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FRIGG FIELD
TCP2

VOL 1
OPERATIONS MANUAL

Norsk Hydro

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FRIGG FIELD

PLATFORM TCP2

VOLUME 1 OPERATIONS MANUAL

CONTENTS

Foreword
Glossary of Symbols
Record of Amendments
List of Contents

Chapter 1 INTRODUCTION

Chapter 2 PLATFORM STRUCTURE

Chapter 3 EQUIPMENT LOCATION

Chapter 4 PRODUCTION FACILITIES

Chapter 5 UTILITIES

Chapter 6 TRANSPORT FACILITIES

Chapter 7 MATERIALS HANDLING

Chapter 8 COMMUNICATIONS

Chapter 9 SAFETY

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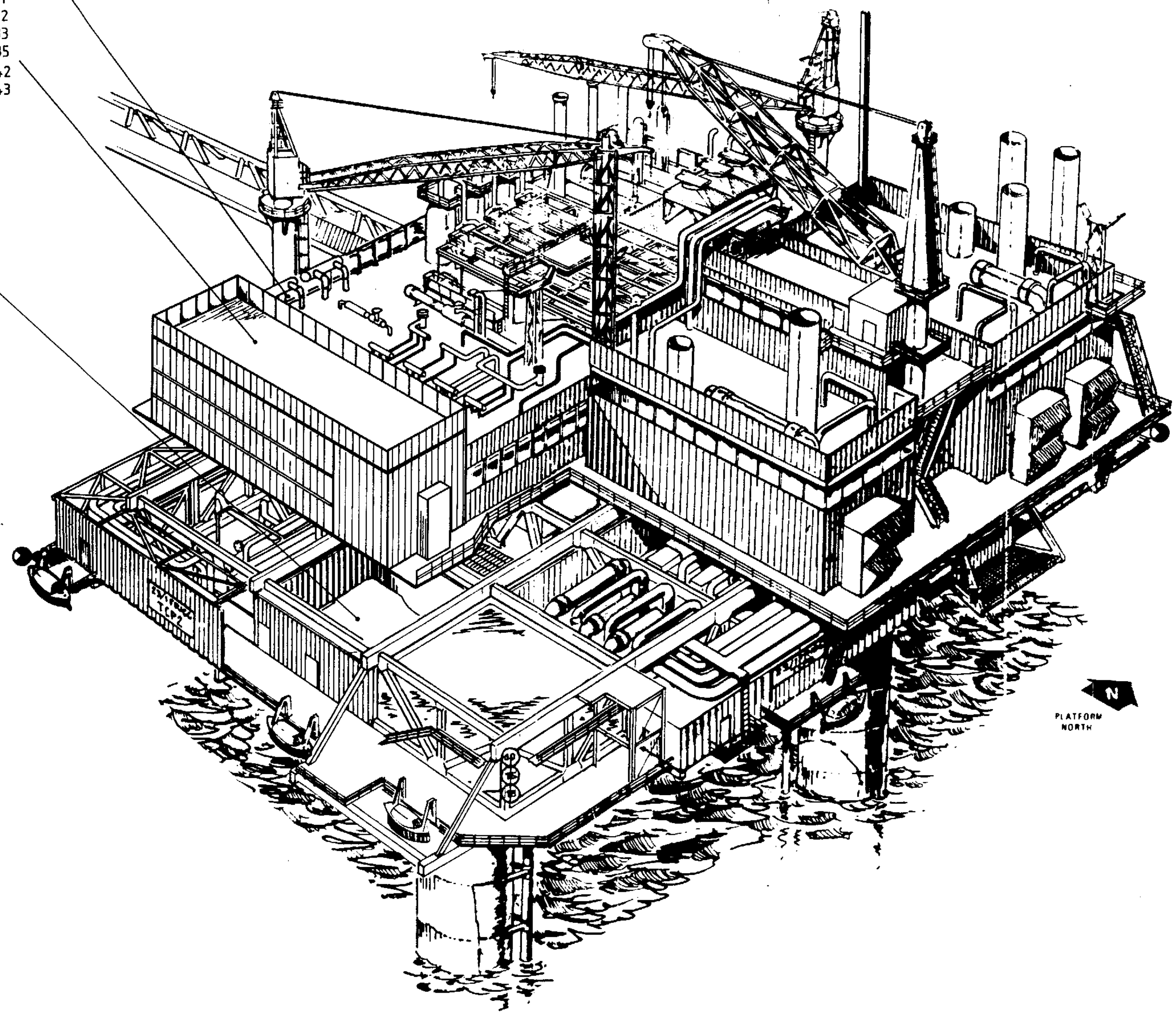
0033
0035
0042
0043

PANCAKE 53 REF. DRWG.
FF 88.21.25.5002



ISSUE 2, OCT. 88

FRONTISPIECE

This is a management document and is the principal document submitted for certification. It contains a summary description of the structure, production utilities and safety systems for guidance and reference at management levels.

It is also intended to serve the additional purpose of providing the operators with operating philosophies and data, and a summary of machinery systems' layout and platform safety.

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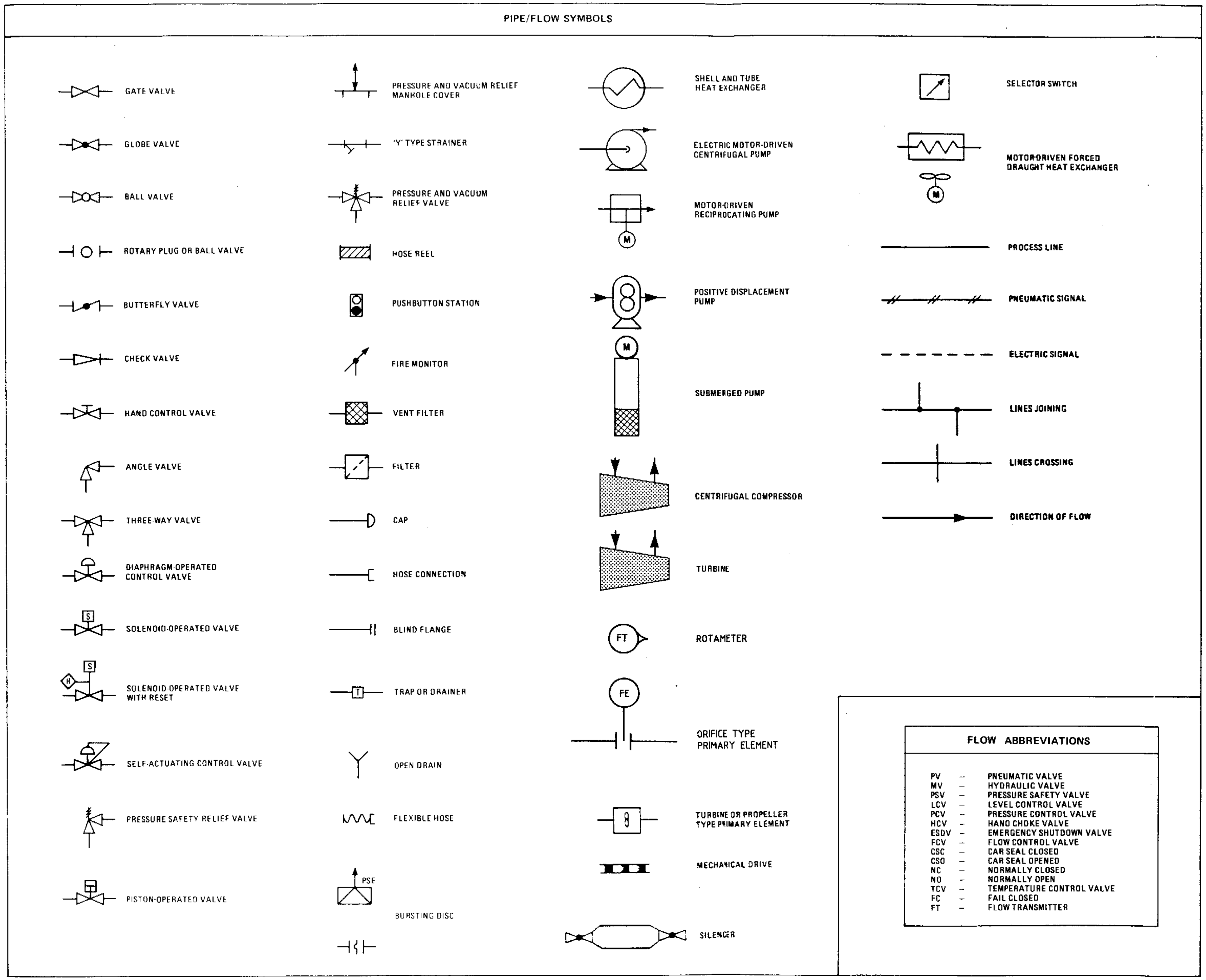
GLOSSARY OF SYMBOLS

ISSUE 2 OCT. 1988

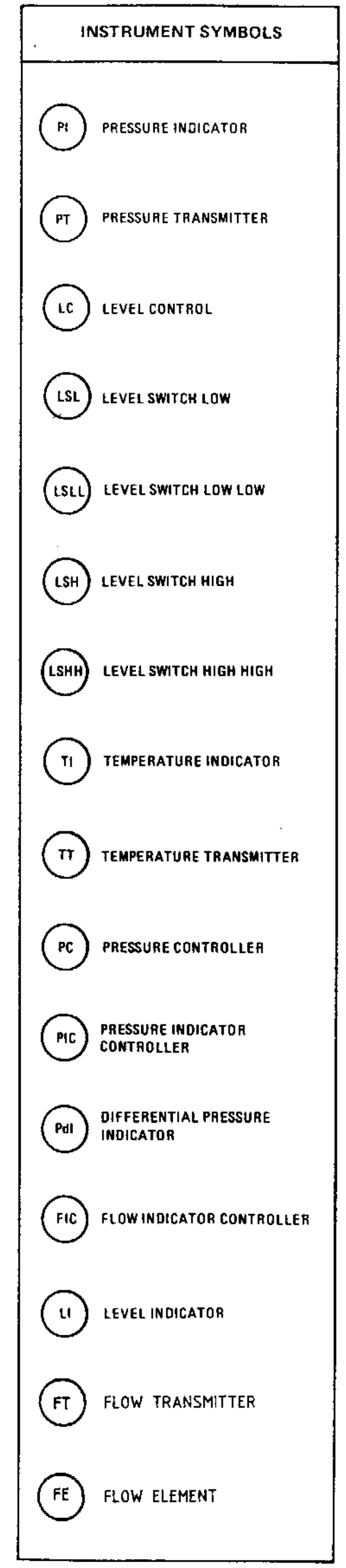
PIPE/FLOW SYMBOLS



FLOW ABBREVIATIONS

PV	–	PNEUMATIC VALVE
MV	–	HYDRAULIC VALVE
PSV	–	PRESSURE SAFETY VALVE
LCV	–	LEVEL CONTROL VALVE
PCV	–	PRESSURE CONTROL VALVE
HCV	–	HAND CHOKE VALVE
ESDV	–	EMERGENCY SHUTDOWN VALVE
FCV	–	FLOW CONTROL VALVE
CSC	–	CAR SEAL CLOSED
CSO	–	CAR SEAL OPENED
NC	–	NORMALLY CLOSED
NO	–	NORMALLY OPEN
TCV	–	TEMPERATURE CONTROL VALVE
FC	–	FAIL CLOSED
FT	–	FLOW TRANSMITTER

INSTRUMENT SYMBOLS



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RECORD OF AMENDMENTS **MASTER FILE**

Issue No	Dated	Amended by (Signature)	Date
1,2,3	OCT 82	K. Gundersen	4/1/83
2	Jun 85	[illegible]	Jun 85
New Index list		T. Haugland	6/1-86
9.3.1→9.3.5	Dec. 85	T. Haugland	20/2-86
Chapter 7.7.5	June 86	T. Haugland	25/1-86
Updated	October-88	K. Tollaksen	14/10-88
"	Jan. 89	K. Tollaksen	12/1/89
"	Jan. 92	K. Tollaksen	13/1/92

TCP2 Operation Manual

List of Contents

Chapter 1 Introduction

			Title	Issue
			Frontpiece	3.Oct. 88
			Contents	2.Aug. 91
Section	1.1		FF Location	5.Aug. 91
Diagram	1.1		FF Location	5.Aug. 91
Section	1.2		FF Summary of Installation	5.Aug. 91
Diagram	1.2		FF Summary of Installation	4.Aug. 91
Section	1.3	Page 1	FF Process Flow	5.Aug. 91
Section	1.3	Page 2	FF Process Flow	5.Aug. 91
Diagram			FF 00 00 00 5000, Main Gas	.Aug. 91
Diagram			FF 00 00 00 5002, Liq. Treat	.Aug. 91
Diagram			FF 00 00 00 5003, HP and LT Vent Lines	.Aug. 91

Chapter 2 Platform Structure

				Issue
			Contents	3.Oct. 82
Section	2.1	Page 1	Platform Construction	2.Jul. 81
Section	2.1	Page 2	Platform Construction	2.Jul. 81
Section	2.1	Page 3	Platform Construction	2.Jul. 81
Section	2.2		Environmental Design Criteria	2.Jul. 81
Diagram	2.2		Environmental Design Criteria	2.Jan. 85
Section	2.3	Page 1	Geotechnical and Structural Instr.	2.Jul. 81
Section	2.3	Page 2	Geotechnical and Structural Instr.	3.Oct. 88
Diagram	2.3		Geotechnical and Structural Instr.	1.Jul. 81
Section	2.4	Page 1	Primary Structure	2.Jul. 81
Section	2.4	Page 2	Primary Structure	3.Oct. 88
Diagram	2.4		Primary Structure	1.Jul. 81
Section	2.5	Page 1	Secondary Structure	4.Oct. 88
Section	2.5	Page 2	Secondary Structure	3.Jan. 85
Diagram	2.5		Secondary Structure	3.Oct. 88
Section	2.6	Page 1	Platform Risers	4.Aug. 91
Section	2.6	Page 2	Platform Risers	4.Aug. 91
Section	2.6	Page 3	Platform Risers	2.Jul. 81
Diagram	2.6		Platform Risers	2.Oct. 88
Section	2.7	Page 1	Materials & Construction	2.Jul. 81
Section	2.7	Page 2	Materials & Construction	2.Jul. 81
Section	2.7	Page 3	Materials & Construction	2.Jul. 81
Section	2.7	Page 4	Materials & Construction	2.Jul. 81
Section	2.7	Page 5	Materials & Construction	2.Jul. 81
Diagram	2.7		Materials & Construction Pipeline Identific.	1.Jul. 80
Section	2.8	Page 1	Cathodic Protection	2.Jul. 81
Section	2.8	Page 2	Cathodic Protection	3.Jan. 85
Section	2.9		Inspection & Maintenance	3.Aug. 91

Chapter 3 Equipment Location

			Title	Issue
			Contents	3.Nov. 88
Section	3.1.1	Page 1	Equipment Location Cellar Deck	6.Aug. 91
Section	3.1.1	Page 2	Equipment Location Cellar Deck	3.Aug. 91
Diagram	3.1.1		Equipment Location Cellar Deck	6.Aug. 91
Section	3.1.2		Equipment Location Main Deck	5.Aug. 91
Diagram	3.1.2		Equipment Location Main Deck	6.Aug. 91
Section	3.1.3		Equipment Location Upper Deck	4.Aug. 91
Diagram	3.1.3		Equipment Location Upper Deck	4.Jun. 91

Chapter 4 Production Facilities

			Contents	6.Aug. 91
Section	4.1		Process Flow	6.Aug. 91
Diagram	4.1.1		General Overview Main Gas System	1.Aug. 91
Diagram	4.1.2		Process Flow TCP2 Extenstion	1.Aug. 91
Diagram	4.1.3		Process Flow East Frigg	1.Aug. 91
Diagram	4.1.4		Methanolated water disposal	4.Aug. 91
Section	4.2		Separation of Frigg Fluids	1.Aug. 91
Diagram	4.2.1		Free Water Knockout Drum	1.Aug. 91
Section	4.3	Page 1	Compression	5.Aug. 91
Section	4.3	Page 2	Compression	5.Aug. 91
Diagram	4.3.1		Compression	3.Oct. 88
Diagram	4.3.2		Compression Main Gas System	1.Aug. 91
Section	4.4		TCP2 Extension Gas System	5.Aug. 91
Diagram	4.4.1		NEF Main Gas	1.Aug. 91
Diagram	4.4.2		Odin Main Gas	1.Aug. 91
Diagram	4.4.3		CV311, Gas Scrubber	1.Aug. 91
Section	4.5	Page 1	East Frigg Tie-in Gas System	4.Aug. 91
Diagram	4.5.1		EF Main Gas overview	1.Aug. 91
Section	4.6	Page 1	Gas drying and metering	6.Aug. 91
Section	4.6	Page 2	Gas drying and metering	6.Aug. 91
Diagram	4.6.1		Gas drying and metering	4.Aug. 91
Diagram	4.6.2		Internals CV2	1.Aug. 91
Diagram	4.6.3		Metering microcomputer	1.Aug. 91
Section	4.7.		Sales Gas Header and Gas export	4.Aug. 91
Diagram	4.7.1		Sales Gas Header	4.Aug. 91
Section	4.8	Page 1	Condensate System	6.Aug. 91
Section	4.8	Page 2	Condensate System	4.Aug. 91
Diagram	4.8.1		Condensate System	1.Aug. 91
Diagram	4.8.2		Heating Loop	1.Aug. 91
Diagram	4.8.3		Condensate Storage	4.Aug. 91
Section	4.9		Water Treatment	3.Aug. 91
Diagram	4.9.1		Water Treatment	4.Aug. 91
Section	4.10		Methanolated Water Treatment	3.Aug. 91
Diagram	4.10.1		Methanolated Water Disposal	1.Aug. 91

Chapter 5 Utilities

			Title		Issue
			Contents Page 1		4.Aug. 91
			Contents Page 2		4.Aug. 91
Section	5.1	Page 1	Power Generation and Interplf. Elec. Con.		6.Aug. 91
Section	5.1	Page 2	Power Generation and Interplf. Elec. Con.		5.Aug. 91
Diagram	5.1		Power Generation and Interplf. Elec. Con.		5.Aug. 91
Section	5.2	Page 1	Electrical Power Distribution		5.Aug. 91
Section	5.2	Page 2	Electrical Power Distribution		6.Aug. 91
Section	5.2	Page 3	Electrical Power Distribution		5.Aug. 91
Diagram	5.2		Electrical Power Distribution		5.Aug. 91
Section	5.3		Emergency Supplies		3.Aug. 91
Diagram	5.3		Emergency Supplies		4.Aug. 91
Section	5.4	Page 1	Battery Supported Supplies		4.Oct. 88
Section	5.4	Page 2	Battery Supported Supplies		5.Oct. 88
Section	5.4	Page 3	Battery Supported Supplies		1.Oct. 88
Diagram	5.4.1		Battery Supported Supplies	Treatment Areas	3.Aug. 91
Diagram	5.4.2		Battery Supported Supplies	Compression Areas	2.Aug. 91
Diagram	5.4.3		Battery Supported Supplies	to E.F. (treat. area)	2.Aug. 91
Section	5.5	Page 1	Glycon Regeneration		5.Aug. 91
Section	5.5	Page 2	Glycon Regeneration		5.Aug. 91
Diagram	5.5		Glycon Regeneration		3.Aug. 91
Section	5.6		TCP2 Extension and E.F. Teg. System		5.Aug. 91
Diagram	5.6		TCP2 Extension and E.F. Teg. System		4.Aug. 91
Section	5.7		Bulk Storage of Glycol		3.Jan. 85
Diagram	5.7		Bulk Storage of Glycol		3.Oct. 88
Section	5.8	Page 1	LP Vent System (Treatment Areas)		6.Aug. 91
Diagram	5.8		LP Vent System (Treatment Areas)		4.Aug. 91
Section	5.9		LP Vent System TCP2 Extension & EF Tie-In		4.Oct. 88
Diagram	5.9		LP Vent System TCP2 Extension & EF Tie-In		3.Oct. 88
Section	5.10	Page 1	LP Vent System (Compression Area)		4.Oct. 88
Section	5.10	Page 2	LP Vent System (Compression Area)		1.Jan. 85
Diagram	5.10		LP Vent System (Compression Area)		3.Oct. 88
Section	5.11	Page 1	HP Relief System		4.Aug. 91
Section	5.11	Page 2	HP Relief System		3.Aug. 91
Diagram	5.11		HP Relief System		3.Aug. 91
Section	5.11.1	Page 1	LT Relief System		4.Aug. 91
Section	5.11.1	Page 2	LT Relief System		4.Aug. 91
Diagram	5.11.1		LF Relief System		3.Aug. 91
Section	5.11.2	Page 1	LT Relief System East Frigg		2.Aug. 91
Section	5.11.2	Page 2	LT Relief System East Frigg		1.Oct. 88
Diagram	5.11.2		LT Relief System East Frigg		2.Aug. 91
Section	5.12		HP Relief TCP2 Extension		4.Oct. 88
Diagram	5.12		HP Relief TCP2 Extension		4.Aug. 91
Section	5.13	Page 1	LT Relief System TCP2 Extension		4.Aug. 91
Section	5.13	Page 2	LT Relief System TCP2 Extension		3.Jan. 85
Diagram	5.13		LT Relief System TCP2 Extension		4.Aug. 91
Section	5.14		Methanol Storage and Injection		5.Aug. 91
Diagram	5.14		Methanol Storage and Injection		4.Aug. 91
Section	5.14.1	Page 1	East Frigg Methanol. Storage and Inject.		1.Oct. 88
Section	5.14.2	Page 2	East Frigg Methanol. Storage and Inject.		1.Oct. 88
Section	5.14.3	Page 3	East Frigg Methanol. Storage and Inject.		1.Oct. 88
Diagram	5.14.1		East Frigg Metha. Storage & Rec. Syst.		2.Aug. 91
Diagram	5.14.2		East Frigg Metha. Storage & Rec. Syst.		2.Aug. 91
FF 85 00 02 5019 P & ID Fuel Gas & Methanol Inject.Syst.					19.May. 91

Chapter 5 Con't

Section	5.15		Washdown System	5.Aug. 91
Diagram	5.15		Washdown System	4.Aug. 91
Section	5.16	Page 1	Drainage System	4.Oct. 88
Section	5.16	Page 2	Drainage System	2.Aug. 91
Diagram	5.16.1		Drainage System Process	4.Aug. 91
Diagram	5.16.2		Drainage System Deck	3.Aug. 91
Diagram	5.16.3		Drainage System Compression Area	2.Aug. 91
Diagram	5.16.4		Drainage System TCP2 Extension & EF	3.Aug. 91
Section	5.17	Page 1	Fuel Gas System (Treatment Areas)	5.Aug. 91
Section	5.17	Page 2	Fuel Gas System (Treatment Areas)	4.Aug. 91
Diagram	5.17		Fuel Gas System (Treatment Areas)	4.Aug. 91
Section	5.18	Page 1	Fuel Gas System (Compression Area)	5.Aug. 91
Section	5.18	Page 2	Fuel Gas System (Compression Area)	3.Jan. 85
Diagram	5.18		Fuel Gas System (Compression Area)	4.Aug. 91
Section	5.19		Fuel Gas For TCP2 Extension	4.Oct. 88
Diagram	5.19		Fuel Gas System TCP2 Extension	.Jun. 88
Section	5.19.1		Fuel Gas For East Frigg	1.Oct. 88
Section	5.20		Diesel Fuel System	4.Aug. 91
Diagram	5.20		Diesel Fuel System	3.Aug. 91
Section	5.21	Page 1	Compressed Air General	3.Aug. 91
Section	5.22	Page 1	Compressed Air Central Complex and DP2	5.Aug. 91
Section	5.22	Page 2	Compressed Air Central Complex and DP2	5.Aug. 91
Section	5.22	Page 3	Compressed Air Central Complex and DP2	4.Aug. 91
Section	5.22	Page 4	Compressed Air Central Complex and DP2	1.Aug. 91
Section	5.22	Page 5	Compressed Air Central Complex and DP2	1.Aug. 91
Diagram	FF 85 00 01 5007		Schematic of new compressed air network	4.Sep. 91
Diagram	5.22.		Air Reservoir Lines	1.Aug. 91
Section	5.23	Page 1	Ventilation Systems Treatment Areas	4.Aug. 91
Section	5.23	Page 2	Ventilation Systems Treatment Areas	4.Aug. 91
Section	5.23	Page 3	Ventilation Systems Treatment Areas	2.Aug. 91
Section	5.23	Page 4	Ventilation Systems Treatment Areas	2.Aug. 91
Section	5.23	Page 5	Ventilation Systems Treatment Areas	2.Aug. 91
Section	5.23	Page 6	Ventilation Systems Treatment Areas	1.Oct. 88
Diagram	5.23.1		Ventilation Systems Treatment Areas	4.Aug. 91
Diagram	5.23.2		Ventilation Systems, Module 51, Treat. Area	1.Oct. 88
Section	5.24	Page 1	Ventilation Systems Compression Areas	3.Jan. 85
Section	5.24	Page 2	Ventilation Systems Compression Areas	3.Jan. 85
Section	5.24	Page 3	Ventilation Systems Compression Areas	1.Jan. 85
Section	5.24	Page 4	Ventilation Systems Compression Areas	1.Jan. 85
Section	5.24	Page 5	Ventilation Systems Compression Areas	1.Jan. 85
Section	5.24	Page 6	Ventilation Systems Compression Areas	1.Jan. 85
Diagram	5.24		Ventilation Systems Compression Areas	2.Jan. 85
Section	5.25	Page 1	Hydraulic System (Treatment Areas)	2.Aug. 91
Section	5.25	Page 2	Hydrualic System (Treatment Areas)	2.Aug. 91
Diagram	5.25		Hydraulic System (Treatment Areas)	3.Aug. 91
Section	5.25.1	Page 1	East Frigg Wellhead Hydraulic System	1.Oct. 88
Section	5.25.1	Page 2	East Frigg Wellhead Hydraulic System	2.Aug. 91
Section	5.25.1	Page 3	East Frigg Wellhead Hydraulic System	1.Oct. 88
Diagram	5.25.1		East Frigg Wellhead Hydraulic System	2.Aug. 91
Section	5.26	Page 1	Hydraulic System (Compression Areas)	3.Aug. 91
Section	5.26	Page 2	Hydraulic System (Compression Areas)	3.Aug. 91
Diagram	5.26		Hydraulic System (Compression Areas)	3.Aug. 91
Section	5.27	Page 1	Cooling Water System	2.Oct. 88
Section	5.27	Page 2	Cooling Water System	2.Oct. 88
Section	5.27	Page 3	Cooling Water System	2.Oct. 88
Section	5.27	Page 4	Cooling Water System	1.Jan. 85
Section	5.27	Page 5	Cooling Water System	1.Jan. 85
Diagram	5.27		Cooling Water System	3.Aug. 91

Chapter 5 Con't

			Title	Issue
Section	5.28	Page 1	Desalinated Water Network	1.Jan. 85
Section	5.28	Page 2	Desalinated Water Network	1.Jan. 85
Diagram	5.28		Desalinated Water Network	2.Aug. 91
Section	5.29	Page 1	Normal Lighting	3.Aug. 91
Section	5.29	Page 2	Normal Lighting	1.Jan. 85
Diagram	5.29.1		Normal Lighting (Treatment Areas)	3.Aug. 91
Diagram	5.29.2		Normal Lighting (Treatment Areas)	3.Aug. 91
Section	5.30		Nitrogen System	2.Aug. 91
Diagram	5.30		Nitrogen System	3.Aug. 91
Section	5.31	Page 1	Corrosion Inhibitor Injection System	2.Aug. 91
Section	5.31	Page 2	Corrosion Inhibitor Injection System	1.Aug. 91
Diagram	5.31		Corrsoion Inhibitor Injection System	1.Nov. 88
Drawing	FF 89 00 27 0048		Corrosion Inhibitor Injection System	8.Aug. 91

Chapter 6 Transport Facilities

			Contents	2.Jul. 81
Section	6.1		Supply Vessels	7.Dec. 91

Chapter 7 Materials Handling

			Contents	4.Jun. 86
Section	7.1	Page 1	Cranes	4.Dec. 91
Section	7.1	Page 2	Cranes	3.Oct. 82
Section	7.1		Dynamic Load Chart - Bucyrus Erie crane	
Diagram	FF 85 00 00 0058		Cranes Working Area	Feb. 91
Diagram	7.1.2		Lifeload On Open Deck Area Cellar Deck	1.Oct. 84
Diagram	7.1.3		Lifeload On Open Deck Area Main Deck	2.May. 88
Diagram	7.1.4		Lifeload On Open Deck Area Upper Deck	2.May. 88
Diagram	7.1.5		Lifeload On Open Deck Area Modules 30,31,32,33	1.Oct. 84
Diagram	7.1.6		Lifeload On Open Deck Area Module 51	1.Oct. 88
Section	7.2		Lifting Equipment	4.Oct. 88
Diagram	7.2		Lifting Equipment	2.Jan. 85
Section	7.3		Bulk Handling Systems	2.Jul. 81
Section	7.4	Page 1	Column Access	1.Jan. 85
Section	7.4	Page 2	Column Access	1.Jan. 85
Section	7.4	Page 3	Column Access	1.Jan. 85
Section	7.5		Overload Protection For MK-60 Cranes	2.Jun. 86

Chapter 8 Communications

			Contents	5.Oct. 88
Section	8.1	Page 1	Radio Links	3.Oct. 88
Diagram	8.1.1		Radio Links FF 00 16 00 0013	3.Aug. 91
Diagram	8.1.2		Radio Links Lifeboat Radio Equipment	3.Oct. 88
Section	8.2	Page 1	Telephone System	5.Aug. 91
Section	8.2	Page 2	Telephone System	2.Oct. 88
Section	8.3	Page 1	Intercomm. System	4.Aug. 91
Diagram	8.3		Intercomm. System	5.Aug. 91
Section	8.4	Page 1	Public Address & Alarm System	6.Aug. 91
Section	8.4	Page 2	Public Address & Alarm System	5.Aug. 91
Diagram	8.4		Public Address & Alarm System	6.Aug. 91

Chapter 8 Con't

			Title	Issue
Section	8.5	Page 1	Navigational Aids	2.Jul. 81
Section	8.5	Page 2	Navigational Aids	2.Jul. 81
Section	8.5	Page 3	Navigational Aids	2.Jul. 81
Section	8.5	Page 4	Navigational Aids	2.Jul. 81
Diagram	8.5.1		Navigational Aids	3.Oct. 88
Diagram	8.5.2		Navigational Aids Overall System	1.Jul. 80
Section 8.6			NEF Slow Scan TV System	1.Jan. 85

Chapter 9 Safety

		Page 1	Contents	5.Oct. 88
		Page 2	Contents	6.Aug. 91
Section	9.1		Offshore Emergency Organisation	3.Aug. 91
Diagram	9.1		Muster List	2.Aug. 91
Section	9.2		EAN Contingency Plan and Emergency Proc.	4.Aug. 91
Section	9.3		Area Classification	5.Dec. 91
FF 85 23 00 0295		Area Classification	Cellar Deck	12.Aug. 91
FF 85 23 00 0294		Area Classification	Main Deck	13.Aug. 91
FF 85 23 00 0293		Area Classification	Upper Deck	11.Aug. 91
FF 85 23 00 0297		Area Classification	Elevations North-West	12.Aug. 91
FF 85 23 00 0296		Area Classification	Elevations East-South	11.Dec. 88
Section	9.4	Page 1	Audible and Visual Alarms	4.Aug. 91
Section	9.4	Page 2	Audible and Visual Alarms	4.Aug. 91
Diagram	9.4.1		Audible and Visual Alarms Cellar Deck	5.Aug. 91
Diagram	9.4.2		Audible and Visual Alarms Main Deck	5.Aug. 91
Diagram	9.4.3		Audible and Visual Alarms Upper Deck	4.Oct. 88
Section	9.5	Page 1	Emergency Shutdown	3.Oct. 88
Section	9.5	Page 2	Emergency Shutdown	4.Aug. 91
Section	9.5	Page 3	Emergency Shutdown	4.Aug. 91
Section	9.5	Page 4	Emergency Shutdown	4.Aug. 91
Section	9.5	Page 5	Emergency Shutdown	6.Aug. 91
Section	9.5	Page 6	Emergency Shutdown	6.Aug.91
Section	9.5	Page 7	Emergency Shutdown	6.Aug. 91
FF 85 16 06 1047, 1048,1049			Shutdown Logic Diagram	
FF 85 16 06 1236,1237, 1238			Shutdown Logic Diagram	
FF 89 16 08 0018, sheet 1, 2			Shutdown Logic Diagram	
FF 87 16 00 1100			Matrix Alarm Compression	Jul..89
FF 85 16 06 1184 (12 shts)			Matrix Alarm Treatment	Sept. 91
Section	9.6	Page 1	Fire and Smoke Detection	3.Oct. 88
Section	9.6	Page 2	Fire and Smoke Detection	3.Oct. 88
FF 85 16 06 1141,sheet 130			Fire Detection System Cellar Deck	10.Aug. 91
FF 85 16 06 1141,sheet 131			Fire Detection System Main Deck, lower level	10.Aug. 91
FF 85 16 06 1141,sheet 132			Fire Detection System Main Deck, upper level	7.May. 89
Section	9.7	Page 1	Gas Detection	4.Aug. 91
Section 9.7		Page 2	Gas Detection	1.Aug. 91
FF 85 16 06 1185,sheet 123			Gas Detection System Cellar Deck	7.Aug. 91
FF 85 16 06 1185,sheet 124			Gas Detection System Main Deck, lower level	7.Aug. 91
FF 85 16 06 1185,sheet 125			Gas Detection System Main Deck, upper level	4.May. 89
Section	9.8	Page 1	Firefighting Facilities	4.Aug. 91
Section	9.8	Page 2	Firefighting Facilities	5.Aug. 91
Section	9.8	Page 3	Firefighting Facilities	5.Aug. 91
Diagram	9.8.1		Firefighting Facilities Cellar Deck	5.Aug. 91
Diagram	9.8.2		Firefighting Facilities Main Deck	5.Aug. 91
Diagram	9.8.3		Firefighting Facilities Upper Deck	4.Aug. 91

Chapter 9 Con't

			Title	Issue
Section	9.9	Page 1	Firewater System	3.Oct. 88
Section	9.9	Page 2	Firewater System	5.Aug. 91
Section	9.9	Page 3	Firewater System	5.Aug. 91
Diagram	9.9.1		Firewater System Treatment Areas	4.Aug. 91
Diagram	9.9.2		Firewater System Compression Areas	2.Oct. 88
Diagram	9.9.3		TCP2 Ext. & Mod. 51 (EF)	5.Aug. 91
Section	9.10	Page 1	Halon System	3.Oct. 82
Section	9.10	Page 2	Halon System	6.Aug. 91
Diagram	9.10.1		Halon System Cellar Deck	5.Aug. 91
Diagram	9.10.2		Halon System Main Deck	5.Aug. 91
Diagram	9.10.3		Halon System Upper Deck	4.Aug. 91
Section	9.11	Page 1	Firewalls and Fire Proofing	4.Aug. 91
Section	9.11	Page 2	Firewalls and Fire Proofing	4.Aug. 91
Section	9.11	Page 3	Firewalls and Fire Proofing	3.Oct. 82
Section	9.11	Page 4	Firewalls and Fire Proofing	5.Oct. 88
Diagram	9.11.1		Firewalls and Fire Proofing Cellar Deck	3.Aug. 91
Diagram	9.11.2		Firewalls and Fire Proofing Main Deck	5.Aug. 91
Diagram	9.11.3		Firewalls and Fire Proofing Upper Deck	4.Aug. 91
Section	9.12	Page 1	First Aid	4.Aug. 91
Diagram	9.12		First Aid	1.Jul. 81
Section	9.13		Escape Routes	2.Jul. 81
Diagram	9.13		Safety Plot Plan & Escape Routes Symbol Legend	4.Aug. 91
Diagram	9.13.1		Safety Plot Plan & Escape Routes Upper Deck	3.Aug. 91
Diagram	9.13.2		Safety Plot Plan & Escape Routes Main Deck	3.Aug. 91
Diagram	9.13.3		Safety Plot Plan & Escape Routes Cellar Deck	3.Aug. 91
Section	9.14		Emergency Lighting	4.Oct. 88
Diagram	9.14.1		Emergency Lighting Treatment Areas	2.Aug. 91
Diagram	9.14.2		Emergency Lighting Treatment Areas	2.Aug. 91
Diagram	9.14.3		Emergency Lighting Compression Areas	2.Aug. 91
Section	9.15	Page 1	Lifesaving Equipment	3.Aug. 91
Section	9.15	Page 2	Lifesaving Equipment	2.Jul. 81
Section	9.15	Page 3	Lifesaving Equipment	3.Aug. 91
Section	9.15	Page 4	Lifesaving Equipment	3.Aug. 91
Diagram	9.15.1		Lifesaving Equipment Watercraft Lifeboat	1.Jul. 81
Diagram	9.15.2		Lifesaving Equipment Liferaft	3.Aug. 91

CHAPTER 1

INTRODUCTION

Contents

Section	1.1	Frigg Field - Location
	1.2	Frigg Field - Summary of Installation
	1.3	Frigg Field - Process Flow

DIAGRAMS

Diagram	1.1	Frigg Field - Location
	1.2	Frigg Field - Summary of Installation
		Frigg Field - Main Gas Process Lines FF 00.00.00.5000
		Frigg Field - Liquid Treatment Lines FF 00.00.00.5002
		Frigg Field - HP & LT Vent Lines FF 00.00.00.5003

FRIGG FIELD LOCATION

1. GENERAL

The Frigg Field is a natural gas field which straddles the line between the Norwegian and UK Sectors of the North Sea Continental Shelf, in blocks 25/1 and 10/1, between 59 degrees 48' and 60 degrees oo' North and between 01 degrees 97' and 02 degrees 15' East (European datum 1960). It lies some 190 km from the Norwegian coast and 370 km from the Scottish coast. The location of the field layout is shown on diagram 1.1.

2. PLATFORMS

There are six platforms, four located in the UK Sector and two in the Norwegian Sector.

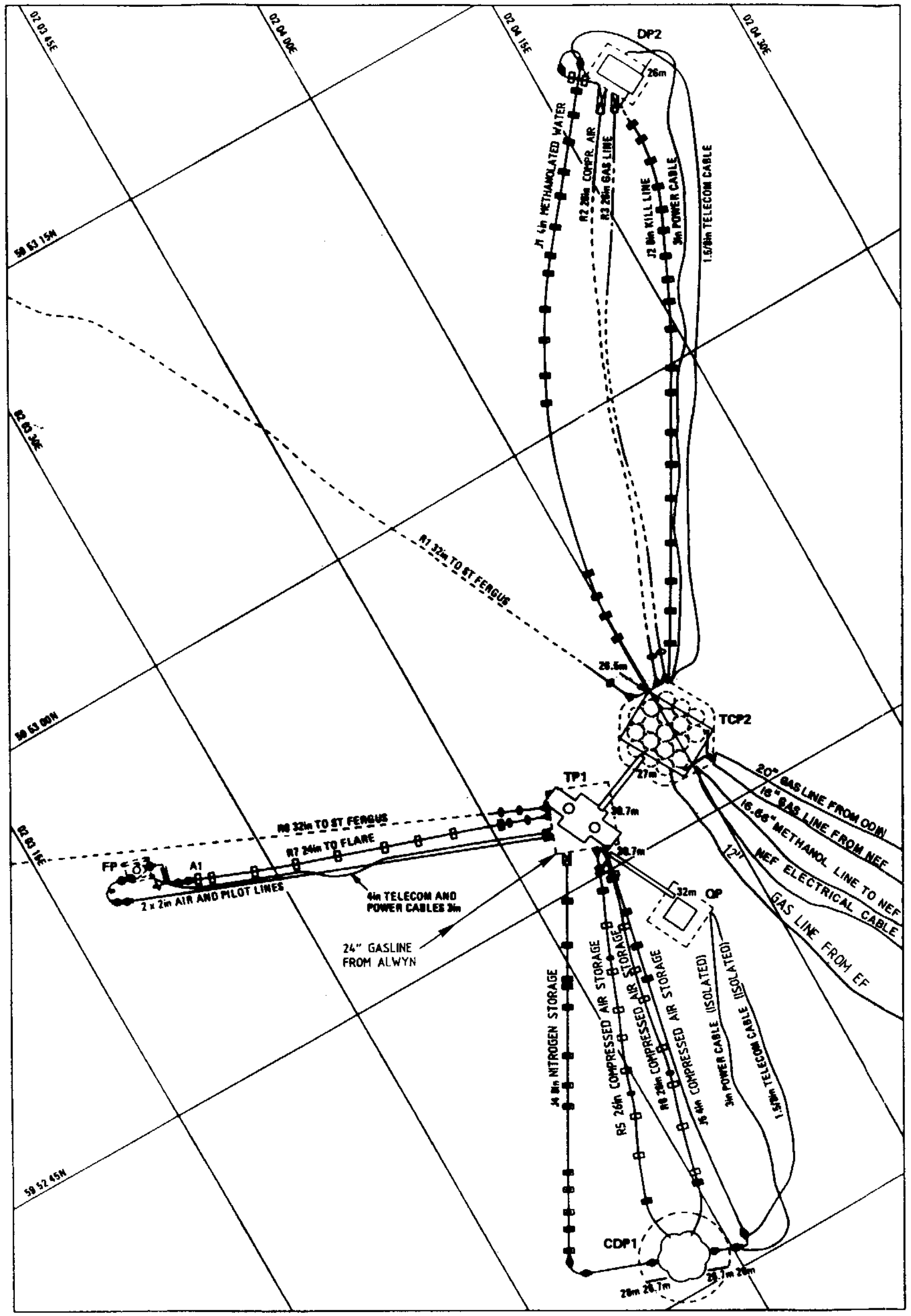
3. SATELLITE FIELDS

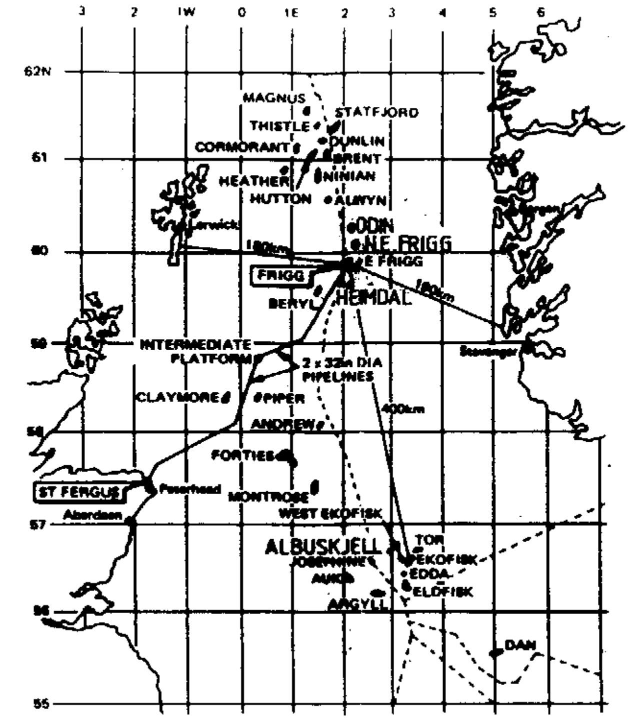
The East Frigg Field is located on the boundary of the blocks 25/1 and 25/2 some 18 km from Frigg Centre.
The North East Frigg Field is located in block 25/1 - 30/10 som 18 km from Frigg Centre.

4. INTERCONNECTED FIELDS

ODIN - 30/10
ALWYN - 3/9 (UK Sector)

END





PLATFORM CO-ORDINATES			
STRUCTURE	GEOGRAPHICAL CO-ORDINATES	UTM CO-ORDINATES	TRUE ORIENTATION
DP1 MAST	59° 52' 40" 710 N 02° 04' 46" 786 E	6 636 334.30 N 446 586.86 E	—
DP2	59° 53' 10" 075 N 02° 04' 28" 004 E	6 638 246 00 N 446 [illegible] E	332° 52' 12"
TP1	59° 52' 47" 276 N 02° 03' 51" 308 E	6 636 540 74 N 447 616 38 E	336° 28' 28"
TCP2	59° 52' 48" 446 N 02° 03' 58" 536 E	6 636 584 14 N 447 743 02 E	331° 03' 06"
QP	59° 52' 42" 421 N 02° 03' 53" 625 E	6 636 388 80 N 447 082 80 E	334° 17' 43"
CDP1	59° 52' 31" 380 N 02° 03' 41" 746 E	6 636 000 38 N 447 400 81 E	010° 37' 41"
FP	59° 52' 53" 519 N 02° 03' 21" 283 E	6 636 740 50 N 447 150 50 E	—

KEY

- UNBURIED LINE
- BURIED LINE OR LINE IN A TRENCH
- CONCRETE BLOCK (25t)
- CONCRETE BLOCK (18t)
- CONCRETE SADDLES
- GROUT BAG
- GROUT BAG NOT IN USE
- MATTRESS
- GREASE BOX
- SEAL PROTECTION
- SEAL PROTECTION WITH FLOW LIMITER
- SEAL PROTECTION WITH PERMANENT SEAL
- HYPERBARIC WELDING POSITION
- 28m CLEARANCE UNDER BRIDGE

NOTE

RIP RAP EXTENDS FROM TP1 TO CONCRETE BLOCK A1 ON R7 24in FLARE LINE

REV. 6, AUG. 1991

FRIGG FIELD – LOCATION

1.1

FRIGG FIELD - SUMMARY OF INSTALLATION

1. GENERAL

Gas produced from the Frigg Field is transported to a treatment terminal at St. Fergus, Scotland, through two parallel 32" diameter pipelines.

2. PLATFORMS

2.1 The function of each Frigg Field platform is as follows :

(a) CDP1 is registered "10/1 - FRIGG - CDP1" as an offshore installation. It is a concrete structure standing in 97m of water. The platform is now abandoned.

(b) DP2 is registered "25/1 - FRIGG - DP2" as an offshore installation. It is an eight-legged steel lattice structure anchored by piles, and stands in 98m of water, and serves as a support for 24 wells and living quarter.

(c) QP is registered "10/1 - FRIGG - QP" as an offshore installation. It is a steel jacket-type structure of four tubular legs, and stands in 104m of water. It is equipped with living quarters capable of accomodating 120 persons.

(d) TP1 is registered "10/1 - FRIGG - TP1" as an offshore installation. It is a concrete structure with a parallel piped base surmounted by two columns supporting a steel deck, and stands in 103m of water. Gas produced and treated on Alwyn is transported to the St. Fergus terminal via this platform through 1 of 2 methods :

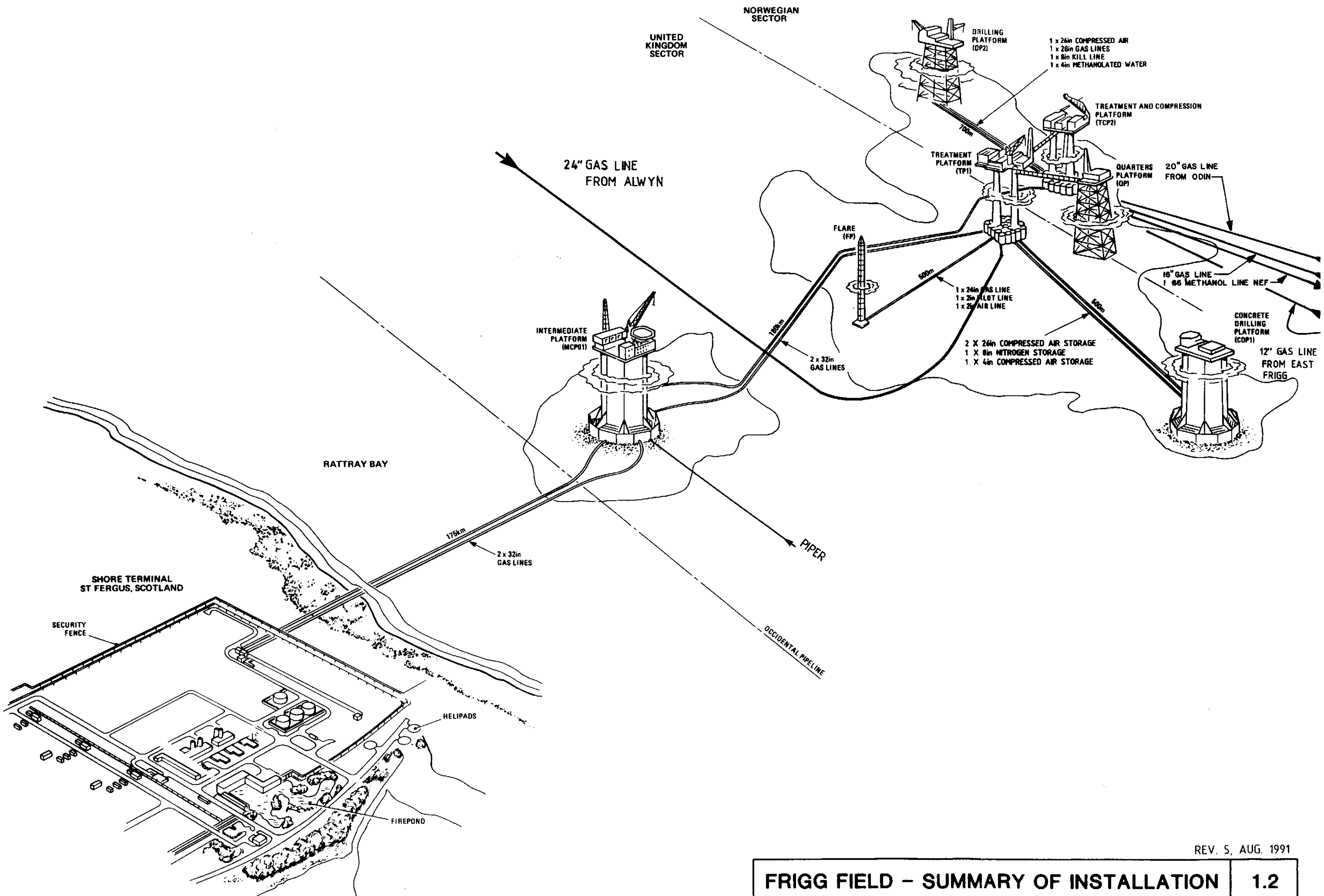
i) Through TP1 sales gas header **or**
ii) Through TCP2 via the TP1/TCP2 dry gas Interconnection Line

(e) TCP2 is registered "25/1 - FRIGG - TCP2" as an offshore installation. It is a concrete structure with a hexagon caisson base surmounted by three columns supporting a steel deck, and stands in 103m of water. Gas produced by DP2, North East Frigg, East Frigg and Odin is treated and compressed on this platform before being transported to the St. Fergus terminal.

(f) FP is registered "10/1 - FRIGG - FP" as an offshore installation. It is a steel articulated column with a concrete ballasted steel base, and stands in 106m of water. It is provided to depressurise TP1 and TCP2 process equipment and sealines.

2.2 The three central platforms, TP1, TCP2 and QP are linked by bridges. Drilling/production platform DP2 is located 800m from its treatment platform. The NEF Field Control Station and subsea equipment are some 18km north-east of Frigg. The East Frigg Subsea production facilities are some 18km east of Frigg.

2.3 Interconnected fields ODIN and ALWYN.



REV. 5, AUG. 1991

FRIGG FIELD – SUMMARY OF INSTALLATION	1.2

FRIGG FIELD PROCESS FLOW

1. GENERAL

1.1 The Frigg Field installation produces, treats, meters and exports natural gas to St. Fergus terminal. At St. Fergus the gas is further treated before it is distributed to consumers through the British Gas Council network.

2. DESCRIPTION

2.1 Gas from 11 producing wells on DP2 passes through one 26" flowline to TCP2. The scrubber desanders installed downstream of each wellhead on DP2 are now bypassed, apart from well A22A where the scrubber is still in operation for observation reasons.
A maximum wellhead pressure of 172 barg and a gas flow rate of 2.0 to 2.5 MMSCMD has been allowed for in the design of scrubber desanders, valves and pipework. Two wells (well 22/24) on DP2 are used for observation purposes and one well (well 3) is for liquid injection (including methanolated water from ODIN, NEF and East Frigg) from TCP2.

2.2 Gas produced by NEF and EF is transported to TCP2 through a 16" and a 12" pipeline for treatment and compression before being transported to St. Fergus terminal. Gas produced by Odin is transported to TCP2 through a 20" line for treatment and compression before being transported to St. Fergus.

2.3 The gas produced and treated on the Alwyn field is transported to TP1 through a 24" line then transferred to the 32" sea line on its way to St. Fergus terminal. There is also the facility to transfer the Alwyn gas to St. Fergus from TCP2 via the TP1/TCP2 dry gas Interconnection Line.

2.4 On TCP2 the gas is treated to prevent water condensation and hydrate formation during its transportation to St. Fergus. Gas compression equipment is installed to boost gas pressure prior to dehydration and pipeline export to St. Fergus. Three parallel treatment streams are installed; each designed for a maximum flow of 15MM SCMD. Two streams are available for operation, one stream is passivated. Each stream contains a separator, glycol contactor and glycol regeneration unit. In addition one FWKO vessel is implemented in the Odin stream process equipment.

2.5 A 32" dry gas interconnection is provided between TP1 and TCP2. Thus after the gas has been metered it can be exported through the sub-sea line of either platform to St. Fergus. This 32" line may also be used to equalize the pressure between the export lines, if required.

.6 When exporting to St.Fergus terminal via TP1 platform there is the facility to inject condensate into the line from TCP2 through a 3in interconnection line between TCP2 and TP1.

2.7 In addition to the main interconnection lines between TP1 and TCP2, the following interconnection lines are installed.

2.7.1
A 3in line to transfer slops from V47 on TP1.

2.7.2
A 3in line for methanol transfer to/from TCP2.

2.7.3
A 2in line to transfer the sump from V13 on TP1.

2.7.4
A 2in line for glycol transfer to/from TCP2.

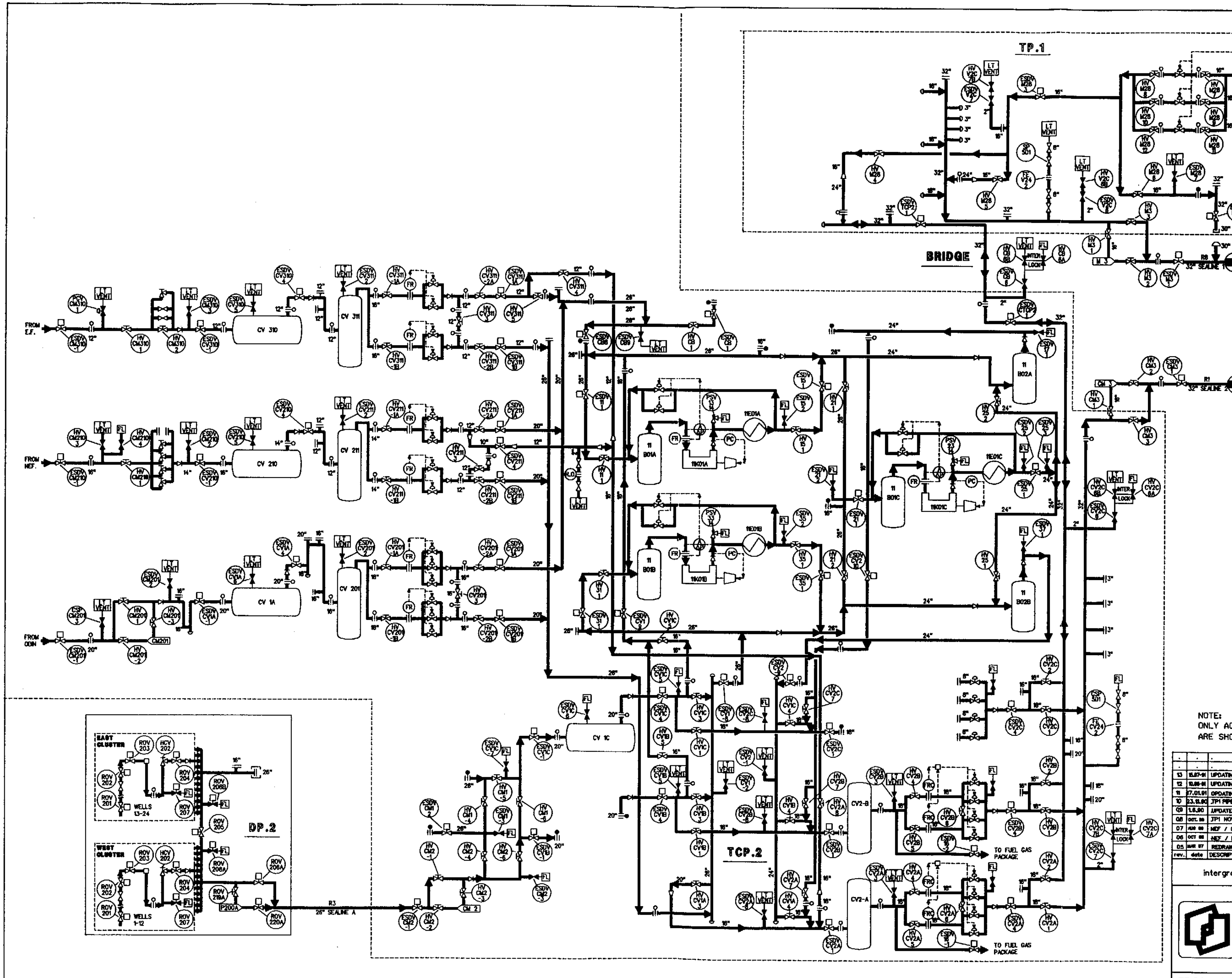
2.8 In an emergency, gas can be flared through the flare platform (FP) at a very high rate to depressurize TCP2 platform. TP1 is connected to FP by a 24 inch subsea line; TCP2 is connected into the start of the sea lineon TP1 via the inter-platform bridge. FP is certified for a continous flow rate of 10 MMSCMD with a maximum allowable short period flow rate of 34 MMSCMD. As the flaring of the gas only takes place as of an emergency or major process upset, FP normally operates as a cold flare. The ingress of air and hence the formation of an explosive mixture is prevented by sweeping the system with nitrogen at a continous flowrate of 2400 SCMD.

A 20 inch diameter cold vent stack is provided on TP1 as a back-up to the main flare platform, but depressurization must be limited to 6 MMSCMD when this is in use.

This back-up system has been modified to handle low temperature gas as a result of ALWYN gas arriving on TP1 at low temperature. Consequently the cold vent system acts as a permanent relief system for equipment and piping handling cold gas as well as being a back-up system for the flare platform.

On TP1 all relief lines from live systems are directed to LT relief system (V47), as the HP relief system is passivated.

Control and display devices for the Frigg Field process installation, NEF, EF, ODIN and ALWYN are contained on QP. More advanced equipment, the FCDA is installed both in CCR on QP, and in Compression Control Room on TCP2, to operate the East Frigg process equipment.



LEGEND

- EMERGENCY SHUTDOWN VALVE (ESDV)
- HIGH PRESSURE RELIEF VALVE (BLOWDOWN) (ESDV)
- LOCALLY OPERATED HYDRAULICALLY ACTUATED VALVE (HV)
- REMOTE OPERATED VALVE (ROV)
- LT VENT — LOW TEMPERATURE VENT
- FL — H.P. RELIEF TO FLARE
- CHECK VALVE
- SPACER

NOTE:
ONLY ACTIVE LINES
ARE SHOWING ON THIS DRAWING

rev.	date	DESCRIPTION	by	app.
.	.	.	.	.
.	.	.	.	.
13	15.07-91	UPDATING	KMV	D.G
12	10.06-91	UPDATING	ABT	.
11	17.01.91	OPDATING	A.B.T	.
10	23.11.90	JP1 PIPE CAPPING ADDED	A.B.T	D.G.
09	1.6.90	UPDATED	W.T	D.G.
08	OCT. 89	JP1 NOW AS A RISER PLATFORM	W.T.	R.Aa.
07	AUG 88	NEF / ODIN X-OVER AND SUCT / DISCH LINES ADDED	D.G.	R.A.
06	OCT 88	NEF / E.F. BY-PASS ADDED	D.G.	R.A.
05	MAR 87	REDRAWN, E.F. AND ALWYN ADDED	D.G.	T.E.H.

intergraph 5000A-NY

elf aquitaine norge a/s p.o.box 168-4001 Stavanger

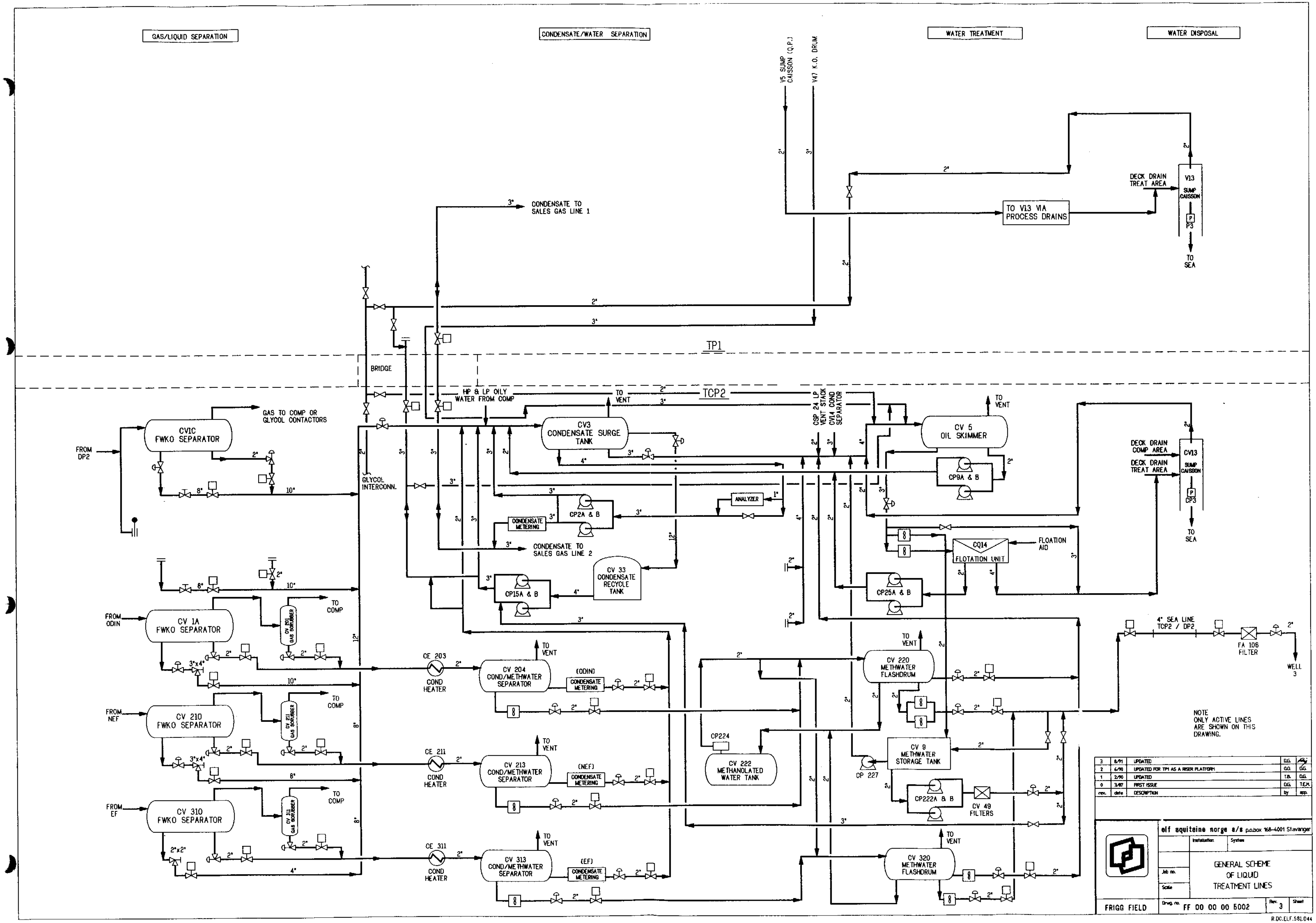
Installation | System

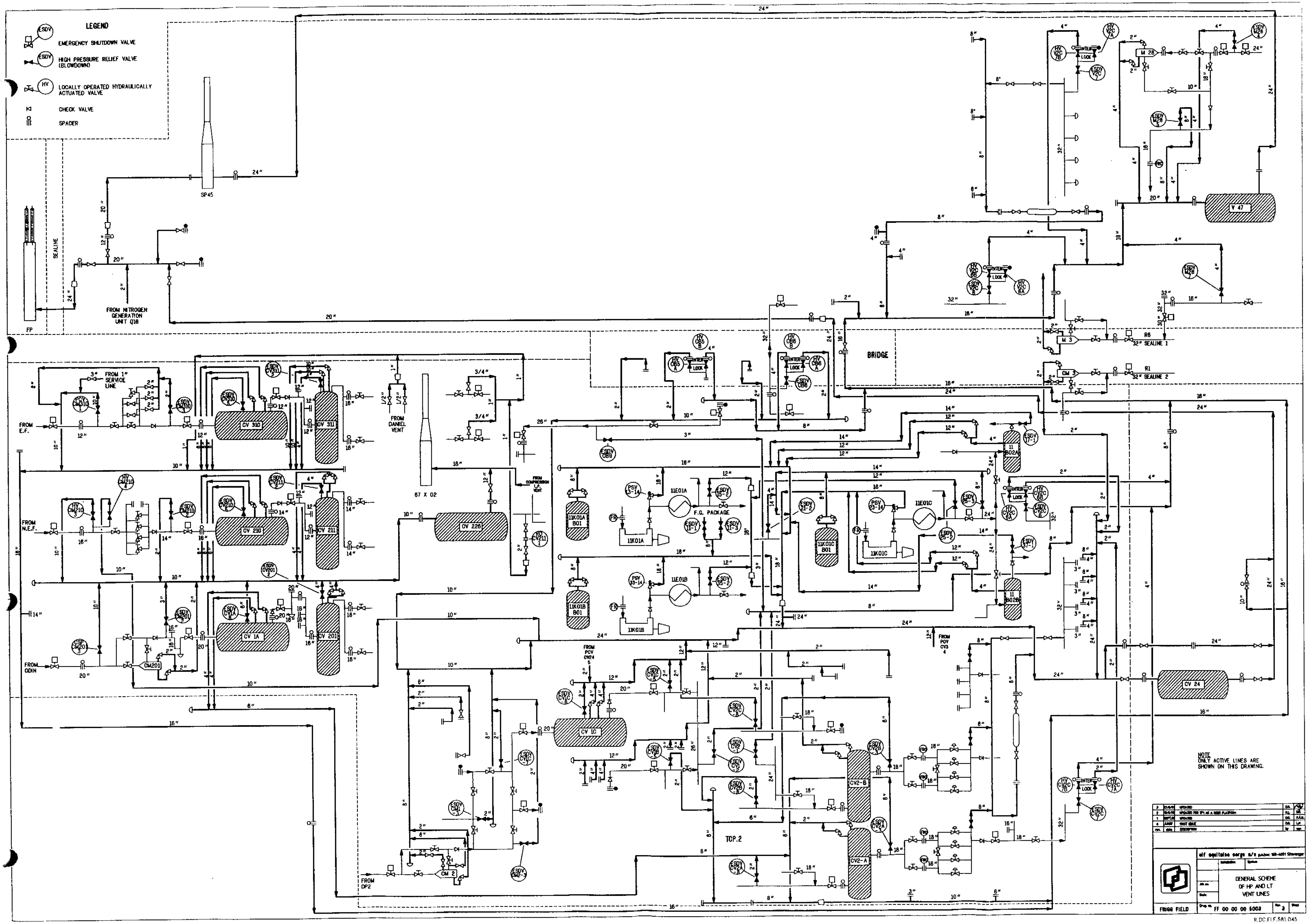
Job no. —

Scale —

GENERAL SCHEME
OF MAIN GAS
PROCESS LINES

FRIGG FIELD | Drwg no. FF 00 00 00 5000 | Rev. 13 | Sheet ./.


GAS/LIQUID SEPARATION
CONDENSATE/WATER SEPARATION
WATER TREATMENT
WATER DISPOSAL
V5 SUMP CAISSON (Q.P.)
V47 K.O. DRUM
TO V13 VIA PROCESS DRAINS
DECK DRAIN TREAT AREA
V13 SUMP CAISSON
P3
TO SEA
CONDENSATE TO SALES GAS LINE 1
TP1
BRIDGE
TCP2
HP & LP OILY WATER FROM COMP
TO VENT
CSP 24 LP VENT STACK
CV14 COND SEPARATOR
CV 5 OIL SKIMMER
CP9A & B
DECK DRAIN COMP AREA
CV13 SUMP CAISSON
CP3
FROM DP2
CV1C FWKO SEPARATOR
GAS TO COMP OR GLYCOL CONTACTORS
GLYCOL INTERCONN.
CV3 CONDENSATE SURGE TANK
ANALYZER
CP2A & B
CONDENSATE METERING
CONDENSATE TO SALES GAS LINE 2
CV 33 CONDENSATE RECYCLE TANK
CP15A & B
CQ14 FLOTATION UNIT
FLOATION AID
CP25A & B
FROM ODIN
CV 1A FWKO SEPARATOR
CV 201 GAS SCRUBBER
TO COMP
CE 203 COND HEATER
CV 204 COND/METHWATER SEPARATOR
(ODIN)
CV 220 METHWATER FLASHDRUM
4" SEA LINE TCP2 / DP2
FA 106 FILTER
WELL 3
FROM NEF
CV 210 FWKO SEPARATOR
CV 211 GAS SCRUBBER
CE 211 COND HEATER
CV 213 COND/METHWATER SEPARATOR
(NEF)
CP224
CV 222 METHANOLATED WATER TANK
CP 227
CV 9 METHWATER STORAGE TANK
CP222A & B
CV 49 FILTERS
NOTE
ONLY ACTIVE LINES ARE SHOWN ON THIS DRAWING.
FROM EF
CV 310 FWKO SEPARATOR
CV 311 GAS SCRUBBER
CE 311 COND HEATER
CV 313 COND/METHWATER SEPARATOR
(EF)
CV 320 METHWATER FLASHDRUM
3 8/91 UPDATED
2 6/90 UPDATED FOR TP1 AS A RISER PLATFORM
1 2/90 UPDATED
0 3/87 FIRST ISSUE
rev. date DESCRIPTION by app.
elf aquitaine norge a/s p.o.box 168-4001 Stavanger
GENERAL SCHEME OF LIQUID TREATMENT LINES
FRIGG FIELD
FF 00 00 00 5002
Rev. 3
R.DC.ELF.581.044



R.DC.FLF.581.045

CHAPTER 2

PLATFORM STRUCTURE

CONTENTS

Section	2.1	Platform Construction
	2.2	Environmental Design Criteria
	2.3	Geotechnical and Structural Instrumentation
	2.4	Primary Structure
	2.5	Secondary Structure
	2.6	Platform Risers
	2.7	Materials and Construction
	2.8	Cathodic Protection
	2.9	Inspection and Maintenance

DIAGRAMS

Diagram	2.2	Environmental Design Criteria
	2.3	Geotechnical and Structural Instrumentation
	2.4	Primary Structure
	2.5	Secondary Structure
	2.6	Platform Risers
	2.7	Materials and Construction

PLATFORM CONSTRUCTION

1. GENERAL

1.1 The platform is a concrete gravity treatment, gas dehydration and compression platform constructed in two parts, namely a steel Main Deck and other deck structures, mounted on a concrete substructure. The substructure comprises various post-tensioned concrete components centred around three central support columns.

1.2 The concrete substructure extends from the seabed to the transition central columns/main deck at elevation +129.700m.

1.3 All structural elements are prestressed using the Freyssinet cable system.

1.4 The main design, construction and installation contractors of the concrete substructure were Norwegian Contractors A/S, Oslo, in accordance with the following criteria:

(a) Elf Norge A/S, Oslo: Specifications for Engineering, Procurement and Construction of Frigg Treatment and Compression Platform No 2 (TCP2), June 1974.

(b) Norwegian Contractors/Grøner: Elf Norge A/S, Frigg TCP2 Concrete Design Criteria, 14.11.74, based on the following Norwegian Standards:

(i) NS3473 Norwegian Code of Practice for the design of concrete structures.
(ii) NS3474 Norwegian Code of Practice for the construction of concrete structures.

(c) Det norske Veritas: Concrete Design Criteria (Special DNV requirement of 28.11.74).

(d) Det norske Veritas: Technical Notes, 'A 6/5 impact loads from boats' and 'A 6/1 wave shock pressure on columns'.

(e) Elf Norge A/S Frigg TCP2 - Concrete Specifications Part II, Construction, February 1975.

1.5 The main deck structure extends from the transition column/main deck at elevation +129.700m to elevation +139.300m. It was designed by Kvaerner Engineering A/S as consultants to Norwegian Contractors, the main contractor, in accordance with the following criteria:

(a) Technical Specifications for steel support frame design TCP2, Elf Norge A/S, February 1975, 1.st revision.

(b) Manual of Steel Construction, 7th edition, AISC.

(c) Rules for Design, Construction and Inspection of Fixed Offshore Structures, Det norske Veritas 1974.

(d) NS3473, Norwegian Standard for Steel Structures, Norwegian Standard Association, May 1973.

(e) Fabricating Specification 1052, No 3/155, Rev 2/JPS, Elf Norge, February 1974.

(f) Minutes of meeting Elf, DNV and Norwegian Contractors at Elf-Norge, Paris Office, 4.11.75.

(g) American Welding Society (AWS D.1.1-72), Structural Welding Code.

(h) Painting Specification for Steel Structures 1052, No 3/169, Rev. 1, Elf-Norge, March 1974.

(i) General Equipment Specification, Coating for Main Structure, SGP07, Class P, Rev 0, September 1972.

1.6 Other deck structures extend from elevation +131.700m to +149.050m. The main design and fabrication contractor was McDermott Hudson, London, in accordance with the following criteria:

(a) Elf Norge, Frigg Field, Material Specifications No 1052 and No 3/145 Rev 3.
(b) Elf Norge, Frigg Field, Fabrication Specifications No 1052/155, Rev 1.
(c) DNV Technical Notes C1/2 and C1/3.

1.7 Phase IIIa Compression, Electrical Generation and Control facilities were added during 1980-81. They were designed by a Kvaerner Technip consortium under the supervision of an EAN project team in accordance with the following criteria:

(a) Recommended Practice for the Planning, Design and Construction of Fixed Offshore Platforms - API.

(b) Specification for the Design, Fabrication and Erection of Structural Steel for Buildings and Bridges - AISC.

(c) Steel Construction Manual - AISC.

(d) Structural Welding Code - AWS.

(e) Rules for Construction and Classification of Fixed Offshore Units - DNV.

(f) Fabricating Specification 1052 No 3/155 JPS/HR/hl, and other specifications for coating, painting etc - Elf Norge.

(g) Testing and Inspection of Cranes for Fixed Offshore Installations.

1.8 All equipment is located in pancakes or modules placed on or within the support frame . The modules and pancakes were built ashore and installed as complete units.

2. DESCRIPTION

2.1 Soil Foundation

The Norwegian Geotechnical Institute, Oslo, as consultants to Norwegian Contractors A/S, were responsible for the interpretation of soil investigations and geotechnical data from which foundation soil parameters used in platform settlement, and geotechnical stability calculations, were determined.

2.2 Materials

2.2.1 Materials to the following specifications were used for constructing the substructure:

(a) Concrete Class C45 (according to NS3473 and 3474) with a 28 day cube strength of $45N/mm^2$.

(b) Reinforcement steel of KS40 (yield strength = $400N/mm^2$).

(c) Prestressing steel, using Freyssinet 12T15 type cable, with a yield strength (f_{02}) of $1566N/mm^2$ and breaking point (f_u) of $1783N/mm^2$.

2.2.2 Materials to the following specifications were used in main deck and other deck structure construction:

(a) Structural steelwork to DIN17100-ST52-3N for primary main deck components, and to DIN17100-ST37-3N and C1 for secondary main deck components.

(b) Structural steelwork to DIN17100-ST52-3N for primary other deck components, and DIN17100-ST37-2 for secondary other deck components.

2.2.3 Materials to the following specifications were used for the Phase IIIa structural and architectural work:

(a) Main support frame - DIN17100-ST52-3N.
(b) Module structure - DIN17100-ST52-3N (Charpy tested at -20°C).
(c) Wall plate, deck plate - MLD.
(d) Stringers - DIN17100-ST37-3U.
(e) Corrugated wall plate - SS Z2 CND A/B.

ENVIRONMENTAL DESIGN CRITERIA

SOIL PROFILE

Tabulated below is the soil profile as define by samples taken from a boring in TCP2 location.

Depth Below Seabed (m)	Soil Description	Water Content (%)
0 to 3.5	Brownish to grey fine to medium sand with shell fragments; very dense (phi. u 39°).	
3.5 to 5.5	Brownish soft clay with silt and sand seams. Normally consolidated.	22.4
5.5 to 9.0	Brownish clay with silt seams. Over-consolidated.	20
9 to 11	Hard brownish clay with extensive silt seams. Overconsolidated.	
11 onwards	Sand.	

CHAPTER 2

PLATFORM STRUCTURE

CONTENTS

Section	2.1	Platform Construction
	2.2	Environmental Design Criteria
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	2.4	Primary Structure
	2.5	Secondary Structure
	2.6	Platform Risers
	2.7	Materials and Construction
	2.8	Cathodic Protection
	2.9	Inspection and Maintenance

DIAGRAMS

Diagram	2.2	Environmental Design Criteria
	2.3	Geotechnical and Structural Instrumentation
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	2.5	Secondary Structure
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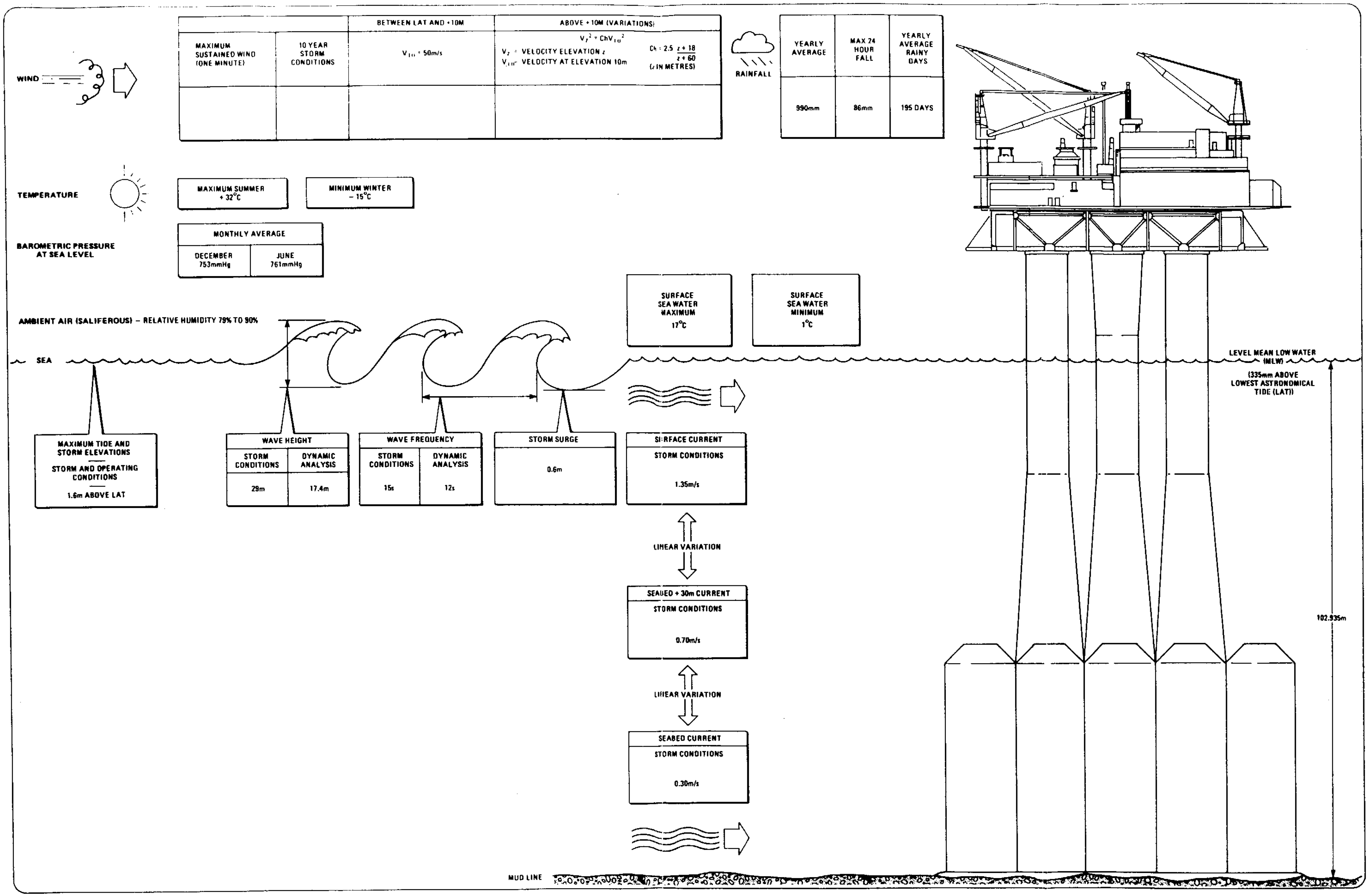
	2.7	Materials and Construction



ISSUE 2 JANUARY 1985

ENVIRONMENTAL DESIGN CRITERIA 2.2

GEOTECHNICAL AND STRUCTURAL INSTURMENTATION

1. GENERAL

1.1 Instrumentation is installed to accurately measure platform environmental conditions.

1.2 The measurements are summarised as follows:

(a) Wave.
(b) Mean water level.
(c) Stress
(d) Earth pressure.
(e) Pore pressure.
(f) Tilt.
(g) Settlement and horizontal displacement.

2. DESCRIPTION

2.1 Oceanographic Instrumentation

Oceanogtaphic instruments are installed to measure the following:

(a) Wave height and period - recorded for 20 minutes every three hours by radar.
(b) Mean water level - pressure sensor.
(c) Wave shock pressure - pressure sensors.

2.2 Foundation Instrumentation

2.2.1 The Syminex foundation instrumentation system is installed to carry out continuous surveillance of foundation conditions, as follows:

(a) Platform tilt - optically measured by accelerometers (two rotational and four linear), located at elevation +45.00m, which work through 90 degrees and give coordinated readings of horizontal disturbances by checking the structure dynamic response relative to the static response.

(b) Shallow pore pressure - measured by eight pressure sensors located under the concrete substructure base.

(c) Deep pore pressure - measured by two sets of five pressure sensors located below the platform base.

(d) Vertical settlement - determined by winching a gamma ray probe which takes measurements against markers embedded in the soil.

(e) Horizontal displacement - measured by a biaxial inclinometer capable of reading up to 30 degrees displacement from the veritcal.

(f) Earth pressure (axial stress) - measured by seven pairs of pressure sensors located under the substructure domes.

2.2.2 Provision is made for occasional experiments in Dyprometry, ie the determination of soil modulus.

2.3 Structure Instrumentation

Instruments are installed to measure the following:

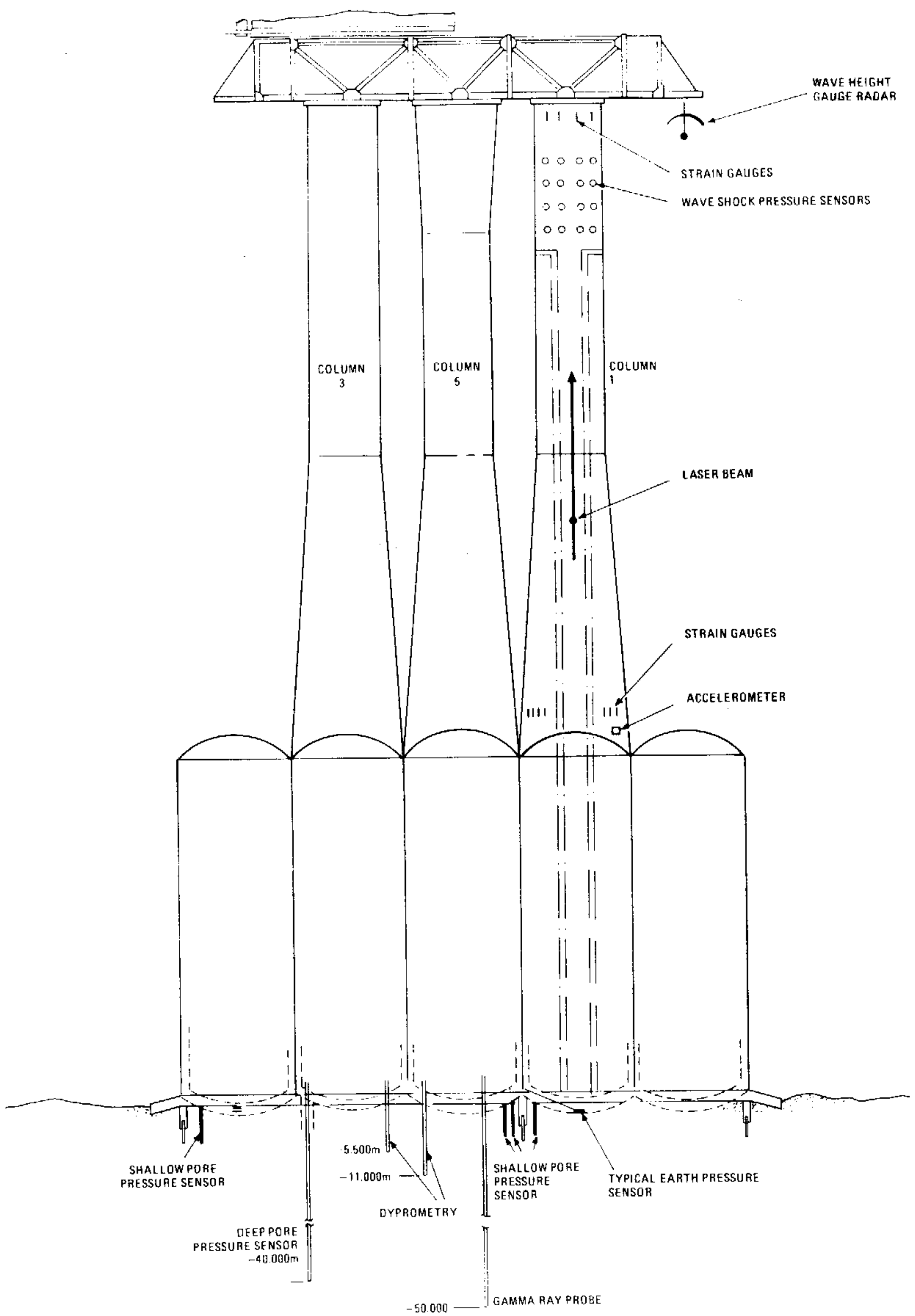
(a) Dynamic response of deck and shaft frame - measured by a laser system located in Column 1.
(b) Stress - measured by strain gauges located at elevations +48.00m and +124.400m.

2.4 Instrumentation Status

The structural data acquisition system has been abandoned since 1. June 1986. Consequently no platform data have been recorded since then, and the system has been removed.

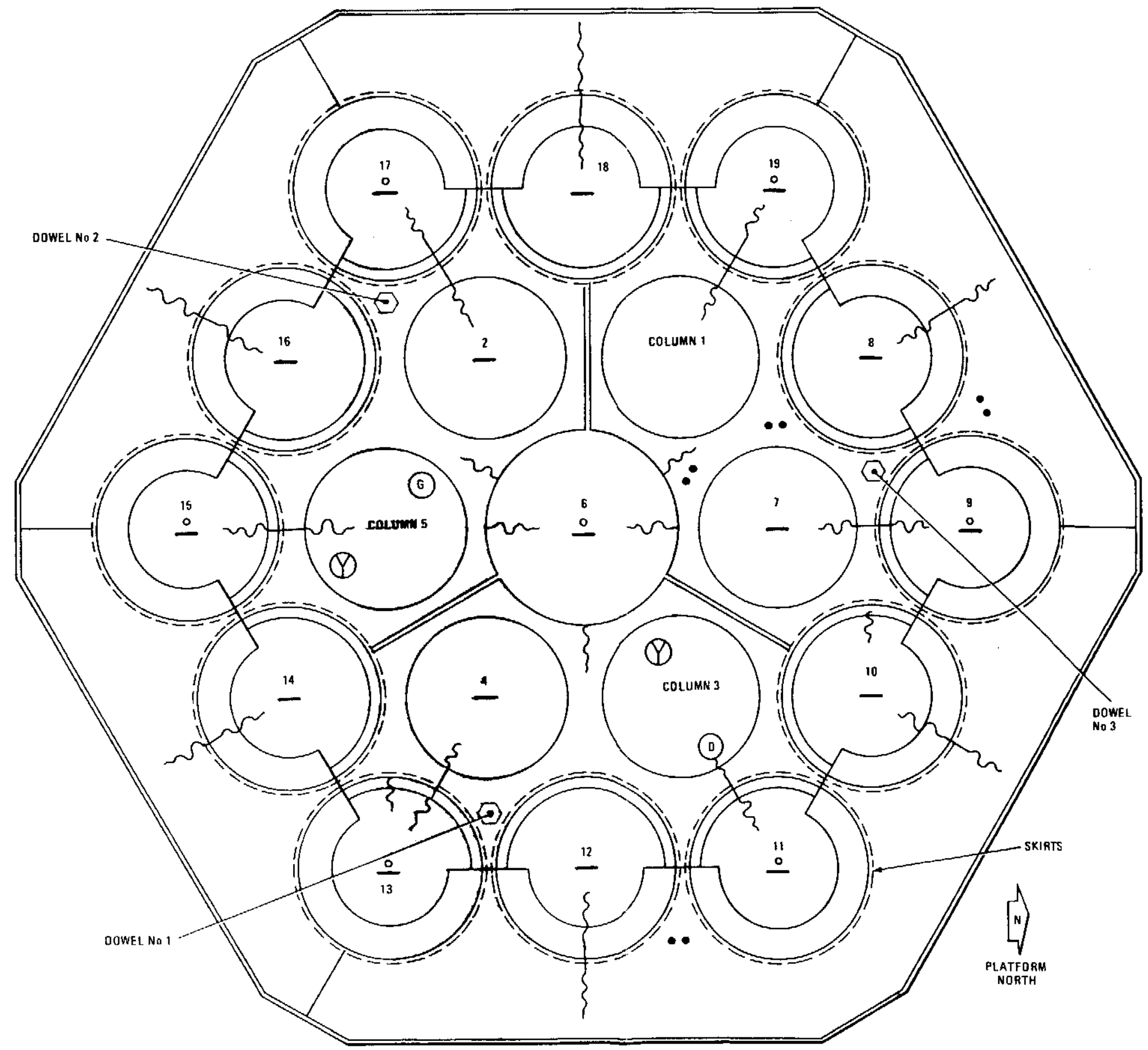
However, the vertical settlement is measured optically from QP once or twice per year. Settlement of TCP2 has reached a stable condition.

END



VIEW LOOKING SOUTH

KEY	
○	CONTACT EARTH PRESSURE SENSOR
● ●	SHALLOW PORE PRESSURE SENSORS
—	STRAIN GAUGED REINFORCEMENT
(G)	GAMMA RAY PROBE FOR VERTICAL SETTLEMENT
(D)	DEEP PORE PRESSURE SENSOR
(Y)	DYPROMETRY



PLAN OF HEXAGONAL FOUNDATION SLAB SHOWING THE FOUNDATION DRAINAGE SYSTEM AND INSTRUMENT LOCATION

ISSUE 1 JULY 1981

GEOTECHNICAL AND STRUCTURAL INSTRUMENTATION	2.3

PRIMARY STRUCTURE

1. GENERAL

1.1 The primary structure is concrete substructure comprising post tensioned components which support the Main Deck structure, upon which stands the pancakes and modules housing the production facilities.

1.2 Main elements of the substructure are as follows:

(a) A hexagonal foundation slab.

(b) A caisson of 19 cylindrical cells, three of which are extended into three columns which support the deck structure.

1.3 The substructure, standing in 104.46m of water, is designed to withstand 100 year wave conditions.

1.4 In addition to the normal reinforcement and the prestressing cables, numerous steel parts are embedded in the structure, mainly in the form of steel fixing plates flush with the concrete surface and anchored in the concrete, namely:

(a) Towing and installation fixing plates.
(b) Mooring and towing eyes.
(c) Utility riser fixing plated.

2. DESCRIPTION

2.1 Foundation Slab

2.1.1 The foundation slab is a $9340m^2$ area raft.

2.1.2 The space between the seabed and the base of the foundation slab is filled with cement grout which was injected immediately after platform installation.

2.1.3 A drainage (anti-liquefaction) system with drains in the dowels and skirts allows for drainage of the foundation slab should the pore pressure build up during storms.

2.2 Support Columns

2.2.1 Each column has an internal base diameter of 18.80m which tapers to an outside diameter of 10.40m at nominal elevation +95.00m, and increases to an outside diameter of 12.82m at elevation +126.90m.

2.2.2 The three columns which provide the main rigid support for the Main Deck structure extend from domed Cells 1, 3 and 5.

2.2.3 The columns, excluding the condensate storage tank (Cell 21) in Column 5 and the ballast cylinder (Cell 20) in Column 1, are filled with water for ballast only. Cell 20, which is kept permanently dry, terminates at elevation + 112.00m, and cell 21 at +42.70m.

2.2.4 The permanent depression draw down in the structure ($25T/m^2$) is relative to the external water pressure. The water level in Columns 3 and 5 is however equal to the external water level. Draw down is controlled by the annulus water level of Column 1, into which overflow pipes from each cell empty freely at elevation +80.00m.

2.2.5 Columns 3 and 5 may be pumped dry for periodic maintenance but are not to be emptied simultaneously.

2.2.6 Temperature control of Columns 3 and 5, which contain hot gas risers, is by water circulation holes at column 3 and water outfall pipes in column 5.

2.2.7 The maximum design temperature difference between outside and inside is 8°C.

2.3 Cells

2.3.1 A total of 19 domed cells, including the three column support cells, form part of the substructure, each being connected by a star cell. The domed cells re constructed as units of outer caisson walls and lower and upper domes. The walls and upper domes connect at elevation +42.70m, and the lower domes are formed into the foundation slab.

2.3.2 Each domed cell has an internal diameter of 18.80m.

2.3.3 Steel skirts are fixed to the foundation under the outer and centre caisson cells, and along the periphery of the base slab.

2.4 Flooding and Dewatering System

For necessary maintenance and inspection of the risers and J-tubes which are located at the inside of the shafts to the process areas, flooding and dewatering system for the columns are installed. The columns (3 and 5) are normally filled with sea water to the sea level.

2.4.1 Flooding System

Flooding is performed by utilizing only the gravity of sea water. Water enters the 18" suction pipe at el. +13.15m and is allowed to enter the column under a full rate of flow. If necessary, throttling can be performed on a butterfly valve which is located on 18" suction line.

With the valves completely opened it will take approximately 53 hours for flooding the columns.

2.4.2 Dewatering System

The dewatering system consist of two 16" pipes (one pipe in each column) routed from the bottom of the columns to a level +13.15m above sea level. Each pipe is equipped with a remote operated valve at the outlet level. The water is pumped out by two electrical driven dewatering pumps which are installed at the bottom of column no. 1.

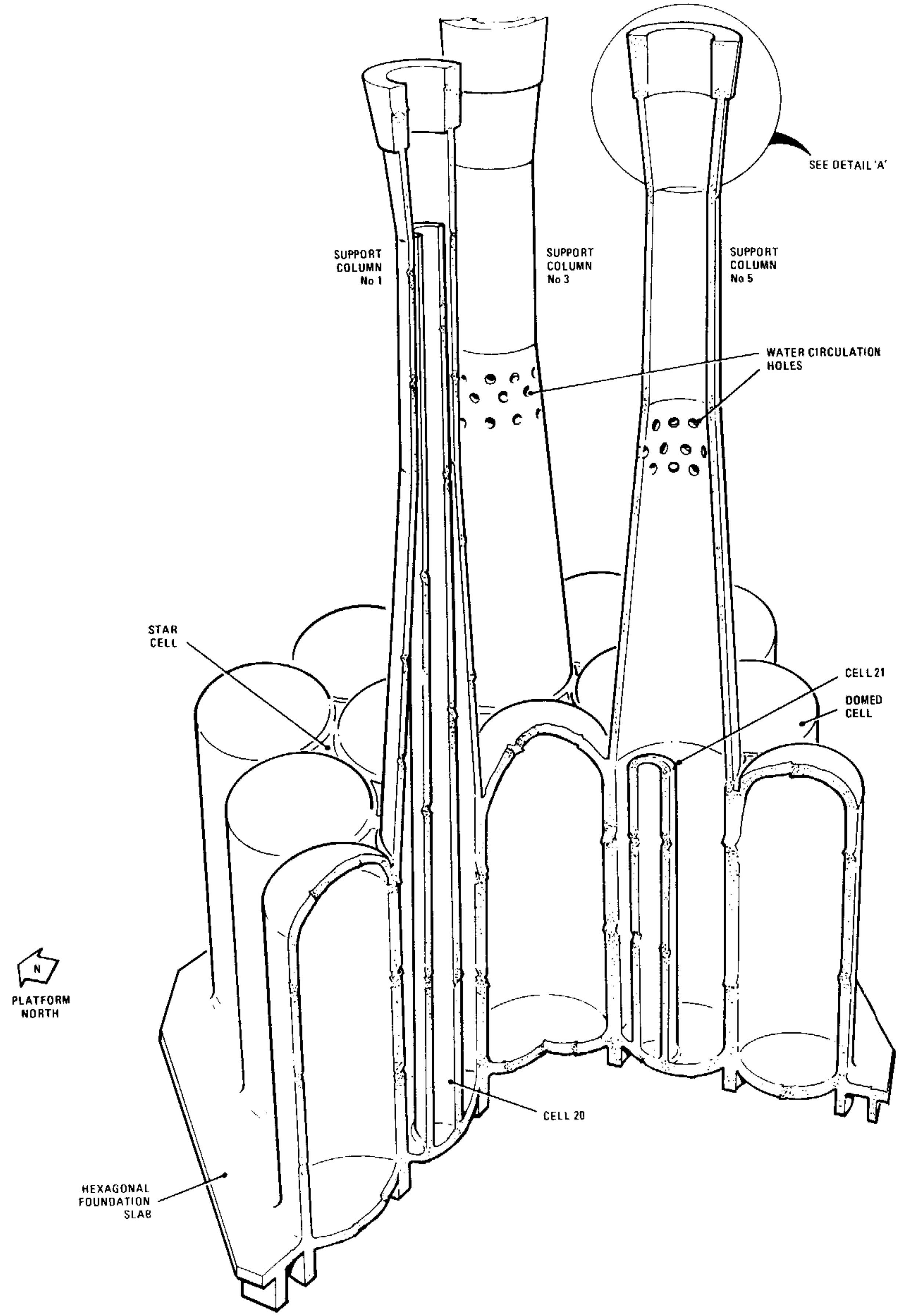
The emptying time is approximately 55 hours for each column (3 & 5).

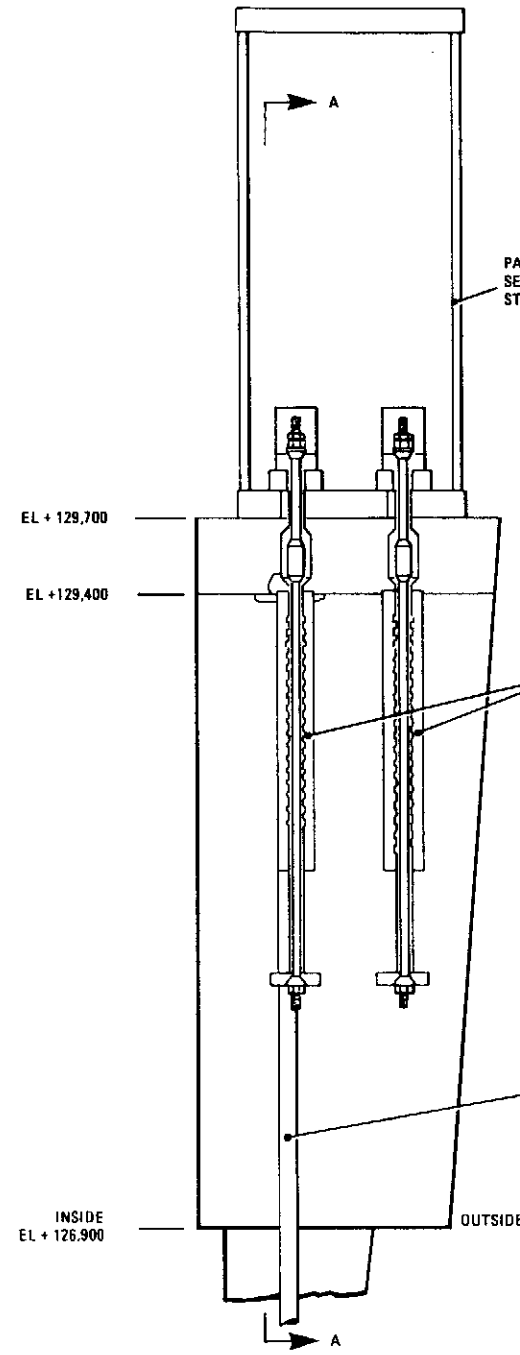
2.4.3 Recirculation System

The heating of water in column no. 3 (column 5 is unaffected) due to hot gas risers and topside cooling water discharge is controlled by the recirculation system. The design allows for a maximum temperature gradient across the column wall of 8 deg. C.

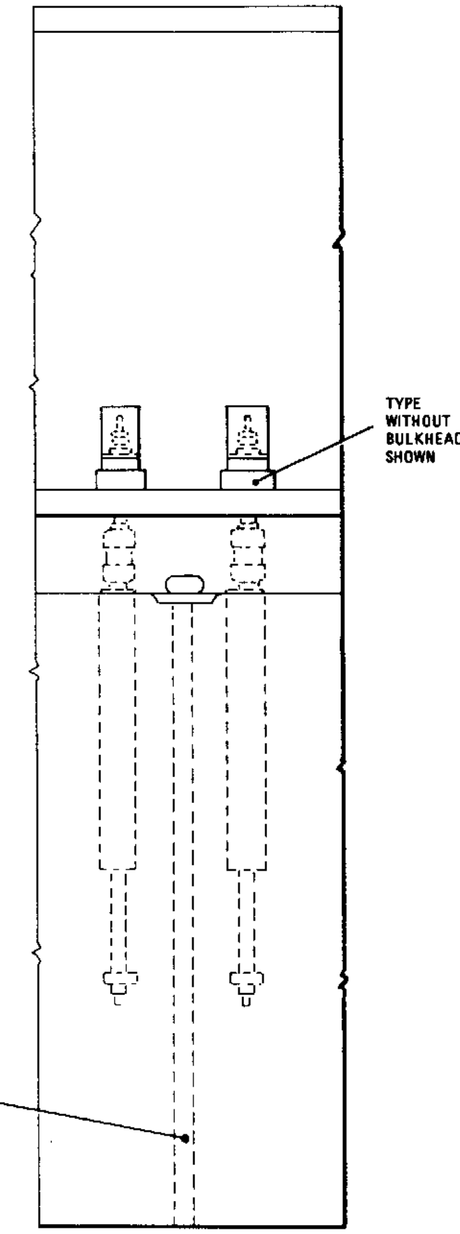
A number of valved holes (24) in the shaft wall between elevations +68m and +78m allow sea water to circulate automatically within the column and as dictated by the daily temperature readings an externally installed water curtain pump can be manually operated as required to flush cold water on to the top of the column water.

In order to empty shaft no. 3 closing the water circulation holes is done by divers deployed from the permanently installed diving system in the shaft. These holes are opened again by divers after flooding to allow circulation.





DETAIL 'A'
SECTION AT TOP OF COLUMN



SECTION A–A

SECONDARY STRUCTURE

1. GENERAL

1.1 The secondary structure contains the pancakes and modules which house the production facilities. It is supported by the Main Deck structure which is divided into Cellar Deck and Main Deck levels.

1.2 The Cellar Deck terminates at elevation +131.70m and the Main Deck at elevation +139.30m (top of Main Deck truss girder) and elevation +139.550m (Module Deck level).

1.3 Each pancake and module houses equipment necessary to a treatment/compression phase or support function as follows:

(a) Pancakes 05, 06, 07 and 62 - treatment and support facilities.
(b) Pancakes 08 and 09 - electrical power generation and control, and support facilities.
(c) Pancake 13 - instrumentation interface.
(d) pancakes 11 and 12 - access and walkways.
(e) Pancakes 40 and 41 - electrical power generation utilities.
(f) Pancake 42 - support utilities and fire pump house.
(g) Pancake 43 - heat exchangers
(h) Pancake 44 - emergency electrical power generation and distribution.
(i) Pancake 45 - pipework.
(j) Pancake 46 - fire pump house
(k) Pancake 53 - NEF and Odin treatment.
(l) Modules 01 to 04 - treatment and support facilities.
(m) Modules 30 and 31 - compression train A and C.
(n) Module 32 - electrical power, control and distribution. Fuel gas package.
(o) Module 33 - Compression train B and LP vent.
(p) Module 50 - NEF and Odin treatment.
(q) Module 51 - EF treatment.

2. DESCRIPTION

2.1 Main Deck Structure

2.1.1 The Main Deck structure (steel support frame) consists of four longitudinal and six transverse trusses. Four of the transverse trusses are rigidly connected to the primary structure support columns by prestressed bolts.

2.1.2 The main truss members are welded box sections, stiffened by bulkheads at the nodes. They are rigidly interconnected by diagonal and upright members.

2.1.3 The pancakes and modules are simply supported on the Cellar Deck and the Main Deck respectively.

2.2 Pancakes, Modules and Other Deck Structures

2.2.1 The pancakes are steel slab elements which make up the Cellar Deck. They are beam rafts with steel top plating, simply supported on cantilevers on the Main Deck structure.

2.2.2 The pancake concept allows for flexible Cellar Deck loading, with maximum allowable uniformly distributed loads ranging from $15kN/M^2$ to $2.5kN/M^2$ as illustrated in diagram 7.1.2 and 7.1.3 of this manual.

2.2.3 The framings over the primary structure support columns are effectively pancake structures with a top grating.

2.2.4 Two pipe support frames are supported on cantilevers on the Main Deck structure, on the east and west sides of the Cellar Deck.

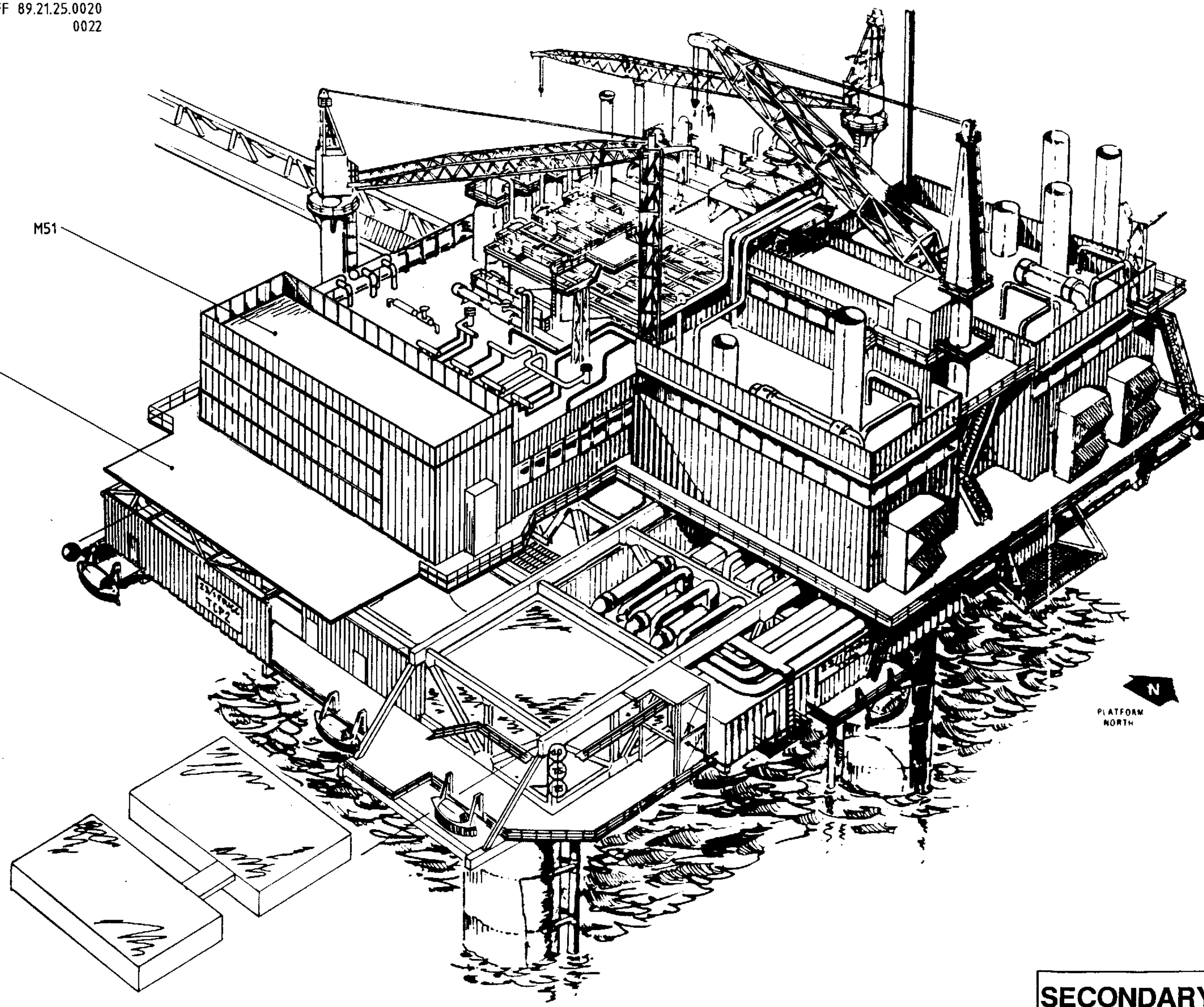
2.2.5 The modules are situated on top of the Main Deck structure. Each module is a simple truss structure, enclosed within corrugated sheeting at the sides, with a steel roof and floor.

2.2.6 The modules terminate at elevation +148.050m.

2.2.7 Three crane pedestals are installed externally at Module Deck level, each supported by rigid members. One is secured to the transverse truss of Module 01, one to the longitudinal truss of Module 04 and one to a transverse truss of Module 32.

M51 REF. DRWG: FF 89.21.25.0031
0032
0033
0035
0042
0043

P950 REF. DRWG. FF 89.21.25.0020
0022



PLATFORM RISERS

1. GENERAL

1.1 Platform risers and 'J' tubes transporting process products and utility services are installed in the primary structure support columns, and the domed cells supporting these columns.

1.2 Some risers and 'J' tubes enter the support columns through tunnels in the foundation slab while others pass externally over the domed cells before entering the columns. The 'J' tubes are connected at the circumference of the foundation slab by bellmouths.

1.3 Risers were designed and constructed in accordance with the following criteria:

(a) Structural design report for TCP2, Internal and External Risers and Subsea Piping, EP0002 and EP003, Volumes 1 and 2.

(b) ANSI Code B31.8, 1975.

(c) Guides for external risers, May 1975.

(d) Vertical clamp on caisson wall design, July 1975.

(e) 'J' tube analysis, July 1975.

(f) Anchor flange platform, October 1975.

(g) External riser tripod support design, October 1975.

(h) Report on safety factors incorporated in the design of penetration through TCP2 concrete shaft and cell walls, 25.10.76.

1.4 All risers and 'J' tubes are supported by anchor flanges in the support columns at elevation +117.70m.

2. DESCRIPTION

2.1 External Risers

2.1.1 The following external risers are installed in Column 3:

(a)	32in back up gas to St Fergus	(RIE, 32" x 1.094")
(b)	26in compressed air storage	(R2E, 26" x 1.0")
(c)	26in back up gas from DP2	(R3E, 26" x 1.0")
(d)	24in flare riser	(R7E, 24" x 0.94")

2.1.2 These risers are supported by strategically located clamps and guides on the foundation slab and the domed cells.

2.1.3 The following external risers are installed in Column 5:

(a)	Future 18in gas	(R4E, 18" x 1.0")
(b)	16in gas from North East Frigg	(E5E, 16" x 1.0)
(c)	20in gas from ODIN	(R6E, 20" x 1.0")

2.1.4 These risers are supported in a similar manner to those of Column 3.

2.2 Internal Risers

2.2.1 The following internal risers are installed in Column 3:

(a)	32in gas to St Fergus	(R1, 32" x 1.094")
(b)	26in compressed air storage	(R2, 26" x 1.0")
(c)	26in gas from DP2	(R3, 26" x 1.0")

2.2.2 The tunnels in the foundation slab through which these risers pass are sealed and filled with stagnant sea water.

2.3 'J' Tubes

2.3.1 The following 'J' tubes are installed in Column 3:

(a) A 10.3/4in tube for the 4 1/2in methanolated water line interconnected with DP2, which passes under Cell 11. (J1, 10 3/4" x 0.75)

(b) An 18in tube, for the 8.5/8in nitrogen storage line interconnected with DP2, which passes under and through Cell 11. (J2, 18" x 0,5")

(c) A 12.3/4in tube for the transport of power cables which are interconnected with DP2 (J3, 12 3/4" x 0.5)

2.3.2 The following 'J' tubes are installed in Column 5:

(a) An 18in tube, equipped with a four tubes plastic bundle, for the EF electrical cable A and the EF umbilical, which passes through and under cell 15 (J4, 18" x 0.5")

(b) An 18in tube, equipped with a four tubes plastic bundle, for the NED 1.66" service line, the NEF umbilical, the EF 1" service line and the EF electrical cable B, which passes through and under cell 15 (J5, 18" x 0.5")

(c) A 12in tube, for future use, which passes through and under cell 13 and under cell 14 (J6, 12" x 0.5")

(d) An 18in tube, for 12" gas line from East Frigg which passes through and under Cell 16 (J7, 18" x 0.5")

2.4 Utility Risers

2.4.1 The following utility risers are installed in or about Column 1:

(a) A 16in diameter external casing, serving washdown pump CP7, which terminates at elevation +91.10m.

(b) A 32in diameter internal casing, serving sump pump CP3, which terminates at elevation +62.46m.

(c) Two 16in diameter external casings, serving flare water curtain pumps CP16A and B, which terminate at elevation +91.10m.

(d) A 22in diameter external casing, serving fire pump CP6B, which terminates at elevation +88.70m.

2.4.2 The following utility risers are installed in or about Column 3:

(a) Four 54in diameter internal casings, for sea water pumps 58PO1A, B, C and D, which terminate at elevation +83.70m.

(b) A 16in diameter external casing, for washdown pump 50P02, which terminates at elevation +91.10m.

(c) Two 16in diameter external casings, for future pumps, which terminate at elevation +91.10m.

(d) A 22in diameter external casing, for fire pump 68P01A, which terminates at elevation +88.70m.

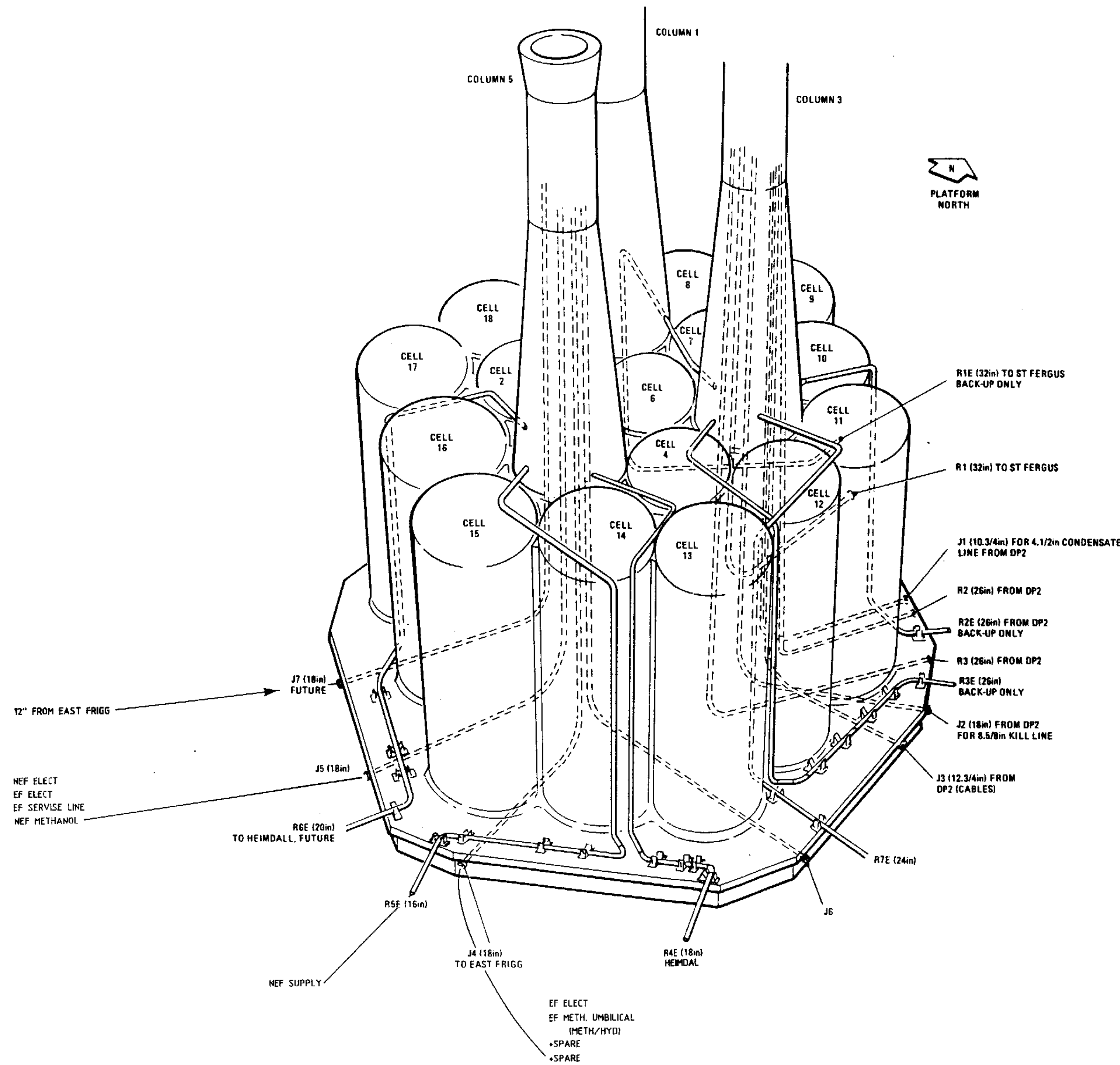
2.4.3 The following utility risers are installed in or about Column 5:

(a) A 22in diameter external casing, serving fire pump CP6A, which terminates at elevation +68.10m.

(b) A 22in diameter external casing,for fire pump 68P01B, which terminates at elevation +68.10m.

(c) Two 54in diameter internal casings, for future sea water pumps 58P01E and F, which terminate at elevation +83.70m.

(d) Two internal sea water rejection shafts (58C01 and 02) which terminate at elevation +99.70m.



ISSUE 2 OCTOBER 1988

PLATFORM RISERS	2.6

MATERIALS AND CONSTRUCTION

1. GENERAL

1.1 The limits of the concrete substructure are from the seabed to the concrete structure and steel deck connections at elevation +129.70m.

1.2 The limits of the Main Deck structure are from transition support columns/main deck at elevation +131.70m to elevation +139.30m.

2. CONTRACTORS

2.1 The substructure was constructed in Andalsnes, Norway; the Main Deck structure was split between Stord Verft, Norway, the CPM yards in Mardyck and Dunkerque, and the UIE yard in Cherbourg, France. Other deck structures were constructed in Spie Batignolles - Vigor, Orkanger, Norway.

2.2 The Phase IIIa Compression, Electrical Generation and Control facilities were constructed in three Norwegian yards namely:

(a) Spie Batignolles - Vigor at Orkanger - three compressor modules and the control module.
(b) Einar Øgrey at Kristiansand - power generation and emergency units.
(c) Nymo at Grimstad - Utilities.

3. DESIGN CODES

Platform constructions complies with the following codes and regulations:

(a) AP16A, 14A and RP14C (AC1318-71 Building Code Requirements for Reinforced Concrete).

(b) ANSI B31 (Piping) and Specification for Design, Fabrication and Erection of Structural Steel for Buildings.

(c) ASME, Section VIII, Pressure Vessel Design Standard.

(d) AWS, Structural Welding, D11, Code 1977.

(e) BSI, BS302 (wire Ropes for Cranes Excavators and General Engineering Purposes).

(f) BSI, BS1515, Part 1 (Carbon Ferritic Alloy Steels).

(g) BSI, BS1663 (Higher Tensile Steel Chain Grade 40 for Lifting Purposes), and BS3243 (Hand operated Chain Pulley Blocks), and BS4018 (Pulley Blocks for Use with Wire Rope for a Maximum Lift of 25 tonf/in^2 Combination).

(h) BSI, BS5345 (Code of Practice for the Selection, Installation and Maintenance of Electrical Apparatus for use in Potentially Explosive Atmosphere), and BS5405 (Code of Practice for the Maintenance of Electrical Switchgear for Voltages up to and including 145kV).

(i) Department of Energy, Offshore Installations, Guidance on Design and Construction.

(j) Department of Trade (Marine Division), Continental Shelf Act, Section 4, 1964, and Markings of Offshore Structures, 1976.

(k) Det Norske Veritas, Rules for Fixed Offshore Structures, 1974.

(l) Elf Norge, Fabrication Specification 1052, No 3/155, Rev 2/TPS, February 1974.

(m) Institute of Electrical and Electronic Engineers, Recommended Practice for Electrical Power Distribution for Industrial Plants Std 141, 1976, and Recommended Practice for Emergency and Standby Power Systems Std 446, 1976, and Recommended Practice for Grounding of Industrial and Commercial Power Systems Std 142, 1972.

(n) International Convention for Safety of Life at Sea, 1960.

(o) International Telecommunications Union, Radio Regulations.

(p) Norwegian Coast Directorate, Regulations for Marking of Production Platforms.

(q) Norwegian Petroleum Directorate, Regulations for Production and Auxiliary Systems on Production Installations.

(r) Statutory Instruments, Offshore Installations, No 1019 (Operational Safety, Health and Welfare Regulations, 1976, and No 486 (Lifesaving Appliances) Regulations, 1977, and No 611 (Firefighting Equipment) Regulations, 1978.

4. MATERIALS

4.1 The concrete structure is constructed from the following materials:

(a) Concrete:

Class C45 (according to NS3473/74) 28 days' cube strength = $45 N/mm^2$

- air void content in splash zone : 4 to 6%
- water/cement ratio:
  - submerged zone : ≤ 0.45
  - splash and atmospheric zone : ≤ 0.40

(b) Concrete mixes:

Structure feature	Cement PC300 DALEN (kg/cm^3)	Sand (0 to 10mm) Veblungsnes (kg/m^3)	Coarse Aggr (10to25mm) Ørlandet (kg/cm^3)	Water ($litres/m^3$)	Admixtures Betoken LP/R/L ($litres/m^3$)	Slump (cm)	Air content %
Concrete skirts	460	800	980	185	6/2/-	10	
Lower domes	420	800	980	180	6/2/-	14	
Cell walls	480	880	880	190	3-6/-/-	8-12	
Upper domes							
-A	460	800	980	190	6/2/-	8-10	
-B	480	790	970	195	6/2/-	10-14	
Shafts	480	790	970	190	1-3/-/0.1	8-10	4

(c) Reinforcement steel:

KS40 (yield strength = 400N/mm^2)
KS40S (weldable reinforcement steel) was used in the splash zone of Columns 1, 3 and 5 in order to facilitate possible future repairs.

Concrete cover to reinforcement:

	below elevation +85700m	**above elevation +85700m**
Minimum cover to ordinary reinforcement	7.5 ± 1.0cm	8.5 ± 1.0cm
Minimum cover to prestressing steel ducts	10cm	10cm

(d) Prestressing steel:

(i) FREYSSINET 12T15 post tensioning system:

Cross section area of 12T15 tendon = 1716mm^2
Yield strength of steel (f_{o2}) = 1566N/mm^2
Breaking strength of steel (f_u) = 1783N/mm^2

Post tensioning anchorages:

Active anchorage Freyssinet type 12T15 (model 294).
Passive anchorage STUP type 12T15 and 12T15A.

(ii) DYWIDAG bolts - Connecting the support columns to the Main Deck structure.

Yield strength (f_{o2}) = 1100N/mm^2
Breaking strength (f_u) = 1250N/mm^2

(e) Grout:

Grout for prestressing cable bolt ducts (batch weight):

Cement: 100kg
Water: 40 litres
Admixture: 1.5% Intraplast B or 1.5% Betokem In(B)

4.2 The selection of materials for construction of the Main Deck structure was based on Plate Material specifications for Fixed Offshore Structures, 1052 No 5/302, Rev 0/JPS, Elf Norge, May 1975. Materials used are as tabulated below:

Designation	**Steel Grade (DIN 17100)**	**Thickness (mm)**	**Classification (DNV Rules)**	**Typical Application**
SHS20	St 52-3N (modified)	12-15-20 -25	Special	Nodes, girders, trusses
SHS40	St 52-3N (modified)	30-40-50 -60-80-100	Special	Heavy wall nodes, girders, trusses
MLO	St 37-3U	various	Secondary	Plating, sections
ML20	St 37-3N	various	Primary	Plating, sections profiles

NOTE
For St 53-3N steel, a minimum yield strength of $3400kp/m^2$ is used for all plate thickness calculations.

4.3 The selection of materials for construction of other deck structures was based on the following:

(a) Elf Norge, Frigg Field, 1052 No 3/145, Fixed Offshore Structures Material Specifications for TP1 and QP, Rev 0, November 1970.

(b) Elf Norge, Frigg Field, 1052 No 3/620, Fixed Offshore Structures Special Material Specifications for TP1 and QP, Rev 0, November 1970.

4.4 Materials used for construction of other deck structures are as tabulated below:

Designation	Steel Grade According to DIN 17100	Classification According to DNV rules	Typical Application
HS20	St 52-3N	Primary structure steel	Main module, girders, members, pad-eyes, crane pedestals.
	St 37-2	Secondary structure steel	Beams and plates, ladders and stairs.

5. PAINTS AND COATINGS

5.1 Preparation and coating of structural surfaces complies with the following codes and regulations:

(a) Swedish Standards SIS:05.5900 (Pictorial Surface Preparation Standards for Painting Steel Surfaces), 1967.

(b) SSPC, Surface Preparation Specification, VISI.

(c) BSI, BS4232 (Surface Finish of Blast Cleaned Steel for Painting), 1967.

(d) European Scale of Degree of Rusting for Anti-corrosive Paints, Stockholm, 1961.

(e) Elf-Re, Standard Specification P7 (Coating for Marine Structures), Rev 1, March 1975.

(f) Elf Norge, Frigg Field, Painting Specification for Steel Structures, DEP1052, No 3/169, Rev 1, March 1974.

(g) ASTM, A123, Zinc Coating (hot galvanised) on Products Fabricated from Rolled, Pressed or Forged Steel Shapes, Plates, Bars and Strips.

(h) ASTM, A153, Zinc Coating (hot dip) on Iron and Steel Hardware.

(i) ASTM, 143, Safeguarding against Embrittlement of Hot Galvanised Structural Steel Products.

(j) Brown and Root Specifications for TCP2-X-101, 102, 106, 108, 109, 110, 112, 116, 117 and 118.

(k) General Equipment Specification, Coating for Marine Structures, SGPO7, Class P, Rev 0, September 1972.

5.2 Platform Risers and 'J' Tubes are coated as follows:

(a) Above water - chlorinated rubber (195 microns minimum) or Scotchcote 206 epoxy (300 microns minimum).

(b) Tidal zone - Monel cladding (3mm thickness), coated with coal tar epoxy (400 microns minimum) with antifouling paint.

(c) Below water - coal tar expoxy (400 microns minimum) or Scotchcote epoxy 312 (400 microns minimum).

5.3 Risers passing through the internal tidal zone in the support columns are clad with Monel 400 (3mm thickness) and coated with coal tar epoxy (400 microns minimum) with a top coat of Durovinyl (800 microns minimum) antifouling paint.

5.4 Risers passing through the sealed tunnels in the foundation slab are coated with zinc metal spray (250 microns minimum) with a top coat of marking paint.

5.5 The 8.5/8in mud kill and 4.1/2in condensate risers in 'J' tubes are coated with coal tar enamel of a nominal 5 to 6 mm thickness.

6. PIPELINE IDENTIFICATION

Pipeline contents are identified by coloured arrows superimposed on coloured bands located at convenient intervals. Flow direction is shown by the arrows which also have the pipeline contents stencilled on them in black letters.

ELF NORGE A/S
PIPELINE IDENTIFICATION COLOUR CODE
FRIGG FIELD

COLOUR CODE	PIPE CONTENT	COLOUR CODE	PIPE CONTENT
	SEA WATER		METHANOL
	FRESH WATER		GLYCOL
	FIREWATER		INHIBITOR
	SEWAGE AND DRAIN		CHEMICALS
	DIESEL OIL		CO_2 AND HALON
	LUB OIL		WET GAS
	HYDRAULIC OIL		DRY GAS
	CONDENSATE		HP RELIEF GAS
	STEAM		LP RELIEF GAS
	COMPRESSED AIR		FUEL GAS
	INSTRUMENT AIR		HP MUD
	VENTILATION PRESSURISATION AND AIR CONDITIONING		LP MUD

CATHODIC PROTECTION

1. GENERAL

1.1 Cathodic protection is provided by a system of sacrificial zinc anodes, which protects all the underwater and buried areas of the structure.

1.2 The system was designed in accordance with the following criteria:

(a)	Life requirement	20 years
(b)	Current requirement for bare steel in mud	$32mA/m^2$
(c)	Current requirement for non-flowing sea water	$53.8mA/m^2$
(d)	Current requirement for flowing sea water	$150.6mA/m^2$
(e)	Current to polarise steel in concrete	$1.08mA/m^2$
(f)	Assumed bare steel area of coal tar enamelled or paint coated items in static environment (See Note)	10%
(g)	Assumed bare steel area of paint coated items in exposed environment (See Note)	20%
(h)	Zinc sacrificial anodes with theoretical consumption	10.72kg/A/year
(i)	Zinc efficiency	90%
(j)	Utilisation factor for zinc anodes	85%
(k)	Sea water resistivity	30 ohm/cm
(l)	Sea bed resistivity	150 ohm/cm

NOTE: Average over the 20 year lifetime.

1.3 In the application of these criteria, allowances have been made for:

(a) Current draining to reinforcing bars, 10A per column.

(b) Accelerated coating deterioration above -20m elevation due to turbulent water.

(c) Increased consumption of anodes in tunnels due to riser movement and elevated water temperature.

1.4 Electrical contact is established between the reinforcement and steel fixing plates for riser supports, tunnels and skirts by a welded 'rebar' system or negative skeleton.

2. DESCRIPTION

2.1 Sacrificial Anodes

2.1.1 Various parts of the steel work (cathodes and the zinc anodes are permanently connected by bonding which creates low resistance path under all platform service conditions.

2.1.2 On all flat surfaces, bar or block anodes of high quality zinc with cast-in steel cores are used. The steel cores are thermit-welded to the structure to ensure good electrical connection.

2.1.3 On risers and pipelines, anodes - either in halves or as bracelets made up of segments mounted on steel rings - are clamped into position. Each half of the anode or segment-bearing steel ring is electrically connected to its associated riser or pipeline by means of stranded copper cable thermit-welded to the pipe surface.

2.1.4 Extra anode capacity on steel skirts, pipelines, risers and riser supports also protects all temporary embedded fixing plates on the submerged part of the concrete structure.

2.1.5 To give additional protection to platform risers, bonding cables are installed between the risers and the zinc anodes fitted to the inside of the tunnels in the foundation slab.

2.2 Zinc Reference Electrodes

2.2.1 Three zinc reference electrodes are installed on the outside of the structure to monitor it.

2.2.2 Columns 3 and 5 each have six reference electrodes installed at different elevations.

2.2.3 The cables from each electrode are led to a junction box at the top of each column. Multicore cables connect the junction boxes with the control monitoring panel.

2.3 Monitoring System

2.3.1 A monitoring system constantly reviews the protection levels of individual pipelines and the structure in general. A monitoring control panel is located in the Instrument Interface Room.

2.3.2 Using the selector switches on the monitoring panel, the appropriate reference electrode and pipeline or structure are selected. A voltmeter indicates the relevant potential.

2.3.3 Additional potential measurements are taken inside the columns by lowering a Ag/AgCL reference electrode. The validity of the results can then be checked.

INSPECTION AND MAINTENANCE

1. GENERAL

The Frigg Field straddling the UK/Norwegian dividing line has four platforms subject to British Jurisdiction, CDP1, TP1, QP and FP; and two, DP2 and TCP2 under Norwegian Jurisdiction. In order to operate the four UK sector platforms, it is a legal requirement to have a current Certificate of Fitness, which is issued by a certifying Authority on behalf of the Department of Energy. This certificate is not required for the Norwegian sector platforms, although a condition evaluation is made by the Norwegian Petroleum Directorate.

In order to obtain the basis for renewal of the Certificate of Fitness and meet the requirements of the condition evaluation all platforms are subjected to major survey.

2. MAINTENANCE/INSPECTION

2.1 Maintenance and Inspection responsibilities are to ensure that all platforms, systems and equipments are kept in a proper state to meet the required production under safe conditions and according to relevant regulations.

2.2 Maintenance and Inspection activities are managed through a single computer based Maintenance Management System called OPTIMIS. The purpose of the system is to:

- organize (7-week plan, weekly plan, maintenance routines),
- formalize (Maintenance Request),
- follow up (reports),

the work of all trades involved in maintenance activities, i.e. mechanics, electricity, instrumentation, telecom, inspection, production, ...

on all equipment i.e. process, utilities, static or moving, vessel or machinery.

2.3 The individual preventive routines, originally compiled from vendors recommendations are constantly revised to take advantage of the operational experience feedback.

Some rotating equipment are planned to be condition monitored to ensure that maintenance is performed before breakdown. Some others are only subject to curative maintenance. They are repaired whenever they break down.

The responsibility of deciding what type of maintenance an equipment should be submitted to, lies with Platform Maintenance, Inspection and Production management in close relation with corresponding trades onshore.

CHAPTER 3

EQUIPMENT LOCATION

CONTENTS

Section	3.1.1	Equipment Location - Cellar Deck
	3.1.2	Equipment Location - Main Deck
	3.1.3	Equipment Location - Upper Deck

DIAGRAMS

Diagram	3.1.1	Equipment Location - Cellar Deck
	3.1.2	Equipment Location - Main Deck
	3.1.3	Equipment Location - Upper Deck

EQUIPMENT LOCATION - CELLAR DECK

Equipment No	Description	Location
CP33 A/B	Diesel oil transfer pumps	Pancake 09
CP2 A/B	Condensate return pumps	Pancake 07
CP6 A	Firewater pump	Central Area
CP6 B	Firewater pump	Pancake 07
CP7	Washdown pump	Central Area
CP8 A/B	Diesel pumps	Pancake 09
CP9 A/B	Slops oil pumps	Pancake 07
CP12 A/B	Methanol injection pumps	Central Area
CP13 A/B	Glycol fill pumps	Central Area
CP15 A/B	Condensate recycle pumps	Pancake 07
CP16 A/B	Water curtain pumps	Central Area
CP17 A/B	Methanol transfer pumps	Central Area
CP220 A/B/C	Teg circulation pumps	Pancake 07
CP222 A/B	Methanolated water injection pumps	Central Area
CP224	Pump for drain. tank, meth. water	Pancake 53
CP225	Pump for inhibitor drum	Pancake 53
CP226	Pump for inhibitor drum	Pancake 53
CP320 A/B	TEG circulation pumps (East Frigg)	Pancake 07
CP270	Inhibitor pump for NEF	Central Area
CP36 A/B	Cooling water pumps	Pancake 08
50 P 02	Washdown pump	Area 63
55 P 01 A/B	Firewater make up pumps	Pancake 42
55 P 03	Turbine wash pump	Pancake 42
58 P 01 A/B/C/D	Seawater pumps	Area 63
58 P 02 A/B	Process freshwater/Teg pumps	Pancake 42
58 P 04 A/B	Utilities freshwater/Teg pumps	Pancake 42
58 P 05 A/B	Drain tank pumps	Pancake 42
68 PD01 A	Firewater pump	Pancake 42
68 PD01 B	Firewater pump	Pancake 46
CV 5	Oil skimmer	Pancake 07
CV 6	Fuel gas scrubber	Pancake 07
CV 7	L.P. Vent Scrubber	Pancake 09
CV 9	Methanolated water storage tank	Central Area
CV 10	Diesel storage tank	Pancake 09
CV 13	Sump caisson	Column No 1
CV 23	Methanol storage tank	Central Area
CV 24	H.P. Relief scrubber	Central Area
CV 33	Condensate recycle tank	Pancake 07
CV 34	Air receiver (fire pump house)	Pancake 07
CV 44	Air receiver (gen. package)	Central Area
CV 204	ODIN condensate methanol separator	Pancake 53
CV 213	NEF condensate methanol separator	Pancake 53
CV 220	Methanolated water flash drum	Pancake 53
CV 222	Methanolated water drainage tank	Pancake 53
CV 225 A/B	Inhibitor drum	Pancake 53
CV 226	L.T. Relief scrubber	Pancake 53
CV 21	Diesel oil filter	Pancake 09
CV 45	Glycol slop tank	Central Area
CV 270	Inhibitor tank for NEF	Central Area

Equipment No	Description	Location
CE 8 A/B	Radiator coolers	Pancake 12
CE 3	Fuel gas exchanger	Pancake 07
CE 203	ODIN condensate heater	Pancake 53
CE 211	NEF condensate heater	Pancake 53
58 E 01	Seawater/freshwater exchanger	Pancake 43
58 E 02	Seawater/freshwater exchanger	Pancake 43
58 E 03	Seawater/freshwater exchanger	Pancake 43
58 E 04	Seawater/freshwater exchanger	Pancake 43
CQ 22 A/B/C	Screw compressors	Pancake 08
CQ 23	Air dryer	Pancake 08
CQ 14	Water treatment package	Pancake 07
CQ 15	Injection of corr. inhibition in J.tubes	Pancake 09
55 X 01 A/B	Freshwater makers	Pancake 42
57 X 01	Air compressor package	Pancake 42
CM 1	Pig receiver (gas from DP2)	Pancake 05
CM 2	Pig receiver (gas from DP2)	Pancake 05
58 C 01	Seawater outfall	Column No 5
58 C 02	Seawater outfall	Column No 5
58 S 01 A/B	Seawater strainer	Area 63
J1-4"	J-tube 1-4" methanolated water to DP2	Area 63
J2-8"	J-tube 2-8" nitrogen store	Area 63
J7-18"	J-tube 7-18" EF riser 12"	Column No 5
R1-32"	Riser 1-32" to St Fergus	Area 63
R2-26"	Riser 2-26" from DP2	Area 63
R3-26"	Riser 3-26" from DP2	Area 63
R5E 16"	Riser NEF 16"	Columns No 5
R6E 20"	Riser ODIN 20"	Columns No 5
53GD1-S01	Emergency diesel generator silencer	Pancake 40

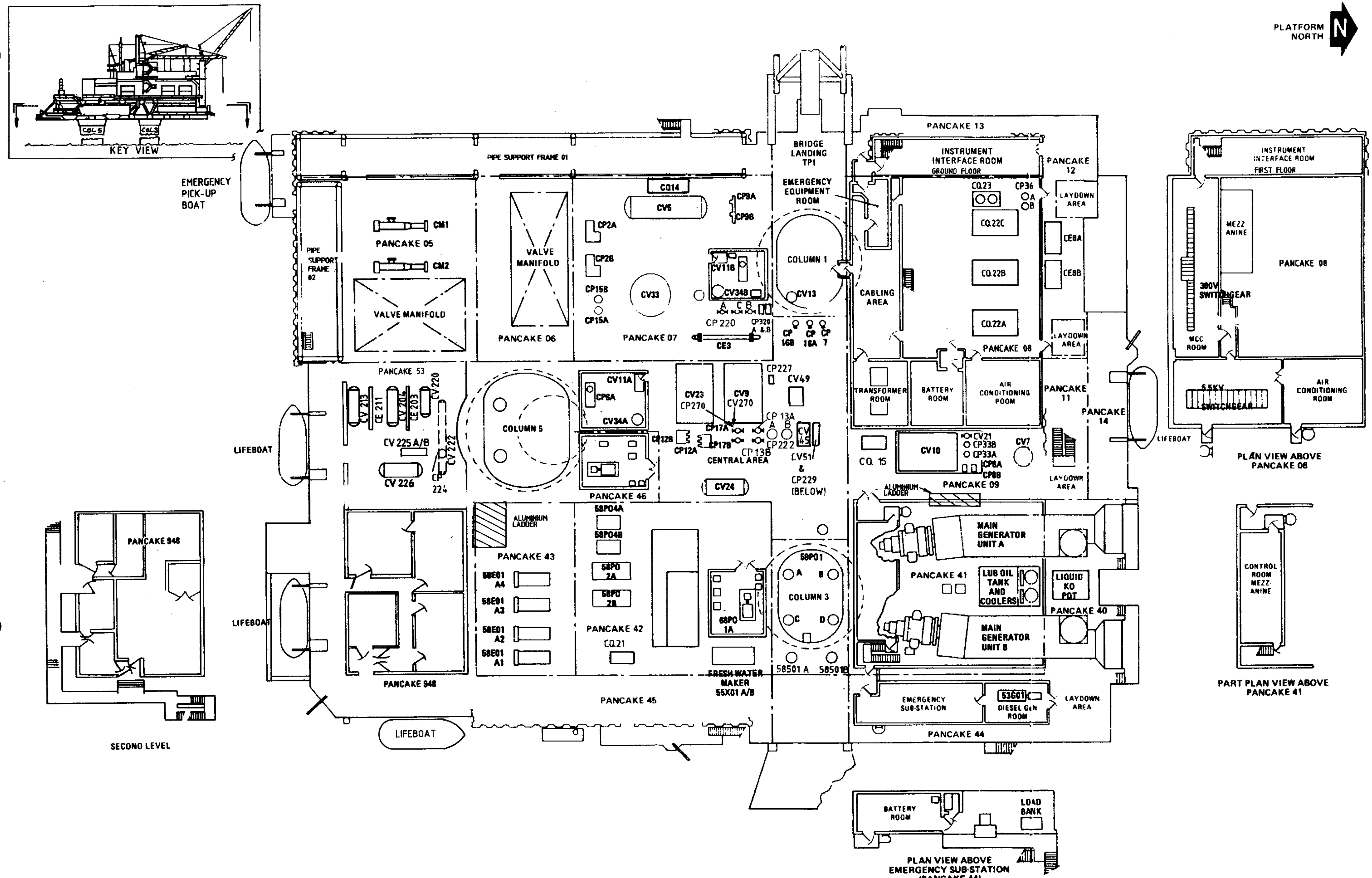
EQUIPMENT LOCATION - MAIN DECK

Equipment No	Description	Module No
CV 1 A/B	F.W.K.O. Separator	02
CV 1 C	F.W.K.O. Separator	03
CV 2 A/B	Glycol contactor	02
CV 2 C	Glycol contactor	03
CV 3	Condensate surge tank	01
CV 201	ODIN gas scrubber	50
CV 210	NEF slug catcher	50
CV 211	NEF gas scrubber	50
CV 310	EF slug cathcer	51
CV 311	EF gas scrubber (Int. Deck)	51
CV 350 A/B	EF methanol tanks (Int. Deck)	51
CO 340	EF hydralic package (Int. Deck)	51
CO 350	EF methanol inj. unit	51
CO 370	EF corrosion inhib. pkg. (Int. Deck)	51
CQ1 A	Glycol regeneraton units	03
CQ1 B/C	Glycol regneration units	04
54 X 01	Vent system	30
54 X 02	Vent system	31
54 X 03	Vent system	33
60 X 01	Crane	32
CM7	Crane	04
CM8	Crane	01
CM9	Pig receiver (condensate from DP2)	01
CSP 24	LP Vent stack	04
CSP M210.1	Silencer	50
CSP M210.2	Silencer	50
T 52.32.1.9	Transformer	32
T 52.32.1.10	Transformer	32
T 52.32.1.11	Transformer	32
T 52.32.1.12	Transformer	32
53 GDI-501	Emergency diesel generator silencer	30
67 B01	LP Vent scrubber	33
11B 01 A	Suction drum	30
11B 01 B	Suction drum	33
11B 01 C	Suction drum	31
11B 02 A	Water separator	30
11B 02 B	Water separator	31
11K 01 A	Natural gas compressor	30
11K 01 B	Natural gas compressor	33
11K 01 C	Natural gas compressor	31
11KG 01 A	Gas compressor turbine	30
11KG 01 B	Gas compressor turbine	33
11KG 01 C	Gas compressor turbine	31
FE CV 311 2A/2B	EF fiscal meter (Int. Deck)	51
CP 32 A/B	Methanol injection pumps	01

EQUIPMENT LOCATION - UPPER DECK

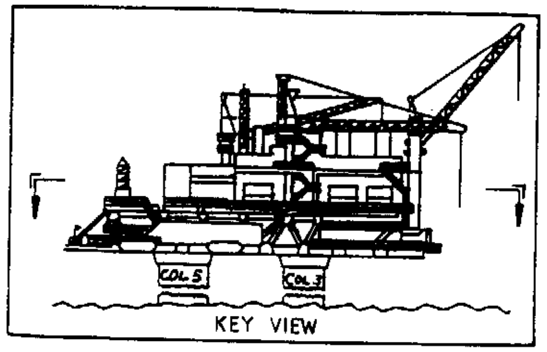
Equipment No	Description	Module No
CV 2 A/B	Glycol contactors	02
CV 2 C	Glycol contactors	03
CV 201	ODIN gas scrubber	50
CV 211	N.E.F. gas scrubber	50
CV 311	Gas scrubber	51
CV 313	EF cond./meth. sep.	51
CV 320	EF. meth. water flash dr.	51
CV 360	EF. meth. flash tank	51
CV 8 A/B	Corrosion inhibitor tanks	04
CP 14 A/B	Corrosion inhibitor pumps	04
CQ1 A	Glycol regeneration unit	03
CQ1 B/C	Glycol regeneraton units	04
CQ5 A/B	Instrument and utility air compressor	04
CQ7	Central hydraulic power unit	01
CQ8 A	Local control station (for pigs)	01
50 X 01 A/B	Fuel gas package	32
50 X 07 A/B	Fuel gas heater package	32
54 X 04	H & V fan room	32
56 X 01	Hydraulic package	32
60 X 01	Crane	32
67 X 01	LP Vent snuffing package	33
67 X 02	LP Vent light gas seal	33
68 X 10.1	Foam package	32
68 X 10.2	Foam package	32
CE2 A/B/C	Glycol air coolers	04
CM3	Pig launcher (gas to Scotland)	01
CM7	Crane	04
CM8	Crane	01
CM 201	ODIN pig receiver	50
11E01 A	Natural gas cooler	30
11E01 B	Natural gas cooler	33
11E01C	Natural gas cooler	31
53GD1-S01	Emergency diesel generator silencer	30
58TO1	Expansion tank	32
CSP 24	LP vent stack	04
CSP M 201.2	Silencer	50
CE 311	EF condensate heat exchanger	51

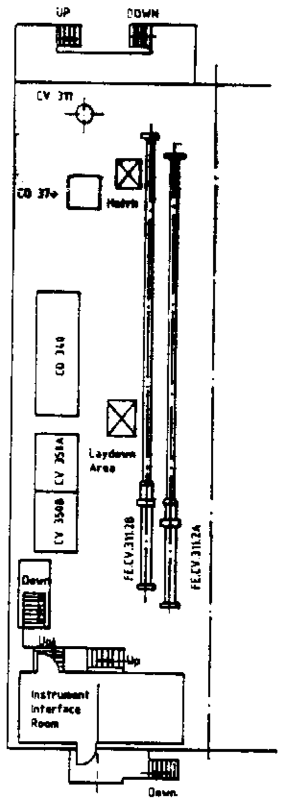
END



ISSUE 6, AUG. 1991

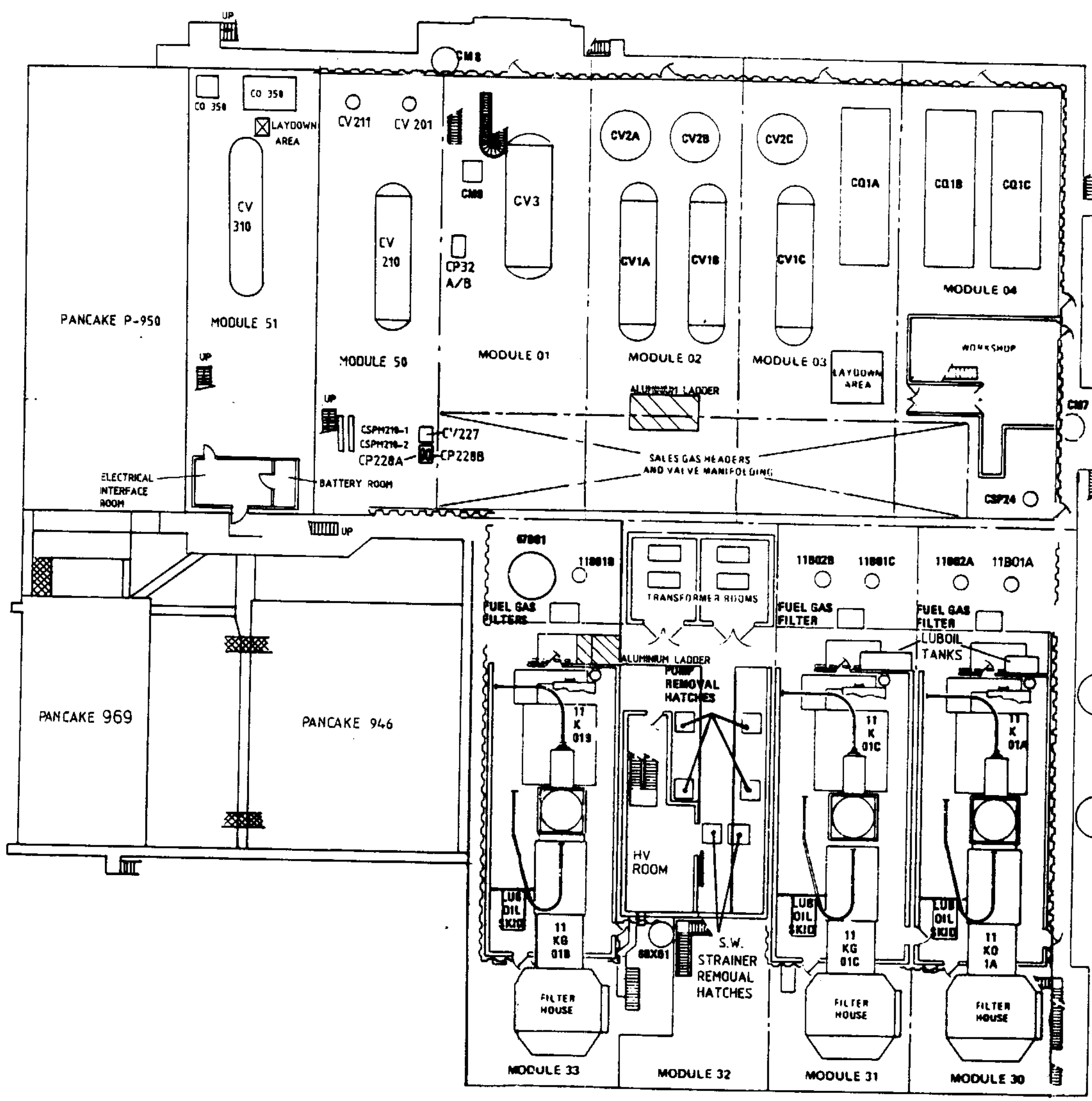
EQUIPMENT LOCATION
Cellar Deck
3.1.1

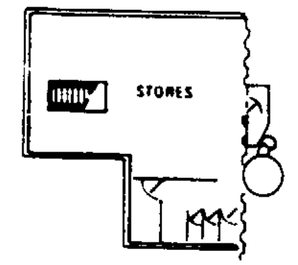




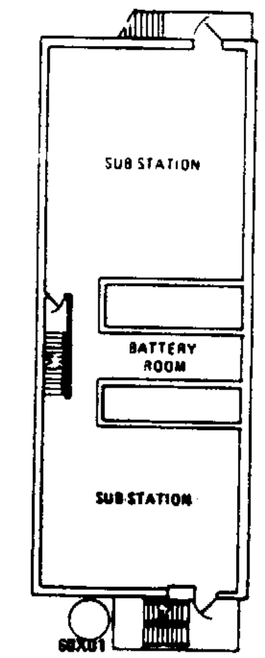
M51 INTERMEDIATE DECK

PLATFORM NORTH





PLAN ABOVE WORKSHOP (MODULE 04)

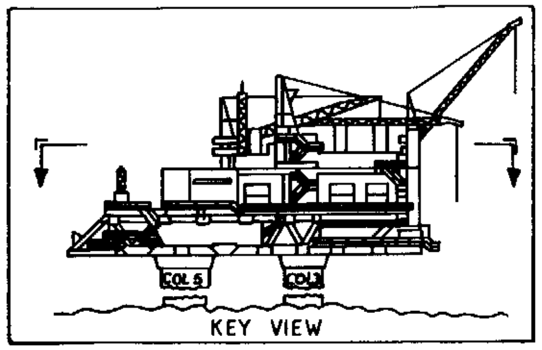


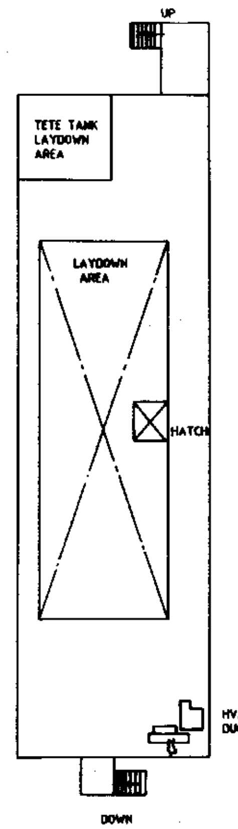
PLAN ABOVE WORKSHOP (MODULE 32)

ISSUE 6, AUG. 1991

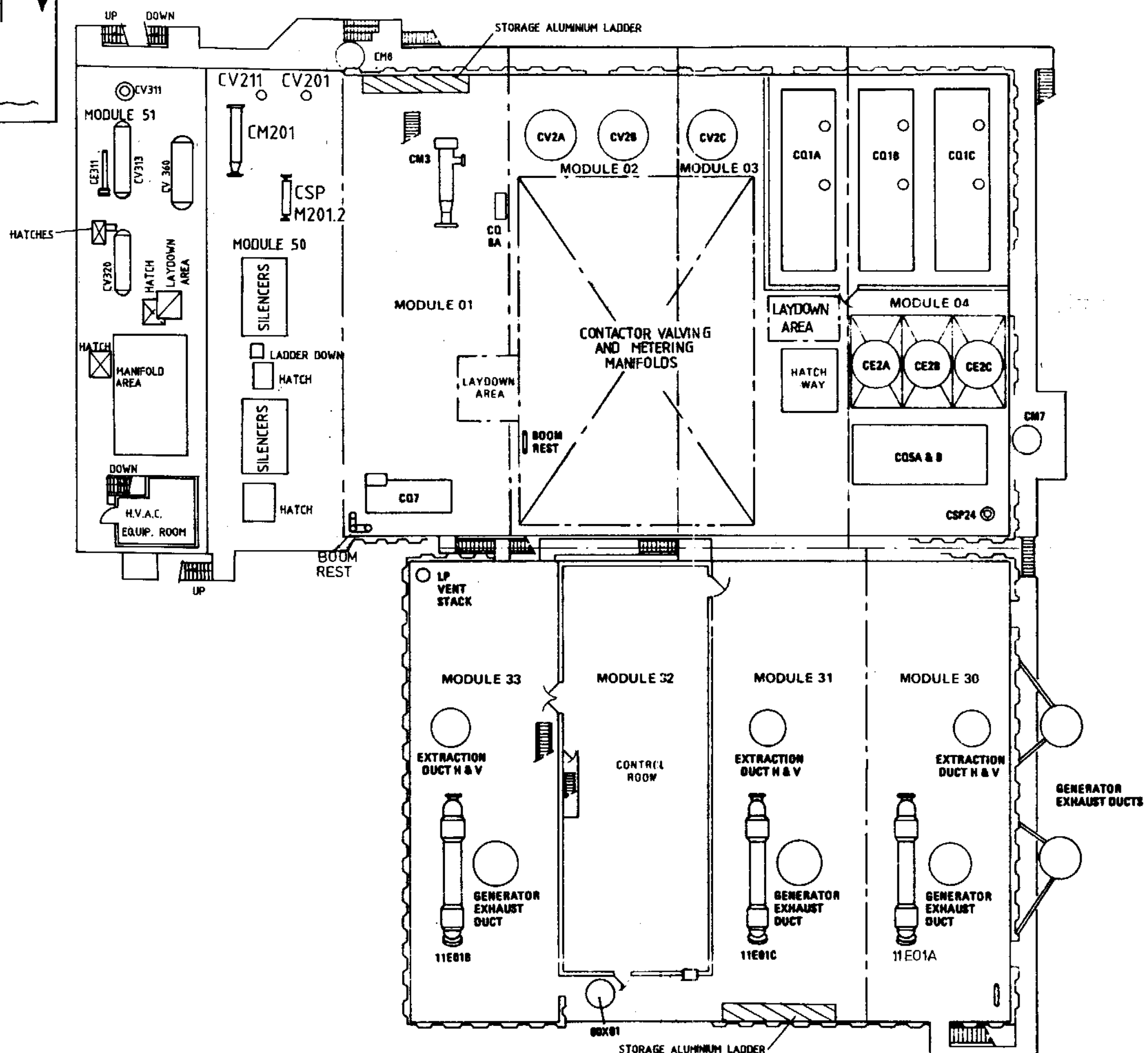
EQUIPMENT LOCATION Main Deck	3.1.2

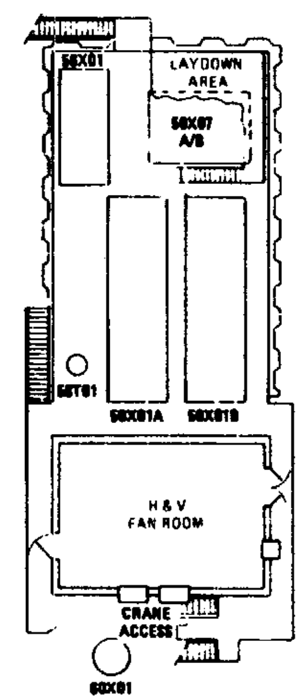
PLATFORM NORTH





MS1 WEATHER DECK





PLAN VIEW
ABOVE CONTROL ROOM
(MODULE 32)

ISSUE 4 JUNE 1991

EQUIPMENT LOCATION Upper Deck	**3.1.3**

CHAPTER 4

PRODUCTION FACILITIES

CONTENTS

Section	4.1	Process Flow
	4.2	Separation of Frigg Fluids
	4.3	Compression
	4.4	TCP2 Ext. Gas System
	4.5	EFTI Gas System
	4.6	Gas Drying and Metering
	4.7	Sales Gas Header and Gas Export
	4.8	Condensate System
	4.9	Water Treatment System
	4.10	Methanolated Water System

DIAGRAMS

Diagram	4.1.1	General Overview Main Gas System
	4.1.2	Simplified Frigg Gas Process
	4.1.3	Condensate System
	4.1.4	Methanolated Water Disposal System
	4.2.1	Free Water Knockout Drum
	4.3.1	Compression Main Gas
	4.3.2	Compression Main Gas
	4.4.1	NEF Main Gas
	4.4.2	Odin Main Gas
	4.4.3	Gas Scrubber
	4.5.1	EF Main Gas
	4.6.1	Gas Drying and Metering
	4.6.2	Internals CV2
	4.6.3	Metering Microcomputer
	4.7.1	Sales Gas Header
	4.8.1	Condensate System
	4.8.2	Heating Loop
	4.8.3	Condensate & Storage
	4.9.1	Water Treatment
	4.10.1	Methanolated Water Disposal

PROCESS FLOW

GENERAL

Wet gas from DP2 enters the platform via a 26" subsea line into a manifold. From the manifold the gas discharges into a treatment stream.

A treatment stream comprises a free water knockout (FWKO) separator, a glycol contactor, a metering facility and four flow control valves. Free liquid is removed in the FWKO separator; the gas is then dried to the required water dewpoint in the contactor. Gas is discharged from the stream via the metering facility and the flow control valves.

Wet gas from the North East Frigg (NEF) field and the Odin field are treated and metered at TCP2 Extension. The TCP2 Extension consists of two systems, one for gas treatment and one for liquid treatment. There is one stream for treatment of Odin gas and one stream for treatment of NEF gas. A stream consists of a FWKO separator, a gas scrubber, a metering facility and flow control valves. After being metered the gas is sent to final treatment and compression on TCP2 before being sent to St.Fergus.

Wet gas from East Frigg Field (EF) is treated and metered in the EF module M51. The module comprises two process streams, one gas treatment and one liquid treatment. The gas stream consist of a free water knockout separator, gas scrubber, metering facilities and a flow control station. After metering the gas is transferred to TCP2 for final treatment and compression.

The operational requirements of St.Fergus may demand a gas discharge pressure higher than that available from the wellheads. In this case Frigg gas leaving the FWKO separators is passed through compressors before entering the glycol contactors.

There are three compressors: A, B and C. Trains A and B each comprise a suction drum, a gas turbinedriven compressor, a gas cooler and a water separator. In train C the water separator for train A or B is being used. Provisions are made for operating the compressors both in parallel and serial modes.

Dry gas from the treatment streams is gathered in the sales gas header and transported to St.Fergus Gas Terminal via one of the two 32" sealines to St.Fergus, one from TP1 and one from TCP2.

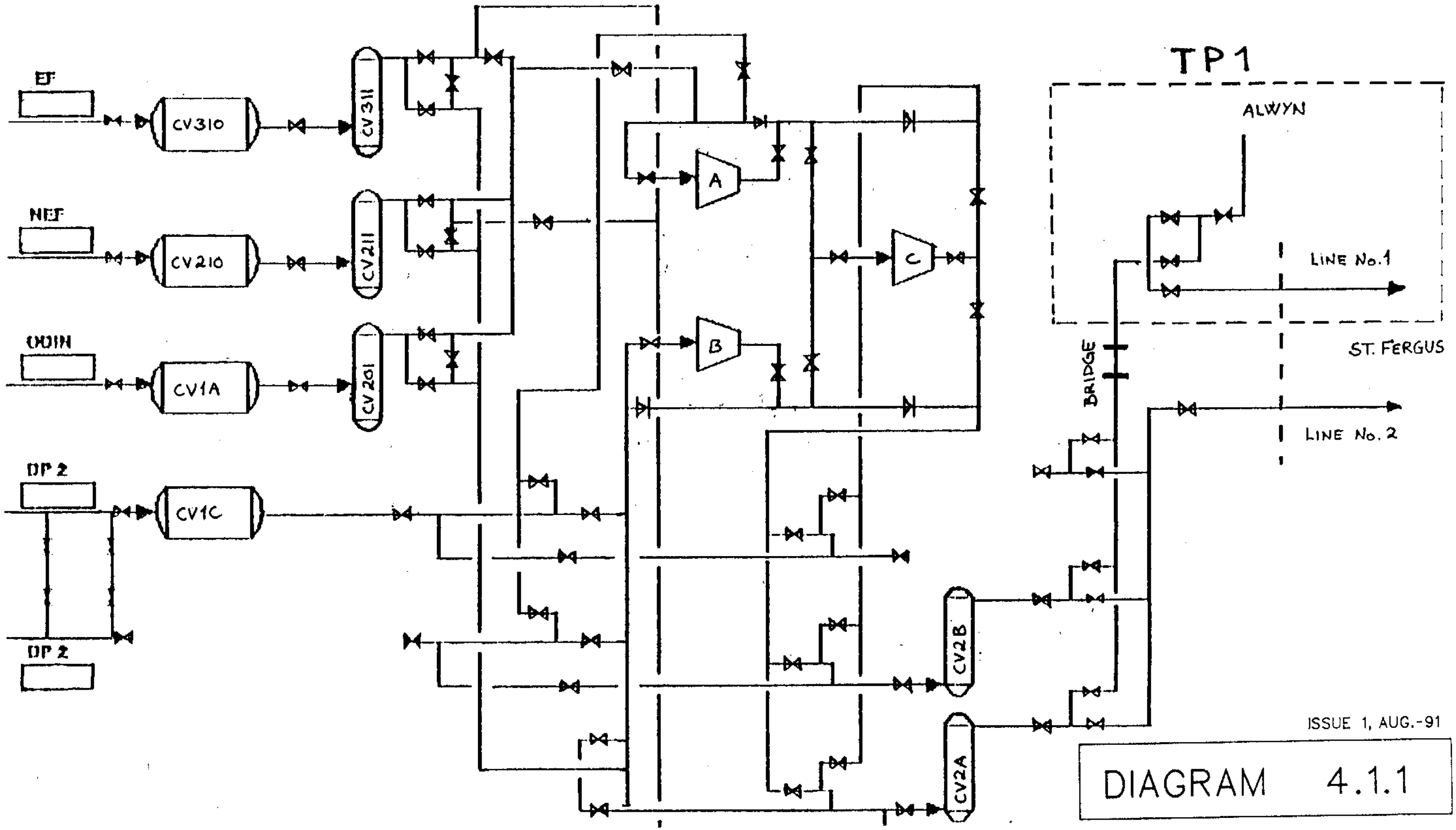
Frigg condensate collected during gas treatment and compression passes through a 3-phase separator (CV3) to remove water before being injected into the 32in sales gas line for recovery at St.Fergus.

The free liquid from NEF, Odin and EF fields is directed into a liquid treating system, comprising a heater, condensate/methanolated water separator and metering facilities for the condensate, which finally ends up in the CV3 separator.

The methanolated water is further treated in the Methanolated Water Flash Drums before being sent to the methanolated water storage tank CV9. The condensate is transferred to CV5, and water is transferred to DP2 for injection into well no. 3.

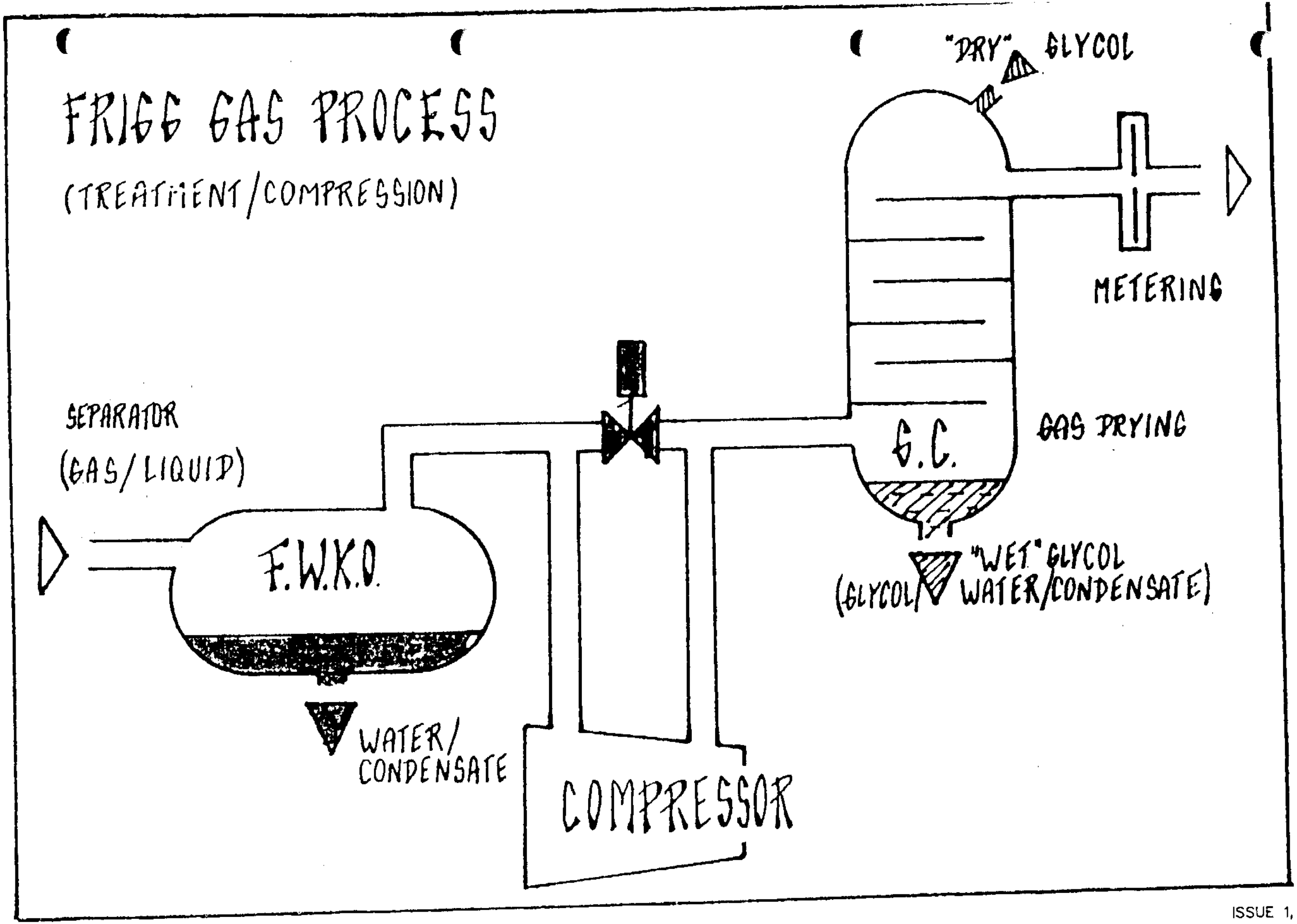
Frigg production water passes through the oil skimmer CV5 to CV9 before being transferred to DP2 for injection into well no. 3.

GENERAL OVERVIEW - MAIN GAS



ISSUE 1, AUG.-91

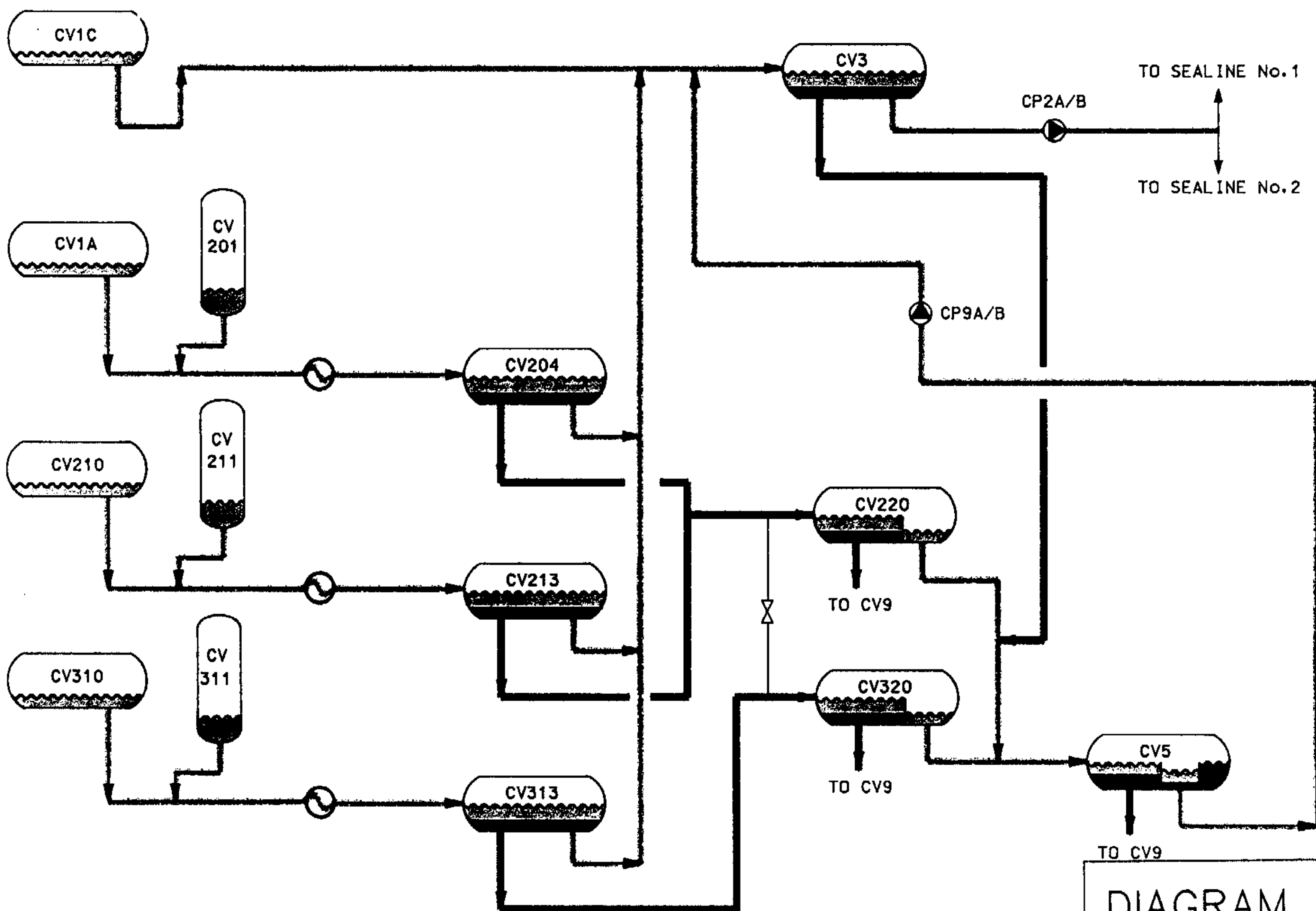
DIAGRAM 4.1.1



ISSUE 1, AUG.-91

DIAGRAM 4.1.2

CONDENSATE SYSTEM - TCP2



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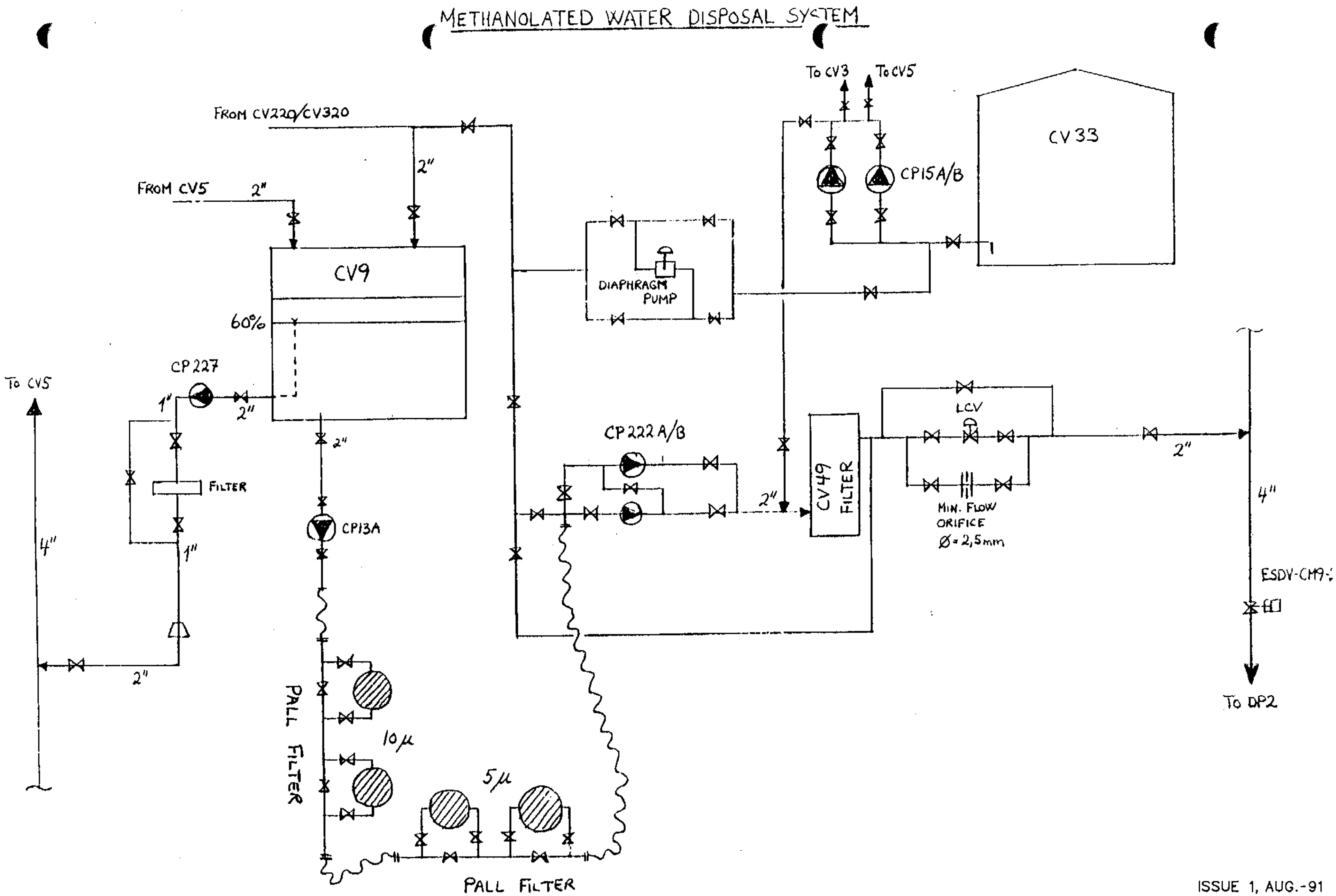
ISSUE 1, AUG.-91

DIAGRAM 4.1.3



ISSUE 1, AUG.-91

DIAGRAM 4.1.4

SEPARATION OF FRIGG FLUIDS

GENERAL

Wet gas from DP2 enters the platform through a 26" sealine. A pig receiver is installed at the termination of the sealine.

During normal operations the pig receiver is by-passed, and the gas is entering the Free Water Knock-out Drum CV1C. The main purpose of this vessel is to remove as much liquid as possible from the gas.

Diagram 4.2.1 shows a sectional view of the separator.

All internal parts are installed to optimize gas/liquid separation, mainly by changing the flow direction of the fluid, thus utilizing the centrifugal forces, and by letting small mist particles coalesce into liquid drops.

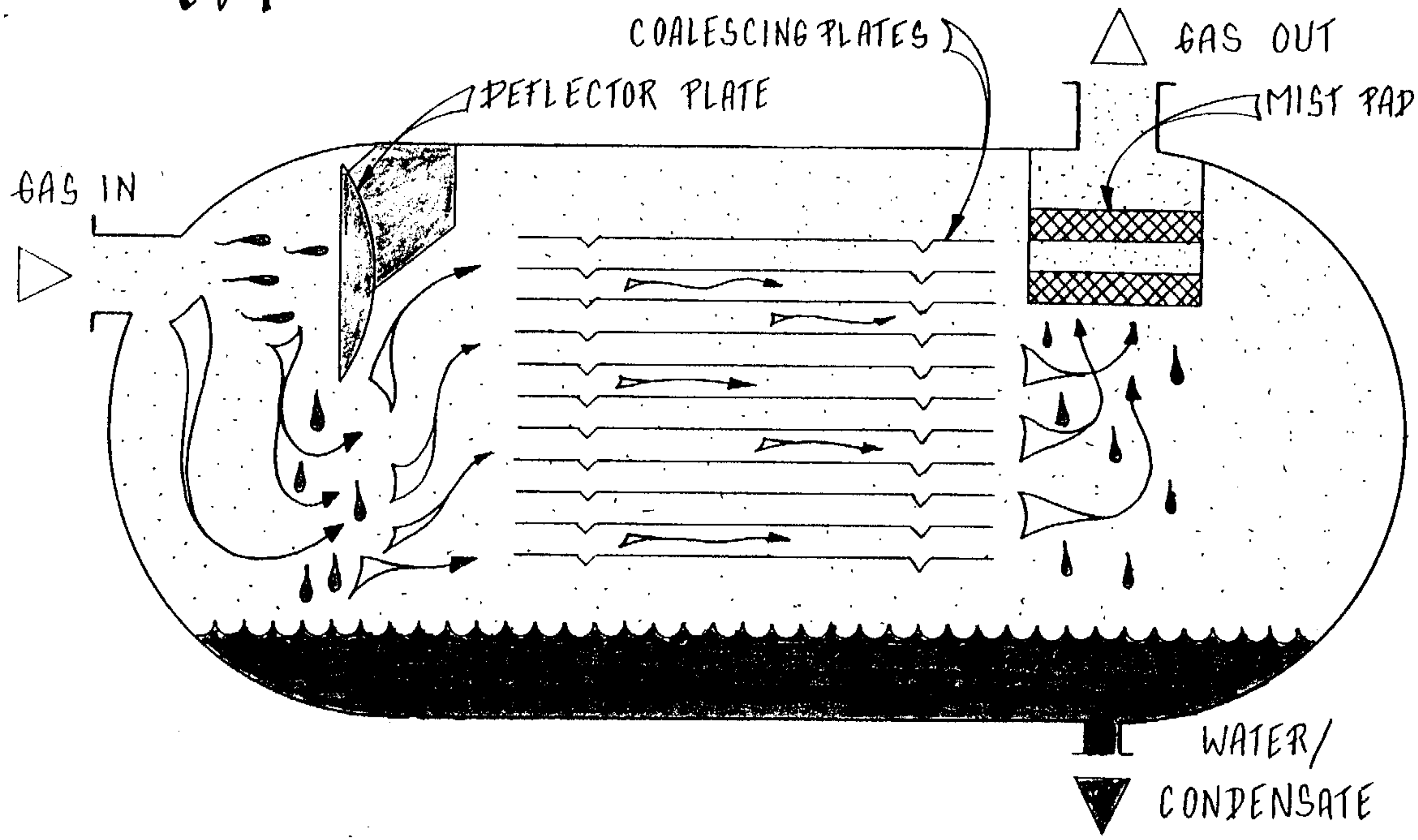
Downstream CV1C there are two alternative flow directions for the gas:

- to enter the gas/glycol contactor for drying
- to enter the compression units for increasing pressure prior to drying.

The gas is by-passing the compression package if sealine pressures at the Frigg end will meet requirements regarding flow and pressure at the St.Fergus end. By by-passing the compressors, quite a lot of energy is saved.

FREE WATER KNOCKOUT DRUM

CV1



COMPRESSION

GENERAL

Gas from the Free Water Knock-out Drums for Frigg, NEF, Odin and EF treatment streams is directed to the compressor package on TCP2, often described as TCP2 C.

The compressors A and B streams comprise a suction drum, a gas turbine-driven compressor unit, a natural gas cooler and a water separator. Compressor C stream does not include a water separator (the one for stream A or B is used).

Any free liquid in the gas is removed in suction drums 11B01A/B. The water-free gas is drawn into natural gas compressor 11K01A/B/C where it is compressed up to 153 barg. After compression the gas is cooled in natural gas cooler 11E01 A/B/C to to 35°C and is passed to water separator drum 11B02A/B/C. Any liquid formed during compression or cooling is removed in 11B02A/B before the gas is passed to the glycol contactors. Liquids from 11B01A/B/C and 11B02A/B are let down under level control to condensate surge vessel CV3. In order to protect each compressor, anti-surge valves are connected between discharge and suction lines.

The suction drums in each line are identical and carry the same fittings and instrumentation. Each drum is vertically mounted with a height of 4.51m and an external diameter of 1.888m. It is designed for a flowrate of 32 MMSCMD at a pressure of 101 bar and temperature of 50°C. Calculated pressure drop from inlet to outlet is 0.35 bar.

The gas coolers in each line are identical and carry the same fittings and instrumentation. Each vessel is a horizontally mounted single-pass countercurrent flow shell and tube heat exchanger. It is designed for a gas flowrate of 32 MMSCMD at 153 bar and a water flowrate of 1152m^3/h. Designed gas inlet temperature is 95°C and outlet 50°C. The duty is 32.57 x 10^6 kcal/h. Calculated pressure drop on the gas side is 0.4 bar and on the water side 1.15 bar. The shell side (cooling water) is protected from overpressure by PSV set at 7.5 bar and a rupture disc RD at 8 bar. The tube side (process gas) is protected from overpressure by PSV on the inlet line, set at 171 bar.

The water separators are identical and carry the same fittings and instrumentation. Each vessel is vertically mounted with a height of 3.593m and an external diameter of 1.188m. It is designed for a flowrate of 32 MMSCMD at a pressure of 152 bar and a temperature of 50°C. Calculated pressure drop from the inlet to outlet is 0.385 bar.

The gas turbine unit driving the compressor in each line consists of a United Technologies Corporation FT4C-3F/GF modular industrial gas turbine complete with control system and auxiliary equipment. The turbine unit consists of a Pratt and Whitney Aircraft GG4C gas generator to produce the hot gases and a Turbo Power and Marine Systems FT4C-3 free (or power) turbine which converts the hot gases into mechanical energy. The free turbine inlet case is bolted to the exhaust case of the gas generator.

The free turbine rotor is aerodynamically coupled to the gas generator and is mechanically independent of the generator. The free turbine is shaft coupled direct to the compressor. The gas turbine is designed to operate on clean natural gas conforming to the TPM Fuel Specifications. The output varies inversely with ambient temperature. The gas turbine can be started and automatically brought to a free turbine speed of 2000 rev/min. The compressor can then be manually or automatically loaded to the desired load point.

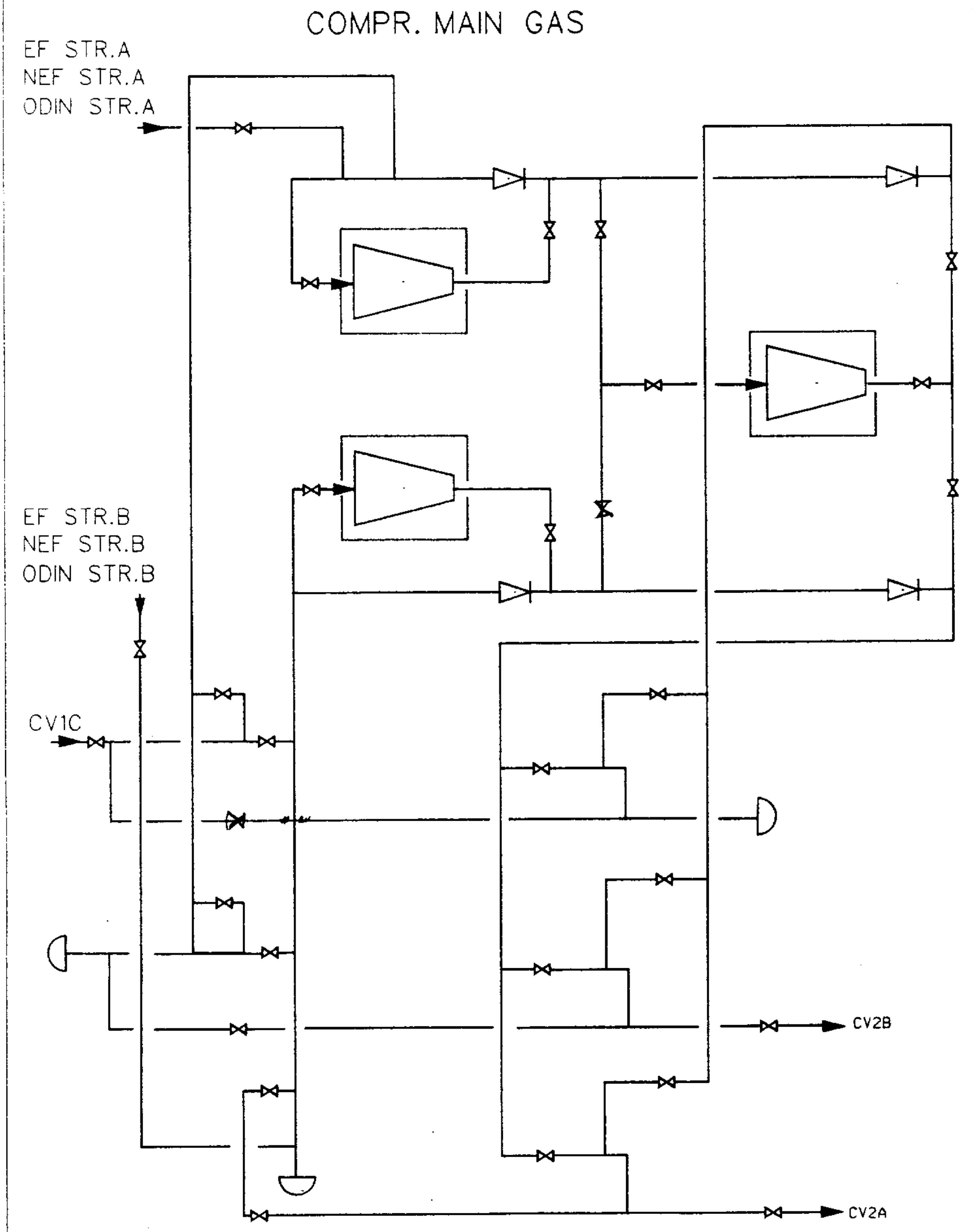
On a normal shutdown the compressor is first automatically unloaded to enable automatic cooldown of the power unit. The engine cooldown begins at a reduced speed until finally the fuel is shut off and both engine and compressor slow to a stop.

The gas turbine is fitted with a Hamilton Standard Division (HSD) SPC2H electrical fuel control which governs the speed of the high power compressor of the gas generator by opening or closing a fuel modulating valve. The fuel control senses the low power compressor rotor speed (N_1), high power compressor rotor speed (N_2), free turbine speed (N_3), gas generator exhaust gas temperature (Tt_7), and inlet air temperature (Tt_2).

The load schedule for the machine defines the maximum power available at any given ambient temperature. The load schedule is subject to a fuel control power limiting device which prevents the engine from exceeding preset exhaust gas temperature limits. The fuel control also limits the N rotor speed. Free turbine overspeed will result in gas turbine shutdown. Each engine is equipped with a pneumatic starter uses natural gas tapped from the fuel line to drive the starter; the gas is vented to the TCP2 - C LP vent system.

The compressor and gas turbine are each provided with a self-contained closed lube oil system in which the lube oil is recovered, filtered and cooled before recirculation. The compressor lube oil system incorporates seal oil pumps which provide lube oil to compressor shaft seals at each end of the compressor casing. The seal oil is maintained at a pressure slightly above that of the gas within the compressor casing. Compressor unit control is effected from unit control panels in Module 32 Control Room. One unit control panel is provided for each compressor unit. Each compressor unit may be manually or automatically loaded. Manual loading is obtained by direct control of the gas generator speed; automatic loading is obtained by monitoring the gas pressure downstream of the compressor by a pressure controller and adjustment of its set point.

Each gas turbine hood is provided with an automatically operated CO_2 fire extinguishing system. The system is actuated by any one of the three temperature detectors set at 232° C (450° F), which are located within the enclosure. Two gas detectors (located within the enclosure) set to operate at 60 % LEL, and any two of six gas detectors (located at the primary air inlet) set to operate at 15 % LEL, will also initiate CO_2 discharge. Manual release of CO_2 may be obtained by operation of a pushbutton on the exterior wall of the enclosure, by operation of a control switch on the unit control panel or by manual operation at the CO_2 bottles. Release of CO_2 will initiate ESD of the compression unit, stopping of the respective ventilation system fans and closure of unit fire dampers. CO_2 is released in two floods, the first of 160 kg (35lb) released over a period of one minute, followed immediately by the second flood of 227kg (5000 lb) over a period of 12 minutes. A 17-second interval elapses between automatic initiation of system release and discharge of CO_2. The discharge of CO_2 will take place immediately on manual release.



ISSUE 1, AUG.-91

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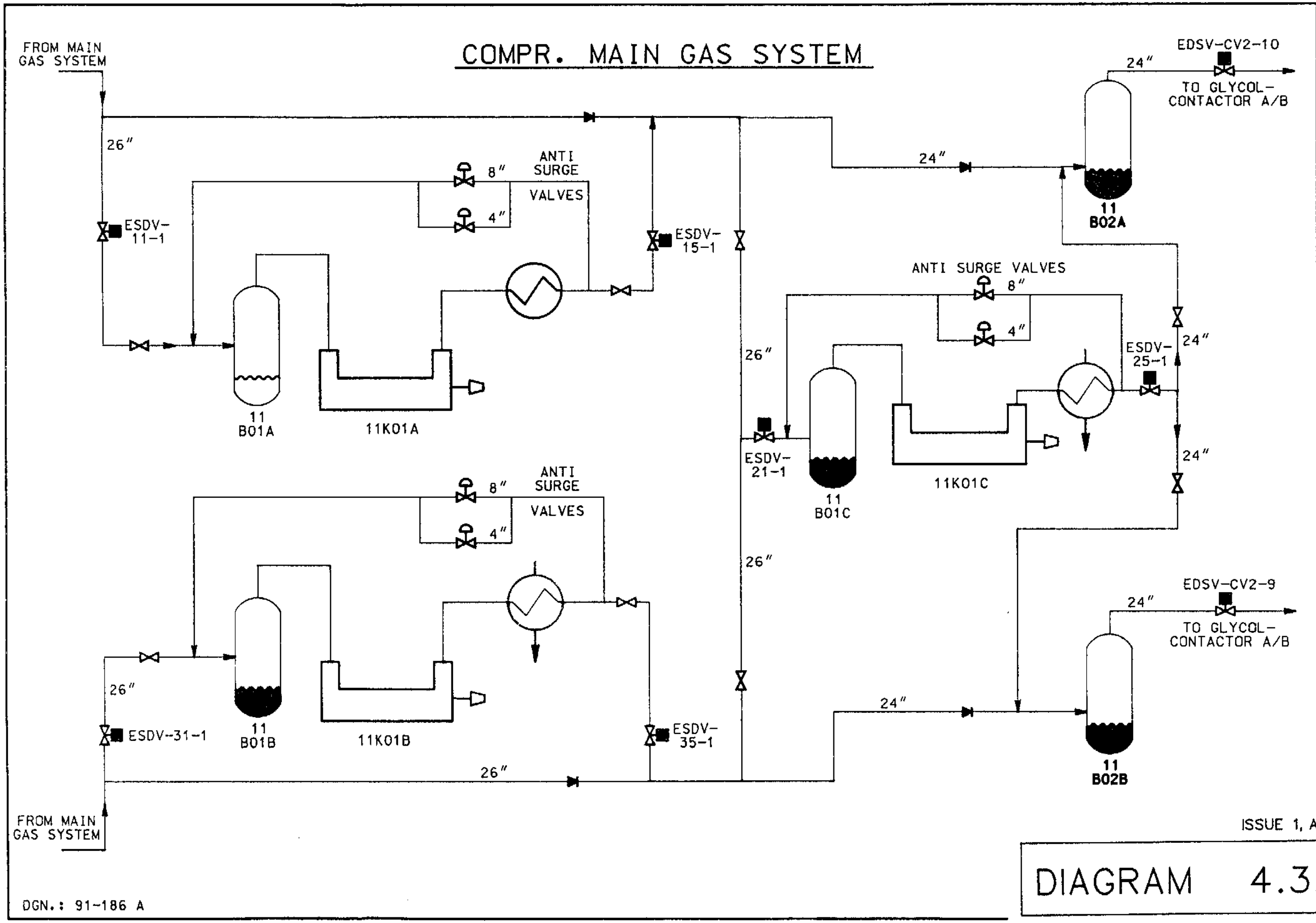
DIAGRAM 4.3.1



ISSUE 1, AUG.-91

DIAGRAM 4.3.2

TCP2 EXTENSION GAS SYSTEM

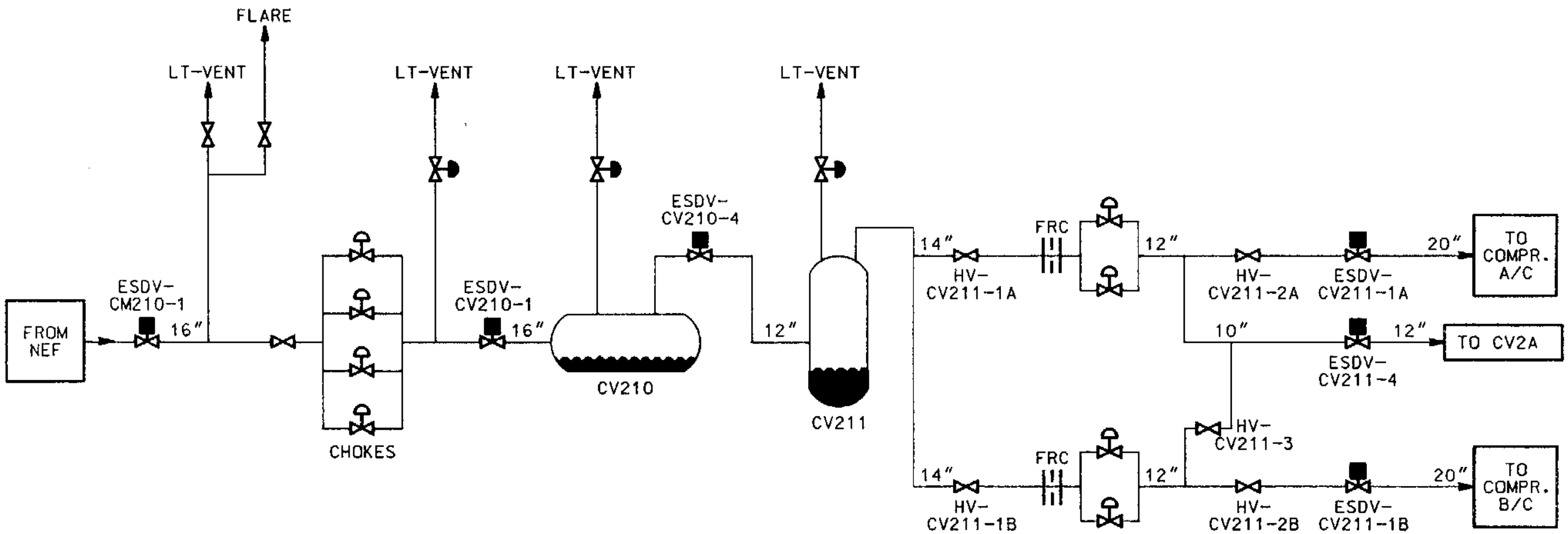
The purpose of the installation is to treat fluids entering TCP2 from the NEF and Odin Fields.

The NEF and Odin gas are treated in two equal streams. A gas stream comprises a FWKO separator, a gas scrubber, two metering stations and flowcontrol valves. In addition the NEF stream has 4 choke valves. The design capacity is 10.2 MSCM/D for the Odin stream and 7.7 MSCM for the NEF stream.

When the NEF gas/liquid arrives at TCP2 Extension the pressure may be adjusted by the four choke valves HCV M210 1A/B/C/D. The gas/liquid enter the NEF FWKO separator CV210. Here the gas is separated from the condensate and methanolated water. When entering the vessel CV210 the gas/liquid has a temperature of 5°C due to transportation through the 18km long sea-line. The liquid is sent under automatic level control to CV 204. If a large amount of liquid slug enters the vessel it will go through the vessel and LCV V2105 will open and send the slug directly to CV3. The gas from the FWKO vessel is sent to the gas scrubber CV 211. The scrubber is equipped with small cyclones and a wire mesh at the gas outlet. The liquid content in the gas leaving the scrubber is reduced so that 95% of the droplets will be in the 10 micron size or smaller. The gas coming from the gasscrubber is split in two separate lines. Each line is equipped with a metering station located upstream the flow control valves. The measured parameters are sent to the Spectra-Tek gas stream metering microcomputer. From the metering station A gas is conducted to compressor A or C and from the metering station B the gas is conducted to compressor B or C.

The difference between the Odin and NEF stream is that there are no chokes on TCP2 Extension for choking of the Odin gas, further more the Odin stream has 6 FCV's compared to the four FCV's on the NEF stream. The chokes for the Odin gas are located on the Odin platform.

NEF MAIN GAS



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ISSUE 1, AUG.-91

DIAGRAM 4.4.1

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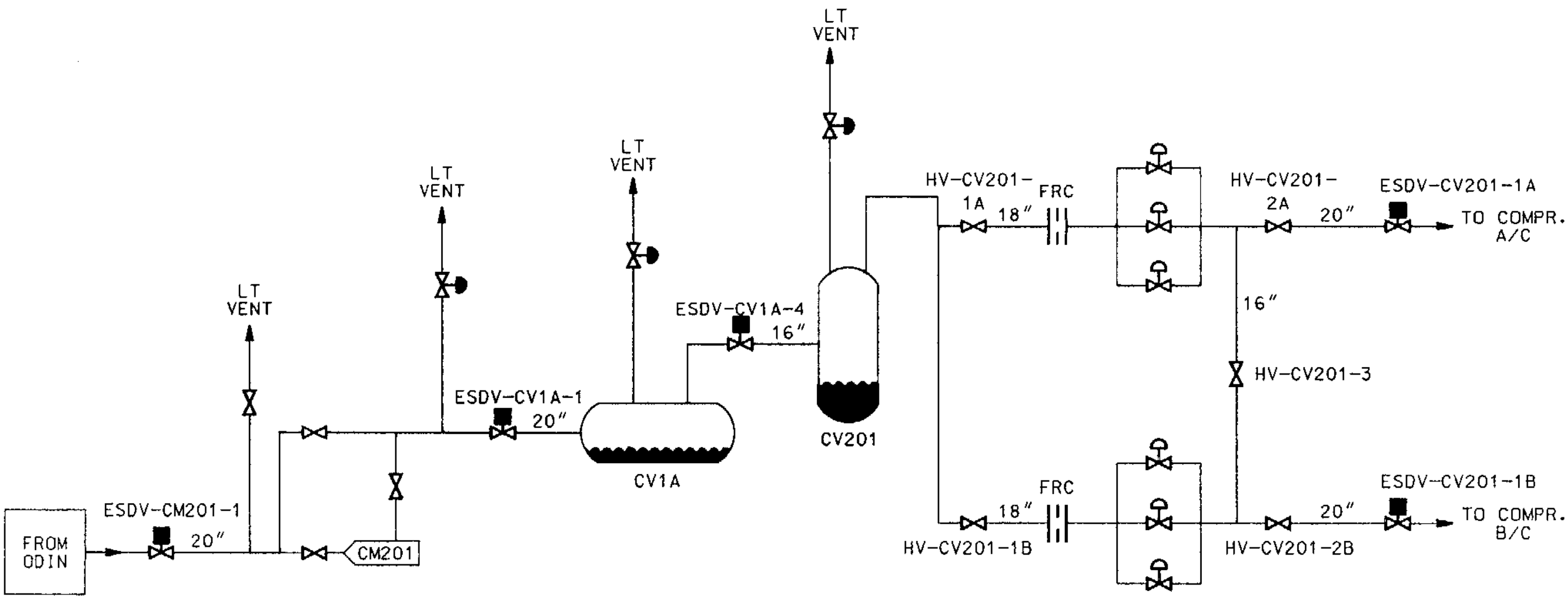
ODIN MAIN GAS



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ISSUE 1, AUG.-91

DIAGRAM 4.4.2

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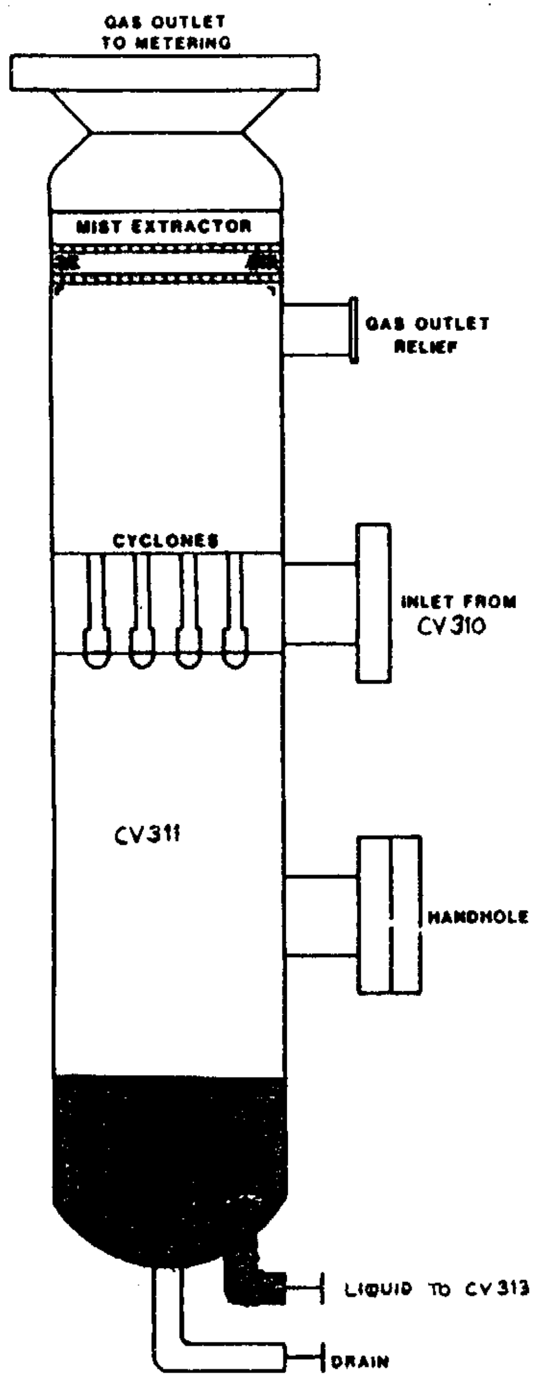
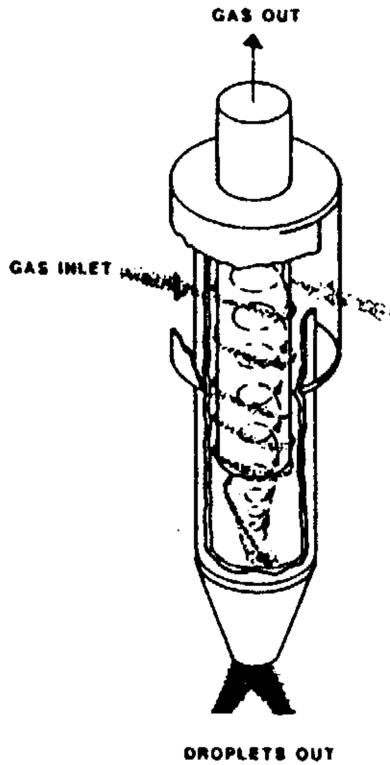
CV311





CYCLONE WORK
PRINCIPLE

ISSUE 1, AUG.-91

DIAGRAM 4.4.3

EAST FRIGG TIE-IN GAS SYSTEM

The purpose of the installation is to treat the fluid entering TCP2 from the East Frigg Field. The fluid treatment systems are quite simular to the ones for TCP2 Extension.

Subsea wells effluents are routed to East Frigg tie-in (EFTI) facilities via a 12" sea line. Well effluent consists of hydrocarbon gas, hydrocarbon condensate and methanolated water.

At the arrival on TCP2, the well effluents are routed to CV 310 (EF slug catcher).

No pressure reduction is performed between the sea line and CV 310. However, a choke valve, by-passed in normal operation, is used during start up for treatment facilities pressurization.

Provision is made for installation of additional choke valves for production choking prior to treatment, if required in the future. A pig receiver, CM 210, was used for dewatering purpose of the sea line. After start up, this pig receiver was disconnected and stored onshore.

In vessel CV 310 the gas is separated from the condensate and methanolated water. The operating pressure will vary from 119 bara to 82,5 bara throughout the field life.

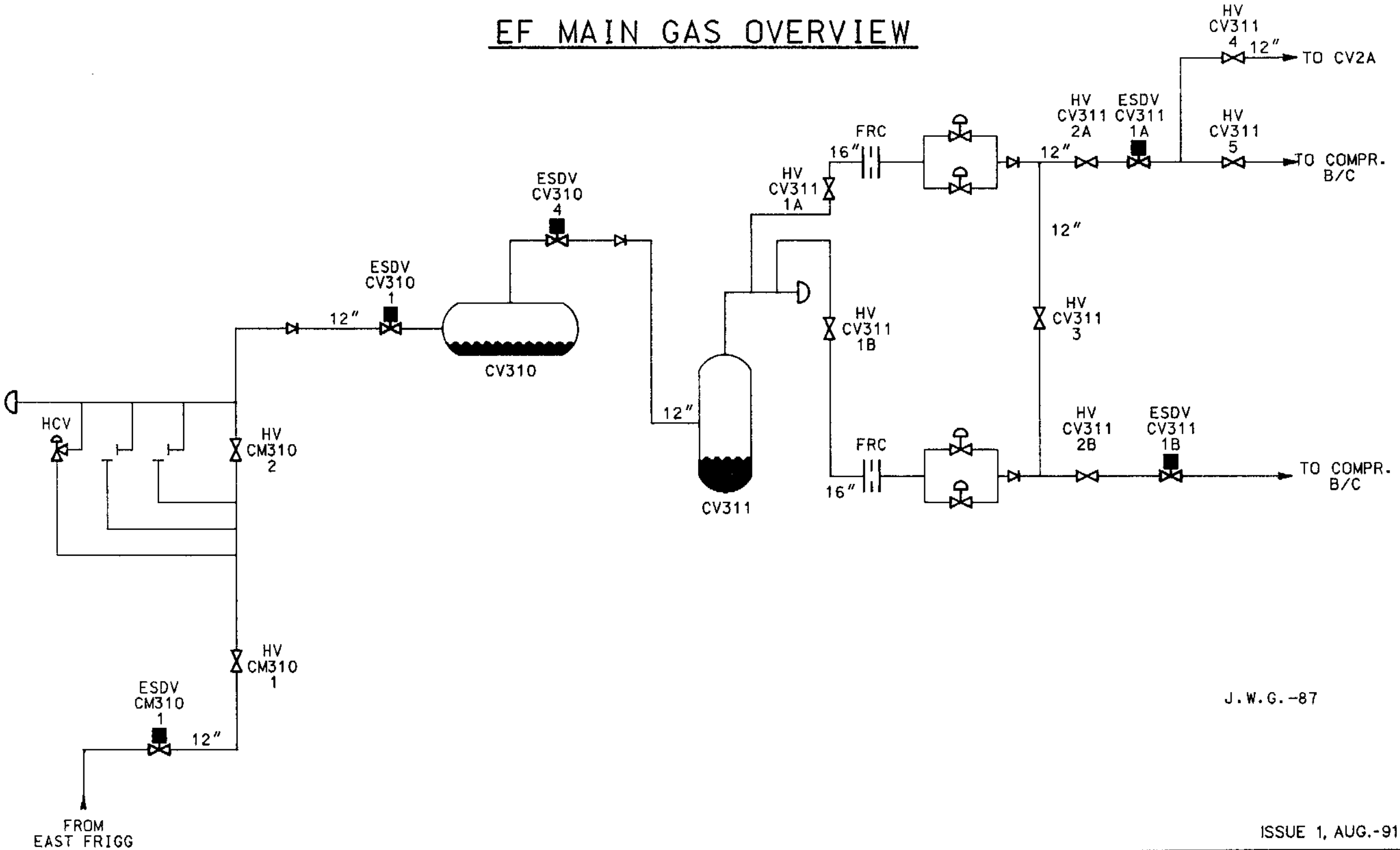
The operating temperature is 5° C (sea temperature).

The slug Catcher effluent gas is sent to the EF Metering Scrubber, CV 311, which will later become the compression outlet scrubber if EF gas compression is required in the future. Operating parameters are the same as for CV 310.

The scrubber outflowing gas is then split in two separate streams and routed to fiscal metering stations A and B.

Gas is finally sent to TCP2 facilities where it is processed together with other Frigg produced streams.

EF MAIN GAS OVERVIEW



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ISSUE 1, AUG.-91

DIAGRAM 4.5.1

91-185b

GAS DRYING AND METERING

GENERAL

Two streams are available for gas drying and metering. Each stream incorporates a glycol contactor, a metering facility and four flow control valves. The gas is dried to the required water dewpoint in the contactor and is discharged from the stream via the metering facility and the flow control valves. Gas from Frigg, EF, NEF and Odin are mixed before they enter these streams.

DESCRIPTION

Gas directly from the FWKO separator or from the compression train enters the glycol contactor, in which it passes upwards through eight "bubble cap" trays. The gas is discharged from the top of the vessel via an 18in line.

Lean glycol from the reboiler is pumped into the contactor near the top and flows down over the bubble cap trays, absorbing any water vapour by intimate contact with the gas. From the base of the vessel, the rich glycol is let down under level control to return to the reboiler. Choke valves in the rich glycol outlet line restrict the flow should the level control valves open fully.

CV2 has a maximum working allowable pressure of 171 barg, which is higher than the static wellhead pressure. CV2 is protected against fire risks by two pressure safety valves set at 171 barg. Emergency shutdown isolation is provided by ESD block valves in the gas inlet line, in the rich glycol outlet line, and in the dry gas outlet line downstream of the metering station. One ESD blowdown valve is connected to the dry gas outlet for decompression of CV2 and the metering station. ESD blowdown valves connected to the dry gas outlet for decompression of CV2 and the metering station. ESD blowdown valves connected to the wet gas inlet line upstream of ESD block valves are for decompression of the pipe between CV1 and CV2.

The total treated gas from each of the two streams is metered by two flow elements installed in parallel. Each flow meter is provided with flow, pressure, temperature and density transmitters which send signals to the metering computer (Spectra-Tek) also signals go to main computer and recorders on QP.

From the paired flow elements gas is discharged to the sales gas header through four flow control valves installed in parallel. Each flow control valve, which is equipped with a downstream silencer, opens and closes in response to signals from the QP computer, and/or the associated flow element. These valves, which close when activated by a high or low pressure in the sales gas header or in the dry gas interconnection, are part of sales gas header primary protection.

Emergency shutdown (ESD) block valves are incorporated in the combined outlet from the flow control valves of each stream. The same ESD blowdown valve as for CV2 is used for the decompression of metering facilities. This valve is located at CV2 dry gas outlet.

Metered gas is discharged to the sales gas header via hydraulically actuated hand valves.

To prevent hydrate formation a methanol injection point is provided upstream of each flow control valve. However, if the gas leaving the gas/glycol contactor is out of specification, just minor quantities are to be treated because of limitations in the methanol supply.

DESRIPTION - METERING MICROCOMPUTER SYSTEM

Field instrument input

The field instruments are of electronic type and output signals will in general be a 4 - 20 mA signal. All the field instrument signals are going to the interface room.

Interface room equipment

Field instrument signals enter metering computer via the IS cubicle. Each metering tube has dedicated a 869 R Stream Measurement Microcomputer (SMM). These computers registrates the stream parameters: temperature, pressure, differential pressure and denisty. Condensate microcomputers registrates Turbine meter pulses, pressure and temperature. Each Stream Measurement Microcomputer communicates with two 869V Central Control Microcomputers (CCM) one of which is mounted on each of the treatment platforms TP1 and TCP2 (Interface Room).

Database Microcomputer on QP

Each Central control microcomputer communicates with an 869V Database Microcomputer (DBM) located on the Quarter Platform (QP Control Room).

A separate digital to analouge rack (DAK-rack) operating as a remote peripheral to the Database Microcomputer provide the analouge outputs for pen recorders.

Data transmitted to Central Control Microcomputers and Database Microcomputers.

Cables between the platforms are used to transmit and receive the metering signals.

The main computer on QP Control Room.

In addition to the metering Microcomputer (Spectra-Tek) stream parameters are also transmitted to the main computer on QP Control Room via the telemetry equipment.

East Frigg Field metering computer (M51)

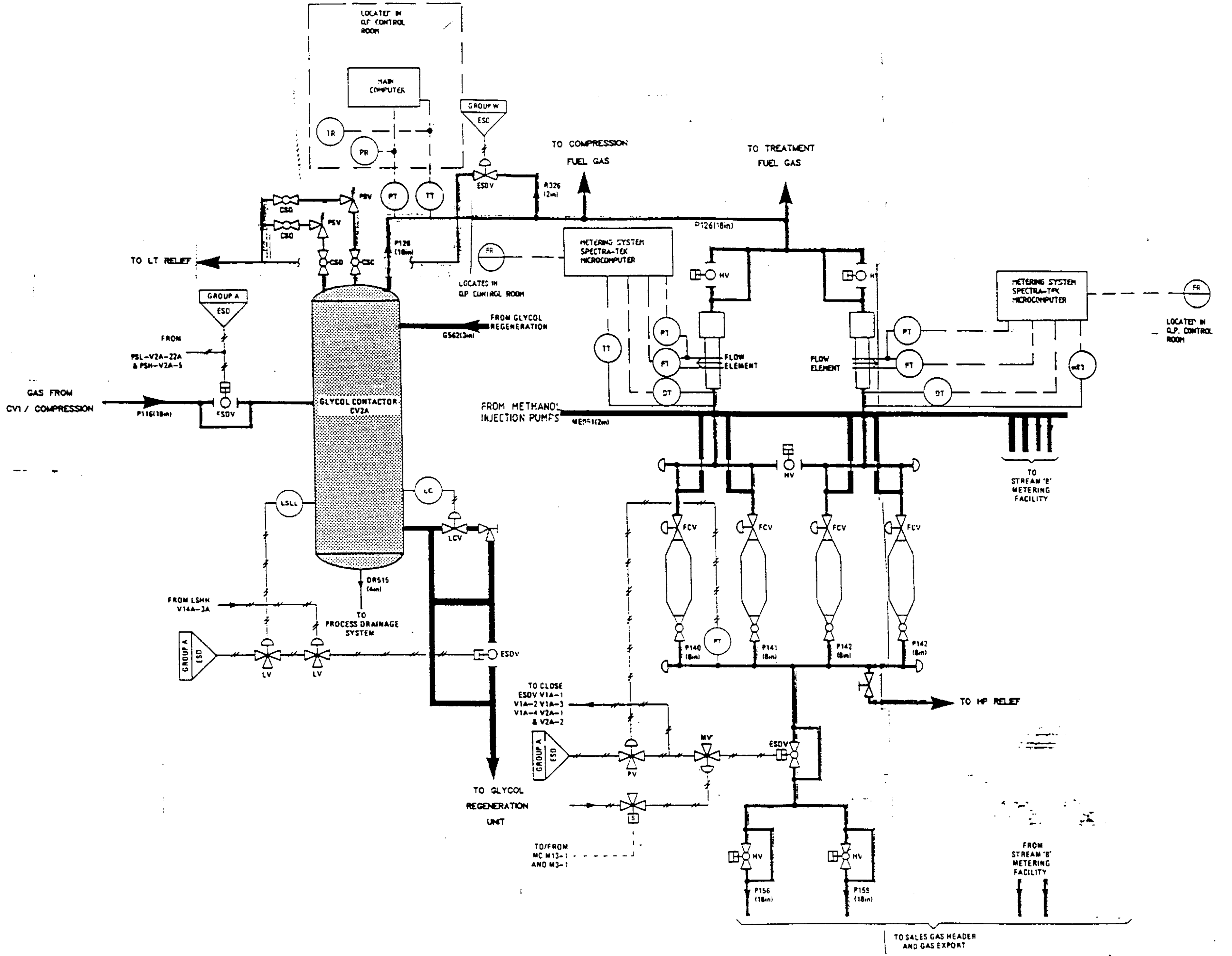
The computer part is based on a duplex concept using two independent and identical computers (mecilec CDX11), assembled in one cabinet located in the instrument interface room. Each computer is interfaced to the field instrument (generally 4-20ma) from the two gas meter run and the condensate meter run via intrinsically safety barrier.

One computer is selected as duty, the other as standby. The computer performs measurements, calculates fiscal quantities and integrates the result into software and mechanical register.

The system computer is linked to the central control microcomputers (CCM1 &CCm2).

The system is operated remotely from the Central Control Room located on QP platform with one visual display unit (VDU) + keyboard and one printer.

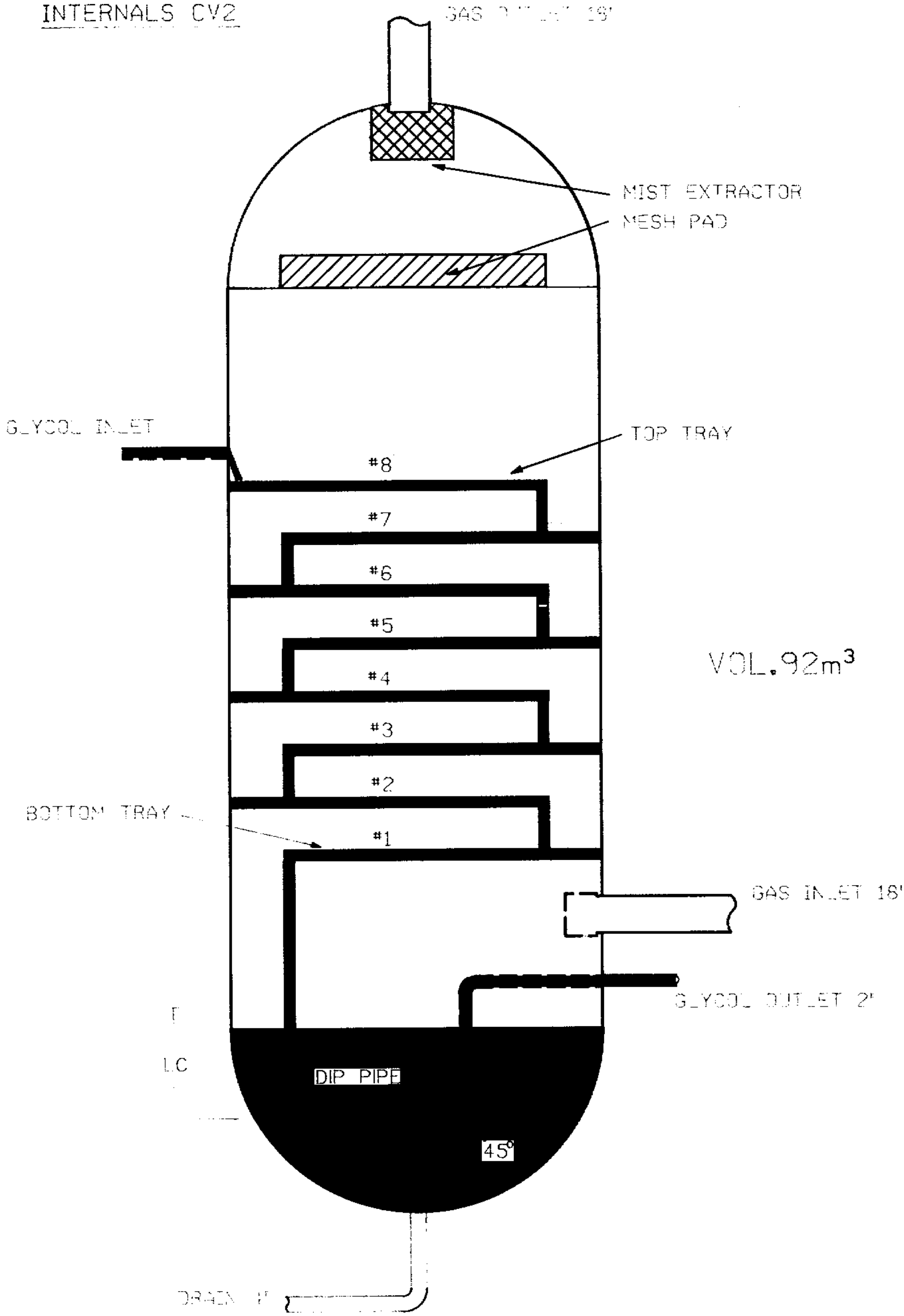
The computer system provides analouge output 4-20mA linked to the Frigg control data aquisition system (FCDA) in order to feed pen recorders in QP Control Room.



ISSUE 4, AUG.-91

GAS DRYING AND METERING 4.6.1

INTERNALS CV2



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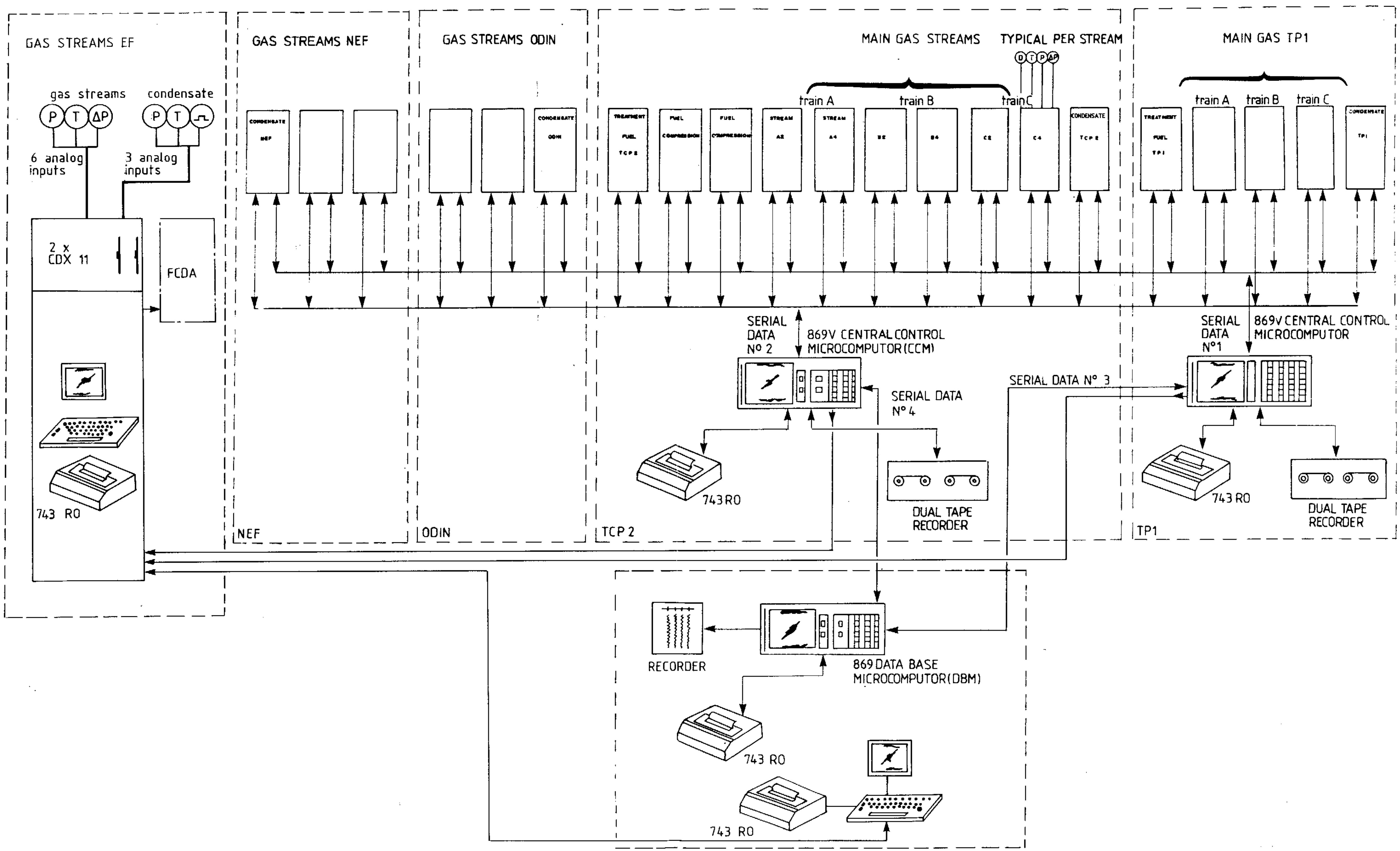
ISSUE 1, AUG.-91

DIAGRAM 4.6.2



ISSUE 1, AUG.-91

SALE GAS METERING MICROCOMPUTER | 4.6.3

SALES GAS HEADER AND GAS EXPORT

Metered dry gas from the three gas treatment streams discharges into the 32in sales gas header. The operating pressure is usually below 148 barg, within a temperature range of 30 to 40° C. The maximum allowable working pressure of the sales gas header is 153.1 barg.

The sales gas header incorporates connections with the two gas treatment streams and pig launcher CM3.

A 32in dry gas interconnection is provided between TP1 and TCP2.

Gas is discharged from the platform through a 32in subsea pipeline which may be isolated from the sales gas header by an emergency shutdown block valve. A pig launcher (CM3) is installed at the inlet of the 32in pipeline. CM3 is isolated from the sales gas header and salesgas pipeline by hydraulically operated block valves.

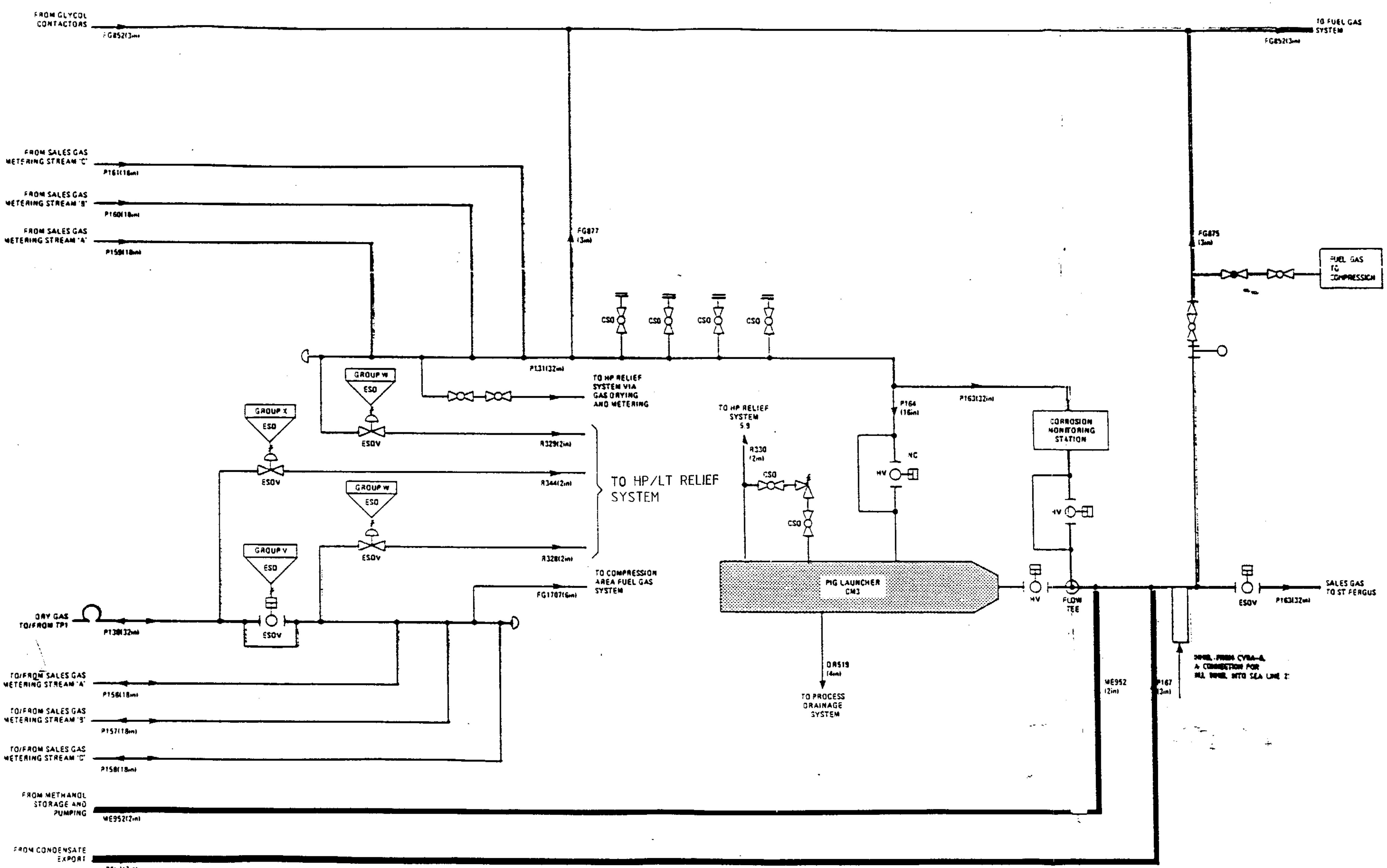
Connections for methanol injection and for the supply of fuel gas are incorporated in the sales gas header and sales pipeline.

The sales gas header is protected against overpressure by the OPPS (Over Pressure Protection Systems).

The 32in sea line to St.Fergus is protected against overpressure by an ESD block valve which closes when the pressure in the sales gas header rises above 152.0 barg.

Emergency depressurisation of the sales gas header and the sales pipeline is by an emergency shutdown (ESD) blowdown valve. Provision has also been made for manual depressurisation of the header, pipeline and CM3.

Recovered condensate is injected into the sales gas pipeline.



ISSUE 1, AUG.-91

SALES GAS HEADER AND GAS EXPORT

4.7.1

CONDENSATE SYSTEM

Recovered condensate from the FWKO separator CVIC is received, collected and distributed by the Condensate Treatment System. Condensate from NEF, Odin and EF is metered and partly treated before sent to this system (see section 4.9B and 4.10B).

The TCP2 condensate system comprises the following:

(a) A 12" hydrocarbon dump header
(b) Condensate surge tank CV3
(c) Condensate return/injection pumps CP 2A/2B
(d) Condensate storage tank CV33

Liquid from the FWKO separators is led to condensate surge tank CV3, which operates at 15 bara, via the 12in hydrocarbon dump header. The PCV CV3-8 installed in the header will close to isolate FWKO condensate should the liquid level or pressure in CV3 rise above 16.38 bara. Downstream of the PCV the header receives liquid from condensate storage, condensate slops and from the level valves down stream of the condensate return pumps.

Condensate from the surge tank CV3 feeds the suction side of condensate return/injection pumps CP2A/B. They are positive displacement pumps, each having a capacity of 20 M^3/hr. at a differential pressure of 153 barg. They are driven by 130 KW electrical motors.

CP2B is operated by manual start and stop, leading to batchwise condensate injection. The CP2A is continuously running. A 45 KW servo-motor is installed for remote control of the variable speed drive (gear) connected to the pump, which is controlled by a level controller on the surge tank. The pump will recycle at 2M^3/hr. and inject at 3M^3/hr. Operation of the pump ensures a continuous flow through the condensate water analyser, which is installed upstream the pumps. The water analyser will override the level controller on the surge tank to avoid injection of condensate in which the water content exceeds 0,5%.

Entrained water separated from the condensate is let down from the base of CV3 to the oil skimmer CV5 (see section 4.8 water treatment system) under the control of an LCV.

Should the condensate return system be unable to cope with the condensate flow, the excess is let down via an LCV to condensate recycle tank CV33 (storage system).

Condensate off-gas is discharged to the Fuel Gas System via a PCV. If the demand for Fuel gas is low, surplus off-gas is discharged to HP relief via a PCV. The surge tank is protected against overpressure by safety valves installed in parallel and set to lift at 19.98 bara.

Selection of either duty turbine input for totalisation and flow indication is entered by command (Metering Microcomputer). If the flowrate values from two meters deviate beyond a pre-set threshold an alarm is raised. Downstream of the flow meters the condensate pressure and temperature are measured. The computer registers the stream parameters (flow, pressure and temperature). The flow is recorded in Q.P. control room (flow recorder panels).

Condensate may be pumped to TP1 for injection into sealine 1 via a 3in line installed downstream of the flow meters. An emergency shutdown valve isolates the interconnecting line in an emergency.

Condensate is injected into the 32in subsea gas line and recovered for further processing at St Fergus.

The NEF/Odin and EF condensate systems are quite identical. The purpose of the systems is to separate condensate and methanolated water.

The liquid and gas are separated in the FWKO separators and gas scrubbers. The liquid is directed through heat exchangers, using TEG as heat transfer medium. The liquid is heated to approximately 35° C to improve the condensate methanolated water separation in the separators CV 204/213/313. The working pressure in these vessels is approximately 18-20barg.

The gas outlet is routed to TCP2 LP vent system. The condensate, separated in the liquid phase upper layer, is withdrawn by a piping internal extension and sent for fiscal metering, prior to the condensate collection in existing TCP2 condensate surge tanks, CV3.

The methanolated water, separated in the liquid phase lower layer are sent to methanolated water flash drums CV220/320.

In the event that recovered condensate is not to be exported through the sea line, the condensate is stored in this system where it is held for subsequent recycling.

The system comprises the following:

(a) Condensate recycle tank CV33.
(b) Condensate recycle pumps CP15A and B.

Recycle tank CV33 has a maximum working pressure of 0.27 barg. A gas blanket (under pressure control) is maintained in the vessel via tappings from the Fuel Gas System.

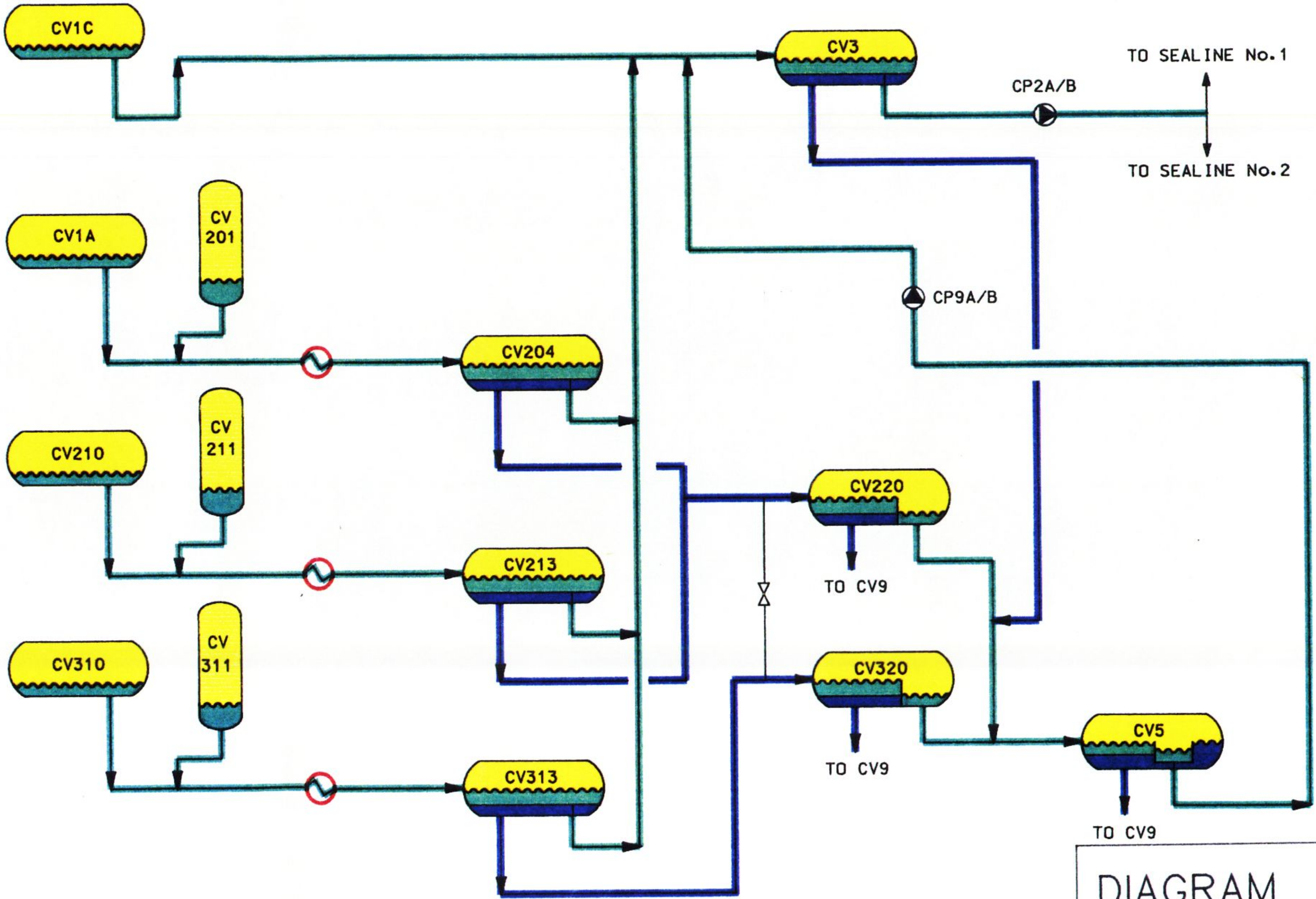
Recycle tank CV33 is protected against over/under pressure by a pressure/vacum relief valve and against overpressure by a pressure safety valve.

Condensate recycle pumps are motor driven, each having a discharge rate of $20m^3/h$ at 18.53 bar. The pumps run one duty, one standby, and are started by local pushbuttons and stopped by a low level signal from the recycle tank.

The condensate recycle pumps take suction from CV33 and discharge to the Condensate Collection System on TCP2.

CV33 can be used as storage tank for meth/water. In this case CP15 A/B will pump directly to injection well on DP2.

CONDENSATE SYSTEM - TCP2



ISSUE 1, AUG.-91

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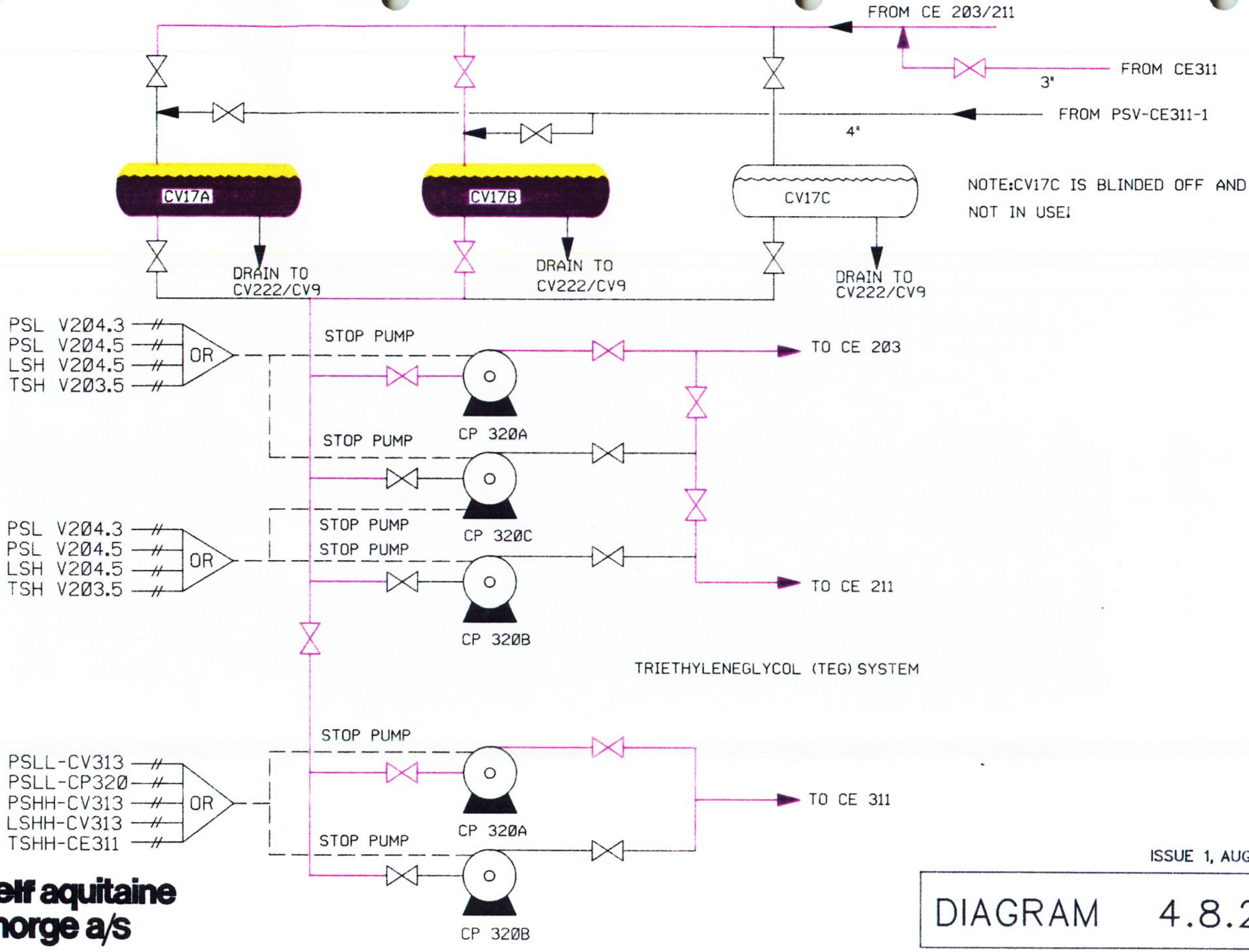
DIAGRAM 4.8.1

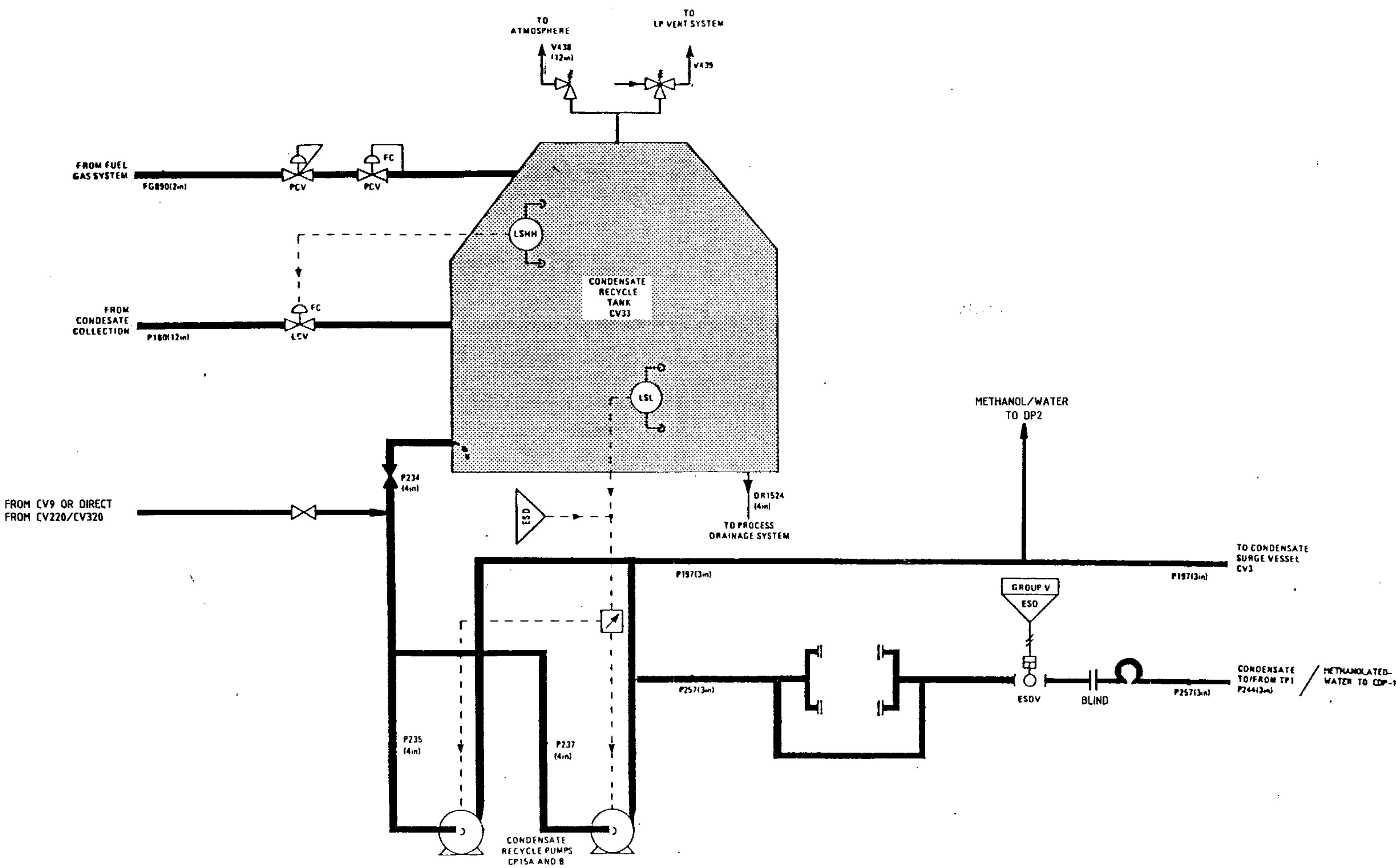


TRIETHYLENEGLYCOL (TEG) SYSTEM

ISSUE 1, AUG.-91

DIAGRAM 4.8.2

elf aquitaine norge a/s



ISSUE 4, AUG.-91

CONDENSATE STORAGE	4.8.3

WATER TREATMENT

Oily water drainage is collected and treated in the Water Treatment System, which separates entrained water, and recycles the condensate.

The system comprises the following:

(a) Oil skimmer CV5
(b) Slop oil pumps CP9 A/B
(c) Methanolated water storage tank CV9
(d) Methanolated water pumps CP 222 A/B
(e) Methanolated water/condensate transfer pump CP 15 A/B.

The oil skimmer receives all the low pressure oily water from extension EF, the treatment and compression areas. The oil skimmer is a horizontal 3-phase vessel with capacity of 3000 bbl/d, in which the water and condensate are separated out.

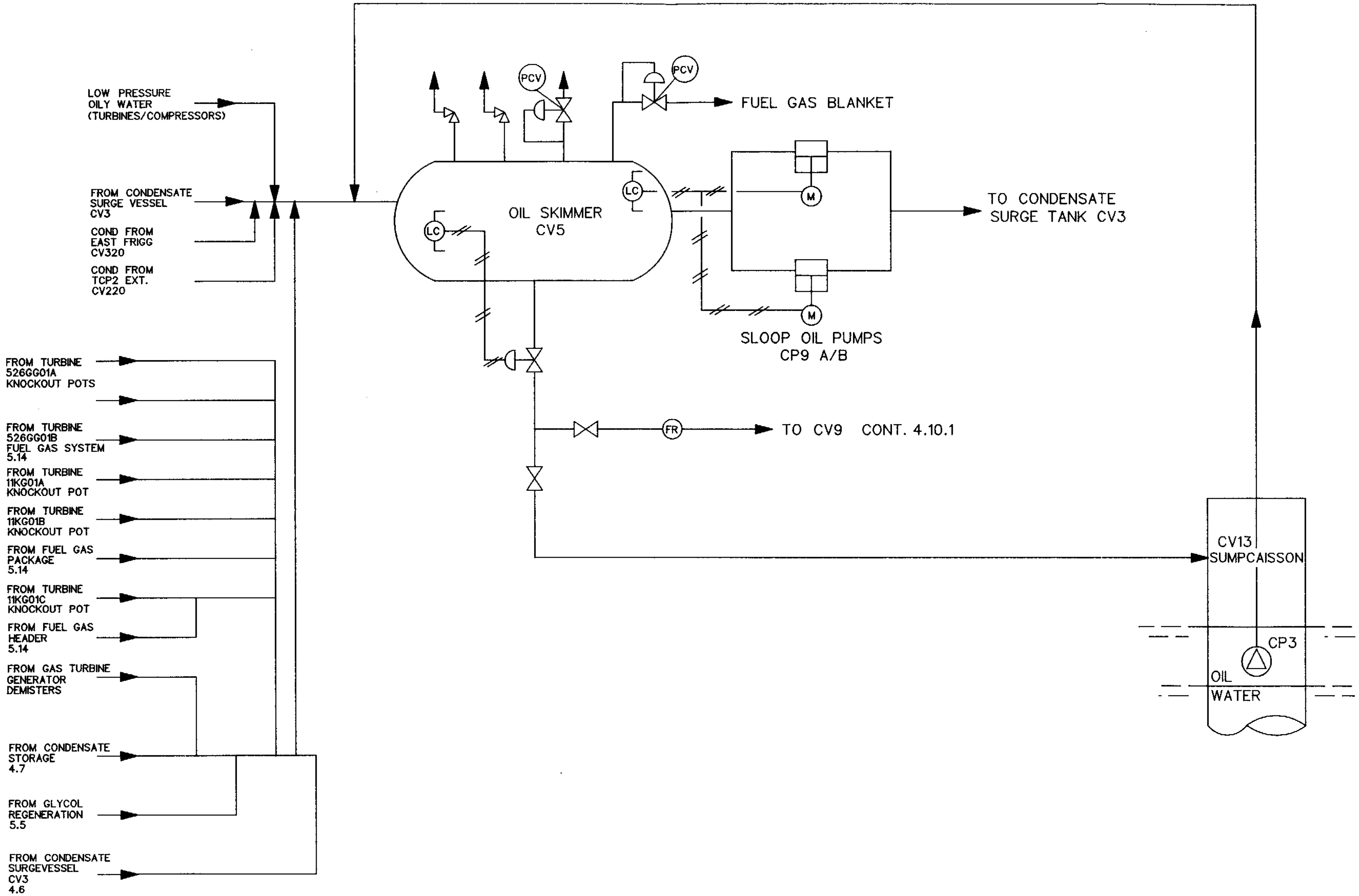
A gas blanket under pressure control is maintained in CV5 via a tapping from the fuel gas system. The vessel operates at 0.8 barg at a temperature close to ambient, and is protected against overpressure by duplicate pressure safety valves.

Slop oil pumps CP9A and B take suction from CV5 and discharge to condensate surge vessel CV3. The motor driven pumps are reciprocating type, each having a capacity of 38 litres/min. at 0.8 barg suction pressure, and 20 barg discharge pressure. The discharge of each pump is protected against overpressure by a safety valve.

The water from CV5 is sent to the methanolated water storage tank CV9 together with the methanolated water from NEF, EF and Odin (see section 4.10).

The polluted water from CV9 is continuously filtered and pumped by CP222 A/B or if a higher pressure is required by CP15 A/B, into the injection well on DP2.

In case of capacity problems with CV9, CV33 (condensate storage vessel) can be used as methanolated water storage.



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WATER TREATMENT 4.9.1

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METHANOLATED WATER TREATMENT

The purpose of this system is to separate condensate and methanolated water prior to injection of methanolated water on DP2.

The system comprises the following:

(a) Condensate methanolated water separator CV204/CV213/CV313

(b) Methanolated water flash drum CV220/CV320

(c) Methanolated water tank CV222

(d) Methanolated water storage tank CV9

(e) Methanolated water injection pumps CP222 A/B

(f) Methanolated water filter unit on TCP2, CV49.

The methanolated water flash drum receives methanolated water from the condensate methanolated water separators. In this flash drum the condensate is separated from the methanolated water. The vessel operates at 10 barg and 20°C. Fuel gas is used as a blanket gas. The drain is directed to the methanolated water tank CV222.

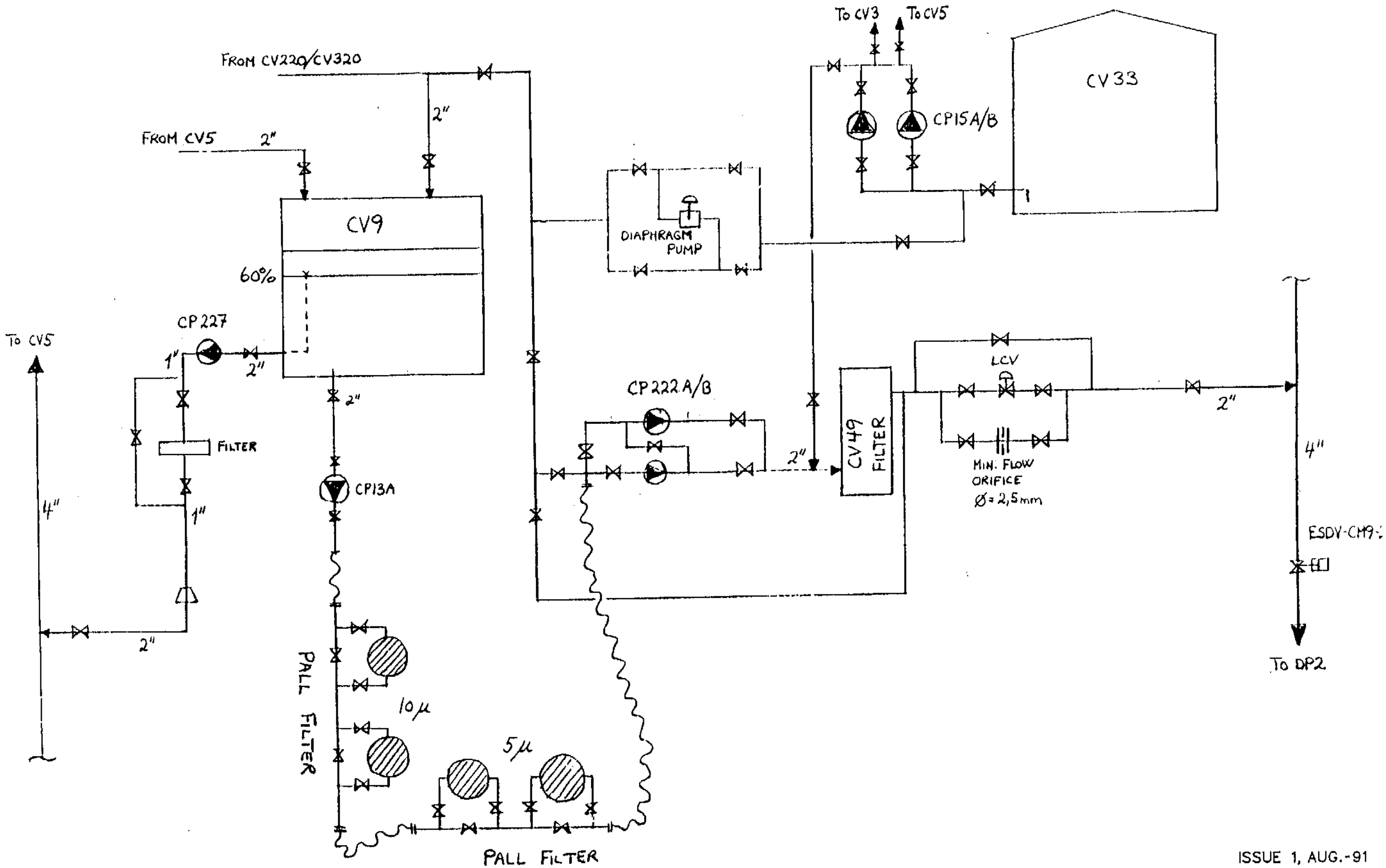
The condensate from CV220/CV320 flows under level control to the oil skimmer CV5, which is part of the condensate system.
The methanolated water from CV220/320 is transferred to the methanolated water storage tank CV9, or it can be directly injected into the injection well. Direct injection without settling in CV9 shall be avoided to prevent plugging in the well.

The remaining condensate in the methanolated water is withdrawn in CV9 by keeping a constant level in the tank. Condensate separated at the surface of the methanolated water is pumped by CP227 to the oil skimmer CV5.
CV9 operates at atmospheric pressure and the capacity is $99M^3$. Nitrogen at 10mb at a flow of approximately $4M^3$/hr. is used as blanket gas to prevent ingress of oxygen.

The methanolated water from CV9 is continuously pumped by CP222 A/B, or CP15 A/B to well 3 on DP2. CP222 A/B are electrical motor driven pumps each having a capacity of $3M^3$/hr. at a delivery pressure of 13barg.
The pumps can be run in series when higher injection pressure is required. CP15 is vertical sentrifugal pump with 35 bar delivery pressure.

The methanolated water is filtered before injection into the well. the filter FA106 located on DP2 is considered as a supplementing filter to the main filtration installed on TCP2, downstream the pump.

METHANOLATED WATER DISPOSAL SYSTEM



ISSUE 1, AUG.-91

DIAGRAM 4.10.1

CHAPTER 5

UTILITIES

CONTENTS

Section	5.1	Power Generation and Inter-platform Electrical Connections
	5.2	Electrical Power Distribution
	5.3	Emergency Supplies
	5.4	Battery Supported Supplies
	5.5	Glycol regeneration
	5.6	TCP2 Extension TEG System
	5.7	Bulk Storage of Glycol
	5.8	LP Vent System Treatment Areas
	5.9	LP Vent System TCP2 Extension
	5.10	LP Vent System Compression Areas
	5.11	HP Relief System
	5.11.1	LT Relief System
	5.11.2	LT Relief System - EF
	5.12	HP Relief TCP2 Extension
	5.13	LT Relief System TCP2 Extension
	5.14	Methanol Storage and Injection
	5.15	Washdown System
	5.16	Drainage System
	5.17	Fuel Gas System Treatment Areas
	5.18	Fuel Gas System Compression Areas
	5.19	Fuel Gas for TCP2 Extension
	5.20	Diesel Fuel System
	5.21	Cancelled (see Chapter 5.22)
	5.22	Compressed Air Supply for Central Complex and DP2
	5.23	Ventilation System Treatment Areas
	5.24	Ventilation System Compression Areas
	5.25	Hydraulic Systems Treatment Areas
	5.26	Hydraulic Systems Compression Areas
	5.27	Cooling Water Systems Compression Areas
	5.28	Desalinated Water Systems Compression Areas
	5.29	Normal Lighting
	5.30	Nitrogen System
	5.31	Corrosion Inhibitor Injection System

DIAGRAMS

Diagram	5.1	Power Generation and Inter-Platform Electrical Connections
	5.2	Electrical Power Distribution
	5.3	Emergency Supplies
	5.4.1	Battery-supported Supplies - Treatment Areas
	5.4.2	Battery-supported Supplies - Compression Areas
	5.5	Glycol Regeneration
	5.6	TCP2 Extension TEG System
	5.7	Bulk Storage of Glycol
	5.8	LP Vent System Treatment Areas
	5.9	LP Vent System TCP2 Extension
	5.10	LP Vent System Compression Areas
	5.11	HP Relief System
	5.11.1	Cold Vent System
	5.12	HP Relief TCP2 Extension
	5.13	LT Relief System TCP2 Extension
	5.14	Methanol Storage and Injection
	5.15	Washdown System
	5.16.1	Drainage System Process
	5.16.2	Drainage System TCP2 Extension
	5.16.3	Drainage System Compression Areas
	5.17	Fuel Gas System Treatment Areas
	5.18	Fuel Gas System Compression Areas
	5.20	Diesel Fuel System
	FF 85 00 01 5007	Schematic of new compressed air network
	5.22	Air reservoir lines
	5.23	Ventilation Systems Treatment Areas
	5.24	Ventilation Systems Compression Areas
	5.25	Hydraulic Systems Treatment Areas
	5.26	Hydraulic Systems Compression Areas
	5.27	Cooling Water Systems Compression Areas
	5.28	Desalinated Water Network
	5.29.1	Normal Lighting - Treatment Areas
	5.29.2	Normal Lighting - Compression Areas
	5.30	Nitrogen System
	5.31	Corrosion Inhibitor Injection System

POWER GENERATION AND INTER-PLATFORM ELECTRICAL CONNECTIONS

1. GENERAL

1.1 The Quarters and Treatment platforms QP, TP1 and TCP2 are joined by bridges which carry interconnecting cables. Submarine cables link TCP2 and TP1 with platforms DP2 and FP respectively.

1.2 Under normal operating conditions power for the whole complex is generated at 5,5 kV by two 13.7 MW gas turbine-driven generators in the TCP2 compression area. TP1 platform has three 2.8MW gas turbine generators but these are passivated and no longer in use. Motor Control Centres on all the platforms are fed with 380V from 5500/380V transformers. Smaller diesel driven generators on DP2, QP and TCP2 compression areas provide 380V standby supplies (DP2), or emergency supplies (QP, TCP2).

1.3 Dual interconnections between TCP2 (compression), QP, TP1 and TCP2 (treatment) busbars are provided by 5.5 kV radial feeders so that, in the event of one cable failing, power can be maintained to each switchboard. Supply to DP2 is a radial feeder from TCP2 5.5 kV busbar. The Flare Platform (FP) is normally fed at 380V by a 4-wire submarine cable from TP1, but due to a malfunction of this cable, power is currently being supplied through a multicore control cable. East Frigg (EF)subsea installations are fed at 950V by two multicore submarine cables from a dual UPS system at TCP2. North East Frigg (NEF) is fed by a 3-wire submarine cable from TCP2 5.5 kV busbars via a 5.5/12 kV transformer. Arrangements are provided for isolating and earthing of all interconnecting cables between platforms.

2. DESCRIPTION

2.1 Generation

2.1.1 Main power is generated at 5.5 kV, 3-phase, 50 Hz by two gas turbines driving 13.7MW (17.15 MVA) Stal-Laval/ASEA generators 52G01 A and B in Pancake 44. These are duel fuelled, able to run on gas or diesel oil. Only one machine is running at a time and this is capable of supplying all the electrical power for the whole field. The second is in automatic standby position.

2.1.2 TP1 platform is fitted with three Rustons gas turbines driving 2.8MW (3.5MVA) generators TA1, TA2 and TA3. These units are passivated and are no longer in operation.

2.1.3 The 5.5 kV system is earthed throughout 17 ohm neutral earthing resistors, one for each main or standby generator.

2.1.4 52G01 A and B are dual fuelled, running on gas or diesel. The sets normally run on gas but will automatically change over to diesel if the gas pressure falls below a predetermined level. Reversion to gas operation is manual only.

2.1.5 52G01 A and B are air started from a discrete air system consisting of two air receivers and three small compressors. One air receiver and electric driven compressor support each turbine. A third diesel driven compressor is used in emergency and can be used to charge either air receiver.

2.1.6 The main generators are capable of being synchronised and operated in parallel if necessary. Their combined fault level is 175MVA (23KA symmetrical) at 5.5 kV.

2.2 Switchboards and Switchgear

2.2.1 The location of the 5.5 kV switchboards making up the 5.5 kV supply network are as follows:

(a) TCP2 Compression Area - Main Substation Module 32.
(b) TCP2 Treatment Area - Switchboard, Cellar Deck, Mezzanie
(c) TP1 - Switchboard Room, Cellar Deck, zone 26
(d) QP - Switchboard Room L26, Lower Level
(e) DP2 - Substation, Module 4, First Level.

2.2.2 The main 5.5 kV switchgear has a design fault rating of 350MVA (37kA symmetrical) at 5.5 kV for one second, but the actual fault level of the system with both main generators running is approximately 175MVA.

2.2.3 The remaining switchboards have a service rating of 800A and a design symmetrical fault rating of 290MVA (30kA symmetrical) at 5.5 kV; the actual fault level is about 120MVA.

2.2.4 The circuit breakers on the boards are of the air break type; those on the main board are motor/spring operated, the remainder are solenoid operated. The tripping and closing coils operate on a 110V dc control supply from locally situated batteries and chargers.

2.2.5 The kV switchboard on DP2 is fed from 5.5kV switchboard, TCP2 treatment area via ACB 308.

3. CONTROL

3.1 Control of the whole Frigg field electrical system is exercised from a central electrical control board in the MCC Room in TCP2 treatment areas.

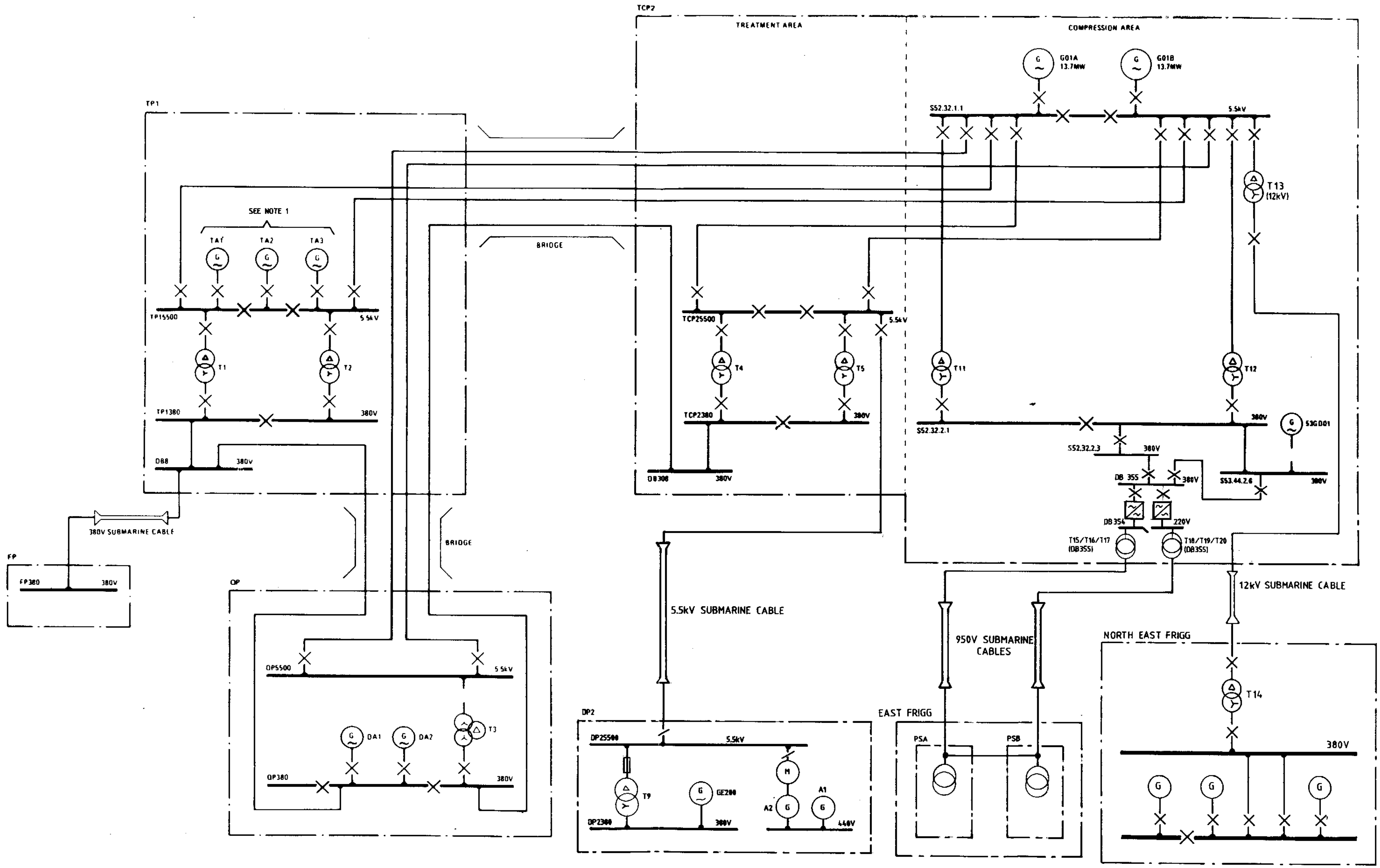
3.2 A mimic diagram on the electrical control board represents the layout of the system and discrepancy switches, set in the mimic, control the various circuit breakers remotely.

3.3 For each of the two main generator sets, a remote control unit is provided to start and stop the set and to provide the controls and indications necessary for its operation.

3.4 Synchronising of incoming generators is carried out automatically, or by manual control using a synchronising trolley at the associated switchboard. Where synchronising is carried out between different parts of the network (eg interconnector feeders) manual control at the switchgear is used. The synchronising trolley is equipped with a check synchroniser unit which permits the circuit breaker to be closed only when the frequency, voltage and phase angle of the incoming supply coincides with these values for the running supply.

3.5 Main generator set gas turbines are monitored from local control rooms located within the generator module. Each of the main generators may be controlled from remote control boards located in TCP2 treatment MCC Room.

3.6 Gas generator enclosures and gas/diesel fuel units are protected against fire by Halon systems which operate automatically or manually. Gas detection facilities are provided which will increase the ventilation rate if gas is detected, or will stop the generator if a high gas concentration is detected.



FOR MORE DETAILED INFORMATION
SEE FF00.23.00.0001.

NOTE 1: GENERATORS TA1, TA2 AND TA3 ARE
PASSIVATED AND NO LONGER IN USE.

ISSUE 5, AUG. 1991

POWER GENERATION AND INTER-PLATFORM ELECTRICAL CONNECTIONS	5·1

ELECTRICAL POWER DISTRIBUTION

1. 5.5 kV SUPPLIES

1.1 The outputs from main generators 52G01A and B feed 25-panel 2000A main switchboard S52.32.1.1. The switchboard consists of 12 circuit breaker panels to control the incoming and principal outgoing circuits, 11 contactor panels to control high voltage motors, and transformers and 2 empty spare panels.

1.2 The busbar is divided into three sections (A, B & C) by two bus-section circuit breakers. Section A and B are supplied by one of the two main generators. Sections A and B independently feed sub-distribution 5.5 kV switchboards in the treatment section of TCP2, in TP1 and in QP. Sections A and B also feed step-down transformers for energising low voltage switchboards in the compression areas. Section A and C feed high voltage motors.

1.3 The outputs from main switchboard busbars A and B, feed 13-panel 800A TCP2 treatment area switchboard TCP2 5500. TCP2 5500 is divided into three sections (A, B and C) by two bussection circuit breakers. Section A and C are supplied from S52.32.1.1 Sections A and B respectively.

1.4 Main Switchboard busbar B also feeds North East Frigg (NEF) through transformer T13 which transforms the voltage up to 12 kV. The electrical power is supplied to NEF via a common 12 kV/signal subsea cable. The subsea cable is spliced at both ends.

2. POWER TRANSFORMERS

2.1 Seven power transformers are installed on TCP2 as follows:

(a) T11 and T12, each rated at 2500 kVA fed from the 5.5 kV main switchboard and supplying the 380V main switchboard.

(b) T9 and T10 each rated at 1000 kVA fed from the 5.5 kV main switchboard and supplying two 380V fuel gas heater switchboard.

(c) T4 and T5, each rated at 1000 kVA fed from TCP2 treatment 5.5 kV main switchboard and supplying TCP2 treatment 380V main switchboard.

(d) T13, rated 630 kVA fed from 5.5 kV main switchboard and supplying 12 kV to NEF.

All except T13 have a nominal ratio 5500/380V with HV off-load tappings of +/- 2.5% and +/-5%. T13 has a nominal ratio of 5.5/12 kV with HV off load tappings of +/- 2.5%. All are Star/Delta connected to Dy 11 with secondary neutral brought out, and solidly connected to the earth.

2.2 The primaries are supplied from 5.5 kV switchboards through HV cables. They are controlled by vacuum contactors with back up fuses at the main 5.5 kV switchboard, and by air circuit breakers at TCP2 treatment 5.5 kV switchboard. The secondaries of T9, T10, T11 and T12 are connected to their LV switchboards by single core cables, several in parallel per phase. T4 and T5 secondaries are connected by solid bar conductors through ducts. The secondary of T13 is connected to SCB 801 by a 3 x 25mm^2 RFOH cable. From SCB 801 a 3 x 25 mm^2 RFOH cable is routed to column 5 where it is spliced with the subsea cable.

2.3 T9, T10, T11 and T12 are oil-filled and cooled by natural circulation. They are fitted with conservators and are protected by Georgin over temperature devices. T4 and T5 are dry type (cast resin) air cooled by natural circulation and are type ASEA Lepper Dyvhk. Over temperature protection is controlled by Siemens 3UN8 relays. Electrical protection is by overcurrent and earth fault relay at the associated HV switchboard, and by overcurrent and earth fault relay (restricted earth fault in the case of T4 and T5 only) at the associated LV switchboard incomer. T13 is a dry type transformer cooled by natural circulation. Overtemperature and loss of SF6 pressure protection are provided. Electrical protection on 5.5 kV side (Primary side of transformer) is by overcurrent and earth fault relay. On 12 kV side (Secondary side of transformer), the electrical protection consists of negative sequence thermal overload relay, overcurrent and earth fault relay.

3. 380V SUPPLIES

3.1 General

3.1.1 The 380V 'low voltage' system comprises a large number of separate LV switchboards and distribution boards. Only those LV switchboards directly supplied through transformers from the 5.5 kV system and the emergency switchboards will be described.

3.1.2 To avoid the different sides of the 5.5 kV system being accidently parallelled out of synchronism through the transformers, the bus-section breakers on the HV switchboards are normally kept closed. If an HB bus-section breaker is open the corresponding LB bus-section breaker is interlocked so that it cannot be closed, or will trip if the HV bus section breaker is opened. The HV breaker or contactor and the LV breaker of each transformer are interlocked so that if the HV breaker is open the LV breaker cannot be closed or will trip if the HV breaker is opened.

3.1.3 In order to keep the fault level within design limits no LV switchboard may be fed by two transformers in parallel. The transformer LV breakers and LB bus section breaker are interlocked so that if both transformer LV breakers are closed the LV bus section breaker cannot be closed. If one transformer LV breaker is closed, at the same time as the LV busbar, the remaining transformer LV breaker cannot be closed (one transformer is capable of supplying the whole switchboard).

3.2 380V Main Switchboard S52.32.2.1 (Compression Area)

3.2.1 S52.32.2.1 provides all the LV power for TCP2 compression areas, with the exception of supplies required for fuel gas heating. S52.32.2.1 is supplied through 2500lKVA transformers T11 and T12. The two incoming and the bus section switch are air break circuit breakers (ACBs) with motor/spring closing mechanisms. The outgoing feeders to the two Motor Control Centres and to the Compression Emergency Switchboard are controlled by normal air break circuit breakers. The remaining outgoing feeders are controlled by moulded-case circuit breakers (MCCBs) backed by HRC fuses.

3.2.2 A separate incomer from the Compression Emergency Switchboard is controlled by ACB650. ACB650 is interlocked with the two incoming ACB's and bus tie (ACB 631-632-633) to prevent it closing if S52.32.2.1 is already being energised from the main supply.

3.2.3 The busbars are rated at 4000A and the switchgear has a design fault level of 50 kA at 380V (33MVA). The two 380V incomer, the bus section and the two interconnection circuit breakers to the emergency board are normally remote controlled from the Central Electrical Control Board; local operation is possible. Remaining breakers are subject to local control only.

3.3 380V Fuel Gas Heater Switchboards S52.32.2.14 and 15 (Compression Area)

3.3.1 S52.32.14 and 15 provide the LV power for fuel gas heating for all fuel gas supplies in the compression areas. Additionally a few small pumps are fed from this board. S52.32.2.14 and 15 are normally supplied through 1000 kVA transformers T9 and T10. Alternative inputs but for limited load from S52.32.2.1 are also provided. The busbar is divided into sections A and B by a bus section switch. The incoming switches are air break circuit breakers (ACBs) with motor/spring closing mechanisms. The bus section switch is a 2500A hand operated switch. All outgoing feeders with the exception of those to heat exchange 50X07E02A and B are controlled by contactors backed by HRC fuses. The exceptions are controlled by ACBs.

3.3.2 The busbars are rated at 2000A and the switchgear has a design fault level capacity of 50 kA at 380V (33MVA). The four incomer circuit breakers are normally remote controlled from the Central Electrical Control Board; local operation is possible. The section switch is subject to hand operation only.

3.4 380V Switchboard TCP2 380 (Treatment Area)

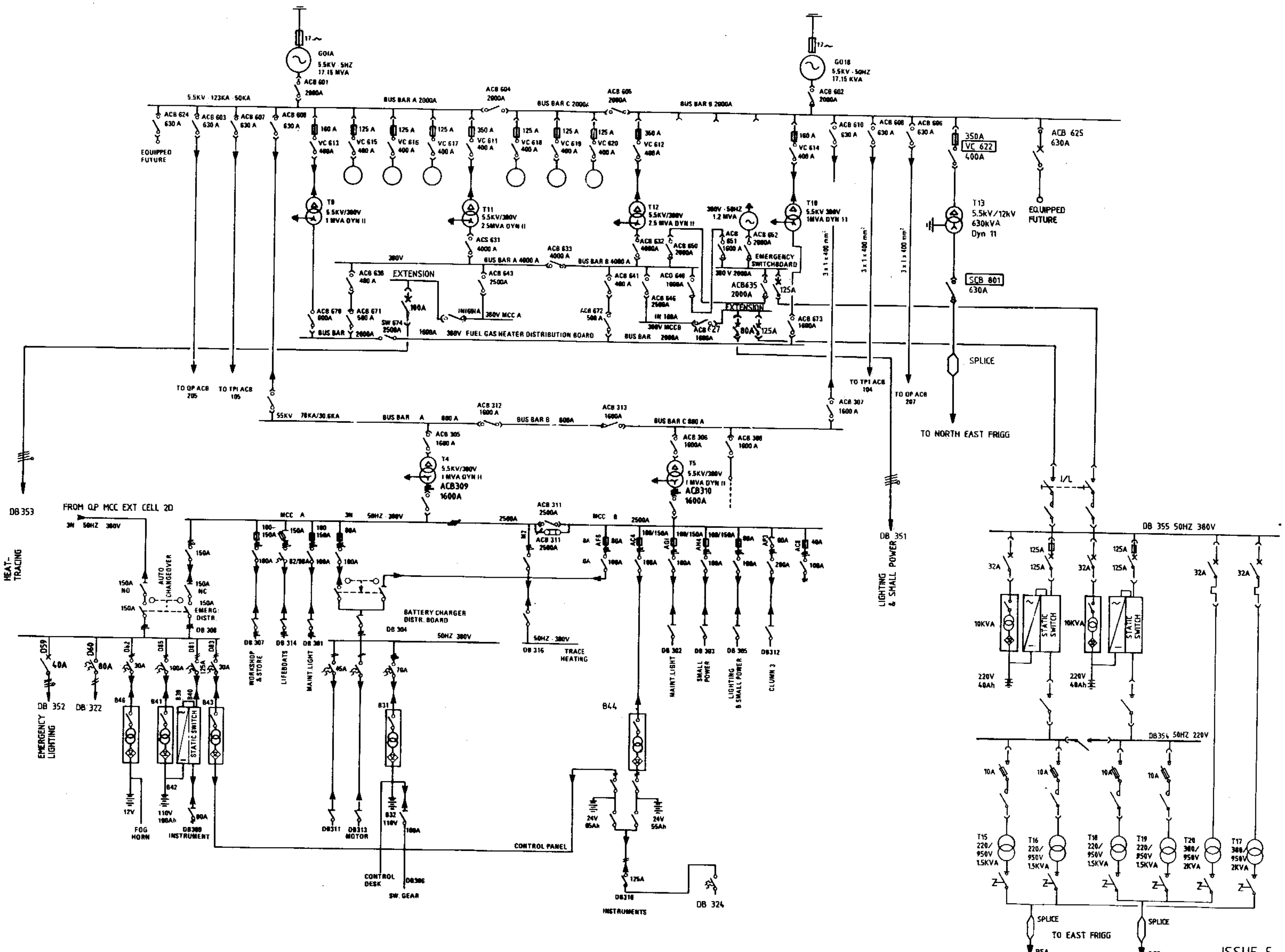
3.4.1 TCP2 380 (also known as the Motor Control Centre (MCC)) provides all the LV power for TCP2 treatment areas. TCP2 380 is supplied through transformers T4 and T5. The board is divided by a 2500A section switch, each transformer supplying one half through a 1600A incomer air break circuit breaker. The design fault level of the MV board and switchgear is 32MVA to handle the combined output of the two transformers. The MCC is located on the Mezzanine level.

3.4.2 Outputs from the 380V switchboard are fed via 132 panels. Those controlling motors are provided with isolating switches, contactors and HRC back-up fuses; those feeding distribution boards mainly have moulded case circuit breakers (MCCBs) and HRC backup fuses.

3.4.3 The isolating switches are capable of breaking the full stalled current of their motor. The contactors provide normal overcurrent overload and earth fault protection and remote start switching, but as their fault capacity is well below the system's 32MVA, the HRC back up fuses are provided, and blow first if the fault current exceeds a contactors capacity.

3.4.4 Fuses provide a similar back up to the MCCBs. These breakers have a maximum breaking capacity of only 8MVA. The fuses deal with all fault currents between this and the design system limit of 32MVA.

3.4.5 Apart from feeding individual motors and heaters, the TCP2 380 switchboard feeds a number of distribution boards.



FOR MORE DETAILED INFORMATION SEE
FF85.23.03.6002 AND FF87.23.00.0073, 0074.

ISSUE 5, AUG. 1991

ELECTRICAL POWER DISTRIBUTION	5.2

EMERGENCY SUPPLIES

1. GENERAL

1.1 TCP2 is provided with a diesel generator which supplies emergency power to the compression areas only. The diesel generator, 53GD01, feeds 380V emergency switchboard S.53.44.2.6, which provides power for the emergency consumers including emergency diesel generator auxiliary switchboard S.53.44.2.7.

1.2 In the event of failure of the diesel generator 53GD01, the emergency generator auxiliary switchboard S.53.44.2.7 has a back up emergency supply from QP diesel generators DA1 and DA2 via the 380V MCC extension. This supply provides the necessary power to the emergency consumers which includes those necessary to start the diesel generator 53GD01 under "black start" conditions.

1.3 The "black start" supply SW699 on emergency diesel generator auxiliary switchboard S.53.44.2.7 is controlled from the central electrical control board ECB 3.

1.4 TCP2 treatment areas rely on QP diesel generators for a supply of emergency power.

2. 380V EMERGENCY SWITCHBOARD S53.44.2.6 (COMPRESSION AREA)

2.1 S53.44.2.6 is normally supplied direct from 380V main switchboard S52.32.2.1. It provides emergency supplies to TCP2 compression areas only and is not interconnected to the treatment areas. Failure of normal power is detected by a busbar transformer and a time delayed under voltage relay which will initiate automatic starting of emergency diesel generator 53G01. When up to speed and fully excited, incomer ACB652 closes automatically and normal incomer ACB651 is locked out. The diesel set will then take the load up to a maximum of 960 kW. When normal supplies are restored the emergency generator is off loaded manually; ACB651 and ACB652 are reset manually and the generator is stopped manually.

2.2 The majority of the outgoing feeders from the emergency switchboard are controlled by MCCBs backed by HRC fuses. Exceptionally the feeders to the 380V emergency diesel generator board and the back feeder to the 380V main switchboard are controlled by ACBs. Both incomers are controlled by ACBs.

2.3 The busbars are rated at 2000A and the switchboard has a design fault level capacity of 50 kA at 380V (33MVA).

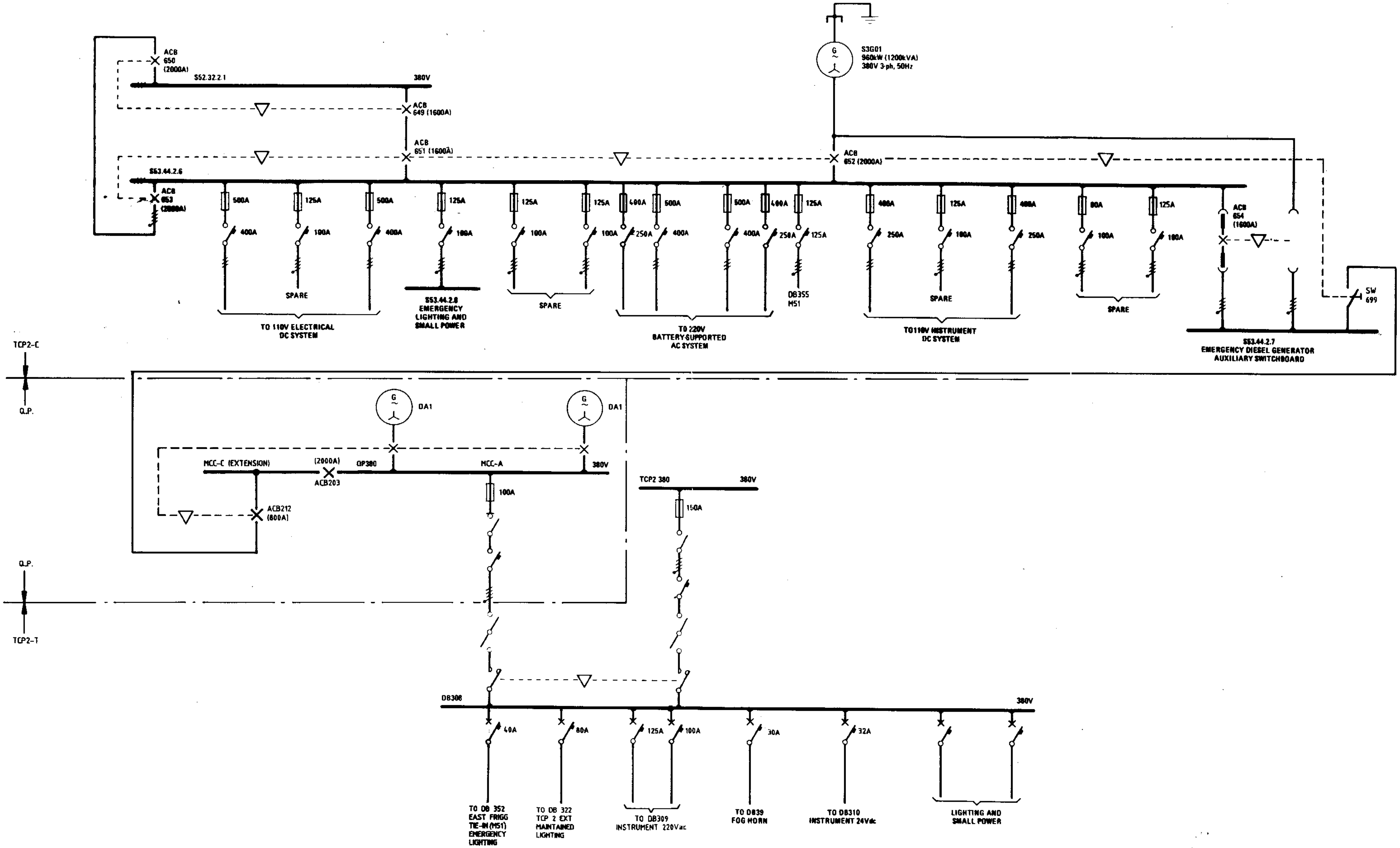
2.4 The interconnector ACBs between the emergency board and the 380V main switchboard are remotely controlled from the Central Electrical Control Board; local control is possible. The emergency generator incomer ACB is normally automatically controlled but may be operated manually.

3. 380V EMERGENCY DISTRIBUTION BOARD DB308 (TREATMENT AREA)

3.1 During normal operation distribution board DB308 (emergency supplies) takes its input from 380V motor control centre TCP2 380. The presence of an input is monitored by a changeover contactor. If the normal input should fail, the contactor operates to select the alternative input from QP diesel generators through motor control centre QP 380 on platform QP.

3.2 The alternative (standby) input from QP 380 is always present at the changeover contactor as long as normal generation and distribution arrangements are in force, but the operation of the contactor prevents the inputs from being paralleled. When main generation fails, however, the alternative input from QP 380 fails too, so that DB308 suffers a supply interruption until the QP standby generators have started automatically. When this has occurred the standby supply to DB308 from QP 308 is automatically connected.

3.3 The QP diesel generators are each rated at 500 kW. The standby supply to DB308 is limited to 80 kVA.



FOR MORE DETAILED INFORMATION SEE
FF87.23.00.0074, FF85.23.03.6002 AND FF96.23.17.6002.

ISSUE 4, AUG. 1991

EMERGENCY SUPPLIES | **5.3**

BATTERY SUPPORTED SUPPLIES

1. GENERAL

1.1 Battery supported supplies are needed for any load that cannot tolerate a short interruption of its power supply. Loads that are essential to the safety of the platform, or to the restoration of normal supplies, and must therefore be able to survive a simultaneous failure of both main and secondary generation, also need a battery supported supply.

1.2 Fourteen separate battery supported dc systems are provided on TCP2. Six are in the compression areas, and eight in the treatment areas. The compression and treatment areas are each provided with a separate battery supported ac supply.

In addition there is a battery supported ac supply system allocated for East Frigg power and control located in the treatment area and fed from the compression area.

1.3 Each of the battery supported systems is supplied from one of the platform ac switchboards through separate transformer/rectifiers. Batteries float across the dc output of the rectifiers on trickle charge. Under normal conditions the transformer/rectifiers feed their associated loads. In the case of battery supported ac supplies the output from the transformer/rectifier provides dc power to invertors to provide an ac output at the desired frequency and voltage. On failure of the ac supply or of the rectifier the batteries take over the full dc load without interruption to the output. When ac supplies are restored the rectifier not only supplies the dc load but will also act as a charger to restore the batteries to full capacity.

2. TREATMENT AREA BATTERY SUPPORTED SUPPLIES

2.1 Two separate battery supported dc systems are associated with the treatment area central 24V dc supply. Their outputs are parallelled, and normally the two systems share the dc load, each carrying 50 percent. If one system, or its supply, should fail, the other can carry the full 100 percent load. If both ac inputs should fail, the batteries take over the dc load without interruption, sharing it equally. Either can carry the load alone if the other is out of service. The 24V dc is fed to DB310.

2.2 One system is supplied from the main MCC, TCP2 380; the other is supplied from DB308 - Emergency Supplies - which is itself supported by the 380V ac standby from Platform QP.

2.3 When ac power is restored after a failure, system No 1 is automatically disconnected from the load and gives its battery a boost charge, while system No 2 takes over the load and trickle charges its battery. The roles can be reversed by pressing the Select Load Charger pushbutton on transformer/rectifier No 2.

2.4 Battery supported dc supplies are also provided for special 'dedicated' systems for particular services; these are not described.

2.5 A battery supported ac system is provided for TCP2 treatment areas. This supplies 220V ac at 50 Hz to 220V ac instrument distribution board DB309.

2.6 Under normal operating conditions a static switch connects a 220V ac single phase supply from the inverter to the maintained ac distribution board DB309. One output from DB308 energises the transformer/rectifier/inverter and keeps the floating battery trickle charged.

2.7 Upon failure on the inverter side the static switch automatically switches over to a direct 220V supply from board DB308.

2.8 The changeover is controlled by a synchronising circuit which ensure that the inverter output is always synchronised with the normal supply. Changeover is therefore smoother and virtually uninterrupted.

3. COMPRESSION AREA BATTERY SUPPORTED SUPPLIES

3.1 Two separate pairs of rectifier/chargers are associated with the TCP2 compression area central 110V dc supply. The outputs of each pair of rectifiers is parallelled. One pair supplies main 110V dc electrical supply switchboard S53.44.4.11 and the other pair supplies main 110V dc instrument supply switchboard S53.44.4.10. The larger of the two pairs of rectifiers supplies two 110V, 762Ah batteries and S53.44.4.11; the smaller pair supplies two 110V, 95Ah batteries and S53.44.4.10. The rectifiers are powered from compression emergency switchboard S53.44.2.6.

3.2 Each dc output switchboard is divided into three parts by two automatically operated bus section breakers into Essential Busbar 'A', Essential Busbar 'B' and Non-essential Busbar sections. Distribution from each section is by means of a number of two pole miniature circuit breakers (MCBs).

3.3 In the event of ac power failure, the batteries assume the dc loads without interruption. Non-essential loads are shed after 10 minutes by automatic opening of bus section breakers ACB690 and ACB 694. Essential Busbar 'B' loads are shed after 30 minutes by automatic opening of bussection breakers ACB691 and ACB693. If ac failure continues, essential busbar load on S53.44.4.11 is shed after two hours and the remaining essential load on S53.44.4.10 is shed after six hours.

3.4 On restoration of ac supplies one battery from each pair must be disconnected from the load and boost charged in turn whilst the other remains on trickle charge.

3.5 Two identical but separated battery supported ac systems including battery charger, inverter, static switch and back up line (through a 50 kVA transformer) are provided for TCP2 compression areas. They supply 220V ac at 50 Hz to the 220V ac switchboard S53.44.3.9, which is divided into two parts. Under normal conditions, each part of S53.44.3.9 switchboard is supplied by its own battery supported ac system through a battery charger inverter and static switch. Breaker ACB692 is open, ACB695 and 696 are closed.

3.6 Under temporary abnormal conditions (short overload or overcurrent, which should not be withstood by the inverter in any case), the static switch operates on automatic change over without interruption from inverter to back up line and vice-versa when the fault has disappeared.

3.7 Under permanent abnormal conditions (inverter or inverter supply failure), the static switch operates on automatic change-over without interruption from inverter to back-up line and remains in this position; the new permanent supply is through the 50kVA back-up line transformer.

3.8 Each battery supported ac system is capable of supplying the whole S53.44.3.9 switchboard. Only one system would be used if the other is out of order, (especially its inverter which is the normal and main supply). Since the two systems cannot be parallelled, the faulty one should be previously disconnected before closing ACB692, then the whole switchboard will be supplied by only one inverter.

3.9 A forced load on either inverter or back up line can be obtained by manually operating the bypass switch, such that the static switch is bypassed in both cases.

3.10 S53.44.3.9 is divided into essential and non-essential parts by an automatically operated bussection breaker ACB692. Distribution from each section is by means of a number of two pole miniature circuit breakers (MCBs).

3.11 In the event of normal failure of AC power, the batteries assume the AC load through the invertors, without interruption. Non-essential loads are shed after 30 minutes by automatic opening of breakers 695 and 696.

4. EAST FRIGG BATTERY SUPPORTED SUPPLIES

4.1 The East Frigg power supply system contains the following major equipment:

380V UPS supply switchboard DB355
Uninterruptable power supply systems EF UPS1 & UPS2
220V no break distribution board DB354
Subsea cable termination cabinet SCTC1
Emergency/subsea cables.

In normal operation, the supply system is split in two independent lines from the 380V UPS supply switchboard to the East Frigg production stations.

4.2 The 380V AC UPS supply switchboard DB355 is feeding the two uninterruptable power supply (UPS) systems installed for East Frigg single phase supply. In addition, this distribution board is feeding the two 3 phase supplies to EAst Frigg (hydraulic pump motors). The distribution board is fed from either 380V AC MCC "B" (s. 52-32-2-3) or from 380V AC emergency switchboard (s.53.44.2.6). The two feeders are interlocked in such a way that both feeders cannot supply the distribution board simultaneously.

4.3 Two uninterruptable power supply systems EF UPS1 and UPS2 are installed to ensure a reliable single phase supply to East Frigg.

The two independent UPS systems have each a battery back up system with a capacity of at least one hour full operation. The battery systems will ensure no break single phase supply during fault or switching periods.

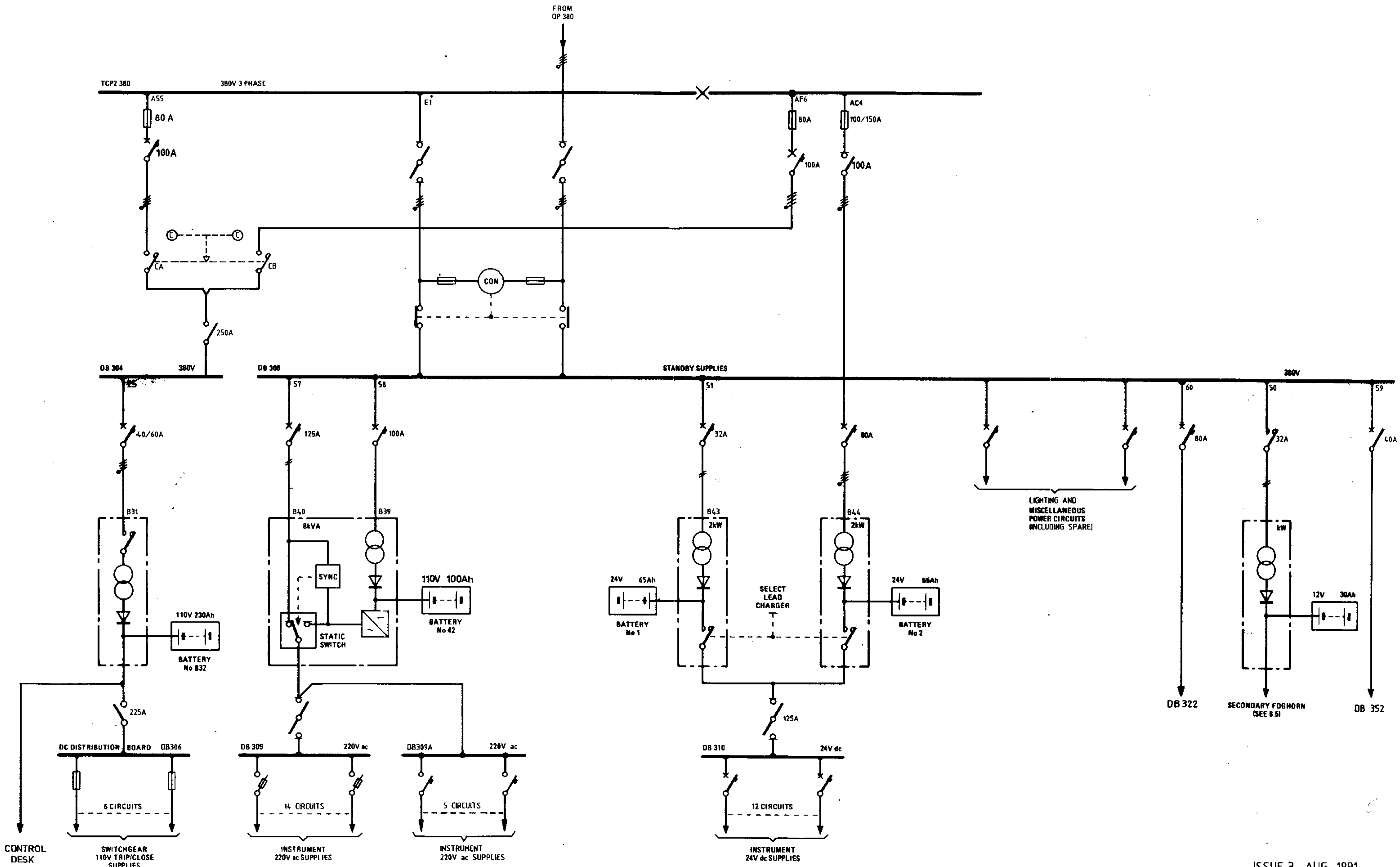
4.4 The two UPS systems are each feeding one half of the 220V no break distribution board DB354.

Between the two sections, a bus tie breaker is installed to achieve a flexible system. Interlocking between the incomer breakers and tie breaker prevent the UPS systems from parallel operation. Each section of the distribution board will feed two single phase East Frigg feeders and Process Control Unit (PCU) in TCP2 Control Room. (Module 32).

4.5 Two single phase feeders from each section of DB354 and two three phase feeders from DB355 is routed to the Subsea Cable Termination Cabinet. This cabinet contains 6 transformers for increasing the subsea supply voltage to 950V AC (subsea cable transfer voltage).

4.6 Two emerged cables are routed from the Subsea Cable Termination Cabinet to Column 5, the emerged cables are spliced with the subsea cables. In this splice, the signal cables are connected to the transmission part of the subsea cables. Each of the subsea cables contain:

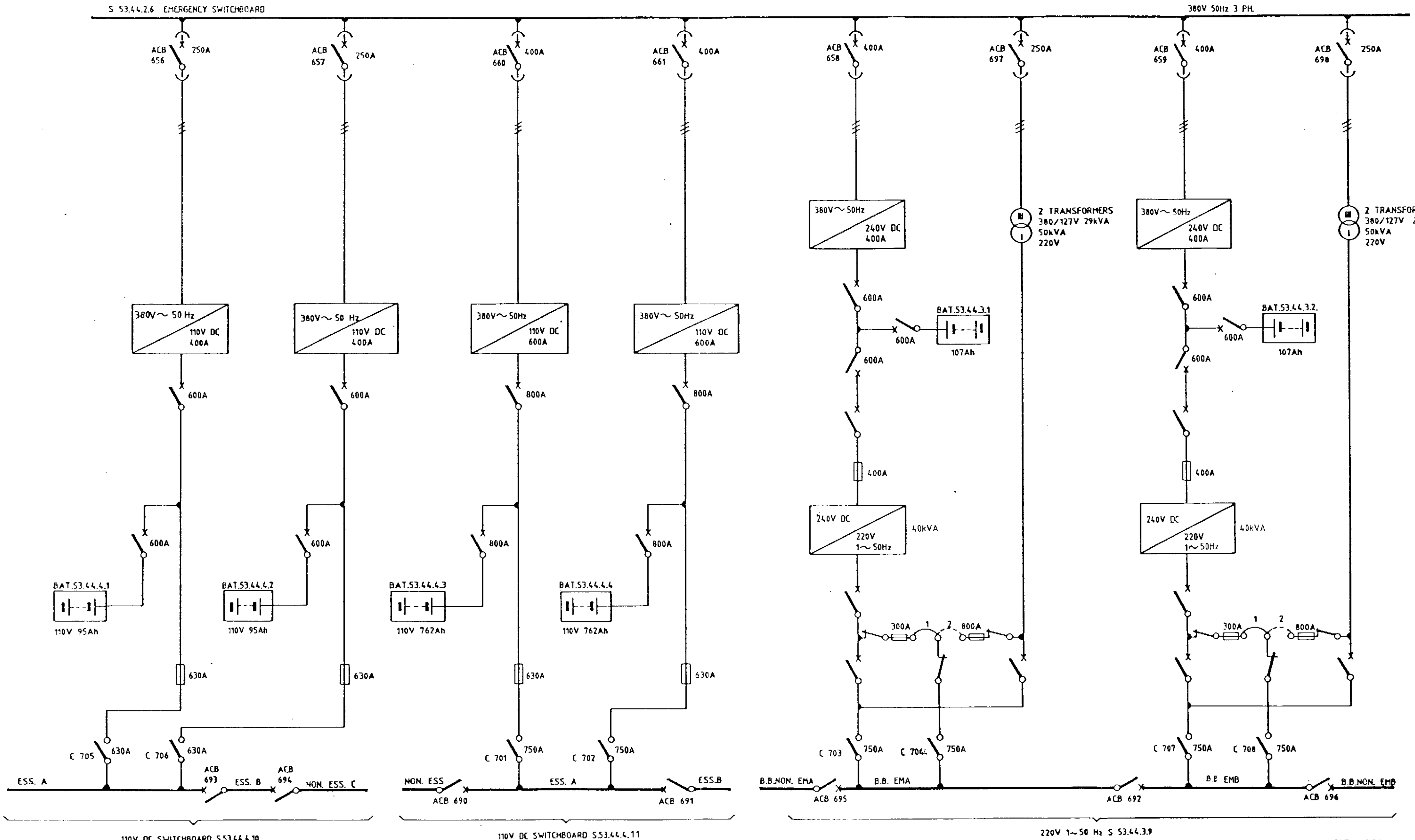
2 single phase cables
1 three phase cable
1 signal cable



ISSUE 3, AUG. 1991

BATTERY - SUPPORTED SUPPLIES
TREATMENT AREAS 5.4.1

FOR MORE DETAILED INFORMATION SEE
FF85.23.03.6002 AND FF85.23.03.6001.



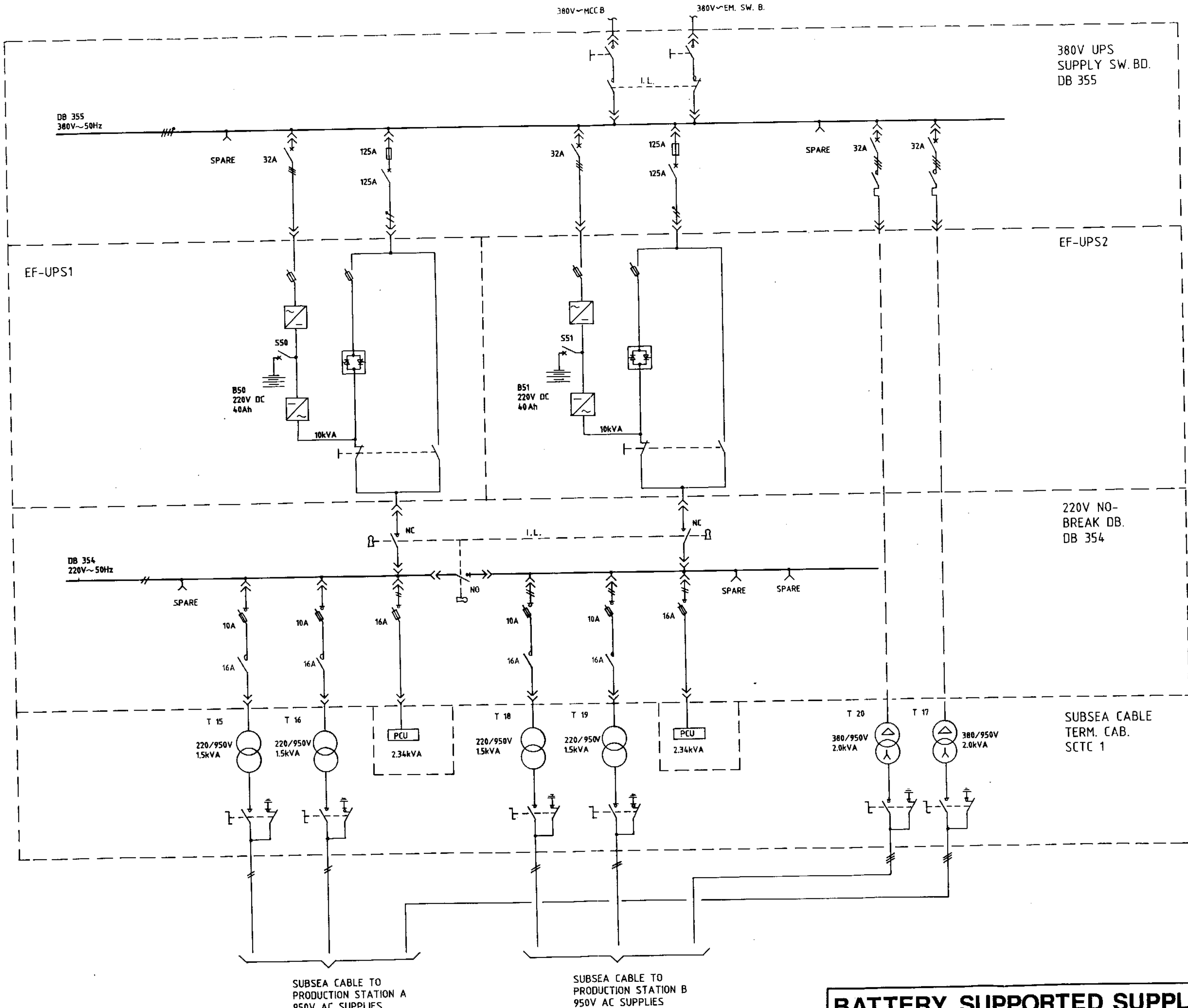
FOR MORE DETAILED INFORMATION SEE
FF87.23.00.0074.

ISSUE 2, AUG. 1991

BATTERY SUPPORTED SUPPLIES

COMPRESSION AREAS

5.4.2



ISSUE 2, AUG. 1991

BATTERY SUPPORTED SUPPLIES
TO EAST FRIGG (TREATMENT AREAS)

5.4.3

GLYCOL REGENERATION (PART OF PROCESS EQUIPMENT)

1. GENERAL

1.1 Two independent, skid mounted, closed circuit glycol regeneration streams are installed, each serving a gas process stream. Hot glycol is also used to heat the Odin, NEF and EF liquids.

1.2 Water rich glycol from the glycol contactors is regenerated to its original concentration by boiling off the water. The regenerated glycol is cooled and recycled back to the contactor.

1.3 Each regeneration stream comprises the following:

(a) Condensate separator
(b) Glycol filter
(c) Charcoal filter
(d) Reflux condenser
(e) Stripping column
(f) Reboiler
(g) Duplicate glycol/glycol heat exchangers
(h) Glycol surge tank
(i) Duplicate glycol pumps
(j) Glycol air cooler

1.4 Stream A only is described. The B stream is identical apart from tag numbers.

1.5 Streams A and B are interconnected at the suction side of glycol pumps (CP10) and at the outlet side of glycol filters to enable glycol to be regenerated at any reboiler.

2. DESCRIPTION

2.1 Rich glycol from glycol contactor CV2A enters condensate separator CV14A. Glycol, under level control, is let down to glycol filter CV15A.

2.2 Separator CV14A operates under pressure control at about 35°C with a maximum glycol flowrate of 16 m^3/h. (The average glycol circulation rate is about 14 m^3 of glycol per million cubic metres of gas). If produced off gas is insufficient to maintain operating pressure, supplementary gas is supplied from the Fuel Gas System. The vessel is protected against overpressure by duplicate pressure safety valves set to lift at 10.4barg. Low, high and high/high liquid level indicate in the Control Room.

2.3 After the removal of entrained solids in filter CV15A, a nominal 10% of glycol flow is diverted through charcoal filter CV20A in which dissolved hydrocarbons, fatty acids, well inhibitor and glycol degradation compounds are removed. Filtered glycol discharges to reflux condenser CE4A.

2.4 Filters CV15A and CV20A operate at 4.5 barg at 27°C. High differential pressure alarms indicate in the Control Room.

2.5 Glycol passes through condenser CE4A where it is preheated, and at the same time provides reflux by cooling the effluent vapour. Glycol at 2.5 barg discharges to the tubed sides of glycol/glycol heat exchangers CE1A1 and 2, which raise the glycol temperature from 49 to 149°C before it enters stripping column CV16A.

2.6 Glycol from the heat exchangers enters CV16A and, together with glycol from the reflux condenser, flows down over five "bubble cap" trays against a counter flow of steam released from the glycol in the reboiler and stripping gas, into reboiler CH1A.

2.7 In reboiler CH1A the glycol is heated to approx. 200°C, boiling off any water remaining in the glycol. This temperature together with stripping gas contact, regenerates the glycol to 99.8% purity. Steam and stripping gas is released from the top of column CV16A to LP vent. The regenerated glycol overflows a weir and gravitates to the shell sides of heat exchangers CE1A1 and 2, which reduce glycol temperature from 200 to 107°C.

2.8 A tapping from the Fuel Gas System supplies, under pressure control, filtered fuel for the reboiler burner and stripping gas. An emergency shutdown (ESD) block valve is incorporated in the common supply line.

2.9 Cool glycol from heat exchangers CE1A1 and 2 discharges into surge tank CV17A, which provides system surge capacity and acts as a holding tank. CV17A, which has a capacity of 21.65 m^3, operates at atmospheric pressure at 108°C. A low liquid level alarm will indicate in the Control Room.

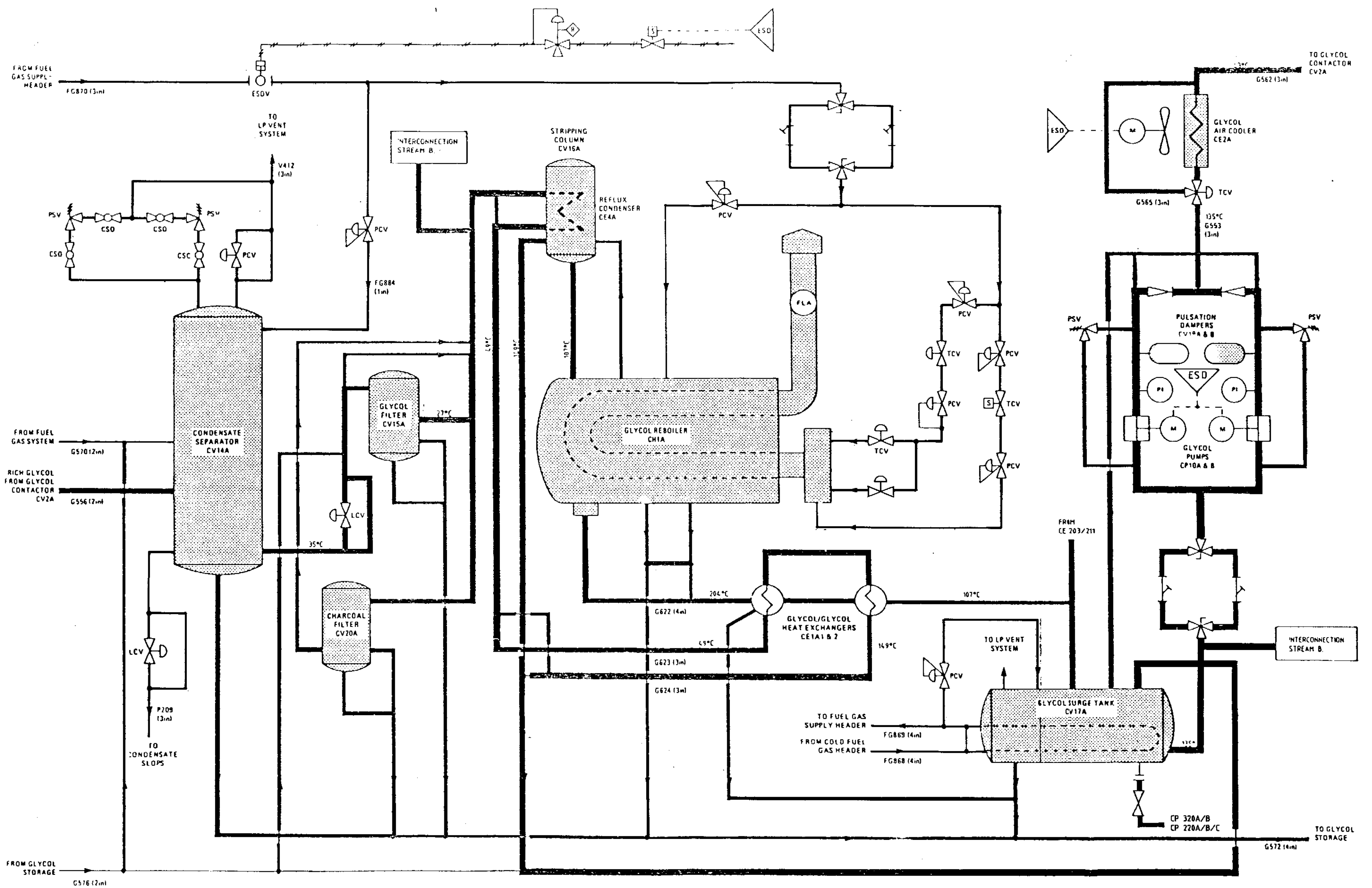
2.10 The heating requirement of the Fuel Gas System is effected by flowing cold fuel through a coil in the base of surge tank CV17A. Heated fuel gas discharges to the fuel gas supply header. A continuous flow gas blanket, under pressure control, is maintained in CV17A via a tapping off the fuel gas heating coil discharge.

2.11 Reciprocating glycol pumps CP10A and B take suction from surge tank CV17A and discharge, via air cooler CE2A, into glycol contactor CV2A, recirculating glycol through the system. The pumps are in parallel and normally operate one duty, one standby, controlled by local Start/Stop pushbuttons. Each pump, driven by a 90 kW electric motor, has a capacity of 15.2 m^3/h at 176 barg. The discharge of each pump is protected against overpressure by a pressure safety valve.

2.12 Hot glycol discharged by the duty glycol pump is cooled from 135°C to working temperature by air blast cooler CE2A. To maintain the temperature of the glycol entering contractor CV2A at a temperature approximately 5°C above the gas temperature a temperature control loop bypasses proportional glycol flow around CE2A. A high glycol temperature alarm will indicate in the Control Room.

2.13 Cooler CE2A comprises a tube and fin radiator surmounted by a cowled four blade fan driven by 15 KW electric motor.

END



ISSUE 3, AUG.1991

GLYCOL REGENERATION | **5.5**

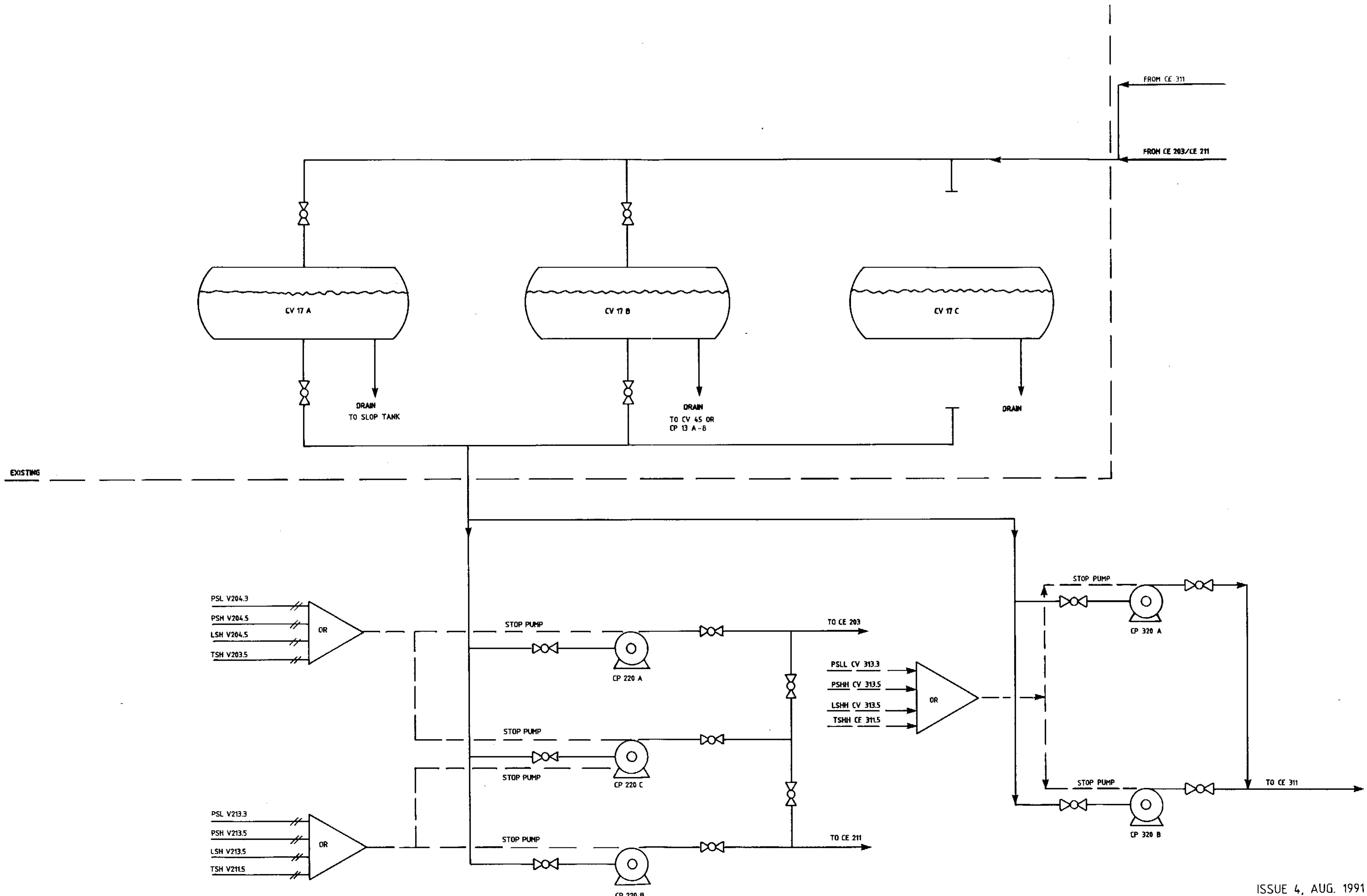
TCP2 EXTENSION AND EF TEG SYSTEM

1. GENERAL

1.1 The purpose of the TEG system is to heat the EF, NEF and Odin condensate/methanolated water before it enters the condensate separators CV313/CV213/CV204.

The closed hot TEG loop is used to heat the condensate/methanolated water from 5°C to 40°C. The hot glycol is pumped through TEG circulation pumps CP320 A/B (for EF) and CP220 A/B/C (for NEF & Odin). The pumps take suction from glycol surge tanks CV17 A/B. The hot TEG is pumped through the heat exchangers CE311 (for EF) and CE203/CE211 for NEF & Odin on the shell side and heat the condensate/methanolated water on the tube side.

The TEG is then returned to the glycol surge tanks CV17 A/B.



ISSUE 4, AUG. 1991

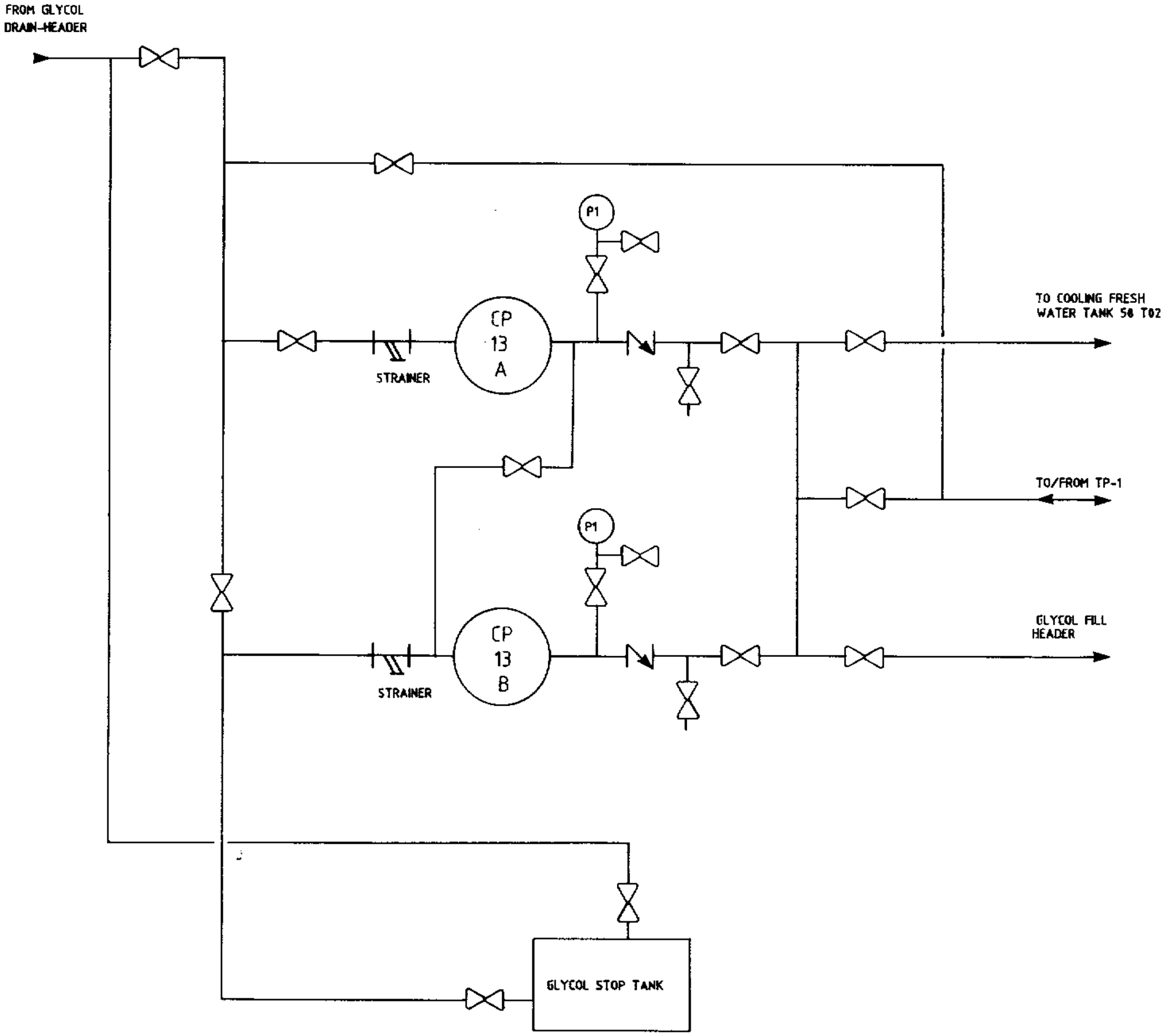
TEG SYSTEM TCP2 EXTENSION & EF	5.6

BULK STORAGE OF GLYCOL

1. GENERAL

1.1 There is no longer storage facilities for glycol on TCP2. The tank CV9 which was previously used as glycol storage tank is now converted to methanolated water storage tank.

All storage of glycol takes place on TP1 in V9 and provision has been made to supply/return glycol from/to TP1.


FROM GLYCOL
DRAIN-HEADER
P1
TO COOLING FRESH
WATER TANK 58 T02
CP
13
A
STRAINER
TO/FROM TP-1
P1
GLYCOL FILL
HEADER
CP
13
B
STRAINER
GLYCOL STOP TANK

LP VENT SYSTEM (TREATMENT AREAS)

1. GENERAL

1.1 Waste and relief gas from treatment equipment operating below 15 barg is discharged to atmosphere by the LP Vent System (Treatment).

1.2 The system comprises the following:

(a) 12in vent header
(b) Two 14in vent headers
(c) Vent scrubber CV7
(d) Vent stack CSP24

1.3 The vent piping configuration is such that any entrained condensate drains to the vent scrubber. The vent headers discharge into the LP vent stack, the 12in header direct and the 14in headers via the vent scrubber.

2. DESCRIPTION

2.1 The following equipment vents into 14in LP vent header V401:

(a) Oil skimmer CV5
(b) Pig receiver CM9
(c) Condensate recycle tank CV33
(d) Fuel gas scrubber CV6 and heater CE3
(e) Glycol surge tanks CV17 A and B
(f) Condensate separators CV14 A and B
(g) LP vent from TCP2 Extension
(h) LP vent from EF

2.2 The following equipment vents into 8in LP vent header V470;

(a) Glycol regeneration stripping columns CV16 A and B

2.3 Where vessels are fitted with parallel pressure safety valves, only one valve is normally in service with its isolating valves car sealed open (CSO) and the other standby with its isolating valves car sealed closed (CSC).

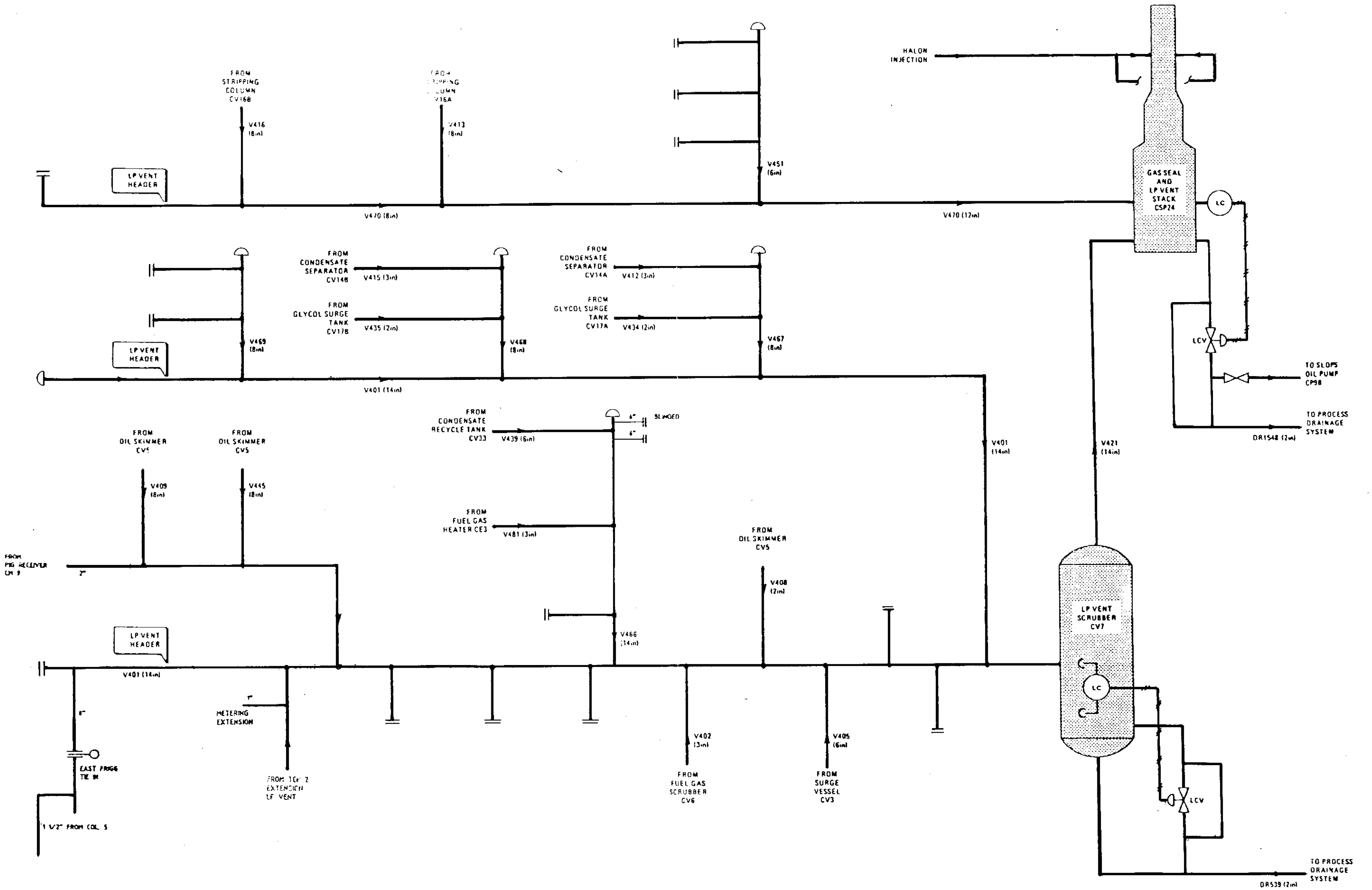
2.4 Waste gas is continuously vented from the glycol regeneration streams' stripping columns (CV16 A & B) and glycol surge tanks (CV17 A & B).

2.5 Entrained liquid in the gas discharged through 14in vent header V401 is separated out in vent scrubber CV7. Liquids are let down, under level control, to process drainage. A high liquid level alarm will indicate in the Control Room.

2.6 Entrained liquids in the gas discharged through 8in vent header V470 is separated out in LP vent stack CSP24. Liquids are let down, under level control, to oil skimmer CV5.

2.7 Waste and relief gas from scrubber CV7 discharges into LP vent stack CSP24 which, together with gas from 8in vent header V470, releases the gases to atmosphere. CSP24 is 22.86m high.

2.8 To prevent ingress of air a gas seal is fitted to CSP24. Provision has been made for purging the vent stack via a tapping off the Fuel Gas System.



ISSUE 4, AUG.1991

LP VENT SYSTEM
Treatment Areas

5.8

LP VENT SYSTEM TCP2 EXTENSION AND EAST FRIGG TIE-IN

1. GENERAL

Relief and waste gas from TCP2 Extension and EF equipment operating below 20 barg is discharged to atmosphere through the TCP2 treatment areas LP vent system. Gas released originates from pressure safety valves and pressure control valves and is collected in headers and sent to the LP vent scrubber CV7.

2. DESCRIPTION

2.1 TCP2 Extension

The following equipment vents into 10in LP vent header.

(a) CV 204 condensate/methanol separator
(b) CV 213 condensate/methanol separator
(c) CV 220 methanolated water flash drum
(d) Vent from metering NEF A + B
(e) Vent from metering ODIN A + B

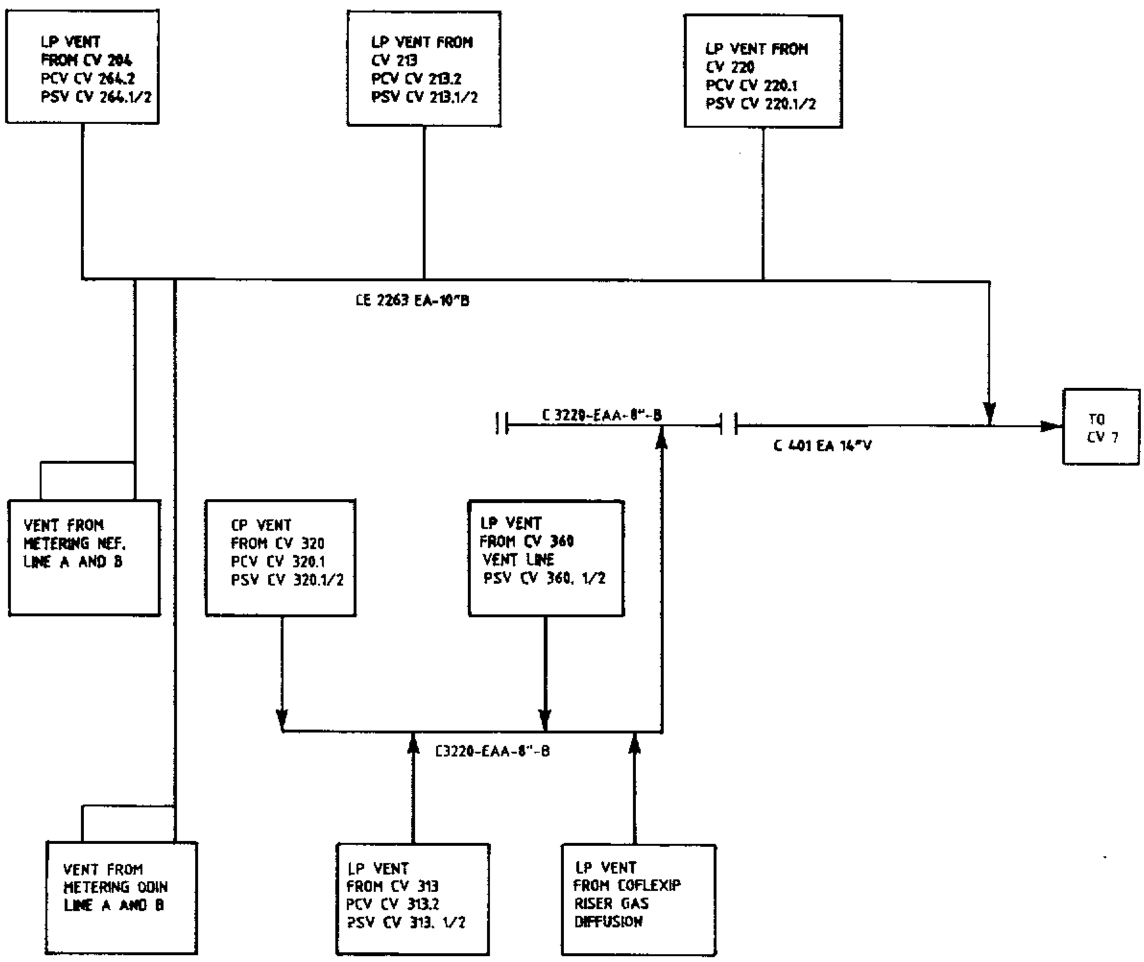
The 10 inch LP vent header is connected to the 14 inch LP vent header V 401. Waste gas is continuously vented from CV204, CV213 and CV220.

2.2 East Frigg

The following equipment vents into the 8 inch LP vent header:

(a) CV313 condensate/methanol separator
(b) CV320 methanolated water flash drum
(c) CV360 methanol flash tank
(d) Gas diffusion from Coflexip riser.

The 8 inch LP vent header is connected to the 14 inch LP vent header V401. Waste gas is continuously vented from CV313/CV 320.



ISSUE 3, OCT. 88

LP VENT SYSTEM TCP2 EXTENSION & EFTI	5.9

LP VENT SYSTEM (COMPRESSION AREA)

1. GENERAL

1.1 Waste and relief gas from low pressure sources in the compression areas is collected and discharged to atmosphere by an LP Vent System.

1.2 The collected gas is discharged via a vent stack as a cold flare. Any liquids collected in the system are passed to the Process Drain System in the treatment area.

1.3 The system comprises the following:

(a) 8in vent header LV001
(b) Vent scrubber 67B01
(c) Cold vent snuffing package 67X01
(d) LP vent stack.

2. DESCRIPTION

2.1 The following equipment vent into the system:

(a) Compressor 11K01A/B/C seal oil systems
(b) Compressor turbines 11KG01A/B/C fuel gas systems
(c) Compressor turbine 11KG01A/B gas expander starters
(d) Generator turbine 52GG01A/B auxiliary fuel gas system
(e) Fuel gas package 50X01A/B low temperature separators
(f) Final decompression from Modules 30, 31, and 33

2.2 Any liquid recovered in vent scrubber 67B01 or from the lowest point of the LP vent stack is let down under level control to the treatment area process Drain system.

2.3 Purge gas from the Fuel Gas System or from CV 226 is supplied to the vent stack. This gas together with light gas seal 67X02 ensures that air is excluded from the vent stack.

2.4 Fire protection for stack is provided by cold vent snuffing package 67X01. 67X01 contains two separate systems for the release of Halon or dry chemical powder respectively. The systems comprise the following:

(a) **Halon 1301.** Two 80kg bottles are provided. The contents of one bottle are sufficient to extinguish a fire under normal gas flow rate of 4620 m^3/h.

(b) **Dry Chemical Power (Potassium Bicarbonate).** Two 250kg sets are provided. One set is capable of extinguishing a fire with a maximum gas flow rate of 3695 m^3/d. The dry powder system will automatically operate if a fire is not extinguished by means of Halon release. A time delay of 20 seconds will elapse between the release of Halon and the release of dry powder.

2.5 Cold vent snuffing may be initiated automatically or manually. Automatic initiation is by means of two ultra-violet detectors and one heat rise detector located at the top of the vent stack. Any two detectors must be triggered to initiate snuffer package operation. Manual operations is initiated locally or from TCP2 Control Room.

2.6 Vent scrupper 67B01 has a design pressure of 3.5 barg, a design temperature of -65° to +100°C and a capacity of 31 m^3. The LP vent stack is 16 inches in diameter and discharges 24 inches above Upper Deck level. ?

3. OPERATION

3.1 Vent scrupper 67B01 normally operates at a pressure slightly above atmospheric to maintain a positive pressure in the system.

3.2 The various equipments discharge to the system as follows:

(a) **Maximum Discharge Rate**

From relief valves (Fuel Gas Package)	= 3.186 MMSCMD
Temperature	= -20°C.

(b) **Normal Discharge Rate**

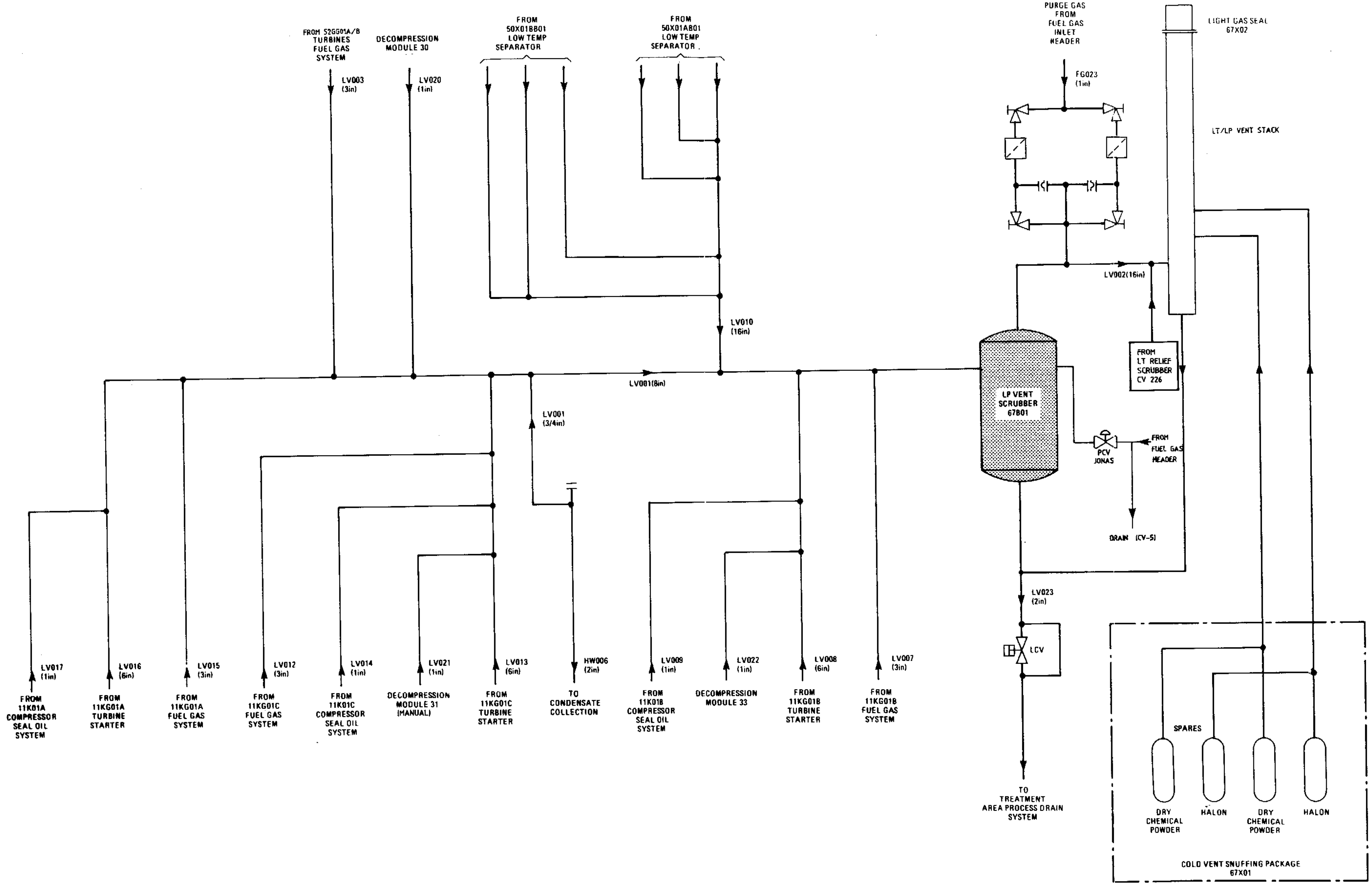
From one gas expander turbine driver for an operating periode of 2 minutes	= 140 m^3 in 2 min
Minimum temperature	= -65°C.

(c) **Continuous Discharge Rates**

From 1 to 4 seal oil drain traps	= 1000 to 4000 m^3/d.
Temperature	= 70°C max.

(d) **Abnormal Discharge Rates**

Approximately 1008 m^3/d.	
Temperature	= 100°C max.



ISSUE 3, OCTOBER 1988

LP VENT SYSTEM Compression Areas	**5.10**

HP RELIEF SYSTEM

1. GENERAL

1.1 High pressure relief gas from process equipment and gas discharged during operational blowdown of process vessels, is discharged to the Flare Platform via TP1, by the HP Relief System.

1.2 The system comprises the following:

(a) Pressure relief and depressurising lines from process equipment and associated process lines, including compression. The gas is directed into the system by subheaders.

(b) 24in relief header R301.

(c) Several subheaders.

(d) HP relief scrubber CV24.

(e) 24in discharge line R340.

1.3 A tapping from the Fuel Gas System enables system purge, but the system is normally swept by N_2 from TPI.

1.4 A HP/LT relief cross-over line is installed downstream CV 24, allowing gas from HP relief to be directed to the LT relief stack on TP-I. A check valve is installed to avoid cold gas from the LT relief to flow into the HP relief system. It has to be noted that the LT relief system cannot take full blowdown from <u>all</u> TPC-2 because of flow limitations.

2. DESCRIPTION

2.1 High pressure vessels and associated pipework are protected against overpressure by pressure safety valves connected to the HP Relief System. They may also be depressurised by emergency shutdown (ESD) blowdown valves. These valves are opened automatically by a Group "W" or "X" emergency shutdown signal, or individually by operating the appropriate hand valve (HSD).

2.2 All ESD block valves close on loss of control air/hydraulic. All ESD blowdown valves open on loss of control air.

2.3 The following process vessels and process lines are depressurised into the HP relief system:

(a) Inlet manifold piping related to CM2.

(b) Pressure safety valves and ESDV on FWKO separator CV1C, and ESDV downstream this vessel..

(c) Natural gas compressors 11K01A, B and C.

(d) Water separators 11B02A and B.

(e) Dry gas header to/from TP1.

(f) Pressure safety valves on glycol contactor CV2B.

(g) Sales gas header.

(h) Pressure safety valve on CM3.

(i) Compression module fuel gas treatment units A and B.

(j) Pressure control valve on condensate surge tank CV3.

2.4 The FWKO separator, water separators and glycol contactor are fitted with two, parallel mounted pressure safety valves (PSV) designed for fire protection only. (The maximum allowable working pressure of these vessels is higher than the static wellhead pressure). One valve is normally in service with its isolating valves car sealed open (CSO), and the other standby with its isolating valves car sealed closed (CSC).

2.5 FWKO separator CV1A and Glycol contactor CV2A are connected to the LT relief system. See section 5.11.1.

2.6 HP relief scrubber CV24 is a horizontal vessel with a maximum operating pressure of 54.8 barg at 20°C. All gases from the 24in relief header flow through the scrubber where any entrained liquid is separated out, thus preventing liquid spillover at the flare and reducing condensate in the underwater flare line to a minimum. Separated liquids are let down, under level control, to process drains. High and low liquid level alarms indicate in the Control Room.

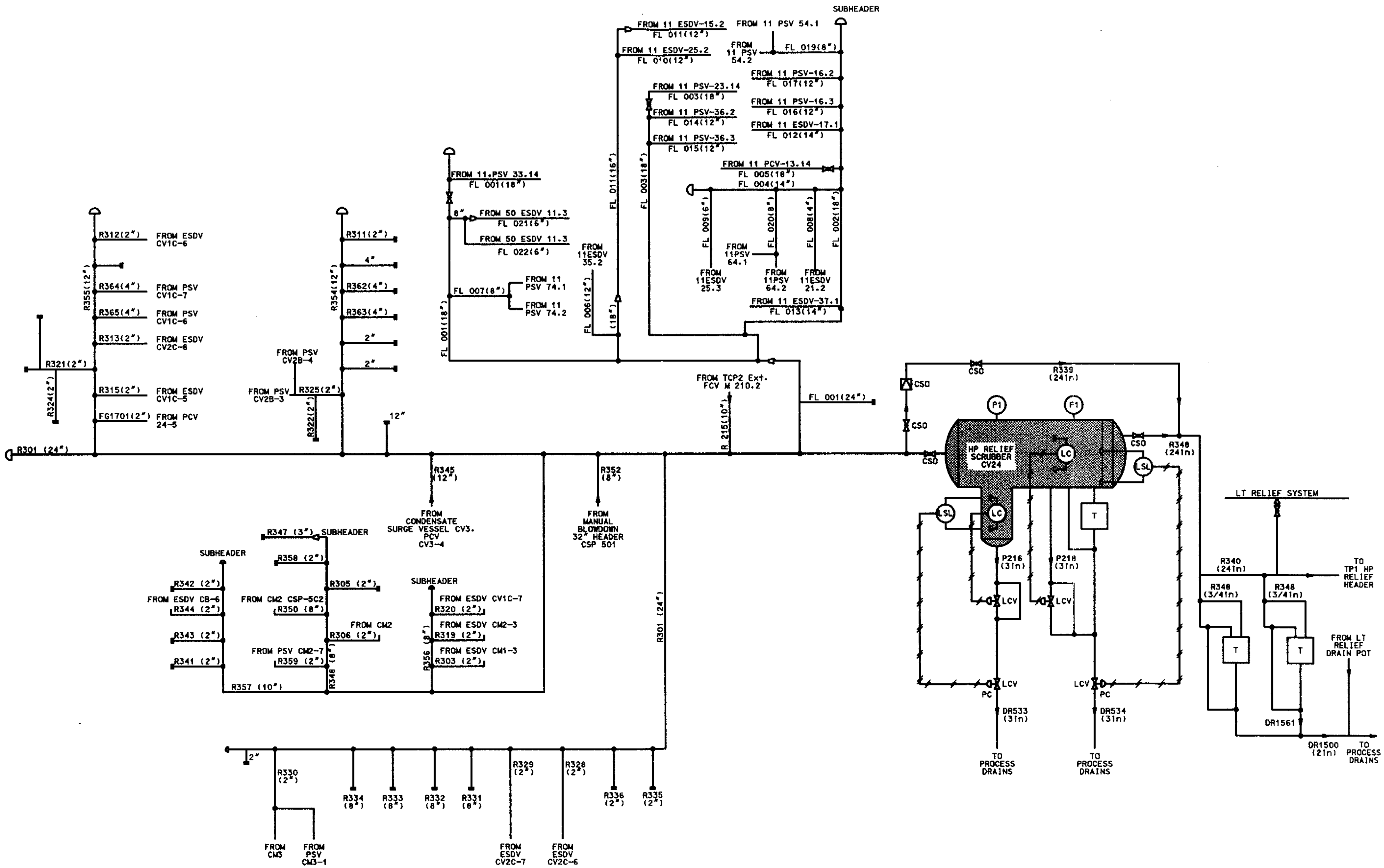
2.7 The HP relief scrubber is protected against overpressure by a 24in valved bypass line fitted with a rupture disc set to burst when the pressure drop across CV24 is more than 3.14 bar.

2.8 Flare gas discharged from CV24 flows into TP1 HP relief header through 24in discharge header R340. A high pressure alarm indicates in the Control Room.

2.9 Flare gas is monitored for flow and pressure. Flow monitor output is recorded and pressure monitor output transmitted to the QP computer.

2.10 Blowdown valves are designed for 90 min decompression time.

2.11 An 8in choke valve is provided which connects each sales gas metering station to the HP Relief System so that the gas may be burnt if necessary.



ISSUE 3, AUG. 1991

HP RELIEF SYSTEM | 5.11

91-192

LT RELIEF SYSTEM

1. GENERAL

1.1 Low temperature gas from Pressure Relief Valves, Pressure Safety Valves and Emergency Shutdown Blowdown Valves is connected and discharged to atmosphere by the cold vent system.

1.2 The collected gas, having a minimum temperature of -80°C is discharged via a Vent Stack and Knockout Drum as a cold flare. Any hydrocarbon liquids are collected in the Knockout Drum and at system drain points and are transferred to the process drain system in the treatment area.

1.3 The Knockout Drum and Vent Stack are located on TP1.

1.4 The HP relief system is connected to the LP relief by a cross-over line including an isolation valve and check valve, preventing cold gas to enter the HP relief system.

2. DESCRIPTION

2.1 The following Pressure Safety Valves vent into the system

PSV.CV1A 6 from FWKO Separator CV1A

PSV.CV1A 7 " " " "

PSV.CV2A 3 " Glycol Contactor CV2A

PSV.CV2A 4 " " " "

2.2 The following lines vent into the system:

Manifold upstream CV2A	(Line C116.EF.18"R) via ESDV CV2A 8
H.P. Gas from CV2A	(Line C126.EF.18"R) via ESDV CV2A 3

Note that gas from ESDV CV1A-6 is routed to TCP2 Ext. LT relief System.

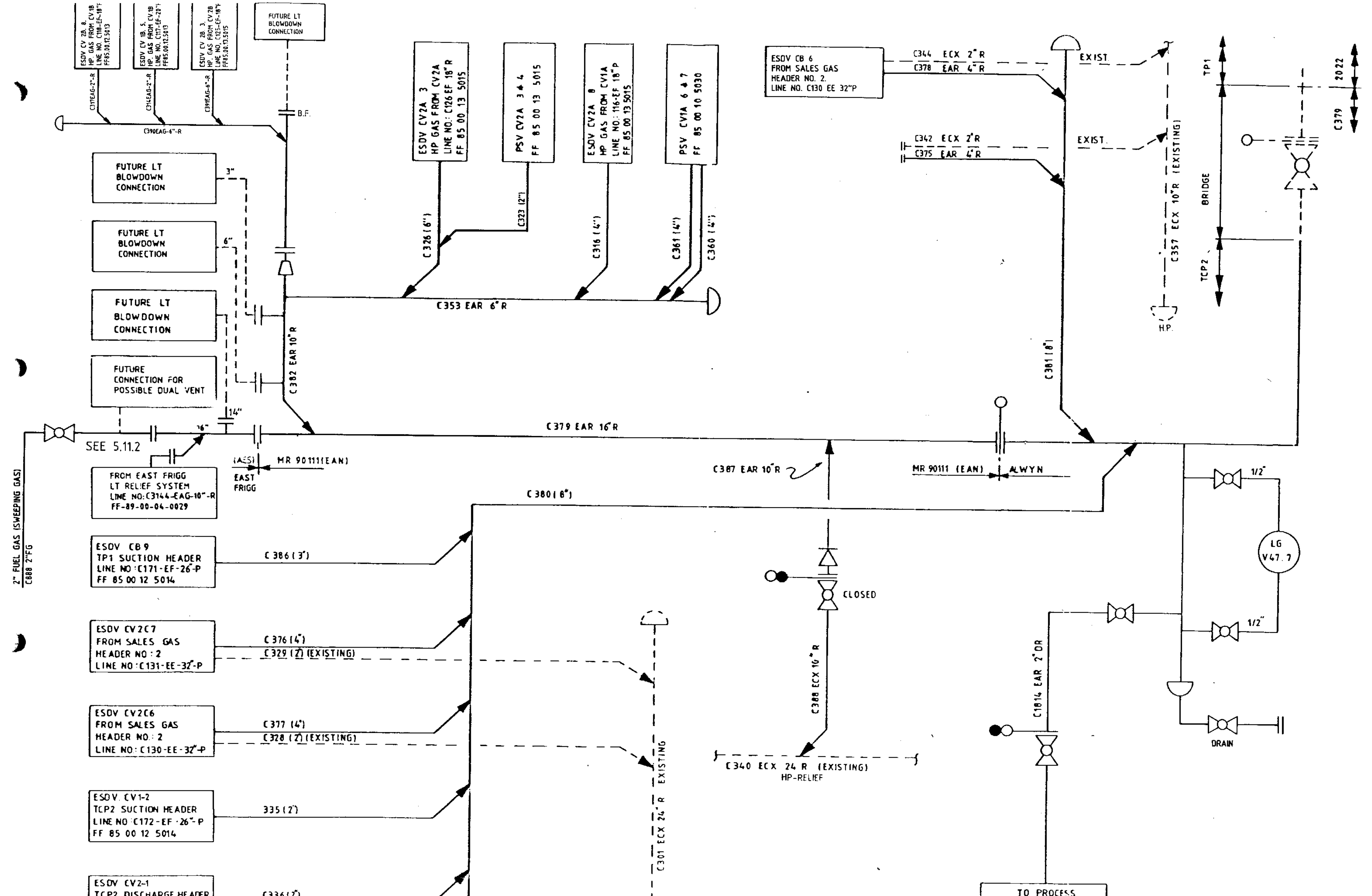
Manifold upstream CV2 B	(Line C118 EF 18"P) via ESDV CV2B 8
HP gas from CV2B	(Line C125 EF 18"P) via ESDV CV2B 3
HP gas from CV1B	(Line C117 EF 20"P) via ESDV CV1B 5
Sales Gas Header No. 2	(Line C130.EF.32"P) via ESDV CB6
Sales Gas Header No. 2	(Line C130 EF 32"P) via ESD CV2C6
TP1 Suction Header No. 2	(Line C171 EF 26"P) via ESDV CB9
Sales Gas Header No. 2	(Line C131 EE 32"P) via ESDV CV2C7
TCP2 Suction Header	(Line C172 EF 26"P) via ESDV CV 2.1
TCP2 Discharge Header	(Line C173 EF 24"P) via ESDV CV 1.2
East Frigg blowdown Header	(Line C3144 Eng. 10"R)

2.3 Spare connections have been included for the blowdown of other lines.

2.4 Any liquid recovered in the drain collection point is taken to the process drain system in the treatment area. This drainage operation is under manual control by visual inspection of level gauge LGV47.7.

2.5 Gas collected on TCP2 is discharged on TP1 via line 2022.EAR 16"R.

2.6 Provisions are provided for sweeping the system by fuel gas. But the system is normally swept by N_2 from TPI.



ISSUE 3, AUG. 1991

LT RELIEF SYSTEM 5.11.1

LT RELIEF SYSTEM EAST FRIGG

1. GENERAL

The East Frigg cold relief system will be a part of the Alwyn cold relief system described in section 5.11.1.

2. DESCRIPTION

The gas release to the LT system originates from depressurization of:

- East Frigg high pressure vessels and lines via PSVs and ESDVs.
- East Frigg sealine via PCV CM 310.1.
- Relief from NEF gas line downstream cross-over.

(a) Depressurization of high pressure vessels and lines

High pressure vessels and lines are protected against fire exposure by dual pressure safety valves (PSVs) which will open for gas release if pressure exceeds a set value. This reduces the pressure which is important, otherwise the equipment would be weakened by excessive heating. The reason why duplex of PSVs are installed is the requirement of the equipment to be continuously online. One PSV will always be in service while the other is on standby (isolated). Each PSV is designed for 100% capacity.

If an emergency situation occurs on the treatment plant, the high pressure process equipment will be sectionalized. By means of emergency shut down valves (ESDVs) on the various sections (equipment), these sections or the whole treatment plant can be depressurized automatically from the control room (2. level shut downs).

The total blow down rate, if a blow down is necessary, is less than the LT relief system capacity of 3.3 MMSCM/D.

LT RELIEF SYSTEM EAST FRIGG

(b) Depressurization of the EF-sealine

The sealine blow down is not connected to the ESD system. This action is voluntary and is performed whenever operating conditions and valve positions are satisfactory. The sealine blow down can also be stopped at any time if necessary.

The operation will be self controlled by PCV CM 310.1 during the blow down period. The total flow will be recorded during the depressurization.

The relieving fluid is routed to the LT-relief system due to low temperature downstream the restriction orifice F0 CM 310.2. The depressurization line is provided with possibility for methanol injection to avoid hydrate formation during the depressurization.

The pressure control valve, PCV CM 310.1, will keep the pressure of 10 bara upstream the restriction orifice, F0 CM 310.2, during the blow down. The restriction orifice is sized to pass 83000 Std m^3/hr at 10 bara upstream pressure.

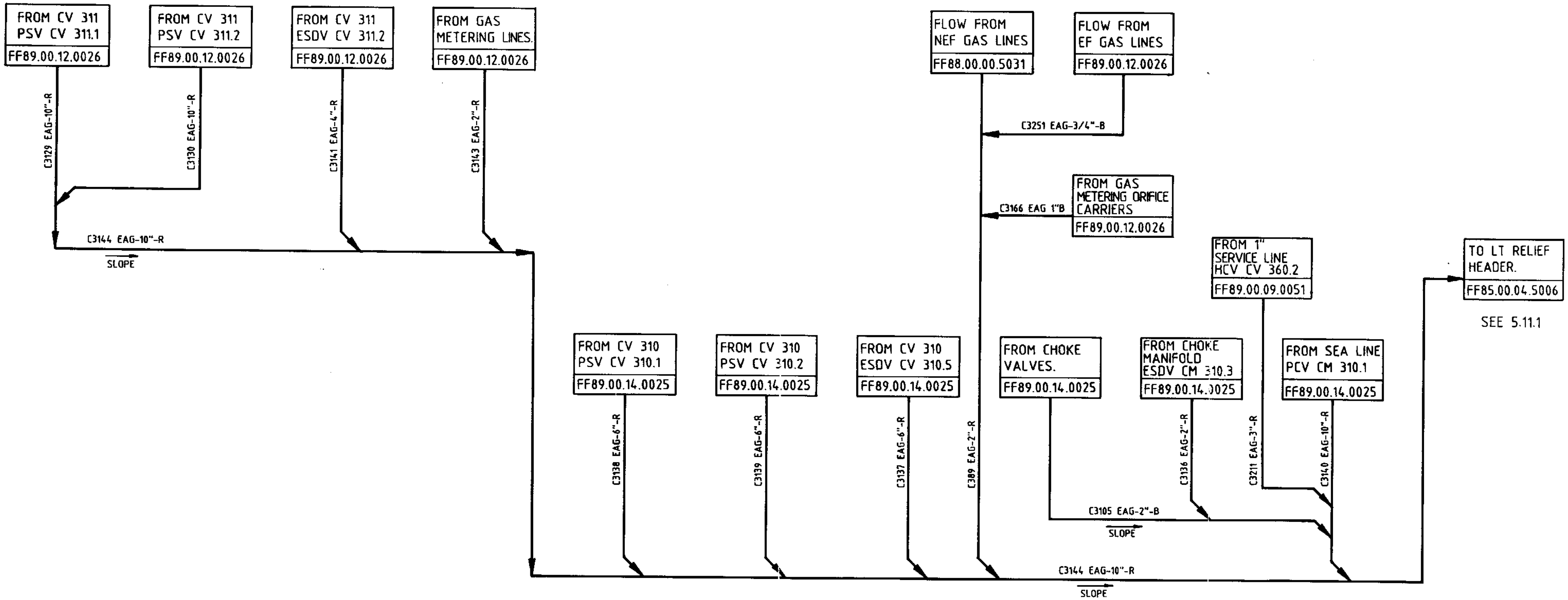
Depressurization conditions:

Initial pressure: 158 bara

Initial flowrate: 2.0 MMSCM/D

Minimum temperature: - 78°C

(downstream F0 CM 310.2)



ISSUE 2, AUG. 1991

LT RELIEF SYSTEM. EAST FRIGG	5.11.2

HP RELIEF TCP2 EXTENSION

1. GENERAL

For relief of high pressure gas from TCP2 Extension two different systems are in use. The high pressure relief system which is connected to HP relief system on TCP2 treatment and compression, and the low temperature (LT) relief system.

2. DESCRIPTION

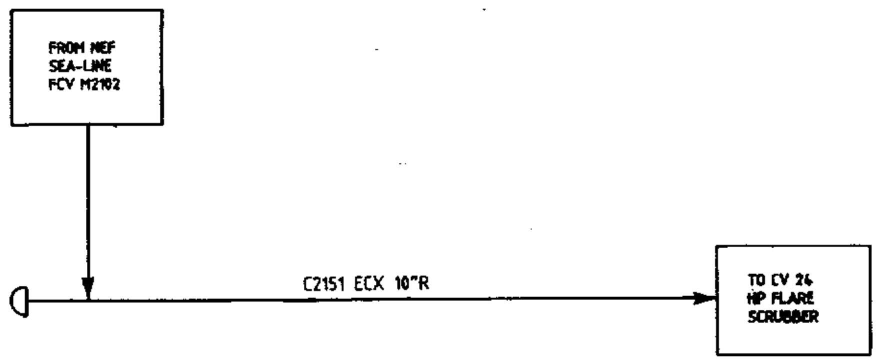
The gas release to HP relief system originates from

(a) Depressurization valve from NEF sealine FCV M210.2

For pressurization of NEF sealine the sealine pressure must be lower than 100 barg and the temperature downstream the blowdown valve should be higher than -40°C before one can use the HP relief system. This is to protect the HP relief system from conditions exceeding the design. When the pressure and temperature exceed these values the gas is released through the LT relief system.

The advantage of depressurizing this way, is that the HP relief has a much higher capacity than the LT system.

The released gas is collected in the existing HP header and sent to the HP relief scrubber CV24.



ISSUE 4, AUG. 1991

HP RELIEF
TCP2 EXTENSION

5.12

LT RELIEF SYSTEM TCP2 EXTENSION

1. GENERAL

The low temperature (LT) relief system is separately installed for TCP2 Extension. However, for CVIA, part of the relief gas is directed to LT relief system for TCP2 treatment. The reason why it has been designed is the low temperature of the gas downstream the blowdown valve, due to the great pressure drop across the valve. From an initial temperature of 5°C, a temperature of -75°C can be reached when depressurizing from 160 bara to near atmospheric pressure. This is below the design conditions for the HP relief system and does therefore necessitate the LT system.

2. DESCRIPTION

The gas release to the LT system originates from depressurization of:

- TCP2 Extension high pressure vessels and lines via PSV's (except CV 1A) and ESDV's
- NEF and sealines via FCV M210.3
- Odin line via CSP M210.3

The released gases to the LT system are collected in headers and sent to the LT relief scrubber (CV 226).

The gas phase from the scrubber is further sent to the existing low pressure (LP) vent stack located in Module 33.

The liquid phase from the scrubber flows to the process drainage system under level control.

(a) Depressurization of high pressure vessels and lines

High pressure vessels and lines are protected against fire exposure by duplex of pressure safety valves (PVS's) which will open for gas release if pressure exceeds a set value. This reduces the pressure which is important, otherwise the equipment would be weakened by excessive heating. The reason why duplex of PSV's are installed is the requirement of the equipment to be continuously online. One PSV will always be in service while the other is on standby (isolated). Each PSV is designed for 100% capacity.

If an emergency situation occurs on the treatment plant, the high process equipment will be sectionalized. By means of blowdown valves (ESDV's) on the various sections (equipment), these sections or the whole treatment plant can be depressurized automatically from the control room (2. level shutdowns).

The total blowdown rate, if a total blowdown is necessary, is less than the LT relief system capacity of 2.8 MMSCM/D.

(b) Depressurization of Sealine

The sealine blowdown is not connected to the ESD system. This action is voluntary and is performed whenever operating conditions and valve positions are satisfactory. The sealine blowdown can also be stopped at any time, if necessary.

Depressurizing NEF sealine, both LT relief system and HP relief system will be used.

At the initial blowdown period, i.e. when the sealine pressure exceeds 100 bara, the low temperature relief system will be used. This is because of the low temperature downstream the blowdown valve, due to the great pressure drop across the valve. The gas release will originate to the LT relief system through depressurization valve (FCV M210.3) and the manually operated isolation valve (HV M210.3). (The corresponding valves for HP relief system will be closed). The depressurization valve (FCV M210.3) is automatically controlled by a flow switch, which will prevent the flowrate from exceeding the design flow rate.
When pressure drops below 100 bara the depressurization will be transferred to HP relief system, through depressurization valve FCV M210.2 and manually operated isolation valve HV M210.4. (The corresponding valves for LT relief system will be closed). The advantage of depressurizing this way is the increased blowdown flowrate.

Initial depressurization period:

System:	LT Relief
Pressure:	160 - 100 bara
Flow rate:	2.8 MMSCM/D

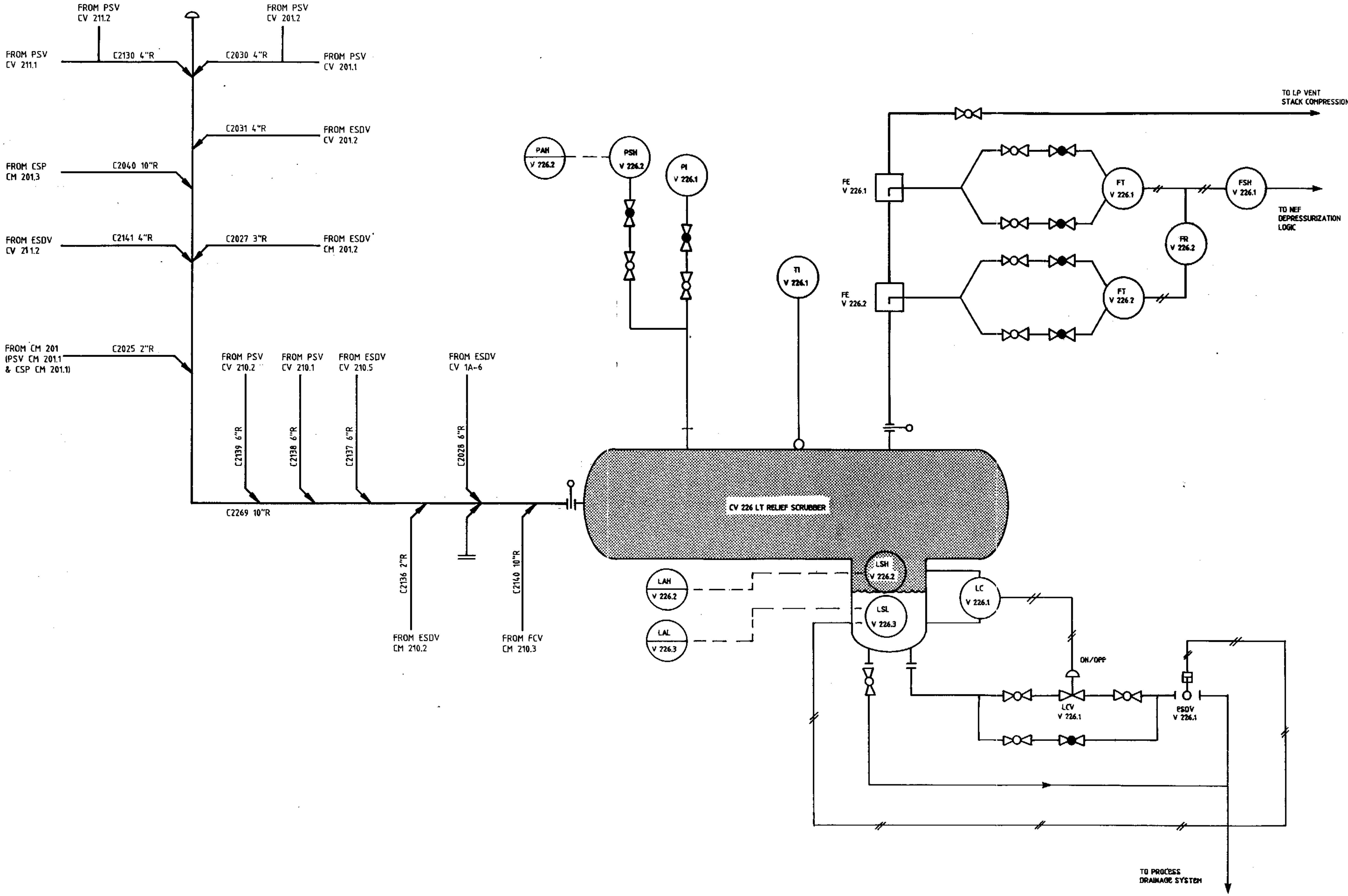
Final depressurization period:

System:	HP Relief
Pressure:	< 100 bara
Flow rate:	8.4 MMSCM/D

Depressurization of ODIN sealine will be operated from ODIN platform. Provisions have however been made to depressurize partially the ODIN sealine from TCP2 in case of plugging of the line by pigs or other unusual situations.
The blowdown is performed by opening of the choke valve CSP M201.1.

Depressurization conditions:

System:	LT Relief
Pressure:	160 bara
Flow rate:	2.8 MMSCM/D



ISSUE 4, AUG. 1991

LT RELIEF SYSTEM
TCP2 EXTENSION

5.13

METHANOL STORAGE AND INJECTION

1. GENERAL

1.1 Methanol is transferred by the CP12A/B from CV23 to the NEF field control station from where it is continuously injected into the NEF sealine, via methanol injection pumps on FCS.

1.2 Methanol is also transferred to the EF Methanol Storage Tank CV 350 A/B via the Transfer Pumps CP 17 A/B.

1.3 To prevent hydrate formation in the subsea sales gas pipeline to St. Fergus; methanol may be injected at points upstream of the flow control valves serving the sales gas metering facilities and in the 32in sales gas header. But the methanol system has limited capacities compared to the quantities of gas being transported in the sealine(s).

1.4 Provision has been made to transport methanol to/from TP1.

1.5 The Methanol Storage and Injection System comprises the following:

(a) Storage tank CV23.
(b) Transfer pumps CP17A and B.
(c) Injection pumps CP12A and B.
(d) Storage tank CV227.
(e) Texsteam injection pumps CP228A (ODIN) sealine, CP22B (NEF) sealine.
(f) East Frigg Methanol Injection System (section 5.14.1)
(g) CP 32 A&B inj. pumps to CV1C (supplied from EF methanol system).

2. DESCRIPTION

2.1 Methanol is stored in tank CV23, which has a capacity of 100 m^3 and operates at ambient pressure, within a temperature range of -9 to 22°C, from TP1 methanol storage tank.

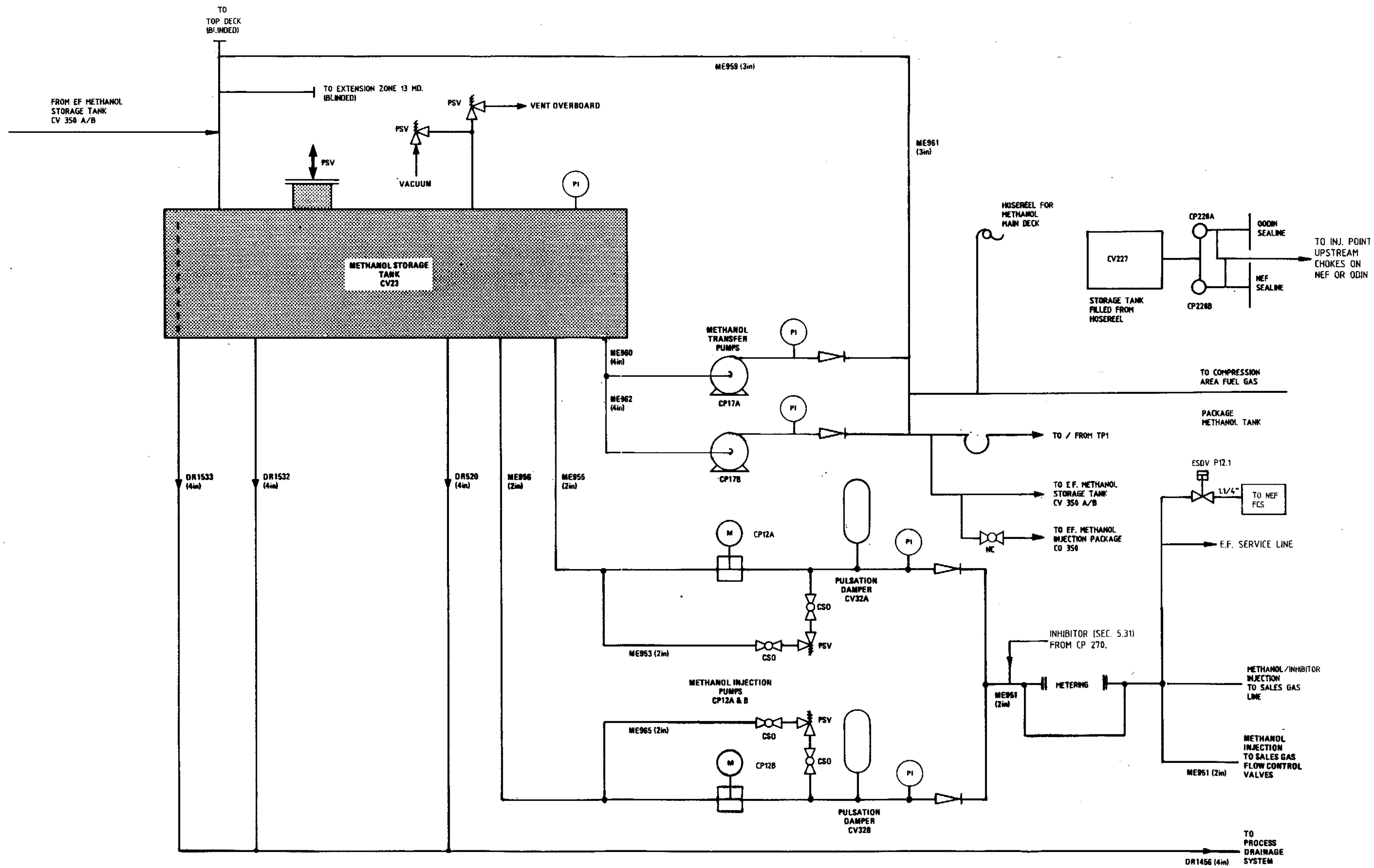
2.2 Tank CV23 is protected against pressure changes by a pressure safety valve and a pressure/vacuum safety valve. High and low liquid level alarms indicate in the Control Room. Level alarm Low Low will stop injection pump CP 12 A/B.

2.3 Centrifugal motor driven transfer pumps CP17A and B are used to transfer methanol to TP1 storage tank, EF storage tank or to the compression area fuel gas package methanol tank. Each pump has a capacity of 227.1 litres/min at 2.07 barg. Both pumps are gravity fed from tank CV23 and discharge to TP1 via the common 3in transfer line. Pump operation is controlled by local Start/Stop pushbuttons.

2.4 Reciprocating motor driven injection pumps CP12A and B are installed in parallel, and normally operate one duty, one standby. Each pump has a capacity of 1000 litres/h at 153 barg differential pressure.

2.5 The duty injection pump (CP12A or B) takes suction from tank CV23. Pulsation dampers are installed to prevent hammering.. The discharge of each pump is protected against overpressure by a safety valve. Operation of CP12A and B is controlled by local Start/Stop pushbuttons and a Duty/Standby selector switch.

2.6 Methanol discharge is monitored for flow which is recorded.



ISSUE 4, AUG. 1991

METHANOL STORAGE AND INJECTION	5.14

EAST FRIGG METHANOL STORAGE AND INJECTION

1. GENERAL

1.1 Methanol is transferred from CV 350 A/B to the EF Subsea Production stations where it is continuously injected.

1.2 To prevent hydrate formation topsides (in M51) provision for methanol injection is made on critical places in the treatment system.

1.3 The methanol injection system comprises three sub systems:

- storage facilities
- injection package
- subsea equipment service facilities

2. DESCRIPTION

2.1 Methanol Storage Tank

2.1.1 East Frigg methanol injection is provided with its own storage tank CV350 A/B. This tank is divided in two independent compartments A and B, each one dedicated to one subsea station via its relevant injection lines. CV350 A/B operating capacity (19.2 m^3) is based on a 4 days methanol requirements on maximum flowrate. This capacity will ensure a 7 days Methanol consumption at 3.5 MSCMD Production rate. CV350 A/B filling may be achieved from two independent sources:

- In normal operation, CV350 A/B is supplied by CP17 A/B from CV23 (100m3 capacity), overflow being routed back to CV23.
- CV350 A/B can be filled directly by gravity from transport pods located on M51 weather deck.

2.1.2 In normal operation, the injection package is supplied from CV350 A/B. However, a direct connection from CV23/CP17 A/B to injection suction header is provided, bypassing CV350 A/B: This line shall be used only for short periods of time, with CP17 A/B constant monitoring.

2.1.3 The storage tank CV350 A/B operates at atmospheric pressure and ambient temperature.

2.1.4 CV350 is protected against pressure changes by vent lines and vacuum PSV's.

2.2 Methanol Injection Package

2.2.1 East Frigg production facilities consist of two subsea stations (A and B).

Station A comprises 3 wells and station B 2 wells.

Methanol is injected in each well via dedicated lines.

2.2.2 Reciprocating motor driven injection pumps CP 350 A1/A2/A3/A4/A5/B1/B2/B3 are installed.

CP 350 A1/A2/A3 are dedicated to station A well 1 & 2
CP 350 B1/B2/B3 are dedicated to station B well 1 & 2
CP 350 A4/A5 are dedicated to station A well 3

Each pump has a capacity of 200 l/hr at 201 barg.

2.2.3 The pumps can be operated either locally from skid or remotely from CCR. Flow rates can be adjusted (stroke adjustment) from CCR.

2.2.4 The flow in each injection line will also be monitored from CCR on an instantaneous and accumulative basis.

2.2.5 Injection pumps are protected against blocked discharge by means of pressure relief valves. Their discharge are routed back to methanol storage tank in order to avoid overheating by methanol recirculation.

2.2.6 Accumulators

Each well injection line is equipped with an accumulator battery to allow the injection of a methanol slug in case of injection unit and platform shut down.

Each accumulator battery has a methanol capacity of 100 1 which will be released to the wellhead within 30 min.

2.2.7 Surface injection lines

Need for occasional methanol injection in surface installation will be achieved via two pumps CP 350 D1/D2. Injection points are located:

- Upstream choke valves manifold
- inlet line of slug catcher CV 310
- inlet line of gas metering scrubber CV311
- upstream sea line depressurization valve
- upstream gas flow control valve

These pumps are also used to fill/refill accumulator batteries.

These pumps are locally operated and locally monitored.

Flow is locally adjusted via manual stroke adjustment and local visualisation via rotameter type flow measurement.

2.3 Methanol Service Facilities

2.3.1 Servicing of subsea equipment is achieved via the service line. Four functions are performed:

- Depressurization of subsea stations piping/annulus of wells during periodic testing of subsea equipment
- Detection of eventual subsea leaks
- Repressurization of subsea stations piping during periodic testing of subsea equipment
- Back-up injection line in case of 1/2" methanol injection line failure.

(a) Depressurization of subsea equipment is performed manually via a hand control valve operated either locally or from CCR. The service line is connected to atmospheric methanol flash tank CV 360 which is used to flash off hydrocarbon gases from the methanol returned from the service line. Methanol is then routed by gravity, to methanol storage tank CV 350 A/B.

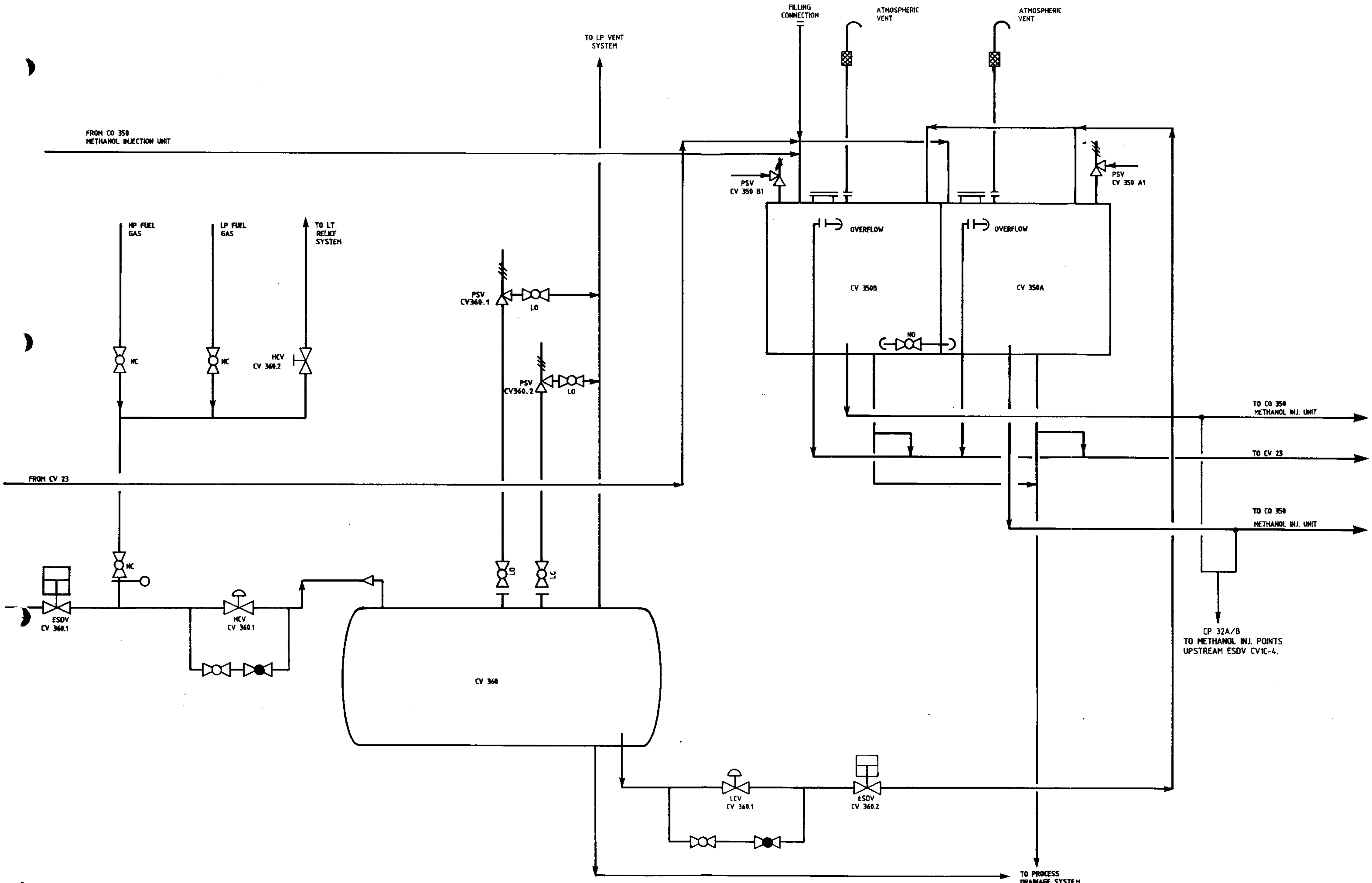
(b) During normal production, the service line is full of methanol at a pressure of 50 bara. Subsea leaks are identified by high/low pressure alarms in CCR.

(c) Repressurization is performed with methanol injection pumps either CP 350 D1/D2 or in addition well injection pumps. If well injection pump is to be used, this operation is manual and has to be followed carefully.

(d) In case of one 1/2" methanol injection line failure, the 1" service line can be used instead via a locally and manually operated interconnection line between in injection lines and the service line. However, due to the absence of accumulator back-up in this configuration, injection shall be limited to workover operations.

2.3.2 (a) The two 10" lines from the production stations A and B to the 12" common production line can be depressurized via the service line through HCV CV 360.2.

(b) Pressurization of these lines can be done using the LP/HP fuel gas.

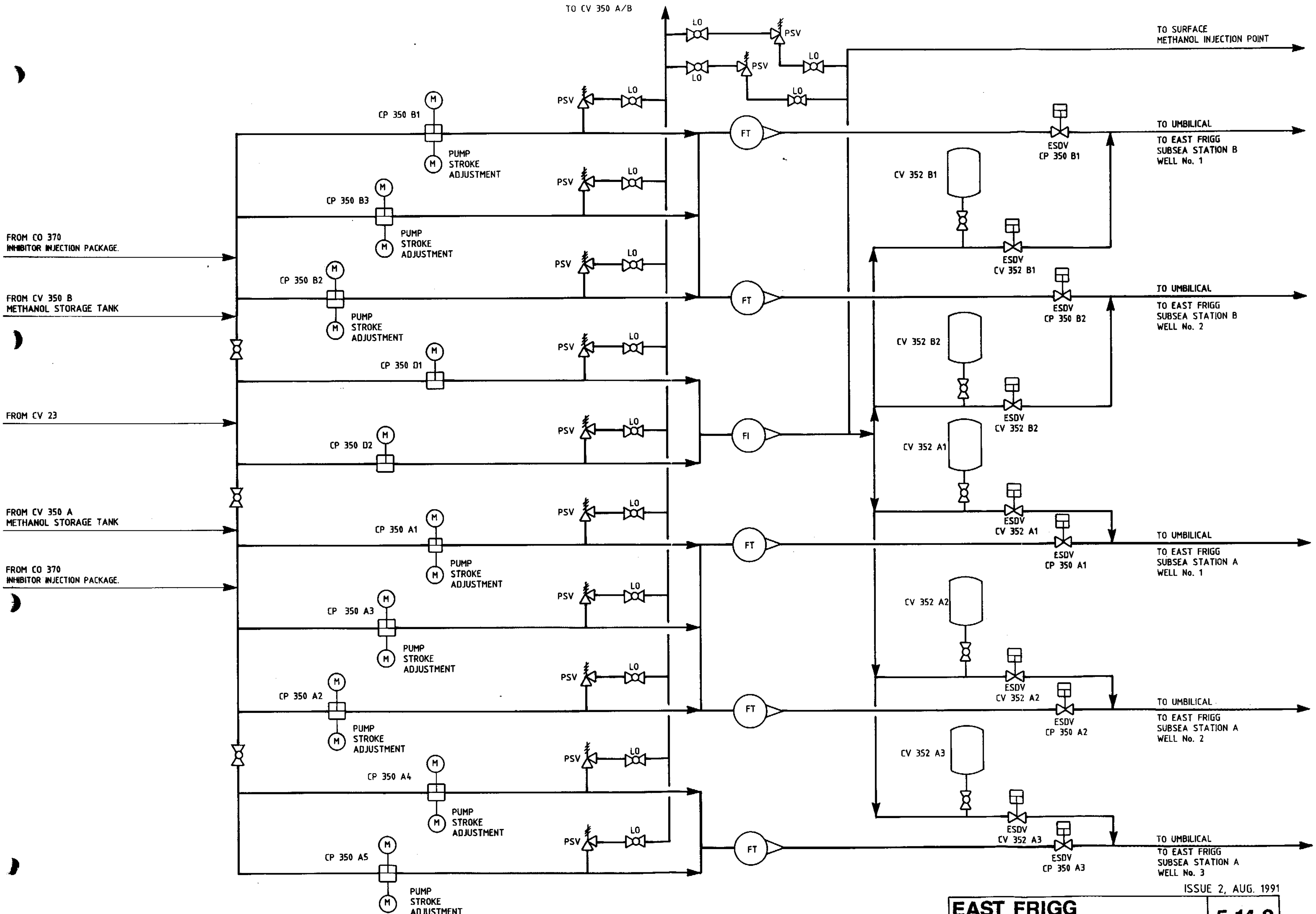


ISSUE 2. AUG. 1991

EAST FRIGG

METHANOL STORAGE & RECOVERY SYSTEM

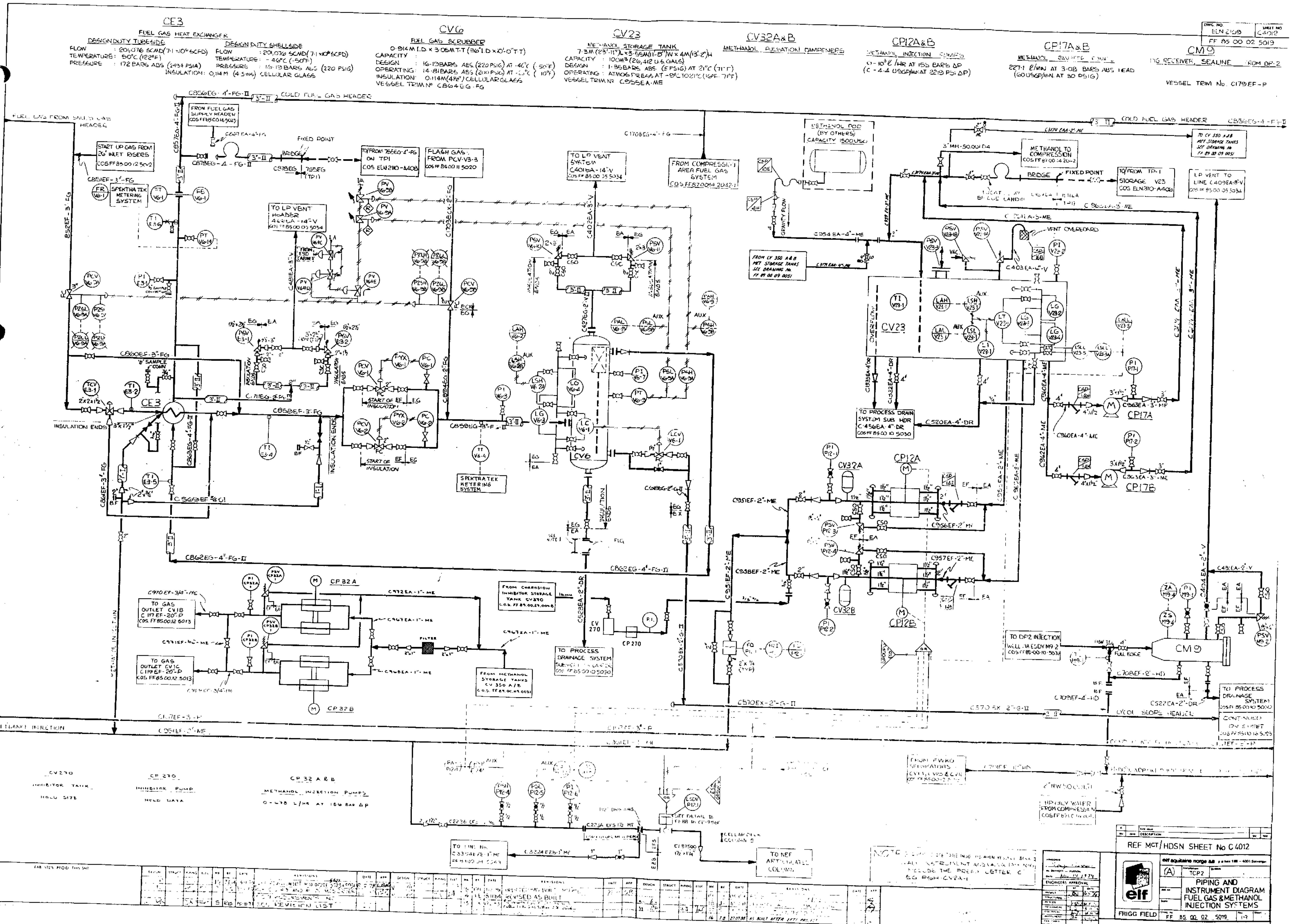
5.14.1



ISSUE 2, AUG. 1991

EAST FRIGG
METHANOL INJECTION PACKAGE

5.14.2


CE3
FUEL GAS HEAT EXCHANGER
DESIGN DUTY TUBESIDE
DESIGN DUTY SHELLSIDE
FLOW : 201,076 SCMD (7.1x10⁶ SCFD)
TEMPERATURE : 50°C (122°F)
PRESSURE : 172 BARS ABS (2497 PSIA)
TEMPERATURE : -46°C (-50°F)
PRESSURE : 16.13 BARS ABS (220 PSIG)
INSULATION : 0.114M (4.5 INS) CELLULAR GLASS
CV6
FUEL GAS SCRUBBER
0.914 M I.D x 3.05 M T-T (36"I.D x 10'-0" T.T)
CAPACITY
DESIGN
OPERATING
INSULATION : 0.114M (4½") CELLULAR GLASS
VESSEL TRIM No CB64EG-FG
CV23
METHANOL STORAGE TANK
CAPACITY : 100M³ (26,412 U.S GALS)
DESIGN : 1.35 BARS ABS (5 PSIG) AT 21°C (70°F)
OPERATING : ATMOS PRESS AT -9°C 102.1°C
VESSEL TRIM No C955EA-ME
CV32A & B
METHANOL PULSATION DAMPENERS
CP12A & B
METHANOL INJECTION PUMPS
CP17A & B
METHANOL TRANSFER PUMPS
227.1 ℓ/MIN AT 3.08 BARS ABS HEAD
(60 USGP/MIN AT 30 PSIG)
CM9
PIG RECEIVER, SEALINE FROM DP-2
VESSEL TRIM No. C179EF-P
COLD FUEL GAS HEADER
FUEL GAS FROM SALES GAS HEADER
START UP GAS FROM 26" INLET RISERS
FROM FUEL GAS SUPPLY HEADER
SPEKTRATEK METERING SYSTEM
FIXED POINT
BRIDGE
FLASH GAS FROM PCV-V3-3
TO LP VENT SYSTEM C401EA-14"-V
TO LP VENT HEADER
FROM COMPRESSION AREA FUEL GAS SYSTEM
METHANOL POD (BY OTHERS) CAPACITY 1500 USG
METHANOL TO COMPRESSION
TO/FROM TP-1 STORAGE V23
LP VENT TO LINE C409EA-8"-V
VENT OVERBOARD
OVERFLOW
CV23
TO PROCESS DRAIN SYSTEM SUB HDR C456EA-4"-DR
CP17A
CP17B
CP12A
CP12B
CV32A
CV32B
INSULATION ENDS
START OF INSULATION
CE3
CV6
CP 32 A
CP 32 B
TO GAS OUTLET CV1B
TO GAS OUTLET CV1C
FROM CORROSION INHIBITOR STORAGE TANK CV270
CP 270
FILTER
FROM METHANOL STORAGE TANKS CV 350 A/B
TO PROCESS DRAINAGE SYSTEM
TO DP2 INJECTION
CM9
FULL BORE
GLYCOL SLOPS HEADER
TO PROCESS DRAINAGE SYSTEM
METHANOL INJECTION
CV 270
INHIBITOR TANK
HOLD SIZE
CP 270
INHIBITOR PUMP
HOLD DATA
CP 32 A & B
METHANOL INJECTION PUMPS
FROM FWKO SEPARATORS
HP OILY WATER FROM COMPRESSION
TO NEF ARTICULATED COLUMN
CELLAR DECK COLUMN 2
REVISED AS BUILT
REF MCT/HDSN SHEET No C 4012
elf aquitaine norge a/s
TCP2
PIPING AND INSTRUMENT DIAGRAM FUEL GAS & METHANOL INJECTION SYSTEMS
FRIGG FIELD
FF 85 00 02 5019
DWG NO ELN 2109
SHEET NO C4012
FF 85 00 02 5019

WASHDOWN SYSTEM

1. GENERAL

1.1 The Washdown System supplies sea water for general washdown purposes.

1.2 The system comprises the following:

(a) Washdown pumps CP7 and 50P02.

(b) Three 4in ring mains.

(c) Twenty-eight washdown hosereels.

1.3 Valved interconnections with the firewater ring main enable the washdown pumps to be used as backup firewater pumps.

2. DESCRIPTION

2.1 Gas Treatment Area Washdown

2.1.1 Washdown pump CP7 is of the vertical centrifugal type, driven by an 89 kW electric motor. It has a capacity of 113 m^3/h at 9.6 bara. Pump operation is controlled by remote Start/Stop pushbuttons at each treatment area hosereel station.

2.1.2 CP7 takes suction through a stilling tube which terminates at elevation -12.19 m, and discharges into the treatment area ring mains through a 6in line.

2.1.3 The two 4in ring mains (UW1302 and UW1307) encircle the treatment area at Cellar, Main and Upper Deck levels respectively. They are interconnected by two 4in cross-overs UW1305 and UW1306. Valved 2in branch lines off the ring mains serve the washdown hosereels.

2.1.4 Each hosereel comprises 31m of 1.1/2in hose terminating with a spray/jet/shut-off nozzle, rated to deliver 379 litres/min.

2.1.5 The treatment are ring main is interconnected with the treatment area firewater system to provide backup facilities. It is also interconnected with TCP2 Extension (and further to East Frigg module 51) and compression areas.

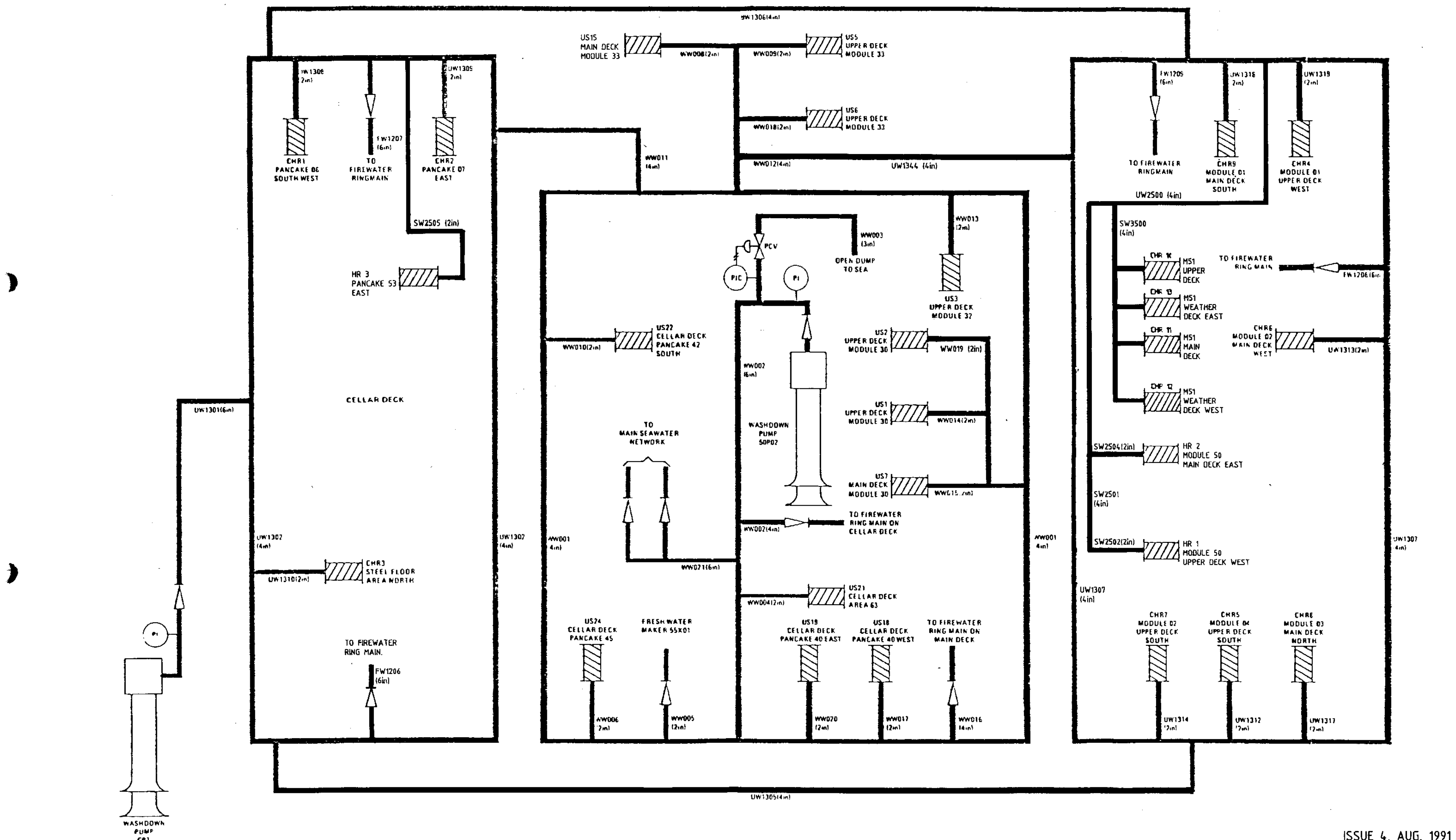
2.2 Gas Compression Area Washdown

2.2.1 Washdown pump 50P02 is of the vertical centrifugal type, driven by an electric motor. It has a capacity of 113 m^3/h at 9.6 barg. Pump operation is controlled by remote Start/Stop pushbuttons at each compression area hosereel station or from the Compression Area Control Room.

2.2.2 50P02 takes suction through a stilling tube which terminates a elevation -12.19m, and discharges into the compression area ring main through a 6in line.

2.2.3 A 4in ring main WW001 (4in) supplies the Cellar, Main and Upper Deck levels of the compression areas. WW001 (4in) is interconnected with UW1302 (4in) and UW1307 (4in). Valved 2in branch lines off the ring main serve the washdown hosereels and the watermaker. A 6in branch line is used to fill the compression area main sea water network before start-up.

2.2.4 The compression area ring main is interconnected with the compression area firewater system to provide backup facilities.



ISSUE 4, AUG. 1991

WASHDOWN SYSTEM	5.15

FOR MORE DETAILED INFORMATION SEE
FF85.00.18.5040, 5041, 5042, FF87.00.18.2048,
FF88.00.17.5044 AND FF89.00.17.0045.

DRAINAGE SYSTEM

1. GENERAL

1.1 The Drainage Systems comprise open and closed systems both of which terminate in a 32in caisson (CV13) located under Pancake 07. The caisson has its upper level above sea level, and its lower section open to the sea below sea level.

1.2 A methanolated Water Drainage System is added to drain all low pressure vessels containing methanolated water. The following vessels are drained through this system:

(a) CV204 ODIN condensate/methanol separator

(b) CV213 NEF condensate/methanol separator

(c) CV220 Methanolated water flash drum

(d) CV 313 EF Condensate/Methanol Separator

(e) CV 320 EF Methanolated Water Flash drum

(f) CV 350 A/B EF Methanol Storage Tank

(g) CV 360 EF Methanol Flash Tank

The drains are gathered into a header going to the methanolated water drainage tank CV222. When the liquid reaches a set high level in vessel CV 222, the drainage tank pump CP 224 will start, and send the liquid to vessel CV 220 or to vessel CV 320. When the liquid reaches a set low level in CV 222 the pump will stop. The pump will also stop on high level, high and low pressure in CV 220 or in CV 320.

2. DESCRIPTION

2.1 Process equipment drains discharge into 4in and 6in closed drain headers, via closed drain subheaders. High and medium pressure vessels are normally not connected to the process drain system, but are blinded off and connected during shutdown periods only.

2.2 The 4in and 6in closed drain headers discharge into the caisson via a 12in open drain header. To prevent the ingress of hydrocarbon gases into the open drains system a liquid seal loop is installed in the 12in open drain header upstream of the closed drain header connections.

2.3 Liquid seals are also fitted to the 2in drain lines of the firewater pump, diesel fuel day tanks (CV11A and B) upstream of the subheader connection.

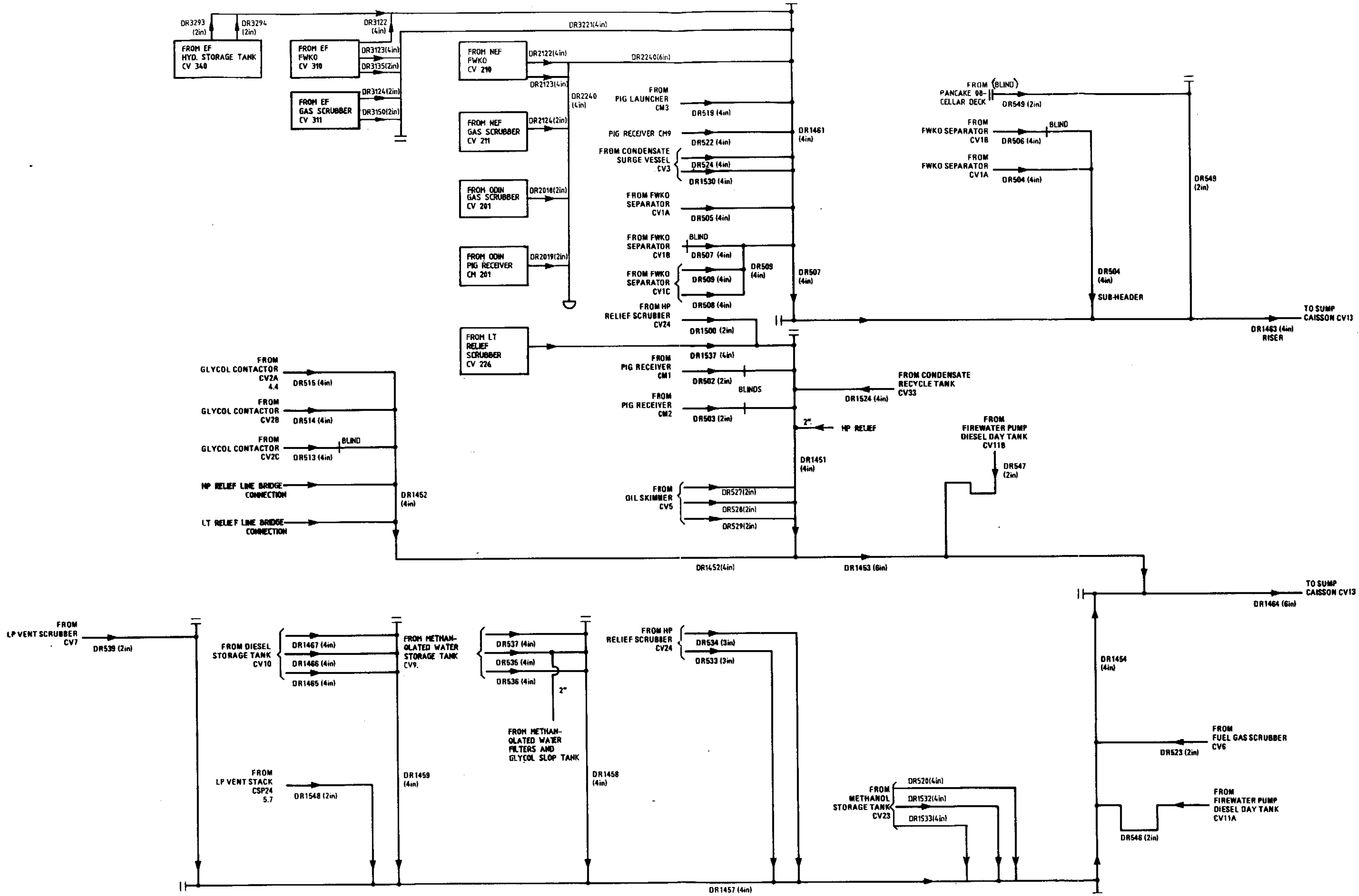
2.4 Platform deck areas are provided with a deck drain system comprising floor gullies leading into deck drain sumps. Each gully has a continuous slope down to the appropriate sump.

2.5 The open deck drain dumps discharge into the caisson via seal boxes, drain manifolds, the subheaders and a 12in open header.

2.6 In the caisson the oil and water separate out. When the oil/water interface reaches a predetermined level, the oil in the sump is pumped out using waste oil sump pump CP3. CP3 discharges to the condensate slops header serving oil skimmer CV5.

2.7 Submersible sump pump CP3 is located inside the caisson. The pump, which is driven by a 3.8 kW electric motor, has a capacity of 95 litres/min at 5.7 bar differential pressure. Pump operation is controlled by remote Start/Stop pushbuttons located adjacent oil skimmer CV5. CP3 stops automatically after 20 min..

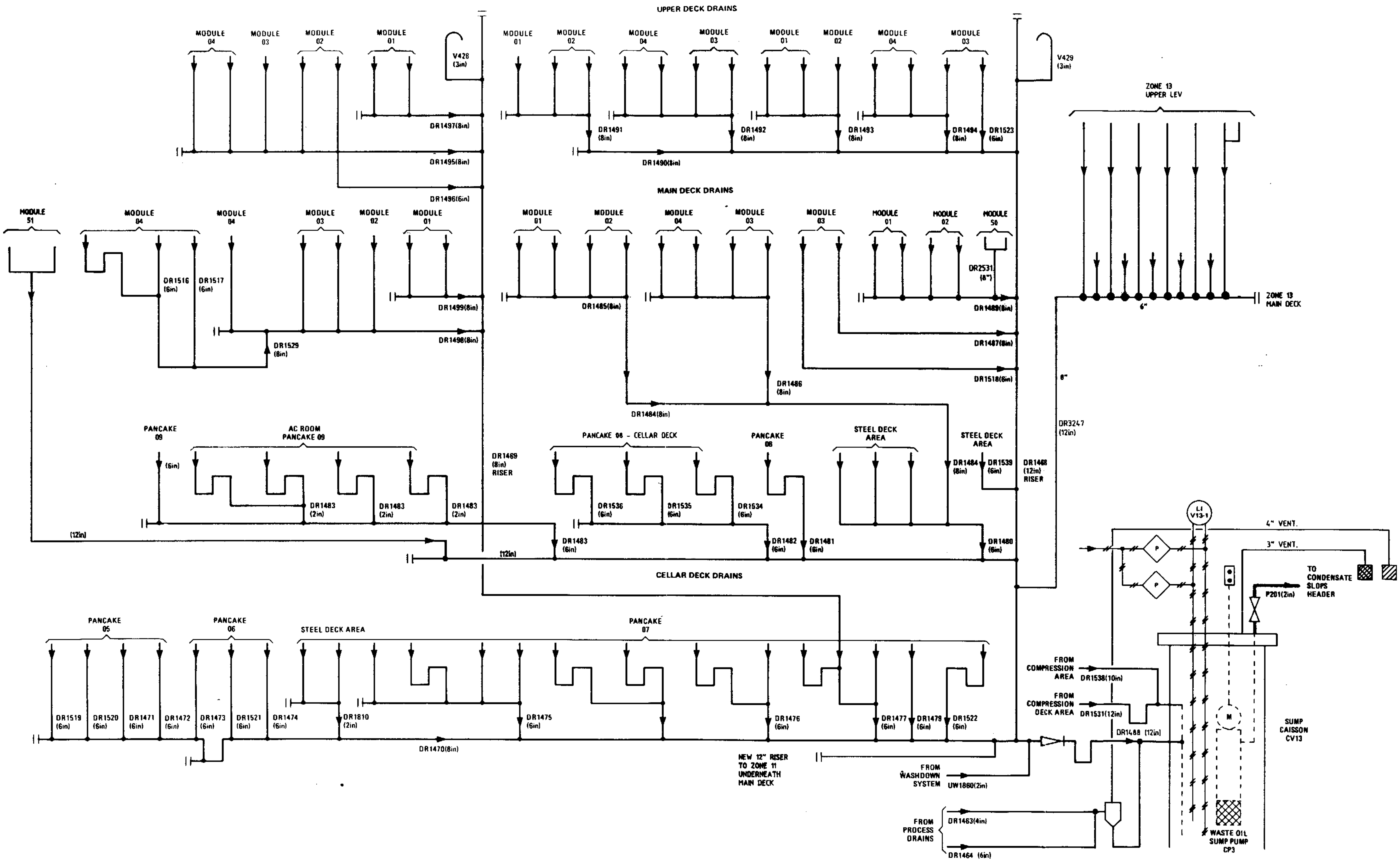
2.8 Caisson oil/water interface level indicator LI-CV13-1 incorporates a bubbler system. The differential pressure between the set-point for sea water and the set-point for oil is determined by the bubbler system, using two bubble tubes terminating at different levels in the caisson. LI-CV13-1 is located near CP3 Start/Stop pushbuttons.



ISSUE 4, AUG. 1991

DRAINAGE SYSTEMS Process | **5.16.1**

'FOR MORE DETAILED INFORMATION SEE FF85.00.10.5030 AND FF88.00.10.5100.

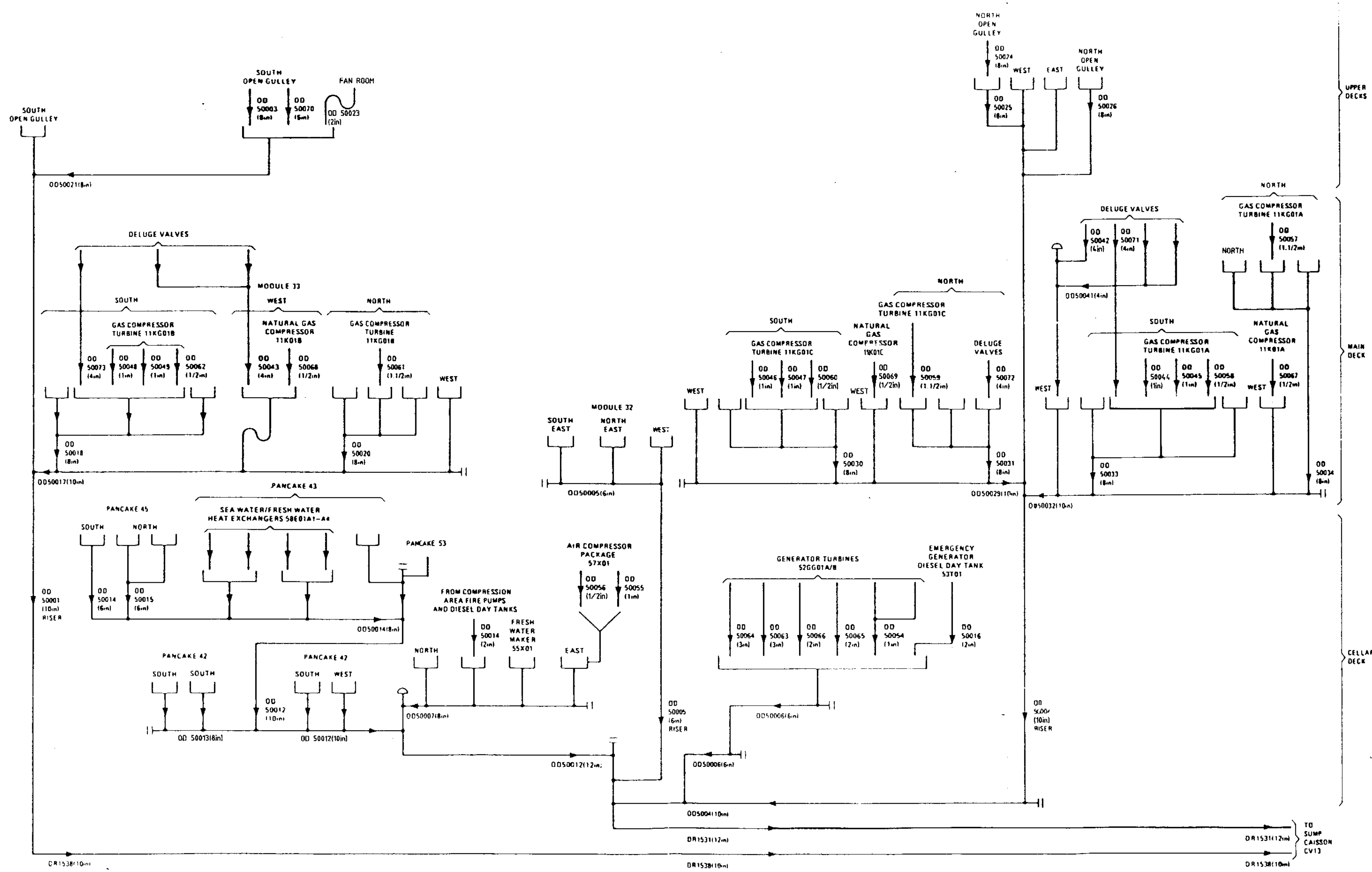


FOR MORE DETAILED INFORMATION SEE FF85.00.10.5031 & 5046, FF89.00.10.0035.

ISSUE 3, AUG. 1991

DRAINAGE SYSTEMS Deck

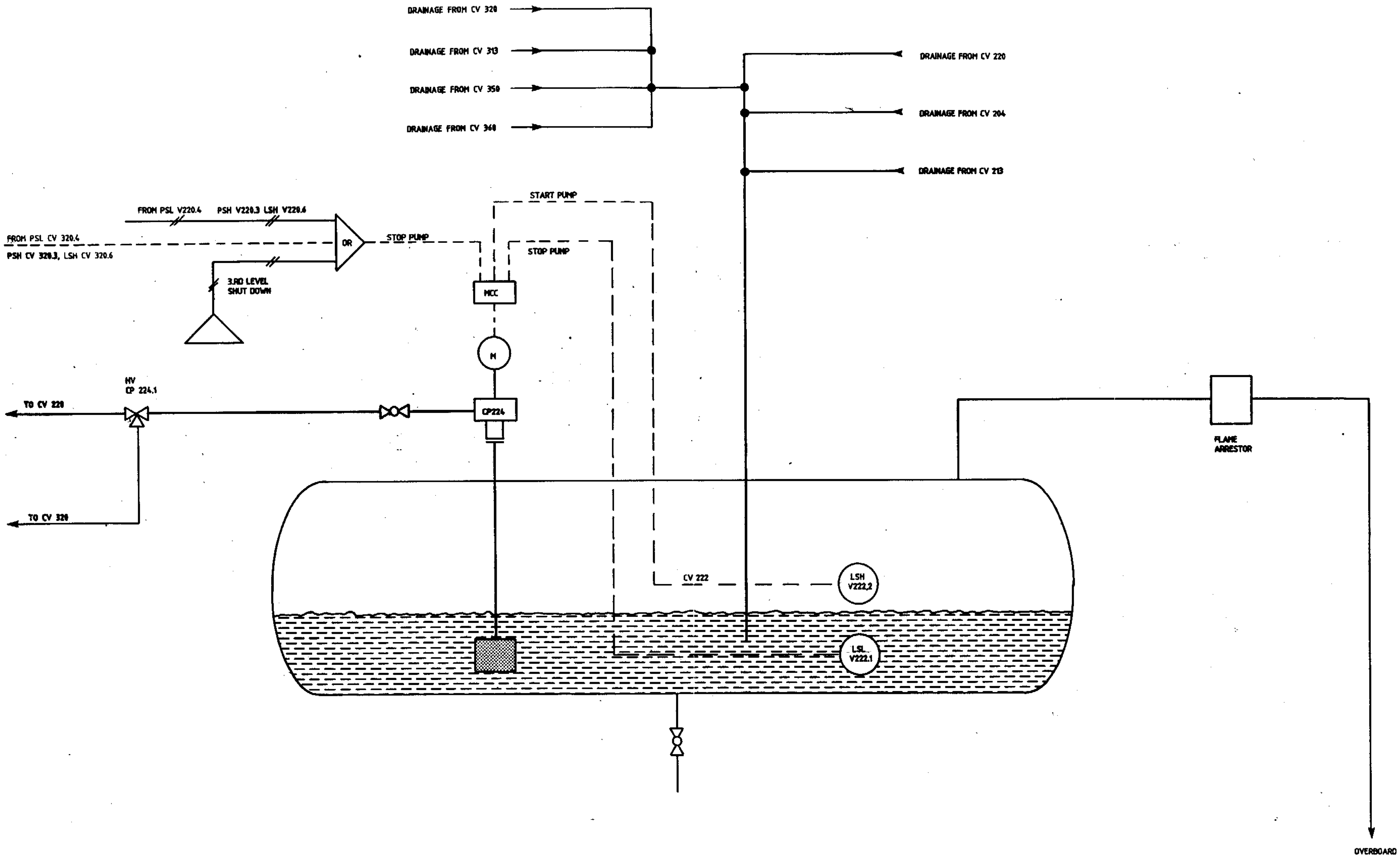
5.16.2



FOR MORE DETAILED INFORMATION SEE
FF87.00.17.2047 AND FF88.00.10.5046.

ISSUE 2, AUG. 1991

DRAINAGE SYSTEMS Compression Areas	5.16.3



ISSUE 3, AUG. 1991

PROCESS DRAINAGE SYSTEM TCP2 EXTENSION & EAST FRIGG	5.16.4

FOR MORE DETAILED INFORMATION SEE
FF.88.00.10.5100 AND FF.88.00.10.5033.

FUEL GAS SYSTEM (TREATMENT AREAS)

1. GENERAL

1.1 The Fuel Gas System for the treatment areas is provided to supply the following:

(a) Gas to the compression fuel gas system.

(b) Purge gas requirement of the HP Relief System (as back-up for the Nitrogen).

(c) Blanket gas requirements of specific process vessels.

(d) Heating and stripping gas requirements of the glycol regeneration streams.

1.2 The primary source of fuel gas is dry gas from the glycol contactors (CV2A & B). This supply may be augmented from the following sources:

(a) Dry gas interconnection line.

(b) Sales gas header.

(c) Gas export pipeline.

1.3 The above sources of fuel gas may be supplemented with pressure controlled flash gas from the condensate surge tank (CV3).

1.4 In the event of platform shutdown, gas from the sales gas header and the gas export pipeline can supply the fuel gas requirements to the compression fuel gas system and high pressure fuel gas system treatment.

1.5 The system comprises the following:

(a) Heat exchanger CE3 (by-passed).

(b) Scrubber CV6.

2. DESCRIPTION

2.1 Heat exchanger CE3 is of the horizontal tube and shell type, which operates at 140 barg (tube) and 12 barg (shell). Source gas, under pressure control, flows through the tube side of CE3 which, in heating fuel gas discharged from scrubber CV6, reduces the gas inlet temperature from 30 to 15°C. From CE3 source gas flows into scrubber CV6. In flowing through CE3 source gas pressure reduces from 140 to 100 barg. (Normally bypassed).

2.2 Gas flow through the tube side of heat exchanger CE3 is controlled by a temperature control loop which increases or bypasses gas flow as determined by the inlet gas temperature at scrubber CV6. A valved 3in bypass line is installed around the tube side of heat exchanger CE3. (Normally bypassed).

2.3 Entrained liquids in the source gas are separated out in scrubber CV6 which operates at 14 barg within a temperature range of -40 to -23°C. Gas flow into CV6 is controlled by duplicate 100 per cent pressure control valves. These valves, which are installed in parallel, reduce inlet gas pressure from working pressure in glycol contactors to 14 barg.

2.4 Scrubber CV6 is protected against overpressure by duplicate pressure safety valves installed in parallel. Each valve is set to lift at 16.19 bara. High and low pressure alarms indicate in the Control Room.

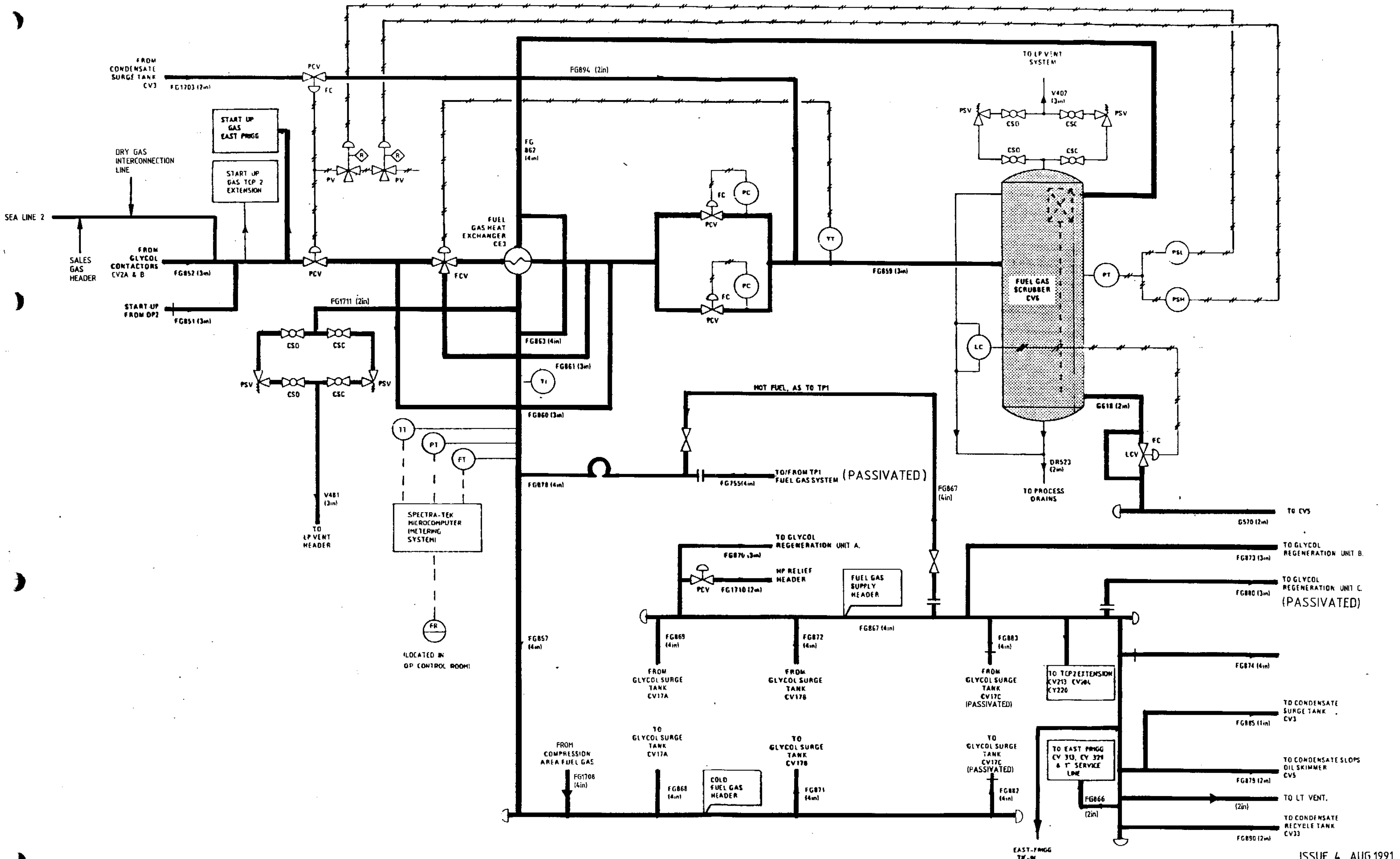
2.5 As the heat exchanger CE3 is normally by-passed, cold fuel gas from CV6 flows into the 4in cold fuel gas header, from which it is directed through the heating coils in any one of the glycol surge tanks (CV17A & B) serving the glycol regeneration streams. Fuel gas, heated by the hot glycol in the glycol surge tanks, then flows into the 4in fuel gas supply header which distributes the fuel gas to the consumers.

2.6 Gas discharged from CV6 is monitored for temperature, pressure and flow, which is recorded.

3. DESCRIPTION - METERING MICROCOMPUTER SYSTEM

Fuel Gas metering

The stream parameters (temperature, flow and pressure) are registered by the flow computer (Spectra-tek). The flow is also recorded locally and in Q.P. control room.



FOR MORE DETAILED INFORMATION SEE
FF.85.00.02.5019, FF.85.00.11.5020 & FF.85.00.16.5025.

ISSUE 4, AUG.1991

FUEL GAS SYSTEM
Treatment Areas

5.17

FUEL GAS SYSTEM (COMPRESSION AREAS)

1. GENERAL

1.1 The Fuel Gas System for the compression areas is provided to supply the following:

(a) Treated fuel gas to natural gas compressors 11KG01A, B and C.

(b) Treated fuel gas to turbo generators 52GG01A and B.

(c) Untreated fuel gas for LP vent purging.

1.2 Fuel gas for treatment is supplied from the following sources:

(a) Wet gas from separator 11B02A outlet.

(b) Dry gas from TCP2 sales gas header, dry gas interconnection line and sealine 2.

(c) Gas from treatment area glycol contactors CV2A & B.

1.3 Two treatment streams are provided, one working, one standby. Each stream is capable of treating 940 800 m^3/d (28000 kg/h). Fuel gas is supplied to users at 20 barg, dewpoint -10°C, and at a minimum temperature of 5°C.

2. DESCRIPTION

2.1 Each fuel gas treatment stream comprises a fuel gas heat exchanger, water heater, hot water pump gas/gas heat exchanger and low temperature separator. A common hot water tank is also provided. The water heaters, hot water pumps, fuel gas heaters and hot water tank form fuel gas heating package 50x07. The gas/gas heat exchangers and low temperature separators form fuel gas package 50x01. Methanol can be injected from a mobile injection pump.

2.2 Assuming that treatment stream A is in use, fuel gas for treatment is heated as required in fuel gas heat exchanger 50x07A. The heating medium for 50x07A is hot water which is circulated round a closed loop system by hot water pump 50x07P01A. The water is heated by four electric immersion heaters arranged in series. Each heater is provided with two heating elements, one of 112 kW and one of 128 kW. One heater is provided with auto-regulated elements, the remainder with auto/manually, regulated elements. The temperatures of the hot water and fuel gas are controlled so as to maintain optimum temperature of fuel gas at the treatment unit outlet.

2.3 Fuel gas passes from the fuel gas heating package through the tube side of gas/gas heat exchanger 50X01AE01. The gas is then expanded through a pressure control valve and passed into low temperature separator 50X01AB01 where any condensates or methanol (when used) are removed. The gas, now at 21 barg and -10°C, is passed to the shell side of 50x01AE01 where it is reheated to 20°C. Treated fuel gas is then distributed to users, each of which is provided with its own ESDV, knockout pot and filters.

2.4 If separator 11B02A is selected as the fuel gas supply, methanol pump 50X01P01A will automatically start. Methanol is injected upstream of gas/gas exchanger 50X01E01 and at the inlet of separator 11B02A in order to prevent hydrate formation.

2.5 The block valves in the fuel gas supply lines are manually selected. Each of the four ESD valves is controlled by a PIC which closes if the pressure downstream falls to a predetermined level. The EDS valves in the supply lines from glycol contactors CVA2A, B and C are closed on operation of the relevant ESD in TCP2 treatment area.

2.6 Low temperature separators 50X01AB01 and 50X01BB01 are protected against overpressure by relief valves set to lift at 23 barg. Any gas so released is vented to the LP Vent System.

3. DESCRIPTION - METERING MICROCOMPUTER SYSTEM

Fuel gas metering compression areas.

The stream parameters (temperature, flow and pressure) are registered by the flow computer (Spectra-tek).
The flow is also recorded locally and in Q.P. control room.

FUEL GAS FOR TCP2 EXTENSION

1. GENERAL

Fuel gas is used as blanketing gas, and start up gas. The fuel gas is taken from the existing fuel gas supply on TCP2.

2. FUEL GAS FOR BLANKETING

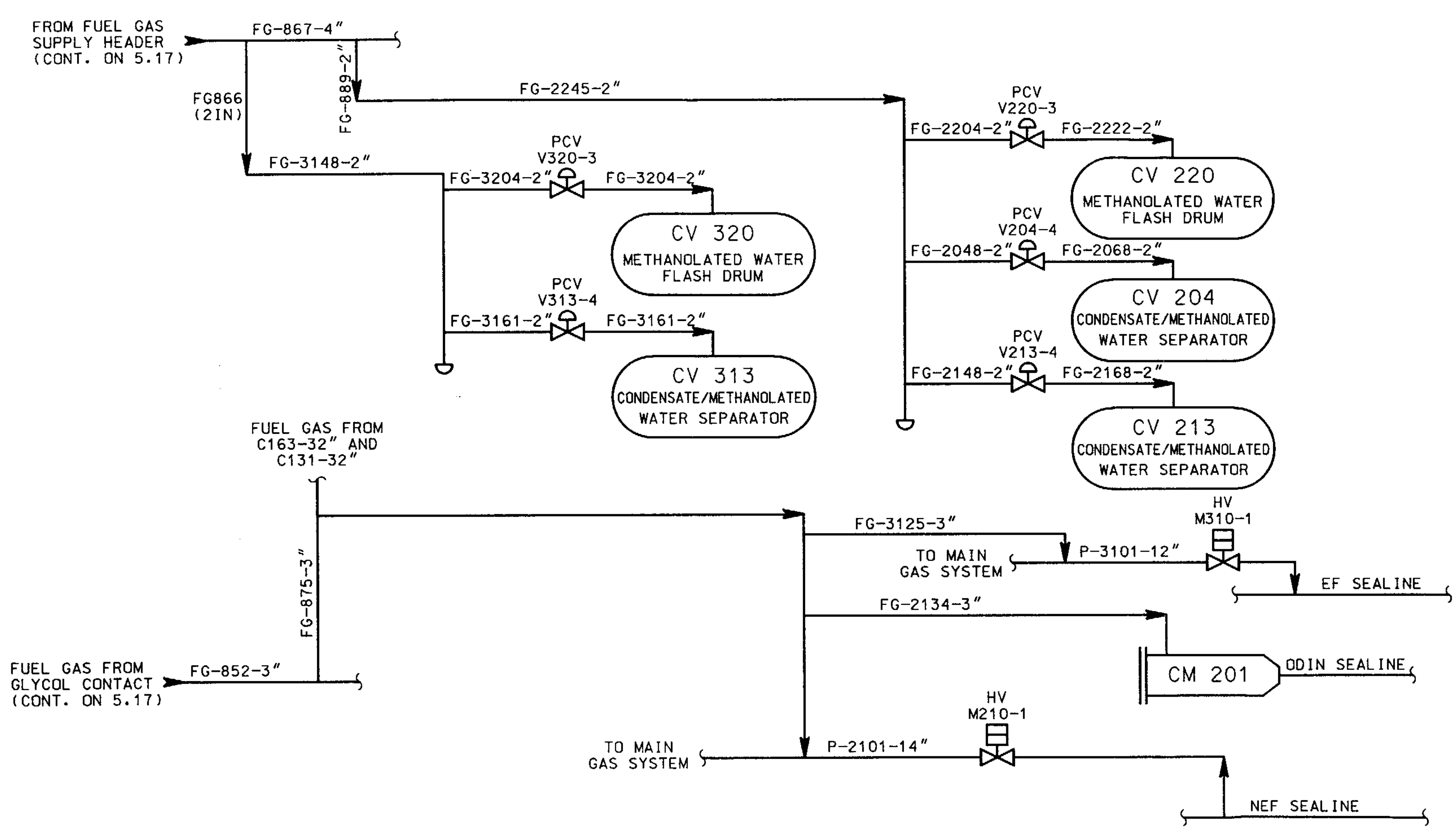
The fuel gas is used as blanket gas in case of a pressure decline in the following vessels:

- CV 213 NEF Condensate/Methanol separator
- CV 204 ODIN Condensate/Methanol separator
- CV 220 Methanolated water flash drum

The fuel gas is taken from the existing fuel gas supply header C867 EA 4" FG.

3. START UP GAS

The ODIN sealine pressurization will be performed from the ODIN field.
The NEF sealine cannot be pressurized from the field because of the submarine wellheads. A high pressure start up gas line is provided for this purpose.
This gas is taken from the existing fuel gas supply header C852 EF 3 FG upstream CV6.



FOR MORE DETAILED INFORMATION SEE
FF88.00.02.5040, FF85.00.16.5025

91-193

ISSUE 2, AUG. 1991

FUEL GAS SYSTEM
EXTENSION AREAS

5.19

FUEL GAS EAST FRIGG

1. GENERAL

Fuel gas is used as blanketing gas, and start up gas. The fuel gas is taken from the existing fuel gas supply on TCP2.

2. FUEL GAS FOR BLANKETING

The fuel gas is used as blanket gas in case of a pressure decline in the following vessels:

- CV 313 Condensate/Methanol separator
- CV 320 Methanolated Water Flash Drum

The LP fuel gas can also be used for pressurization purposes of part of the sealine via the 1" service line.

The fuel gas is taken from the existing fuel gas supply header C867 EA 4" FG.

3. START UP GAS

A high pressure start-up gas line is provided of pressurization for the EF sealine. This gas is taken from the existing fuel gas supply header C 852 EF 3 FG upstream CV6.

DIESEL FUEL SYSTEM

1. GENERAL

1.1 The Diesel Fuel System supplies fuel to the day tanks serving the diesel engines driving the firewater pumps, the platform cranes, the emergency generator and the users in the compression ares, which includes the Generator turbines 52G01A and B.

1.2 The system comprises the following:

(a) Storage tank CV10.

(b) Pumps CP8A and B.

(c) Pumps CP33A and B (for Generator turbines 52G01A and B).

(d) Filter CV21.

(e) Local control panel.

1.3 An interconnection with Platform TP1 allows the system to supply diesel fuel to and accept it from TP1.

2. DESCRIPTION

2.1 Diesel fuel is stored in tank CV10 which has a capacity of 100 m^3 and a maximum working pressure of 1.35 bara at 21°C. Normal tank replenishment is from a service vessel through the unloading stations. CV10 is protected against pressure changes by a pressure/vacuum safety valve.

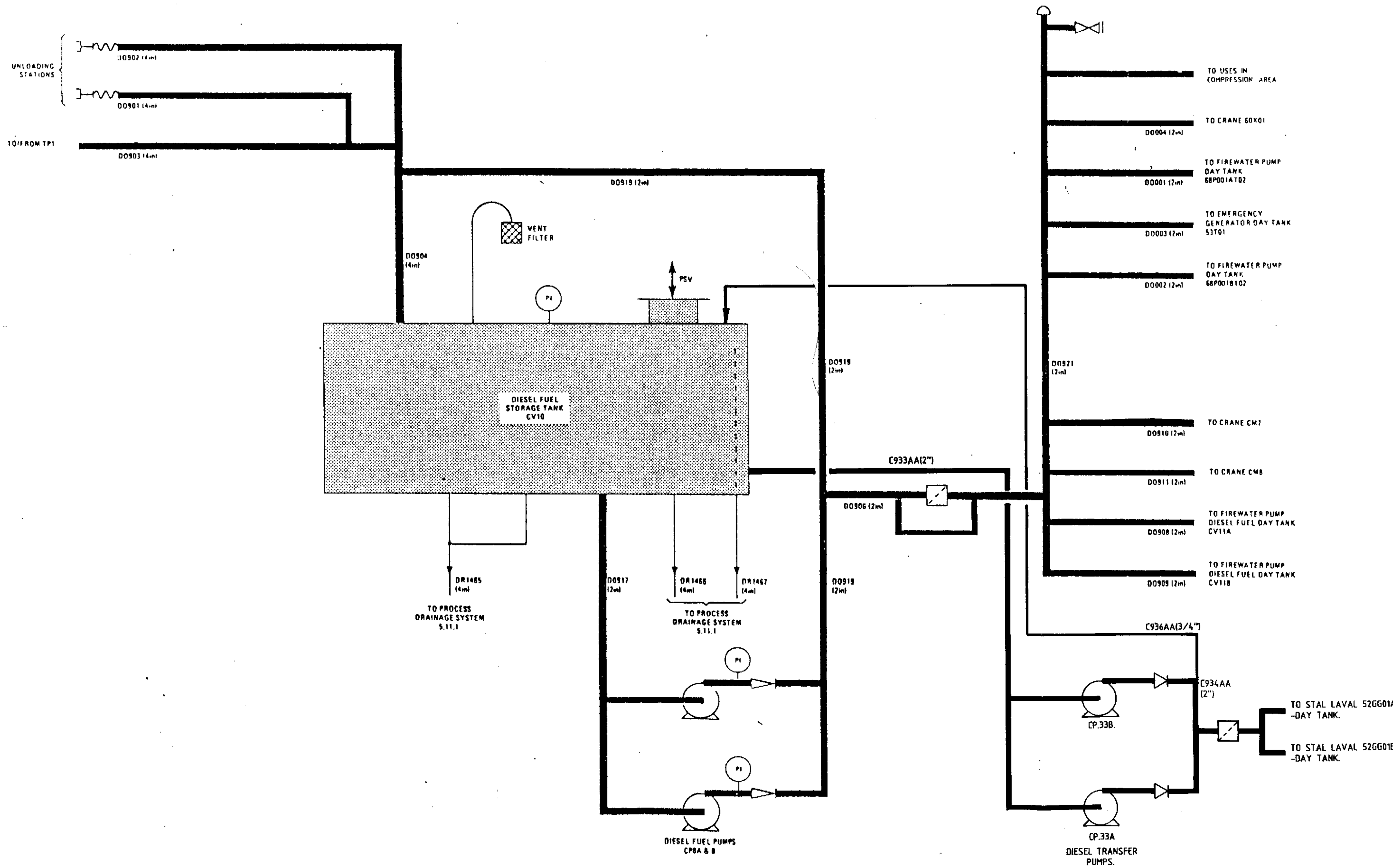
2.2 Level indication of tank CV10 is indicated locally and remotely at the local control panel, and the diesel fuel local control panels of TP1 and QP. Level indication of the firewater pump diesel fuel day tanks is also indicated at the local control panel.

2.3 Diesel fuel is distributed to consumers by motor-driven pumps CP8A and B, which are installed in parallel and normally operate one duty, one standby, as determined by a local hand selector switch. Each pump has a capacity of 113.6 litres/min at 4.2 barg.

2.4 The duty pump (CP8A or B) takes suction from tank CV10, and discharges to consumers through filter CV21. Pump operation is controlled by Start/Stop pushbuttons at the local control panel, and the diesel fuel local control panel of TP1.

2.5 Consumer isolating block valves are manifolded adjacent the local control panel, enabling system operation by one operator.

2.6 Diesel fuel is also distributed to the diesel day tanks for turbine 52G01A & 52G01B, by motor driven pumps CP33A & B. These operate in parallel, but on automatic, only one pump runs depending on which M/C has switched to diesel operation. When manual operation is selected, the pumps can be operated from the control panel (CP33A/B mezz. level-control room) or local beside the pumps at CV10 storage tank. Fire in zone 06 (local area beside CV10) will stop the pumps.



FOR MORE DETAILED INFORMATION SEE
FF.85.00.19.5027.

ISSUE 3, AUG. 1991

DIESEL FUEL SYSTEM | 5.20

1. GENERAL

Section 5.21 compressed air (treatment areas) is redundant due to modification to compressed air supply system on TCP2 (MR85161). Refer section 5.22 for information.

COMPRESSED AIR SUPPLY FOR CENTRAL COMPLEX AND DP2

1. GENERAL

Three air compressors (Atlas Copco ZR3-58) and ancillary equipment, installed in zone 5 (previous gas turbine room) deliver compressed and dry air to central complex and DP2. Since air is only supplied from one location the compressed air system for compression areas is permanently interconnected with the treatment compressed air system at pancake 46 and module 30 for instrument air and utility system. See drawing FF8500015007 for description of compressed air network.

Compressed oil free and pulsation free air is supplied by CQ 22A, CQ 22B and CQ 22C which are two-stage water cooled electric motor driver screw compressors. Each compressor have a capacity of 1200 m^3/hr at discharge pressure of 10.5 barg.

The air compressor package delivering dry air to above mentioned air network comprises the following:

(a) Air compressors CQ22 A/B/C.
(b) Circulation pumps for cooling water CP36 A/B.
(c) F.W. radiator coolers CE8 A/B/C/D.
(d) Air dryer CQ 23 and CQ 21.
(e) F.W. expansion tank.
(f) Air receiver 57 X01 T01.
(g) Dried air reservoir for 3 hours.
(26" lines to TP1, CDP1 & DP2).

2. COMPRESSORS

2.1 The three Atlas Capco air compressors have individual dedicated microprocessor control panel. The controllers are programmable which means that all local shut down threshold can be adjusted/modified. Eventual alarms, status and shut down are displayed to the operators locally. For each of the controllers general alarms signals are transmitted to QP control room and displayed on annunciator LC12 and LC9. In addition electrical motor on/off information is also displayed on the annunciator in QP control room.

2.2 During normal consume of instrument and plant air the capacity allows that one compressor is running duty I and one is running as duty II. The 3rd compressor is set in stand-by mode. In order to get equal run time on unit A,B and C the operator manually re-program the local controllers with a given frequency.

The compressor duty selection is based on the pressure on the air header outlet.

- 1st duty I comp.lead 9, unload 10.5 bar.
- 2nd duty II comp.load 8.7, unload 10.2 bar.
- 3rd stand by comp.load 7, unload 8.5 bar.

Note: The stand by comp. is programmed to allow electrical motor to stop. On duty I and II the electrical motor is running continuously.

For programming the air compressor controller refer to the Atlas Copco Instruction book Reg. code A/B ZR 2/6-10 1988-11 page 17, 22 and 23.

Normal programmme setting for CQ 22 A/B/C.

	Programmer switch no.	Programmable date	Normal setting
Duty 1	1	Unloading pressure	10.5
	10	Max permissible number of start per hour	0
Duty 2	1	Unloading pressure	10.2
	10	Max. permissible number of start per hour	0
Stand-by	1	Unloading pressure	8.5
	10	Max. permissible number of start per hour	1

Remaining settings to be "normal" defined in Fig. 12 page 22 and 23 in above mention instruction book except setting 11 max. permissible number of motor start per day which shall be 12 for all three compressors.

3. AIR RECEIVER/AIR RESERVOIR

Two 26" sealines (going to DP2 and CDP1) are tied in to the central complex and DP2 air network to ensure sufficient air reservoir in case of anomalies as shutdowns, repair, maintenance etc. The reservoir is refreshed with air from the dryers at acceptable dewpoint. The air receiver 57x01 and the above mentioned reservoir pressure will vary between 10.5 and 9 Bar. The air reservoir will last approximate 3 hours in event of shutdown. The service air network is automatic shutdown in event of falling pressure, see chapter 6.2 and diagram 5.22 for more detailed description.

4. AIR DRYERS

4.1 The air dryer Deltech MWE 3350 CQ 23, which is installed in compressor room on pancake 5, is operating following the below described principle:

During heating period the dessicant bed is heated by immersion heaters fitted into finned tube pockets. These are controlled by a thermostat. At the same time a small proportion of dried air (2.2% at standard conditions) is reduced to near atmospheric pressure and passed through the dessicant bed. Any residual moisture in the bed is vaporised by the heat and driven out by extremely dry air. After 3 hours max. of controlled heating the heaters are switched off, but the purge air continues. This carries away any residual moisture and allows the bed to cool. Fifteen minutes before the end of the cycle the purged air outlet valve closes and the absorber vessel gradually increases in pressure to await changeover.

4.2 Vessel changeover is initiated by an electrically operated cam timer which operates on the principle of continuous absorption in two alternating absorber towers filled with dessicant. Whilst one vessel is drying compressed air the other vessel is being regenerated by heat and a small flow of dry air. The total cycle time of the dryer is 9 hours. This is the time taken for one vessel to go through a complete cycle of absorption and deabsorption. This is made up as follows: 4 1/2 hours absorption, 3 hours max. purging with heat, 1 1/4 hours min. purging without heat, 1/4 hours repressurization.

4.3 A power economiser unit have been installed in the air dryer control cabinet. The instrument measures the outlet air from the dryer and relates this value to a pre-determined setpoint.
If the dewpoint is lower than this set point no heating is necessary next cycle. The controller then direct cut of power to the electrically operated cam timer which controls the power relay.

4.4 The CQ23 air dryer is totally local controlled. However, the dewpoint control unit starts an alarm if the temperature exceeds -20°C. This alarm is transmitted to QP and displayed on the same annunciator as above.

4.5 The air dryer CQ21 which is situated on pancake 42 (compression) has a local control cabinet mounted in the fire pump room A. from the cabinet one general alarm is transmitted to QP control room and displayed on above mentioned annunciator. Normally air dryer CQ21 is running as duty air dryer. Drying and filtrate of the compressed air from the air compressors continue in a automatic sequence controlled by a PLS.

4.6 The CQ21 air dryer operates according to the following principle: The "wet" compressed air flows through an inlet filter into one of two dryers, each capable of handling 1800 m^3/hr, where moisture is removed by a dessicant chemical. The dried air then passes through an outlet filter to the air receiver. The "non-duty" dryer is simultaneously regenerated (i.e. moisture removed from the disccant) by air taken from external, heated and sent through the dryer, regeneration when dewpoints rises above -40°C for dryer in action. Each dryers produce air at a dewpoint of -40°C at 10.3 barg.

5. FRESH WATER RADIATOR COOLERS AND CIRCULATING PUMPS

5.1 The cooling water system consists of four radiator coolers including electrical motors and fans, one expansion tank, two circulating pumps and 4" interconnection pipe to TCP2 compression turbine generators (Stal Laval) cooling system. Maximum cooling water inlet pressure is 5.5 bar. Recommended pressure 3 bar. The radiator cooler and pumps are manual controlled from a panel in vicinity of CQ22C.

5.2 No alarm function is installed on the cooling water ancillary system. However, the operator is implicit warned by means of the cooling water temperature and flowcontrol on each of the three compressor packages. If something goes wrong the first warning will be when the 95% cooling water temperature threshold on the compressors in operation is exceeded. This alarm goes to QP control room, and the operator can take appropriate action in accordance with operation manual of the air compressor system. In the event that the 100% threshold is exceeded a local shutdown of the relevant compressor is directed by the compressor local controller. The only monitoring means available for the operator are the local pressure gages on the F.W. circulating pumps.

6. DISTRIBUTION

6.1 The compressed air system consists of two separate distribution systems supplied from a common header. See FF 85 00 01 5007 Compressed air network.
The two systems are:

(a) An instrument air system serving modules, pancake gas compression seal air system, and other specific users.

(b) A plant system supplying utility station, pneumatic hoists, and gas turbine washing system, etc.

The two branches from the common compressed air header line which supply instrument air and plant air are under the control of their own pressure control valves (PCV). The standard of both instrument and service air is therefore the same, in terms of humidity and filtration, since the supply is common (only one air receiver for all compressor/ dryer sets).

6.2 The instrument air line PCV is controlled at 7.3 barg to supply the instrument air ring mains, the service air line PCV is controlled at 8.0 barg to supply service air. It should be noted that in the event of falling pressure in the air receiver, the service air line will be shut off preferentially in order to safeguard instrument air supplies. This modulation of the service air PCV is carried out by a pressure switch which senses pressure in the instrument air line.

6.3 In the event of low instrument air alarm is transmitted to QP control room and displayed on the same annunciator as described above.

6.4 In order to ensure air to winches in TCP2 and TP1 column in case of emergency a separate high pressure air system have been installed. (Refer to Compressor air network FF 85 00 01 5007)

The system consists of six air bottles, one three stage air compressor, air reducing valves and interconnection pipes.

If pressure in instrument air system falls below 5.5 barg air will be supplied via 2" line from the high pressure (200 barg) reservoir (7.2 m^3), which can supply up to 700 m^3/hr air at 5.5 barg pressure.

In order to utilize the emergency air the winch operators must operate the valves selecting air supply on the relevant winch station. In addition the high pressure reservoir can supply emergency air to the instrument air network through a interconnecting pipe. However, if the pressure falls below a preset limit (80 barg) remaining air is reserved exclusively for winch emergency air by automatically closing the interconnection line to the instrument air network.

6.5 Dry air to DP" is supplied through one 26" sea line. The volume in the line act also as reservoir in case of stop of air supply from central complex.

6.6 The TP1 and TCP2 air network is interconnected by two 3" pipes over the bridge. One for instrument and one for plant air supply.

7. SHUTDOWN OF AIR COMPRESSORS AND ALARM ANNUNCIATION

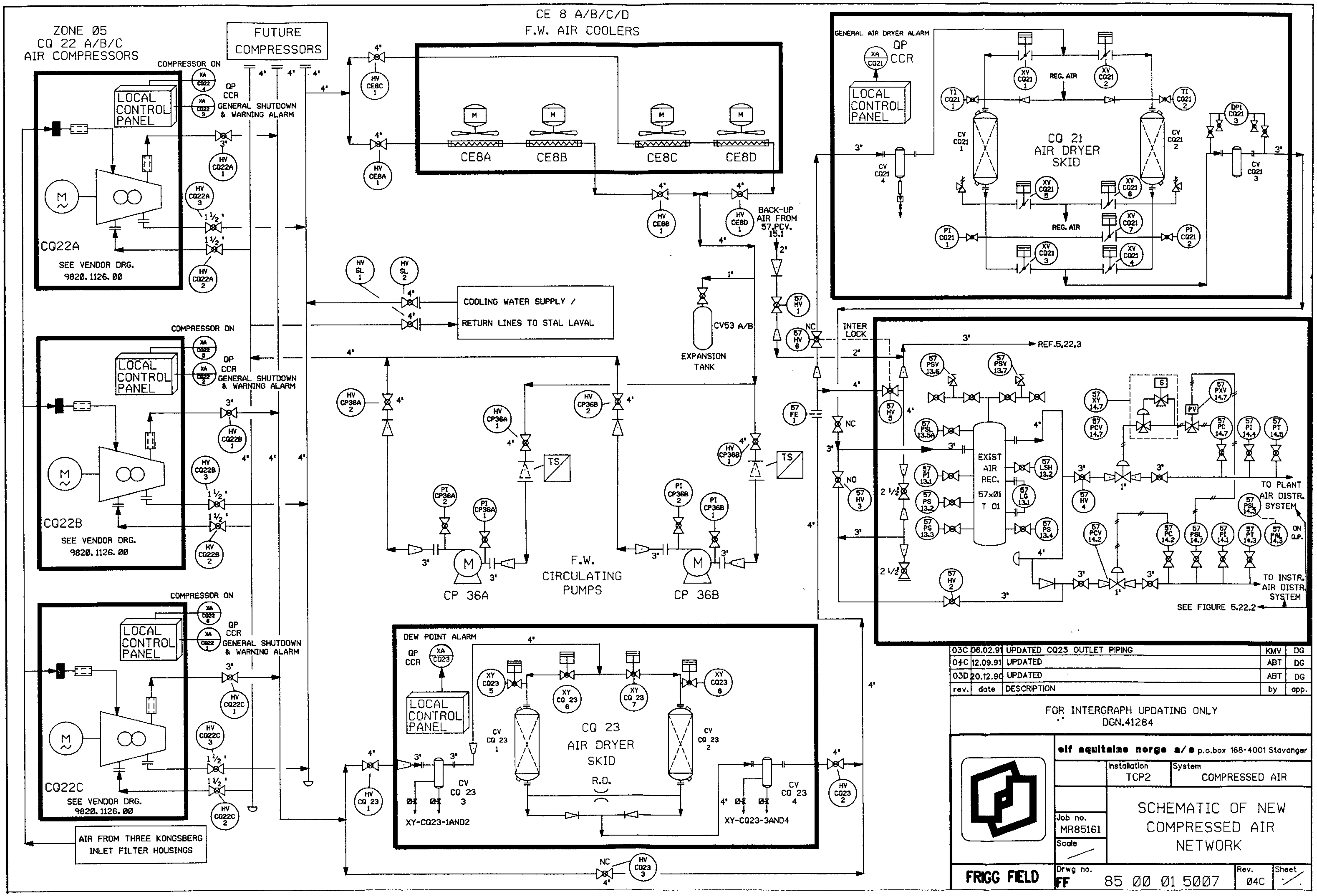
7.1 Automatic shut down of running compressor and associated equipment is initiated if preset parameters limits on the compressor local controllers are exceeded, if over pressure in the room is lost, gas in room, gas in compressor air intake, smoke/heat detector, gas/fire in work shop, common air inlet gas detection or any 3rd level ESD.

Note: Shutdown directed from one local compressor controller or gas in compressor air inlet will only initiate alarm on QP and local shutdown of relevant air compressor.

7.2 The following alarms annunciation is available for the operators on QP control room (LC12 and LC9).

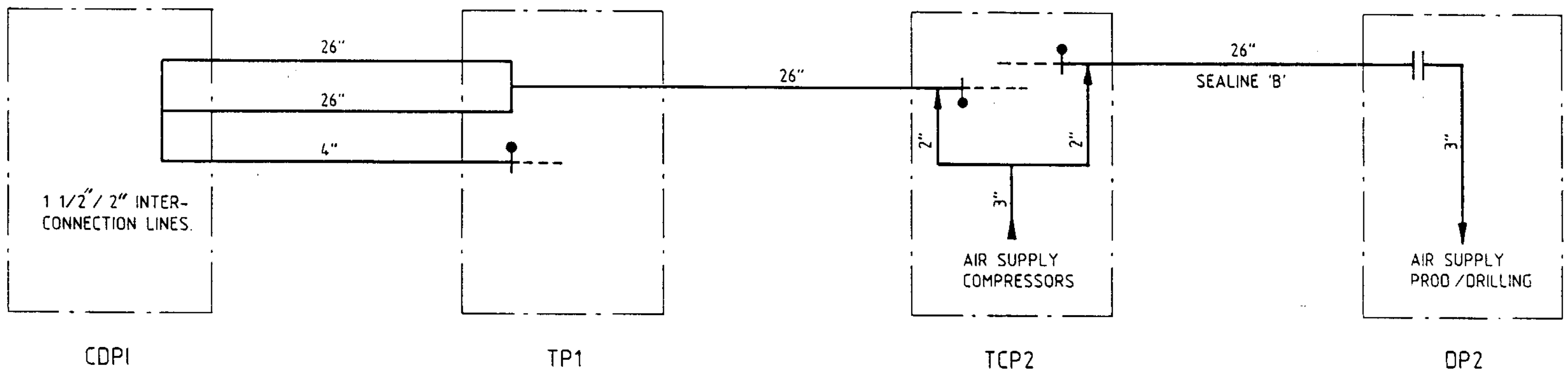
- General fault on air dryer	(XA-CQ21 air dryer alarm)
- Dewpoint above -20°C alarm	(XA-CQ23 dew point)
- General fault on air compressors and warning	(XA-CQ22-1 CQ22A) (XA-CQ22-2 CQ22B) (XA-CQ22-3 CQ22C)
- Status on compressor's electrical motors	(XA-XQ22-4 XQ22A) (XA-CQ22-5 CQ22B) (XA-CQ22-6 CQ22C)
- Low instrument air pressure	(57-PAL 14.3)

In addition the operators have a pressure gage showing constantly the air pressure on the instrument air network (the pressure sensor is installed on TP1).



ZONE Ø5
CQ 22 A/B/C
AIR COMPRESSORS
FUTURE COMPRESSORS
CE 8 A/B/C/D
F.W. AIR COOLERS
CE8A
CE8B
CE8C
CE8D
COMPRESSOR ON
LOCAL CONTROL PANEL
QP CCR
GENERAL SHUTDOWN & WARNING ALARM
CQ22A
CQ22B
CQ22C
SEE VENDOR DRG. 9820.1126.ØØ
COOLING WATER SUPPLY / RETURN LINES TO STAL LAVAL
CV53 A/B
EXPANSION TANK
BACK-UP AIR FROM 57.PCV. 15.1
F.W. CIRCULATING PUMPS
CP 36A
CP 36B
GENERAL AIR DRYER ALARM
CQ 21 AIR DRYER SKID
REG. AIR
INTER LOCK
REF.5,22,3
EXIST AIR REC. 57xØ1 T Ø1
TO PLANT AIR DISTR. SYSTEM
TO INSTR. AIR DISTR. SYSTEM
ON Q.P.
SEE FIGURE 5.22.2
DEW POINT ALARM
CQ 23 AIR DRYER SKID
R.O.
XY-CQ23-1AND2
XY-CQ23-3AND4
AIR FROM THREE KONGSBERG INLET FILTER HOUSINGS
03C 06.02.91 UPDATED CQ23 OUTLET PIPING KMV DG
04C 12.09.91 UPDATED ABT DG
03D 20.12.90 UPDATED ABT DG
rev. date DESCRIPTION by app.
FOR INTERGRAPH UPDATING ONLY
DGN.41284
elf aquitaine norge a/s p.o.box 168-4001 Stavanger
Installation TCP2
System COMPRESSED AIR
Job no. MR85161
Scale
SCHEMATIC OF NEW COMPRESSED AIR NETWORK
FRIGG FIELD
Drwg no. FF 85 ØØ Ø1 5ØØ7
Rev. Ø4C
Sheet

AIR RESERVOIR LINES.



NOTE 1.) DEFINED LINES ARE ACTING AS AIR RESERVOIR FOR ALL PLATFORMS.
TP1 IS SUPPLIED VIA 3" LINES FOR INSTRUMENT AND PLANT AIR SYSTEM FROM TCP2.

NOTE 2.) THE 26" SEALINE 'B' BETWEEN TCP2 AND DP2 IS ALSO ACTING AS AN AIR SUPPLY LINE TO DP2.

VENTILATION SYSTEMS (TREATMENT AREAS)

1. GENERAL

1.1 Platform enclosed areas are provided with pressurised ventilation systems complying with the particular zone hazardous classification.

1.2 Three pressurisation levels are maintained, namely 12mmWG, 6mmWG and 5mmWG. Each area has an exhaust system which maintains the required pressure within, and provides the necessary air changes.

1.3 Facilities are provided for heating and cooling distribution air to maintain environmental conditions.

1.4 Sound attenuators are fitted to supply ducting as required. Fresh air and recirculating quantities are controlled by servomotor operated dampers.

1.5 Air is distributed through ducting fitted with grilled outlets.

2. DESCRIPTION

2.1 Air Conditioning and Air Compressor Rooms (Pancakes 08 and 09)

2.1.1 Fresh air from an external safe area is drawn into a common intake plenum chamber through ducting fitted with a gas detector and servomotor operated damper. The air flows through a 95 kW heater, manually operated damper and a filter before entering the chamber.

2.1.2 Air is supplied at a rate of seven changes per hour by two parallel 18.5 kW axial flow fans (equipped with anti-vibration dampers and flexible ducting connections) which normally operate one duty, one standby. The fans take suction and discharge through ducting fitted with servomotor operated suction and manually and servomotor operated discharge dampers. The discharge dampers are interlocked with the fans' duty/standby selector switches and automatic differential pressure changeover facilities to prevent short circuiting of air.

2.1.3 Air discharged by the duty supply fan is distributed to the workshop/stores, Air Compressor Room and HVAC Plant Rooms through an air manifold and individual ducting fitted with manually and servomotor operated dampers. Air to the Air Compressor Room and HVAC Plant Rooms flows through a 120 kW heater.

2.1.4 A positive 6mmWG air pressure is maintained by the duty supply fan operating in conjunction with pressure controlled, servomotor operated louvres which exhaust to atmosphere. Each exhaust louvre is fitted with a gas detector.

2.2 Instrument Interface, Cabling, Switchgear Rooms and MCC (Pancakes 08, 09 and 13)

2.2.1 Fresh air from the common intake plenum chamber is supplied at a rate of 12 changes per hour by two parallel 11 kW axial flow fans (equipped with anti-vibration dampers and flexible ducting connections) which normally operate one duty, one standby. The fans take suction and discharge through ducting fitted with manually and servomotor operated suction and servomotor operated discharge dampers.

2.2.2 Air discharged by the duty supply fan flows through a cooling unit into an air manifold, from which it is distributed through individual ducting fitted with manually and servomotor operated dampers and heaters as follows:

(a) Instrument Interface Room: a 63 kW heater, at a rate of 17 changes per hour.

(b) Cabling Room and MCC: 41 kW heaters, at a rate of 12 and 15 changes per hour respectively.

(c) Switchgear Room: a 36 kW heater, at a rate of 12 changes per hour.

2.2.3 Ducting, fitted with a manually reset fire damper and a servomotor operated damper, supplies the Emergency Supply Room with air from the Cabling Room.

2.2.4 Air is extracted by an axial flow exhaust fan (equipped with anti-vibration dampers and flexible ducting connections) through individual ducting fitted with manually and servomotor operated dampers. The exhaust fan discharges through a filter into the common intake plenum.

2.2.5 Manually reset fire dampers are fitted to the extract ducting of the Instrument Interface and Cabling Rooms, and the supply ducting of the Instrument Interface Room.

2.2.6 A positive 6mmWG air pressure is maintained by the duty supply fan operating in conjunction with pressure controlled, servomotor operated exhaust louvres. The Switchgear Room exhaust louvre discharges into the Plant Room; the other louvres discharge to atmosphere. Each exhaust louvre is fitted with a gas detector.

2.3 Battery and Void Rooms (Pancake 08)

2.3.1 Fresh air from the common intake plenum chamber is supplied, at a rate of 30 changes per hour, by two parallel 2.2 kW axial flow fans (equipped with anti-vibration dampers and flexible ducting connections) which normally operate one duty, one standby. The fans take suction from and discharge through ducting fitted with servomotor operated dampers.

2.3.2 Air discharged by the duty supply fan flows through individual ducting fitted with manually and servomotor operated dampers. The Battery Room supply ducting is also fitted with a manually reset fire damper.

2.3.3 Air is extracted from the Battery Room to atmosphere by two parallel 2.2 kW axial flow fans and a single 2 kW axial flow fan equipped with anti-vibration dampers and flexible ducting connections. The parallel fans normally operate one duty, one standby. The exhaust ducting if fitted with manually and servomotor operated dampers and gas detectors.

2.3.4 A positive 5mmWG air pressure is maintained by the duty supply fan operating in conjunction with pressure controlled, servomotor operated exhaust louvres fitted with gas detectors. The Battery Room exhaust louvre discharges to atmosphere and the Void Room louvre discharges into the Plant Room.

2.3.5 The Battery Room may be ventilated naturally by ducting from an external safe area, fitted with a gas detector and servomotor operated damper.

2.4 Workshop, Stores, Elect. W/Shop and Toilets (Module 04)

2.4.1 Air is supplied via ducting from the main manifold in the HVAC Room. The ducting comes into the module through a fire damper mixing box, filter and two servo operated dampers.

2.4.2 Air discharged flows into an air manifold through servomotor operated dampers from which it is distributed through individual ducting fitted with manually operated dampers and heaters as follows:

(a) Toilets: a 9.7 kW heater, at a rate of 23 charges per hour.

(b) Electrical Workshop: a 4.9 kW heater, at a rate of 16 changes per hour.

(c) Workshop (Mezzanine Level): a 41 kW heater, at a rate of 12 changes per hour.

(d) Workshop (Main Deck Level): a 50 kW heater, at a rate of 14 changes per hour.

2.4.3 Air is extracted from the toilets to atmosphere by two parallel o.55 kW axial flow fans which normally operate one duty, one standby. Suction is taken through ducting fitted with manually and servomotor operated dampers and discharged through ducting fitted with a servomotor operated damper and a gas detector. The fans are equipped with anti-vibration dampers and flexible ducting connections.

2.4.4 Air is extracted from the Workshop Main Deck Level (welding area) to atmosphere by two parallel 0.75 kW exhaust fans (equipped with anti-vibration dampers and flexible ducting connections) which normally operate one duty, one standby. Suction is taken through ducting fitted with manually and servomotor operated dampers and discharge is through ducting fitted with servomotor operated dampers and a gas detector.

2.4.5 A positive 12mmWG air pressure is maintained in the Workshop, Stores and Elect. W/Shop, and 6mmWG in the toilets by the duty supply fan operating in conjunction with pressure controlled, servomotor operated louvres which exhaust to atmosphere. Each exhaust louvre is fitted with a gas detector.

2.5 Fire Pump Houses 1 and 2 (Pancake 07)

2.5.1 Fire Pump Houses 1 and 2 are served by individual ventilation units CQ12A and B respectively. Each unit comprises the following:

(a) Two parallel 1.1 kW axial flow supply fans which normally operate one duty, one standby, equipped with anti-vibration dampers and flexible ducting connections.

(b) Suction ducting from an external safe area fitted with a gas detector, servomotor operated dampers, mixing box, filter and a heater. The heater serving Fire Pump House 1 is 40 kW and Fire Pump House 2 is 45 kW.

(c) Discharge to atmosphere ducting fitted with servomotor operated dampers and a sound attenuator.

2.5.2 The mixing boxes receive fresh air and, when required, return air for recirculation.

2.5.3 Air is supplied to both Fire Pump Houses at a rate of 18 changes per hour.

2.5.4 A positive 6mmWG air pressure is maintained by the duty supply fan operating in conjunction with pressure controlled louvres which exhaust to atmosphere. Each exhaust louvre is fitted with a gas detector.

2.6 Transformer Room (Pancake 08)

2.6.1 Air is supplied by two parallel 2.2 kW axial flow fans (equipped with anti-vibration dampers and flexible ducting connections) which normally operate one duty, one standby. The fans take suction from an external safe area through ducting fitted with a gas detector, servomotor operated dampers and a filter.

2.6.2 The duty supply fan discharges, at a rate of 37 changes per hour, through ducting fitted with servomotor operated dampers.

2.6.3 Air is extracted to atmosphere by two parallel 2.2 kW axial flow fans (equipped with anti-vibration dampers and flexible ducting connections) which normally operate one duty, one standby. Suction is taken through ducting fitted with manually operated dampers and discharged through ducting fitted with servomotor operated dampers and a gas detector.

2.6.4 A positive 6mmWG air pressure is maintained by the duty supply fan operating in conjunction with a pressure controlled, servomotor operated louvre which exhausts to atmosphere. The exhaust louvre is fitted with a gas detector.

2.7 Emergency Supply Room (Pancake 09)

2.7.1 Air from the HVAC Plant Room is supplied through grilled ducting at a rate of 19 changes per hour.

2.7.2 Emergency air is supplied by a 2.2 kW axial flow fan which takes suction from an external safe area through ducting fitted with a gas detector and manually and servomotor operated dampers.

2.7.3 Air is extracted through grilled ducting which discharges into the HVAC Plant Room.

2.7.4 A positive 12mmWG air pressure is maintained by the duty Cabling Room supply fan operating in conjunction with a pressure controlled, servomotor operated louvre which exhaust to atmosphere. The exhaust louvre is fitted with a gas detector.

2.8 Control

2.8.1 Control of the ventilation systems serving the HVAC Plant, Battery and Transformer Rooms is from a control panel located in the HVAC Plant Room. Local control facilities are also provided.

2.8.2 Control of the ventilation systems serving the Fire Pump Houses is from local control panels. Local control facilities are also provided.

2.8.3 Systems not provided with control panels are locally controlled.

2.8.4 The ventilation systems will automatically shut down on actuation of the Fire and/or Gas Detection Systems, or on loss of differential pressure.

2.9 Instrument Interface Electrical Interface, Battery and HVAC Plant Rooms. (M51).

2.9.1 The ventilation systems in module 51 are designed to provide and maintain a safe overpressurised environment in the various enclosed areas.

2.9.2 The system comprises 3 systems, each having separate ducting, fans and accessories. All systems are provided with dual fan arrangement.

2.9.3 The controls, instrumentation and the alarms are located on a panel in the M51 HVAC Plant Room. The controls are linked to the fire and gas protection and ESD logic to provide shut down of ventilation as required.

2.9.4 Fresh air from safe area on weather deck level is supplied by two parallel centrifugal two speed fans (equipped with anti-vibration dampers and flexible ducting connections), which normally operate one duty and one stand-by. One of the fans is connected to emergency power supply switchboard. The fans take suction and discharge through ducting fitted with manually suction dampers and pneumatic operated discharge dampers.

2.9.5 Air discharged by the supply fan is distributed through stainless steel ducting fitted with fire damper, manually operated balancing dampers and electric heaters in branches to each room as follows:

(a) Instrument Interface Room: Design heat gain 4.6 kW. Electric heater rating 12.0 kW. Air flow rate of 15 changes per hour during winter time and 30 changes per hour during summer time.

(b) Electrical Interface Room: Design heat gain 3.9 kW. Electrical heater rating 10.0 kW. Air flow rate of 13 changes per hour during winter time and 26 changes per hour during summer time.

(c) Battery Room: Design heat gain 0.4 kW. Electric heater rating 3.3 kW. Air flow rate of 30 changes per hour constantly maintained by a self regulating constant air flow controller on the supply air banch duct.

(d) HVAC Plant Room: No design heat gain. No electric heater is provided. Air flow rate of 6 changes per hour during winter time and 12 changes per hour during summer time.

2.9.6 A positive air pressure is maintained by the duty supply fan operating in conjunction with pneumatic operated pressure control dampers in the extract ducting. The overpressure is maintained at the following values:

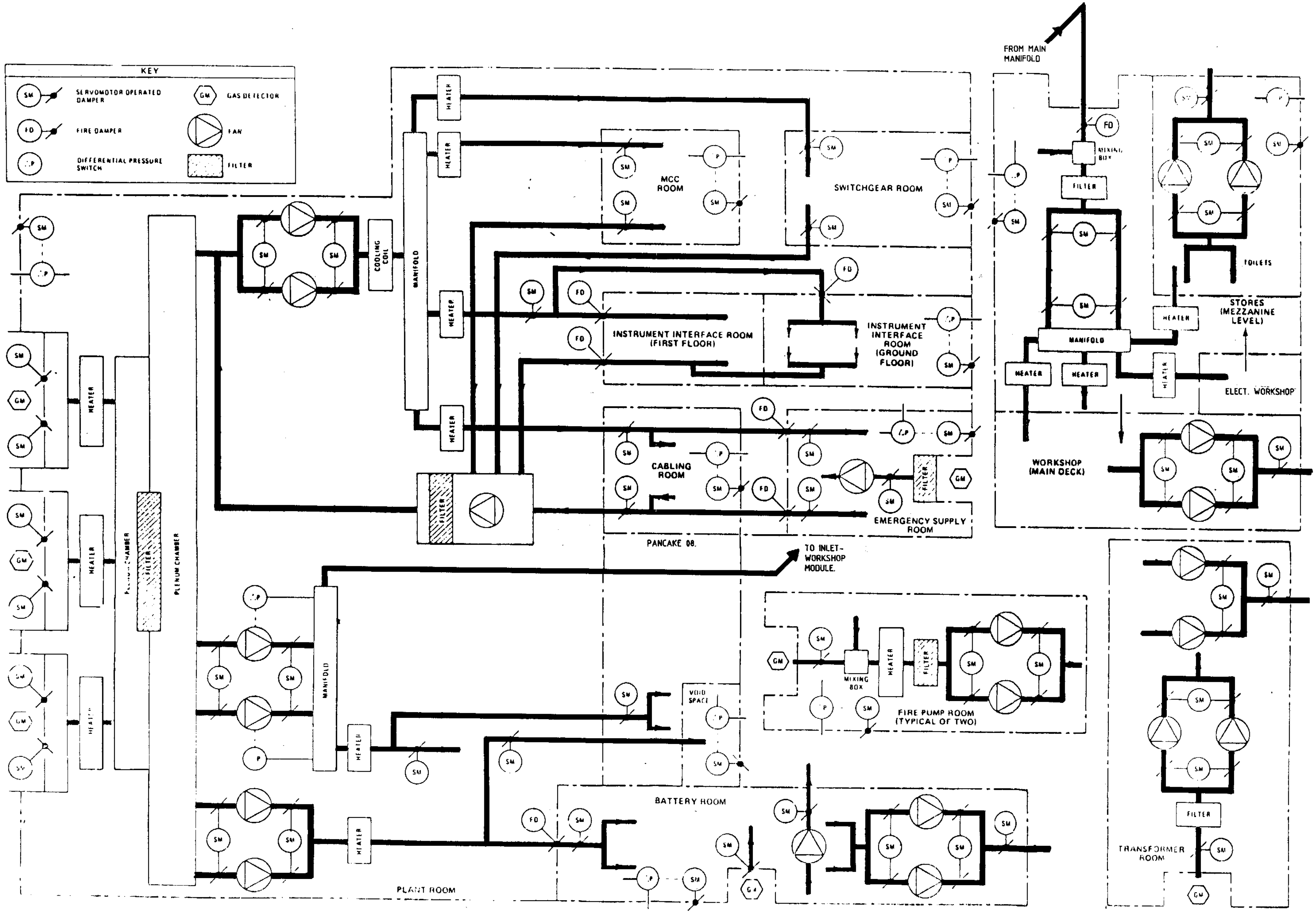
Instrument Interface Room	:	6.0 mmWG
Electrical Interface Room	:	8.0 mmWG
Battery Room	:	6.0 mmWG
HVAC Equipment Room	:	6.0 mmWG

Overpressures are related to adjacent classified areas.

2.9.7 Air is extracted from the Battery Room to atmosphere by a dedicated extract system. Battery room extract system consists of two parallel centrifugal fans, one duty and one stand-by. The fans are equipped with anti-vibration dampers and flexible ducting connections, and take suction through a manual shutoff damper and discharge through a pneumatic operated shutoff damper.

One of the extract fans is connected to the emergency switch board.

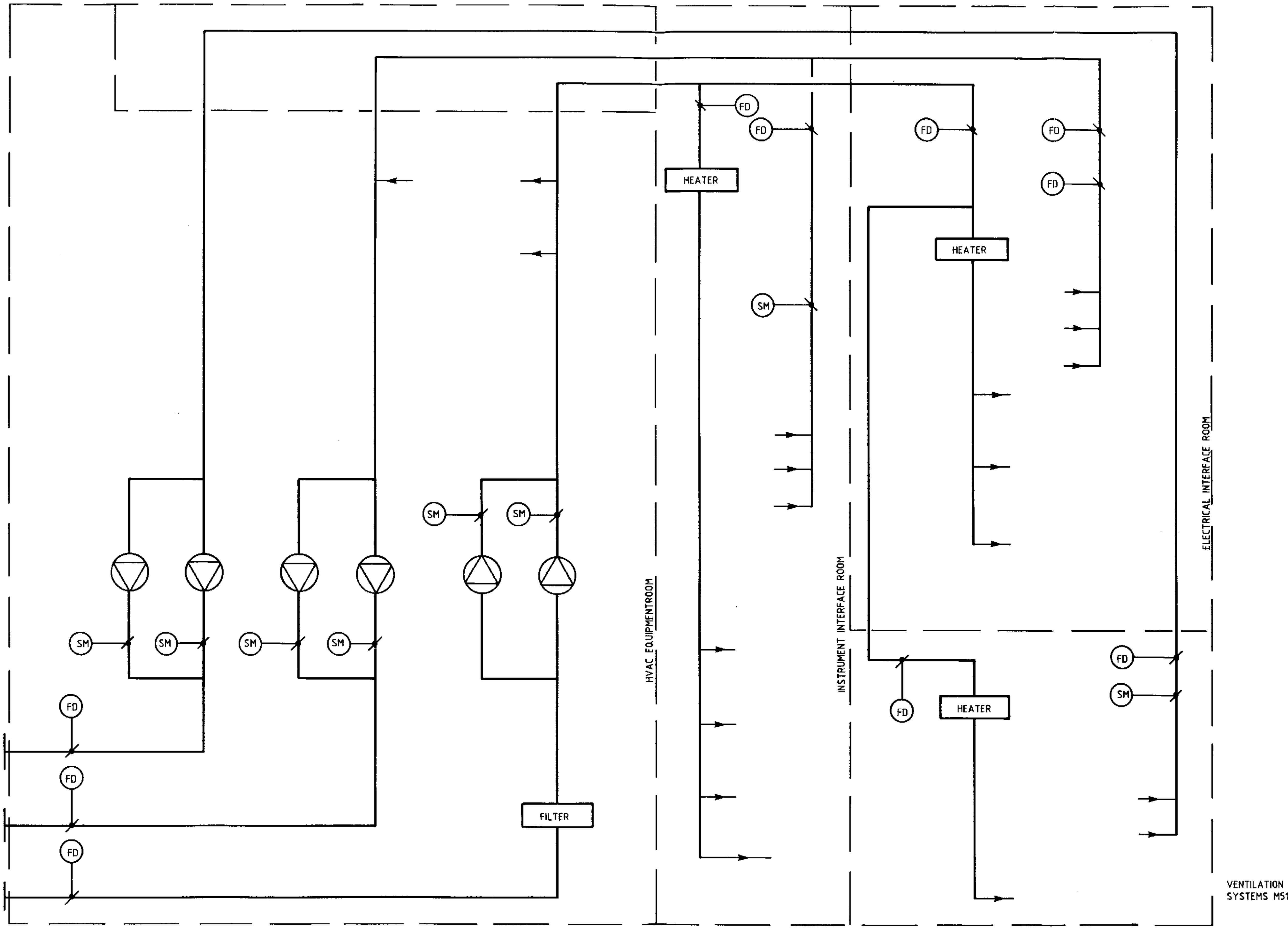
The Battery Room is maintained at a underpressure of 2.0 mmWG related to the adjacent Electrical Interface Room.



ISSUE 4, AUG. 1991

VENTILATION SYSTEMS
Treatment Areas

5.23.1



ISSUE 0, OCT. 00

VENTILATION SYSTEMS MODULE 51 TREATMENT AREAS	5.23.2

VENTILATION SYSTEMS (COMPRESSION AREAS)

1. GENERAL

1.1 The Ventilation Systems in the compression areas are designed to provide and maintain a positive differential pressure in the various enclosed areas.

1.2 The system comprises 13 sub-systems, each having separate ducting, fans and accessories. The majority of systems are provided with a dual fan arrangement.

1.3 The main controls, instrumentation and alarms are located on a panel in the Compression Area Control Room. The controls are linked to the fire and gas protection and ESD logic to provide shutdown of ventilation as required.

2. DESCRIPTION

2.1 Compressor Module Ventilation

2.1.1 Each of the Compressor Modules is ventilated by separate system; each system, with the exception of tag numbers, is identical.

2.1.2 Each compressor module area is classified as follows:

(a) Zone 1 (without ventilation).

(b) Zone 2 (with ventilation).

2.3.1 Fresh air is drawn from an intake in the east wall of each module. The intake is provided with a gas detector and a motor operated shut-off damper. Air is supplied to a compressor module by two parallel 3.7 kW axial flow fans which normally operate one duty, one standby. The fans take suction and discharge through ducting which is provided with motor operated suction dampers and manually operated non-return discharge dampers. To ensure correct operation, the suction dampers are interlocked with the fans' duty/standby selector switch and the fan starter switch.

2.1.4 To ensure adequate ventilation of a module, air discharged by the duty supply fan is distributed via grilles. Air is supplied at a rate of 2400 m^3/h which ensures an air change rate of 12 changes per hour. The module is not pressurised and the air is not filtered or heated. Air is discharged via an exhaust hood in the module roof.

2.2 Fan Room and Substation Ventilation

2.2.1 The Fan Room and the Substation in Module 32 are ventilated by a common system. They are classified as follows:

(a) "Unclassified" (with ventilation).

(b) Zone 1 (without ventilation).

2.2.2 Fresh air is drawn from an intake in the east wall of the Fan Room. The intake is provided with a gas detector and a motor operated shut-off damper. Air is supplied to the Fan Room and the Substation by two parallel 10 kW centrifugal fans which normally operate one duty, one standby. The fans take suction and discharge through ducting provided with motor operated suction dampers and manually operated non-return discharge dampers. To ensure correct operation, the suction dampers are interlocked with the fans' duty/standby selector switch and the fan starter switch. The common suction ducting is provided with a filter unit and an electrical heater unit. The heater unit is rated at 88 kW and is thermostatically controlled to maintain a room temperature of 10°C.

2.2.3 Air discharged by the duty supply fan is distributed via ducting and grilles to ensure adequate ventilation of the rooms. Air is supplied at a rate of 2500 m^3/h to the Fan Room and 13 000 m^3/h to the Substation; this ensures a total air change rate of 12 changes per hour. The ducting to the Substation is provided with a fire damper. A positive pressure of 6mmWG is maintained by the duty supply fan operating in conjunction with pressure controlled, motor operated modulating dampers which exhaust to atmosphere. The outlet from the Fan Room and the outlet from the Substation are located in the north wall.

2.3 Control Room Ventilation

2.3.1 The Control Room is classified as follows:

(a) "Unclassified" (with ventilation).

(b) Zone 1 (without ventilation).

2.3.2 Fresh air is drawn from an intake in the east wall of the Fan Room. The intake is provided with a gas detector and a motor-operated shut-off damper. The inlet facilities are provided with an air conditioning system comprising the following units:

(a) A mixing section containing two dampers operated by a common motor to maintain a maximum recirculation rate of 50 per cent.

(b) A filter unit.

(c) An air preheater unit of 50 kW capacity.

(d) A humidifier unit designed for 90 per cent relative humidity at 11°C which will maintain the humidity range in the room between 45 and 55 per cent RH.

(e) A cooling coil of 72 000 kcal/h capacity

(f) A reheating coil of 40 kW capacity.

The skid-mounted cooling unit for the system uses Freon 22 as the refrigerant.

2.3.3 Treated air is supplied to the Control Room by two parallel axial flow fans which normally operate one duty, one standby. The fans take suction and discharge through ducting provided with motor operated suction dampers and manually operated non-return discharge dampers. The suction dampers are interlocked with the fans' duty/standby selector switch and the fan starter switch to ensure correct operation of the dampers. The normally operating fan is driven by a 6.5 kW ac motor; the standby fan is driven by a 6 kW dc motor.

2.3.4 Air discharged by the duty supply fan is distributed via ducting from the Fan Room to the Control Room. Fire dampers are provided where the ducting passes through firewalls. The thermostatically controlled electric preheater and reheater, operating in conjunction with the cooling coil controls, maintain a room temperature of 23°C (summer) and 20°C (winter).

2.3.5 A positive pressure of 6mmWG is maintained by the duty supply fan operating in conjunction with pressure controlled, motor operated modulating dampers which exhaust to atmosphere. The outlet from the Control Room is located in the east wall.

2.4 12 kV HV room ventilation in module 32

2.4.1 12 kV HV room is classified as follows:

(a) "Unclassified" (with ventilation).

(b) Zone 1 (without ventilation).

2.4.2 Fresh air is drawn from an intake in the east wall of the 12 kV room. The intake is provided with a gas detector and a motor operated shut-off damper. Air is supplied to the 12 kV room by a single 3,6 kW centrifugal fan. Air is discharged via ducting and grilles at a rate of 5000 m^3/h which ensures an air change rate of 12 changes per hour. The suction ducting is provided with a filter unit and an electrical heater unit. The heater unit is rated at 40 kW and is thermostatically controlled to maintain a room temperature of 22°C. A positive pressure of 6mmWG is maintained by the supply fan operating in conjunction with a pressure controlled, motor operated modulating damper which exhaust to atmosphere. The outlet from the 12 kV room is located in the east wall of the module.

2.5 Turbo Generator Room Ventilation

2.5.1 The Turbo Generator Room is classified as follows:

(a) "Unclassified" (with ventilation).

(b) Zone 1 (without ventilation).

2.5.2 Fresh air is drawn form intakes in the floor of Pancake 41. Each intake is provided with a gas detector and a motor operated shut-off damper. Air is supplied to the room by two axial flow fans which normally operate one duty, one standby. The fans take suction and discharge through ducting provided with motor operated suction dampers and manually operated non-return discharge dampers. The suction dampers are interlocked with the fans' duty/standby selector switch and the fan starter switch to ensure correct operation of the dampers.

2.5.3 Air discharged by the duty supply fan is distributed via ducting and grilles to ensure adequate ventilation. Air is supplied at a rate of 2500 m^3/h to the turbo generator control room mezzanine and 24 500 m^3/h to the Turbo Generator Room; this ensures an air change rate of 12 changes per hour. The discharge ducting to the Mezzanine is provided with a filter unit, a fire damper and an electric heater unit. The heater unit is rated at 26 kW and is thermostatically controlled to maintain a room temperature of 22°C. The discharge ducting to the Turbo Generator Room is provided with a demister. A positive pressure of 6mmWG is maintained in the Turbo Generator Room and the Mezzanie by the duty supply fan operating in conjunction with pressure controlled, motor operated modulating dampers which exhaust to atmosphere. The outlet from the Turbo Generator Room is located in the floor; the outlet from the Mezzanine is led via ducting to the east wall of the Turbo Generator Room.

2.6 Diesel Fire Pump Room Ventilation

2.6.1 Each of the Diesel Fire Pump Rooms is ventilated by a separate system; each system with the exception of tag numbers is identical.

2.6.2 The Diesel Fire Pump Rooms are classified as follows:

(a) "Unclassified" (with ventilation)

(b) Zone 1 (without ventilation).

2.6.3 The Diesel Fire Pump Room ventilation system is similar to the Turbo Generator Room ventilation system. The differences between the systems are:

(a) Three inlets are provided in the Diesel Fire Pump Room.

(b) Filtration and heater units are not provided in the Diesel Fire Pump Room.

(c) A hydraulically driven supply fan is provided in the Diesel Fire Pump Room to remove radiated heat. The hydraulically driven fan is started automatically when the fire pump diesel is started.

(d) The standby axial flow fan is driven by a dc motor.

2.6.4 Air is supplied by the duty supply fan at a rate of 21003 m^3/h and by the hydraulically driven fan at a rate of 13000 m^3/h; this ensures an air change rate of 12 changes per hour. A positive pressure of 6mmWG is maintained in the Diesel Fire Pump Room by the duty supply fan operating in conjunction with a pressure controlled, motor operated modulating damper which exhausts to atmosphere. Three inlets and two outlets are located in the decks of each of the Diesel Fire Pump Rooms.

2.7 Battery Room Ventilation

2.7.1 The Battery Room, with or without ventilation, is classed as an "Unclassified" area.

2.7.2 The room is ventilated by an extraction fan unit which draws air from the room by two 0.75 kW axial flow fans which normally operate one duty, one standby. The fans exhaust through ducting provided with motor operated suction dampers and manually operated non-return discharge dampers. The suction dampers are interlocked with the fans' duty/standby selector switch and the fan starter switch to ensure correct operation of the dampers.

2.7.3 The air inlet to the room is located on the top deck of Pancake 44; it is provided with a pressure controlled, motor operated modulating damper and a gas detector. Air is drawn into the room at a rate of 1500 m^3/h. A negative pressure of 10mmWG is maintained in the room by the duty exhaust fan operating in conjunction with the pressure controlled, motor operated modulating damper located at the inlet. The exhaust fan discharges through an outlet in the east wall of the room.

2.7.4 Battery charging is automatically inhibited for 30 minutes after ventilation system start-up. The charging of batteries is automatically stopped on failure of the ventilation system.

2.8 Emergency Substation Ventilation

2.8.1 The Emergency Substation, with or without ventilation, is classed as an "Unclassified" area.

2.8.2 The ventilation system is similar to the Workshop ventilation system. The differences between the systems are:

(a) The heater unit is located in the discharge ducting of the supply fan and is rated at 20 kW. The electric heater will not operate until the fan has been running for 30 minutes.

(b) The air flowrate is 5200 m^3/h which is sufficient to remove 30 kW of heat from the electrical equipment within the room and maintain a temperature below 40°C.

(c) The centrifugal flow fan is driven by a 1.35 kW motor.

2.8.3 The air inlet for the Substation is located on the north edge of Pancake 44, the air being supplied by external ducting. The air outlet is located on the east wall of the Substation.

2.9 Diesel Generator Room Ventilation

2.9.1 The Diesel Generator Room, with or without ventilation, is classed as an "unclassified" area.

2.9.2 The room is ventilated by the remote radiator fan which is hydraulically driven. The hydraulically driven fan automatically starts when the diesel engine is started. The fan draws in air for ventilation at a rate of 68500 m^3/h and air for combustion within the diesel engine at a rate of 6000 m^3/h. Inlet and outlet louvres are provided with shut-off dampers which open and close automatically on starting and stopping the diesel engine. The inlet louvres are provided with gas detectors. There is no requirement for room pressurisation.

2.10 Transformer Room Ventilation

2.10.1 The Transformer Rooms are ventilated by a common system; they are classified as follows:

(a) Zone 1 (without ventilation).

(b) Zone 2 (with ventilation).

2.10.2 Fresh air is drawn from an intake on the north wall of Module 30 via ducting to a fan unit located outside the Transformer Rooms. The intake is provided with a gas detector and a motor operated shut-off damper. Air is supplied to the rooms by two 2.6 kW axial flow fans which normally operate one duty, one standby. The fans take suction and discharge through ducting provided with motor operated suction dampers and manually operated non-return discharge dampers. The suction dampers are interlocked with the fans' duty/standby selector switch and the fan starter switch to ensure correct operation of the dampers. The common suction is provided with a filter unit; the fan discharge ducting divides to supply either one or both of the rooms. The inlet ducting to each room is provided with a shut-off damper where the ducting passes through the firewalls. Air is supplied at a total rate of 7000 m^3/h, normally equally distributed to each room; this ensures an air change rate of 12 changes per hour. The rooms are not pressurised.

2.11 Each ventilation system comprises some or all of the following equipments. The equipments listed have the same function regardless of the system to which they are fitted.

(a) **Filter Sections.** The filter is of a low velocity, throwaway type, made of fire resistant non-organic fibres. Each filter is fitted with a filter blockage alarm.

(b) **Shut-off Dampers.** The damper is installed in gastight walls, AO firewalls and A60 firewalls. In the event of a fire, the fusible link will melt and the damper motor will close the damper.

(c) **Pressure-controlled Modulating Dampers.** These are modulated by comparison of a common atmospheric reference pressure to control room pressure.

(d) **Fire Dampers.** These are fusible link type dampers (similar to shut-off dampers) with an A60 fire rating.

(e) **Non-return Dampers.** These must be manually locked closed when a fan is dismantled from the plant.

(f) **Balancing Dampers.** These are manually controlled and are used to adjust the air flow to each ventilated area of the plant.

3. SYSTEM CONTROL AND SHUTDOWN

3.1 Dual Fan System

3.1.1 The system comprises two fans mounted in parallel which are operated as one duty, one standby. Only one fan and its corresponding dampers can operate at the same time. The duty fan is started manually, but the standby fan can be started manually or automatically as required. The fans can be controlled locally or from the Control Room.

3.1.2 Shut-off dampers are electrically interlocked with their respective fans and will open and close automatically as the fans start and stop.

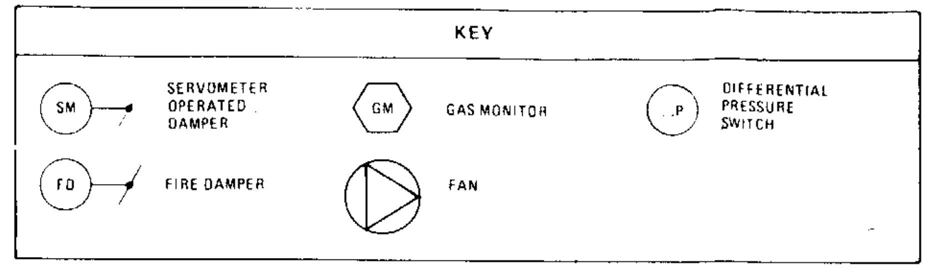
3.1.3 A flow sensor is fitted in the ducting to measure air flow. If no air flow is measured in the ducting a LOSS OF FLOW alarm will annunciate in the Control Room. The shut-off dampers for the duty fan will close, the fan will stop, the dampers for the standby fan will open and the standby fan will start.

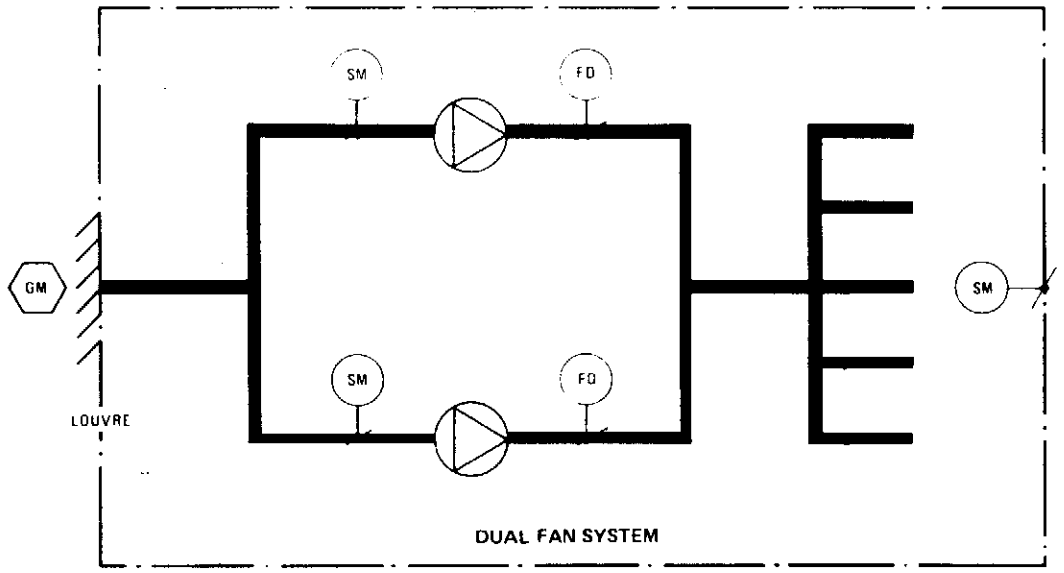
3.1.4 Should the LOSS OF FLOW alarm occur again, the standby fan will stop, all motorised dampers will close and (with the exception of the Battery Room) an alarm signal will be sent to the Shutdown System. In the Battery Room, all battery charging will stop but no alarm will be given to the Shutdown System.

3.2 Single Fan System

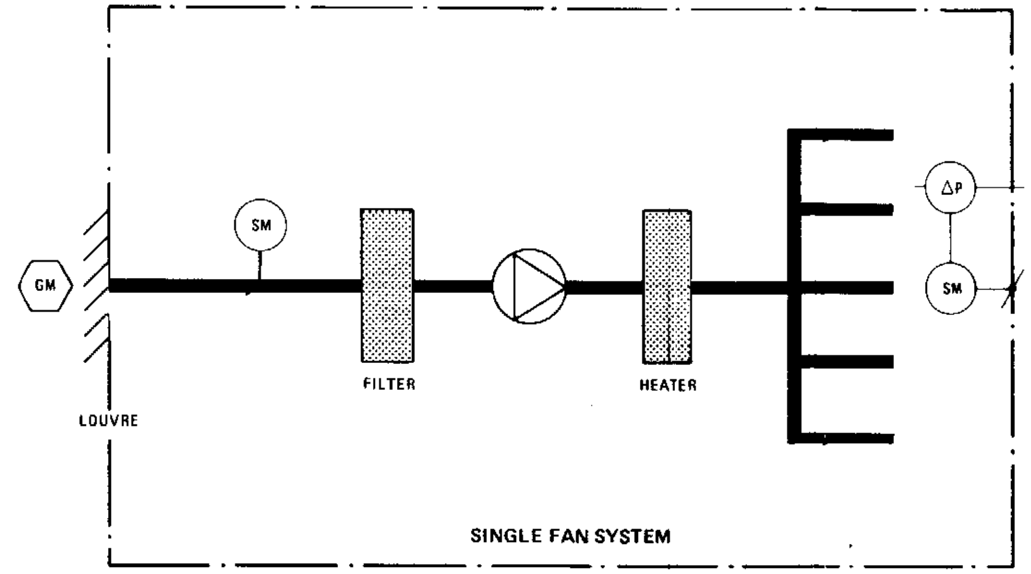
The fan is manually controlled locally or remotely from the Control Room. A flow sensor is fitted in the ducting; on loss of flow, the motorised dampers will close, the fan will stop and an alarm signal passes to the Shutdown System.

END

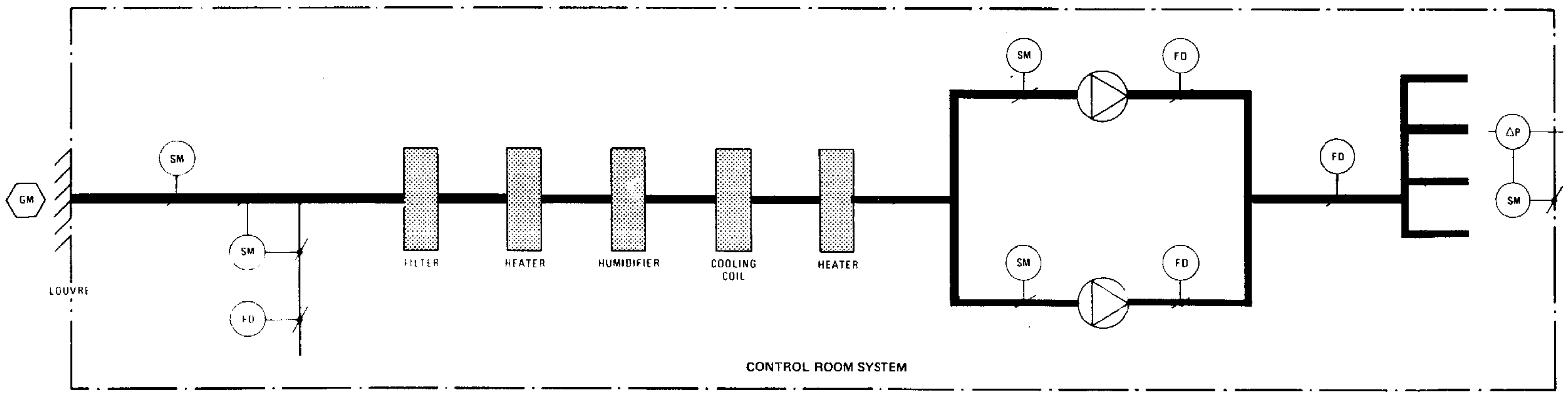




DUAL FAN SYSTEM



SINGLE FAN SYSTEM



CONTROL ROOM SYSTEM

ISSUE 2 JANUARY 1985

VENTILATION SYSTEMS Compression Areas	5.24

HYDRAULIC SYSTEM (TREATMENT AREAS)

1. GENERAL

1.1 The Hydraulic System provides the motive power for the hydraulically operated hand (HV) and emergency shutdown (ESD) block valves:

1.2 The system comprises the following:

(a) Central unit CQ7 which incorporates a reservoir, two pumps, main accumulator sets, and distribution and control circuits.

(b) Local accumulator sets.

(c) Local control stations.

(d) Valve controllers and actuators.

(e) Pneumatic control circuits.

2. DESCRIPTION

2.1 Central Unit CQ7

2.1.1 Hydraulic fluid is stored in reservoir CV42 which has a capacity of 4500 litres. An alarm will indicate in the Control Room should the fluid content fall below 1000 litres. Replenishment is by a filter/breather on top of the reservoir. Hydraulic fluid can be supplied from TCP2 compression through a 1½" line between CQ7 and Hydraulic oil storage tanks located in module 30 in the compression area.

2.1.2 Two parallel installed gear type pumps CP22A and B, normally operate by one on duty, one standby to pressurise the system. Each pump, driven by a 30 kW electric motor, has a capacity of 100 litres/min at 150 barg. The pumps take suction from reservoir CV42 through individual lines, and discharge to the distribution circuits serving the valve controllers through a common discharge manifold. Duty pump operation is controlled by high and low pressure switches set at 107 barg (stop pump) and 100 barg (start pump), excess pressure being relieved into the reservoir by a pump discharge pressure safety valve. An alarm will indicate in the Control Room should the system pressure fall below 100 barg.

2.1.3 The operation of pumps CP22A and B is controlled from a local control panel, provided with Auto/Manual and Duty/Standby selector switches. Should the duty pump fail the standby pump is brought into automatic operation by resetting the Duty/Standby switch to DUTY.

2.1.4 An emergency hand pump, installed in parallel with the motor-driven pumps, can be used in the event of main pump failure or maintenance. This pump has a capacity of 0.045 litres per double stroke.

2.1.5 The 62 main accumulator sets each comprise a 50-litre accumulator, and a nitrogen storage bottle charged to 80 barg. Each set is protected against overpressure by a fusible plug, incorporated in the accumulator nitrogen connection, which melts at 145°C.

2.2 Distribution

2.2.1 The four distribution systems each comprise supply and return lines to which each valve actuator is connected, via its controller. Each system is supplied separately from pumps CP22A and B discharge manifold. The return lines from these systems discharge into the reservoir through four strainers. Three spring-loaded check valves provide relief should the strainers become partially blocked.

2.2.2 Two groups of accumulator sets, one of six and one of thirteen, similar to those in central unit CQ7, are provided as a standby hydraulic supply for specific ESDVs Other ESDVs have standby accumulators incorporated in their controllers.

2.3 Valve Controllers

2.3.1 The three types of valve controllers used are as follows:

(a) Type F. Movement of the valve actuator is determined by a directional control valve, which is controlled by either a local manual valve or a remote control valve.

(b) Type B. Similar to type F, differing only in that the supply line incorporates an intergral accumulator (5 litres/min valve controllers) or is connected to a local accumulator set (50 and 100 litres/min valve controllers).

(c) Type C. Used for locally controlled valves. The valve actuator is positioned either by a manual valve (50 litres/min controllers) or a directional control valve (100 litres/min controllers).

(d) The accumulator sets permit valve operation on failure of central unit CQ7.

2.3.2 The three control valves (HV CM3-1, 2 and 3) serving pig launcher CM3 are operated from a control valve manifold (CQ8).

2.3.3 For manual control of the pig launch sequence, the valve actuators of HV CM3-1, 2 and 3 are positioned by manual valves at CQ8. HV CM3-1 actuator is positioned direct; HV CM3-2 and 3 actuators through directional control valves.

2.3.4 For automatic control of HV CM3-1, 2 and 3, the valve actuators are automatically positioned by the pig launch sequence. Valve actuator speed is adjustable by a key operated dual flow control valve.

2.3.5 Pilot lamps indicate the status of HV CM3-1, 2 and 3.

2.4 TCP2 Extension

2.4.1 The hydraulic power for NEF and ODIN module (TCP2 Extension) ESDV's and HV's is derived from TPC2 Treatment area central hydraulic power unit CQ7.

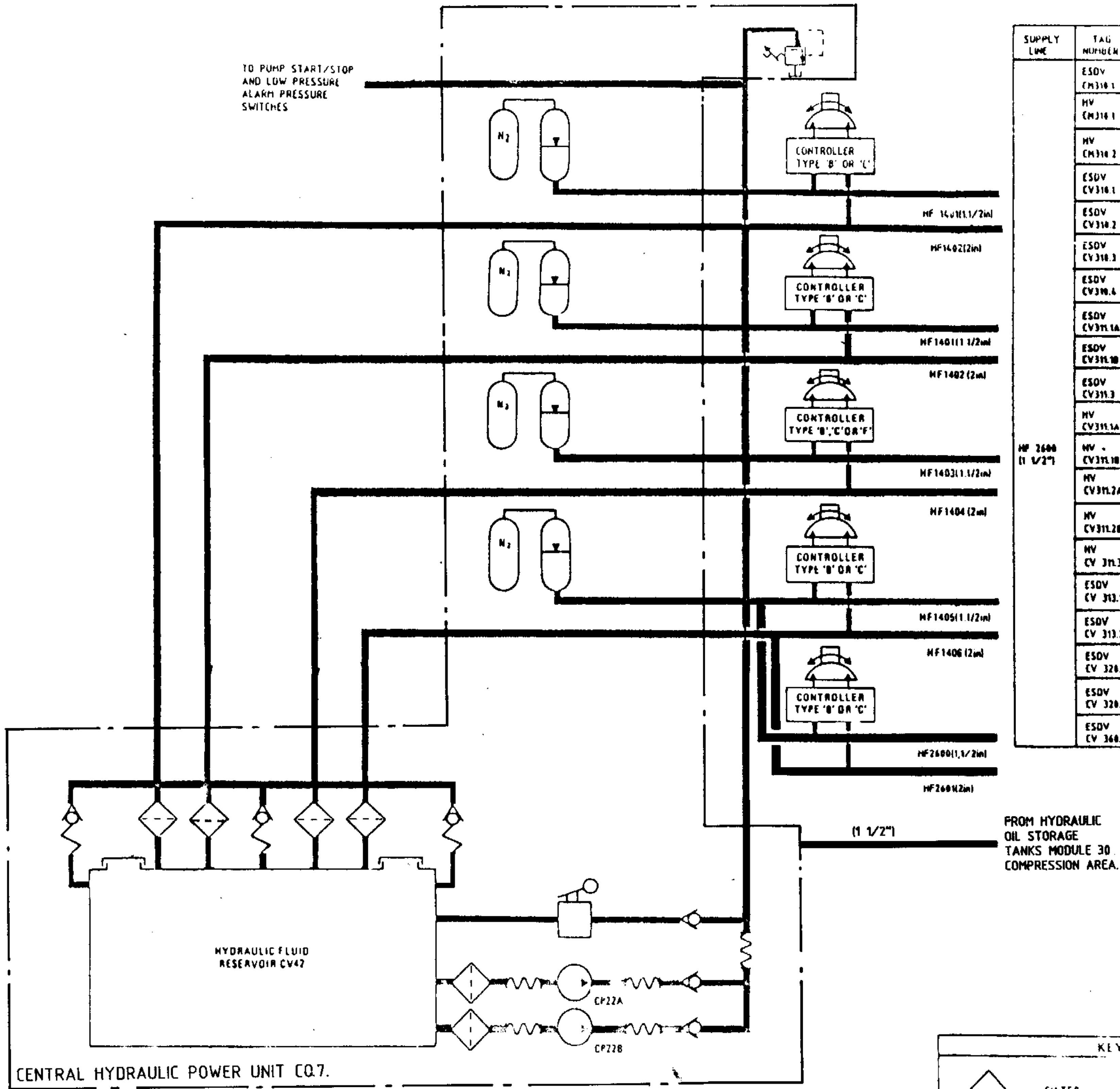
2.4.2 The hydraulic supply and return headers for TCP2 Extension are C2600-EZS-1½" HF and C2601-EB-2"HF and tie into the Treatment headers C1405EZ-1½"HF and C1406EB-2"HF respectively.

2.4.3 The ESDV's for TCP2 Extension each have a local accumulator sets providing standby hydraulic supply.

2.5 East Frigg module M51

2.5.1 The hydraulic power for East Frigg module ESDV's and HV's is derived from TPC2 Treatment area central hydraulic Power unit CQ7.

2.5.2 The hydraulic supply and return headers are C3248-EZA-1½"-HF and C3249-EBB-2"-HF respectively and tie into the headers C2600EZS-1½"-HF and C2601EB-2"-HF.



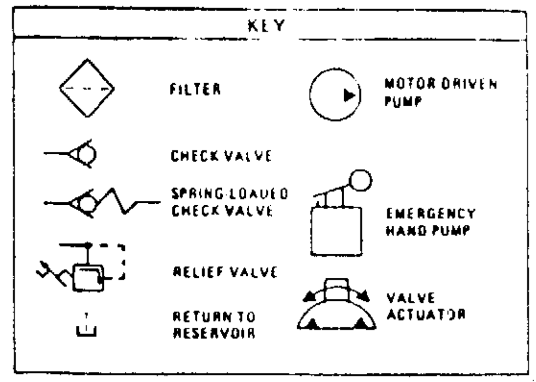
SUPPLY LINE	TAG NUMBER	CONT.	LITRE/MIN
HF 2600 (1 1/2")	ESDV CM310.1	B	
	HV CM310.1	C	
	HV CM310.2	C	
	ESDV CV310.1	B	
	ESDV CV310.2	B	
	ESDV CV310.3	B	
	ESDV CV310.4	B	
	ESDV CV311.1A	B	
	ESDV CV311.1B	B	
	ESDV CV311.3	B	--
	HV CV311.1A	C	
	HV CV311.1B	C	
	HV CV311.2A	C	
	HV CV311.2B	C	
	HV CV 311.3	C	
	ESDV CV 313.1	B	
	ESDV CV 313.2	B	
	ESDV CV 320.1	B	
	ESDV CV 320.2	B	
	ESDV CV 360.2	B	

SUPPLY LINE	TAG NUMBER	CONT.	LITRE/MIN
HF 2600 (1 1/2in)	ESDV V201.1A	B	
	ESDV V211.1A	B	
	ESDV V211.1B	B	
	ESDV V201.1B	B	
	HV V211.1A	C	
	HV V 211.1B	C	
	HV V201.1A	C	
	HV V201.1B	C	
	HV V201.2A	C	
	HV V211.2A	C	
	HV V211.2B	C	
	HV V201.2B	C	
	HV M201.1	C	
	HV M201.2	C	
	HV M201.3	C	
	ESDV V210.4	B	
	HV M210.1	C	
	ESDV V210.3	B	
	ESDV V210.1	B	
	ESDV V210.2	B	
	ESDV V211.3	B	
	ESDV V201.3	B	
	ESDV M201.1	B	
	ESDV M210.1	B	
	ESDV CV211.4	B	

SUPPLY LINE	TAG NUMBER	CONT.	LITRE/MIN
HF 1401 (1.1/2in)	ESDV CV2A-4	B	50
	ESDV CV1B-4	B	50
	ESDV CV1C-1	B	50
	ESDV CV1C-3	B	50
	ESDV CV1C-2	B	5
	HV CV1A-3	C	50
	HV CV1B-3	C	50
	HV CV1C-3	C	50
	HV CV2B-2	C	50
	HV CV2B-1	C	50
	HV CV2A-2	C	50
	HV CV2A-1	C	50
	ESDV CV-1-8	B	50
	ESDV CV-2-9	B	50
HF 1403 (1.1/2in)			
	ESDV CV1C-4	B	50
	ESDV CV1B-2	B	5
	ESDV CV1B-3	B	50
	ESDV CV1B-1	B	50
	HV CV1C-1	C	50
	HV CV1C-4	C	50
	HV CV1B-4	C	50
	HV CV1B-1	C	50
	HV CV2A-4	F	50
	HV CV2A-5	F	50
	HV CV2A-6	F	50
	HV CV2B-4	F	50
	HV CV2B-5	F	50
	HV CV2B-4	F	50
	ESDV CV1.9		
	ESDV CV2.10		

SUPPLY LINE	TAG NUMBER	CONT.	LITRE/MIN
HF 1405 (1.1/2in)			
	HV CM[illegible]	C	50
	ESDV CM1-2	B	50
	ESDV CTCP2-1	B	100
	ESDV CB-1	B	50
	ESDV CB-2	B	50
	ESDV CB-7	B	5
	ESDV CB-3	B	5
	ESDV CM3-1	B	100
	ESDV CM2-1	B	50
	ESDV CM9-2	B	5
	HV CM2-4	C	50
	HV CM1-4	C	50
	HV CM1-5	C	50
	HV CM1-6	C	50
	HV CM2-6	C	50
	HV CM2-1	C	50
	HV CM2-2	C	50
	HV CB-1	C	50
	HV CB-2	C	50
	ESDV M201-1	B	50
	ESDV M210-1	B	50
HF 1407 (1.1/2in)	ESDV CV2A-1	B	50
	ESDV CV1A-4	B	50
	ESDV CV2B-1	B	50
	ESDV [illegible]	B	50
	ESDV [illegible]	B	5
	ESDV CV1A-3	B	50
	ESDV CV1A-1	B	50
	ESDV CV2B-2	B	5
	ESDV CV2A-2	B	50
	HV CV1A-1	C	50
	HV CV1A-4	C	50

KEY



FOR MORE DETAILED INFORMATION SEE
FF.85.00.08.5035, 5036, 5039, FF.88.00.08.5045 & FF.89.00.08.0058.

ISSUE 3, AUG. 1991

HYDRAULIC SYSTEM
Treatment Areas

EAST FRIGG WELLHEAD HYDRAULIC SYSTEM

1. GENERAL

The purpose of EFTI Hydraulic power unit is to provide hydraulic power for operation of EF subsea valves.

The power unit consists of two main hydraulic power subsystems:

- one supplying hydraulic oil at 183 bar g (2655 psi) for operation of EF subsea safety valves.
- one supplying hydraulic oil at 319 bar g (4630 psi) for operation of EF subsurface safety valves (SSSV's).

It also includes a manually operated supply line for hydraulic oil pressurization up to 459 bar g (6650 psi) for unblocking EF subsurface safety valves (short period and exceptional use).

The hydraulic oil delivered to the subsea stations are filtered to a cleanliness of code NAS 1638 class 6. The filter size used is 10 micron.

2. DESCRIPTION

2.1 LP Hydraulic Tank

The LP hydraulic tank CV 340 provides following functions:

- hydraulic oil storage
- water/oil separation
- hydraulic oil treatment

The tank supplies the HP and VHP hydraulic pumps with hydraulic fluid.

2.2 Hydraulic System

The HP hydraulic system consists of:

- two hydraulic jockey pumps CP343A/B (pneumatic) - one duty, one stand-by
- one HP hydraulic main pump CP341 (electrical)
- one dual filter
- one accumulator bank comprising two piston type accumulators (CV341A/B)
- two pressure control valves - one duty, one stand-by.

Pressure in accumulators is maintained by starting/stopping the jockey pump CP343 A (or CP343 B) and the HP main pump CP 341 on given pressure levels.

Delivery pressure to umbilical and subsea valves are maintained in the line by a pressure control valve.

2.3 VHP Hydraulic System

The VHP hydraulic system consists of:

- two VHP hydraulic jockey pumps CP344A/B (pneumatic) - one duty, one stand-by
- one VHP hydraulic main pump CP342 (electrical)
- one dual filter
- one accumulator bank comprising two piston type accumulators (CV342A/B)
- two pressure control valves - one duty, one stand-by
- one VHP hydraulic Booster pump CP346 (see 2.6).

Pressure in accumulators is maintained by starting/stopping the jockey pump CP344 A (or CP344 B) and the HP main pump CP342 on given pressure levels.

Delivery pressure to umbilical and subsea valves are maintained in the line by a pressure control valve.

2.4 Hydraulic Return Line

The hydraulic return line collects return fluid from all subsea/subsurface safety valves and routes the fluid back to the LP Hydraulic Tank, CV340.

Return flow is measured and totalized.

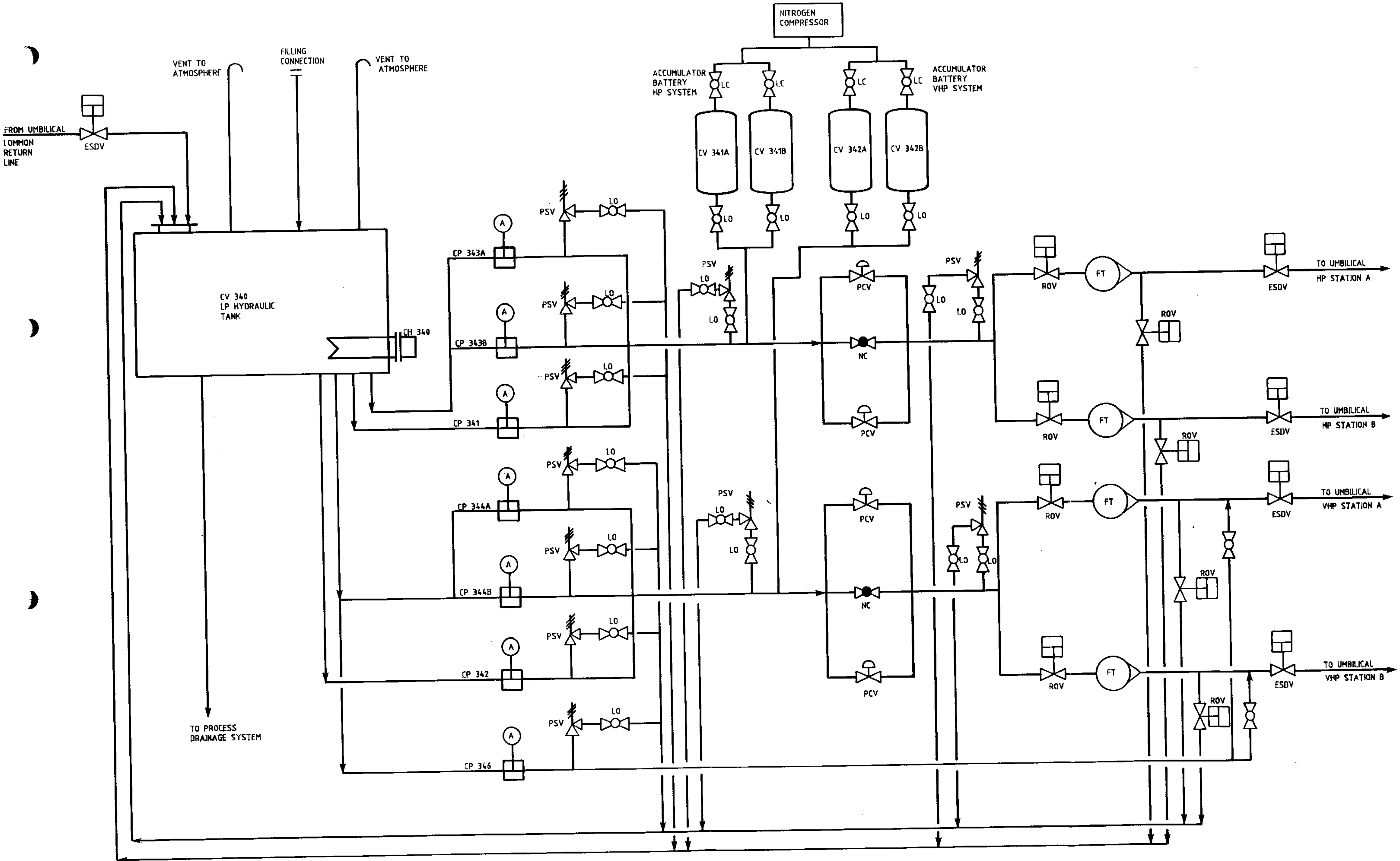
2.5 HP/VHP Supply Line Depressurization

The HP and VHP supply lines can if necessary be depressurized by opening the remote operated valves.

The flow during depressurization is restricted by needle valves and hydraulic fluid is routed back to the LP hydraulic tank, CV 340

2.6 Subsea Valves Unblocking

An air driven pump, CP 346, is provided for temporary use and exceptional very high pressure supply up to 459 bar g (6650 psi). The purpose is to provide extra pressure for unblocking subsea valves if necessary.



FOR MORE DETAILED INFORMATION SEE FF.89.00.34.0054, 0055 AND 0056.

ISSUE 2, AUG. 1991

EAST FRIGG

WELLHEAD HYDRAULIC SUPPLY

HYDRAULIC SYSTEM (COMPRESSION AREAS)

1. GENERAL

1.1 The Hydraulic System provides the motive power for the hydraulically operated hand (HV) and emergency shutdown (ESD) block valves.

1.2 The system comprises the following:

(a) Central unit 56x01 which incorporates a reservoir, two pumps, main accumulator set, and distribution and control circuits.

(b) Local accumulator sets.

(c) Valve control stations.

(d) Valve controllers and actuators.

(e) Pneumatic control circuits.

2. DESCRIPTION

2.1 Central Unit 56 x 01

2.1.1 Hydraulic fluid is stored in reservoir 56xOT01 which has a capacity of 4500 litres. An alarm will indicate in the Control Room should the fluid content fall below 1000 litres. Replenishment is by a filter/breather on top of the reservoir Hydraulic fluid can be supplied to the reservoir in 56xOT01 and to the Treatment central hydraulic power unit CQ7 through a 1½" line from the hydraulic oil storage tanks located in Module 30.

2.1.2 Gear type pumps 56x01P01A/B in parallel normally operate one duty, one standby to pressurise the system. Each pump, driven by a 37 kW electric motor, has a capacity of 80 litres/min at 206 barg. The pumps take suction from reservoir 56xOT01 through individual lines, and discharge to the distribution circuits serving the valve controllers through a common discharge manifold. Duty pump operation is controlled by high and low pressure switches set at 138 barg (stop pump) and 125 barg (start pump), excess pressure being relieved into the reservoir by a pump discharge pressure safety valve. An alarm will indicate in the Control Room should the system pressure fall to 118 barg.

2.1.3 The operation of pumps 56x01P01 A/B is controlled from a local control panel, provided with Auto/Manual and Duty/Standby selector switches. Should the duty pump fail the standby pump is brought into automatic operation by resetting the Duty/Standby switch to DUTY.

2.1.4 The 6 main accumulator sets each comprise a 50-litre accumulator, and a nitrogen storage bottle charged to 138 barg. Each set is protected against overpressure by a fusible plug, incorporated in the accumulator nitrogen connection, which melts at 145°C.

2.2 Distribution

2.2.1 The two distribution systems each comprise supply and return lines to which each valve actuator is connected, via its controller. Each system is supplied separately from pump 56 x OT01 A/B discharge manifold. The return lines from these systems discharge into the reservoir through four strainers. Three spring-loaded check valves provide relief should the strainers become partially blocked.

2.3 Valve Controllers

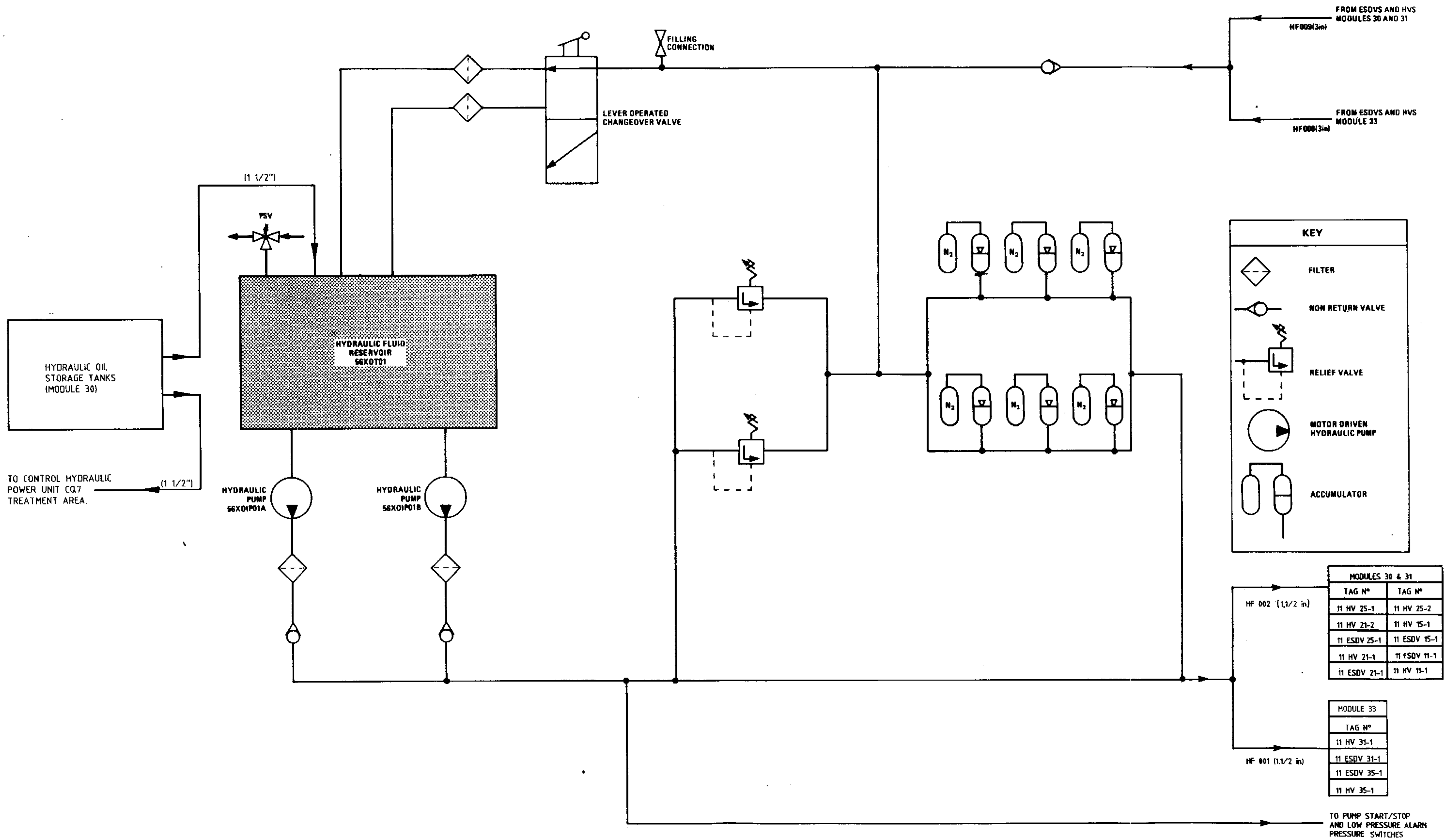
2.3.1 The three types of valve controllers used are as follows:

(a) Type F. Movement of the valve actuator is determined by a directional control valve, which is controlled by either a local manual valve or a remote control valve.

(b) Type B. Similar to type F, differing only in that the supply line incorporates an intergral accumulator (5 litres/min valve controllers) or is connected to a local accumulator set (50 and 100 litres/min valve controllers).

(c) Type C. Used for locally controlled valves. The valve actuator is positioned either by a manual valve (50 litres/min controllers) or a directional control valve (100 litres/min controllers).

(d) The accumulator sets permit valve operation on failure of central unit 56xOT01.



MODULES 30 & 31	
TAG N°	TAG N°
11 HV 25-1	11 HV 25-2
11 HV 21-2	11 HV 15-1
11 ESDV 25-1	11 ESDV 15-1
11 HV 21-1	11 ESDV 11-1
11 ESDV 21-1	11 HV 11-1

MODULE 33
TAG N°
11 HV 31-1
11 ESDV 31-1
11 ESDV 35-1
11 HV 35-1

ISSUE 3, AUG. 1991

HYDRAULIC SYSTEM
Compression Areas

5.26

FOR MORE DETAILED INFORMATION SEE
FF.87.00.01.2051.

COOLING WATER SYSTEM (COMPRESSION AREAS)

1. GENERAL

1.1 Cooling Water System for the compression areas comprise the following:

(a) Process Fresh Water Cooling System.

(b) Utilities Fresh Cooling System.

(c) Main Sea Water Cooling System.

1.2 The Process Fresh Water Cooling System and the Utilities Fresh Water Cooling System are supplied with make-up water from the cooling fresh water/TEG drain tank. The fresh water in the systems is mixed with TEG in the proportion of 70/30 per cent water/TEG. The TEG is added as an antifreeze measure. For descriptive purposes the mixture will be referred to as "Fresh Water".

2. PROCESS FRESH WATER COOLING SYSTEM

2.1 Description

2.1.1 The Gas Compression area Process Fresh Water Cooling System provides the cooling medium for three Natural Gas Coolers. These coolers reduce the gas delivery temperature to 30 - 50°C.

2.1.2 The fresh water is recirculated round the system by a process fresh water pump. A second pump is maintained at auto standby. Each pump is protected against low flow conditions by a bypass valve fitted downstream. The valve opens at a flow of 250 m^3/h.

2.1.3 Four sea water/fresh water heat exchangers are connected to the system to reduce the fresh water temperature downstream of the natural gas coolers. When two compressors are running, all four heat exchangers are being operated. Where one compressor is running, two are in operation, two on stand-by.

2.1.4 An expansion tank is connected to the system downstream of the seawater/fresh water heat exchangers to cater for system surges caused by temperature fluctuations. The tank also provides a datum point from which system level can be monitored.

2.1.5 A steady fresh water temperature of 15°C is required at the natural gas cooler inlet to avoid fluctuations in gas delivery temperature. This achieved by a temperature control valve fitted in the bypass line round the sea water/fresh water heat exchangers. The TCV will allow some water to bypass the heat exchangers if the required fresh water temperature is not being achieved.

2.1.6 Fresh water supply and return lines from the Utilities Fresh Water Cooling System are located upstream and downstream of the heat exchangers respectively.

2.2 Equipment Details

2.2.1 Process Fresh Water Pumps 58P02A/B

Capacity	2000 m^3/h.
Minimum flow	250 m^3/h.
Suction pressure	2.4 barg.
Discharge pressure	7.05 barg.
Power supply	5.5 kV, 3-phase, 50 Hz.
Power consumption	400 kW.
Speed	1500 rev/min.

2.2.2 Expansion Tank 58T01

Capacity	6.5 m^3.
Operating pressure	1 barg. (atmospheric)
Design pressure	7 barg.
Operating temperature	15°C.
Design temperature	60°C.

2.2.3 Natural Gas Coolers 11E01A/B/C

Flowrate	32M m^3/d.
Operating pressure	153 barg.
Gas inlet temperature	normal 65°C, max 95°C.
Gas out temperature	normal 30°C, max 50°C.
Calculated gas pressure drop	0.4 barg.

2.2.4 Sea Water/Fresh Water Heat Exchangers 58E01A1, 58E01A2, 58E01A3 and 58E01A4.

	Inlet	Outlet
Fresh water flow (Gas at 50°C)	2,136,963kg/h	2,136,963kg/h
Fresh water flow (Gas at 30°C)	4,281,777kg/h	4,281,777kg/h
Operating temperature (Gas at 50°C)	43.5°C	15°C
Operating temperature (Gas at 30°C)	35.9°C	14°C
Operating pressure	4 barg	3 barg
Design temperature	60°C	
Design pressure	6.9 barg	

3. UTILITIES FRESH WATER COOLING SYSTEM

3.1 Description

3.1.1 The **Utilities Fresh Water Cooling System** provides the cooling medium or supply water for the following equipment in the Gas Compression area:

(a) Gas compressor and turbine oil coolers.

(b) Alternator and exiter coolers.

(c) Air conditioning package condenser.

3.1.2 System flow is maintained by two utilities fresh water pumps which operate with one duty and the other at auto standby. The pumps take a suction from the Main Fresh Water Cooling System.

3.1.3 The pumps are protected against low flow conditions by recirculation, under flow control, back to their suction at a flow of 40 m^3/h.

3.1.4 Used water from the utility coolers returns, under pressure control set at 7 barg, to the Process Fresh Water Cooling System.

3.2 Equipment Details

Utilities Fresh Water Pumps 58P04A/B

Capacity	460 m^3/h.
Minimum flow	40 m^3/h.
Suction pressure	2.4 barg.
Discharge pressure	7.9 barg.
Power supply	380V, 3-phase, 50 Hz.
Power consumption	90 kW.
Speed	1500 rev/min.

4. PRIMING AND MAKE-UP

4.1 Description

4.1.1 The Process and Utility Fresh Water Cooling System are primed and supplied with make-up water from the cooling fresh water drain tank. The tank is full of a 70/30 per cent mixture of fresh water/TEG. A corrosion inhibitor is also injected.

4.1.2 Fresh water is supplied to the tank from the Desalinated Water Network as required. TEG is supplied from glycol tank V9, located on TP1. Glycol is pumped from the tank by one of two TEG make-up pumps (55P02A and 55P02B) located adjacent the tank.

4.1.3 Water/TEG is pumped from cooling fresh water drain tank 58T02 into the cooling system by on of two fresh water drain tank pumps (58P05A and 58P05B). The pumps operate with one duty and the other at standby. The duty pump is started and stopped automatically by level switches located on the expansion tank.

4.2 Equipment Details

4.2.1 TEG Make-up Pumps 55P02A and 55P02B

Capacity	5 m^3/h.
Suction pressure	0.35 barg.
Discharge pressure	5.55 barg.
Speed	1500 rev/min.
Power supply	380V, 3-phase, 50 Hz.
Power consumption	1.5 kW.

4.2.2 Fresh Water Drain Tank Pumps 58P05A and 58P05B

Capacity	20 m^3/h.
Suction pressure	0.05 barg.
Discharge pressure	3.65 barg.
Power supply	380V, 3-phase, 50 Hz.
Power consumption	4 kW.

4.2.3 Cooling Fresh Water Drain Tank 58T02

Capacity	80 m^3.
Operating pressure	Atmospheric.
Operating temperature	-9°C to 45°C.

5. MAIN SEA WATER SYSTEM

5.1 Description

5.1.1 The Gas Compression area Main Sea Water Cooling System supplies the following equipment:

(a) Sea water/fresh water heat exchangers.

(b) Watermakers.

5.1.2 Sea water for the system is drawn by four submerged pumps, located at the top of Column 3. Each pump motor is housed in a water-filled enclosure, in which the fresh water is maintained under pressure (by gravity) from a water tank. This prevents the ingress of sea water which would cause damage to the motor.

5.1.3 The four pump discharges are connected in two pairs so that the system can be operated with two pumps duty and two pumps at standby. Each pair of pumps supplies sea water through a self-cleaning strainer, which removes suspended solids above 2mm size, to two sea water/fresh water heat exchangers. The heat exchangers are used to cool fresh water for the Process and Utility Fresh Water Cooling Systems. Used sea water is discharged overboard via outfalls located in Column 5.

5.1.4 Sea water supply for feed water to the Watermakers can taken from either pair of pumps, downstream of the strainers.

5.1.5 Prior to start-up, the system is primed to remove as much as possible. Priming water is supplied from the Washdown System. During start-up, any remaining air is automatically vented from the system through air traps located at high points on the heat exchangers.

5.1.6 During pump shutdown, 'hammering',ie water hammer caused by air locks in the system, is avoided by air inlet vents installed downstream of the strainers. These vents allow air into the system if it is suddenly depressurised and this action cushions the hammering effect.

5.1.7 All remote instrumentation and alarms are located in the Control Room.

5.2 Equipment Details

5.2.1 Sea Water Pumps 58P01A and 58P01C

Capacity	2000 m^3/h.
Discharge pressure	2 barg.
Discharge temperature	10°C.
Power supply	5.5 kV, 3-phase, 50 Hz.
Power consumption	461 kW.
Speed	1500 rev/min.
BHP at shut-off	350 kW.

5.2.2 Sea Water Pumps 58P01B and 58P01D

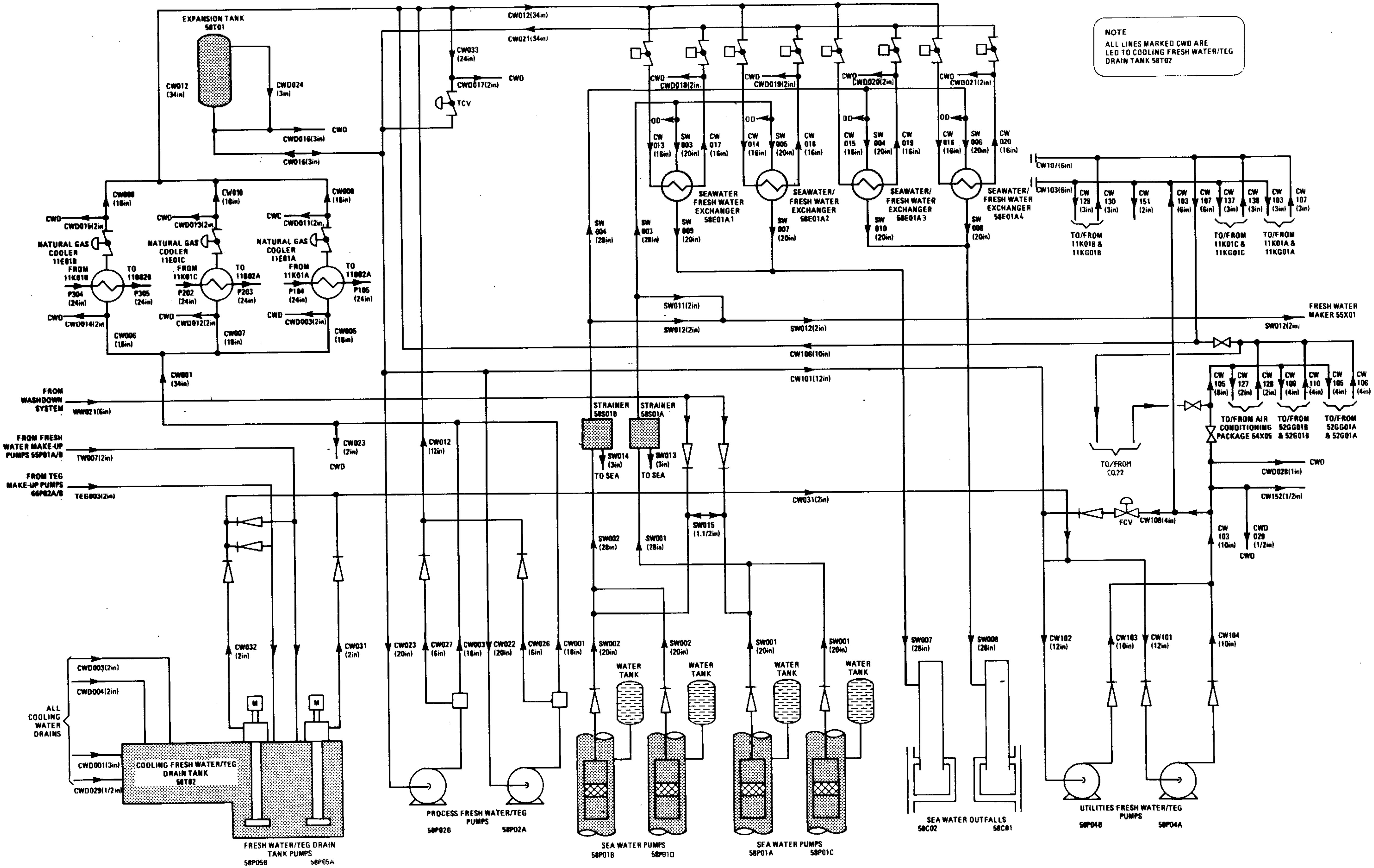
Capacity	2000 m^3/h.
Discharge pressure	2 barg.
Discharge temperature	10°C.
Power supply	5.5 kV, 3-phase, 50 Hz.
Power consumption	480 kW.
Speed	1500 rev/min.
BHP at shut-off	200 kW.

5.2.3 Sea Water Strainers 58S01A and 58S01B

Flowrate	4000 m^3/h.
Inlet pressure	2 barg
Maximum permissible dP	0.04 barg.

5.2.4 Sea Water/Fresh Water Heat Exchangers 58E01A1, 58E01A2, 58E01A3 and 58E01A4.

	Inlet	Outlet
Sea water flow (Gas at 50°C)	4 120 000kg/h	4 120 000kg/h
Sea water flow (Gas at 30°C)	8 240 000kg/h	8 240 000kg/h
Operating temperature (Gas at 50°C)	10°C	24°C
Operating temperature (Gas at 30°C)	10°C	20.8°C
Operating pressure	1.7 barg	0.7 barg
Design temperature	35°C	
Design pressure	3 barg	



ISSUE 3, AUG. 1991

COOLING WATER SYSTEMS	5.27

FOR MORE DETAILED INFORMATION SEE
FF.87.00.11.2017, 2035 AND FF.87.00.12.2018.

DESALINATED WATER NETWORK

1. GENERAL

1.1 The Desalinated Water Network produces and distributes fresh water to the following users in the Gas Compression Area.

(a) Fresh Water Cooling Systems.

(b) Turbine Compressor Wash Water Systems.

(c) Turbine Washing Systems.

(d) Fresh water supplies on Upper and Main Decks and various Pancakes.

1.2 The Desalinated Water Network is interconnected through a sterilization unit to the potable water system on Q.P. and TP1.

1.3 Fresh water is produced from sea water by two identical vapour compression watermakers. The source of feed water for the units is either:

(a) Main Sea Water Cooling System, or

(b) Washdown System.

2. DESCRIPTION

2.1 The watermakers require a specific pressure of approximately 3 barg for efficient operation and the source water pressures may differ from this. Booster pumps are therefore installed upstream of the watermaker inlet to increase pressure from the Main Sea Water Cooling System source, and a PCV is installed on the Washdown System source to give the required pressure in the watermaker.

2.2 Brine is dumped to waste by blowdown pumps. Destillate pumps transfer the fresh water to fresh water storage tank 55T01.

2.3 In order to minimise scale formation in the watermaker, its own chemical dosing package continually doses an antiscale solution to the watermaker inlet.

2.4 The purity of fresh water distillate leaving the watermaker is continually monitored. High salinity will automatically cause water to be dumped to waste.

2.5 A dosing pump automatically injects anti-corrosion chemical into the flow from the watermaker.

2.6 The fresh water tank is provided with four electrical heaters (55Y01A/B/C/D) to prevent freezing in winter.

2.7 Two fresh water make-up pumps (55P01A/B) mounted in the fresh water tank, supply all the users in the Compression Package except the turbine compressor washwater system. This system has its own turbine washing pump (55P03).

2.8 In the event of low fresh water demand by users, running pumps are protected by flow control valves in their discharge lines, which will divert flow back to the fresh water tank.

3. EQUIPMENT DETAILS

3.1 Watermaker Booster Pumps

Power supply	380V, 3-phase, 50 Hz.
Speed	3000 rev/min.
Flowrate	11.4 m^3/h.

3.2 Fresh Watermakers 55X01A/B

Destillate output per unit	2.27 m^3/h (54.48 tonnes/d).
Feed rate per unit	5.7 m^3/h
Brine production per unit	3.43 m^3/h
Residual salinity (MAX)	4mg/litre TDS (as NaC1).

3.3 Anti-corrosion Package 55X01

Tank capacity	1.1 m^3 complete with mixer.
Tank construction	Carbon steel with internal epoxy lining.
Dosing pumps	Capacity = 0 to 100 litres/h Discharge pressure - 2 barg

3.4 Fresh Water Tank 55T01

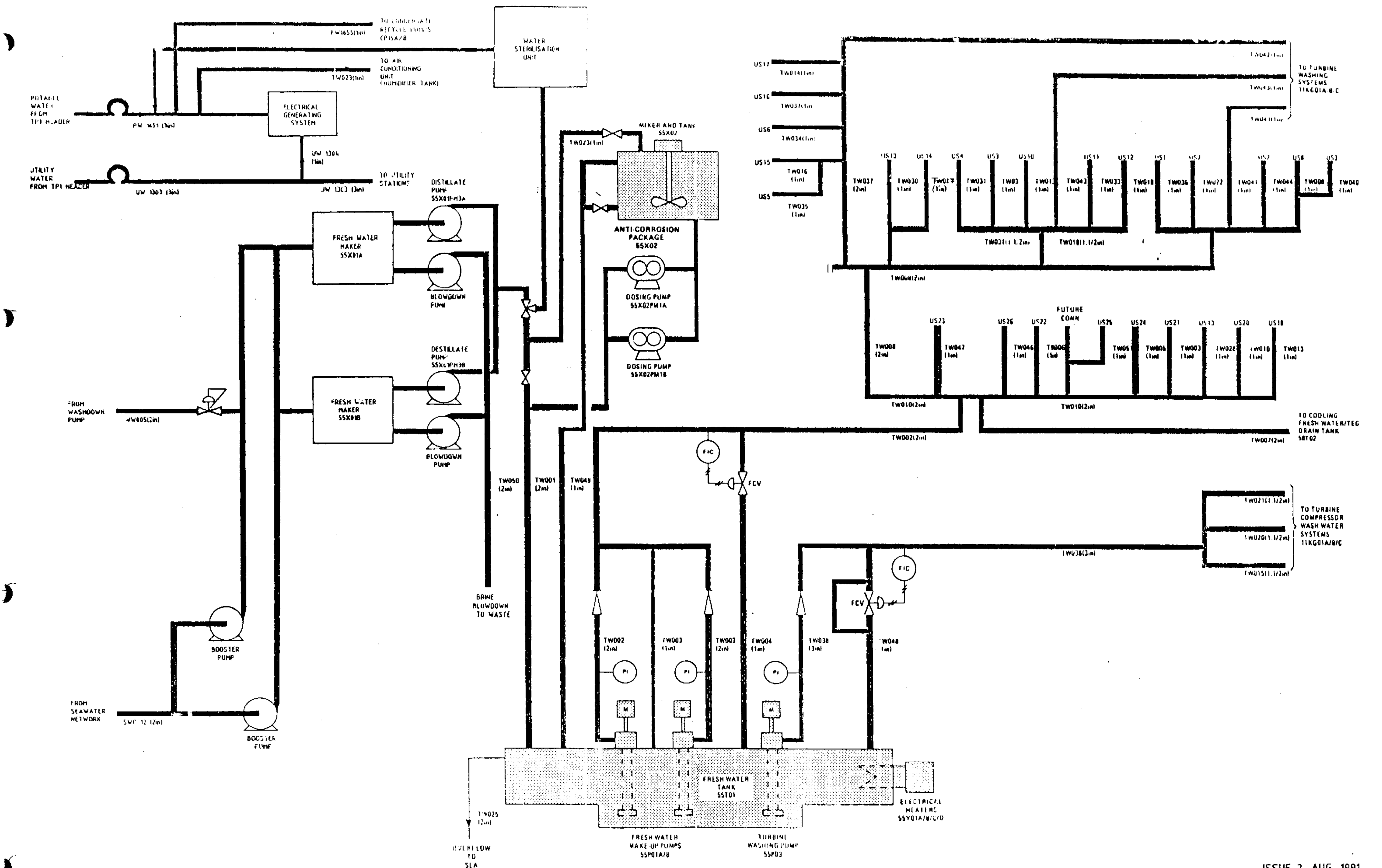
Capacity	50 m^3/h.
Operating pressure	Atmospheric.
Operating temperature	11°C to 19°C.

3.5 Fresh Water Make-up Pumps 55P01A/B

Capacity	10 m^3/h.
Suction pressure	0.05 barg.
Discharge pressure	3.75 barg.
Power supply	380V, 3-phase, 50 Hz.
Power consumption	2.1 kW.
Speed	2840 rev/min.

3.6 Turbine Washing Pump 55P03

Capacity	22.7 m^3/h.
Suction pressure	0.05 barg.
Discharge pressure	9.05 barg.
Power supply	380V, 3-phase, 50 Hz.



ISSUE 2, AUG. 1991

DESALINATED WATER NETWORK 5.28

FOR MORE DETAILED INFORMATION SEE FF.87.00.10.2050.

NORMAL LIGHTING

1. GENERAL

1.1 Two entirely independent lighting systems are provided, one for the treatment areas and one for the compression areas. The systems are each sub-divided into normal and emergency sub-systems. The sub-distribution boards DB 321 and DB 351 in treatment area are though fed from MCCB in compression area. These two DB's provide the supplies for TCP2 Extension (Mod. 50) and East Frigg (Mod. 51) respectively.

1.2 All lighting fittings operate at 220V single-phase derived between phase and neutral of 380V distribution boards.

1.3 Treatment Area (including Extension and East Frigg) lighting systems comprise:

(a)	Normal lighting	Supplied from distribution board DB301, DB302, DB321 and DB351. Certain fittings supplied by DB301 are provided with their own rechargeable batteries and automatic changeover facilities.
(b)	Standby/Emergency lighting	Supplied from distribution board DB308, DB322 or DB352 which has a standby input from QP (includes lifeboat lighting and floodlighting). Certain fittings are provided with their own rechargeable batteries and automatic changeover facilities.

Building lighting and outside lighting are on separate circuits.

1.4 Compression Area lighting systems comprise:

(a)	Normal lighting	Supplied from lighting switchboard A and B.
(b)	Emergency lighting	Supplied from an emergency switchboard which has an input from auxiliary generator 53GD01. Certain fittings are provided with their own rechargeable batteries and automatic changeover facilities.

1.5 It should be noted that all the lighting mentioned above is in use under normal operating conditions. If main generation should fail, only (b) is operative until the standby generators start and come on load. Normal lighting via DB308 is available only when 5.5 kV supplies are available.

2. LIGHTING FITTINGS

2.1 For indoor use lighting fittings are of the twin-tube 2 x 40W cold-cathode fluorescent tube type. For outdoor use both fluorescent and floodlight fittings are used. Incandescent lighting is included at walkways to provide light during loss of fluorescent lighting due to voltage dips. All fittings are enclosed for Zone 1 areas.

2.2 Lighting of certain external areas is by floodlight, those of most importance being fed from emergency board DB308. The floodlights used are of four kinds:

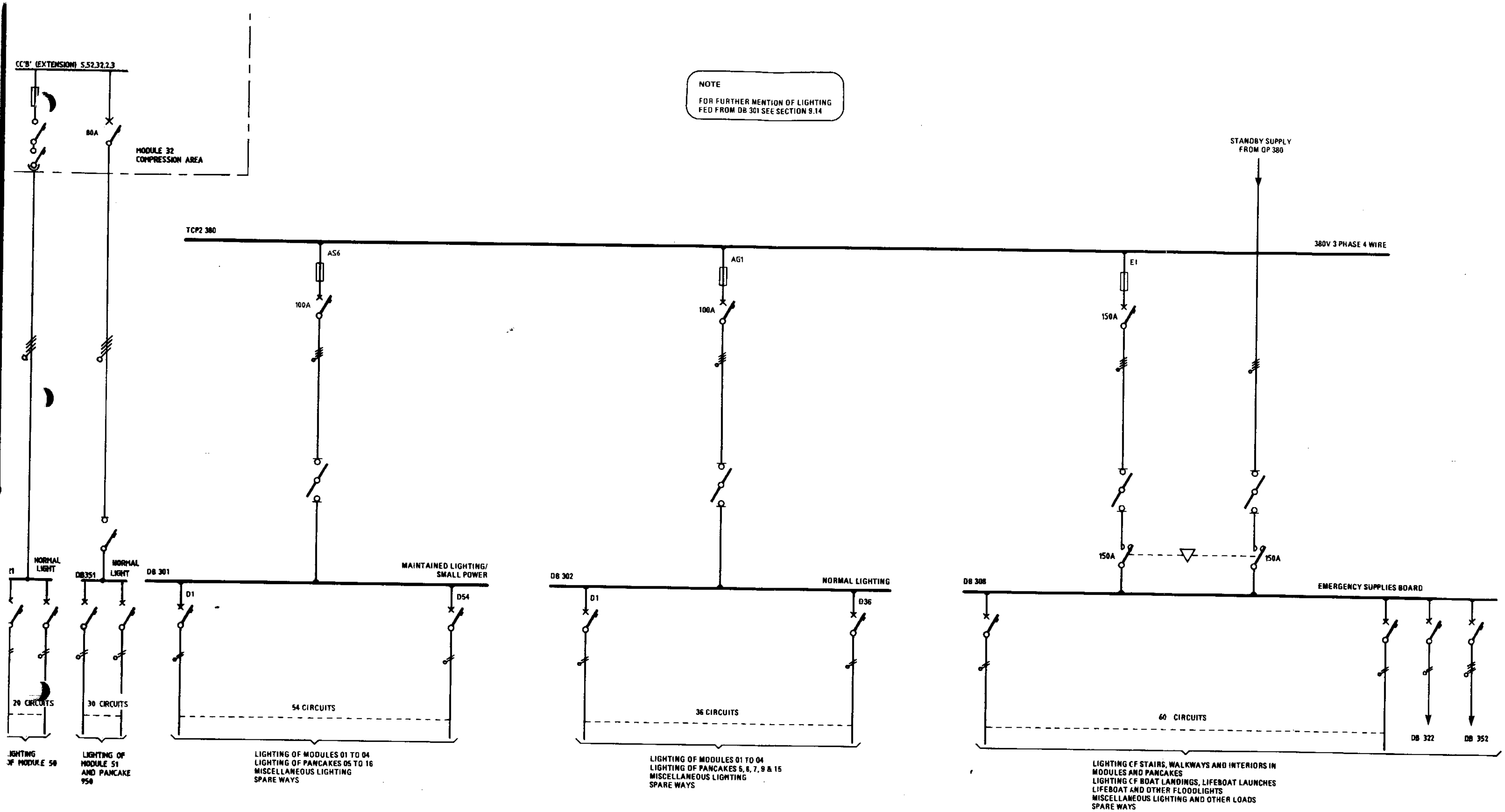
250 W mercury vapour
400 W high pressure sodium
500 W tungsten-halogen
2000 W tungsten-halogen

All the floodlights are weatherproof, but not explosion-proof, and they are therefore not used in hazardous areas.

3. LIGHTING LEVELS

The designed levels of lighting are as follows:

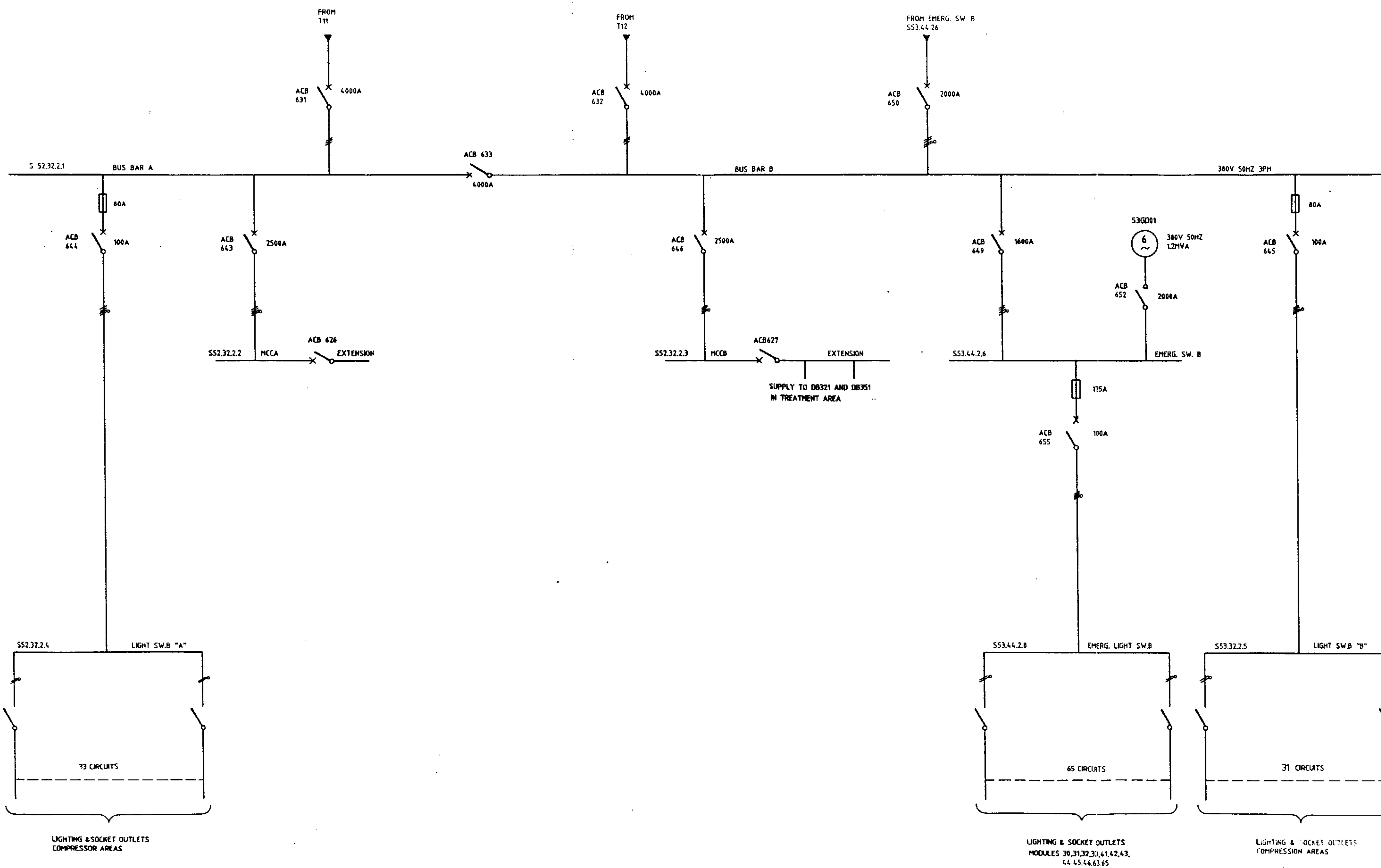
Control Rooms	500 lux
Switchrooms	200 lux
Pump, valves etc.	50 lux
Operating platforms	50 lux
Ladders and stairways	50 lux
Gauges etc.	50 lux
Docking areas	50 lux



) FOR MORE DETAILED INFORMATION SEE
FF.85.23.03.6001, FF.85.23.03.6002 AND FF.89.23.03.0026

ISSUE 3, AUG. 1991

NORMAL LIGHTING Treatment Areas	**5.29.1**



FOR MORE DETAILED INFORMATION SEE
FF.87.23.00.0073, 0074.

ISSUE 3, AUG. 1991

NORMAL LIGHTING
Compression Area

5.29.2

NITROGEN SYSTEM

1. GENERAL

1.1 The purpose of the nitrogen system, is to supply the field with nitrogen for the following purposes: purging, sweeping, inerting, pressure testing and OPPS testing.

2. NITROGEN UNIT (TPI)

2.1 The Linde nitrogen unit on TP1 is providing nitrogen gas at a rate of 150 m^3/hour and purity of about 99%. Outlet pressure is 3 bar.

3. H.P. COMPRESSION UNIT (TP1)

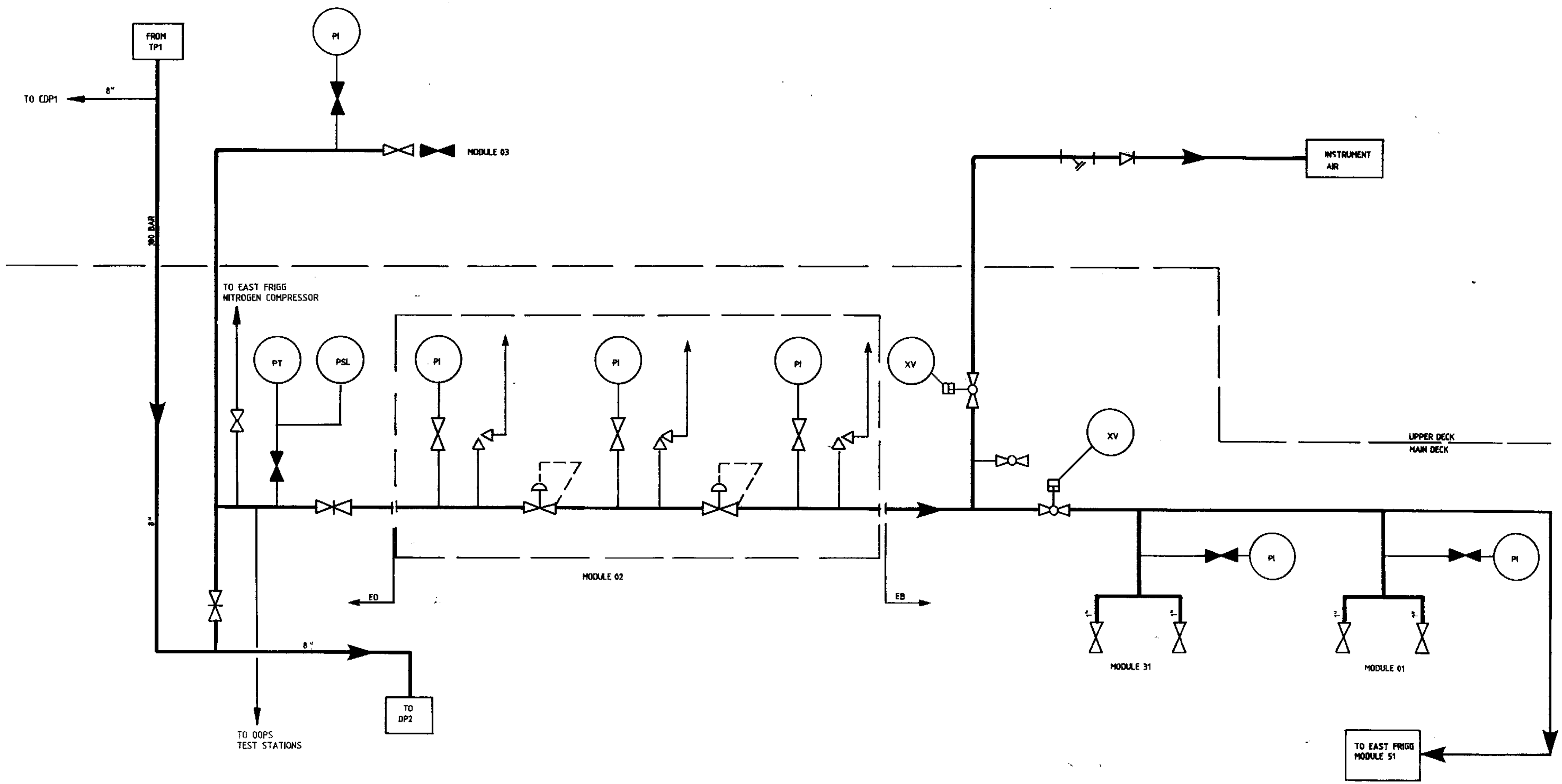
3.1 The nitrogen compression unit is packing the H.P. reservoir (8" mudline network) keeping a pressure of 172 bars.

4. H.P. RESERVOIR STORAGE

4.1 8" mudline volume:

CDP1 - TP1	= 25 m^3	
TP1 - DP2	= 36 m^3	
Total	61 m^3	

END



FOR MORE DETAILED INFORMATION SEE
FF.00.20.00.0007.

ISSUE 3, AUG. 1991

NITROGEN SYSTEM 5.30

CORROSION INHIBITOR INJECTION SYSTEMS

Sea line - St.Fergus

1. GENERAL

1.1 The inhibitor is injected to protect the sealine against internal corrosion. The normal flow rate is 3 litres of inhibitor per one million cubic meter of gas.

1.2 The system comprises the following main items:

(a) Filling station

(b) Surge tanks CV 8 A/B (each 6 m^3)

(c) Filter

(d) Calibration tank

(e) Injection pumps CP 14 A/B

2. DESCRIPTION

2.1 The skid mounted package is located on zone 4 UL. A frame is installed so that transportable supply tanks (6 m^3) can be landed on top of suction tanks, and emptied by gravity.

Each suction tank is equipped with an electrical driven agitator to prevent settling. A vent line, including a flame arrestor, is common for both tanks.

There are two reciprocating injection pumps, driven by electrical motors, each having a flow capacity of 39.6 litre/hr. Max injection pressure is 217 barg.

A graded calibration tank is installed to periodically check injection rates.

The inhibitor is flowing through a 3/4" pipeline into the 32" subsea line to St. Fergus.

3. EAST FRIGG

3.1 General

The inhibitor is injected to protect the sealine against internal corrosion. The max. flow rate is 0.32 litres of inhibitor (per head) per hour.

3.2 The system comprises the following main items:

(a) Filling station

(b) Storage tank CV370

(c) Calibration pot

(d) Injection pumps CP370 A & B

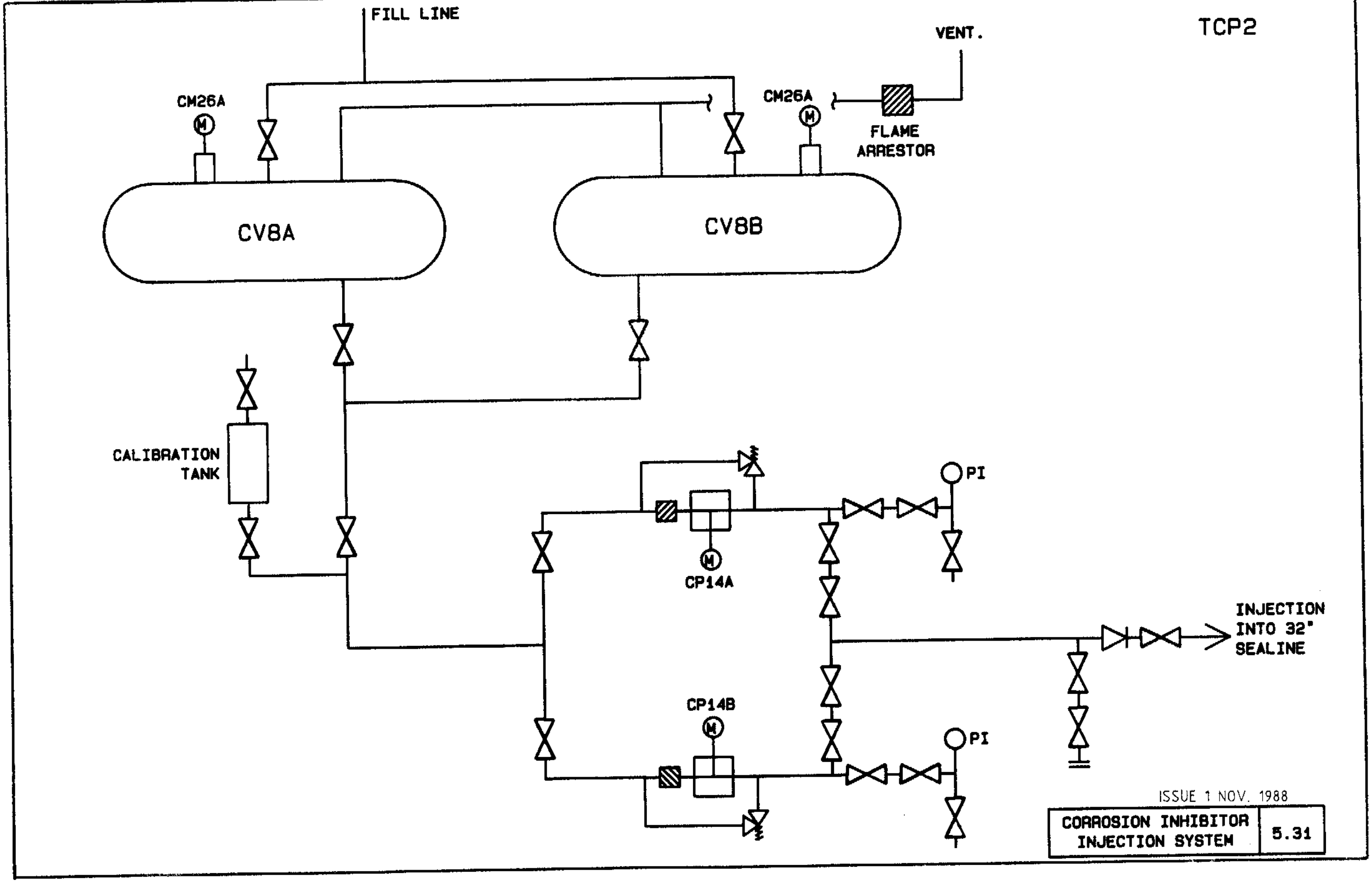
3.3 Description

The package is located in Mod. 51 - intermediate deck. A filling connection is located on the weather deck south west side. Fill is by gravity feed into storage tank CV370. There are two vent lines each with a flame arrestor for this tank.

There are two injection pumps, CP370 A & B, driven by electric motors, each having a flow capacity of 0,32 litres/ HR (each head). Max injection pressure to methanol inj. package is 6 bara, where the pressure is further increased to (105-202) bara, before being transported further to East Frigg Sea Line. See drawing FF.89.00.27.0048.

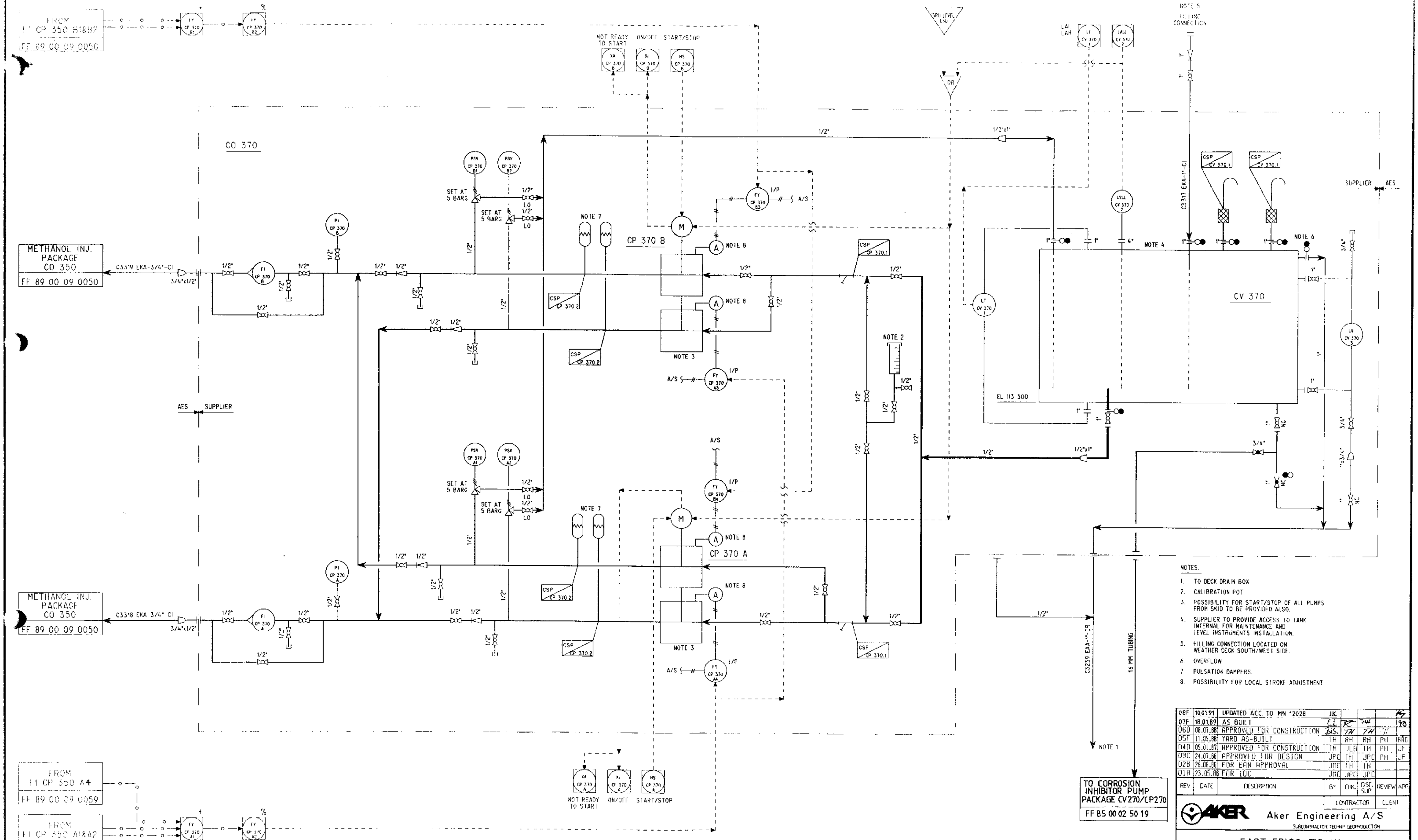
4. NORTH EAST FRIGG

A 3/4" line from storage tank CV370 (East Frigg-module 51) is connected to NEF methanol inj. line via tank CV270 and pump CP270. Inhibitor is pumped into the sea line via ESDVP12.1. (see sec. 5.14).



ISSUE 1 NOV. 1988

CORROSION INHIBITOR INJECTION SYSTEM	5.31



CP 370 A/B

CORROSION INHIBITOR INJ. PUMPS

OPERATING TEMP.	:	AMB.
OPERATING PRESS.	:	ATM./4 BARA
DESIGN TEMP.	:	-9/50 °C
DESIGN PRESS.	:	6 BARA
CAPACITY (EACH HEAD)	:	0.32 L/HR

CV 370

CORROSION INHIBITOR STORAGE TANK

OPERATING TEMP.	:	AMB.
OPERATING PRESS.	:	ATM.
DESIGN TEMP.	:	-9/50 °C
DESIGN PRESS	:	1.04 BARA
OPERATING CAP.	:	200 l
SIZE	:	BY SUPPLIER (HOLD)

REV	DATE	DESCRIPTION	BY	CHK.	DISC. SUP.	REVIEW	APP
08F	10.01.91	UPDATED ACC. TO MN 12028	JK.				
07F	18.01.89	AS BUILT					
06D	08.07.88	APPROVED FOR CONSTRUCTION		TH	TH		
05F	11.05.88	YARD AS-BUILT	TH	RH	RH	PH	RAG
04D	05.01.87	APPROVED FOR CONSTRUCTION	TH	JLB	TH	PH	JF
03C	24.07.86	APPROVED FOR DESIGN	JPC	TH	JPC	PH	JF
02B	26.06.86	FOR EAN APPROVAL	JMC	TH	TH		
01A	23.05.86	FOR IDC	JMC	JPC	JPC		

CONTRACTOR | CLIENT

Aker Engineering A/S

SUBCONTRACTOR TECHNIP GEOPRODUCTION

EAST FRIGG TIE-IN

elf aquitaine norge a/s p.o.box 168-4001 Stavanger

A1 | Installation TCP2 | System CORROSION INHIBITOR

A

Job no 5193

Scale

P & I DIAGRAM
CORROSION INHIBITOR
INJECTION PACKAGE

FRIGG FIELD | Drwg no FF 89 00 27 0048 | Rev 08F | Sheet 1/1

CHAPTER 6

TRANSPORT FACILITIES

CONTENTS

Section 6.1 Supply Vessels

SUPPLY VESSELS

1 GENERAL

1.1 It is anticipated that the following supply vessels will be engaged in the replenishment of platforms

1.2 The table covers relevant data concerning the supply vessels' dimensions and capabilities

Vessel	LENGHT OVERALL	BEAM	DRAUGHT	GROSS TONNAGE (TONNS)	FREE DECK SPACE	CAPACITIES					DISCHARGE RATES				METHANOL TRANSPORT CAPACITY
						DECK CARGO	POTABLE WATER	BULK TANKS	DRILL WATER	FUEL OIL	POTABLE WATER	DRILL WATER	FUEL OIL	CEMENT	
VIKING FIGHTER	69.30m	15.50	5.70	2075	40x12.5m	1200T	1000T	6000cbf	730T	500m^3	150m^3/h HEAD 80m	150m^3/h HEAD 80m	170m^3/h HEAD 80m	50T/h	120m^3
NORMAND SKIPPER	58.95m	12.60	4.10	499			276T	4280cbf		453m^3					80m^3

NOTE

VIKING FIGHTER is equipped as FI-FI class II and oil recovery vessel

NORMAND SKIPPER is equipped as FI-FI class I

ISSUE 1.Jan.-92

CHAPTER 7

MATERIALS HANDLING

CONTENTS

Section	7.1	Cranes
	7.2	Lifting Equipment
	7.3	Bulk Handling Systems
	7.4	Column Access
	7.5	Overload protection for MK - 60 cranes

DIAGRAMS

7.1.1	Cranes
7.1.2	Allowable Liveload on Open Deck area - Cellar Deck
7.1.3	Allowable Liveload on Open Deck area - Main Deck
7.1.4	Allowable Liveload on Open Deck area - Upper Deck
7.1.5	Allowable Liveload on Open Deck area - Module 30-33
7.2	Lifting Equipment

CRANES

1. GENERAL

1.1 Two Bucyrus Erie Mk 60 pedestal mounted marine cranes CM7 and CM8 are provided. CM7 is located on the south-west corner of Module 01 and CM8 on the north-east corner of Module 04.

1.2 A Nyland Verksted 30/10 pedestal mounted crane 60X01 is mounted on the east side of module 32.

1.3 The cranes are supplied for general lifting duties within their lifting areas.

2. DESCRIPTION

2.1 Bucyrus Erie

2.1.1 Each cranes's load performance is as follows:

(a) Main Hoist 43.09 tonnes at 80° boom angle, 7.62m radius.
3.18 tonnes at 18° boom angle, 36.57m radius.

(b) Whip Hoist 5.44 tonnes at 80° to 37° boom angle, 6.10m to 32.00m radius.
2.72 tonnes at 16° boom angle, 38.10m radius.

2.1.2 Each crane has a boom length of 36.58m and operates within a range of 80° above to 12° below the horizontal.

2.1.3 Power to each crane is supplied by a General Motors 12V-71N 12-cylinder diesel engine, via hydraulic transmission.

2.1.4 An adjustable boom hoist limit device enables the boom to be stopped at predetermined high and low angles. Actuating pins on the boom foot trip the microswitch which controls the boom hoist hydraulic motor's operation. These pins normally work from 60° to 80° above to 12° below the horizontal. An override button, located in the operator's cab, allows the boom to be raised or lowered beyond the trip position.

2.1.5 A two block warning device operates when the hoist line hook reaches a predetermined distance from the boom hoist sheaves. Two limit switches, mounted on the boom point, are wired in parallel so that actuation of either switch will cause a warning bell to sound.

2.1.6 An anti-two block shut-off device prevents the hook from being drawn into the boom hoist sheaves. Two limit switches, mounted on the boom point, are wired in parallel so that actuation of either will initiate shutdown of the hydraulic motors.

NOTE! OPERATIONAL RESTRICTIONS - CM7 & CM8

TEMPORARY DERATING OF MK 60 CRANES

The Bucyrus Erie MK 60 cranes have been derated as from 04.12.91
Main hoist: 50%
Whip hoist: 25%

The Dynamic Load Chart dated 09.12.91 is to be used until the cranes are upgraded again

2.2 Nyland Verksted

2.2.1 Load performance:

(a)	Main Hoist	30 tonnes at 10.1m radius 12 tonnes at 33.2m radius
(b)	Whip Hoist	10 tonnes at 3.62m radius

2.2.2 The crane has a boom length of 38.545m, power is supplied by a diesel engine via hydraulic transmission.

2.3 Manitowoc

2.3.1 A Manitowoc Model 4000W crawler type crane is temporarily sited on the main deck. This crane is used for lifts around the main deck area only. It must not be used for loading or unloading supply vessels. Also it is forbidden to swing or lower the boom over a classified area.

DYNAMIC LOAD CHART

BUCYRUS-ERIE MK-60. 120 FT. BOOM – MAXIMUM LOAD ON HOOK

WIRE ROPE SPEC.: HOIST LINE : BR.LOAD/STRENGTH – 35000kp/190kp/mm²
BOOM HOIST LINE : BR.LOAD/STRENGTH – 46900kp/180kp/mm²

WHIP HOIST – SINGLE LINE 75%

BOOM ANGLE (DEG)	BOOM RADIUS (m)	DECK TO DECK	SIGNIFICANT WAVE HEIGHT (m)							
			.5	1.0	1.5	2.0	3.0	4.0	5.0	6.0
		SWL (t)								
0.0	39.6	2.5	2.0	1.5	1.0	1.0	.5	.5	.5	.5
16.0	38.2	2.5	2.5	2.0	1.5	1.0	.5	.5	.5	.5
23.0	36.7	3.0	3.0	2.0	1.5	1.5	1.0	1.0	.5	.5
28.0	35.3	3.5	3.5	2.5	2.0	1.5	1.0	1.0	1.0	1.0
32.0	34.0	4.5	4.5	3.5	2.5	2.0	1.5	1.5	1.0	1.0
37.0	32.2	5.5	5.0	4.0	3.5	2.5	2.0	2.0	1.5	1.5
80.0	8.5	5.5	5.5	4.5	3.5	2.5	2.0	2.0	1.5	1.5

MAIN HOIST – 4 PARTS 50%

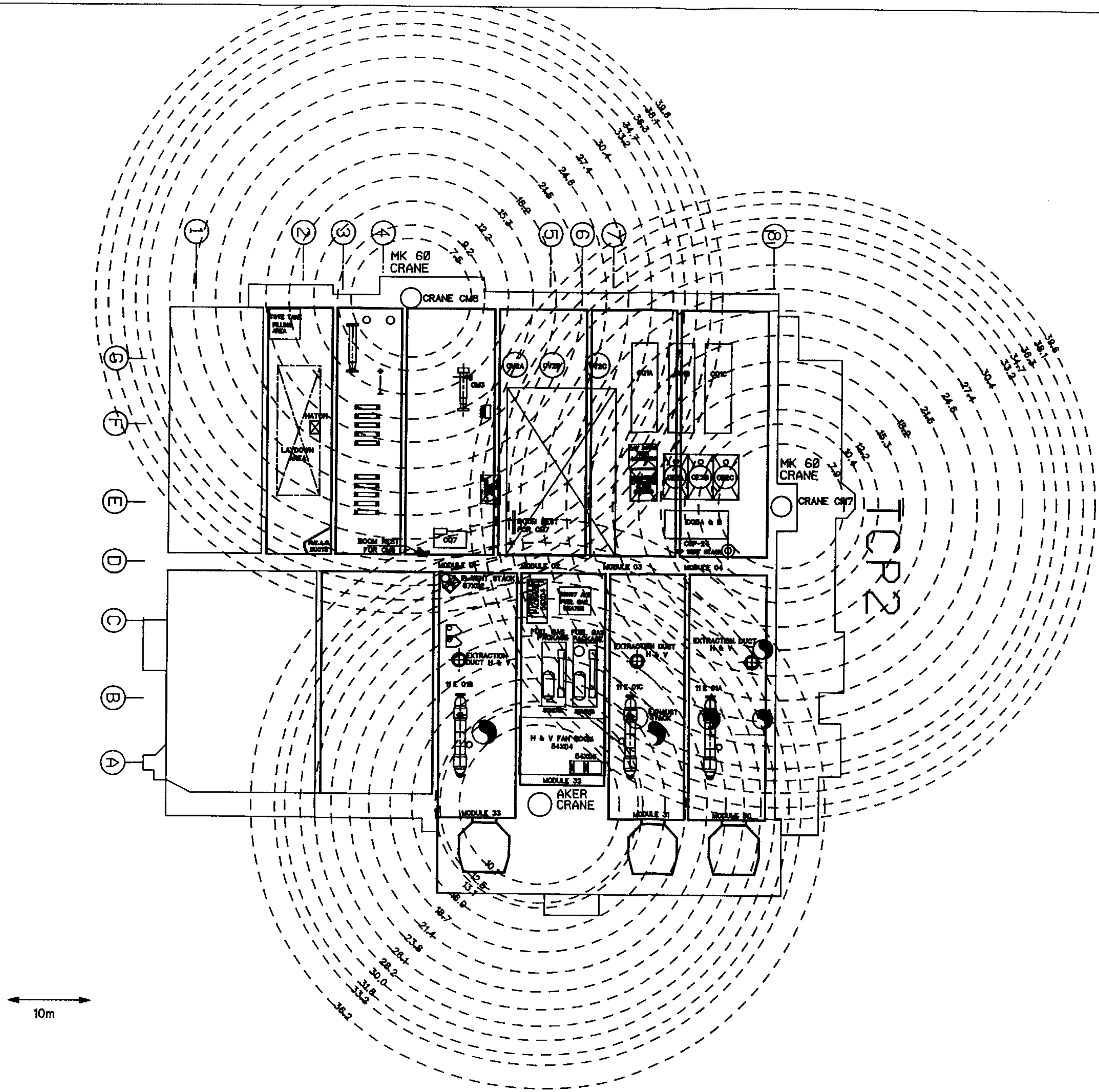
BOOM ANGLE (DEG)	BOOM RADIUS (m)	DECK TO DECK	SIGNIFICANT WAVE HEIGHT (m)							
			.5	1.0	1.5	2.0	3.0	4.0	5.0	6.0
		SWL (t)								
0.0	38.1	.5	.5	0.0	0.0	0.0	[illegible]	[illegible]	[illegible]	[illegible]
18.0	36.3	1.0	.5	.5	.5	0.0	[illegible]	[illegible]	[illegible]	[illegible]
25.0	34.7	1.0	.5	.5	.5	.5	[illegible]	[illegible]	[illegible]	[illegible]
30.0	33.2	1.5	1.0	.5	.5	.5	.5	[illegible]	[illegible]	[illegible]
38.0	30.4	2.0	1.5	1.0	1.0	.5	.5	[illegible]	[illegible]	[illegible]
45.0	27.4	3.0	2.5	1.5	1.5	1.0	.5	[illegible]	[illegible]	[illegible]
51.0	24.6	4.0	3.0	2.5	2.0	1.5	1.0	[illegible]	[illegible]	[illegible]
57.0	21.5	5.5	4.5	3.5	3.0	2.5	1.5	[illegible]	[illegible]	[illegible]
63.0	18.2	8.0	6.5	5.0	4.0	3.5	2.5	[illegible]	[illegible]	[illegible]
68.0	15.3	10.5	9.0	7.0	8.0	5.0	3.5	[illegible]	[illegible]	[illegible]
73.0	12.2	14.5	12.5	10.5	9.0	7.5	5.5	[illegible]	[illegible]	[illegible]
79.0	9.2	21.5	18.5	15.5	13.5	11.5	8.5	[illegible]	[illegible]	[illegible]
80.0	7.9	24.0	22.0	15.0	16.0	14.0	10.5	[illegible]	[illegible]	[illegible]
80.0	7.9	24.0	22.0	19.0	16.0	14.0	10.5	9.0	7.5	[illegible]

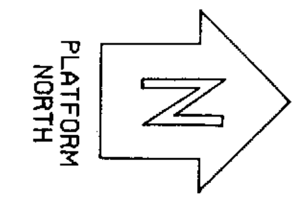
[blank box]	**DEPENDENT ON SKILL OF OPERATOR WHETHER LOAD CLEARS SECOND WAVE**
[crossed box]	LIFTING NOT PERMITTED IF SIGN. WAVE EXCEED 3.0M OR WIND EXCEED 30KTS.

This load chart is valid from 091291 until further notice.

ELF AQUITAINE NORGE A/S MAINTENANCE DEPT.

P.M.Vølstad





NOTE:

FOR LOAD CHARTS
SEE TABLES EACH CRANE
AKER CRANE 100% RATING
CM8 MK60 CRANE 100% RATING
CM7 MK60 CRANE 75% OF MAX MOMENT.

rev.	date	DESCRIPTION	by	app.
0	12.02.91	FIRST ISSUE	OØ	.

DGN.:PPLAN

elf aquitaine norge a/s p.o.box 168-4001 Stavanger

Installation: TCP2
System: STRUCTURAC

Job no.

CRANES WORKING AREA

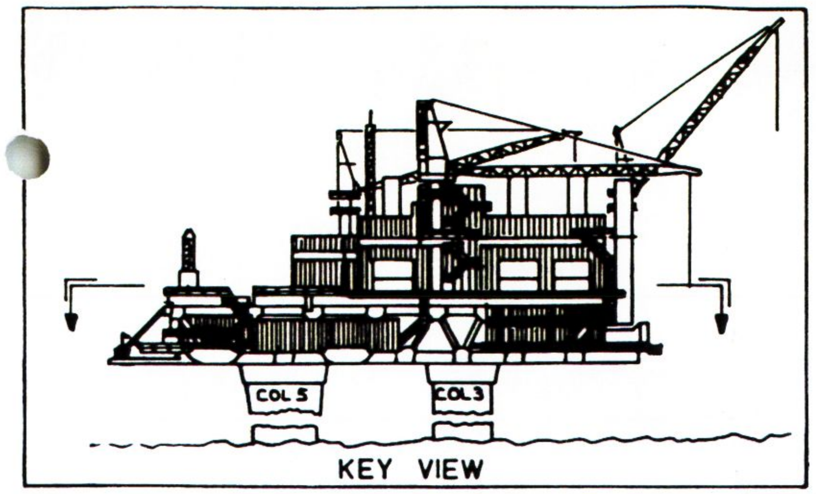
Scale: 1:500

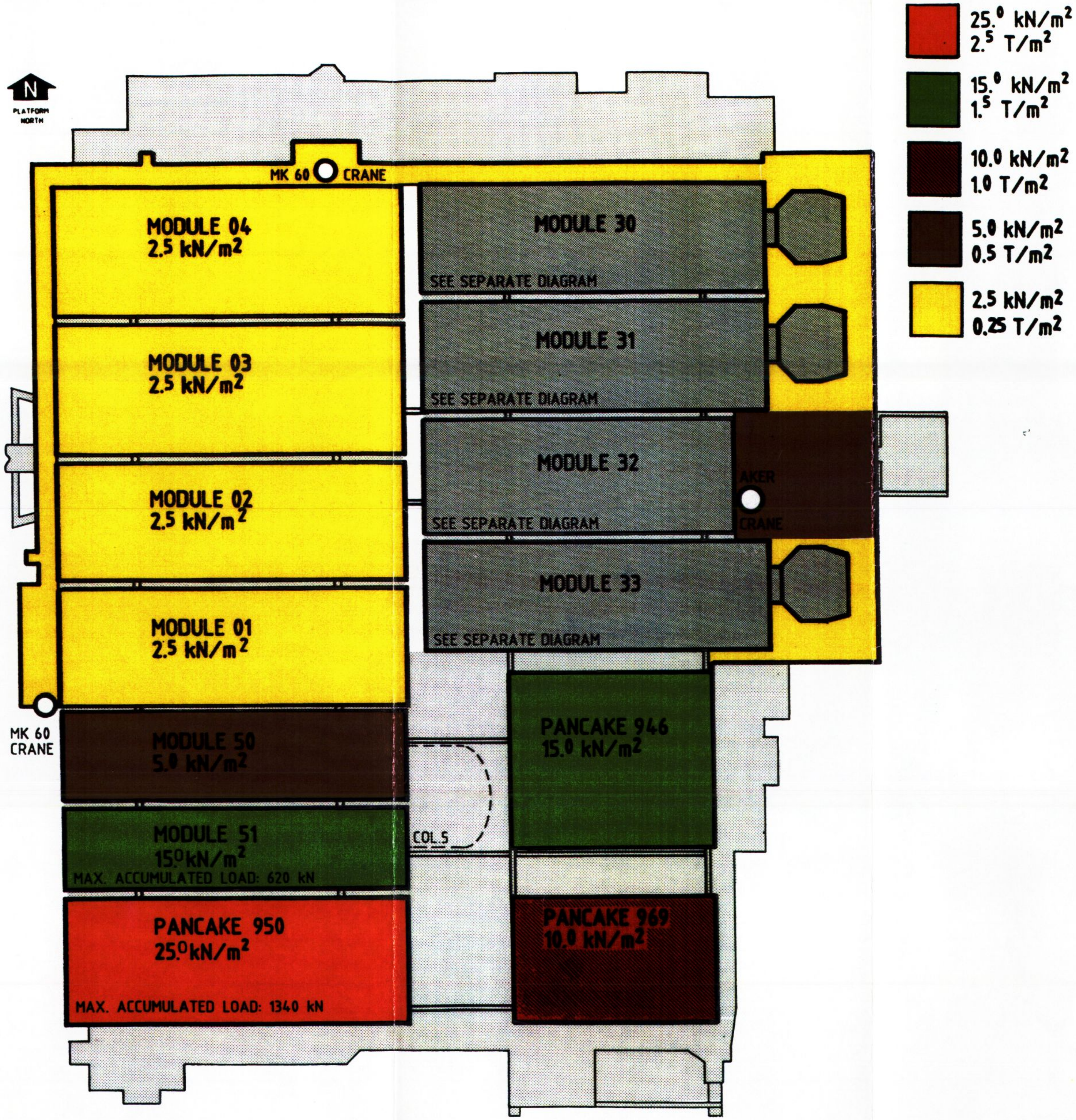
FRIGG FIELD

Drwg no.: FF 85-00-00-00-58

Rev.: 0

Sheet: ./.

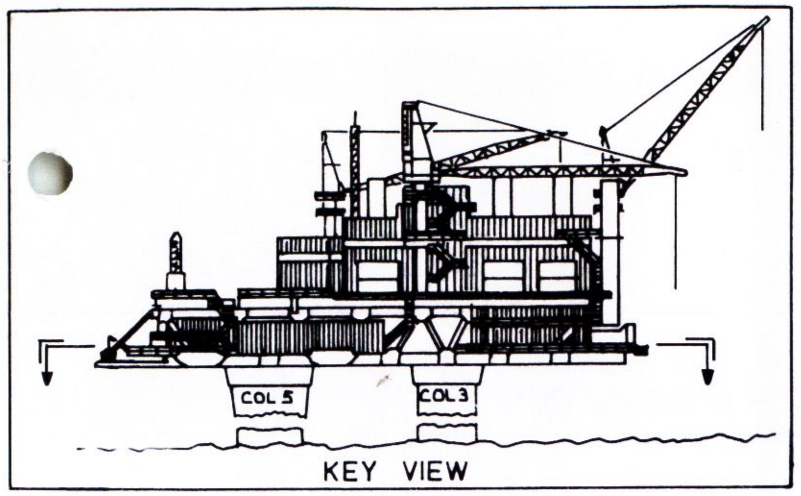


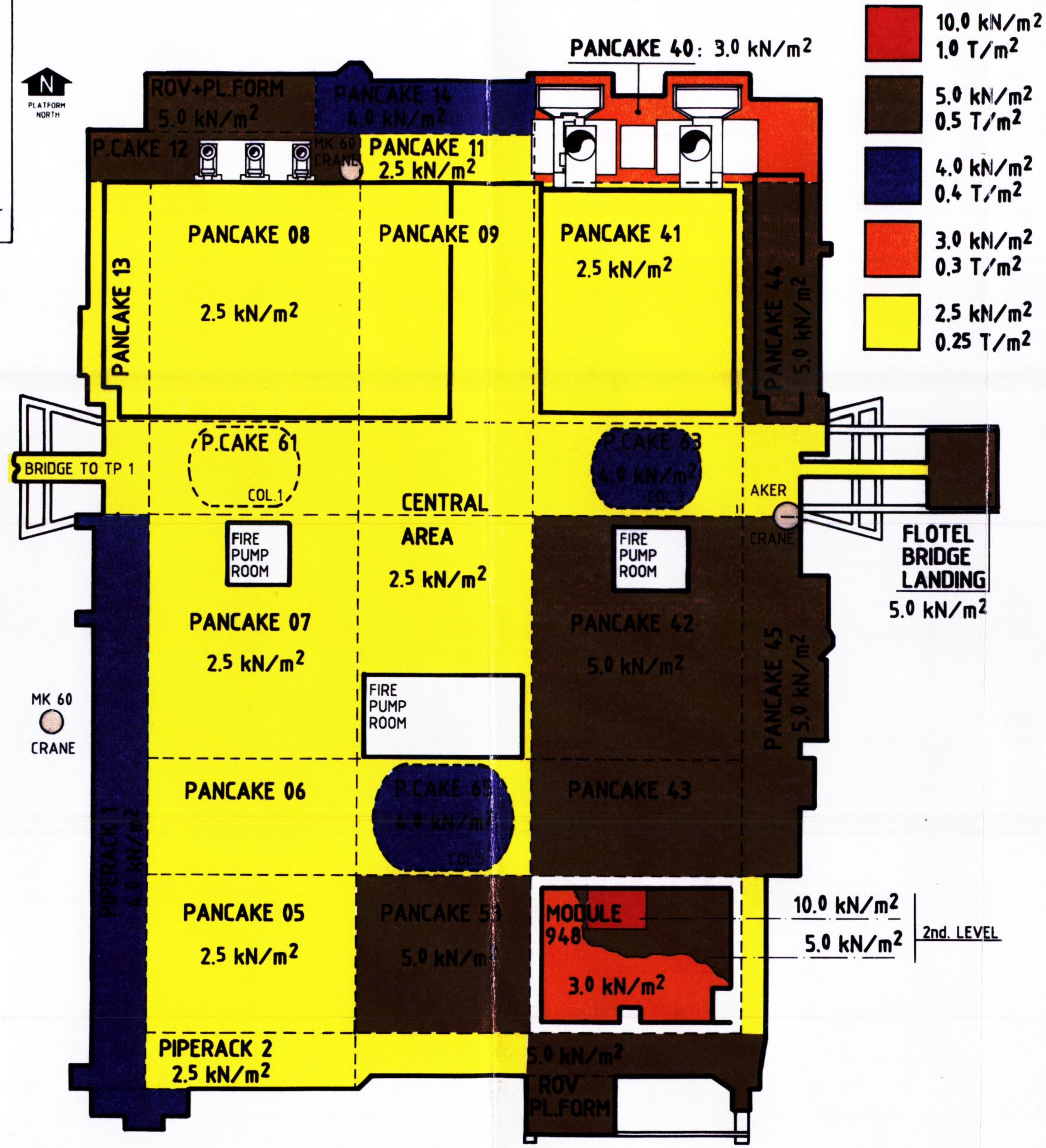


MAIN DECK
ALLOWABLE LIVELOAD

ISSUE 2 MAY 1988

LIVELOAD ON OPEN DECKAREA Main deck	7.1.3

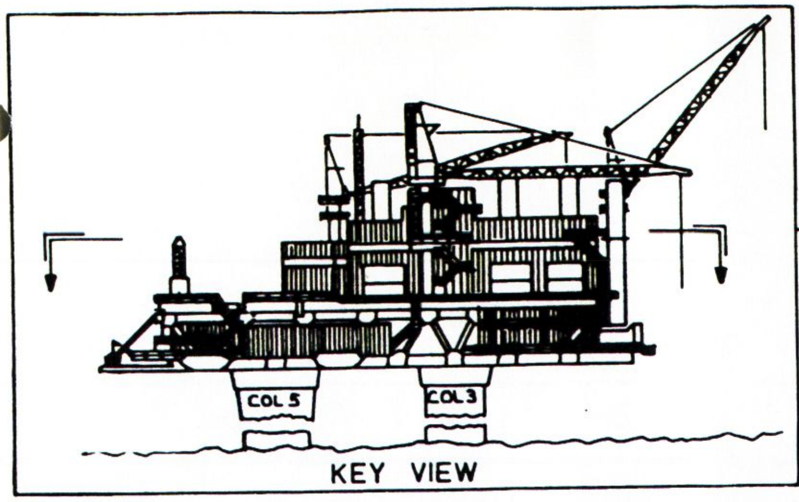


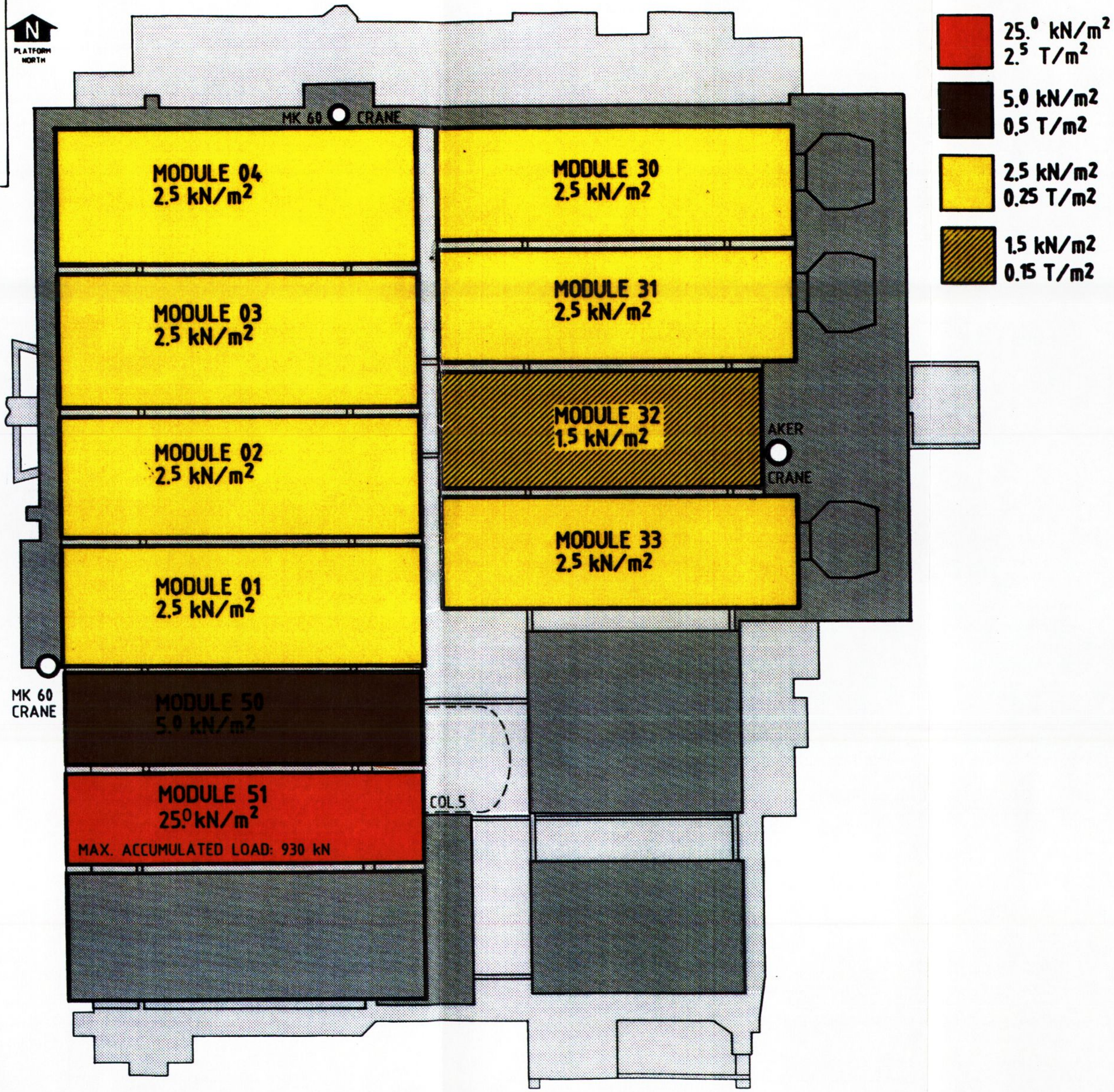


CELLAR DECK
ALLOWABLE LIVELOAD

ISSUE 1 OCT. 1984

LIVELOAD ON OPEN DECKAREA Cellar deck	7.1.2

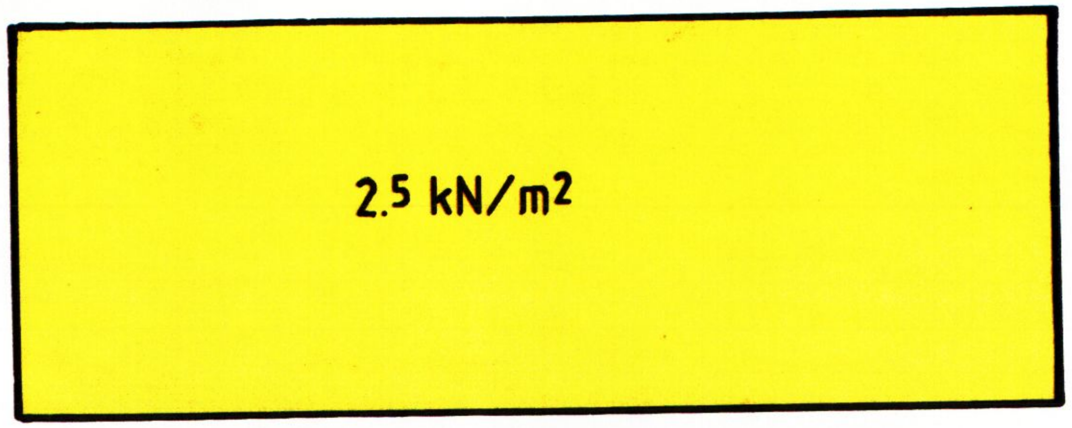




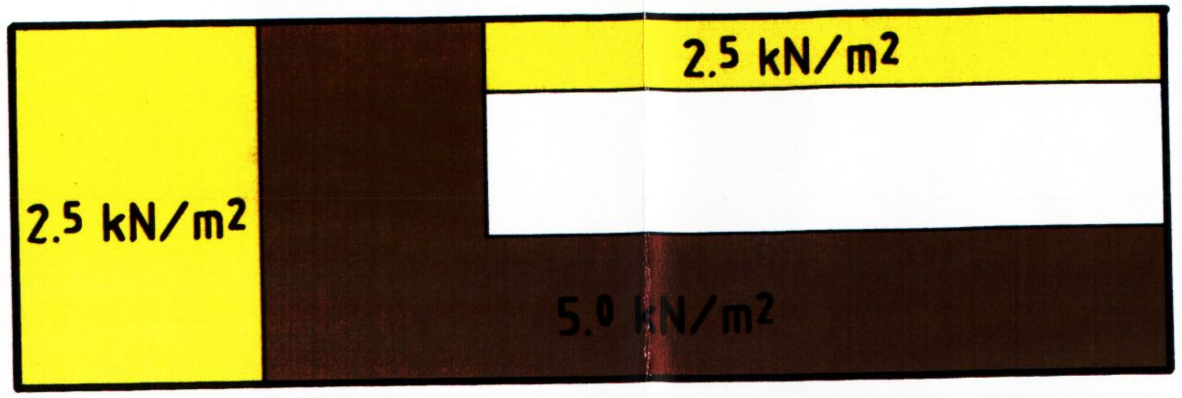
UPPER DECK
ALLOWABLE LIVELOAD

ISSUE 2 MAY 1988

LIVELOAD ON OPEN DECKAREA Upper deck	7.1.4

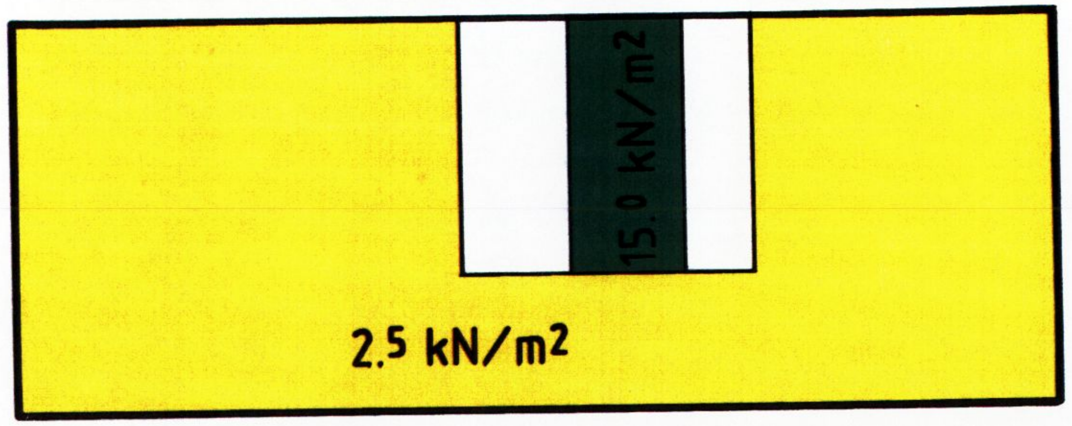


CONTROL ROOM DECK



MAIN DECK

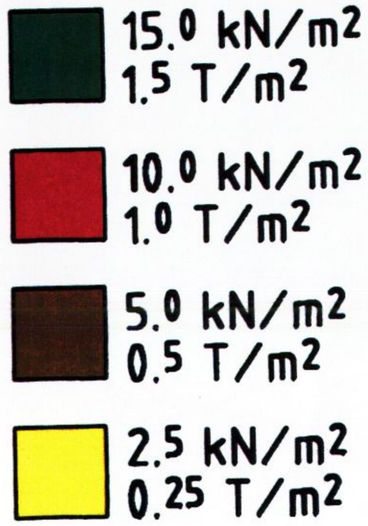
MODULE 30, 31 & 33
ALLOWABLE LIVELOAD



SUBSTATION DECK

MAIN DECK

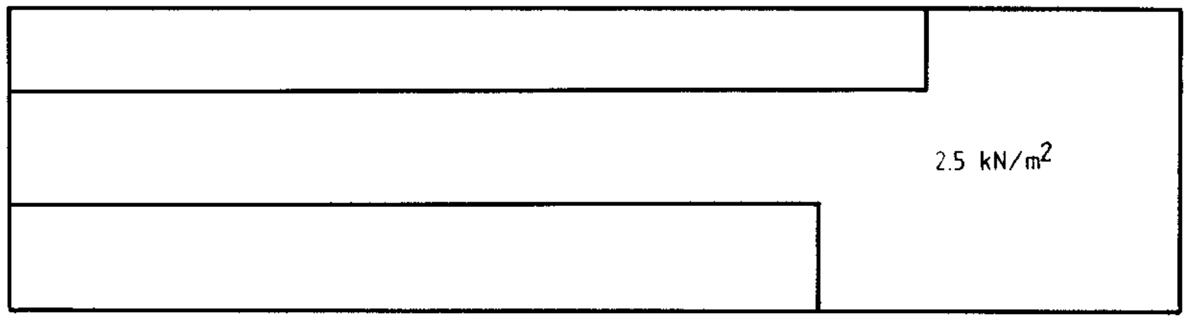
MODULE 32
ALLOWABLE LIVELOAD



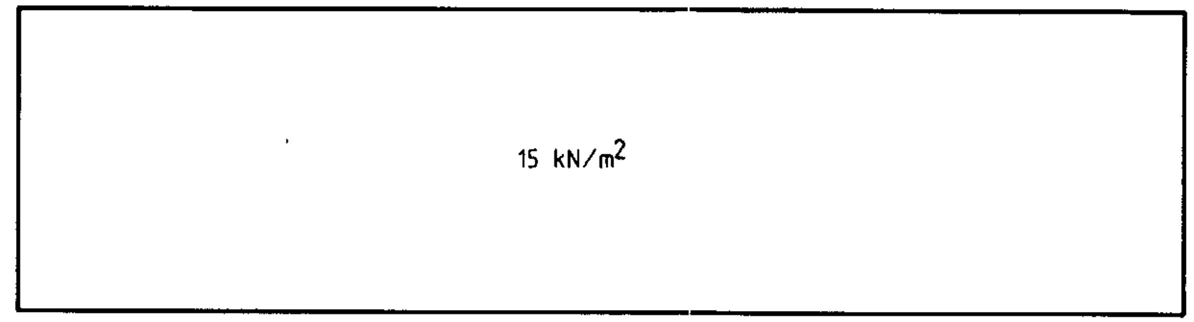
ISSUE 1 OCT. 1984

LIVELOAD ON OPEN DECKAREA Modules 30, 31, 32 & 33	7.1.5

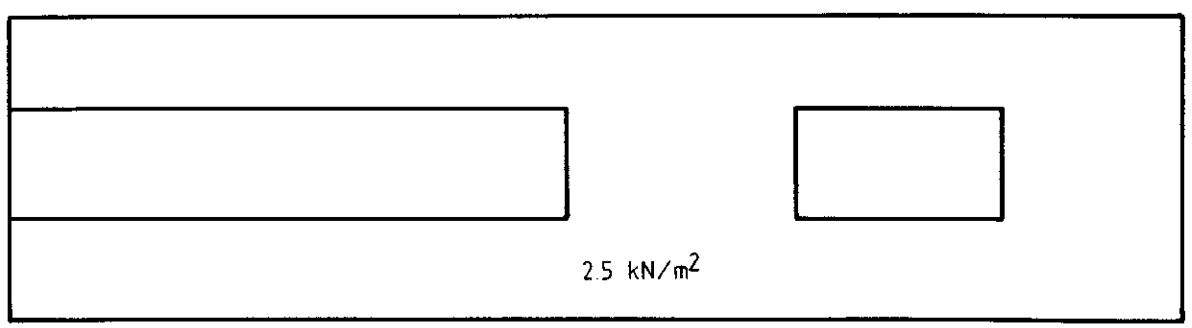
PLATFORM NORTH



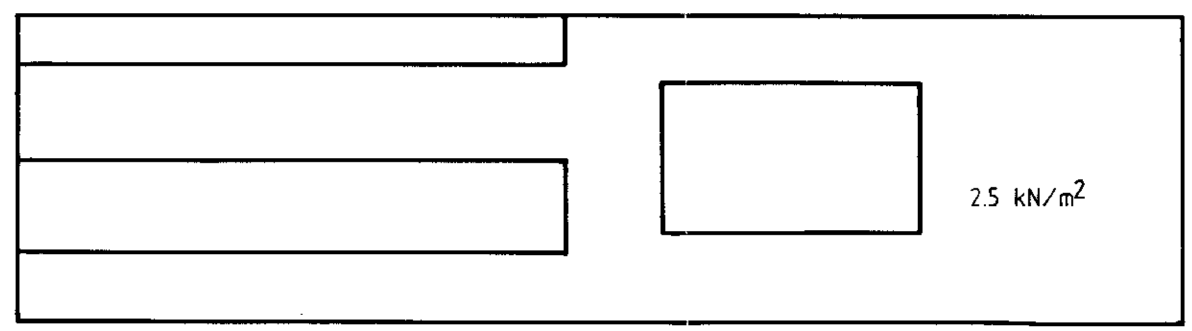
INTERMEDIATE DECK



WEATHER DECK



MAIN DECK



UPPER DECK

MODULE 51

ALLOWABLE LIVELOAD

LIFTING EQUIPMENT

TAG NO.	LOCATION	FUNCTION
COMPRESSION AREAS		
60X05A B/C	Module 30,31 and 33	Serving 11K01 A/B/C 11KG01A/B/C
60X06A B/C		
60X08A	Module 32	Serving 58P01A/B
60X08B		Serving 58P01C/D
60X09A	Pancake 41	Serving 52G01A
60X09B		Serving 52G01B
60X10	Pancake 42	Serving pumps and motors
60X11A		Serving 68P01A
60X11B	Pancake 46	Serving 68P01B
TREATMENT AREA		
CM 350	Module 51 Upper deck	Serving Misc. Equipment
CM 351	Module 51 Intermediate deck	Serving Misc. Equipment
CM 352	Module 51 Main deck	Serving EF choke valve

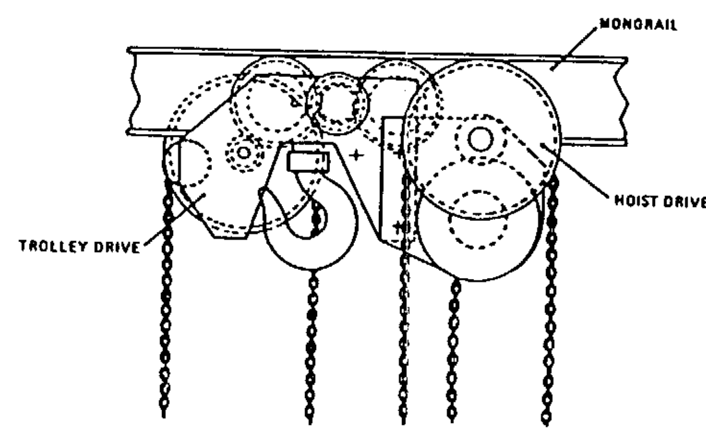


FIG 1

BULK HANDLING SYSTEMS

1. GLYCOL

1.1 Glycol is normally supplied from TP1 via a 2in fill line. It may also be replenished from a service boat through flexible hoses and 4in lines from the unloading stations.

1.2 Storage tank level is indicated locally at the unloading stations.

2. METHANOL

2.1 Methanol is normally supplied in $5.7m^3$ capacity transportable pods and gravity fed into the storage tank.

2.2 Methanol may also be supplied from and transferred to TP1 via a 3in line.

3. DIESEL FUEL

3.1 Diesel fuel is supplied from TP1 via a 4in fill line or alternatively from a service boat.

3.2 When bunkering from a service boat diesel fuel is taken on through flexible hoses and 4in lines from the unloading stations.

3.3 Storage tank level is indicated locally at the unloading stations.

4. BOAT LANDINGS

4.1 Loading from supply boats should not be attempted under the following conditions:

(a) Current greater than 1.5 knots (0.77m/s).

(b) Wind greater than 40 knots (20.50m/s).

(c) Waves higher than 5m at a frequency greater than 8.5s.

4.2 The unloading stations are floodlit by 500W tungsten lamps.

END

COLUMNS ACCESS

1. COLUMN NO. 1

1.1 Levahn 2T. winch C1
Design code: Gruveheisanlegg fra Direktoratet for arbeidstilsynet.
Personnel winch for column access from Elevation 126.500 to Elevation 14.900. The winch is a double drum type with nominal pull 20.0 kN hoisting height 140 meter. Hoisting speed 0.5 meter/second. The winch is hydraulically driven, with an electric/air driven hydraulic powerpack. There is also an air back up system for emergency use. There are two hoisting wires, each of them has the capacity to take all the hoisting load.
The winch has two brakes - one operating brake and one safety brake. Both brakes are fail-safe and have a safety factor of more than three. In order to ensure equal load in the two wires, a hydraulic balancing system is installed within the winch. The winch is equipped with

- Overspeed Governor
- Overload Governor
- Climbing Guard for improper wire winding
- Adjustable limit switches for top and bottom positions of basket
- Emergency stop
- Spooling Gear

The hoist has an aluminium basket with safe working load 5.0.kN. The basket is guided by two guiding wires.

2. COLUMN NO. 3

2.1 Mape 1T. Winch C 3
Design Code: F.E.M.
Personnel winch for column access from Elevation 113.000 to Elevation 9.250. The winch is a double drum type with nominal pull 10.0 kN hoisting height 150 meter. Hoisting speed: 20 meter/minute: The winch is electrically driven, with an air driven back-up motor.
There are two hoisting wires. In order to ensure equal load in the two wires, a mechanical balancing system is installed on top of the baskets. There are two baskets for this winch - one basket for personnel access which is guided by two guiding wires, and another basket for inspection safe working load for both baskets is 5.0 kN.

2.2 Levahn 1T. Emergency winch C 3.
Design Code: Gruveheisanlegg fra Direktoratet for Arbeidstilsynet.
Emergency personnel winch for column from Elevation 128.900 to Elevation 8.860.

Winch pull	:	10.0 kN SWL
Winch speed	:	0-60 m/min variable
Drum diam.	:	320 mm first layer
Drum width	:	360 mm
Drum capacity	:	142 m 10mm DIA wire in 4 layers

The winch motor is an Ingersoll-Rand multivane motor which is directly flanged to a gear reduction unit from Brevini, EC2045RM.

At the input side of the gear there is a failsafe multi lamell brake which is air lifted.

The drum is connected to the gear output axel through a splined coupling.

The gear unit output axle bearing thereby also act as bearing for the drum.
The other side of the drum has an axle resting in a spherical roller bearing in the frame side.

Proper winding of the wire rope on the drum is ensured by the wireguiding device. This consists of a penduling leadsheave, positioned by an endless threaded lead screw. The wire goes from the leadsheave between two guiding sheaves and then out from the winch.

In addition there is a threaded axle with nuts that engage the bottom limit switch.
The top limit switch may be placed to be engaged by the basket. On the drum there is a proper winding guard that stops the hoisting is wire is wound in more than four layers.

The winch is controlled by a remotely placed four-way throttle valve which is linked to the winch by two 1 1/4" pipes.

On the drum there is a fail safe two-shoe brake. The brake is spring applied, air released.

The hoist has a steel basket which can carry a stretcher inside.
Safe working load 3.5 kN.
The basket is guided by two guiding wires.

3. COLUMN NO. 5

3.1 Levahn 2T. winch C5
Design code: Gruveheisanlegg fra Direktoratet for arbeidstilsynet.
Personnel winch for column access from Elevation 110.250 to Elevation 45.250. The winch is also used for inspection purposes of three risers in the column from Elevation 112.720 to Elevation 45.250. The winch is a double drum type with nominal pull 20.0 kN hoisting height 100 meter. Hoisting speed: 0.5 meter/second. The winch is hydraulically driven, with an electric/air driven hydraulic powerpack. There is also an air back up system for emergency use. There are two hoisting wires, each of them has the capacity to take all the hoisting load.
The winch has two brakes - one operating brake and one safety brake. Both brakes are fail-safe and have a safety factor of more than three. In order to ensure equal load in the two wires, a hydraulic balancing system is installed on top of the basket.
The winch is equipped with

- Overspeed Governor
- Overload Governor
- Climbing Guard for improper wire winding
- Adjustable limit switches for top and bottom positions of basket
- Emergency stop
- Spooling Gear

There are two baskets for this winch, one basket for personnel access which is guided by two guiding wires, and another basket for inspection. Safe working load for both baskets is 5.0 kN.

3.2 Levahn 1T. Emergency winch C 5.
Design Code: Gruveheisanlegg fra Direktoratet for Arbeidstilsynet.
Emergency personnel winch for column from Elevation 127.720 to Elevation 8.470.

Winch pull	:	10.0 kN SWL
Winch speed	:	0-60 m/min variable
Drum diam.	:	320 mm first layer
Drum width	:	360 mm
Drum capacity	:	142 m 10mm DIA wire in 4 layers

The winch motor is an Ingersoll-Rand multivane motor which is directly flanged to a gear reduction unit from Brevini, EC2045RM.

At the input side of the gear there is a failsafe multi lamell brake which is air lifted.

The drum is connected to the gear output axel through a splined coupling.

The gear unit output axle bearing thereby also act as bearing for the drum.
The other side of the drum has an axle resting in a spherical roller bearing in the frame side.

Proper winding of the wire rope on the drum is ensured by the wireguiding device. This consists of a penduling leadsheave, positioned by an endless threaded lead screw. The wire goes from the leadsheave between two guiding sheaves and then out from the winch.

In addition there is a threaded axle with nuts that engage the bottom limit switch.
The top limit switch may be placed to be engaged by the basket. On the drum there is a proper winding guard that stops the hoisting is wire is wound in more than four layers.

The winch is controlled by a remotely placed four-way throttle valve which is linked to the winch by two 1 1/4" pipes.

On the drum there is a fail safe two-shoe brake. The brake is spring applied, air released.

The hoist has a steel basket which can carry a stretcher inside.
Safe working load 3.5 kN.
The basket is guided by two guiding wires.

OVERLOAD PROTECTION FOR MK - 60 CRANES

1. GENERAL

Crane Safe model 88B is manufactured by Reg-Tek prosess-Teknikk A/S in Norway. Crane Safe is an overload-protection system, using a static data memory for storage and generation of the crane's load moment curve.

2. DESCRIPTION

The Crane Safe System consists of the following main components:

- Pendulum potentiometer for measurement of the outreach.

- Loadcells for measurement of load in the hook.

- Electronic unit with an indicator panel.

CHAPTER 8

COMMUNICATIONS

CONTENTS

Section	8.1	Radio Links
	8.2	Telephone System
	8.3	Intercom System
	8.4	Public Address and Alarm System
	8.5	Navigation Aids
	8.6	NEF Slow Scan TV System

DIAGRAMS

8.1.1	Radio Links - Overall System FF 00 16 00 0013
8.1.2	Radio Links - Lifeboat Radio Equipment
8.3	Intercom System
8.4	Public Address System
8.5.1	Navigational Aids - Location
8.5.2	Navigational Aids - Overall System

RADIO LINKS

1. GENERAL

Radio communications, except for lifeboat communications, are conducted from Platform QP, See the QP Operations Manual.

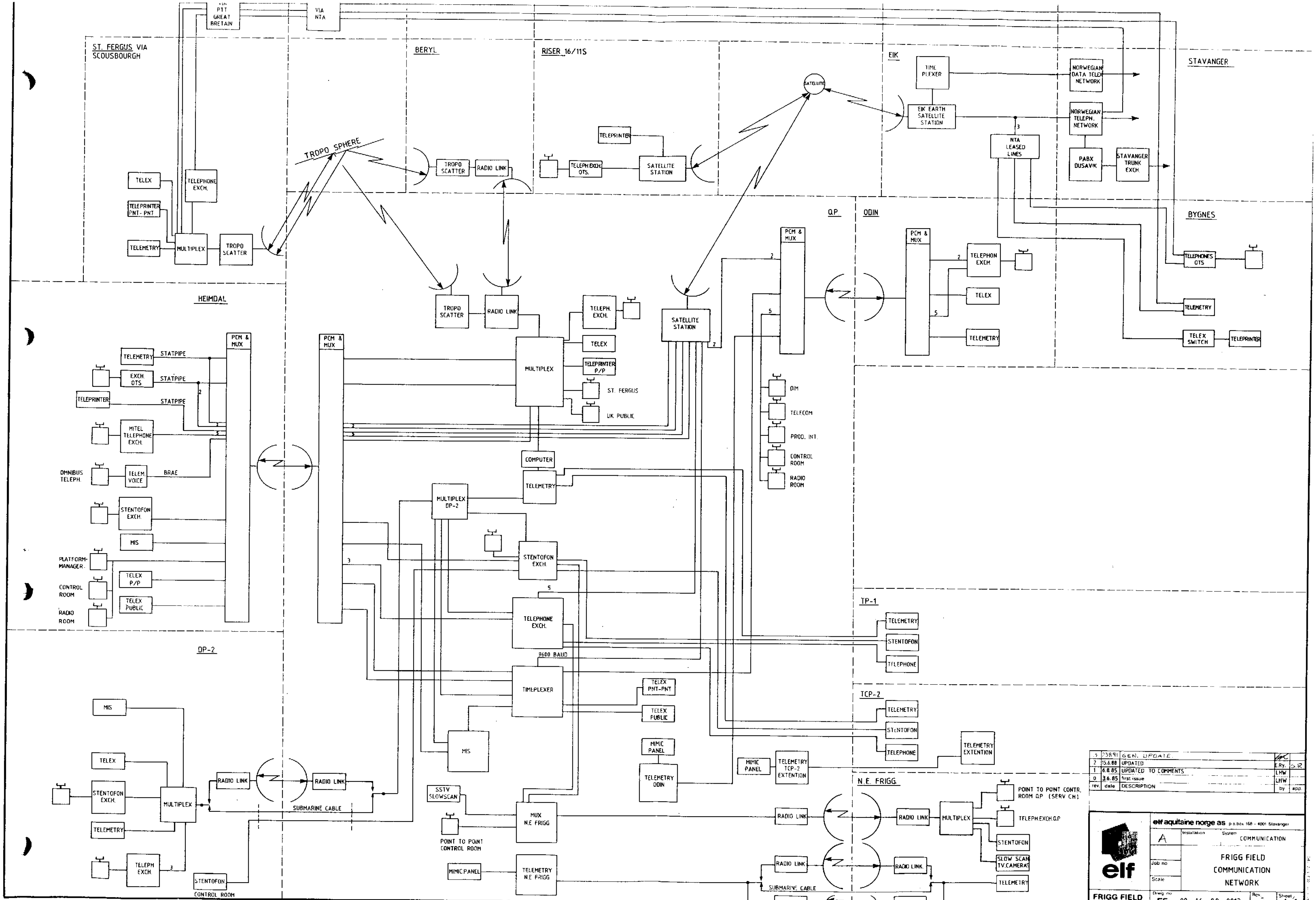
2. LIFEBOAT COMMUNICATIONS

2.1 The only items of radio equipment associated solely with TCP2 are VHF transceivers and radio beacons in the five lifeboats.

2.2 All lifeboats are equipped with Dancom RT408 transcerivers which provide two-way communication on the international marine VHF frequencies.

2.3 The sets are powered from the lifeboat engine 12V starter batteries. The batteries are kept charged through flexible connections which are automatically released when the boat are lowered.

2.4 Each lifeboat has an automatic Jotron 'Tron 1C' radio beacon which floats upright and automatically begins to transmit on 121.5 and 243 MHz when lowered into the water. It has its own sealed, non-rechargeable battery which must be replaced after use or every three years.



rev.	date	DESCRIPTION	by	app.
3	23.8.91	GEN. UPDATE		
2	15.6.88	UPDATED	ERy.	S.R
1	6.8.85	UPDATED TO COMMENTS	LHW	
0	3.6.85	first issue	LHW	

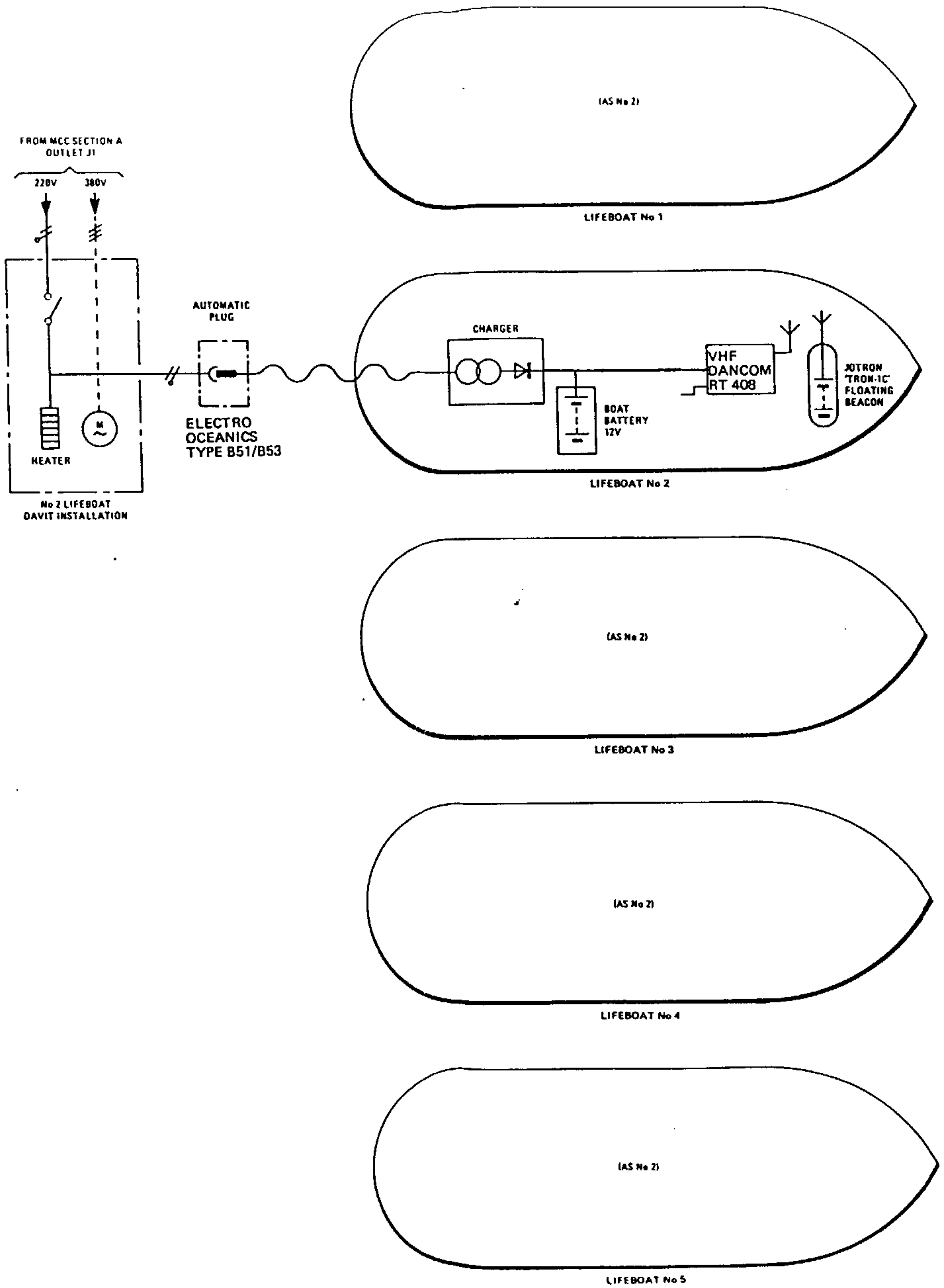
elf aquitaine norge as p.o.box 168 - 4001 Stavanger

elf

Installation: A — System: COMMUNICATION

FRIGG FIELD COMMUNICATION NETWORK

FRIGG FIELD — Dwg no: FF 00 16 00 0013 — Rev. 3 — Sheet 1 1



3,Oct.-88

RADIO LINKS
Lifeboat Radio Equipment

8.1.2

TELEPHONE SYSTEM

1. GENERAL

1.1 The exchange telephone system is common to all four main platforms comprising the Frigg Field. Platforms QP and TP1 form a network having common exchange in QP, the telephones in TP1 being outstations from this exchange.

1.2 TCP2 has its own exchange which is connected by four trunk lines to the QP exchange by cable via bridges to TP1 and to QP.

1.3 The detached platform DP2 has its own exchange, but is connected by three tie-lines to the central QP/TP1/TCP2 system via submarine cable link, with an alternative microwave link if the cable should fail.

1.4 In addition to the above, two dedicated telephone sets on NEF FCS are coupled via the UHF link to QP. One to a dedicated telephone set in the QP control room, one to the QP exchange.

1.5 The full telephone network is shown in block form in Diagram 8.1 where its position in relation to other inter-platform communications is shown.

2. DESCRIPTION

2.1 Exchanges

2.1.1 The principal automatic exchange on QP is a Mitel SX200. The exchange has a maximum of 208 lines available for interval, inter-platform and satellite communication with Norway. A second exchange, Mitel SX10, is provided to be used with the UK tropospheric - scatter radio link.

2.1.2 The exchanges on DP2 and TCP2 are Mitel SX100 exchanges. These have a maximum of 104 lines each for internal or inter-platform communication.

2.2 Instruments

Both wall-mounted and desk-type telephone instruments are provided, the latter being used in necessary, enclosed for use in a Division 1 area

2.3 Shore Links

2.3.1 The 208 line main exchange is also used for satellite communication with Norway (Stavanger), for which five trunk lines are provided between the exchange and the satellite earth station on QP.

2.3.2 Through this satellite link it is possible to speak to subscribers anywhere on the Norwegian public network. Telex, telewriter and facsimile services are also available through this link.

2.3.3 Radio communication with the UK (St Fergus) is through the Mitel SX-10 exchange, to which are connected 9 additional telephone instruments exclusively for this service. In addition, there are telephones for point-to-point connection to St Fergus (not through the exchange), and also five telephones for direct link with the UK public telephone network (not through the exchange). All are multiplexed with telex, telewriter and telemetry services and are passed to St Fergus either by direct troposcatter, or alternatively by line-of-sight microwave to Beryl and thence by Beryl's troposcatter to St Fergus. See Section 8.1.

2.3.4 There are telex and telewriter links between Platform QP and Norway, and between QP and UK, using the same satellite and troposcatter radio links as the telephone uses. At the Stavanger and St Fergus terminal the telex links can be extended into the Norwegian and Uk public telex network.

2.4 Power Supplies

The power for the TCP2 exchanges comes from a dedicated battery bank which is charged from the common 220V ac net. There is sufficient battery capacity to maintain the operation of the exchange for at least 24 hours after complete loss of ac supply.

INTERCOM SYSTEM

1. GENERAL

1.1 A powered Intercom System, type Pamex, independent of the network connects all the control rooms and most of the offices and main living rooms of all five platforms, comprising the main Frigg Field, and the Field Control Station of the satellite North East Frigg Field. This is installed primarily for operational use.

1.2 A main exchange is installed on QP with satellite exchanges on TCP2 and DP2. This enables all subscribers to call any extension required. The system enables conference groups to be set up and messages to be given via the general call facility. The subsriber can use the system as a loudspeaking voice controlled system or push to talk, or as a full Duplex private telephone system, except for the exproof extension which is voice controlled or push to talk.

1.3 The NEF FCS Intercom system, type Pamex is coupled to the main QP exchange via one channel in the NEF UHF communications link.

1.4 The full Intercom network is shown in block form in diagram 8.1, where its position in relation to the other inter platform communication is shown.

2. DESCRIPTION

2.1 All control rooms and exproof extensions on the complex are directly connected to the QP exchange. The control room on DP2 are directly connected to the QP exchange via the submarine cable. The satellite exchange on TCP2 is connected to the QP exchange via cable. The satellite exchange on DP2 are connected to the QP exchange via the multiplex system normally using the submarine cables, but changing over to microwave Radiolinks on failure of the cable channel.

2.2 The main exchange on QP is for a maximum of 80 subscribers and 8 speech channels. The exchange is expandable to 240 subscribers. The satellite exchanges located on TCP2 and DP2 are for a maximum of 48 subscribers and 4 speech channels.

2.3 The QP exchange is capable of setting up a conference group with the TP1 interface room 1, TCP2 interface room, control room compression, DP2 control room and QP control room. Further more, the QP control room, QP radio, QP rig office and QP telecom are capable of using the general call facility to give messages.

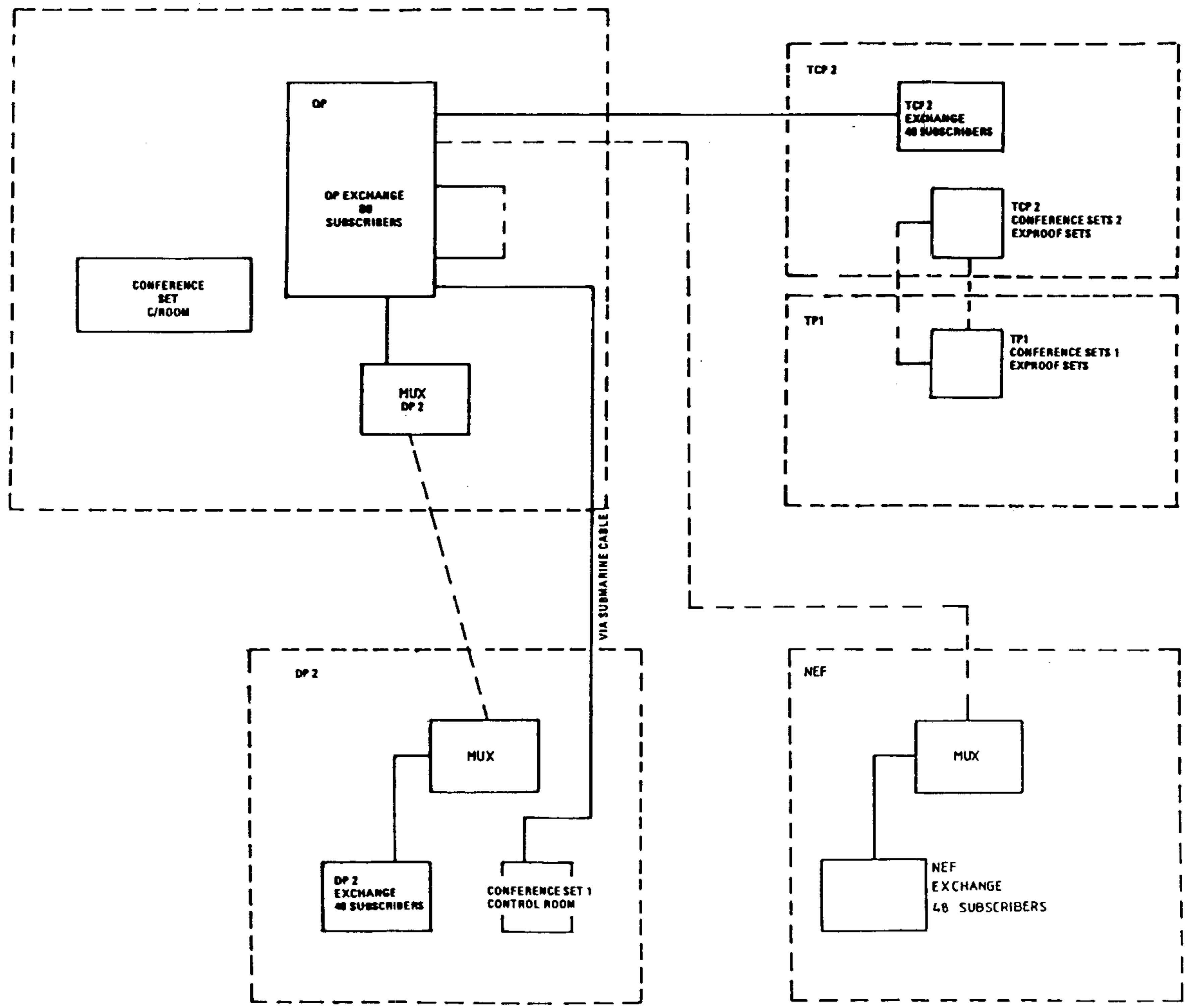
2.4 The satellite exchanges are powered so that they will have power cut off in case of a shutdown. The QP exchange will cut off power to all sets connected to it on the treatment platforms in case of a shutdown on the treatment platforms. Exproof sets are not included in this cut off.

2.5 The normal desksets are loudspeaking with a built-in loudspeaking mode, with high background noise or the push to talk button can be used for normal functions. The set can also be used as a full duplex telephone set by lifting the control unit from the loudspeaker and using it as a handset.

2.6 The exproof sets are wall mounted with a built-in mike and external loudspeaker. The sets can be used as a semiduplex voice controlled set or, in case of high background noise for normal function, a push to talk mode.

2.7 The exchange on NEF FCS is for a maximum 48 subscriber and 4 speech channels. Only 20 subscribers numbers and trunkcards are used for interfacing with the UHF radio link to QP.

END


OP
OP EXCHANGE
SUBSCRIBERS
CONFERENCE SET C/ROOM
MUX DP 2
TCP 2
TCP 2 EXCHANGE
TCP 2 CONFERENCE SETS 2 EXPROOF SETS
TP1
TP1 CONFERENCE SETS 1 EXPROOF SETS
VIA SUBMARINE CABLE
DP 2
MUX
DP 2 EXCHANGE
CONFERENCE SET 1 CONTROL ROOM
NEF
MUX
NEF EXCHANGE 48 SUBSCRIBERS

PUBLIC ADDRESS AND ALARM SYSTEM

1. GENERAL

The Public Address (PA) System is common to three platforms-QP, TP1 and TCP2. It also provides the vehicle for the broadcasting of alarms. It is controlled from Master PA and Alarm Control Panels in QP Control Room.

2. DESCRIPTION

2.1 Public Address

2.1.1 The main items are housed in a 'PEGFA Rack' located in the Telemetry room on QP. It includes the main 4000W speech amplifier requiring 8kW of uinterruptible supply, which is obtained from a 40KVA inverter providing 220V, 3PH, 50HZ through DA01.

Another 'PEGFA Rack' 1800W amplifier is installed in TCP2 Emergency engine control room. This rack is controlled from TCP2 compression control room and from QP control room. Loudspeakers on East Frigg module are connected to this amplifier rack.

2.1.2 The PEGFA Rack includes the following:

(a) Line selector (25-way). Direct output from the speech amplifier into groups of lines on the various platforms. It is remotely controlled from the PA Control Panel and the Alarm Control Panel in QP, the Fire and Gas Detection System on TP1 and TCP2 and Fire Detection on QP.

(b) Alarm Selector. Selects which alarm tone is directed into which platform.

(c) Alarm Signal Generator. Generates continuous or interrupted tones for passing to the various platforms by the Alarm Selector. The alarm signal generator contains two independent circiuts such that, if one fails, the other is brought automatically into operation. Such a changeover initiates an alarm at the System Alarm Panel in the QP Control Room.

(d) Alarm Test Unit.

(e) Microphone and pre-amplifier.

(f) Pilot loudspeaker.

(g) Instrumentation and controls.

2.1.3 All loudspeakers are provided with taps on their internal transformers by which their acoustic output may be reduced in steps from the rated output (20W in most cases).

2.1.4 Associated with certain loudspeakers in noisy areas are two flashing lights - blue for public address and red for alarm.

2.2 Alarms

2.2.1 There are three types of general alarm:

(a)	Alert Signal	Two tone signal followed by an announcement over the PA system.
(b)	Muster Alarm	Consisting of a continuous signal tone.
(c)	General Platform Alarm (GPA)	Consisting of intermittent signal tones of one second duration, with a one second interval between tones. The GPA will be interrupted (after approximately 8 seconds) by pushing the alert signal button and an announcement given over the PA system.

2.2.2 The system is capable of simultaneously broadcasting any one of the tree alarms over any one of the three platforms QP, TP1 and TPC2, ie a General platform alarm may be given on TP1 while a Muster alarm is being given on QP and TCP2.

2.2.3 There is automatic priority ranking of alarms on each platform. The priority of the signals in order of their importance is as follows:

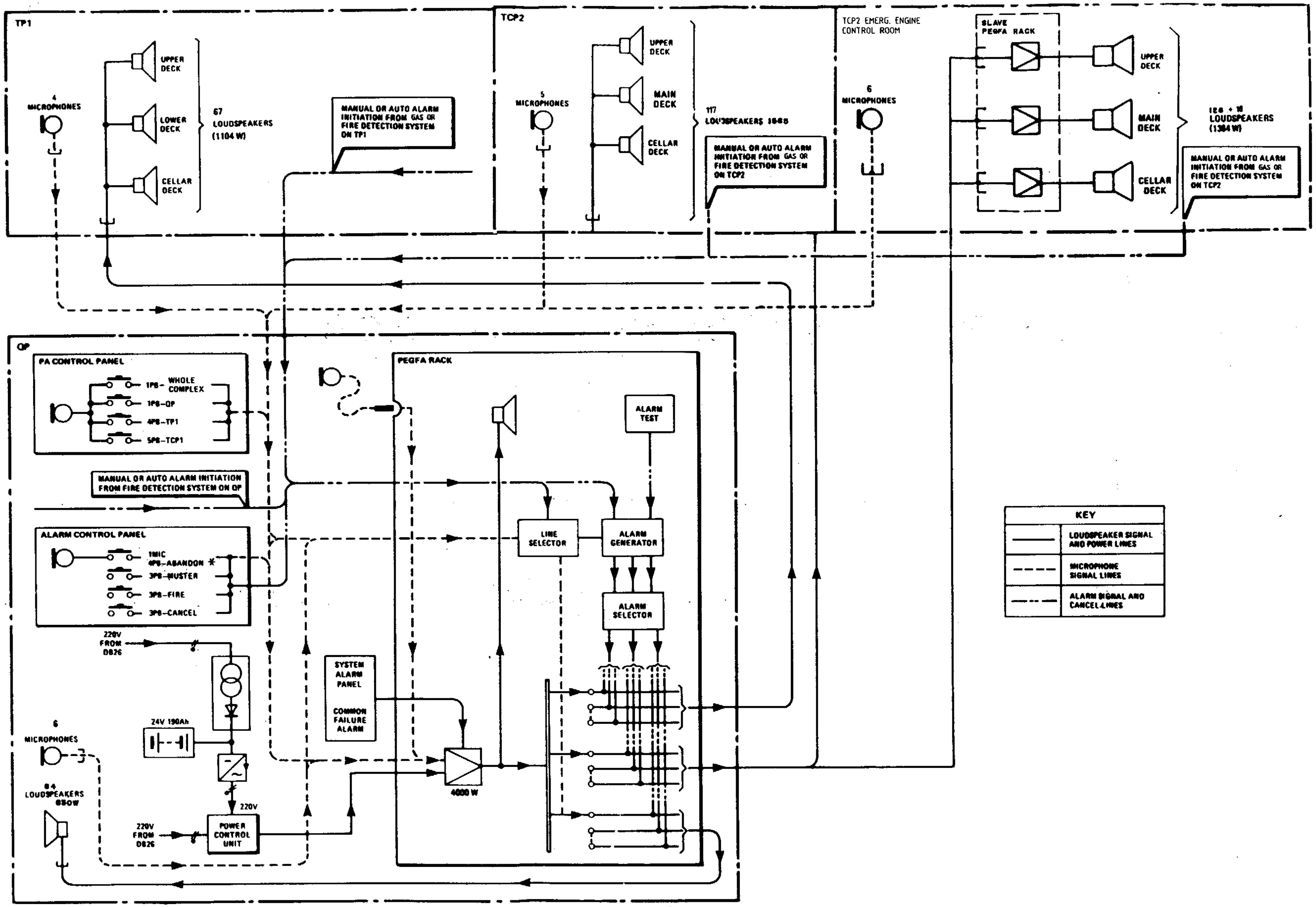
Priority 1 - Alert Signal
Priority 2 - Muster Alarm
Priority 3 - General Platform Alarm (GPA)

For example, if a GPA is being given on a platform and a Muster alarm is initiated on the same platform, the Muster alarm will override. The public address system is distinct in that an alert signal will override any alarm tone for a period of 10 seconds.

2.2.4 All audible alarms are initiated from one or other of the Alarm Control Panels except a Fire or gas Alarm (GPA), which is automatically activated by the fire or gas detection systems. Gas alarm on Q.P. does not automatically operate the P.A. system as for the rest of the Frigg Field.

2.2.5 If an alarm (GPA or Muster) has been given either manually or automatically, it can be cancelled by the CANCEL pushbutton on whichever Alarm Control Panel has been actuated.

2.2.6 The power of the alarm lights is derived from Distribution Board DB25 from the PEGFA Rack, and it is distributed through a Flashing Lamp Distribution Board/Relay Cabinet. There is a total of eight blue and eight red lamps in QP.



ISSUE 6, AUG. 1991

PUBLIC ADDRESS SYSTEM	8.4

* 4PB-ABANDON IS THE ALERT SIGNAL PUSHBUTTON.

NAVIGATIONAL AIDS

1. GENERAL

1.1 Navigation equipment installed on platforms QP, TP1 and TCP2 complies with the requirements of the UK Department of Trade (Marine Division) January 1976 'Standard Marking Schedule for Offshore Installations'.

1.2 The following navigational aids are installed:

(a) Navigation lights.

(b) Obstruction lights.

(c) Foghorns.

(d) Helideck lights.

(e) Identification lights.

1.3 The navigation lights and main foghorns of all three platforms form two single inter-platform system. Each system is separately controlled from Platform QP.

1.4 The obstruction lights are self-contained systems on each platform.

1.5 The identification lights are only on Platform QP.

2. DESCRIPTION

2.1 Navigation Lights

2.1.1 Three grouped sets of inter-platform white lights are installed as follows:

(a) One set on the north-east corner of TP1 at Cellar Deck level.

(b) One set on the south-east corner of TCP2 at Cellar Deck level.

(c) One set on the south-west corner of QP at Lower Deck level.

2.1.2 Each set comprises two main white lights and one secondary white light mounted vertically, with the secondary light topmost. Each light is enclosed in a marine lantern fitted with a single-piece fresnel lens.

2.1.3 The main lights are visible in clear weather over a range of 15 nautical miles through 270°. The two have a combined nominal luminous intensity of 14 000 candelas.

2.1.4 The secondary light is visible in clear weather over a range of 10 nautical miles through 270°. It has a nominal luminous intensity of 14 000 candelas.

2.1.5 The secondary lantern is equipped with a rotating lampholder containing four lamps. If a lamp fails, the next is automatically rotated into its place. An alarm will indicate in the Control Room when the last lamp is used.

2.2 Subsidiary Lights

2.2.1 Subsidiary red lights are installed on the other three corners of each platform, and at the centre of the bridges connecting them.

2.2.2 Each light is visible in clear weather over a range of three nautic miles through 270° (bridge lights 360°).

2.2.3 Each light is enclosed in a marine lantern fitted with a single-piece fresnel lens and a red filter.

2.2.4 Each lantern is equipped with a rotating lampholder containing four lamps. If a lamp fails, the next is automatically rotated into its place. An alarm will indicate in the Control Room when the last lamp is used.

2.3 Obstruction Light

2.3.1 To warn aircraft of projections above the platforms, red obstruction lights are installed on the microwave tower of QP and the cranes of all three platforms.

2.3.2 The vertical distance between lights is a nominal 10m.

2.4 Identification Lights

2.4.1 Three grouped sets of identification lights are installed on the microwave tower of Platform QP, 120° apart.

2.4.2 Each set comprises three main and three standby white lights, each contained in a stainless steel enclosure.

2.4.3 All lights are visible in clear weather over a range of 22 nautical miles. Each light has a luminous intensity of 200 000 candelas.

2.5 Power Supplies

2.5.1 All navigational aids except secondary foghorns and obstruction lights receive their power supplies from Platform QP.

2.5.2 Each of the two main white navigation lights on each platform contains one 120V, 500W lamp. Each pair are connected in series and fed through a 220/240V auto-transformer in the base from the HALS 15 control unit supplied from distribution board DB31 on Platform QP.

2.5.3 The secondary white and subsidiary red navigation lights each contain one 12V lamp. The white light's power is 24W and the red light's 6.6W. Power at 120V, 150Hz is fed through a 120/12V transformer in each base from the ILS 750 Control Box supplied from the 24V, 100Ah battery supported navigation aids system of Platform QP.

2.5.4 The obstruction lights are supplied as follows:

(a) Platform QP - at 220V ac from DB31 (with battery support).

(b) Platform TP1 - at 220V ac from DB8 (no battery support).

(c) Platform TCP2 - at 220V ac from DB308 (no battery support).

2.6 Navigation Aids Control

2.6.1 A control unit HALS 15 (in QP) codes and distributes power supplies to the main white navigation lights of QP, TP1 and TCP2. A separate unit, ILS 750 (in QP), controls and codes power supplies to the secondary white and subsidiary red navigation lights on these platforms.

2.6.2 Operation of QP, TP1 and TCP2 main white, subsidiary red and obstruction lights is normally controlled by separate sun switches on QP. A manual override switch is located in the QP Radio Room.

2.6.3 In the event of a main white navigation light failure, the secondary white light automatically comes into operation, giving an alarm indication in the Control Room.

2.6.4 All navigation lights on the three platforms are synchronised to transmit the morse letter 'U' every 15 seconds.

2.6.5 Should normal power supplies to the secondary white or subsidiary red navigation lights be interrupted, the lights will automatically continue to function powered by the 24V battery system. This battery has sufficient capacity to maintain the secondary white and subsidiary red lights and main foghorns on all three platforms for a minimum of four days and nights.

2.6.6 A control unit in the battery switch room of Platform QP distributes power supplies to the main and standby identification lights. Operation of these lights is normally controlled by a sun switch on QP. A manual override switch is located in the Radio Room for use during helicopter operations. The lights are synchronised to flash at five second intervals.

2.6.7 In the event of main white identification lights failure, the standby lights automatically illuminate, together with alarm indication in the Radio Room.

2.7 Foghorns

2.7.1 Main and secondary foghorns are separately mounted and installed in pairs as follows:

(a) At the centre of TP1 north face, Cellar Deck level.

(b) At the centre of TCP2 east face, Cellar Deck level.

(c) At the centre of QP south face, Deck Support level.

2.7.2 Each main foghorn is a vertical array of eight emitters producing a horizontal acoustic beam through 360°, which sounds over a range of two nautical miles in still air.

2.7.3 Each secondary foghorn comprises two emitters producing a horizontal acoustic beam through 360°, which sounds over a range of half a nautical mile in still air.

2.8 Foghorn Power Supplies

2.8.1 The main foghorns of QP, TP1 and TCP2 operate in parallel at 120V, 250Hz. This supply is provided through control unit SCR 750 (in QP) containing a transformer/rectifier and inverter, with the navigational aids 24V, battery system floating across the dc link. The rectifier in this unit acts as a charger for the 24V, 1000Ah navigational aids battery. Power to the control unit is supplied from distribution board DB31 on Platform QP.

2.8.2 The secondary foghorns on the three platforms are supplied independently of each other. All are dc operated and powered from local 12V, 30Ah transformer/rectifiers and batteries. Each is fed from the local emergency (standby) supplied board. The batteries float across the transformer/rectifier outputs. A 'float' and 'boost' facility is provided. Float is the normal trickle charge condition and Boost is used to recharge the battery. When the battery is fully charged it will revert automatically to Float, indication being given at the charger panel.

2.9 Foghorn Control

2.9.1 The main foghorns on QP, TP1 and TCP2 are manually operated by a switch in the QP Radio Room.

2.9.2 Control unit SCR 750 (in QP) controls and codes power supplies to the main foghorns of all three platforms, the common output current being measured by a Horn Current Monitor in QP. Should the output of any main foghorn fall below a preset level, the control unit automatically initiates sounding of the secondary foghorns on all three platforms, and causes an alarm to indicate in QP Control Room.

2.9.3 The secondary foghorns on TP1 and TCP2 are synchronised to the secondary foghorn on QP, which acts as 'master'. There is no independent direct switching of the secondary foghorns, they operate from the main foghorn control unit, but only on main foghorn failure.

2.9.4 The main and secondary foghorns are synchronised to sound the morse letter'U' every 30 seconds.

2.9.5 Should normal power supplies to a main foghorn be interrupted, it automatically continues to receive power from the 24V, 1000Ah navigational aids battery system. This battery system has sufficient capacity to maintain the main foghorns on all three platforms (as well as the secondary white and subsidiary red navigation lights) for a minimum of four days and nights.

2.9.6 Should normal power supply to a secondary foghorn be interrupted, its 12V, 30Ah battery automatically takes over. The battery system has sufficient capacity to maintain the foghorn for a minimum of four days and nights.

2.10 Helideck Lighting

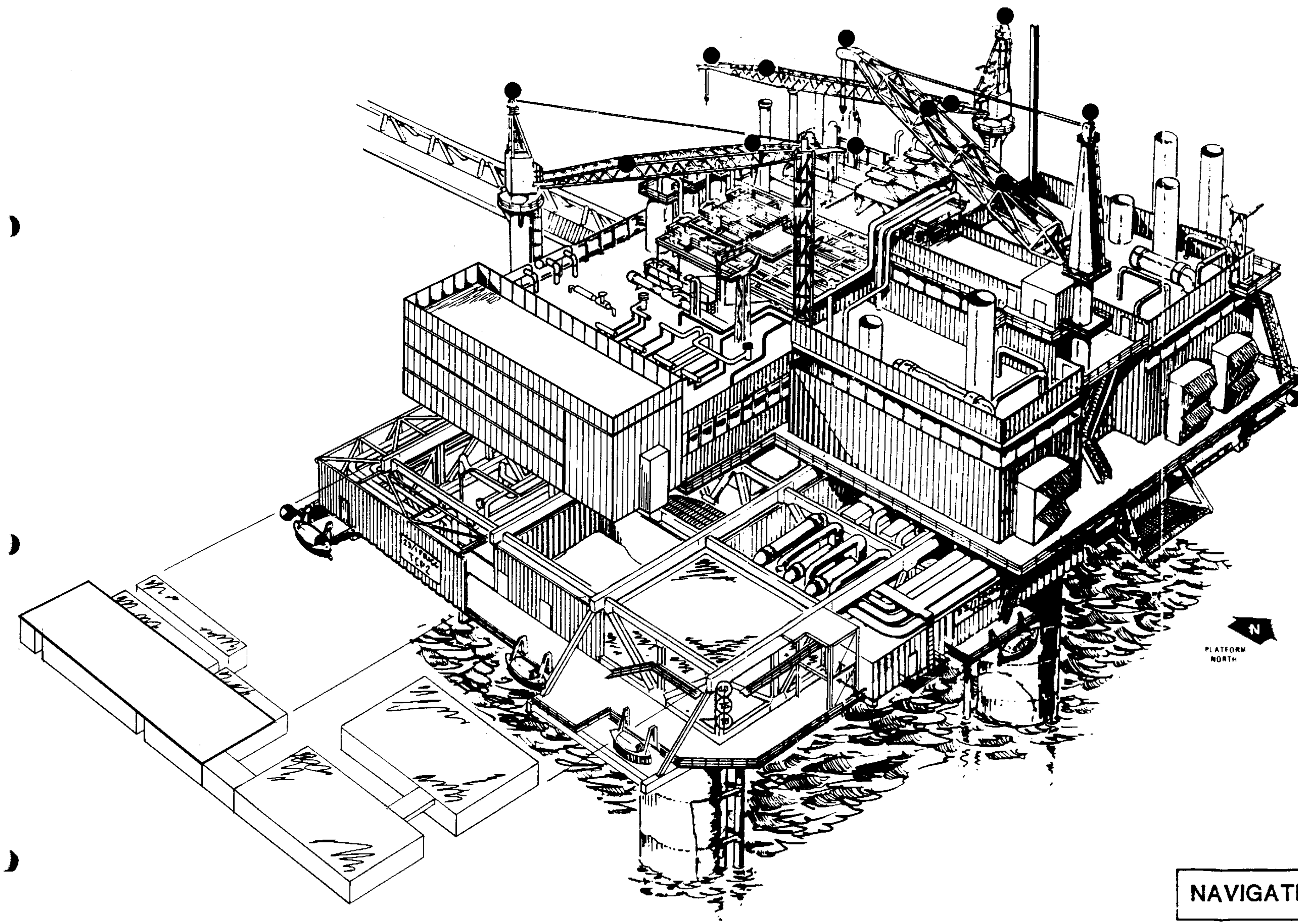
2.10.1 The QP helideck perimeter is marked by 32 flush-mounted, 25W lights, alternately blue and white. They are a nominal 3m apart.

2.10.2 To ensure that the loss of any one light will not leave the perimeter unmarked, the lights are fed by six separately switched circuits at 110V ac. Power is supplied from distribution board DB31 via a transformer/rectifier with supporting battery, followed by an inverter. Final distribution is through DB25.

2.10.3 Should the power supply be interrupted the helideck lights are automatically transferred to battery supply.

2.10.4 Operation of the lights is manually controlled by the Helicopter Control Officer.

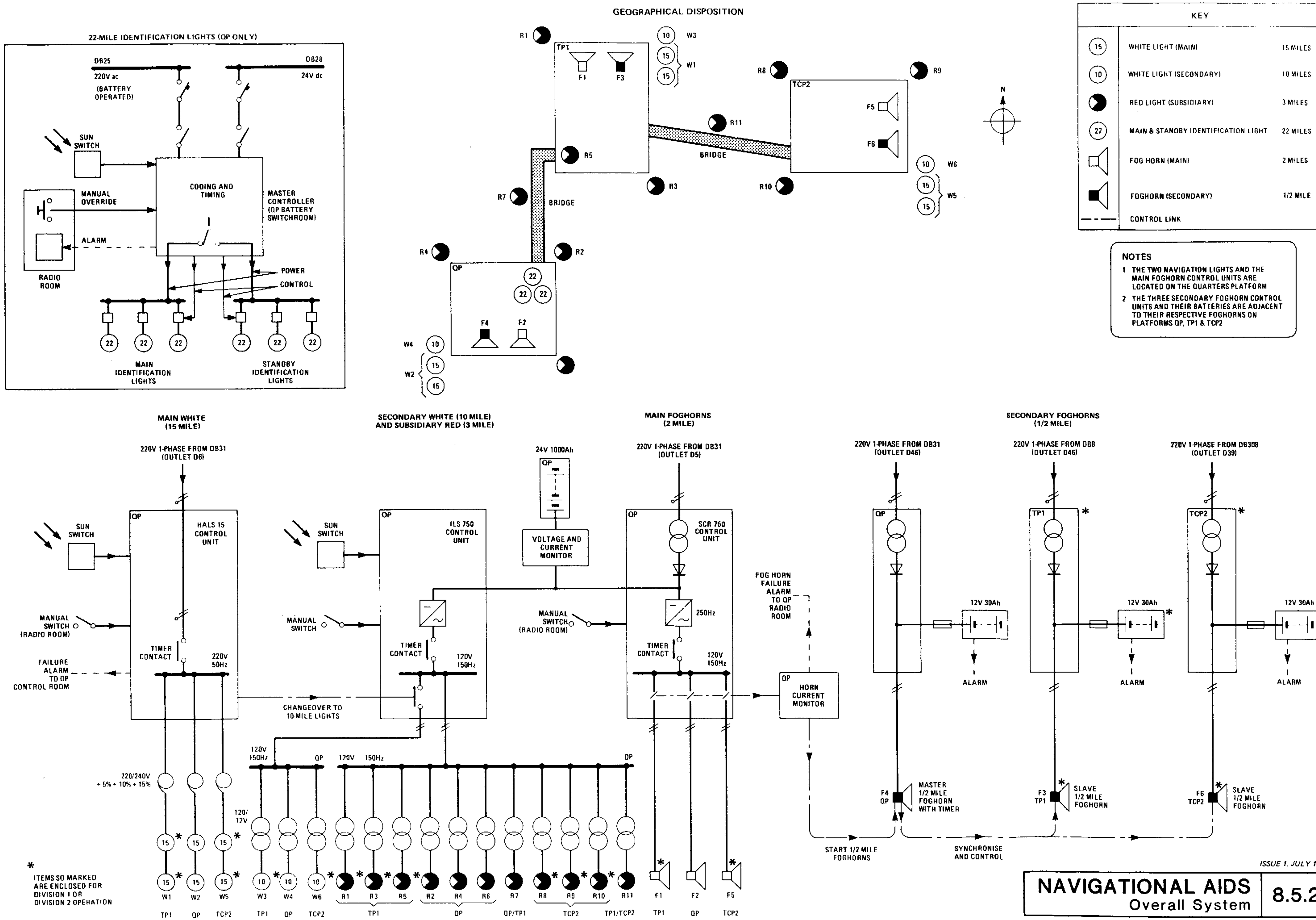
2.10.5 Two pairs of 500W tungsten-halogen floodlights are installed on the hangar roof to illuminate the helideck. Power is supplied from emergency supplies board DB25.



KEY		
(15)	WHITE LIGHT (MAIN)	15 MILES
(10)	WHITE LIGHT (SECONDARY)	10 MILES
◕	SUBSIDIARY (RED) LIGHT	3 MILES
●	AIRCRAFT OBSTRUCTION LIGHT	
✚	FOGHORN (MAIN)	2 MILES
⧓	FOGHORN (SECONDARY)	1/2 MILE

ISSUE 3, OCT. 88

NAVIGATIONAL AIDS	8.5.1



ISSUE 1. JULY 1980

NAVIGATIONAL AIDS
Overall System **8.5.2**

NEF SLOW SCAN TV SYSTEM

1. GENERAL

1.1 A slow scan closed circuit Television System installed on NEF FCS enables operators on the FCS (normally unmanned) and QP to monitor the situation at sensitive locations on the FCS.

2. DESCRIPTION

2.1 Five closed circuit remotely controllable cameras are located on the FCS. Signals are sent from these cameras via a videoswitching matrix, the UHF communication link, and a slow scan converter to a standard TV monitor on QP.

2.2 A remote control panel in QP allows for camera selection, focus, wiper and washer controls.

CHAPTER 9

SAFETY

CONTENTS

Section	9.1	Organisation
	9.2	EAN Contingency Plan and Emergency Procedures
	9.3	Area Classification
	9.4	Audible and Visual Alarms
	9.5	Emergency Shut-downs
	9.6	Fire and Smoke Detection
	9.7	Gas Detection
	9.8	Firefighting Facilities
	9.9	Firewater System
	9.10	Halon Systems
	9.11	Firewalls and Fireproofing
	9.12	First Aid
	9.13	Escape Routes
	9.14	Emergency Lighting
	9.15	Lifesaving Equipment

DIAGRAMS

Diagram		Area Classification - Cellar Deck FF 85 23 00 0295
		Area Classification - Main Deck FF 85 23 00 0294
		Area Classification - Upper Deck FF 85 23 00 0293
		Area Classification - Elevation North and West FF 85 23 00 0297
		Area Classification - Elevation East and South FF 85 23 00 0296
	9.4.1	Audible and Visual Alarms - Cellar Deck
	9.4.2	Audible and Visual Alarms - Main Deck
	9.4.3	Audible and Visual Alarms - Upper Deck
		Shutdown Logic Diagram FF 85 16 06 1047, 1048, 1049
		Shutdown Logic Diagram FF 85 06 1236, 1237, 1238
		Shutdown Logic Diagram FF 89 16 08 0018, sht. 1, 2
		Matrix Alarm FF 87.16.00.1100 - Compression
		Matrix Alarm FF 85.16.06.1184 (12 sheets) Treatment
		Fire and Smoke Detection - Cellar Deck FF 85 16 06 1141, sht. 130
		Fire and Smoke Detection - Main Deck FF 85 16 06 1141, sht. 131
		Fire and Smoke Detection - Upper Deck FF 85 16 06 1141,sht. 132
		Gas Detection - Cellar Deck FF 85 16 06 1185, sht.123
		Gas Detection - Main Deck FF 85 16 06 1185, sht.124
		Gas Detection - Upper Deck FF 85 16 06 1185, sht.125
	9.8.1	Firefighting Facilities - Cellar Deck
	9.8.2	Firefighting Facilities - Main Deck
	9.8.3	Firefighting Facilities - Upper Deck
	9.9.1	Firewater System - Treatment Areas
	9.9.2	Firewater System - Compression Areas
	9.9.3	Firewater System - TCP2 Ext. & East Frigg, Mod. 51
	9.10.1	Halon Systems - Cellar Deck
	9.10.2	Halon Systems - Main Deck
	9.10.3	Halon Systems - Upper Deck
	9.11.1	Firewalls and Fireproofing - Cellar Deck
	9.11.2	Firewalls and Fireproofing - Main Deck
	9.11.3	Firewalls and Fireproofing - Upper Deck
	9.12	First Aid
	9.13	Symbol Legend
	9.13.1	Safety plot plan & escape routes - Upper Deck
	9.13.2	Safety plot plan & escape routes - Main Deck
	9.13.3	Safety plot plan & escape routes - Cellar Deck
	9.14.1	Emergency Lighting - Treatment Areas
	9.14.2	Emergency Lighting - Treatment Areas
	9.14.3	Emergency Lighting - Compression Areas
	9.15.1	Lifesaving Equipment - Watercraft Lifeboat
	9.15.2	Lifesaving Equipment - Liferaft

OFFSHORE EMERGENCY ORGANIZATION

1. GENERAL

The muster list gives a brief description of the emergency organization, and what to be done by individuals in case of an emergency situation, types of emergency alarms and special warning/danger, distributions to lifeboats and a sketch of lifeboats/muster stations.

1.1 It is issued by the Safety Department and can be revised only by agreement with the department.

1.2 A copy of the muster list is posted at the following location:

Compression Control Room
Operator's office
Coffee Container

2. INSTRUCTIONS AND DUTIES

2.1 Emergency teams are established to cope with the various emergency situation.

2.2 Emergency centre team will take command for all emergency actions. It is led by Offshore Installation Manager (OIM), Field Manger) and includes Safety Superintendent, Production Superintendent, Maintenance Superintendent and Control Room Operators.

The safety Superintendent is the installation's deputy OIM, and as such will take over responsibility if the OIM, should become disabled.

2.3 Production fire team on duty led by Production Supervisor on duty.

2.4 Production fire team off duty led by Production Supervisor off duty. Two production fire teams are responsible for the immediate and direct action with regards to rescue of personnel, fire fighting, cooling etc., as well as intervention on process system.

2.5 Technical team led by one Maintenance Supervisor.

The technical team is responsible for the immediate and safe technical intervention on electrical system, fire pumps operations, emergency generators and other technical interventions. It also acts as back up fire team.

2.6 First aid lead led by Medical Nurse.
The medical nurse with the trained first aid team is responsible for medical treatment.

2.7 Helideck team - led by helicopter landing officer is responsible for actions related to helicopter operation.

2.8 Search team - led by camp boss is responsible for checking that living quarter is clear of personnel.

2.9 Lifeboat crews: for each lifeboat in use a team of 3 led by commander is responsible for safe evacuations of personnel.

2.10 The Radio Operator is responsible for relaying information to/from the platform.

3. ABANDON PLATFORM

3.1 The order to abandon platform will be given by OIM (Field Manager).

MUSTER LIST/MØNSTRINGSPLAN

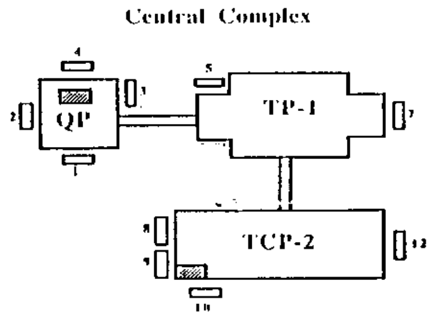
ALARMS/ALARMER:

GENERAL PLATFORM ALARM (GPA)/
GENERELL PLATFORM ALARM:

INTERMITTANT HORN
(RED FLASHING LIGHTS IN NOISY AREAS)
AVBRUTT LYDSIGNAL ‒ ‒ ‒ ‒ ‒ ‒ ‒ ‒ ‒ ‒ ‒ ‒
(BLINKENDE RODT LYS I STOYOMRÅDER)

- **MUSTER ALARM/**
  MØNSTRINGSALARM

CONTINUOUS HORN
(RED FLASHING LIGHTS IN NOISY AREAS)
KONTINUERLIG LYDSIGNAL ————————————
(BLINKENDE RØDT LYS I STØYOMRÅDER)



- Gas Emergency: The GPA will be interrupted (after ab. 8 sec.)
- Fire Emergency: and announcement given on Emergency PA.

- Gassnødsituasjon: GPA vil bli avbrutt (etter ca. 8 sek.)
- Brann nødsituasjon: og en annonsering gitt på Emergency PA.

GASLEAK
Anyone detecting a gas leak shall:
- Immediately stop all work in the area and put equipment in a safe condition.
- Inform the control room.
- Evacuate to safe area.
- Act as instructed on the PA-system.

GASS LEKKASJE
Enhver som oppdager en lekkasje skal:
- Øyeblikkelig stanse alt arbeid i området samt sikre utstyret.
- Informere kontrollrommet.
- Gå til et sikkert område.
- Følg instrukser gitt via PA-systemet.

FIRE
Anyone detecting a fire shall:
- Raise the alarm
- Without endangering himself, try to limit or extinguish the fire.

BRANN
Enhver som oppdager en brann skal:
- Gi alarm
- Forsøke å begrense eller slukke brannen dersom dette kan skje uten fare for ham selv.

GENERAL PLATFORM ALARM
- Stop work immediately and put equipment in a safe condition.
- Go to your allocated emergency station. (Ref. your IC card).
- Await further instructions.

GENERELL PLATFORM ALARM
- Stans arbeidet øyeblikkelig og sikre utstyret.
- Gå til fordelt nødstasjon (Ref. ditt IC-kort).
- Avvent videre instrukser.

MUSTER ALARM
- Stop work immediately and put equipment in a safe condition.
- Put on warm clothing and collect your survival suit if time permits.
- Go to your designated lifeboat station
- Await further instructions

MØNSTRINGSALARM
- Stans arbeidet øyeblikkelig og sikre utstyret.
- Ta på varme klær og hent din overlevingsdrakt dersom tiden tillater det
- Gå til den livbåten hvor du er fordelt
- Avvent videre instrukser.

SPECIAL WARNINGS/DANGERS/INSTRUCTIONS
SPESIELLE ADVARSLER/FARER/INSTRUKSER

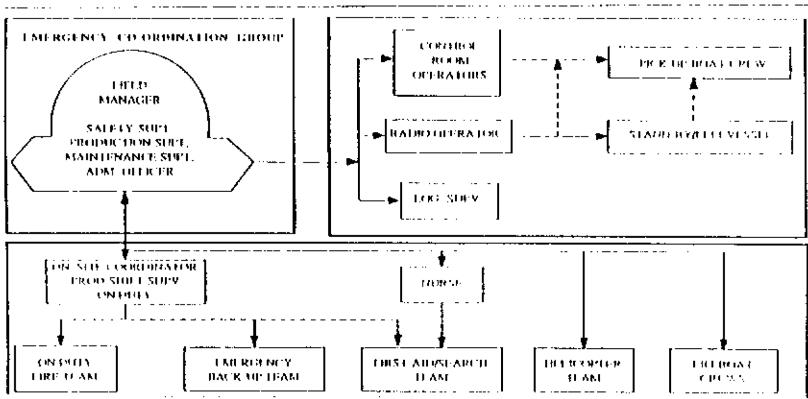
ABANDON PLATFORM — Order to abandon the platform might be given on the PA- or Emergency PA-system, by radio or other available communicational means.

FORLAT PLATTFORMEN — Ordre til å forlate plattformen vil bli gitt over PA-systemet eller Nød PA-systemet, over radio eller et hvilket som helst annet tilgjengelig kommunikasjonsmiddel.

MAN OVERBOARD — Anyone observing a man overboard should shout "MAN OVERBOARD", throw lifebuoy(s), raise the alarm by informing control room or radio room while keeping the man in sight.

MANN OVERBORD — Enhver som observerer en mann overbord skal rope "MANN OVERBORD", kaste livbøye(r) og slå alarm ved å informere kontrollrommet eller radiorommet mens man passer på ikke å miste mannen av syne.

EMERGENCY ORGANIZATION – NØDORGANISASJONEN



DISTRIBUTION TO LIFEBOATS – FORDELING TIL LIVBÅTENE

LIFEBOAT NO. 1	LIFEBOAT NO. 2	LIFEBOAT NO. 3	LIFEBOAT NO. 4	LIFEBOAT NO. 5	LIFEBOAT NO. 6

APPENDIX 5

EAN CONTINGENCY PLAN AND EMERGENCY PROCEDURES

1. GENERAL

This document establishes the procedures to be used by the Elf Offshore Installation Manager or his deputy with regard to fixed structures, working barges, mobile rigs, supply and standby vessels in the Frigg Fields and/or transport units to and from the Frigg Field. It itemises the procedures to be used in the event of the following major incidents:

Fire/Explosion	
Escape of gas or condensate (Hydrogen Sulphide/Riser Rupture/Pipelines/Methanol)	
Helicopter crash on platform	
Helicopter ditch	
Damage to auxiliary vessel	
Man overboard	
Loss of well control	
Abandon platform/Re-entry	
Mooring failure	Not applicable
Uncontrolled drift/Drifting objects	
Storm or severe weather	
Deterioration Sea worthiness	Not applicable
Diving accident/HRV procedure	
Medical emergency	
Oil spill/COndensate leak at sea	
Radiation leak (loss of or damage to radioactive source)	
Criminal act	
Sea-bed movement	
Collision	
Structural failure	
Failure of equipment affecting safety	
Emergency on NEF and EF	

AREA CLASSIFICATION

1. GENERAL

1.1 Platform areas have been evaluated for risk using the Institute of Petroleum Model Code of Safe Practice, Drilling and Production in Marine Areas (2nd Edition Part 8, 1972 Section 8) and the latest revision of the Institute of Petroleum Electrical Safety Codes as a basis.

East Frigg Tie-In Module M51 areas has been evaluated using Norwegian Petroleum Directorate Guidelines for area classification stipulated 01.11.83.

1.2 A danger area is one in which there exists, or may exist, a dangerous atmosphere. These areas are classified Zone 1 and Zone 2 or Unclassified as defined below.

ZONE 1	An area which a dangerous atmosphere is likely to occur under normal operating conditions.
ZONE 2	An area which a dangerous atmosphere is only likely to occur under abnormal operating conditions.

2. UNCLASSIFIED AREAS

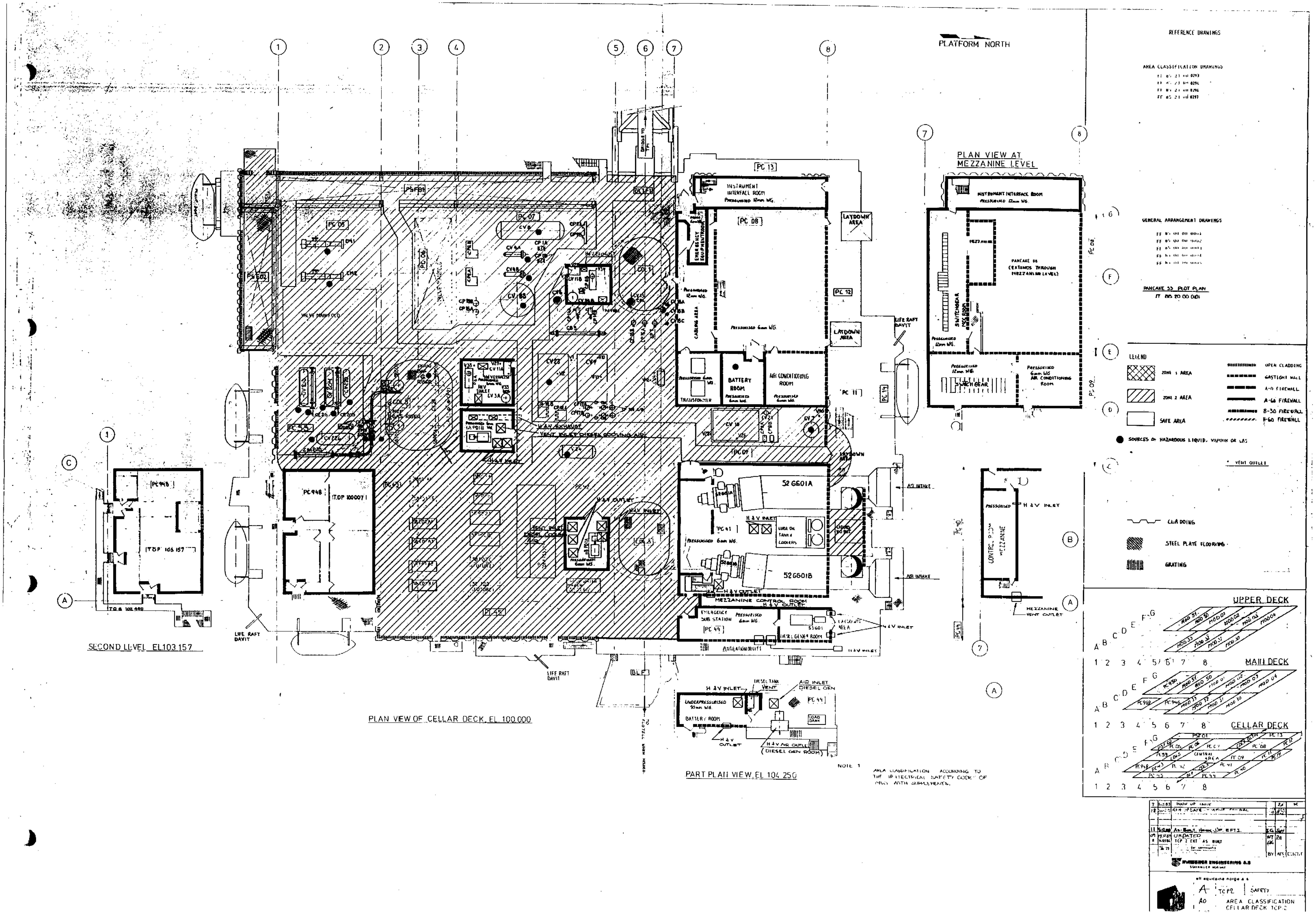
These are areas not included in the dangerous category and, on TCP2, are achieved as follows:

(a) Pressurising an enclosed space with air taken from an unclassified area.

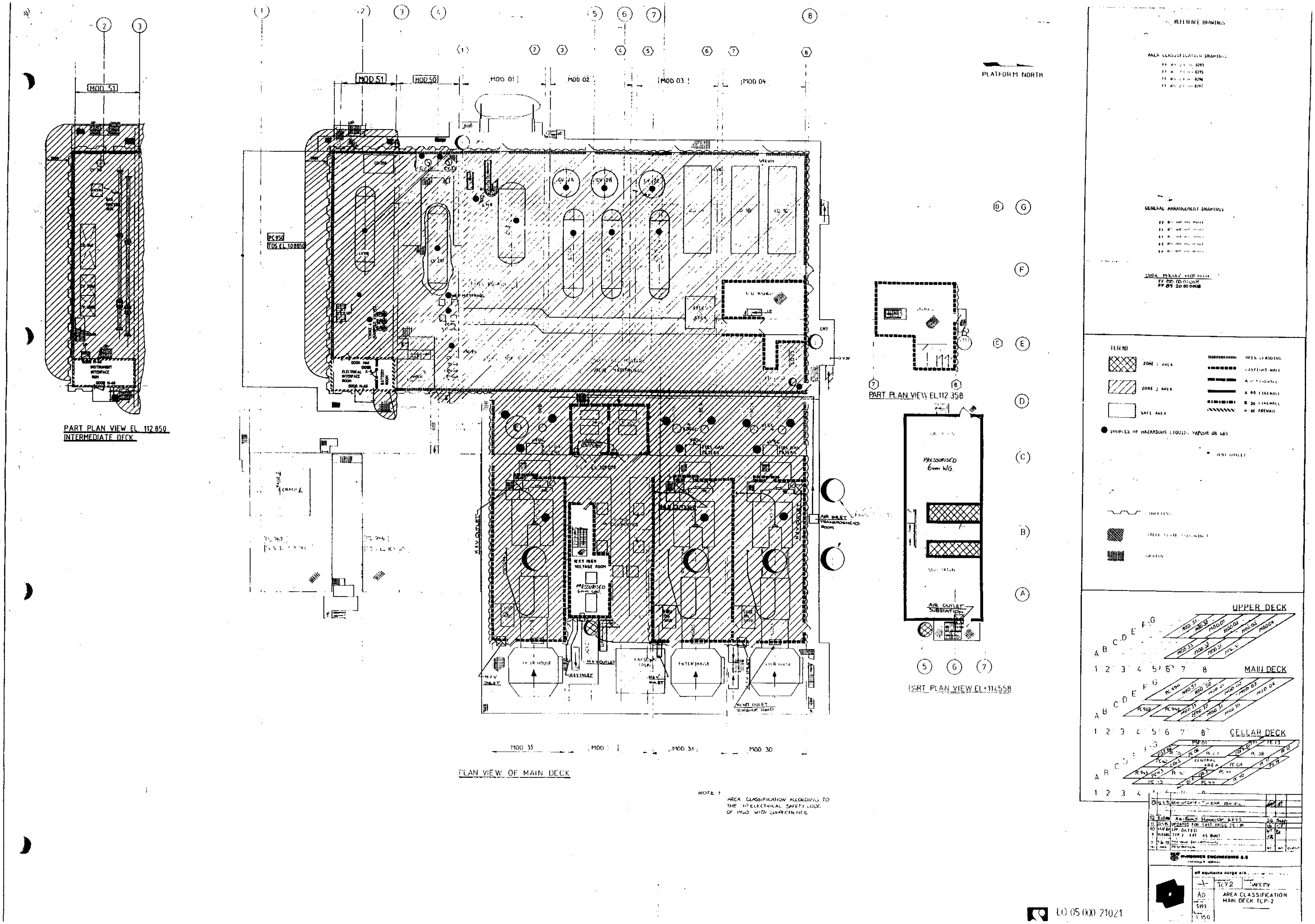
(b) Defining exterior areas which are considered to be an adequate distance from any possible gas or vapour escape, so that the gas or vapour will be dispersed before reaching this area.

(c) Force vented areas which have a high rate of ventilation, with air coming from an unclassified area.

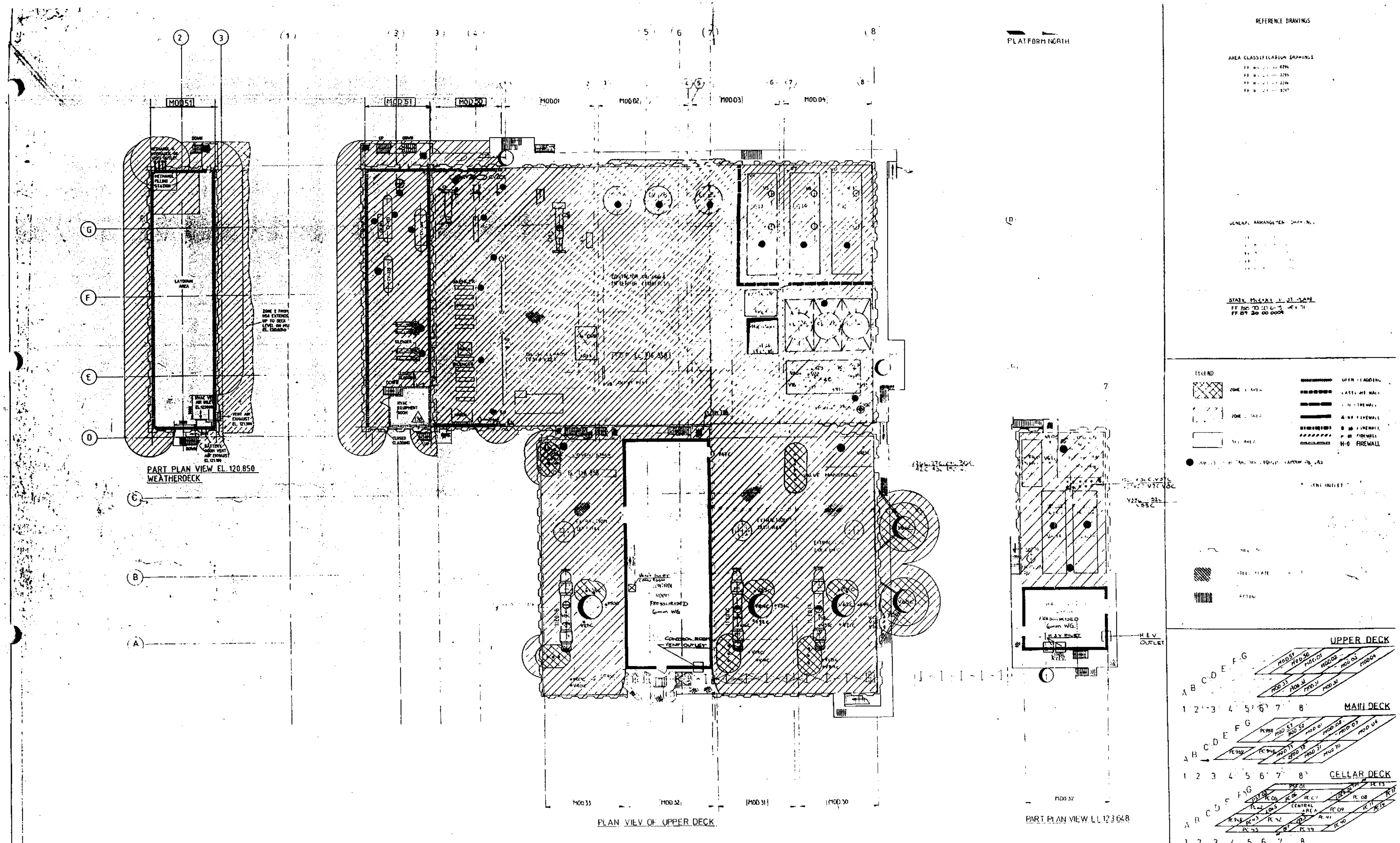
NOTE! A pressurised or force vented area may be classified as zone 1 when loss of ventilation.



PLATFORM NORTH
PLAN VIEW AT MEZZANINE LEVEL
REFERENCE DRAWINGS
AREA CLASSIFICATION DRAWINGS
GENERAL ARRANGEMENT DRAWINGS
PANCAKE 55 PLOT PLAN
LEGEND
ZONE 1 AREA
ZONE 2 AREA
SAFE AREA
SOURCES OF HAZARDOUS LIQUID, VAPOUR OR GAS
VENT OUTLET
OPEN CLADDING
GASTIGHT WALL
A-0 FIREWALL
A-60 FIREWALL
B-30 FIREWALL
H-60 FIREWALL
CLADDING
STEEL PLATE FLOORING
GRATING
UPPER DECK
MAIN DECK
CELLAR DECK
INSTRUMENT INTERFACE ROOM
LAYDOWN AREA
BATTERY ROOM
AIR CONDITIONING ROOM
TRANSFORMER
SWITCHGEAR
52 G601A
52 G601B
MEZZANINE CONTROL ROOM
EMERGENCY SUB STATION
LIFE RAFT DAVIT
SECOND LEVEL EL 103 157
PLAN VIEW OF CELLAR DECK EL 100 000
PART PLAN VIEW EL 104 250
DIESEL GEN ROOM
NOTE 1
AREA CLASSIFICATION ACCORDING TO THE NPD ELECTRICAL SAFETY CODE OF 1981 WITH SUPPLEMENTS.
UPDATED
TCP 2 EXT AS BUILT
elf aquitaine norge a s
TCP2
SAFETY
AREA CLASSIFICATION CELLAR DECK TCP 2



MOD 51
MOD 50
MOD 01
MOD 02
MOD 03
MOD 04
PLATFORM NORTH
PC950
TOS EL.108850
PART PLAN VIEW EL. 112.850
INTERMEDIATE DECK
PART PLAN VIEW EL.112.358
PART PLAN VIEW EL.+114558
PRESSURISED
6mm WG.
AIR OUTLET
SUBSTATION
AIR INLET
TRANSFORMERS
ROOM
VERY HIGH
VOLTAGE ROOM
PRESSURISED
6mm WG.
H.V.OUTLET
H.V.INLET
FILTER HOUSE
VENT INLET
TURBINE HOOD
BATTERY ROOM
ELECTRICAL
INTERFACE
ROOM
INSTRUMENT
INTERFACE
ROOM
MOD 33
MOD 31
MOD 30
PLAN VIEW OF MAIN DECK
NOTE 1
AREA CLASSIFICATION ACCORDING TO
THE IP ELECTRICAL SAFETY CODE
OF 1965 WITH SUPPLEMENTS
REFERENCE DRAWINGS
AREA CLASSIFICATION DRAWINGS
GENERAL ARRANGEMENT DRAWINGS
LEGEND
ZONE 1 AREA
ZONE 2 AREA
SAFE AREA
OPEN CLADDING
SOURCES OF HAZARDOUS LIQUIDS, VAPOUR OR GAS
UPPER DECK
MAIN DECK
CELLAR DECK
CENTRAL
AREA
13 GEN. UPDATE - TURBINE REMOVAL
12 AS-BUILT HOOK-UP EFTI
11 UPDATED FOR EAST FRIGG TIE-IN
10 UP-DATED
9 TCP 2 CXT AS BUILT
DESCRIPTION
STAVANGER NORWAY
elf aquitaine norge a/s
TCP2
SAFETY
A0
5193
1:150
AREA CLASSIFICATION
MAIN DECK TCP-2
LO 05 000 21021



11		GEN. UPDATE - TURBINE REMOVAL		
10		AS-BUILT. HOOK-UP, EFTI	IG	
09		UPDATED FOR LAST FRIGG TIE-IN		
08		UP-DATED		
Rev.	Date	DESCRIPTION	BY	APP

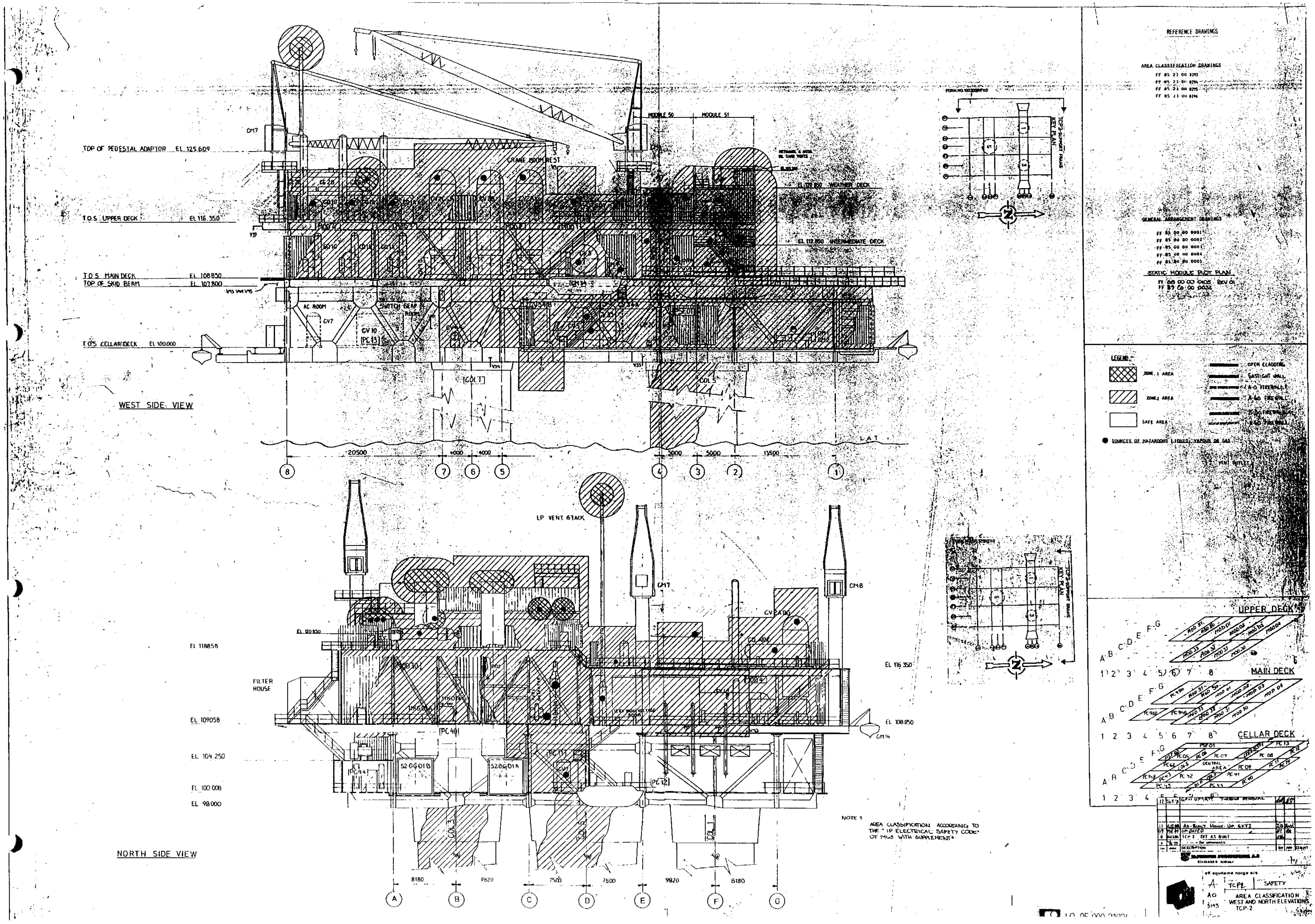
KVAERNER ENGINEERING A.S
STAVANGER NORWAY

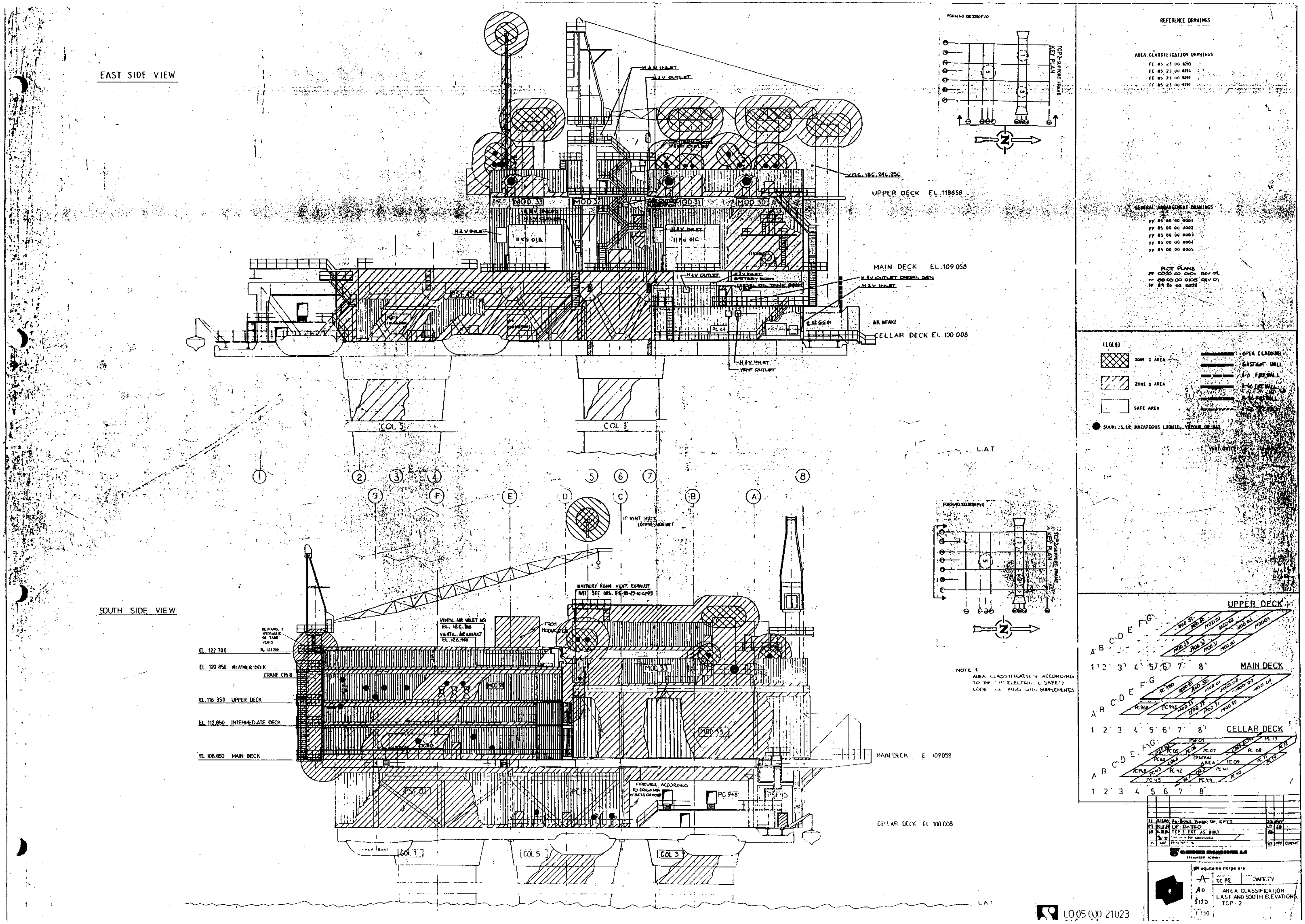
elf aquitaine norge a/s

A	TCP-2	SAFETY
A0	AREA CLASSIFICATION UPPER DECK TCP 2	
5193		
1:150		

FRIGG FIELD

10.05.00 21:26
sofresid norge a.s


TOP OF PEDESTAL ADAPTOR EL 125.609
T.O.S. UPPER DECK EL 116.350
T.O.S. MAIN DECK EL 108.850
TOP OF SKID BEAM EL 107.800
T.O.S. CELLAR DECK EL 100.000
CRANE BOOM REST
EL 120.850 WEATHER DECK
EL 112.850 INTERMEDIATE DECK
AC ROOM
SWITCH GEAR ROOM
WEST SIDE VIEW
LP VENT STACK
FILTER HOUSE
EL 118.858
EL 109.058
EL 104.250
EL 100.008
EL 98.000
EL 116.350
EL 108.850
NORTH SIDE VIEW
REFERENCE DRAWINGS
AREA CLASSIFICATION DRAWINGS
GENERAL ARRANGEMENT DRAWINGS
STATIC MODULE PLOT PLAN
KEY PLAN
LEGEND
ZONE 1 AREA
ZONE 2 AREA
SAFE AREA
SOURCES OF HAZARDOUS LIQUID, VAPOUR OR GAS
OPEN CLADDING
GASTIGHT WALL
UPPER DECK
MAIN DECK
CELLAR DECK
CENTRAL AREA
NOTE 1
AREA CLASSIFICATION ACCORDING TO THE "IP ELECTRICAL SAFETY CODE" OF 1965 WITH SUPPLEMENTS.
12 GAS UPDATE TURBINE REMOVAL
11 AS-BUILT HOOK-UP GETI
09 UP-DATED
8 TCP 2 EXT AS BUILT
DESCRIPTION
STAVANGER NORWAY
elf aquitaine norge a/s
TCP2
SAFETY
AREA CLASSIFICATION
WEST AND NORTH ELEVATIONS
TCP-2


EAST SIDE VIEW
H.A.V INLET
H.A.V OUTLET
UPPER DECK EL. 118858
MOD 33
MOD 32
MOD 31
MOD 30
MAIN DECK EL. 109 058
CELLAR DECK EL. 100 008
AIR INTAKE
H.A.V INLET
VENT OUTLET
COL 5
COL 3
L.A.T.
SOUTH SIDE VIEW
EL. 122.700
EL. 120 850 WEATHER DECK
CRANE CM 8
EL. 116 350 UPPER DECK
EL. 112 850 INTERMEDIATE DECK
EL. 108 850 MAIN DECK
BATTERY ROOM VENT. EXHAUST
MAIN DECK EL. 109 058
CELLAR DECK EL. 100 008
FIREWALL ACCORDING TO DRAWING
PSF 02
PC 948
PSF 45
COL 1
COL 5
COL 3
KEY PLAN
REFERENCE DRAWINGS
AREA CLASSIFICATION DRAWINGS
GENERAL ARRANGEMENT DRAWINGS
PLOT PLANS
LEGEND
ZONE 1 AREA
ZONE 2 AREA
SAFE AREA
OPEN CLADDING
GASTIGHT WALL
SOURCES OF HAZARDOUS LIQUID, VAPOUR OR GAS
UPPER DECK
MAIN DECK
CELLAR DECK
CENTRAL AREA
11 5/12/88 As Built, Hook-Up, EFTI
09 14/12/84 UP-DATED
08 14/03/84 TCP 2 EXT AS BUILT
elf aquitaine norge a/s
TCP2
SAFETY
AREA CLASSIFICATION EAST AND SOUTH ELEVATIONS. TCP - 2
A0
5195
1:150
L0 05 (X) 21023

AUDIBLE AND VISUAL ALARMS

1. GENERAL

1.1 Audible and visual alarms are provided to give personnel information on the safety status of the platform.

1.2 Overall platform audible and visible alarms are broadcast by the Public Address (PA) system, refer to section 8.4. These alarms are divided into the following categories:

(a) Alert signal

(b) Muster alarm

(c) General platform alarm (GPA)

1.3 Local alarms are provided in certain areas for personnel evacuation and fire team orientation.

2. DESCRIPTION

2.1 Overall platform audible alarms

2.2.2 The audible alarms, broadcast by the Public Address system, are automatically ranked in following priorities:

(a) Alert signal - two tone signal followed by announcement over the PA system (can be abandon platform or man overboard).

(b) Muster alarm - continuous tone

(c) General platform alarm - Intermittant tone at one second intervals. This will be followed by an announcement over the PA System. A GPA is initiated by fire or gas detection.

If a 'GPA'alarm is being given and a 'Muster' alarm is initiated, the 'Muster' alarm will override. Note that gas on Q.P. does not automatically operate a 'GPA'.

An Alert signal is a verbal command given over the public address system from a microphone at the main control desk. This verbal command follows a 2-tone signal and will override alarm tone for a period of 10 seconds.

2.1.2 Operation of audible alarms is controlled manually from pushbuttons and automatically by the Fire or gas Detection Systems. Muster and GPA alarm pushbuttons are situated on the Alarm Control Panel in the Control Room. A selector switch on the Alarm Control Panel allows for alarm tone selection. 'Muster'and GPA alarms may be cancelled by actuation of a 'Cancel' pushbutton at the Alarm Control Panel.

2.2 Local Audible Alarms

2.2.1 Halon protected areas have electrically operated bells installed, activated on system release.

2.3 Visual Alarms

2.3.1 Selected platform areas, notably noisy areas, are provided with flashing lamps operated by the Public Address System as follows:

- Red lamps for alarm
- Blue lamps for public address

2.3.2 At each entrance to a Halon protected area, a local lamp panel is installed with the following functions:

- Green lamp illuminated: system in manual
- Amper lamp illuminated: system in automatic
- Red lamp illuminated: Halon released

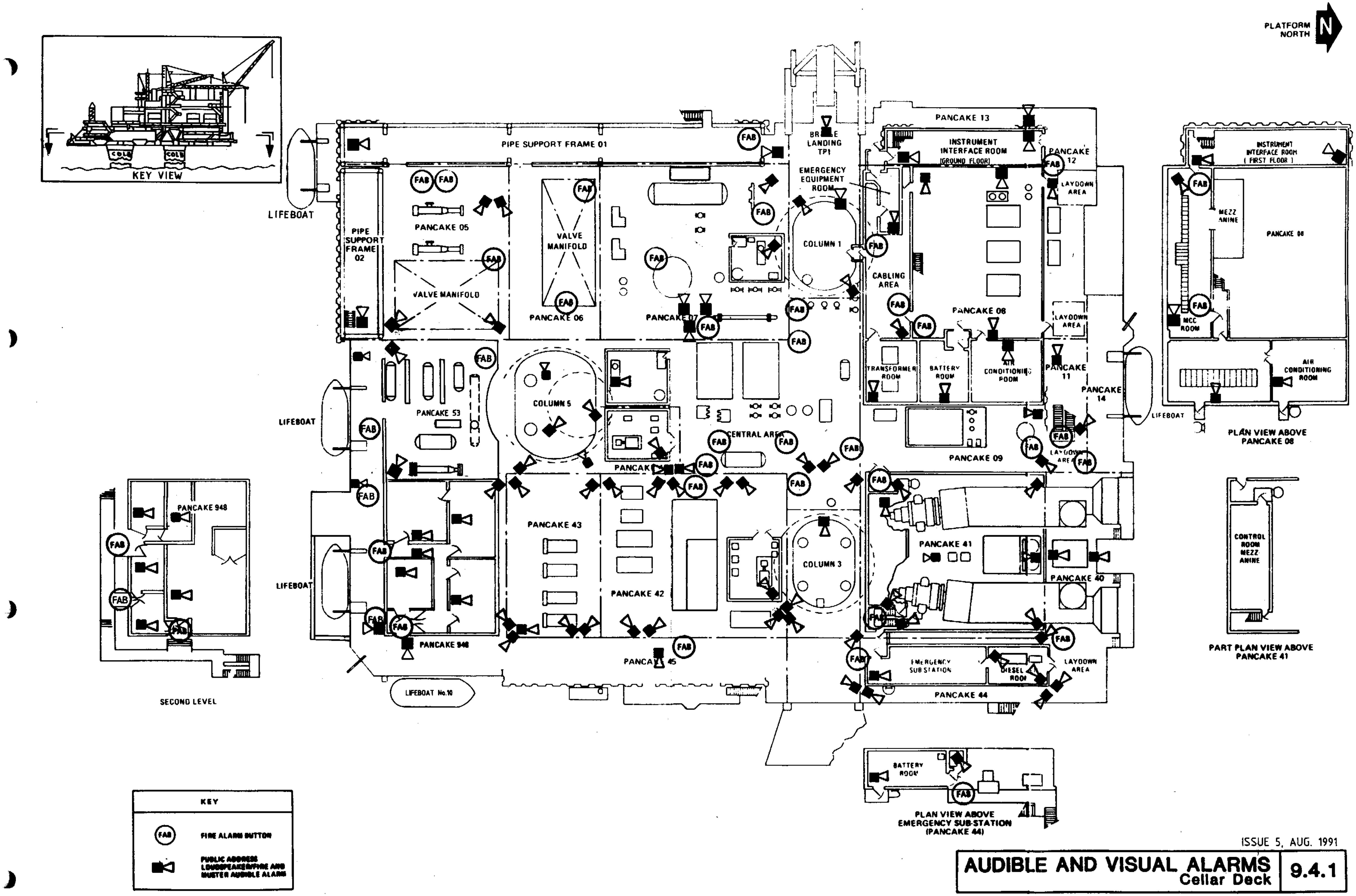
2.3.3 Red flashing lamps are provided at room entrances to indicate fire condition inside area, operated by Fire Detection system.

2.4 Action in the Event of an Alarm

2.4.1 Alert signal - All personnel to act as instructed over the PA system.

2.4.2 On hearing the 'Muster' alarm all personnel must proceed to their designated lifeboat station and await further instructions.

2.4.3 On hearing the GPA (Fire or gas alarm) all personnel assigned to a fire party must assemble at their fire stations. All other personnel must proceed to their allocated emergency station (refer to IC card) and await further instructions over the PA System.

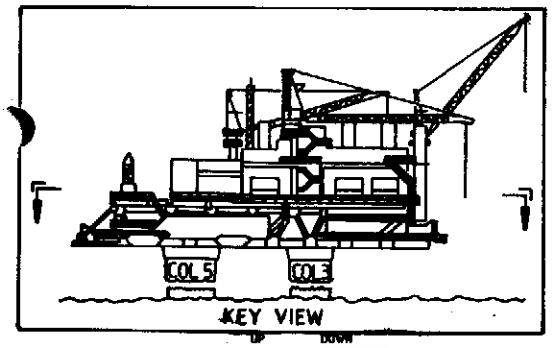


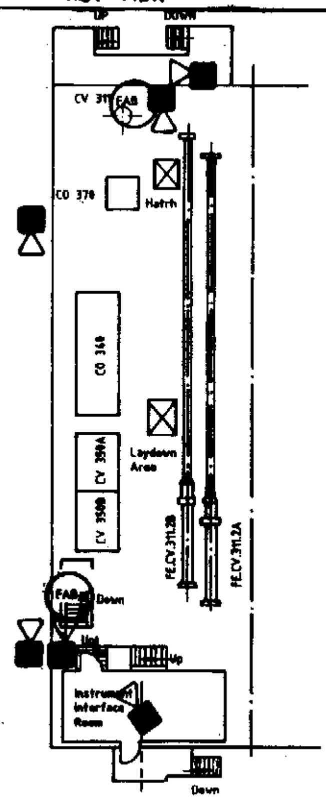
ISSUE 5, AUG. 1991

AUDIBLE AND VISUAL ALARMS
Cellar Deck

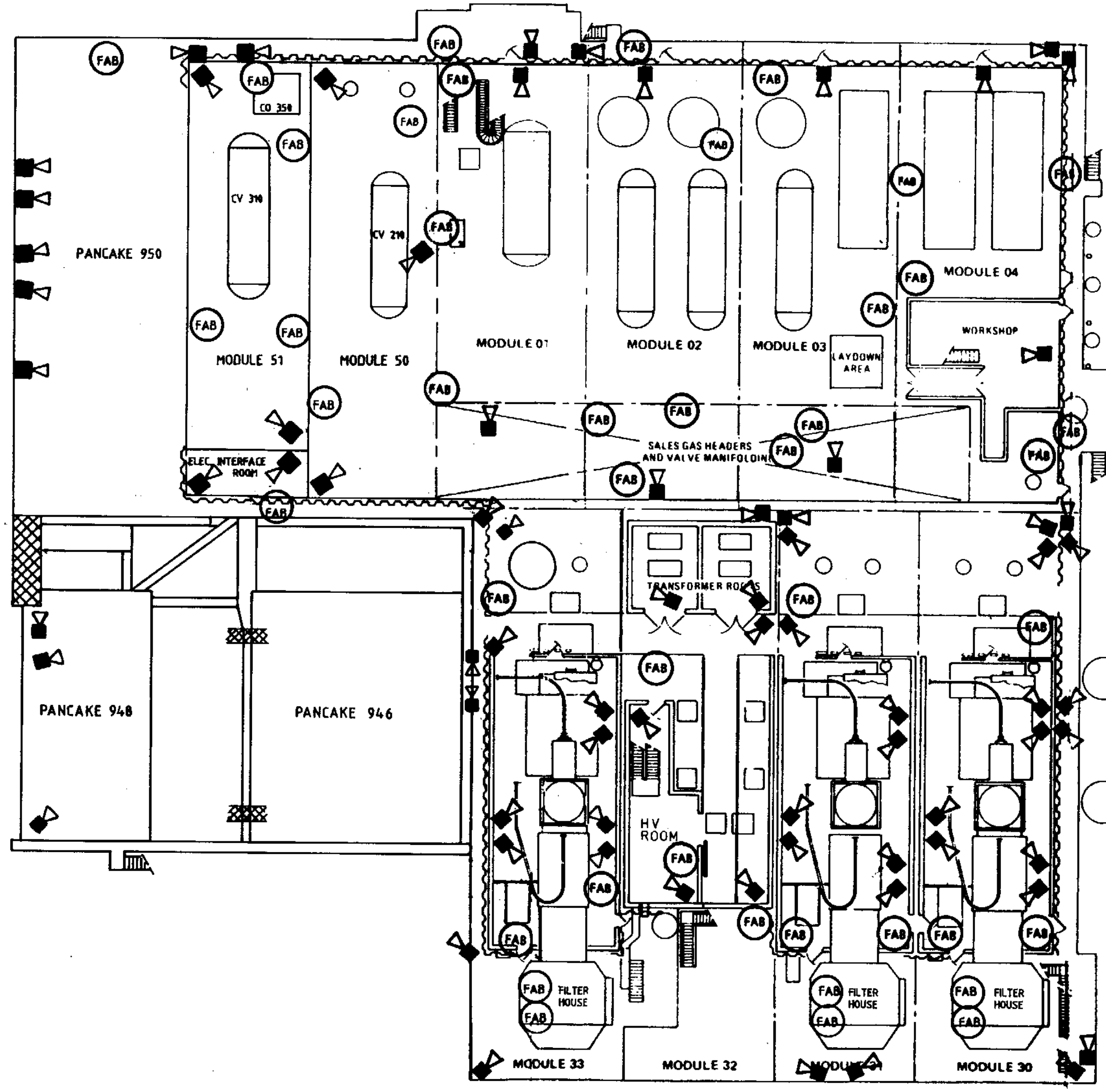
9.4.1

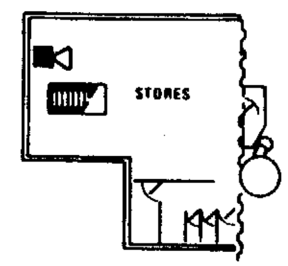
PLATFORM NORTH



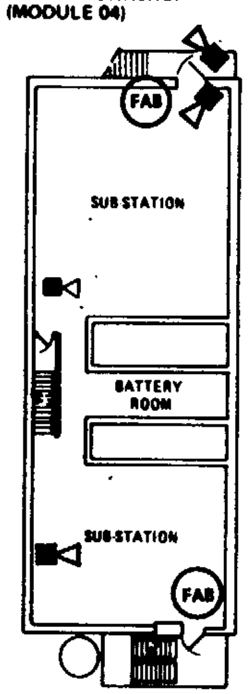


MS1 INTERMEDIATE DECK





PLAN ABOVE WORKSHOP (MODULE 04)



PLAN ABOVE WORKSHOP (MODULE 32)

KEY	
(FAB)	FIRE ALARM BUTTON
[symbol]	PUBLIC ADDRESS LOUDSPEAKER/ FIRE AND MUSTER AUDIBLE ALARM

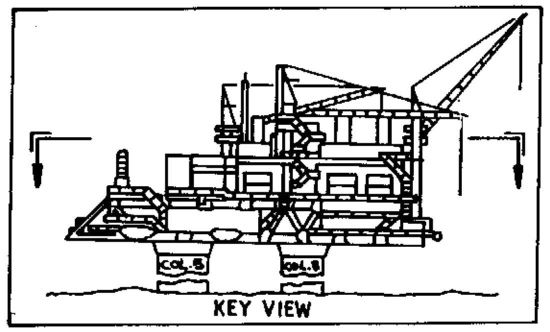
ISSUE 5, AUG. 1991

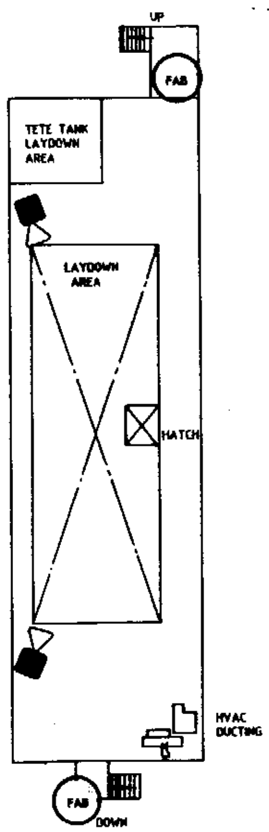
AUDIBLE AND VISUAL ALARMS
Main Deck

9.4.2

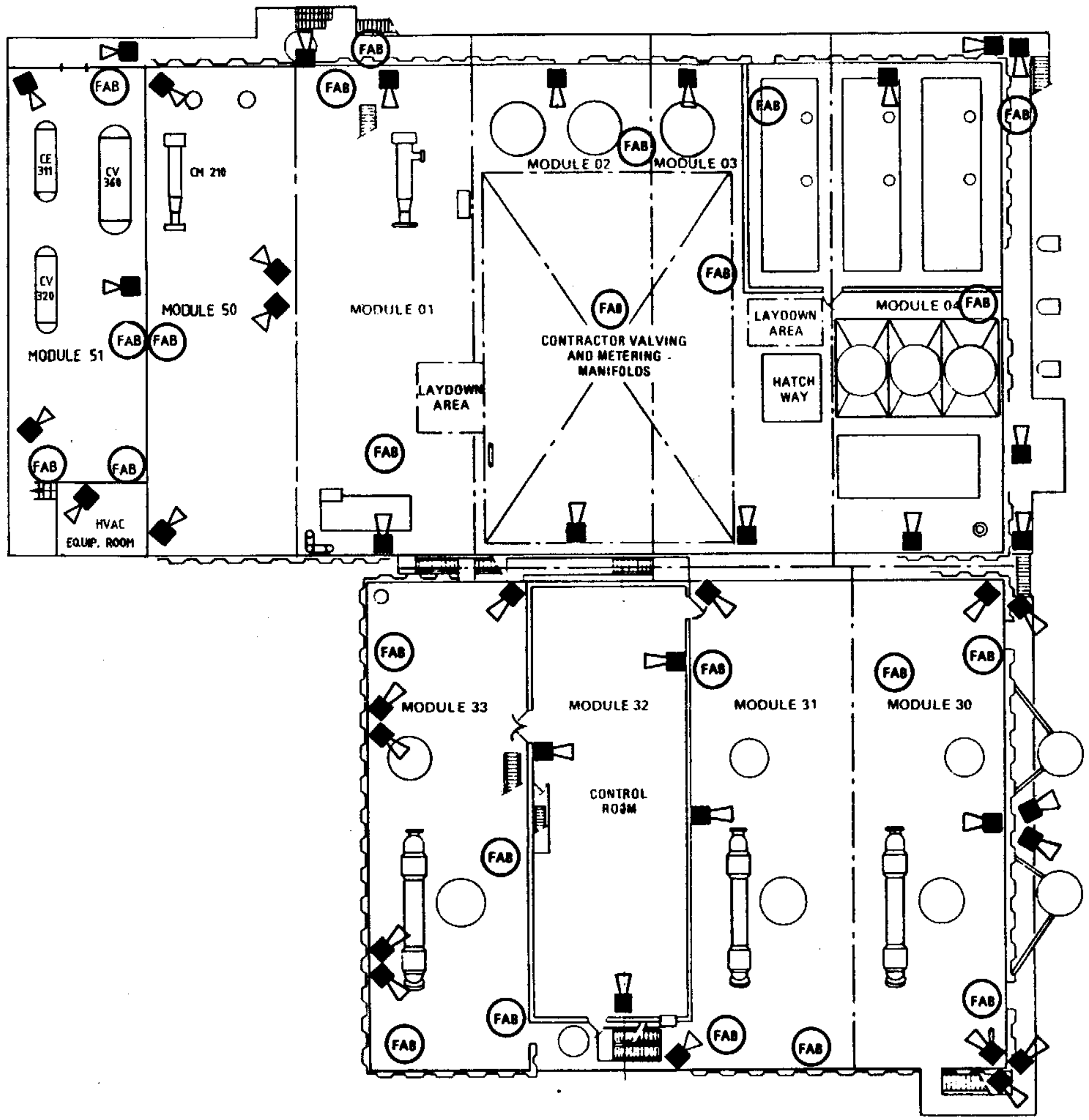
PLATFORM NORTH

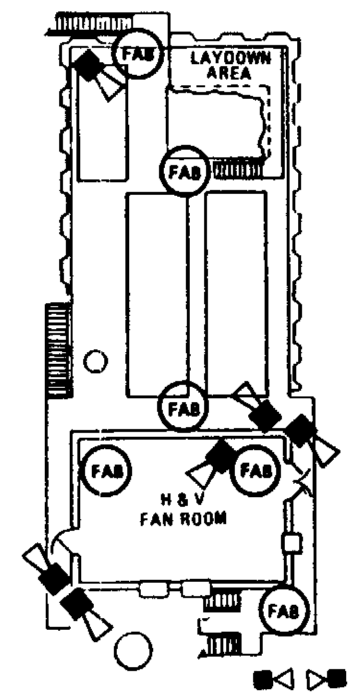
N





M51 WEATHER DECK





PLAN VIEW ABOVE CONTROL ROOM MODULE 32

KEY	
FAB	FIRE ALARM BUTTON
	PUBLIC ADDRESS LOUDSPEAKER/ FIRE AND MUSTER AUDIBLE ALARM

ISSUE 6, OCTOBER 1988

AUDIBLE AND VISUAL ALARMS
Upper Deck

9.4.3

EMERGENCY SHUTDOWNS

1. GENERAL

1.1 QP Control Room provides centralised manual control for emergency shutdowns of the Frigg Field drilling and treatment platforms.

1.2 In addition each platform has its own integral independent emergency shutdown system.

2. DESCRIPTION

2.1 General

2.1.1 The treatment and compression areas of TCP2 are considered for shutdown purposes as two separate, though related platforms. This ensures that when possible only one area will be shut down by factors which do not directly affect the other.

2.1.2 In common with the remainder of the ESD systems for the Frigg Field, the ESD systems of TCP2 provide five levels of equipment shutdown. These levels are based on the degree of danger arising from any of the emergencies as follows:

Equipment Shutdown Level	Emergency Situation
First	A situated which leads to operation of the Field Shutdown (FSD) pushbutton.
Second	A situation which leads to operation of pushbuttons which initiate an Emergency Shutdown (ESD) with decompression of the treatment or compression areas.
Third	1. A situation which leads to operation of pushbuttons which initiate an ESD without decompression of the treatment or compression areas.
	2. Fire detection in the treatment or compression open areas.
	3. Gas detection in the treatment or compression open areas.
	4. Gas detection around the treatment area glycol regeneration firewalls, and CE2A & CE2B.
Fourth	Various process malfunctions.
Fifth	

2.2 First Level Shutdown

2.2.1 General

The platform first level shutdown is initiated by operation of the ESD pushbutton in the QP Control Room only.

2.2.2 Effects of a First Level Shutdown

The occurrence of the first level emergency shutdown operation initiates the following in the treatment and compression areas:

(a) A complete process shutdown without decompression.

(b) Loss of all 5.5kV supplies.

(c) The process pumps stop, the compressors stop, the fuel gas system shuts down and the ventilation systems shut down.

(d) The emergency diesel generators start.

(e) The fire pumps start.

(f) The warning horns sound and warning lights flash.

(g) The relevant alarm annunciators operate in the TCP2 Interface Room, Compression Area Control Room and the QP Control Room.

(h) Shutdown TP1, DP2, NEF, EF.

(i) Third level, fourth level and fifth level shutdown are also initiated by first level shutdown.

2.3 Second Level Shutdown

2.3.1 Second level shutdown of the treatment areas is initiated by operation of ESD pushbuttons, located as follows:

QP Control Room (CHS-12)
TCP2 Interface Room (CHS-13)

2.3.2 Effects of Treatment Area Second Level Shutdown

The operation of either of the second level ESD pushbuttons initiates the following:

(a) A complete treatment process shutdown with decompression after an adjustable delay of from 10 seconds to 10 minutes.

(b) Isolation of non-essential power supplies.

(c) The treatment process pumps and fans stop, and the ventilation system shuts down.

(d) The fire pumps start.

(e) The warning horns sound and warning lights flash.

(f) The relevant alarm annunciators operate in the TCP2 Interface Room and the QP Control.

(g) Shutdown DP2

(h) Third, fourth and fifth level shutdown are also initiated from second level shutdown.

2.3.3 Second level shutdown of the compression areas is initiated by operation of ESD pushbuttons located as follows:

QP Control Room
TCP2 Compression Control Room

2.3.4 Effects of Compression Areas Second Shutdown

The operation of either of the second level ESD pushbuttons initiates the following:

(a) A complete compression process shutdown with decompression after a delay of 45 seconds.

(b) Isolation of non-essential supplies and shutdown of main turbogenerators.

(c) The process pumps stop.

(d) The emergency diesel generators start.

(e) The fire pumps start.

(f) The fuel gas system shuts down.

(g) The warning horns sound and warning lights flash.

(h) The relevant alarm annunciators operate in QP and TCP2 Compression Control Rooms.

2.4 Third Level Shutdown

2.4.1 Third level shutdown of the treatment areas is initiated by the following:

(a) Operation of ESD pushbuttons, located as follows:

QP Control Room (CHS-ESD-6)
TCP2 Interface Room (CHS-ESD-1)
Lifeboat Stations (treatment and compression areas)
TP1 Bridge (CHS-ESD-4)
Motor Control Centre (CHS-ESD-5)

(b) First or second level shutdown of treatment areas.
(c) Detection of fire in the treatment areas.
(d) Detection of gas at a level of 60 per cent LEL in the treatment areas.
(e) Detection of gas at a level of 60 per cent LEL around the glycol regeneration firewalls and CE2A & CE2B.
(f) Detection of gas in compression process area at 60% LEL via time delay.
(g) Detection of fire in compression process area - 2nd threshold.
(h) First and Second level shutdown.

Limited 3rd level shutdown of treatment areas is initiated by the following:

(a) Detection of gas 60% LEL in selective vent. air inlets.

(b) Detection of fire - 2nd threshold in selective areas.

2.4.2 Effects of a Third Level Shutdown in Treatment Areas

Detection of gas in the common ventilation inlet ducts shuts down the ventilation system only, and detection of fire and gas in the Workshop/Stores Areas and Fire Pump Houses shuts down the treatment area ventilation system only. Except where otherwise stated, the occurrence of any other of the third level emergency situations initiates the following:

(a) A complete process shutdown without decompression.

(b) Load shedding of all non-essential electrical supplies.

(c) The process pumps and fans stop.

(d) The ventilation system shuts down on fire and gas detection only.

(e) The fire pumps start on operation of the ESD pushbuttons, fire and gas detection only.

(f) The deluge valves open on fire detection, and gas detection around the glycol regeneration firewalls only.

(g) The warning horns sound and warning lights flash on operation of the ESD pushbuttons and fire and gas detection only.

(h) The relevant alarm annunciators operate in the TCP2 Interface Room and the QP Control Room.

(i) Fourth and fifth level shutdown are also initiated from third level shutdown.

2.4.3 If third level shutdown of treatment areas is initiated by gas detection in compression open process areas, shutdown will be delayed by a time switch. This is in order to allow the shutdown signal to be manually overridden from QP Control Room if required.

2.4.4 Operation of ESD pushbuttons at TP1 bridge and lifeboat stations will also initiate third level shutdown of compression areas.

2.4.5 Third level shutdown of the compression areas is initiated by the following:

(a) Operation of ESD pushbuttons, located as follows:

QP Control Room (total third level)
QP Control Room (limited third level)
TCP2 Compression Control Room (total third level)
TCP2 Compression Control Room (limited third level)
Lifeboat Stations (treatment and compression areas)
TP1 Bridge

(b) Detection of fire in compression area open process areas.

(c) Detection of gas at a level of 60 per cent LEL in compression area open process area.

(d) Detection of fire in treatment area.

(e) Detection of gas at a level of 60 per cent LEL in treatment areas, via time delay.

(f) First level shutdown or second level shutdown compression.

(g) Fire detection in the compressor turbine hood.

(h) Gas detection at 60 per cent LEL inside the Compressor Module.

(i) Gas detection at 60 per cent LEL in the Compressor Room air outlet.

(i) Gas detection at 60 per cent LEL in the Compressor Room air inlet.

(k) Gas detection at 60 per cent LEL in the Generator Room air outlet.

(l) Gas detection at 60 per cent LEL in the Generator Room air inlet.

(m) Fire detection in the Generator Room or Mezzanine.

(n) Fire detection at the fuel gas package.

(p) Gas detection at 60 per cent LEL at the fuel gas package.

2.4.6 Effects of a Third Level Shutdown in Compression Areas

Shutdown of the compression area may be total or may exclude the fuel gas package. Total third level shutdown includes shutdown of the fuel gas system. The turbines G01A/B change over to diesel fuel operation. Total failure of the main generators will initiate start - emergency generators TCP2 & QP for total black start conditions, see section 5.3

2.4.7 The effects of third level (limited) process shutdown:

(a) A complete compression process shutdown without decompression.

(b) Isolation of non-essential supplies.

(c) The fire pumps starts.

(d) Deluge valves open only on detection of fire in process areas.

(e) Warning horns sound and warning lights flash.

(f) The relevant alarm annunciators operate.

2.4.8 The effects of total third level shutdown are:

(a) Third level process shutdown as above.

(b) Shutdown of fuel gas system.

2.5 Fourth Level Shutdown.

2.5.1 Forth level shutdown of the treatment area.

2.5.1.1 The treatment area is divided into many sections, each having individual fourth shutdown initiation.

The section are in two main categories:

i) Inlet separator CVIC
ii) Outlet streams A/B

2.5.1.2 Initiation.

i) Initiations for fourth level shutdown of the inlet separator are:

a) Pusthbutton
b) Low process pressure associated with the separator

ii) Initiations for fourth level shutdown of one outlet stream are:

a) Pushbutton in QP Control Room
b) Pushbutton in TCP2 Interface Room
c) Low pressure in glycol contactor
d) High pressure in stream outlet to Sales Gas Export System

2.5.1.3 Fourth level shutdown is also initiated by first, second or third level shutdown.

2.5.2 <u>Effects of a Treatment Area Fourth Level Shutdown</u>

i) Effects of fourth level shutdown on the inlet separator is closure of the associated ESDVs.
ii) Effects of fourth level shutdown on one outlet stream are closure of the associated ESDV's, stopping associated pumps and shutdown of associated Glycol Regeneration unit.

2.5.3 Fourth level shutdown of the compression areas is initiated by the following:

(a) Operating of ESD pushbuttons located in the Compression Area Control Room, outside each compressor module, and each compressor local panel.

(b) Gas detection at 60 per cent LEL in the turbine hood, the vent air inlet hood inside the compressor module, compressor room air outlet, compressor room air inlet and 15 per cent LEL in the compressor gas turbine combustion air intake.

(c) Fire detection in the compressor turbine hood.

(d) Various equipment faults.

(e) ESD pushbutton outside the Generator Room.

(f) Gas detection 60 per cent LEL at the Generator Room air outlet.

(g) Fire detection inside the Mezzanine and Generator Room.

(h) Gas detection at 60 per cent LEL at generator fuel gas K0 drum.

(j) Fire detection at generator fuel K0 drum.

(k) Gas detection at 60 per cent LEL at fuel gas package.

(l) Fire detection at fuel gas package.

(m) Gas detection 60% LEL generator room air inlet.

2.5.4 Effects of compression area fourth level shutdown:

(a) Individual compressor shutdown which is initiated by (a), (b), (c) or (d) in 2.5.3 above.

(b) Individual generator fuel gas shutdown which is initiated by (e), (f), (h) or (j) above.

(c) Fuel gas package inlet shutdown which is initiated by (k) or (l) above.

(d) Operation of relevant deluge valves initiated by (l) above.

(e) Starting of firewater pumps. (For initiation see Third Level Shutdown)

2.6 Fifth Level Shutdown

Fifth level shutdowns of treatment and compression areas are initiated by sensors located in the various process streams or equipment. They operate to shut down individual items of equipment and/or pipelines within process streams. Additionally pushbuttons are provided locally, in the Generator Control Room and in the Treatment MCC Room to shut down individual turbogenerators in the compression area.

2.7 Overpressure Protection System

In addition to the five levels of shutdown detailed above three levels of protection exist against overpressure in the sales gas export system.

2.7.1 Initiation

i) Initial Barrier.
Intitiated on sealine valve not fully open.

ii) Primary Protection.
Initiated on pressure greater than 151 bar sensed in TP1 export system (or TCP2 if Dry Gas Interconnection open).

iii) Secondary Protection.
Initiated on pressure greater than 154 bar sensed in export system of either platform.

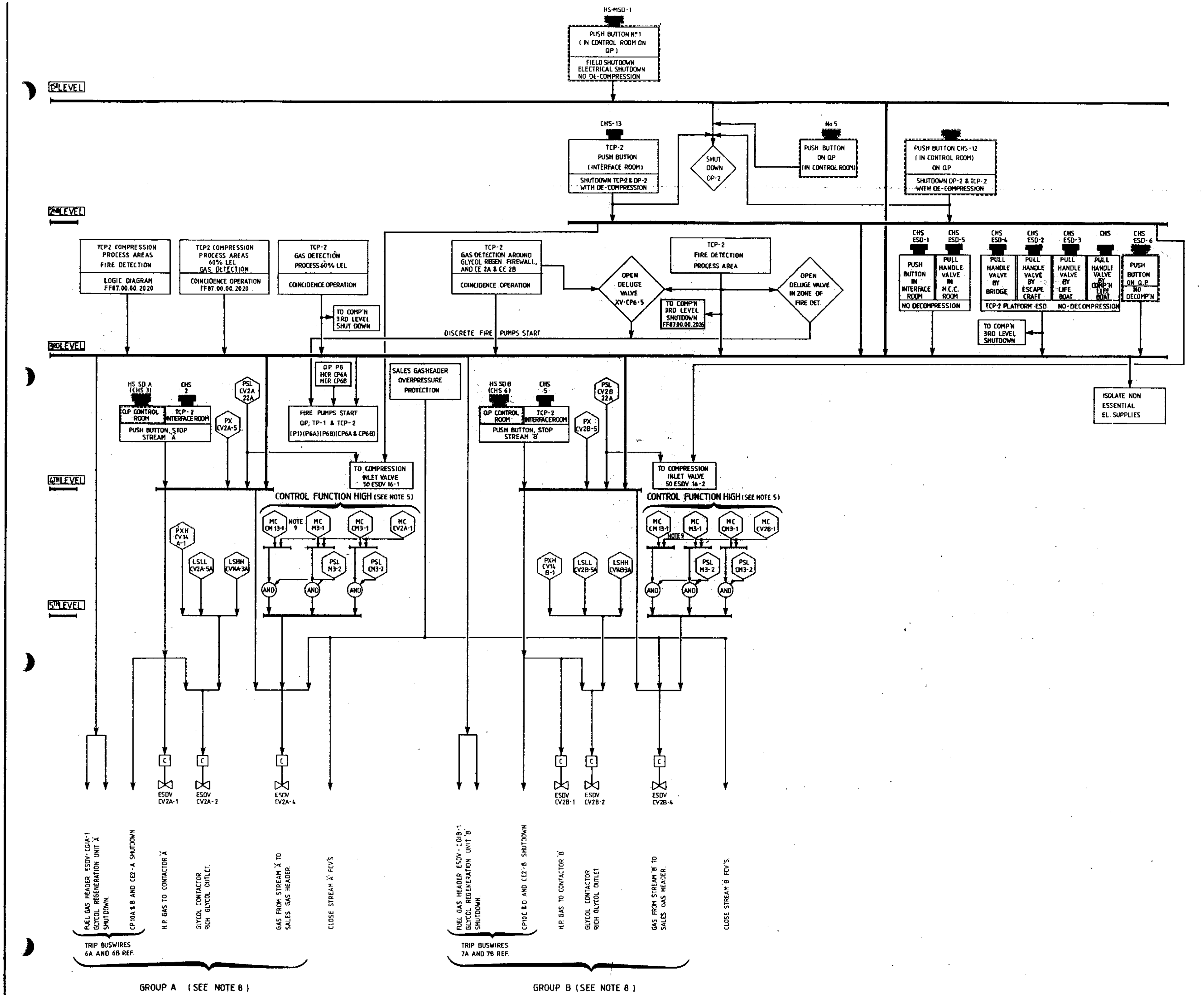
2.7.2 Effects

i) Initial Barrier.
Trip of compressor and closure of stream FCV's and ESDV's.

ii) Primary Protection.
As initial plus closure of Dry Gas Interconnection Line ESDV.

iii) Secondary Protection.
Closure of fuel gas ESDV's to all compressors without selection.

N.B. Reference is made to the specific Operation Manual for the OPPS for functional description and detailed breakdown of effects for the different process configurations.



MATCH LINE FOR CONTINUATION SEE DRW. N° FF-85-16-06-1048

NOTES.

1. THESE DRAWINGS TO BE READ IN CONJUNCTION WITH SHUTDOWN LOGIC FOR TP1. SEE REFERENCE DRAWINGS BELOW.
2. THERE ARE 5 LEVELS OF SHUTDOWN, 1ST, 2ND AND 3RD ARE SAFETY LEVELS. 4TH AND 5TH ARE PROCESS SHUTDOWN LEVELS.
3. FOR LIST OF NON-ESSENTIAL SUPPLIES. SEE ELECTRICAL LOAD DATA SHEETS.
4. PUSH BUTTONS OR INSTRUMENTS SHOWN WITH DOUBLE LINES ARE LOCATED ON TP1 OR QP.
5. MC-M3-1 TO BE MANUALLY SWITCHED IN WHEN GAS IS FLOWING FROM TCP-2 TO TP-1
6. IF TCP-2 CONDENSATE IS BEING INJECTED INTO TP-1 PIPELINE TO SCOTLAND, THEN A CONTROL SIGNAL MUST BE MANUALLY CONNECTED SO THAT IF VALVE "ESDV-M3-1" (GAS TO SCOTLAND) CLOSES, PUMPS CP1A, CP1B, CP2A, B & C ARE STOPPED.
7. HIGH OR LOW PRESSURE AT INTERMEDIATE PLATFORM IS TELEMETERED TO TCP-2 TO CLOSE "ESDV-CM3-1" STOP CM-3 PIG LAUNCH & STOP PUMPS, CP1A, CP1B, CP2A, CP2B & CP2C
8. EACH STREAM / GROUP SHUTDOWN HAS AN ASSOCIATED "AUTHORISE" PUSHBUTTON ON QP WHICH MUST BE OPERATED TO ALLOW RE-OPENING OF A VALVE AFTER SHUTDOWN.
9. MC CM13.1 IS RESERVED FOR FUTURE INSTALLATION.

LEGEND

- EMERGENCY SHUTDOWN VALVE (VALVE OPEN)
- EMERGENCY SHUTDOWN VALVE (VALVE CLOSED)
- MANUAL INITIATION
- SELECTOR SWITCH (LOCKABLE TYPE) LOCATED ON MAIN CONTROL PANEL.
- PUSH BUTTON

REFERENCE DRAWINGS

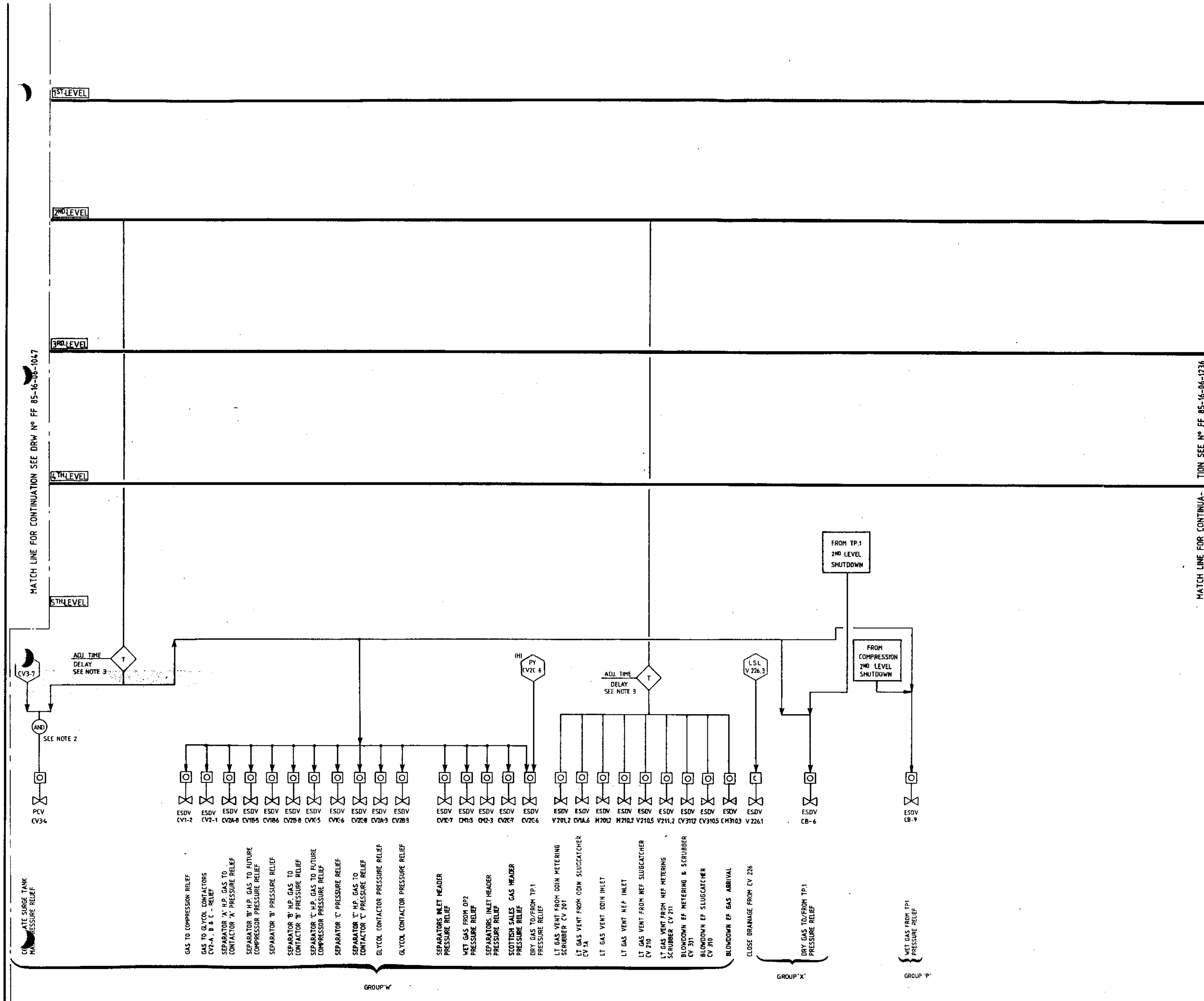
SHUTDOWN LOGIC DIAGRAM TCP-2 (PROCESS)	FF-85-16-06-1048 FF-85-16-06-1236 FF-85-16-06-1237 FF-85-16-06-1238 FF-89-16-08-0018 Sht 1&2
SHUTDOWN LOGIC DIAGRAM TCP-2 (ELECTRICAL)	FF-85-16-06-1049 FF-89-16-08-0018 Sht 3
SHUTDOWN LOGIC DIAGRAM TP1 (PROCESS)	FF-95-16-06-1050 FF-95-16-06-1414
SHUTDOWN LOGIC DIAGRAM TP1 (ELECTRICAL)	FF-95-16-06-1051
SHUTDOWN LOGIC DIAGRAM TCP-2-C	FF-87-00-00-2020

rev.	date	DESCRIPTION	by	app
17	23.9.91	AS BUILT FOLIO 12677.		SR
16	02.07.90	TP1 RISER NB MN 12317	BK	SR
15	18.05.89	GENERAL UPDATE	P.F.	SR
14	23.11.88	AS-BUILT. EF TIE-IN.	JG	
13	27.9.88	GENERAL UPDATE		SR
12	6.86	REDRAWN	KU	

REPLACES MCD HUDSON DRG. . . . . ELN 2169 SHEET C 7001

elf aquitaine norge as p.o.box 168 - 4001 Stavanger

A	Installation: TCP 2 / System: SAFETY
Job no. / Scale	SHUTDOWN LOGIC - DIAGRAM (PROCESS)
FRIGG FIELD	Drwg. no. FF 85-16-06-1047 / Rev. 17 / Sheet 1/1



NOTES

1. FOR GENERAL NOTES AND LEGEND SEE FF 85-16-06-1047
2. CV3 WILL ONLY PRESSURE RELIEVE ON A 2ND LEVEL BLOWDOWN SIGNAL PROVIDED THERE IS A LOW PRESSURE SIGNAL FROM PT-CV3-7
3. 10 SEC. TO 10 MIN ADJUSTABLE TIME DELAY TO ALLOW HYDRAULIC SHUT-IN ESD VALVES TO CLOSE BEFORE DECOMPRESSION.

rev.	date	DESCRIPTION	by	app.
18	13.9.91	AS BUILT FOLIO 12677	[illegible]	SR
15	16.05.89	GENERAL UPDATE	P.F.	SR
14	23.11.88	AS-BUILT EF TIE-IN.	IG	[illegible]
13	29.9.88	GENERAL UPDATE	UB	SR
17	24.10.90	UPDATED FOLIO 12682.	[illegible]	SR
16	11-6-90	TP1 RISER 'AS BUILT' (MN 12517)	[illegible]	SR

REPLACES MCO HUDSON DRG. . . . ELN 2169 SHEET C 7002

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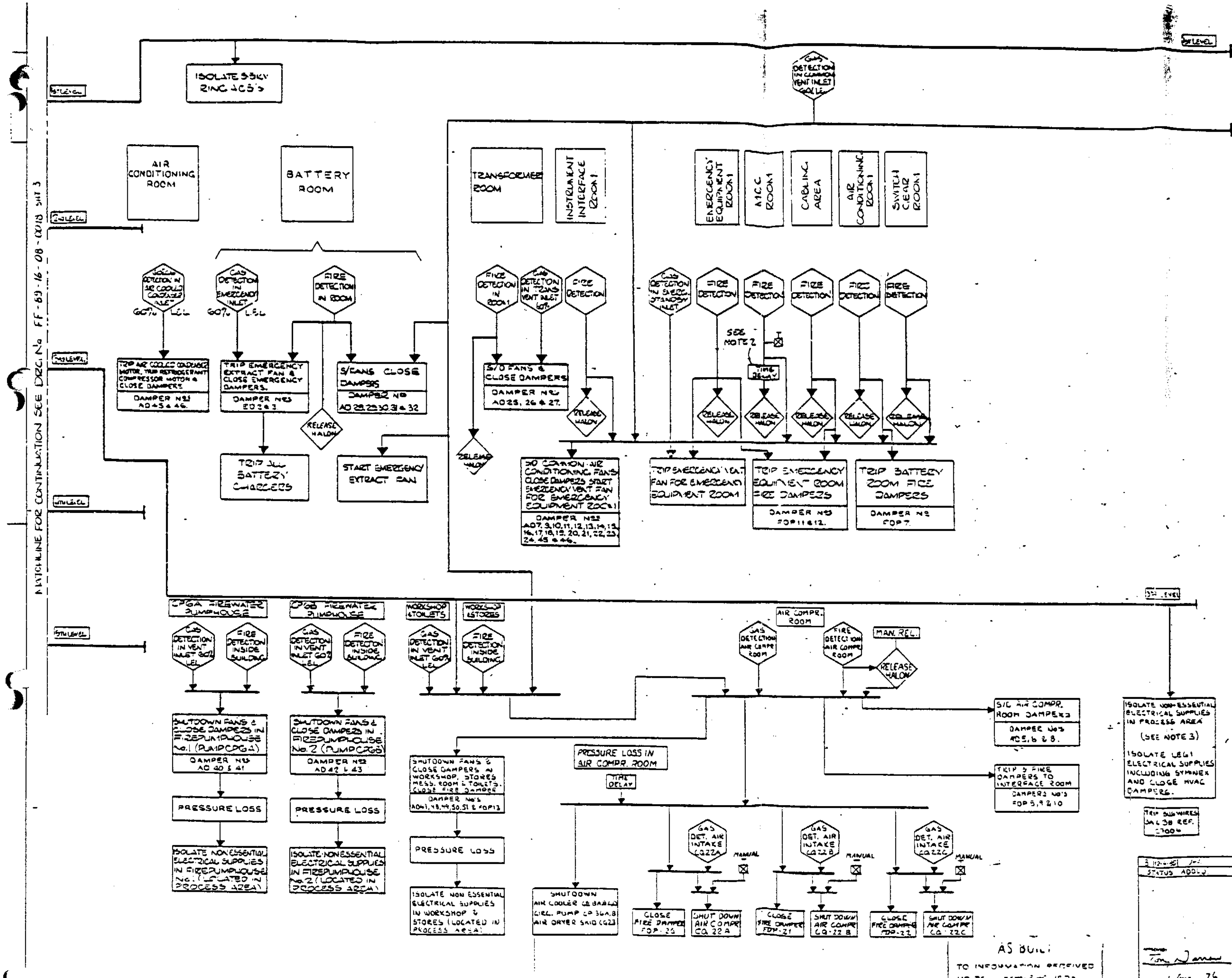
A	Installation TCP.2	System SAFETY
Job no.	SHUTDOWN LOGIC-DIAGRAM (PROCESS)	
Scale		

FRIGG FIELD	Drwg. no. FF 85-16-06-1048	Rev 18	Sheet 1/1



— NOTES —

1. FOR GENERAL NOTES, LEGEND & REFERENCE DRGS. SEE DRG. No FF-85-16-06-1047
2. ALL HALON RELEASE SOLENOID VALVES HAVE A BUILT IN TIME DELAY TO ALLOW THE FANS TO STOP & DAMPERS TO CLOSE. IN ADDITION THE MCC ROOM SOLENOID VALVE HAS FURTHER DELAY TO ALLOW PERSONNEL EVACUATION. SEE FIRE & GAS LAYOUTS FOR OTHER MANUAL RELEASES
3. ALL ELECTRICAL SUPPLIES IN PROCESS AREA TO BE ISOLATED EXCEPT FOR THE FOLLOWING:-
   a) ALARM SYSTEMS
   b) PUBLIC ADDRESS SYSTEMS
   c) LIGHTING & NAVIGATION AIDS.
   d) SHUTDOWN SYSTEM
   e) TELEPHONE SYSTEM
   f) GAS DETECTION SYSTEM
   g) FIRE DETECTION SYSTEM
   h) TELEMETRY SYSTEM.
4. AD — AUTOMATIC DAMPER. ED — EMERGENCY AUTOMATIC DAMPER. FDP — FIRE DAMPER.

MATCHLINE FOR CONTINUATION SEE DRG. No FF-85-16-08-0018 SHT 3

AS BUILT TO INFORMATION RECEIVED UP TO OCTOBER 1976

REVISIONS
- ELWMS REF. ADDED
- ADDED LEG 1 3RD LEVEL
- MODIFIED GAS TURBINES SHUTDOWN
- UPDATED FOLIO
- UPDATED FOLIO
- DRAWING REF No CHANGED
- APPROVED FOR CONSTRUCTION
- REVISED AS BUILT STAMP ADDED

ELF-NORGE
FRIGG FIELD

TREATMENT/COMPRESSION PLATFORM No.2

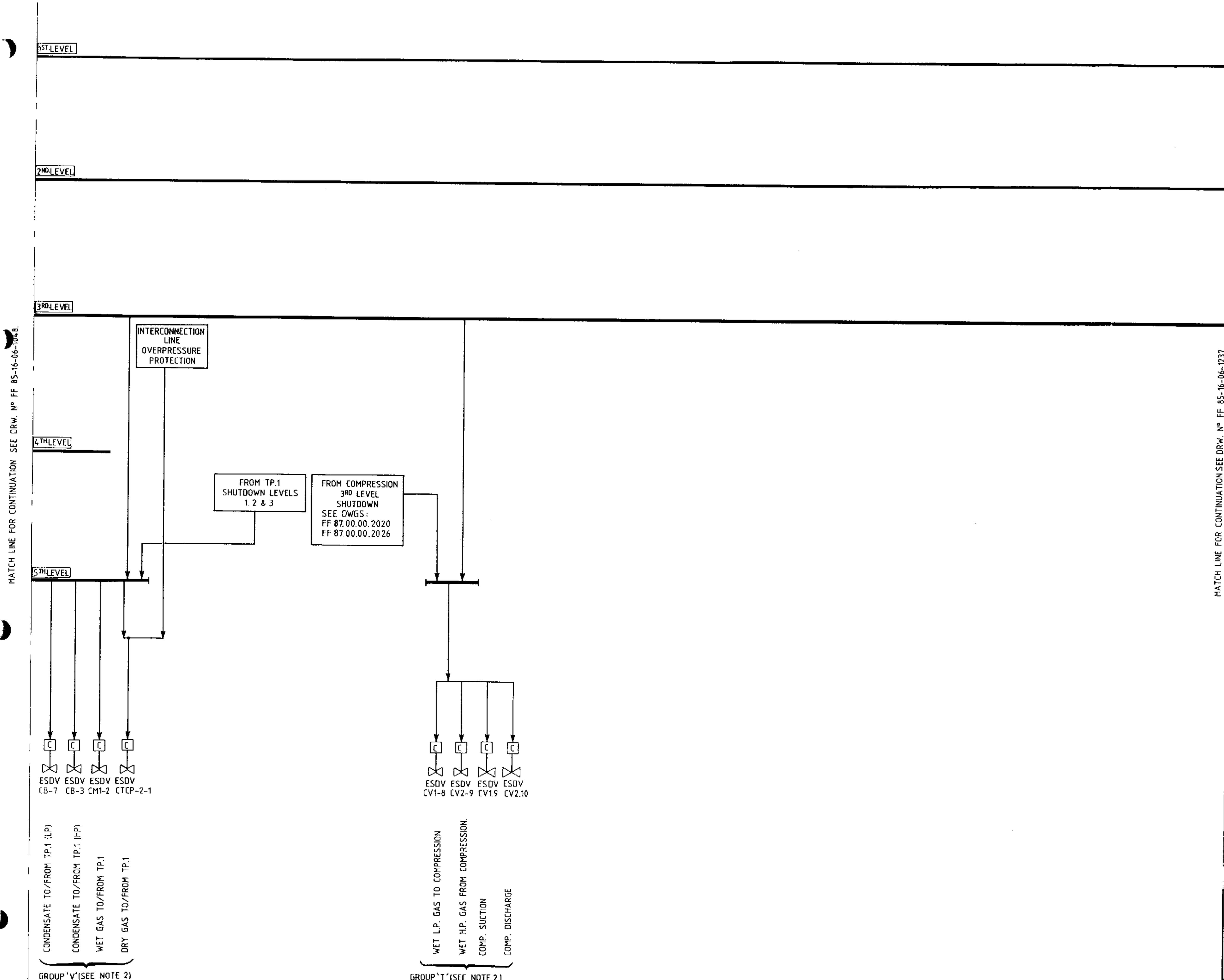
NORTH SEA JOB 1-40-E2 W.O. 104-M.

McDERMOTT—HUDSON
LONDON — ENGLAND

SCALE NONE — DATE 3RD FEB 76

FF 85-16-06-1049

SHUTDOWN LOGIC DIAGRAM (ELECTRICAL)



NOTES.

1. FOR GENERAL NOTES AND LEGEND SEE DRG N° FF 85-16-06-1047
2. AUTHORISE PUSH BUTTON ON OP MUST BE OPERATED TO ALLOW RE-OPENING OF VALVE AFTER SHUTDOWN.

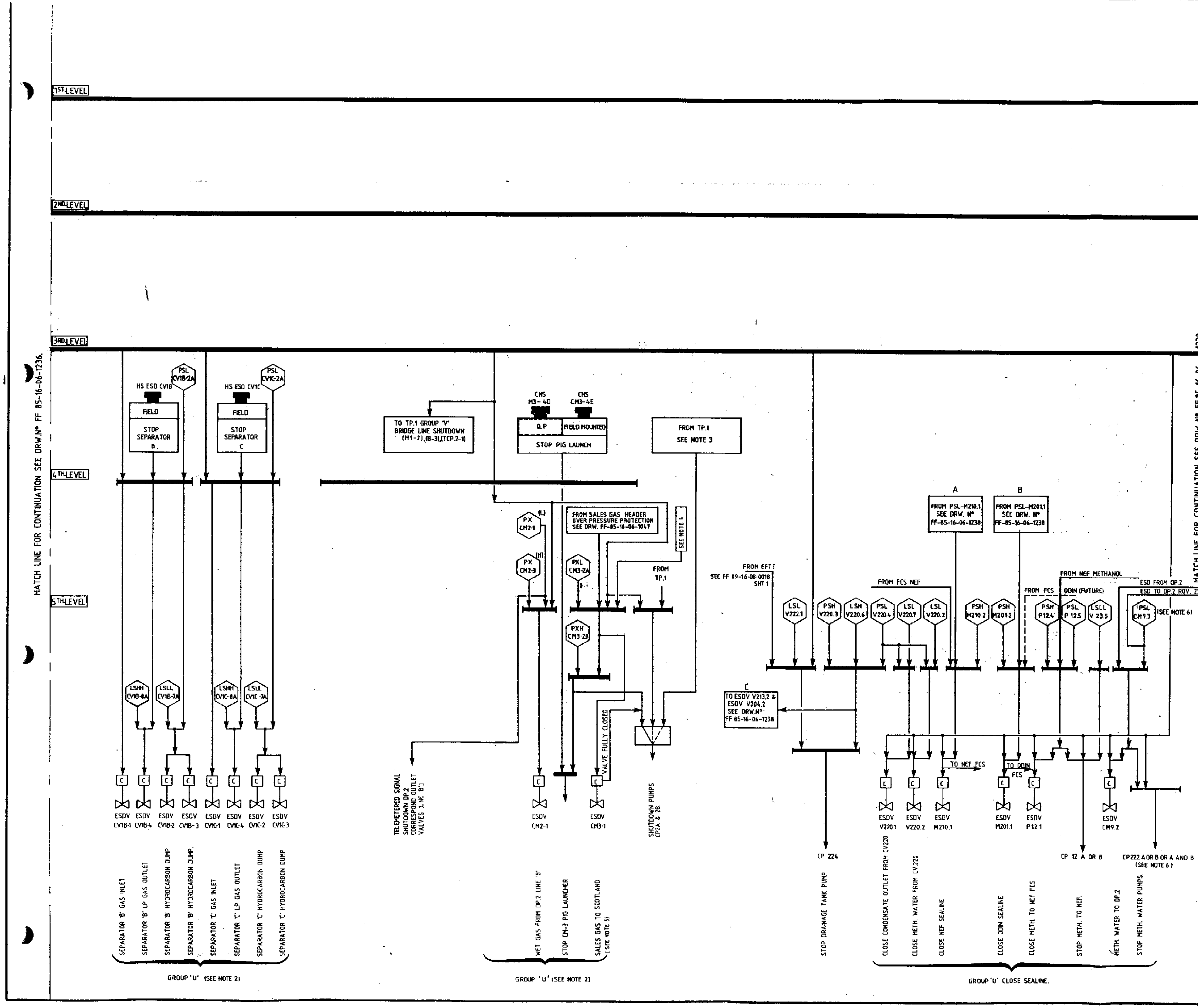
rev	date	DESCRIPTION	by	app
2	1-3-90	A/B. MN12317, MN13048, TPI RISER A/B MN12160	GAS	SR
1	[illegible]	GENERAL UPDATE	PF	SR
0	6.86	first issue	LHW	

elf

elf aquitaine norge as p.o. box 168 4001 Stavanger

A	Installation TCP.2	System SAFTY
Job no	SHUTDOWN LOGIC-DIAGRAM (PROCESS)	
Scale –		

FRIGG FIELD	Drwg no FF 85-16-06-1236	Rev 2	Sheet 1 / 1



NOTES.

1. FOR GENERAL NOTES AND LEGEND SEE DRAWING Nº: FF 85-16-06-1047
2. AUTHORISE PUSH BUTTON ON Q.P MUST BE OPERATED TO ALLOW REOPENING OF VALVE AFTER SHUTDOWN.
3. IF TCP.2 CONDENSATE IS BEING INJECTED INTO TP.1-PIPELINE TO SCOTLAND, THEN A CONTROL SIGNAL MUST BE MANUALLY CONNECTED SO THAT IF VALVE ESDV-CM3-1 (GAS TO SCOTLAND) CLOSES PUMPS CP2A AND B ARE STOPPED.
4. HIGH OR LOW PRESSURE AT INTERMEDIATE PLATFORM IS TELEMETERED TO TCP.2 TO CLOSE ESDV-CM3-1, STOP CM-3 PIG LAUNCH AND STOP PUMPS, CP2A & B.
5. FUNCTION VALVE NOT FULLY OPEN INITIATES INITIAL BARRIER OVERPRESSURE PROTECTION.

REFERENCE DRAWINGS.

FF 88-16-06-9155 SHUTDOWN & SAFETY FUNCTIONS
FF 88-16-06-9150 SHUTDOWN GENERAL LOGIC DIAGRAM FOR TCP.2
FF 88-16-06-9152 FIRE DET. LOGIC PRINCIPLE DIAGRAM 2 SHEETS.
FF 88-16-06-9153 GAS DET. LOGIC PRINCIPLE DIAGRAM 2 SHEETS.
FF 88-16-06-9851 PUBLIC ADDRESS AND ALARM SYSTEM.
FF 89 16 08 0018 EFTI SHUTDOWN DETAIL LOGIC DIAGRAM

NOTE 6. ESD AND PSL SIGNAL FROM DP-2 WILL STOP CP222A OR B OR A AND B WHEN PUMPING TO DP-2.

rev.	date	DESCRIPTION	by	app.
5	13.9.91	AS BUILT FOLIO 12219.		SR
4	03.07.90	TPI RISER NB MN 12317		SR
3	11.05.89	GENERAL UPDATE	P.F.	SR
2	23.11.88	AS-BUILT, EF TIE-IN.	I.G.	
1	06.88	UPDATED MN 90127	MM	SR
0	06.86	first issue	LHW	

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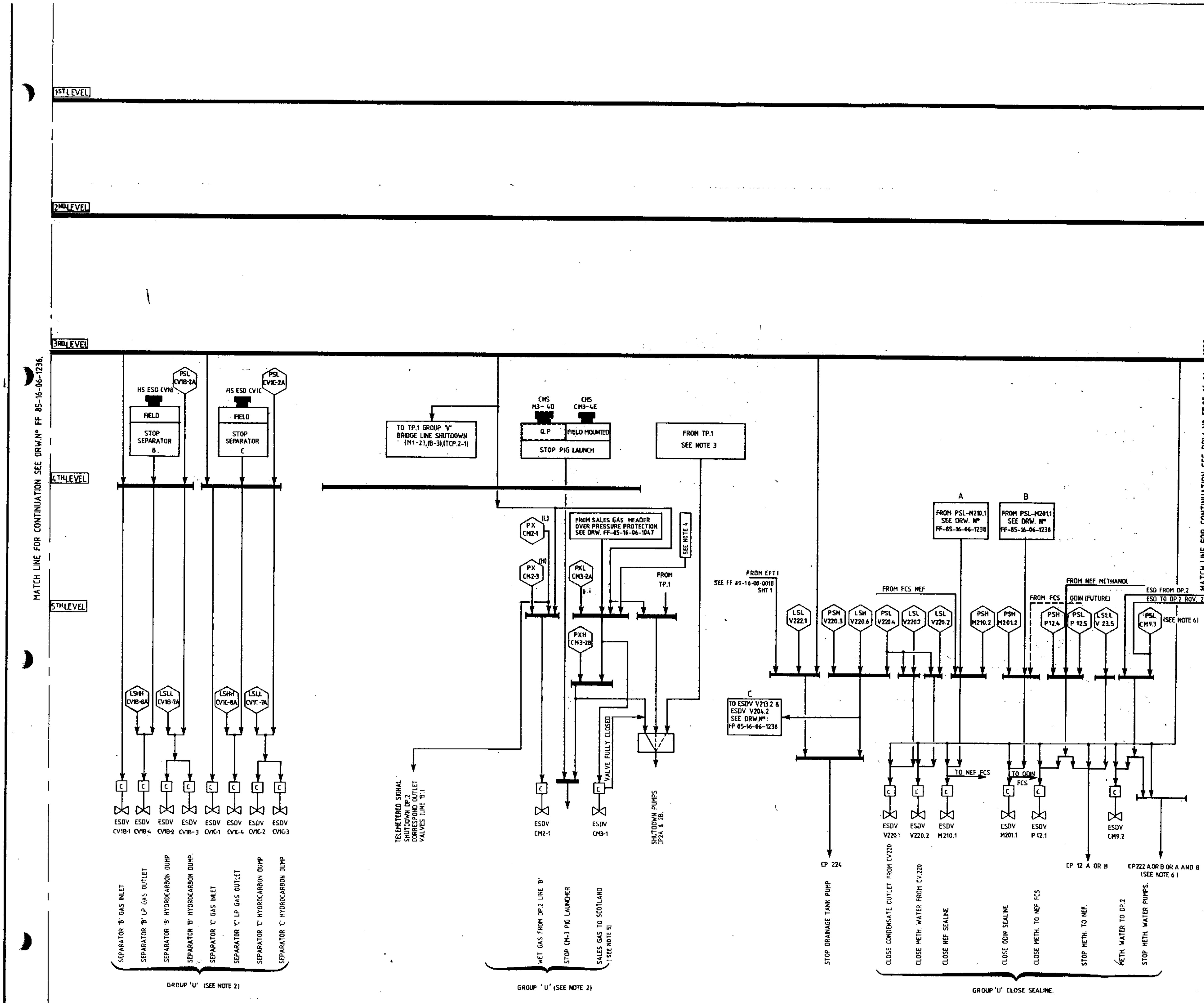
A | Installation: TCP. 2 | System: SAFETY

Job no. | SHUTDOWN LOGIC – DIAGRAM (PROCESS)

Scale

FRIGG FIELD | Drwg no. FF 85-16-06-1237 | Rev. 5 | Sheet 1/1



NOTES.

1. FOR GENERAL NOTES AND LEGEND SEE DRAWING N°: FF 85-16-06-1047
2. AUTHORISE PUSH BUTTON ON Q.P MUST BE OPERATED TO ALLOW REOPENING OF VALVE AFTER SHUTDOWN.
3. IF TCP.2 CONDENSATE IS BEING INJECTED INTO TP.1-PIPELINE TO SCOTLAND, THEN A CONTROL SIGNAL MUST BE MANUALLY CONNECTED SO THAT IF VALVE ESDV-CM3-1 (GAS TO SCOTLAND) CLOSES PUMPS CP2A AND B ARE STOPPED.
4. HIGH OR LOW PRESSURE AT INTERMEDIATE PLATFORM IS TELEMETERED TO TCP.2 TO CLOSE ESDV-CM3-1, STOP CM-3 PIG LAUNCH AND STOP PUMPS, CP2A & B.
5. FUNCTION VALVE NOT FULLY OPEN INITIATES INITIAL BARRIER OVERPRESSURE PROTECTION.

REFERENCE DRAWINGS.

FF 88-16-06-9155 SHUTDOWN & SAFETY FUNCTIONS
FF 88-16-06-9150 SHUTDOWN GENERAL LOGIC DIAGRAM FOR TCP.2
FF 88-16-06-9152 FIRE DET. LOGIC PRINCIPLE DIAGRAM 2 SHEETS.
FF 88-16-06-9153 GAS DET. LOGIC PRINCIPLE DIAGRAM 2 SHEETS.
FF 88-16-06-9851 PUBLIC ADDRESS AND ALARM SYSTEM.
FF 89 16 08 0018 EFTI SHUTDOWN DETAIL LOGIC DIAGRAM

NOTE

6. ESD AND PSL SIGNAL FROM DP-2 WILL STOP CP222A OR B OR A AND B WHEN PUMPING TO DP-2.

rev.	date	DESCRIPTION	by	app.
5	13.9.91	AS BUILT FOLIO 12219.	[illegible]	SR
4	02.07.90	TP1 RISER NB MN 12317	B.E.	SR
3	11.05.89	GENERAL UPDATE	P.F.	SR
2	23.11.88	AS-BUILT, EF TIE-IN.	I.G.	[illegible]
1	06.88	UPDATED MN90127	MM	SR
0	06.86	first issue	LHW	

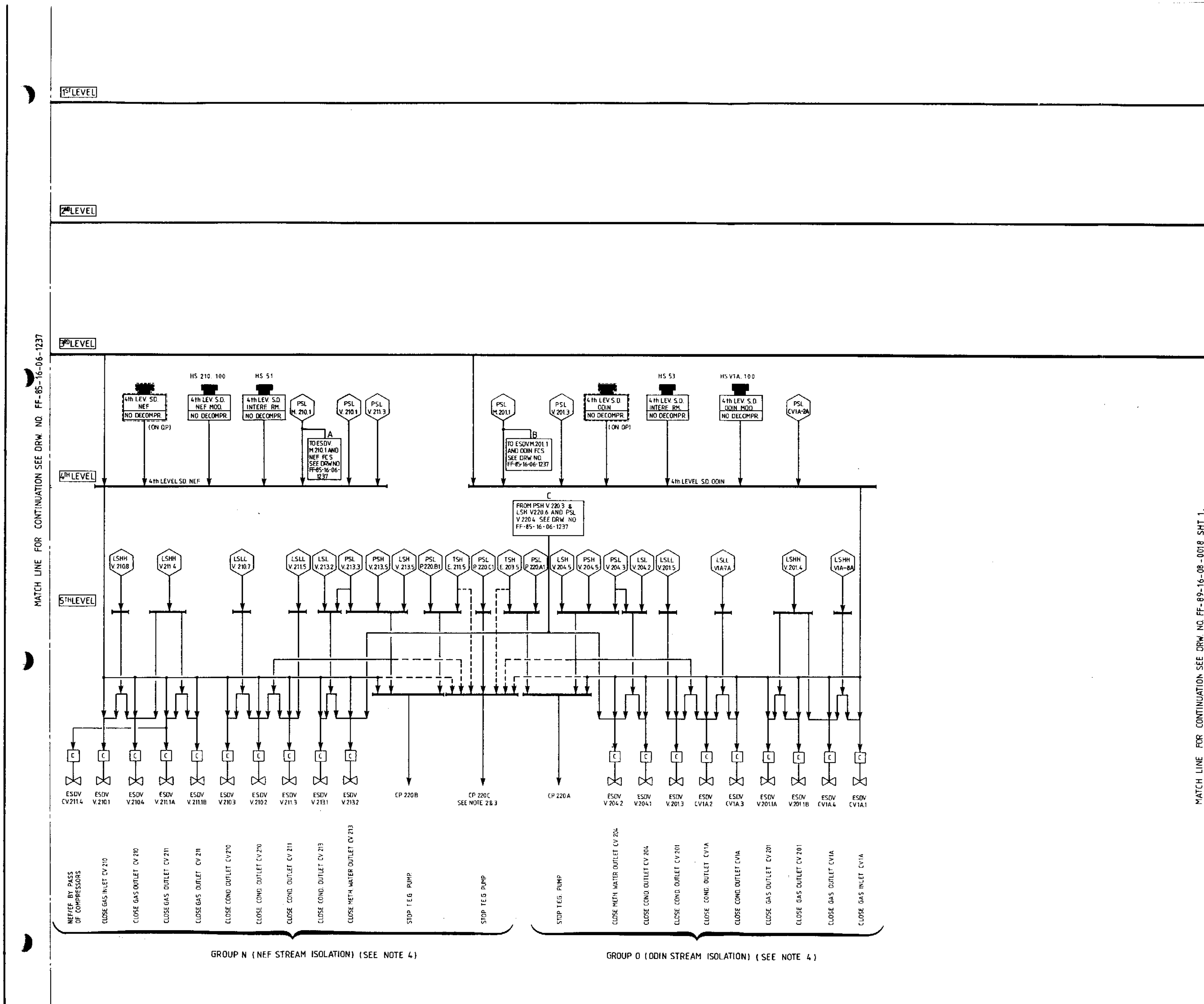
elf aquitaine norge as p.o.box 168 – 4001 Stavanger

A | Installation: TCP. 2 | System: SAFETY

Job no. | Scale

SHUTDOWN LOGIC – DIAGRAM (PROCESS)

FRIGG FIELD | Drwg. no. FF 85-16-06-1237 | Rev. 5 | Sheet 1/1



NOTES.

1. FOR GENERAL NOTES AND LEGEND SEE DRW. NO. FF-85-16-06-1047
2. IF PUMP 'C' IS USED AS STAND BY FOR PUMP 'A' IT WILL ONLY BE STOPPED BY SIGNALS FROM CE 203, CV 204 (TSH E203.5, PSH V204.5, PSL V204.3 AND LSH V204.5) AND GROUP 0 ESD SIGNAL. SIGNALS FROM CE 211, CV 213 (TSH E211.5, PSH V213.5, PSL V213.3 AND LSH V213.5) AND GROUP N ESD SIGNAL WILL BE LOCKED.
3. IF PUMP 'C' IS USED AS STAND BY FOR PUMP 'B' IT WILL ONLY BE STOPPED BY SIGNALS FROM CE 211, CV 213 (TSH E211.5, PSH V213.5, PSL V213.3 AND LSH V213.5) AND GROUP N ESD SIGNAL. SIGNALS FROM CE 203, CV 204 (TSH E203.5, PSH V204.5, PSL V204.3 AND LSH V204.5) AND GROUP O ESD SIGNAL WILL BE LOCKED.
4. AUTHORISE PUSH BUTTON ON QP MUST BE OPERATED TO ALLOW REOPENING OF VALVE AFTER SHUT DOWN.

REFERENCE DRAWINGS.

FF-88-16-06-9155 SHUT-DOWN & SAFETY FUNCTIONS
FF-88-16-00-9150 SHUT-DOWN GENERAL LOGIC DIAGRAM FOR TCP 2
FF-88-16-06-9152 FIRE DET., LOGIC PRINCIPLE DIAGRAM 2 SHEETS
FF-88-16-06-9153 GAS DET., LOGIC PRINCIPLE DIAGRAM 2 SHEETS
FF-88-16-06-9851 PUBLIC ADDRESS AND ALARM SYSTEM

rev.	date	DESCRIPTION	by	app
4	8.2.90	AS BUILT MN 85139/1 (Folio 11321)	R2dL	SR
3	16.0[illegible]	GENERAL UPDATE	P.F	SR
02	28.11.88	REFERENCE DWG NO CHANGED	IG	[illegible]
1	27.9.88	GENERAL UPDATE	[illegible]	SR
0	06.86	first issue	KU	

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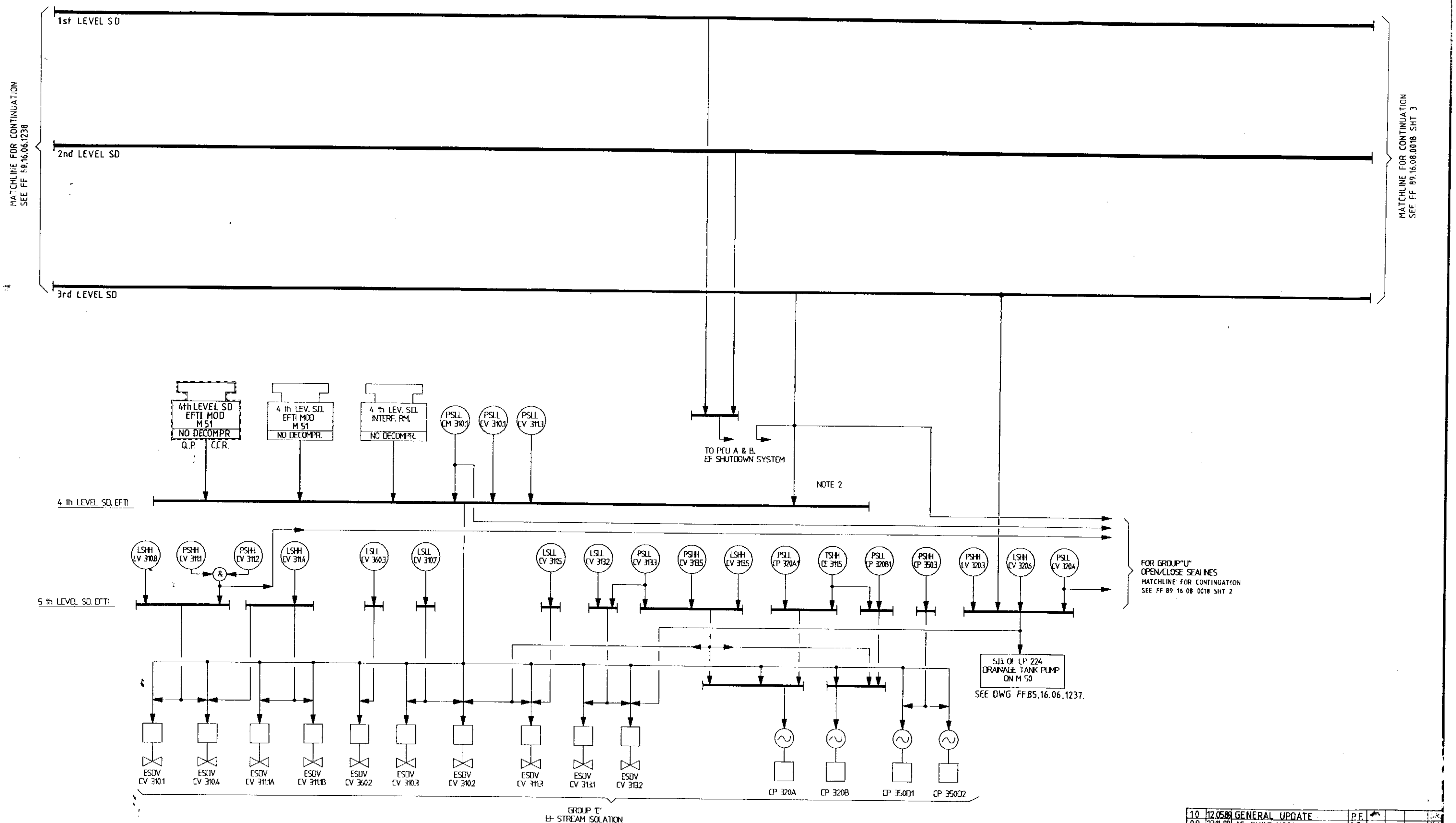
A	Installation: TCP 2	System: SAFETY
Job no	SHUTDOWN LOGIC - DIAGRAM (PROCESS)	
Scale		
FRIGG FIELD	Drwg no: FF - 85-16-06-1238	Rev: 4 / Sheet: 1 1



NOTES

1. 3 POSITION SWITCH : POSITION 1 : LSLL CV 350 A2 GOES TO OUTPUT A.
LSLL CV 350 B2 GOES TO OUTPUT B
POSITION 2 : LSLL CV 350 A2 GOES TO OUTPUT A&B.
LSLL CV 350 B2 DISCONNECTED
POSITION 3 : LSLL CV 350 B2 GOES TO OUTPUT A&B
LSLL CV 350 A2 DISCONNECTED
2. GROUP "E" BYPASS SWITCH INHIBITS SHUTDOWN OF GROUP "E" VALVES ONLY FROM 3 rd LEVEL SD.
3. GROUP "U" BYPASS SIGNAL INHIBITS SHUTDOWN OF GROUP "U" VALVES ONLY FROM 3 rd LEVEL SD.

LEGEND

MISC.	GROUP	GROUP	GROUP	GROUP

LEGEND

ISOLATION ESD VALVE NORMALLY OPEN ESD POSITION : CLOSE

METHANOL BACK UP ESD VALVE NORMALLY CLOSED. ESD POSITION OPENS FOR 30 MINUTES

BLOW DOWN ESD VALVE NORMALLY CLOSED ESD POSITION : OPEN

D 30 — TIME DELAY - ESD DELAYED FOR 30 MINUTES

T 30 — TIMER - ON ESD WILL OPERATE ESDV FOR 30 MINUTES

I — INHIBIT BLOCK - ESD SIGNAL ON I - INPUT WILL INHIBIT OPERATION OF ESDV OR RESET TO CLOSED POSITION

REFERENCE DRAWINGS/SPECIFICATIONS

NO.	TITLE
FF 88 16 08 9551	SHUTDOWN LOGIC DIAGRAM (FOR NEF & ODIN)
FF 00 16 00 5801	FRIGG FIELD SHUT DOWN GENERAL LOGIC DIAGRAM
FF 89 00 00 0024	SCHEMATIC PROCESS DIAGRAM
FF 89 16 06 1047	SHUTDOWN LOGIC DIAGRAM (PROCESS)
FF 89 16 06 0014	FIRE DETECTION LOGIC DIAGRAM
FF 89 16 06 0010	GAS DETECTION LOGIC DIAGRAM
EF 20 00 00 0049	EF ESD LOGIC DIAGRAM

REV	DATE	DESCRIPTION	BY	CHK.	DISC. SUP.	REVIEW	APP
10	12.05.89	GENERAL UPDATE	P.E.				
09	23.11.88	AS-BUILT HOOK-UP	I G				

CONTRACTOR | CLIENT

Aker Engineering A/S
SUBCONTRACTOR TECHNIP GEOPRODUCTION

EAST FRIGG TIE-IN

elf aquitaine norge a/s pobox 168-4001 Stavanger

A | Installation: TCP 2 | System: HYDRAULIC AND S.D.

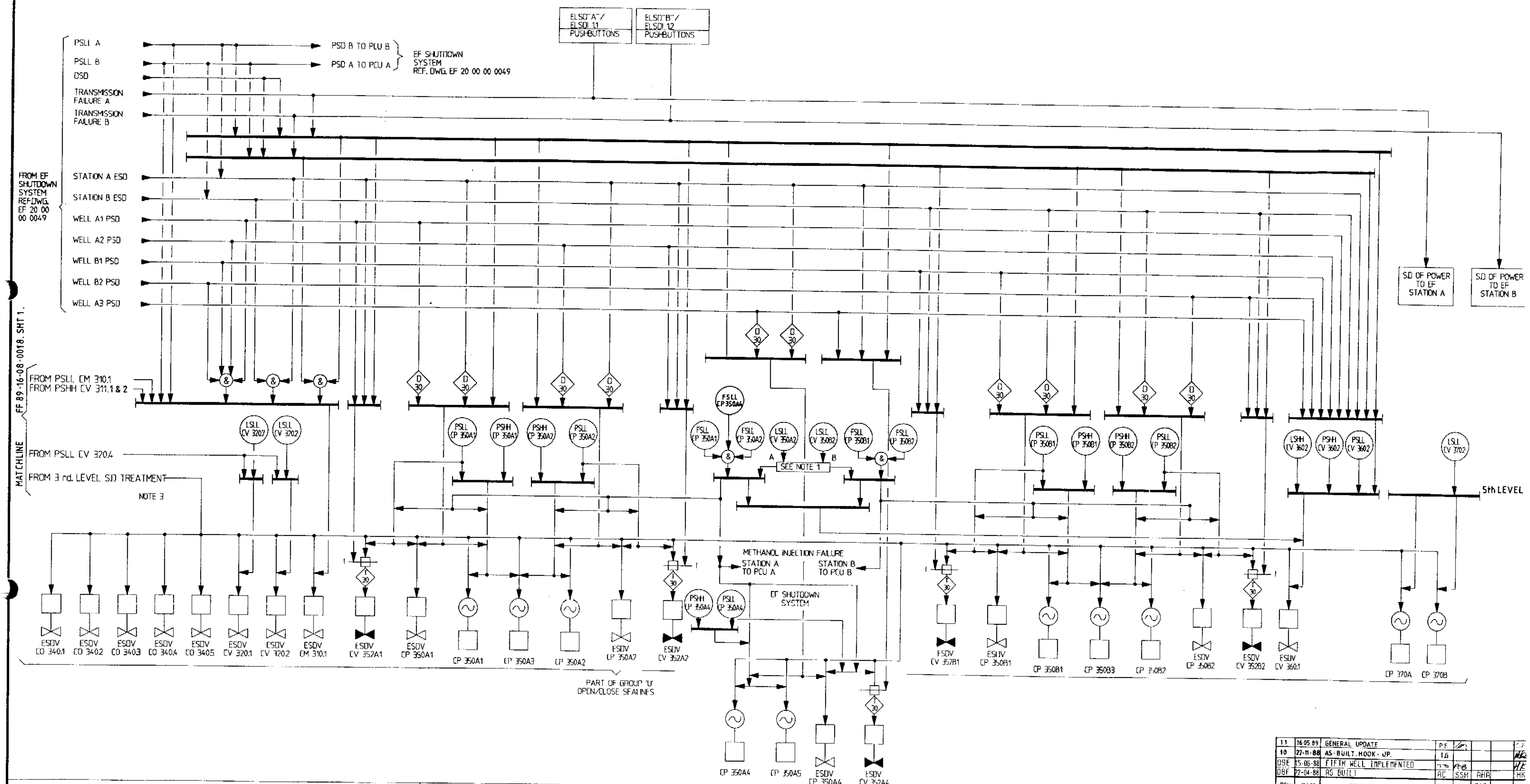
A

Job no: 5193

Scale: NONE

EFTI SHUT DOWN DETAIL LOGIC DIAGRAM EAST FRIGG TIE-IN

FRIGG FIELD | Dwg no: FF 89 16 08 0018 | Rev: 10 | Sheet: 1/3



NOTES

1. 3 POSITION SWITCH : POSITION 1 : LSLL CV 350 A2 GOES TO OUTPUT A,
   LSLL CV 350 B2 GOES TO OUTPUT B
   POSITION 2 : LSLL CV 350 A2 GOES TO OUTPUT A&B,
   LSLL CV 350 B2 DISCONNECTED
   POSITION 3 : LSLL CV 350 B2 GOES TO OUTPUT A&B
   LSLL CV 350 A2 DISCONNECTED
2. GROUP "E" BYPASS SWITCH INHIBITS SHUTDOWN OF GROUP "E" VALVES ONLY FROM 3 rd LEVEL SD.
3. GROUP "U" BYPASS SIGNAL INHIBITS SHUTDOWN OF GROUP "U" VALVES ONLY FROM 3 rd LEVEL SD.

LEGEND

MISC.	GROUP	GROUP	GROUP	GROUP

LEGEND

- ISOLATION ESD VALVE NORMALLY OPEN FSD POSITION : CLOSE
- METHANOL BACK UP ESD VALVE NORMALLY CLOSED. ESD POSITION :OPENS FOR 30 MINUTES
- BLOW DOWN ESD VALVE NORMALLY CLOSED ESD POSITION : OPEN
- D 30: TIME DELAY - ESD DELAYED FOR 30 MINUTES
- T 30: TIMER - ON ESD WILL OPERATE ESDV FOR 30 MINUTES
- INHIBIT BLOCK - ESD SIGNAL ON I - INPUT WILL INHIBIT OPERATION OF ESDV OR RESET TO CLOSED POSITION

REFERENCE DRAWINGS/SPECIFICATIONS

NO.	TITLE
FF 88 16 08 9551	SHUTDOWN LOGIC DIAGRAM (FOR NEF & ODIN)
FF 00 16 00 5801	FRIGG FIELD SHUT DOWN GENERAL LOGIC DIAGRAM
FF 89 00 00 0024	SCHEMATIC PROCESS DIAGRAM
FF 85 16 06 1047	**SHUTDOWN LOGIC DIAGRAM (PROCESS)**
FF 89 16 06 0014	FIRE DETECTION LOGIC DIAGRAM
FF 89 16 06 0010	GAS DETECTION LOGIC DIAGRAM
EF 20 00 00 0049	FF ESD LOGIC DIAGRAM

REV	DATE	DESCRIPTION	BY	CHK.	DISC. SUP.	REVIEW	APP
11	16.05.89	GENERAL UPDATE	P.F.				
10	22-11-88	AS-BUILT. HOOK-UP.	T.G.				
09E	15-06-88	FIFTH WELL IMPLEMENTED					HK
08F	22-04-88	AS BUILT	AC	SSH	AHA		HK

CONTRACTOR | CLIENT

Aker Engineering A/S
SUBCONTRACTOR TECHNIP GEOPRODUCTION

EAST FRIGG TIE-IN

elf aquitaine norge a/s p.o.box 168-4001 Stavanger

	Installation	System
A	TCP 2	HYDRAULIC AND S.D.

Job no 5193
Scale NONE

EFTI SHUT DOWN DETAIL LOGIC DIAGRAM EAST FRIGG TIE-IN

FRIGG FIELD — Drwg no FF 89 16 08 0019 — Rev 11 — Sheet 2/3

Det store arket skal inn her!!!

nr 286

Sht. No.	Rev. No.	Date	by	Title
1	17	13.9.91	[illegible]	Front / Index sheet
2	15	04.07.90	BK	Group 'A'
3	15	04.07.90	BK	Group 'B'
4				
5	14	23.01.90	RK	Group 'N'
6	12	16.05.89	PAF	Group 'O'
7	17	13.9.91	[illegible]	Group 'U'
8	17	13-9-91	[illegible]	Group 'U'
9	17	13.9.91	[illegible]	Group 'T', 'V', 'W'
10	16	24.10.90	IS.	Group 'X' 'P' & Miscellaneous
11	12	16.05.89	PAF	Group 'E' (East Frigg)
12	h2	16.05.89	BK	Group 'U'
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rev.	date	DESCRIPTION	by	app.
14	23.01.90	AS BUILT MN 85139/1 (11321) & (13048) 85149	R.J.	[illegible]
13	26/7/89	GENERAL UPDATE	PAF.	
12	16.05.89	GENERAL UPDATE	PAF	
11	14.12.88	EAST FRIGG TIE-IN AS BUILT	I.G.	[illegible]
9	13.11.87	AS BUILT	S.B.	SR
17	13.9.91	AS BUILT FOLIO 12677 & 12219 (SHT. 4 DELETED)	[illegible]	SR
16	24.10.90	UPDATED FOLIO 12682	RF	SR.
15	04.07.90	TPI RISER A/B MN 12317	B.K.	SR
10	05.08.88	GENERAL UPDATE	K.V.	SR

SR

THIS DRAWING SUPERSEDES:

McDERMOTT – HUDSON, ELN2169 – D700 – 85

elf

elf aquitaine norge a/s p.o.box 168 – 4001 Stavanger

	Installation	System
A	TCP2 T	ESD

Job no.

Scale

ANALYSIS OF SAFETY FUNCTIONS

FRIGG FIELD

Drwg. no.	Rev.	Sheet
FF __ __ 85 16 06 11 84	17	1/12

SIZE A3 Form. 100.298

ANALYSIS OF SAFETY FUNCTION

Group A

Stream A isolation

S.D. LEVEL	DEVICE	TAGS	LOCATION	HP gas inlet glycol contactor	Gas to sales header	Rich glycol from glycol contactor	Glycol regeneration unit	Electrical shut down			Compression inlet valve	Flow control to sales gas header			
			FUNCTION PERFORMED / SHUT DOWN OR CONTROL DEVICE I.D.	ESDV.CV2A-1	ESDV.CV2A-4	ESDV.CV2A-2		CE2A - stop	CP10A - stop	CP10B - stop	50 ESDV. 16-1	FCV-CV2A-2A	FCV-CV2A-2B	FCV-CV2A-2C	FCV-CV2A-2D
1	Break glass push button	HS. MSD. 1	QP Control room	X	X	X	X	X	X	X	X				
2	Break glass push button	CHS. 12	QP Control room	X	X	X	X	X	X	X	X				
	Break glass push button	CHS. 13	TCP2 Shut down cab.	X	X	X	X	X	X	X	X				
3	Push button	CHS. ESD. 6	QP Control panel	X	X	X	X	X	X	X					
	Push button	CHS. ESD. 1	TCP2 Shut down cab.	X	X	X	X	X	X	X					
	Pull handle valve	CHS. ESD. 2	TCP2 Field	X	X	X	X	X	X	X					
	Pull handle valve	CHS. ESD. 3	TCP2 Field	X	X	X	X	X	X	X					
	Pull handle valve	CHS. ESD. 4	TCP2 Field	X	X	X	X	X	X	X					
	Pull handle valve	CHS. ESD. 5	TCP2 Field	X	X	X	X	X	X	X					
	Pull handle valve	at comp. life boat	Compression field	X	X	X	X	X	X	X					
	Contacts in series	Fire in process area	TCP2 Fire Cabinet	X	X	X	X	X	X	X					
	Contacts in series	Gas 60% in proc. area	TCP2 Gas Cabinet	X	X	X	X	X	X	X					
	Contacts in series	Fire in comp. proc. area	Comp. Control room	X	X	X	X	X	X	X					
	Contacts in series	Gas 60% comp.proc.area	Comp. Control room	X	X	X	X	X	X	X					
4	Push button	HS. SD - A (C-HS-3)	QP Control panel	X	X	X		X	X	X					
	Push button	CHS. 2	TCP2 Shut down cab.	X	X	X		X	X	X					
	Pressure switch	PX CV2A-5	TCP2 Field	X	X	X		X	X	X					
	Pressure switch	PSL CV2A - 22A	TCP2 Field	X	X	X		X	X	X	X				
5	Pressure switch	LSLL-CV2A - 5A	TCP2 Field			X									
	Pressure switch	LSHH-CV14A - 3A	TCP2 Field (glycol unit)			X									
	Pressure switch	PXH-CV14A-1	TCP2 Field(glycol unit)			X									
	Relay contact	MC CM3. 1	TCP2 Miscel. rack		(1)										
	Telemetry contact	MC M3. 1	from TP1		(1)										
	Relay contact	MC CV2A. 1	TCP2 Miscel. rack		(1)										
	Pressure switch	PSL-CM3. 2	TCP2 Field		(2)										
	Telemetry contact	PSL- M3. 2	from TP1		(2)										
OPPS	Pressure switch (PRIMARY)	PSH-CV2B-25	TCP2 Field		X							X	X	X	X
	Pressure switch (PRIMARY)	PSH-CV2B-26	TCP2 Field		(4)							(4)	(4)	(4)	(4)
	Limit switch (INITIAL)	EZSH-CM3-1	TCP2 Field		(3)							(3)	(3)	(3)	(3)
	Limit switch (INITIAL)	EZSH-M3-1	From TP1		(4)							(4)	(4)	(4)	(4)
	Pressure switch (PRIMARY)	PSH-M28-14	From TP1		(4)							(4)	(4)	(4)	(4)
	Pressure switch (PRIMARY)	PSH-V2B-25	From TP1		(4)							(4)	(4)	(4)	(4)
	Pressure switch (PRIMARY)	PSH-V2B-26	From TP1		(4)							(4)	(4)	(4)	(4)

NOTE:
1. MC.M3. 1 and MC.CV2A. 1 must both be operated to close ESDV.CV2A. 4 when the stream is connected to pipe 1.
- or MC.CM3.1 and MC.CV2A. 1 must be operated to close ESDV.CV2A. 4 when the stream is connected to pipe 2.

2. PSL M3. 2 closes ESDV.CV2A. 4 when the stream is connected to pipe 1.
PSL CM3. 2 closes ESDV.CV2A. 4 when the stream is connected to pipe 2.

3. Function " valve not fully open "

4. Only operates if any TCP2 HV to interconnection line is not fully closed. (HV-CV2A/B/C-2)

The choice of the pipe is operated from the selector switch CHS.A

Rev.	Date	DESCRIPTION	by	app.
10	08.08.88	GENERAL UPDATE	K.V	
8	13.8.87	REVISED AT1 "AB"	OO	
12	16.05.89	GENERAL UPDATE	PAF	
15	04.07.90	TP1 RISER A/B MN 12317	BK	

Contractor: McDERMOTT-HUDSON ELN2169 - D700 - 85

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FRIGG FIELD

A

Installation: TCP 2 T — System: ESD

Job no. — Scale

GROUP 'A'

Drwg. no. FF 85 16 06 11 84 — Rev. 15 — Sheet 2/

ANALYSIS OF SAFETY FUNCTION

Group B

Stream B isolation

S.D. LEVEL	DEVICE	TAGS	LOCATION	HP gas inlet glycol contactor	Gas to sales header	Rich glycol from glycol contactor	Glycol regeneration unit	Electrical shut down			Compression inlet valve	Flow control to sales gas header			
			SHUT DOWN OR CONTROL DEVICE I.D.	ESDV.CV2B-1	ESDV.CV2B-4	ESDV.CV2B-2		CE2B - stop	CP10C - stop	CP10D - stop	50 ESDV. 16-2	FCV-CV2B-2A	FCV-CV2B-2B	FCV-CV2B-2C	FCV-CV2B-2D
1	Break glass push button	HS. MSD. 1	Q.P Control room	X	X	X	X	X	X	X	X				
2	Break glass push button	CHS. 12	Q.P Control room	X	X	X	X	X	X	X	X				
	Break glass push button	CHS. 13	TCP2 Shut down cab.	X	X	X	X	X	X	X	X				
3	Push button	CHS. ESD. 6	Q.P Control panel	X	X	X	X	X	X	X					
	Push button	CHS. ESD. 1	TCP2 Shut down cab.	X	X	X	X	X	X	X					
	Pull handle valve	CHS. ESD. 2	TCP2 Field	X	X	X	X	X	X	X					
	Pull handle valve	CHS. ESD. 3	TCP2 Field	X	X	X	X	X	X	X					
	Pull handle valve	CHS. ESD. 4	TCP2 Field	X	X	X	X	X	X	X					
	Pull handle valve	CHS. ESD. 5	TCP2 Field	X	X	X	X	X	X	X					
	Pull handle valve	at comp. life boat	Compression field	X	X	X	X	X	X	X					
	Contacts in series	Fire in process area	TCP2 Fire Cabinet	X	X	X	X	X	X	X					
	Contacts in series	Gas 60% in proc. area	TCP2 Gas Cabinet	X	X	X	X	X	X	X					
	Contacts in series	Fire in comp. proc. area	Comp. Control room	X	X	X	X	X	X	X					
	Contacts in series	Gas 60% comp.proc.area	Comp. Control room	X	X	X	X	X	X	X					
4	Push button	HS.ESD - B (C-HS-6)	Q.P Control panel.	X	X	X		X	X	X					
	Push button	CHS. 5	TCP2 Shut down cab.	X	X	X		X	X	X					
	Pressure switch	PX CV2B-5	TCP2 Field	X	X	X		X	X	X					
	Pressure switch	PSL CV2B - 22A	TCP2 Field	X	X	X		X	X	X	X				
5	Pressure switch	LSLL-CV2B - 5A	TCP2 Field			X									
	Pressure switch	LSHH-CV14B - 3A	TCP2 Field (glycol unit)			X									
	Pressure switch	PXH-CV14B-1				X									
	Relay contact	MC CM3. 1	TCP2 Miscel. rack		(1)										
	Telemetry contact	MC M3. 1	from TP1		(1)										
	Relay contact	MC CV2B. 1	TCP2 Miscel. rack		(1)										
	Pressure switch	PSL-CM3. 2	TCP2 Field		(2)										
	Telemetry contact	PSL- M3. 2	from TP1		(2)										
OPPS	Pressure switch (PRIMARY)	PSH-CV2B-25	TCP2 Field		X							X	X	X	X
	Pressure switch (PRIMARY)	PSH-CV2B-26	TCP2 Field		(4)							(4)	(4)	(4)	(4)
	Limit switch (INITIAL)	EZSH-CM3-1	TCP2 Field		(3)							(3)	(3)	(3)	(3)
	Limit switch (INITIAL)	EZSH-M3-1	From TP1		(4)							(4)	(4)	(4)	(4)
	Pressure switch (PRIMARY)	PSH-M28-14	From TP1		(4)							(4)	(4)	(4)	(4)
	Pressure switch (PRIMARY)	PSH-V2B-25	From TP1		(4)							(4)	(4)	(4)	(4)
	Pressure switch (PRIMARY)	PSH-V2B-26	From TP1		(4)							(4)	(4)	(4)	(4)

NOTE:

1. MC.M3. 1 and MC.CV2B. 1 must both be operated to close ESDV.CV2B. 4 when the stream is connected to pipe 1.
   - or MC.CM3.1 and MC.CV2B. 1 must be operated to close ESDV.CV2B. 4 when the stream is connected to pipe 2.
2. PSL M3. 2 closes ESDV.CV2B. 4 when the stream is connected to pipe 1. PSL CM3. 2 closes ESDV.CV2B. 4 when the stream is connected to pipe 2.
3. Function " valve not fully open "
4. Only operates if any TCP2 HV to interconnection line is not fully closed. (HV-CV2A/B/C-2)

The choice of the pipe is operated from the selector switch CHS.B

Rev.	Date	DESCRIPTION	by	app.
10	08.08.88	GENERAL UPDATE	K.V.	
8	13.8.87	REVISED ATI "AB"	OO	
12	16.05.89	GENERAL UPDATE	PAF	
15	04.07.90	TP1 RISER A/B MN 12317	BK	

Contractor: McDERMOTT-HUDSON ELN2169 - D700 - 85

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A | Installation: TCP 2 T | System: ESD | Job no. | Scale | GROUP 'B'

Drwg. no. FF 85 16 06 11 84 | Rev. 15 | Sheet 3/

ANALYSIS OF SAFETY FUNCTION

Group 'N'

NEF isolation

S.D. LEVEL	DEVICE	TAGS	LOCATION	Close gas inlet CV210 (ESDV-V210.1)	Close cond. outlet CV210 (ESDV-V210.2)	Close cond. outlet CV210 (ESDV-V210.3)	Close gas outlet CV210 (ESDV-V210.4)	Close gas outlet CV211 (ESDV-V211.1A)	Close gas outlet CV211 (ESDV-V211.1B)	Close cond. outlet CV211 (ESDV-V211.3)	NEF/EF BY PASS OF COMPRESSORS (ESDV-CV211.4)	Close meth. water outlet CV213 (ESDV-V213.2)	Close cond. outlet CV213 (ESDV-V213.1)	Stop T.E.G. pump (CP-220 B)	Stop T.E.G. pump (CP-220 C)
1	Push button	CHS-MSD-1	Q.P. Control room	X	X	X	X	X	X	X	X	X	X	X	X
2	Push button	CHS-12	Q.P. Control room	X	X	X	X	X	X	X	X	X	X	X	X
	Push button	CHS-13	TCP2 Shut down cab.	X	X	X	X	X	X	X	X	X	X	X	X
3	Push button	CHS-ESD-6	Q.P. Control panel	X	X	X	X	X	X	X	X	X	X	X	X
	Push button	CHS-ESD-1	TCP2 Shut down cab.	X	X	X	X	X	X	X	X	X	X	X	X
	Pull handle valve	CHS-ESD-2	TCP2 Field	X	X	X	X	X	X	X	X	X	X	X	X
	Pull handle valve	CHS-ESD-3	TCP2 Field	X	X	X	X	X	X	X	X	X	X	X	X
	Pull handle valve	CHS-ESD-4	TCP2 Field	X	X	X	X	X	X	X	X	X	X	X	X
	Pull handle valve	CHS-ESD-5	TCP2 Field	X	X	X	X	X	X	X	X	X	X	X	X
	Pull handle valve	at comp. lifeboat	Compression field	X	X	X	X	X	X	X	X	X	X	X	X
	Contact in series	Gas 60% in proc. area	TCP2 Gas cabinets	X	X	X	X	X	X	X	X	X	X	X	X
	Contact in series	Fire in process area	TCP2 Fire cabinets	X	X	X	X	X	X	X	X	X	X	X	X
	Contacts in series	Gas 60% comp proc. area	Comp. cont. room	X	X	X	X	X	X	X	X	X	X	X	X
	Contacts in series	Fire comp. proc. area	Comp. cont. room	X	X	X	X	X	X	X	X	X	X	X	X
4	Push button	HS SD-N	Q.P. Control room	X	X	X	X	X	X	X	X	X	X	X	(1)
	Push button	HS 51	TCP2 I/F Room	X	X	X	X	X	X	X	X	X	X	X	(1)
	Push button	HS 210.100	TCP2 Field	X	X	X	X	X	X	X	X	X	X	X	(1)
	Pressure switch	PSL-V210.1	TCP2 Field	X	X	X	X	X	X	X	X	X	X	X	(1)
		PSL-M210.1	TCP2 Field	X	X	X	X	X	X	X	X	X	X	X	(1)
		PSL-V211.3	TCP2 Field	X	X	X	X	X	X	X	X	X	X	X	(1)
5	Pressure switch	LSLL-V210.7	TCP2 Field		X	X									
		LSHH-V210.8	TCP2 Field	X			X								
		LSLL-V211.5	TCP2 Field							X					
		LSHH-V211.4	TCP2 Field				X	X	X		X				
		TSH-E211.5	TCP2 Field											X	(1)
		LSL-V213.2	TCP2 Field									X	X		
		PSH-V213.5	TCP2 Field		X					X				X	(1)
		PSL-V220.4	TCP2 Field									X			
		PSH-V220.3	TCP2 Field									X			
		PSL-P220 B1	TCP2 Field											X	
		PSL-V213.3	TCP2 Field		X					X		X	X	X	(1)
		LSH-V213.5	TCP2 Field		X					X				X	(1)
		LSH-V220.6	TCP2 Field									X			
		PSL-P220 C1	TCP2 Field												X

NOTE.

1. Teg pump (CP220C) is common standby pump for CP220A (Group 'O') and CP220B (Group 'N') and stops on signals indicated thus (1) only if in service for CP220B.

Rev.	Date	DESCRIPTION	by	app.
14	23.1.90	AS BUILT MN 85139/1 (1132)	RK	
2	16.05.89	GENERAL UPDATE	PAF	
6	27.07.84	NEF added	J.J.	

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FRIGG FIELD

A

Installation: TCP2 T

System: ESD

Job no.

Scale

GROUP 'N'

Drwg. no. 85 16 06 11 84

Rev.

Sheet

A3. Form 100.314

ANALYSIS OF SAFETY FUNCTION

Group 'O'

ODIN isolation

S.D. LEVEL	DEVICE	TAGS	LOCATION	ESDV-CV1A-1 (Close gas inlet CV1A)	ESDV-CV1A-2 (Close cond. outlet CV1A)	ESDV-CV1A-3 (Close cond. outlet CV1A)	ESDV-CV1A-4 (Close gas outlet CV1A)	ESDV-V201-1A (Close gas outlet CV201)	ESDV-V201-1B (Close gas outlet CV201)	ESDV-V201-3 (Close cond. outlet CV201)	ESDV-V204-2 (Close meth. water outlet CV204)	ESDV-V204-1 (Close cond. outlet CV204)	CP-220A (Stop T.E.G. pump)	CP-220C (Stop T.E.G. pump)
1	Push button	CHS-MSD-1	Q.P. Control room	X	X	X	X	X	X	X	X	X	X	X
2	Push button	CHS-12	Q.P. Control room	X	X	X	X	X	X	X	X	X	X	X
	Push button	CHS-13	TCP2 Shut down cab.	X	X	X	X	X	X	X	X	X	X	X
3	Push button	CHS-ESD-6	Q.P. Control panel	X	X	X	X	X	X	X	X	X	X	X
	Push button	CHS-ESD-1	TCP2 Shut down cab.	X	X	X	X	X	X	X	X	X	X	X
	Pull handle valve	CHS-ESD-2	TCP2 Field	X	X	X	X	X	X	X	X	X	X	X
	Pull handle valve	CHS-ESD-3	TCP2 Field	X	X	X	X	X	X	X	X	X	X	X
	Pull handle valve	CHS-ESD-4	TCP2 Field	X	X	X	X	X	X	X	X	X	X	X
	Pull handle valve	CHS-ESD-5	TCP2 Field	X	X	X	X	X	X	X	X	X	X	X
	Pull handle valve	at compression lifeboat	compression field	X	X	X	X	X	X	X	X	X	X	X
	Contact in series	Gas 60% in proc. area	TCP2 gas cabinets	X	X	X	X	X	X	X	X	X	X	X
	Contact in series	Fire in process area	TCP2 fire cabinets	X	X	X	X	X	X	X	X	X	X	X
	Contact in series	Gas 60% comp.proc.area	Comp. cont. room	X	X	X	X	X	X	X	X	X	X	X
	Contact in series	Fire comp.proc. area	Comp. cont. room	X	X	X	X	X	X	X	X	X	X	X
4	Push button	HS-SD-0	Q.P. Control room	X	X	X	X	X	X	X	X	X	X	①
	Push button	HS-53	TCP2 I/F room	X	X	X	X	X	X	X	X	X	X	①
	Push button	HS-V1A 100	TCP2 Field	X	X	X	X	X	X	X	X	X	X	①
	Pressure switch	PSL-M201-1	TCP2 Field	X	X	X	X	X	X	X	X	X	X	①
		PSL-V1A-2A	TCP2 Field	X	X	X	X	X	X	X	X	X	X	①
		PSL-V201-3	TCP2 Field	X	X	X	X	X	X	X	X	X	X	①
5	Pressure switch	LSLL-V1A-7A	TCP2 Field		X	X								
		LSHH-V1A-8A	TCP2 Field	X			X							
		LSLL-V201-5	TCP2 Field							X				
		LSHH-V201-4	TCP2 Field				X	X	X					
		TSH-E203-5	TCP2 Field										X	①
		PSL-V204-3	TCP2 Field		X					X	X	X	X	①
		PSH-V204-5	TCP2 Field		X					X			X	①
		LSL-V204-2	TCP2 Field								X	X		
		LSH-V204-5	TCP2 Field		X					X			X	①
		PSL-V220-4	TCP2 Field								X			
		PSH-V220-3	TCP2 Field								X			
		LSH-V220-6	TCP2 Field								X			
		PSL-P220A-1	TCP2 Field										X	
		PSL-P220C-1	TCP2 Field											X

NOTE.

1. Teg. pump (CP-220C) is common standby pump for CP-220A (Group 'O') and CP-220B (Group 'N') and stops on signals indicated thus ① only if in service for CP-220A.

Rev.	Date	DESCRIPTION	by	app.
12	16.05.89	GENERAL UPDATE	PAF	[illegible]
6	27.07.84	ODIN added	J.J.	
0		First issue		

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FRIGG FIELD

A	Installation TCP2 T	System ESD		
Job no.	GROUP 'O'			
Scale				
Drwg. no. FF	85 16 06 11 84	Rev. 12	Sheet 6/	

ANALYSIS OF SAFETY FUNCTION

Group U

Platform isolation
and common functions.

S.D. LEVEL	DEVICE	TAGS	LOCATION	Wet gas from DP2 / ESDV-CM2-1	(Future) / ESDV-CM13-1	Sales gas to Scotland / ESDV-CM3-1	T.o.m. dry gas from 26"(Future) / ESDV-CM4-1	T.o.m. dry gas from 32"(Future) / ESDV-CM5-1	Gas line 'B' } For closing R.O.V. on DP2. / PSL-CM2	DP2 shut down (DSD)	DP2 shut down (ESD)	Elec. non essential supplies	Electrical shut down / CP2A / 2B	Firewater pumps / CP6-A start	CP6-B start	Start firewater pumps to QP & TP1	Pig launching sequence interdiction	Q/P Protection to TP1	Trip compressor A/B/C	Separator gas inlet / ESDV-CV1B-1	Separator dump valve / ESDV-CV1B-2	Separator dump valve / ESDV-CV1B-3	HP gas to glycol contactor / ESDV-CV1B-4	Separator gas inlet / ESDV-CV1C-1	Separator dump valve / ESDV-CV1C-2	Separator dump valve / ESDV-CV1C-3	[illegible] / ESDV-CV1C-[illegible]
1	Break glass push button	CHS-MSD-1	QP Control room	X	X	X	X	X		X		X	(2)	X	X	X	X			X	X	X	X	X	X	X	X
2	Break glass push button	CHS-12	QP Control room	X	X	X	X	X			X	X	(2)	X	X	X	X			X	X	X	X	X	X	X	X
	Break glass push button	CHS-13	TCP2 S.D. Cabinet	X	X	X	X	X			X	X	(2)	X	X	X	X			X	X	X	X	X	X	X	X
3	Push button	CHS-ESD-6	QP Control panel	X	X	X	X	X				X	(2)	X	X	X	X			X	X	X	X	X	X	X	X
	Push button	CHS-ESD-1	TCP2 S.D. Cabinet	X	X	X	X	X				X	(2)	X	X	X	X			X	X	X	X	X	X	X	X
	Pull handle valve	CHS-ESD-2	TCP2 Field	X	X	X	X	X				X	(2)	X	X	X	X			X	X	X	X	X	X	X	X
	Pull handle valve	CHS-ESD-3	TCP2 Field	X	X	X	X	X				X	(2)	X	X	X	X			X	X	X	X	X	X	X	X
	Pull handle valve	CHS-ESD-4	TCP2 Field	X	X	X	X	X				X	(2)	X	X	X	X			X	X	X	X	X	X	X	X
	Pull handle valve	CHS-ESD-5	TCP2 Field	X	X	X	X	X				X	(2)	X	X	X	X			X	X	X	X	X	X	X	X
	Pull handle valve	At comp. life boat	Comp. Field	X	X	X	X	X				X		X	X	X	X			X	X	X	X	X	X	X	X
	Contacts in series	Fire in process area	TCP2 Fire cabinet	X	X	X	X	X				X	(2)	X	X	X	X			X	X	X	X	X	X	X	X
	Contacts in series	Gas 60% in proc. area	TCP2 Gas cabinet	X	X	X	X	X				X	(2)	X	X	X	X			X	X	X	X	X	X	X	X
	Telemetry contact	Start firewater pumps	From QP and TP1											X	X	X											
	Contacts in series	Fire in comp.proc. area	Comp. control room	X	X	X	X	X				X	(2)	X	X	X	X			X	X	X	X	X	X	X	X
	Contacts in series	Gas 60% comp.proc.area	Comp. control room	X	X	X	X	X				X	(2)	X	X	X	X			X	X	X	X	X	X	X	X
	Relay contact	Auto start from comp.	Comp. control room											X													
	Relay contact	Auto start from comp.	Comp. control room												X												
4	Pressure switch	PSL-CV1B-2A	TCP2 Field																	X	X	X	X				
	Hand switch	HS-ESD-CV1B	TCP2 Field																	X	X	X	X				
	Pressure switch	PSL-CV1C-2A	TCP2 Field																					X	X	X	X
	Hand switch	HS-ESD-LV1C	TCP2 Field																					X	X	X	X
OPPS	Secondary Protection	SC1 or SC2	TCP2C Control Room															(6)	(7)								
	Limit switch (INITIAL)	EZSH-M3-1	TP1 Field																(4)								
	Limit switch (INITIAL)	EZSH-CM3-1	TCP2 Field										(2)				X		(5)								
	Pressure switch (PRIMARY)	PSH-CV2B-25	TCP2 Field			X							(2)				X	(4)	X								
	Pressure switch (PRIMARY)	PSH-CV2B-26	TCP2 Field										(2)				X	X	(4)								
	Pressure switch (PRIMARY)	PSH-M28-14	TP1 Field(Alwyn)										(4)				(4)		(4)								
	Pressure switch (PRIMARY)	PSH-V2B-25	TP1 Field										(4)				(4)		(4)								
	Pressure switch (PRIMARY)	PSH-V2B-26	TP1 Field										(2)				X		(4)								
5																											
	Pressure switch	PSH-CM2-3	TCP2 Field	X	X																						
	Pressure switch	PSL-CM2-1	TCP2 Field	X	X				X																		
	Pressure switch	PSH-CM4-1	TCP2 Field				X																				
	Pressure switch	PSL-CM4-2	TCP2 Field				X																				
	Pressure switch	PSH-CM5-1	TCP2 Field					X																			
	Pressure switch	PSL-CM5-2	TCP2 Field					X																			
	Pressure switch	PXL-CM3-2A	TCP2 Field			X							(2)				X										
	Pressure switch	PXH-CM3-2B	TCP2 Field										(2)				X										
	Valve position switch	EZSL-CM3-1	TCP2 Field										X														
	Telemetry contact	Stop CP2A / B	From TP1										(2)														
	Pushbutton	CHS M3-4D	QP														X										
	Push button	HCR-CP6 A	QP Fire/Gas panel											X													
	Push button	HCR-CP6 B	QP Fire/Gas panel												X												
	Position switch	ZS-CM3-1	TCP2 Field														X										
	Pushbutton	CHS CM3-4E	TCP2 Field														X										
	Telemetry contact	PSHL CIP-1	From intern platform			X							(2)				X										
	Pressure switch	LSLL-CV1B-7A	TCP2 Field																		X	X					
	Pressure switch	LSHH-CV1B-8A	TCP2 Field																				X				
	Pressure switch	LSLL-CV1C-7A	TCP2 Field																						X	X	
	Pressure switch	LSHH-CV1C-8A	TCP2 Field																								X

NOTE.

1. –

2. CP2A&B Shutdown depended upon selection for sealine 1 or 2.

3. For group 'U' see also sheet 8 & 12.

4. Only if any interconnection line HV not fully closed (HV-CV2A/B/C-2)

5. Function "not fully open"

6. Only if Alwyn producing through TP1 topsides via back-up line (HV M28-4 or 5 not fully closed)

7. Either SC sensing overpressure in any sales gas export component stops fuel gas to all 3 compressors

Rev.	Date	DESCRIPTION	by	app.
11	14.12.88	REF. DRAWING ADDED	AGT	MB
17	13.9.91	AS BUILT 12219.	IS	[illegible]
15	04.07.90	TP1 RISER A/B MN 12317	BK	[illegible]
12	16.05.89	GENERAL UPDATE	PAF	[illegible]

Contractor: McDERMOTT-HUDSON
ELN2169 - D700 - 85

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FRIGG FIELD

A

Installation: TCP2 T
System: ESD
Job no.
Scale
GROUP 'U'
Drwg. no. FF 85 16 06 11 84
Rev. 17
Sheet 7/

ANALYSIS OF SAFETY FUNCTION

Group 'U'
Including
platform isolation
(ODIN & NEF)

S.D. LEVEL	DEVICE	TAGS	LOCATION	Close ODIN sealine ESDV-M201.1	Close NEF sealine ESDV-M210.1	Stop Condensate Pump CP 227	Close condensate outlet from CV220 ESDV-V220.1	Close meth. water from CV220 ESDV-V220.2	Methanolated water to DP2 ESDV-CM9.2	Close meth. to NEF FCS ESDV-P12.1	Stop meth. waters pumps CP-222 A/B	Stop meth. to NEF CP-12 A/B	Stop water flush pump CP 229	Stop drainage tank pump CP-224	Close ROV 223 on DP2 meth. water PSL CM9-3
1	Push button	CHS-MSD-1	Q.P. Control room	X	X	X	X	X	X	X	X	X	X	X	
2	Push button	CHS-12	Q.P. Control room	X	X	X	X	X	X	X	X	X	X	X	
	Push button	CHS-13	TCP2 Shut down cab.	X	X	X	X	X	X	X	X	X	X	X	
3	Push button	CHS-ESD-6	Q.P. Control room	X	X	X	X	X	X	X	X	X	X	X	
	Push button	CHS-ESD-1	TCP2 Shut down cab.	X	X	X	X	X	X	X	X	X	X	X	
	Pull handle valve	CHS-ESD-2	TCP2 Field	X	X	X	X	X	X	X	X	X	X	X	
	Pull handle valve	CHS-ESD-3	TCP2 Field	X	X	X	X	X	X	X	X	X	X	X	
	Pull handle valve	CHS-ESD-4	TCP2 Field	X	X	X	X	X	X	X	X	X	X	X	
	Pull handle valve	CHS-ESD-5	TCP2 Field	X	X	X	X	X	X	X	X	X	X	X	
	Pull handle valve	At comp. lifeboat	compression field	X	X	X	X	X	X	X	X	X	X	X	
	Contact in series	Gas 60% in proc. area	TCP2 gas det. cab's	X	X	X	X	X	X	X	X	X	X	X	
	Contact in series	Fire in process area	TCP2 fire det. cab's	X	X	X	X	X	X	X	X	X	X	X	
	Contact in series	Gas 60% comp.proc.area	Comp. cont. room	X	X	X	X	X	X	X	X	X	X	X	
	Contact in series	Fire comp. proc. area	Comp. cont. room	X	X	X	X	X	X	X	X	X	X	X	
4	Pressure switch	PSL-M201-1	TCP2 Field	X											
		PSL-M210-1	TCP2 Field		X										
		PSL-V210-1	TCP2 Field												
5	Pressure switch	PSH-M201-2	TCP2 Field	X											
		PSH-M210-2	TCP2 Field		X										
		PSL-V220-4	TCP2 Field				X	X						X	
		PSH-V220-3	TCP2 Field											X	
		LSL-V220-2	TCP2 Field					X							
		LSL-V220-7	TCP2 Field				X								
		LSH-V220-6	TCP2 Field											X	
		PSL-CM9-3	TCP2 Field						X		X				X
		LSLL-V23-5	TCP2 Field									X			
		PSL-P12-5	TCP2 Field							X		X			
		PSH-P12-4	TCP2 Field							X		X			
		LSL-V222-1	TCP2 Field											X	
	Telemetry contact	ESD Signal from DP2	DP2						X		X				
	Telemetry contact	ESD Signal from NEF	NEF		X										
	Telemetry contact	Meth. Sea Line PSH	NEF							X		X			

NOTE.

1. For group 'U' see also sheet 7 & 12.

Rev.	Date	DESCRIPTION	by	app.
11	14.12.88	UPDATED	IG	
17	13-9-91	GEN. UPDATE		
12	18/5/89	GENERAL UPDATE	PAF	
9		First issue		

Contractor

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FRIGG FIELD

A	Installation TCP2 T	System ESD
Job no.	GROUP 'U'	
Scale		
Drwg. no. FF 85 16 06 11 84	Rev. 17	Sheet 8

ANALYSIS OF SAFETY FUNCTION

Groups V bridge isolation

Group W, blow down (with time delay)

Group T, compression isolation

S.D. LEVEL	DEVICE	TAGS	LOCATION	Condensate to/from TP1 ESDV.CB3	Condensate to/from TP1 ESDV.CB7	Wet gas to/from TP1 ESDV.CM1.2	Dry gas to/from TP1 ESDV.CTCP2.1	Compression isolation ESDV.CB8	Bridge isolation-SEE NOTE 3 GROUP V-TP1	Wet gas from DP2 Vent ESDV.CM1.3	Wet gas from DP2 Vent ESDV.CM2.3	LT gas vent ESDV-M201-2	LT gas vent ESDV-CV1A-6	LT gas vent ESDV-V201-2	Glycol contactor vent ESDV.CV2A.3	Gas to glycol contactor vent ESDV.CV2A.8	LT gas vent ESDV.CV2-1	HP gas vent ESDV.CV1B.5	Separator vent ESDV.CV1B.6	Glycol contactor vent ESDV.CV2B.3	Gas to glycol contactor vent ESDV.CV2B.8
1	Break glass push button	HS.MSD.1	QP Control room	X	X	X	X	X	X												
2	Break glass push button	CHS.12	QP Control room	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Break glass push button	CHS.13	TCP2 Shut down cab.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3	Push button	CHS.ESD.6	QP Control room	X	X	X	X	X	X												
	Push button	CHS.ESD.1	TCP2 Shut down cab.	X	X	X	X	X	X												
	Pull handle valve	CHS.ESD.2	TCP2 Field	X	X	X	X	X	X												
	Pull handle valve	CHS.ESD.3	TCP2 Field	X	X	X	X	X	X												
	Pull handle valve	CHS.ESD.4	TCP2 Field	X	X	X	X	X	X												
	Pull handle valve	CHS.ESD.5	TCP2 Field	X	X	X	X	X	X												
	Pull handle valve	At comp. life boat	Compression field	X	X	X	X	X	X												
	Contacts in series	Fire in process area	TCP2 Fire cabinet	X	X	X	X	X	X												
	Contacts in series	Gas 60% in proc. area	TCP2 Gas cabinet	X	X	X	X	X	X												
	Contacts in series	Fire in comp. proc. area	Comp. control room	X	X	X	X	X	X												
	Telemetry contact	Bridge isolation-NOTE 3	from TP1-Group V	X	X	X	X														
	Contacts in series	Gas 60% comp.proc.area	Comp. control room	X	X	X	X	X	X												
	Relay contact	Bridge isolation	Comp. control room																		
	Relay contacts	Compression isolation	Comp.control room					X													
4	Pneumatic relay	PX.CV3.7	TCP2 Field																		
	Pneumatic relay	PY.CV2C.6	TCP2 Field																		
OPPS	Pressure switch (PRIMARY)	PSH-CV2B-25	TCP2 Field			(1)															
	Pressure switch (PRIMARY)	PSH-CV2B-26	TCP2 Field			(1)															

DEVICE	TAGS	HP gas vent ESDV.CV1C.5	Separator vent ESDV.CV1C.6	Gas to glycol contactor vent ESDV.CV2C.8	HP gas vent ESDV.CV2C.6	Wet gas from DP2 vent ESDV.CV1C.7	Sales gas header vent ESDV.CV2C.7	Condensate surge tank vent PCV.CV3.4	COMP.SUCTION (T) ESDV.CV1.9	COMP.DISCHARGE (T) ESDV.CV2.10	Comp. 3rd level shut down	LT gas vent ESDV.CV1-2	Wet gas to compression ESDV.CV1.8	Wet gas from compression ESDV.CV2.9	LT GAS VENT. ESDV.CM 310.3.	" " ESDV.CV 310.5.	" " ESDV.CV 311.2.	LT gas vent ESDV-M210-2	LT gas vent ESDV-V210-5	[illegible]
Break glass push button	HS.MSD.1								X	X	X		X	X						
Break glass push button	CHS.12	X	X	X	X	X	X	(2)	X	X		X	X	X	X	X	X	X	X	X
Break glass push button	CHS.13	X	X	X	X	X	X	(2)				X	X	X	X	X	X	X	X	X
Push button	CHS.ESD.6								X	X			X	X						
Push button	CHS.ESD.1								X	X			X	X						
Pull handle valve	CHS.ESD.2								X	X	X		X	X						
Pull handle valve	CHS.ESD.3								X	X	X		X	X						
Pull handle valve	CHS.ESD.4								X	X	X		X	X						
Pull handle valve	CHS.ESD.5								X	X	X		X	X						
Pull handle valve	At comp. life boat								X	X	X		X	X						
Contacts in series	Fire in process area								X	X			X	X						
Contacts in series	Gas 60% in proc. area								X	X			X	X						
Contacts in series	Fire in comp. proc. area								X	X			X	X						
Telemetry contact	Bridge isolation-NOTE 3																			
Contacts in series	Gas 60% comp.proc.area								X	X			X	X						
Relay contact	Bridge isolation								X	X										
Relay contacts	Compression isolation												X	X						
Pneumatic relay	PX.CV3.7							(2)												
Pneumatic relay	PY.CV2C.6				X															
Pressure switch (PRIMARY)	PSH-CV2B-25																			
Pressure switch (PRIMARY)	PSH-CV2B-26																			

NOTE:

1. Only operates if any TCP2 HV to interconnection line is not fully closed. (HV-CV2A/B/C-2)
2. Condensate blowdown only i.p. signal from PX-CV3-7.
3. For control device see matrix (TPI) FF 95.16.06.1046 sht.7. group V valves are located on TP1.

Rev.	Date	DESCRIPTION	by	app.
13	26/7/89	GENERAL UPDATE	PAf	
17	13.9.91	AS BUILT FOLIO 12677.	IS	[signature]
15	04.07.90	TP1 RISER A/B MN 12317	BK	[signature]
14	17.01.90	AS BUILT MN 85149	EVK	[signature]

Contractor: McDERMOTT-HUDSON ELN2169 - D700 - 85

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FRIGG FIELD

A

Installation: TCP2 T

System: ESD

Job no.

Scale

GROUPS: T,V, & W

Drwg. no. FF 85 16 06 11 84

Rev. 17

Sheet 9/

ANALYSIS OF SAFETY FUNCTION

Miscellaneous
(Drainage CV 226)

Groups X
(Bridge blowdown)
Group P
(Gas to compressor blowdown)

S.D. LEVEL	DEVICE	TAGS	LOCATION	ESDV-CB6 (Dry gas to/from TP1)	ESDV-V226-1 (Close drainage from CV226)	ESDV-CB9 (Gas to Compressor blow down)
2	Break glass push button	CHS 12	QP Control room	X		X
	Break glass push button	CHS 13	TCP2 Shut down cab.	X		X
	Telemetry contact SEE NOTE 1	Bridge blowdown	from TP1 - group w.	X		
	Relay contact	Bridge blowdown	from compression			X
5	Pressure switch	LSL-V226-3	TCP2 Field		X	

NOTE: 1) FOR CONTROL DEVICE SEE MATRIX FF.95.16.06.1046 SHT.7. GROUP 'W' VALVES ARE LOCATED ON TP1.

Rev	Date	Description	by	app
16	24.10.90	UPDATED FOLIO 12682	IS	RF
15	04.07.90	TP1 RISER A/B MN 12317	BK	
2	15/5/89	GENERAL UPDATE	PAF	
11	14.12.88	GENERAL UPDATE	AGT	MB

Contractor: McDERMOTT-HUDSON ELN2169 - D700 - 85

elf aquitaine norge a/s, P.O. Box 168, 4001 Stavanger — FRIGG FIELD

A | Installation: TCP2 T | System: ESD
Job no. | GROUPS X, P & MISCELLANEOUS
Scale
Drwg. no. FF 85 16 06 11 84 | Rev. | Sheet 10

Form 100.314

ANALYSIS OF SAFETY FUNCTION

Group 'E'

East Frigg Isolation

S.D. LEVEL	DEVICE	TAGS	LOCATION	Close gas inlet CV310 / ESDV-CV310.1	Close cond. outlet CV310 / ESDV-CV310.2	Close cond. outlet CV310 / ESDV-CV310.3	Close gas outlet CV310 / ESDV-CV310.4	Close gas outlet CV311 / ESDV-CV311.1A	Close gas outlet CV311 / ESDV-CV311.1B	Close cond. outlet CV311 / ESDV-CV311.3	Close meth. water outlet CV313 / ESDV-CV313.2	Close cond. outlet CV313 / ESDV-CV313.1	Stop T.E.G. pump / CP-320A	Stop T.E.G. pump / CP-320B	Close liquid outlet CV360 / ESDV-CV360.2	Stop surface meth. inj. pumps / CP350-D1/D2
1	Break glass push button	CHS-MSD-1	Q.P. Control room	X	X	X	X	X	X	X	X	X	X	X	X	X
2	Break glass push button	CHS-12	Q.P. Control room	X	X	X	X	X	X	X	X	X	X	X	X	X
	Break glass push button	CHS-13	TCP2 Shut down cab.	X	X	X	X	X	X	X	X	X	X	X	X	X
3	Push button	CHS-ESD-6	Q.P. Control panel	X	X	X	X	X	X	X	X	X	X	X	X	X
	Push button	CHS-ESD-1	TCP2 Shut down cab.	X	X	X	X	X	X	X	X	X	X	X	X	X
	Pull handle valve	CHS-ESD-2	TCP2 Field	X	X	X	X	X	X	X	X	X	X	X	X	X
	Pull handle valve	CHS-ESD-3	TCP2 Field	X	X	X	X	X	X	X	X	X	X	X	X	X
	Pull handle valve	CHS-ESD-4	TCP2 Field	X	X	X	X	X	X	X	X	X	X	X	X	X
	Pull handle valve	CHS-ESD-5	TCP2 Field	X	X	X	X	X	X	X	X	X	X	X	X	X
	Pull handle valve	at comp. lifeboat	Compression field	X	X	X	X	X	X	X	X	X	X	X	X	X
	Contact in series	Gas 60% in proc. area	TCP2 Gas cabinets	X	X	X	X	X	X	X	X	X	X	X	X	X
	Contact in series	Fire in process area	TCP2 Fire cabinets	X	X	X	X	X	X	X	X	X	X	X	X	X
	Contact in series	Gas 60% comp.proc.area	Comp. cont. room	X	X	X	X	X	X	X	X	X	X	X	X	X
	Contact in series	Fire comp.proc. area	Comp. cont. room	X	X	X	X	X	X	X	X	X	X	X	X	X
4	Push button		Q.P. Control room	X	X	X	X	X	X	X	X	X	X	X	X	X
	Push button		TCP2 I/F Room	X	X	X	X	X	X	X	X	X	X	X	X	X
	Push button		TCP2 Field	X	X	X	X	X	X	X	X	X	X	X	X	X
	Pressure switch	PSLL-CM310.1	TCP2 Field	X	X	X	X	X	X	X	X	X	X	X	X	X
	Pressure switch	PSLL-CV310.1	TCP2 Field	X	X	X	X	X	X	X	X	X	X	X	X	X
	Pressure switch	PSLL-CV311.3	TCP2 Field	X	X	X	X	X	X	X	X	X	X	X	X	X
	Pushbutton	P.B.C -HS - 54	TCP2 M51 I/F RM	X	X	X	X	X	X	X	X	X	X	X	X	X
	Pushbuttons	14 ESD 1,2,3 & 4	TCP2 M51 FIELD	X	X	X	X	X	X	X	X	X	X	X	X	X
5	Pressure switch	LSLL-CV310.7	TCP2 Field		X	X										
	Pressure switch	LSHH-CV310.8	TCP2 Field	X			X									
	Pressure switch	LSLL-CV311.5	TCP2 Field							X						
	Pressure switch	LSHH-CV311.4	TCP2 Field				X	X	X							
	Pressure switch	PSHH-CV311.1	TCP2 Field	(1)			(1)									
	Pressure switch	PSHH-CV311.2	TCP2 Field	(1)			(1)									
	Pressure switch	TSHH-CE311.5	TCP2 Field										X	X		
	Pressure switch	LSLL-CV313.2	TCP2 Field								X	X				
	Pressure switch	LSHH-CV313.5	TCP2 Field		X					X			X	X		
	Pressure switch	PSLL-CV313.3	TCP2 Field		X					X	X	X	X	X		
	Pressure switch	PSHH-CV313.5	TCP2 Field		X					X			X	X		
	Pressure switch	LSHH-CV320.6	TCP2 Field								X					
	Pressure switch	PSLL-CV320.4	TCP2 Field								X					
	Pressure switch	PSHH-CV320.3	TCP2 Field								X					
	Pressure switch	PSLL-CP320.A1	TCP2 Field										X			
	Pressure switch	PSLL-CP320.B1	TCP2 Field											X		
	Pressure switch	LSLL-CV360.3	TCP2 Field.												X	
	Pressure switch	PSHH-CP350.3	TCP2 Field													X

NOTE.

1. Shutdown signal from PSHH-CV311.1 & PSHH-CV311.2 only when both switches trip.

Rev.	Date	DESCRIPTION	by	app
12	18/5/89	GENERAL UPDATE	PAF	
11	14.12.88	AS-BUILT EAST FRIGG TIE-IN	IG	
10	21.09.88	First issue East Frigg tie-in	PF	

Contractor

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FRIGG FIELD

A | Installation: TCP2 T | System: ESD

Job no | GROUP 'E'

Scale

Drwg. no. FF 85 16 06 11 84 | Rev. 12 | Sheet 11

A3 Form 100.314

ANALYSIS OF SAFETY FUNCTION

GROUP 'U'

EAST FRIGG

S.D. LEVEL	DEVICE	TAGS	LOCATION	Close EF sealine (ESDV-CM 310.1)	Close condensate outlet from CV 320 (ESDV-CV 320.1)	Close meth. water from CV 320 (ESDV-CV 320.2)	STOP drainage tank pump (CP-224)	STOP corrosion inhibitor pump (CP-370 A/B)	CLOSE HYDR. RETURN (ESDV. CO 340.5)	CLOSE ST. B VHP HYDR. LINE (ESDV. CO 340.4)	CLOSE ST. A VHP HYDR. LINE (ESDV. CO 340.2)	CLOSE ST. B HP. HYDR. LINE (ESDV. CO 340.3)	CLOSE ST. A HP. HYDR. LINE (ESDV. CO 340.1)	STOP HP HYDR. PUMP (CP 341)	STOP HP HYDR. PUMPS (CP 343 A/B)	STOP VHP HYDR. PUMP (CP 342)	STOP VHP HYDR. PUMPS (CP 344 A/B)	STOP VHP HYDR. BOOSTER PUMP (CP 346)
1	Break glass pushbutton	CHS-MSD-1	Q.P. Control room	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2	Break glass pushbutton	CHS-12	Q.P. Control room	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Break glass pushbutton	CHS-13	TCP2 Shut down cab.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3	Push button	CHS-ESD-6	Q.P. Control room	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Push button	CHS-ESD-1	TCP2 Shut down cab.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Pull handle valve	CHS-ESD-2	TCP2 Field	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Pull handle valve	CHS-ESD-3	TCP2 Field	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Pull handle valve	CHS-ESD-4	TCP2 Field	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Pull handle valve	CHS-ESD-5	TCP2 Field	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Pull handle valve	At comp. lifeboat	compression field	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Contact in series	Gas 60% in proc. area	TCP2 gas det. cab's	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Contact in series	Fire in process area	TCP2 fire det. cab's	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Contact in series	Gas 60% in comp. process area	Comp. control room	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Contact in series	Fire in comp. process area	Comp. control room	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4	Pressure switch	PSLL CM 310.1	TCP2 Field	X														
5	Pressure switch	PSHH CV 311.1	TCP2 Field NOTE1	(1)														
		PSHH CV 311.2	TCP2 Field NOTE	(1)														
		LSLL CV 320.2	TCP2 Field			X												
		LSLL CV 320.7	TCP2 Field		X													
		LSHH CV 320.6	TCP2 Field				X											
		PSLL CV 320.4	TCP2 Field		X	X	X											
		PSHH CV 320.3	TCP2 Field				X											
			TCP2 Field															
		LSLL CV 350. A2	TCP2 Field															
		LSLL CV 350. B2	TCP2 Field															
		LSHH CV 360.2	TCP2 Field															
		PSLL CV 360.2	TCP2 Field															
		PSHH CV 360.2	TCP2 Field															
		PSLL CP 350.A1	TCP2 Field															
		PSHH CP 350.A1	TCP2 Field															
		PSLL CP 350.A2	TCP2 Field															
		PSHH CP 350.A2	TCP2 Field															
		FSLL CP 350.A1/A2/A4	TCP2 Field															
		PSLL CP 350.B1	TCP2 Field															
		PSHH CP 350.B1	TCP2 Field															
		PSLL CP 350.B2	TCP2 Field															
		PSHH CP 350.B2	TCP2 Field															
		FSLL CP 350.B1/B2	TCP2 Field NOTE3															
		PSLL CP 350.4	TCP2 Field															
		PSHH CP 350.4	TCP2 Field															
		LSLL CV 370.2	TCP2 Field					X										
EF		DISASTER SHUT DOWN	EF Subsea	X														
		PSLL A&B	EF Subsea	X														
		PSLL A	EF Subsea	X														
		PSLL B	EF Subsea	X														
		TRANS. FAILURE A&B	EF Subsea	X														
		TRANS. FAILURE A	EF Subsea															
		TRANS. FAILURE B	EF Subsea															
	Push Button	STATION A&B ESD	EF Subsea	X														
	Push Button	STATION A ESD	EF Subsea															
	Push Button	STATION B ESD	EF Subsea															
	Push Button	ST. A WELL 1 PSD	EF Subsea															
	Push Button	ST. A WELL 2 PSD	EF Subsea															
	Push Button	ST. A WELL 3 PSD	EF Subsea															
	Push Button	ST. B WELL 1 PSD	EF Subsea															
	Push Button	ST. B WELL 2 PSD	EF Subsea															
		ALL WELLS PSD	EF Subsea	X														
	Push Button	EL SD A																
	Push Button	EL SD B																

S.D. LEVEL	DEVICE	TAGS	LOCATION	Close met. service line (ESDV CV 360.1)	Open met. acc. line ST. B well 2 FOR 30 min. THEN CLOSE (ESDV CV 352.B2)	Open met. acc. line ST. B well 1 FOR 30 min. THEN CLOSE (ESDV CV 352.B1)	Open met. acc. line ST. A well 2 FOR 30 min. THEN CLOSE (ESDV CV 352.A2)	Open met. acc. line ST. A well 1 FOR 30 min. THEN CLOSE (ESDV CV 352.A1)	Open met. acc. line ST. A well 3 FOR 30 min. THEN CLOSE (ESDV CV 352.A4)	Close met. inj. line ST. B well 2 (ESDV CP 350.B2)	Close met. inj. line ST. B well 1 (ESDV CP 350.B1)	Close met. inj. line ST. A well 2 (ESDV CP 350.A2)	Close met. inj. line ST. A well 1 (ESDV CP 350.A1)	Close met. inj. line ST. A well 3 (ESDV CP 350.A4)	Stop met. inj. pump to ST. B well 2 (CP 350 B2/B3)	Stop met. inj. pump to ST. B well 1 (CP 350 B1/B3)	Stop met. inj. pump to ST. A well 2 (CP 350 A2/A3)	Stop met. inj. pump to ST. A well 1 (CP 350 A1/A3)	Stop met. inj. pump to ST. A well 3 (CP 350 A4/A5)	EF EMERGENCY SHUT DOWN (SUB SEA) (EF ESD)	EF STATION A PROD. SHUT DOWN (SUB SEA) (EF ST.A PSD)	EF STATION B PROD. SHUT DOWN (SUB SEA) (EF ST.B PSD)
1	Break glass pushbutton	CHS-MSD-1	Q.P. Control room	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
2	Break glass pushbutton	CHS-12	Q.P. Control room	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
	Break glass pushbutton	CHS-13	TCP2 Shut down cab.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
3	Push button	CHS-ESD-6	Q.P. Control room	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X
	Push button	CHS-ESD-1	TCP2 Shut down cab.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X
	Pull handle valve	CHS-ESD-2	TCP2 Field	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X
	Pull handle valve	CHS-ESD-3	TCP2 Field	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X
	Pull handle valve	CHS-ESD-4	TCP2 Field	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X
	Pull handle valve	CHS-ESD-5	TCP2 Field	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X
	Pull handle valve	At comp. lifeboat	compression field	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X
	Contact in series	Gas 60% in proc. area	TCP2 gas det. cab's	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X
	Contact in series	Fire in process area	TCP2 fire det. cab's	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X
	Contact in series	Gas 60% in comp. process area	Comp. control room	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X
	Contact in series	Fire in comp. process area	Comp. control room	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X
4	Pressure switch	PSLL CM 310.1	TCP2 Field																			
5	Pressure switch	PSHH CV 311.1	TCP2 Field NOTE1																			
		PSHH CV 311.2	TCP2 Field NOTE																			
		LSLL CV 320.2	TCP2 Field																			
		LSLL CV 320.7	TCP2 Field																			
		LSHH CV 320.6	TCP2 Field																			
		PSLL CV 320.4	TCP2 Field																			
		PSHH CV 320.3	TCP2 Field																			
			TCP2 Field																			
		LSLL CV 350. A2	TCP2 Field	X	(3)	(3)	X	X	X	(3)	(3)	X	X	X	(3)	(3)	X	X	X		X	(3)
		LSLL CV 350. B2	TCP2 Field	X	X	X	(4)	(4)	(4)	X	X	(4)	(4)	(4)	X	X	(4)	(4)	(4)		(4)	X
		LSHH CV 360.2	TCP2 Field	X																		
		PSLL CV 360.2	TCP2 Field	X																		
		PSHH CV 360.2	TCP2 Field	X																		
		PSLL CP 350.A1	TCP2 Field					X					X					X				
		PSHH CP 350.A1	TCP2 Field															X				
		PSLL CP 350.A2	TCP2 Field				X					X					X					
		PSHH CP 350.A2	TCP2 Field														X					
		FSLL CP 350.A1/A2/A4	TCP2 Field	X			X	X	X			X	X	X			X	X	X		X	
		PSLL CP 350.B1	TCP2 Field			X					X					X						
		PSHH CP 350.B1	TCP2 Field													X						
		PSLL CP 350.B2	TCP2 Field		X					X					X							
		PSHH CP 350.B2	TCP2 Field												X							
		FSLL CP 350.B1/B2	TCP2 Field NOTE3	X	X	X				X	X				X	X						X
		PSLL CP 350.4	TCP2 Field						X					X					X			
		PSHH CP 350.4	TCP2 Field																X			
		LSLL CV 370.2	TCP2 Field																			
EF		DISASTER SHUT DOWN	EF Subsea	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
		PSLL A&B	EF Subsea	X						X	X	X	X	X	X	X	X	X	X			
		PSLL A	EF Subsea	X			X	X	X			X	X	X			X	X	X			
		PSLL B	EF Subsea	X	X	X				X	X				X	X						
		TRANS. FAILURE A&B	EF Subsea	X						X	X	X	X	X	X	X	X	X	X			
		TRANS. FAILURE A	EF Subsea	X			X	X	X			X	X	X			X	X	X		X	
		TRANS. FAILURE B	EF Subsea	X	X	X				X	X				X	X						X
	Push Button	STATION A&B ESD	EF Subsea	X						X	X	X	X	X	X	X	X	X	X			
	Push Button	STATION A ESD	EF Subsea	X			X	X	X			X	X	X			X	X	X			
	Push Button	STATION B ESD	EF Subsea	X	X	X				X	X				X	X						
	Push Button	ST. A WELL 1 PSD	EF Subsea	X				X					X					X				
	Push Button	ST. A WELL 2 PSD	EF Subsea	X			X					X					X					
	Push Button	ST. A WELL 3 PSD	EF Subsea	X					X					X					X			
	Push Button	ST. B WELL 1 PSD	EF Subsea	X		X					X					X						
	Push Button	ST. B WELL 2 PSD	EF Subsea	X	X					X					X							
		ALL WELLS PSD	EF Subsea	X						X	X	X	X	X	X	X	X	X	X			
	Push Button	EL SD A		X			X	X	X			X	X	X			X	X	X			
	Push Button	EL SD B		X	X	X				X	X				X	X						

NOTES
1. SHUTDOWN SIGNAL FROM PSHH CV 311.1 & PSHH CV 311.2 ONLY WHEN BOTH SWITCHES TRIPS
2. THREE POSITIONS HANDSWITCH PROVIDED TO TAKE INTO ACCOUNT EXCEPTIONAL OPERATIONS OF CV 350 A/B AND ROUTE LSLL CV 350 A2 AND B2 ACCORDINGLY (ref. EF SAFE-Chart: S-FF-89-00-1054)
3. ACTIVATED IF SERVICED FROM CV 350 A SEE ALSO NOTE 2.
4. ACTIVATED IF SERVICED FROM CV 350 B SEE ALSO NOTE 2.
5. FOR GROUP 'U' SEE ALSO SHEET 7& 8.

REV	DATE	DESCRIPTION	BY	CHK.	DISC. SUP.	REV.	APP.
12	21.05.89	GENERAL UPDATE	PAF				S.R.
11	14.12.88	EAST FRIGG TIE-IN	I.G.				[illegible]

EAST FRIGG TIE-IN

CONTRACTOR

elf aquitaine norge a/s
P.O. BOX 168
4001 STAVANGER

FRIGG FIELD

A | Installation: TCP2 T | System: ESD.

Job no | Scale | GROUP 'U'

Drwg no: FF 85 16 06 1184 | Rev. 12 | Sheet 12

FIRE AND SMOKE DETECTION

1. GENERAL

1.1 The system provides fire detection facilities in all platform areas.

1.2 The following four types of sensors are used:

(a) Heat.

(b) Infra-red.

(c) Smoke.

(d) Ultra-violet.

1.3 Sensors in the treatment areas transmit electric impulses to the Fire and Gas Detector Control Panel in the Interface Room, via a Minerva Type T870 controller. The control panel provides visual indication of the area in which a fire has occurred, initiates audible/visual alarms and where necessary operates an extinguishant system.

1.3.1 The fire detection system on Module M51 is connected to the existing fire detection system for treatment areas. The connections are made via a new fire detection cabinet located in M51 Interface Room. All detection- and fire alarm buttons are using AFA-MINERVA T 827 control units.

1.4 The system operates at +24V dc from a 220V, 50Hz single-phase supply.

1.5 A fire alarm and extinguishant release can also be manually activated.

1.6 Each sensor in the gas compression area will send a signal to the Fire Detection Panel located in the Compression Area Control Room. The fire detection panel provides indications and action as in para 1.3 above.

2. DESCRIPTION

2.1 Treatment Area

2.1.1 Heat detectors are installed in enclosed areas in which rapid temperature changes are expected. The sensors used are Minerva Type F80, which are located in the Generator Room on the Cellar Deck and in the Workshop and Store on the Main Deck.

Heat detector in Module M51 are installed in electrical interface room, instrument interface room and HVAC equipment room. Detectors used are AFA-MINERVA type H900.

2.1.2 Infra-red detectors are installed in areas in which combustible material is expected to burn with a flame. The sensors used are Minerva Type F70, which are located in Pancake 07 on the Cellar Deck and throughout the Main Deck.

2.1.3 Smoke detectors are installed in clean environmental areas where the highest risk of fire is from smouldering rather than high flame content fires. The sensors used are Minerva Types F35 and F50 which are located in Module 04 on the Main Deck and throughout the Cellar Deck.

Smoke detectors in Module M51 are installed in battery room, electrical interface room, instrument interface room and HVAC equipment room. Detectors used are AFA-MINERVA type F35C.

2.1.4 Ultra-violet, Det-Tronics Type C7037B detectors are installed in Pancakes 05, 06 and 53 on the Cellar Deck, module 50 Main Deck.

Ultra-violet detectors are installed in all process areas in Module M51. They are connected in series and there is one loop per deck. The detectors are of DET-TRONICS type U76.

2.1.4.1

Manual fire alarm buttons are installed in all process areas on M51 and are AFA-MINERVA GFU/FA "Break Glass" type.

2.1.4 Operation of any one sensor will automatically initiate the following:

(a) Indication of the fire location on the Fire and Gas Detector Control Panel and the Mimic Panel.

(b) Audible and, where appropriate, visual alarms.

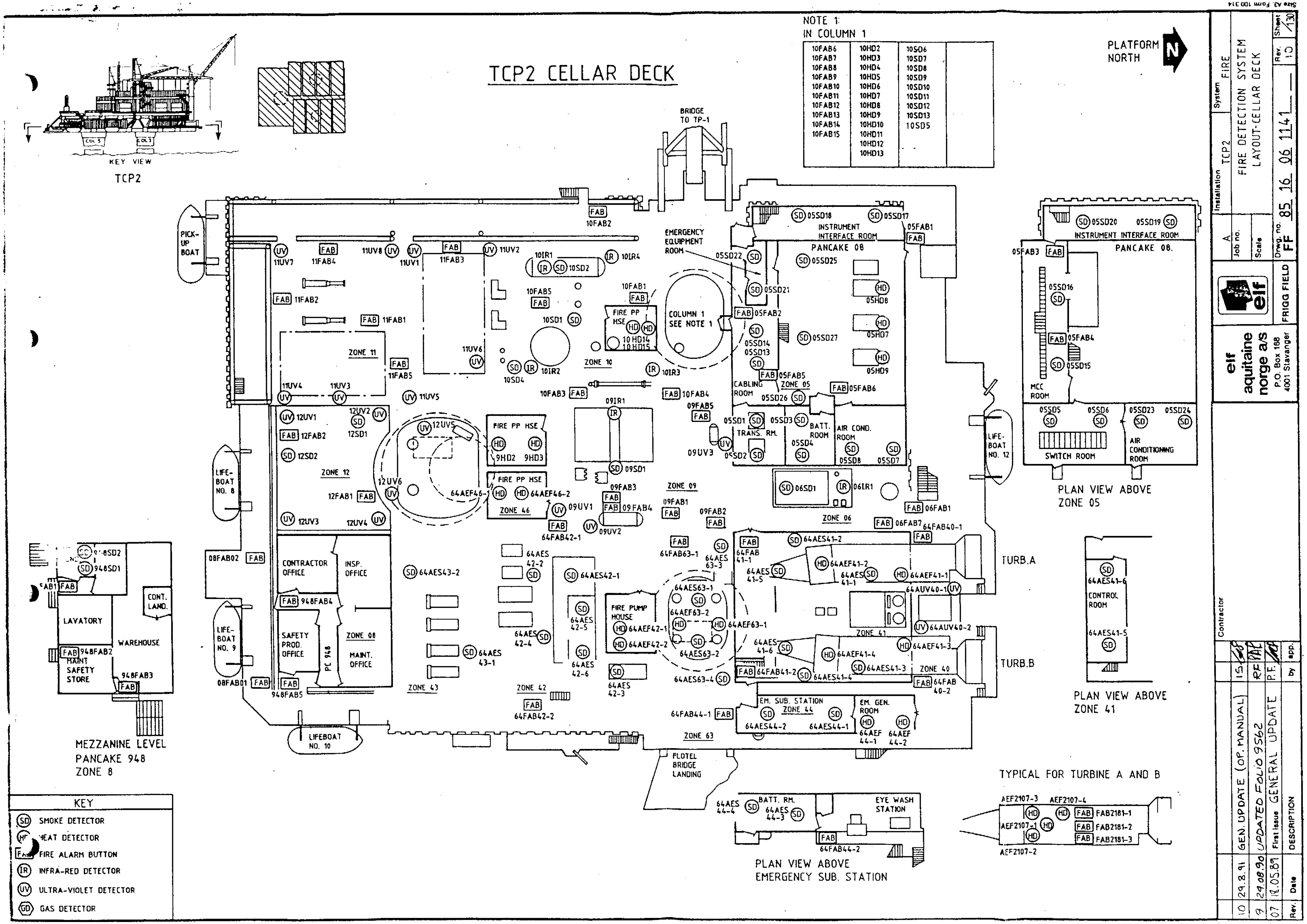
(c) Platform emergency shutdown (when appropriate).

(d) If appropriate, Halon release.

(e) Open deluge valve XV-CP6-5 plus deluge valve in zone of fire detection, if fire detection is in process ares.

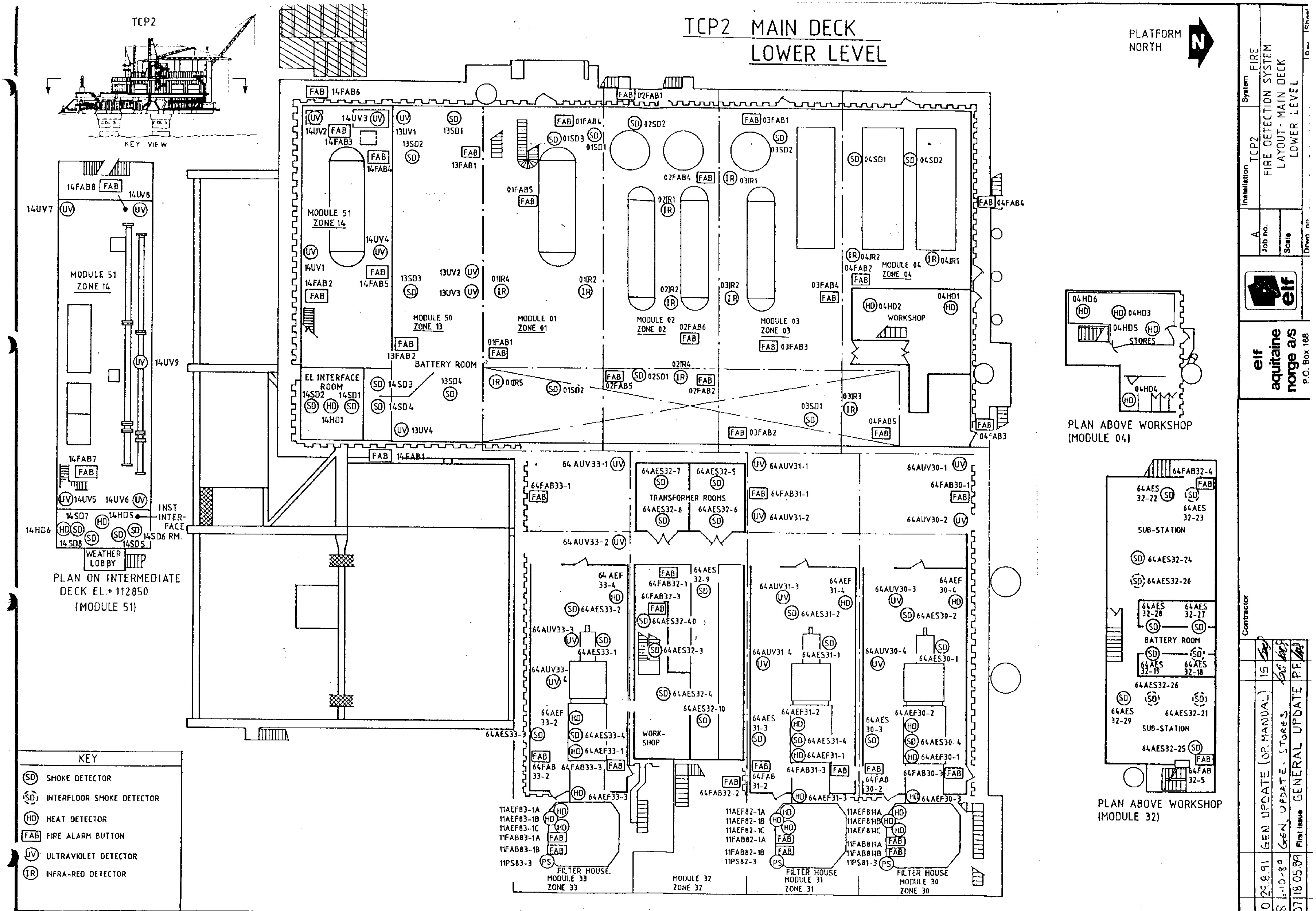
2.1.6 Start-up of the fire pumps is initiated by the coincident operation of two sensors in the same area.

2.1.7 Sensors serving a Halon protected area are coincidence interlocked such that two or more sensors must actuate to initiate system release.

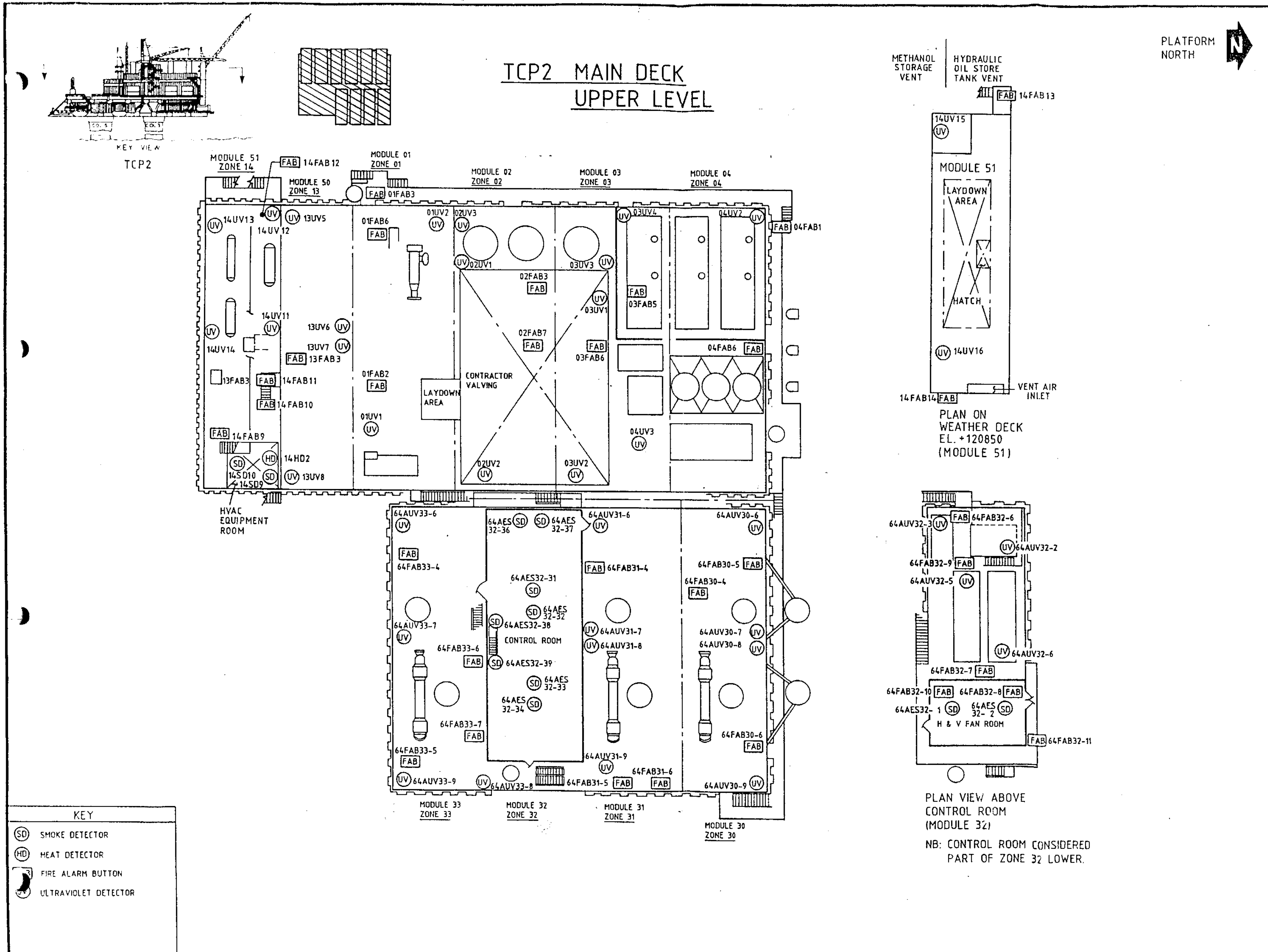


TCP2 CELLAR DECK
KEY VIEW
TCP2
NOTE 1:
IN COLUMN 1
10FAB6 10FAB7 10FAB8 10FAB9 10FAB10 10FAB11 10FAB12 10FAB13 10FAB14 10FAB15
10HD2 10HD3 10HD4 10HD5 10HD6 10HD7 10HD8 10HD9 10HD10 10HD11 10HD12 10HD13
10SD6 10SD7 10SD8 10SD9 10SD10 10SD11 10SD12 10SD13 10SD5
PLATFORM NORTH
N
BRIDGE TO TP-1
PICK-UP BOAT
EMERGENCY EQUIPMENT ROOM
COLUMN 1 SEE NOTE 1
FIRE PP HSE
ZONE 11
ZONE 10
ZONE 12
ZONE 46
ZONE 09
ZONE 06
ZONE 05
ZONE 08
ZONE 43
ZONE 42
ZONE 41
ZONE 40
ZONE 44
ZONE 63
INSTRUMENT INTERFACE ROOM
PANCAKE 08
CABLING ROOM
TRANS. RM.
BATT. ROOM
AIR COND. ROOM
MCC ROOM
SWITCH ROOM
AIR CONDITIONING ROOM
PLAN VIEW ABOVE ZONE 05
LIFE-BOAT NO. 8
LIFE-BOAT NO. 9
LIFE-BOAT NO. 12
LIFEBOAT NO. 10
CONTRACTOR OFFICE
INSP. OFFICE
SAFETY PROD. OFFICE
MAINT. OFFICE
PC 948
FIRE PUMP HOUSE
TURB.A
TURB.B
CONTROL ROOM
PLAN VIEW ABOVE ZONE 41
EM. SUB. STATION
EM. GEN. ROOM
FLOTEL BRIDGE LANDING
LAVATORY
WAREHOUSE
CONT. LAND.
MAINT SAFETY STORE
MEZZANINE LEVEL PANCAKE 948 ZONE 8
BATT. RM.
EYE WASH STATION
PLAN VIEW ABOVE EMERGENCY SUB. STATION
TYPICAL FOR TURBINE A AND B
AEF2107-3 AEF2107-4 AEF2107-1 AEF2107-2 FAB2181-1 FAB2181-2 FAB2181-3
KEY
SD SMOKE DETECTOR
HD HEAT DETECTOR
FAB FIRE ALARM BUTTON
IR INFRA-RED DETECTOR
UV ULTRA-VIOLET DETECTOR
GD GAS DETECTOR
System FIRE
Installation TCP2
FIRE DETECTION SYSTEM LAYOUT-CELLAR DECK
Job no. A
Rev. 10
Sheet 10/130
Drwg. no. FF 85 16 06 1141
FRIGG FIELD
elf aquitaine norge a/s
P.O. Box 168 4001 Stavanger
Contractor
10 29.8.91 GEN. UPDATE (OP. MANUAL)
9 29.08.90 UPDATED FOLIO 9562
07 18.05.89 First issue GENERAL UPDATE
Rev. Date DESCRIPTION by app.
Size A3. Form 100.314

TCP2 MAIN DECK LOWER LEVEL



TCP2 MAIN DECK UPPER LEVEL



System	FIRE
Installation	TCP2
Title	FIRE DETECTION SYSTEM LAYOUT - MAIN DECK UPPER LEVEL
Rev	07
Sheet	/32
Job no.	A
Scale	
Drwg. no.	FF 85 16 06 1141
	FRIGG FIELD
	elf aquitaine norge a/s P.O. Box 168 4001 Stavanger
Contractor	
7	14.05.93	GENERAL UPDATE	P.F.
Rev	Date	First issue	by	app

GAS DETECTION

1. GENERAL

1.1 The system is provided to monitor and detect the presence of flammable gases and vapour concentrations. It uses remotely installed sensors in detector heads, linked to gas alarm modules in the Gas Detector Control Panels located in the Interface room for treatment and extension areas and Compression control room for compression areas.

1.1.1 The gas detection system in Module M51 is connected to the existing gas detection system for treatment areas. The new system is linked to the existing via a new gas detection panel in M51 instrument interface room. Sensors used for Module M51 is SIEGER model SG7B with model 910 sensor housing and PJB1 terminal housing.

1.2 The sensors used in treatment areas are Sieger Model 1402 Type 770, which are unaffected by atmospheric or humidity changes. The sensor used in extension areas are coupled to Sieger Model FS1A. The sensors used in Compression areas are coupled to Sieger FS16 Modules.

1.3 Each detection point comprises either one or two independent sensor heads, connected to their gas alarm module by intrinsically safe cable.

1.4 The sensor heads each transmit an electrical signal proportional to the detected level of gas to their associated control unit. This signal will allow a reading of gas concentration to be made.

2. DESCRIPTION

2.1 Each control unit contains two manually operated alarm set-points, one for each sensor head. The set-points are adjustable in the 0 to 100 per cent range of the lower explosion limit (LEL) of a gas/air mixture. Sensors at the entrances to the Instrument Interface Room, the Emergency Equipment Room and the Cabling Room operate on a single LEL value only which initiates the appropriate alarm and shutdown function. At the other detection points the sensor heads are set to operate at different levels.

2.2.1 Detection of Gas at the lower value of the set range, (20% LEL) first threshold, is detected by one sensor and will result in the following:

(a) General platform alarm (GPA)

(b) Alarm in QP control room

(c) Indication at the Gas detection panels

(d) Selective inputs alarm TCP2 MCC room and isolate selective supplies.

2.2.2 Detection of Gas at the higher value of the set range, (60% LEL) second threshold will result in the following (dependant upon which areas is affected):

(a) All detectors - General platform alarm

(b) Process area detectors - Fire pump start on TCP2, TP1 & QP

(c) Indication at the Gas detection panels

(d) Process treatment areas: third level shutdown of the treatment area followed by third level shutdown of compression area.

(e) Process compression areas: third level shutdown of the compression area follewed by third level shutdown of treatment area.

(f) Compression area fuel gas package: this will initiate shutdown of the turbo generators and, consequently field shutdown.

(g) Compressor rooms: shutdown of the respective compressor.

(h) Ventilation system: gas detection in the ventilation inlet ducting will initiate shutdown of the respective ventilation fans and dampers and if necessary isolation of any interfacing electrical equipment. Gas detection in the compressor rooms' ventilation outlets will initiate shutdown of the respective compressor and isolation of the electrical equipment in the compartment.

(i) Glycol regenerator, firewall and CE2A and CE2B: third level shutdown of treatment area, open deluge valve XCP6-5 and start fire pumps QP, TP1 and TCP2.

2.3 The automatic action of the system may be inhibited by use of keyswitches at the Gas Detector Control Cabinet.

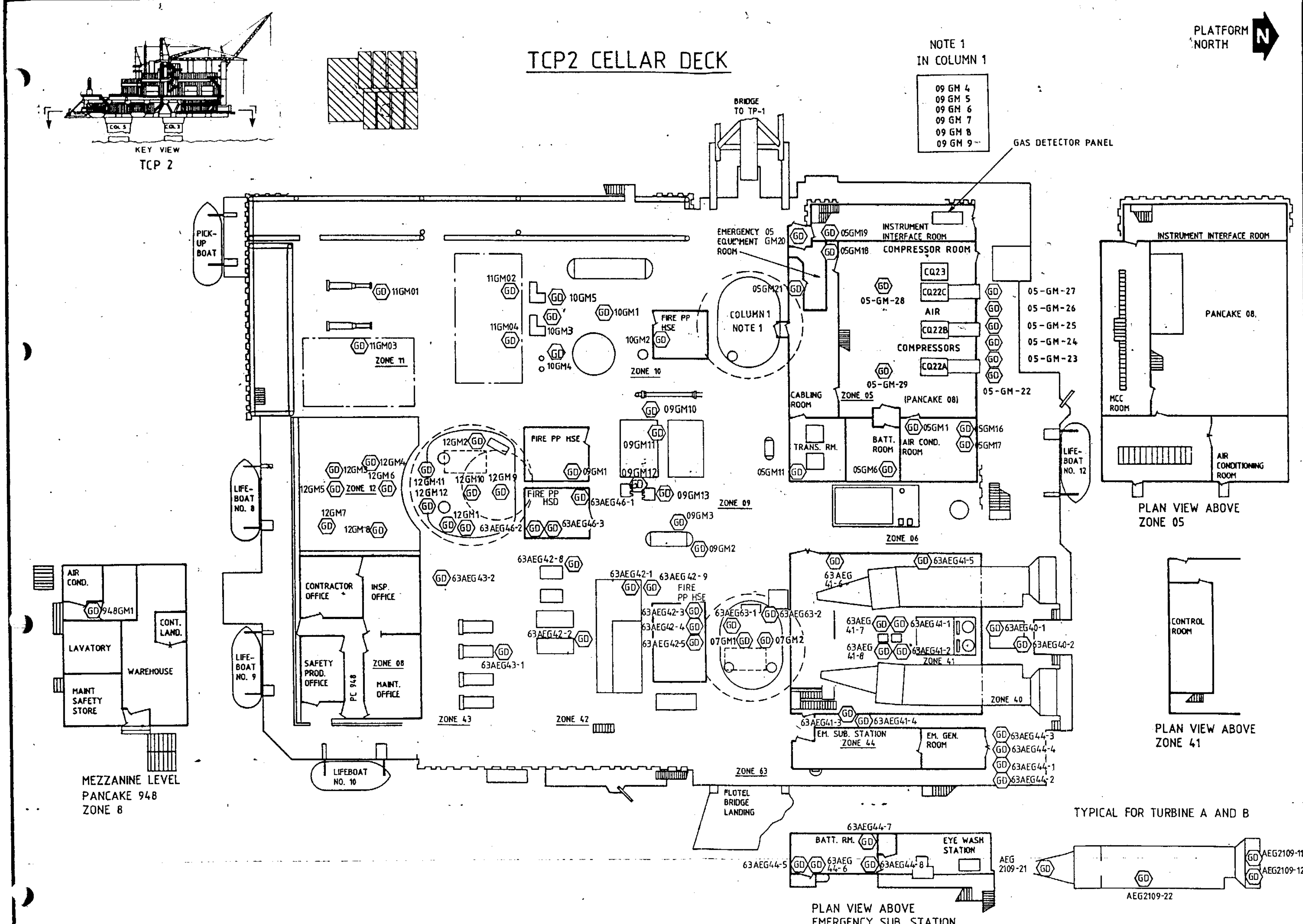
2.4 Each sensor is provided with a test gas facility.

2.5 Gas alarm warning light (manual)

A yellow flashing light located on TCP2 Bridgehead is activated by a manually operated switch (light on indication) located in QP control Room.

If a hazard arises on TP1 platform the warning light is to prevent personnel entering into the hazardous area.

TCP2 CELLAR DECK



Size A3, Form 100.314

Installation: TCP 2 | System: GAS

GAS DETECTION SYSTEM
LAYOUT - TCP 2 CELLAR DECK

Rev.: 7 | Sheet: 123

Job no.: A | Scale: | Drwg. no.: FF 85 16 06 1185

FRIGG FIELD

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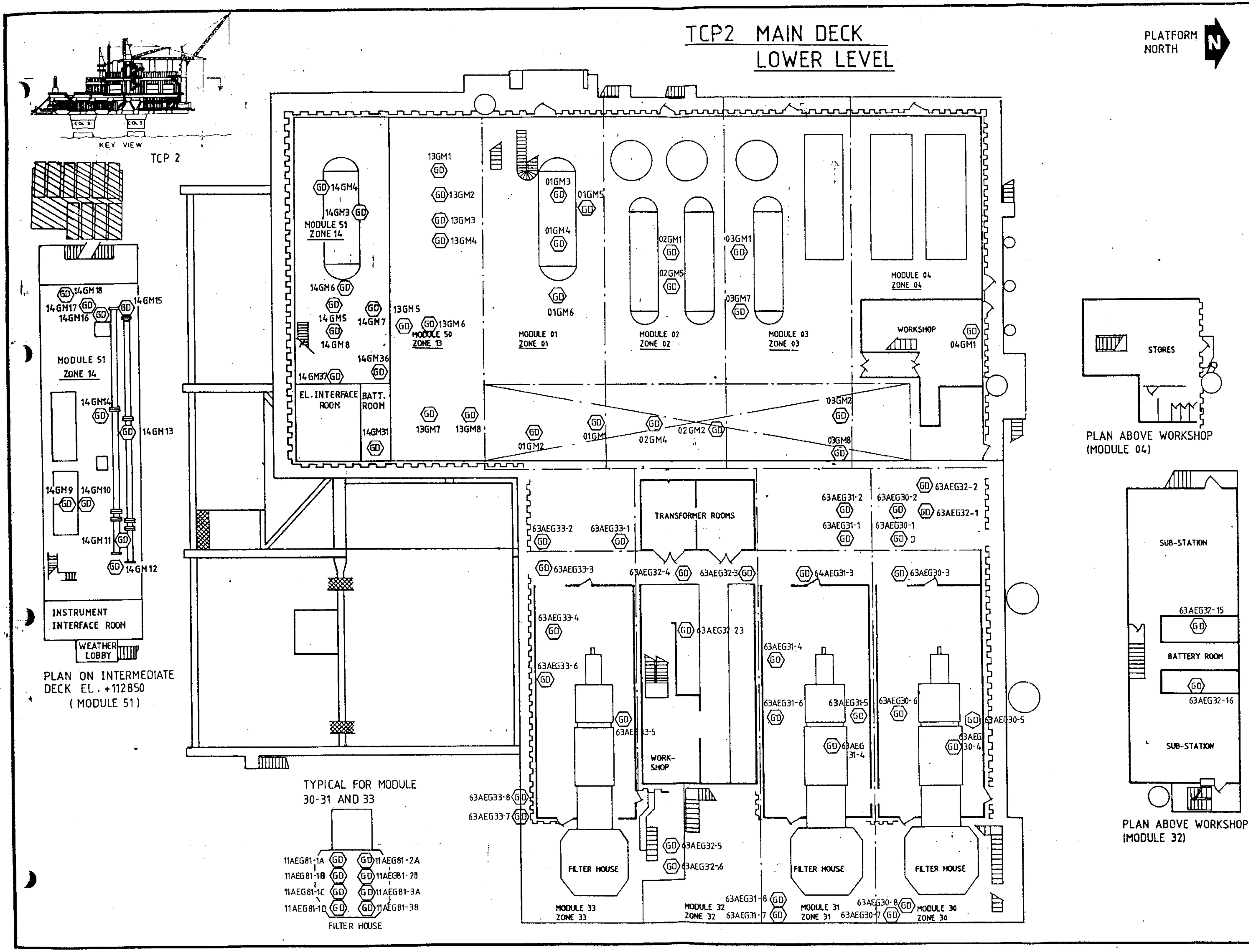
Contractor

Rev.	Date	Description	by	app.
7	04.08.91	UPDATED FOLIO 10508	AN	
6	07.05.91	UPD. FOLIO 12159, 12598	SV	
5	13.08.90	UPDATED FOLIO 9562	RF	
	19/5/89	First issue GENERAL UPDATE		

TCP2 MAIN DECK LOWER LEVEL



Rev.	Date	Description	by	app
7	29.8.91	GEN. UPDATE (OP. MANUAL)	IS	
6	07.05.91	UPDATED FOLIO 12159	SV	
5	13.08.90	UPDATED FOLIO 12664,12316	RF	
4	19/5/89	First issue GENERAL UPDATE		

Contractor

elf aquitaine norge a/s
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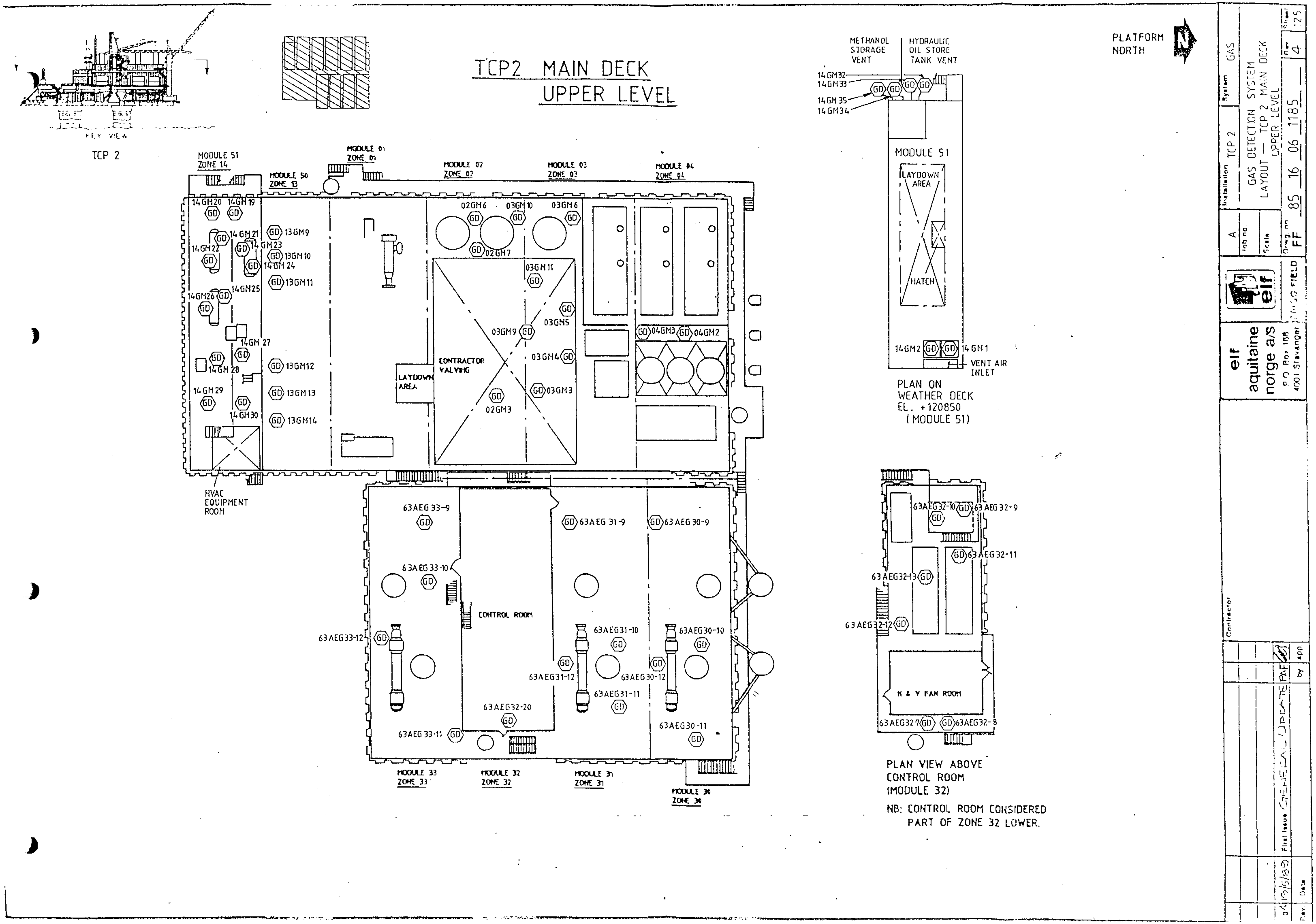
4001 Stavanger

FRIGG FIELD

elf

Job no: A
Installation: TCP 2
System: GAS
GAS DETECTION SYSTEM LAYOUT — TCP 2 MAIN DECK LOWER LEVEL
Scale:
Drwg no: FF 85 16 06 1185
Rev: 7
Sheet: 124


TCP2 MAIN DECK
UPPER LEVEL
PLATFORM NORTH
N
KEY VIEW
TCP 2
MODULE 51
ZONE 14
MODULE 50
ZONE 13
MODULE 01
ZONE 01
MODULE 02
ZONE 02
MODULE 03
ZONE 03
MODULE 04
ZONE 04
14GM20
14GM19
14GM21
14GM22
14GM23
14GM24
14GM25
14GM26
14GM27
14GM28
14GM29
14GM30
13GM9
13GM10
13GM11
13GM12
13GM13
13GM14
02GM6
03GM10
03GM6
02GM7
03GM11
03GM5
03GM9
03GM4
03GM3
02GM3
04GM3
04GM2
CONTRACTOR VALVING
LAYDOWN AREA
HVAC EQUIPMENT ROOM
63AEG 33-9
63AEG 33-10
63AEG33-12
63AEG 33-11
63AEG 31-9
63AEG 30-9
CONTROL ROOM
63AEG31-10
63AEG31-12
63AEG31-11
63AEG30-10
63AEG30-12
63AEG30-11
63AEG32-20
MODULE 33
ZONE 33
MODULE 32
ZONE 32
MODULE 31
ZONE 31
MODULE 30
ZONE 30
METHANOL STORAGE VENT
HYDRAULIC OIL STORE TANK VENT
14GM32
14GM33
14GM35
14GM34
MODULE 51
LAYDOWN AREA
HATCH
14GM2
14GM1
VENT AIR INLET
PLAN ON WEATHER DECK EL. +120850 (MODULE 51)
63AEG32-10
63AEG32-9
63AEG32-11
63AEG32-13
63AEG32-12
H & V FAN ROOM
63AEG32-7
63AEG32-8
PLAN VIEW ABOVE CONTROL ROOM (MODULE 32)
NB: CONTROL ROOM CONSIDERED PART OF ZONE 32 LOWER.
Installation TCP 2
System GAS
GAS DETECTION SYSTEM LAYOUT — TCP 2 MAIN DECK UPPER LEVEL
Job no. A
Scale
Drwg no FF 85 16 06 1185
Rev 4
Sheet 125
elf aquitaine norge a/s
P.O. Box 168 4001 Stavanger
FRIGG FIELD
Contractor
First issue
GENERAL UPDATE
Rev.
Date
by
app

FIREFIGHTING FACILITIES

1. GENERAL

1.1 The platform is provided with automatic and manual firefighting facilities in accordance with NPD regulations for production and auxiliary systems on production platforms 1980.

1.2 Each platform area is provided with one or more of the following:

(a) Automatic extinguishant systems.

(b) Manual extinguishant systems.

(c) Firemen's outfits and associated equipment.

1.3 The applications of the various types of extinguishant used are as follows:

(a) **Water.** Suitable for fires involving wood, bedding or paper.

(b) **Foam.** Most suitable for flammable liquids. It must not be used on electrical equipment.

(c) **Dry Chemicals.** These are of foam compatible type, most suitable for flammable liquids and electrical fires. Dry chemical powder has no cooling properties and therefore gives no protection against re-ignition.

(d) **Carbon Dioxide.** Suitable for flammable liquids and electrical fires, particularly where it is necessary to avoid further damage. Gives no protection against re-ignition. Since CO2 is an inert gas, there is danger of asphyxiation if used in a confined space.

(e) **Halon 1301 (BTM).** This is a colourless, odourless, electrically non-conductive gas that extinguishes or prevents ignition by inhibiting the chemical reaction of fuel and oxygen and is the least toxic of the vapour fire extinguishing agents. It may create a hazard to personnel from the nature of the gas itself, and from the products of decomposition that result from exposure to the fire or other hot surfaces.

2. DESCRIPTION

2.1 Automatic Extinguishant Systems

2.1.1 Halon (BTM)

Independent Halon 1301 (BTM) systems are installed in platform areas presenting a special fire hazard or containing electrical equipment. The gas which is stored in pressurised cylinders is released by operation of the Fire Detection System in the immediate area. Each system may also be released manually.

2.1.2 Sprinkler System

Thirty separate sprinkler systems are installed, each being strategically located to extinguish a fire in or around an item or items of equipment. The systems are operated by a pressure loss in pneumatic detection system. This may be caused automatically by the bursting of a frangible bulb due to heat rise, or automatically by fire detection, or manually by the operation of deluge control valves.

2.2 Manual Extinguishing System

2.2.1 The manual systems which are located throughout the platform comprise the following:

(a) Portable fire extinguishers.

(b) Deluge systems.

(c) Water hosereels.

(d) Foam/water hosereels.

(e) Monitors.

(f) Appropriate systems are supplied with sea water by the Firewater System.

2.2.2 There are two types of portable fire extinguishers as follows:

(a) Dry powder. These are chemicals extinguishers pressurised by a CO2 bottle attached to the container. They are in sizes of 12kg and 50kg. The 50kg containers are trolley mounted.

(b) CO2 These are 6kg hand-operated extinguishers containing liquefied Co2.

2.2.3 Manual release valves for the Deluge systems are located near the following equipment:

1 Pig receiver CM9.
2 Pig receiver CM1 and CM2.
3 Pig receiver CM201
4 Central storage tanks CV9, CV10 and CV23.
5 Flash Drum CV220.
6 FWKO separators CV1 B and C.
7 Slug Catchers CV1A and CV210.
8 Condensate storage tank CV33.
9 Clycol contactors CV2A, B and C.
10 Pig launcher CM3.
11 Condensate surge tank CV3.
12 Condensate coalescers CV4A and B. (Equipment removed. Valve still in place).
13 Condensate separators CV14A, B and C.
14 Glycol reboilers CH1A, B and C.
15 East Frigg Methanol Flash Tank CV-360.
16 East Frigg Slug Catcher CV-310.
17 LP vent knockout drum 67B01.
18 Suction drums 11B01A, B and C.
19 Water separators 11B02A and B.
20 Gas compressors 11K01A, B and C.
21 Fuel gas package 50x01.
22 Hydraulic package 56x01.
23 Natural gas coolers 11E01A, B and C.
24 ESDV's CM1.1, CM2.1 and CM3.1.
25 East truss structure cooling.

2.2.4 Water hosereels are located throughout the platform. Each reel contains 30 metres of rubber hose with a jet/spay nozzle. A gearing device is fitted for crank winding. Washdown hosereels may also be used for firefighting.

2.2.5 Foam/water hosereels are installed on the Cellar Deck and Main Deck. Foam concentrate is introduced into the water stream through eductors installed upstream from the hosereels.

2.2.6 Water monitors are installed throughout the platform. The monitors are movable through 360° in the horizontal plane and may be locked in any position.

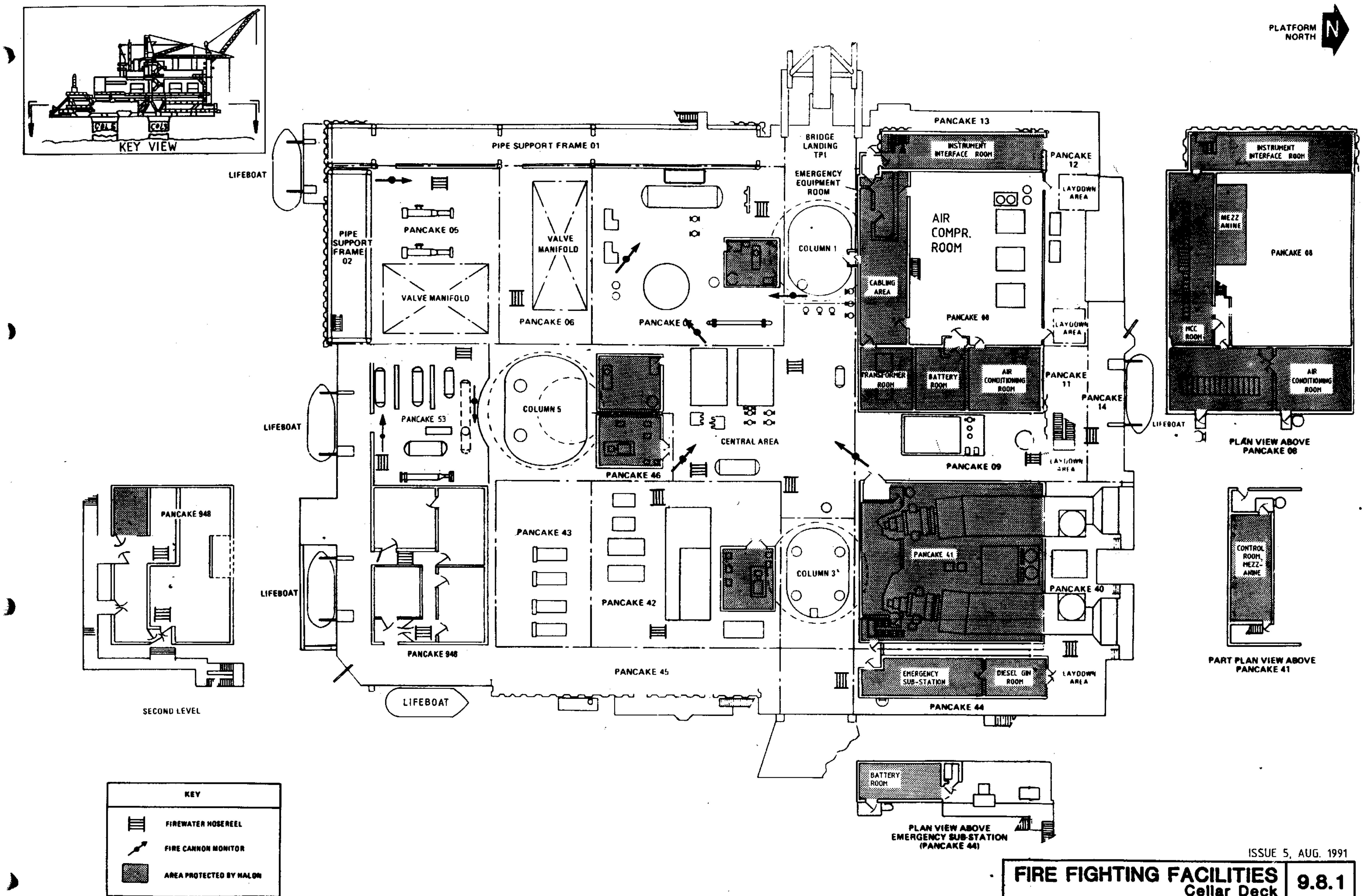
2.2.7 Two fireman's stations and a technical team station contain firefighting equipment for the protection of firefighters/rescue teams, and to enable them to effect forced entry. The equipment is contained in protective boxes at the following positions:

(a) Firemans stations
1 Cellar Deck - Entrance to bridge - TP1.
2 Main Deck - Entrance to module 32 - East side

(b) Technical team station
1 Cellar Deck - Entrance to bridge - TP1

2.2.8 Each fireman's station is equipped as follows:

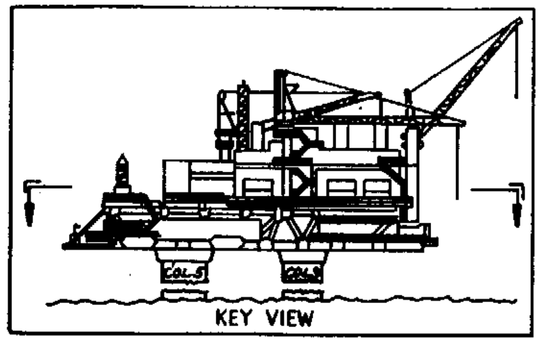
Fireman's outfit (5 off)
Self-contained breathing apparatus (3 off)
Safety belt harness (2 off)
Safety line (2 off)
Signal code plates (2 off)
Small axe (2 off)
Safety lamp (5 off)
Crowbar (2 off)
Door breaker(2 off)
Sledge hammer
Asbestos blanket (2 off)
Large Axe
Electric drill complete with:
  spare 5/8in bit
  25m extension cable
Hacksaw with spare blades
Loud hailer
Spare key and 'O' ring for breathing apparatus
First aid kit

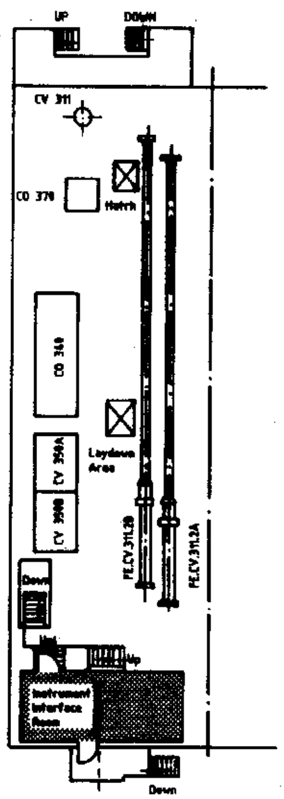


ISSUE 5, AUG. 1991

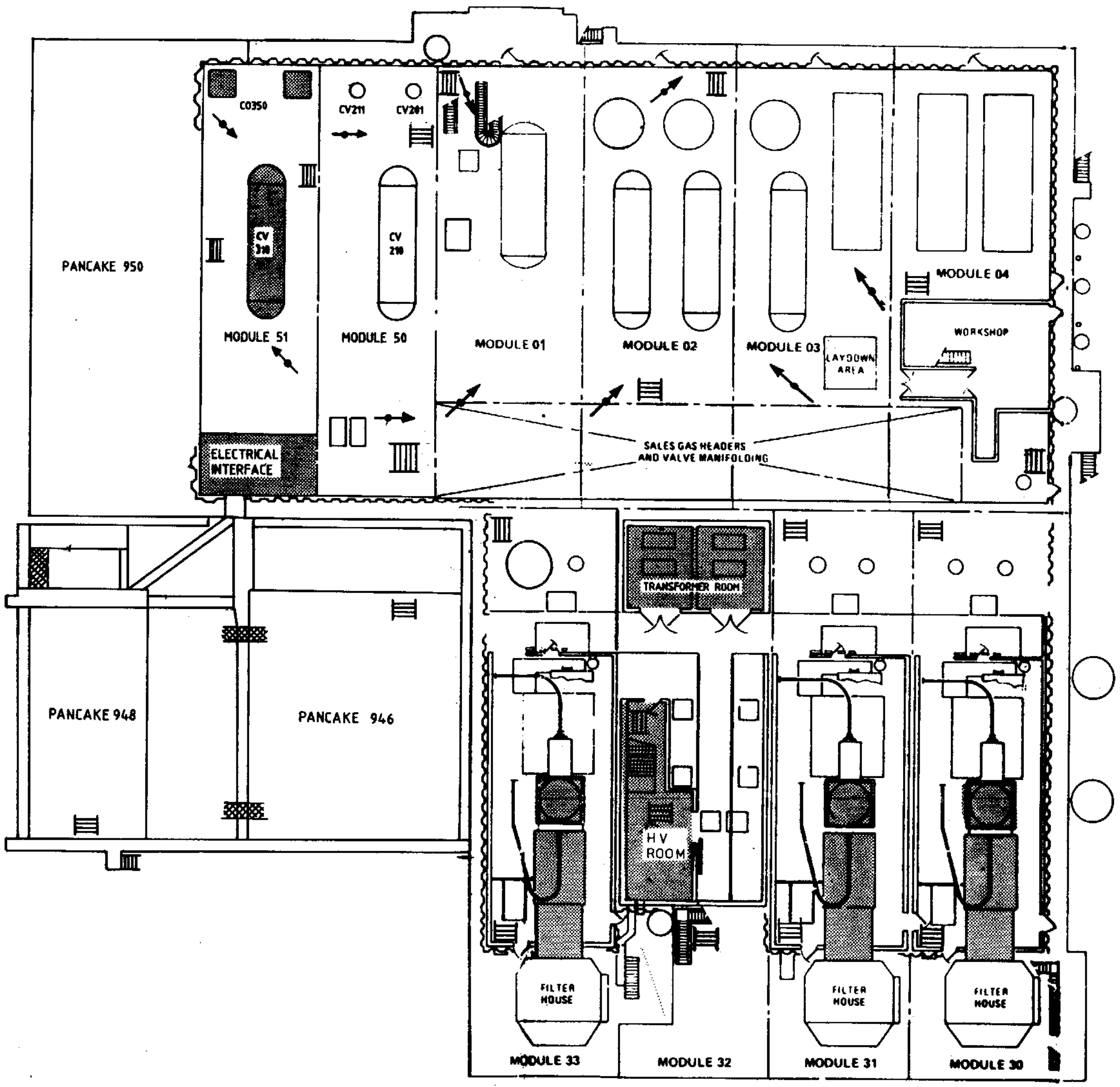
FIRE FIGHTING FACILITIES
Cellar Deck | **9.8.1**

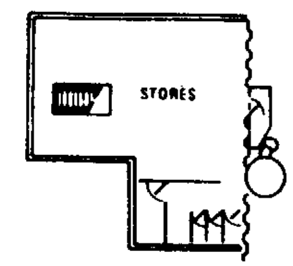
PLATFORM NORTH



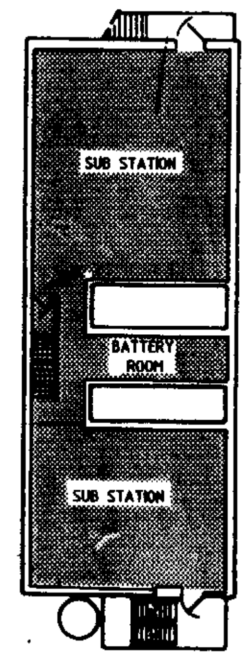


M51 INTERMEDIATE DECK

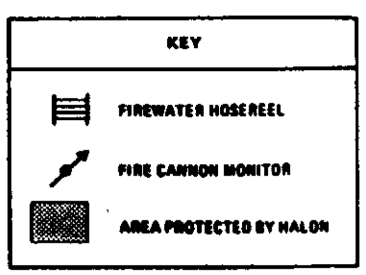




PLAN ABOVE WORKSHOP (MODULE 04)



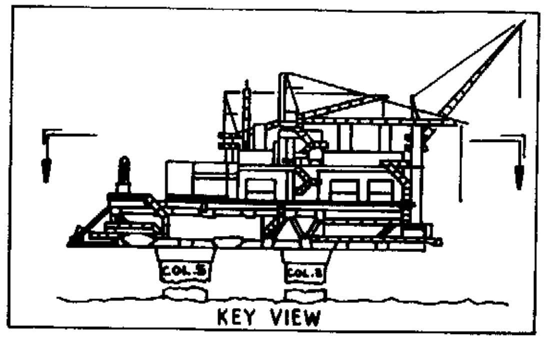
PLAN ABOVE WORKSHOP (MODULE 32)

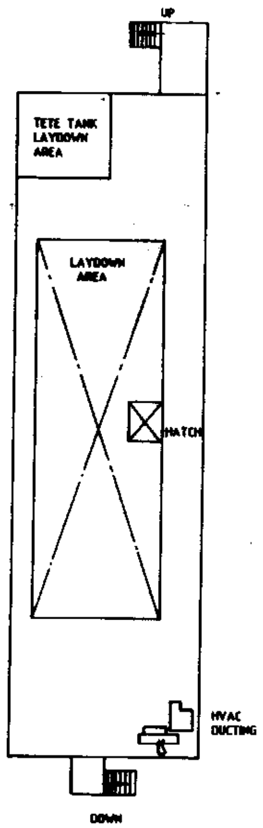


ISSUE 5, AUG. 1991

FIRE FIGHTING FACILITIES
Main Deck

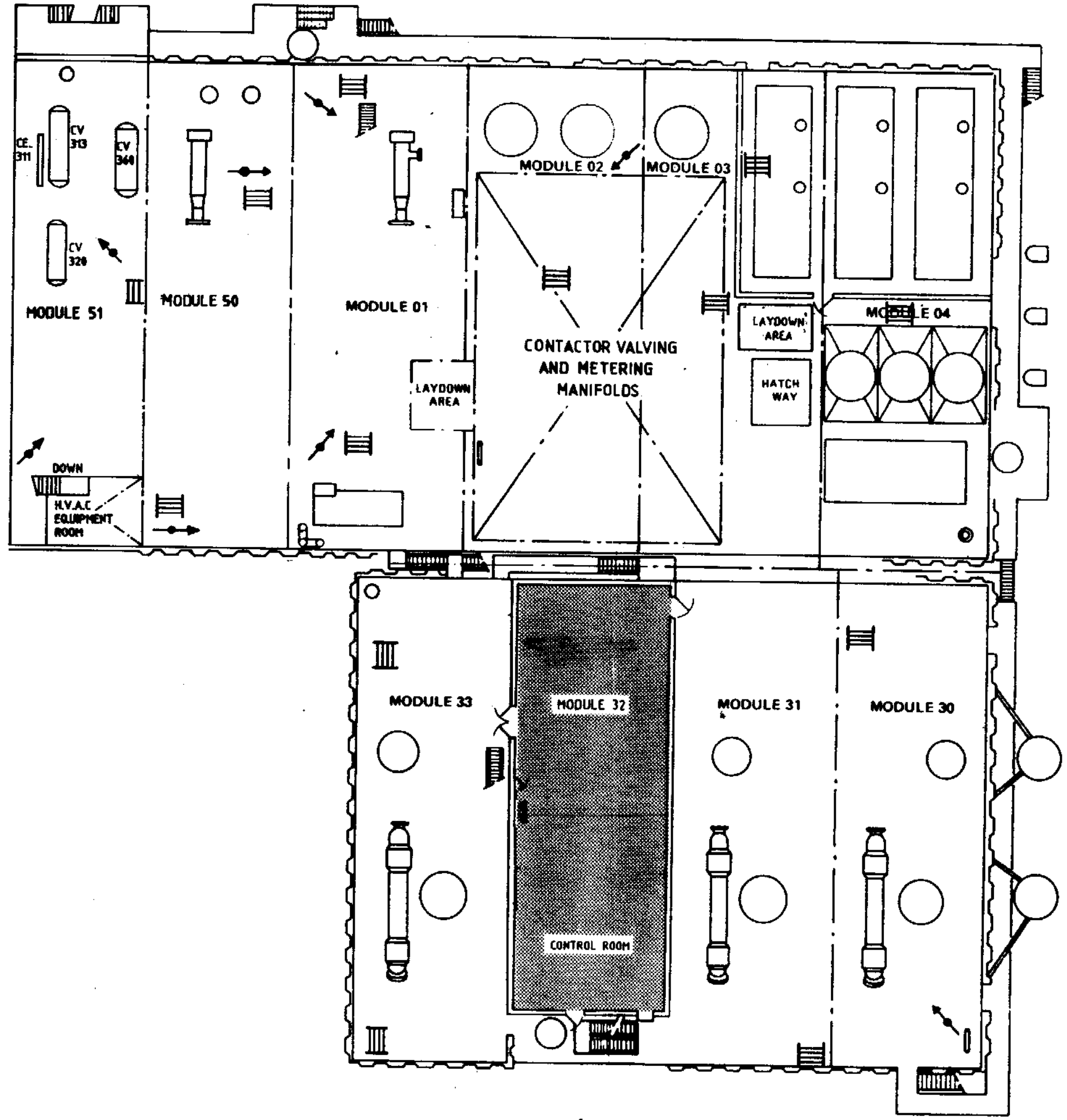
9.8.2

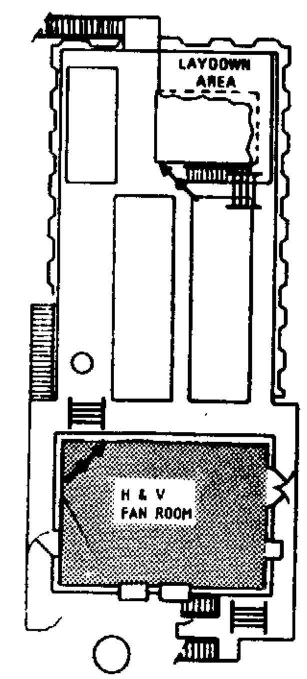




M51 WEATHER DECK

EFTI MOD M51
FIREFIGHTING EQUIPMENT
TO BE ADDED
REF DWG FF0900060040





PLAN VIEW
ABOVE CONTROL ROOM
(MODULE 32)

KEY

	FIREWATER HOSEREEL
	FIRE CANNON MONITOR
	AREA PROTECTED BY HALON

ISSUE 4, AUG.1991

FIRE FIGHTING FACILITIES
Upper Deck

9.8.3

FIREWATER SYSTEM

1. GENERAL

1.1 The platform is served by 12in firewater ringmains which are supplied with chlorinated sea water by diesel-driven fire pumps.

1.2 Valved offtakes throughout the ring main supply firewater to the following firefighting equipment:

(a) Water Hosereels

(b) Water / Foam Hosereels

(c) Monitors

(d) Sprinkler System.

(e) Deluge Systems

1.3 The firewater ring mains are interconnected with similar ring mains on TP1 and QP. This connection enables the firewater pumps of any one platform to supply the firewater system of the other two.

2. DESCRIPTION

2.1 Treatment Area

2.1.1 Fire pumps CP6A and B located in Pancake 07 on the Cellar Deck are driven by 12-cylinder Detroit diesel engines, model 12V-71T rated at 510 bhp at 1800 rev/min. Each engine is provided with an electric (battery) start system and a pneumatic start system. These pumps supply the treatment area ring mains.

2.1.2 Each pump is a vertical turbine type within a stilling tube, which takes suction from the sea at elevation - 12.2m. The nominal capacity of each pump is 7570 litres/min at a discharge pressure of 9.63 bar.

2.1.3 Pump operation is controlled automatically or manually as follows:

(a) Automatically
- (i) By operation of the fire and gas detection systems, via the fire and gas detector control panel in the Instrument Interface Room.
- (ii) On operation of TP1 and/or QP fire pumps.
- (iii) On a pressure drop in header.

(b) Manually
- (i) By operation of fire alarm pushbuttons strategically located throughout the platform, and similar pushbuttons on TP1 and QP.
- (ii) By operating of start pushbuttons located on the fire pump control panels (one each for electric and pneumatic start).

2.1.4 Auto/start/test switches located on each pump control panel enable the pumps and engines to be periodically tested

2.2 Compression Area

2.2.1 Fire pumps 68P01A and B located on Pancakes 42 and 46 respectively are driven by diesel engines. The diesel engines are provided with a pneumatic start system.

2.2.2 Each pump is a two stage pump. The first stage pump is hydraulically driven and has a capacity of $465m^3/h$ at a discharge pressure of 5.3 barg and speed of 2500 rev/min. The second stage pump has a capacity of $465m^3/h$ at a discharge pressure of 8.6 barg and a speed of 2000 rev/min.

2.2.3 The fire pump diesel engines provide drive for the second stage pump and also drive for a hydraulic power pump. The output from the hydraulic power is used to drive the first stage pump.

2.2.4 Automatic starting of the pumps is initiated at TCP2 Control Room, QP Control Room or by fire alarm pushbuttons (FABs). Fire pump start will also be initiated by operation of the Emergency Shutdown System.

2.2.5 Thirty separate deluge/sprinkler/water spray systems are installed throughout the platform for protection of equipment and areas as follows:

	Equipment/Area	Location
1)	Pig receivers CM1 and CM2	Pancake 05
	Pipe support frame No 2 (port)	
2)	Pancake 53	Cellar Deck
3)	Condensate recycle tank CV33	Pancake 06 and 07
	Pipe support frame No 2 (port)	
4)	Glycol storage tank CV9	Steel floor east
	Methanol storage tank CV23	(Cellar Deck)
5)	Diesel storage tank CV10	Pancake 09
6)	Condensate surge tank CV3	Module 01 (Main Deck)
	Pig receiver CM9	
7)	Slug catcher CV1A	
	FWKO separators CV1 B/C	Modules 02 and 03
	Glycol contactors CV2A/B/C	(Main Deck)
8)	Condensate separators CV14A/B/C	Module 03 (Main Deck)
9)	Module 01/02/03/04	Main Deck
10)	LP vent knockout drum 67B01	
	Suction drum 11B01B	Module 33 (Main Deck)
11)	Compressor Room	Module 33 (Main Deck)
12)	Suction drum 11B01C	
	Water separator 11Bo2B	Module 31 (Main Deck)
13)	Compressor Room	Module 30 (Main Deck)
14)	Slug Catcher CV210 & CV201/CV211	Module 50 (Main Deck)
15)	CM201 & General Area	Module 50 (Upper Deck)
16)	Compressor Room	Module 31

	Equipment/Area	Location
17)	Suction drum 11B01A Water separator 11B02A	Module 30 (Main Deck)
18)	Pig launcher CM3	Module 01 (Upper Deck)
19)	Modules 02 and 03	Upper Deck
20)	Glycol reboiler area firewall	Modules 03 an 04 (U. Deck)
21)	Fuel gas package 50X01A/B Hydraulic package 56X01	Module 32 (Upper Deck)
22)	Natural gas cooler 11E01A	Module 30 (Upper Deck)
23)	Natural gas cooler 11E01B	Module 31 (Upper Deck)
24)	Natural gas cooler 11E01C	Module 33 (Upper Deck)
25)	Module 51	Main and intermediate deck
26)	Module 51	Upper deck
27)	ESDV's CM1.1, CM2.1, CM3.1	PC 42 Cellar Deck
28)	ESDV's CM1.1, CM2.1, CM3.1	PC 42 Cellar Deck
29)	East Truss Cooling Structure	PC 43 Cellar Deck
30)	Offices, south east corner	PC 948 Cellar Deck

2.2.6 The deluge/sprinkler/water spray systems are operated:

(a) automatically by operation of the Emergency Shutdown System initiated by fire detection

or

(b) manually by operation of a deluge valve.

2.3 Operation

2.3.1 The firewater ring main is maintained at a pressure of 6.18 bar by the brine pumps serving the watermakers on QP. Should the pressure in the ring main drop to 3.08 bar an alarm is initiated in the QP Control Room.

2.3.2 If both watermakers are down, two pressure switches are manually put in service. These switches automatically control starting and stopping of the selected brine pump, maintaining a pressure of between 4.12 bar and 6.87 bar in the ring main.

2.3.3 When the fire pump is running, ring main pressure is maintained by a pressure control valve, excess sea water discharging overboard. This valve is also used to discharge sea eater overboard, during pumping tests.

2.3.4 The firewater ring mains in the compression area are cross-connected to the treatment area ring main and to the compression area washdown system.

HALON SYSTEMS

1. GENERAL

1.1 Independent Halon systems are installed to combat fires in platform areas presenting a special fire hazard or containing electrical equipment.

1.2 Halon 1301 (BTM) is a colourless, odourless, electrically non-conductive gas that extinguishes or prevents ignition by inhibiting the chemical reaction of fuel and oxygen. It is designs to conform with National Fire Protection Association (NFPA) Standard 12A, using a 5 per cent minimum concentration at 20°C, and is the least toxic of the vapour fire extinguishing agents.

1.3 Halon 1301 is normally very safe. However, when a system is activated, the affected area should be vacated as soon as possible. Under extreme conditions the Halon can break down to form an acidic compound.

1.4 The gas is stored in rechargeable containers mounted in racks near the protected area.

2. DESCRIPTION

2.1 Halon is distributed within each protected area by a pipework system, fitted with discharge nozzles specially designed to suit the particular application, and strategically located to flood the entire area.

2.2 Operation of a system is automatically or manually initiated as follows:

(a) Automatically, by operation of the fire detection sensors (smoke detectors) within the area, via the Fire and Gas Detector Control Panel in the Control Room. The smoke detectors, which are coincidence -interlocked, will operate the Halon system for their associated area only.

(b) An automatic release; circuitry within the Fire and Gas Detector Control Panel will automatically initiate associated alarm indication, fire pump start and appropriate emergency shutdown action.

(c) Manually, by operation of a release lever situated at the entrance to the protected area.

2.3 On either automatic or manual operation of a system a preset logic time delay of between 5 to 30 seconds, prior to Halon release, allows for evacuation of personnel.

2.4 Visual indication is provided on Halon Control Panels at the entrance to a BTM-protected area, showing the system state as follows:

(a) An illuminated RED lamp indicates BTM being released.

(b) An illuminated AMBER lamp indicates system in 'automatic'.

(c) An illuminated GREEN lamp indicates system in 'manual'.

2.5 A keyswitch located in the Halon Control Panel provides local control of the operating mode.

2.6 An audible warning will sound prior to and during the release of BTM.

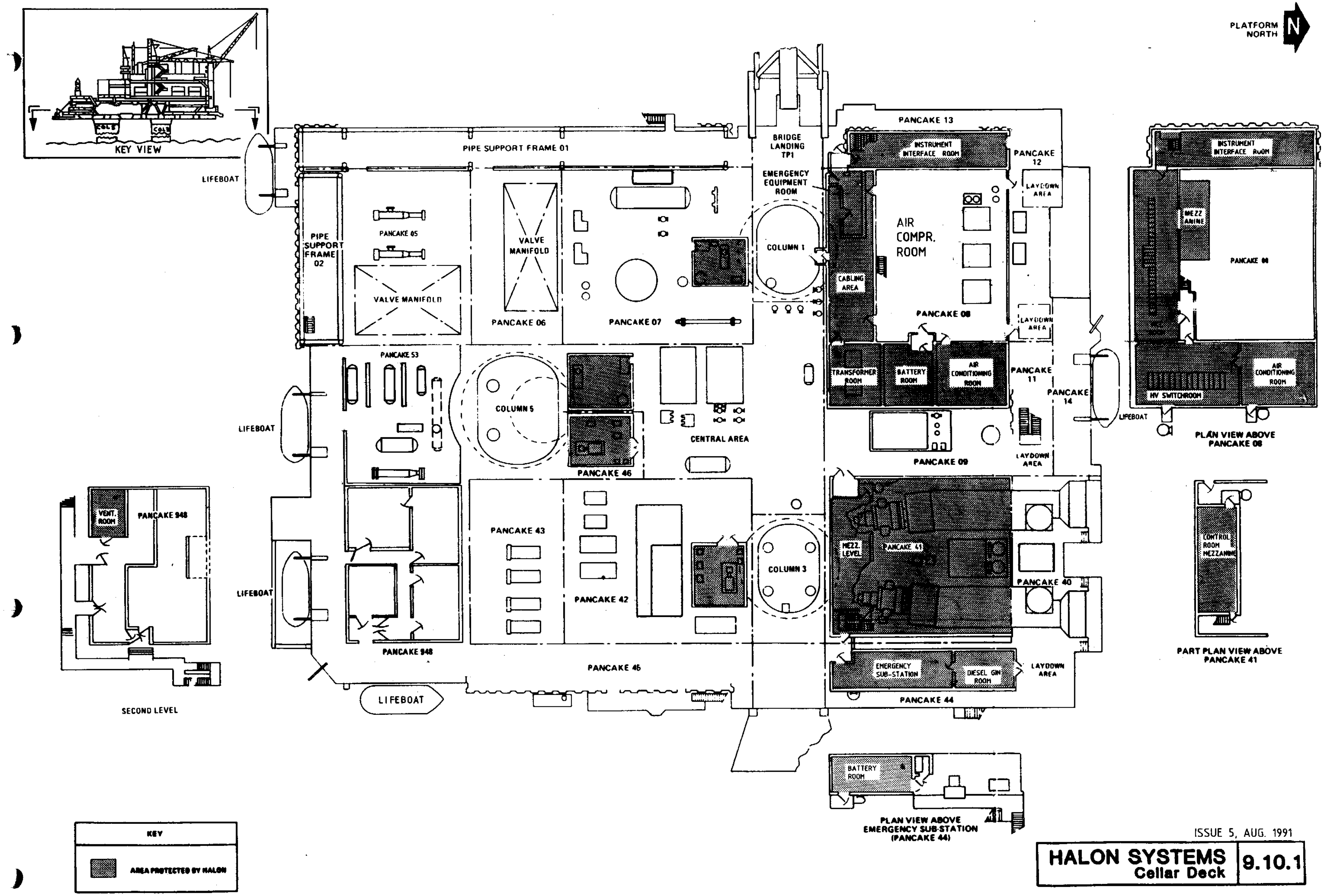
2.7 Independent Halon systems are installed in the areas listed below, that is, each area has its own Halon bottles and smoke detectors which only activate the system within that particular area.

TREATMENT AREAS

Room/Area	Zone/Level	Weight of Halon (kg)	Number of Containers
Condensate StorageTank	Module 02	-	-
Vent Stack	Module 04	-	-
Cabling Room	Pancace 08	106	3
Emergency Supply Room	Pancake 08	22	1
Transformer Room	Pancake 09	51	1
Air Conditioning Room	Pancake 09	198	4
Battery Room	Pancake 09	46	1
Interface Room	Pancake 13	-	1
Motor Control Centre	Mezzanine Level	150	3
HV Switchgear Room	Mezzanine Level	120	3
Fire Pump Room CP6A	Pancake 07	92	2
Fire Pump Room CP6B	Pancake 07	90	2
Battery Room	Module 51	12.5	1
HVAC Room	Module 51	47.5	1
Instrument Interface Room	Module 51	29.5	1
Electrical Interface Room	Module 51	25.5	1

COMPRESSION AREAS

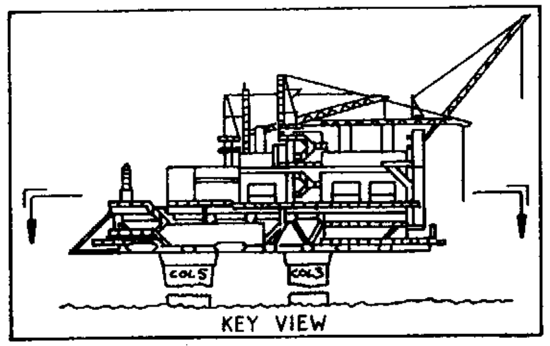
Room/Area	Zone/Level	Weight of Halon (kg)	Number of Containers
HV Switchgear Room (NEF)	Module 32	-	-
H&V Fan Room	Module 32	110	2
Transformer Room	Module 32	110	2
Substation	Module 32	450	6
Control Room	Module 32	600	8
Diesel Generator Room	Pancake 44	45	3
Battery Room	Pancake 44	30	2
Emergency Substation	Pancake 44	55	1
Turbo Generator Room	Pancake 41	675	9
Turbo Generator Control Room	Pancake 41	45	3
Fire Pump Room	Pancake 42	110	2
Fire Pump Room	Pancake 46	75	1
Ventilation Room	Module 948	22	1
Gas Compressor Hood	Module 30		
Gas Compressor Hood	Module 31		
Gas Compressor Hood	Module 33		

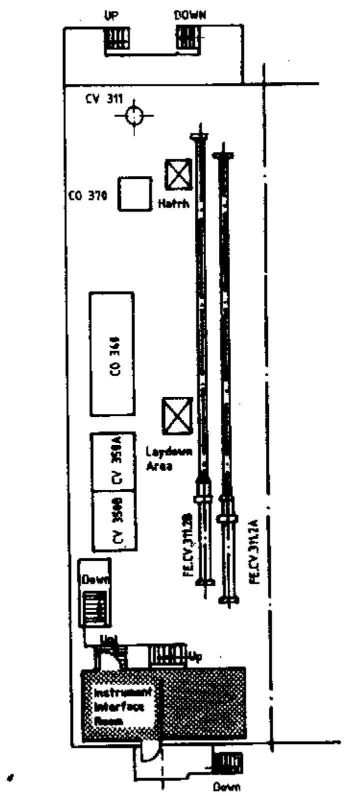


ISSUE 5, AUG. 1991

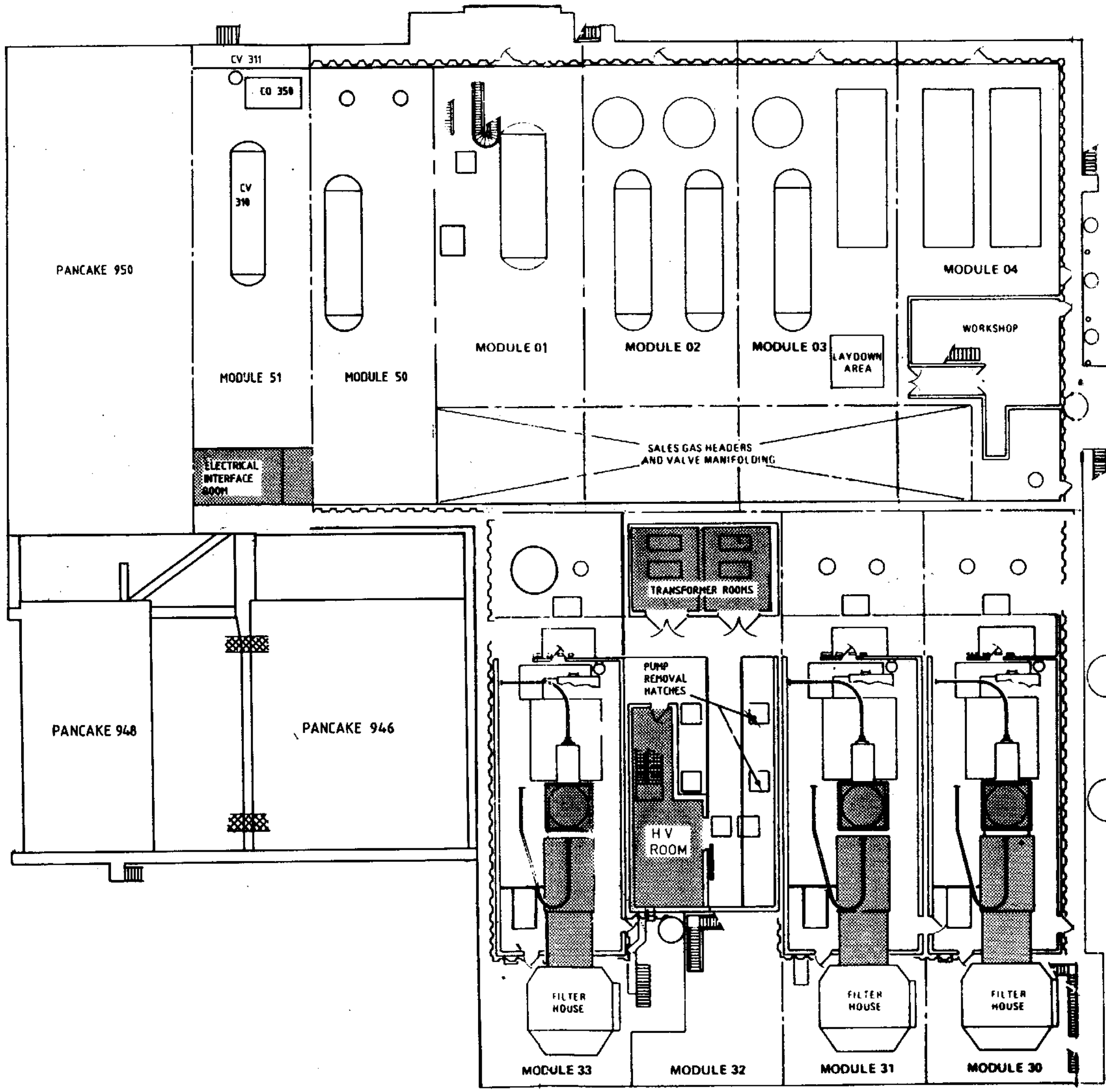
HALON SYSTEMS
Cellar Deck
9.10.1

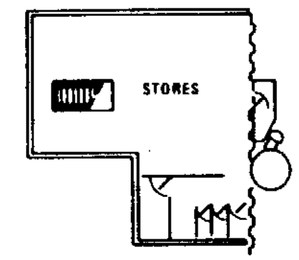
PLATFORM NORTH



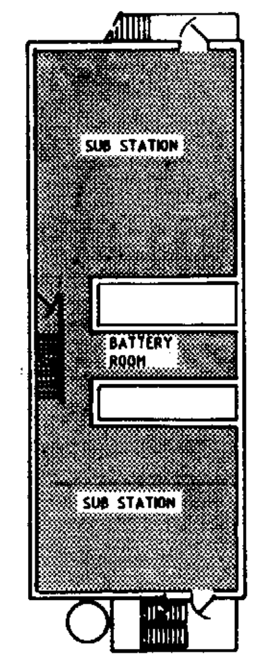


M51 INTERMEDIATE DECK





PLAN ABOVE WORKSHOP (MODULE 04)



PLAN ABOVE WORKSHOP (MODULE 32)

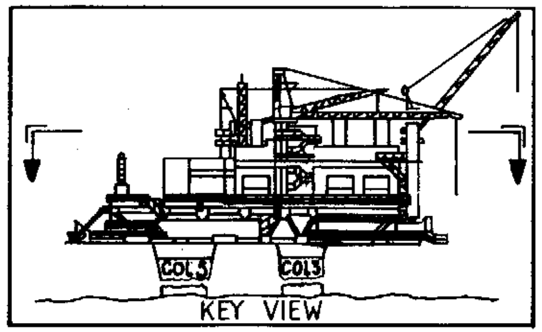
KEY

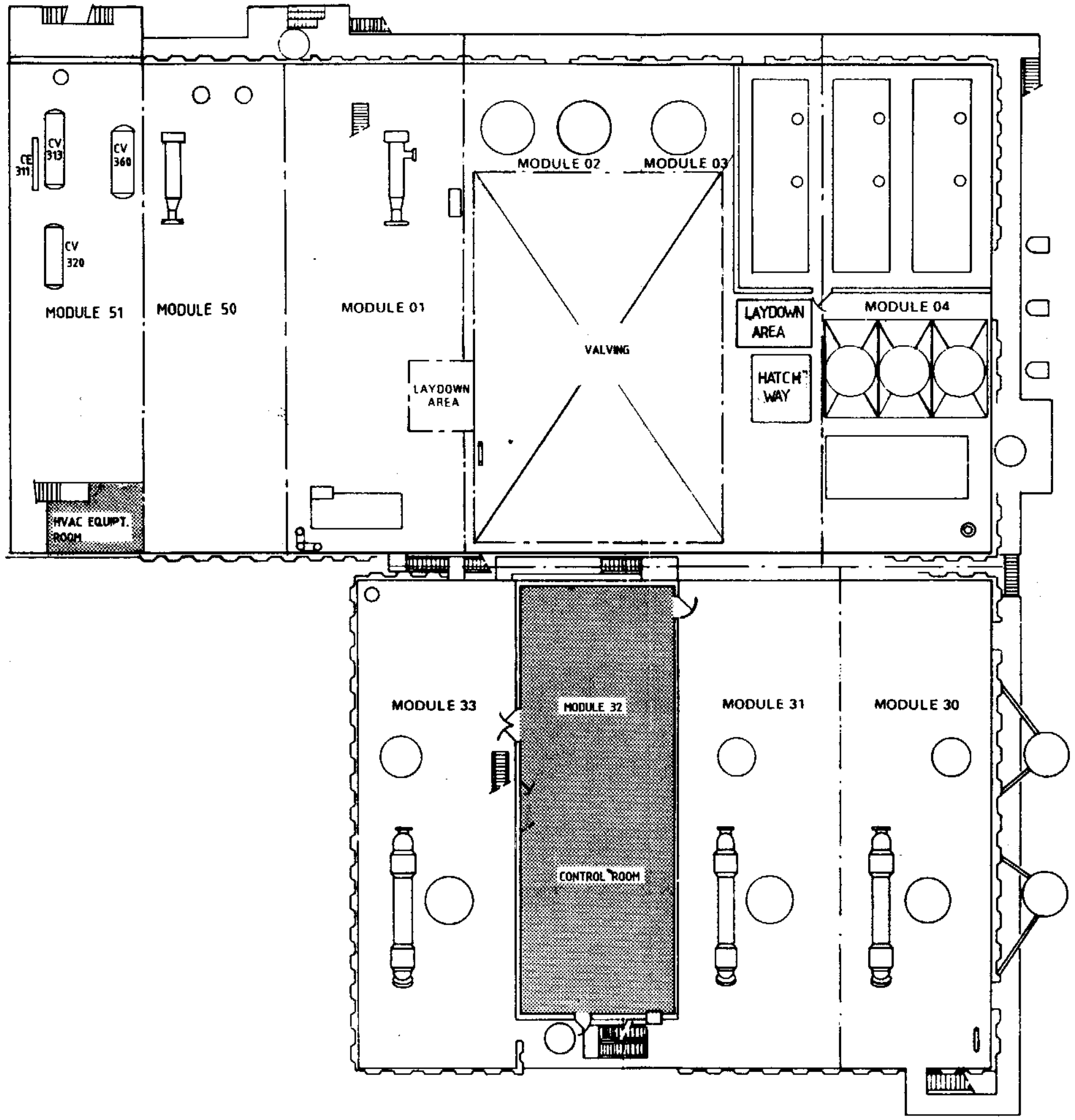
AREA PROTECTED BY HALON

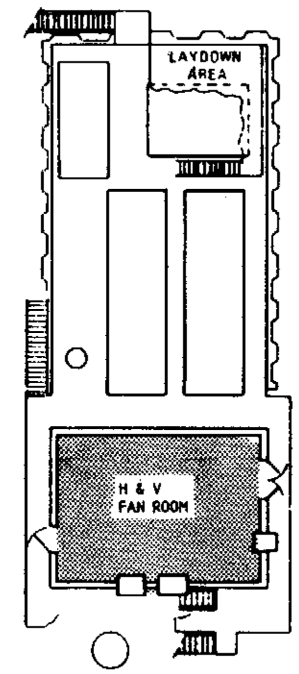
ISSUE 5, AUG 1991

HALON SYSTEMS
Main Deck
9.10.2

PLATFORM NORTH N







PLAN VIEW
ABOVE CONTROL ROOM
(MODULE 32)

KEY
AREA PROTECTED BY HALON

ISSUE 4, AUG.1991

HALON SYSTEMS Upper Deck	9.10.3

FIREWALLS AND FIREPROOFING

1. GENERAL

1.1 Firewalls are installed at various locations throughout the platform to limit the spread of fire and to give maximum protection to personnel. They are constructed from steel plate, strengthened as necessary by corrugation of stiffeners. They protect certain areas from fire and/or prevent a fire from spreading by containing it within the area.

1.2 Firewalls, fireproofing, the sealing of apertures through these walls and self-closing doors are part of the platform's safety features.

1.3 Equipment vital to the safety of personnel is protected by additional firewalls.

1.4 Firewall and ceiling insulation is achieved with Rockwool, fire-retardant panels or air gaps between steel plates.

1.5 Permanent outside walls are constructed from 'Profilac' corrugated stainless steel sheets.

1.6 Deck floors are constructed from 8mm mild steel plate.

2. DESCRIPTION - TREATMENT MODULES

2.1.1 Upper Deck

Glycol regeneration units CQ1A, B and C are enclosed by two external walls and two inner facing firewalls constructed from 5mm steel plate to Solas Class A0 rating.

2.1.2 Module 51 (E.F.)

The HVAC Room located at the east side of Mod.51 under the weather deck, is enclosed on all sides by H.O. firewalls.

2.2 Main Deck

2.2.1 Workshop

The Workshop in Module 04 has one external wall constructed from 'Profilac' stainless steel and all internal walls constructed from 5mm mild steel sheet clad with Rockwool and aluminium sheet.

2.2.2 Stores

The Stores in Module 04 at Mezzanine Level has one external wall constructed from 'Profilac' stainless steel and all internal walls constructed from 5mm mild steel sheet clad with Rockwool and aluminium sheet. The stores floor is constructed from 6mm mild steel plate.

2.2.3 Module 51 (E.F.)

The electrical interface room, located at the east side of Mod. 51 is surrounded on three sides by H60 firewalls. The two doors to external exits are constructed to H60 standard. The remaining wall to the battery room is an A.O. firewall with an A.O. firedoor.

2.2.4 The Battery room is located next to the elect. I/Face room and is separated by an A.O. firewall and door. The remaining three walls of the battery room are to H60 standard.

2.2.5 The Instrument Interface Room, located at the east sided of Mod. 51 and above the main deck at mezzanine level, is surrounded on all sides by H60 firewalls and is served by two doors.

2.3 Cellar Deck

2.3.1 Fire Pump Houses 1 and 2

The Fire Pump Houses located in Pancake 07 are both enclosed by Solars Class A60 firewalls and ceilings. The doors for each pump house are self-closing Solas Class A60 rated.

2.3.2 Instrument Interface Room (Cellar Deck Level)

The instrument Interface Room located in Pancake 13 is enclosed by Solas Class A60 firewalls. The door opening into the Interface Room is a self-closing type, Solas Class A60 rated.

2.3.3 Instrument Interface Room (Mezzanine Level)

The Interface Room is enclosed by Solas Class A60 firewalls and ceiling. The door opening into the Interface Room is a self-closing type, Solas Class A60 rated.

2.3.4 Swithgear, Generator and Control Rooms (Mezzanine Level)

The outside walls and ceiling of the Switchgear, Air Compressor, MCC and Air Conditioning Rooms are all Solas Class A60 rated. The dividing walls are not rated.

2.3.5 Transformer Room and Battery Room

The Transformer and Battery Rooms located in Pancake 09 are both enclosed by Solas Class A60 firewalls. The doors for each room are mild steel double skinned constructions, each skin being 2.5mm thick.

2.3.6 Air conditioning Room

The Air Conditioning Room located in Pancake 09 has two internal firewalls rated as Solas Class A60, one internal wall constructed from 5mm thick mild steel plate. The door opening into the room is a mild steel double skinned construction, each skin being 2.5mm thick.

2.3.7 Cabling Room

The Cabling Room located in Pancake 08 has three Solas Class A60 firewalls; the fourth adjoining the Air Compressor Room, is constructed from mild steel plate 5mm thick. The doors opening to the Transformer Room, Production Area, and Air Compressor are mild steel double skinned constructions, each skin being 2.5mm thick. The doors through the Emergency Supply Room are Solas Class A60 rated, self-closing type.

2.3.8 Air Compressor Room

The Air Compressor Room located in Pancake 08 has two walls adjoining the Air Conditioning Room and the Cabling Room constructed from mild steel plate; the other two walls are Solar Class A60 firewalls.

2.3.9 Office/Warehouse Module 948

The two level module containing offices on the first floor and warehouse and toilet facilities on the second floor is constructed with A60 class external walls. On both levels the A60 rating is extended into the internal door openings. The second level warehouse access is provided with a gas tight wall of similar construction to that specified for A0 rated walls.

3. DESCRIPTION - COMPRESSION MODULES

3.1 Exterior Walls

3.1.1 Solas A60 Walls

A60 walls have a basic structure of minimum 4mm steel plate stiffened at regular intervals, the external 4mm plate skin being welded, continuous and water- and gastight. The steel is insulated internally with 75mm Rockwool of 110kg/m^3 density, the mats being covered by 25mm hotdipped galvanised wire mesh and fixed to the steel plate by 3mm diameter steel pins and clips. The thickness of insulation covering steel stiffening angles and channels is reduced to 25mm. An aluminium foil vapour barrier of 'alu-kraft' or equal approved type with taped and sealed joints is boned to the insulation so as to provide an effective, continuous barrier against water vapour. Internal mechanical protection of the insulation is provided by corrugated steel sheeting, type 'Robertson Versacor BR45'.

3.1.2 Solas A0 Walls

Walls classified as being Solas A0 rated consist of a continuous welded steel plate skin of 4mm minimum thickness. Where additional acoustic insulation is required, this is 25mm Rockwool of 45kg/m^3 density placed between steel stringers. Where thermal insulation is required, this is 50mm Rockwool of 45kg/m^3 density placed between and over steel stringers. An aluminium foil vapour barrier of Alu-kraft or equal approved type sealed with tape is boned to the insulation to give a continuous and effective barrier to the passage of water vapour.

3.1.3 Gastight Walls

All gastight rated outboard walls (those walls facing the sea where no Solas A60 or Solas A0 ratings are required) are constructed from 2mm thick stainless steel corrugated sheeting. The stainless steel is of Z2 CND 17/13 quality, panel widths to be 980mm with 61.5mm corrugations and one continuous panel to cover the height specified. The cladding panels are continuously welded to each other on the sides and to stainless steel profiles on the ends which in turn are continuously welded to upper and lower truss chords. All gastight rated inboard walls (those walls not facing the sea) are of minimum 4mm stiffened steel plate similar to that specified for Solas A0 rated walls.

3.1.4 Non-rated Cladding

Non-rated cladding is identical in all respect to the stainless steel cladding described above in section, with the exception that the cladding is stopped at the top to allow a clear opening of 600mm and at the bottom to allow a clear opening of 300mm in order to provide free ventilation.

3.1.5 Roofs and Floors

The roof and floors with Solas rating are of similar construction to the walls with identical rating.

3.2 Interior Partitions

Internal walls with a Solas A-rating are identical in every respect with external walls already described, except that where the partition divides two areas which are both heated, the vapour barrier may be omitted.

3.2.1 Internal Gastight Walls

Internal gastight walls are comprised of 4mm stiffened steel plate continuous welded along all sides.

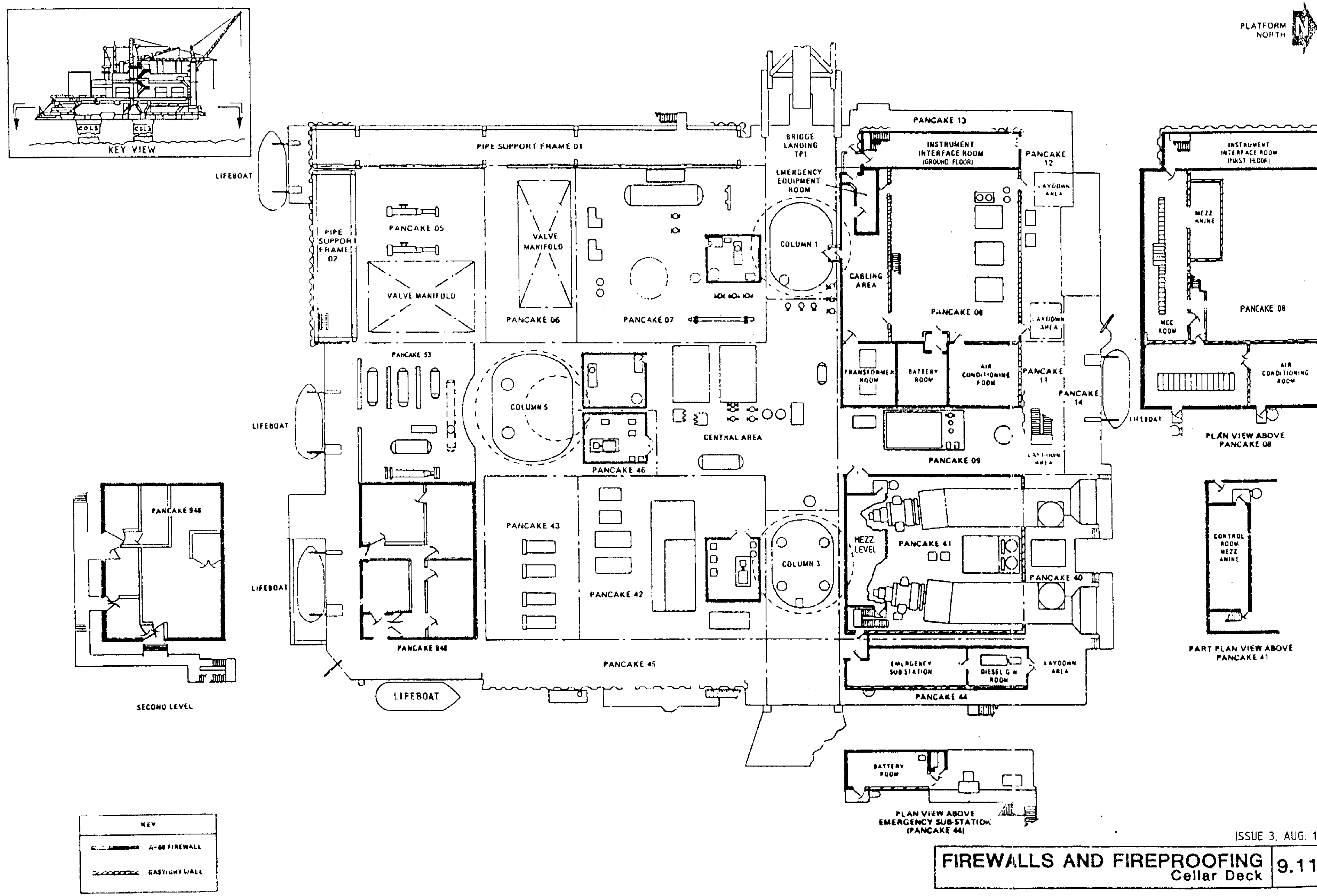
3.2.2 Solas B15 Walls and Ceilings

In the Control Room and whereever specified on the architectural drawings, the internal walls and the internal lining for the external walls are comprised of rigid walls elements approximately 900 x 3010 x 50mm thick of 'Isolamin 33B'type as manufactured by Norrbotten Stal A/S. B15-rated ceilings in the Control Room and wherever specified on the architectural drawings consist of 0.7mm profiled steel sheets linked to form a continuous ceiling, as manufactured by 'Daempa'type 308.

3.2.3 The internal and external doors carry the same Solas rating as the walls in which they are fixed.

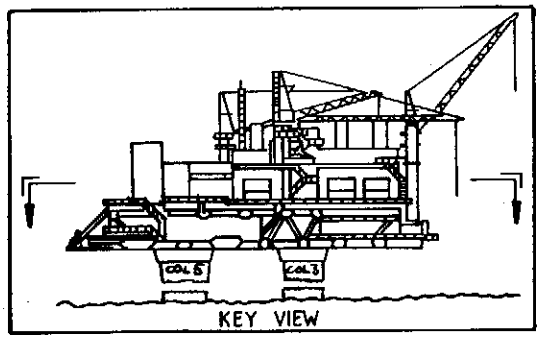
3.3 The list below indicates where the various types of wall are provided.

Upper deck		
H&V Fan Room		- A60
Control Room	- Module 32	- A60
HVAC Room	- Module 51	- H-O
Main Deck		
Substation	- Module 32	- A60
Transformer Room	- Module 32	- A0
Fire Pump Room	- Pancake 07	- A60
Battery Room	- Module 51	- H60
Electr. Interface Room	- Module 51	- H60
Instrument Interface Room	- Module 51	- H60
HV Room	- Module 32	- Gastight
Compressor Room	- Module 30	- Gastight
Compressor Room	- Module 31	- Gastight
Cellar deck		
Battery Room	- Pancake 44	- A60/Gastight
Emergency Substation	- Pancake 44	- A60/Gastight
Diesel Generator Room	- Pancake 77	- A60/Gastight
Turbogenerator Room	- Pancake 41	- A60/Gastight
Fire Pump Rooms	- Pancake 46 and 42	- A60
Pancake 45	-	- Open cladding

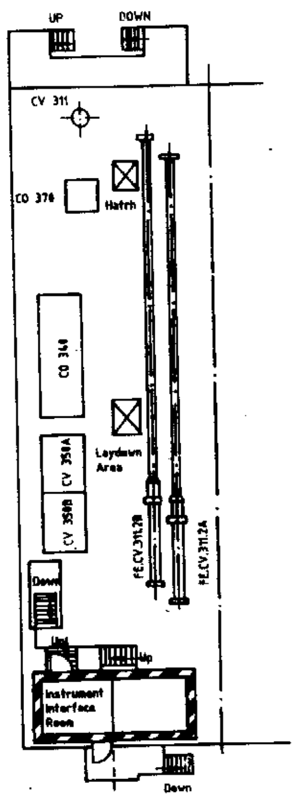


ISSUE 3, AUG. 1991

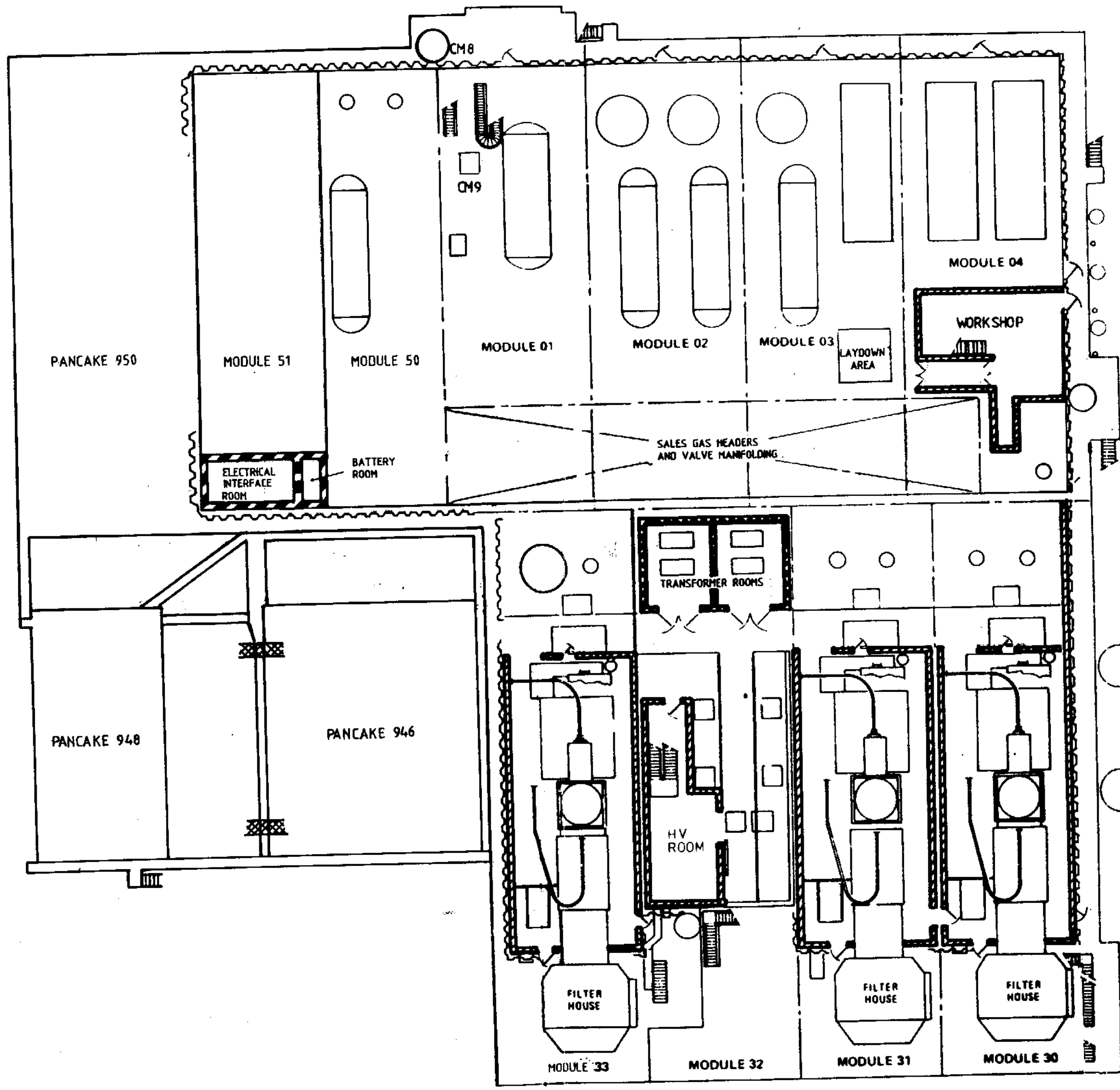
FIREWALLS AND FIREPROOFING
Cellar Deck | **9.11.1**

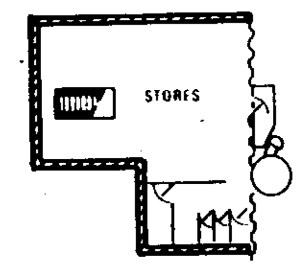


PLATFORM NORTH
N

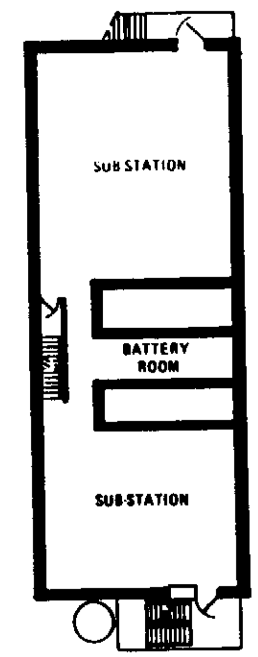


M51 INTERMEDIATE DECK

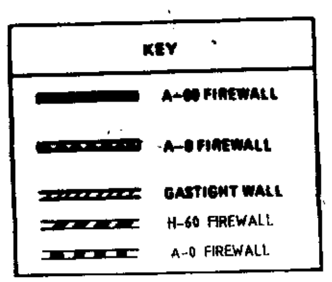




PLAN ABOVE WORKSHOP (MODULE 04)



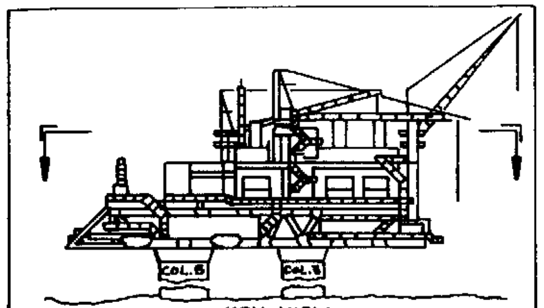
PLAN ABOVE WORKSHOP (MODULE 32)



ISSUE 5, AUG. 1991

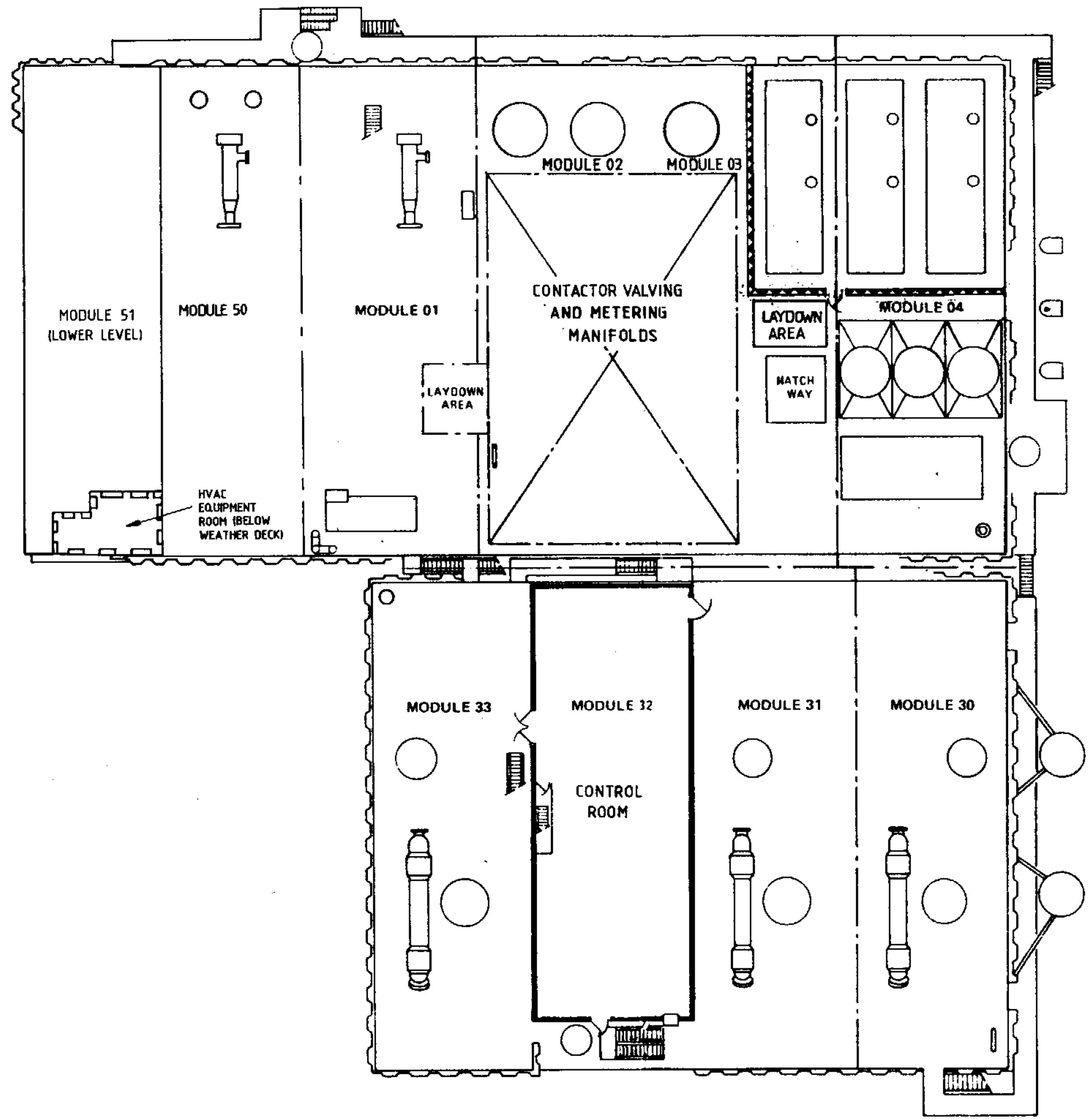
FIREWALLS AND FIREPROOFING
Main Deck

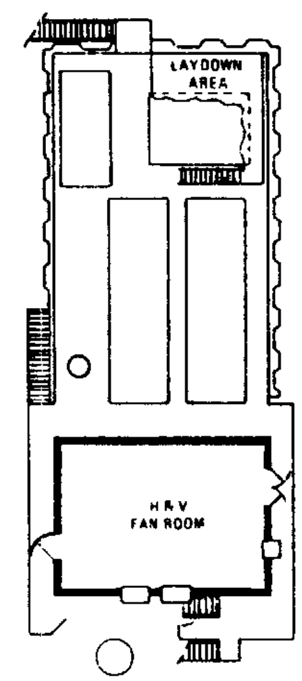
9.11.2



KEY VIEW

PLATFORM NORTH N





PLAN VIEW
ABOVE CONTROL ROOM
(MODULE 32)

KEY
- A-60 FIREWALL
- A-0 FIREWALL
- H-0 FIREWALL

ISSUE 4, AUG. 1991

FIREWALLS AND FIREPROOFING Upper Deck	9.11.3

FIRST AID

1. GENERAL

1.1 Platform QP is equipped with medical facilities to cater for the total completment of 128 men working on Platforms QP TP1 and TCP2.

1.2 The hospital is located on the middle deck of Platform QP.

1.3 First aid kits and stretchers are distributed around the platforms and a trained nurse will be available to administer first aid.

2. RESPIRATORY RESUSCITATION (ARTIFICIAL RESPIRATION)

2.1 General

2.1.1 There are several widely published methods of artificial respiration, the most effective of which are Mouth-to-Mouth (Mouth-to-Nose).

2.2 Mouth-to-Mouth (Mouth-to-Nose)

1) Lay the patient on his back with support under the back of neck (Fig 1).

2) Clear the patient's mouth of any obstruction eg water, oil, debris, vomit, false teeth, etc. (Fig 2).

3) Press the top of the patient's head to tilt it backwards. This ensures that the patient's airway is open (Fig 1).

4) Press the patient's chin upwards to ensure that the tongue is clear of the airway (Fig 3).

5) Open your mouth and take a deep breath, pinch the patient's nostrils closed (Fig 4).

6) Place your mouth over the patient's, making sure that you have a good seal, and blow into the patient's mouth causing the chest to rise (Fig 5).

7) Remove your mouth and watch the patient's chest fall.

8) Repeat this cycle at a rate of 12 breaths per minute until normal breathing resumes, or until all hope is abandoned.

9) When normal breathing resumes, place the patient into the Coma position (Fig 6). This ensures that any vomiting, saliva etc does not interfere with the patient's natural breathing.

10) Keep a close watch on the patient's breathing at this stage, and obtain medical help as soon as possible.

11) If for any reason the patient's mouth cannot be sealed, the hand supporting the chin may be used to close the mouth and the Mouth-to-Nose method used (Fig 7).

Figure 1

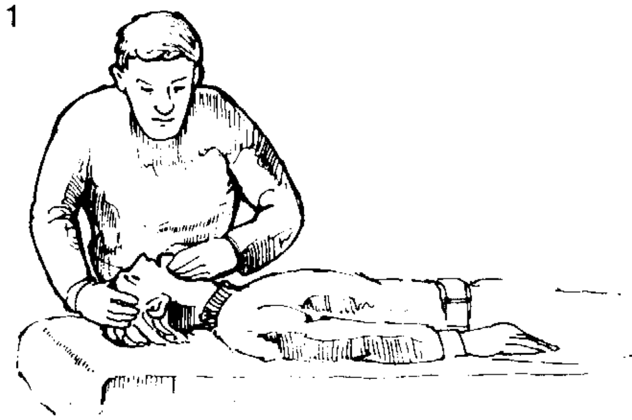


Figure 2

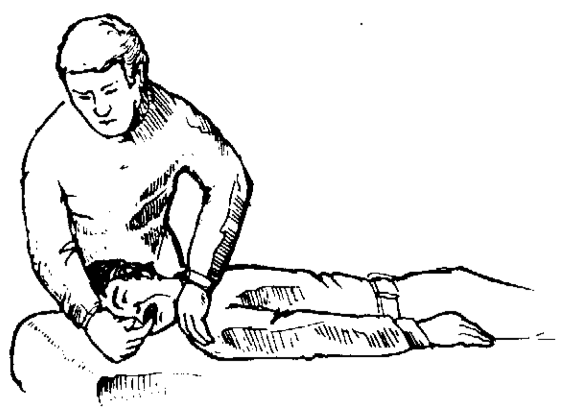


Figure 3

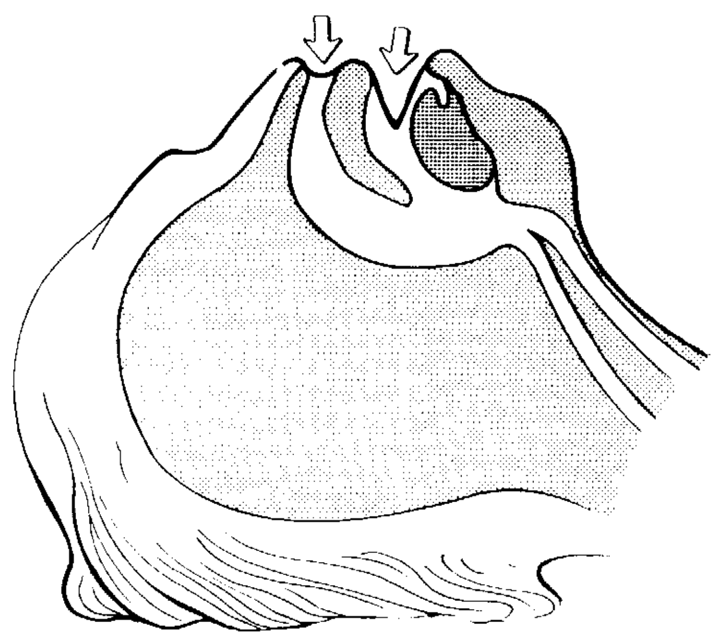


Figure 4

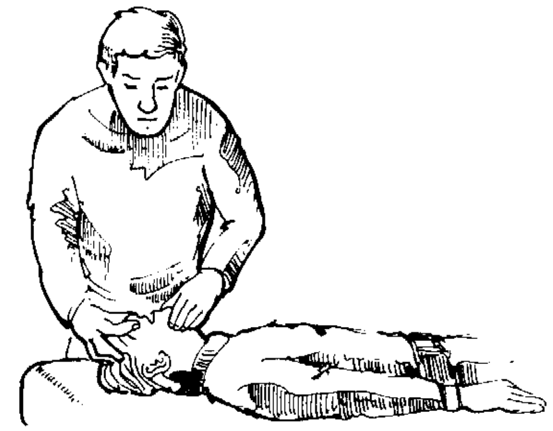


Figure 5

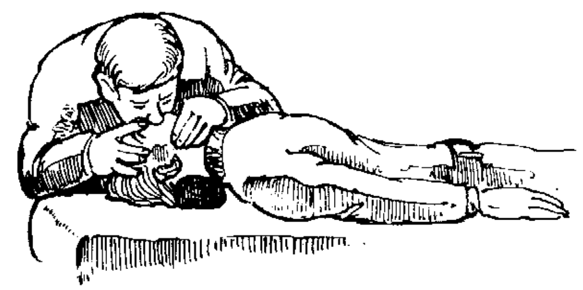


Figure 6

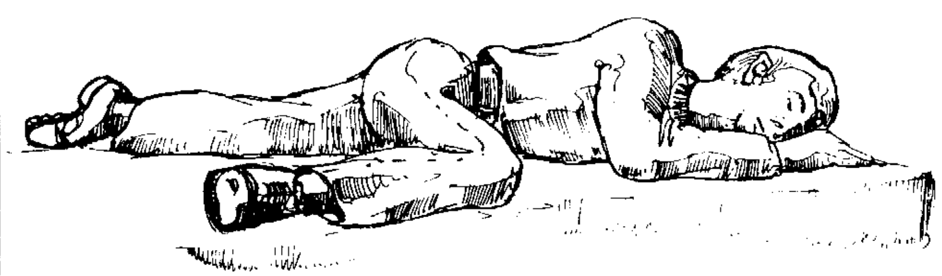
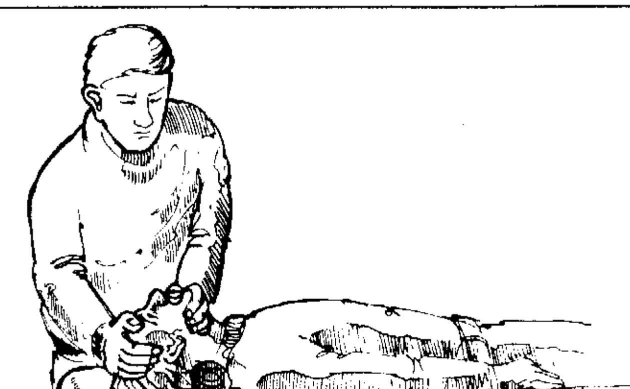


Figure 7



Mouth-to-Mouth
(Mouth-to-Nose)

Figure 8

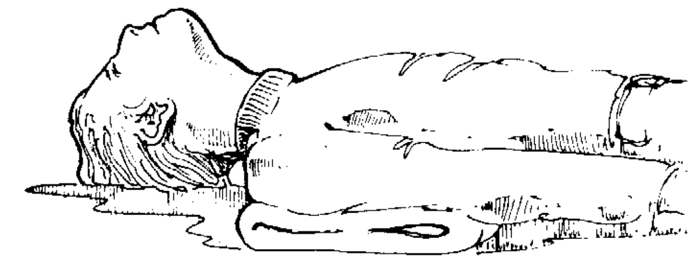


Figure 9

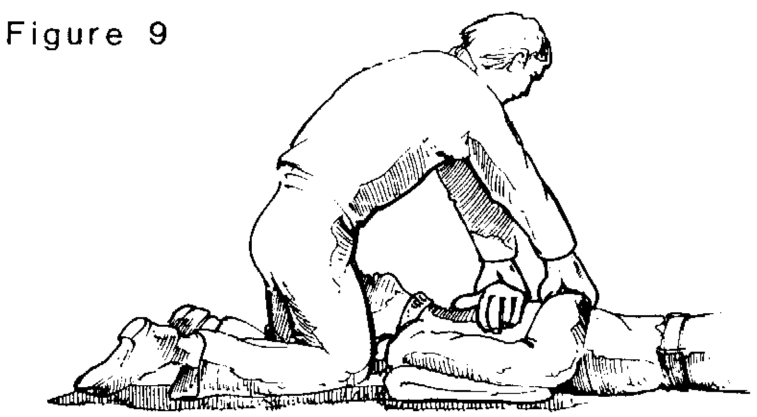


Figure 10

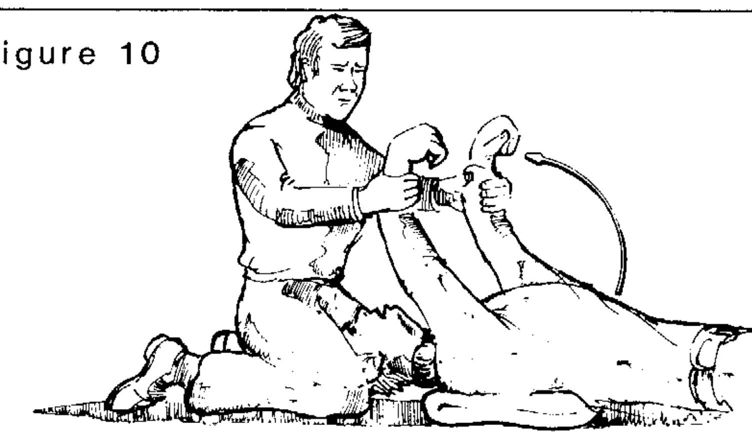
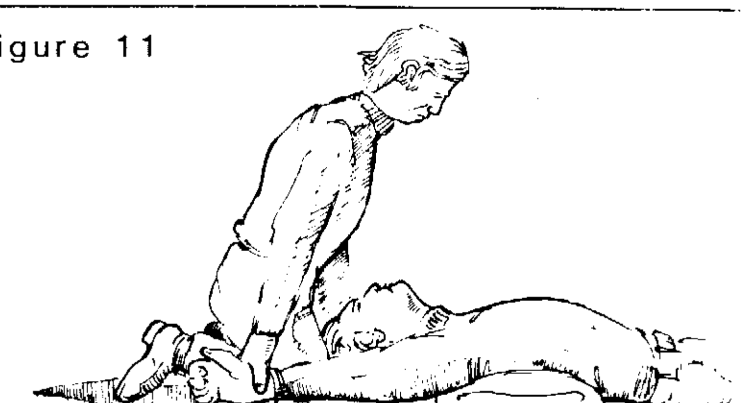


Figure 11



Silvester

RESPIRATORY RESUSCITATION

ESCAPE ROUTES

1. GENERAL

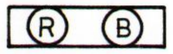
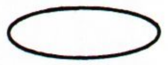
1.1 Escape routes are clear routes leading from the accommodation and working areas to the lifeboat stations.

1.2 There are exit points from each module or area which lead to an escapeway.

1.3 All regularly manned areas are provided with at least two well-defined escape routes, which are indicated by prominently displayed signs. To avoid confusion and/or panic, personnel should, if possible, never move along escape routes against the directional arrows.

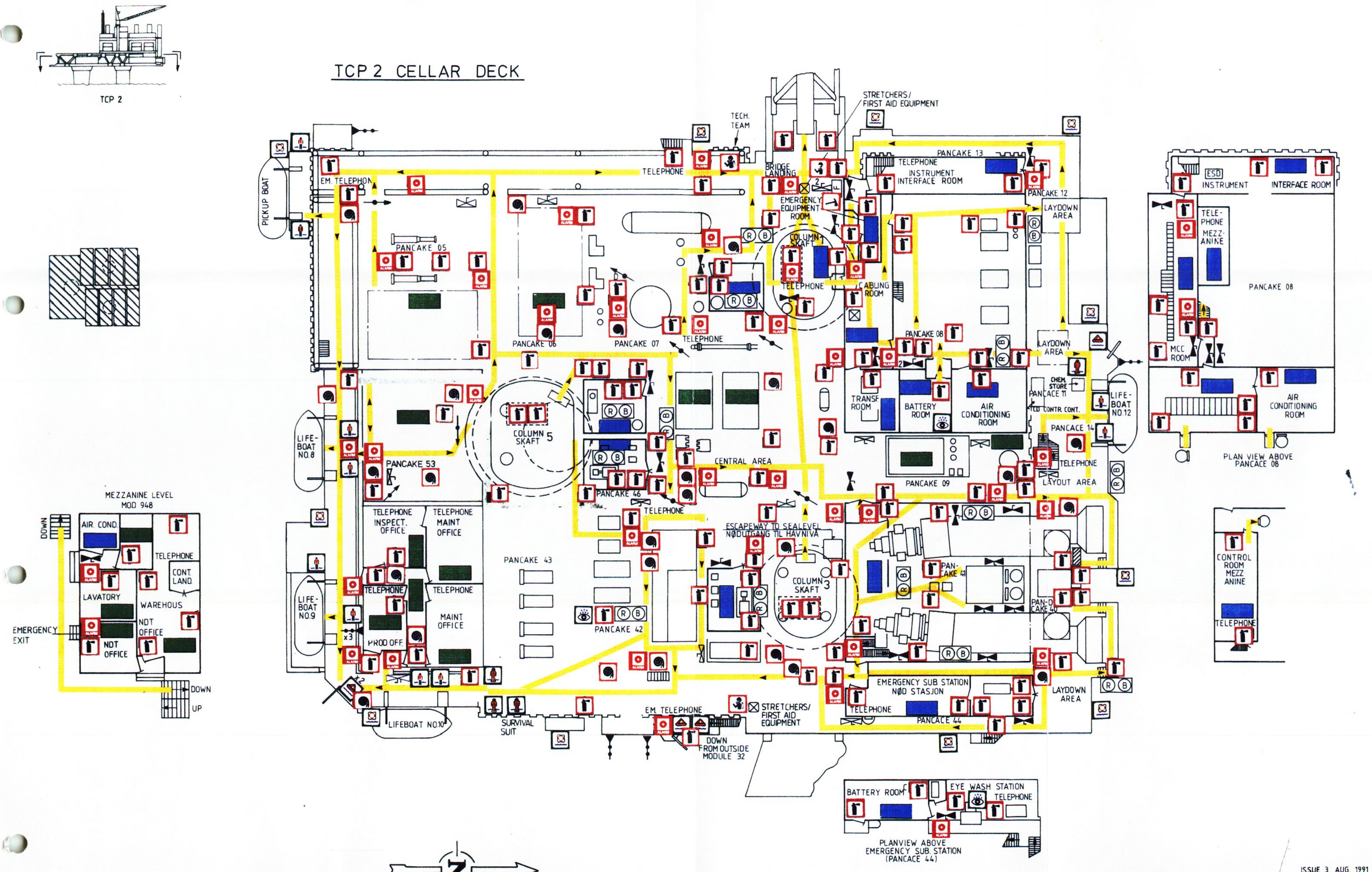
1.4 Personnel are allotted a lifeboat station on arrival on the platform, and should familiarise themselves with its position and the escape routes leading to it.

1.5 In the event of main power failure, adequate lighting of the escape routes is provided by the emergency lighting system.

SYMBOL	SYMBOL DESCRIPTION	SYMBOL FORKLARING
	PORTABLE FIRE-EXTINGUISHER DRY CHEMICAL, WATER, CO_2.	FLYTTBART BRANNSLUKKINGSAPPARAT PULVER, VANN, CO_2
	STATIONARY FI-FI EQUIPMENT FOAM UNIT, HOSE REELS, WASHDOWN REELS	FAST MONTERT BRANNSLUKKINGSUTSTYR SKUM ENHET, BRANNSLANGE, SPYLESLANGE
	ALARM PUSHBUTTON FIRE PUMP START, GENERAL ALARM, MUSTER ALARM, DISASTER SHUTDOWN, EMERGENCY SHUTDOWN	ALARMKNAPP BRANNPUMPESTART, GENERELL, MØNSTRINGS ALARM MANUELL UTLØSNING D.S.D. E.S.D.
	FIRE, TECHNICAL TEAM LOCHER BREATHING APPARATUS, FIREMEN OUTFIT	BRANN, TEKNISK LAG SKAP PUSTEAPPARAT, BRANNMANNS UTSTYR
	CRASH KIT	HAVARI UTSTYR
	LIFERAFT	REDNINGSFLÅTE
	LIFEJACKETS	REDNINGSVESTER
	SURVIVAL SUIT	OVELEVNINGS DRAKT
	LIFE BUOYS	LIVBØYER
	AREA PROTECTED BY HALON OR CO_2	OMRÅDE BESKYTTET AV HALON ELLER CO_2
	AREA PROTECTED BY DELUGE	OMRÅDE BESKYTTET AV OVERRISLING
	ESCAPE ROUTES	RØMNINGSVEIER
	RED & BLUE FLASHING LIGHT	RØDT OG BLÅTT BLINKENDE LYS
	MANUEL ACTUATION OF AUTOMATIC HALON OR CO_2	MANUELL UTLØSNING AV DET AUTOMATISKE HALON/CO_2 ANLEGGET
	MANUEL DELUGE START COCK	MANUELL START AV OVERRISLINGSANLEGGET
	LIFEBOATSTATION	LIVBÅTSTASJON
	FIRE WATER MONITOR	VANNKANON
	KNOTTED ROPE.	TAU MED KNUTER.

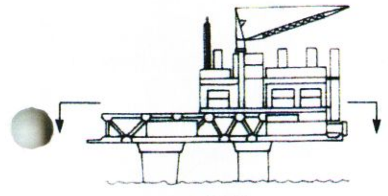
ISSUE 1, AUG. 1991

SAFETY PLOTPLAN & ESCAPE ROUTES

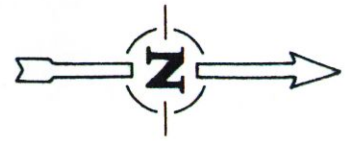


ISSUE 3, AUG. 1991

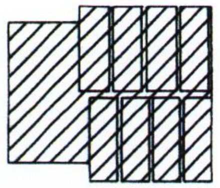
SAFETY PLOTPLAN & ESCAPE ROUTES Cellar Deck	**9.13.3**

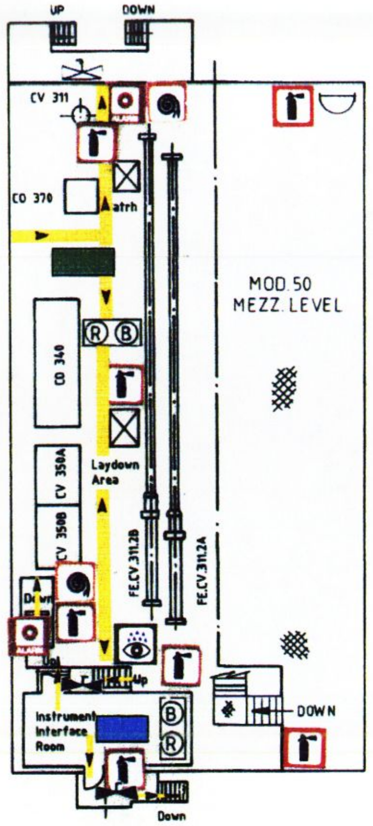


TCP 2

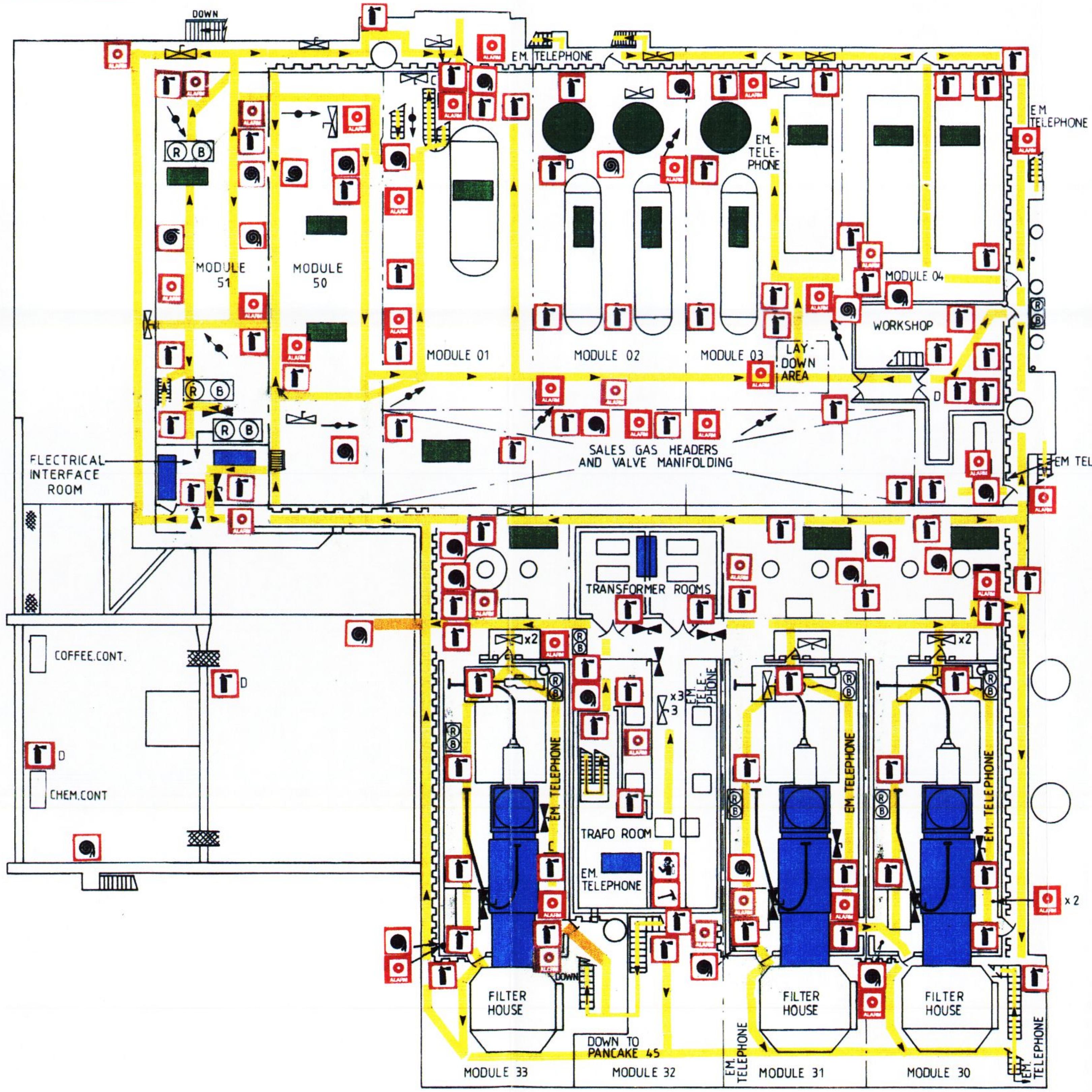


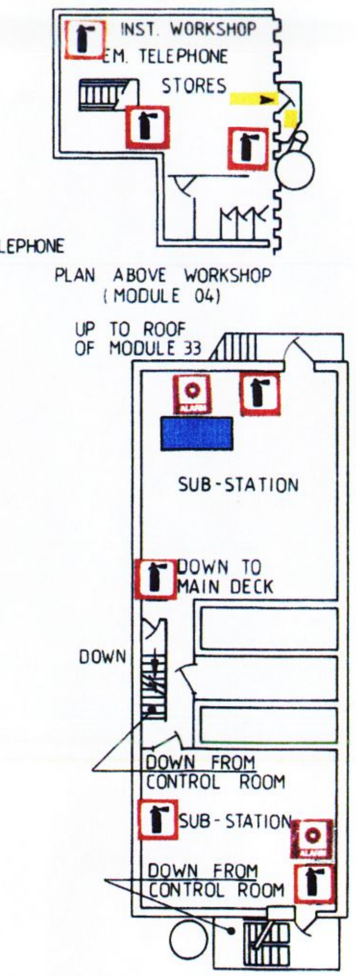
TCP 2 MAIN DECK





M51 INTERMEDIATE DECK

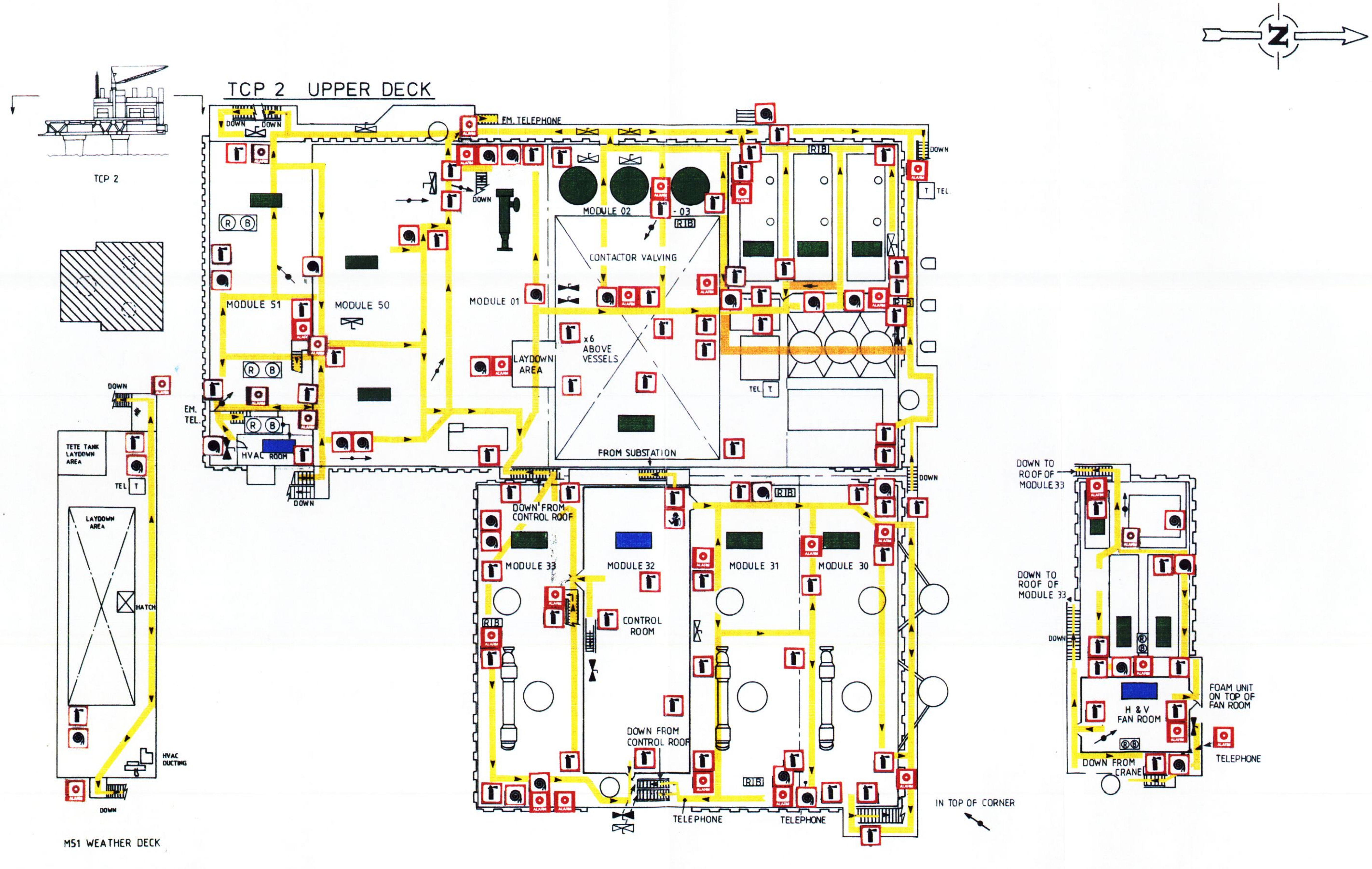




PLAN ABOVE WORKSHOP (MODULE 32)

ISSUE 3, AUG 1991

SAFETY PLOTPLAN & ESCAPE ROUTES Main Deck	9.13.2



ISSUE 3, AUG.1991

SAFETY PLOTPLAN & ESCAPE ROUTES Upper Deck	9.13.1

EMERGENCY LIGHTING

1. GENERAL

For the purposes of this Section, Emergency Lighting is considered to be lighting that is battery-maintained and remains in operation for a limited period when all electricity generation has failed.

2. LIGHTING FITTINGS

2.1 Maintained lighting fittings are of the twin-tube 2 x 40W cold-cathode fluorescent type. They are similar to standard fittings but have a rechargeable, tubular, 6V battery mounted on top, together with a transformer/rectifier charger, an undervoltage relay, an inverter and a transformer. Flourescent lighting fittings in Module 51 have a 12V battery and rectifier/inverter equipment located inside the housing.

2.2 During normal operation the charger provides a trickle charge for the battery, and both tubes are fed from the normal 220V AC output. When this fails the undervoltage relay connects the battery to the inverter, whose output is fed to the transformer and thence at 220V to one tube only. This arrangement provides emergency lighting at half the normal level for about 45 minutes.
When 220V AC supply fails lighting fittings in M51 will provide approximately 35% of normal level from one tube for more than one hour.

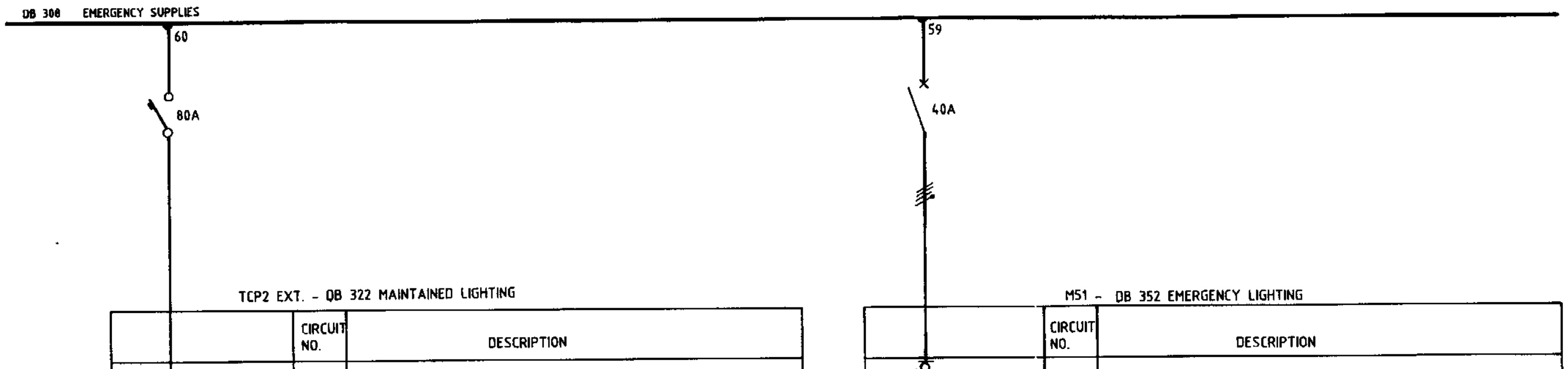
2.3 Upon reappearance of the normal supply the circuit returns to normal and the battery is recharged. The recharge is slow, no boots rate being provided, and can take up to 24 hours after a deep discharge.

END

…8201

	POSI-TION		CIR-CUIT	
D	1		037	LEVEL GAUGE, CELLAR DECK
	2		038	SPARE
	3		039	COLUMN 03, ANCHOR DECK
	4		040	COLUMN 06, ANCHOR DECK
	5		041	SOCKET OUTLET COLUMN 3.
	6		042	WORKSHOP AND STORES, MAIN DECK
	7		043	UNDER CELLAR DECK COLUMN 1
	8		044	UNDER CELLAR DECK COLUMN 3
	9		045	UNDER CELLAR DECK COLUMN 5
	10		046	SPARE
	11		047	SPARE
	12		048	SPARE
E	1		049	SPARE
	2		050	SPARE
	3		051	SPARE
	4		052	SPARE
	5		053	SPARE
	6		054	SPARE

HOLD 24/10-91



TCP2 EXT. - DB 322 MAINTAINED LIGHTING

CIRCUIT NO.	DESCRIPTION
1	ANTI PANIC LIGHTS MOD. 50
2	MAIN DECK MOD. 50
3	WALKWAYS OUTSIDE MOD. 50
4	INTERMEDIATE DECK MOD. 50
5	UPPER DECK MOD. 50
6	P.C. 53 ANTI PANIC LIGHTING
7	P.C. 53 LIGHTING
8	SPARE
9	SPARE
10	SPARE
11	SPARE
12	SPARE
13	SPARE
14	SPARE
15	SPARE
16	SPARE
17	SPARE
18	SPARE
19	SPARE
20	HEATING ELEMENT IN PANEL

M51 - DB 352 EMERGENCY LIGHTING

CIRCUIT NO.	DESCRIPTION
1	EM. LIGHT. MAIN DECK M51
2	EM. LIGHT. EL INTERF. ROOM/BATT. ROOM M51
3	EM. LIGHT. INTERMEDIATE DECK
4	EM. LIGHT. INSTRUMENT INTERFACE ROOM M51
5	EM. LIGHT. UPPER DECK SOUTH & HVAC ROOM M51
6	EM. LIGHT. UPPER DECK CENTRE & NORTH M51
7	EM. LIGHT. WEATHER DECK M51
8	EM. LIGHT. STAIRWAYS WEST SIDE M51
9	EM. LIGHT. STAIRWAYS EAST SIDE M51
10	EM. LIGHT. SOUTH SIDE M51
11	EM. LIGHT. MAIN DECK M51
12	SPARE
13	SPARE
14	SPARE
15	SPARE
16	SPARE
17	SPARE
18	SPARE
19	SPARE
20	HEATING ELEMENT IN PANEL DB352

FOR MORE DETAILED INFORMATION SEE
FF.85.23.03.6001 AND FF89.23.03.0027.

ISSUE 2, AUG. 1991

EMERGENCY LIGHTING
TREATMENT AREAS

DESCRIPTION
V. H.V. ROOM MOD. 32
REHOUSE & TRANSFORMER ROOMS MOD. 32
V. ... ROOM/WAREHOUSE MOD. 32. SOCKETS.
ER DECK MOD. 30. SOCKETS.
BINE ROOM & UNDER CONTROL ROOM MOD. 41
BINE ROOM & CONTROL ROOM MOD. 41
BINE ROOM CENTRAL AREA MOD. 41
KWAYS ALONG PANCAKE 40 MOD. 40
CAKE 40 MOD. 40. SOCKETS.
BINE ROOM & CONTROL ROOM MOD. 41. SOCKETS.
AREA MODULE AREA MOD. 42
COMPRESSOR PACKAGE MOD. 42
AREA MOD. 42. SOCKETS.
MN 3 MOD. 63. SOCKETS.
AKE 43 MOD. 43
AKE 43 MOD. 43. SOCKETS.
AKE 45 MOD. 45
N ... D. 65
AKE 46 MOD. 46
AKE 46 MOD. 46. SOCKETS.
N 3 MOD. 63
WATER MAKER PACKAGE MOD. 42
NAL PLATFORM PANCAKE 44 MOD. 44
RY ROOM/DIESEL GEN. ROOM MOD. 44
ENCY SUB. STATION MOD. 44
ENCY SUB. STAT/DIESEL GEN/BATTERY ROOM MOD. 44
IAL PLATFORM MOD. 44. SOCKETS.
OM MOD. 32. SOCKETS.
E MOD. 45. SOCKETS.
ECK/ EXTERNAL WALKWAYS MOD. 33
WATER MAKER PACKAGE MOD. 42
WATER PUMP ROOM. SOCKETS.
WAY TO SEA COLUMN 3. FLOODLIGHT.

HOLD 24/10/91

LIFESAVING EQUIPMENT

1. GENERAL

Lifesaving equipment providing the primary means of personnel evacuation from the platform comprise the following:

(a) Four 42-man lifeboats (Watercraft).

(b) One open launch (emergency pick-up boat).

(c) Five 25-man liferafts.

(d) Twenty-two lifebuoys.

2. DESCRIPTION

2.1 Watercraft Lifeboats

2.1.1 Each glass fibre Watercraft lifeboat is powered by a 22kW Lister HRWZ water-cooled diesel engine. The engines are equipped with Bryce Berger hydraulic starting systems and Borg Warner hydraulic transmission.

2.1.2 The lifeboat system is designed to enable the crew to evacuate the platform quickly. The lifeboat itself is totally enclosed and independent of the outside atmosphere, and protected by a water spray system which enables the lifeboat to survive an oil fire for 10 minutes (about 1.6km width) when proceeding at maximum speed.

2.1.3 The water spray system consists of a 16 000 litre compressed air cylinder charged to 2483 bar, driving a Watercraft CP10 pump which draws sea water through the bottom of the boat and discharges it through a filter to the spray nozzles.

2.1.4 The air exhausted from the water spray system pump is sufficient to supply the engine when running at full throttle, to provide air for personnel, and to maintain a slight pressure in the passenger space for the exclusion of toxide fumes.

2.1.5 The lifeboat carries sufficient fuel for 24 hours operation and is also provided with the following emergency equipment, stowed in the steering console locker:

(a) Pyrotechnic signals.

(b) Portable radio-telephone for emergency frequency only: battery operated and providing two-way voice communications, plus a two-tone alarm transmission which actuates alarm systems in ships and coastguard stations.

(c) A flashing beacon with line: battery operated and normally hung upside down. When inverted, the beacon automatically switches on and will operate while floating in water.

(d) VHF beacon buoy for air/sea rescue: release of the flexible antenna switches on the beacon which continues to operate for 48 hours.

(e) Hand torch, battery operated.

(f) Portable radar reflector.

2.1.6 The boat has two watertight doors on each side for embarkation, and is attached to the two sets of falls by Mills release gear, operated by the helmsman by means of a handle mounted on the port side of the steering platforms. The gear is designed so that it will not release until the boat is waterborne.

2.1.7 The Schat Type ORD/DHM davits allow the boat to be lowered without power at a controlled speed of 18 to 36m/min.

2.1.8 Lowering is controlled by the helmsman by means of a wire which passes through the canopy at the control position. Lowering ceases at any position on release of the control wire.

2.1.9 Hoisting is normally be electric motor, but may also be carried out by hand crank, which does not revolve when the hoist motor is running or when the boat is being lowered by gravity.

2.1.10

To lower lifeboat:

1) Check that the winch brake is fully ON.

2) Release the gripes by opening the quick-release slip hooks, and allow the weight of the boat to be taken by the falls. Check that the Mills quick-release gear wire is not fouling the superstructure.

3) Embark personnel and secure the hatches, and check that the ventilator installed in the top of the cover is open.

4) The person designated as helman will start the engine as follows:

   (a) Check that the fuel tank outlet valves are open.

   (b) Depress and hold the throttle control pushbutton (to disengage the transmission) and push the throttle lever to the Full Ahead position.

   (c) Check that the decompression levers are facing forward.

   (d) In cold weather, lift the Overload Stop (painted yellow).

   (e) Take up the slack on the hydraulic start lever, then firmly pull the lever through its full travel.

   (f) Return the start lever to its original position.

   (g) When the engine fires, move the throttle lever to the Neutral position. The lever engages the hydraulic transmission when operated.

5) Pull the control wire to lower the boat.

6) When the boat is waterborne and the weight is off the falls, pull the quick-release handle to disengage the Mills release gear.

7) Close the ventilator.

8) Move the trottle lever to the required Ahead position and steer the boat away from the platform.

9) If required, operate the water spray system by opening the valve (painted red) under the forward centre seat.

2.1.11 To hoist the lifeboat:

1) At the davit, check that the winch brake is fully ON.

2) Check the function of the 'overhoist' and 'stowed position' limit switches by manually operating the levers.

3) Position the lifeboat under the falls, and engage the Mills release gear.

4) Stop the engine.

5) Close the main circuit breaker at the davit.

6) Operate the winch motor and hoist the lifeboat. Check that the control wire is coiling correctly.

7) When the lifeboat is 6in from the stowed position, stop the winch motor.

8) Open the main circuit breaker and complete stowage of the boat by handcrank.

9) Secure the gripes.

10) When the boat is secure, release the brake to take the weight on the falls, then reapply the winch brake.

2.2 Liferafts

2.2.1 Two 20-man inflatable liferafts are provided at stations on the east and west sides of the Production Deck.

2.2.2 The liferafts are davit launched with a full complement of men on board, plus provisions, search detection equipment, first-aid kit, etc.

2.2.3 Each liferaft comprises two superimposed buoyance tubes, a double-skin floor and a canopy. The buoyancy tubes are inflated automatically by a CO2 cylinder located under the raft which is discharged during the launch sequence. Inflation of the raft also erects the canopy.

2.2.4 Water pockets under the liferaft provide stability, and a drogue may be streamed to limit drift and provide directional stability.

2.2.5 To launch the liferaft:

1) Place the liferaft valise on deck below the davit.

2) Secure the raft bowsing lines to the deck cleats.

3) At the davit, attach the release hook to the ring on the liferaft.

4) Place the crank handle in position and traverse the davit to the outboard position.

5) Pull the painter to inflate the liferaft.

6) When the raft if fully inflated, boarding may commence.

NOTE
Personnel must remove shoes and sharp objects before boarding the liferaft.

7) When the raft is loaded, release the bowsing lines.

8) Lift the brake lever and allow the raft to descend under control of the winch centrifugal brakes. The brake can also be released from within the raft by pulling the brake release line; this pulls the brake lever over centre.

9) During the descent pull the hook trip wire and cock the hook release mechanism. When the raft reaches the water it will be release automatically.

10) Paddle away from the platform.

11) In cold conditions, inflate the floor. Remove the bung from the valve in the floor and inflate using the hand bellows.

12) Adjust the doorway to suit the weather conditions, but ensure adequate ventilation at all limes. Yawning and lack of energy indicate the need for fresh air.

13) If required to be towed, the towline must be attached only to the liferaft painter bridle or painter attachment patch.

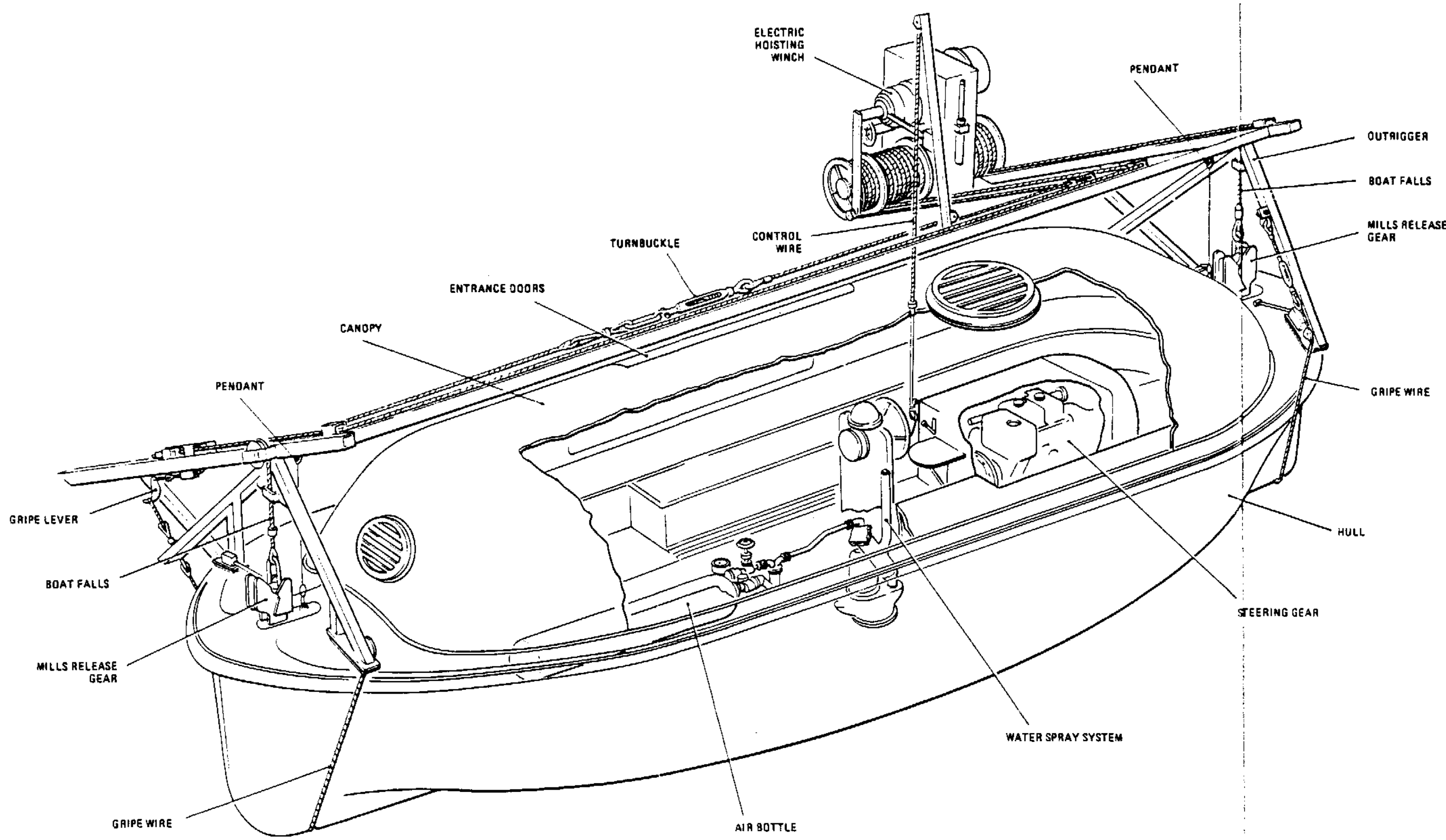
14) Rescue survivors either by throwing the rescue line and quoit or pass the quoit over one arm and swim to the survivor. Unconscious survivors must be lifted under the armpits and slid gently backwards into the raft.

2.3 Lifebuoys

2.3.1 Each lifebuoy is equipped with a water activated light which is automatically released when the lifebuoy is thrown overboard.

2.3.2 Once activated the light will illuminate for 45 minutes.

2.3.3 A lightweight throwing line 50m long is attached to each lifebuoy.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CANOPY
PENDANT
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GRIPE WIRE
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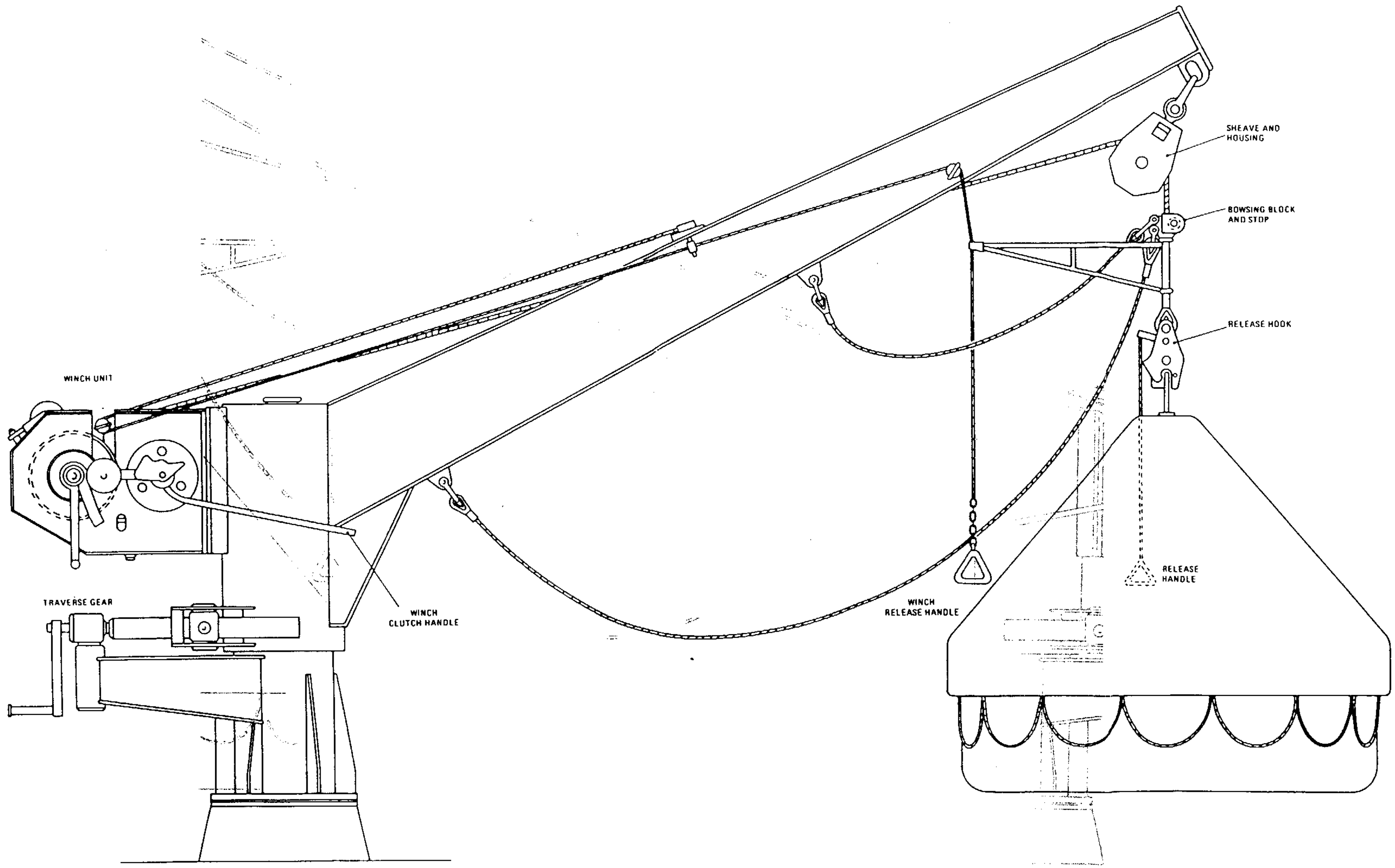

ISSUE 3, Aug.91