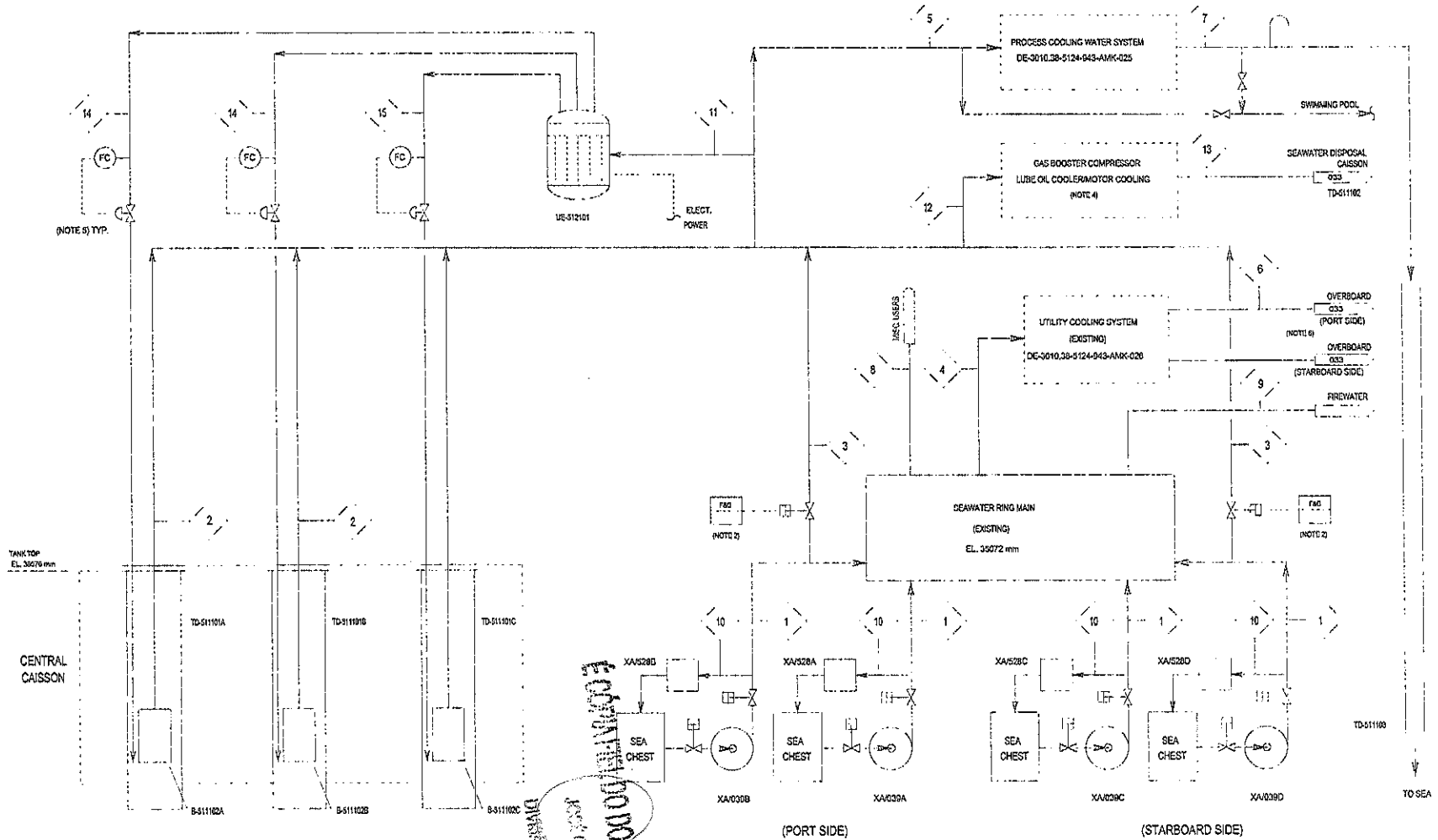
XA/039A/B/C/D (P53101,02,03&04)
SEAWATER SERVICE/BALLAST PUMPS (EXISTING)

XA/528A/B/C/D (A42501,02,03&04)
ELECTRO[illegible]RINATORS (EXISTING)

TD-511103
SEAWATER COOLANT DUMP CAISSON (NEW)

TD-511101A/B/C
SEAWATER SUPPLY CAISSONS (NEW)

UE-512101
CAISSON PUMPS ANTI-BIOFOULING UNIT (NEW)



STREAM No.			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
PRESSURE (NOTE 7)		barg																	
TEMPERATURE		°C	28	28	28	28	28	28	36	28	28	28	28						
MASS FLOWRATE	OPERATING	kg/h x 10					8,842		8,842										
	DESIGN	kg/h x 10					7,526		7,526			2,506							
FLOWRATE	OPERATING	m³/h					8,605		8,714										
	DESIGN	m³/h					8,101		7,386			2,530							
DENSITY		kg/m³	1,022	1,022	1,022	1,022	1,022		1,019	1,022		1,022	1,022	1,022					
NOTES																			

1. PUMPS XA/039 B & C ARE CONNECTED TO E SERVICES BOARD. FOR NORMAL OPERATION UNIT NEED DC RUN, UNDER FIRE CONDITIONS BOTH PUMPS WILL OPERATE.
2. DESIGN FLOW MET BY FOUR PUMPS B-511102A/B/C AND XA/039/D, UNDER FIRE CONDITIONS, CAISSON PUMPS WILL BE SHUTDOWN & XA/039A/C MADE AVAILABLE FOR FIRE FIGHTING.
3. FOR DETAILS OF SEAWATER DEMAND SIDE DOCUMENT: NC-3010.38-5124-943-AMK-004.
4. EXISTING GAS BOOSTER COMPRESSOR ANCILLARIES REMAIN SEAWATER COOLED.
5. FLOW AUTOMATICALLY ADJUSTED TO SUIT PUMP RUNNING STATUS.
6. SEAWATER RETURN IS TO PORT SIDE OR STARBOARD SIDE.
7. PRESSURES ARE AT EQUIPMENT ELEVATION.

DE-3010.38-5124-943-AMK-025	MFD PROCESS COOLING WATER SYSTEM	
DE-3010.38-5124-943-AMK-026	MFD UTILITY FIREWATER COOLING SYSTEM	
DRAWING NUMBER	DRAWING TITLE	
SUPERSEDED DRAWINGS		

REV	DATE	DESCRIPTION OF REVISION	DRN BY	CHK BY	APPD BY	APPD CLIENT
A		FOR ECOS GRAPHICS	PC			

BRAGOIL
NOBLE DENTON | Petronas | AMEC

UTILITY FLOW DIAGRAM
SEAWATER SUPPLY SYSTEM

DRAWING NUMBER: DE-3010.38-5111-943-AMK-024
REV: A

P-122304
GAS BOOSTER
INLET COOLER

B-122303A/B
TEST SEPARATOR CRUDE PUMPS
(SEAL OIL COOLERS)

P-UC-122301A/B/C-01
1ST. STAGE
SUCTION COOLERS

P-UC-122301A/B/C-02
2ND. STAGE
SUCTION COOLERS

P-UC-122301A/B/C-03
3RD. STAGE
SUCTION COOLERS

P-UC-122301A/B/C-04
3RD. STAGE
DISCHARGE COOLERS

E30001 (EXISTING)
GAS BOOSTER
INTERSTAGE COOLER

E30002 (EXISTING)
GAS BOOSTER
OUTLET COOLER

P-123302A/B
TEG COOLERS

P-122312A/B/C
CRUDE OIL BOOSTER
PUMP SEAL OIL COOLERS

P-122308/9/10/11A/B/C
CRUDE EXPORT PUMP
LUBE OIL AND
SEAL OIL COOLERS

P-512401A/B/C/D
CENTRAL PROCESS
COOLING EXCHANGERS

B-512401A/B/C
PROCESS COOLING
CIRCULATION PUMPS

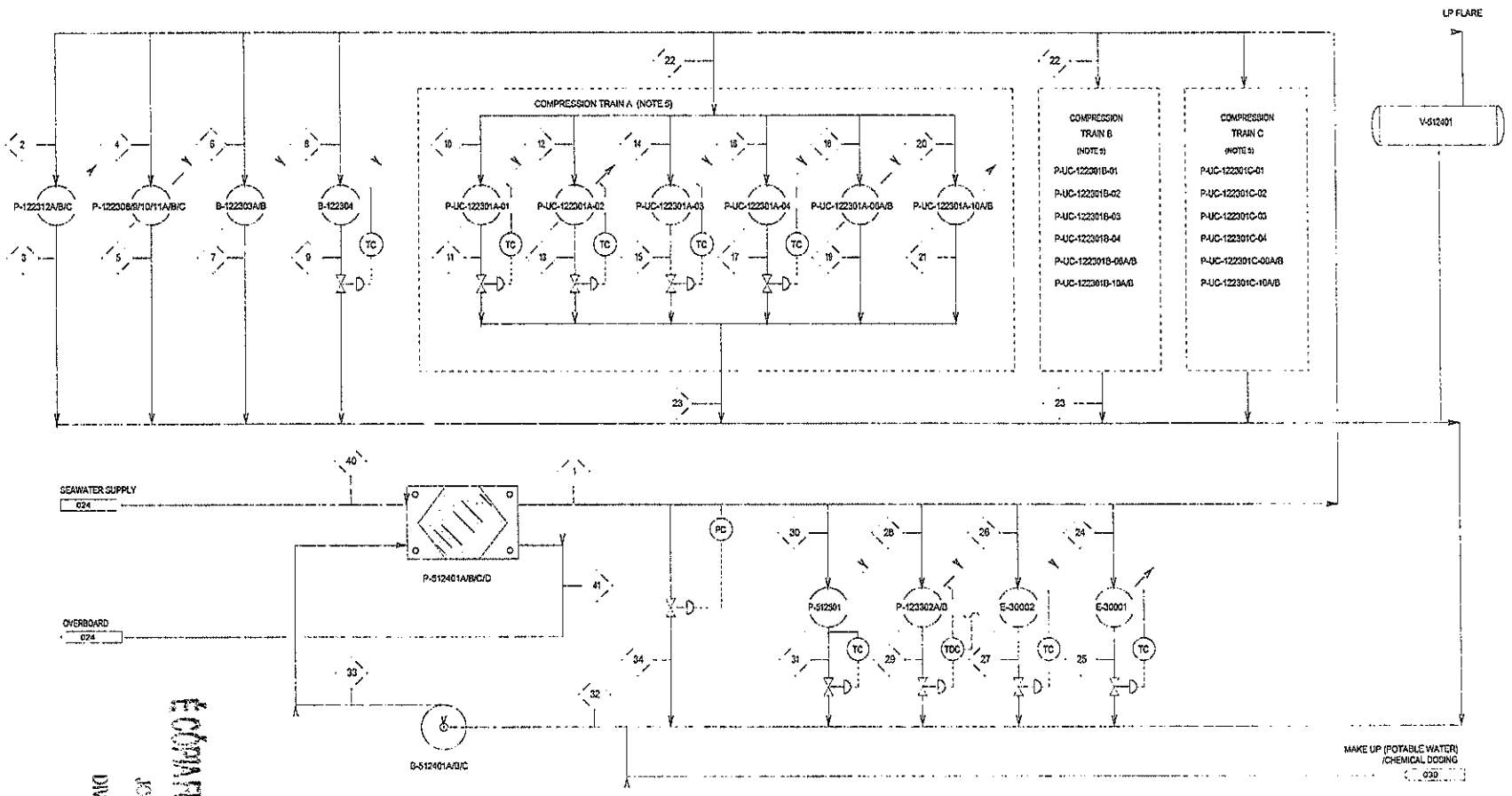
P-UC-122301A/B/C-06A/B
COMPRESSOR
LUBE OIL COOLERS

P-UC-122301A/B/C-10A/B
TURBINE
LUBE OIL COOLERS

P-512501
HEATING MEDIUM
DUMP COOLER

V-512401
PROCESS COOLING
EXPANSION VESSEL

1. FOR DETAILS OF FRESHWATER FLOWRATES SEE DOC: MC-3010.38-5124-941-AM*
FLOWS SHOWN ARE FOR A [illegible] DUCTION CASE.
2. FW = FRESHWATER.
SW = SEAWATER.
3. INTERMITTENT USE.
4. NOT NORMALLY IN USE.
5. NORMAL CASE IS FOR TWO COMPRESSION TRAINS OPERATING.
6. FLOW IS FOR MAX. SEA TEMPERATURE.
7. PRESSURES SHOWN ARE AT EQUIPMENT ELEVATION.



STREAM No.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	40	41
FLUID	(NOTE 2)	FW	FW	FW	FW	FW	FW	FW	FW	FW	FW	FW	FW	FW	FW	FW	FW	FW	FW	FW	FW	FW	FW	FW	FW	FW	FW	FW	FW	FW	FW	FW	FW			SW	SW
PRESSURE	(NOTE 7) barg																																				
TEMPERATURE	°C	32	32	45	32	45	32	45	32	45	32	45	32	45	32	45	32	45	32	45	32	45	32	45	32	45	32	45	32	45	32	45	45			29	49
MASS FLOWRATE - OPERATING	kg/h x 10³		146	15	84	40	18	84	40	1466	163	361	419	826	182	361	419	826	1629	1466	1466	3439	3439	234	234	6842	6842	6842	146	1466	4026	4026			3421	3421
DESIGN	kg/h x 10³		169	18	93	53	17	92	53	1838	202	397	481	878	201	397	481	878	1838	1838	1838	3763	3763	257	257	7527	7527	7527	161	1838	4429	4429			3763	3763
FLOWRATE OPERATING	m³/h		146	15	89	34	18	85	40	1466	164	362	421	829	185	365	423	831	1496	1504	1496	3456	3470	235	235	6155	6905	6774	147	1504	4046	4046			3397	3397
DESIGN	m³/h		161	16	93	09	17	93	04	1646	203	399	483	881	203	401	485	884	1646	1654	1646	3662	3817	259	262	8947	7306	7386	162	1664	4451	4451			3803	3803
DENSITY	kg/m³ (TP)	995	995	1022	999	995	991	991	991	995	995	995	995	995	990	990	990	990	995	995	995	990	995	991	965	991	999	1022	1019	991	999	995	995			1019	1019
NOTES				3				3																												6	6

DE-3010.38-1222-940-AMK-012 | PFD - GAS COMPRESSION
DRAWING NUMBER | DRAWING TITLE
REFERENCE DRAWINGS

REV	DATE	DESCRIPTION OF REVISION	DRN BY	CHK BY	APPD BY	APPD DATE
A		FOR ECOS GRAPHICS	TC			

BRASOIL
NOBLE DENTON | Petromec | AMEC

TITLE
UTILITY FLOW DIAGRAM
PROCESS COOLING
WATER SYSTEM

DRAWN/DATE P.CARROLL
CHECKED/DATE G.CURATI
APPROVED/DATE
SCALE NONE
SIZE A1

DRAWING NUMBER
DE-3010.38-S424-943-AMK-025
REV A

COMPANY CONFIDENTIAL DOCUMENT

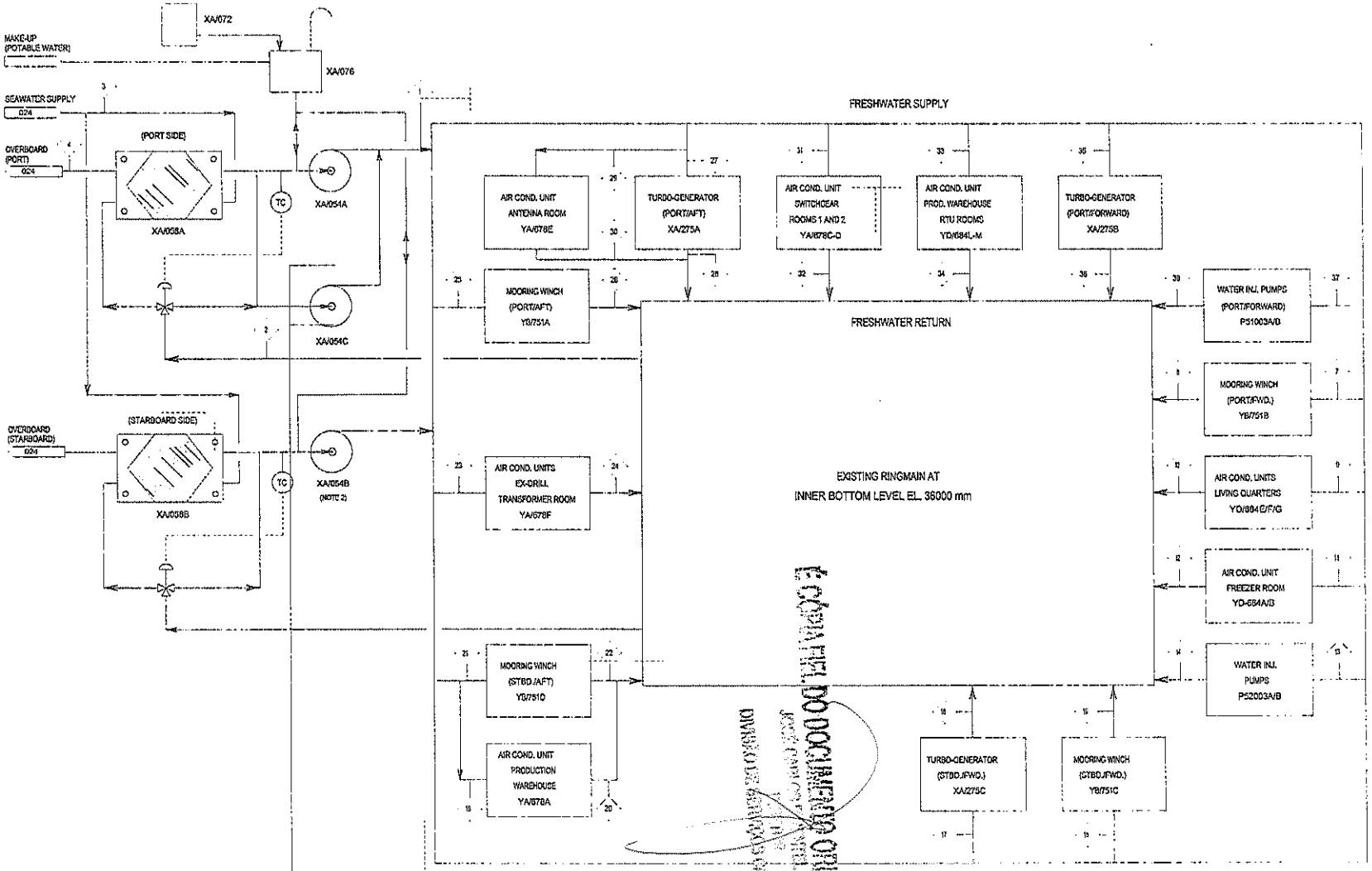
XA/07[illegible] CHEMICAL D ANK (EXIST.RELOCATED)

XA/076 EXPANSION TANK (EXIST.RELOCATED)

XA/058A/B (E-55101/2) CENTRAL FRESHWATER HEAT EXCHANGERS (EXIST.)

XA/054A/B (P-5510[illegible]) FRESHWATER CIRCULATION PUMPS (EXIST.)

XA/054C AUXILIARY FRESHWATER COOLING PUMP (EXIST.)



STREAM No.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
PRESSURE (NOTE 4)	bara	91	3.0	3.2				8.0	4.0	8.0	4.0	8.0	4.0	8.0	4.0	8.0	4.0	8.0	4.0	8.0	4.0	8.0	4.0	8.0	4.0	8.0	4.0	8.0	4.0	8.0	4.0	8.0	4.0	8.0	4.0	8.0	4.0	8.0	4.0		
TEMPERATURE	°C	38	45	28				38	45	38	45	38	45	38	45	38	45	38	45	38	45	38	45	38	45	38	45	38	45	38	45	38	45	38	45	38	45	38	45		
MASS FLOWRATE: OPERATING	kg/h x 10^3	581.7	581.7	456.0				20.6	20.6	41.3	41.3	99.2	99.2	99.5	99.2	20.6	20.6	94.3	94.3	0.5	0.5	20.6	20.6	3.0	3.0	29.6	20.6	94.3	94.3	0.5	0.5	2.9	2.9	20.6	20.6	94.3	94.3	99.5	99.5		
: DESIGN	kg/h x 10^3	636.0	636.0	501.6				32.5	32.5	45.4	45.4	21.1	21.1	99.5	21.1	32.6	32.6	103.7	103.7	0.5	0.5	32.6	32.6	3.3	3.3	32.5	32.5	103.7	103.7	0.5	0.5	3.2	3.2	22.7	22.7	103.7	103.7	99.5	99.5		
VOL.FLOWRATE: OPERATING	m^3/h (TP)	665.8	587.5	446.2				30.9	30.1	41.0	41.7	19.5	19.4	91.1	19.4	30.0	30.1	95.0	95.0	0.5	0.5	30.0	30.1	3.0	3.0	30.0	33.1	95.0	95.0	0.5	0.5	2.9	2.9	20.7	20.9	95.0	95.5	91.1	91.4		
: DESIGN	m^3/h (TP)	644.4	646.3	450.0				33.0	33.1	45.8	46.0	21.3	21.3	100.3	100.6	33.0	33.1	35.0	104.5	0.5	0.5	33.0	33.1	3.3	3.3	33.0	33.1	104.5	104.8	0.5	0.5	3.2	3.2	22.8	22.9	104.5	104.8	100.3	100.6		
LIQUID DENSITY	kg/m^3 (TP)	863	990	1022				993	990	993	990	993	990	993	990	993	990	993	990	993	990	993	990	993	990	993	990	993	990	993	990	993	990	993	990	993	990	993	990		
NOTES								3	3							3	3							3	3			3	3												

1. FOR DETAILS OF FLOWS INCLUDING INTERMITTENT, SEE DOCUMENT MC-3010-38-5124-041-
2. ONE PUMP/EXCHANGER IS ON STANDBY
3. ONLY ONE WINCH OPERATED AT A TIME.
4. PRESSURES ARE AT TANK TOP LEVEL.

DRAWING NUMBER	DRAWING TITLE
RESPONSIBLE DISCIPLINE	

REV	ISSUED DATE	DESCRIPTION OF REVISION	ORIG BY	CHK BY	APPD BY	APPR CLIENT
A		FOR ECDS GRAPHICS	PC			

BRASOIL

NOBLE DENTON | Petronius | AMEC

TITLE

UTILITY FLOW DIAGRAM
UTILITY FRESHWATER
COOLING SYSTEM

ORIGINATOR	P.CANNELL
CHECKED DATE	G.DUNATT
APPROVED DATE	
SCALE	NONE
DRAWING NUMBER	DE-3010-38-5124-943-AMK-026
REV	A

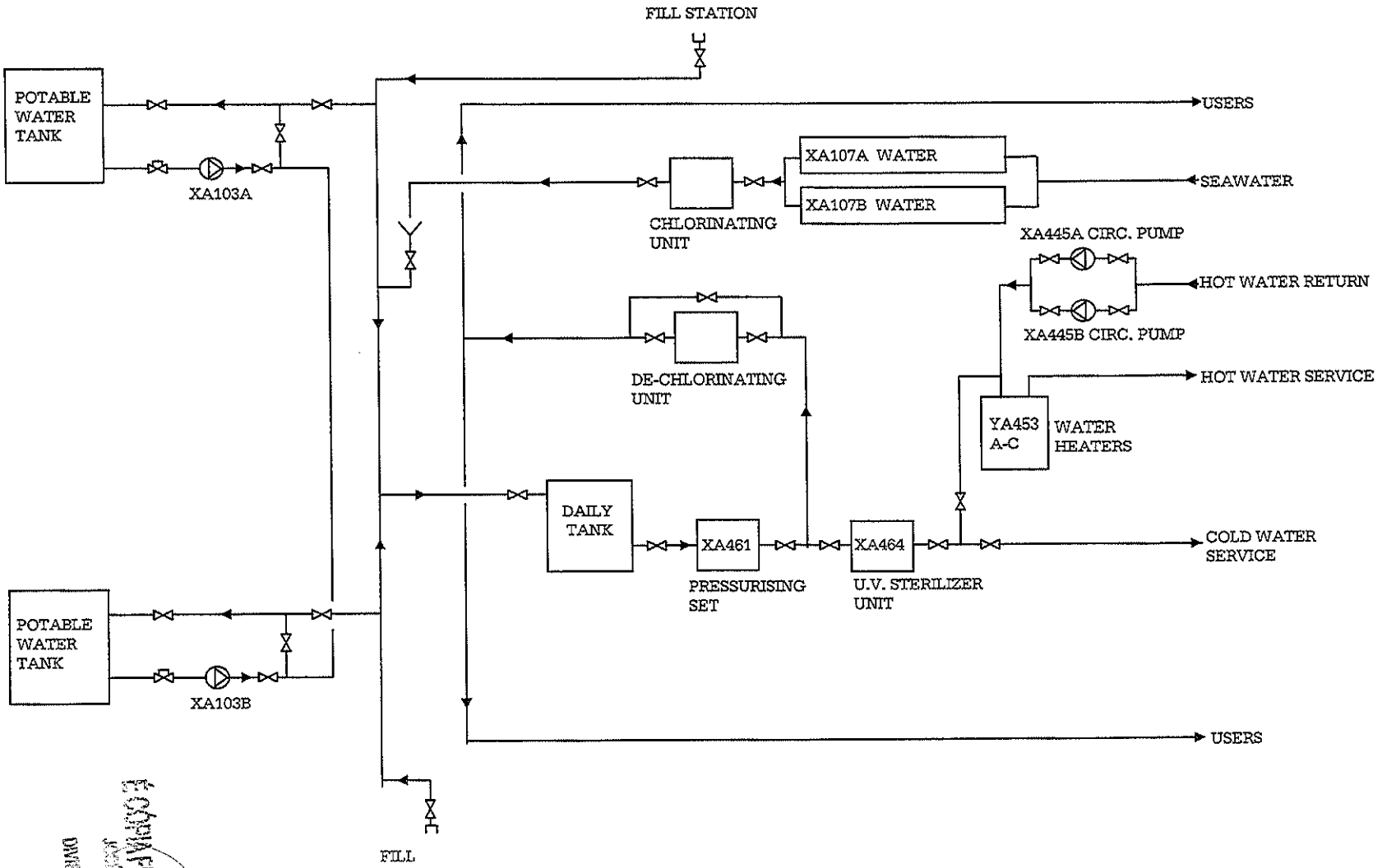
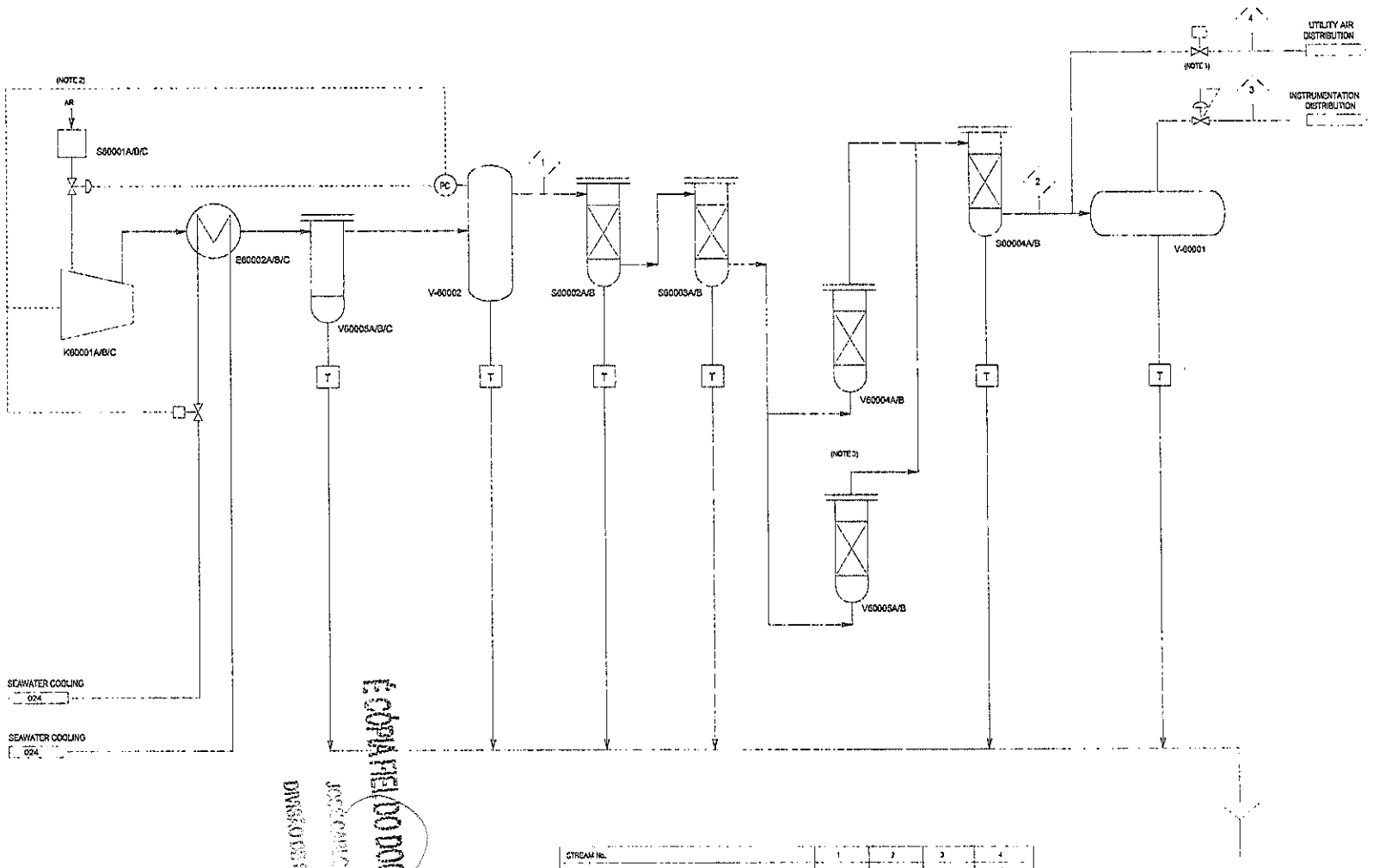


Fig. 4.3.9
Potable Water System Simplified Diagram

S60001A/B/C	E60002A/B/C	V60005A/B/C	V60002	S60002A/B	S60003A/B	V60004A/B	V60004A/B	V60001
COMPRESSOR SUCTION FILTERS	AFTERCOOLERS	MOISTURE SEPARATORS	WET AIR RECEIVER	AIR FILTERS	AIR FILTERS	AIR DRYERS	AIR FILTERS	INSTRUMENT AIR RECEIVER
K60001A/B/C AIR COMPRESSORS						V60005A/B AIR DRYERS		

1. UTILITY AIR IS ISOLATED WHEN AIR RECEIVER PRESSURE REDUCES TO 5.5 barg.
2. THE 3 COMPRESSORS START IN SEQUENCE FOLLOWING PRESSURES:
   8.4, 8.2 AND 8.0 barg.
3. DRYERS ARE HEATLESS REGENERATION TYPE REGENERATION INITIATED BY MOISTURE ANALYSER.



STREAM No.			1	2	3	4
FLUID			AIR	AIR	AIR	AIR
PRESSURE	barg.		0.0	0.0	8.5	8.5
TEMPERATURE	°C.		40	40	40	40
TOTAL MASS FLOWRATE	OPERATING	kg/h.	1870	1700	1700	0
	DESIGN	kg/h.	3820	3473	2600	95
VAPOUR FLOWRATE	OPERATING	m³/h. (TP)	1551	1741	1627	0
	DESIGN	m³/h. (TP)	3079	3567	3117	97
	DESIGN	Sm³/h. (STP)	3170	3680	2400	75
NOTES						

REV	DATE	DESCRIPTION OF REVISION	DRN BY	CHK BY	APPD BY	APPD CLIENT
A		AFD			PC	

DRAWING NUMBER | DRAWING TITLE
REFERENCE DRAWINGS

BRAGOIL | P36-RONCADOR FIELD DEVELOPMENT CONTRACT : L0277

NOBLE DENTON | Petronec | AMEC

TITLE: UTILITY FLOW DIAGRAM INSTRUMENT AIR SYSTEM

DRAWN/DATE: PCARROLL
CHECKED/DATE: G.CURATI
APPROVED/DATE:
CLIENT APPROVAL/DATE:

DRAWING NUMBER: DE-3010.38-5134-943-AMK-035
REV: A

TD-511102
SEAWATER DISPOSAL CAISSON

TD-533601
PRODUCTION CAISSON B-533606A/B SKIM OIL PUMPS

V45001
HAZARDOUS OPEN DRAINS DRUM

P-45002A/B
HAZARDOUS OPEN DRAINS DRUM PUMP

V-533605
TANK TOP DECK ..
B-533605
TANK TOP DECK SUMP T

V-533604A/B
DRAINS STORAGE TANKS B-533604A/B DRAINS STORAGE PUMPS

V45002
CLOSED DRAINS DRUM B-533603A/B CLOSED DRAINS PUMPS

YD/731E
MATRIX SEPARATOR OIL PUMP

YD/731B
RIX SEPARATOR

YD/731C
SKIM PILE PUMP

YD/731A
SKIM PILE

SPECIFIC NOTES

1. NORMALLY NO FLOW
2. INTERMITTENT FLOW
3. ONE TANK AND PUMP IN EACH AFT COLU..
4. PRODUCTION CAISSON AND SKIM PILE MOUNTED ON OUTSIDE WALL OF CENTRAL CAISSON. DISPOSAL CAISSON IS INSIDE CENTRAL CAISSON.

BOOSTER COMPRESSOR AUXILIARIES 024
PRODUCED WATER DEGASSER 037 V-533501 DEGASSER
PRODUCED WATER 037 V-533501
HYDROCYCLONES AND DEGASSER OILY WATER 037
BOOSTER COMPRESSOR SUCTION KO DRUM 012 V-30001
SAFETY GAS KO DRUM 012 V-12001
TEG FLASH TANK 022 V-12301
OIL EXPORT P/G LAUNCHERS P&IS 011
LP-12201A/B/C
HP FLARE DRUM 012 V-4301 (NOTE 1)
LP FLARE DRUM 031 V-511202 (NOTE 1)
PRODUCTION TRAIN A & B INLET 011
ATMOSPHERIC SEPARATORS
TO OIL EXPORT PUMPS
DELUGE DRAINS
SKID PANS
WATER INJECTION MANIFOLD 023
LP FLARE 031
V45001
V45002
P45002A/B
B-533605
B-533603A/B
SKID PANS
V-533605
SAFETY GAS KO DRUM 031
B-53360GA/B
INTERIOR /EXTERIOR DECK DRAINS
YD/731C
YD/731E
YD/731B
MAIN DECK
TANK TOP
WATER INJECTION FILTRATION 023
CENTRAL FRESHWATER EXCHANGER 024
WATER INJECTION PUMPS/SEAWATER PACKAGES 026
PORT & STB. COLUMN DUMP PIPE (TYPICAL OF 2)
V-533604A/B (NOTE 3)
B-533604A/B
TO SEA
TD-511102 (NOTE 4)
TD-533601 (NOTE 4)
PORT AFT COLUMN/STBD AFT COLUMN (NOTE 3)
YD/731A (NOTE 4)

STREAM No.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
PHASE		LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID				LIQUID									
PRESSURE	bar g																										
TEMPERATURE	°C																										
TOTAL MASS FLOWRATE	OPERATING kg/h																										
	DESIGN kg/h																										
VAPOUR FLOWRATE	OPERATING m³/h (TP)																										
	DESIGN m³/h (TP)																										
	DESIGN Sm³/h (NTP)																										
LIQUID FLOWRATE	OPERATING m³/h (TP)																										
	DESIGN m³/h (TP)																										
LIQUID DENSITY	kg/m³ (TP)																										
NOTES																											

REV	DATE	DESCRIPTION OF REVISION	DRN BY	CHK'D BY	APP'D BY	APP'D CLIENT
A		FOR ECOS GRAPHICS	PC			

DRAWING NUMBER | DRAWING TITLE
REFERENCE DRAWINGS

PETROBRAS | P36-RONCADOR FIELD DEVELOPMENT CONTRACT : L0277

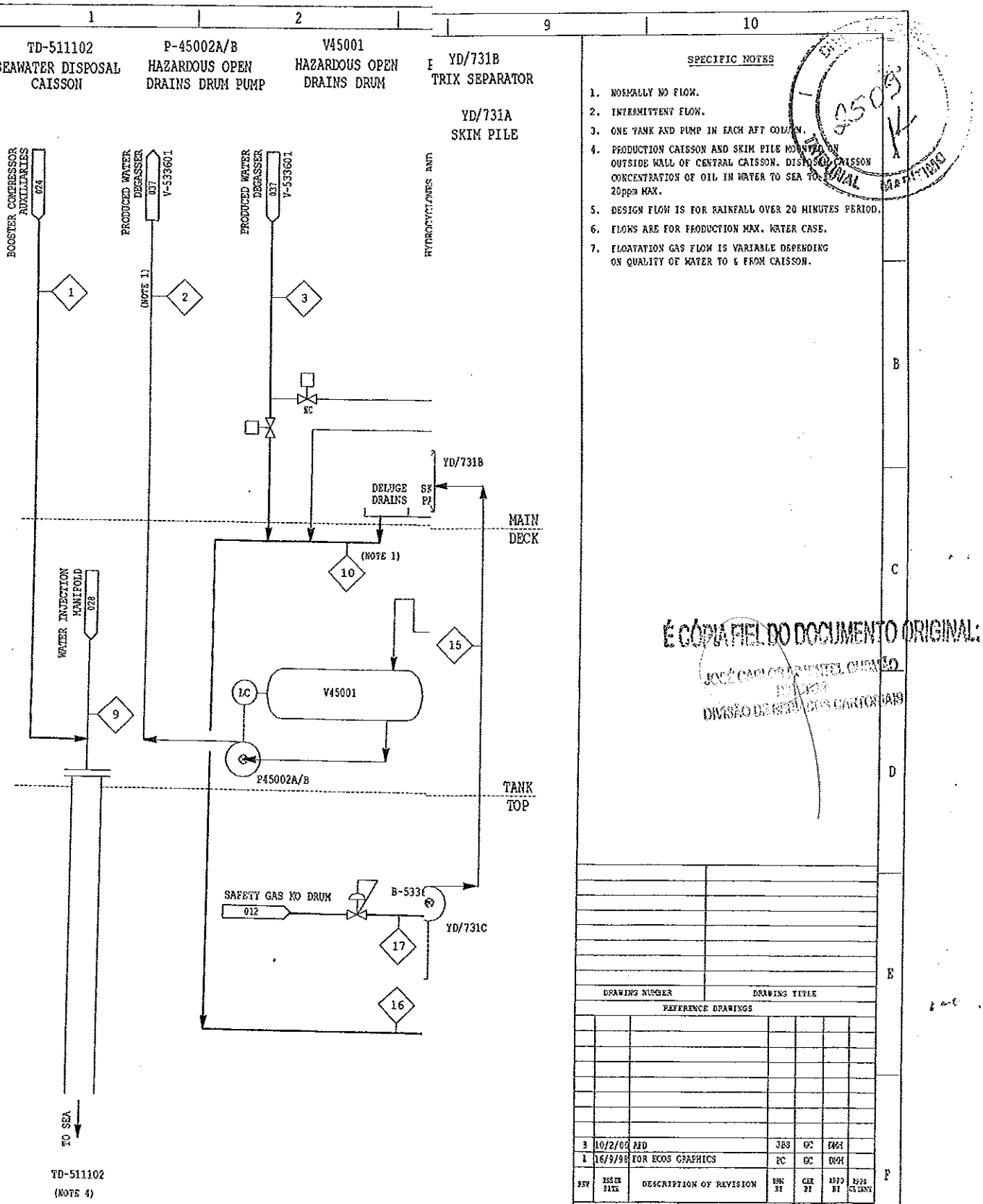
NOBLE DENTON | Petronius | AMEC

TITLE
UTILITY FLOW DIAGRAM
DRAINAGE SYSTEM

DRAWN P.CARROLL
CHECKED G.DURATI
APPROVED
ISSUED
SCALE NONE
SIZE A

DRAWING NUMBER
DE-3010.38-5338-940-AMK-033
REV A

CONTROLLED DOCUMENT



SPECIFIC NOTES

1. NORMALLY NO FLOW.
2. INTERMITTENT FLOW.
3. ONE TANK AND PUMP IN EACH AFT COLUMN.
4. PRODUCTION CAISSON AND SKIM PILE MOUNTED ON OUTSIDE WALL OF CENTRAL CAISSON. DISPOSAL CAISSON CONCENTRATION OF OIL IN WATER TO SEA TO BE 20ppm MAX.
5. DESIGN FLOW IS FOR RAINFALL OVER 20 MINUTES PERIOD.
6. FLOWS ARE FOR PRODUCTION MAX. WATER CASE.
7. FLOATATION GAS FLOW IS VARIABLE DEPENDING ON QUALITY OF WATER TO & FROM CAISSON.

DRAWING NUMBER	DRAWING TITLE

REFERENCE DRAWINGS

REV	ISSUE DATE	DESCRIPTION OF REVISION	DRN BY	CHK BY	APPD BY	APPD CLIENT
B	10/2/00	AFD	JBS	GC	DMH	
A	16/9/98	FOR ECOS GRAPHICS	PC	GC	DMH	

STREAM No.			1	2	3		
FLUID			SEAWATER	OILY WATER	PROD. WATER		
PRESSURE	bar a		1.01	1.1	1.01		
TEMPERATURE	°C		40	20	40		
TOTAL MASS FLOWRATE	OPERATING	kg/h	36500	0	172740		
	DESIGN	kg/h	40100	10000	200000		
VAPOUR FLOWRATE	OPERATING	Kg/h	-	-	-		
	DESIGN	Kg/h	-	-	-		
LIQUID FLOWRATE	OPERATING	m³/h	35.9	0	173.6		
	DESIGN	m³/h	39.4	10	201		
LIQUID DENSITY		kg/m³	1017.1	1030	995		
NOTES				1	6		

BRASOIL | P36-RONCADOR FIELD DEVELOPMENT CONTRACT : L0277

NOBLE DENTON | Petromec | AMEC

TITLE

UTILITY FLOW DIAGRAM

DRAINAGE SYSTEM

DRAWN/DATE P.CARROLL 16/9/98

CHECKED/DATE G.CURATI 16/9/98

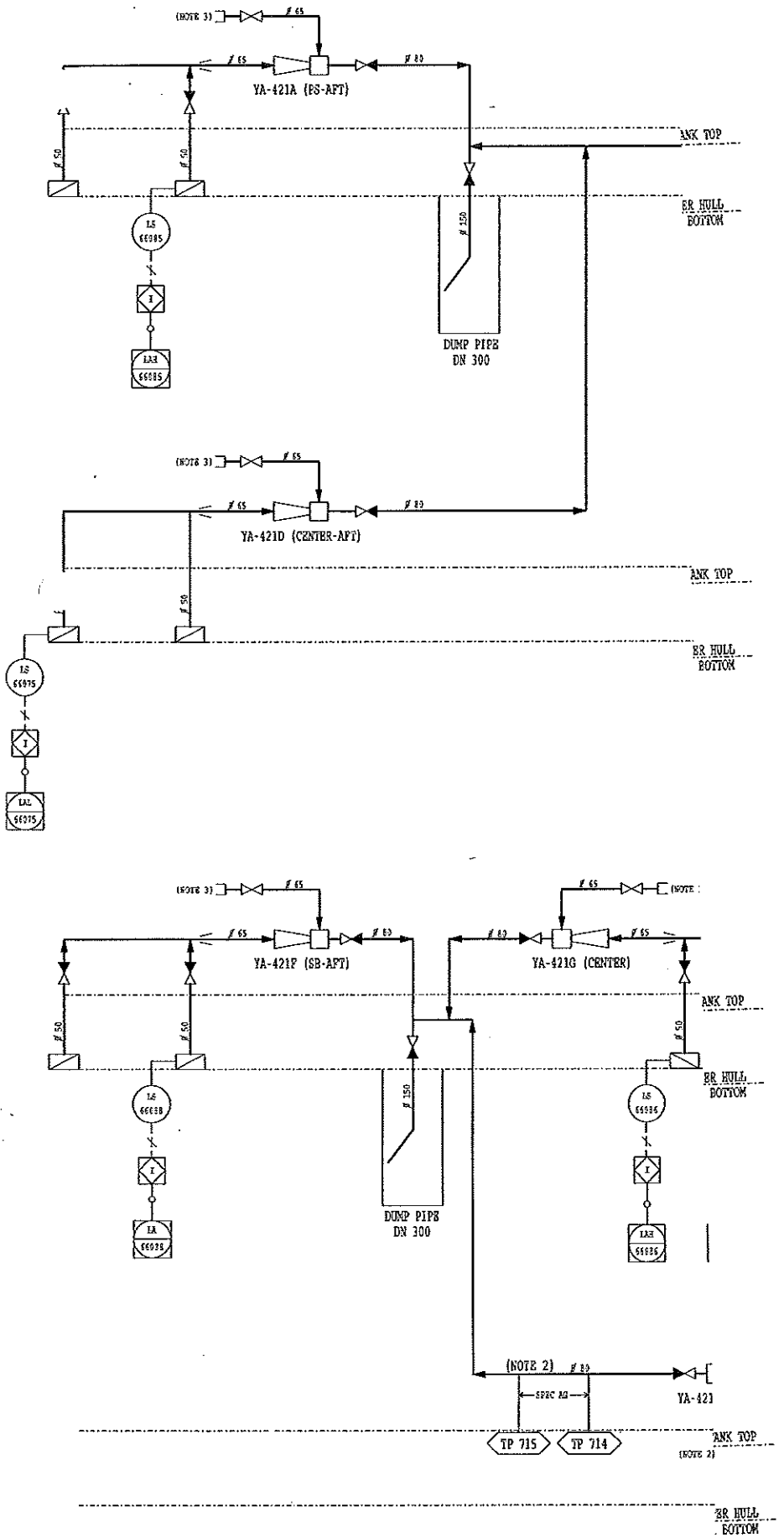
APPROVED/DATE D.HARWOOD 16/9/98

SCALE NONE

DRAWING NUMBER DE-3010.38-5336-943-AMK-033

REV B

033.dgn CAD REV 1.1 09/08/00



SPECIFIC NOTES

1 - SITE VERIFICATION REQUIRED FOR AS BUILTS.
2 - LINE REROUTED.
3 - CONNECT WITH FRESH WATER SYSTEM.

SIMBOLOGY

STOP CHECK VALVE
SB STARBOARD
PS PORTSIDE

THIS DRAWING HAS BEEN DEVELOPED FROM PICANTIERI DRAWING NUMBER A505 21175 (SHT 1 OF 4) REV. M

THIS DRAWING WAS REDRAWN BY UTC AND INCORPORATES THE INFORMATION OF DWG'S: DE-3010.38-5331-944-AMK-540-03 REV. A

DRAWING NUMBER	DRAWING TITLE

REFERENCE DRAWINGS

REV	ISSUE DATE	DESCRIPTION OF REVISION	DRAWN BY	CHKD BY	APPD BY	APPD CLIENT
C	21/11/00	REVISED WHERE INDICATED BY UTC	JAA	RJB	CH	
B	15/3/00	REDRAWN BY UTC	JBS	MFR	MJB	
A	10/2/99	FOR CONSTRUCTION	GC	GC		

BRASOIL

P36-RONCADOR FIELD DEVELOPMENT
CONTRACT No :- 7/15/2150

NOBLE DENTON | Petromec | AMEC

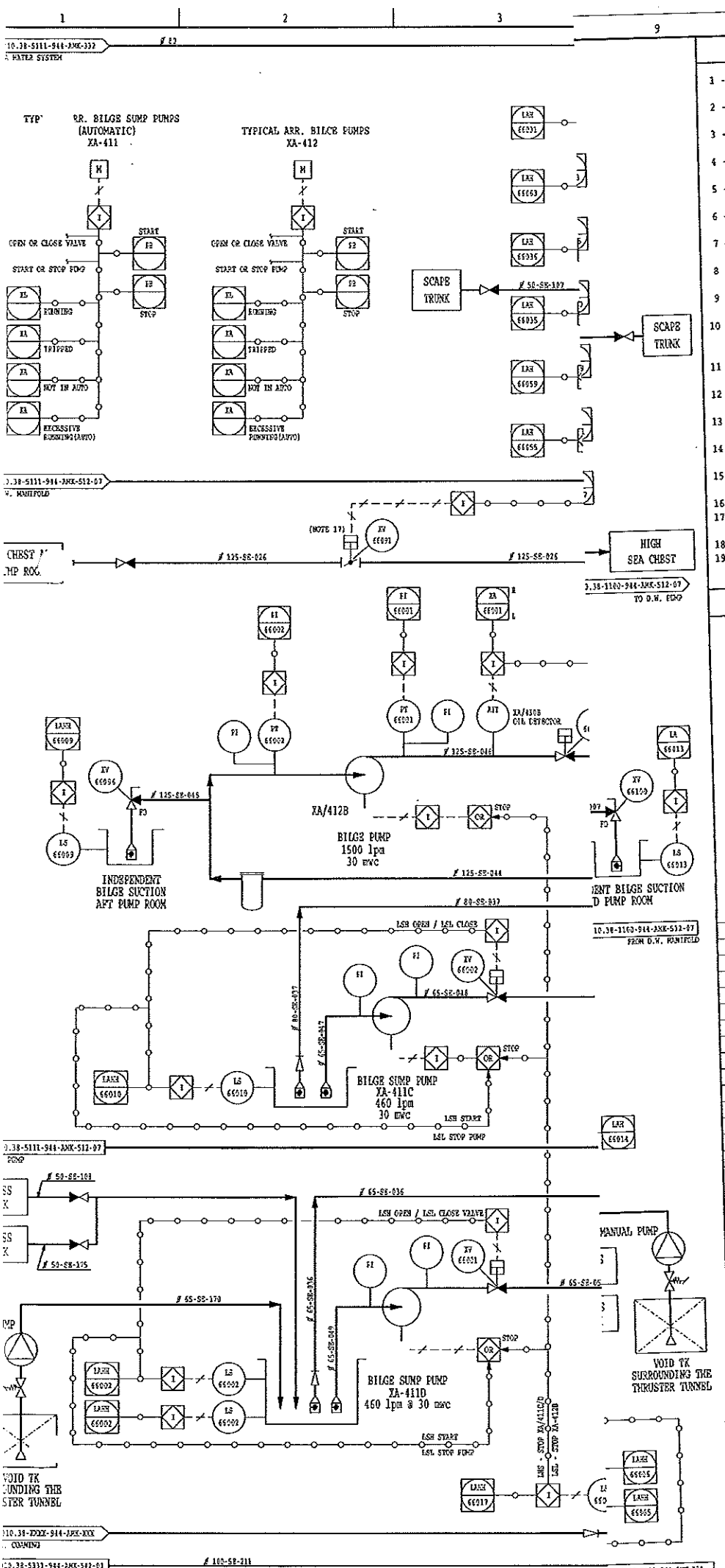
TITLE

P & I DIAGRAM
BILGE
PIPING SYSTEM

TANK TOP & UPPER HULL

DRAWN/DATE	G.C. 10.2.99
CHECKED/DATE	G.C. 10.2.99
APPROVED/DATE	
SCALE	NONE

DRAWING NUMBER: DE-3010.38-5331-944-AMK-540-06 REV: C



SPECIFIC NOTES

1 - PIPING SHALL BE HOT-DIPPED GALVANIZED AFTER FABRICATION.
2 - INSIDE THE TANKS WILL NOT BE USED STRAUS-JOINTS, BUT THE PIPING WILL BE HEAD WELDED
3 - VALVE TO BE CAST STEEL AS INDICATED & COME WITH CLASS TEST CERTIFICATE & HYDROSTATIC TEST RESULT CERT.
4 - ALL VALVE WITH REMOTE CONTROL SHALL COME WITH CLASS TEST CERTIFICATE & HYDROSTATIC TEST RESULT CERTIFICATE
5 - FOR EMERGENCY BILGE SUCTION OF EACH PUMP ROOM TO BE REFERRED TO SW PIPING SYSTEM.
6 - ALL VALVES IN THE BILGE MANIFOLDS SHALL BE OF THE STOP CHECK TYPE.
7 - ALL VALVES IN THE BILGE SYSTEM ON THE LOWER HULL SHALL BE REMOTE OPERATED FROM THE ECRC AND CCRC.
8 - BILGE HIGH LEVEL ALARM SHALL BE INSTALLED FOR THE PUMP ROOM & THRUSTER ROOM SUMPS.
9 - ALL VALVES REMOTELY OPERATED SHALL BE CAPABLE OF BEING LOCALLY OPERATED BY ACTUATOR OR MANUALLY.
10 - LOCAL MANUAL OPERATION SHALL BE WITH A HANDWHEEL ATTACHED OR STORED ADJACENT TO THE VALVE OR BY MANUAL HYDRAULIC OVERRIDE.
11 - ALL REMOTE OPERATED VALVES SHALL HAVE LOCAL AND REMOTE VALVE POSITION INDICATORS.
12 - HIGH LEVEL - AUTO START PUMP & OPEN VALVE
LOW LEVEL - AUTO STOP PUMP & CLOSE VALVE.
13 - STATUS DISPLAY FOR ALL REMOTE OPERATED VALVES TO BE SHOWN AT ECRC AND CCRC.
14 - ALL LEVEL & GENERAL ALARMS TO BE DISPLAYED AT ECRC AND CCRC.
15 - THIS DRWG. TO BE READ IN CONJUNCTION WITH THE SYSTEM SPEC. BOOKLET.
16 - SITE VERIFICATION REQUIRED FOR AS BUILTS.
17 - HIGH OIL LEVEL CLOSE VALVE. PUMP XA-411 STARTS, VALVE CLOSE.
18 - XA-411A/B AND XA-412A START VALVE OPEN.
19 - XA-412 START VALVE OPEN XA-411 START VALVE CLOSE.

SIMBOLOGY

STOP CHECK VALVE

SELF-CLOSING VALVE

THIS DRAWING HAS BEEN DEVELOPED FROM PICANTIERI DRAWING NUMBER A505 21175 (SHT 1 OF 4) REV. M

THIS DRAWING WAS REDRAWN BY UTC AND INCORPORATES THE INFORMATION OF DWG'S: DE-3010.38-5331-944-AMK-540-01 REV. A

DRAWING NUMBER	DRAWING TITLE

REFERENCE DRAWINGS

REV	ISSUE DATE	DESCRIPTION OF REVISION	DRAWN BY	CHKD BY	APPD BY	APPD CLIENT
B	15/3/00	REDRAWN BY UTC	JBS	MFR	MJB	
A	18/2/99	AFC	GC	GC		

BRASOIL | P36-RONCADOR FIELD DEVELOPMENT CONTRACT No :- 7/15/2150

NOBLE DENTON | Petromec | AMEC

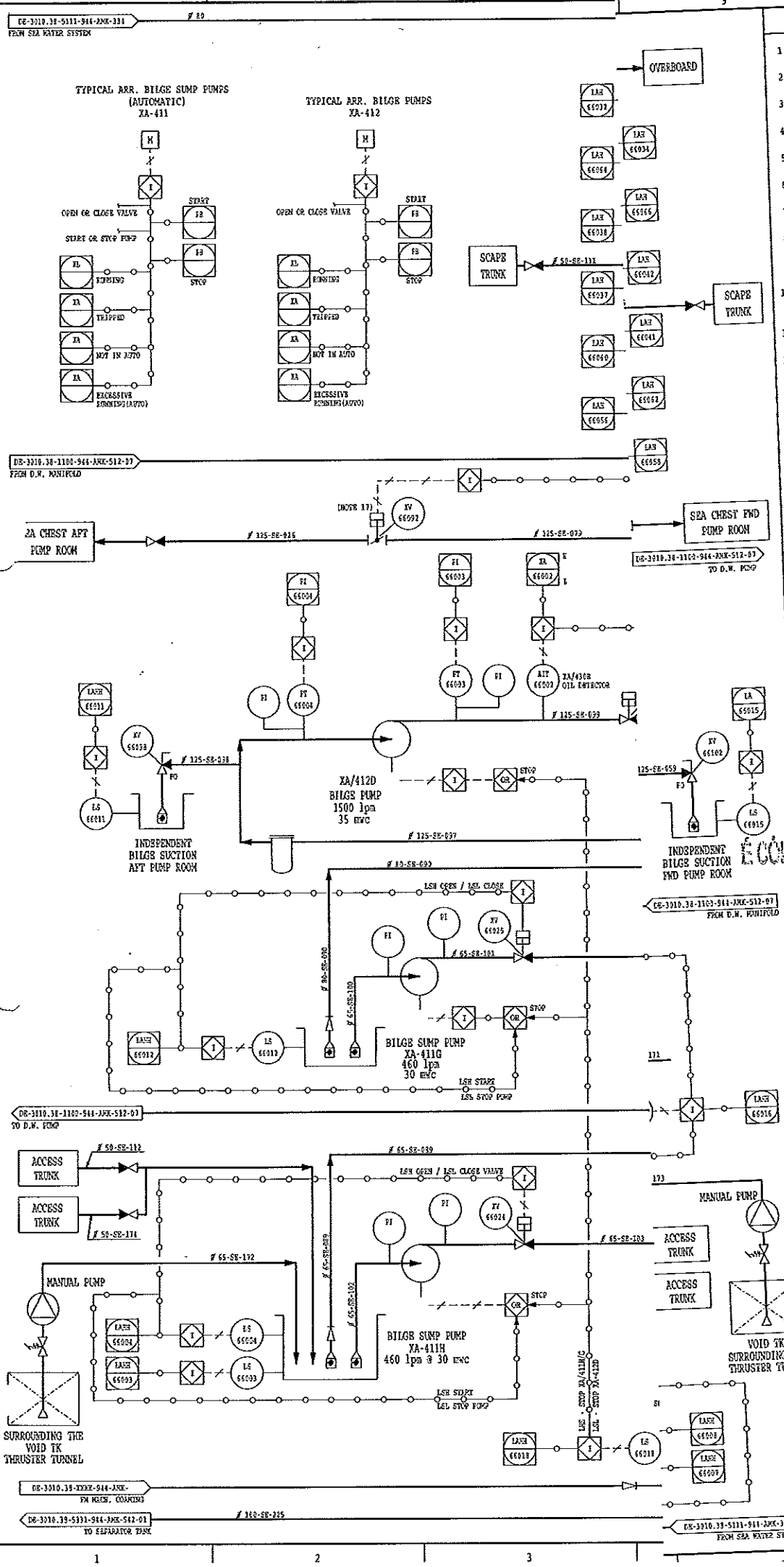
TITLE

P & I DIAGRAM
BILGE
PIPING SYSTEM

LOWER HULL - PORT SIDE

DRAWN/DATE G.C. 10.2.99
CHKD/REV/DATE G.C. 10.2.99
APPROVED/DATE
SCALE NONE

DRAWING NUMBER DE-3010.38-5331-944-AMK-540-02 REV B



SPECIFIC NOTES

1 - PIPING SHALL BE HOT-DIPPED GALVANIZED AFTER FABRICATION.
2 - INSIDE THE TANKS WILL NOT BE USED STRAUS-JOINTS, THE PIPING WILL BE HEAD WELDED
3 - VALVE TO BE CAST STEEL AS INDICATED CLASS TEST CERTIFICATE & HYDROSTATIC TEST RESULT
4 - ALL VALVE WITH REMOTE CONTROL SHALL COME WITH CLA TEST CERTIFICATE & HYDROSTATIC TEST RESULT CERTIF
5 - FOR EMERGENCY BILGE SUCTION OF EACH PUMP ROOM TO REFERRED TO SW PIPING SYSTEM.
6 - ALL VALVES IN THE BILGE MANIFOLDS SHALL BE OF THE STOP CHECK TYPE.
7 - ALL VALVES IN THE BILGE SYSTEM ON THE LOWER HULL SHALL BE REMOTE OPERATED FROM THE ECRC AND CCRC.
8 - BILGE HIGH LEVEL ALARM SHALL BE INSTALLED FOR TH PUMP ROOM & THRUSTER ROOM SUMPS.
9 - ALL VALVES REMOTELY OPERATED SHALL BE CAPABLE OF BEING LOCALLY OPERATED BY ACTUATOR OR MANUALLY.
10 - LOCAL MANUAL OPERATION SHALL BE WITH A HANDWHEEL ATTACHED OR STORED ADJACENT TO THE VALVE OR BY M HYDRAULIC OVERRIDE.
11 - ALL REMOTE OPERATED VALVES SHALL HAVE LOCAL AND REMOTE VALVE POSITION INDICATORS.
12 - HIGH LEVEL - AUTO START PUMP & OPEN VALVE
LOW LEVEL - AUTO STOP PUMP & CLOSE VALVE.
13 - STATUS DISPLAY FOR ALL REMOTE OPERATED VALVES T SHOWN AT ECRC AND CCRC.
14 - ALL LEVEL & GENERAL ALARMS TO BE DISPLAYED AT ECRC AND CCRC.
15 - THIS DRWG. TO BE READ IN CONJUNCTION WITH THE SYSTEM SPEC. BOOKLET.
16 - SITE VERIFICATION REQUIRED FOR AS BUILTS.
17 - HIGH OIL LEVEL CLOSE VALVE. PUMP XA-411 STARTS, VALVE CLOSE.
18 - XA-411E/F AND XA-412C START VALVE OPEN.
19 - XA-412 START VALVE OPEN XA-411 START VALVE CLO
20 - XA-412 START VALVE CLOSE XA-411 START VALVE OP

SIMBOLOGY

STOP CHECK VALVE

SELF-CLOSING VALVE

THIS DRAWING HAS BEEN DEVELOPED FROM FINCANTIERI DRAWING NUMBER A505 21175(SHT 1 OF 4) REV. M

THIS DRAWING WAS REDRAWN BY UTC AND INCORPORATES THE INFORMATION OF DWG'S: DE-3010.38-5331-944-AMK-540-03 REV. A

DRAWING NUMBER	DRAWING TITLE

REFERENCE DRAWINGS

REV	ISSUE DATE	DESCRIPTION OF REVISION	DRAWN BY	CHK BY
B	15/3/00	REDRAWN BY UTC	JBS	MFI
A	18/2/99	AFC	GC	GC

BRASOIL | NOBLE DENTON | Petromec

P36-RONCADOR FIELD DE
CONTRACT No :-

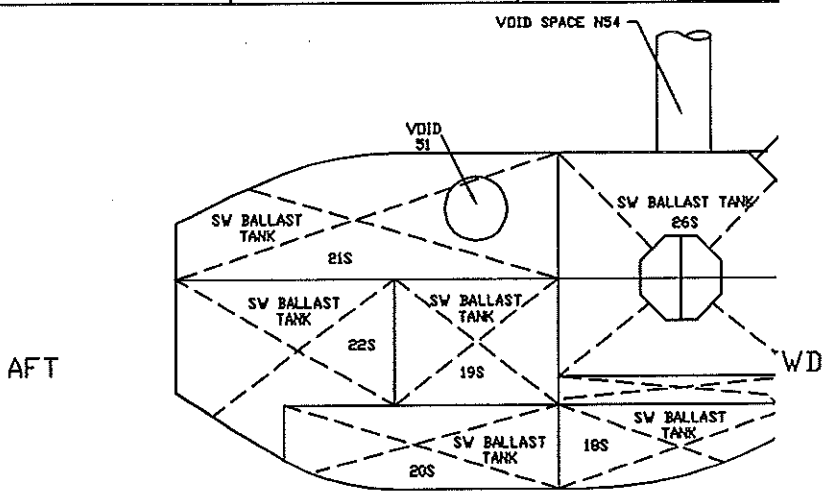
TITLE

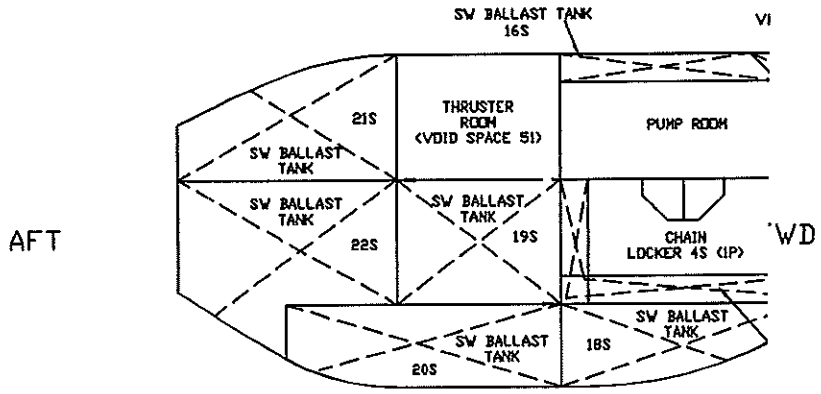
P & I DIAGRAM
BILGE
PIPING SYSTEM

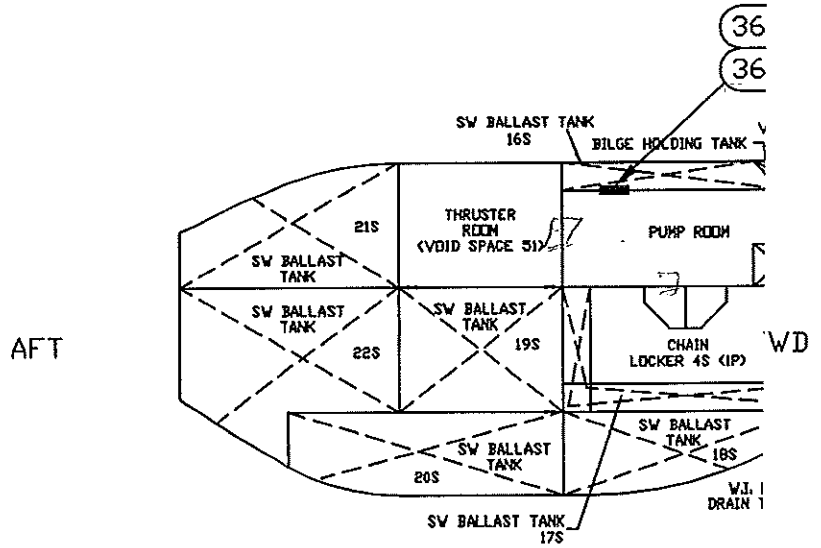
LOWER HULL - STARBOARD

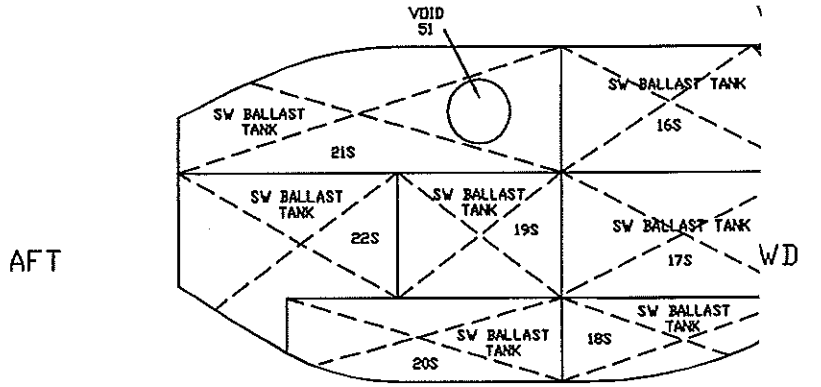
DRAWING NUMBER

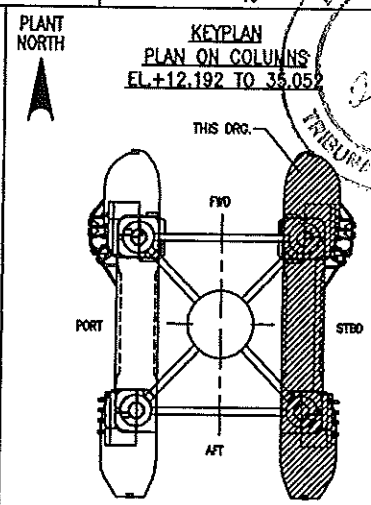
DE-3010.38-5331-944-AMK-54(











NOTES:

1. THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH FINCANTIERI DRG. A20326090 REV G.

DRAWING NUMBER	DRAWING TITLE

REFERENCE DRAWINGS

REV	ISSUE DATE	DESCRIPTION OF REVISION	DRAWN BY	CHKD BY	APPD BY	APPD CLIENT
D	02.18.99	AS BUILT	SCE	AT	AT	

BRASOIL — P36-RONCADOR FIELD DEVELOPMENT
CONTRACT No :- 7/15/2150

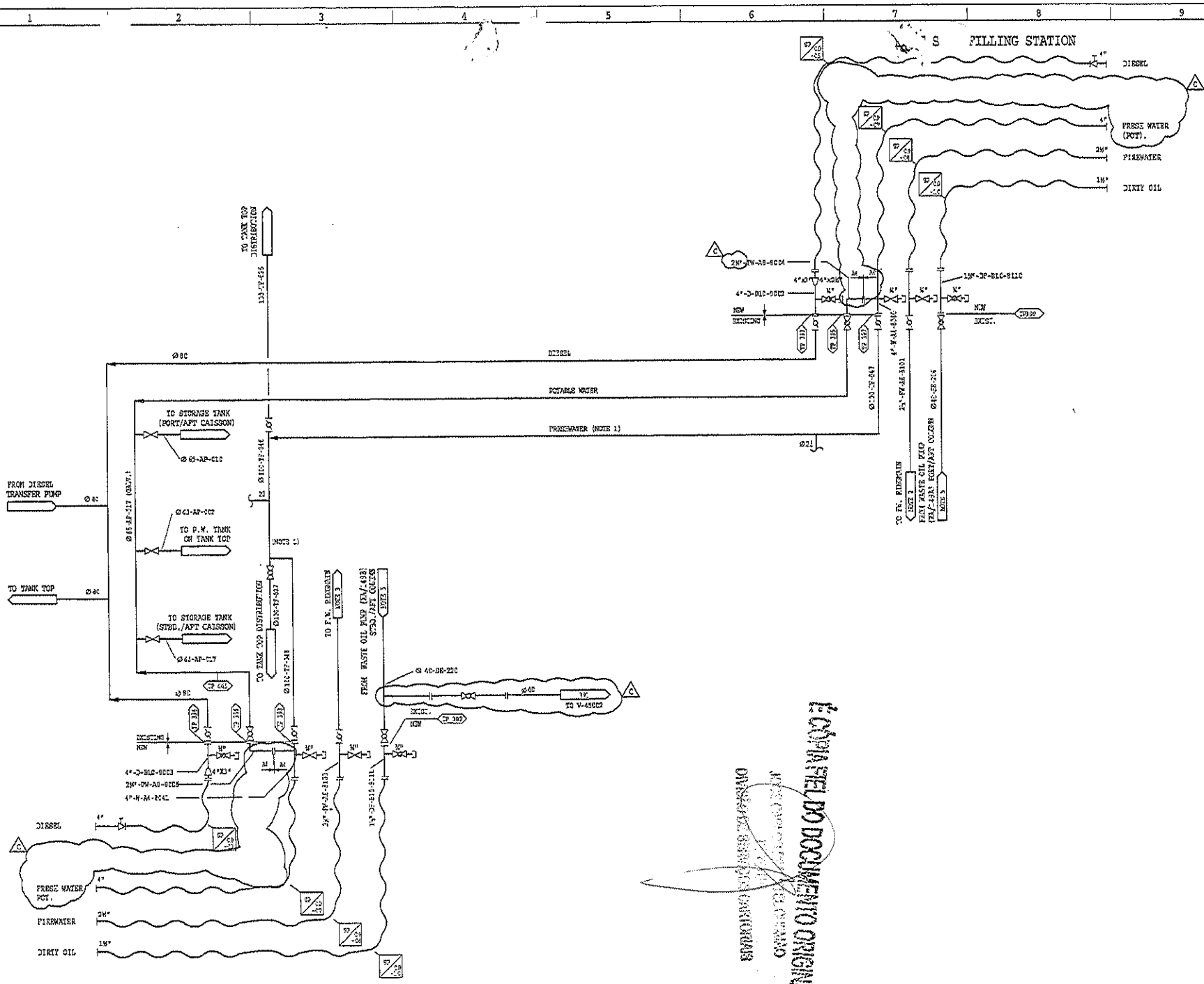
NOBLE DENTON — Petromec — AMEC

TITLE

PLAN ON LOWER HULL SHOWING ADDITIONAL MANHOLES

DRAWN/DATE: SCE/SEP.99
CHECKED/DATE: AT/OCT.99
APPROVED/DATE: AT/OCT.99
SCALE: 1:200 (A1)

DRAWING NUMBER: DE-3010.3B-1200-200-NBD-502-01
REV: 0



SPECIFIC NOTES

1. EXISTING DRILL WATER LINES USED FOR FRESH WATER BUNKERING.
2. CONTINUED ON SAFETY P&ID : DE-3010.38-4523-947-AMK-146.02.
3. CONTINUED ON SAFETY P&ID : DE-3010.38-4523-947-AMK-146.01.
4. HOSES TO BE STORED ON EACH SIDE OF PLATFORM WITH CRANE ACCESS. EXISTING HOSES TO BE REPLACED. REFER TO STASOIL ANNEX 16 OF BASIC DESIGN FOR NEW HOSES SPECIFICATIONS.
5. REFER TO FINCANTIERI DRG. A5E021175 SHT.4 FOR CONTINUATION.

DRAWING NUMBER	DRAWING TITLE

REFERENCE DRAWINGS

NO	DATE	DESCRIPTION OF REVISION	DRN BY	CHK BY	APP'D BY	APP'D DESIGN
E	31/11/00	REVISED MIDDLE PLATFORM TO VTC	JNA	XID	CH	
D	00/00/00	REVISED AFC	PC			
A	15/10/98	AFC	PC	CC	GMH	
0	25/03/98	FOR IDC	PFC	CC		

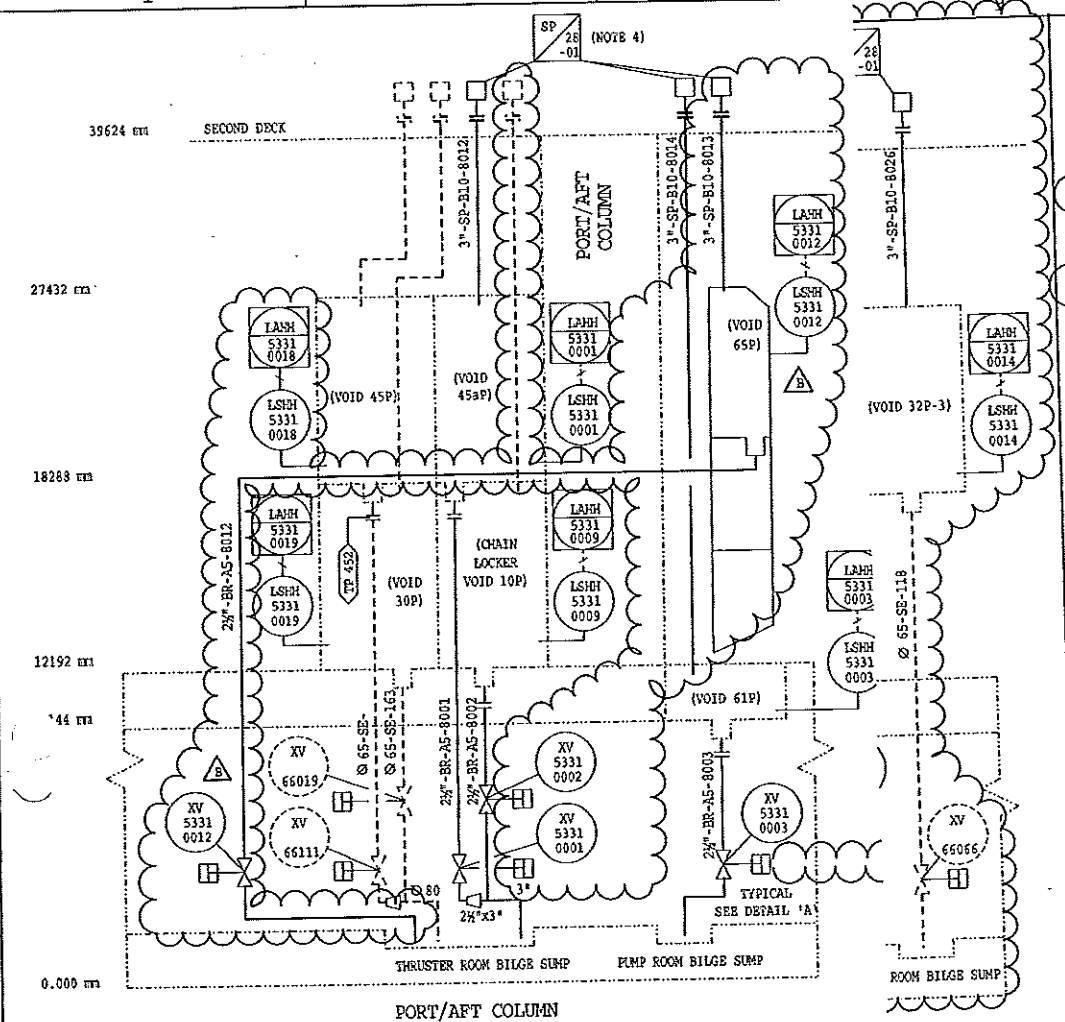
PROJECT: P36-RONCADOR FIELD DEVELOPMENT CONTRACT : LC277

CONTRACTOR: NOBLE DENTON | PETROBRAS | AMEC

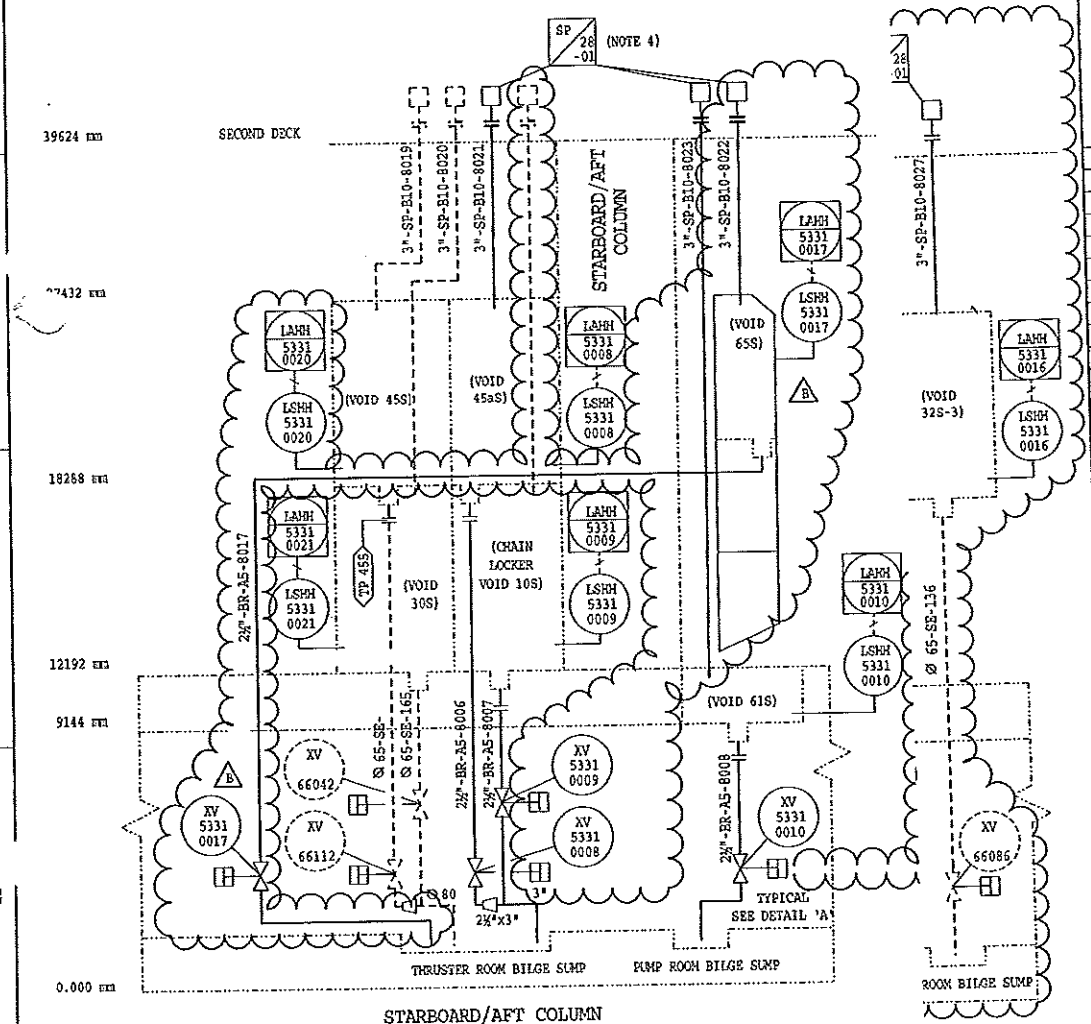
TITLE: P & I DIAGRAM BUNKERING SYSTEM

DRAWN: D.CARROLL 26/03/98
DESIGNED: D.CHACO 26/03/98
APPROVED: P.FLINDAN 27/03/98
SCALE: NON-

DRAWING NUMBER: DE-3010.38-5133-944-AMK-441 REV: C



PORT/AFT COLUMN



STARBOARD/AFT COLUMN

SPECIFIC NOTES

1. VALVES ARE OPERATED BY ELECTRO-HYDRAULIC ACTUATOR. VALVES ARE GLOBE/CHECK TYPE.
2. LEVEL SWITCHES ARE WALL MOUNTED INSIDE VOIDS.
3. LEVEL SWITCHES IN VOIDS ALARM ONLY. DRAINING IS MANUAL OPERATION.
4. 'WINEL' VENT.
5. VOIDS 32P-1 AND 32S-1 HAVE BEEN DIVIDED TO FORM ADDITIONAL VOIDS 32P-3 AND 32S-3 RESPECTIVELY.

FOR EXISTING BILGE PIPING SYSTEM REFER TO FINCANTIERI DRG: DE-3010.38-5331-944-AMK-540.01 TO 05.

REV	ISSUE DATE	DESCRIPTION OF REVISION	DRN BY	CHK BY	APP BY
B		REVISED AFC	PC		
A	17/06/99	AFC	PC	GC	RS
0	29/05/99	IDC	FFC	GC	DS

DRAWING NUMBER | DRAWING TITLE

REFERENCE DRAWINGS

BRASOIL | P36-RONCADOR FIELD DEVELOPM
CONTRACT : L0277

NOBLE DENTON | Petromec

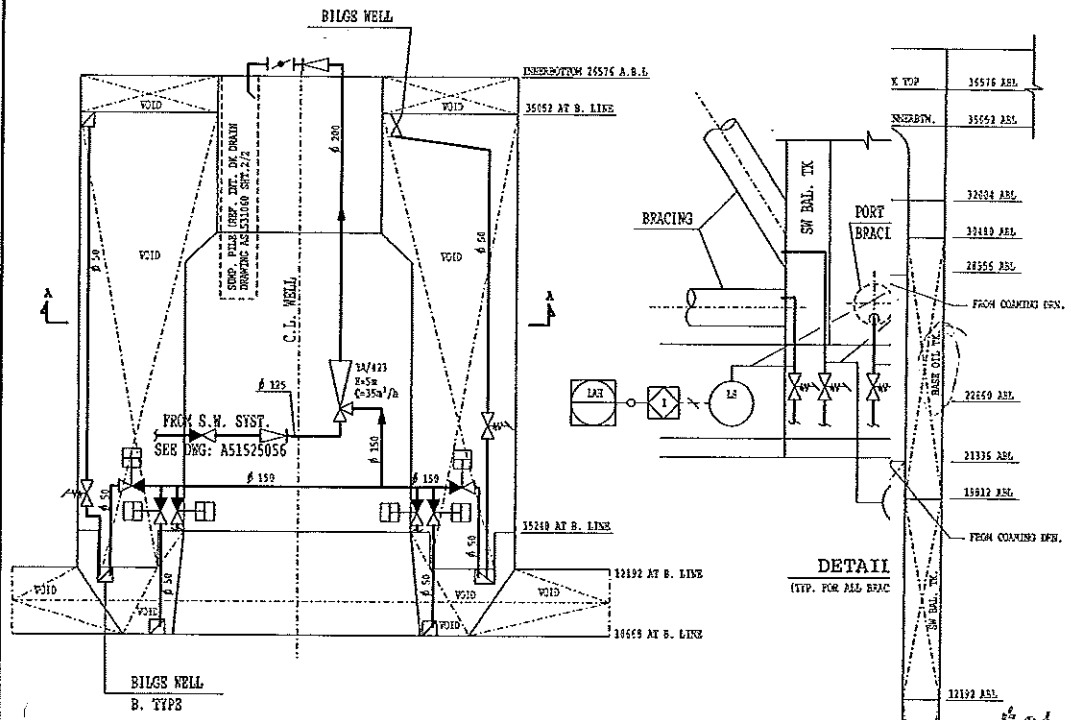
TITLE

P & I DIAGRAM

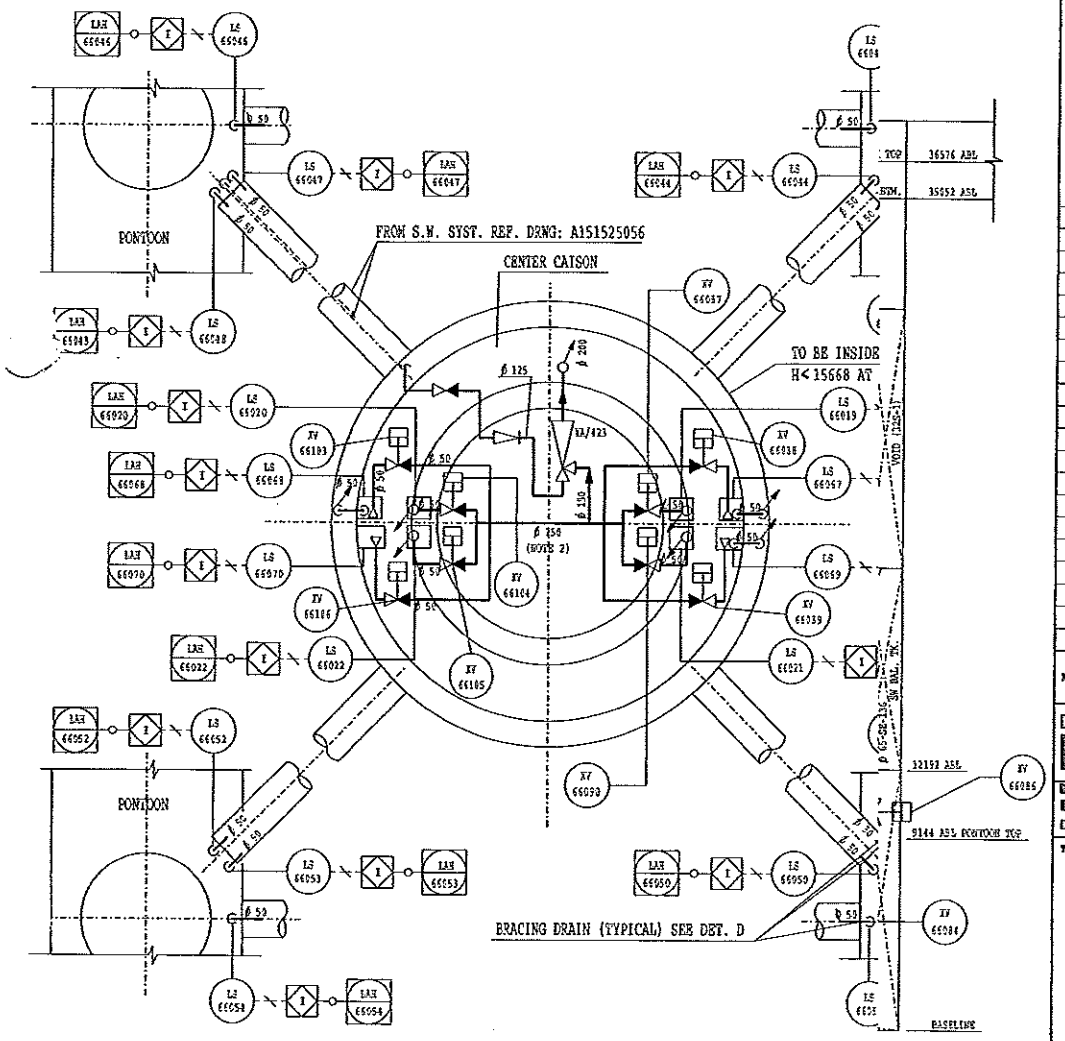
BILGE SYSTEM

DRAWN/DATE P.CA 28/0
CHECKED/D G.CU 29/0
APPROVED/ D.N.H 29/0
SCALE NO

DRAWING NUMBER
DE-3010.38-5331-944-AMK-500



ELEVATION VIEWING INBD.



SECTION A-A

SPECIFIC NOTES

1 - SITE VERIFICATION REQUIRED FOR AS BUILTS.
2 - SEE AMEC P & ID DE-3010.38-5331-944-AMK-500 FOR MODIFICATIONS IN THIS AREA.

SIMBOLOGY

STOP CHECK VALVE

SELF-CLOSING VALVE

THIS DRAWING HAS BEEN DEVELOPED FROM FINCANTIERI DRAWING NUMBER A50521175 (Sht 1 of 4) REV. M

DRAWING NUMBER	DRAWING TITLE

REFERENCE DRAWINGS

REV	ISSUE DATE	DESCRIPTION OF REVISION	DRAWN BY	CHKD BY	APPD BY	APPD CLIEN
B	15-3-00	REDRAWN BY UTC	JAA	MFR	MJB	
A	19-2-99	AFC	GC	GC		

BRASOIL

NOBLE DENTON

Petromec

AMEC

P36-RONCADOR FIELD DEVELOPMENT
CONTRACT No :- 7/15/2150

TITLE

P&I DIAGRAM
BILGE
PIPING SYSTEM

COLUMNS

DRAWN/DATE	CHECKED/DATE	APPROVED/DATE	SCALE
GC 10-2-99	GC 10-2-99		—

DRAWING NUMBER: DE-3010.38-5331-944-AMK-540-05

REV: B

É CÓPIA FIEL DO DOCUMENTO ORIGINAL:

JOSÉ CARLOS DE MATTOS CARMÃO
DIVISÃO DE SERVIÇOS CARTORIAIS

5 MARINE OPERATIONS

P36 is a fit-for-purpose Unit and the following information will assist in the planning, preparation and performing of marine related operations, and ensure that the operations are carried out in a safe manner and in accordance with the required standards.

The Operating Manual is meant to provide the crew with sufficient information and guidelines. All involved personnel must be familiar with the procedures.

The Operating Manual should be used in conjunction with the rest of the Quality Assurance documentation and the Instruction Manuals from the different equipment suppliers/manufacturers, as well as the drawings and other information supplied.

The manual is to be used by the Section Superintendents and their assistants onboard to achieve and maintain safe working conditions for all personnel onboard P36.

The manual has been compiled on the assumption that the unit will be operated by experienced, certified and well qualified crews, and it deals primarily with the main procedures to be implemented to perform marine operations and safe offshore production operations.

Prior to any activity taking place all equipment required should be made ready for use and checked to ensure that it is in good condition. Function tests to be carried out as far as is practical and possible.

Ultimately the FPU Manager remains responsible for the FPU and the safety of the crew at all times.

5.1 TRANSIT OPERATIONS

5.1.1 General

The intent of this section is to give guidelines only for transit. It is expected that the unit will be moved twice in her life.

For the specific operation of transit the Contractor responsible for performing the work or another nominated party should prepare a detailed and comprehensive procedure. The information given in this manual is purely to provide a background for the detailed procedure.

5.1.2 Organisation

5.1.2.1 *Responsibility for Personnel involved in Transit Operations*

1. FPU Manager

Responsible for the safety of the FPU and crew at all times. Ultimately responsible for all navigation, towing, and mooring activities. During such operations, the FPU Manager will be responsible for liaison with the Operator.

2. Marine Supt.

Will be responsible for the stability and ballasting of the FPU at all times.

3. Control Room Operators

Control Room Operators will operate the navigation and ballasting equipment and will report directly to the Marine Supt. who reports to the FPU Manager.

4. Other Section Superintendents as appointed by the FPU Manager

5. Anchor Handling Tug (AHT) Captain

Fully responsible for the safety of his vessel and crew. He will manoeuvre his vessel and direct the crew activities and will report directly to P36 FPU Manager

5.1.2.2 Qualifications

1. Marine Supt.

- ? To have relevant experience
- ? Knowledge of stability calculations and procedures
- ? Knowledge of ballast systems and procedures
- ? Knowledge of relevant codes and standards

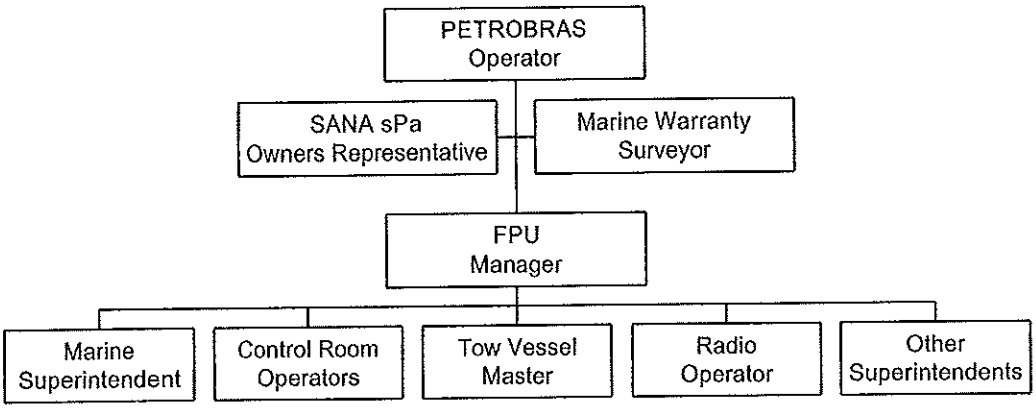
2. Control Room Operators

- ? To have relevant experience of transit operations
- ? Knowledge of relevant codes and standards
- ? Knowledge of the detailed transit procedures and equipment

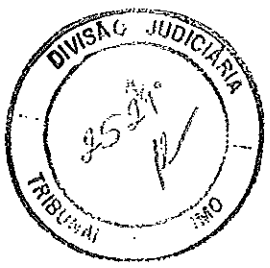
5.1.2.3 Reporting

Marine Supt. is reporting to FPU Manager after each navigation operation and after completion of the mooring operation. Attached organisation charts for transit operations

Organisation for Transit Operations of P-36



5.1.3 Preparations



5.1.3.1 People Involved

- FPU Manager
- Control Room Operator on Duty
- Marine Supt.
- Winch Operators fixed team appointed by FPU Manager
- Anchor Handling / Towing / Supply Vessel

5.1.3.2 Information Regarding Operations

Information on relevant operations to be distributed as follows:

- FPU Manager
- Marine Supt./Safety Supt.
- Relevant Control Room Operators
- Maintenance Supt.
- Anchor Handling / towing / supply vessel
- Stand-by vessel where applicable

5.1.3.3 Weather and FPU Motions Information

Radio Operator is responsible for keeping relevant weather and FPU motions information available on request from relevant persons:

- Wind speed
- Wind direction
- FPU heave
- FPU roll
- FPU pitch
- FPU Speed (if in transit)

5.1.4 Departure Preparations (with checklists)

Before leaving location all equipment required should be made ready for use and all equipment not necessary should be closed down and secured for FPU move. Useful checklists are shown in the following paragraph (as applicable).

5.1.4.1 Leaving Location Procedures

The following formalities are required

a) Planned FPU Move - FAX

A fax should be sent to the authorities approximately 14 days before a planned move, with a copy to the Marine Surveyor, Client and Owner, containing the following information:

FPU:	Petrobras-36	
Present location:		From date:
ETD		
Next location:		
Distance:		N Miles:
Location Date:		Hrs.:
At average speed:		Knots
Water Depth:		
Lifeboat capacity.	Port	Persons
	Stbd	Persons
	Total:	Persons
Planned number of persons on board during transit:		Persons
	(sign)	FPU Manager

Fig 5.1.4.1 – Information to be faxed prior to departure

b) Departure Approval

Prior to departure a transportation approval is usually required for Client/Insurance Purposes. An authorised Marine Warranty Surveyor from a recognised firm will after a survey of the unit, and the towing vessel and a review of the towage procedures, issue an 'Approval' for departure based on given information.

c) Manning Certificates

The manning has to be approved by Ministero Marina Mercantile.

d) Before leaving location, an inventory of:

? Fuel oil
? Diesel oil
? Lub oil
? Potable water

should be obtained from the Anchor Handling Tugs, Towing Tugs, stand-by vessels and the FPU. This report should be noted into the FPU' s deck log and be handed over to the Operator.

e) Pre-Departure Muster

Prior to departure a lifeboat muster should be held.

f) Leaving Location Checklists

Useful Checklists are included in the next pages.

5.1.4.2 *Checklist for FPU Removal*

CHECKLIST FOR DEPARTURE	**Responsible ✍ FPU Manager**
Checklist to be used before departure, when in transit and when planning mooring at arrival location.	

Item	Description	Checked
1.	Information on next location obtained from Operator: Written order identification: Date: _____ Water depth: _____ FPU heading: _____ Co-ordinates : _____ Other: _____ FPU Move fax sent to Client, Marine Surveyor and authorities	
2.	Weather forecasts over period of move have been obtained and is attached	
3.	Arrangements for Weather Forecasts to be supplied throughout the duration of the voyage	
4.	Pre-move meeting and briefing held with Section Supts, key personnel and operators representative	
5.	Signed Check-lists received from: Marine Supt. including Control Room Operators Maintenance Supt. Process Superintendent Medic Clerk, Catering Supt., Radio Operator	
6.	Course of next location verified with tug captains and plotted on FPU charts	
7.	Spot check of items to be performed by others above completed:	
8.	Control room and Bridge watches established for 24 hours coverage.	
9.	Sufficient fuel, water and other supplies for duration of the tow are on board the FPU	
10.	All assisting vessels checked for sufficient supplies	
11.	FPU loading calculations have been completed and show adequate stability for both transit conditions and ballasting / deballasting operation	
12.	Wheelhouse Control – Consoles checked, stand-by ready for use. Manoeuvring Equipment Navigation Equipment VHF/UHF Communication Equipment Mooring Control Console	
13.	Lifeboat muster carried out prior to FPU move	
	ITEMS TO BE CHECKED BEFORE MOORING AT NEW LOCATION:	
14.	Weather forecast over the period of mooring has been obtained and max. environmental forces have been checked against the operational limitations	
15.	Mooring procedures have been planned and agreed with tug captains according to approved mooring calculations	
16.	Briefing held with all Section Superintendents	
	SPECIAL REMARKS	
	FPU MANAGER: _____ (sign) DATE: _____	

CHECKLIST FOR DEPARTURE	**Responsible ≤ Marine Superintendent**
DEPARTMENT:	STABILITY SECTION
Status of the below listed items to be reported back to the FPU Manager for registration.	

Item	Description	Checked
1.	FPU loading calculations have been completed and show actual VCG below allowable VCG for: A. All stages of ballasting/deballasting B. Transit draft 11.0 m transit condition	
2.	Pennant wire and spare mooring gear inventory completed prior to arrival or Mooring	
3.	Anchor winches brakes, chains and wildcats inspected and checked for defects and ready for use	
4.	Tow bridles inspected and ready for use	
5.	Ballast system fully operational. Control console tested and all ballast tanks and void spaces have been sounded and recorded	
6.	Radar inspected, operating	
7.	VHF and hand-held radios/mobile phones charged and ready	
8.	Proper charts provided and available for use	
9.	All watertight openings through decks, bulkheads, caissons and hulls are closed and secured. Any omissions are noted in log	
10.	All deck hatches, manholes and ventilation ducts to be closed for move are closed and secured	
11.	All crane booms laid down in proper cradles and secured	
12.	All crane wires checked for defects	
13.	All loose deck cargo, secured for move and weight recorded	
14.	All deck stores and below deck equipment secured for move	
15.	All loading hoses and work boat tie-up lines secured for move	
16.	Ship sides, columns and under deck area inspected for loose wires and not secured items. Items recorded and secured	
17.	Control room operators, crane operators and key personnel briefed in the planned operation, carried out their checks, reported back to Section Supt. and are stand-by for operation	
	SPECIAL REMARKS	
	Marine Superintendent _____ (sign) DATE: _____	

CHECKLIST FOR DEPARTURE	**Responsible & Maintenance Superintendent**
Status of the below listed items to be reported back to the FPU Manager for registration.	

Item	Description	Checked
	DEPARTMENT: TECHNICAL SECTION	
1.	All generators available and ready for use Generators off-line are noted in log.	
2.	Control and Power Management System operational	
3.	Fuel system checked for proper pressure and flow, clean filters, water in settling tanks etc.	
4.	Air system checked, clear filter oil, proper inlet pressure and proper exhaust back pressure	
5.	Unit ventilation system checked and operational	
6.	Exhaust blowers on and operating properly	
7.	All gearbox Lub oil pumps operating properly and Lub system checked for leaks	
8.	Heat exchangers cooling water on and adjusted to proper pressure	
9.	Communication wheelhouse control room tested	
10.	Mooring winches lubricated and Lub oil level checked in gearboxes	
11.	Mooring winches cooling water checked	
12.	Mooring winch brakes checked	
13.	Mooring line length counters lubricated and operating properly	
14.	Mooring line load cells and indicators operating properly	
15.	Emergency Anchor(s) on Rack and connected to chain	
	DEPARTMENT: ELECTRICAL	
16.	All power supply systems and equipment checked and operational	
17.	All electrical components of the mooring system checked and operational, i.e. controls, indicator lights, motors, emergency stops, etc.	
18.	All malfunctions have been reported	
	SPECIAL REMARKS	

Maintenance Superintendent _____ (sign) DATE: _____

5.1.5 Transit Condition

5.1.5.1 General Information

CAUTION

During transit the number of people on board must be no more than 65 persons because the forward lifeboats cannot be used due to the interference with main and secondary towing bridles.

The nominal draft of P36 for transit shall be 11.0m.

During transit voyages messages should be sent to the Automated Search and Rescue or similar system enforced in the area of operations.

During transit it is necessary to monitor the weather changes. In areas where weather may change rapidly, obtain weather forecast frequently.

In case that bad weather is forecasted for the area, plan and prepare for bad weather in time.

If passing ocean areas with very shallow water, i.e. less than 35-40 metres, following precautions are to be made:

? Before passing this area there must be a good weather forecast for a period equal to the time required for passing the area, including reasonable margin.

? P36 should not be ballasted down to survival draft in stormy weather if the water depth is less than mentioned above.

5.1.5.2 Transit Assisted by Tug Boat

Transit route plans and procedure shall be discussed and agreed with tugboat captain before start of towing. See also paragraph 5.1.4: "Departure Preparations (with checklists)".

Navigational lights during transit with tugboat to be as per international rules for vessels under tow. Other lights which may obstruct or can be mistaken for navigational lights shall be turned off.

5.1.5.3 Weather Limitations

In transit draft condition the Unit cannot withstand the same sea condition as in survival draft. Violent slamming by seas against horizontal bracing must be avoided. If such slamming is unavoidable by altering heading, reducing speed or by other means, the Unit should be ballasted down to survival draft (18.0m) until weather conditions improve. The limiting conditions for transit are reported in Volume 1 – paragraph 1.6.2 and summarised below.

	Operating Mode	Transit	Transit Survival
Draft	Moulded (m)	11.0	18.0
Criteria		Max Load on Braces	10-Year Return Period
Wind-	1min mean (m/s)	35.0	41.7
Current	Surface (m/s)	n/a	n/a
Wave -	H_S (m)	4.9	10.1
	T_P (sec)	7.98 – 12.1	11.5-17.4
	Direction (from)	n/a	n/a

5.1.5.4 Transportation by Heavy Lift Vessel

If the unit is to be transported by heavy lift vessel i.e. a dry transportation of the unit, then this shall be the subject of special consideration.

5.1.5.5 Quayside/Inshore Mooring

In the event of a quayside or inshore mooring, a mooring arrangement shall be prepared based upon duration, season, surrounding landscape etc, by a qualified Naval Architect with experience of mooring arrangements.

5.1.6 Towing

Ref: Doc. Title: *Towing and Mooring Arrangements*
Doc. No: *DE-3010.38-1320-140-394-01 to -02*

5.1.6.1 Estimation of Towing Forces and Drifting Forces

The estimation of towing forces is considered necessary for correct decision on tug boat size for a certain tow, and during a tow operation being able to take corrective actions not to overload towing gear due to heavy weather conditions or too high towing speed.

The calculation of towing forces shall be computed for each towage condition by a qualified Naval Architect with experience of such calculations. These calculations shall be submitted to the FPU Manager as part of the specific transportation manual to be prepared by a nominated contractor.

The minimum continuous bollard pull for ocean towing required by a warranty surveyor such as Noble Denton, is in the region of 330 Tonnes.

5.1.6.2 Ocean Towing

If requested by OWNER or as a contractual requirement a declaration from a marine warranty survey company, approved by the insurance company, has to be obtained (by recognised Marine Surveyor).

An onboard survey is normally required before approval is granted. In addition to relevant information about the unit and towing vessels the following information is required for consideration and evaluation for the issue of the declaration.

5.1.6.3 Tow Route and Procedure

? Tow route, estimated date of departure and arrival, possible locations of refuge and refuelling program for the towing vessel.

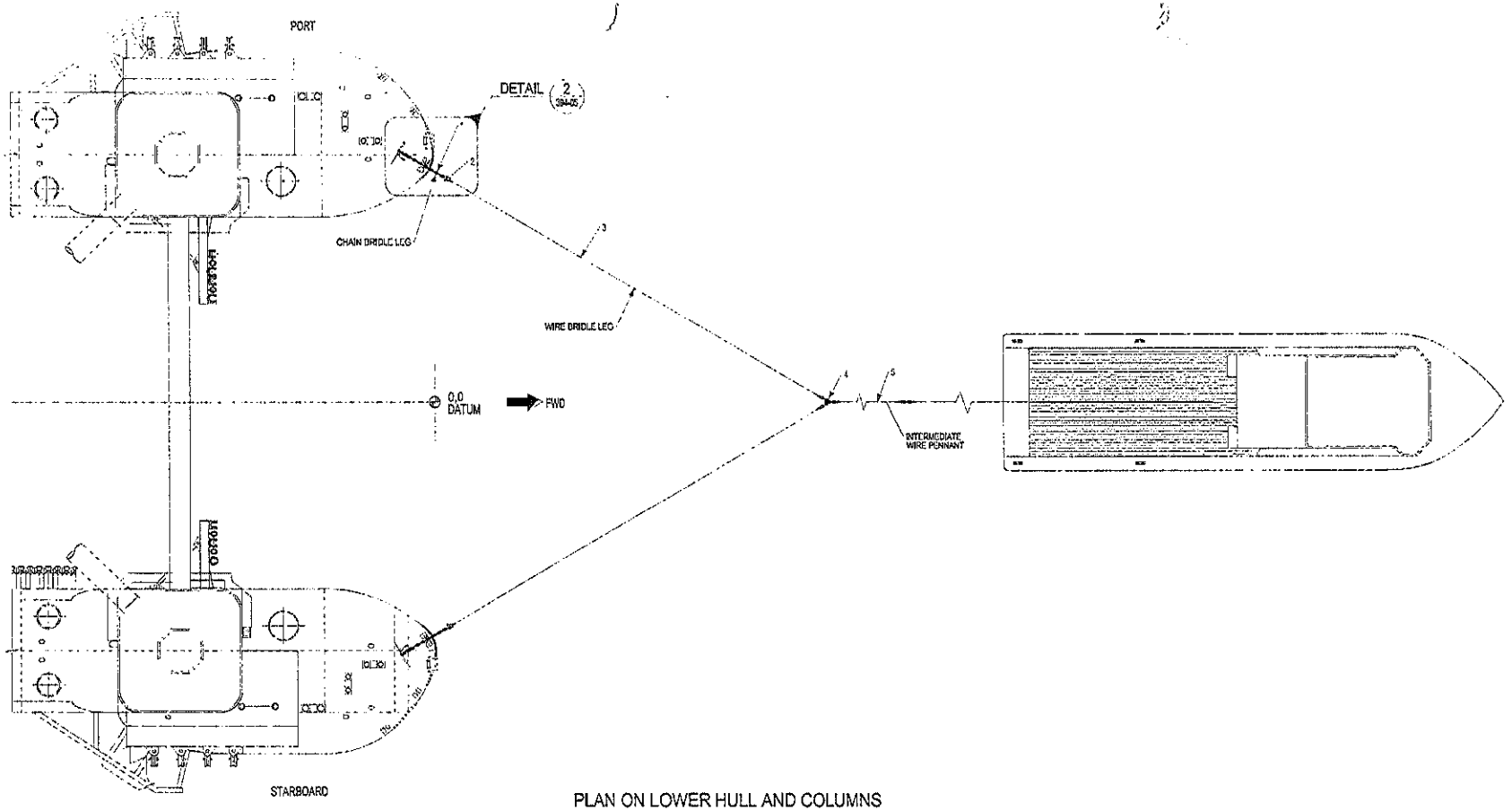
5.1.8.2 Disconnecting Tug Boat

When the tug boat is disconnecting the towing gear from his own towing wire, drop the towing gear in the water and start retrieving on the winch recovery system simultaneously.

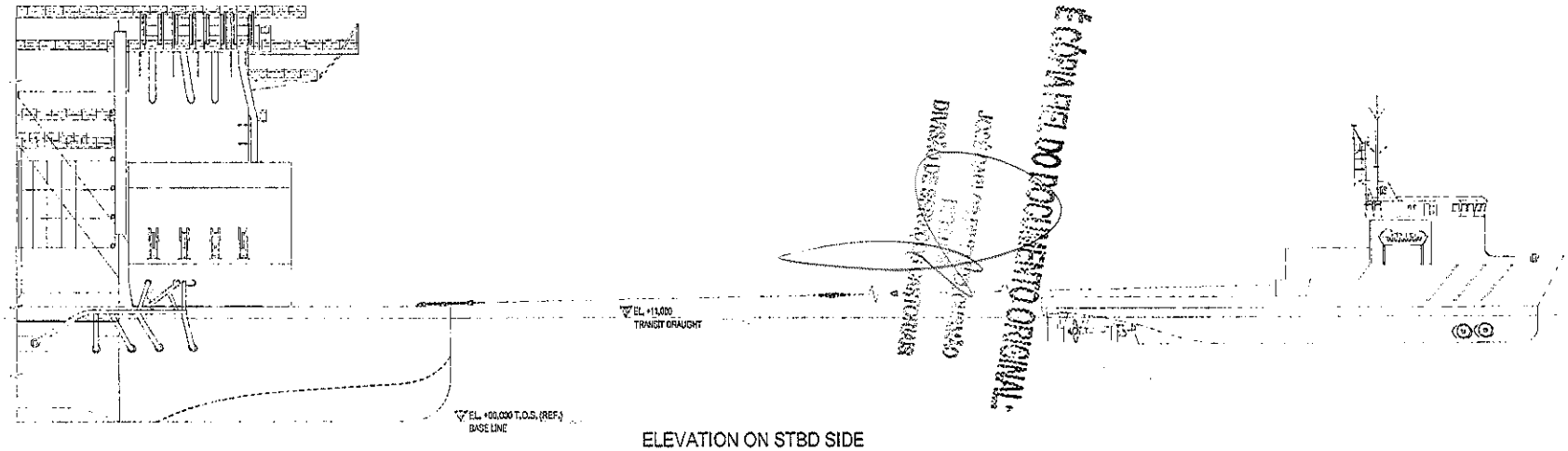
When the towing bridle is not in use, it should be secured properly.

5.1.9 Emergency Mooring System

Prior to arrival at Roncador Field the unit shall be equipped with at least two anchors and sufficient chain.



PLAN ON LOWER HULL AND COLUMNS



ELEVATION ON STBD SIDE

NOTES

1. THIS ARRANGEMENT IS SPECIFIC FOR INSHORE TOWAGE FROM QUEBEC TO SEPT ISLES AND OCEAN TOWAGE FROM RIO DE JANEIRO TO RONCADOR FIE
2. TOWING SYSTEM DESIGNED FOR A . . MAX BOLLARD PULL OF 185 TONNES.
3. FOR TUG WITH B.P. GREATER THAN 185 TONNES THE TOWING BRIDLE WILL NEED TO BE MODIFIED.
4. USE OF EXISTING EQUIPMENT IS SUBJECT TO SATISFACTORY SURVEY.
5. REFER TO THE FOLLOWING DOCUMENTS FOR AS BUILT MODIFICATIONS TO TOWING SYSTEM:

WDITP No. 1550003-05
1550003-11
1550003-10

FSK-D-H No. 241
373
381

EQUIPMENT LIST TABLE (USING EXISTING TOW EQUIPMENT)

ITEM	DESCRIPTION	QTY	MBL
1	87mm GRADE U2 STUD CHAIN WITH END LINKS AT EACH END.	5.5m 2 OFF	393t
2	130t SWL BOLT TYPE GREEN PIN ANCHOR SHACKLE.	5 OFF	650t
3	c77mm WIRE ROPE WITH HARD EYE AT EACH END *	48m 2 OFF	390t
4	TRIANGULAR PLATE SWL 130t	1 OFF	430t

EQUIPMENT LIST TABLE (NEW TOW EQUIPMENT)

ITEM	DESCRIPTION	QTY	SWL
5	77mm WIRE ROPE WITH HARD EYE AT EACH END *	40m	75t

* WIRE 6x41 (10+6/0+0+1) WARRINGTON + IWRC (1770 N/mm²)

DRAWING NUMBER	DRAWING TITLE
DE-3010.38-1320-140-NBD-394-00	TOWING ARRANGEMENT
DE-3010.38-1320-140-NBD-394-05	MAIN TOWING SYSTEM DETAILS
DE-3010.38-1320-140-NBD-394-06	SECONDARY TOWING SYSTEM

REFERENCE DRAWINGS

RCV	DATE	DESCRIPTION OF REVISION	DESIGN INT	CHKD INT	APPD INT	APPD CLIENT
0	02.11.09	ISSUED AS BUILT	SCL	AT	AT	
A	17.04.98	RE-ISSUED AFC	KSH	AT	JO	
0	07.05.99	ISSUED AFC	SCL	MDC	JO	

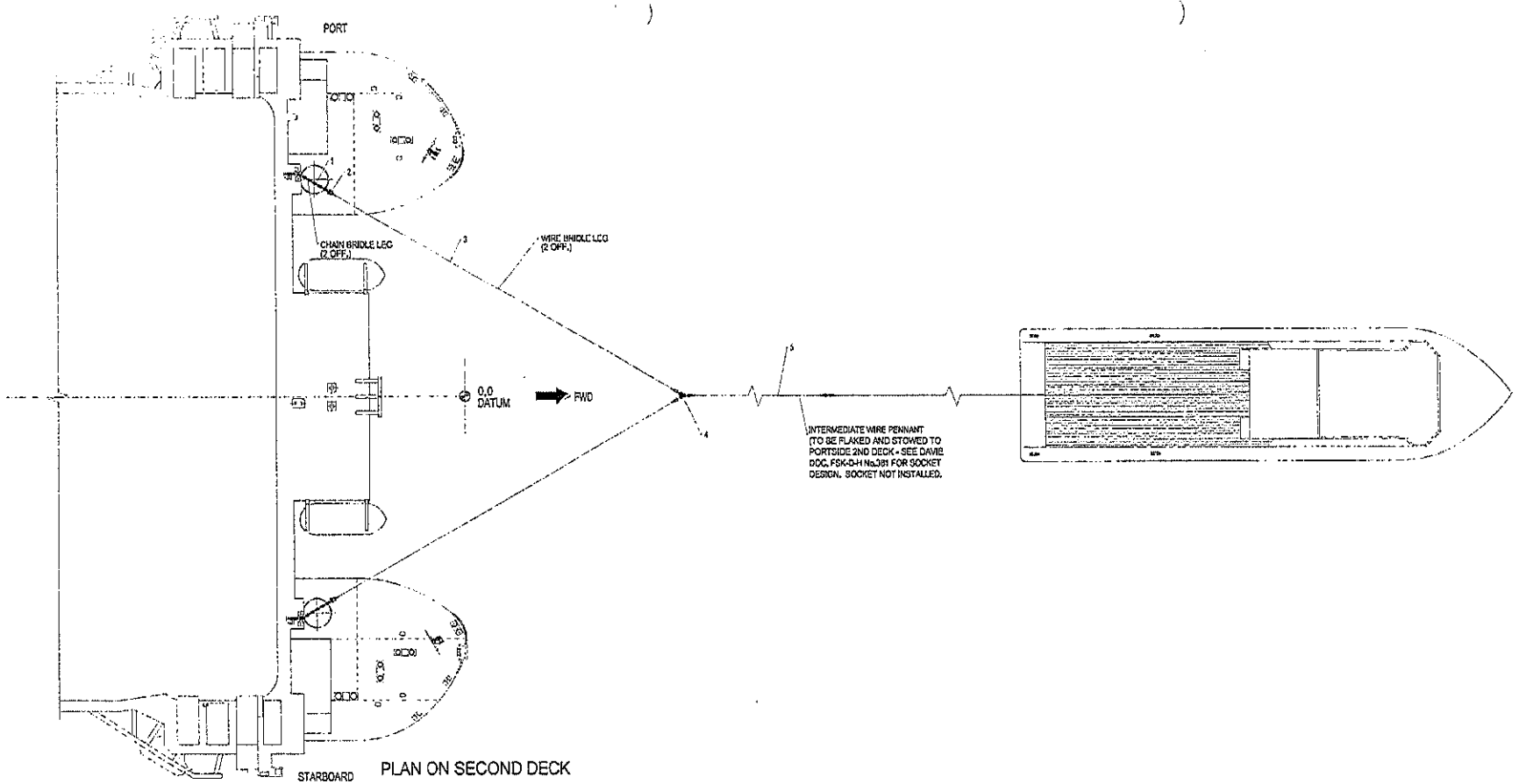
BRASOIL | PETROBRAS | NOBLE DENTON | PETROTEC | AKER

P56-RONCADOR FIELD DEVELOPMENT
CONTRACT No. [illegible]/15/2150

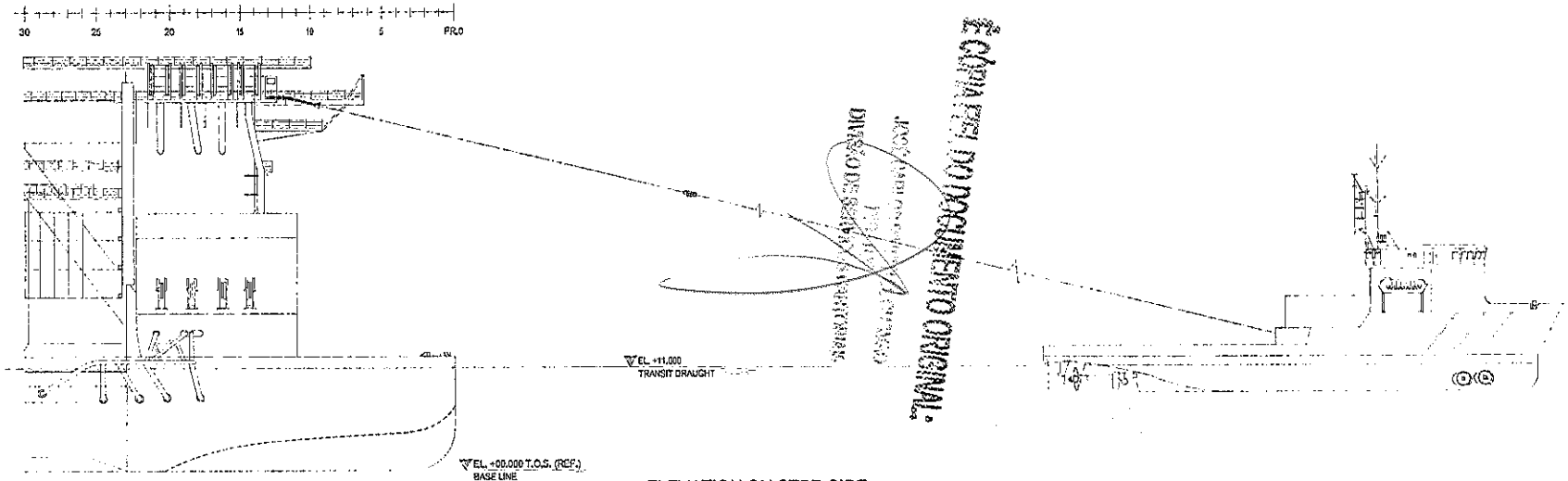
TITLE
TOWING AND MOORING ARRANGEMENT
MAIN TOWING SYSTEM

DRAWN/DATE DCS/MAY.09
CHECKED/DATE AT/ NOV 09
APPD/DATE AT/ NOV 09
SCALE 1:200
RCV B

DRAWING NUMBER
DE-3010.38-1320-140-NBD-394-01



PLAN ON SECOND DECK



ELEVATION ON STBD SIDE

NOTES

1. THIS ARRANGEMENT IS SPECIFIC FOR INSHORE TOWAGE FROM QUEBEC TO SEPT ISLES AND OCEAN TOWAGE FROM RIO DE JANEIRO TO RONCADOR FIE
2. TOWING SYSTEM DESIGNED FOR A MAX BOLLARD PULL OF 165 TONNES.
3. USE OF EXISTING EQUIPMENT IS SUBJECT TO SATISFACTORY SURVEY
4. DIMENSIONS & LOCATIONS OF TOWING BRACKET AS PER PETROMEC SURVEY DATED 11/8/99 REF QUE.GE.2773

EQUIPMENT LIST TABLE (USING EXISTING TOW EQUIPMENT)

ITEM	DESCRIPTION	QTY	MBL
1	87mm GRADE U2 STUD CHAIN WITH END LINKS AT EACH END.	5.5m 2 OFF	380
2	130t SWL BOLT TYPE GREEN PIN ANCHOR SHACKLE.	5 OFF	650t
3	ø77mm WIRE ROPE WITH HARD EYE AT EACH END *	48m 2 OFF	390t
4	TRIANGULAR PLATE SWL 130t	1 OFF	430t

EQUIPMENT LIST TABLE (NEW TOW EQUIPMENT)

ITEM	DESCRIPTION	QTY	MBL
5	ø77mm WIRE ROPE WITH HARD EYE AT EACH END *	100m	390t

* WIRE 6x41 (16+8/8+8+1) WARRINGTON + IWRC (1770 N/mm²)

DRAWING NUMBER | DRAWING TITLE

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION OF REVISION	DRWN BY	CHD BY	APPD BY	APPD CLIENT
C	29.11.99	ISSUED AS BUILT	SCC	AT	AT	
B	12.08.99	RE-ISSUED AFC	KH	AT	JO	
A	20.05.99	AFC - HOLD 1 REMOVED	SCE	YSE	JO	
0	07.05.99	ISSUED AFC	SCE	YSE	JO	

136 RONCADOR FIELD DEVELOPMENT
CONTRACT No :- 7/15/2150

NOBLE DENTON | Petromec | AMEC

TITLE
TOWING AND MOORING ARRANGEMENT
SECONDARY TOWING SYSTEM

DRAWN DATE: SCE/MAY.99
CHECKED BY: AT/NOV 99
APPROVED BY: AT/ NOV 99
SCALE: 1:250 UNO

DE-3010.38-1320-140-NBD-394-02 REV C

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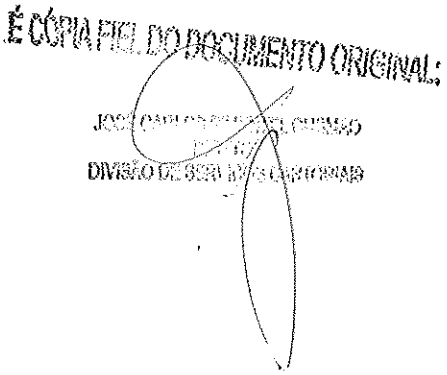
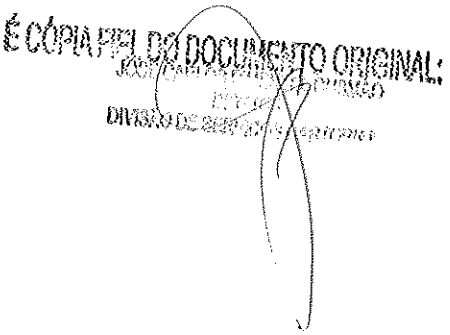

É CÓPIA FIEL DO DOCUMENTO ORIGINAL:


DIVISÃO JUDICIÁRIA
TRIBUNAL MARÍTIMO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5.2 MOORING SYSTEM

5.2.1 Mooring System

Ref: Doc. Title: Mooring System – Layout and Anchor Pattern
Doc. No: DE-3010.38-1320-962-336-01 to –02

The Unit is moored by a 16-line pre-laid near taut-leg passive mooring system, as shown in the sketch below and on enclosed drawing DE-3010.38-1320-962-NBD-336-01. No thrusters' assistance is required for the mooring system at any time.

a. *Applicable Standards*

The mooring system has been designed according to the rules of:

- API RP-2SK – Recommended Practice for Design and Analysis of Station-keeping Systems for Floating Structures– 2nd Edition
- Registro Italiano Navale – Rules for MODU's
- Petrobras General Technical Specification – ET-3010.38-1200-940-PPC-001 and Annex X - Deviations
- Petrobras Naval Design Premises – ET-3010.38-1320-940-PPC-001

NOTE: Mooring winch and control system operations are described in Volume 4 of this Manual.

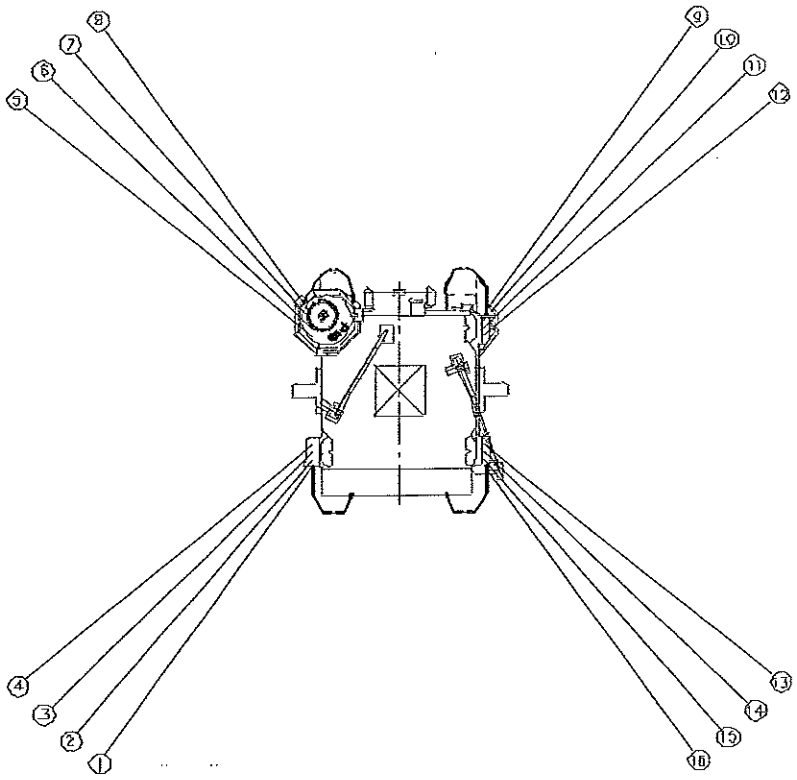


Fig 5.2.1 Mooring System Configuration

5.2.2 Mooring System Components

5.2.2.1 Mooring Line Make-up

Ref: Doc. Title: Mooring Lines – Component Details
Doc. No: DE-3010.38-1320-962-337-01 to –02

Each mooring line is made up of the following components. It should be noted that the bitter end of the top chain stored is not fixed in the chain locker but kept free such that in the event of an emergency all mooring lines can be released.

Segment	Position	Type	MBL [Te]	Nom. Dia [mm]	Length [m]
1.	From anchor to seabed	Spiral-strand Wire rope	1000	102	200
2.	Intermediate	R4 stud chain	833	90	50
3.	Intermediate	Parallel strand Polyester	1000	185	600
4.	Intermediate	R4 stud chain	833	90	3
5.	Intermediate	Parallel strand Polyester	1000	185	600
6.	Intermediate	R4 stud chain	833	90	3
7.	Intermediate	Parallel strand Polyester	1000	185	600
8.	Intermediate	R4 stud chain*	833	90	20
9.	To the fairlead	R4 stud chain	833	90	113
10.	To chain locker	R4 stud chain	833	90	>300

* Or Polyester Rope Insert as required by Petrobras

The mooring system is pre-laid, except for Segments 9 and 10 which is the FPU's chain. Each mooring line is connected to a Vertical Loaded Anchor (VLA) at the seabed.

5.2.2.2 *Spare Equipment*

The mooring system is designed to hold the P36 on location even if one line, however, the following spares shall be kept onboard or at the nearest land storage base (as indicated):

Subject to Confirmation of Spares and Specifications by Petrobras

Type	MBL [Te]	Nom. Dia [mm]	Length [m]	Quantity	Storage Location
Spiral Strand	1000	102	200	1	Base
R4 stud chain *	833	90	50	1	Base
R4 stud chain *	833	90	20	1	Base
R4 stud chain *	833	90	3	2	Base
Parallel strand Polyester	1000	185	600	1	Base
End Joining Shackle	833	90	-	4	Base

*Chain to be supplied with enlarged end links at either end

5.2.3 Installation of Mooring System

The mooring system shall be pre-laid prior to the arrival of the Unit at Roncador field. The FPU shall be connected to each line by the rig part of the chain. To avoid any interference with risers and subsea equipment, the anchor pattern and spread mooring radius shall be as shown on the attached drawings.

Mooring line connections shall always be through the fairleads on the columns. Under no circumstances should a mooring line be connected anywhere else on the Unit, even temporarily.

The FPU is equipped with approximately 450m of chain for each line to assist with hook-up, connection to pre-laid lines and pre-tensioning.

All temporary anchor racks shall be removed prior to hook-up of the FPU on location.

Following pre-tensioning at least 300m of chain per line would be available in each chain locker.

Nominal mooring line pretension is set at 140 tonnes but may be subject to adjustments at the field.

All mooring lines are held in place by dedicated mooring winches set on BRAKE mode after system pre-tensioning. No chain-stoppers are used. Foundation pads for each mooring winch are fitted with load cells for tension monitoring. Line tension and length readings are displayed on panels at the remote control cabins, located at each corner column on second deck and at the mooring system control console in the CCR.

5.2.4 Operation of Mooring System

The mooring system of the P36 for Roncador field is a passive system; i.e. no adjustment of line tensions is planned throughout the in-service life of the FPU except for the following:

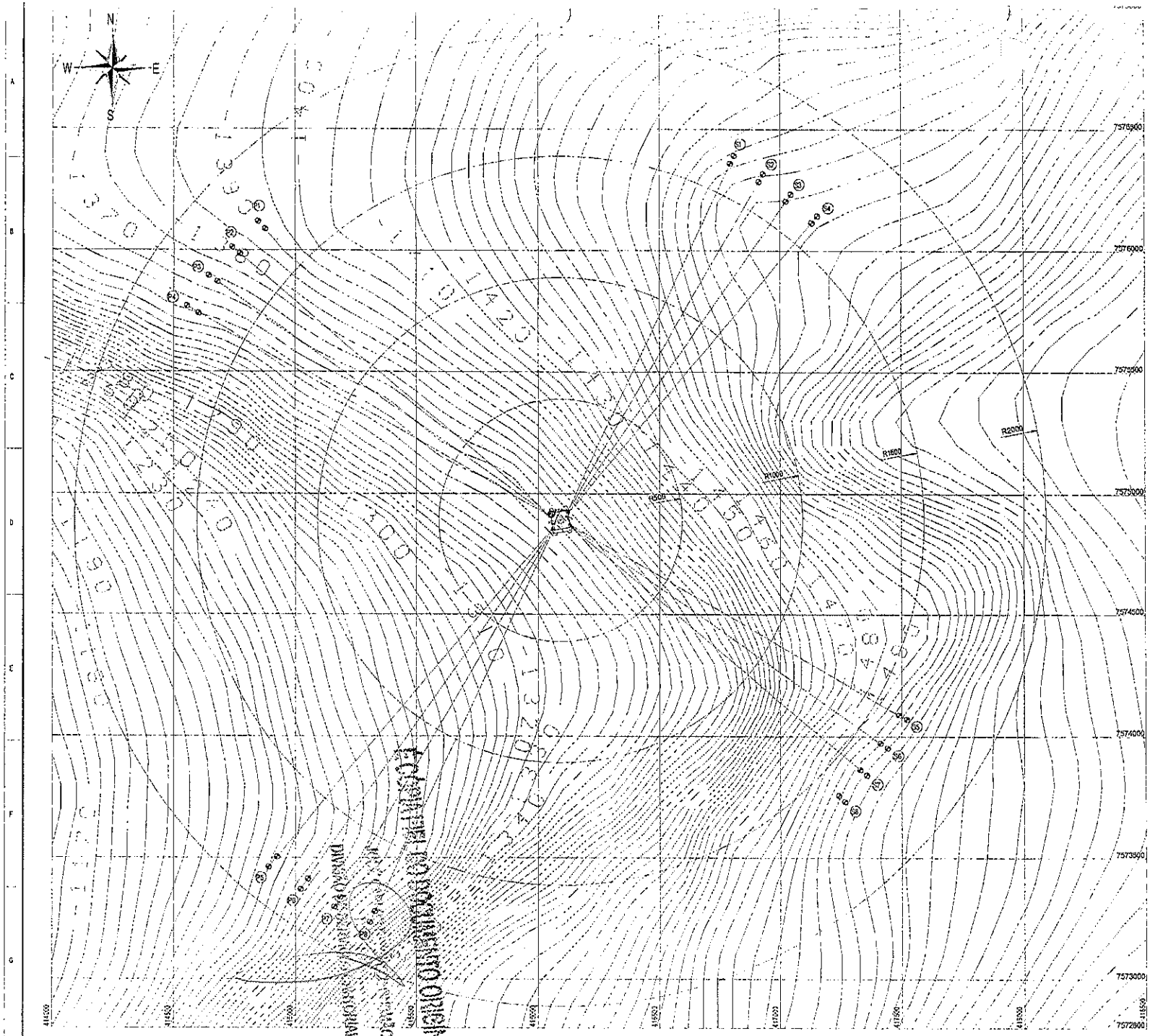
- ? Adjust line pre-tension of all lines after about one-two months from installation to take-up any slack due to polyester rope creep behaviour.
- ? During and just after SCR/flexible riser pull-in operations adjustment to line tensions may be required to assist pull-in operations and correct datum position of the FPU.
- ? After replacement of mooring line components for inspection or maintenance.

Each mooring winch should be permanently set to BRAKE mode after installation and any line tension adjustment operations. Nominal pretension is set at 140 tonnes.

Detailed procedures for operation of the mooring winches are included in the winch manufacturer manual.

5.2.5 Inspection of Fairleads

For planned inspection of the fairleads the FPU shall be deballasted to 18m inspection draft condition. No adjustment to line tensions is required for such inspections. Inspection of fairleads shall be carried out externally from a small boat.



ID	LINE LENGTH (m)	WATER DEPTH (m)	TOUCHDOWN POSITION EAST (m)	TOUCHDOWN POSITION NORTH (m)	ANCHOR POSITIONS EAST (m)	ANCHOR POSITIONS NORTH (m)
S1	2198	1493.00	416790.02	7576353.69	41680[illegible]	576398.78
S2	2198	1502.00	416908.80	7576290.08	41692[illegible]	576321.23
S3	2198	1506.00	417022.83	7576210.32	417043[illegible]	7576239.68
S4	2198	1509.00	417130.09	7576121.79	417153.04	7576148.14
S5	2198	1507.00	417459.32	7574092.47	417320.24	7574074.61
S6	2198	1512.00	417412.91	7573976.53	417442.05	7573956.12
S7	2198	1513.00	417329.94	7573865.78	417357.09	7573843.00
S8	2198	1510.00	417240.40	7573760.27	417265.55	7573735.12
P1	2198	1390.00	414874.10	7576095.23	414864.20	7576125.13
P2	2198	1378.00	414769.87	7575990.87	414738.97	7575918.48
P3	2198	1369.00	414679.40	7575875.78	414640.78	7575900.72
P4	2198	1356.00	414589.24	7575753.83	414551.82	7575776.02
P5	2198	1231.00	414922.71	7573507.86	414888.41	7573466.95
P6	2198	1248.00	415051.44	7573418.97	415021.65	7573376.42
P7	2198	1268.00	415187.45	7573343.94	415162.27	7573300.32
P8	2198	1291.00	415329.32	7573283.64	415308.57	7573239.37

NOTES

1. UNIT HEADING 350°
2. RIG CENTRE COORDINATES:

   410092.0 E
   7574803.0 N

3. WATER DEPTHS ARE APPROXIMATE
   WATER DEPTH AT RIG CENTRE: 1362m
4. LINE LENGTH IS NOMINAL AND INCLUDES 9m ALLOWANCE FOR SHACKLES.

DRAWING NUMBER | DRAWING TITLE

REFERENCE DRAWINGS

REV	ISSUE DATE	DESCRIPTION OF REVISION	DRAWN BY	DWD BY	APPD BY	APPD CLIENT
D	18.11.97	ISSUED AFC FOLLOWING RELOCATION	SCC			
C	03.10.97	AFD	RHS	MDC	AT	
B	22.09.97	AFD	RHS	MDC	AT	
A	07.08.97	FOR COMMENT	RHS	MDC	AT	
0	22.07.97	IDC	RHS	MDC	AT	

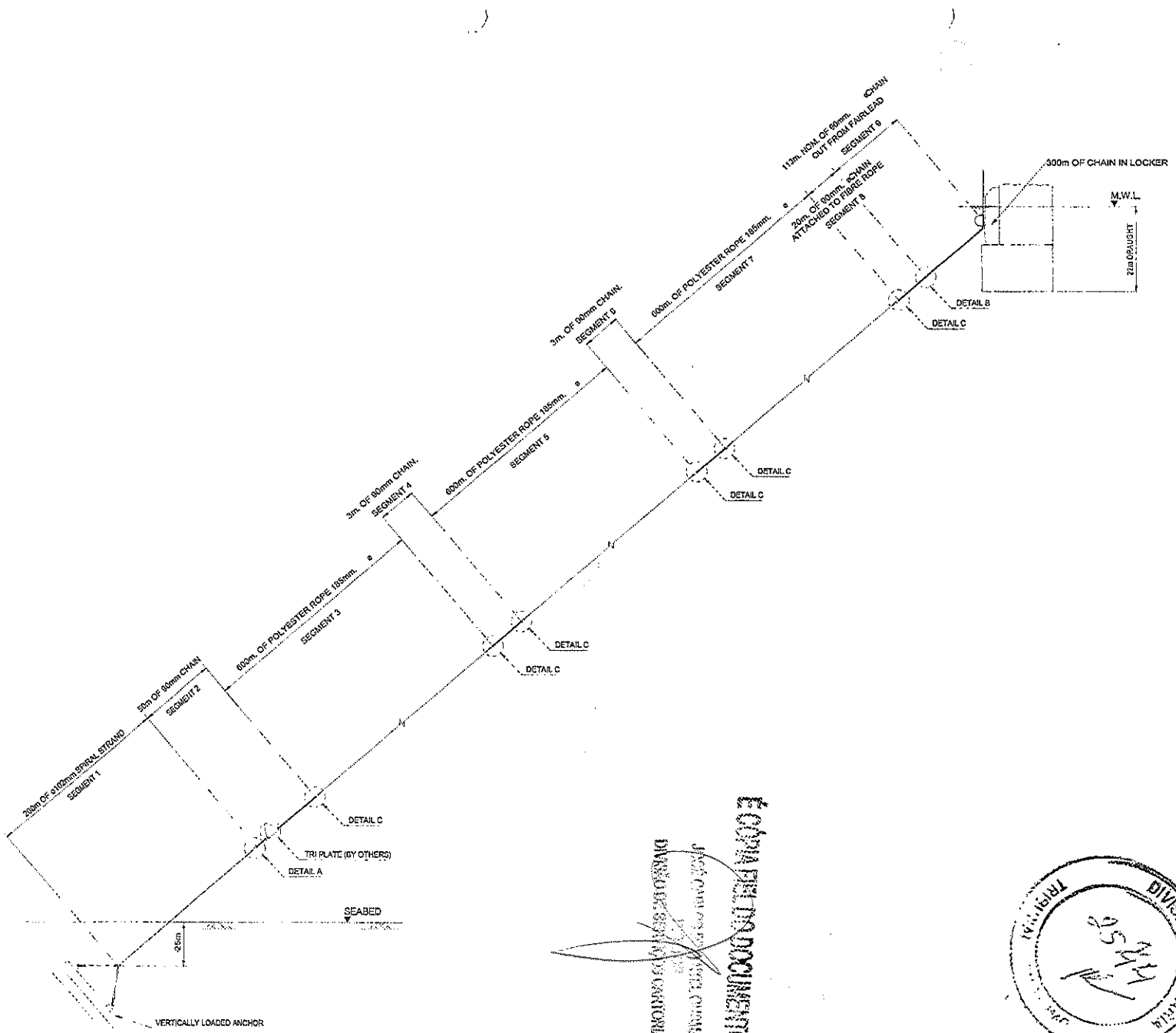
BRASOIL | P36-RONCADOR FIELD DEVELOPMENT CONTRACT No :- 7/15/2150

NOBLE DENTON | Performance | AMEC

TITLE: MOORING SYSTEM-LAYOUT AND ANCHOR PATTERN

DRAWN/DATE: RHS/JUL.97
DESIGN/DATE:
APPROVED/DATE:
SCALE: 1:7500 (A1)

DRAWING NUMBER: DE-3010.38-1320-962-NBD-336-01 REV: 0



NOTES

1. ALL LENGTHS ARE NOMINAL STRETCHED LENGTHS.
2. COMPONENT LENGTHS ARI EYE TO EYE.
3. FIBRE ROPE IS POLYESTER PARALLEL STRAND BRAIDED ROPE 185mmø NOMINAL & 1000tne M.B.L.
4. POLYESTER ROPE SHALL BE AS PER PETROBRAS SPEC. ET-3000.00-6051-962-PGT-001 DATED MARCH 1998
5. ALL CHAIN TO BE R4 GRADE STUDLINK.
6. WIRE ROPE TO BE SPIRAL STRAND, 102mm NOMINAL DIAMETER, MBL=1000Te.
7. ALL SHACKLES SHALL BE AS PER PETROBRAS SPEC. ET-3000.00-6051-962-PGT-001 DATED MARCH 1998

REV	DESCRIPTION OF REVISION
0	FINAL ISSUE
A	APD
B	APD
C	DC

BRASOIL	P36-RONCADOR FIELD DEVELOPMENT CONTRACT No :- 7/15/2150
NOBLE DENTON / Petromec / AMEC	

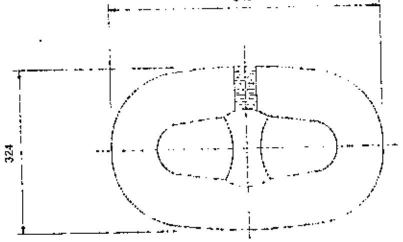
MOORING LINES-
COMPONENT DETAILS
SHEET 1 OF 2

DRAWN/DATE	RHG/OCT.97
CHECKED/DATE	AT/OCT.99
APPROVED/DATE	AT/OCT.99
SCALE	N.T.S.

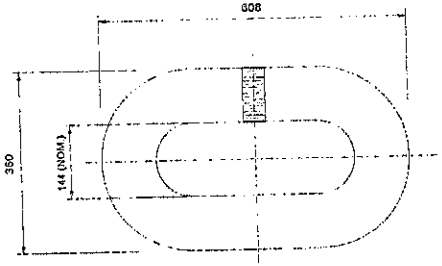
DRAWING NUMBER: DE-3010.38-1320-962-NBD-337-01
REV: C

NOTES

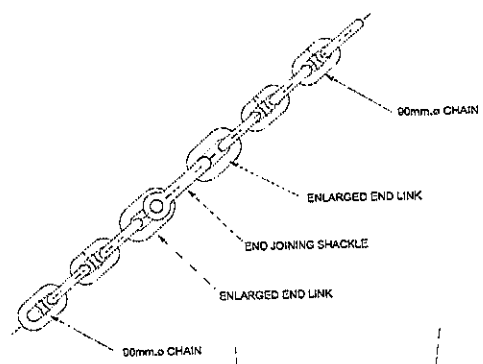
1. DETAILS OF ANCHOR CONNECTIONS TO BE SPECIFIED BY ANCHOR INSTA' N CONTRACTORS



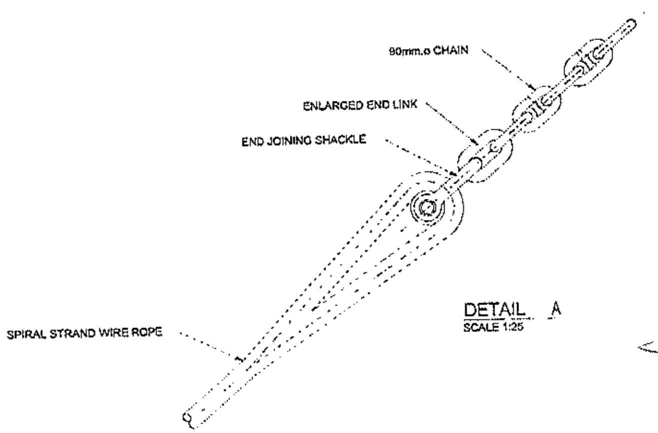
TYPICAL COMMON LINK
SCALE 1:5



TYPICAL ENLARGED END LINK
SCALE 1:5

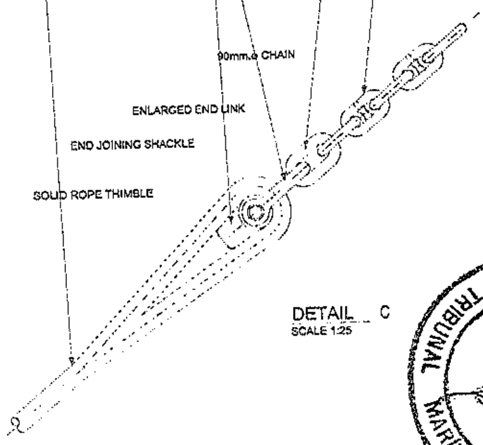


DETAIL B
SCALE 1:25



DETAIL A
SCALE 1:25

FIBRE ROPE



DETAIL C
SCALE 1:25

É CÓPIA FIEL DO DOCUMENTO ORIGINAL:
JOSÉ CARLOS ... GUSMÃO
DIVISÃO DE SERVIÇOS CARTORIAIS

DIVISÃO JUDICIÁRIA
TRIBUNAL MARÍTIMO
Nº 25145

BRASOIL — P36-RONCADOR FIELD DEVELOPMENT CONTRACT No :- 7/15/2150

NOBLE DENTON — Petromec — AMEC

TITLE: MOORING LINES- COMPONENT DETAILS SHEET 2 OF 2

DRAWN/DATE	RHS/OCT.07
CHECKED/DATE	AT/OCT.09
APPROVED/DATE	AT/OCT.09
SCALE	N.T.S.
REV	C

DRAWING NUMBER: DE-3010.38-1320-962-NBD-337-02

HALT pushbutton operation is not inhibited by CCR mimic ACTIVE/BLOCK selector position.

To restart system operation, after an emergency HALT block, CCR mimic RESET pushbutton must be pressed.

The ballast control system has three operating modes:

- ? LOCAL MANUAL
- ? COMPUTER MANUAL
- ? COMPUTER AUTOMATIC

LOCAL MANUAL operating mode indicates that pumps and valves be individually managed by an on site operator in a fully manual procedure. LOCAL MANUAL mode is operated from local mimics and is active only for the relevant quadrant equipment.

COMPUTER MANUAL operating mode indicates that pumps and valves may be individually managed by the CCR operator through a fully manual procedure. COMPUTER MANUAL mode is operated from CCR consoles and from CCR mimic. Both LOCAL and COMPUTER MANUAL modes may be used at the same time on different ballast system quadrants. This allows a mix manual operation mode. In mix manual mode the ballast system is operated from different control areas: the CCR and the operative LOCAL CONTROL POSITION. This operation mode is allowed as command transfer interlocks inhibit unauthorised system control from two different control positions.

COMPUTER AUTOMATIC operating mode indicates that dedicated control programs will automatically manage pumps and valves. This operating mode is possible from CCR consoles.

The automatic fill (AUTOFILL) and drain (AUTODRAIN) routines will automatically manage all necessary valves and pumps to fill or drain an operator selected tank.

To be set operative COMPUTER AUTOMATIC mode requires:

- ? All local mimics set in REMOTE

- ? CCR MIMIC key selector set in BLOCK
- ? System equipment set at initial state
- ? Some main system alarms not present

A. LOCAL MANUAL MODE

Through LOCAL MANUAL mode operation of each quadrant valve and pump may be individually commanded. Valves and pumps states and tank levels monitoring are possible from all operator interfaces.

Local mimics operations do not consider any process interlock to operator commands or special start/stop or open/close sequences. That is to say, nothing will inhibit the operator to perform commands in any sequence he decides.

While operating in LOCAL MANUAL mode system monitoring may be done either from local mimics or from the CCR consoles.

B. COMMANDS, MONITORING AND ALARMING

Commands

The following commands are possible from each local mimic:

- ? quadrant ballast pump start and stop - quadrant valves open and close (for all fail set and fail open \ close valves)
- ? quadrant throttling valve full open/close and intermediate position set
- ? Local Mimic State Monitoring (local or remote): Mimics will supply the minimum amount of information required to supervise ballast system operation. Monitoring may be also done from the CCR consoles. Consoles monitoring allows to integrate ballast system within the overall plant.

The following variables are indicated on each local mimic:

- ? Quadrant ballast pump state
- ? Quadrant valves states (for all fail set and fail open \ close valves)
- ? Throttling valve percentage opening
- ? Local mimic panel state

? Quadrant tanks level

Alarms

While operating in local manual mode system alarming functions are still done through CCR or ECR consoles. No special alarming functions are foreseen on mimics.

C. COMPUTER MANUAL MODE

Through Computer Manual mode operation each valve and pump may be individually commanded. Valves and pumps states and tanks level monitoring are possible from all operator interfaces.

COMPUTER MANUAL mode may be operated from:

? CCR mimic
? CCR VDUs

CCR mimic system operation is intended as a normal operation procedure. To prevent water hammer damages CCR mimic operations consider the following start/stop pumps sequences and no individual suction and delivery valves controls are possible.

a. START Sequence:

1. The operator chooses and opens the relevant sea chest on duty valves.

2. The operator actuates the pump start command. This command will first open the pump suction valve. Once the system receives the valve open signal, it will immediately set the pump start command.

3. About 2 sec after pump running the throttling type delivery valve will begin to open slowly (opening speed about 1% per sec) until full (100%) opening is reached.

NOTE: After the start sequence ends the operator may change throttling valve opening percentage pressing the close pushbutton while checking relevant indicator for valve desired position.

b. *STOP sequence:*

1. The operator actuates the pump stop command. At the same time that the pump stops, the suction valve starts closing.

2. About 2 sec after the pump stop command has been send, the throttling type delivery valve becomes slowly to close (closing speed about 1% per sec) until full (0%) close is reached.

NOTE: This sequence will take place after an operator stop command or after a pump trip

START/STOP sequences are operated only on the same quadrant pumps and valves.

As previously stated, seawater pumps may be used for ballast purposes. In this case the following considerations apply.

a. A software switch is used to set each sea water pump service (FLUID/BALLAST) and interlock seawater pumps commands from the not selected system.

b. The service switch may be operated only if the relevant seawater pump is not running.

c. Seawater ballast systems isolation valves may not be opened from CCR mimic or VDUs, ballast system displays. The CLOSE command is instead active.

d. While in ballast service, quadrant seawater pump operation is interlock with relevant isolation valves close position-limit switches.

e. When used for ballast purposes seawater pumps may only run at low speed.

f. When used for ballast purposes, seawater pumps delivery valve are ON/OFF type. Thus, START/STOP sequences are still active but no OPEN/CLOSE control is possible.

CCR VDUs manual operations do not consider any process interlock to operator commands, but in order to prevent water hammer damages pumps START/STOP previously described sequences are provided.

System operation from CCR VDUs is intended as a normal operation procedure.

CCR VDUs manual operations and displays are similar to mimics representations to ease operation. VDUs also give enhanced monitoring capabilities even when system is manually controlled from mimics.

D. COMMAND, MONITORING AND ALARMING

While operating in computer manual mode CCR consoles have the same monitoring functions. Command and alarming functions are also be the same ones, but they are possible only from one console at the time, as set from the command transfer procedure.

Commands

The following commands are possible from CCR VDUs:

- ? Ballast pumps start and stop
- ? Sea water pumps start and stop (interlock as described)
- ? Valves open and close (for all fail set and fail open \ close valves)
- ? Throttling valves percentage opening set
- ? Quadrant 1-4 start/stop sequences active

The following commands are possible from the CCR mimic:

- ? Ballast pumps start and stop
- ? Sea water pumps start and stop (interlock as described)
- ? Valves open and close (for all fail set and fail open\close valves)
- ? CCR mimic state (active/block)
- ? Halt operations
- ? Emergency reset

Monitoring:

Overall plant state-monitoring functions are available. Specifically, ballast system relative video displays indicate:

- ? Ballast pumps status
- ? Sea water pumps status and service
- ? Pumps state \ command incongruent
- ? Pumps CUTOUT protection trip
- ? Valves status (for all fail set and fail open \ close valves)
- ? Valves state \ command incongruent
- ? Throttling valves state
- ? Throttling valves percentage opening (actual valve)
- ? Throttling valves state \ command incongruent
- ? CCR mimic state (active \ block)
- ? Local mimics state (local \ remote)
- ? Tanks level (% volume)
- ? Emergency halt operations
- ? FPU trim
- ? FPU heel
- ? FPU draught

The following variables are indicated on the CCR mimic:

- ? Sea water pumps status
- ? Valves status (for all fail set and fail open \ close valves)
- ? Throttling valves percentage opening (actual value)
- ? CCR mimic panel state (active \ block)
- ? Tanks level
- ? Emergency halt operations
- ? Emergency reset

Alarms

Overall plant-alarming functions are available. The following are specific ballast system alarms:

- ? Pumps trip
- ? Pumps incongruent
- ? Valves incongruent
- ? Emergency halt operations
- ? Local mimics state (local \ remote)
- ? High tanks level (on height value)
- ? Large trim of Unit
- ? Large heel of Unit
- ? High draft of Unit
- ? Quadrants 1-4 start/stop sequences state (inhibited/active)
- ? Low pumps suction pressure (delayed override on pump start, inhibited on pump not running).

Also, at any time, a discrepancy alarm is given if the actual state is not the same as the last commanded state and the equipment remains under IAS control.

E. COMPUTER AUTOMATIC MODE OPERATION CHARACTERISTICS

Through Computer Automatic mode operation all the system valves, tanks and ballast pumps ere considered as a whole. Dedicated control programs will automatically manage valves and pumps to execute automatic fill (AUTOFILL) and automatic empty (AUTOEMPTY) routines. The scope is to transfer a desired amount of water from the sea to a tank (AUTOFILL) or from a tank to the sea (AUTOEMPTY).

Automatic tank filling operation may be done either using ballast pumps or by free flooding. Free flood is possible if drift level is higher than 15m and the filling operation should not be done on a column tank. Automatic tank draining operations are not possible by free flood and a ballast pump should be always used. The AUTOFILL and AUTOEMPTY routines do not consider seawater pumps in ballast service to fill or drain a tank.

Computer automatic mode routines allow ballast system operation without direct operator supervision.

While computer automatic operation mode is active, valves, tanks and pumps operational state are monitored from all operator interfaces. Computer automatic operating mode is possible from CCR consoles as a normal operation procedure. Only one console at a time is active as set from the command transfer procedure.

F. AUTOFILL and AUTOEMPTY SOFTWARE DESCRIPTION

The AUTOFILL/AUTOEMPTY control program will manage all system valves and pumps as a whole.

The program is managed through the following macro commands and software keys set:

SOFTWARE KEYS: COMPUTER AUTO

TANK SET POINT

MACRO COMMANDS: START OPERATION

CONFIRM

CHANGE ROUTE

PAUSE ON COURSE OPERATION

RESTART PAUSED OPERA TION

ABORT ON COURSE OPERATION

To start the program operation the system must be set as to fulfil the following starting conditions:

- All local mimics set in REMOTE
- CCR MIMIC key selector set in BLOCK
- System equipment set at initial state: all ballast system valves are set at a predetermined position and all ballast pumps are stopped
- Some main system alarms not present: the presence of one of the following alarms will not allow computer automatic mode to be set:
  - All ballast pumps tripped or at local
  - High trim alarm active

- High heel alarm active
- Sea water pump not isolated from ballast system
- System emergency halt active

The operator should select COMPUTER AUTOMATIC MODE on the overall ballast system display. This selection is inhibited if the starting conditions are not correct. The following display shows tanks identifications and actual levels as well as the command to execute to write the new level set point for a defined tank. Follow display indication to write TANK SET POINT. The new level set point is shown on the display behind the tank actual level measurement.

The program automatically decides if it should perform an AUTOFILL or an AUTOEMPTY operation comparing the actual tank level and the desired one, or new tank level set point.

To effectively begin operations the START OPERATION command must be executed.

To sequence determine a feasible route to work and then hold up waiting for the CONFIRM command.

The CONFIRM command execution indicates that the operator accepts the program choice route and allows it to proceed further.

The CHANGE ROUTE command will indicate the program to search for another route if the operator does not want to operate on the first one automatically selected choice.

An alarm is set if no more choices are possible. This alarm will also reset the START OPERATION command.

Once the CONFIRM command is actuated the sequence will open the selected tank valve and the selected water circuit valves; finally it will start the selected ballast pump (if required). Pump valve, throttling delivery valve and pumps are operated following the previously described start sequence in order to minimise water hammer effects.

If while proceeding on the chosen route the sequence fails to either open or close a valve or to start a pump the following will take place:

- ? a failed route alarm is set and the failed valve is indicated;
- ? the sequence repositions already open/close valves and start pumps as from its initial state;
- ? the CONFIRM command will be reset.

During the operation cycle the PAUSE, RESTART and ABORT macro commands may be used.

PAUSED OPERATION stops the on-course operation.

RESTART PAUSED OPERATION resumes the temporarily interrupted sequence from where it has been paused.

A watchdog timer automatically executes the ABORT macro command after 5 minutes; the PAUSED OPERATION command is executed unless the sequence is restarted.

PAUSED OPERATION basically activates the following sub-sequence:

- ? stop the ballast pump
- ? close tank valve and start closing pump throttling valve, which will close with stop sequence ramp speed.

The RESTART PAUSED OPERATION command basically activates the following sub-sequence:

- ? open tank valve
- ? start ballast pump (if required)
- ? throttling valve begins to open following delay and speed ramp set for start sequence.

The ABORT OPERATION command will definitely block the on-course operation ending the operation cycle (that is to say, the operating pump (if any) will stop and all opened valves will close). The system does not memorise the already followed cycle steps but resets all stated auto-mode parameters, including COMPUTER AUTOMATIC mode operation selection.

During COMPUTER AUTOMATIC mode operation the following events automatically set the ABORT macro command:

- ? Any local mimic set at LOCAL
- ? CCR mimic HALT pushbutton press
- ? Controlled pump trip
- ? Computer auto operation mode reset
- ? High heel alarm
- ? High trim alarm
- ? High draught alarm

NOTE: For further details see "Ballast System Manual".

5.3.3 Limitations

According to the stability analysis of the Unit (see following paragraph 5.4).

Due to structural considerations in the pontoon the following limitations apply.

- ? Filling of pontoon tank shall only be carried out by gravity
- ? No simultaneous gravity filling of pontoon tanks from column tanks being filled by pumping
- ? Filling of column tanks, and emptying of all tanks by pumping, shall be done in symmetry mode.

As the ballast system is laid out to comply with the requirements of NMD regarding the ballast system capabilities with a heel angle after one compartment damage, no limitations apply for the ballast pumps pumping capability during normal operations.

5.3.4 Ballast / Deballast Procedures

The following ballast / deballast procedures outline the requirements for operations.

It is assumed that the ballast system is operative before initiating a ballasting operation.

See paragraph 5.3.2.1for ballast/deballast operation mode.

5.3.4.1 Ballasting from Transit to Operating Draft

Ballasting to submerge the Unit to the desired draft is carried out by the means of free flooding and neither ballast quantity in the tanks, nor order of filling, is limited. When ballasting of column tanks is required these tanks must be filled by the ballast pumps.

One typical ballast tank condition is ballasting from transit condition to operating condition. Ballasting shall be carried out step by step taking confirmation of the tank condition.

General Rules

1) Prior to ballasting the Unit, Marine Superintendent will decide the procedure of filling. The procedure is to be controlled against the max. VCG limitations (see Appendix - Volume 7 of this Manual). .

2) Limit crane operations during ballasting as this might give unpredictable heel/trim.

3) When the Unit is at even keel if necessary adjust trim and heel.

4) Fill simultaneously 2+4 tanks in each pontoon

CAUTION: The tank filling should be carried out symmetrically.

5) The pontoon tanks in the corners shall be filled before the column tanks and when filling the column tanks by pumping, all valves in pipes into the pontoon tanks shall be closed.

6) Close all the remote control valves when the FPU is submerged to the desired draft. The column tank valves must be closed when not in use.

The loading procedures of FPU's tanks in ballasting from transit draft to operating draft are reported in Volume 7 of this Manual.

5.3.4.2 Ballasting and Deballasting from Transit to Transit Survival Draft

The ballasting procedures are similar to the ones detailed at paragraph 5.3.4.1.

General Rules for Deballasting

1) Prior to deballasting the Unit, Marine Supt. will decide the procedure of pumping. The procedure is to be controlled against the max VCG limitations (see Volume 7 of this Manual and following paragraph 5.3.4.6).

2) No crane operations during deballasting as this might give unpredictable heel/trim.

3) Open the remote control valves to the main ballast lines

4) Open the remote control valves to the tanks according to the decided procedure

   CAUTION: *Deballasting of tanks must be carried-out symmetrically.*

5) Open remote control valves to overboard.

6) Start running the ballast pumps

7) Raise the Unit and keep it at even keel. Close the remote control valves when tanks are empty and open for the next tanks.

8) After the deballasting procedure is completed, stop ballast pumps and close all remote control valves.

The loading procedures of FPU's tanks in ballasting from transit draft (11.00m) to transit survival draft (18.00m) are reported for the stability calculations in Volume 7: Stability Book

5.3.4.3 Deballasting from Operation to Survival Draft

Not applicable for service life at Roncador Field as operating and survival draft is the same at 22.00m.

5.3.4.4 Ballasting/Deballasting from Operation to Inspection Draft

Deballasting the Unit from operating draft condition to inspection draft condition (for inspection of fairleads) is carried out by pumping out ballast water from the tanks.

Deballasting should be carried out step by step taking confirmation of the actual tank condition.

Neither ballast quantity in the tanks, nor the order of emptying, is limited, except that eventual ballast in the column tanks shall be emptied first.

To ensure the FPU can satisfy the stability requirements at all stages, it will be necessary to deballast in essentially the reverse order as indicated in para. 5.3.4.1, or 5.3.4.2 as applicable.

Ballasting/deballasting sequences from/to inspection draft (18.00m) to operating draft (22.00m) are reported for the stability calculations in Volume 7: Stability Book.

5.3.4.5 Maintaining Operating Draft

During operations the deadweight, and hence the draft and also the trim and heel angles, will change continuously. This will have to be compensated by operating the ballast system. Such operation of the ballast system is often defined as "trimming".

The Control Room Operator will therefore, after having monitored changes to the draft and trim/ heel angles outside set limits, have to initiate ballast operations in close co-operation with the Marine Supt.. During these operations it is most important to control free surface effects in "active" ballast tanks as excessive free surface might have some unwanted effects on the VCG of the unit.

Which ballast tanks to be used during "trimming" shall be according to the stability analysis and the loading condition calculation (see also paragraph 5.4.5).

5.3.4.6 Maximum Allowable VCG at Various Drafts

Condition	Draft	Allowable VCG	Limiting Condition
Operating	**22.00**	**23.04**	**Damaged Stability**
Transition	21.00	26.60	GM>0.3m (Transition)
Transition	20.00	26.80	GM>0.3m (Transition)
Transition	19.00	27.00	GM>0.3m (Transition)
Transit Survival/ Inspection	**18.00**	**25.23**	**Damaged Stability**
Transition	17.00	27.50	GM>0.3m (Transition)
Transition	16.00	27.40	GM>0.3m (Transition)
Transition	15.00	26.90	GM>0.3m (Transition)
Transition	14.00	26.50	GM>0.3m (Transition)
Transition	13.00	28.20	GM>0.3m (Transition)
Transition	12.00	65.90	GM>0.3m (Transition)
Transit	**11.00**	**44.90**	**Damaged Stability**

5.3.5 Emergencies and Failures

a) Ballast Alarms

? The Control Room Operator will control any alarm arising in the ballast system.

? The Control Room Operator will regularly print-out the pending alarms for logging purposes

b) Stability

? The Control Room Operator, with the Marine Supt., will adopt the required corrective action in order to restore the stability margin to the previously calculated limits.

? Investigations will be carried out in order to clear the cause of any alarms raised due to exceedance of allowable stability/stress levels.

c) Hardware/Piping Alarms

? Maintenance personnel will be contacted in order to repair the fault.

5.3.6 Routine Checks by Ballast Operator

? The Control Room Operator in co-operation with the Marine Supt. shall calculate the scheduled ballast operation for final approval by the FPU Manager. In addition to maintaining acceptable values for VCG the unit shall not be subjected to too high stress levels due to torsional moments on the structure. Such moments can result if the ballast operation gives a non-symmetrical ballast distribution.

? The appropriate max VCG will be selected according to the operational criteria, weather, operational criteria, etc., according to the stability analysis requirements.

? The actual Lightship and Deadweight shall be referenced as specified in Volume 7: Stability Book

? Logging of stability shall be made.

? Empty and full tank conditions will, if possible, be verified manually when any doubt should arise from tank level sensor outputs.

? The Control Room Operator/Marine Supt. shall, on identifying any relevant differences between the calculated and actual stability margin, stop the ballast operations (all tank valves closed).

? Any relevant differences between the calculated and actual stability margin will require a proper investigation, which will determine the corrective action to be taken.

5.4.4 Ship's Weight Definitions

5.4.4.1 Definition of Lightship Weight

The lightship weight is determined on the basis of the FPU's displacement obtained by the draft measurement which was carried out together with the inclining experiment subject to the correction of weights to be added and deducted in compliance with the definition of the "light ship weight".

The lightship weight comprises the structure together with all machinery, plant, and outfitting, which is permanently attached to the structure of the unit. This includes: -

- ? All items of structure
- ? All paint, linings, insulation and joinery
- ? Anodes and cathodic protection system
- ? Fixed production equipment
- ? All fittings, equipment and inventories to make the unit fit for operation at sea. e.g. loose mooring and towing equipment, chain chasers, pennants, lifesaving equipment, cranes in stowed position, elevators at highest point and sea chest covers in permanent storage area
- ? All machinery in the dry condition including three helifuel tanks for the refuelling skid,
- ? Spare gear and tools which are required for class or certification purposes and all shackles, snatchblocks etc that are permanently onboard for the riser pull-in operations.

The lightweight also includes liquids in normally full systems as follows:

- ? Firewater piping systems, sprinkler and foam systems
- ? Potable water piping systems
- ? Liquids in the ship's sewage, drains, freshwater and sea water systems, but excluding water in tanks
- ? Lubrication oil, fuel oil, hydraulic oil and fluids in machinery systems but excluding fluids in tanks
- ? Liquids in the bilge, ballast and tank stripping systems, but excluding liquids in tanks

The lightweight does not include: -

- ? All water injection and process train fluids whether they are in circulating pipes or plant
- ? All production fluids whether they are in risers, circulating pipes or tanks
- ? All process equipment spares.
- ? Specific items such as the SCR riser pull-in winch and diving equipment which will only be onboard for a short period.

The lightship data shall be updated continuously. Any alteration to the Unit that may effect the lightship data shall be recorded, and the lightship data corrected accordingly. The "Lightship Amendments" record shall be kept onboard together with a file of documents related to the alterations. Copies of the lightship amendment record and documentation of new entries shall be sent to the Operator base.

5.4.4.2 Lightship Data

1. The completed "Total to Date" is to be carried forward to a new record sheet and the above procedure repeated.

This data are reported in Volume 7: Stability Book, Inclining Test Report.

5.4.4.3 Lightship Alterations Record Database

In order to keep track of the total lightship weight distribution alterations onboard the FPU, a list of all lightship weight changes has to be prepared.

Attached are standard notes of recording alterations to lightship weight along with a standard "Record of Alterations to Lightweight" sheet.

NOTES:

2. All changes to the lightweight and centres of gravity as determined by inclination test (see Volume 7: Stability Book) are to be monitored and recorded on the "Record of Alterations" sheet as attached.

3. A lightweight change is the addition, removal or relocation of any item welded, bolted or permanently fixed to the Unit's structure.

4. The running total of weight and centres of gravity for alteration to the lightweight of any given time is to be included in the calculation of any proposed loading condition at line item "Lightship alterations to date" as listed on Stability Calculation Form.

5. Once all lines in a "Record of Alterations" sheet have been filled, it is to be totalled along with the total brought forward from any previous sheet.

6. Three copies are to be forwarded to the Certifying Authority for noting. Two copies will be returned: one copy for retention on board the unit and one for the Operator's records.

FPU Petrobras 36 Record of Alteration to Lightship since Inclining Test	Sheet No

Line No	Date	Description of Item Added (+) or Removed (-)	Weight (Tonnes)	LCG (m)	Longitudinal Moment (T.m)	TCG (m)	Transverse Moment (T.m)	VCG (m)	Vertical Moment (T.m)
		Total from sheet No.							
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
		Total to Date							

This sheet shows the weights and centres of gravity of additions to (or removals from) the structure of the unit and the plant and equipment fitted to the structure by welding, bolting, or other permanent method.

.....

Signature of Reporting Officer

The information on this sheet has been noted by the Certifying Authority.

5.4.4.4 Definition of Deadweight

Deadweight is defined as the difference between total displacement at operating draft and lightship. The deadweight is split into the following items:

a. Operating loads including crew and their effects, stores and provisions, deck loads and production loads

b. Liquids loads in all tanks except production liquids

c. Mooring loads including, where applicable, tension from anchor chain or anchor and chain onboard, as defined in Loading Conditions, Volume 7: Stability Book and form "P36 - Stability Calculations"

d. Installed riser loads as defined in Loading Conditions, Volume 7: Stability Book and form "P36 - Stability Calculations"

5.4.5 Stability and Loading Condition Calculation Procedure

The loading condition shall be calculated daily and controlled towards the allowable VCG curve, with a sufficient deck load margin taking the following into account:

- ? Season
- ? Planned operations.
- ? Weather forecast.

The final VCG of the unit must be equal to or below the allowable VCG approved by the certifying authority.

Copies of the daily loading conditions shall be submitted to the base/head office for their files (weekly).

The stability may be calculated manually or automatically by using the FPU's load and on board stability calculator EASEACON.

During normal calculations or input data on load calculator (as applicable), the operator may also take into consideration the added weight of marine growth (see paragraph 5.4.7) and of loose equipment (see paragraph 5.4.8).

In the stability calculation also the vertical tension of moorings and installed risers should be taken into account.

5.4.5.1 Stability Calculation by Load and Stability Calculator – EASEACON Program

EASEACON is a Loading and Planning program developed by Marine Alignment *A/S* Denmark.

The program calculates trim, heel and stability for any condition. Furthermore it is equipped with Anti heel, Anti trim, Draft Investigation, Tank planning with an online link to a tank monitoring system, General Cargo planning, Cranes lift simulation, Mooring and Chain particulars, Installed Riser Loads and an Output module covering all facilities in the program.

EASEACON is approved by RINA as a Multi-point Stability instrument.

For further details please refer to the "EASEACON Program" and "Integrated Automation System" (IAS) manuals.

NOTE:

"The EASEACON Loading and Planning Program is designed to support the Operations Manual. It is not to be used to replace the Operations Manual. In the event of a discrepancy between the loading program and the Operations Manual shall prevail."

5.4.6

5.4.6 Ice and Snow Load Calculation

Section Deleted. Not applicable for service life offshore Brazil.

5.4.7 Marine Growth

Generally, weeds and fouling flourish near to the surface, particularly between 8 metres above to 40 metres below mean water level, and growth usually decreases as depth below the surface increases.

Extensive marine growth will increase the sectional area of a member and alter its surface characteristics, both changes tending to increase resistance to waves and currents and to increase the loads applied to the structure.

For example, the marine growth with thickness of 50mm at operating draft will increase the projected area under water by 2% (head current). The added weight shall be considered in the stability calculation as a "VARIATIONS" item.

5.4.8 Loose Equipment (not included in lightship unit weight)

In order to keep track of the total weight distribution onboard the FPU, a list of all loose equipment onboard has to be prepared.

Below an example is given of how such a list can be organised using the various group systems.

All alterations of loose equipment shall be listed within the appropriate group.

The normal stored location is specified with corresponding centre of gravity.

The list should be updated according to the "As Is" onboard equipment at all times. Please note that both new items and removed items shall be included in the list as shall position changes. In the case of position changes the item shall be noted as removed with the old centre of gravity, and added with the new centre of gravity.

The loose equipment weight shall be considered in the stability calculation as a "VARIATIONS" item.

The different groups are listed in tables below. They are examples of the Loose Equipment Unit Weight Database.

Loose Equipment Weight Database

GROUP 1 ITEM	HULL AND STRUCTURE LOCATION	WEIGHT [Tonnes]	CENTRE OF GRAVITY		
			LCG	TCG	VCG

GROUP 2 ITEM	PRODUCTION EQUIPMENT/SYSTEMS LOCATION	WEIGHT [Tonnes]	CENTRE OF GRAVITY		
			LCG	TCG	VCG

GROUP 3 ITEM	MISCELLANEOUS EQUIPMENT LOCATION	WEIGHT [Tonnes]	CENTRE OF GRAVITY		
			LCG	TCG	VCG

GROUP 4 ITEM	EQUIPMENT FOR CREW LOCATION	WEIGHT [Tonnes]	CENTRE OF GRAVITY		
			LCG	TCG	VCG

GROUP 5 ITEM	MACHINERY SYSTEMS LOCATION	WEIGHT [Tonnes]	CENTRE OF GRAVITY		
			LCG	TCG	VCG

GROUP 6 ITEM	MISCELLANEOUS PLATFORM EQUIPMENT LOCATION	WEIGHT [Tonnes]	CENTRE OF GRAVITY		
			LCG	TCG	VCG

5.4.9 When to Go To Survival

1) *From Transit Conditions*

The Unit must be ballasted to transit survival draft (18.0m) when seastate exceeds limit values. The limiting criterion is excessive slamming on the horizontal braces.

	Operating Mode	Transit	Transit Survival
Draft	(m)	11.0	18.0
Criteria		Max Load on Braces	10-Year Return Period
Wind-	1min mean (m/s)	35.0	41.7
Current	Surface (m/s)	n/a	n/a
Wave -	H_S (m)	4.9	10.1
	T_P (sec)	7.98 – 12.1	11.5-17.4
	Direction (from)	n/a	n/a

When planning for transit, it shall be verified with appropriate calculations that, when ballasting temporarily, the maximum allowable VCG curve is complied with (see also paragraph. 5.3.4.6).

2) *From Operating to Survival*

For service life at Roncador Field the operating draft of the Unit is the same as the survival draft i.e. 22.0m. Therefore no change in draft is required once the FPU is fully moored.

5.4.11 Checklist for Stability Operations

CHECKLIST RESPONSIBLE: MARINE SUPERINTENDENT

During any stability operations this check list to be followed, status recorded and filed:

Item	Description	Checked
1.	Communication between relevant parties established	
2.	Watertight closing appliances checked	
3.	Variable loads recorded and considered	
4.	Installed riser loads calculated and included	
5.	Stability calculated on ballast computers	
6.	Mooring line forces calculated	
7.	Max Allowable VCG curve used in calculation	
8.	Effective VCG below allowable VCG for the actual condition	
9.	Stability acceptable for operation	
10.	Manual stability calculation required	
11.	Manual stability calculation performed	
12.	Mooring winches cooling water checked	
13.	Mooring winch brakes checked	
14.	Mooring line length counters lubricated and operating properly	
15.	Mooring line load cells and indicators operating properly	
16.	Emergency Anchor(s) on Rack and connected to chain (where applicable)	
	SPECIAL REMARKS	
	Marine Superintendent _____ (sign) DATE: _____	

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5.3 BALLASTING/DEBALLASTING OPERATIONS

5.3.1 General Recommendation and Organisation

Loading and unloading of ballast, since it will imply trim and stability has a direct influence on the safety and operating performance of the Unit. For these reasons all people involved in the operation and maintenance must be fully familiar with the mode of operation and components of the system.

Only ballast operators are authorised to use the system under the authority and supervision of the FPU Manager and Marine Supt.. No maintenance work on any part of the ballast system, or its control system, shall be initiated unless agreed by the FPU Manager.

Large ballasting and deballasting operations when changing draft shall only be made under direct supervision of FPU Manager or Marine Supt..

A. Responsibility

1) *FPU Manager*

The FPU Manager is responsible for the operations of the FPU ballasting systems

2) *Marine Superintendent*

The Marine Supt. is responsible for the stability and ballasting of the FPU. He will be in close contact with the FPU Manager and give instructions to the control room Operators. The Marine Supt. is responsible for ensuring that all personnel under his supervision have the necessary qualifications and experience to properly carry out the work assigned to them.

3) *Control Room Operators*

Control room operators are responsible for the operations of the ballast systems, and will carry out operations on instructions from the Marine Supt.. They will also be responsible for maintaining all records and logs related to the ballasting operations. Control room operators shall report to Marine Superintendent.

B. Qualifications

1) *Marine Superintendent*

- ? To have relevant experience.
- ? Knowledge of stability calculations and procedures.
- ? Knowledge of ballast systems and procedures.
- ? Knowledge of relevant codes and standards.

2) *Control Room Operators*

- ? To have relevant experience.
- ? Knowledge of relevant codes and standards.
- ? Detailed knowledge of the ballast systems and procedures

C. Reporting

Control room operators to report directly to the Marine Superintendent after each ballast operation and otherwise when necessary.

The Marine Supt. reports directly to FPU Manager.

All significant ballast operations will be reported in the following logs

- ? Morning Report
- ? Daily Log
- ? Navigation Log

D. Applicable Codes and Standards

? Registro Italiano Navale (RINA)

5.3.2 Description of the Ballast System

The ballast system with equipment is described in Volume 4.3, paragraph 4.3.1.

The ballast system hardware is described in Volume 4.6, paragraph 4.6.8.

The ballast system operation mode is described in following paragraph 5.3.2.1.

5.3.2.1 Ballast System Operation Mode

The ballast system equipment may be operated from the following areas

? Central Control Room (CCR)
? Four (4) Local Control positions

By means of two different types of operator interface devices:

? video \ keyboard units (VDUs)
? mimic panels

Arranged as indicated below

CCR:	VDUs
	Central *mimic* panel
LOCAL CONTROL POSITIONS:	local *mimic* panels

Ballast system operations are normally performed from CCR, following the operations criteria indicated in the following.

CCR VDUs commands are allowed only if CCR console has been logged in by a password qualified operator and command transfer is set at CCR position.

CCR mimic panel commands are active if mimic panel key switch selector is set at the ACTIVE position and command transfer is set at CCR position. System operation through CCR VDUs and CCR mimic panel should be considered as a Normal operation procedure.

Ballast system operation may also be partially or fully done from the LOCAL CONTROL POSITIONS by means of the local mimics. There are 4 LOCAL CONTROL POSITIONS, one at the top of each FPU column. Local mimics commands are limited to the relevant quadrant ballast system devices.

It will be always possible to set a local mimic operative just placing the LOCAL\REMOTE selector at LOCAL. There are neither hardware nor software interlocks to perform this highest priority operation. Switching to Local mimic command is possible even with both IAS data highways out of service.

If a local mimic is active, CCR commands are hardwired inhibited by the local mimic relay logic. Thus local mimics command and monitoring is not in anyway interlocked by RTUs electronic equipment failure.

Local mimic control is released only when local mimic REMOTE lamp is fix lighting. This occurs after the LOCAL/REMOTE selector is set at REMOTE and the control room operator has done the transfer accept command.

Local mimic LOCAL/REMOTE selector position is indicated at all operator interfaces.

Ballast system operation from local mimics should be considered as a maintenance or emergency procedure and not as a normal operating procedure.

Ballast system operations may be blocked pressing the CCR mimic HALT pushbutton. This pushbutton is hardwired to all RTUs relay logic in such a way that it will cause all valves to close and all pumps to stop. HALT pushbutton is operative even with Local mimics working at Local.

HALT pushbutton operation is not in any way limited by an IAS electronic failure.

5.4 STABILITY

5.4.1 General

The purpose of this section and the following procedures is to assist in planning, preparing and performing ballast and deballast operations, loading and offloading deck cargo and consumables and to ensure adequate stability of the P36.

5.4.2 Organisation

5.4.2.1 Responsibility

1. FPU Manager

   The FPU Manager shall be responsible for the operations of the FPU. The FPU Manager will be responsible for initiating training and simulation operations for the section leaders in order for these persons also to meet emergency situations.

2. Marine Supt.

   The Marine Supt. will be responsible for the stability and ballasting of the FPU. He is responsible for calculating the loading condition daily and that this condition is controlled against the allowable VCG.

3. Control Room Operators

   The control room operators will be responsible for the operations of the ballast systems, and will carry out the operations on instructions from the Marine Supt.. They will also be responsible for maintaining all records and logs relating to the ballasting conditions.

5.4.2.2 Qualifications

1. Marine Supt.

- ? To have relevant experience
- ? Knowledge of relevant codes and standards

? Detailed knowledge of stability procedures

? Detailed knowledge with procedures in case of damage.

2. *Control Room Operators*

? To have relevant experience

? Knowledge of relevant codes and standards

? Detailed knowledge of ballasting systems and procedures

? Detailed knowledge with procedures in case of damage.

5.4.2.3 Reporting

? Marine Supt. to report directly to the FPU manager

? Control room operators to report to the Marine Supt.

? A copy of the daily stability calculations shall be submitted to the base/head office for their files

? All stability operations will be reported daily in the following logs: Daily Log, Navigation Log.

5.4.2.4 Applicable Codes and Standards

? Registro Italiano Navale (RINA)

? IMO

5.4.3 Preparations

a) *People Involved*

? FPU Manager

? Marine Supt.

? Control Room Operator

b) *Information Regarding Stability Operations*

Information on stability operations to be distributed as follows:

? FPU Manager

? Marine Supt.

? Maintenance Supt.

c) *Operational Limitations/Restrictions*

The VCG of the Unit must be within the allowable VCG approved by the Authorities for the actual conditions. Refer to Volume 7: Stability Book and to results of stability calculations stated in paragraph 5.4.5.

The basic principles are that the Unit shall, in any circumstances, fulfil the stability requirements both for intact and damaged stability in Transit, Survival and Operating conditions

CAUTION

If required, at intermediate drafts between the Transit, Transit Survival and Operating conditions, the Unit should be temporarily ballasted/deballasted to comply with the referenced max. allowable VCG curves.

1) Transit and Operating/Survival Drafts

a) Transit draft 11.0 m

b) Operating/Survival draft 22.0 m

c) Inspection draft 18.0 m

2) Max Allowable Vertical Centre of Gravity

Petrobras-36 is certified by RINA and complies with IMO Regulations.

For the max allowed VCG in transit, at operating draft, and at inspection draft, refer to Volume 7: Stability Book and paragraph 5.3.4.6

3) Watertight Doors and Hatches

All watertight doors and hatches must be kept permanently closed.

d) Communications

The Marine Supt. is responsible for establishing communication between the involved persons.

5.4.10 Damaged Stability

a) General

? The Unit is so designed that in the event of any one compartment or two exposed adjacent compartments in the water line area at operating or transit drafts (within locations specified for this purpose in the rules of the various regulatory bodies) becoming accidentally flooded, the Unit will remain stable and will be able to withstand the effect of a 50 knots wind superimposed in the damaged condition without causing down flooding through any opening.

? The VCG of a specific condition must be within the max. allowable VCG. As indicated by the "Allowable VCG Curve", the Unit satisfies the requirements (refer also to Volume 7: Stability Book).

b) Countermeasures

In the event that the Unit is flooded due to collision, or some other reason, prompt corrective measures may be necessary.

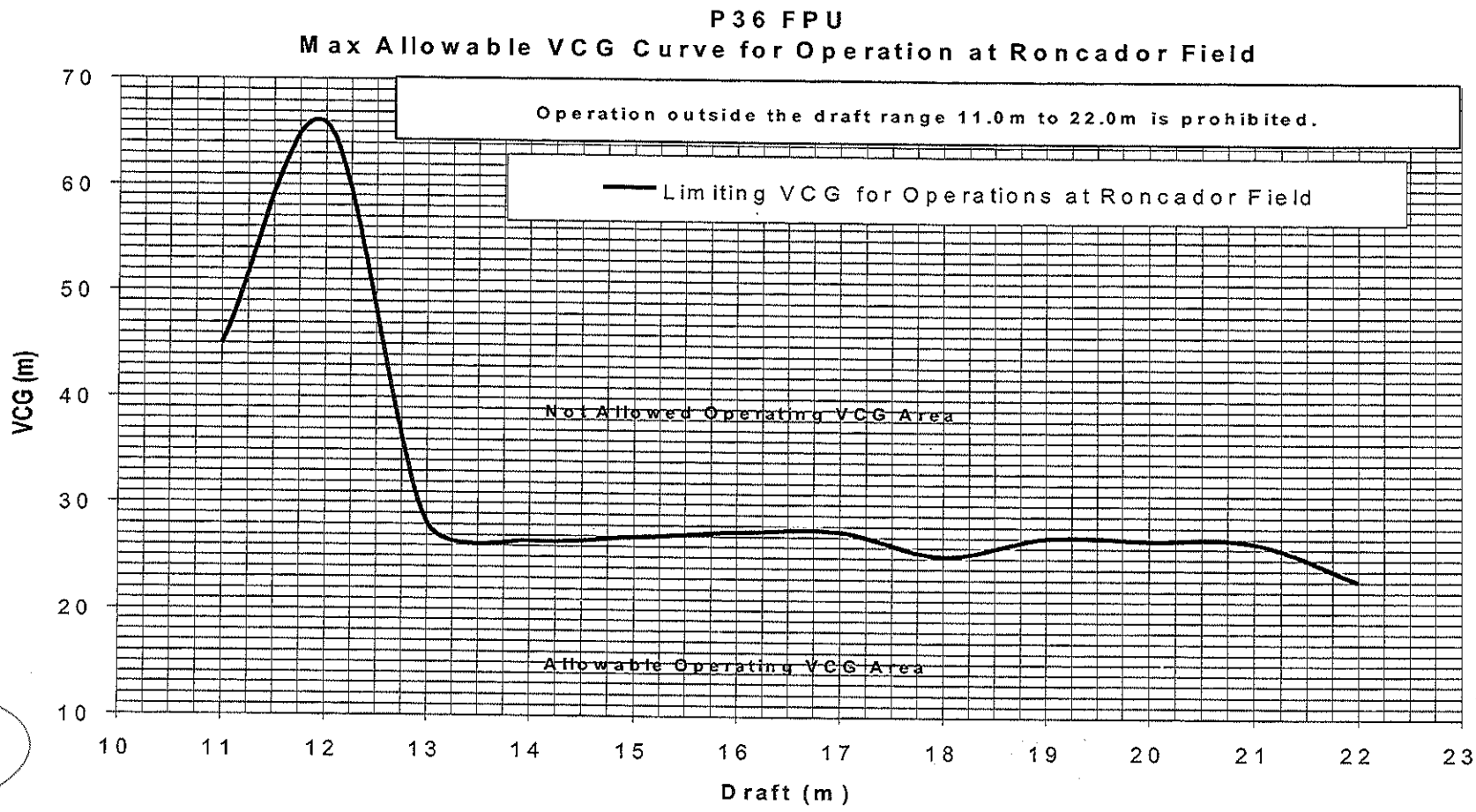
The inclination might cause a shift of cargo and equipment resulting in further inclination. Loose items may also cause structural damage effecting the watertight integrity. It is therefore of importance to correct the trim and heel caused by flooding. This operation must be carried out with due attention to the stability of the FPU.

After the Unit has been restored to proper trim and heel, it may be deballasted to a new draft, where for instance temporary repairs for the damaged area might be possible.

NOTE: The operations for damage control are reported in Volume 7 : Stability Book

5.4.10.1 Emergency Procedure in Case of Damage

Refer to Volume 6: Emergency/Safety Procedures.



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CERTIDÃO

CERTIFICO que, nesta data foi anexado o 4º Volume do anexo F fls ao processo 19489/01 fls. 36

O referido é verdade e dou fé.

Ano 11 **de** Abril **de 200**1.

É CÓPIA FIEL DO DOCUMENTO ORIGINAL

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