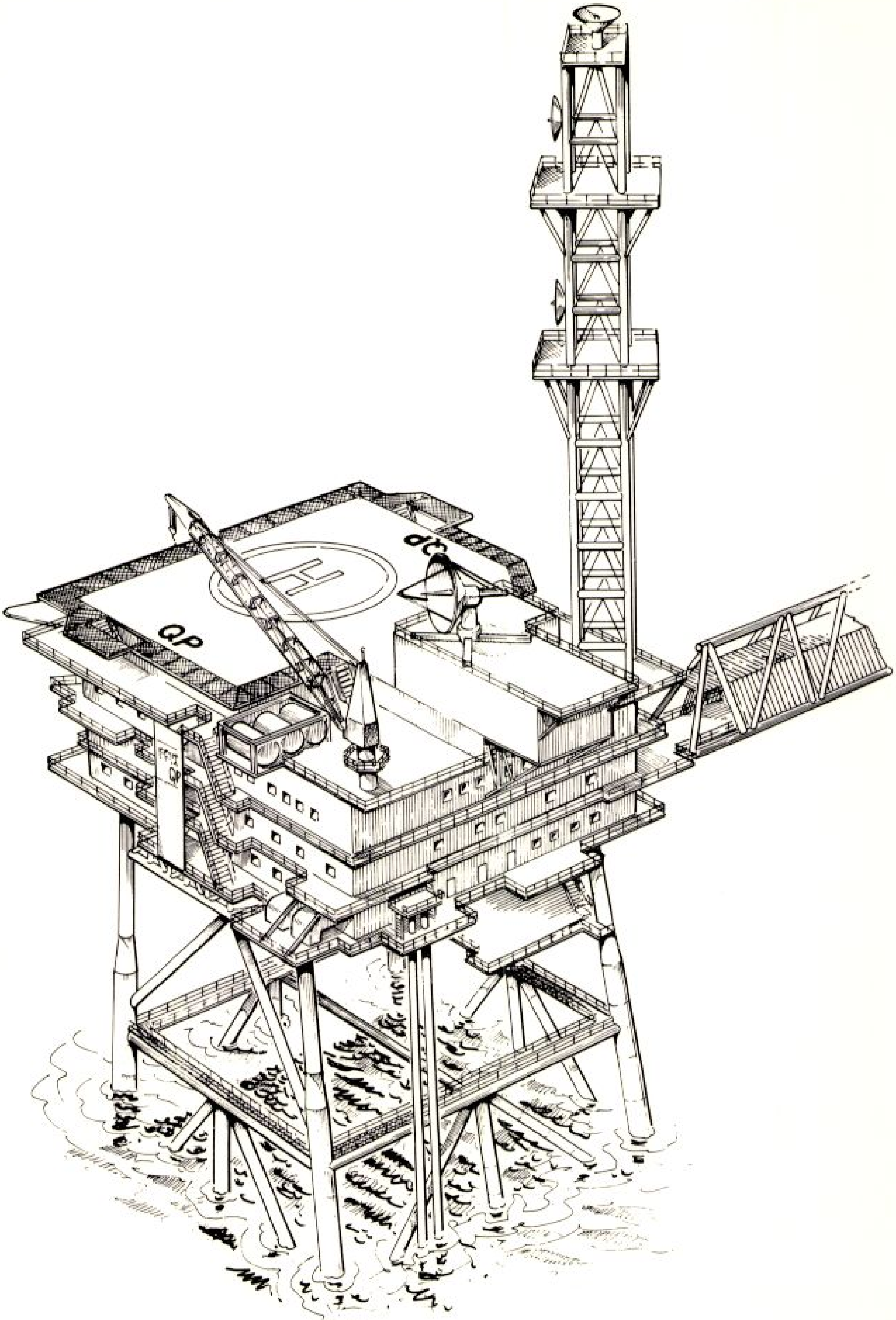
elf aquitaine norge a/s

FRIGG FIELD
QP

VOL 1
OPERATIONS MANUAL

Norsk Hydro | statoil | TOTAL

mark one



ISSUE 1. JULY 1980

FRONTISPIECE

FRIGG FIELD

QUARTERS PLATFORM

VOLUME 1 OPERATIONS MANUAL

CONTENTS

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' layouts and platform safety.

FOR USE WITH TP1, QP, FP AND TCP2	FOR USE WITH DP2 AND CDP1	
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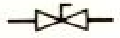
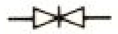
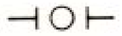
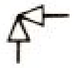
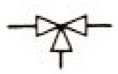
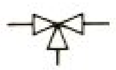
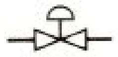
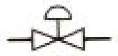
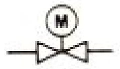
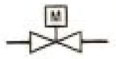
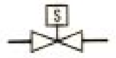
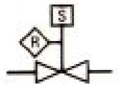
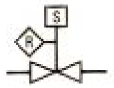
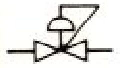
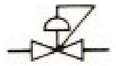
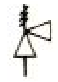
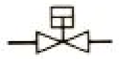
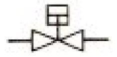
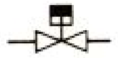
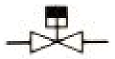
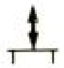
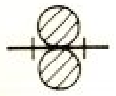
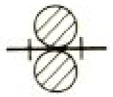
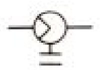
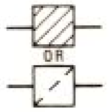
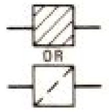
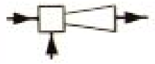
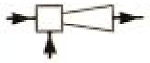
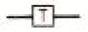
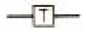
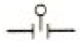
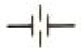
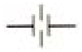
		GLOBE VALVE
		NEEDLE VALVE
		PLUG VALVE
		BALL VALVE
		ROTARY PLUG OR BALL VALVE
		BUTTERFLY VALVE
		CHECK VALVE
		HAND CONTROL VALVE
		ANGLE VALVE
		THREE-WAY VALVE
		DIAPHRAGM-OPERATED CONTROL VALVE
		ROTARY MOTOR-OPERATED VALVE
		SOLENOID-OPERATED VALVE
		SOLENOID-OPERATED VALVE WITH RESET
		SELF-ACTUATING CONTROL VALVE
		PRESSURE SAFETY RELIEF VALVE
		FAIL SAFE OPEN
		FAIL SAFE CLOSE
		PRESSURE AND VACUUM RELIEF MANHOLE COVER
		'Y' TYPE STRAINER
		DUPLEX BASKET STRAINER

FOR USE WITH TP1, QP, FP AND TCP2	FOR USE WITH DP2 AND CDP1	
		PERMANENT STRAINER
		FILTER
		EJECTOR/BOOSTER
		CAP
		HOSE CONNECTION
		BLIND FLANGE
		SCREWED CAP
		TRAP OR DRAINER
		FLEXIBLE HOSE
		BLIND AND SPACER
		ORIFICE PLATE
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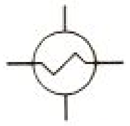
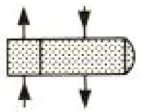
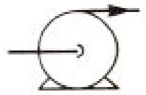
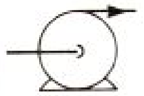
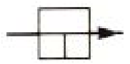
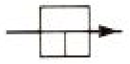
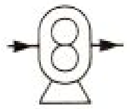
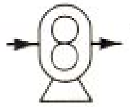
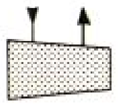
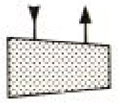
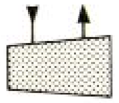
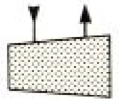
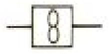
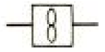
		SHELL AND TUBE HEAT EXCHANGER
		ELECTRIC MOTOR-DRIVEN CENTRIFUGAL PUMP
		RECIPROCATING PUMP
		POSITIVE DISPLACEMENT PUMP
		CENTRIFUGAL COMPRESSOR
		TURBINE
		TURBINE OR PROPELLER TYPE PRIMARY ELEMENT

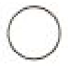
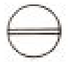
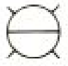
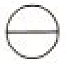
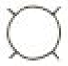
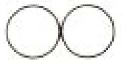
	PROCESS LINE
	PNEUMATIC SIGNAL
	ELECTRIC SIGNAL
	CAPILLARY TUBING
	HYDRAULIC SIGNAL

FLOW ABBREVIATIONS

BS & W	BASIC SEDIMENT AND WATER	PB	PUSHBUTTON
DR	DRAIN	PCV	PRESSURE CONTROL VALVE
FCV	FLOW CONTROL VALVE	P/I	PRESSURE TO CURRENT
FG	FLOW SIGHT-GLASS	PXS	PRESSURE VALVE LIMIT SWITCH
I/P	CURRENT PRESSURE	RO	RESTRICTION ORIFICE
LC	LOCKED CLOSED	TCV	TEMPERATURE CONTROL VALVE
LCV	LEVEL CONTROL VALVE		
LO	LOCKED OPEN		
NC	NORMALLY CLOSED		
NO	NORMALLY OPEN		

INSTRUMENTS

SYMBOLS

	LOCAL MOUNTED INSTRUMENT		LOCAL PANEL MOUNTED INSTRUMENT		BACK OF LOCAL PANEL MOUNTED INSTRUMENT		MIMIC PANEL MOUNTED INSTRUMENT		INSTRUMENT IN INTERFACE ROOM
	MAIN PANEL MOUNTED INSTRUMENT		BACK OF MAIN PANEL MOUNTED INSTRUMENT		PILOT LIGHT		DUAL FUNCTION INSTRUMENT		

IDENTIFICATION TABLE AND COMBINATION OF LETTERS

INSTRUMENT FUNCTION / MEASURED VARIABLE		T TRANSMITTER	I INDICATING	R RECORDING	C CONTROLLING	AL ALARM LOW	AH ALARM HIGH	Y COMPUTING	E ELEMENT	W WELL	SL SWITCH LOW	SH SWITCH HIGH	Q INTEGRATOR	X SPECIAL COMPONENT	G GAUGE	HC HAND CONTROLLER	HS HAND SWITCH
ANALYSIS	A	AT	AI	AR													
FLOW	F	FT	FI	FR	FC	FAL	FAH	FY	FE		FSL	FSH	FQ	FX		FHC	FHS
LEVEL	L	LT	LI	LR	LC	LAL	LAH	LY			LSL	LSH			LG		LHS
PRESSURE	P	PT	PI	PR	PC	PAL	PAH				PSL	PSH		PX			PHS
PRESSURE DIFFERENTIAL	Pd	PdT	PdI		PdC	PdAL	PdAH				PdSL	PdSH					
TEMPERATURE	T	TT	TI	TR	TC	TAL	TAH	TY	TE	TW	TSL	TSH		TX			THS
MISC	X	XT	XI	XR				XY	XE		XSL	XSH					

ISSUE 1. JULY 1980

GLOSSARY OF SYMBOLS

RECORD OF AMENDMENTS

Issue No	Dated	Amended by (Signature)	Date

CHAPTER 1

INTRODUCTION

CONTENTS

DIAGRAMS

FRIGG FIELD – LOCATION

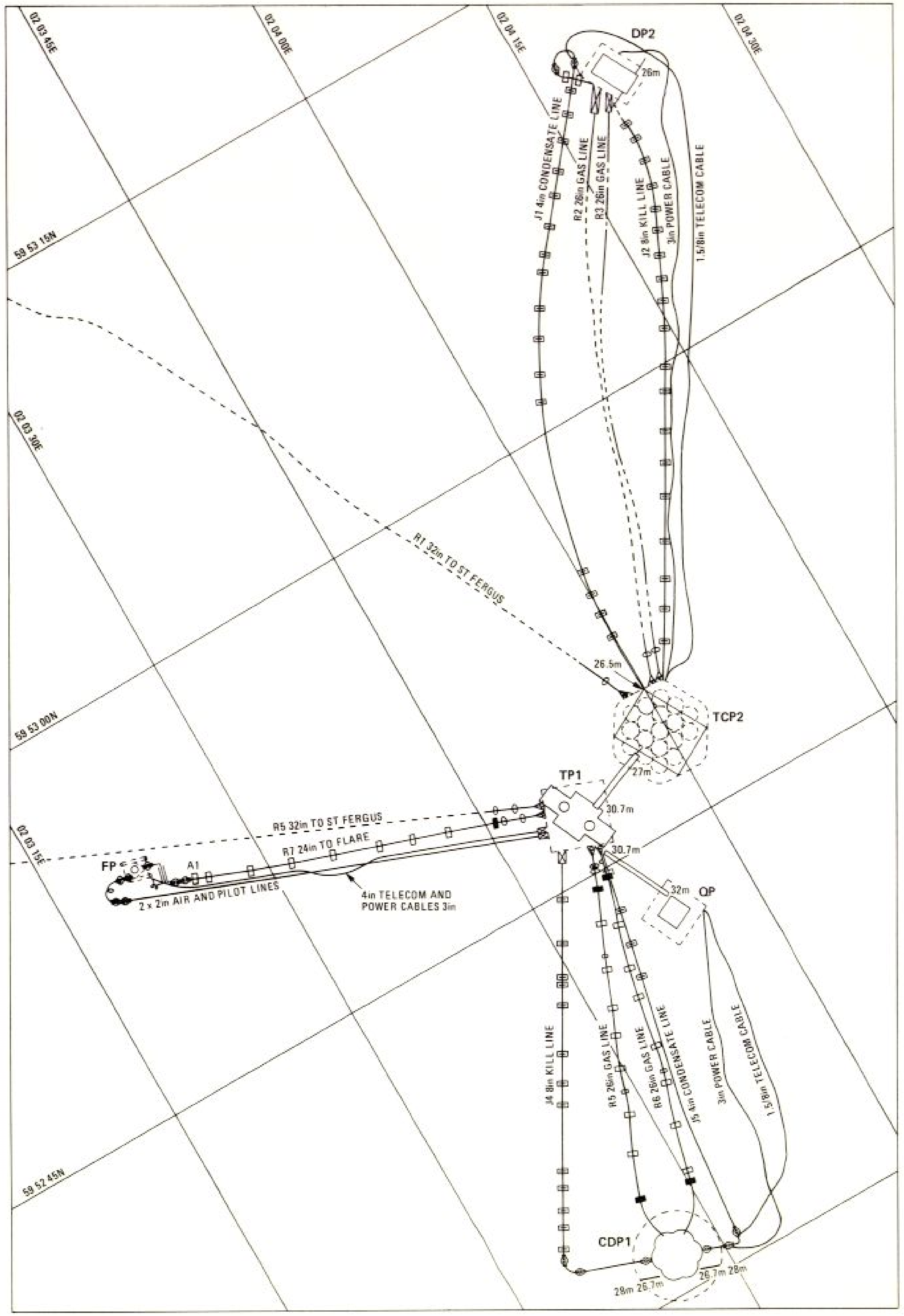
1 GENERAL

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°48′ and 60°00′ North and between 01°97′ and 02°15′ East (European datum 1960). It lies some 190km from the Norwegian coast and 370km from the Scottish coast. The location of the field and field layout is shown on Diagram 1.1.

2 PLATFORMS

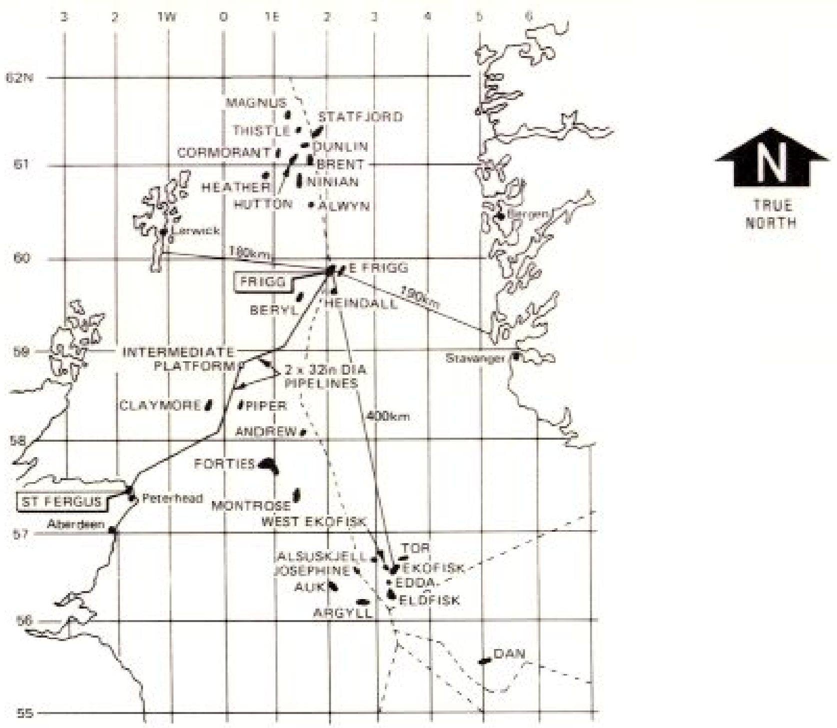
There are six platforms, four located in the UK Sector and two in the Norwegian Sector.

END



NOTE

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



PLATFORM CO-ORDINATES

STRUCTURE	GEOGRAPHICAL CO-ORDINATES	UTM CO-ORDINATES	TRUE ORIENTATION
DP1 MAST	59° 52' 40" 719 N 02° 04' 48" 755 E	6 638 334.39 N 448 505.95 E	——
DP2	59° 53' 10" 075 N 02° 04' 20" 604 E	6 639 248 60 N 448 080 90 E	332° 52' 12"
TP1	59° 52' 47" 276 N 02° 03' 51" 366 E	6 638 549 74 N 447 616 38 E	335° 20' 28"
TCP2	59° 52' 48" 446 N 02° 03' 59" 536 E	6 638 584 14 N 447 743 92 E	331° 03' 06"
QP	59° 52' 42" 421 N 02° 03' 53" 825 E	6 638 399 00 N 447 652 50 E	334° 17' 43"
CDP1	59° 52' 31" 389 N 02° 03' 41" 745 E	6 638 060 39 N 447 459 81 E	019° 37' 41"
FP	59° 52' 53" 519 N 02° 03' 21" 293 E	6 638 749 50 N 447 159 50 E	——

KEY

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

ISSUE 1. JULY 1980

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 32in diameter pipelines. An intermediate Manifold and Compression Platform, MCP01, installed approximately midway between Frigg and St Fergus, will be used to increase pipeline capacity when future gas fields adjoining Frigg are in production.

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, and is provided to drill and produce from 24 wells.

(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. It is provided to drill and produce from 24 wells.

(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 accommodating a maximum of 120 personnel.

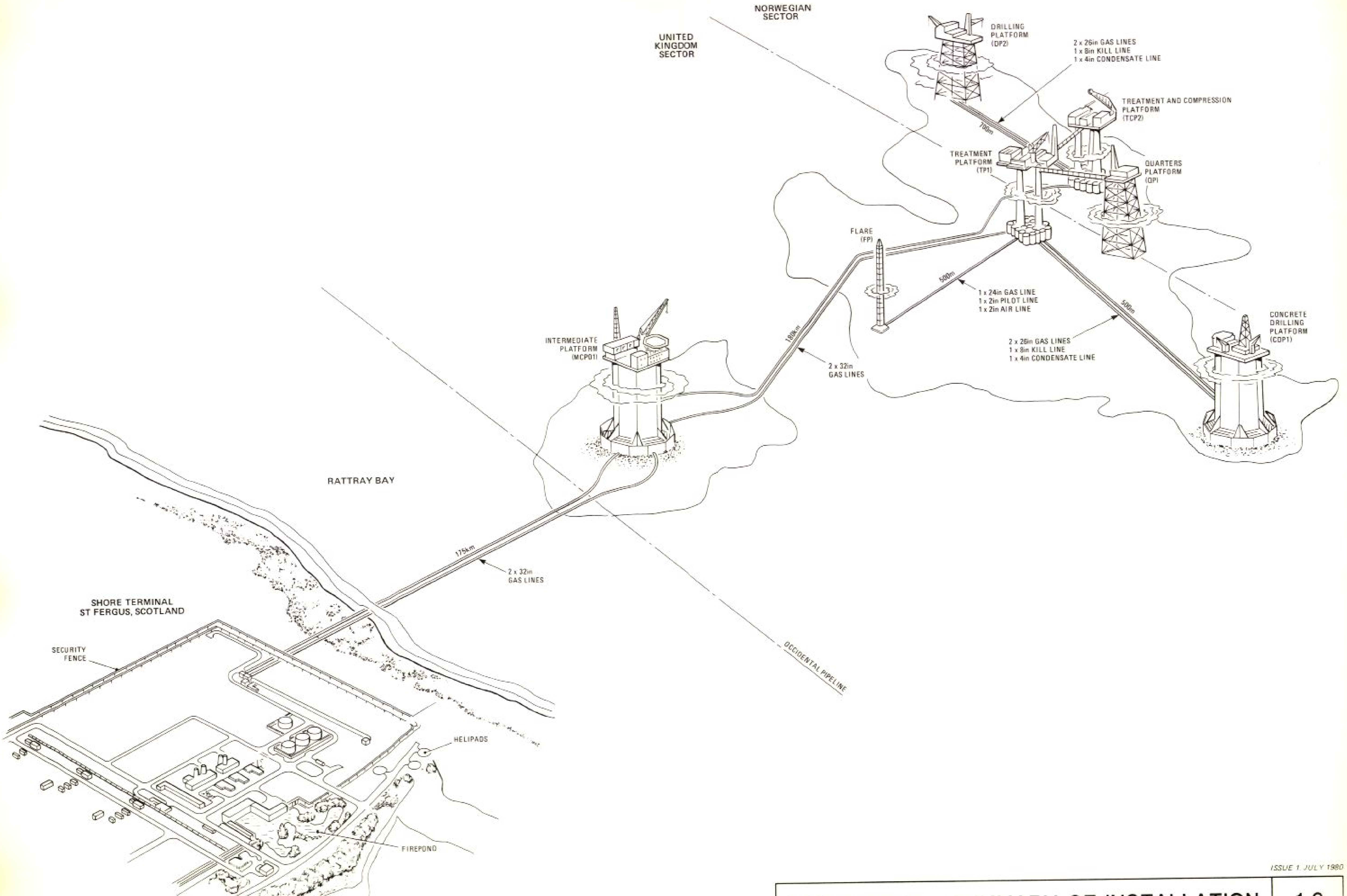
(d) TP1 – is registered '10/1 – FRIGG – TP1' as an offshore installation. It is a concrete structure with a parallel piped base surmounted by two columns supporting a steel deck, and stands in 103m of water. Gas produced by CDP1 is treated on this platform before being transported to the St Fergus terminal.

(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 is treated 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 ballast steel base, and stands in 106m of water. It is provided to depressurise TP1 and TCP2 process equipment in an emergency blowdown.

2.2 The three central platforms TP1, TCP2 and QP are linked by bridges. Drilling/production platforms CDP1 and DP2 are located a nominal 500m and 800m from their respective treatment platforms.

END



ISSUE 1 JULY 1980

FRIGG FIELD – SUMMARY OF INSTALLATION

1.2

FRIGG FIELD – PROCESS FLOW

1 GENERAL

The Frigg Field installation produces, treats, meters and exports natural gas via an intermediate manifold booster platform 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 produced from the 24 wells drilled from CDP1 is first treated in scrubber desanders before passing through two 26in flow lines to TP1. Separator facilities for individual wellheads on CDP1 are designed for a maximum wellhead pressure of 170 bar and a gas flowrate of 2.0 to 2.5 MMSCMD.

2.2 Gas produced from the 24 wells drilled from DP2 is treated in separator facilities similar to those in CDP1 before it is led through two 26in lines to TCP2.

2.3 On TP1 the gas is treated to prevent water condensation and hydrate formation during its transportation to St Fergus. Three parallel treatment streams are installed; each is designed for a maximum flow of 15 MMSCMD. Two streams are normally in operation with the third at standby. Each stream contains a separator, a glycol contactor and a glycol regeneration unit. Equipment is also installed for condensate treatment and fuel gas production.

2.4 The process equipment installed on TCP2 is similar to that on TP1. However, provision has been made for the future installation of compression units for use as and when the decrease of wellhead pressures renders such action necessary.

2.5 A wet-gas line between TP1 and TCP2 enables either treatment platform to deal with all or part of the gas from the other's production platform should the need arise.

2.6 A dry-gas interconnection is provided between TP1 and TCP2. Thus, once gas has been metered it can be exported through the sea line of either platform.

2.7 In an emergency gas can be flared through FP at a very high rate in order to depressurise TP1 and/or TCP2. TP1 is connected to FP by a 24in sea line; TCP2 is connected into the origin of the sea line on TP1 via the inter-platform bridge. The maximum flowrate is estimated to be 30 to 34 MMSCMD. 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 fuel gas at a continuous rate of 18 000m^3/d for the two stacks. A 20in diameter cold vent stack is provided on TP1 as a 'back-up' to the main flare platform. The cold vent stack will become operational on failure of the existing FP flare system.

2.8 Control and display devices for the whole Frigg Field installation are contained in QP.

3 CONTROL

The determining factor in controlling process flow is the required pressure at the St Fergus terminal inlet. There are a number of variables such as the number of wells in use, the number of glycol units in use, the number of 26in lines in use, the pressure required at St Fergus, the setting of the well chokes and the number and settings of the pressure control valves. These are taken into consideration by a computer which will indicate optimum settings for given parameters.

Two hypothetical cases are given below, Case 1 for a fairly high demand and Case 2 for a low demand.

Case 1

Data

Gas flowrate in 32in line (MMSCMD)	20
Frigg inlet pressure in 32in line (bara)	140
St Fergus inlet pressure (bara)	85.7
Pressure drop in control valves (bar)	5
Number of glycol units on flow	3
Number of 26in pipes on flow	1
Gas flowrate in one 26in line (MMSCMD)	20
Number of wells on flow	10

CDP1 Production Data

Well flowrate (MMSCMD)	2
Wellhead pressure (bara)	166.7
Wellhead temperature (deg C)	50
CDP1 outlet pressure (bara)	146.6
CDP1 outlet temperature (deg C)	46
Wellhead choke 0/0 opening	40

26in Pipes Flow Data

TP1 inlet pressure (bara)	145
TP1 inlet temperature (deg C)	29
Mean gas velocity m/sec	4.97
Water flowrate in pipe (m^3/d)	11.67
Condensate flowrate (m^3/d)	28.74

Glycol Units Production Data

Gas flowrate in one unit (SCMD)	6.67
Contactor operating pressure (bara)	145
Contactor operating temperature (deg C)	29
Maximum flowrate (MMSCMD)	16.2
Water to be removed (litres/MMSCMD)	343.8
Glycol circulation rate (litres/MMSCMD)	8594.84
Stripping gas flowrate (SCMH)	21.4
Air signal (lbf/in^2)	16
Per cent open, valve 1	83
Per cent open, valve 2	23
Per cent open, valve 3	3
Per cent open, valve 4	0
Output signal (lbf/in^2) on valve 1	26
Output signal (lbf/in^2) on valve 2	12
Output signal (lbf/in^2) on valve 3	7
Output signal (lbf/in^2) on valve 4	6

Case 2

Data

Gas flowrate in 32in line (MMSCMD)	5
Frigg inlet pressure in 32in line (bara)	90
St Fergus inlet pressure (bara)	59.1
Pressure drop control valves (bar)	20
Number of glycol units on flow	1
Number of 26in pipes on flow	1
Gas flowrate in one 26in line (MMSCMD)	5
Number of wells on flow	3

CDP1 Production Data

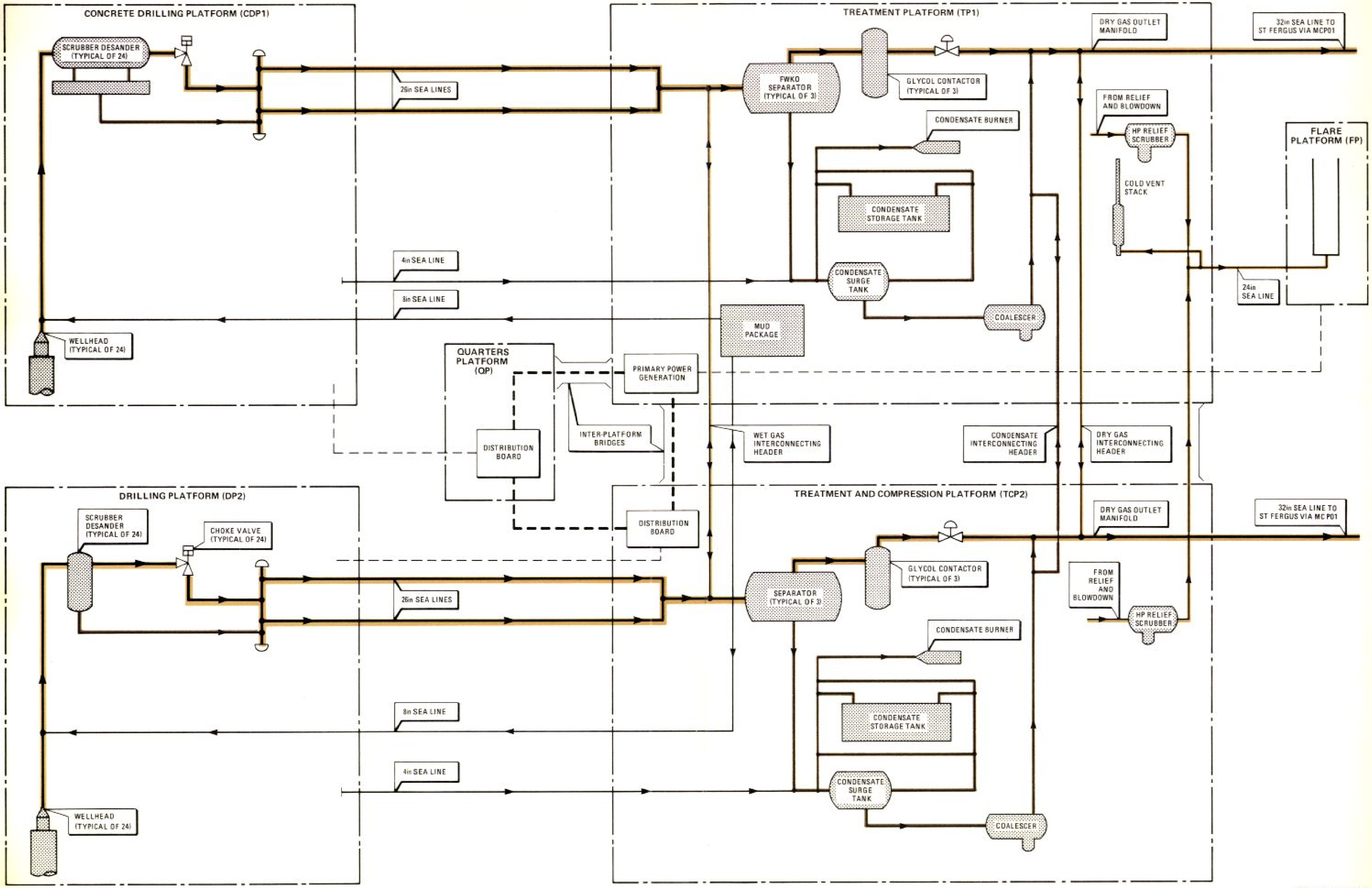
Well flowrate (MMSCMD)	1.67
Wellhead pressure (bara)	168.3
Wellhead temperature (deg C)	49
CDP1 outlet pressure (bara)	113
CDP1 outlet temperature (deg C)	38
Wellhead choke 0/0 opening	21

26in Pipes Flow Data

TP1 inlet pressure (bara)	110
TP1 inlet temperature (deg C)	10
Mean gas velocity (m/sec)	1.54
Water flowrate in pipe (m^3/d)	3.97
Condensate flowrate (m^3/d)	14.97
Hydrates formation conditions	--
Methanol injection rate (litres/MMSCMD)	720.38

Glycol Units Production Data

Gas flowrate in one unit (MMSCMD)	5
Contactor operating pressure (bara)	110
Contactor operating temperature (deg C)	10
Maximum flowrate (MMSCMD)	13.52
Water to be removed (litres/MMSCMD)	98.8
Glycol circulation rate (litres/MMSCMD)	2470.11
Stripping gas flowrate (SCMH)	6.2
Air signal (lbf/in^2)	13
Per cent open, valve 1	62
Per cent open, valve 2	2
Per cent open, valve 3	0
Per cent open, valve 4	0
Output signal (lbf/in^2) on valve 1	21
Output signal (lbf/in^2) on valve 2	7
Output signal (lbf/in^2) on valve 3	6
Output signal (lbf/in^2) on valve 4	6



ISSUE 1 JULY 1980

FRIGG FIELD – PROCESS FLOW 1.3

CHAPTER 2

PLATFORM STRUCTURE

CONTENTS

DIAGRAMS

PLATFORM CONSTRUCTION

1 GENERAL

The Quarters Platform (QP) is a four-legged launch-type structure supporting facilities for field personnel accommodation, helicopter transport, communications and process platform control. The primary structure and secondary structure modules were manufactured at onshore construction yards. The platform was designed to withstand the loading condition occurring during transportation and installation. The jacket in particular was checked for launching and up-ending. A sufficient number of buoyancy tanks were added to ensure that up-ending after launching could be performed. The main design contractors were McDermott-Hudson.

2 DESIGN CRITERIA

2.1 The following codes were used as a basis for the design of the platform bearing in mind the environmental conditions detailed in Section 2.2.

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

(b) American Petroleum Institute — API RP2A API Recommended Practices for Planning, Designing and Constructing Fixed Offshore Platforms, Sixth edition 1975 and Seventh edition 1976.

(c) American Institute of Steel Construction Manual of Steel Construction, Seventh edition, June 1973.

(d) American Welding Society (AWS D1.1—72) Structural Welding Code September 15, 1972, with revision 1—73 and 2—74.

(e) Det norske Veritas — Technical Notes for Fixed Offshore Structures.

It should be noted that the one-third increase in allowable stresses permitted by the above documents was not adopted for the design of this platform.

2.2 Soil Foundation

2.2.1 The foundation was based upon the interpretation of soil data reported by the Norwegian Geotechnical Institute in their Preliminary Report 73048 dated October 26, 1973, and the laboratory data transmitted in their letter of February 5, 1974.

2.2.2 A safety factor of 1.5 was used for storm environmental loading and 2.0 for operating condition.

2.3 Loading Conditions

The platform was designed and checked for load conditions acting separately or in combination, namely: storm environmental load conditions for at least three directions (two major axes and a diagonal); self-weight of structure; and module and deck loading.

2.4 Wave and Current Forces

2.4.1 Wave theory; Stokes 5th Order. The current velocity was added vectorially to the wave particle velocity before the total force was computed.

2.4.2 The forces were computed using the Morrizon equation (deterministic).

2.4.3 The values of drag (C_D) and inertia (C_M) coefficients used were as follows:

Diam ⩽ 60in	**Diam ⩾ 60in**
C_D = 0.70	C_D = 0.75
C_M = 1.70	C_M = 2.0

2.4.4 The following allowances were made for radial accumulated marine growth (RAG) at the stated elevations (MGE):

MGE	**RAG**
+3.5 to −1.5m	6.5cm
−1.5 to −8.5m	10.0cm
−8.5 to −13.0m	6.5m

2.4.5 A survey of accumulated marine growth is carried out annually.

2.4.6 Wind, wave and current directions were assumed to act in the same direction.

2.5 Allowable Stresses

2.5.1 The platform was designed so that all members were sized for basic allowable stresses specified by AISC.

2.5.2 The joints were designed in accordance with API RP2A. The AISC allowable punching shear stresses were increased by one-third for the launch condition only.

2.5.3 The grouted connection between pile and jacket leg was designed in accordance with British Standard Code of Practice CP110, 1972 Edition.

2.6 Module Weights

The weights of the modules are:

Module 'A'	–	1630 KIP
Module 'B'	–	2054 KIP
Microwave Tower	–	320 KIP

ENVIRONMENTAL DESIGN CRITERIA

1 SOIL PROFILE

Tabulated below is the soil profile as defined by samples taken from boring B6B in the QP location.

Depth Below Seabed (m)	Soil Description	Water Content (%)	$CaCO_3$ Content (%)
0 to 7	Brownish grey fine-to-medium sand with shell fragments	20 to 24	2.2 at 1m
7 to 16	Brownish grey clay with thin seams of fine sand and gravel	15 to 33	
16 to 21	Fine grey sand with several layers of silty clay	21 to 32	
21 to 28	Brownish grey clay with layers of fine sand and silt	25 to 31	
28 to 36	Grey silty sand with layers of silty clay	13 to 22	
36 to 83	Hard grey clay with some sand marbling and gravel. At around the 380m mark some silt and sand pockets were evident	13 to 24	3.2 at 62m 11.1 at 79m
83 to 102	Grey medium sand with some gravel and shell fragments	15 to 27	6.4 at 84m 28.1 at 89m 11.6/15.0 at 94m 17.4 at 98m

WIND

		BETWEEN LAT AND + 10m	ABOVE + 10m (VARIATIONS)
MAXIMUM SUSTAINED WIND (ONE MINUTE)	10 YEAR STORM CONDITIONS	$V_{10} = 50$ m/s	$V_z^2 = Ch\ V_{10}^2$ V_z = VELOCITY AT ELEVATION $_z$ V_{10} = VELOCITY AT ELEVATION 10m $Ch = 2.5\ \frac{z+18}{z+60}$ (z IN METRES)
MAXIMUM GUST WIND (THREE SECONDS)	10 YEAR STORM CONDITIONS	62.5 m/s	AS ABOVE

RAINFALL

YEARLY AVERAGE	MAX 24 HOUR FALL	YEARLY AVERAGE RAINY DAYS
990mm	86mm	195 DAYS

TEMPERATURE

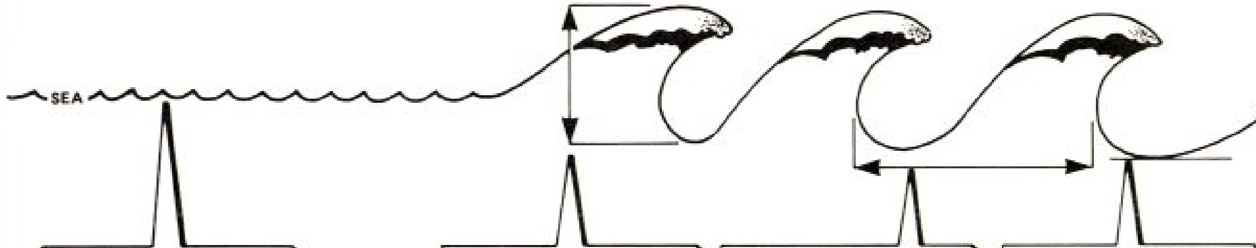
MAXIMUM SUMMER	MINIMUM WINTER
+ 32°C	− 15°C

BARIMETRIC PRESSURE AT SEA LEVEL

MONTHLY AVERAGE	
DECEMBER 753mm.Hg	JUNE 761mm.Hg

AMBIENT AIR (SALIFEROUS) – RELATIVE HUMIDITY 79% TO 90%

SURFACE SEA WATER MAXIMUM	SURFACE SEA WATER MINIMUM
17°C	1°C



MAXIMUM TIDE AND STORM ELEVATIONS

STORM AND OPERATING CONDITIONS

1.6m ABOVE LAT

WAVE HEIGHT	
STORM CONDITIONS	DYNAMIC ANALYSIS
29 m	17.4 m

WAVE FREQUENCY	
STORM CONDITIONS	DYNAMIC ANALYSIS
15s	12s

STORM SURGE

0.6m

SURFACE CURRENT

STORM CONDITIONS

1.35m/s

LINEAR VARIATION

SEABED + 30m CURRENT

STORM CONDITIONS

0.70m/s

LINEAR VARIATION

SEABED CURRENT

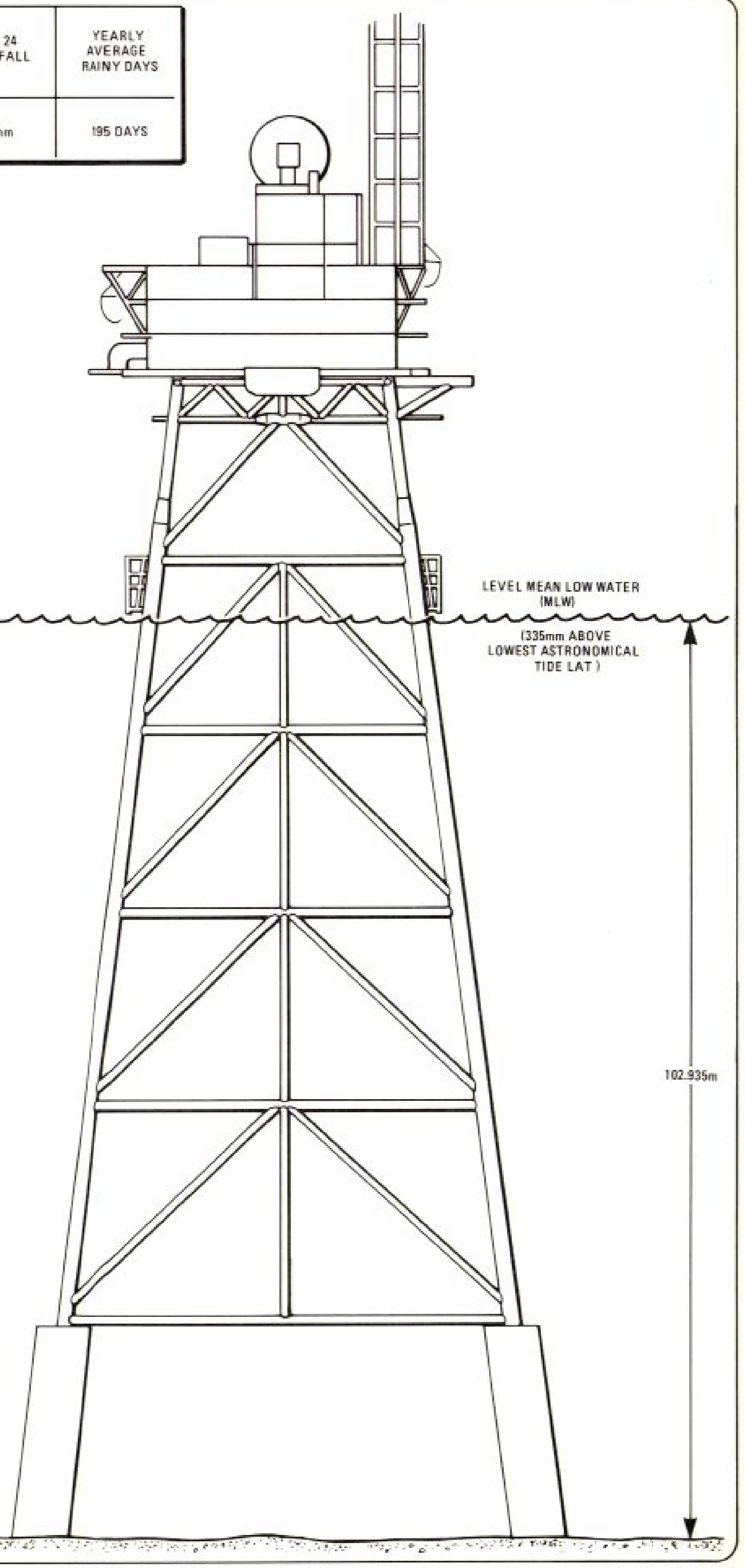
STORM CONDITIONS

0.30m/s

MUD LINE

NOTE

NO EXACT VALUES CAN BE GIVEN FOR ANY OPERATIONAL CONDITIONS. VALUES CALCULATED FROM DYNAMIC ANALYSIS ARE GIVEN FOR WAVE HEIGHT AND PERIOD IN ADDITION TO THOSE UNDER STORM CONDITIONS



ISSUE 1, JULY 1980

ENVIRONMENTAL DESIGN CRITERIA

OCEANOGRAPHIC AND METEOROLOGICAL DATA ACQUISITION

1 GENERAL

QP is equipped with an oceanographic and meteorological Data Acquisition System (DAS). The DAS comprises sensor instruments disposed about the platform structure and a cabinet located in the Radio Room. The cabinet displays and records information sensed by the instruments. The recorded information in the form of a raw data tape is sent monthly to the Norwegian authorities and is used to provide a long term analysis of prevailing conditions in the Frigg Field.

2 OCEANOGRAPHIC INSTRUMENTATION

Oceanographic instrumentation is installed to measure the following:

(a) Wave height — the sensor is used to measure wave height. The signals induced by waves are processed for time and frequency.

(b) Water level — water level is measured against platform level and the resultant indications are used to determine platform settlement. One water level measurement is taken every 20 minutes and, ignoring wave and tidal variations, the water level measurement is plotted against mean sea level within ±2cm.

(c) Surface current — measurement of instant speed and direction of the surface current (direction being plotted against true north) is permanently recorded for calculation of the average speed and direction and is made every 20 minutes.The surface current meter is located 75m above seabed level.

(d) Bottom current — the bottom current meter is located 5m above seabed level, and takes measurements in a similar manner to the surface current meter. The ranges of both current meters (surface and bottom) is 0 to 5m/s for speed, and 0 to 360 degrees for direction.

(e) Water temperature — surface and bottom water temperatures are measured at 5m below the water level and 5m above the seabed. One measurement is taken and recorded every three hours. The range of the sensors is 0 to 30°C within an accuracy of ±0.5°C.

3 METEOROLOGICAL INSTRUMENTATION

Meteorological instrumentation is installed to measure the following:

(a) Wind speed and direction — instant wind speed and direction are recorded for 20 minutes every three hours and an average is calculated every 20 minutes. The range of the wind speed measurements is 0 to 60m/s within an accuracy of ±0.5m/s up to 5m/s, and the range of the wind direction measurements is 0 to 360 degrees within an accuracy of ±5 degrees.

(b) Barometric pressure — recorded every 20 minutes within a range of 100 mb (adapted to local conditions) with an accuracy of ±1 mbar.

(c) Humidity — recorded every three hours within a range of 0 to 100 per cent with an accuracy of ±3 per cent.

(d) Air temperature — recorded every 20 minutes within a range of −20°C to +30°C with an accuracy of ±0.5°C.

The disposition of the sensors is shown on Diagram 2.3.

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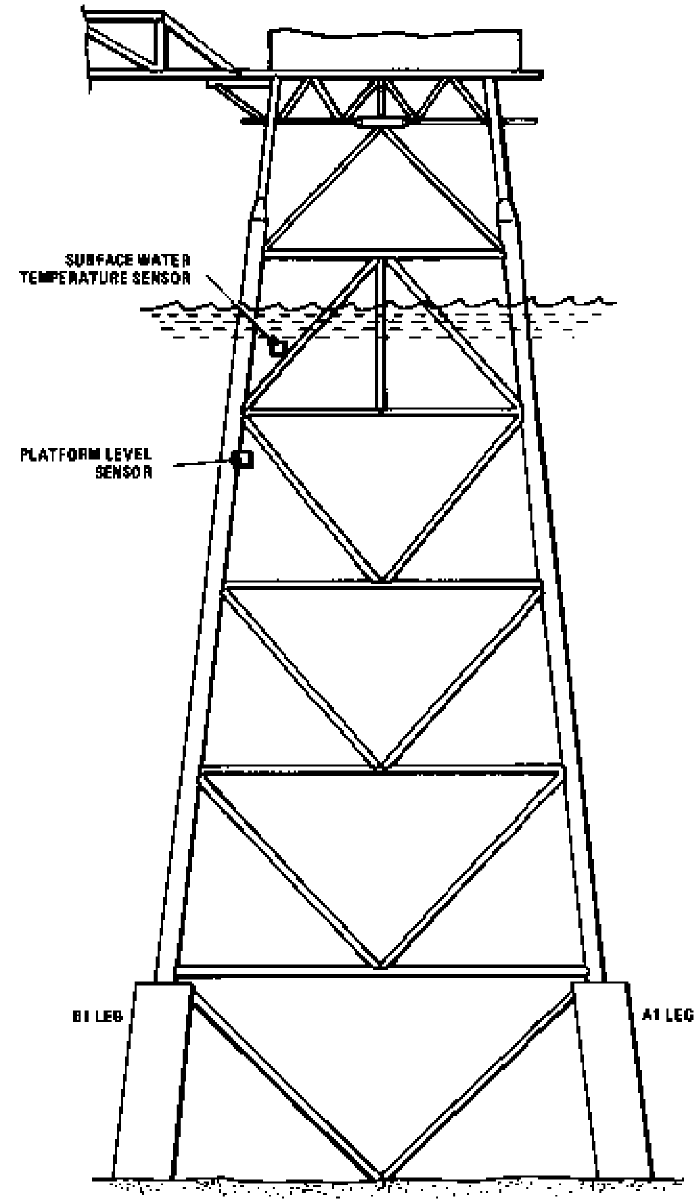
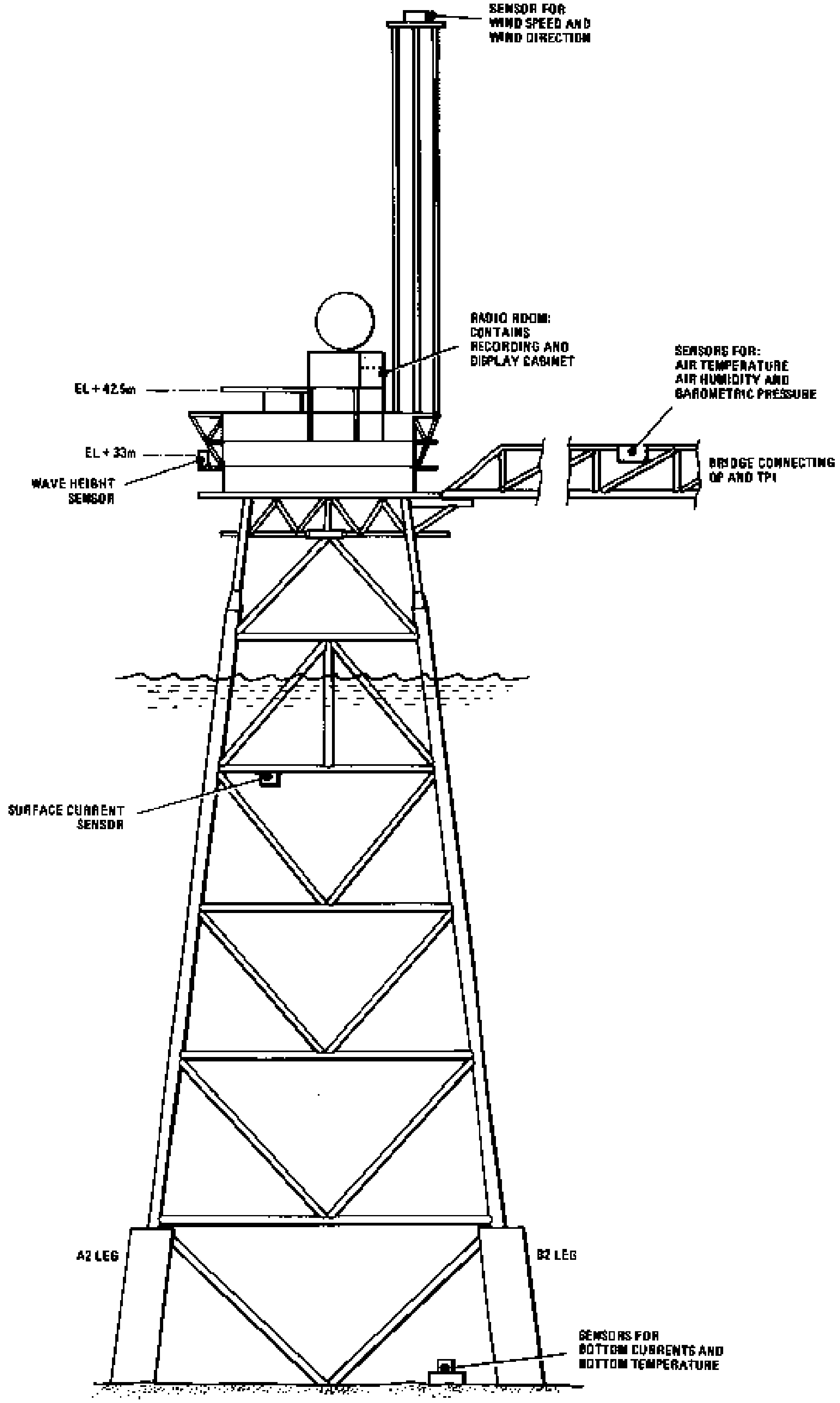

SURFACE WATER TEMPERATURE SENSOR
PLATFORM LEVEL SENSOR
B1 LEG
A1 LEG


SENSOR FOR WIND SPEED AND WIND DIRECTION
RADIO ROOM: CONTAINS RECORDING AND DISPLAY CABINET
SENSORS FOR: AIR TEMPERATURE AIR HUMIDITY AND BAROMETRIC PRESSURE
EL + 42.5m
EL + 33m
WAVE HEIGHT SENSOR
BRIDGE CONNECTING OP AND TP1
SURFACE CURRENT SENSOR
A2 LEG
B2 LEG
SENSORS FOR BOTTOM CURRENTS AND BOTTOM TEMPERATURE

PRIMARY STRUCTURE

1 GENERAL

The primary structure comprises three main sections; these are:

(a) The jacket — the section between the seabed and elevation +7.315m.

(b) The piling — secures the jacket to the seabed.

(c) The deck support frame — the section which projects from the jacket to elevation +26.07m.

2 JACKET

2.1 The jacket is a four-legged launch-type structure of tubular construction throughout. It is 113m in height and square in plan. The sides are 26.9m at elevation +6.1m, and 54.47m at elevation −104m. Horizontal diamond bracing separates the legs at Levels 1, 2, 3, 4 and 5. Four outer truss lines, A, B, 1 and 2, are formed by a series of 'K' brace members. The total jacket weight is approximately 4210 tonnes.

2.2 Each leg has a diameter of 60in at elevation +6.1m, increasing to 72in at elevation −51.17m and 120in at elevation −73.94m. Two additional trusses, each of 36in diameter, which were necessary for launching, are located on the south face of the jacket. The launch trusses are tied into the diamond brace at each horizontal elevation. Each platform leg is provided with two piling sleeves which extend from elevation −73.94m to elevation −104.00m.

2.3 Special high strength Steel-20 is used to fabricate the intersections between the component parts of the 'K' brace members and to fabricate the intersections of the 'K' brace members with the jacket legs. The wall thickness of all tubular members is increased in the splash zone to allow for corrosion.

3 PILING

3.1 The jacket structure is secured to the seabed by eight primary piles into each of which is placed an insert pile. The primary piles are each of 52in diameter and are located by the piling sleeves on the platform legs. The primary piles are driven into the seabed to a depth of between 15.24m and 18.29m.

3.2 The insert piles each have a diameter of 42in and taper to 36in over approximately 38m. The insert piles are placed within the primary piles into a 48in diameter hole which is drilled to a depth of 83.8m below the mudline. The insert piles are grouted into the drilled holes and the primary piles.

4 DECK SUPPORT STRUCTURE

4.1 The deck support frame is of tubular construction throughout and comprises two load-carrying trusses 'A' and 'B', joined by two secondary trusses 1 and 2. The support frame forms a natural continuation of the jacket and extends to elevation +26m. Two storage tanks are located within the deck support frame; these are positioned above the expected maximum wave crest level. The weight of the deck support frame is approximately 580 tonnes.

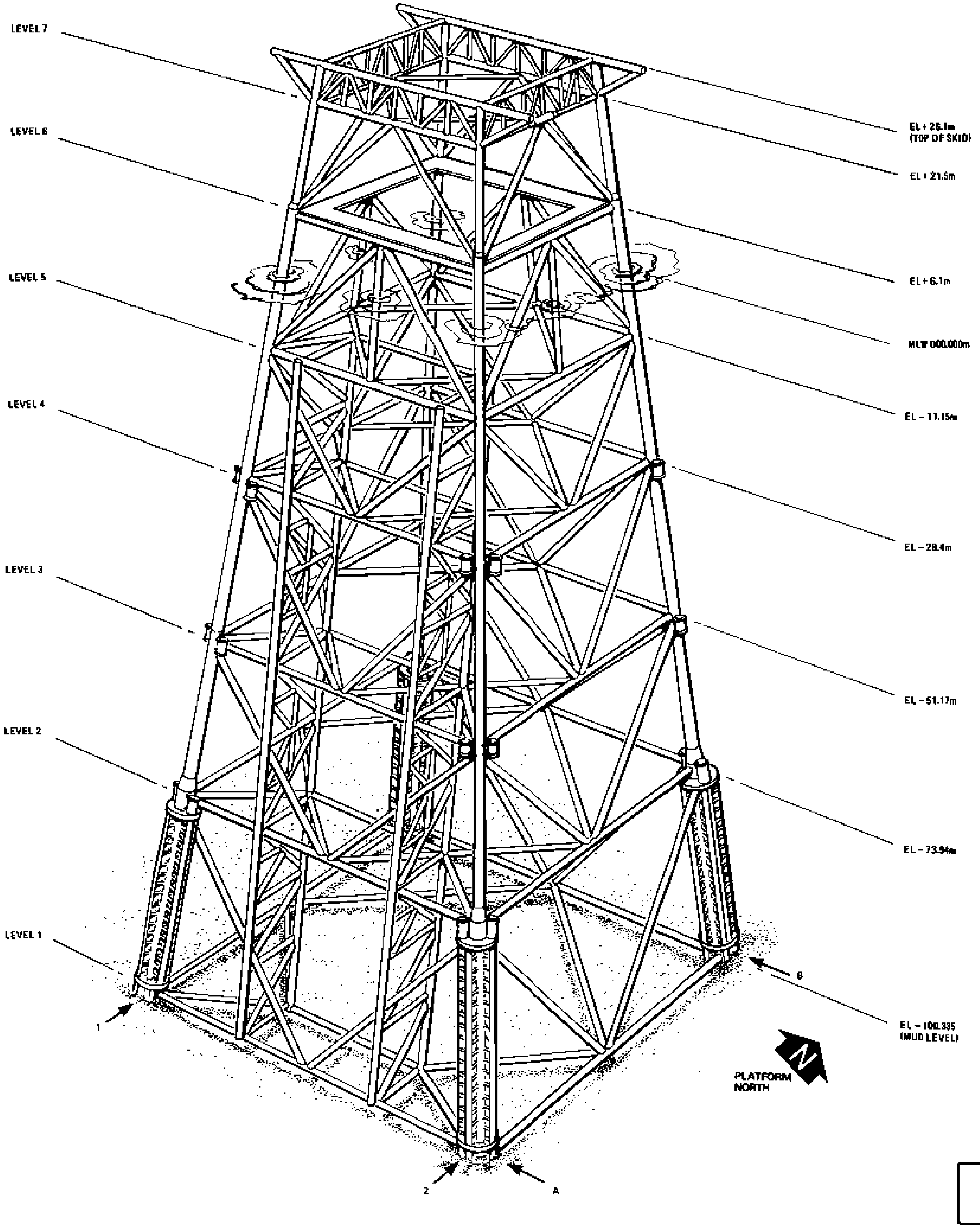
4.2 Special high strength Steel-20 is used to fabricate the intersections between the component parts of the 'K' brace members and to fabricate the intersections of the 'K' brace members with the jacket legs.

5 MINOR STRUCTURES

5.1 A landing is provided at the top of the support frame on the north face for a 90m bridge which connects QP with TP1.

5.2 Three of the jacket legs support electrical risers which extend into the deck support structure.

5.3 Five sea water casings are located on the east side of the primary structure. These provide stilling tubes for sea water pumps P1, P5, P4A and P4B. The remaining casing forms caisson V3 for pump P6.



PRIMARY STRUCTURE 2.4

SECONDARY STRUCTURE

1 GENERAL

The secondary structure comprises two main sections – Modules A and B. The module roofs are surmounted by a helideck, a helicopter hangar, a microwave antennae tower and a crane.

2 MODULES A AND B

2.1 Each module has four deck levels, these are:

(a) Lower floor – elevation + 26.91m

(b) Middle floor – elevation + 30.88m

(c) Upper floor – elevation + 34.50m

(d) Roof – elevation + 38.18m

2.2 The decks are supported by four main trusses per module; these trusses are fabricated from structural shapes and form the outer walls of the modules. Secondary deck beams transmit load to deck girders which in turn transmit load to the nodes of the trusses. The trusses are supported by the deck support structure. Modules A and B are rectangular in plan and are separated by a distance of 1.9m which forms the main access corridor within the secondary structure.

2.3 Module A is 16.4m x 28m in plan and weighs approximately 770 tonnes. Module B is 16.4m x 25.7m in plan and weighs approximately 880 tonnes. The modules provide accommodation facilities for the 120 personnel working in the Frigg Field complex. The modules also provide control, communication and administration facilities.

2.4 The facilities are distributed on the various deck levels of the modules as follows:

(a) Lower floor, Module A – Living accommodation, workshop and stores.

(b) Lower floor, Module B – Utilities and platform support systems to provide potable water, fire water, emergency electrical power, electrical switchgear and transformers, motor control centre, sewage treatment plant, waste incineration, laboratory and air conditioning plant room.

(c) Middle floor, Module A – Food preparation and storage, restaurant, laundry, linen storage and living accommodation.

(d) Middle floor, Module B – Infirmary and living accommodation.

(e) Upper floor, Module A – Recreation and living accommodation.

(f) Upper floor, Module B – Control room, office accommodation, computer room, radio and telemetry equipment.

(g) Roof, Module A – UK troposphere communication equipment, switchgear room, rotary no-break and inverter battery room, potable water tank.

(h) Roof, Module B – Air conditioning equipment, Norwegian communications room, crane and microwave antennae tower.

3 HELIDECK AND HANGAR

The helideck will accept landing and take-off of a Sikorski S61L or similar helicopter. The helicopter hangar, complete with workshop facilities, will accommodate a Bell 212 helicopter. An aero-maritime radio room is located on the north side of the helicopter hanger. A satellite antenna is mounted on the roof of the helicopter hangar.

4 OTHER STRUCTURES

The microwave antennae tower comprises eight square section vertical members which are joined in pairs by a series of 'K' brace members. The trusses thus formed are arranged to form a structure which is square in plan and 65m in height.

5 MINOR STRUCTURES

Access to all floors is gained by a series of external and internal walkways and ladders. External walkways at each floor level extend completely around Modules A and B.

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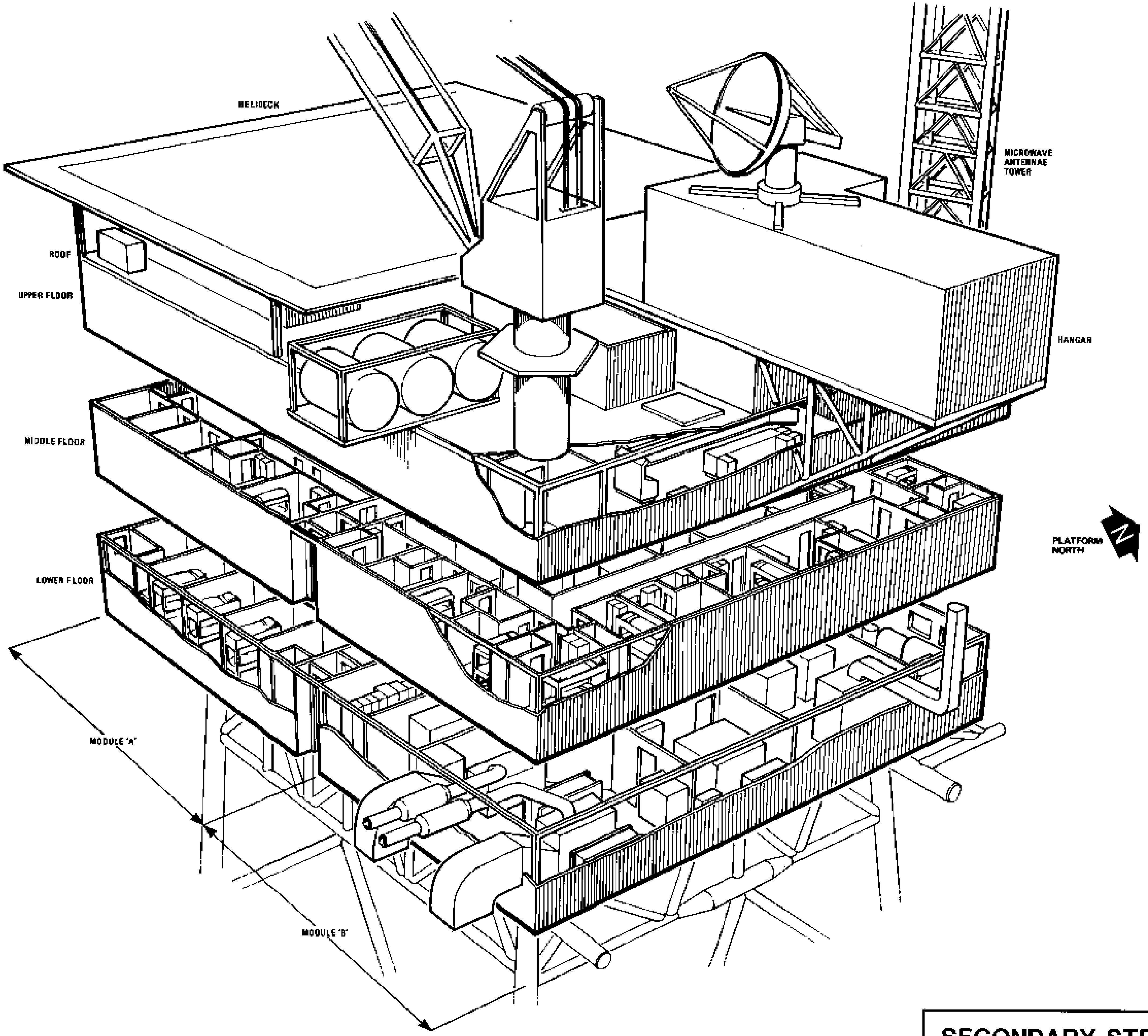


SECONDARY STRUCTURE

MATERIALS AND CONSTRUCTION

1 GENERAL

1.1 Typical applications and materials used in the construction of the platform excepting the microwave antennae tower are given in the following table:

Designation	Steel grade according to DIN 17100	Supplementary requirements for impact testing and z-direction ductility	Typical application
HSS20	St 52–3N modified	Impact testing at –20°C	Cans, braces, girders, trusses, plates, shapes
SHSS20	St 52–3N modified	Impact testing at –20°C z-direction ductility to be $RA_Z \geqslant 30\%$	Heavy wall cans, braces, piles, main girders, trusses
SHSS40	St 52–3N modified	Impact testing at –40°C z-direction ductility to be $RA_Z \geqslant 30\%$	Nodes

1.2 The selection of materials is based on the following specifications:

(a) Elf Aquitaine Norge — Frigg Field — 1052 No 3–145: Fixed Offshore Structures, Materials Specification, Rev 3 — November 1973,

(b) Elf Aquitaine Norge: Special Material Specification for QP and TP1, 1052 No 3 – 620/Rev D, November 1973.

1.3 The materials used in the construction of the microwave antennae tower are:

(a) E26 quality 4 for structural elements.

(b) E26 quality 2 for walkways and brackets.

2 CONTRACTORS

2.1 The primary structure was designed by McDermott-Hudson of London, and was fabricated by Union Industrielle et d'Entreprise at Cherbourg from a number of parts delivered by subcontractors, and was installed at the Frigg Field during the summer of 1975.

2.2 The secondary structure was designed by McDermott-Hudson of London, and was fabricated at Chantiers de la Garonne, France.

2.3 The microwave antennae tower was designed and fabricated by La Charpente Moderne, France.

3 DESIGN CODES

The platform was designed and built to comply with the following codes and regulations:

American Institute of Steel Construction — Manual of Steel Construction, seventh edition June 1973

American National Standards Institute ANSI — B31.3 (Piping)

American Petroleum Institute API RP2A

American Society of Mechanical Engineers ASME Section VIII

American Welding Society AWS D1.1–72

British Standards Institution BS 1515

British Standards Institution BS 5405

Department of Trade, Marine Division — Continental Shelf Act 1964

Department of Trade — Markings of Offshore Structures 1976

Det norske Veritas — Rules for the Design, Construction and Inspection of Fixed Offshore Structures 1974

Det norske Veritas — Technical Notes for Fixed Offshore Structures

Elf Aquitaine Norge — Frigg Field 1052 No 3 155 Fixed Offshore Structures Fabrication Specification Rev 1 — May 1973

French Standard — NF A 35501

Institute of Electrical and Electronic Engineers — Recommended Practice for Electrical Power Distribution for Industrial Plants Std 141 — 1976

Institute of Electrical and Electronic Engineers — Recommended Practice for Grounding of Industrial and Commercial Power Systems Std 142 — 1972

Institute of Petroleum — Code of Safe Practice, Electrical Part 1 — 1965

International Convention for Safety of Life at Sea — 1960

International Telecommunication Union — Radio Regulations

Norwegian Coast Directorate — Regulations for Marking of Production Platforms

Statutory Instruments 1976 — No 1019 The Offshore Installations (Operational Safety, Health and Welfare) Regulations 1976

Statutory Instruments 1977 — No 486

The Offshore Installations (Lifesaving Appliances) Regulations 1977

Statutory Instruments 1978 — No 611 The Offshore Installations (Fire Fighting Equipment)

SSCP 1019 — Installation and Servicing of Electrical Fire Alarm Systems

4 PAINTING SPECIFICATIONS

Jacket and main deck painting:

1052 No 3 — 169 — JPS/J6 — Elf Norge Frigg Field Painting Specification for Steel Structures Rev 1 — March 1974

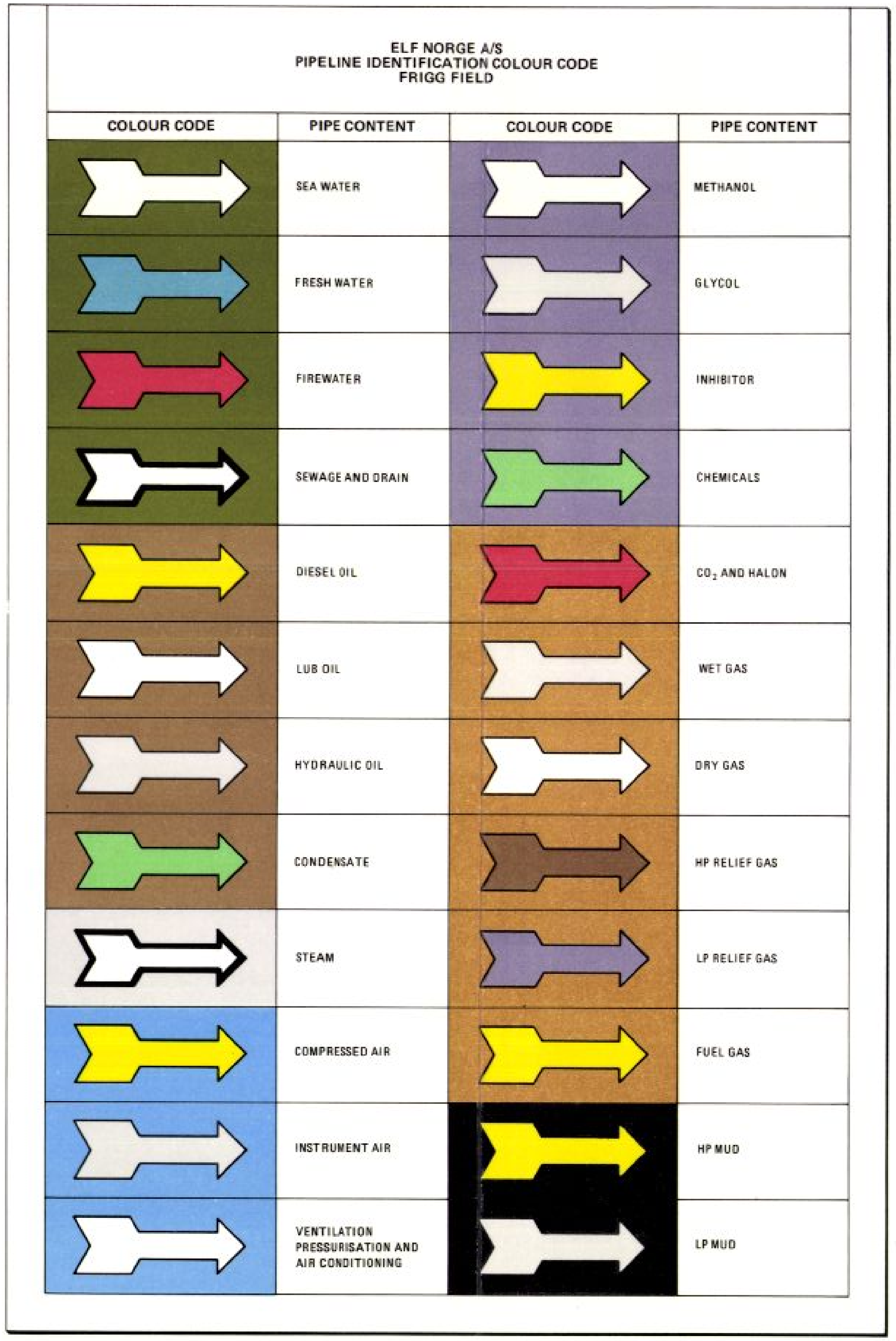
Non-skid surfaces — Solid decking and gratings used as walkways.

Yellow non-slip paint

5 PIPELINE IDENTIFICATION SYSTEM

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

END



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

To prevent corrosion by galvanic action, sacrificial aluminium anodes are located at strategic points around the jacket structure. The sacrificial anodes will corrode more readily than the jacket structure, thus affording protection.

2 DESIGN CRITERIA

Design life	20 years
Current density in sea water	130mA/m^2
Current density in mud	35mA/m^2
Current density in concrete	5mA/m^2
Current density for coated steel	50mA/m^2
Anode type	Al—In—BA777
Anode net weight	365kg

3 ANODE DETAILS

3.1 **Elevation**	**Number of Anodes**
−11.15m	39
−11.15m to −28.4m	39
−28.4m	20
−28.4m to −51.17m	46
−51.17m	27
−51.17m to −73.94m	47
−73.94m to −104m	108
−104m	40

3.2 Anode Dimensions

Length	2630mm
Height	240mm
Bottom breadth	260mm
Top breadth	220mm
Stand-off distance	500 or 750mm

END

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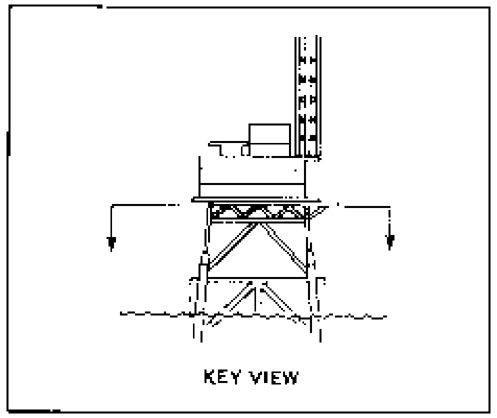
END

CHAPTER 3

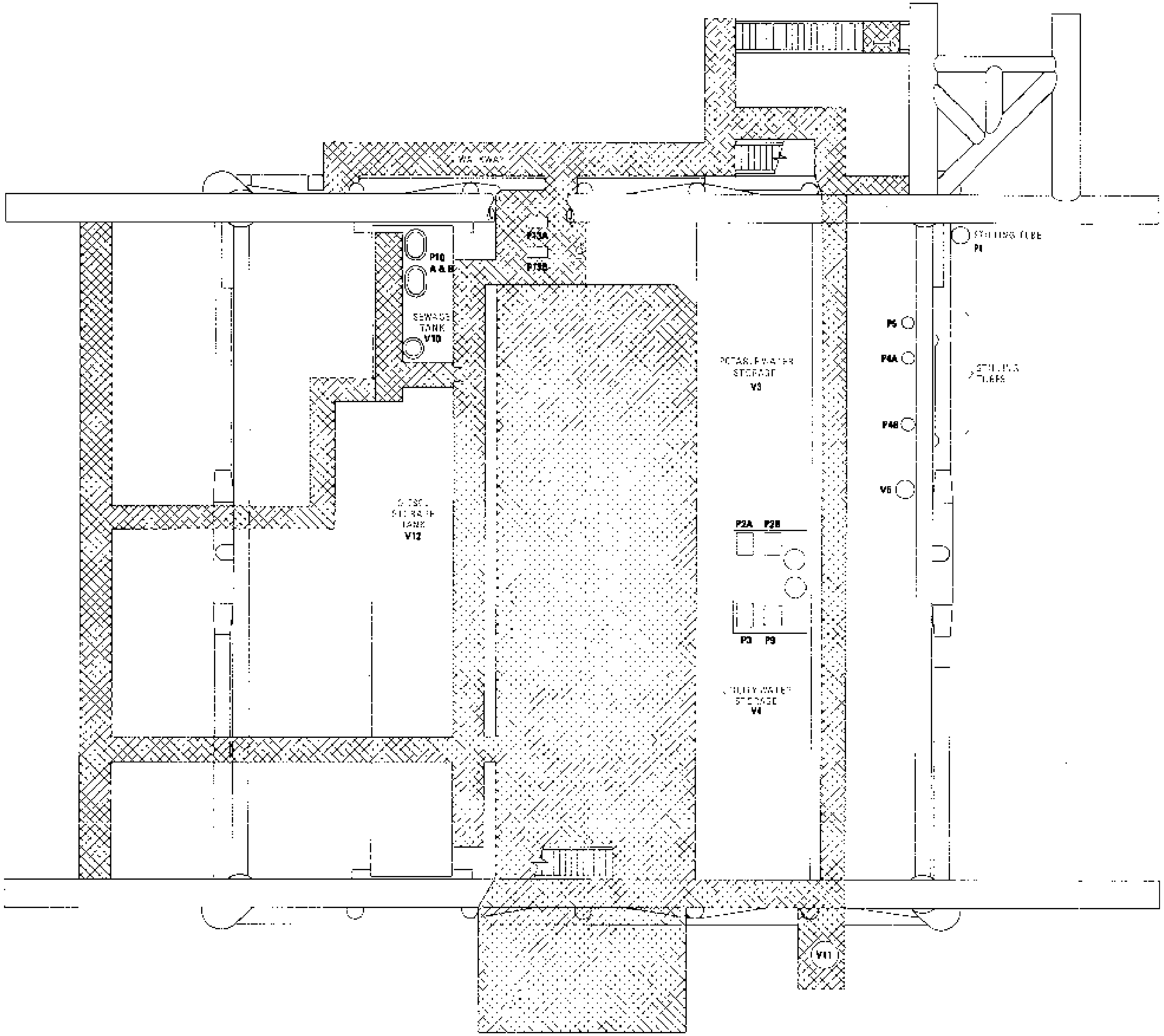
EQUIPMENT LOCATION

CONTENTS

DIAGRAMS



N
PLATFORM NORTH



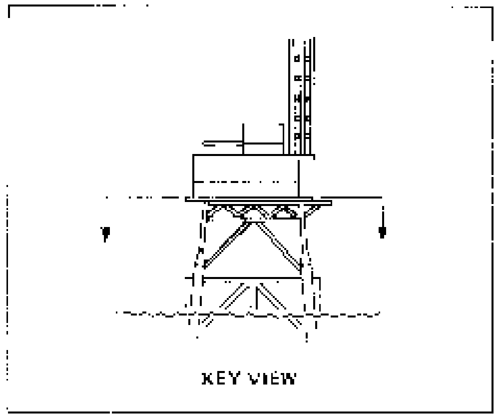
KEY

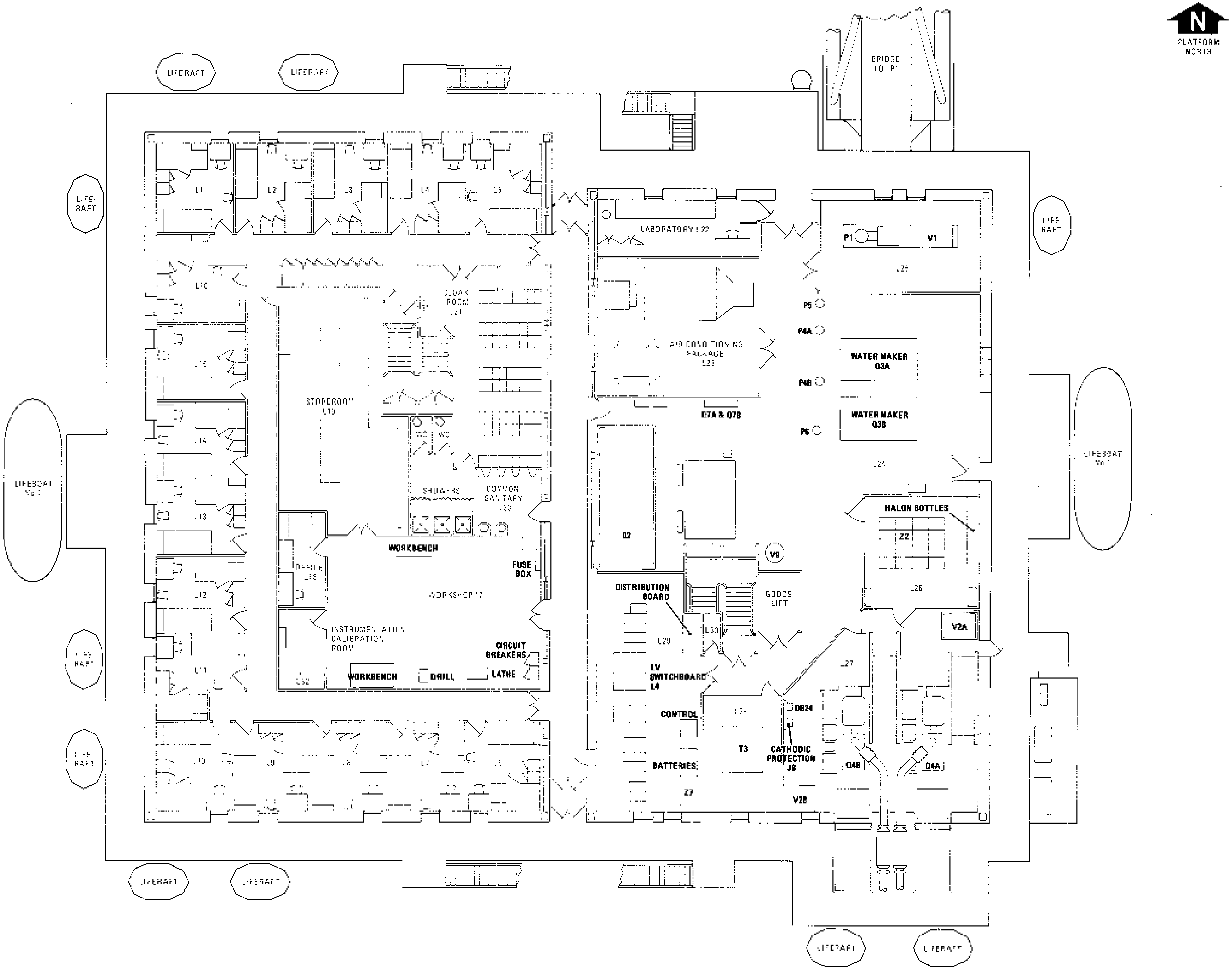
P2A	POTABLE WATER PUMP	
P2B	POTABLE WATER PUMP	
P3	UTILITY WATER PUMP	
P9	JOCKEY PUMP	
P10A	SEWAGE PUMP	INSIDE V10
P10B	SEWAGE PUMP	
P13A	DIESEL TRANSFER PUMP	
P13B	DIESEL TRANSFER PUMP	
V6	SUMP CAISSON	
V11	TRANSFORMER DRAIN TANK	

ISSUE 1. JULY 1980

EQUIPMENT LOCATION
Deck Support Level

3.1.1





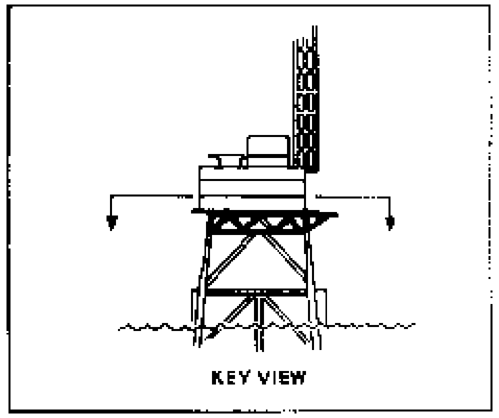
KEY

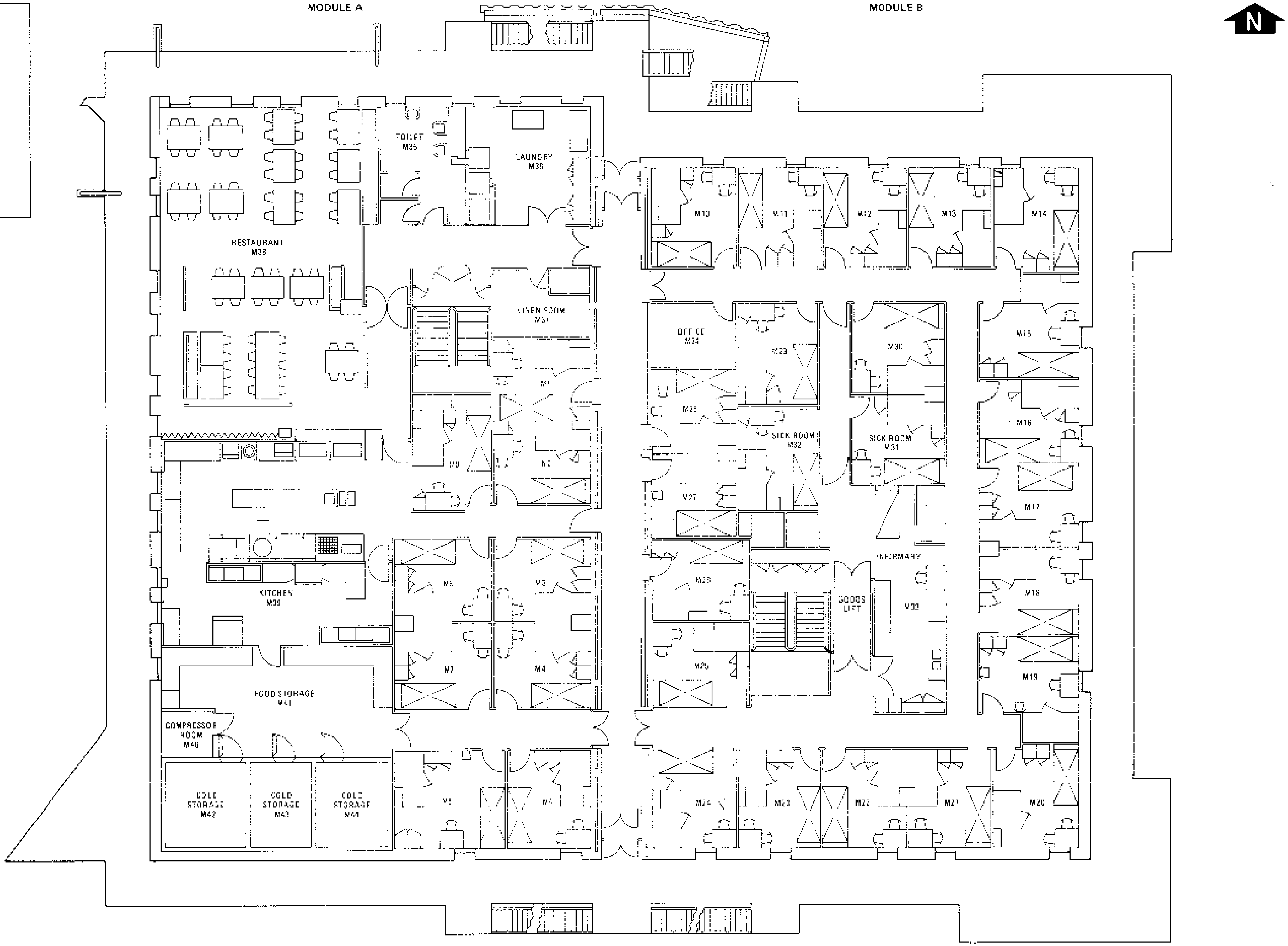
P1	FIREWATER PUMP
P4A	BRINE PUMP
P4B	BRINE PUMP
P5	WASHDOWN PUMP
P6	SUMP PUMP
Q2	SEWAGE TANK
Q4A	EMERGENCY GENERATOR
Q4B	EMERGENCY GENERATOR
Q7A	WATER STERILISATION
Q7B	WATER STERILISATION
T3	TRANSFORMER
V1	DIESEL DAY TANK
V2A	DIESEL DAY TANK
V2B	DIESEL DAY TANK
V9	UTILITY WATER PRESSURE TANK
Z2	5.5kV SWITCHGEAR
Z7	BATTERIES

ISSUE 1. JULY 1980

EQUIPMENT LOCATION
Lower Level

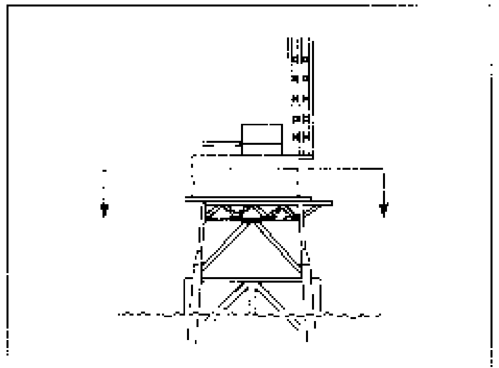
3.1.2

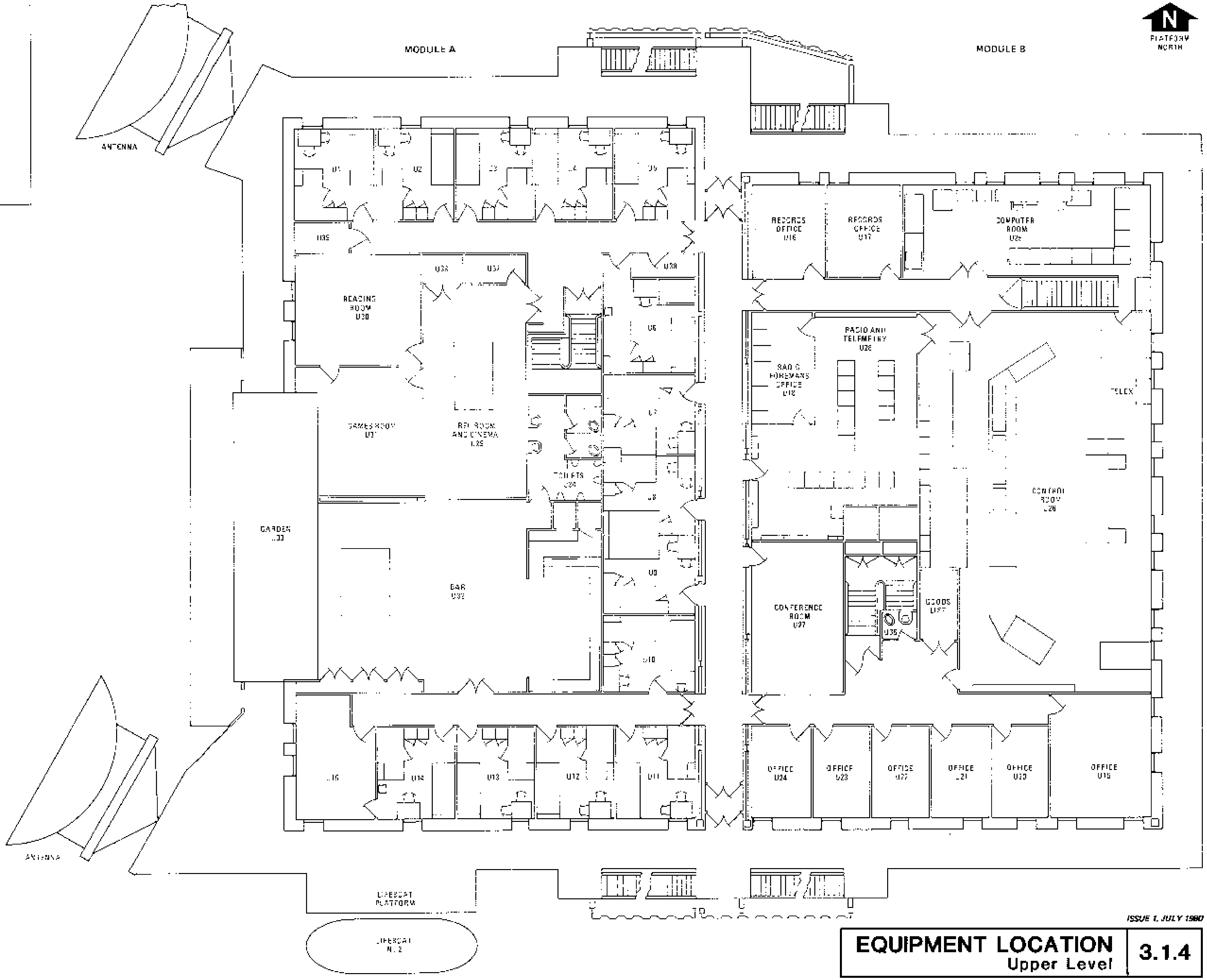




EQUIPMENT LOCATION
Middle Level

3.1.3

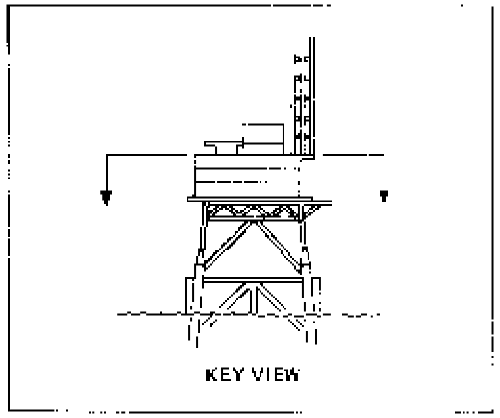


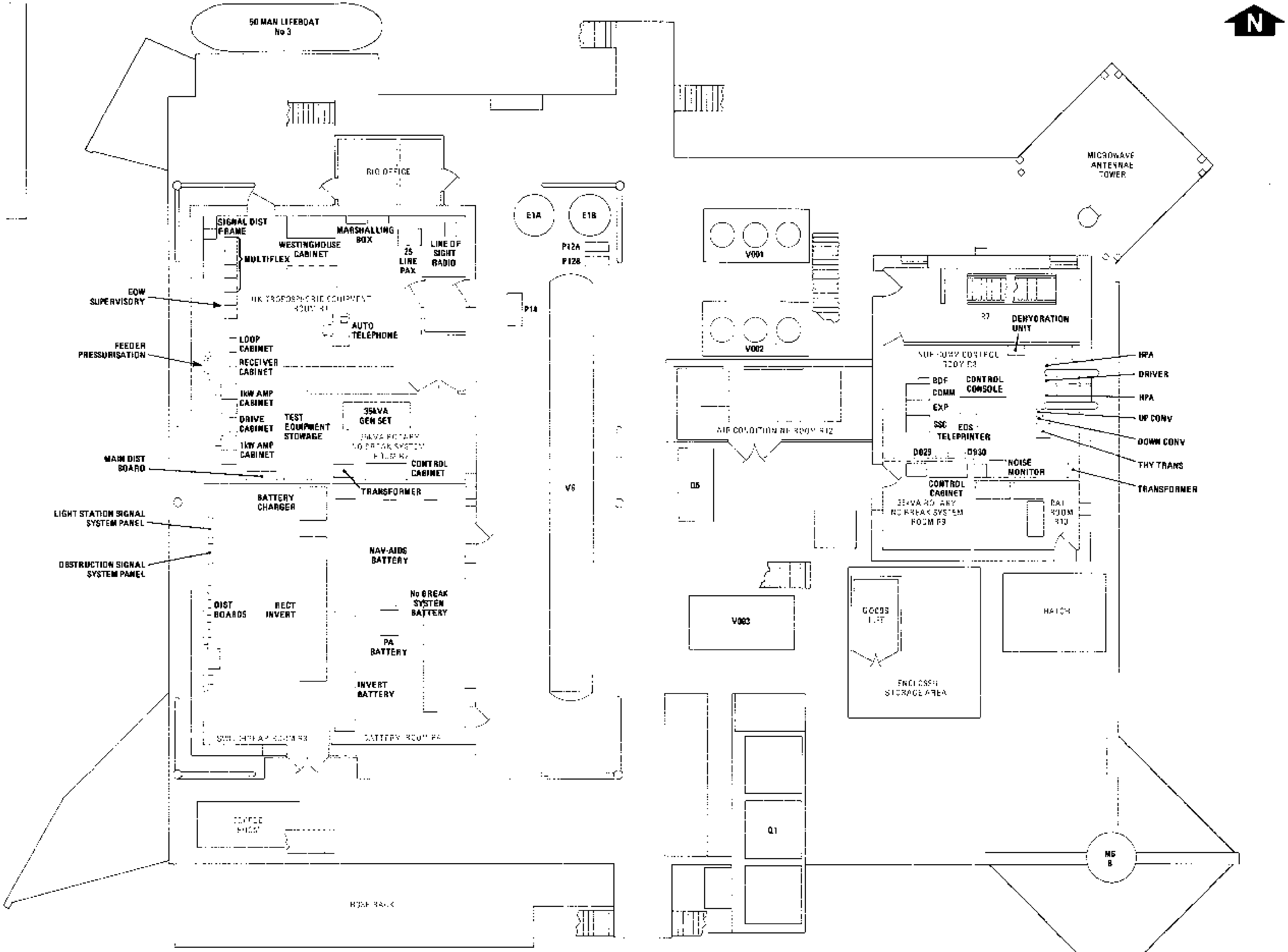


ISSUE 1, JULY 1980

EQUIPMENT LOCATION
Upper Level

3.1.4


KEY VIEW



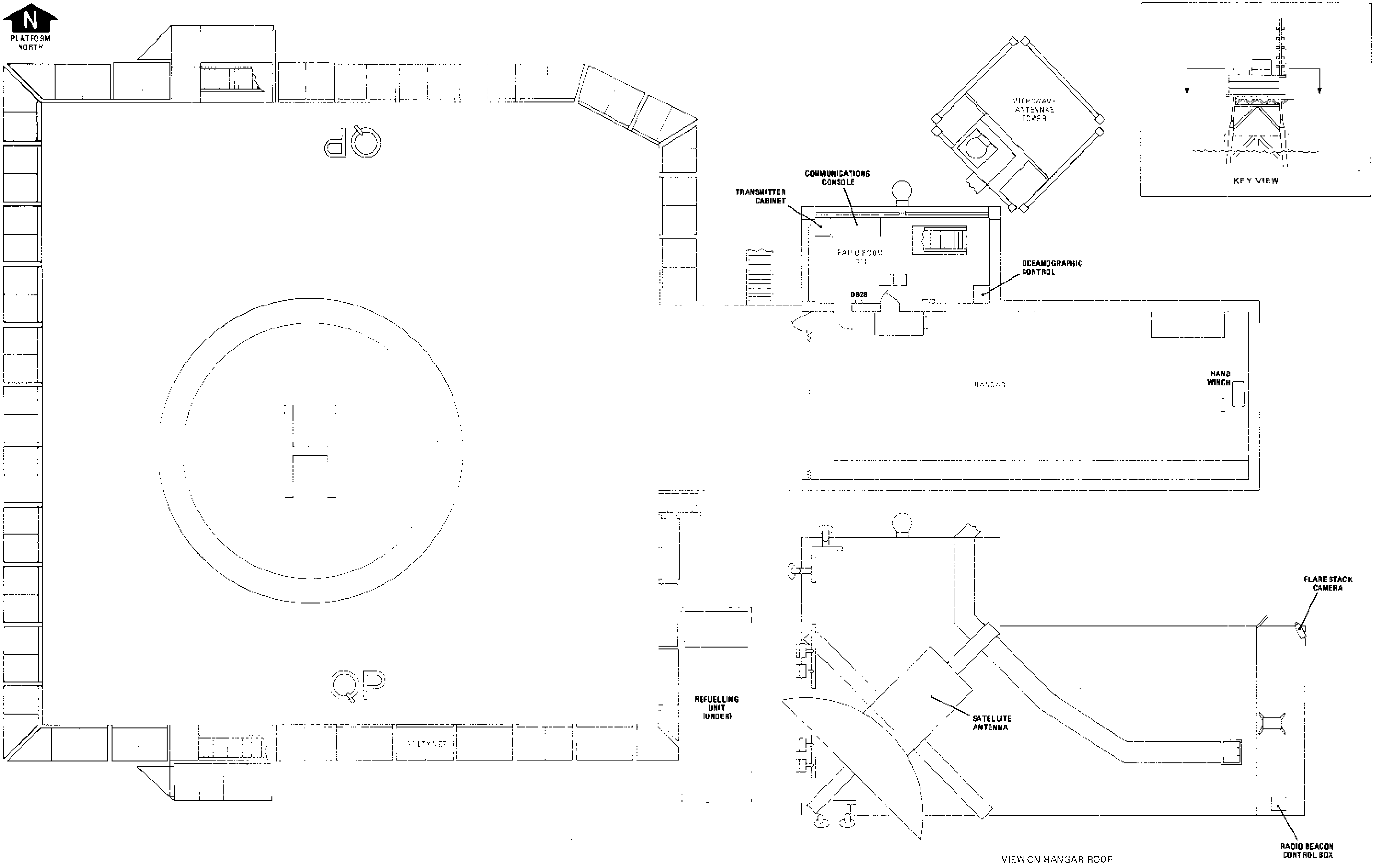
KEY

E1A	WATER HEATER
E1B	WATER HEATER
M68	BUCYRUS – ERIE ML 60 MARINE CRANE
P12A	WATER CIRCULATION PUMP
P12B	WATER CIRCULATION PUMP
P14	DOMESTIC HOT WATER PUMP
Q1	AVIATION FUEL PACKAGE
Q5	POWDER AND FOAM UNIT
V001	AIR COOLED CONDENSERS
V002	AIR COOLED CONDENSERS
V003	AIR COOLED CONDENSERS
V6	POTABLE WATER HEADER TANK

ISSUE 1. JULY 1980

EQUIPMENT LOCATION
Roof Level

3.1.5



ISSUE 1. JULY 1980

EQUIPMENT LOCATION
Helideck Level

3.1.6

CHAPTER 4

SYSTEM MANAGEMENT

CONTENTS

PRODUCTION CONTROL FACILITIES

1 GENERAL

Facilities are provided on the platform to monitor and control each of the Frigg Field platform process systems from a central control room. A main console contains individual sections for the monitoring and control of process systems on CDP1, DP2, TP1 and TCP2, together with field utility systems and fire and gas detection systems. Monitoring facilities only are provided for the Frigg Field electrical power network at the main console. A separate console, also located in QP Control Room, provides monitoring and control facilities for FP. Each section of the console comprises a mimic panel, a control panel and an instrument and alarm panel.

2 COMPUTER INPUTS AND OUTPUTS

2.1 Facilities are provided for the computer on QP to accept an input direct from St Fergus or manually on receipt of teletype instructions from St Fergus. The data output from the computer may be fed directly into the various process control systems, be displayed visually as a print-out, or be displayed on a Visual Display Unit (VDU). The visual outputs are used to enable the operator to make required field adjustments.

2.2 The displays on the VDU comprise simplified flow diagrams on which are indicated the latest recorded stream and vessel conditions such as temperatures, levels, pressures, flowrates and valve positions, or any flow streams which have initiated an alarm.

2.3 The computer can be programmed to simulate the process conditions which will obtain as a result of the adjustment of various set-points. The projected conditions can then be displayed on the VDU. The various simulations are:

Option 1	Gas Characteristics
Option 2	Glycol Treatment Parameters
Option 3	Wellhead Conditions
Option 4	Hydrates Formation Conditions
Option 5	Methanol Circulation Rate
Option 6	Hydrocarbons Condensation
Option 7	Temperature Drop in 26in Lines
Option 8	Flow Conditions Between CDP1 and TP1
Option 9	Flow Conditions in 32in Lines to Scotland
Option 10	Control System on Main Flow Valves TP1
Option 11	Field Flow Control

NOTE Examples of Option 11 are given as Cases 1 and 2 in Section 1.3.

2.4 The computer output data are transmitted to shore installations by teletype and used in this form for data logging.

END

CHAPTER 5

UTILITIES

CONTENTS

DIAGRAMS

POTABLE WATER SYSTEM

1 GENERAL

1.1 Two water makers, Q3A and B, are provided to produce potable water for the platform. Each water maker is a sea water distillation plant of the vapour-compression type capable of producing 36 366 litres/day.

1.2 Two brine pumps, P4A and B, are provided. They normally operate with one running and the other at standby. Each pump has a capacity of 94.6 litres/min at 9.42 bara and can supply all the requirements of the water makers. In addition, the duty brine pump is used to maintain the firemain system pressurised to 6.18 bar during periods of low demand.

2 STORAGE

2.1 Potable water and utility water are stored in a large storage tank divided by a weir into two compartments, V3 and V4; each has a capacity of 151 400 litres.

2.2 Distillate from the water makers is led to potable water storage tank V3. Once this tank is filled, water flows over the weir into V4.

2.3 Tank V3 can also be filled from a tanker through hose connections at either boat landing.

3 DISTRIBUTION

3.1 Distribution to consumers is from head tank V6 which is maintained at working level by potable water pumps P2A and B. Each pump is a Worthington Simpson Model 2DVC82 sump pump powered by a 30hp electric motor and rated at $34m^3/h$ at 6.87 bara.

3.2 Potable pump discharge water is first filtered and then passed through an ultraviolet water purifier before being led to the header tank.

3.3 Potable water head tank V6 is divided into two equal compartments with a total capacity of 27 252 litres. One side serves as the main head tank and the other serves as a 100 per cent spare.

3.4 From the potable water head tank the purified water flows by gravity to either the Quarters Building or across the bridges to TP1 and TCP2 for general use. The water sent to the Quarters Building goes to water circulation pumps P12A and B which supply potable water to two cold water circuits, two hot water heaters E1A and B and to a thermostatic mixer. A pressure regulator returns excess water to V6 to give a working pressure of 2.5 bar in the hot and cold water systems.

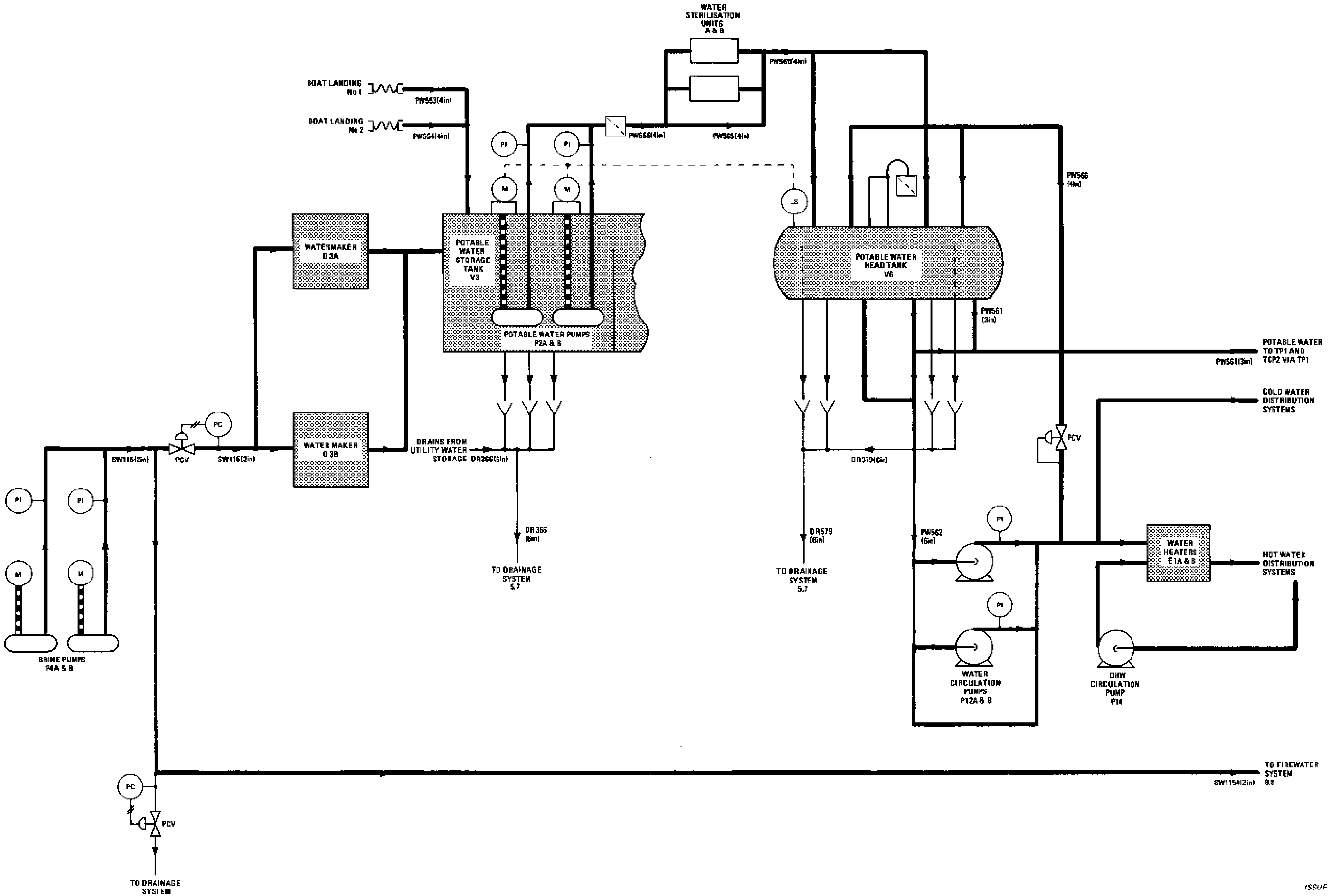
3.5 The two cold water circuits provide supplies:

(a) for drinking, washing and for kitchen use, and

(b) for WCs and urinals.

3.6 Water heaters E1A and B produce water at 70°C which is used directly in the kitchen and laundry. Some of the hot water is mixed with cold in a thermostatic mixer to provide a supply at 45°C for use in showers and lavatories. Both hot water circuits return to recirculating pump P14 which can discharge either to the water heaters or to the thermostatic mixer.

END



ISSUE 1. JULY 1980

POTABLE WATER SYSTEM	5.1

UTILITY WATER STORAGE AND DISTRIBUTION

1 GENERAL

1.1 Utility water is stored in compartment V4 of the utility and potable water storage tank.

1.2 Water from the water makers or boat landings 1 and 2 flows into potable water storage tank V3. When the potable water tank is full, excess water passes over a weir into utility water storage tank V4.

1.3 Tank V4 has a capacity of 151.4m^3. Excess water overflows to waste through a line set 2in below the level of the weir top.

1.4 Water for the utility water system is supplied by two pumps situated in tank V4. Jockey pump P9 is rated at 6.8m^3/h at 6.9 bara and is driven by a 15 hp electric motor. Utility water pump P3 is rated at 34m^3/h at 6.9 bara and is driven by a 30 hp electric motor.

1.5 Operation of the jockey pump and the utility water pump is controlled by two pressure switches mounted on utility water pressure tank V9.

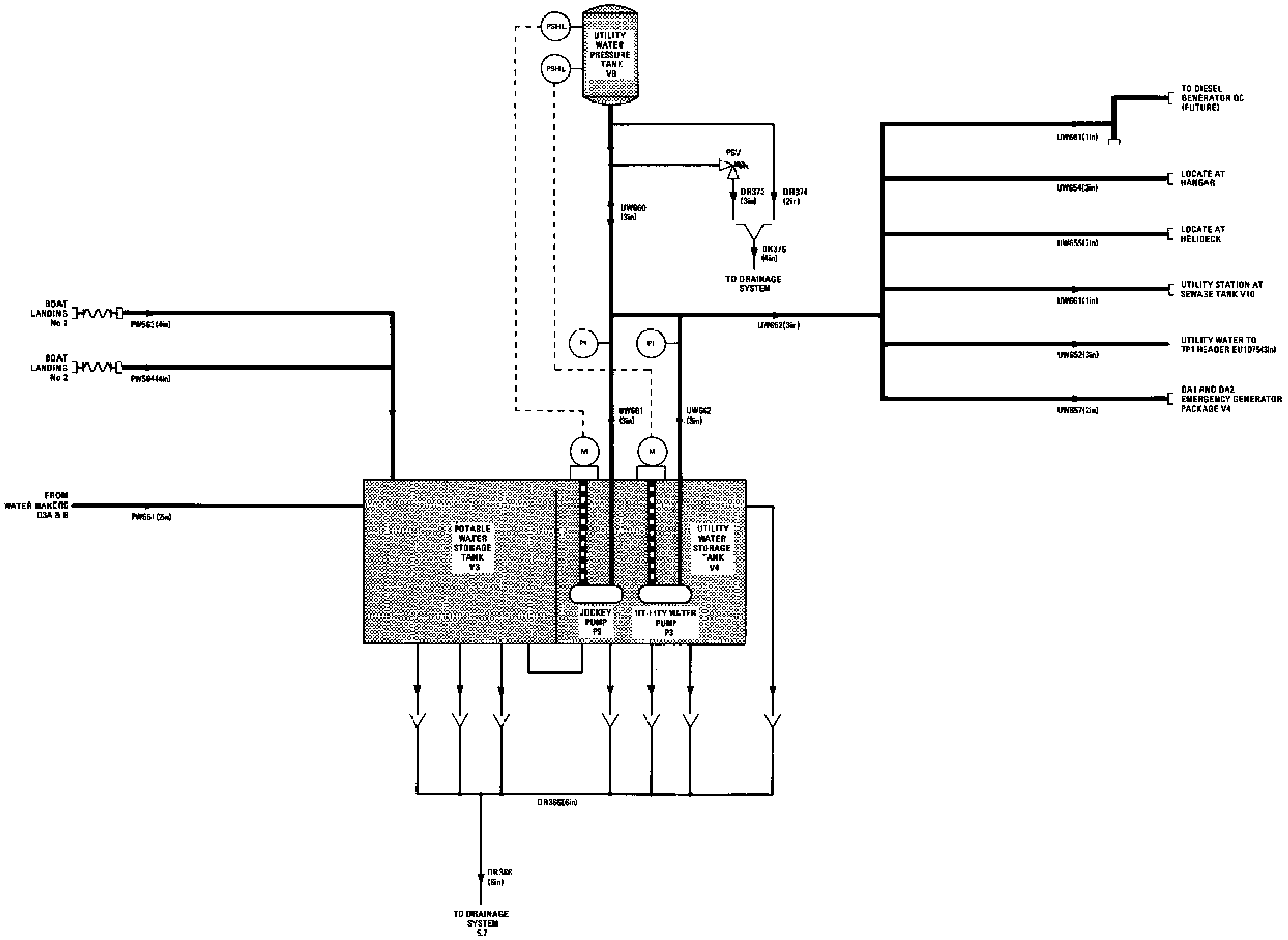
1.6 Utility water pressure tank V9 is rated at a maximum working pressure of 11.35 bara at 38°C and has a capacity of 662 litres.

1.7 When the pressure in the utility system falls to 5.2 bara, the jockey pump will start and re-pressurise the system to 6.9 bara.

1.8 For normal requirements, jockey pump P9 will keep the system at the required pressure. If the demand exceeds the jockey pump capacity, the utility water pump will start and will run until the system reaches 6.9 bara, when both pumps will stop.

1.9 Any excess pressure will be relieved to the platform drainage system.

1.10 Utility water from this system is supplied to various parts of the platform and to TP1 and TCP2.



ISSUE 1, JULY 1980

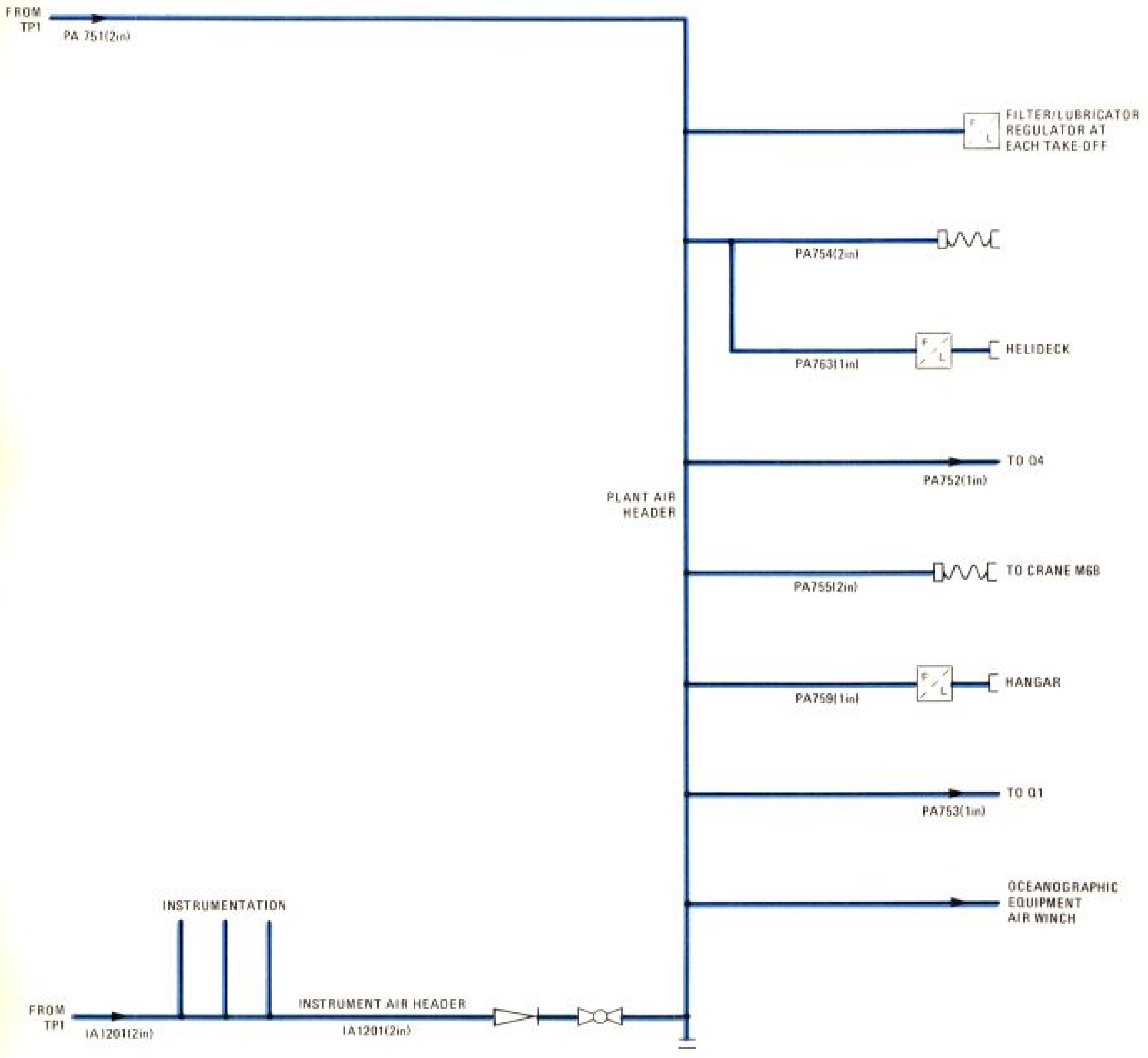
UTILITY WATER STORAGE AND DISTRIBUTION

5.2

COMPRESSED AIR

1 GENERAL

Compressed air to meet QP requirements will normally be supplied from platform TP1 through two 2in lines, PA751 and IA1201.


FROM TP1
PA 751(2in)
FILTER/LUBRICATOR REGULATOR AT EACH TAKE-OFF
F
L
PA754(2in)
PA763(1in)
HELIDECK
TO Q4
PA752(1in)
PLANT AIR HEADER
PA755(2in)
TO CRANE M68
PA759(1in)
HANGAR
TO Q1
PA753(1in)
OCEANOGRAPHIC EQUIPMENT AIR WINCH
INSTRUMENTATION
FROM TP1
IA1201(2in)
INSTRUMENT AIR HEADER
IA1201(2in)

DIESEL FUEL SYSTEM

1 GENERAL

1.1 Supplies of diesel fuel to meet the requirements of consumers on QP are delivered by pumps P8A and P8B from diesel storage tank V10 on TP1. The fuel is transferred through 2in line DO251 to a manifold from which fuel is directed to the consumers.

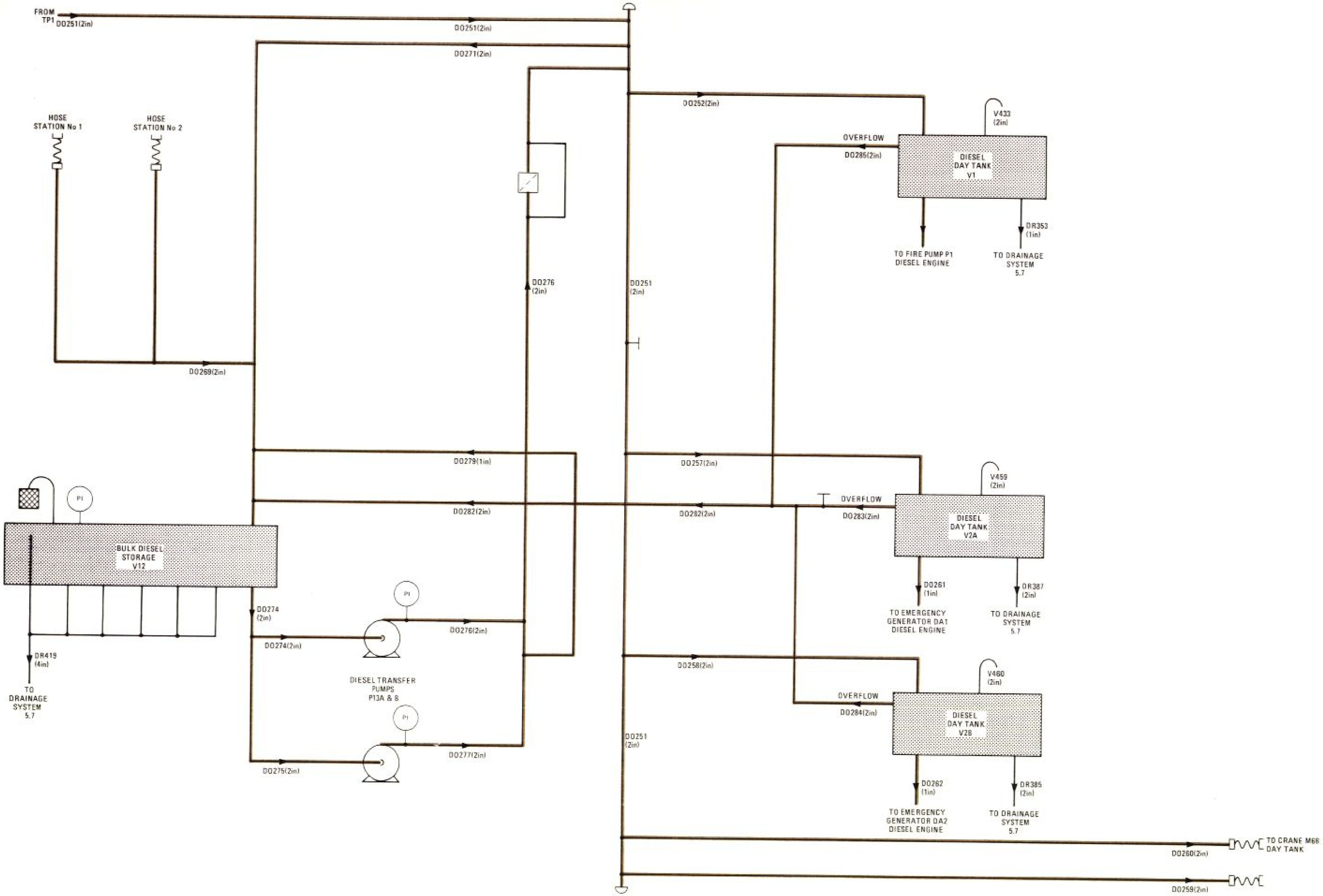
1.2 The first block valve to each consumer is on the manifold located near the local control panel. The panel indicates high and low level alarms for all QP diesel day tanks. The panel also has Stop and Start buttons for diesel transfer pumps P8A and P8B located on TP1. This combination of controls allows one man to transfer fuel from TP1 to any consumer on QP.

1.3 The day tanks of diesel oil consumers on QP are as follows:

Tank No	Capacity (litres)	Description	Location
V1	1137	Fire pump P1	Lower level, Module B
V2A	2790	Emergency generator DA1	Lower level, Module A
V2B	2790	Emergency generator DA2	Lower level, Module A
		Crane M6B	Roof level, Module B

1.4 For the purposes of self-sufficiency, bulk storage tank V12 with a capacity of 95m^3 is provided at deck support level in Module A. Two electrically driven centrifugal diesel transfer pumps, P13A and B, take suction from V12 and pressurise the fuel header to supply the above consumers. Each pump has a capacity of 113.6 litres/min at 5.2 bar.

END



ISSUE 1. JULY 1980

DIESEL FUEL SYSTEM	5.4

JET FUEL SYSTEM

1 GENERAL

1.1 Jet Fuel System Package Q1 is provided on the roof of Module B for helicopter refuelling. Three skid-mounted fuel storage tanks, V7A, B and C, are provided. Each tank is 214mm long with a diameter of 214mm, and has a capacity of 7600 litres. Outlets from each tank are led to a common 2in suction line.

1.2 A portable jet fuel tank (pod), Q15, is provided and used to transport fuel on the supply vessel for transfer to the storage tanks. The capacity of this tank is 2271 litres.

1.3 Two alternating glandless pumps, P7A and B, driven by compressed air from the platform air supply have a combined delivery of 190 litres/min at 2.1 bar. Their discharge line is led to a fuel meter, hosereel and nozzle via a filter/water separator, V8.

1.4 An emergency nitrogen supply is provided, stored in bottles, and connected to the fuel pump plant air supply. Should the plant air supply fail, the nitrogen can be used to run the fuel pump at its rated flow for a maximum of eight minutes.

1.5 The filter/water separator is provided to remove impurities from the fuel. The unit has a rated flow of 190 litres/min and filters the fuel to the following standards:

(a) Water at outlet; less than 15 ppm.

(b) Solids at outlet; less than 0.26mg/litre.

(c) Solids at outlet; less than 1 micron particle size.

END

WASHDOWN SYSTEM

1 GENERAL

1.1 A washdown pump (P5) and four hosereels are provided for general washdown use around the platform.

1.2 The washdown pump is a Sigmund Pulsometer Model FN–08B vertical turbine pump, powered by a 120 hp (90kW) electric motor. It is rated at 1892 litres/min at 9.22 bar at the discharge nozzle.

1.3 In an emergency the washdown hosereels can be used for firefighting purposes. The supply can then be either as normal from pump P5, or from 10in firewater header FW102.

1.4 The pump takes its suction from the sea and is located in Module B, lower level. The hosereels are located at the following positions:

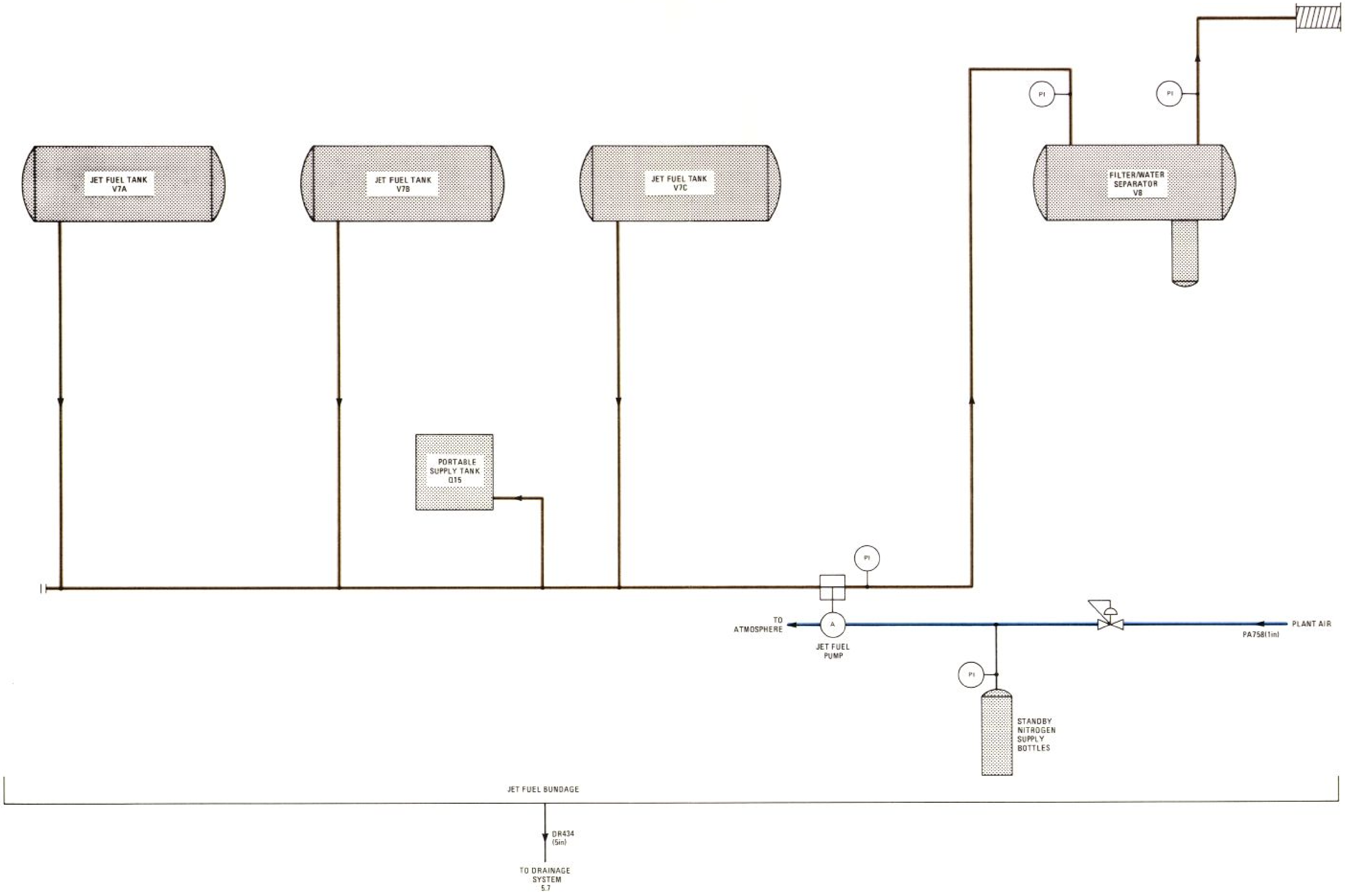
(a) HR1; outside the fire pumphouse in Module B, lower level.

(b) HR2; by the sewage pump control panel in Module B, lower level.

(c) HR3; outside the generator building in Module B, lower level.

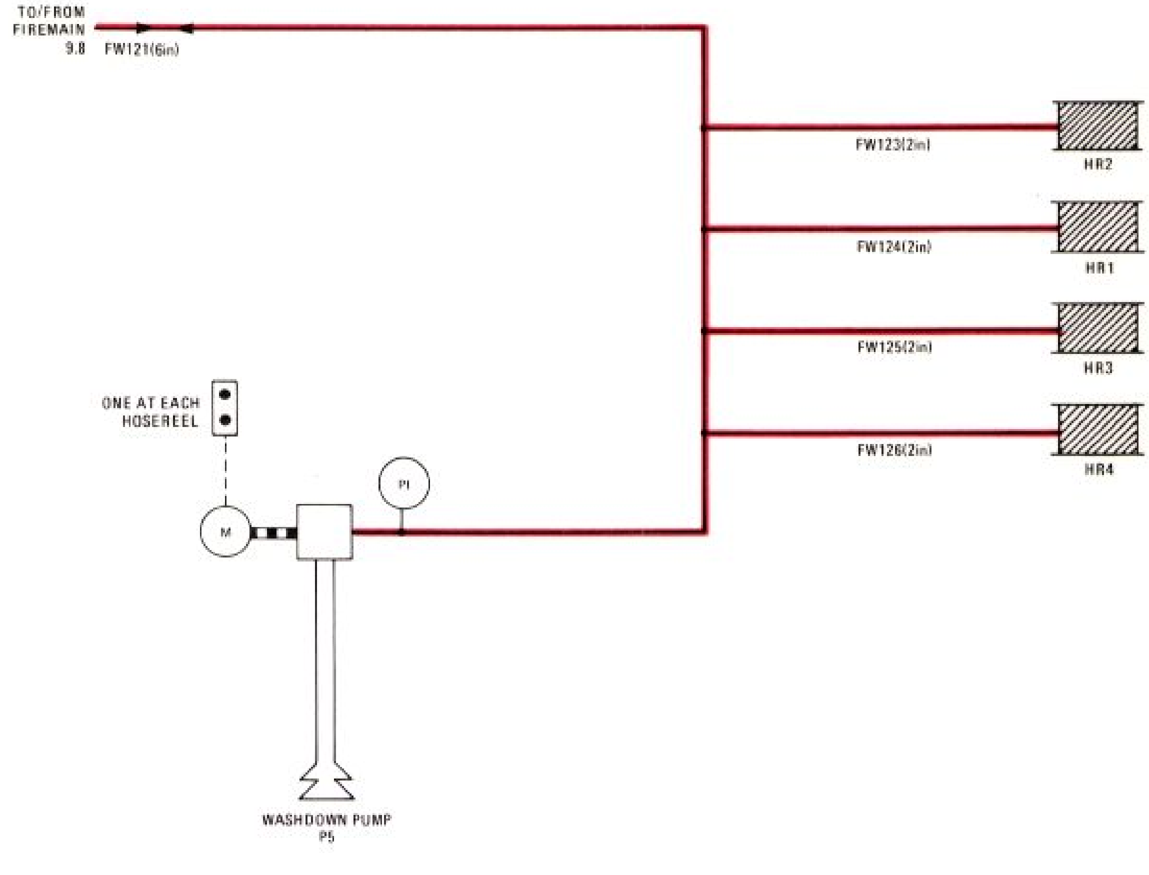
(d) HR4; on the Helideck.

END



ISSUE 1. JULY 1980

JET FUEL SYSTEM	5.5



ISSUE 1. JULY 1980

WASHDOWN SYSTEM

5.6

DRAINAGE SYSTEM

1 OPEN DRAINS

1.1 All oil and water collected in drainage troughs, gulleys etc passes through an open drain system into sump caisson V5 located below Module B. This caisson has its upper section above and its lower section below sea level; its bottom is open to the sea.

1.2 In the caisson the oil and water separate out leaving the oil floating on the surface of the water. When the oil/water interface reaches a predetermined level the sump is pumped out, either across the bridge to TP1 or, during self-sufficiency, to drums.

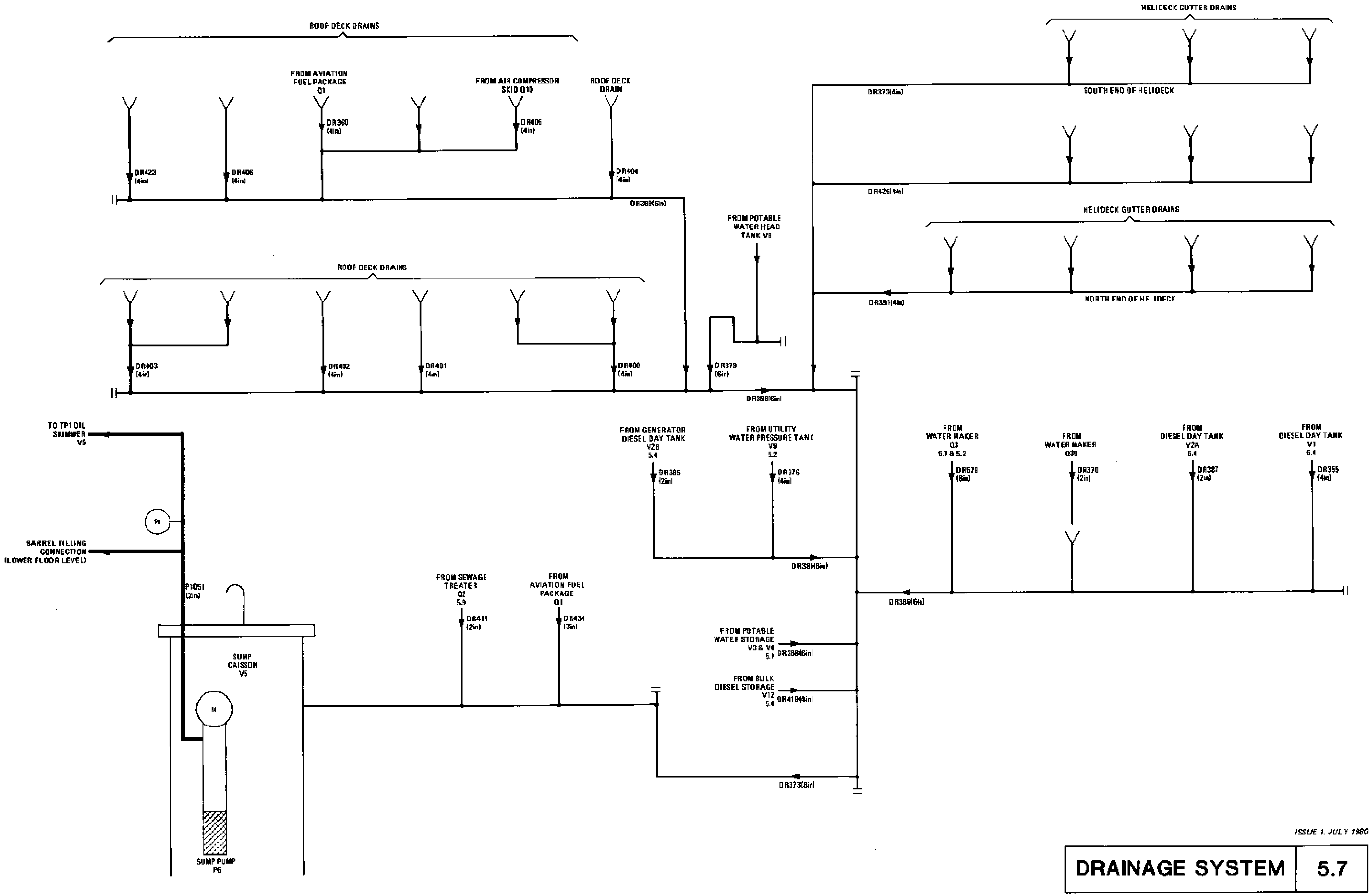
1.3 Sump pump P6, located in the sump caisson, is a Sumo 12 CP2 submersible pump driven by a 51 hp electric motor. This pump is rated at 95 litres/min at 7.8 bar.

1.4 A sump oil level indicator is located near the pump Start/Stop switches mounted locally at quarters lower level.

2 TRANSFORMER DRAINS

Drains from transformer T3 are collected in drain tank V11 located at deck support frame level in Module B.

END



ISSUE 1. JULY 1980

DRAINAGE SYSTEM | **5.7**

VENTILATION SYSTEMS

1 GENERAL

1.1 The ventilation systems provide the following:

(a) The accommodation areas with sufficient changes of conditioned air to ensure adequate ventilation for personnel.

(b) The technical and service areas with air which is heated or cooled in order to promote habitability.

(c) Sufficient extraction rates to promote adequate circulation of fresh air.

1.2 Six systems are provided as listed below:

(a) Lower level air conditioning system – this serves the accommodation areas of Modules A and B.

(b) Roof level air conditioning system – this serves the technical rooms and offices on the upper and roof decks.

(c) Service area ventilation system – this supplies the utilities rooms on the lower level of Module B.

(d) Two separate battery room ventilation systems – these are provided in Rooms R4 and R10.

(e) Compressor Room M10 ventilation system.

1.3 The design criteria for the air conditioned areas are:

Overpressure	6mmWG
Temperature	22°C
Relative humidity	35 to 50%

2 LOWER LEVEL AIR CONDITIONING SYSTEM

2.1 Fresh air, drawn from the underside of the platform, and recirculated air from within the accommodation areas is passed through two air-handling units working in parallel. The air is then distributed throughout the accommodation areas by high level ductwork. Fresh air is supplied at a rate of $4.767m^3/s$, and recirculation air at a rate of $3.872m^3/s$. Each air-handling unit is capable of meeting 60 per cent of the total cooling requirements of the accommodation modules.

2.2 Each air-handling unit is a package unit which comprises the following equipment:

(a) Filter section: containing four filter panels.

(b) Preheater section: comprising an 88kW electric heater battery of sufficient capacity to raise the handled air through 14°C. Control of the heater is through a four-step controller actuated by a control thermostat. The heater is equipped with a high limit safety cut-out thermostat, and is also interlocked with the supply fans to prevent operation under no airflow conditions.

(c) Coil section: containing a 175kW cooling capacity direct expansion sprayed-cooling coil. The spray pipes are capable of delivering 2.5 litres/s.

(d) Heater section: comprising a 104kW electric reheater battery of sufficient capacity to raise the handled air volume through 22°C. Operation and control of the battery is as described for the preheater.

(e) Fan section: containing a fan handling an air volume of $4.653m^3/s$ against the 110mmWG of the system. The fan is directly driven by a 15kW electric motor, and fitted with anti-vibration mountings and flexible ductwork connections.

2.3 The fresh air intake is provided with a motor-operated spring-loaded damper, a manually operated regulating damper and a gas detection unit. The motor-operated damper will close automatically on detection of gas.

2.4 Both air-handling units discharge air into a plenum supply box via short ductwork connections, each duct incorporating a manually operated regulating damper. From this supply plenum box, three zone branch ducts and one room supply duct are taken. The room supply duct is equipped with a manually operated regulating/isolating damper and serves Laboratory L22. Each duct incorporates a 1kW electric reheater battery. The three zone branch ducts serve: Module A lower floor, Module A middle and upper floors, and Module B middle and upper floors.

2.5 Supply ducts from each main riser are each provided with a manually operated regulating/isolating damper and an acoustic attenuator. Distribution ductwork is provided on each floor and serves the various rooms/areas; each terminal is provided with a 1.2 or 1.8kW capacity electric reheater unit. Each reheater battery is equipped with a regulating/isolating damper. The battery is controlled by a room thermostat.

2.6 All zone supply ducts are provided with fire dampers where they penetrate firewalls or floors. The fire dampers are held in the open position by a fusible linkage. In-duct fires will result in fusion of the linkage, thus closing the fire damper.

3 COOLING EQUIPMENT

3.1 The cooling equipment for the lower level air conditioning unit is of the direct expansion type, utilising R22. Each of the two air-handling units is served by its own cooling system comprising: compressor/receiver unit; air-cooled condenser; evaporator, and associated refrigerant pipework, valves and controls.

3.2 The evaporators are integral within the air-handling unit. The total capacity of each cooling coil is 175kW (maximum required operational capacity being 107kW for Module A and 68kW for Module B) and the handled volumes of 5.5m^3/s are cooled from the 'on-coil' condition of 22°C dry bulb and 18.6°C wet bulb, to the 'off-coil' temperature of 10°C; the evaporating temperature for both coils is 3°C.

3.3 The refrigerant compressor/receivers are package units, with an open-type compressor (184kW cooling capacity); each compressor is belt driven by a 55kW electric motor. The evaporating and condensing temperatures are 3°C and 40°C, and the saturated suction and discharge temperatures are 2°C and 90°C respectively.

3.4 Each compressor/receiver unit is connected to its own roof-mounted condenser which has a total heat rejection capacity of 240kW with a condensing temperature of 40°C. Each condenser is fitted with three fans, each directly driven by a 2.2kW electric motor, with a total air volume of 19.4m^3/s.

3.5 Cooling equipment controls are interlocked with the respective air conditioning unit supply fan controls to prevent operation of the system when air is not being circulated.

3.6 Supply air is preheated, cooled/dehumidified or humidified, and reheated within each air conditioning/handling unit, the room air supply temperature being determined by electric reheater batteries.

4 RECIRCULATION SYSTEM

Accommodation and recreation areas discharge air to the corridors through door grilles. A high level ductwork system, incorporating corridor extract grilles, returns this air to the main HVAC Plant Room via a main riser duct for each module. Each corridor extract duct is equipped with manually operated dampers fitted upstream of the connection to Module A or B main extract riser duct. All distribution branch and riser ducts are provided with fire shut-off dampers where they penetrate firewalls and floors.

5 ACCOMMODATION AREAS EXTRACTION SYSTEMS

5.1 Air from the accommodation areas is extracted via the toilets and bathrooms, and via the kitchen extraction system. Extract air from the toilets is discharged to atmosphere at roof level. Extract air from the kitchen is discharged to atmosphere through the floor of the platform.

5.2 Air is extracted from the kitchen (M39) through two high level canopies each of which contains a fire damper. The canopies are connected by a common duct to a centrifugal type fan which is belt driven by a 1.5kW motor. The extract air is removed at a rate corresponding to an air change rate of 18 per hour.

5.3 Air extracted from the kitchen is ducted to the low level of Room L32 and discharged to atmosphere through the floor of the platform, via an automatic shut-off damper. The damper is operated by an electric servomotor, incorporating spring-return, to automatically close on failure of the electrical power supply.

5.4 Extract air from the toilets and bathrooms on the lower, middle and upper levels is discharged at roof deck level by a package air-handling unit. The package air-handling unit comprises a belt-driven centrifugal fan, and two 1.85kW electric motors (one duty and one standby) located on the roof of Module B. The changeover from the duty to the standby motor is a manual operation, requiring the fitting of Vee belts. The fan is capable of handling a total air quantity of 3.15m^3/s, against the system resistance of 30mmWG. The discharge ducting from the air-handling unit to atmosphere is provided with an automatic shut-off damper, driven by a spring-return electric servomotor, which automatically closes in the event of failure of the electrical power supplies.

5.5 Air is extracted from Laboratory L22 through a duct connected to a canopy. The duct incorporates an axial flow fan, directly driven by a 0.25kW electric motor, and capable of handling a total air quantity of 0.417m^3/s, against the system resistance of 10mmWG. Air is discharged to atmosphere through the laboratory floor. The discharge ducting is fitted with a shut-off damper, driven by a spring-return electric servomotor, which automatically closes in the event of failure of the electrical power supplies.

5.6 Additional Laundry Room M36 extract facilities, comprising a fan and ductwork, are provided. The fan is of the centrifugal type, belt driven by a 0.18kW electric motor, and capable of handling a total air quantity of 0.166m^3/s. Operation of the centrifugal fan is interlocked with the laundry extract blower unit. The fan discharges to atmosphere at roof level.

6 ROOF LEVEL AIR CONDITIONING SYSTEM

6.1 Fresh air, mixed with recirculated air from the technical rooms, is passed through an air-handling unit and is distributed to the technical rooms at upper and roof levels. Fresh air is supplied at a rate of 2.778m^3/s, and recirculated air at a maximum rate of 3.026m^3/s.

6.2 The air-handling unit is a package unit which comprises the following sections:

(a) Filter section: containing eight cellular-type filter panels arranged in series, with two banks each of four units. The filters have an efficiency of 1 micron and are arranged for side withdrawal.

(b) Air conditioning section: containing preheater, humidification coil, cooling coil and moisture eliminator.

6.3 The 80kW electric preheater battery is of sufficient capacity to raise the temperature of the handled air volume through 11°C. Operation of the heater is controlled through a five-stage step controller actuated by a thermostat. The battery is equipped with a high limit safety cut-out thermostat, and is also interlocked with the supply fans to prevent operation with no airflow. Air from the preheater passes through a sprayed-coil humidifier to the direct expansion, 163kW cooling capacity evaporator coil. The spray pipes are capable of delivering 1.25 litres/s.

6.4 Air is taken from the air conditioning section into a housing comprising three separate compartments: suction plenum, fan section, and discharge supply plenum.

6.5 Two connections between the suction plenum and the fan inlets are provided, each containing motorised non-return dampers.

6.6 The fan section contains two centrifugal fans (one duty and one standby). Each fan is belt driven by an 11kW electric motor and is capable of handling the total air quantity of 5.805m^3/s, against the system resistance of 120mmWG. Both fans are provided with discharge non-return dampers. The discharge dampers are installed in the division between the fan section and the discharge supply plenum.

6.7 The fan suction and discharge dampers are driven by electric servomotors: these are interlocked with the supply fan selector switch and automatic changeover facilities. The changeover equipment is activated by pressure differential switches installed across the fan suction and discharge connections. The dampers prevent short-circuiting of air and are also used for isolating purposes.

6.8 Air from the handling unit is discharged into a supply plenum and is distributed via ten zone branch ducts. Ducts to Rooms R1, R8, R11, U25 and U28 are provided with absolute filters. Reheater batteries are provided in each duct.

6.9 The supply duct to Room U26 is cross-connected to the lower level air conditioning distribution system. The connection is taken from Module B central riser and incorporates a regulating/ isolating damper and a 15kW electric reheater battery. This duct is normally closed, being used for emergency Control Room supply in the event of failure of the roof-top air conditioning plant.

6.10 Operation of each of the zone, room, or area electric reheater batteries is controlled through a room control proportioning thermostat. All heaters are equipped with a high limit safety cut-out thermostat, and are also interlocked with the air conditioning supply fan, to prevent operation in the event of airflow failure.

6.11 Fire dampers are each provided with a fusible linkage assembly to ensure fail-safe operation in the event of an in-duct-fire.

6.12 Both the fans' suction and discharge dampers are driven by electric servomotors; these are interlocked with the supply fan selector switch and automatic changeover facilities. The changeover equipment is activated by differential pressure switches installed across the fan suction and discharge connections. The dampers prevent short-circuiting of air and are also used for isolating purposes.

7 COOLING EQUIPMENT

7.1 The cooling equipment for the roof level air conditioning unit is of the direct expansion type using R22 and comprises: compressor/receiver unit; air-cooled condenser; evaporator; and associated refrigerant pipework, valves and controls.

7.2 Operation of the cooling equipment is interlocked with the air conditioning unit supply fan (via the roof HVAC control panel) in order to prevent operation of the system when air is not being circulated.

7.3 The evaporator is located within the coil section of the air conditioning package unit. The total cooling capacity is 175kW per hour and the handled volume of 5.804m^3/s is cooled from 22°C and 70 per cent relative humidity to the off-coil temperature of 10°C; the evaporating temperature is 3°C.

7.4 The compressor/receiver package unit, located in Room R12, comprises the following major items of equipment:

(a) An open-type compressor, belt driven by a 55kW electric motor, with a cooling capacity of 175kW at an evaporating temperature of 3°C and a condensing temperature of 40°C. Saturated suction and discharge temperatures are 2°C and 90°C respectively.

(b) A liquid refrigerant receiver.

7.5 The air-cooled condenser is located on Module B roof adjacent to grid line 3. The unit is manufactured with a stainless steel casing and contains two condensing coils constructed from copper tubes with copper fins. The condenser total heat rejection is 240kW and the condensing temperature is 40°C. The condenser is fitted with eight fans, each driven by a 1.1kW electric motor, handling a total air quantity of $20m^3/s$.

8 RECIRCULATION/EXTRACT SYSTEM

8.1 A recirculation/extract system serving the roof level air conditioned areas is provided. Air is extracted from the corridor through a central grille installed within the false ceiling. Ductwork from the grille partially recirculates air to the central HVAC system; the remaining air is exhausted to atmosphere. Both the exhaust and recirculation ducts connected to the extract grille are fitted with regulating dampers, operated by an electric servomotor and actuated by a pressure controller. The exhaust ductwork is connected through Module B roof to the extract fan package unit, incorporating a fire damper where penetrating Module B fireproofed roof.

8.2 The extract air-handling unit is a package unit containing a centrifugal fan, belt driven by two 1.5kW electric motors (one duty and one standby). The changeover from the duty to the standby motor is a manual operation, requiring the fitting of Vee belts. The fan is capable of handling a total air quantity of $2.3m^3/s$, against the system resistance of 25mmWG.

8.3 The discharge ducting from the air-handling unit to atmosphere is provided with an automatic shut-off damper operated by an electric drive servomotor. The motor incorporates a spring-return to ensure automatic closing upon failure of the electrical power supply.

9 SERVICE AREA VENTILATION

9.1 Fresh air, drawn from the underside of the platform, and recirculated air from Room L23 is passed through an air-handling unit in Room L23. The air is then distributed to the service areas on the lower floor of Module B. The fresh air is normally supplied at a rate of $1.5m^3/s$ with no recirculation. When external temperatures fall to minimum working levels, up to 50 per cent of air may be recirculated.

9.2 The air-handling unit is a package unit comprising the following:

(a) Filter section: containing two aluminium filter panels.

(b) Heater section: a 37.5kW electric heater battery capable of raising the temperature of handled air 21°C. The heater is controlled by a three-stage step controller actuated by a room thermostat. The heater is equipped with a high limit safety cut-out thermostat, and is also interlocked with the supply fan to prevent operation under no airflow conditions.

(c) Fan section: a centrifugal flow fan, directly driven by a 4kW electric motor, handling an air volume of $1.50m^3/s$ against the system resistance of 30mmWG.

9.3 The service area ventilation system maintains the rooms it serves at a temperature of not less than 8°C. Additional heating facilities are provided in the Fire Pump Room to maintain a temperature of not less than 22°C.

9.4 Certain of the service facilities require additional ventilation when in use; this is provided as follows:

(a) Emergency Generator Ventilation: Fresh air is drawn from the underside of the platform through two intakes located in the floor of Generator Room L27. Incoming air is monitored by a gas detector and passes through automatic dampers. The dampers are operated by individual electric motors which are interlocked with the emergency generators to ensure automatic opening in the event of generator operation. Air at a rate of $15m^3/s$ per generator is drawn through each intake by each generator radiator fan. Exhaust air is discharged to atmosphere via two extract ducts each connected to a generator radiator.

(b) Service Area Transformer Room Ventilation: Fresh air is drawn from the underside of the platform through two intakes located in the floor of Transformer Room L28. Incoming air is monitored by a gas detector and passes through an automatic shut-off damper. Each damper is operated by an electric servomotor with a spring-return to automatically close the fresh air intakes on interruption of the electrical power supply. Room supply air is totally fresh and the air volume of 0.97m^3/s handled by two axial flow fans (one duty and one standby). The fans are connected directly to the intakes and discharge to the room through connections which incorporate motorised non-return dampers. The two fans, directly driven by 0.55kW electric motors, are equipped with automatic changeover facilities. The non-return dampers are also used for isolating purposes and are operated by an electric servomotor, interlocked with the fan selector switch. Air is exhausted from Transformer Room L28 via a floor-mounted duct, and discharged to atmosphere. The discharge duct is fitted with a motorised automatic shut-off damper, as described for the fresh air inlets.

(c) MCC Room Battery Extract Ventilation: Air is extracted from the vicinity of the batteries by a canopy above the battery cabinets. Two axial flow extract fans (one duty and one standby) are fitted in the ducting from the canopy. Each fan is directly driven by a 0.25kW electric motor. Manually operated non-return dampers are provided to prevent short-circuiting of air. The extract fans discharge through ducting led to atmosphere through the deck. These ducts incorporate damper assemblies operated by an electric servomotor, which automatically shuts the dampers in the event of discontinuation of the electric power supply.

10 UK COMMUNICATIONS BATTERY ROOM R4 VENTILATION

10.1 Fresh air from a cowl in the external cladding is monitored by a gas detector and passes through an automatic shut-off damper. The shut-off damper is driven by an electric servomotor with spring-return, to automatically close the fresh air intake on interruption of the electrical power supply or on detection of gas.

10.2 Room supply air is passed through ducting incorporating suction side non-return dampers, operated by an electric servomotor. This motor is interlocked with the supply fan selector switch and automatic changeover facilities. The dampers prevent short-circuiting of air, and are also used for isolating purposes.

10.3 Two axial flow supply fans are provided (one duty and one standby). Each fan is directly driven by a 2.2kW electric motor, and is capable of handling an air quantity of 1.667m^3/s.

10.4 Automatic changeover of the fans is effected via the roof level control panel, activated by a signal from explosion-proof airflow switches installed in each fan discharge connection.

10.5 Room supply air is heated by a 60kW electric heater battery which is operated by a seven-step controller actuated by a room control proportioning thermostat. The heater maintains an internal temperature of 16°C and is interlocked with the supply fans to prevent heater battery operation without airflow; the heater battery is further protected by a high limit safety cut-out thermostat.

10.6 Air is extracted from the room by two axial flow fans (one duty and one standby). Each fan is directly driven by a 2.2kW electric motor, and capable of handling the total extract air quantity of 1.667m^3/s. Each fan is provided with non-return dampers which are operated by an electric servomotor, interlocked with the extract fan selector switch, airflow switches and automatic changeover facilities. The dampers prevent short-circuiting of air and are also used for isolating purposes.

10.7 Air is discharged through an exhaust duct in the external cladding. The exhaust duct is equipped with a manual regulating damper for balancing and isolating purposes.

10.8 The Battery Room is maintained at a negative static pressure relative to adjoining areas.

11 NORWEGIAN COMMUNICATIONS BATTERY ROOM R10 VENTILATION

Supply and extract ventilating systems provided are as for UK Communications Battery Room R4 described above, with the exception of the following:

(a) Heater battery capacity is 10.5kW.

(b) Heater operation is by a two-stage control thermostat (as opposed to the step controller).

(c) Supply fan motor size is 0.55kW.

(d) Supply fan air quantity is 0.278m^3/s.

(e) Extract fan motor size is 0.55kW.

(f) Extract fan air quantity is 0.278m^3/s.

12 COMPRESSOR ROOM M40 VENTILATION

12.1 The Cold Room compressor units, located in Room M40, are ventilated by a high level axial flow extract fan.

12.2 Fresh air is introduced through a low level intake installed through the external cladding. The incoming air is monitored by a gas detector before passing through an automatic shut-off damper. The damper is driven by an electric servomotor equipped with spring-return to ensure automatic closing on interruption of the electrical power supplies.

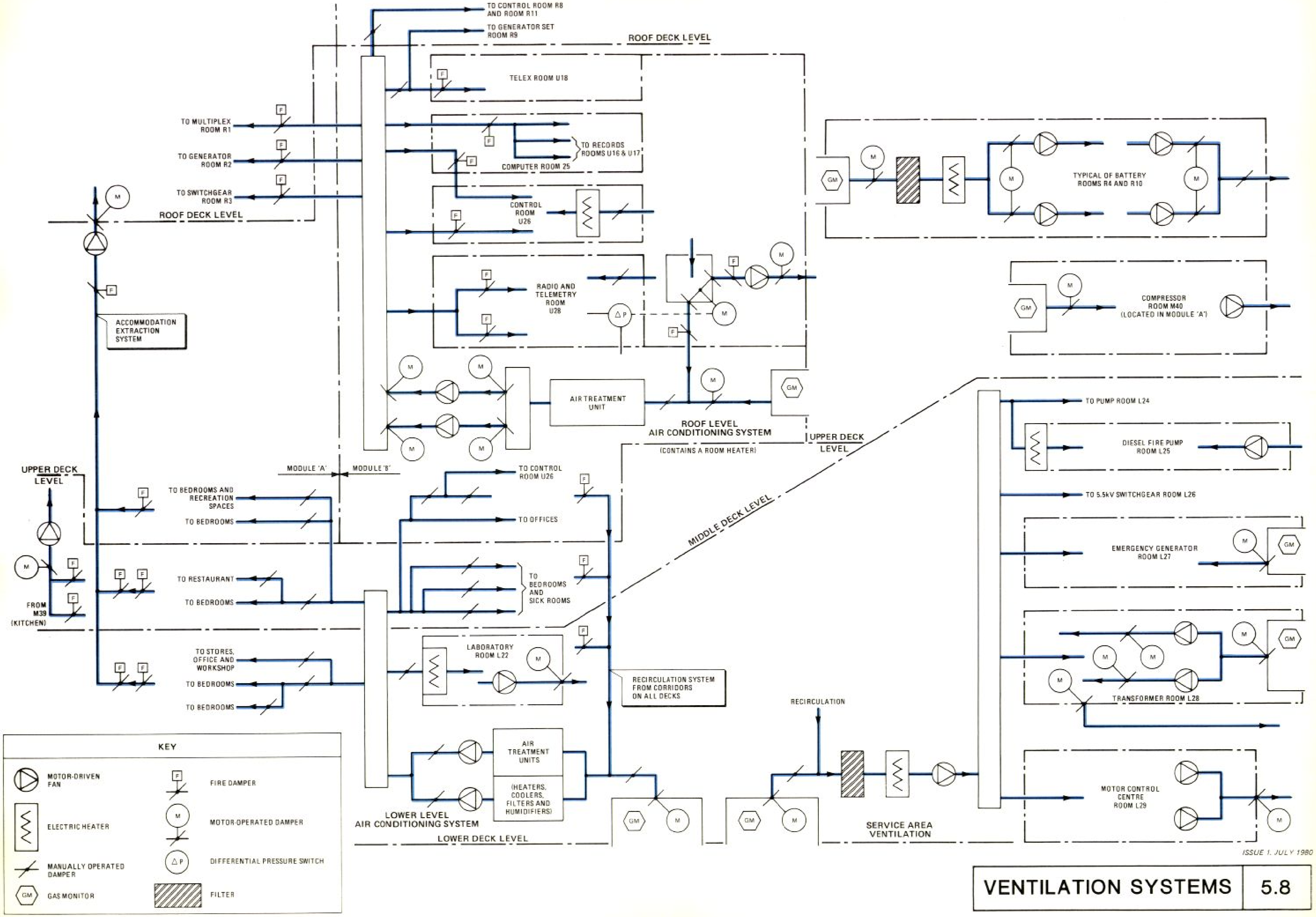
12.3 Air is extracted from the room through a high level duct incorporating an axial flow fan. The fan is capable of handling an air quantity of 0.27m^3/s and is directly driven by a 1.1kW electric motor.

13 SYSTEMS SHUTDOWN

13.1 The electrical power supply to all systems is automatically tripped in response to a signal from either the fire or the gas detection systems. Electrical power supplies will also be tripped on operation of QP ESD pushbutton or operation of the fire alarm pushbuttons.

13.2 This will ensure that the fresh air intake and exhaust air outlet auto shut-off dampers will close.

END



ISSUE 1. JULY 1980

VENTILATION SYSTEMS 5.8

SEWAGE TREATMENT

1 GENERAL

1.1 Sewage flows under the influence of gravity into sewage tank V10 situated at deck support level in Module B. V10 has a capacity of $17m^3$ and contains two submerged sewage pumps, P10A and B. These pumps each have a capacity of 140 litres/min at 1.92 bar, and are driven by 1.5kW electric motors. Sewage from V10 is discharged by P10A and B to sewage treater Q2 for biological reduction.

1.2 The operation of pumps P10A and B can be either manual or automatic. During automatic operation the pumps are controlled by level switches. A Duty/Standby selector and an Auto/Manual switch are also provided.

1.3 Normal pump operation is by timer, such that a run of up to half an hour by one-minute intervals is obtained. Total time between switchings is up to 8 hours maximum with 15-minute intervals. The timer can be overriden by high level and high-high level switches.

1.4 At Q2 the raw sewage influent is directed into a digestive reducer basket located in the first aeration compartment, where the organic waste is subjected to hydraulic maceration before passing through a mesh screen into the first aeration compartment.

1.5 The wastes are then aerated and biologically consumed prior to entering the second and third compartments where final degradation is completed. Aeration is provided by a positive displacement blower located on top of the tank and belt driven by an electric motor. Air is distributed through non-clog diffusers at 1.29 to 1.39 bara.

1.6 The effluent next passes through a chlorinator containing dry chlorine tablets to the clarifying chamber where it is retained for 15 to 30 minutes before leaving the plant as a clear odourless liquid. This clear liquid is passed to sump caisson V5 for normal disposal.

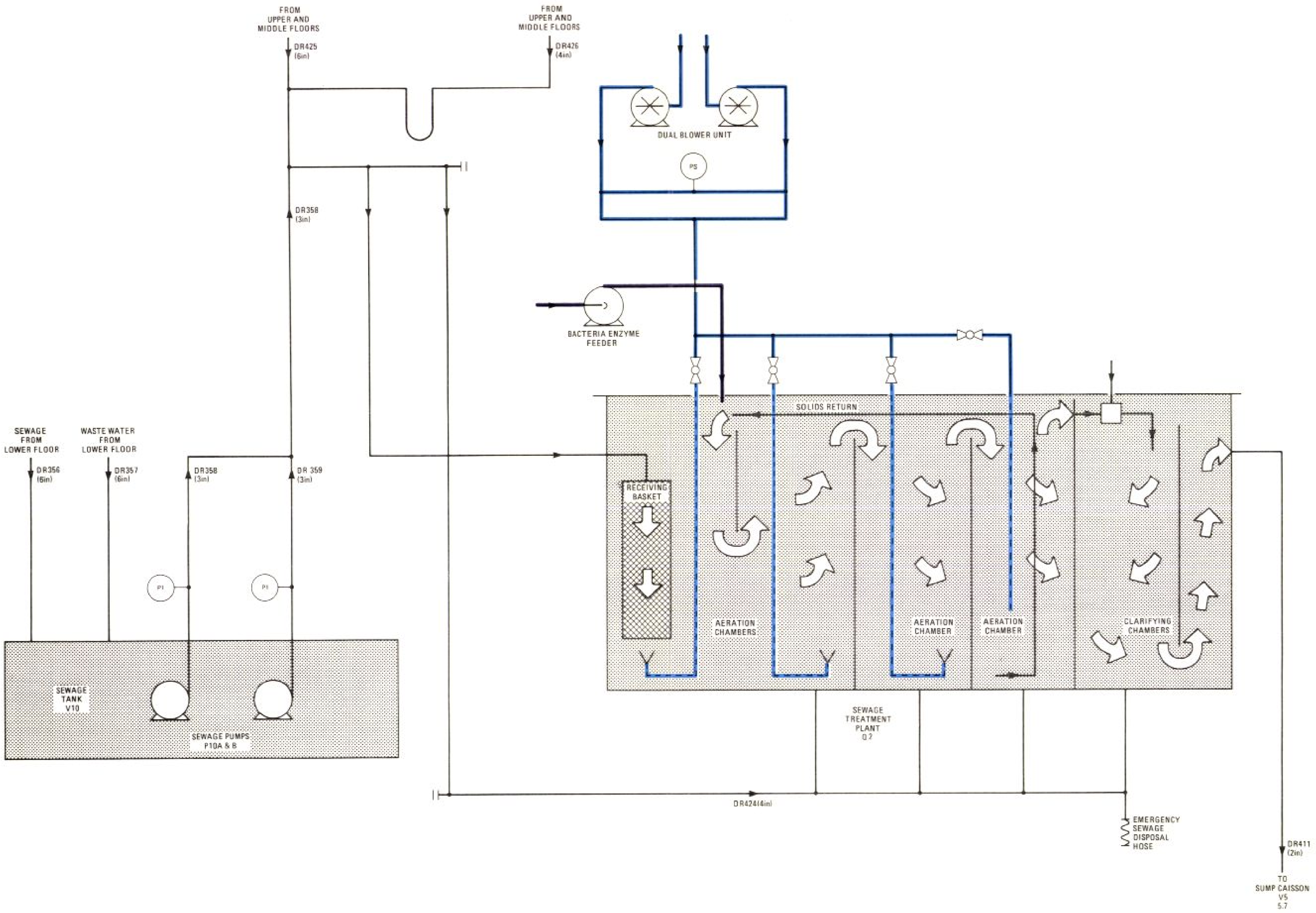
1.7 Sewage treatment plant Q2 produces effluent which does not exceed the following criteria:

Biochemical oxygen demand (BOD)	50 ppm
Suspended solids	150 ppm
Nominal flowrate	19 litres/min
Maximum flowrate	152 litres/min

1.8 Bacterial enzymes in powder form are automatically added to the active system at a rate of 30 to 60 grams per day. The feeding of the powder is by a mechanical feeder located on top of the tank, directly over the first aeration compartment.

1.9 Should the sewage treatment plant have to be taken out of service, the untreated influent may be discharged overboard.

END



ISSUE 1. JULY 1980

SEWAGE TREATMENT

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 QP, TP1 and TCP2 with platforms CDP1, DP2 and FP.

1.2 Under normal operating conditions power for the whole complex is generated at 5.5kV by large gas turbine-driven generators in TP1 augmented by smaller gas turbine-driven generators in TCP2, both groups feeding their respective 5.5kV switchboards. No power is used at 5.5kV however, as the Motor Control Centres on all the platforms are fed with 380V from 5500/380V transformers. Smaller diesel-driven generators on CDP1, DP2 and QP provide 380V standby supplies.

1.3 Interconnections between QP, TP1 and TCP2 form a 5.5kV ring main so that, in the event of one cable failing, power can be maintained to each switchboard. Supplies to CDP1 and DP2 are radial feeders from the ring main. Exceptionally, the Flare Platform (FP) is fed at 380V by a 4-wire submarine cable from TP1. Special arrangements are provided for isolating and earthing-down all interconnecting cables between platforms.

1.4 Central control of the electrical system on TP1, QP and TCP2 is exercised from the Electrical Control Room (MCC Room) in TP1.

2 DESCRIPTION

2.1 Generation

2.1.1 Power is generated at 5.5kV, 3-phase, 50Hz by three gas turbines driving 3.0MW$_e$ (3.5MVA) generators TA1, TA2 and TA3 on TP1. These are augmented by three gas turbines driving 1.4MW$_e$ (1.75MVA) generators TA4, TA5 and TA6 on TCP2.

2.1.2 The 5.5kV system is earthed through neutral earthing resistors, one for each main generator. The values of the resistors are as follows:

(a) Generators TA1, TA2 and TA3 — 17 ohm.

(b) Generators TA4, TA5 and TA6 — 34 ohm.

2.1.3 TA3, TA4, TA5 and TA6 are gas-fuelled only, whereas TA1 and TA2 are dual-fuelled, running on gas or diesel oil. These sets normally run on gas but will automatically change over to liquid fuel if the gas pressure falls below a predetermined level. In all cases reversion to gas is manual only.

2.1.4 Generator sets TA1, TA2 and TA3 are started by diesel engines through torque converters, the engines themselves being started electrically from local 24V batteries. Generator sets TA4, TA5 and TA6 are air-started from the plant air system.

2.2 Switchboards and Switchgear

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

(a) TP1 — Switchboard Room, Cellar Deck, Zone 06.

(b) TCP2 — Switchroom, Cellar Deck, Mezzanine.

(c) QP — Switchboard Room L26, Lower Level.

(d) CDP1 — Electrical Room, Module BR1.

(e) DP2 — Substation, Module 4, First Level.

2.2.2 The switchboards have a service rating of 800A and a designed symmetrical fault rating of 290MVA at 5.5kV; the actual fault level is about 120MVA.

2.2.3 The switchgear associated with switchboards CDP1 5500 and DP2 5500 consists of rotary switches. These are manually closed but electrically tripped. They are suitable for fault making but only load breaking; fuses in the outgoing circuits provide protection against through faults.

2.2.4 All circuit breakers on the boards are of the solenoid-operated air break type, fitted with protective relays. The tripping and closing coils operate on a 110V dc control supply from locally situated batteries and chargers. The designations and service ratings of the breakers are given in Diagram 5.10.

2.2.5 The only loads on the 5.5kV switchboards are the 5500/380V transformers supplying the 380V Motor Control Centres.

3 SYSTEM CONTROL

3.1 General

Overall control and monitoring of the electrical system for TP1, TCP2 and QP is carried out on TP1 from the Generator Control Desk and the Control Mimic situated in the Machinery Control Room on the Mezzanine level of Zone 05. Control and monitoring is described in the following paragraphs.

3.2 Generator Control Desks

The Generator Control Desk on TP1 is the principal position for controlling the three gas turbine-driven generators on TP1, the three gas turbine-driven generators on TCP2 and the two diesel-driven generators on QP. Control of the generator sets on TCP2 only can be exercised from a similar desk in the Electrical Control Room in Pancake 08 on TCP2, although the other generator sets are also monitored there.

3.3 Mimic Control Panels

3.3.1 The mimic control panels are wall-mounted and situated over the Generator Control Desk in both TP1 and TCP2.

3.3.2 On TP1 the panel remotely controls, by means of discrepancy switches, the 5.5kV supply switchgear on platforms TP1, TCP2 and QP. In the case of the 5.5kV rotary switches in CDP1 and DP2 the discrepancy devices serve only to indicate the switch position. The panel indicates, by means of lamps, which generators (gas turbine or diesel) are running, and an indication is given on wattmeters of the power delivered by each generator, the power passing along the ring main interconnectors and the power delivered to each main feeder transformer.

3.3.3 The panel on TCP2 remotely monitors, but does not control, the TCP2 5.5kV circuit breakers and all 5.5kV main switchgear on the other four platforms. The panel indicates, by means of lamps, which generators (gas turbine or diesel) are running on any of the platforms, and an indication is given on wattmeters of the power delivered by each generator in TCP2 only, the power passing along the ring main interconnectors from TCP2 and the power delivered to each main feeder transformer in TCP2 and to platform DP2.

3.3.4 The mimic panel on QP is for monitoring purposes only. It carries turbine circuit-breaker and transformer status indications for the whole complex.

3.3.5 Control facilities associated with the 380V part of the system are covered in Section 5.11.

3.3.6 The panel incorporates a Lamp Test facility.

3.4 5.5kV Switchgear

3.4.1 Provision is made for local control of the circuit breakers at the 5.5kV switchboards on TP1, TCP2 and QP; a Local/Remote selector switch and trip and close pushbuttons are provided on each breaker cubicle.

3.4.2 If there is a voltage on both sides of a bus-section breaker — or ring main breaker — it cannot be closed. Synchronising is provided only on the generator incomer circuit breakers and on the breakers at the TCP2 end of the TP1 to TCP2 ring main interconnector and the QP end of the TCP2 to QP interconnector. Synchronising of generator incomer breakers can be carried out either automatically (the normal method) or manually at the switchboard using a mobile synchronising trolley. Interconnector breakers can only be synchronised manually.

3.4.3 Interlocks are provided to lock out the circuit breaker and rotary switch at each end of the submarine interconnectors to CDP1 and DP2 when the cables are earthed. Conversely, the cable cannot be earthed when the associated breaker and switch are closed.

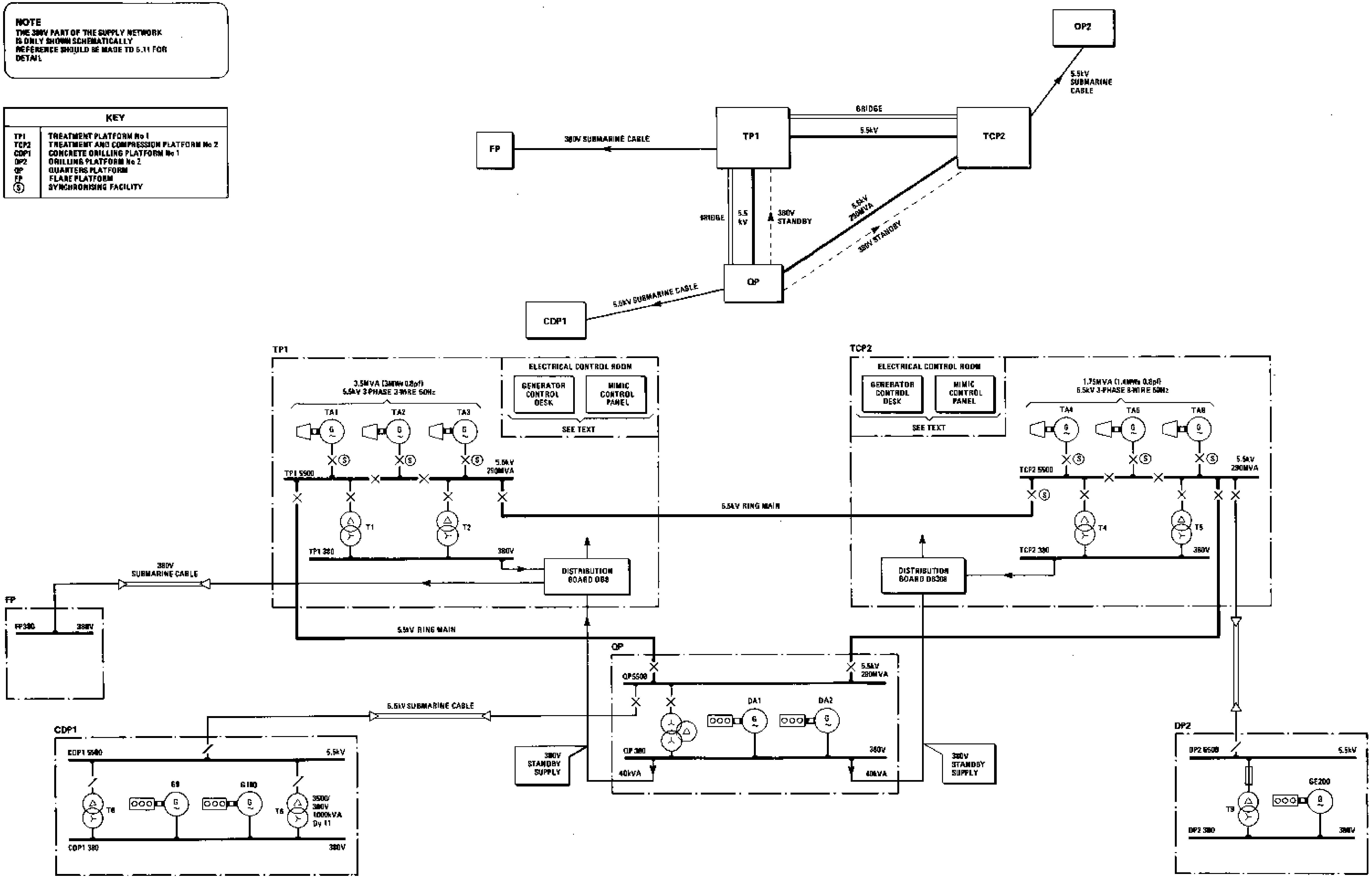
3.5 Shutdown

See Section 9.4

END

NOTE
THE 380V PART OF THE SUPPLY NETWORK
IS ONLY SHOWN SCHEMATICALLY
REFERENCE SHOULD BE MADE TO 5.11 FOR
DETAIL

KEY	
TP1	TREATMENT PLATFORM No 1
TCP2	TREATMENT AND COMPRESSION PLATFORM No 2
CDP1	CONCRETE DRILLING PLATFORM No 1
DP2	DRILLING PLATFORM No 2
QP	QUARTERS PLATFORM
FP	FLARE PLATFORM
Ⓢ	SYNCHRONISING FACILITY



ISSUE 1- JULY 1980

POWER GENERATION AND INTER-PLATFORM ELECTRICAL CONNECTIONS

5.10

ELECTRICAL POWER DISTRIBUTION

1 GENERAL

1.1 The principal items of plant and the main features of the distribution network are shown in Diagram 5.11.

1.2 Main power is received, but not generated, on Platform QP. It comes into switchboard QP 5500 at 5.5kV, 50Hz, through a ring main system interconnected with platforms TP1 and TCP2, where the 5.5kV generators are located. No power is consumed at 5.5kV, and the ring main supply is immediately transformed to 380V (the working voltage of the platform), the 380V system being solidly earthed.

1.3 Distribution for lighting, some heating and minor services is at 220V, taken between phase and neutral of various 380V distribution boards fed from the Motor Control Centre QP 380.

1.4 Two 380V diesel-driven auxiliary generators provide standby power in the event of failure of the 5.5kV main supply.

2 DESCRIPTION

2.1 5.5kV Supplies

2.1.1 Switchboard QP 5500 consists of two 800A ring main incomer units and two 200A feeders. One is to the local 5500/380V transformer T3, and the other is for the 5.5kV interconnector to Platform CDP1.

2.1.2 All 5.5kV switchgear is of the air-break type, solenoid-operated and has a design fault rating of 290MVA at 5.5kV. It is located in Switchboard Room L26 on the lower level on Module B and is housed in withdrawable trucks provided with the normal safety earthing-down facilities.

2.1.3 The local transformer, located in Module B, Room L28, is rated 1500kVA with a nominal ratio 5500 ±2.5% ±5%/380V (off-load tappings) and is star/star connected Yy0d. The HV neutral is resistance earthed, and the LV neutral is earthed through a contactor (see Section 5.12). Because of the star/star connection, balance is improved by a closed delta tertiary winding. However, no connections from this winding are brought out.

2.1.4 The transformer is askarel-filled and hermetically sealed. Overpressure and overtemperature protection is provided.

2.2 380V Supplies

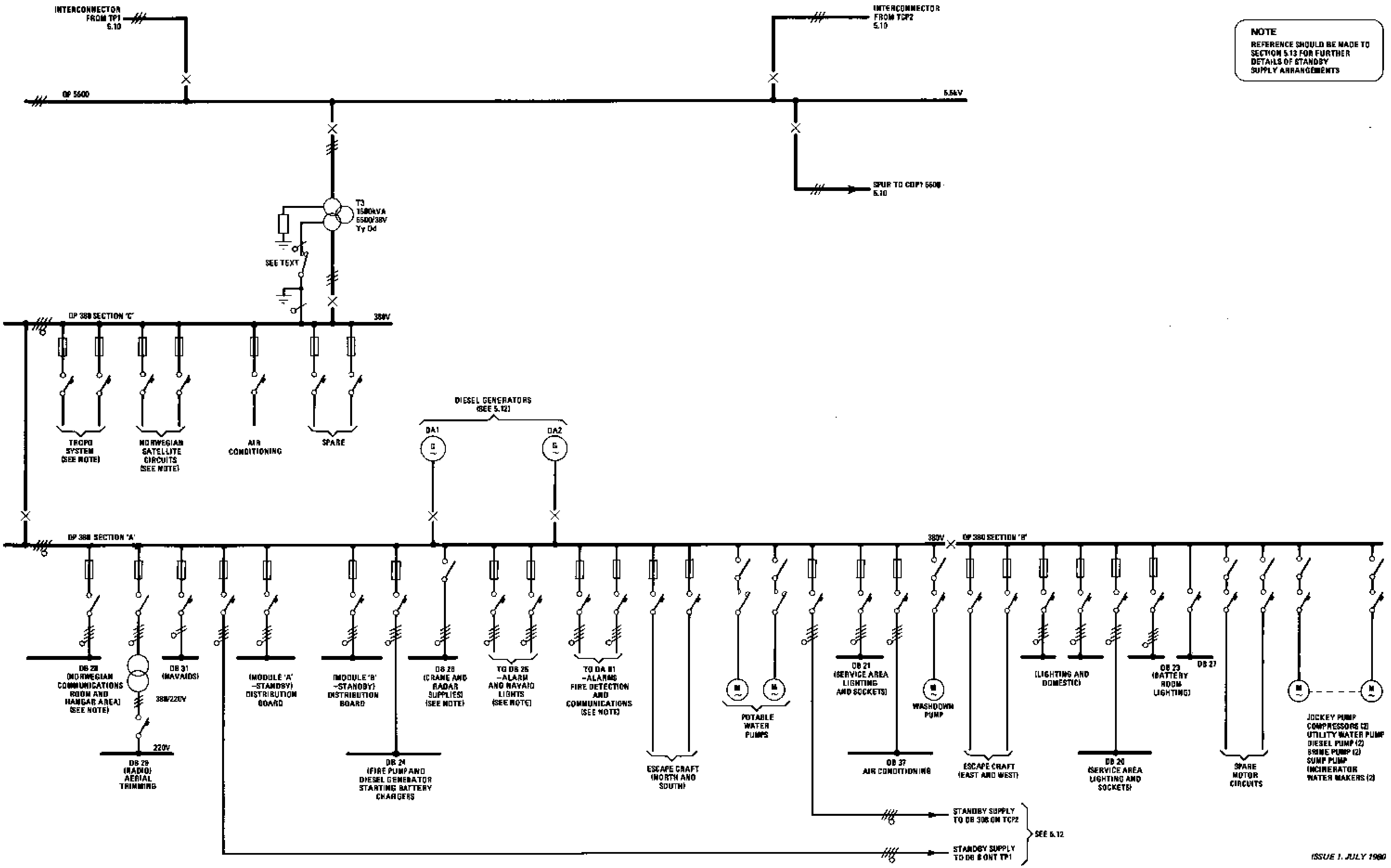
2.2.1 Output from transformer T3 is at 380V 4-wire and is connected to Motor Control Centre QP 380, located in Room L29 on the lower level of Module B, through a 3-pole air circuit breaker. The star point on the 380V side is connected to the neutral busbar through a single-pole contactor, the neutral busbar itself being solidly earthed.

2.2.2 QP 380 comprises a single 380V 4-wire Motor Control Centre (MCC) switchboard divided into three sections (A, B and C) connected by bus-section circuit breakers. The busbar design fault level is 31MVA for one second. Transformer T3 feeds Section C through an incomer circuit breaker and thence Sections A and B. The numerous feeder panels control motors and supply distribution boards including Standby Supply boards on TP1 and TCP2 and Maintained Supply boards DB25 and DA01. These provide an uninterrupted ac supply to certain vital services through rectifier/inverter units supported by batteries.

3 SYSTEM CONTROL

The main switchgear on QP and the other platforms, ie the 380V incomer and section breakers, are remotely controlled by discrepancy switches on the Mimic Control Panel in the Electrical Control Room on TP1. The similar panel on TCP2 monitors but does not control these breakers. Outgoing feeder switchgear is controlled locally at the QP 380 switchboard.

END



NOTE

REFERENCE SHOULD BE MADE TO SECTION 5.13 FOR FURTHER DETAILS OF STANDBY SUPPLY ARRANGEMENTS

ELECTRICAL POWER DISTRIBUTION 5.11

STANDBY SUPPLIES

1 GENERAL

1.1 Platform QP is equipped with two diesel-driven generators which start automatically in the event of main supply failure and feed Motor Control Centre (MCC) QP 380 at 380V.

1.2 Board QP supplies the 380V services on QP as well as 380V Emergency Supplies boards on TP1 and TCP2.

2 DESCRIPTION

2.1 Standby Generators

2.1.1 Diesel-driven 380V 500kW generators DA1 and DA2 start on detection of power loss at QP 380. The first machine to attain full speed connects itself to Section A of the QP 380 busbar, thereby supplying services normally fed from it, and locks out the incoming breaker from transformer T3. The second generator then synchronises itself with the first and connects itself to the busbar.

2.1.2 The generator neutrals are earthed through the neutral busbar of QP 380 which is solidly earthed thus providing the 380V system earth.

2.1.3 Transformer T3 is rated at 1500kVA and normally functions as a step-down supply transformer. To provide balance a tertiary delta-connected winding is fitted, but the terminals are not brought out.

2.1.4 The transformer LV star point is connected to the neutral busbar through a contactor interlocked with the auxiliary generator incomer breakers. This ensures that when either generator is connected to the busbar, the LV connection to the neutral is removed thus preventing circulating currents between the transformer and the generators.

2.1.5 The HV neutral connection of the transformer is permanently earthed through a 17-ohm current-limiting resistor. When the transformer is operating normally in its step-down mode, the transformer HV neutral earth current is monitored by a relay which, if the earth current exceeds a certain predetermined value, disconnects the transformer from the system.

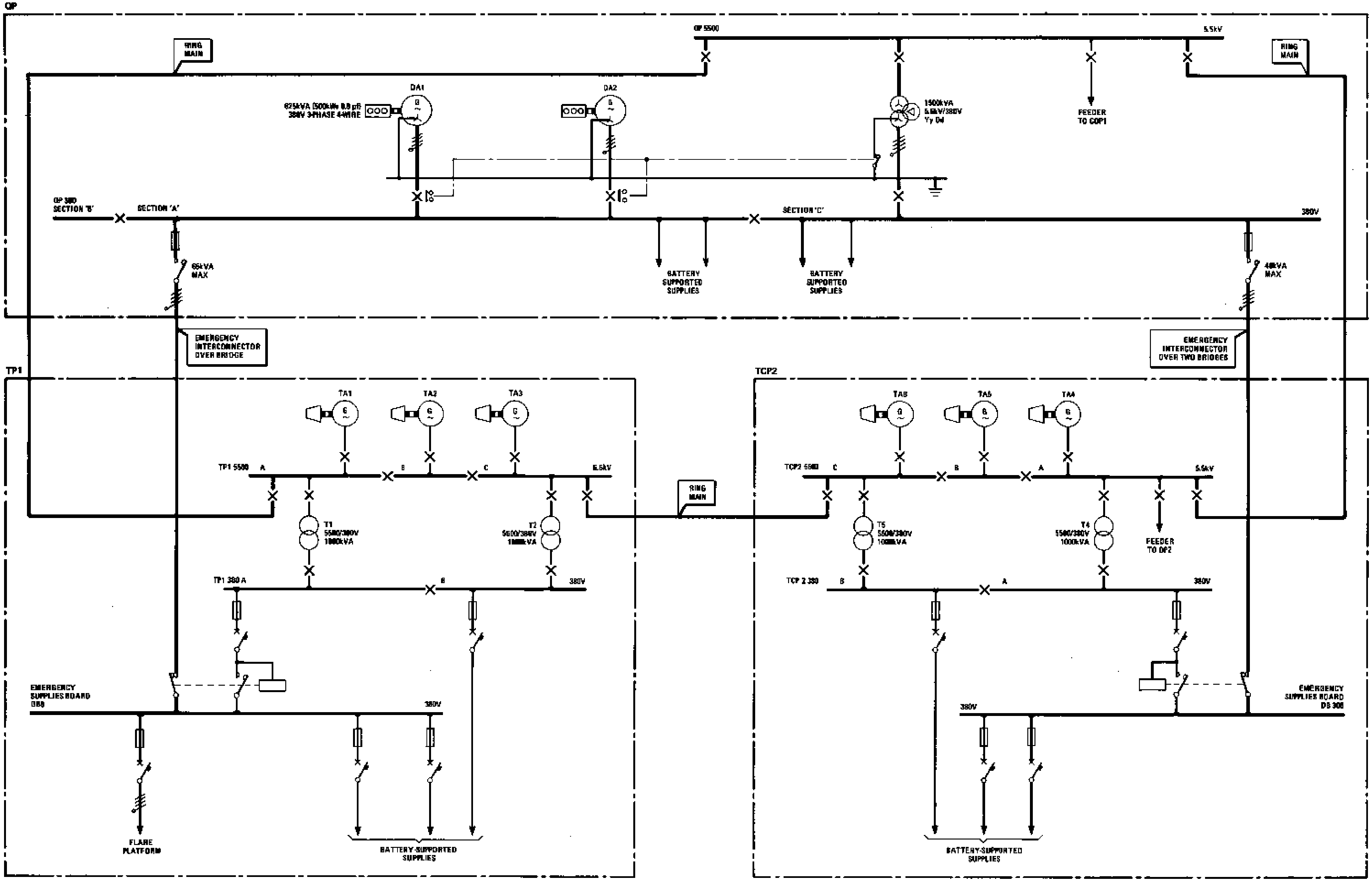
2.1.6 Feeders from QP 380 supply the Emergency Supplies boards DB8 and DB308 on platforms TP1 and TCP2 respectively, thereby ensuring that these platforms have a direct 380V standby power source from QP's diesel generators.

2.1.7 After a 5.5kV power failure where DA1 and/or DA2 have been started (whether automatically or remotely) and when normal 5.5kV supplies have again become available, the generators would normally be manually stopped and normal supplies reconnected remotely from the Electrical Control Room in TP1.

2.1.8 If Platform QP is operating independently of TP1 and TCP2, diesel generators DA1 and DA2 are then the prime suppliers. In this case the alarms for the QP generators appear on the Mimic Monitoring Panel in Room U26.

2.1.9 Both generators are provided with local starting and control panels for use if the remote link fails or for local test-running. Local/Remote selection is made at these panels.

END



NOTE

REFERENCE SHOULD BE MADE TO SECTION 5.11 FOR DETAILS OF OTHER SERVICES SUPPLIED FROM OP 380

STANDBY SUPPLIES

BATTERY-SUPPORTED SUPPLIES

1 GENERAL

1.1 Platform QP is equipped with alternative supplies used in the event of normal 5.5kV supply failure. These supplies are grouped as follows:

(a) Standby Supplies; see Section 5.12.

(b) Battery-supported DC Supplies.

(c) Battery-supported AC Supplies.

1.2 Certain maintained supplies are utilised under emergency conditions.

2 DESCRIPTION

2.1 Battery-supported DC Supplies

Unlike the other platforms of the Frigg complex there is no central battery-supported platform dc system. There are, however, separate dc systems each supplied from the platform's 380/220V ac system through separate transformer rectifiers (chargers) and numbered after their battery numbers. Batteries float on each system; under normal conditions the transformer/rectifier supplies the full dc load, and the battery floats on a trickle-charge. On failure of the ac system, or of the rectifier itself, the battery takes over the full dc load without interruption. On reappearance of the ac supply the rectifier not only again supplies the dc load but also acts as a charger to the battery, giving it a full boost charge if necessary, to restore it to full capacity. The battery then reverts automatically to its trickle-charge state.

2.2 Battery-supported AC Supplies

2.2.1 Certain ac services on the platform must have power supplies that are not interrupted and therefore cannot be supplied direct from QP 380 because of the dead period between loss of main supply and the start-up of QP's auxiliary diesel generators. Such supplies are provided by a rectifier system and battery similar to that of a dc system, but the dc output passes through an inverter to provide the battery-supported ac. On loss of incoming dc the battery and inverter maintain the ac output uninterrupted.

2.2.2 On failure of the ac mains the Helideck perimeter lights, the secondary and subsidiary navigation lights and the Public Address System continue from a maintained supply of this type.

2.2.3 In the case of Systems 2 and 3 under normal conditions a static switch in each unit passes a 220V single-phase supply from QP 380 direct to the Maintained AC distribution boards DB25 and DA01. This same source also energises the rectifier and keeps the floating battery trickle-charged. If the QP 380 supply should fail, the static switching unit automatically switches over to the alternative inverted supply, which is now maintained from the battery alone. The actual changeover is controlled by a synchronising circuit which ensures that the inverted supply is at all times in synchronism with the normal. Changeover is then smooth and virtually uninterrupted.

2.2.4 When the normal supply is restored, the static switching unit reverts to the normal incomer, controlled as before by the synchronising circuit. The rectifier will also recharge the battery, if necessary at full boost rate. After recharge, the battery will revert automatically to the trickle-charge state.

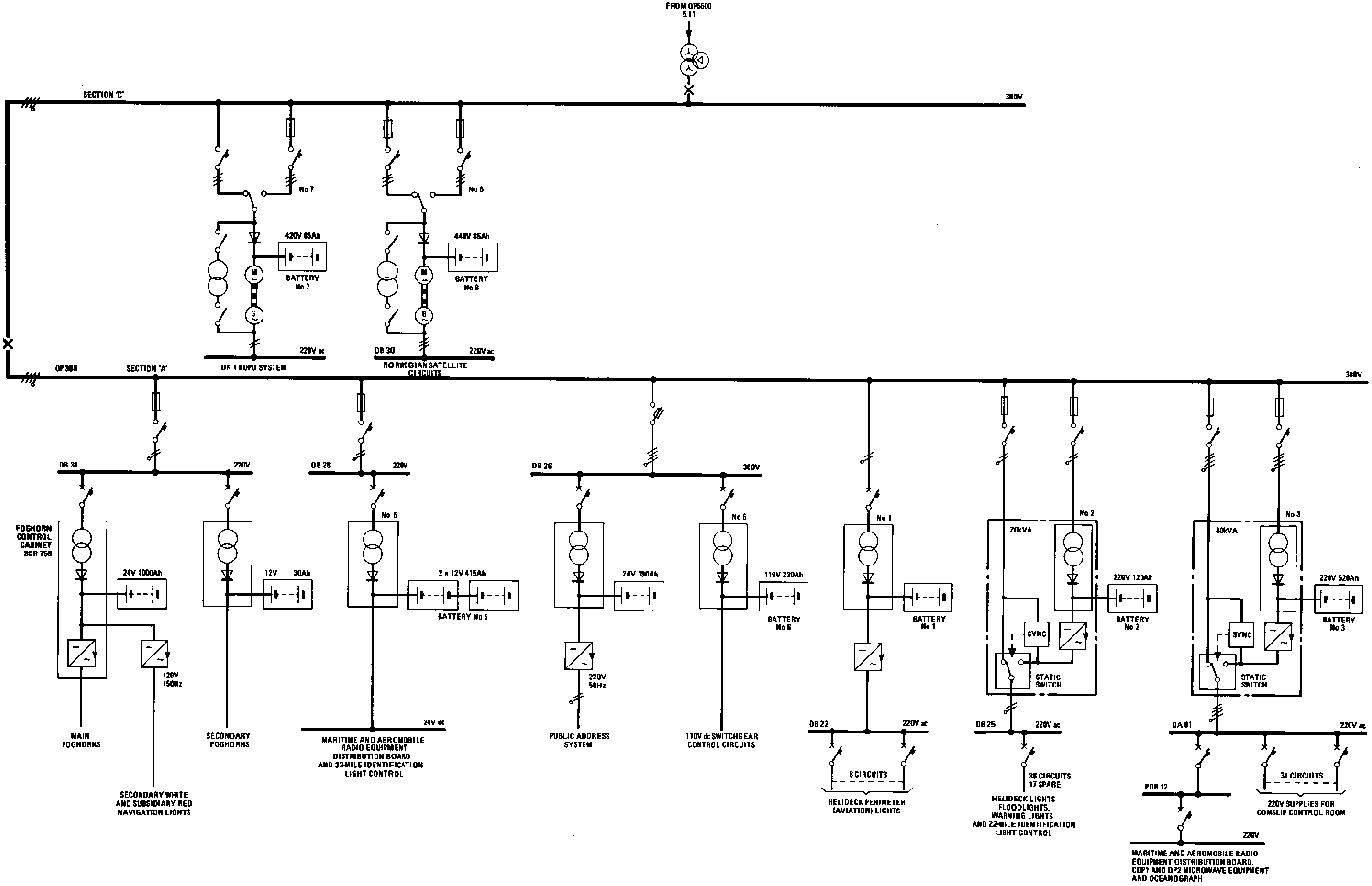
2.2.5 Two motor-generator sets provide uninterrupted ac supplies for the UK Tropospheric System and the Norwegian satellite circuits via two distribution boards. Floating on the dc link between the rectifier and motor is a 440V (or 420V) 85Ah battery. On failure of the ac supply the battery keeps the dc motor running – and so maintains an unbroken ac supply to the radio equipment – until the battery is discharged or the ac supply is restored. The battery should give the following periods of power:

(a) 10 minutes for the Norwegian Satellite installation.

(b) 20 minutes for the UK Tropospheric installation.

2.2.6 The battery is arranged to be disconnected by a contactor during the motor starting period so that it will not be heavily discharged during the starting cycle. When the motor is up to speed, the battery is float charged.

2.2.7 A further feature is a 'bypass transformer'. This is arranged to feed the incoming 380V ac direct to the radio equipment through a step-down 380/220V transformer, thereby bypassing the rectifier and rotating plant. It is used if the machine or rectifier is faulty or cannot for any reason be started. It comes into operation automatically, and the motor-generator is disconnected and stops if the running machine or charger develops a fault or if the battery voltage fails.



ISSUE 1, JULY 1980

BATTERY–SUPPORTED SUPPLIES

5.13

NORMAL LIGHTING

1 GENERAL

1.1 The lighting systems on QP are of the following three types:

(a)	Normal lighting	Supplied from distribution boards connected to the 380V Motor Control Centre.
(b)	Standby lighting	Supplied from distribution boards connected to the Motor Control Centre and supplied with standby power on failure of the main supply.
(c)	Emergency (maintained) lighting	This lighting is supplied from the same distribution boards as (b) above and is described in Section 9.13.

1.2 Lighting of certain external areas, for example the hangar roof area, is by floodlight, those of most importance being 'backed-up' by the standby power supply system.

2 DESCRIPTION

2.1 Supplies

2.1.1 All lighting fittings operate at 220V and are supplied from distribution boards. Some of them though termed 'lighting', also feed power to sockets and some of the small power circuits. These boards are all supplied at 380/220V, 3-phase, 4-wire, with outputs balanced between the three phases and neutral through 2-pole miniature circuit breakers.

2.1.2 The boards supplying normal lighting are fed from section B (the 'unimportant' services section) of QP 380, and the standby lighting from section A. In the event of 5.5kV ring main supply failure the section breaker connecting sections A and B of QP 380 opens, shedding that load connected to section B. Section A remains supplied from the standby system.

2.1.3 It should be noted that all the lighting mentioned in Paragraph 1.1 is in use under normal operating conditions. If main generation should fail, only the emergency (maintained) lighting is operative until the standby generators start and come on load, then the standby lighting becomes available.

2.2 Lighting Fittings

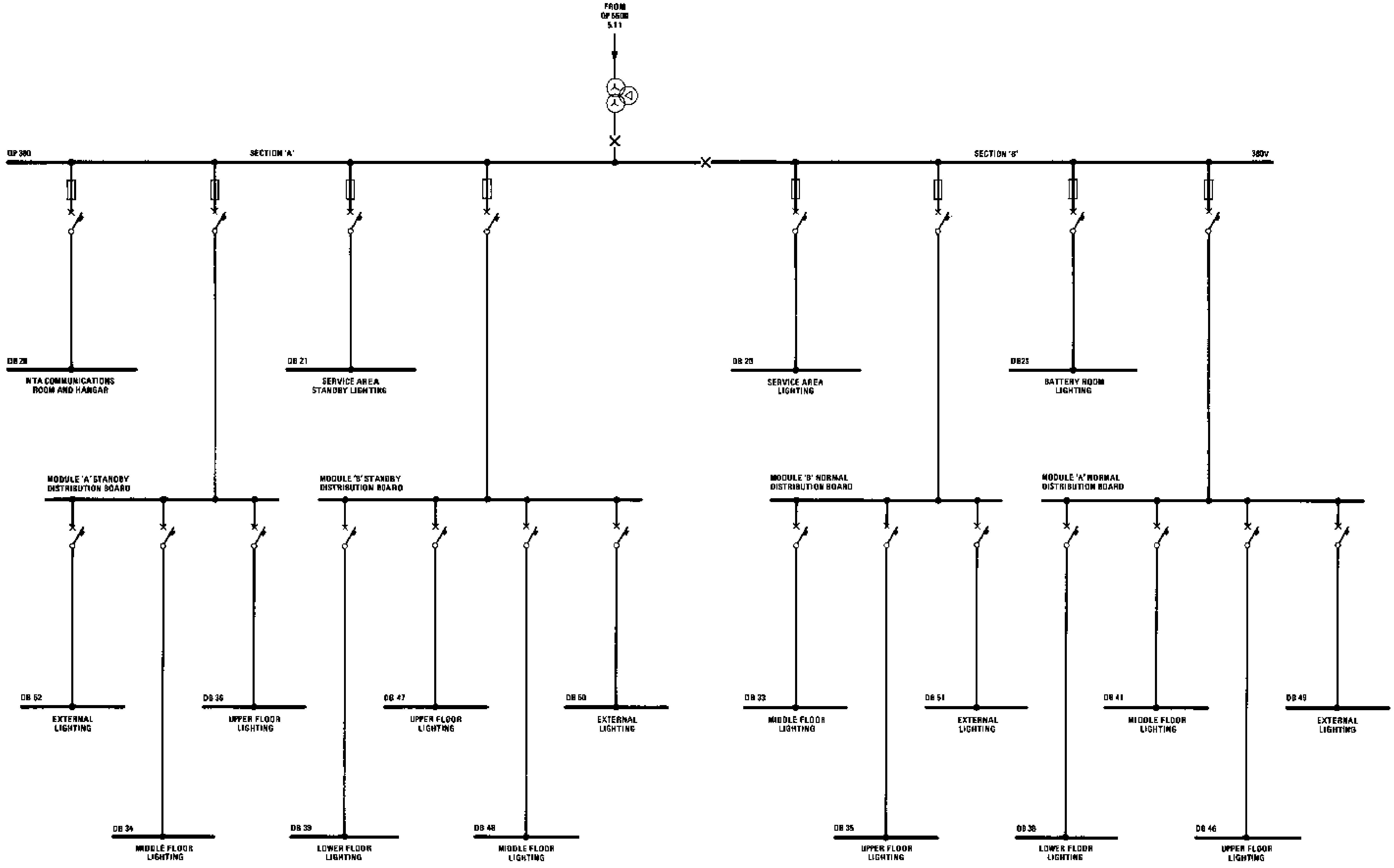
2.2.1 The standard 220V lighting fitting is equipped with twin 40W cold-cathode fluorescent tubes inside a translucent cover. There are a few variations, the most important being the battery-supported version of the standard fitting; this is described in Section 9.13.

2.2.2 The floodlights used to illuminate external areas are of three types:

250W mercury vapour,
500W tungsten-halogen,
2000W tungsten-halogen.

All the floodlights are weatherproof, but not explosion-proof.

END



ISSUE 1 JULY 1990

NORMAL LIGHTING	5.14

CHAPTER 6

TRANSPORT FACILITIES

CONTENTS

DIAGRAMS

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	Length Overall	Beam	Draught	Gross Tonnage (tonnes)	Free Deck Space	Capacities					Discharge Rates			
						Deck Cargo	Potable Water	Bulk Tanks	Drill Water	Fuel Oil	Potable Water	Drill Water	Fuel Oil	Cement
'TENDER CAPTAIN'	80.77m	18m	4.30m	1375.91	58 x 15m	2500 tonnes	$300m^3$	$283m^3$	$200m^3$		Head 61m $50m^3/h$	Head 61m 2 x $250m^3/h$	Head 61m $250m^3/h$	Head 61m 100 tonnes/h
'WILMA MERMAID' and 'WILMA MARINER'	64.40m	13.80m	4.70m	499	38 x 11m	800 tonnes	$146m^3$	4 x $42.5m^3$ ($170m^3$)	$937m^3$	$937m^3$	Head 60m $50m^3/h$	Head 60m 2 x $160m^3/h$	Head 60m 2 x $106m^3/h$	40–$50m^3/h$
'WEST OSPREY'	53.15m	11.50m	3.77m	499	20 x 8.5m	483 tonnes	$207m^3$	$133m^3$	$262m^3$	$352m^3$	Head 60m $80m^3/h$	Head 60m $80m^3/h$	Head 60m $96m^3/h$	
'RIG MASTER'	57.5m	11m	4.25m	500	29 x 8.8m	600 tonnes	$200m^3$	$104.5m^3$	$396m^3$	$250m^3$	Head 65m $80m^3/h$	Head 65m $100m^3/h$	Head 65m $85m^3/h$	50 tonnes/h
'SEAWAY JURA'	63.60m	13.40m	4.70m	500	36 x 9.8m	600 tonnes	$250m^3$	$263m^3$	$280m^3$	$600m^3$	Head 70m $50m^3/h$	Head 70m $100m^3/h$	Head 70m $100m^3/h$	Head 70m $30.6m^3/h$
'MAERSK TRAVELLER'	58.5m	12.2m	4.4m	499	33.5 x 9.1m	500 tonnes		$170m^3$	$510m^3$	$500m^3$	Head 70m $100m^3/h$	Head 70m $100m^3/h$	Head 70m $100m^3/h$	60 tonnes/h
'STAD GIRL'	58m	13m	4.26m	499	40 x 11m	930 tonnes	$680m^3$	$166m^3$		$410m^3$	Head 64m $200m^3/h$	Head 64m $200m^3/h$	Head 64m $100m^3/h$	Head 50m 40 tonnes/h

END

HELIDECK

1 GENERAL

1.1 The Helideck and its hangar are installed on the roof of the accommodation modules with the Helideck on the west side and the hangar on the east side.

1.2 The square deck measures 25.3m from edge to edge. A safety net 1.5m wide is provided around the perimeter, except for the hangar entrance.

1.3 Access to and from the Helideck is provided by two stairways located on the north and south sides.

1.4 Helideck lighting is provided by four floodlights mounted on the hangar roof and powered from the 220V ac supply.

1.5 A ring of alternate white and blue landing lights spaced at 3m intervals are installed around the Helideck perimeter.

1.6 The Helideck markings and colours are shown in Diagram 6.2.

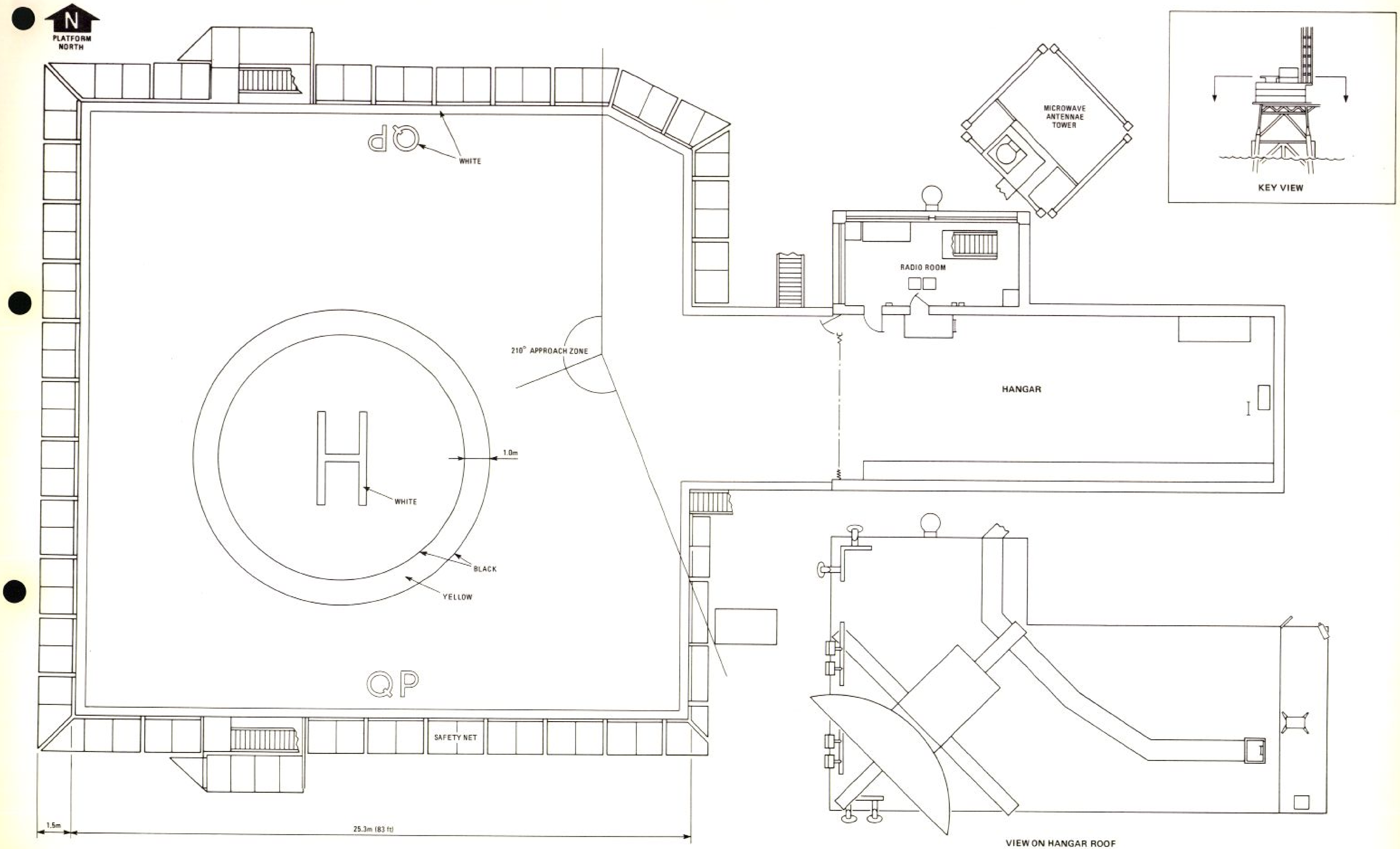
2 HELICOPTER

2.1 The Helideck is designed to accommodate the Sikorsky S61N helicopter or its equivalent.

2.2 Principal specifications are as follows:

Rotor diameter	18.9m (62 ft)
Power units	2 turbines
Fuel	Kerosine
Maximum weight	9299kg (20 500 lb)
Carrying capacity	23 passengers
Payload at maximum range	635kg (1400 lb)
Range	361.37km (195 nautical miles)
Speed	222.3km/h (120 knots)

2.3 The hangar, complete with workshop facilities, is only large enough to accommodate a B212 helicopter.



VIEW ON HANGAR ROOF

HELIDECK

CHAPTER 7

MATERIALS HANDLING

CONTENTS

DIAGRAMS

CRANE

1 GENERAL

1.1 A pedestal mounted Bucyrus-Erie Mk 60 marine crane located at the south-east corner of the platform is supplied for general lifting duties within the lifting area shown on Diagram 7.1.

1.2 The crane'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.

1.3 The crane has a boom length of 36.58m.

1.4 Power is supplied by a General Motors 12V 71W, 12-cylinder diesel engine, via hydraulic transmission.

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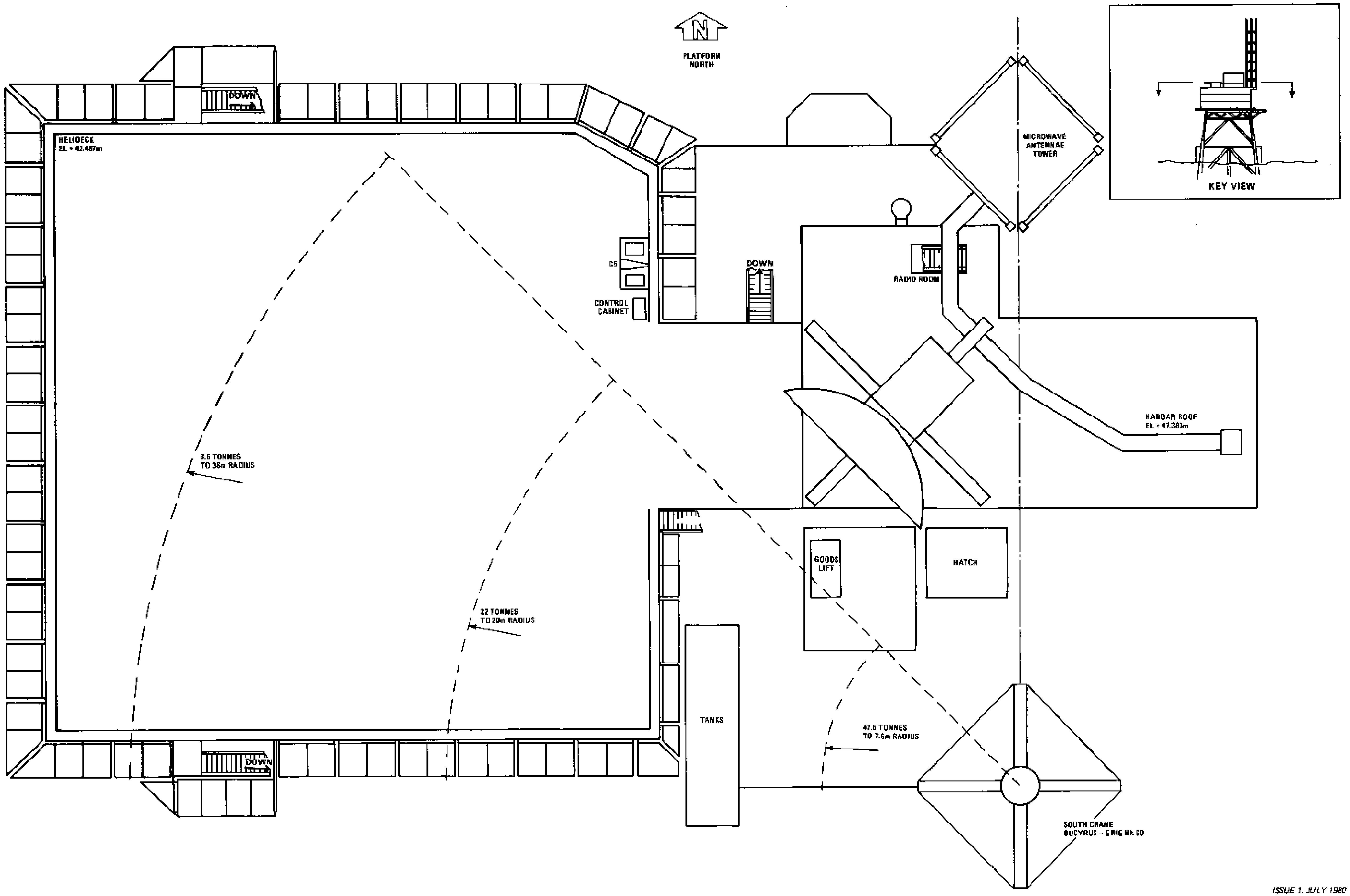
PLATFORM
NORTH
N
HELIDECK
EL + 42.457m
DOWN
DOWN
DOWN
DOWN
C5
CONTROL
CABINET
RADIO ROOM
MICROWAVE
ANTENNAE
TOWER
KEY VIEW
HANGAR ROOF
EL + 47.383m
3.6 TONNES
TO 36m RADIUS
22 TONNES
TO 20m RADIUS
47.6 TONNES
TO 7.6m RADIUS
GOODS
LIFT
HATCH
TANKS
SOUTH CRANE
BUCYRUS – ERIE Mk 60

BULK HANDLING SYSTEMS

1 DIESEL FUEL

1.1 Diesel fuel is normally supplied through 2in line DO251 from TP1. It may also be supplied by service boat.

1.2 When bunkering from a service boat, diesel fuel is taken on through 4in lines DO269 from Hose Stations 1 and 2, via flexible hoses.

1.3 Storage tank level is indicated locally at the Hose Stations. An alarm will indicate at the local control panel located near the diesel fuel distribution manifold, when the tank has filled to the upper level.

2 POTABLE WATER

2.1 Potable water is normally produced by water makers Q3A and Q3B. It may be supplied by service boat in an emergency.

2.2 When bunkering from a service boat, potable water is taken on through 4in lines PW553 and PW554, from Hose Stations 1 and 2 respectively, via flexible hoses.

2.3 Storage tank level is indicated locally at the Hose Stations.

3 JET FUEL

3.1 Replenishment of jet fuel storage is from a portable jet fuel tank (pod) Q15, which is transported by service boat.

3.2 The portable tank is lifted onto the grating above storage tanks V7A, B and C, which are replenished by gravitation via a flexible hose.

DECK LOAD LIMITATIONS

1 GENERAL

The following limitations establish the permissible imposed deck loadings for personnel movement, storage and maintenance operations.

2 LOWER DECK

2.1 Design live loads with the exception of specified areas:

Skid load (Unit 8)	0.825 KIP/ft
Deck plate and scantlings	70 lb/ft^2
Main beams and trusses	50 lb/ft^2
Walkways	50 lb/ft^2

Exceptions to the above are:

Scantling in the vicinity of sewage treatment unit	420 lb/ft^2
Main beam under LV switchboard	30 lb/ft^2
Platform alongside bridge access	480 lb/ft^2

2.2 Equipment Weights

Equipment	Maximum Weight (KIP)
Incinerator	12
Firewater pump	36
Brine pumps	0.4
Washdown pump	9.3
Sump pump	0.4
Sewage treater	61
Water makers	31
Emergency diesel generators	30.4
Generator diesel day tank	12
Utility water pressure tank	3.5
Air conditioning package	
Enclosed lifeboats	7.9
Transformer	10.7
LV switchboard	20
Batteries	3
5.5kV switchgear	13
Oceanographic equipment gantry	3

Note: Maximum winch pull on oceanographic equipment gantry 10 KIP.

3 MIDDLE DECK

Design Live Loading

Deck plate and scantlings	70 lb/ft^2
Main beams and trusses	50 lb/ft^2
Walkways	50 lb/ft^2

4 UPPER DECK

4.1 Design Live Loading

Deck plate and scantlings	70 lb/ft²
Main beams and trusses	50 lb/ft²
Walkways	50 lb/ft²

4.2 30 ft diameter antenna 2 KIP dead load 45 KIP horizontal wind load.

4.3 Equipment Weights

Equipment	Maximum Weight (KIP)
Terminal cabinet	1.2
Telemetry	6.9
Telephone distribution frame	0.66
Telemetry	6.62
Telemetry	4.41
Alarms	3.64
Computer	0.88
Fire and gas control units	2.78
Control panel	6.62
Utilities	0.88
Fire and gas panel	0.88
Control panel and mimic	1.1
Control desk	1.39
Control panel and mimic	1.1
Computer	0.88
Telephone cabinets	1.85
Terminal cabinet	1.06
Enclosed lifeboat	7.9

5 ROOF DECK

5.1 Design Live Loading

Deck plate and scantlings	70 lb/ft²
Main beams and trusses	50 lb/ft²
Tower legs	± 1100 KIP vertical

5.2 Equipment Weights

Equipment	Maximum Weight (KIP)
Powder and foam tanks	3.4
Hot water heaters	
Aviation fuel package	69
Lifeboat	7.9
Crane	
Potable water head tank	93
Battery room	3
Battery room	
Transformer	1
Dehydration unit	0.3
IDF	0.3
Transformer	0.3
Noise monitor	0.2

Equipment	Maximum Weight (KIP)
BDF, SCPC x 2 SME	5
Conversion equipment	5
Air condensers	
Control cabinet	2.0
35kVA generator set	
Multiplex and EOW supervisory	0.1
	0.1
Loop cabinet, receiver cabinet, 1kWA cabinet x 2 drive cabinets	0.6
Microwave tower 55m high	320

6 HELIDECK AND HANGAR

Design Live Loading

Sikorsky S61N	19.0 KIP
Maximum wheel load	4.2 KIP
Radio room	50 lb/ft^2
Safety net	135 lb/linear ft
Hoist for bosun's chair	2 KIP

7 HANGAR ROOF

Design Live Loading

Hangar roof	30 lb/ft^2
Meteorological equipment support	60 lb/ft^2
Roof goods lift covered loading area	70 lb/ft^2

8 LOADING AND STORAGE

8.1 Loads are not to exceed those specified in the design calculations.

8.2 Care should be taken to ensure that storage in open areas is kept within the areas marked on designer's drawings.

8.3 Where storage is prohibited, the areas must be clearly marked.

CHAPTER 8

COMMUNICATIONS

CONTENTS

DIAGRAMS

RADIO LINKS

1 GENERAL

1.1 Radio communications are conducted principally from QP, with TP1 and TCP2 linked to it by cables over the connecting bridges and CDP1 and DP2 by submarine cable. CDP1 and DP2, being detached, have independent radio links for use between them and QP in the event of cable failure. They also carry separate marine/air radio equipment.

1.2 From QP the link to the shore station (EIK) in Norway is by satellite. The link from QP to the St Fergus terminal in the UK is by dual tropospheric scatter system (tropo).

1.3 In addition to the inter-platform links there is a radio link from QP to Beryl Platform. This allows Beryl's tropo link with the UK to be used for communications by QP in the event of the QP tropo failing or if propagation conditions are unsatisfactory. Conversely Beryl can utilise QP's tropo system.

2 DESCRIPTION

2.1 Equipment

The radio equipment on QP is situated on several deck levels and in several rooms as follows:

(a) Aero-Maritime Room R11/Radio and Telemetry Room U28. They contain the following equipment:

Main Skanti transmitter
Main Skanti receiver
H/F transmitter
Main receiver
Eddystone broadcast receiver (tunable) EB37
Watch receiver DC301 (2182kHz)
Drake RR2 Communications receiver (tunable)
VHF/FM (Ship) transmitter-receiver (Marconi/Argonaut)
VHF/AM (Air) transmitter-receiver (King-Ky 195)
Single-sideband (SSB) transmitter-receiver
Radio beacon
Communication console

} Maritime and Aeromobile Equipment

Telemetry equipment
Inter-platform radios (CDP1 and DP2)
Oceanograph control panel
Radar displays

(b) Lower Communications Room (Norwegian Room) R8.

This room contains the control console and all the radio equipment associated with the satellite communications system.

(c) UK Communications Room R1 containing the following:

Control cabinet and radio equipment
Beryl line-of-sight radio
Multiplex equipment

(d) Telex Room U20 containing the telex equipment for inter-platform connection and connection to Norway.

(e) Control Room U26 containing the telex equipment for connection to UK.

2.2 Inter-platform Links

2.2.1 As mentioned in Paragraph 1.1 links between QP and platforms CDP1 and DP2 are normally by submarine cable. Microwave links, with their helix aerials on the microwave tower, are provided as a standby.

2.2.2 Associated with each cable/microwave link is a multiplex unit which combines, or separates, the telemetry, telephone and interphone signals which use the link. There is also a switching unit at each end which automatically diverts the signal to the radio path if the cable link should fail. Reversion from radio to cable however must be carried out manually, unless the radio path fails, in which case reversion to cable is automatic. An override switch can be used to lock the system to the radio path, regardless of its state.

2.2.3 There is also a separate microwave line-of-sight dual radio link between QP and Beryl Platform. This carries to Beryl the signals which would otherwise use the two UK tropospheric channels (see Paragraph 2.3). From Beryl they would be carried to the UK on Beryl's own alternative tropospheric scatter channels.

2.2.4 The two small dish aerials for this link are also on the microwave tower.

2.3 Platform-to-Shore Links

2.3.1 Communication with Norway from the Frigg Field is via Intelsat IV or IVa, which are geostationary satellites located above the Atlantic Ocean. This communication channel carries telephone, telex, telewriter and facsimile services es shown in Diagram 8.1.

2.3.2 Communication with the UK is by dual 'tropospheric scatter' channels which carry, in addition to services similar to those to Norway (except facsimile), complete two-way telemetry services. Telemetry data information from all four platforms is collected in QP and processed in a computer, whence it goes through a multiplex to the tropospheric transmitter to be passed to St Fergus. In the opposite direction command signals from St Fergus are received in QP, demultiplexed and sent to the appropriate platforms through further multiplex links.

2.3.3 The main multiplexer makes possible the transmission of telemetry, telephone, telex and telewriter signals over the same tropospheric channel. The two direct channels are not used together; they are alternatives, and each is a separate simplex system.

2.3.4 The alternative pair of channels to the UK via Beryl Platform's own tropospheric scatter system is linked to Frigg (QP) by the dual line-of-sight microwave channel providing an alternative route for transmission or reception.

2.3.5 The two large dish aerials for the UK tropospheric system are mounted on the north-west and south-west corners of the living accommodation block (PLQ) at second-floor level. The large dish aerial for the Norwegian satellite earth station on QP is located on the hangar roof.

2.3.6 Whereas the two UK tropospheric dish aerials are fixed, the Norwegian satellite dish position must be constantly trimmed to follow the satellite 'wander'. This is achieved by separate aerial trimming motors which cease to function in the event of main ac supply failure. The Norwegian satellite radio set, however, will continue operating from the battery via the maintained supply.

2.4 Radio Beacon

The radio beacon's aerial is on the top of the helicopter hangar and the display is in the Aero-Maritime Room R11.

2.5 Lifeboat Communications

2.5.1 The radio equipment installed in each lifeboat is a VHF Marconi 'Survivor' transmitter-receiver, which incorporates an internal hand-cranked generator to provide electrical power. There is no external power supply.

2.5.2 Also in each lifeboat is a self-contained radio beacon which transmits at 250mW on two frequencies, 121.5MHz and 243MHz. The beacon floats upright and automatically starts transmitting when placed in the water. It contains its own sealed, non-rechargeable battery, which must be replaced after use, or every three years.

2.6 Radar

2.6.1 The radar installed on QP is a 10cm marine radar for general air and surface surveillance and for control of traffic related to operations, eg aircraft, supply ships, tankers and barges. It is also used as a standby facility for helicopter control and landing assistance. Its operating range is a 50 nautical miles radius.

2.6.2 The aerial and pre-amplifier for the set is located on the microwave tower, the other equipment and display being housed in Aero-Maritime Room R11.

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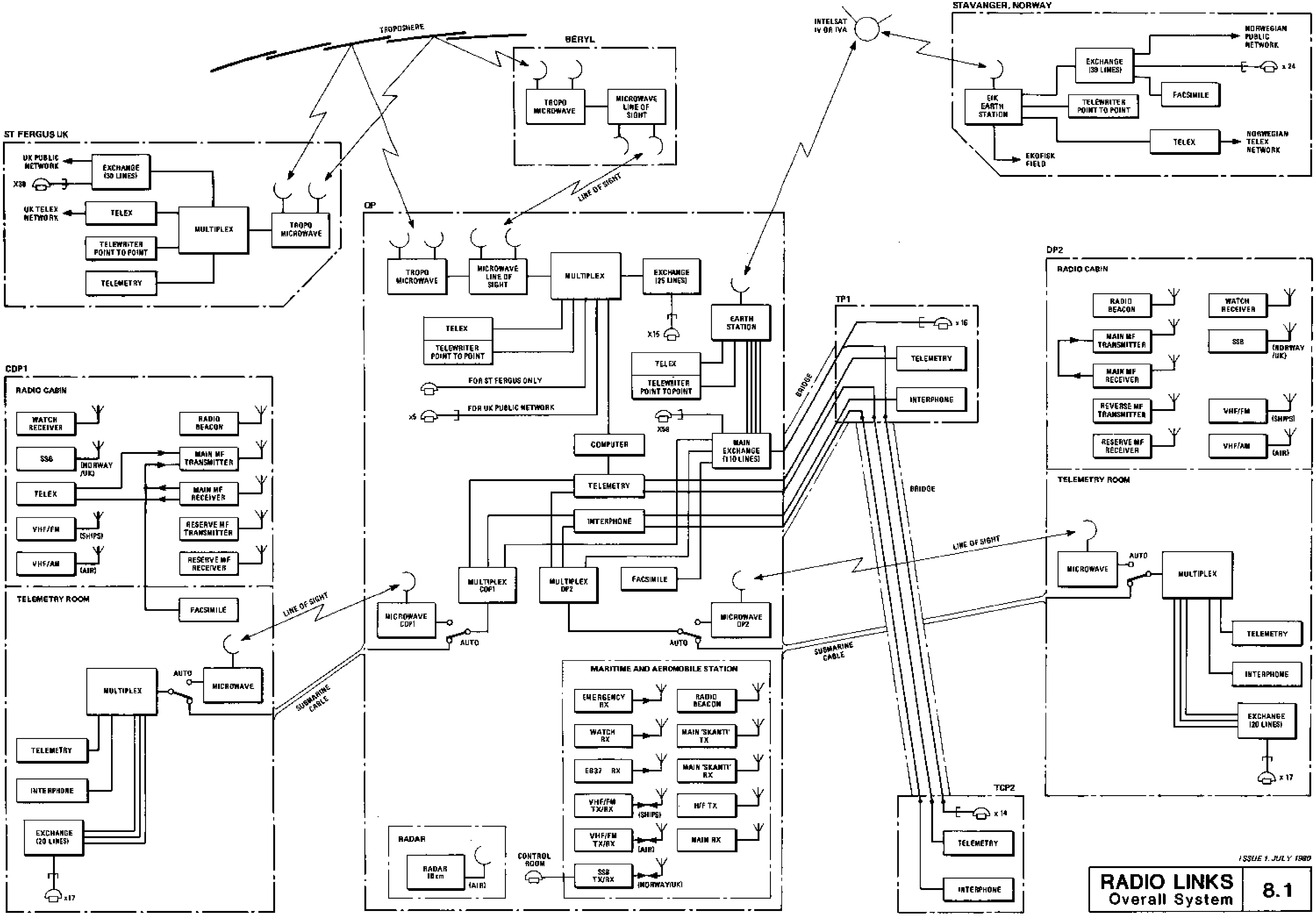


ISSUE 1. JULY 1980

RADIO LINKS
Overall System

8.1

TELEPHONE SYSTEM

1 GENERAL

1.1 The exchange telephone system is common to all five main platforms comprising the Frigg Field. Platforms QP, TP1 and TCP2 form a network having a common exchange in QP, the telephones in TP1 and TCP2 being outstations from this exchange.

1.2 The detached platforms CDP1 and DP2 each have their own exchanges, but each is connected by three tie-lines to the central QP/TP1/TCP2 system via a submarine cable link, with an alternative microwave link if the cable should fail.

1.3 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 in QP has 110 lines for internal (within QP) and inter-platform communications, and also for satellite communication with Norway. A second, 25-line, exchange is provided for use with the UK tropospheric-scatter radio link. The exchanges are of the conventional crossbar type.

2.1.2 The sub-exchanges in CDP1 and DP2 each have 20 lines, which include the three tie-lines to the main system via the under-sea cable or microwave links.

2.2 Instruments

Both wall-mounted and desk-type telephone instruments are provided, the latter being used in most offices and living accommodation. Wall-mounted types are, where necessary, enclosed for use in a Division 1 area.

2.3 Shore Links

2.3.1 The 110-line main exchange is also used for satellite communication with Norway (Stavanger), for which four 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 other 25-line exchange, to which are connected 16 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 the UK, using the same satellite and troposcatter radio links as the telephone uses. At the Stavanger and St Fergus terminals the telex links can be extended into the Norwegian and UK public telex networks.

2.4 Power Supplies

This dc power for the QP exchanges is derived at 380V ac from the MCC via distribution board DB28, which supplies 220V single-phase (phase-to-neutral). This is taken to a local transformer/rectifier which converts it to 48V dc. A battery floats on the dc side and has sufficient capacity to maintain the whole telephone system operational for 24 hours after complete loss of ac supply.

END

INTERPHONE SYSTEM

1 GENERAL

1.1 A powered Interphone System, independent of the exchange telephone network, connects the control rooms of all five platforms comprising the main Frigg Field. It is installed primarily for operational use.

1.2 An exchange in QP Control Room enables the operator to call any outstation either singly, in groups (for conference) or as a general call. Outstations, however, may call into QP only. They can only speak to each other if, at the request of an outstation, the QP operator sets up a 'conference' link between the calling and the required outstation. He can participate if he desires.

1.3 A Stentophone System is also provided.

2 DESCRIPTION

2.1 Interphone System

2.1.1 All outstations are directly connected by cable to the QP exchange, except for platforms CDP1 and DP2. For each of these two platforms the signal route is via the multiplex system, normally using the submarine cable but changing over automatically to a microwave radio link on failure of the cable channel.

2.1.2 The central exchange in QP has 12 ways, four of which are to the other platform control rooms, with eight spare ways for eventual use within QP. The master station in QP Control Room is a plug-in desk-mounted console with a separate wall-mounted panel loudspeaker. The console has 12 outstation calling switches, with a buzzer and 12 indicating lights to announce which outstation is calling.

2.1.3 Outstation equipment in TP1 Control Room is powered by the platform's 220V ac system. The equipment consists of a permanently wired outlet unit mounted on the vertical panel of the control desk. The unit contains a built-in microphone. The loudspeaker is mounted separately on the desk table. A similar arrangement is provided on TCP2.

2.1.4 The outstation equipment in CDP1 and DP2 (connected via the multiplex links) consists of a wall-mounted outlet unit close to the control desk and a loudspeaker and control panel flush-mounted on the vertical part of the desk. This is plugged into the wall unit by flexible cord. The microphone is mounted on the horizontal part of the desk on a flexible stalk.

2.1.5 The central QP exchange and all outstations have microphones and separate loudspeakers, leaving the operator's hands free. Communication is 'duplex', ie two-way conversation may be held without having to hold a press-to-speak switch.

2.1.6 Call-up is by both lamp and buzzer. The QP operator's console has a row of call lamps, one for each outstation.

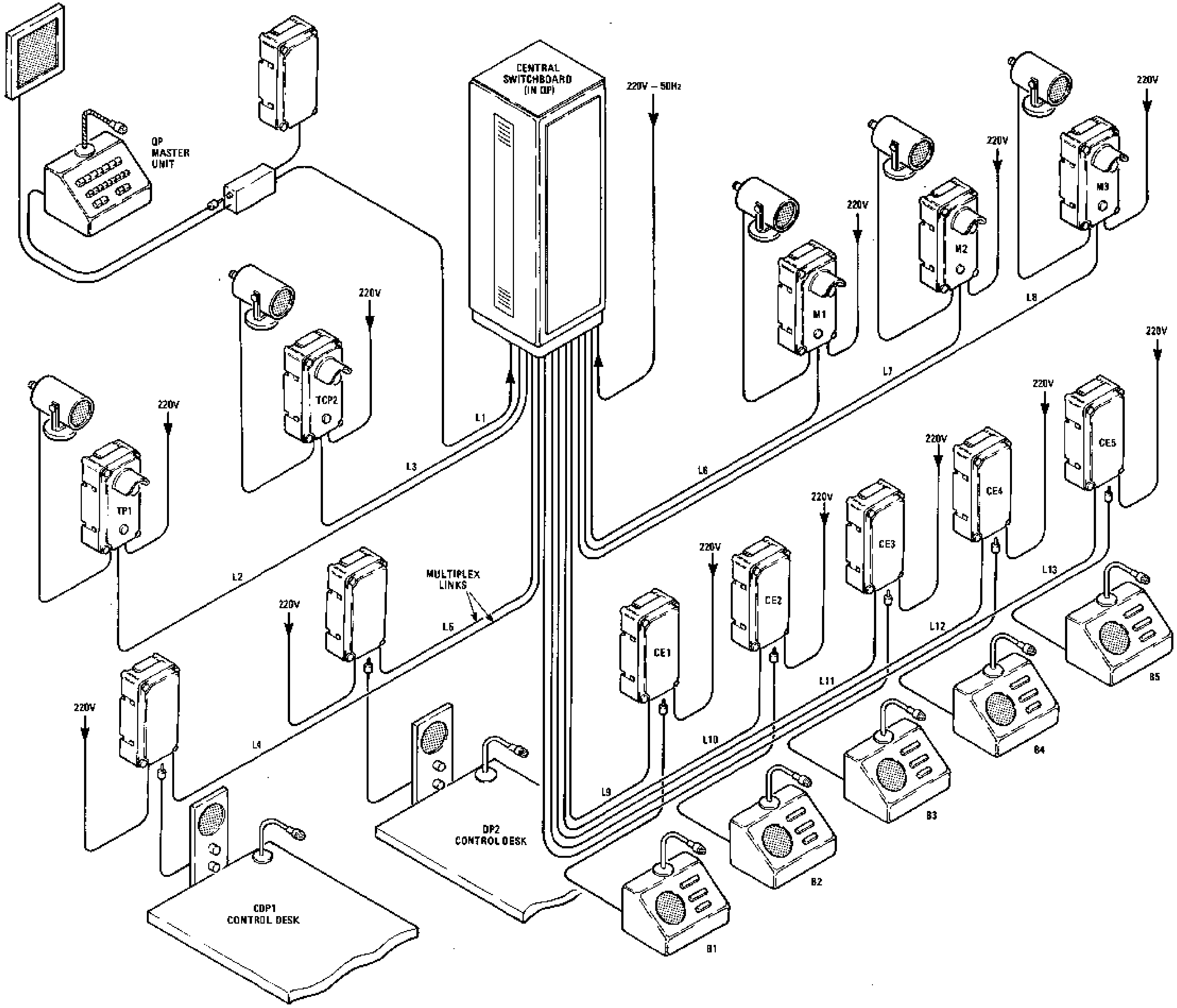
2.2 Stentophone System

2.2.1 This 12-direction interphone network is equipped with two transfer lines and a general call.

2.2.2 The 12 extensions and the master station are connected either by cable or by multiplex telephone.

2.2.3 There are three types of substations (extensions) namely:

Wall mounted (5 in number).
Desk pattern (5 in number).
Panel pattern (2 in number).



INTERPHONE SYSTEM | 8.3

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 Radio and Telemetry Room. It includes the main 3000W speech amplifier requiring 5kW of uninterruptible supply, which is obtained either from a 220V, single-phase supply from the main switchboard (QP 380) through DB26, or from a separate rectifier/inverter providing 220V, single-phase, 50Hz supported by a 24V 195Ah battery. This is sufficient to maintain the system operational with full output for 30 minutes after complete failure of QP's normal supply system. The rectifier/charger for the battery is supplied at 220V, single-phase, 50Hz also through distribution board DB26.

2.1.2 The PEGFA Rack includes the following:

(a) Line selector (25-way). Directs 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 and from the Fire Detection Systems in all the three platforms.

(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 circuits such that, if one fails, the other is brought automatically into operation. Such a changeover initiates an alarm at the System Alarm Panel in QP Control Room.

(d) Alarm Test Unit.

(e) Microphone and preamplifier.

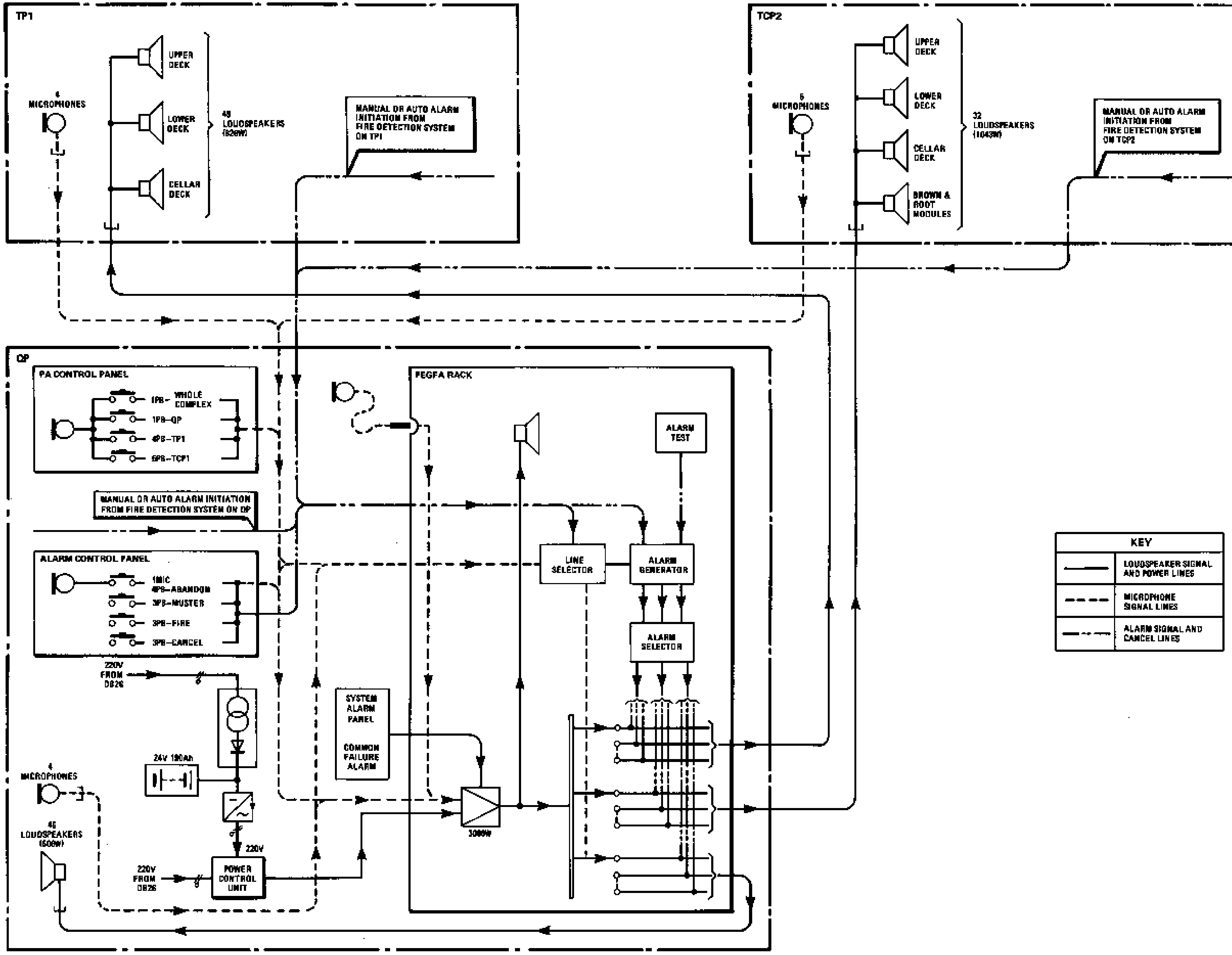
(f) Pilot loudspeaker.

(g) Instrumentation and controls.

2.1.3 Certain of the loudspeaker groups are arranged for selective muting (for example sleeping quarters at night when only an operational broadcast is being made). The muting is carried out by use of the appropriate line selector switches at the PA Control Panel in QP Control Room.

2.1.4 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).

2.1.5 Associated with certain loudspeakers in noisy areas are two flashing lights – blue for public address and red for alarm. Loudspeakers which are connected solely for alarm have red lights only, these flash automatically while the PA broadcast or the alarm is sounding.



ISSUE 1. JULY 1980

PUBLIC ADDRESS SYSTEM	8.4

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 systems. 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 nautical 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 Lights

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 at elevation +67.658m, to cover 360°.

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 and flashes once every five seconds.

2.4.4 The lights are automatically operated by a photo-cell. A manual On/Off switch is installed to override the system during helicopter take-off and landing.

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 unit 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 Navigational Aids Control

2.6.1 Control unit HALS 15 (in QP) codes and distributes power supplies to the main white navigation lights of QP, TP1 and TCP2. 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) supplies 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

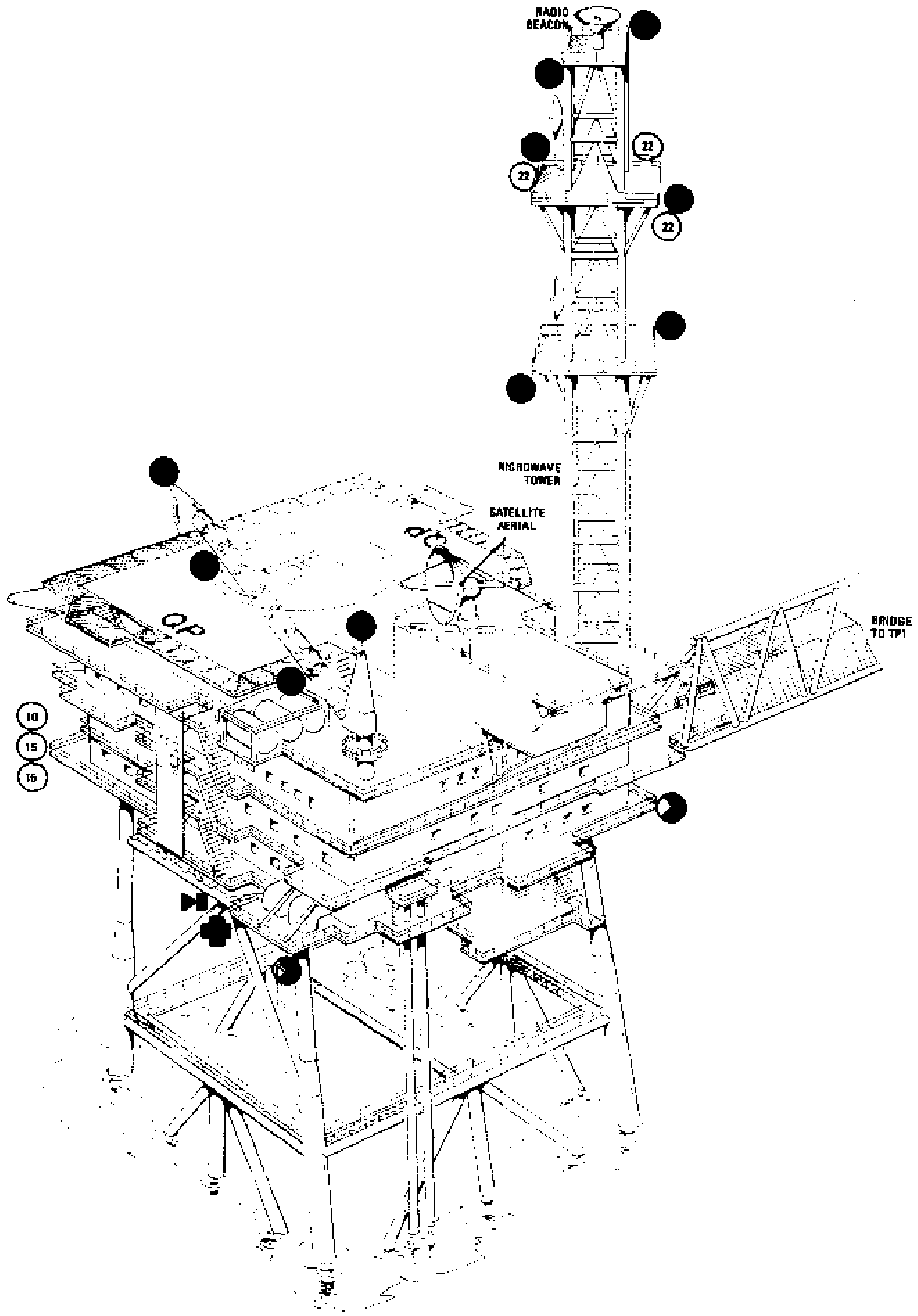
2.10.1 The QP Helideck perimeter is marked by 32 flush-mounted, 25W lights, alternately blue and white. They are a nominal 3m apart.

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.

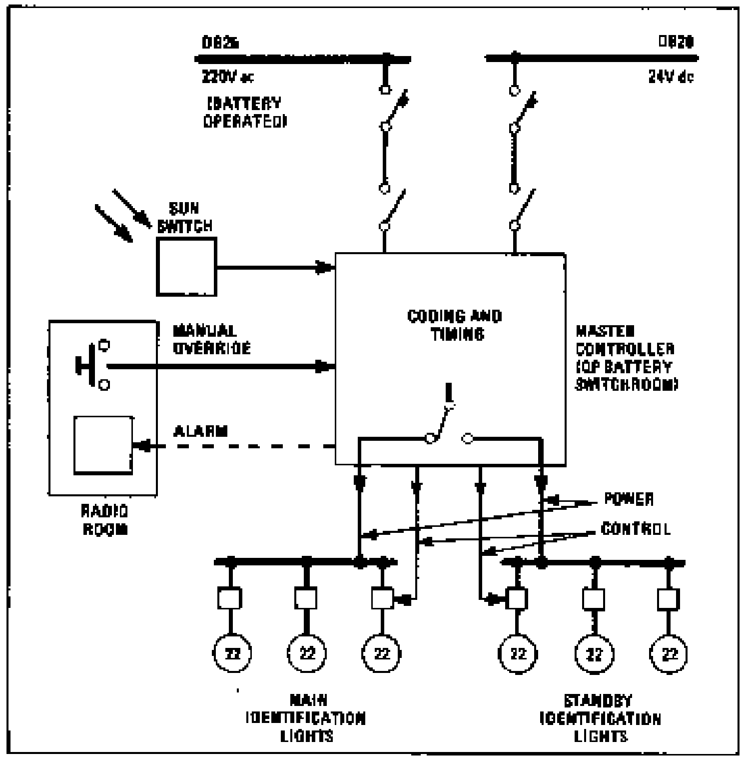


KEY		
⑮	WHITE LIGHT (MAIN	– 15 MILES
⑩	WHITE LIGHT (SECONDARY)	– 10 MILES
㉒	MAIN AND STANDBY IDENTIFICATION LIGHTS	– 22 MILES
◑	SUBSIDIARY (RED) LIGHT	– 3 MILES
●	AIRCRAFT OBSTRUCTION LIGHT	
✚	FOGHORN (MAIN)	– 2 MILES
⧓	FOGHORN (SECONDARY)	– 1/2 MILE

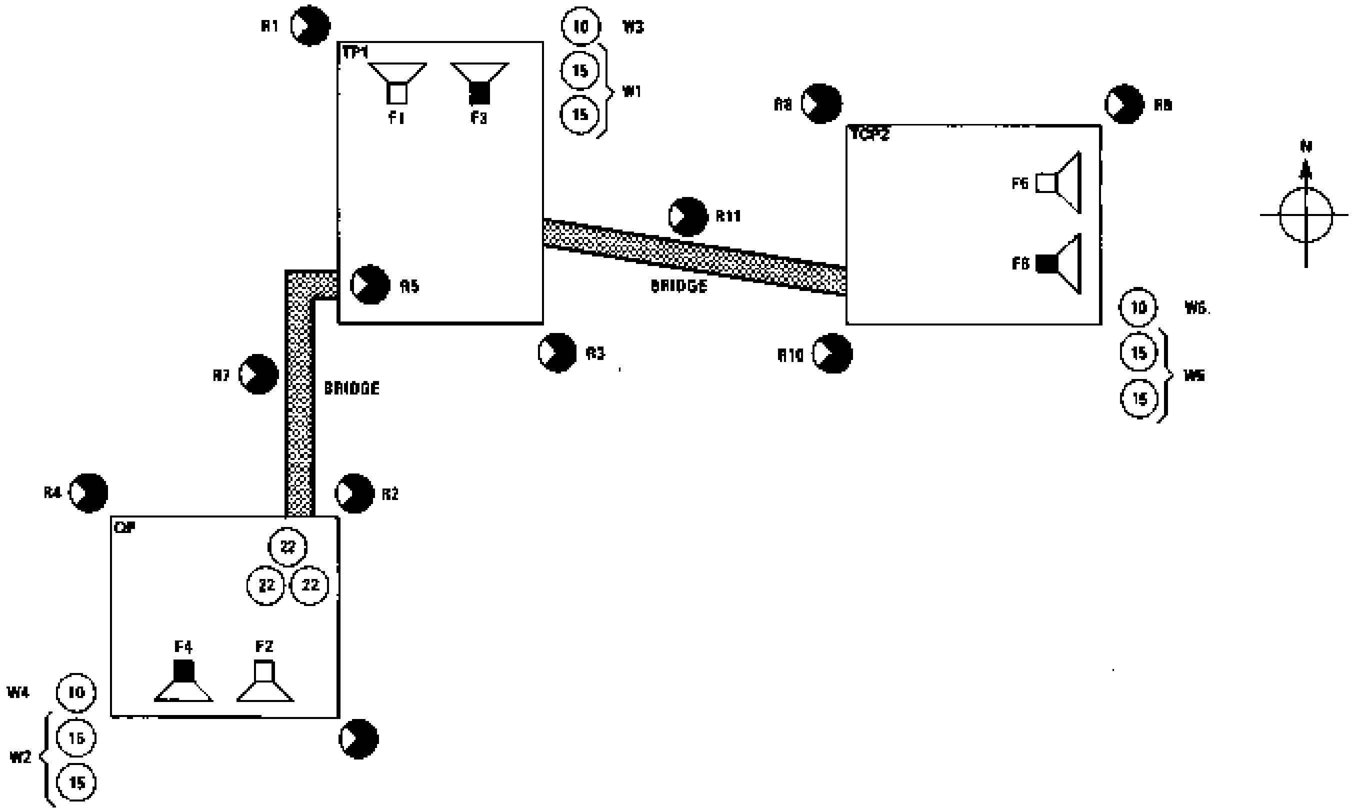
ISSUE 1. JULY 1980

NAVIGATIONAL AIDS Location	8.5.1

22-MILE IDENTIFICATION LIGHTS (QP ONLY)



GEOGRAPHICAL DISPOSITION

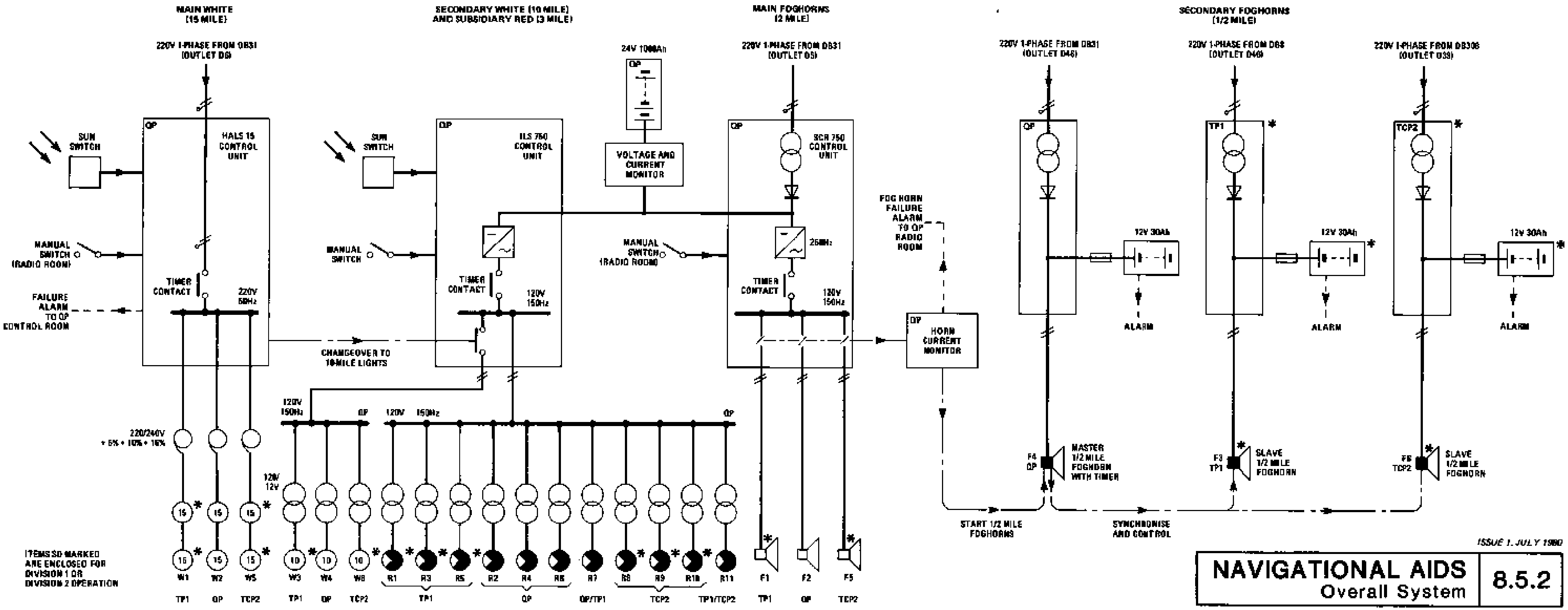


KEY

⑮	WHITE LIGHT (MAIN)	15 MILES
⑩	WHITE LIGHT (SECONDARY)	10 MILES
●	RED LIGHT (SUBSIDIARY)	3 MILES
㉒	MAIN & STANDBY IDENTIFICATION LIGHT	22 MILES
◁	FOG HORN (MAIN)	2 MILES
◀	FOGHORN (SECONDARY)	1/2 MILE
— - —	CONTROL LINK	

NOTES

1. THE TWO NAVIGATION LIGHTS AND THE MAIN FOGHORN CONTROL UNITS ARE LOCATED ON THE QUARTERS PLATFORM
2. THE THREE SECONDARY FOGHORN CONTROL UNITS AND THEIR BATTERIES ARE ADJACENT TO THEIR RESPECTIVE FOGHORNS ON PLATFORMS QP, TP1 & TCP2



ISSUE 1. JULY 1980

NAVIGATIONAL AIDS
Overall System

8.5.2

CHAPTER 9

SAFETY

CONTENTS

DIAGRAMS

** To be issued later*

DIAGRAMS (Continued)

ORGANISATION

To be issued later

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 Field 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:

(a) Fire/explosion.

(b) Total loss or damage which puts the installation out of operation.

(c) Total loss or damage to work barge, supply boat or standby bessel.

(d) Uncontrolled drift of rig or work barge from drilling or operating position.

(e) Uncontrolled blowout or other case of uncontrolled release of hydrocarbons, with or without ignition.

(f) Helicopter crashing or landing in the sea or crash landing on the installation, mobile rig, barge, work boat or standby vessel etc.

(g) Major sabotage or threat of major sabotage.

(h) Oil or other form of serious pollution.

(j) Serious illness, sudden death, or serious accident.

(k) Diving accident.

(l) Serious crime.

(m) Loss of, accident with, or danger from any radioactive source.

(n) Minor illness requiring evacuation.

(p) Man overboard.

(q) Any other incident requiring action or assistance from EAN.

AUDIBLE AND VISUAL ALARMS

1 GENERAL

1.1 Audible and visual alarms are provided to give operators information on the safety status of the platform. Alarms are divided into the following categories:

(a) Verbal command.

(b) Muster alarm.

(c) Fire alarm.

1.2 Audible alarms are broadcast by the public address system, which is common with the public address systems of TP1 and TCP2. Power supplies to the public address system are supported by a 24V, 190Ah battery system which has sufficient capacity to maintain the system fully operational for 30 minutes on failure of normal supply.

2 DESCRIPTION

2.1 Audible Alarms

2.1.1 Operation of audible alarms is controlled manually from pushbuttons and automatically by the Fire Detection System. Muster and fire alarm pushbuttons are situated on the Alarm Control Panel in the Control Room, with further fire alarm pushbuttons strategically located throughout the platform.

2.1.2 An 'Abandon' alarm is a verbal command given over the public address system from a microphone at the main control desk.

2.1.3 A selector switch on the Alarm Control Panel allows for alarm tone selection as follows:

(a) Fire alarm — intermittent tone at one-second intervals.

(b) Muster alarm — continuous tone.

2.1.4 The audible alarm system is capable of simultaneously broadcasting one alarm over the three platforms or various alarms to different platforms, eg an 'Abandon' alarm may be given on TP1, whilst a 'Muster' alarm is being given on QP and TCP2.

2.1.5 Operation of the public address system will override an audible alarm for 10 seconds.

2.1.6 Audible alarms are automatically ranked in the following priorities:

(a) Verbal command.

(b) Muster alarm.

(c) Fire alarm.

If a 'Fire' alarm is being given and a 'Muster' alarm is initiated, the 'Muster' alarm will override.

2.1.7 The 'Muster' alarm is manually initiated from the Alarm Control Panel. The 'Fire' alarm is initiated either at the Alarm Control Panel, from fire alarm pushbuttons or automatically by the Fire Detection System.

2.1.8 'Muster' and 'Fire' alarms may be cancelled by actuation of a 'Cancel' pushbutton at the Alarm Control Panel.

2.2 Visual Alarms

2.2.1 Selected platform areas, notably noisy areas, are provided with Red lamps which automatically flash when an alarm sounds.

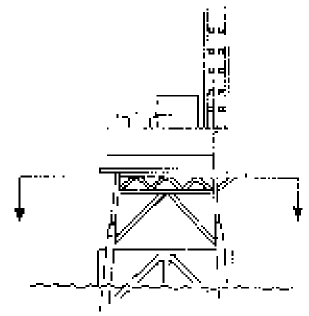
2.2.2 A Red lamp at the entrance to a Halon protected area illuminates on system release.

2.3 Action in the Event of an Alarm

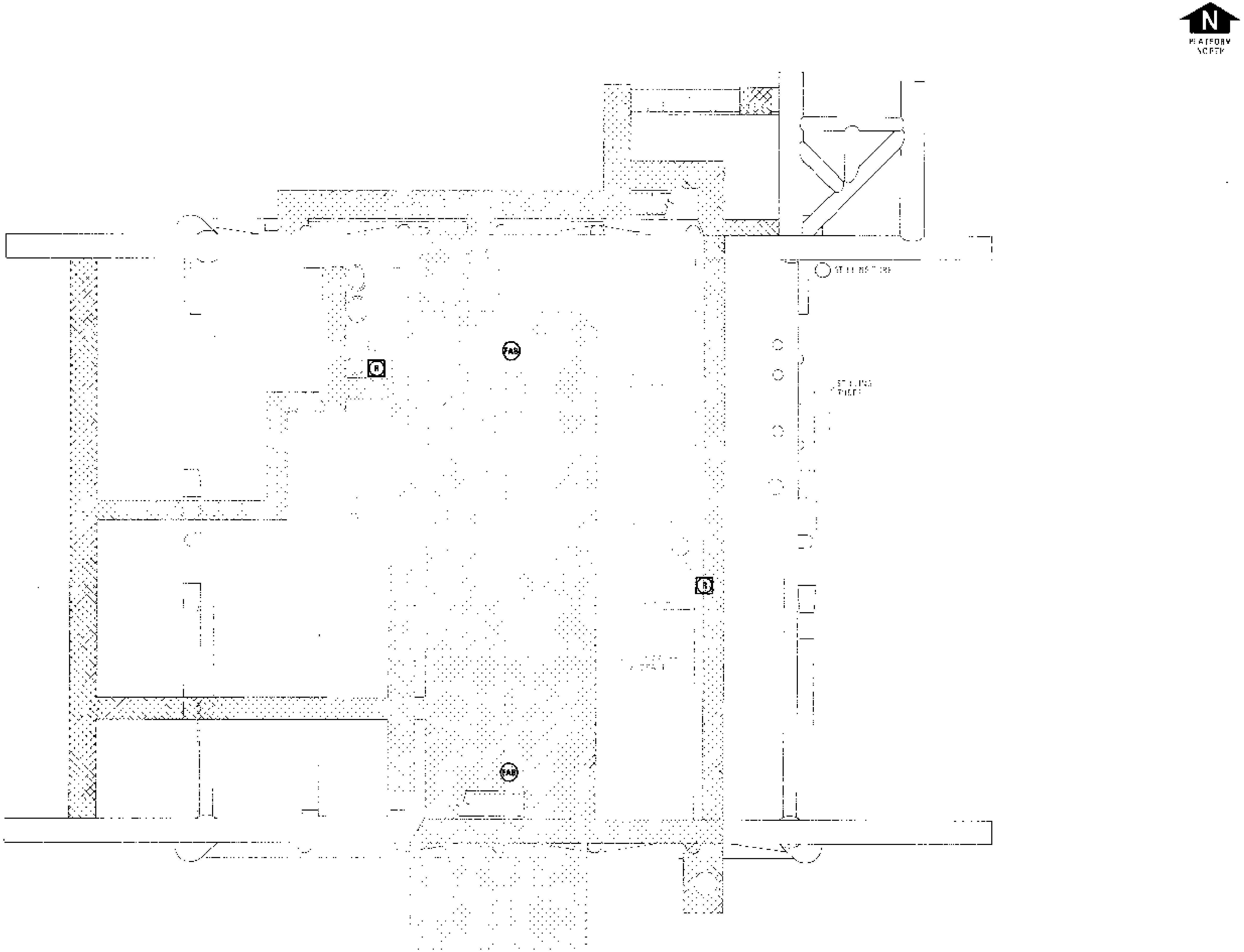
2.3.1 On hearing the 'Fire' alarm all personnel assigned to a fire party must assemble at their fire stations. All other personnel must proceed to their allotted lifeboat stations and await further instructions.

2.3.2 On hearing the 'Muster' alarm all personnel must proceed to their stations in accordance with the procedures.

END



KEY VIEW

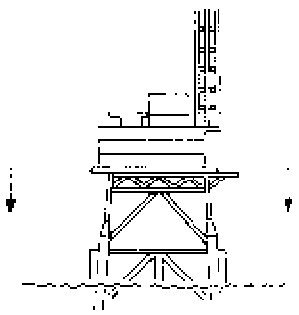


KEY	
FAB	FIRE ALARM BUTTON
R	RED ALARM FLASHING LIGHT

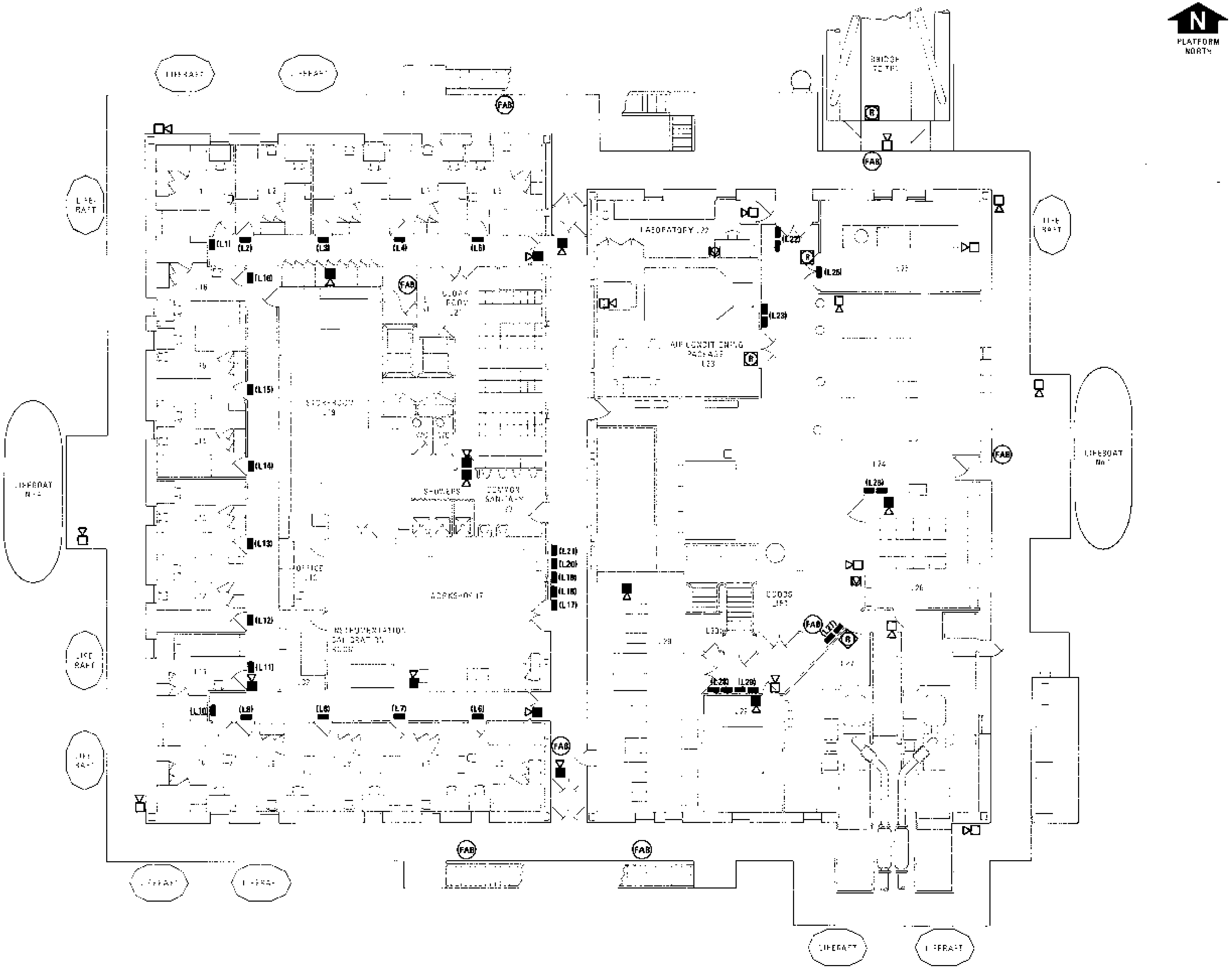
ISSUE 1. JULY 1980

AUDIBLE AND VISUAL ALARMS
Deck Support Level

9.3.1



KEY VIEW



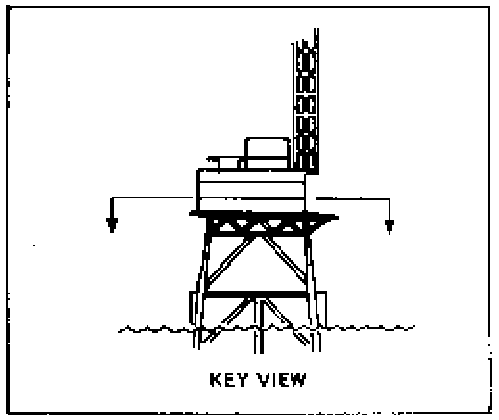
KEY

- (FAB) FIRE ALARM BUTTON
- ☐◁ PA AUDIBLE ALARM LOUDSPEAKER
- ■◁ AUDIBLE ALARM LOUDSPEAKER
- ☒ MICROPHONE
- ▬ FIRE FLASHING LIGHT ALARM (ROOM No in PARENTHESIS)
- (R) RED ALARM FLASHING LIGHT

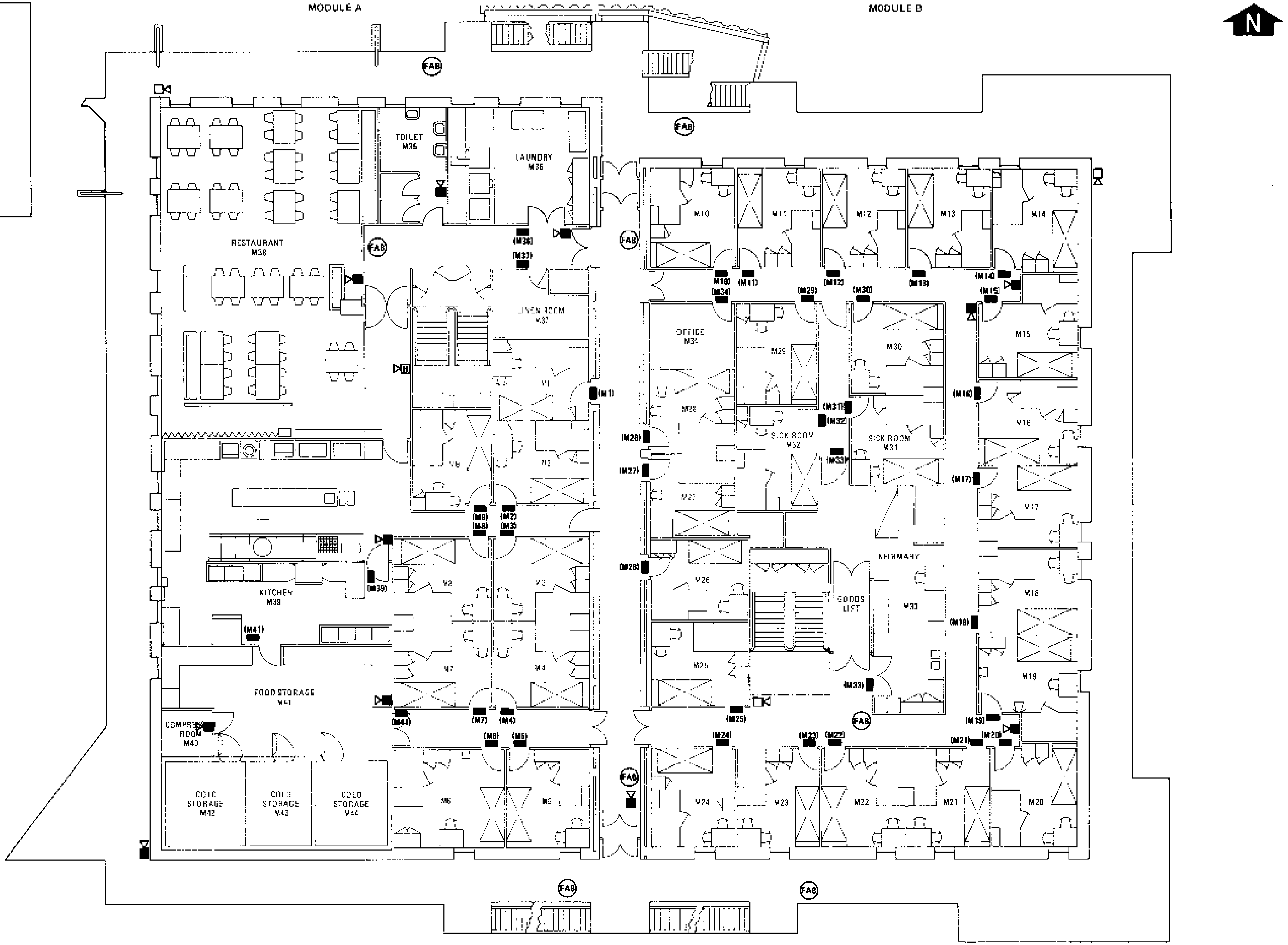
ISSUE 1. JULY 1980

AUDIBLE AND VISUAL ALARMS
Lower Level

9.3.2



KEY VIEW



KEY

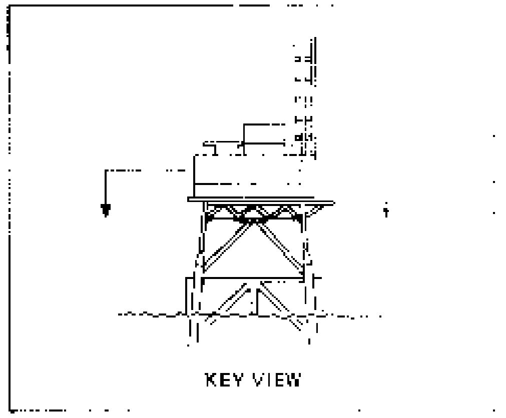
FAB	FIRE ALARM BUTTON
☐◁	PA AUDIBLE ALARM LOUDSPEAKER
■◁	AUDIBLE ALARM LOUDSPEAKER
H◁	LOCAL FIRE ALARM LOUDSPEAKER
■	FIRE FLASHING LIGHT ALARM (ROOM No IN PARENTHESIS)

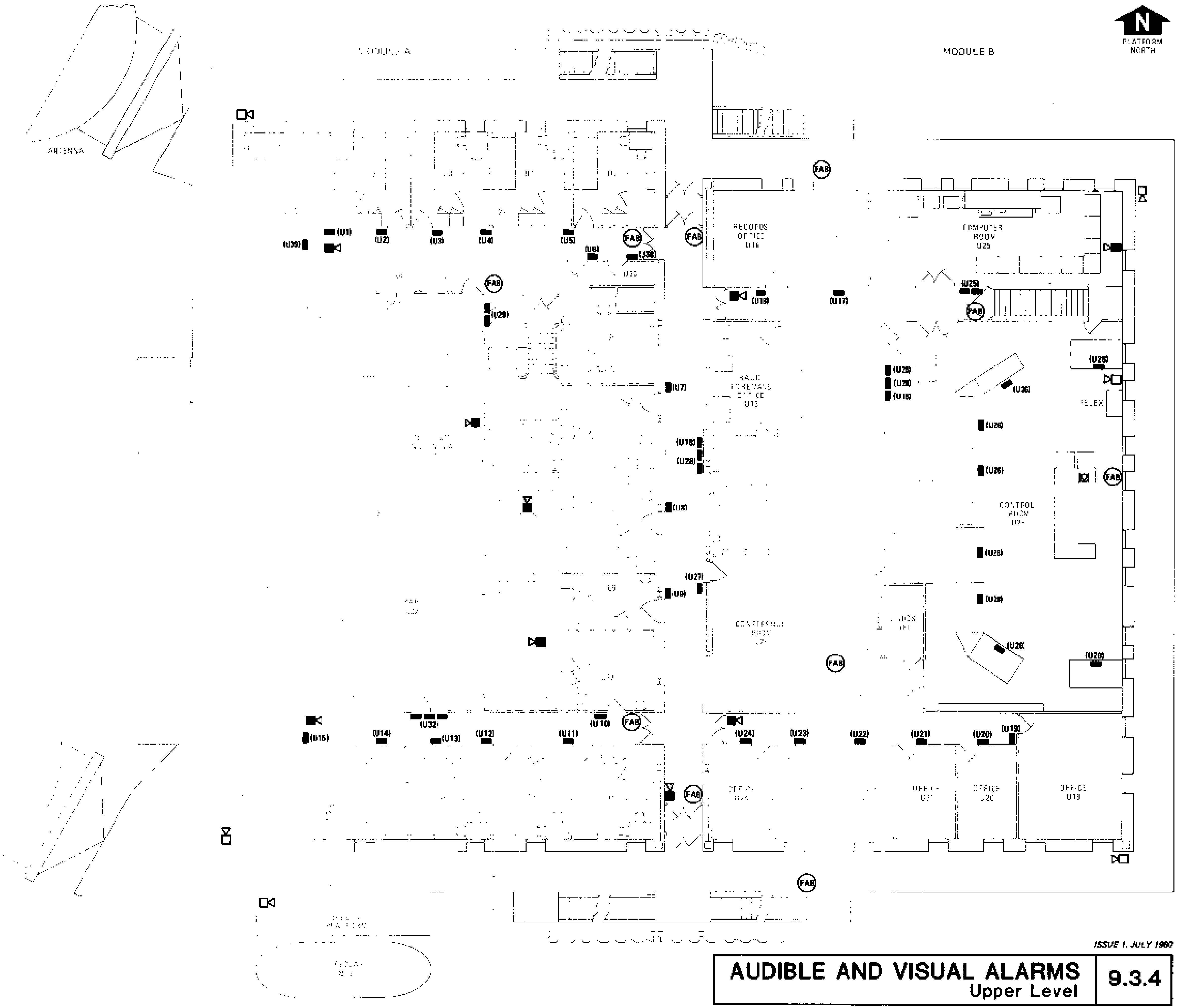
ISSUE 1. JULY 1980

AUDIBLE AND VISUAL ALARMS

Middle Level

9.3.3





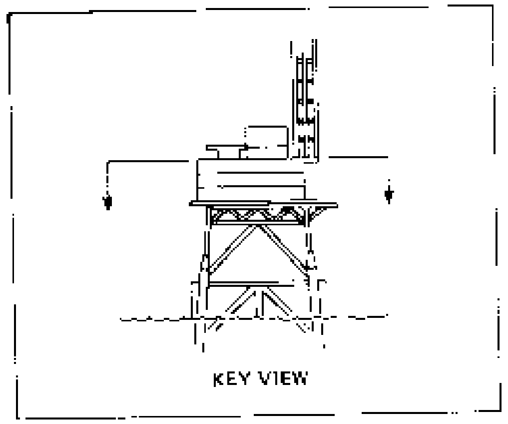
KEY

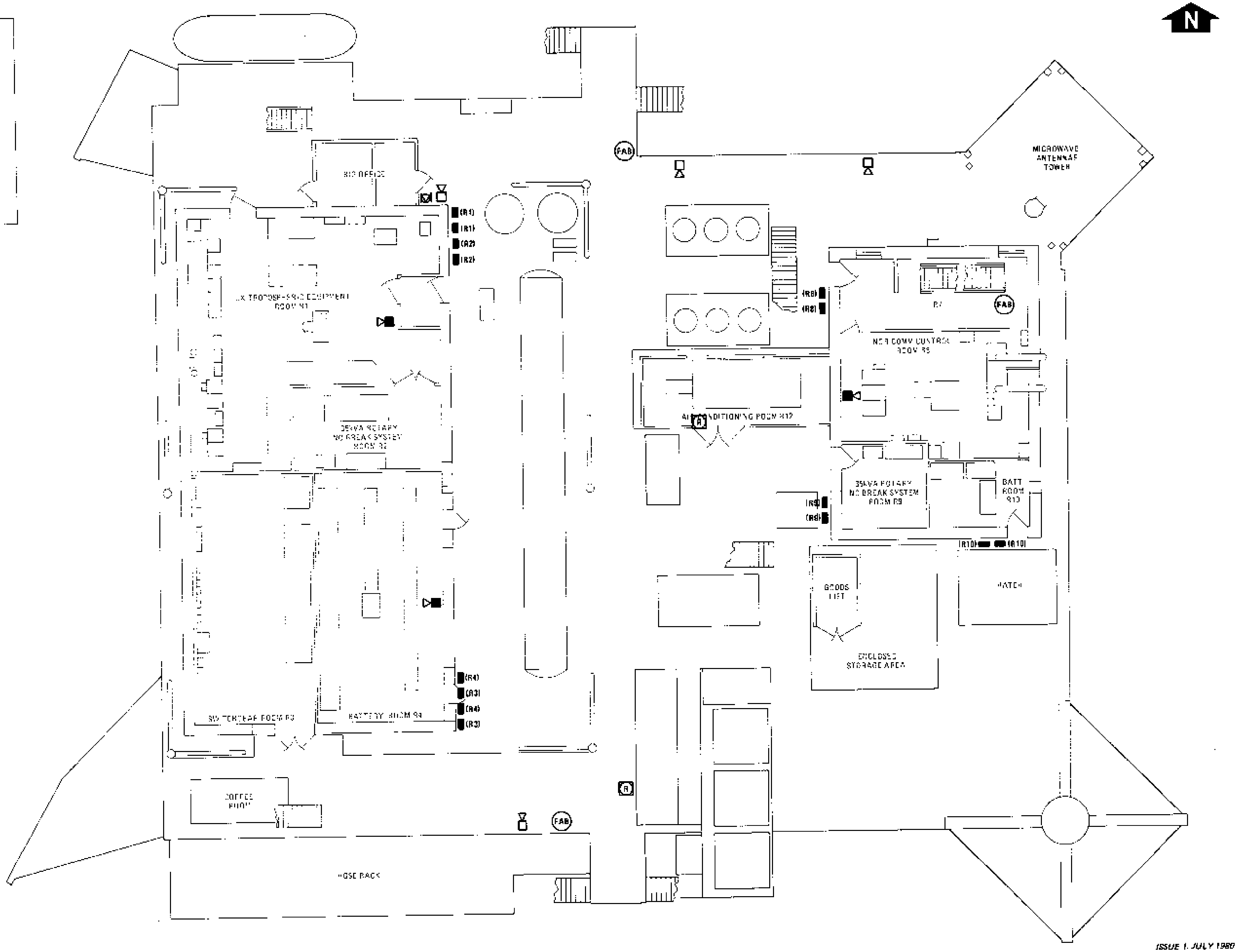
FAB	FIRE ALARM PUSHBUTTON
□◁	PA AUDIBLE ALARM LOUDSPEAKER
■◁	AUDIBLE ALARM LOUDSPEAKER
□◁	LOCAL FIRE ALARM LOUDSPEAKER
☒	MICROPHONE
▬	FIRE FLASHING LIGHT ALARM (ROOM No IN PARENTHESIS)

ISSUE 1, JULY 1980

AUDIBLE AND VISUAL ALARMS
Upper Level

9.3.4



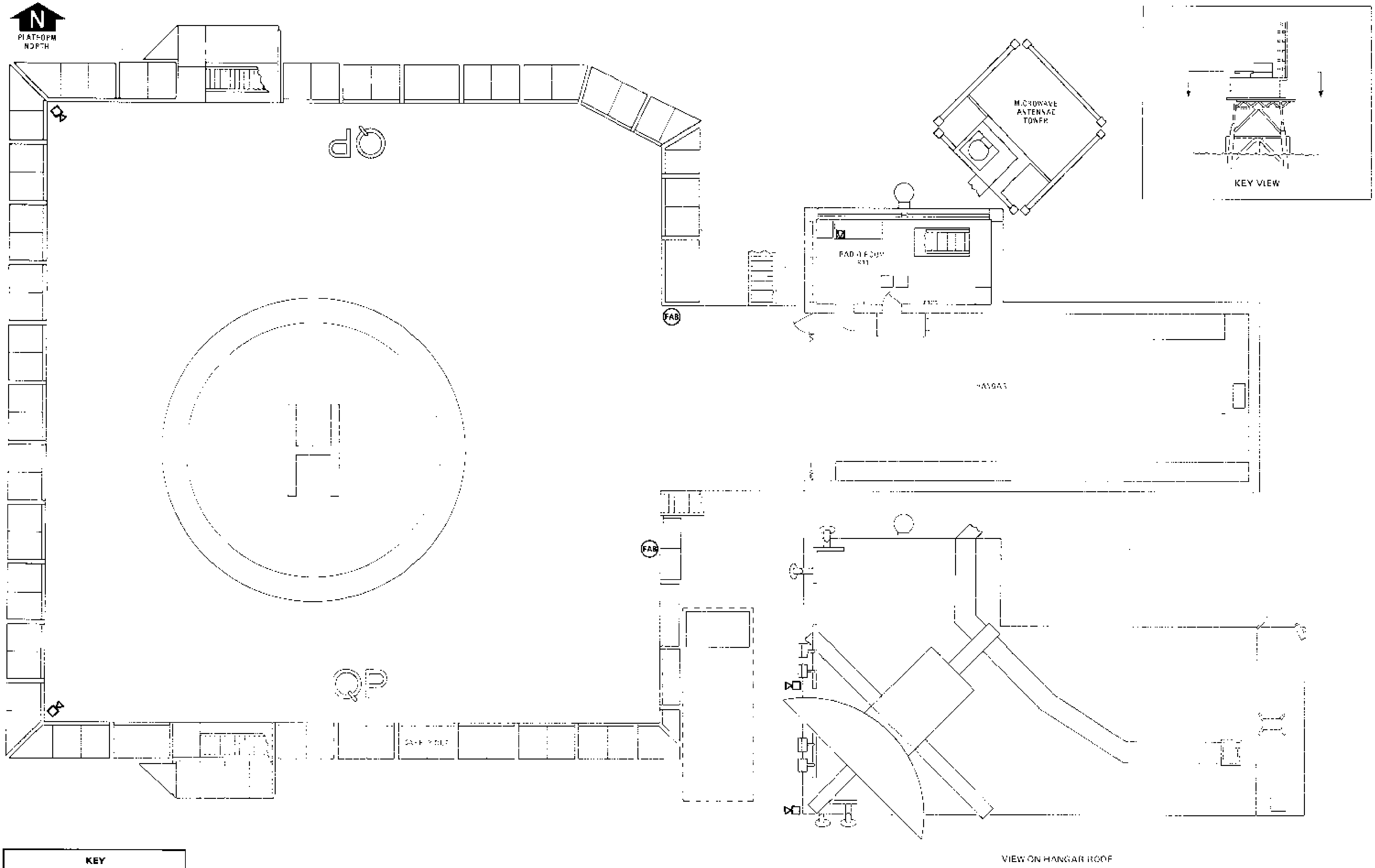


KEY	
(FAB)	FIRE ALARM BUTTON
▷	PA AUDIBLE ALARM LOUDSPEAKER
◀	AUDIBLE ALARM LOUDSPEAKER
☒	MICROPHONE
▬	FIRE FLASHING LIGHT ALARM (ROOM No IN PARENTHESIS)
Ⓡ	RED ALARM FLASHING LIGHT

ISSUE 1. JULY 1980

AUDIBLE AND VISUAL ALARMS
Roof Level

9.3.5



KEY

- (FAB) FIRE ALARM PUSHBUTTON
- PA AUDIBLE ALARM LOUDSPEAKER
- MICROPHONE

ISSUE 1. JULY 1980

AUDIBLE AND VISUAL ALARMS
Helideck Level
9.3.6

EMERGENCY SHUTDOWN

1 GENERAL

1.1 QP Control Room provides centralised manual control for the emergency shutdown of the Frigg Field drilling and treatment platforms.

1.2 The platform has its own integral independent emergency shutdown systems.

2 DESCRIPTION

2.1 Frigg Field Emergency Shutdown

Seven pushbuttons situated in the Control Room enable degrees of Field Shutdown (FSD) and Emergency Shutdown (ESD) to be initiated as tabulated below:

Pushbutton	Shutdown Level	Degree of Platform Shutdown
HS–MSD–1	First	FSD – No decompression
HS–12	Second	ESD and decompression of TP1. ESD of CDP1
CHS–12	Second	ESD and decompression of TCP2. ESD of DP2
No 4	Second	ESD of CDP1
No 5	Second	ESD of DP2
HS–ESD–6	Third	ESD of TP1 – No decompression
CHS–ESD–6	Third	ESD of TCP2 – No decompression

2.2 QP Emergency Shutdown

2.2.1 An ESD is initiated by any one of the following:

(a) Automatically, by the Fire Detection System.

(b) Automatically, by the Gas Detection System.

(c) Manually, by actuation of a pushbutton at the Central Control Desk.

2.2.2 Operation of the Fire Detection System will sound the fire alarm, shut down heating and ventilation systems, close fire dampers, isolate non-essential electrical supplies, start the fire pumps and, as appropriate, release Halon systems.

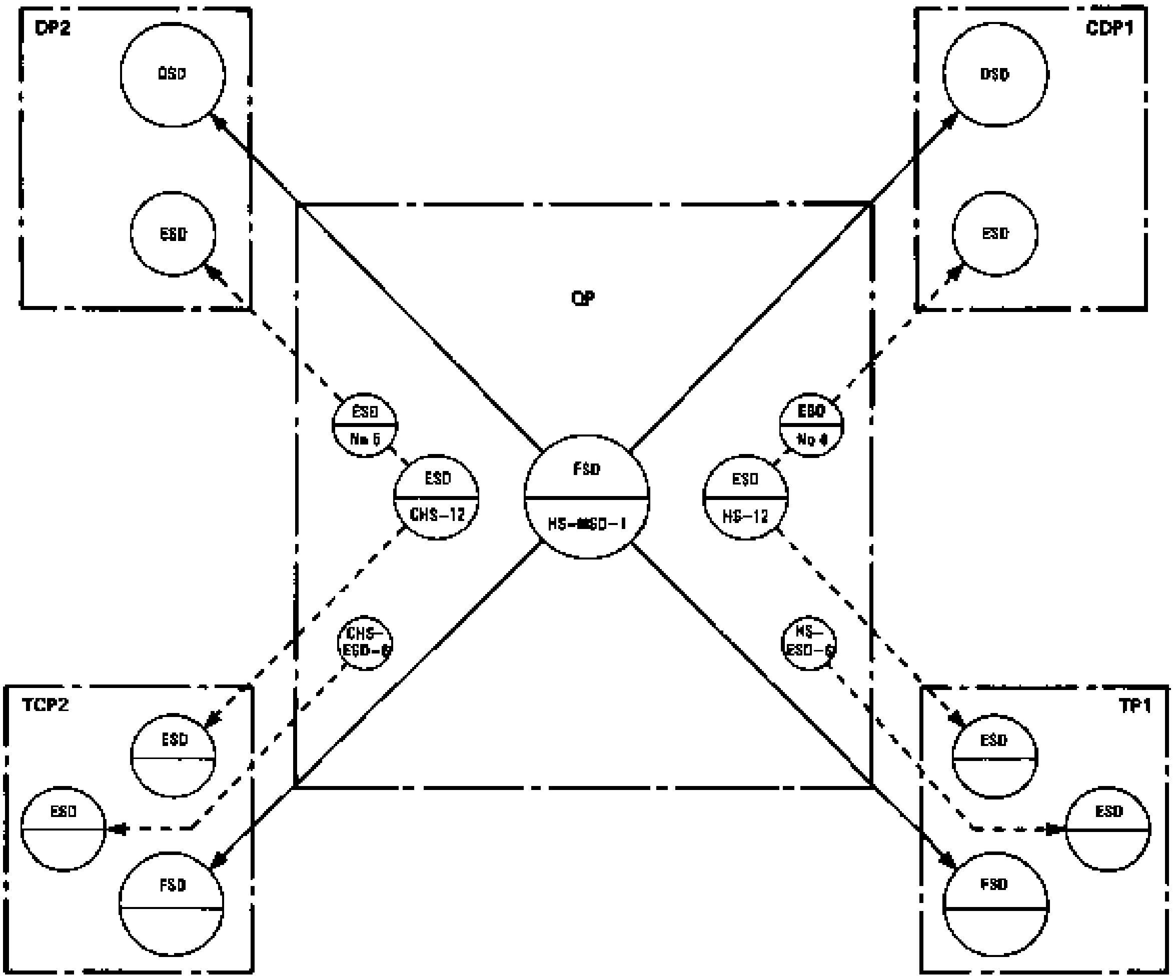
2.2.3 Operation of the Gas Detection System will isolate non-essential electrical supplies, shut down heating and ventilation systems, close control dampers and start the fire pumps.

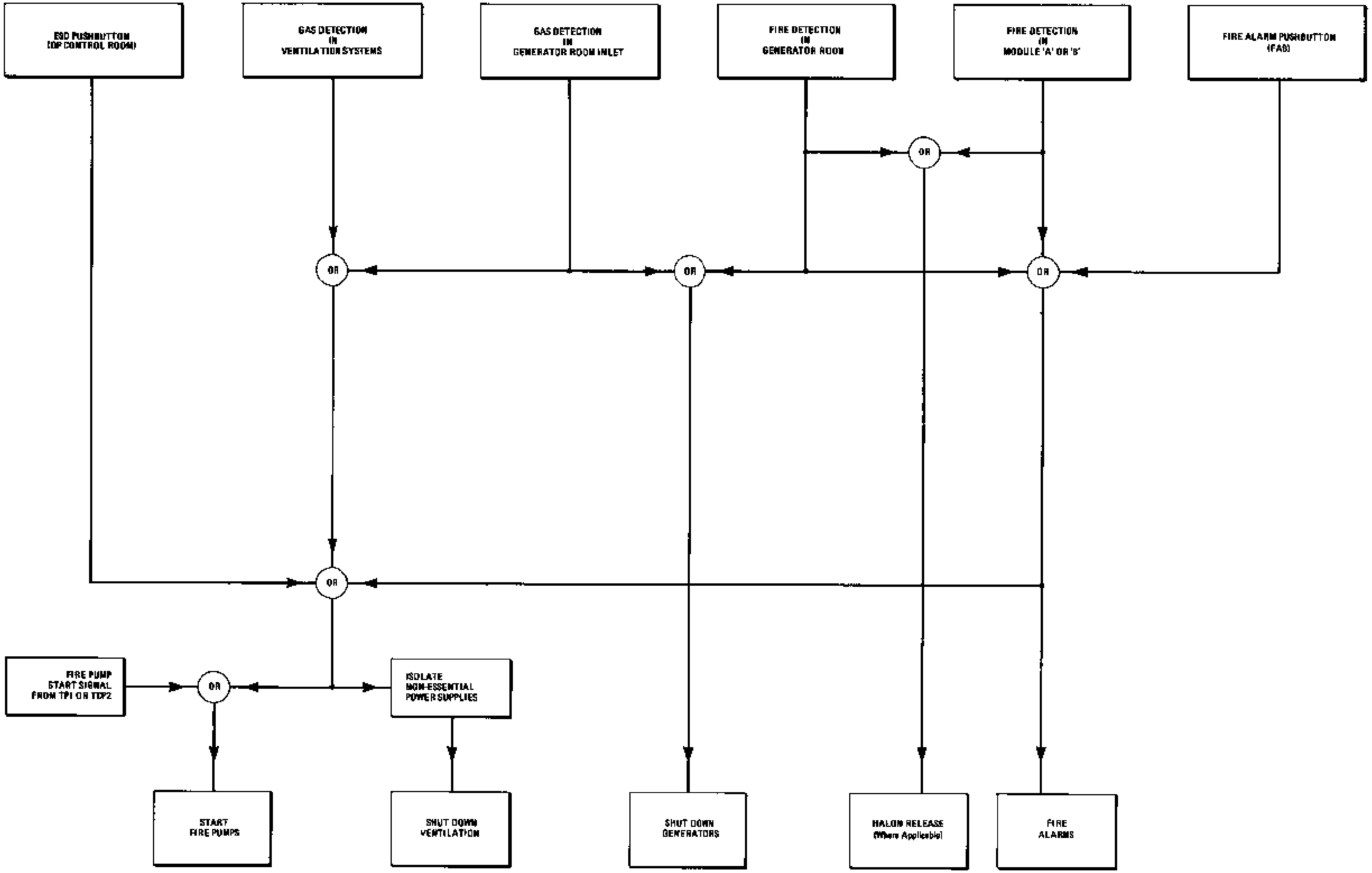
2.2.4 Gas detection in the air inlets of the generators will initiate local generator action only. Gas detection in other air does not initiate generator shutdown.

2.2.5 Fire and gas detection systems, communications, navigational aids, and internal and external lighting remain operational after an ESD.

2.2.6 Operation of the ESD pushbutton initiates an ESD without raising fire and gas alarms or Halon release.

END


DP2
DSD
ESD
CDP1
DSD
ESD
QP
ESD
No 5
ESD
CHS-12
FSD
HS-MSD-1
ESD
No 4
ESD
HS-12
CHS-
ESD-6
HS-
ESD-6
TCP2
ESD
ESD
FSD
TP1
ESD
ESD
FSD



ISSUE 1. JULY 1980

EMERGENCY SHUTDOWN
Quarters Platform

9.4.2

FIRE AND SMOKE DETECTION SYSTEM

1 GENERAL

1.1 The system provides fire detection in all platform areas.

1.2 The following four types of sensors are used:

- (a) Heat.
- (b) Infra-red.
- (c) Smoke.
- (d) Ultraviolet.

1.3 Each sensor transmits an electrical impulse to the Fire and Gas Detector Control Panel in the control room, via a Minerva Type T870 controller. The control panel provides visual indication of the area in which a fire has occurred, raises audible/visual alarms and where necessary operates an extinguishant system.

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.

2 DESCRIPTION

2.1 Heat detectors are installed in enclosed areas in which rapid temperature changes are expected. The sensors used are Minerva Type F80, which are located throughout the middle and lower levels.

2.2 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 throughout the lower level and the Helideck.

2.3 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 throughout the platform.

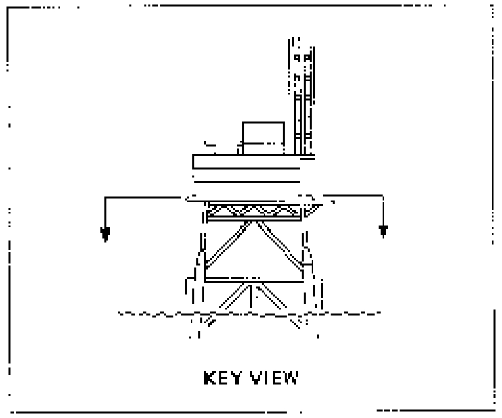
2.4 A Det-Tronics Type C7037B ultraviolet detector is installed in the air compressors/fuel tanks area of the roof level.

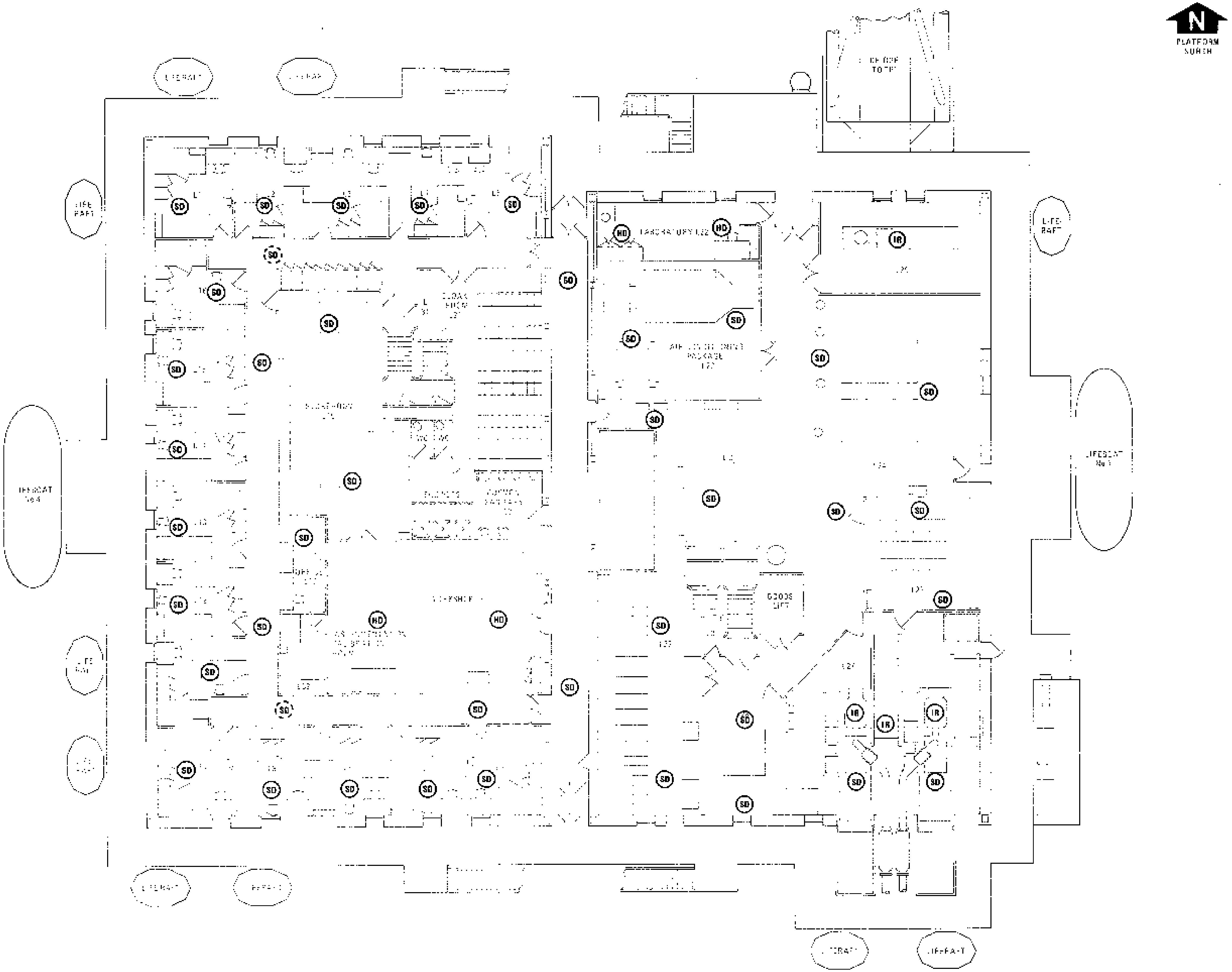
2.5 Operation of any one sensor will automatically initiate the following:

- (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) Start-up of QP, TP1 and TCP2 fire pumps.
- (d) Platform emergency shutdown.
- (e) If appropriate, Halon release.

2.6 Sensors serving a Halon protected area are coincidence-interlocked such that two or more sensors must actuate to initiate system release.

END





KEY

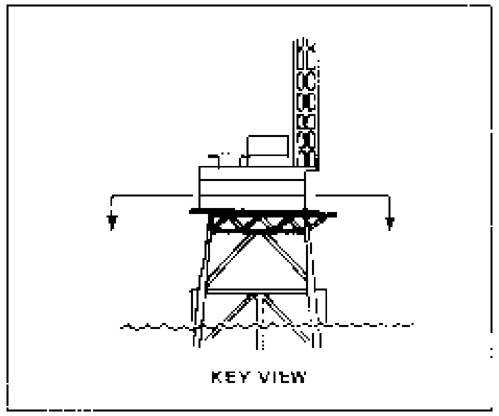
(SD) INTER-FLOOR SMOKE DETECTOR
(SD) SMOKE DETECTOR
(IR) INFRA-RED DETECTOR
(HD) HEAT DETECTOR

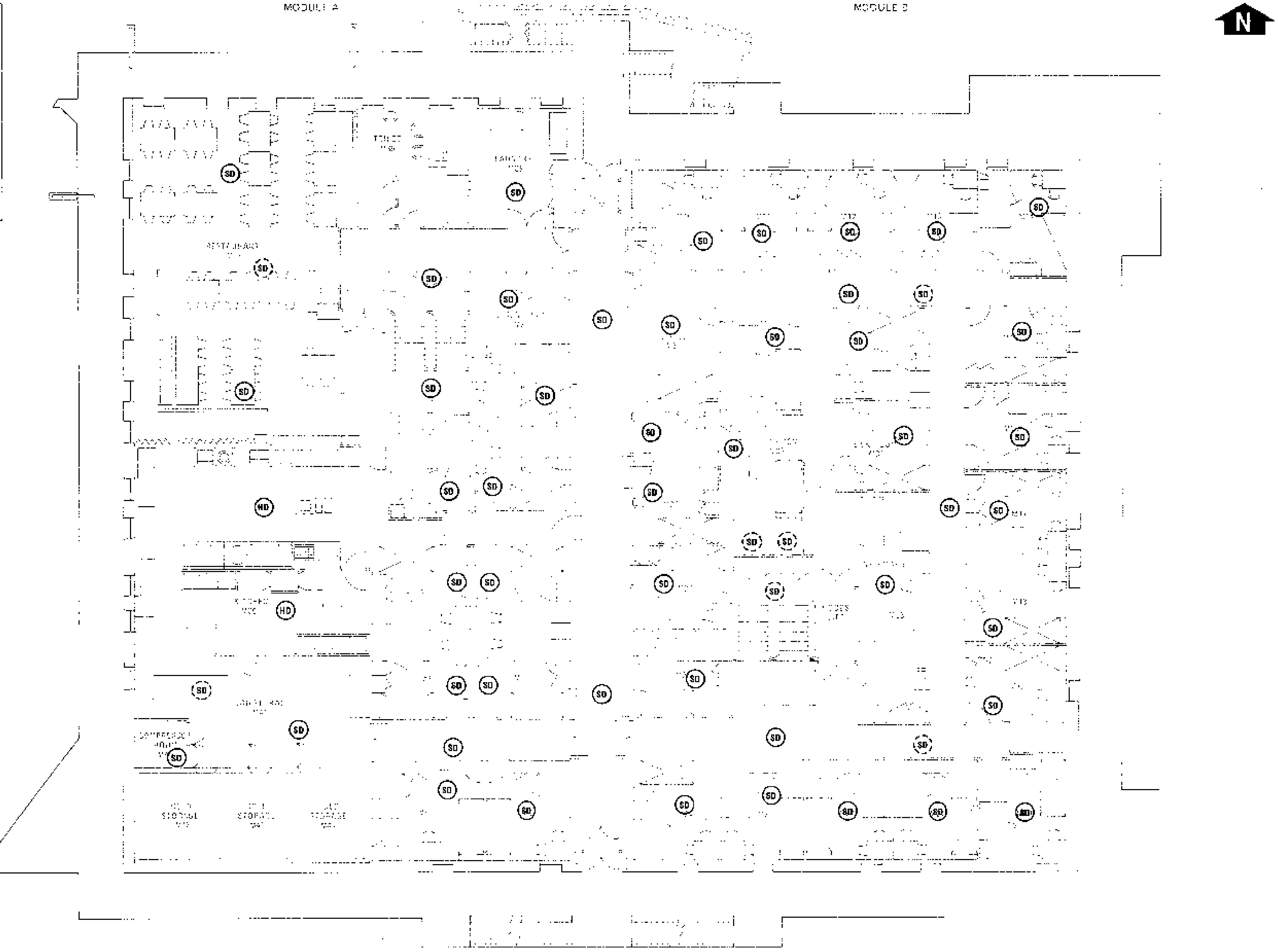
ISSUE 1, JULY 1980

FIRE AND SMOKE DETECTION SYSTEM

Lower Level

9.5.1





KEY

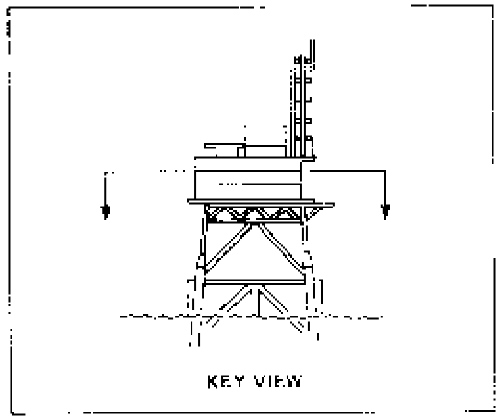
SD	INTER-FLOOR SMOKE DETECTOR
SD	SMOKE DETECTOR
HD	HEAT DETECTOR

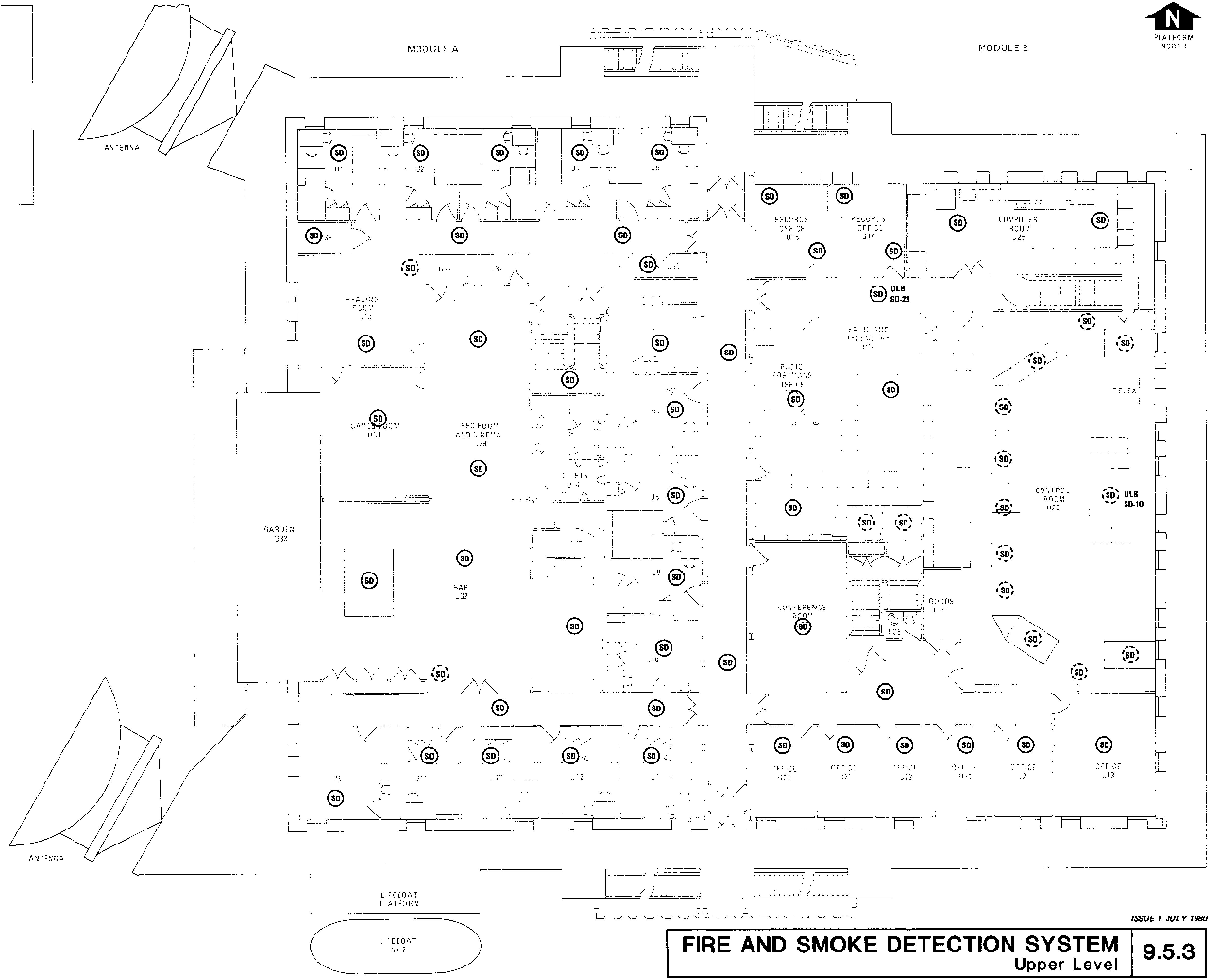
ISSUE 1, JULY 1980

FIRE AND SMOKE DETECTION SYSTEM

Middle Level

9.5.2





KEY

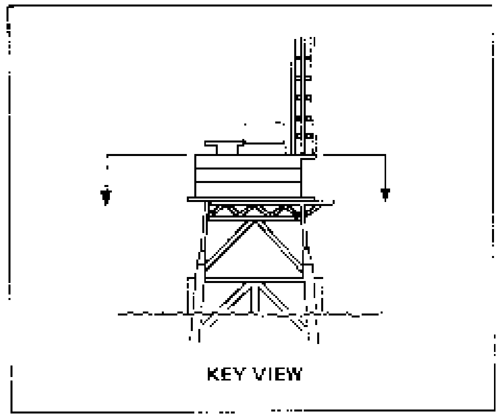
(SD) INTER-FLOOR SMOKE DETECTOR

(SD) SMOKE DETECTOR

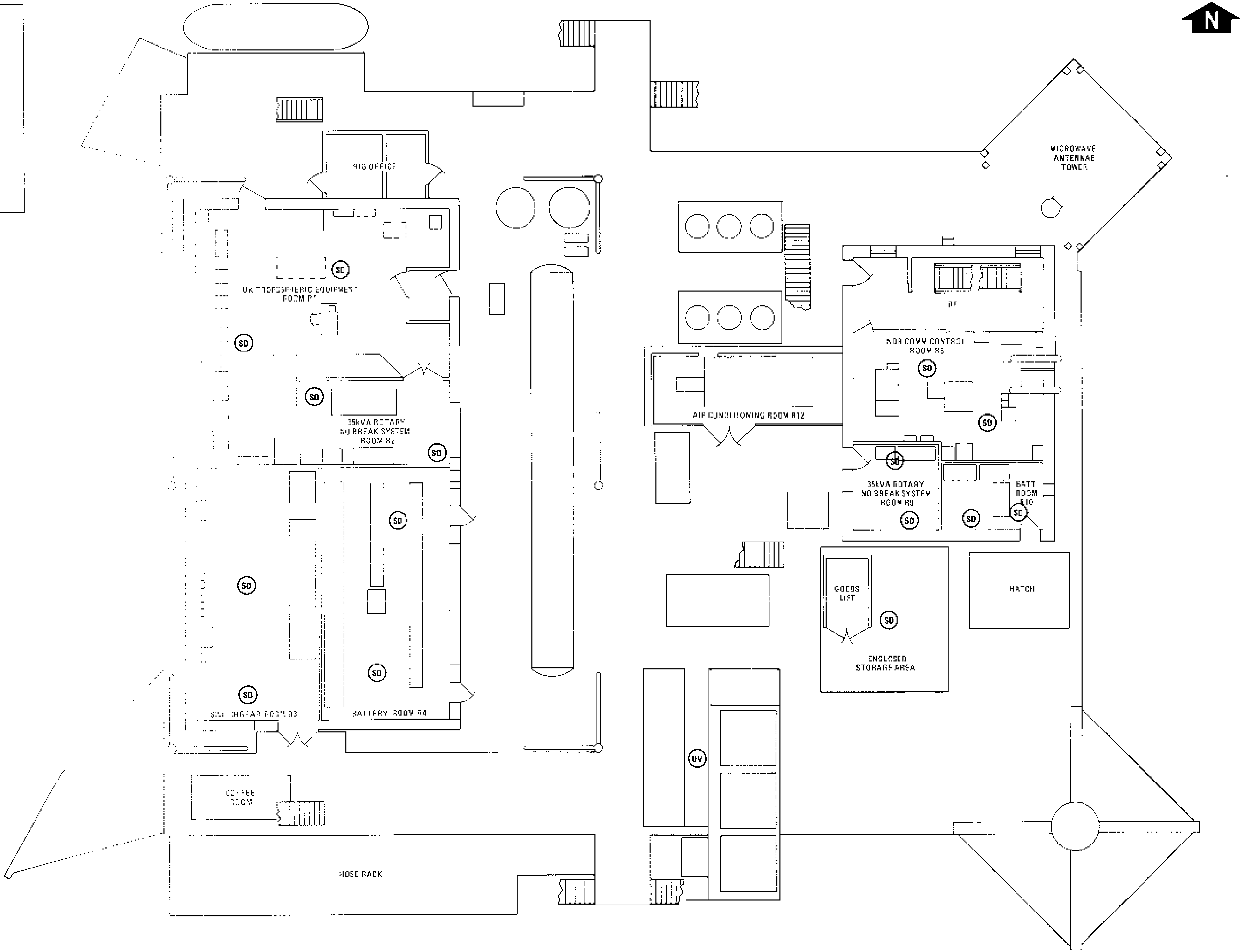
ISSUE 1, JULY 1980

FIRE AND SMOKE DETECTION SYSTEM
Upper Level

9.5.3



KEY VIEW



KEY

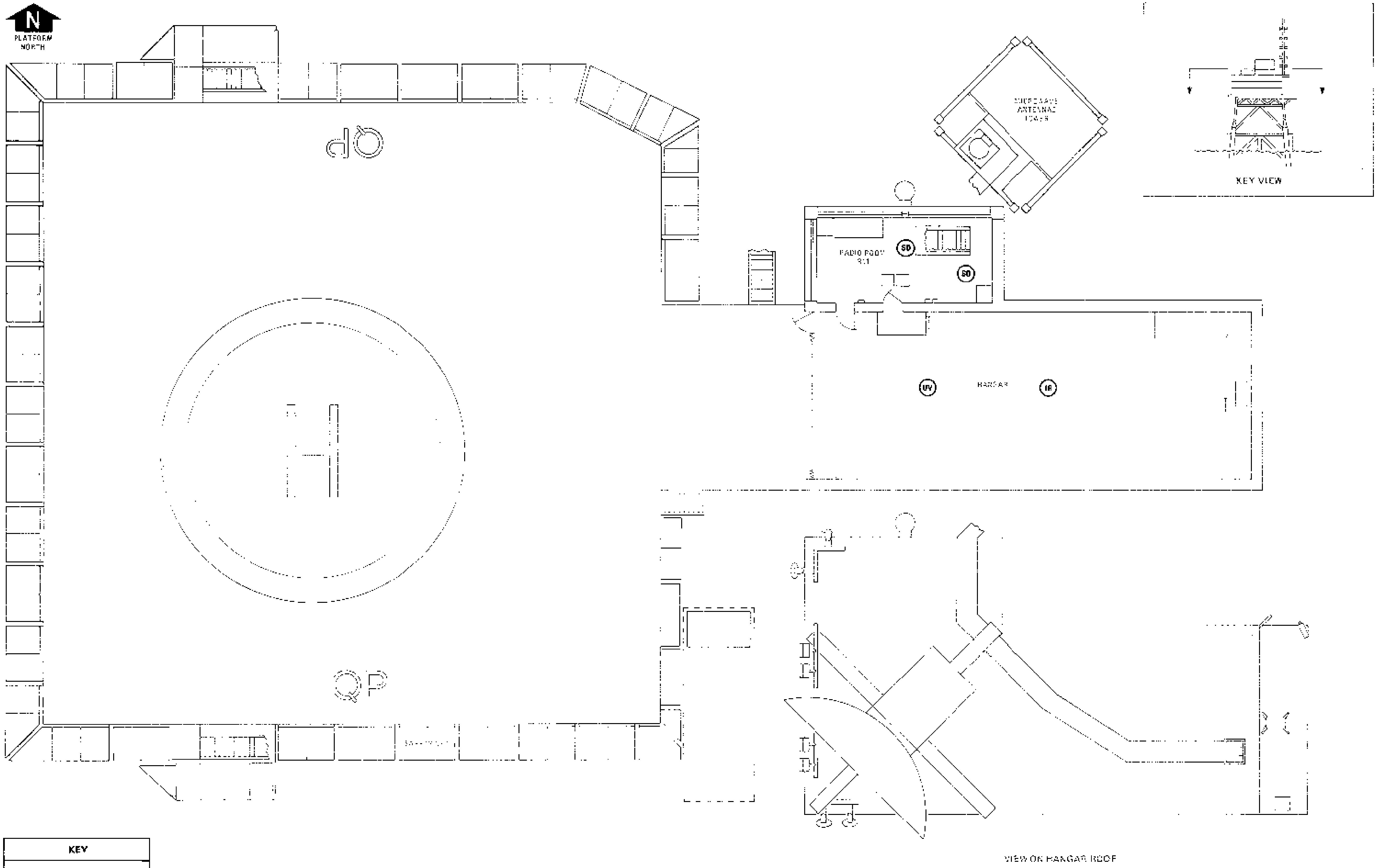
SD	SMOKE DETECTOR
UV	ULTRA-VIOLET DECTOR

ISSUE 1. JULY 1980

FIRE AND SMOKE DETECTION SYSTEM

Roof Level

9.5.4



KEY

- (IR) INFRA-RED DETECTOR
- (SD) SMOKE DETECTOR
- (UV) ULTRAVIOLET DETECTOR

ISSUE 1. JULY 1980

FIRE AND SMOKE DETECTION SYSTEM
Helideck Level

9.5.5

GAS DETECTION SYSTEM

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 Fire and Gas Detector Control Panel, located in the control room.

1.2 The sensors used are Sieger Model 1402 Type 770, which are unaffected by atmospheric or humidity changes.

1.3 Each detection point comprises two independent sensor heads, connected to their gas alarm module by intrinsically safe cable.

2 DESCRIPTION

2.1 Each sensor comprises two platinum filament detectors representing two resistance arms of a balanced bridge network, fitted into a detector head within an explosion-proof housing. Selected catalysts are impregnated into the support of one filament, and at set heating temperatures the carrier becomes supersensitive to flammable gases. Resultant surface combustion varies the electrical resistance of the filament and unbalances the bridge network. The proportional out-of-balance voltage is amplified to operate switching circuits at the appropriate gas alarm module.

2.2 The two sensors are set to actuate at a coincidental Lower Explosive Level (LEL) of a 5 per cent gas to air mixture. Should any one detector operate, the appropriate gas alarm module will automatically initiate the following:

(a) Audible/visual alarms.

(b) Shutdown of heating and ventilation systems.

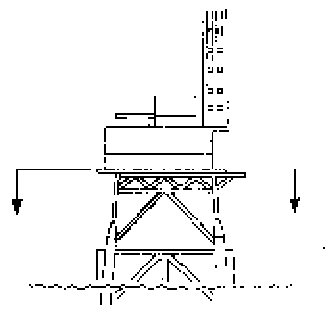
(c) Start QP, TP1 and TCP2 fire pumps.

(d) Indication of the location of the gas incident at the Fire and Gas Detector Control Panel in the control room.

(e) Platform emergency shutdown.

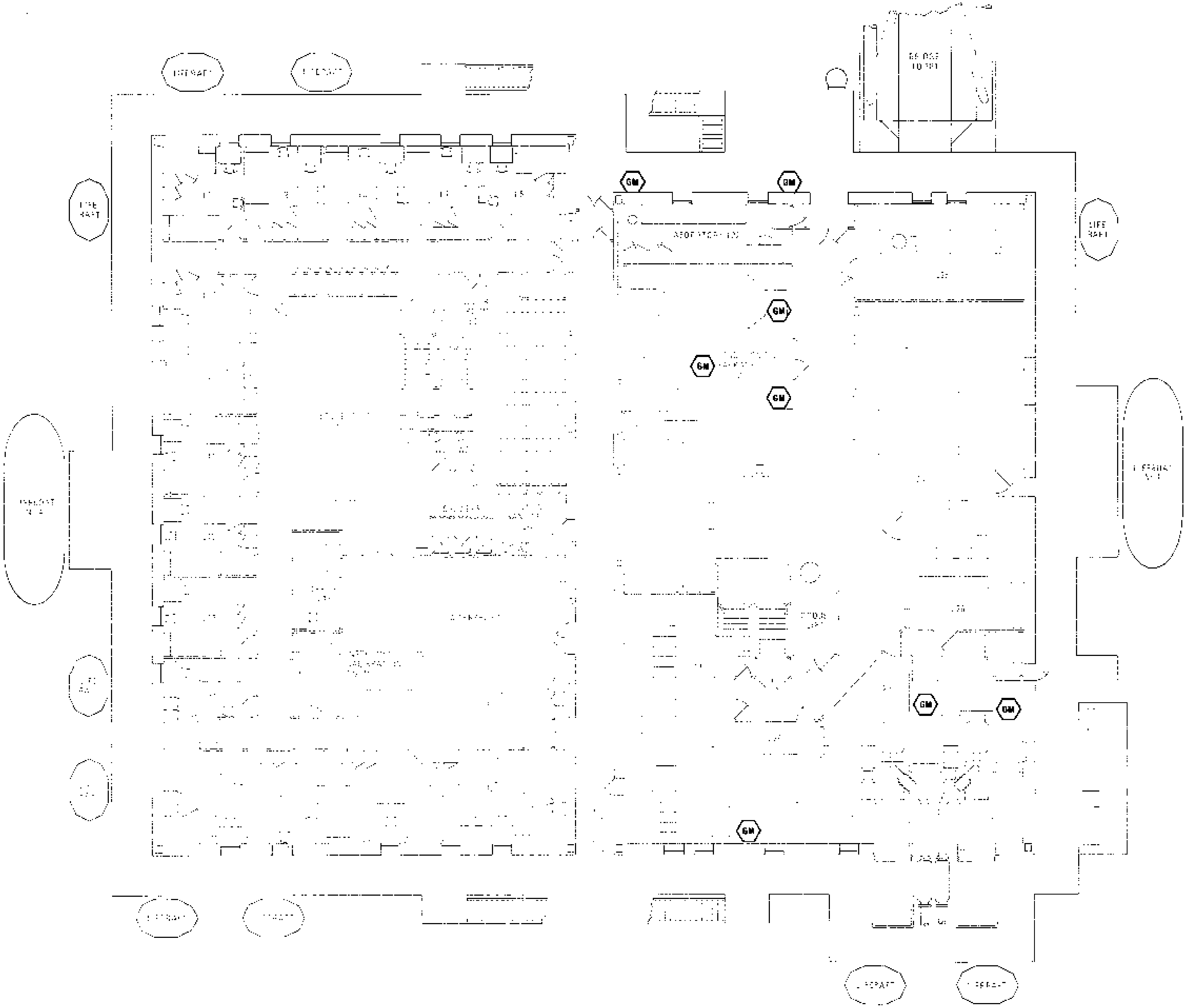
2.3 The automatic action of the system may be inhibited by use of keyswitches at the Fire and Gas Detector Control Cabinet.

2.4 Each sensor is provided with a test gas facility.



KEY VIEW

PLATFORM NORTH

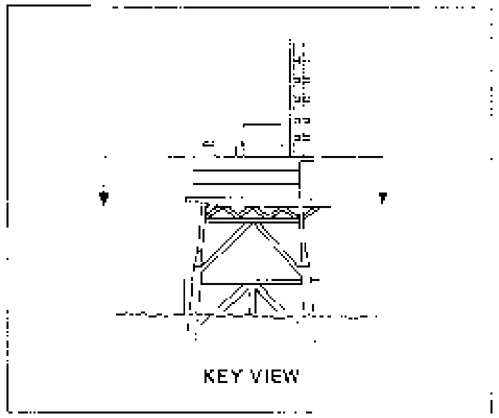


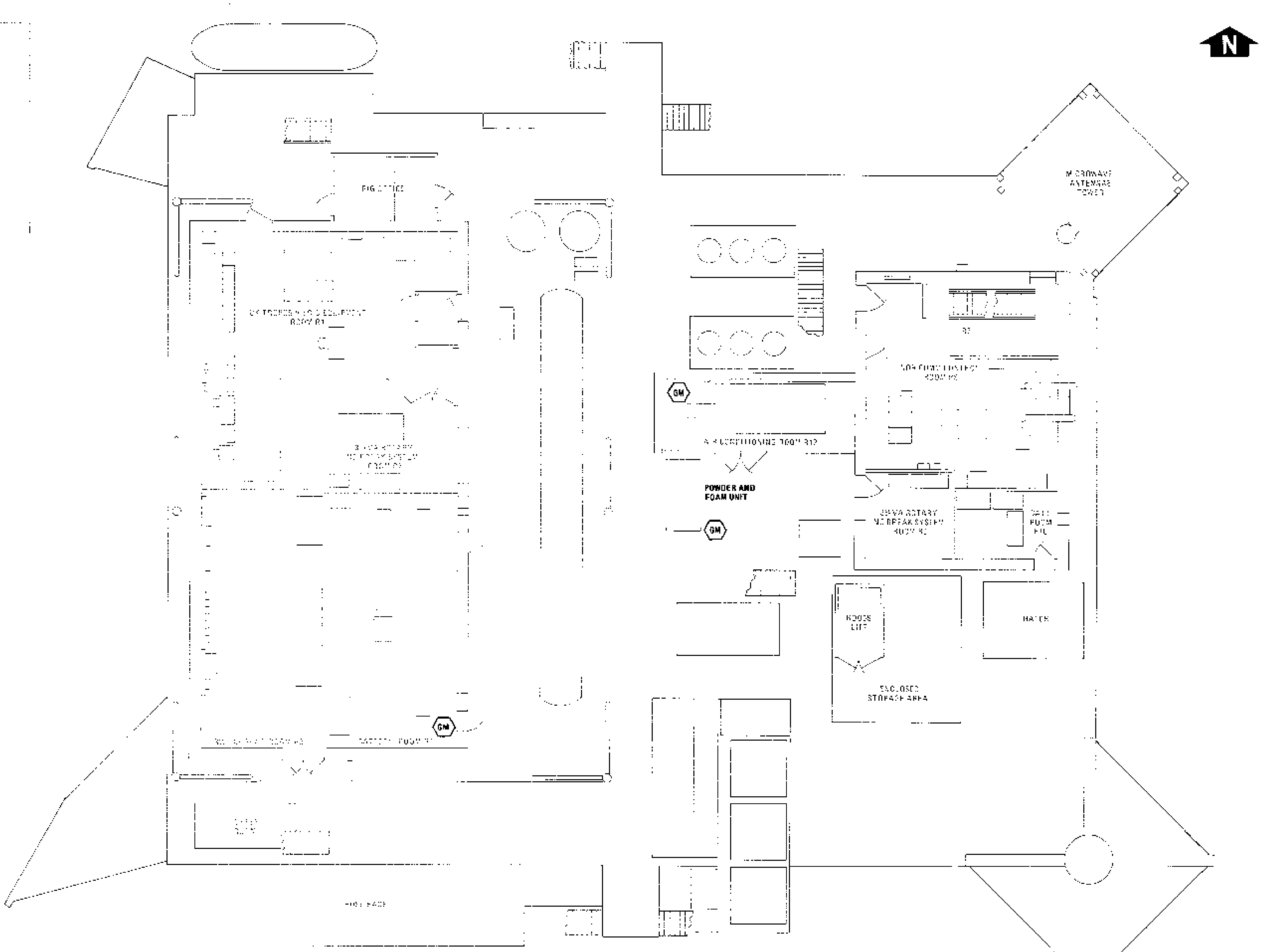
KEY
GM GAS DETECTORS

ISSUE 1. JULY 1980

GAS DETECTION SYSTEM
Lower Level

9.6.1





KEY

GM GAS DETECTOR

ISSUE 1, JULY 1980

GAS DETECTION SYSTEM
Roof Level

9.6.2

2.3 Control

2.3.1 Indication and location of fire detection, gas detection and manual alarm is provided at the Fire and Gas Detector Control Panel in the control room. From the panel logic system, fail-safe control cables are led to platform areas to operate ventilation dampers, shut down ventilation systems and start the fire pumps.

2.3.2 The fire pump may be remotely started from fire alarm pushbuttons throughout the platform, or by the local start pushbuttons. Operation of any pushbutton will start TP1 and TCP2 fire pumps.

2.3.3 The fire pump will also start on receipt of a signal from TP1 and/or TCP2, and when the water/foam release lever on the Helideck is operated.

FIREFIGHTING FACILITIES

1 GENERAL

1.1 QP is provided with automatic and manual firefighting facilities in accordance with rulings by the following:

(a) Mineral Workings (Offshore Installations) Act 1971. Proposals for Regulations on Fire Fighting Systems and Appliances.

(b) Department of Trade (Marine Division).

(c) Det norske Veritas.

1.2 Each platform area is provided with one or more of the following:

(a) Automatic extinguishant systems.

(b) Manual extinguishant systems.

(c) Fireman outfits and associated equipment.

1.3 The applications of the various types of extinguishants used are as follows:

(a)	Water	— suitable for fires involving wood, bedding and paper.
(b)	Foam	— most suitable for flammable liquids. It must not be used on electrical equipment.
(c)	Dry Chemicals	— these are of the 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 CO_2 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 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 be released manually.

2.1.2 Certain areas of the platform are provided with sprinkler systems.

2.2 Manual Extinguishant Systems

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) Chemical hosereels.
- (f) Monitors.
- (g) Appropriate systems are supplied with sea water by the Firewater System.

2.2.2 There are three types of portable fire extinguishers as follows:

(a) Dry Powder	–	these are chemical extinguishers pressurised by a CO_2 bottle attached to the container. They are in sizes of 12kg and 100kg. The 100kg containers are trolley mounted.
(b) Gas/Water	–	these are 10kg extinguishers activated by a pressurised CO_2 cartridge within the container.
(c) CO_2	–	these are gas extinguishers in sizes of 6kg and 10kg.

2.2.3 Deluge systems are installed in the diesel fuel storage tank area and on the jet fuel tanks.

2.2.4 Water hosereels are located throughout the platform. Each reel contains 30m of rubber hose with a jet/spray 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 Helideck. Foam is supplied by a foam/dry chemical unit, located on Module 8 roof.

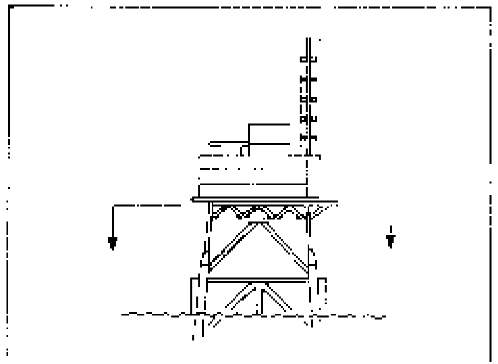
2.2.6 Water and foam/water monitors are installed on the Helideck and hangar deck. Foam is supplied by the foam/dry chemical unit.

2.2.7 Dry chemical hosereels are installed on the Helideck. They are supplied with chemical by the foam/dry chemical unit.

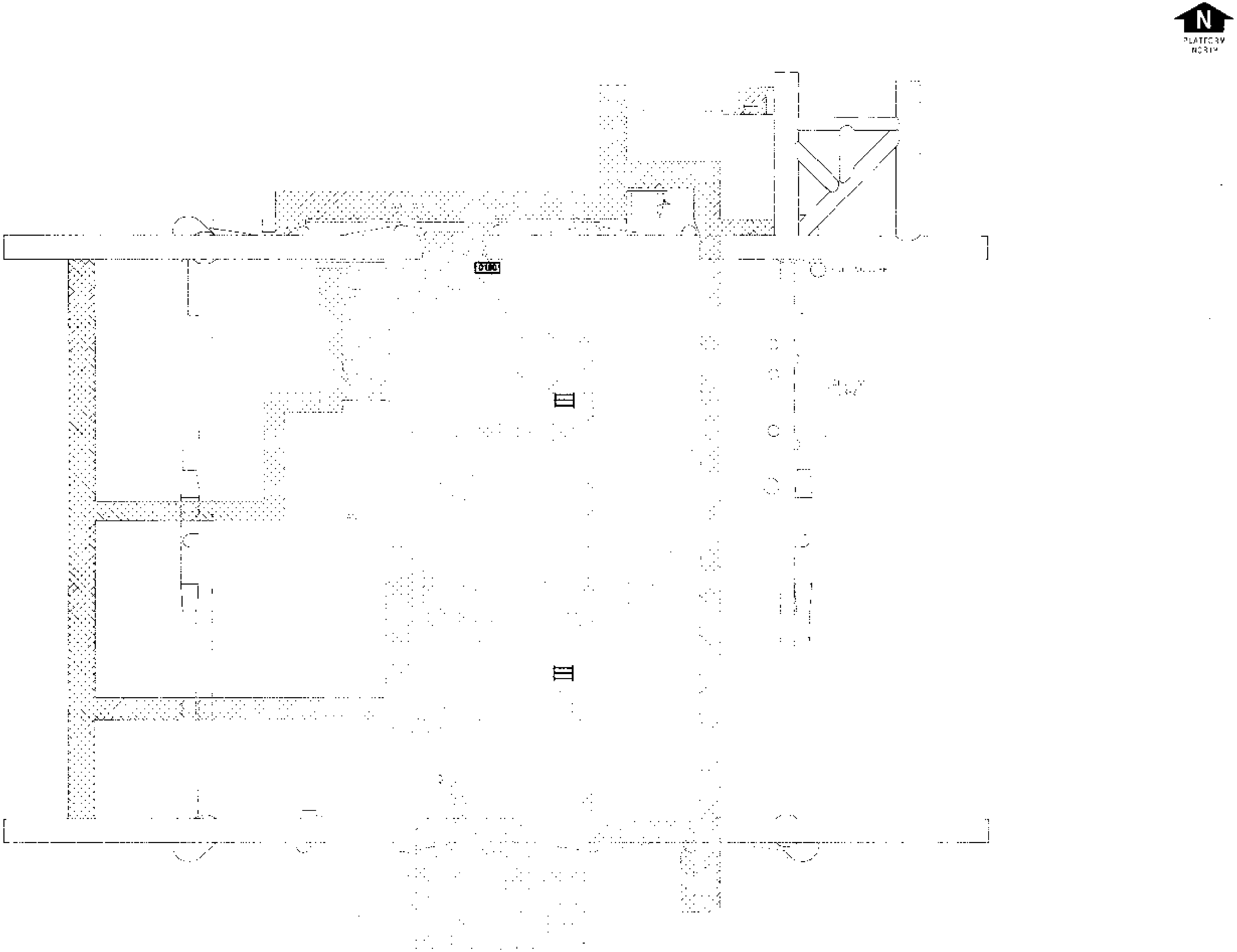
2.2.8 Three fireman's stations and a technical team station contain firefighting equipment for the protection of firefighters/rescue teams, and to enable them to effect forced entry. The equipment is contained in protective boxes at the following positions:

- (a) Fireman's Stations
  - (i) Hangar entrance on the Helideck level.
  - (ii) The roof level storage area.
  - (iii) Bridge entrance on the lower level.
- (b) Technical Team Station

  Bridge entrance on the lower level.
- (c) Spare sets of breathing apparatus are situated in the control room.



KEY VIEW



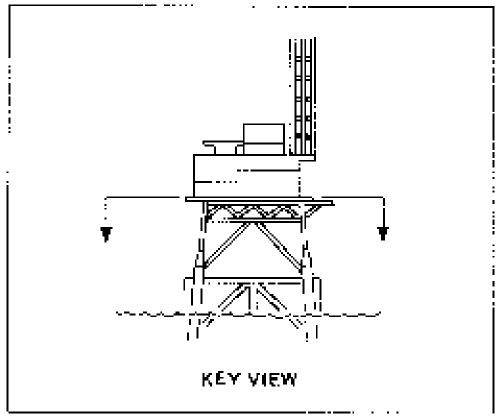
KEY

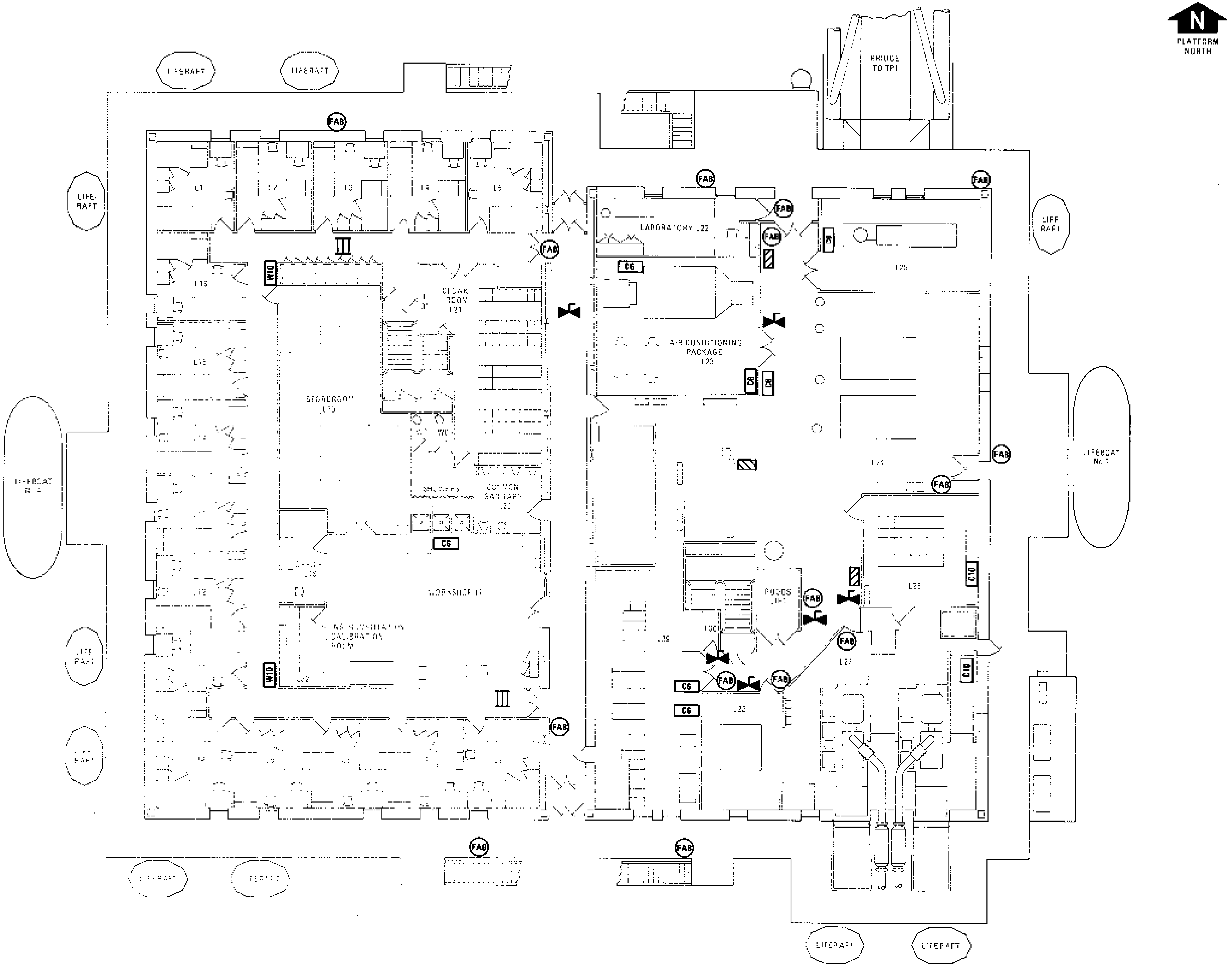
D100	100kg DRY POWDER EXTINGUISHER
☰	WATER HOSEREEL

ISSUE 1. JULY 1980

FIREFIGHTING FACILITIES
Deck Support Level

9.7.1



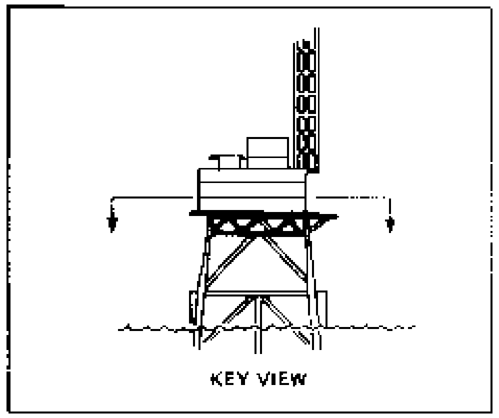


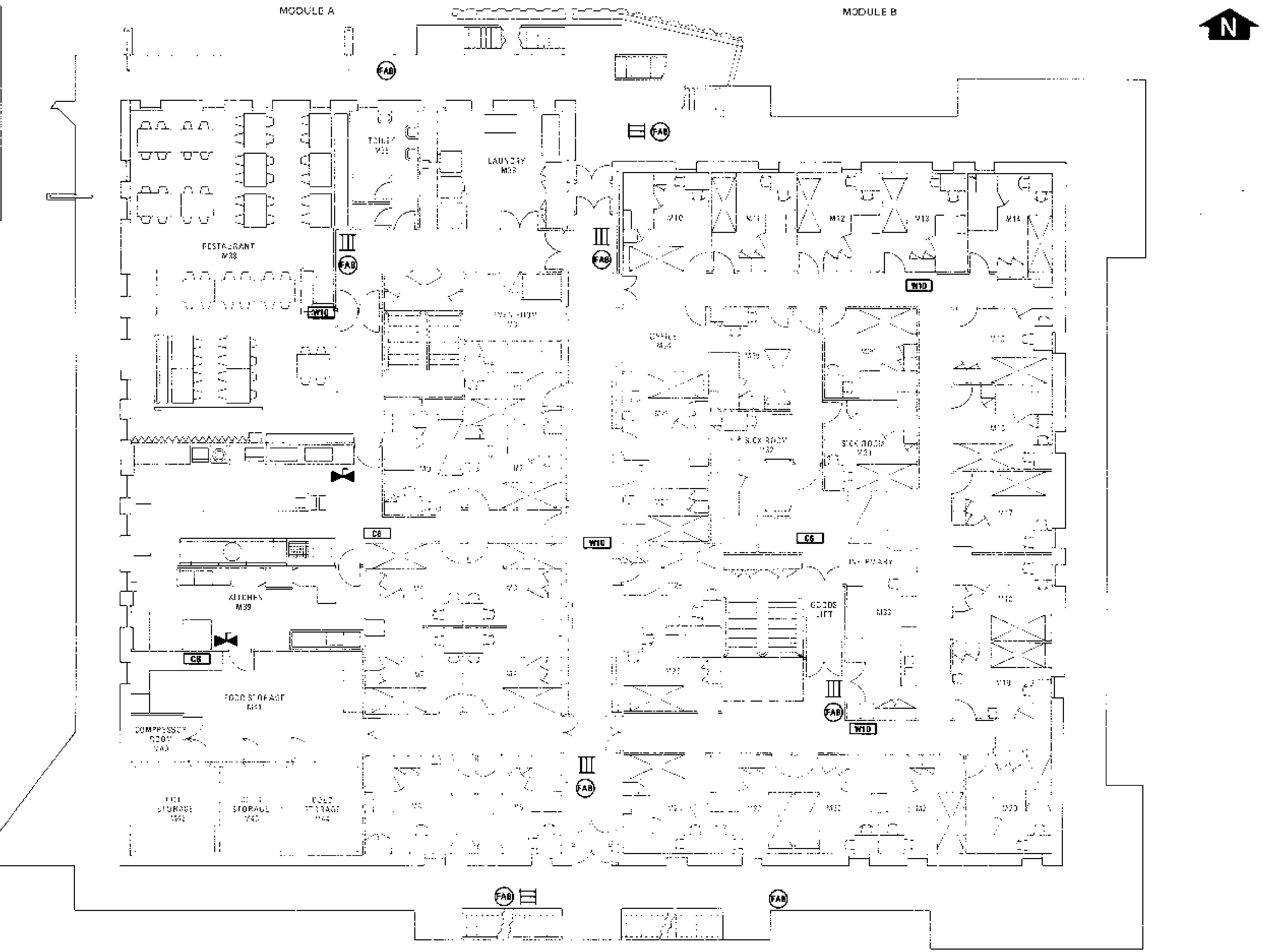
KEY	
C6	6kg CO_2 EXTINGUISHER
C10	10kg CO_2 EXTINGUISHER
W10	10kg GAS/WATER EXTINGUISHER
FAB	FIRE ALARM PUSHBUTTON
☰	WATER HOSEREEL
▨	WASHDOWN HOSEREEL
⧓	HALON MANUAL RELEASE

ISSUE 1. JULY 1980

FIREFIGHTING FACILITIES
Lower Level

9.7.2





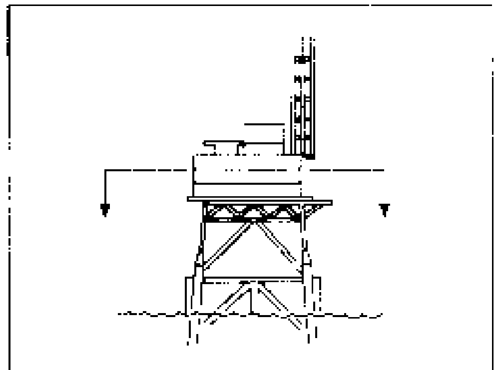
KEY

- C6 6kg CO$_2$ EXTINGUISHER
- W10 10kg GAS/WATER EXTINGUISHER
- FAB FIRE ALARM PUSHBUTTON
- Ⅲ WATER HOSEREEL
- ⧓ HALON MANUAL RELEASE

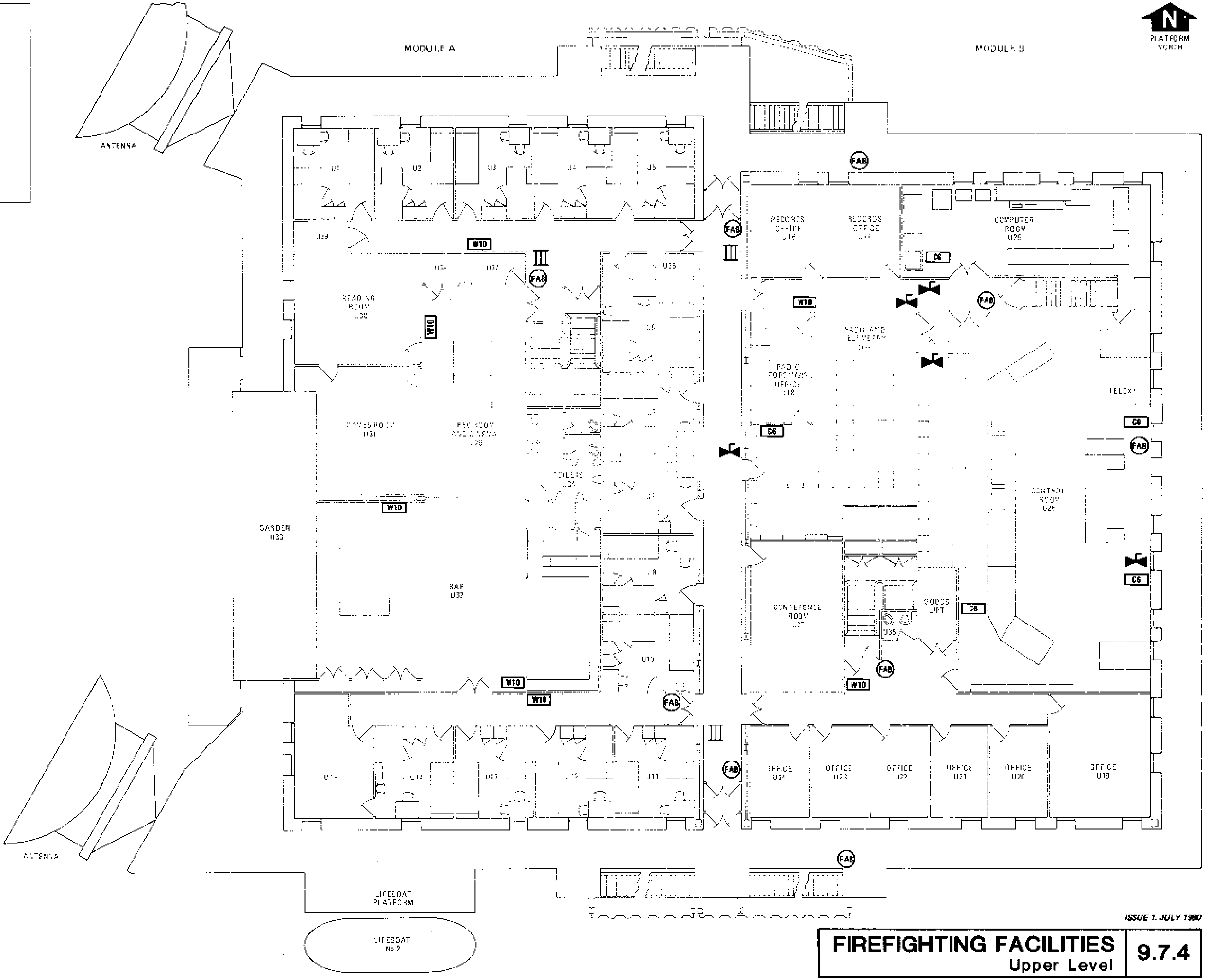
ISSUE 1. JULY 1980

FIREFIGHTING FACILITIES
Middle Level

9.7.3



KEY VIEW



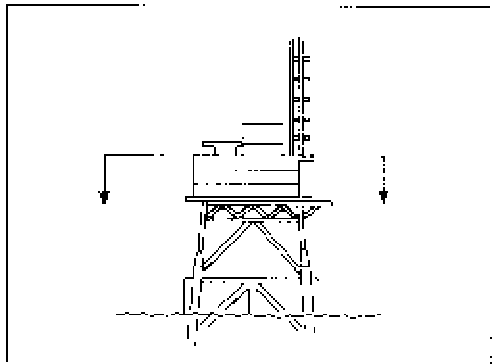
KEY

C6	6kg CO_2 EXTINGUISHER
W10	10kg GAS/WATER EXTINGUISHER
FAB	FIRE ALARM PUSHBUTTON
Ⅲ	WATER HOSEREEL
⋈	HALON MANUAL RELEASE

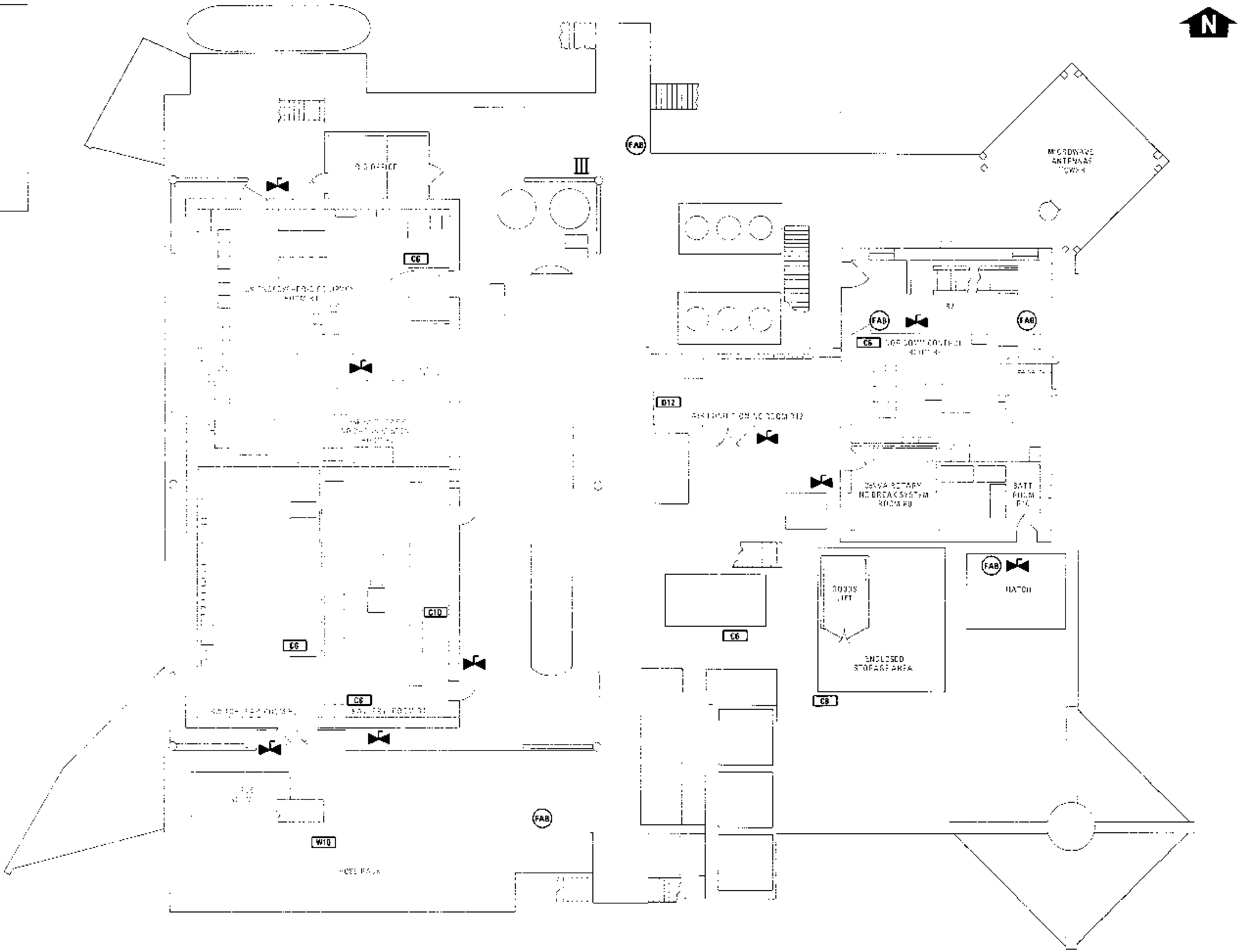
ISSUE 1. JULY 1980

FIREFIGHTING FACILITIES
Upper Level

9.7.4



KEY VIEW



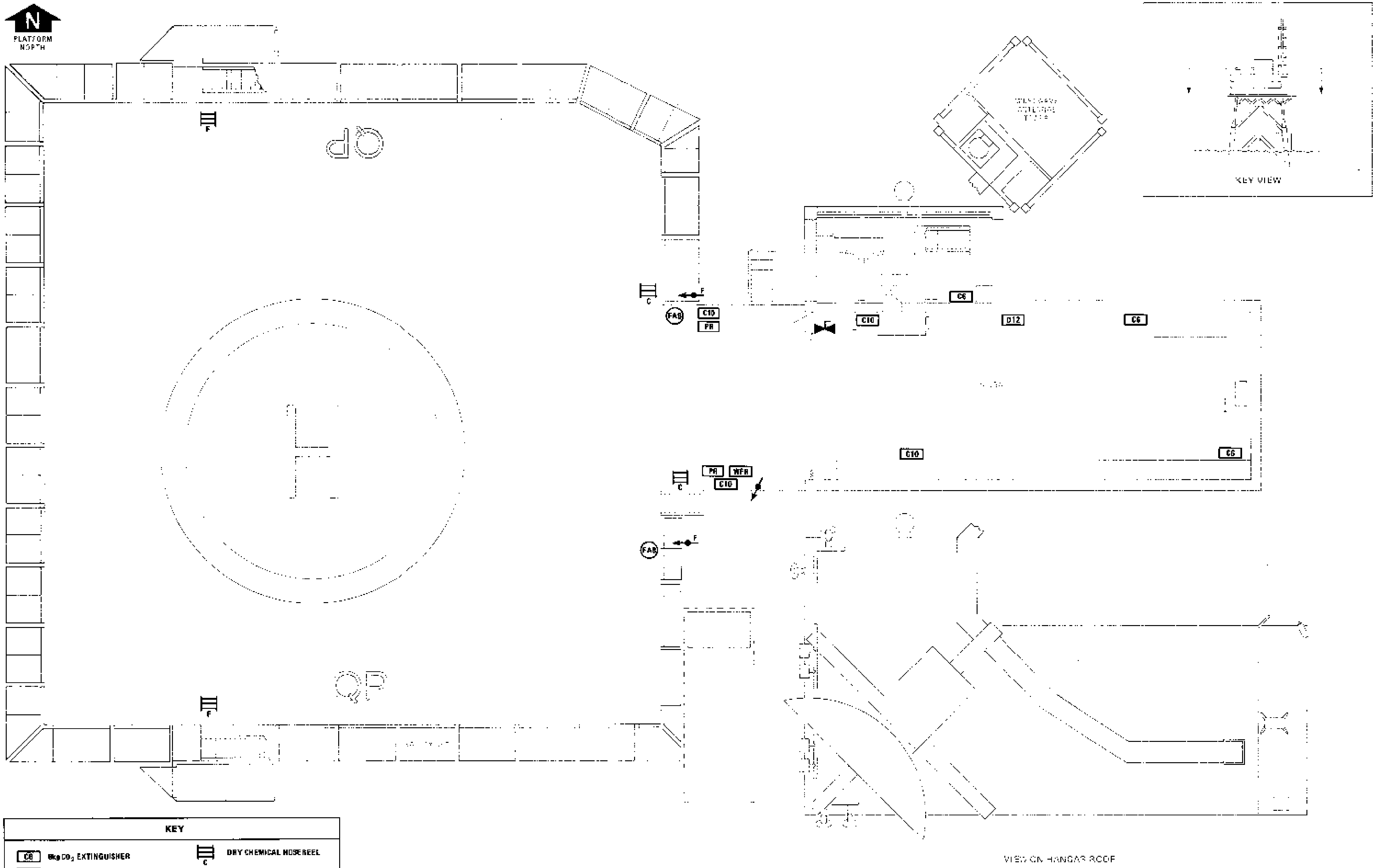
KEY

C6	6kg CO_2 EXTINGUISHER
C10	10kg CO_2 EXTINGUISHER
D12	12kg DRY POWDER EXTINGUISHER
W10	10kg GAS/WATER EXTINGUISHER
FAB	FIRE ALARM PUSHBUTTON
☰	WATER HOSEREEL
⋈	HALON MANUAL RELEASE

ISSUE 1. JULY 1980

FIREFIGHTING FACILITIES
Roof Level

9.7.5



KEY

C6	6kg CO_2 EXTINGUISHER	☰ C	DRY CHEMICAL HOSEREEL
C10	10kg CO_2 EXTINGUISHER	FAB	FIRE ALARM PUSHBUTTON
D12	12kg DRY POWDER EXTINGUISHER	←●— F	FOAM MONITOR
⧓	HALON MANUAL RELEASE	PR	POWDER RELEASE LEVER
☰ F	WATER/FOAM HOSEREEL	WFR	WATER/FOAM RELEASE LEVER
		←●—	WATER MONITOR

ISSUE 1. JULY 1990

FIRECIGHTING FACILITIES
Helideck Level

9.7.6

FIREWATER SYSTEM

1 GENERAL

1.1 The platform is served by a 10in firewater ring main which is supplied with sea water by a diesel engine driven fire pump.

1.2 Valved off-takes, throughout the ring main, supply firewater to the following firefighting equipment:

(a) Water hosereels.

(b) Water/foam hosereels.

(c) Deluge systems.

(d) Living Quarters sprinkler systems.

1.3 The firewater ring main is interconnected with a similar ring main on TP1 so that the firewater pumps on either platform can supply either or both firewater systems. Hose connections at the Hose Loading Stations permit firefighting boats to connect into the system.

1.4 In the event of a platform shutdown, washdown pump P5 is supplied with emergency power and can therefore be considered as a second fire pump supplying the four washdown hosereels.

2 DESCRIPTION

2.1 Diesel Fire Pump

2.1.1 Diesel fire pump P1 is driven by a 12-cylinder Detroit diesel engine, model 12V–71T, rated at 510 bhp at 1800 rev/min, and is located in Module B, lower level. The engine is provided with an electric (battery) start system and a pneumatic (nitrogen) start system.

2.1.2 The pump is a vertical turbine type within a stilling tube, which takes suction from sea at elevation −12.506m. It has a nominal capacity of 7570 litres/min at 14.11 bar discharge nozzle pressure.

2.1.3 Pump operation is controlled either 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 control room.

(ii) On operation of TP1 and/or TCP2 fire pumps.

(iii) When the foam/water release lever on the Helideck is operated.

(b) Manually

(i) By operation of fire alarm pushbuttons strategically located throughout the platform, and similar pushbuttons on TP1 and TCP2.

(ii) By operation of pushbuttons near the diesel engine (one each for electric and pneumatic start).

2.1.4 An Auto/Start test switch near the diesel engine is provided to enable the pump and engine to be tested.

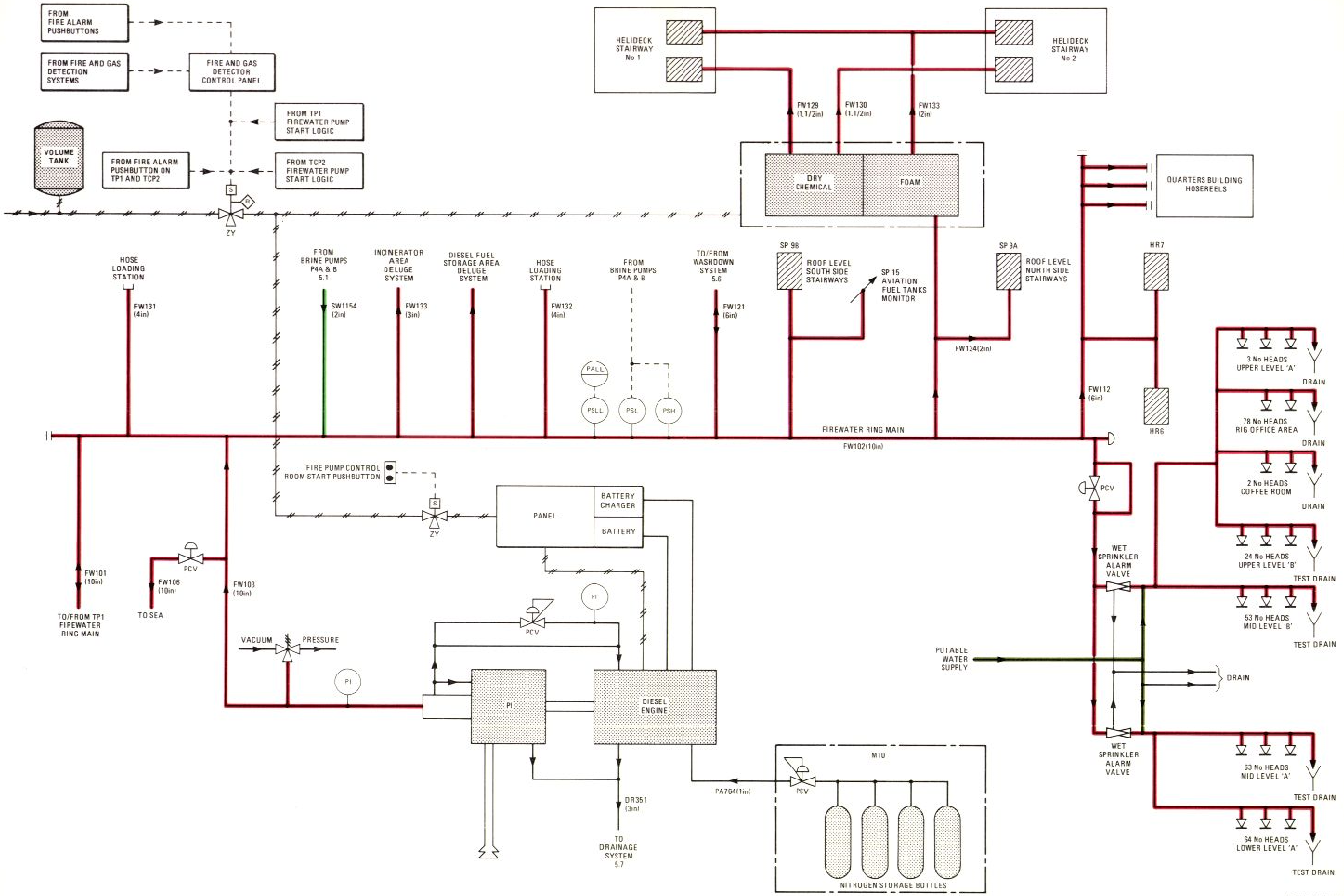
2.2 Control

2.2.1 The firewater ring main is maintained at a pressure of 6.18 bar by one of the brine pumps serving the water makers, which runs continuously during water maker operation. Should the brine pump fail, a pressure switch, set at 3.08 bar, will cause alarm indication in the control room.

2.2.2 If both water makers 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.

2.2.3 When the fire pump is running, ring main pressure is maintained by a pressure control valve, excess sea water being discharged overboard. This valve is also used to discharge sea water overboard during pump tests.

END



FIREWATER SYSTEM 9.8

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 designed 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, which includes ventilation shutdown and the closure of associated fire dampers.

(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 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'.

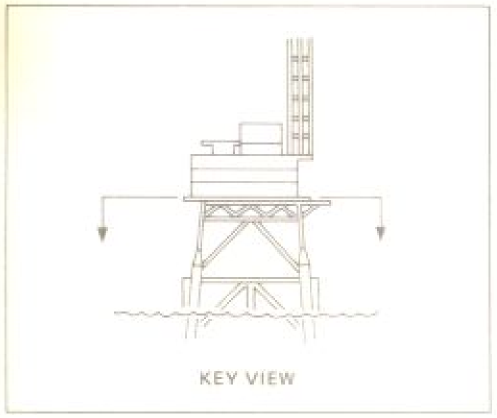
2.5 An audible warning will sound prior to and during the release of BTM.

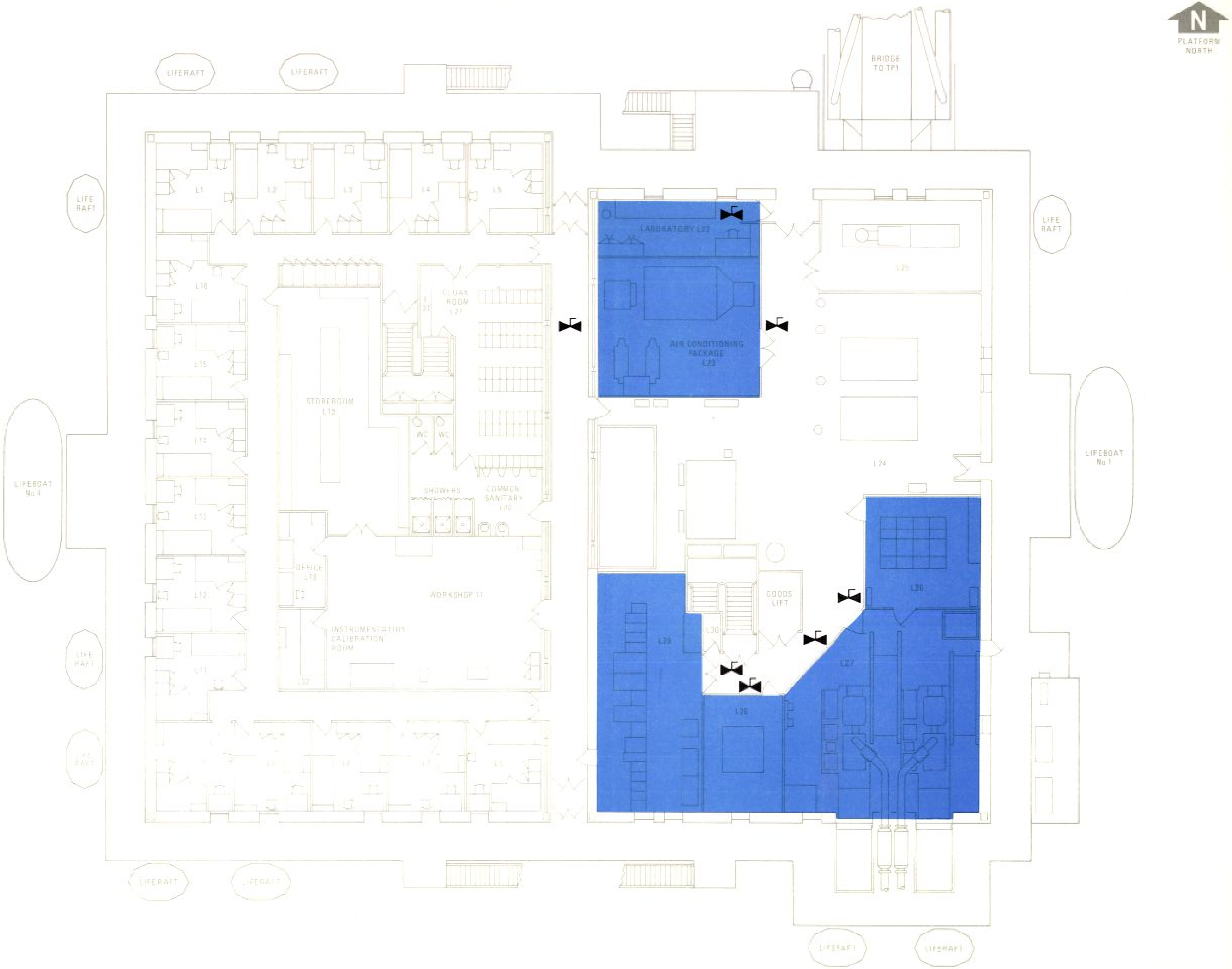
3. LOCATION OF HALON SYSTEMS

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.

Area	Weight of Halon (kg)	Number of Containers
Helideck Level		
Radio Room, R11	21.3	1
Roof Level		
Tropospheric Equipment Room, R1	60.3	2
35kVA Rotary 'No Break' Room, R2	14.5	1
Switchgear Room, R3	45.3	1
Battery Room, R4	47.6	1
Control Room, R8	30.4	1
35kVA Rotary 'No Break' Room, R9	9.9	1
Battery Room, R10	9.5	1
Air Conditioning Room, R12	29.1	1
Upper Level		
Computer Room, U25	33.1	1
Control Room, U26	85.2	2
Radio and Telemetry Room, U28	41.3	1
Middle Level		
Kitchen, M39	5.0	1
Lower Level		
Laboratory, L22	12.7	1
Air Conditioning Plant, L23	51.7	2
5.5kV Switchgear Room, L26	29.9	1
Generator Room, L27	84.4	2
Transformer Room, L28	22.2	1
MCC, L29	55.8	2

NOTE: The Halon system installed in the kitchen (M39) is manually operated only.





KEY

🟦	AREA PROTECTED BY HALON
⧓	BREAK GLASS MANUAL RELEASE

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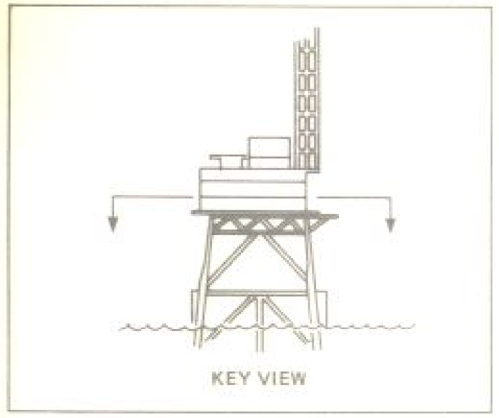
HALON SYSTEMS
Lower Level

9.9.1



KEY

🟦	AREA PROTECTED BY HALON
⧓	BREAK-GLASS MANUAL RELEASE

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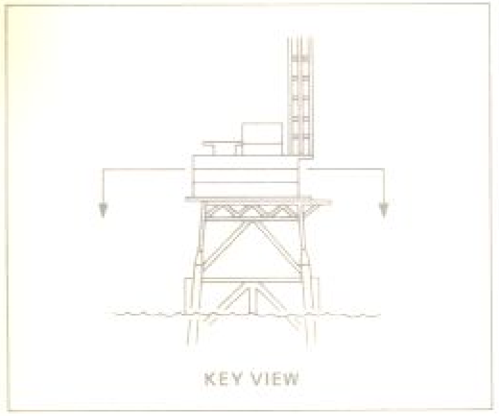
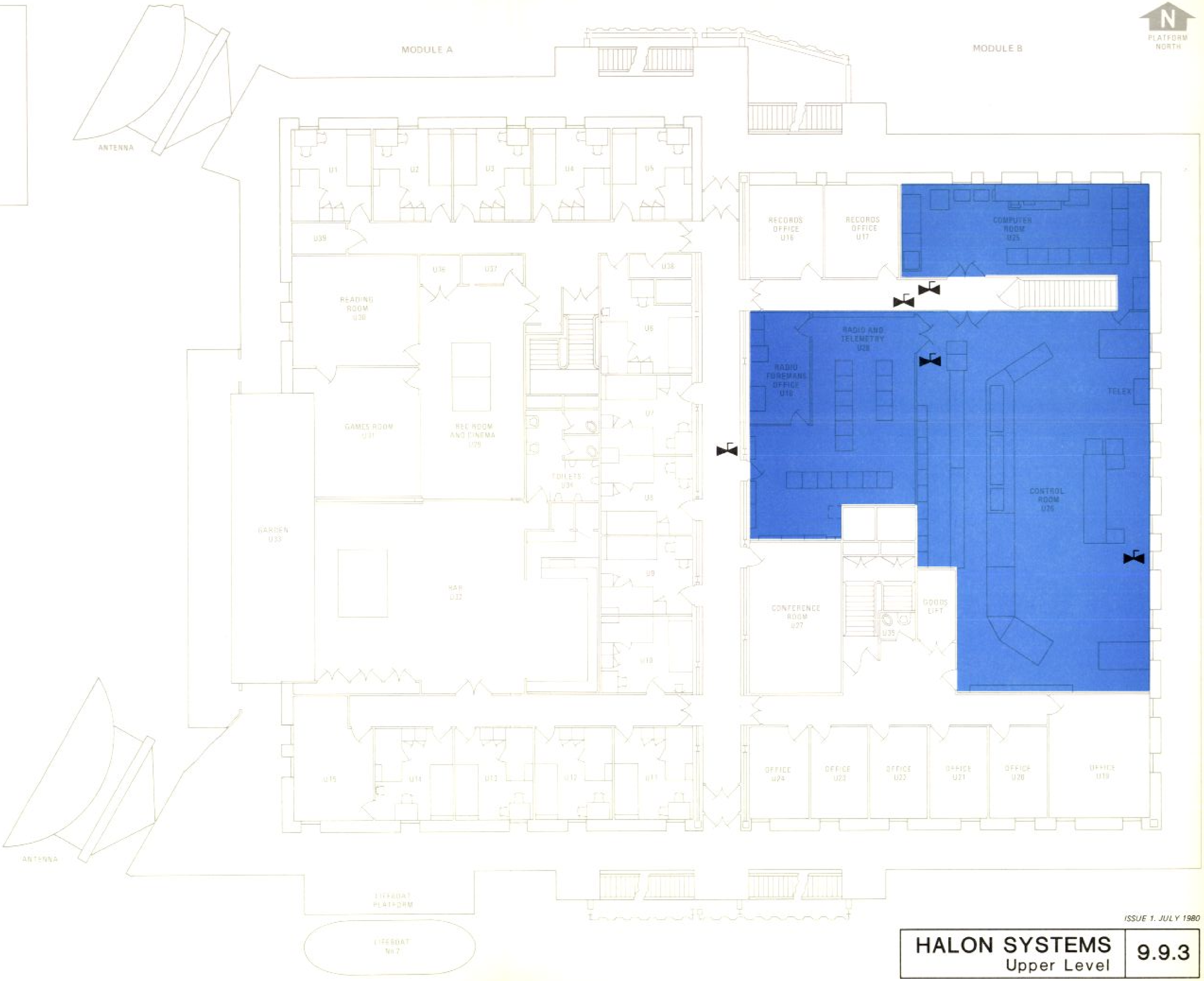
HALON SYSTEMS
Middle Level

9.9.2





KEY

🟦	AREA PROTECTED BY HALON
⧓	BREAK-GLASS MANUAL RELEASE

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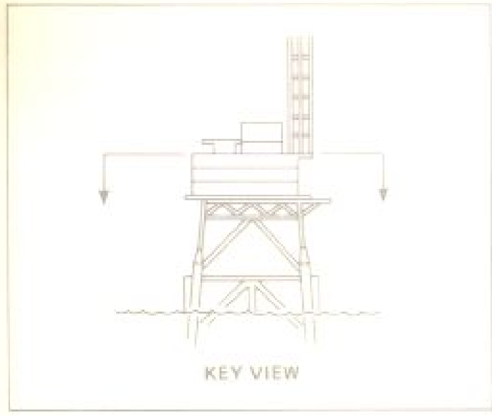
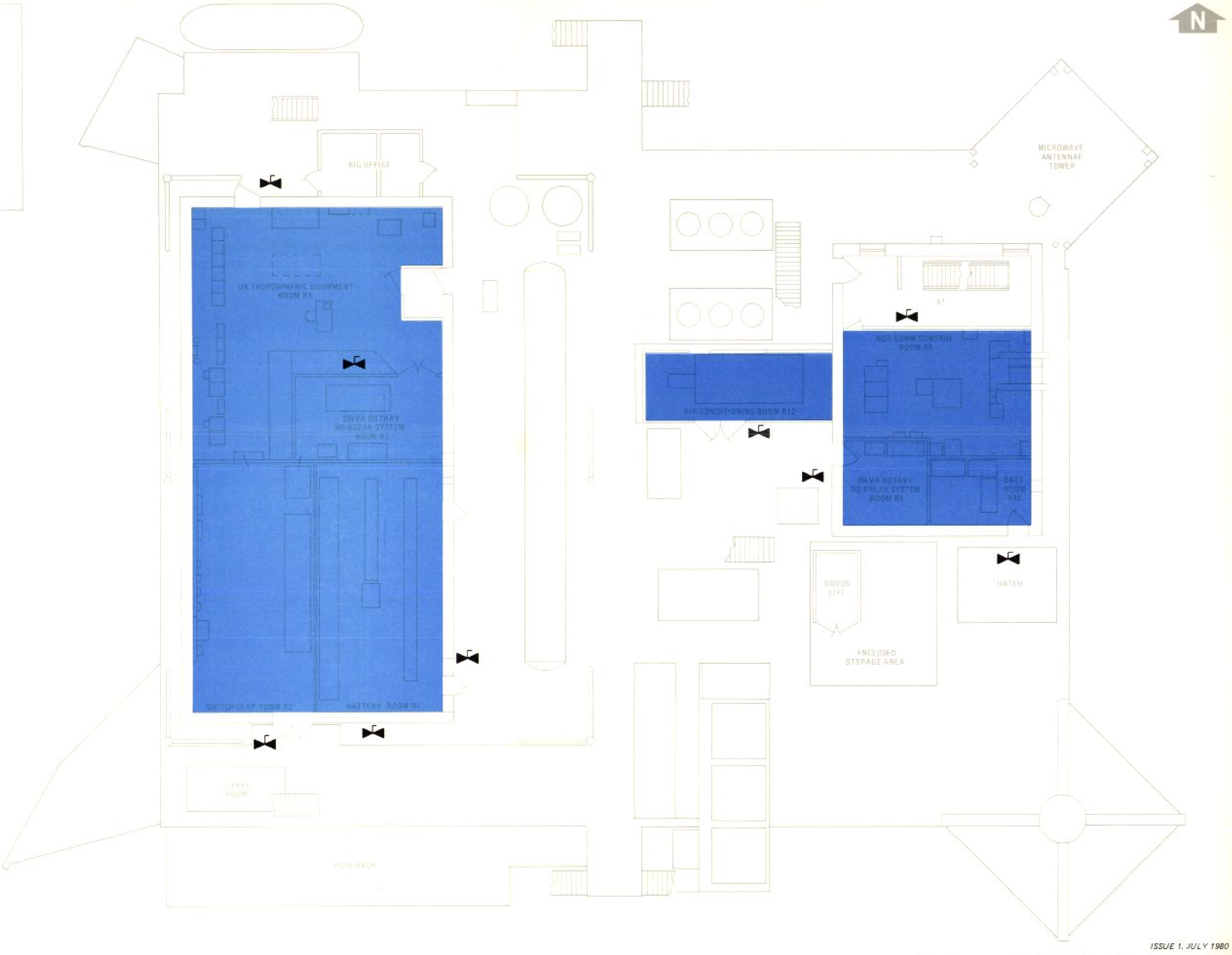
HALON SYSTEMS
Upper Level
9.9.3





KEY

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⧓	BREAK-GLASS MANUAL RELEASE

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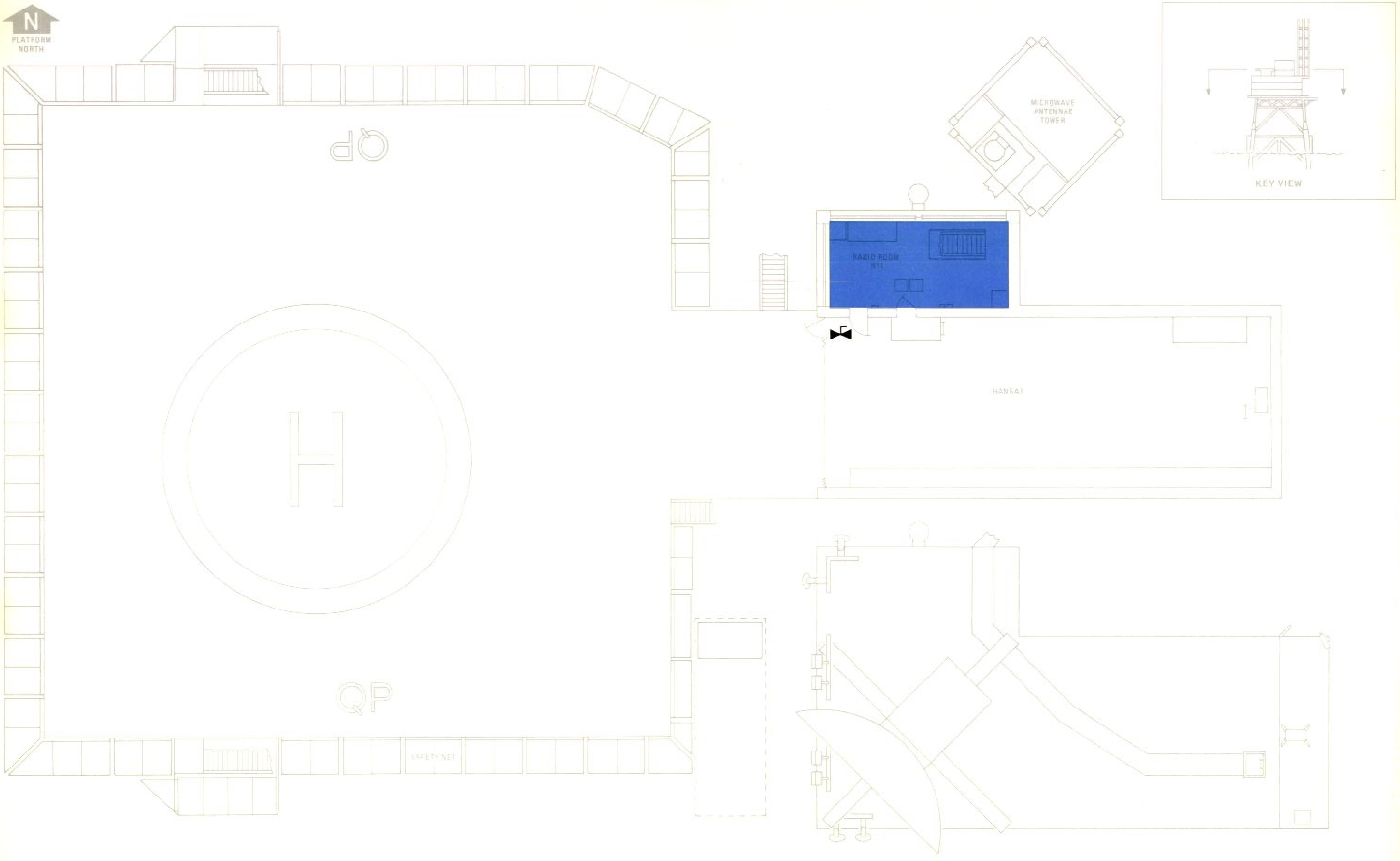
HALON SYSTEMS
Roof Level
9.9.4



KEY

🟦	AREA PROTECTED BY HALON
⧓	BREAK-GLASS MANUAL RELEASE

ISSUE 1. JULY 1980

HALON SYSTEMS
Helideck Level

9.9.5

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 or 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 Communication equipment and equipment vital to the safety of personnel in an emergency is protected by additional firewalls.

1.4 The platform is divided into four zones for fireproofing, these are:

(a) Module A lower and middle levels.

(b) Module A upper level.

(c) Module B lower level.

(d) Module B middle and upper levels.

2 DESCRIPTION

2.1 Module A

2.1.1 The lower and middle levels are separated from the upper level by a horizontal sheet steel bulkhead, upon which are attached layers of vermiculite, cork and concrete.

2.1.2 The stairs and goods lift from the middle to the upper levels are contained within the lower and middle levels' zone by a 6mm sheet steel extension from the horizontal bulkhead.

2.1.3 The galley, which is located on the middle level, has walls and a false ceiling constructed of Isolamin which conform to B15 fire rating. The serving hatch has a sliding steel shutter.

2.1.4 Module A is separated from Module B by a wall constructed of Isolamin.

2.2 Module B

2.2.1 The lower level is separated from the middle and upper levels by a horizontal bulkhead, upon which are attached layers of vermiculite, cork, concrete and carpet (French classification M2).

2.2.2 The stairs and goods lift from the lower to the middle levels are contained within the middle and upper levels' zone by a 6mm sheet steel extension from the horizontal bulkheads.

2.2.3 Module B is separated from Module A by a wall constructed of Isolamin.

2.3 Penetrations

2.3.1 Stairwell doors which pierce both horizontal bulkheads are self-closing and conform to B15 fire rating. Access doors to specific platform areas are also self-closing.

2.3.2 Service ducts which penetrate these bulkheads are internally sealed with 6mm steel plate, through which the services pass via Class A transits.

2.3.3 The internal stairwell from Module B upper level to the roof is enclosed in 6mm steel. The door at the foot conforms to B15 fire rating.

2.3.4 The goods lift shaft, which runs from Module B lower level to the roof, is encased in 6mm steel. Access doors conform to B15 fire rating.

2.4 Vital Equipment Protection

2.4.1 Internal floor to ceiling walls constructed of 6mm steel plate, and access doors conforming to B15 fire rating, are installed in the following:

(a) Fire Pump Room L25.

(b) Emergency Generator Room L27.

(c) MCC Room L29.

2.4.2 To protect communications equipment from a Helideck hangar fire, the hangar floor over rooms R8, R9 and R10 and the internal wall of R11, conform to A60 fire rating.

2.4.3 Self-closing doors are fitted to Halon-protected areas.

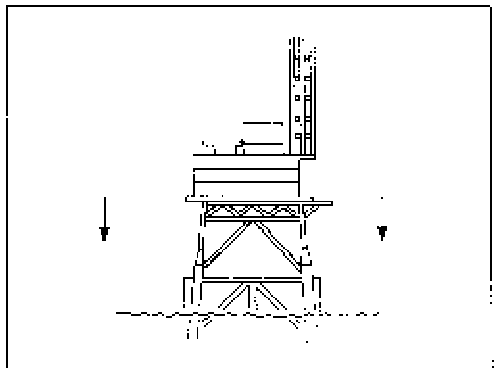
2.5 Corridors

2.5.1 The walls of the main north and south exit corridors, which are situated in the centre of the lower, middle and upper levels, are constructed of Isolamin in two sections to give a cavity effect and A60 fire rating. The top section of the walls at each level are constructed of Navalite.

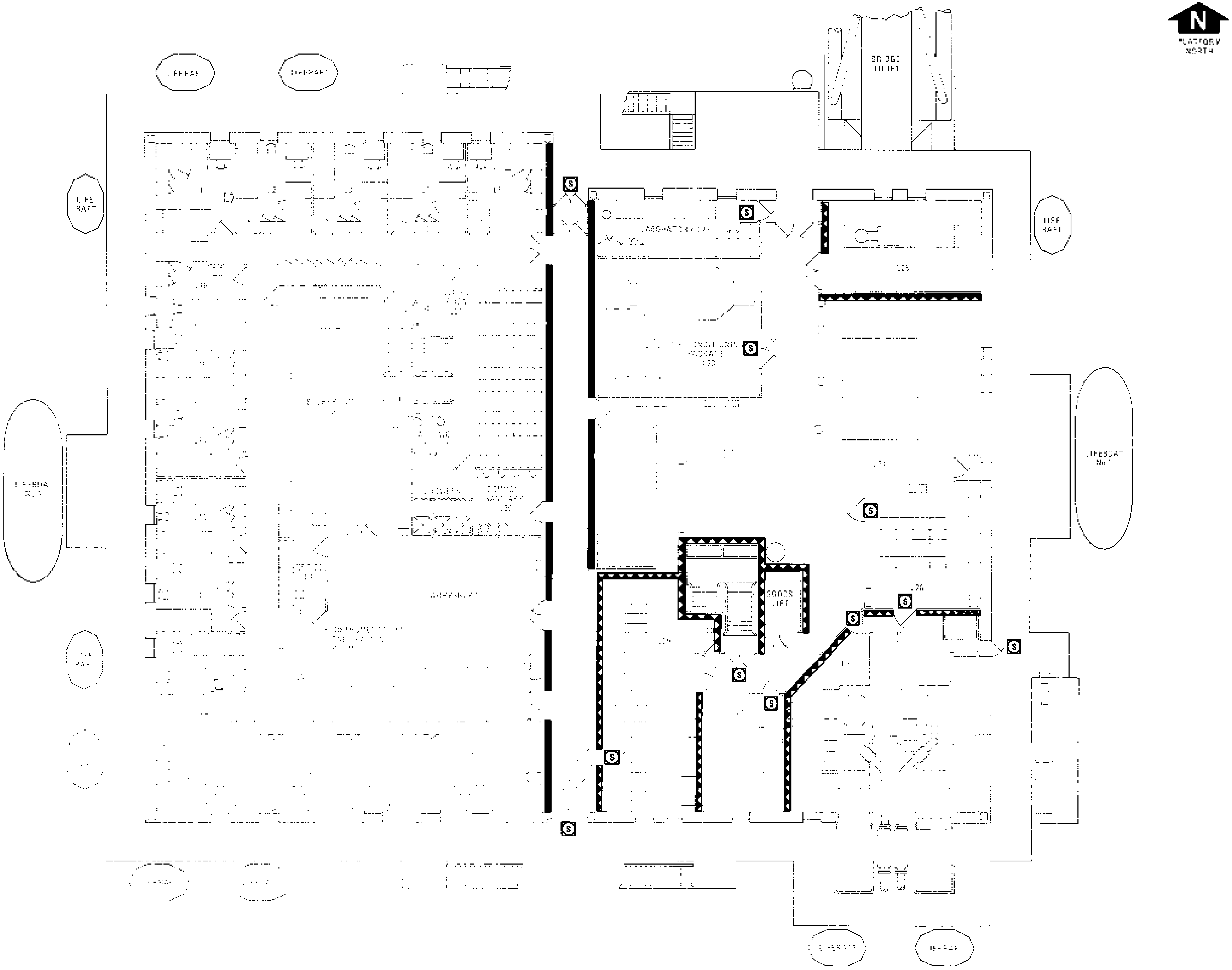
2.5.2 The walls of the remaining minor corridors, which are similar to a standard two-man room, are constructed of double skin Isolamin, and conform to B15 fire rating.

2.5.3 The doors at each level which exit onto external walkways are self-closing, and conform to B15 fire rating, excluding the east wall door of MCC Room L29, which is constructed of 6mm sheet steel.

END



KEY VIEW



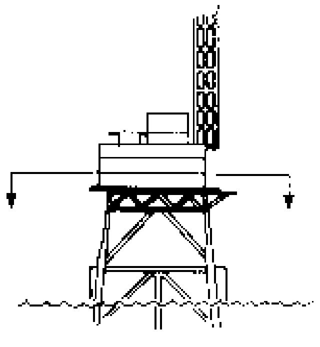
KEY

- Ⓢ SELF-CLOSING DOOR
- ▬ A60 FIREWALL
- ▼▼▼ 6mm STEEL FIRE WALL

ISSUE 1. JULY 1980

FIREWALLS AND FIREPROOFING
Lower Level

9.10.1



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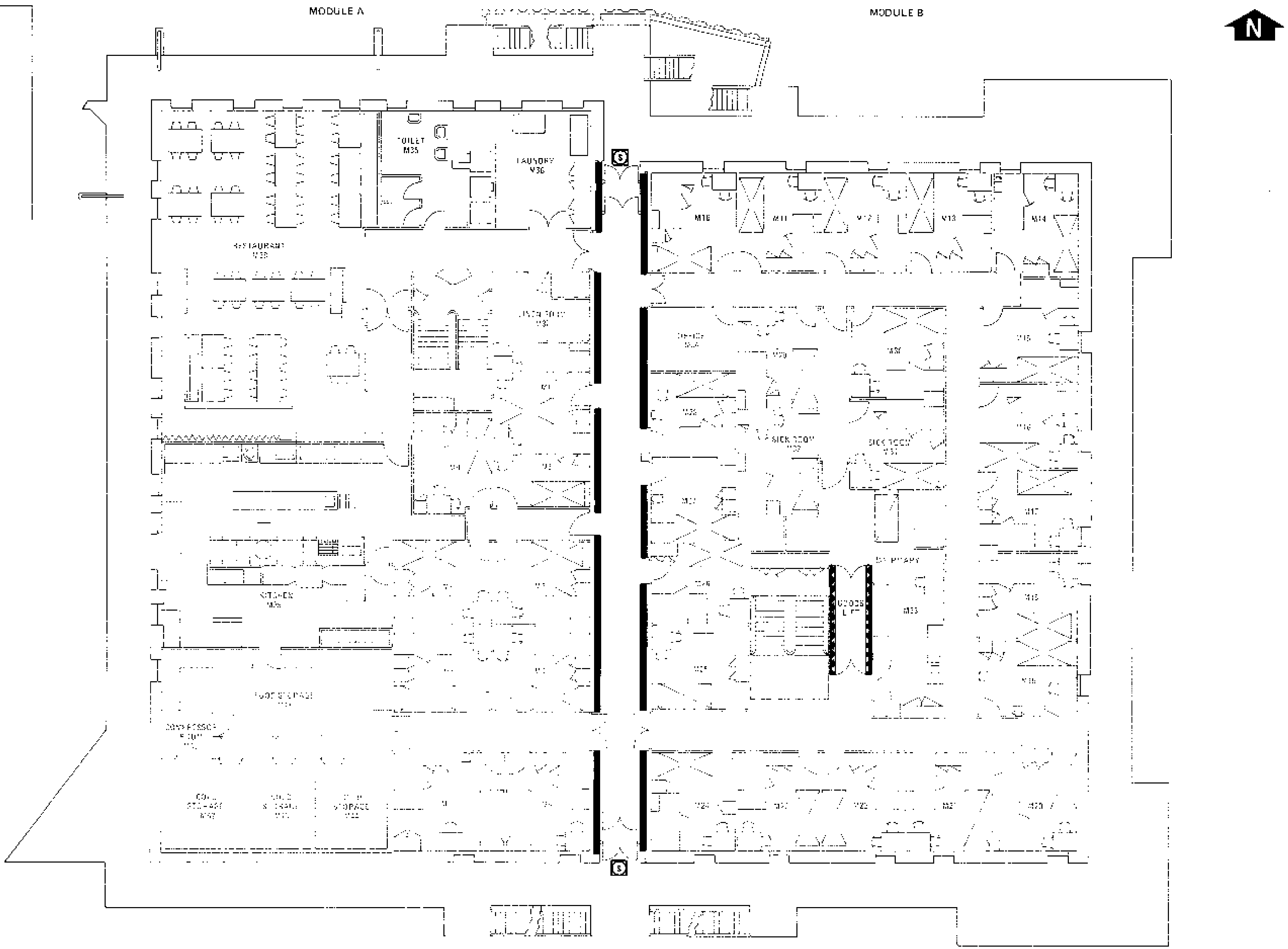


KEY

▣ SELF-CLOSING DOOR

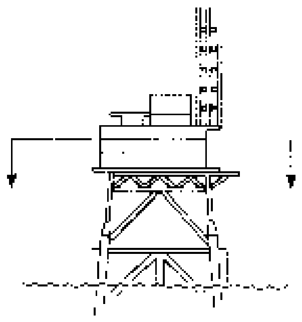
▬ A-60 FIRE WALL

▬ 6mm STEEL FIRE WALL

ISSUE 1, JULY 1980

FIREWALLS AND FIREPROOFING
Middle Level

9.10.2



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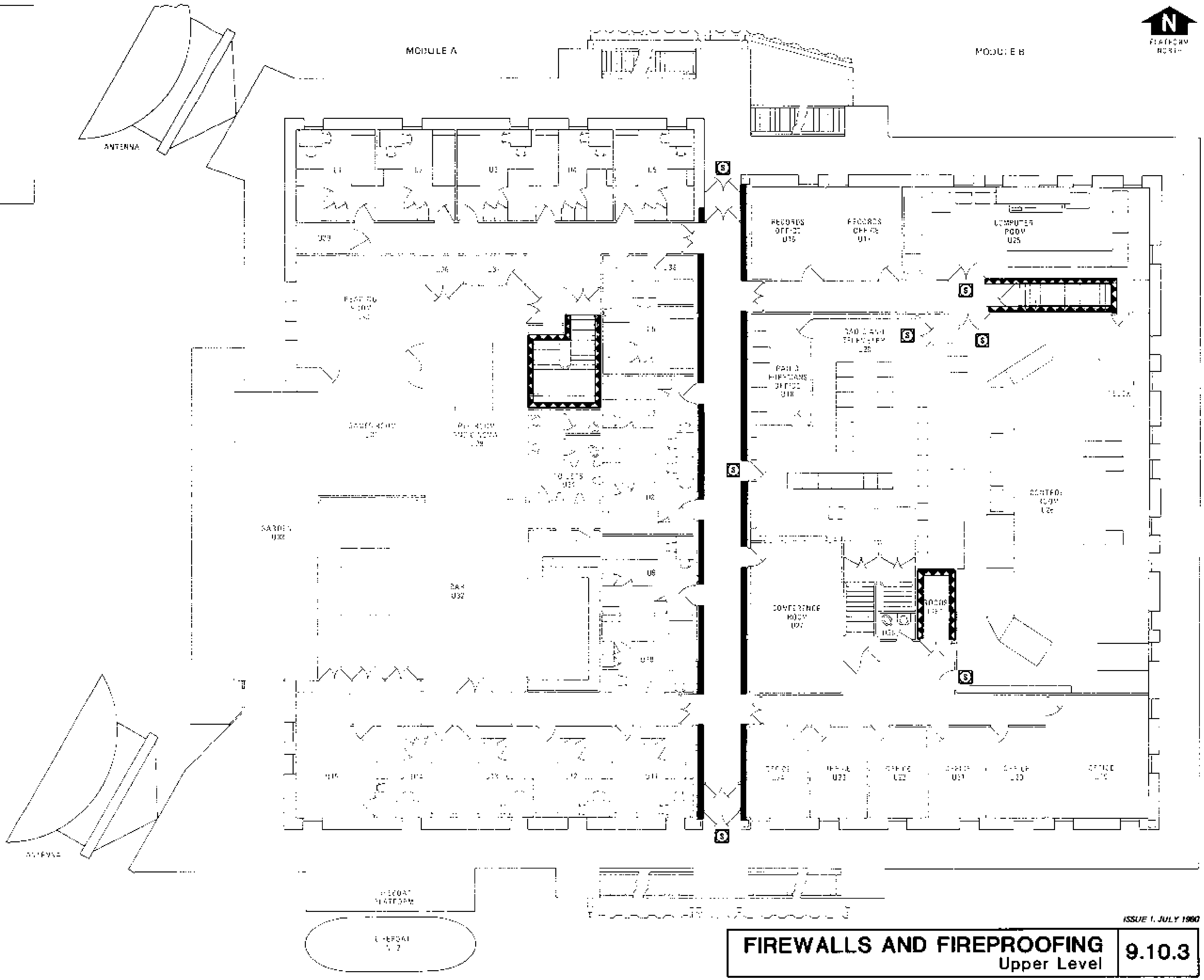


KEY

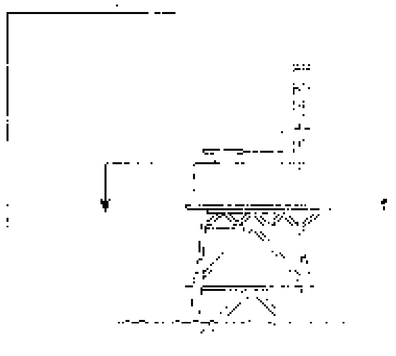
S	SELF-CLOSING DOOR
▬	A60 FIRE WALL
▲▼▲	8mm STEEL FIRE WALL

ISSUE 1, JULY 1980

FIREWALLS AND FIREPROOFING

Upper Level

9.10.3



KEY VIEW

KEY

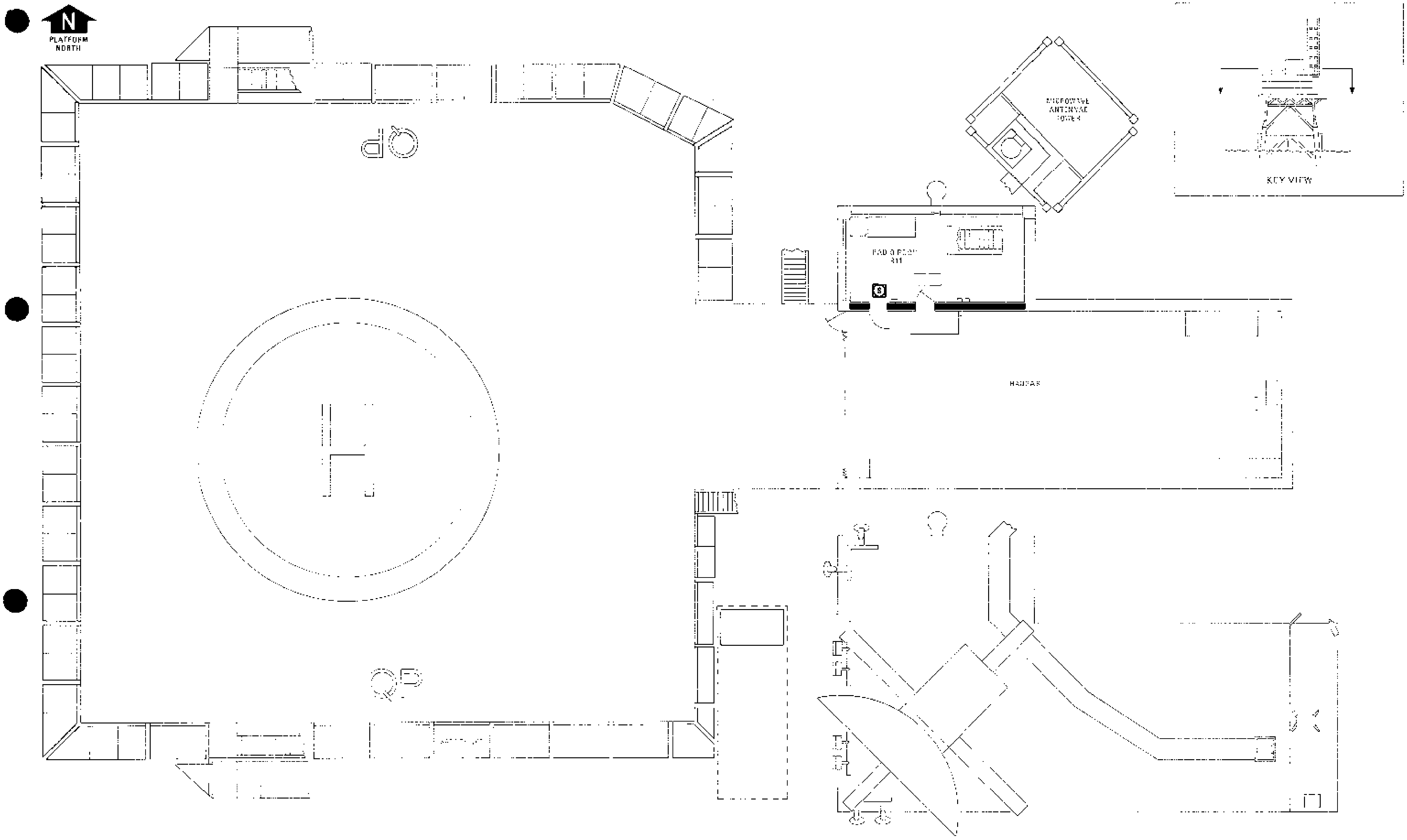
S	SELF-CLOSING DOOR
▲▲▲▲▲	6mm STEEL FIRE WALL

ISSUE 1. JULY 1980

FIREWALLS AND FIREPROOFING

Roof Level

9.10.4



VIEW ON HANGAR ROOF

KEY

S	SELF-CLOSING DOOR
▬	A60 FIRE WALL

ISSUE 1, JULY 1990

FIREWALLS AND FIREPROOFING
Helideck Level

9.10.5

FIRST AID

1 GENERAL

1.1 Platform QP is equipped with medical facilities to cater for the total complement of 120 men working on QP, TP1 and TCP2.

1.2 Two sick rooms and an infirmary are located on the middle deck of QP.

1.3 First aid kits and stretchers are distributed around the platform 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 publicised methods of artificial respiration, the most effective of which are Mouth-to-Mouth (Mouth-to-Nose) and the Silvester method.

2.1.2 Whichever method is used, it must be commenced immediately the patient is discovered.

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 10 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).

2.3 Silvester Method

If through some injury to the face, Mouth-to-Mouth (Mouth-to-Nose) cannot be used, the Silvester Method is recommended as an alternative. Proceed as follows:

(1) Lay the patient on his back.

(2) Place a support (folded jacket or similar) under the patient's shoulders (Fig 8).

(3) Clear the patient's mouth of obstructions, eg water, oil, debris, vomit, false teeth, etc.

(4) Kneel astride the patient's head (Fig 9).

(5) Grasp the patient's wrists and cross them over the lower part of his chest (Fig 9).

(6) Rock forward and press down on the patient's chest (Fig 9).

(7) Rock back and swing the patient's arms out and to the rear as far as possible (Figs 10 and 11).

(8) Repeat at a rate of 10 to 12 cycles per minute until normal breathing resumes, or all hope is abandoned.

(9) Keep the patient's mouth clear at all times.

RESPIRATORY RESUSCITATION

Figure 1

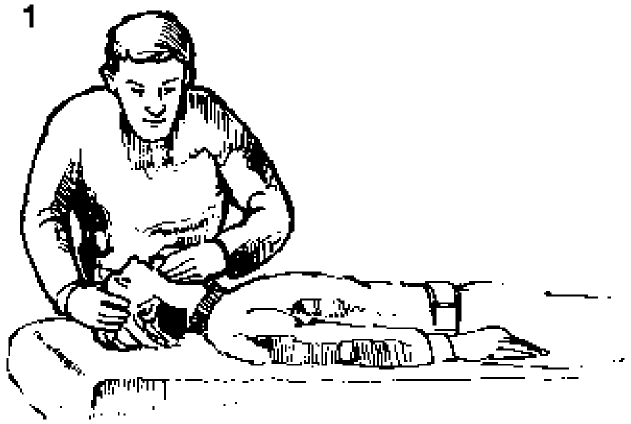


Figure 2

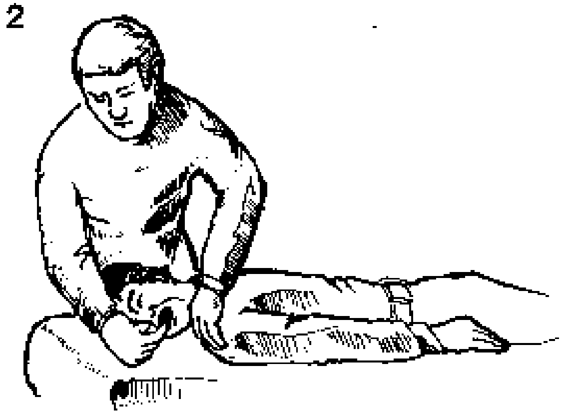


Figure 3

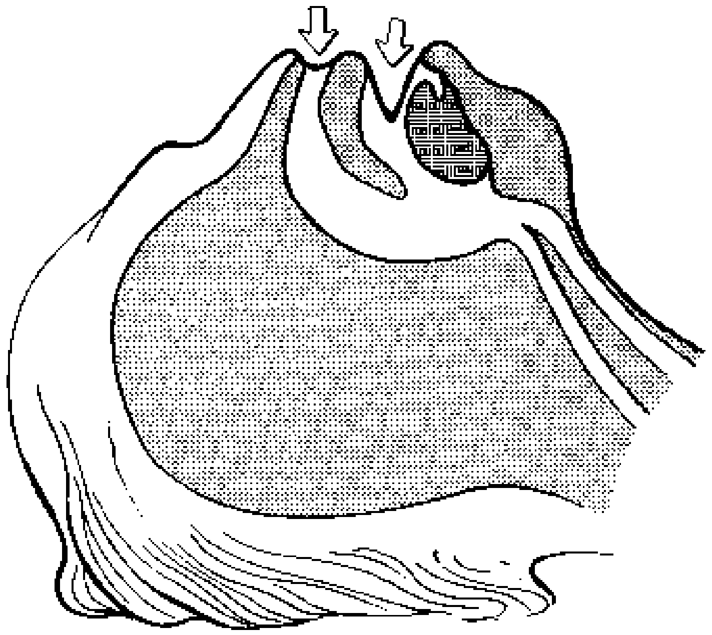


Figure 4

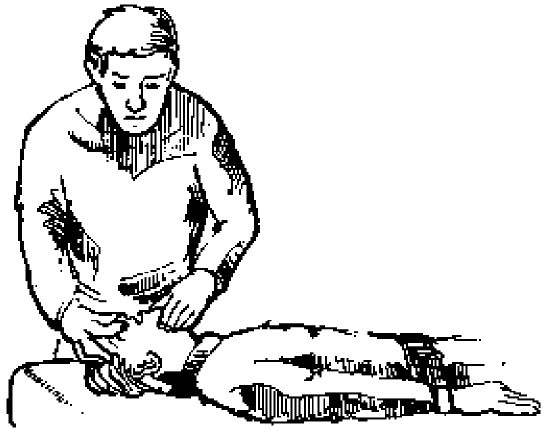


Figure 5

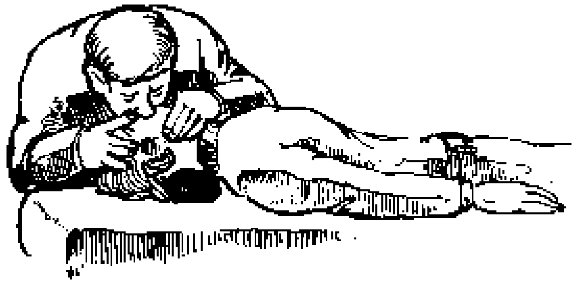


Figure 6

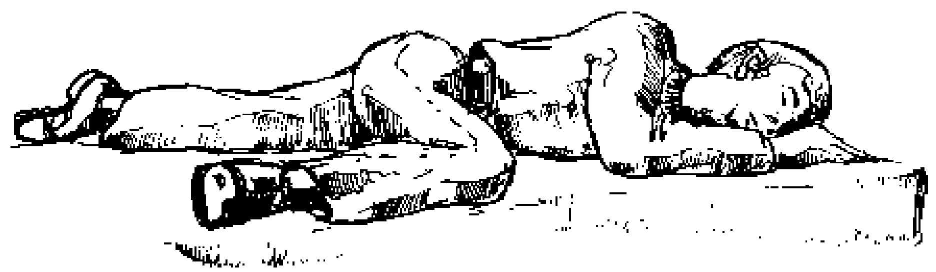
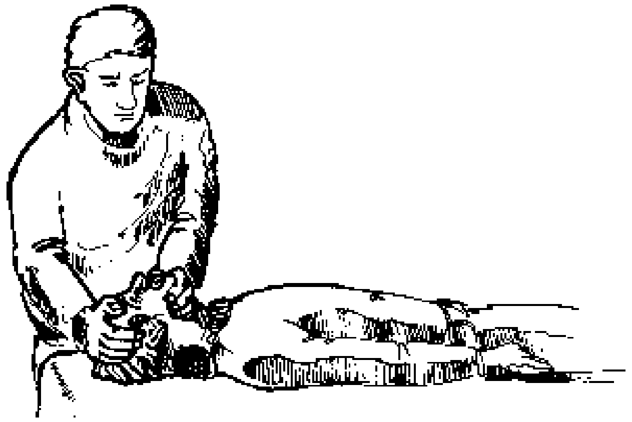


Figure 7



Mouth-to-Mouth
(Mouth-to-Nose)

Figure 8

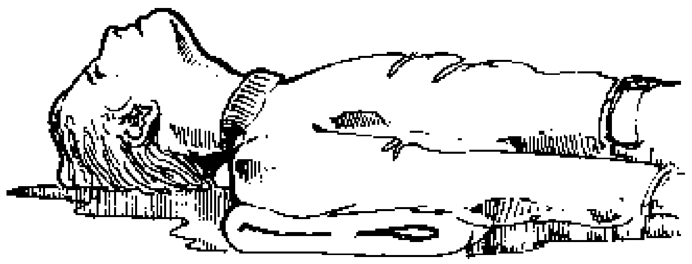


Figure 9

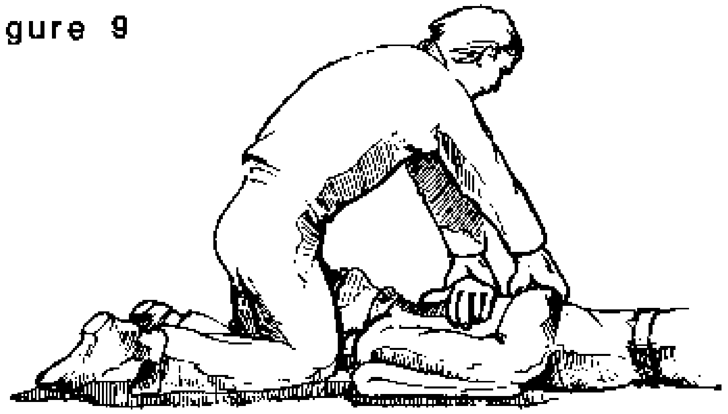


Figure 10

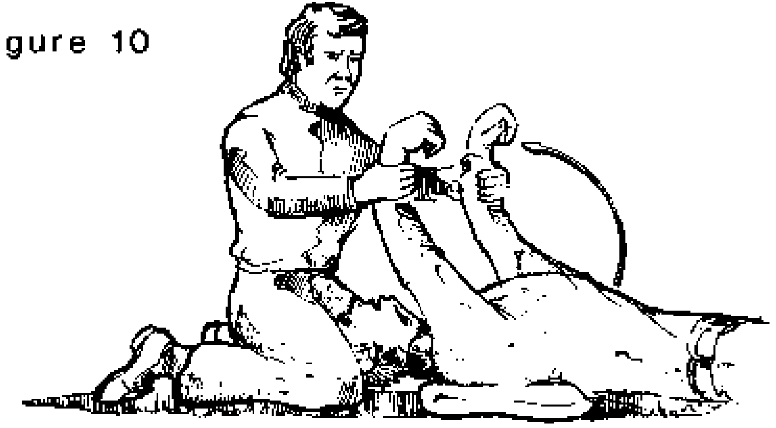
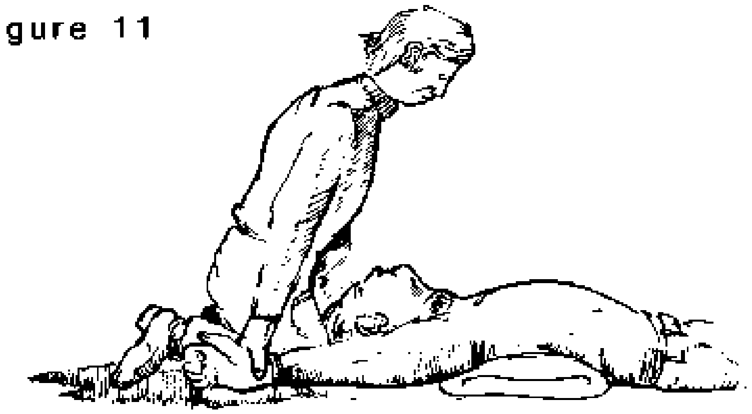


Figure 11



Silvester

ESCAPE ROUTES

1 GENERAL

1.1 Escape routes are clear routes leading from the accommodation and working areas to the lifeboat stations located at the roof, upper and lower levels and to the liferaft stations at the lower level of the platform.

1.2 There are exit points from each module or area which lead to an escapeway.

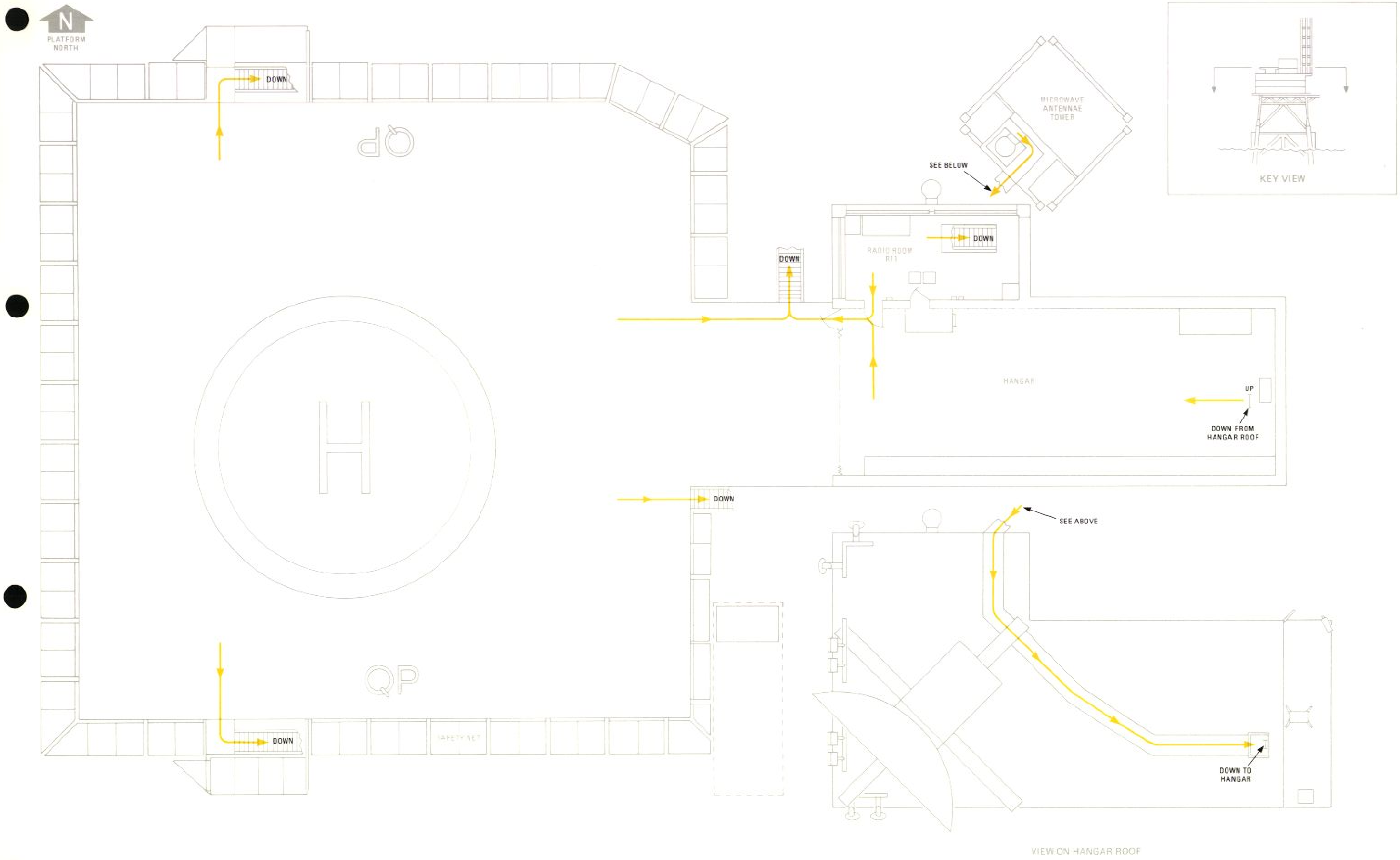
1.3 All regularly manned areas are provided with at least two well-defined escape routes which are indicated by prominently displayed signs. To avoid confusion and/or panic, personnel should, if possible, never move along escape routes against the directional arrows.

1.4 Personnel are allotted a lifeboat station on arrival on the platform, and should familiarise themselves with its position and the escape routes thereto.

1.5 In the event of main power failure, adequate lighting of the escape routes is provided by the emergency lighting system.

1.6 The escape routes are indicated on Diagrams 9.12.1 to 9.12.6.

END

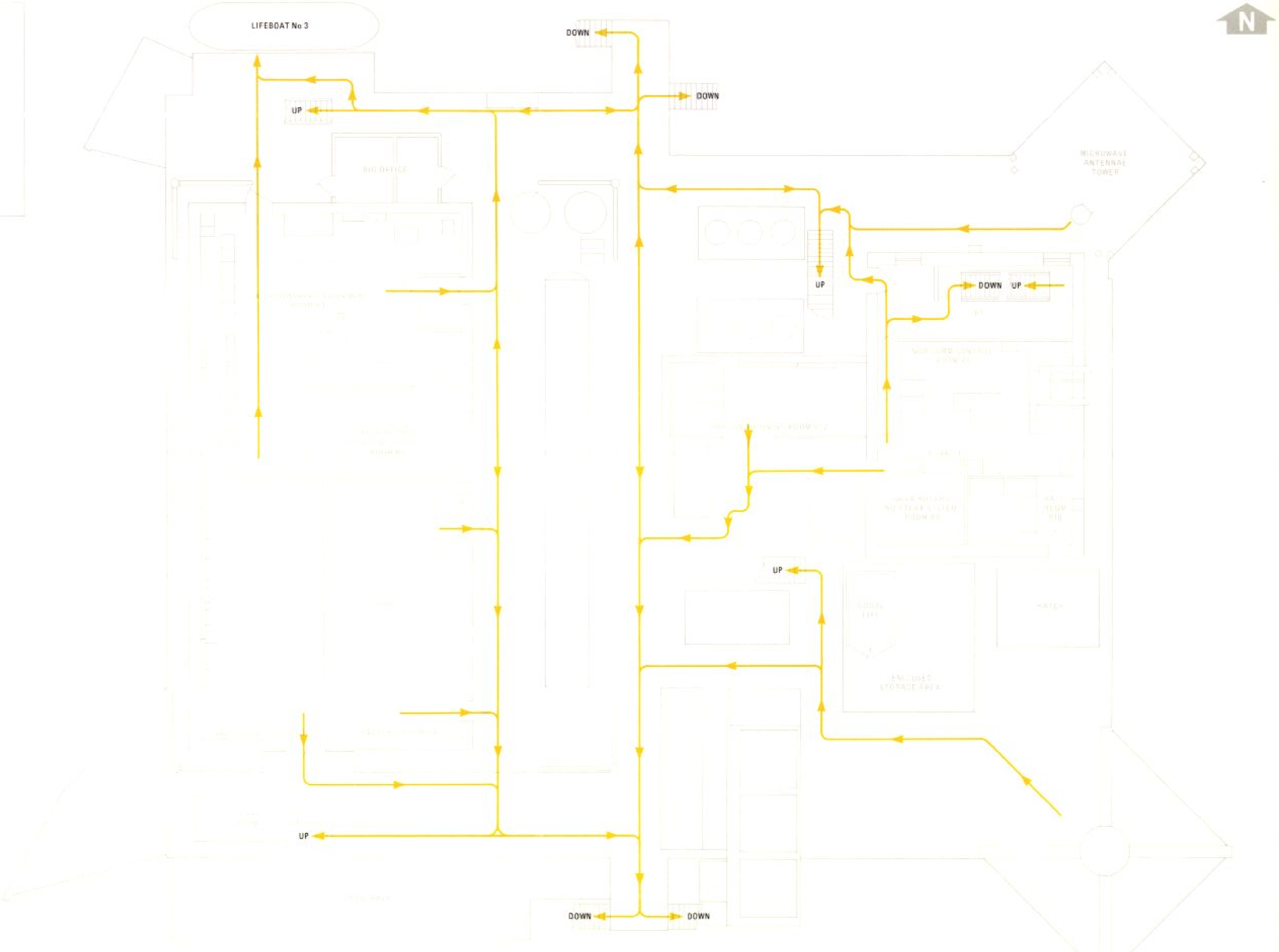


VIEW ON HANGAR ROOF

ISSUE 1. JULY 1980

ESCAPE ROUTES
Helideck Level

9.12.1



KEY

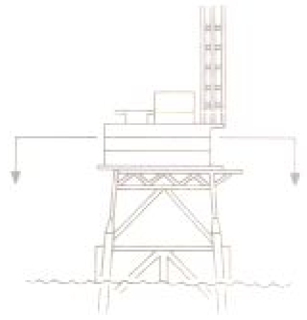
— ◄ — ECAPE ROUTE

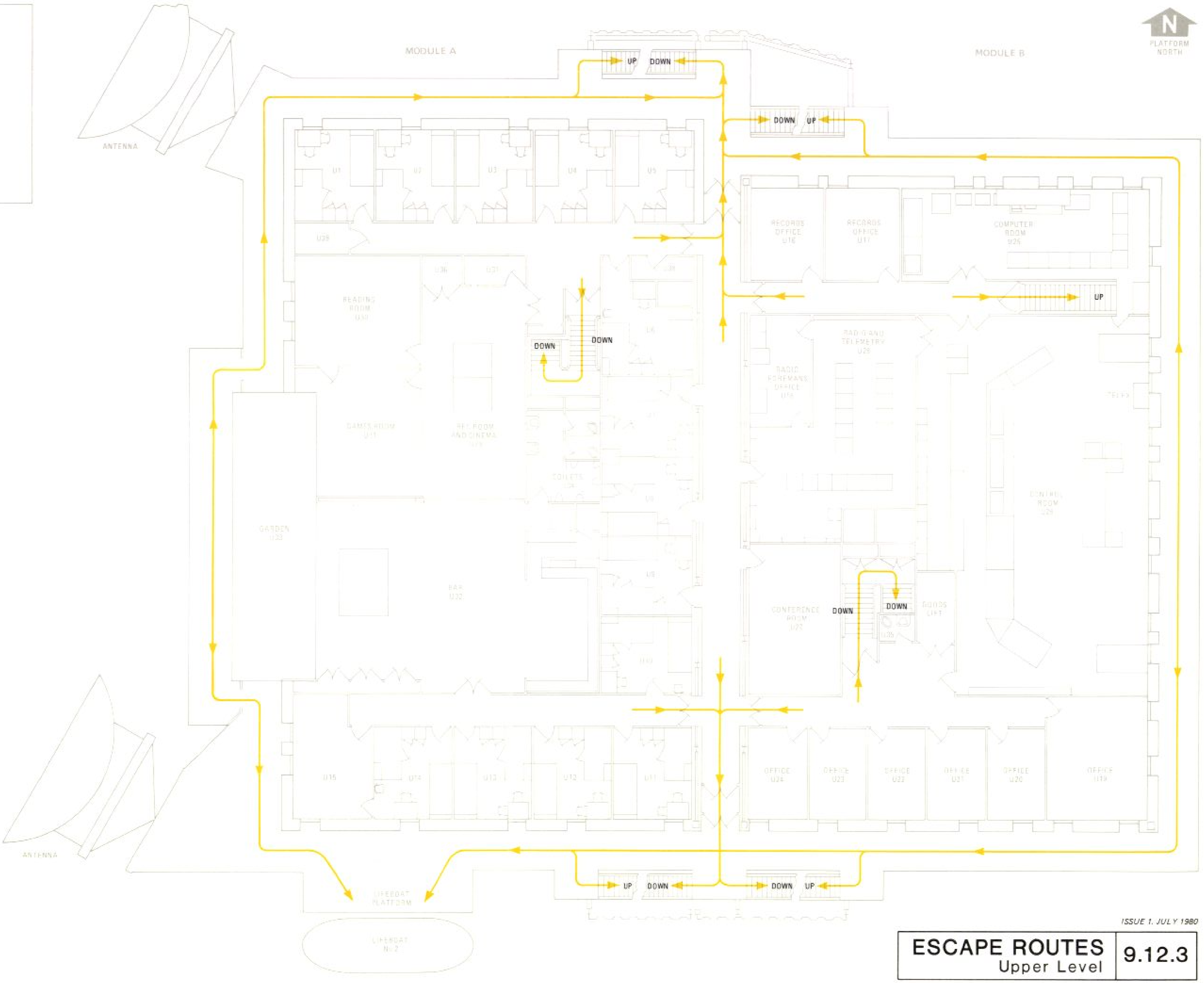
ISSUE 1. JULY 1980

ESCAPE ROUTES

Roof Level

9.12.2





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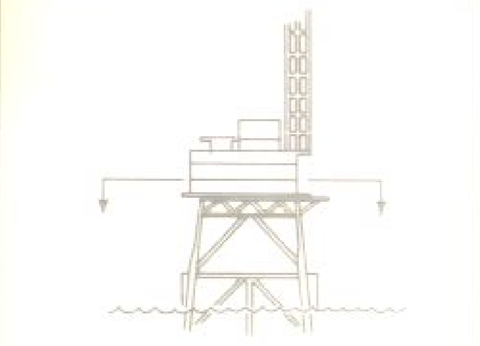
━━▶ ESCAPE ROUTE

ISSUE 1. JULY 1980

ESCAPE ROUTES
Upper Level

9.12.3



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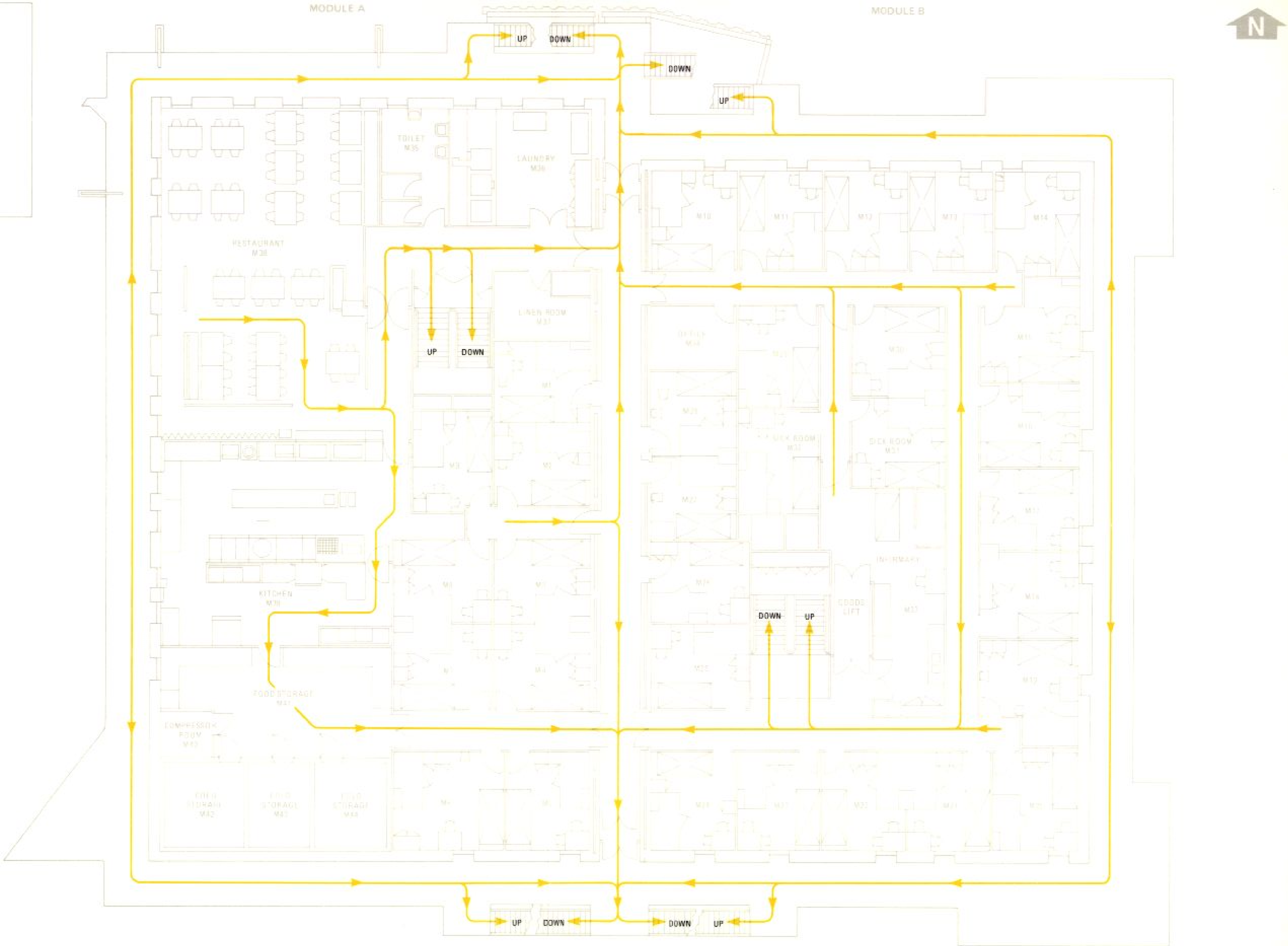

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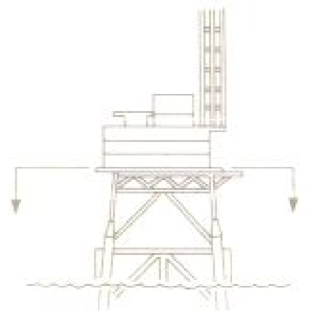
ESCAPE ROUTE

ISSUE 1 JULY 1980

ESCAPE ROUTES

Middle Level

9.12.4



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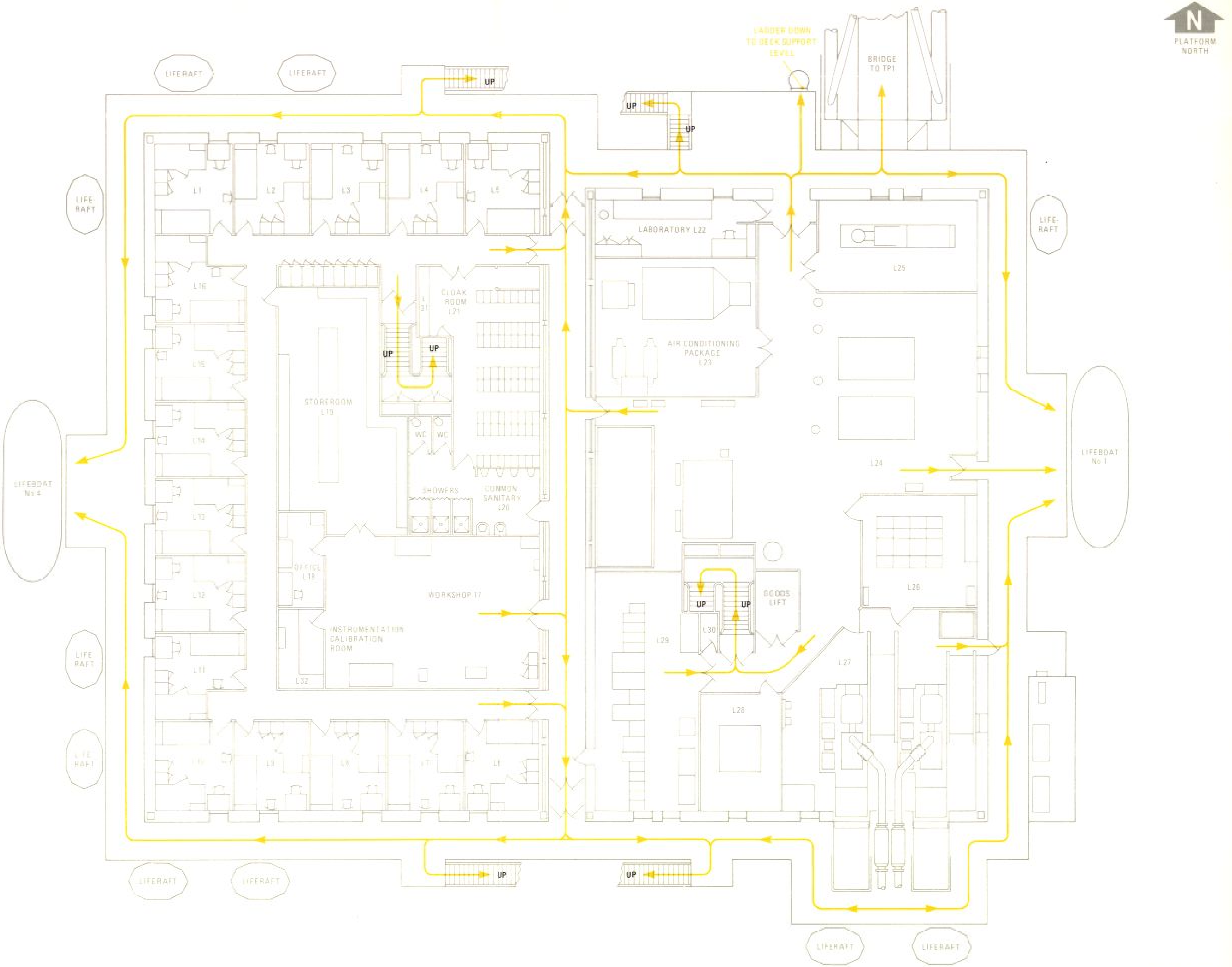
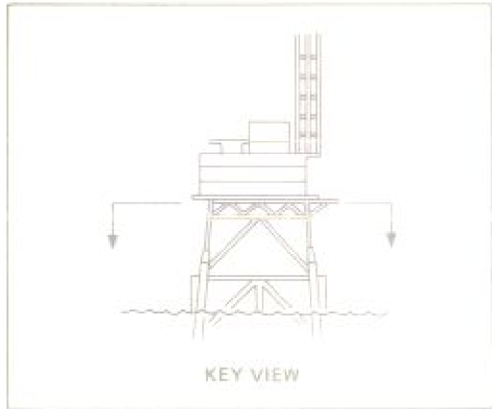


KEY	
⟶	ESCAPE ROUTE

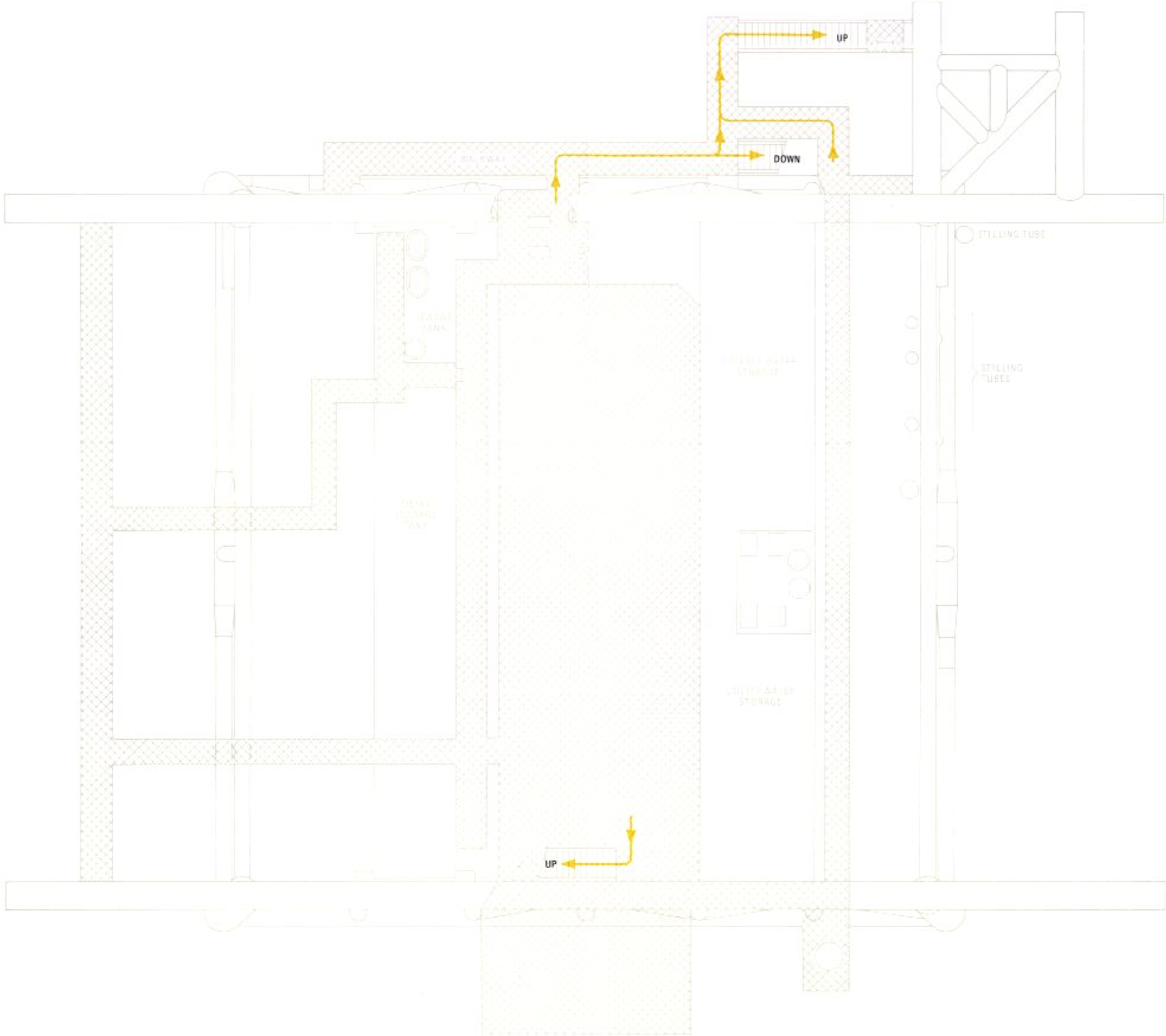
ISSUE 1. JULY 1980

ESCAPE ROUTES
Lower Level

9.12.5



N
PLATFORM
NORTH



KEY	
➤	ESCAPE ROUTE

ISSUE 1. JULY 1980

ESCAPE ROUTES
Deck Support Level
9.12.6

EMERGENCY LIGHTING

1 GENERAL

The lighting on Platform QP referred to here as Emergency Lighting is that which is battery-maintained. The batteries are an integral part of the fittings which are interspersed with the normal lighting (except for those in the Aero-Maritime Room).

2 DESCRIPTION

2.1 Supplies

2.1.1 Certain distribution boards feed both battery-maintained and normal light fittings. Both types are operative under normal conditions, therefore their distribution board supplies are shown on Diagram 5.14 — Normal Lighting.

2.1.2 Four emergency lights for the Aero-Maritime Room, one on the wall and three at the console, are supplied direct from DC System No 5 via the Maritime and Aeromobile Radio Equipment distribution board.

2.2 Light Fittings

A certain number of special emergency ac fluorescent light fittings are dispersed over all compartments and areas. They are similar to the standard light fitting but have, in addition, a rechargeable, tubular 6V battery on top of the fitting, together with a transformer/rectifier/charger, and undervoltage relay, an inverter and transformer feeding one of the tubes only. Normally the charger maintains the battery trickle-charged, and both tubes are energised from the 220V ac main. When this fails, the undervoltage relay connects the battery through the inverter and transformer to one tube, which is kept lit at 220V ac from the battery source for approximately 90 minutes. On the reappearance of the main supply the circuit returns to normal and the battery recharges. The recharge is slow and can take up to 24 hours after a deep discharge.

END

LIFESAVING EQUIPMENT

1 GENERAL

1.1 Lifesaving equipment providing the primary means of personnel evacuation from the platform, comprises the following:

- (a) Four 50-man lifeboats.
- (b) Ten 25-man self-inflating liferafts.

1.2 The lifeboat system enables personnel to evacuate the platform quickly. The four lifeboats are located as follows:

- (a) Two on the lower level, one each on the east and west side external walkways.
- (b) One on the south side external walkway of the upper level.
- (c) One on the north side of the roof level.

1.3 The lifeboats are totally enclosed, and protected by a water spray system which enables them to survive in an oil fire for 10 minutes. This allows the lifeboat to travel approximately one mile through burning oil when proceeding at maximum speed.

1.4 The liferafts are installed as a 'back-up' to the lifeboats. They are stowed in fibreglass containers located, approximately 20m apart, around the external walkway encircling the lower level.

1.5 Lifejackets and lifebuoys are provided as additional individual lifesaving appliances.

2 DESCRIPTION

2.1 Lifeboats

2.1.1 The lifeboats are fibreglass Schat Watercraft Mk II lifeboats, fully equipped with survival equipment.

2.1.2 Each lifeboat is powered by a 29.5 hp Lister HRW2 water-cooled diesel engine, fitted with a Bryce Berger hydraulic start system and Borg Warner hydraulic gears.

2.1.3 The water spray system consists of a nominal 16m^3 capacity tank charged to 250 bar, driving a Watercraft CP10 pump which draws sea water through the bottom of the boat and discharges it through a filter to spray nozzles.

2.1.4 Air exhausted from the water spray 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 to exclude toxic fumes.

2.1.5 The lifeboat is stowed in Schat Type ORD/DHM davits which allow the boat to be lowered, without power, at a controlled speed of 60 to 120 ft/min. Lowering, controlled by the helmsman, is by means of a control wire which passes through the boat canopy at the control position and connects to the winch brake. Lowering ceases at any position on release of the control wire.

2.1.6 The lifeboat is attached to the davit by two sets of falls, via Mills release gear. The release gear is operated from a handle on the port side of the steering platform, and is so designed that it will not release until the boat is waterborne.

2.1.7 The lifeboat is hoisted by a Schat Type BE4 winch, which is driven by an electric motor controlled from a local panel. Limit switches are fitted to the boat mounting to stop the motor when the boat is in the stowed position and to prevent overhoisting. A crank handle is provided to rewind the falls in the event of power failure and for final boat stowage. The handle does not revolve when the hoist motor is running or when the boat is being lowered by gravity.

2.1.8 When the boat is in the stowed position it is secured by a gripe wire at bow and stern. The gripe wire is secured at the inboard end by a slip hook to facilitate quick release and incorporates a turnbuckle for adjustment.

2.1.9 Access into the lifeboat is by two watertight doors at each side.

2.1.10 The lifeboat carries sufficient fuel for 24 hours' operation, and is provided with emergency equipment stowed in the steering console locker, as follows:

(a) Pyrotechnic signals.

(b) A battery-operated portable radio-telephone, for emergency frequency use only, which incorporates a distress alarm facility that actuates alarm systems in ships and coastguard stations.

(c) A battery-operated flashing beacon, with line, which is stowed upside down. When inverted, the beacon automatically switches on and will operate when floating in water.

(d) A VHF beacon buoy for air/sea rescue. Release of the flexible antenna switches on the beacon, which then operates for 48 hours.

(e) A battery-operated hand torch.

(f) A portable radar reflector.

2.2 Liferafts

2.2.1 The liferafts are of the MM Mk 6 SOLAS approved type, each, in its container, being stowed in a deck stowage cradle.

2.2.2 Each liferaft comprises two superimposed buoyancy tubes, a double-skin floor and a canopy. The buoyancy tubes are automatically inflated by a CO_2 cylinder located in a pocket underneath the raft, which is discharged during the launch sequence. Inflation of the raft also erects the canopy. Boarding may commence approximately 30 seconds after launch.

2.2.3 Water pockets under the liferaft provide stability, and a drogue may be streamed to limit drift and provide directional stability.

2.2.4 Access to the raft is by embarkation ladders and knotted ropes via boarding ramp. A lifeline encircles the raft.

2.2.5 Each liferaft is provided with the following equipment and emergency rations:

Bailer	2
Sponge	2
Safety knife	2
Inflator (bellows type)	1
Repair kit	1
Rescue line with quoit	1
Paddles	2
Water-activated cells with lamps	2
Parachute distress signal	2*
Hand flares	6*
Signalling torch and spare batteries	1

Signalling mirror	1*
Whistle	1*
Fishing kit	1*
Concentrated food	300 oz*
Sweets	150 oz*
Potable water	37.5 litre
Graduated drinking vessel	1*
Safety tin openers	3*
Anti-seasickness tablets	150*
First aid kit	1*
Rescue signal table	1
Instruction book	1*
Record card	1

NOTE
Items marked * are stored in the emergency pack within each liferaft. Other items are stowed in the raft.

2.3 Lifejackets

2.3.1 The one-piece lifejackets, approved by the Department of Trade, are filled with kapok and made from low flammability material with rot-proof covering and tapes.

2.3.2 A total of 340 lifejackets is provided as follows:

(a) In eight fibreglass boxes, each box containing 25 lifejackets and located as shown on Diagrams 9.14.4 to 9.14.7. Each box is coloured orange and marked in English '25 Lifejackets', and in Norwegian '25 Redningsvest'.

(b) The remaining 140 lifejackets are located in the sleeping quarters, two per cabin.

2.4 Lifebuoys

2.4.1 A total of 84 lifebuoys is provided. They are located throughout the platform on external walkways, as shown on Diagrams 9.14.3 to 9.14.7.

2.4.2 Each lifebuoy installation is provided with a Buoysmoke smoke marker and a water-activated Aqualite.

2.4.3 When the lifebuoy is thrown overboard, the Aqualite is automatically released by its lanyard. Once in the water it will illuminate for 45 minutes.

2.4.4 The Buoysmoke is manually pulled from its bracket, which breaks the device that operates smoke release, and then thrown overboard. The smoke signal operates for 15 minutes.

3 OPERATION

3.1 To Lower the Lifeboat

Personnel are to exercise lifeboat drill at least once every 10 days. On hearing the 'intermittent' signal of the Muster Alarm, personnel are to proceed to their allotted lifeboat station and:

(1) Check that the winch brake is fully on.

(2) Release the gripes by pulling the quick-release slip hooks, and allow the weight of the boat to be taken by the falls. Check that the operating wire of the Mills quick-release gear is not fouling the superstructure.

(3) Check that the fuel tank outlet valves are open.

(4) Using the hydraulic start system, start the engine as follows:

  (i) Depress and hold the throttle control pushbutton (to disengage the gears), and push the throttle lever to the Full Ahead position.

  (ii) Check that the decompression levers are facing forward.

  (iii) In cold weather, lift the Overload Stop (painted yellow).

  (iv) Take up the slack on the starting lever, then firmly pull the lever and, overcoming initial resistance, move the lever through its full travel.

  (v) Return the starting lever to its original position.

  (vi) When the engine fires, move the throttle lever to the Neutral position. The lever engages the hydraulic gears when operated.

(5) Open the hatches and ventilators, embark personnel, secure the hatches.

(6) Pull the control wire to lower the boat.

(7) When the boat is waterborne and the weight is off the falls, pull the quick-release handle to disengage the Mills release gear.

(8) Close the ventilators.

(9) Move the throttle lever to the required Ahead position, then steer the lifeboat away from the platform.

(10) If required, operate the water spray system by opening the valve (painted red), under the forward centre seat.

3.2 To Hoist the Lifeboat

(1) 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 starter box main circuit breaker at the winch position.

(6) Operate the winch motor and hoist the lifeboat. Check that the control wire is coiling correctly.

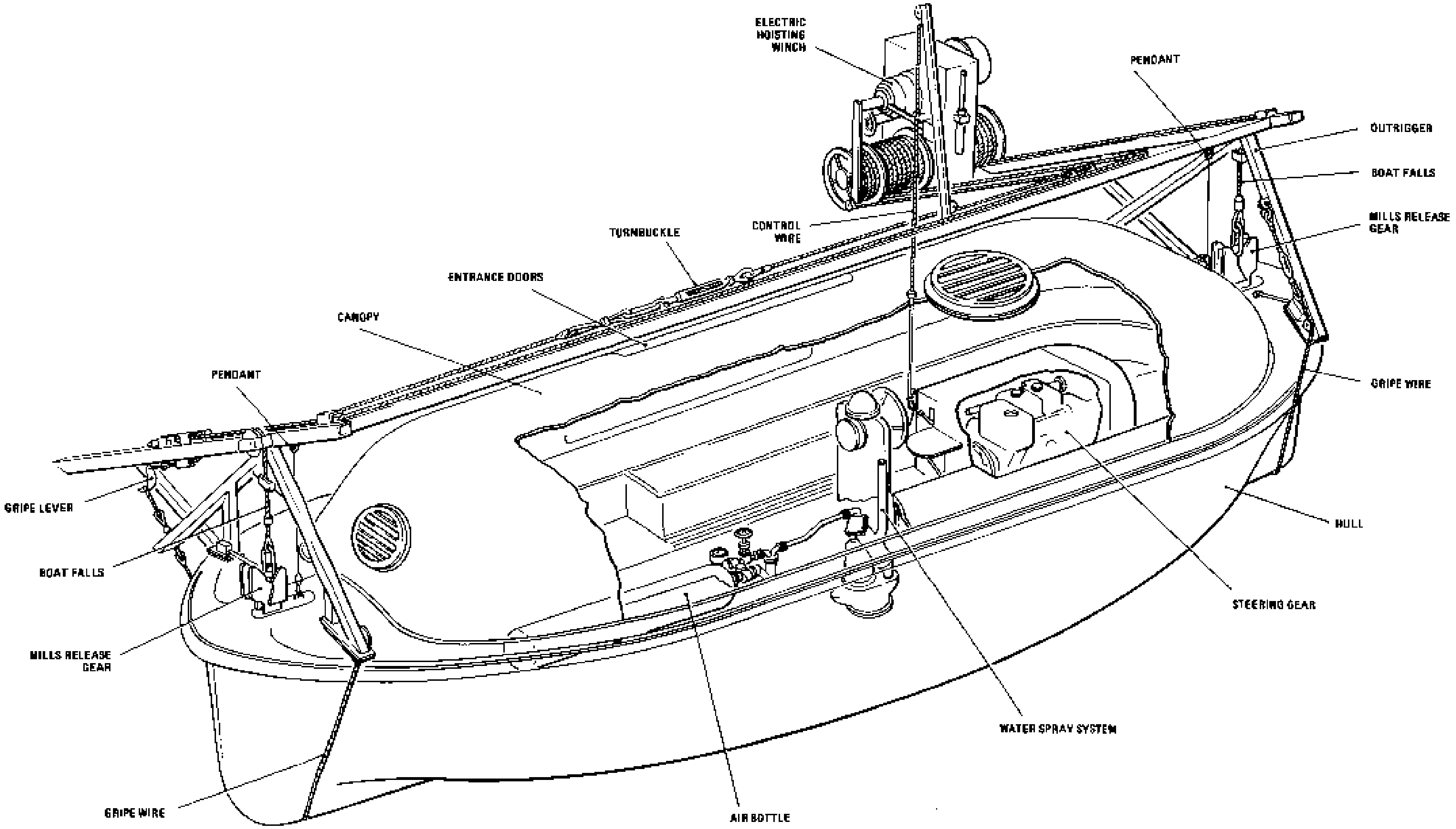
(7) When the lifeboat is 6in from the stowed position, stop the winch motor.

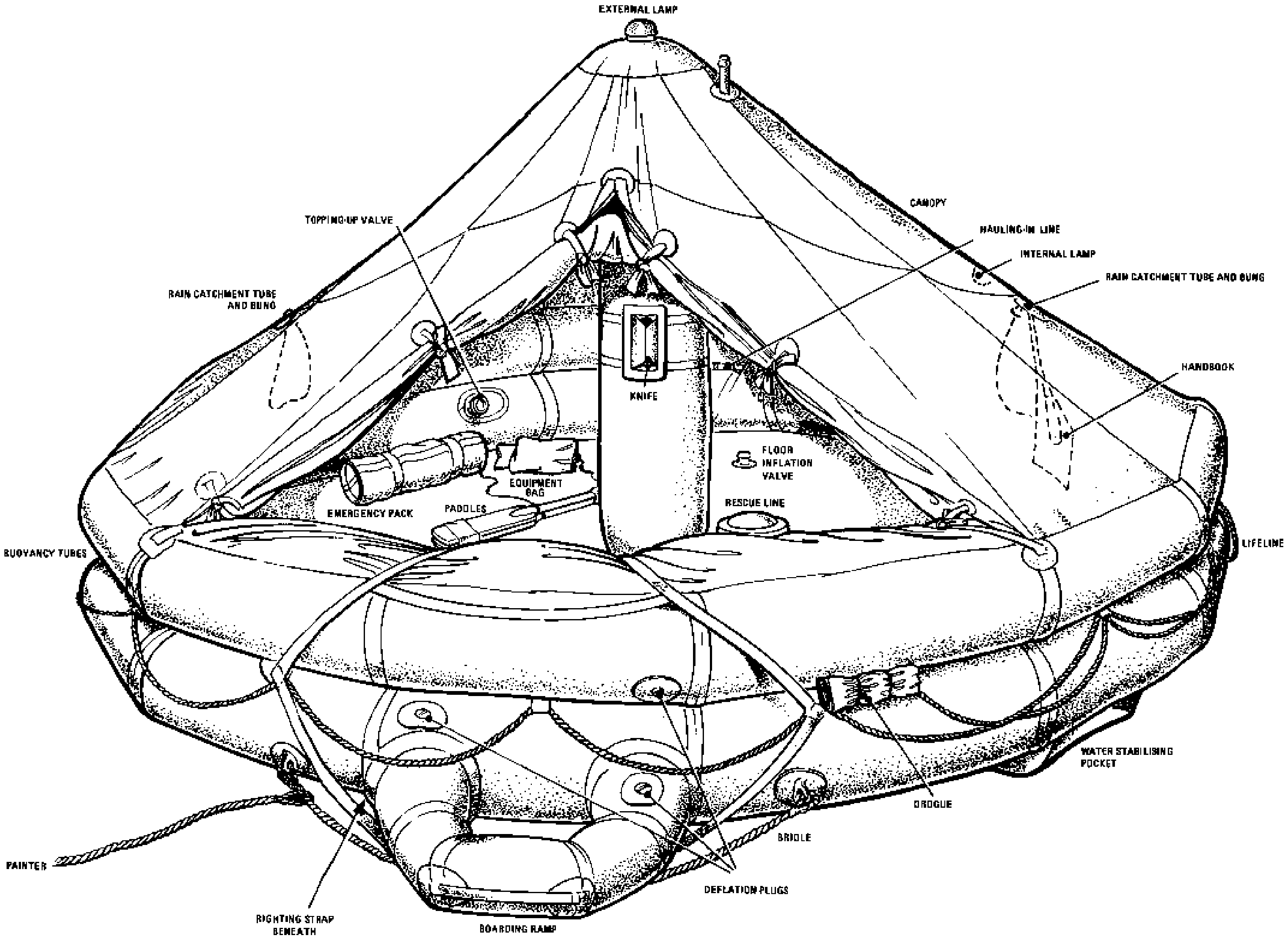
(8) Open the main circuit breaker and complete stowage of the boat by hand crank.

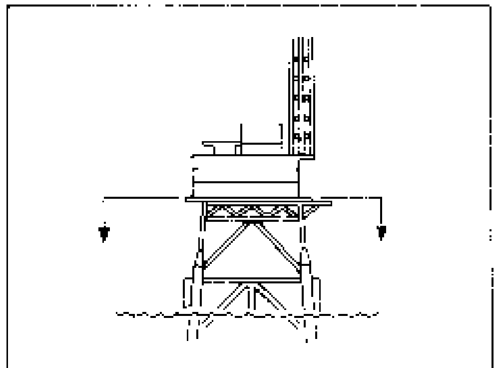
(9) Secure the gripes.

(10) When the boat is secure, release the brake to take the weight off the falls, then leave the brake fully on.

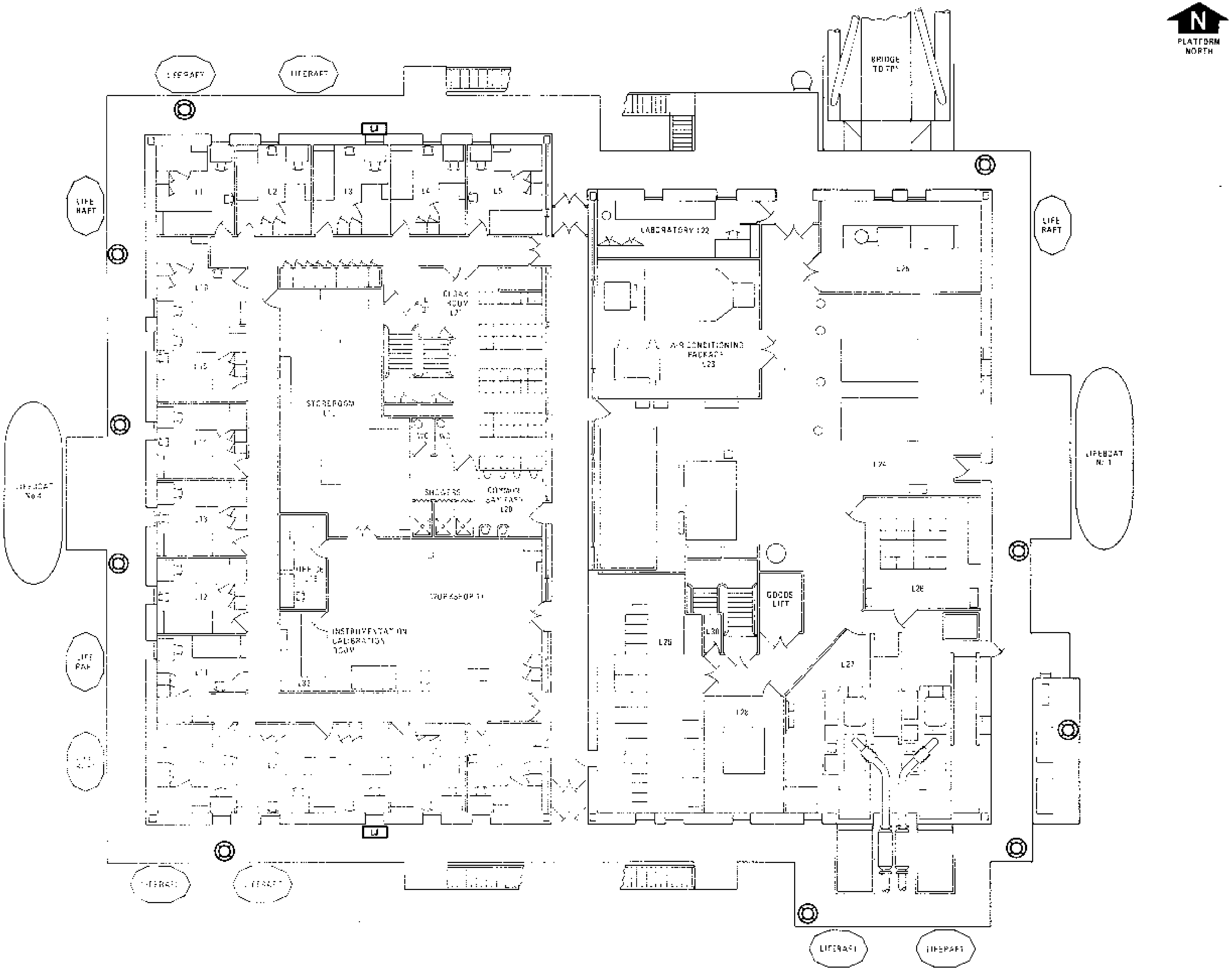
END


ELECTRIC HOISTING WINCH
PENDANT
OUTRIGGER
BOAT FALLS
MILLS RELEASE GEAR
TURNBUCKLE
CONTROL WIRE
ENTRANCE DOORS
CANOPY
PENDANT
GRIPE WIRE
GRIPE LEVER
HULL
BOAT FALLS
STEERING GEAR
MILLS RELEASE GEAR
WATER SPRAY SYSTEM
GRIPE WIRE
AIR BOTTLE


EXTERNAL LAMP
TOPPING-UP VALVE
CANOPY
HAULING-IN LINE
INTERNAL LAMP
RAIN CATCHMENT TUBE AND BUNG
RAIN CATCHMENT TUBE AND BUNG
HANDBOOK
KNIFE
FLOOR INFLATION VALVE
EQUIPMENT BAG
EMERGENCY PACK
PADDLES
RESCUE LINE
BUOYANCY TUBES
LIFELINE
WATER STABILISING POCKET
DROGUE
BRIDLE
DEFLATION PLUGS
PAINTER
RIGHTING STRAP BENEATH
BOARDING RAMP



KEY VIEW



KEY

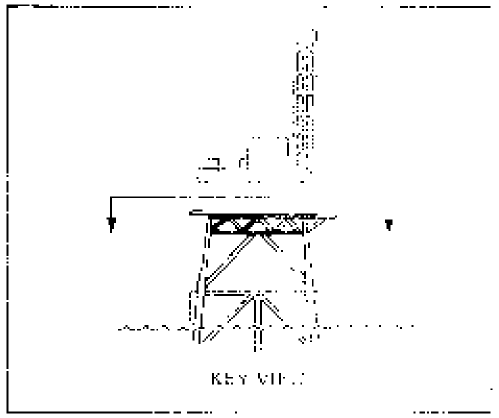
◎ TWO LIFEBUOYS

LJ LIFEJACKET CONTAINER

ISSUE 1, JULY 1990

LIFESAVING EQUIPMENT
Lower Level

9.14.3



KEY

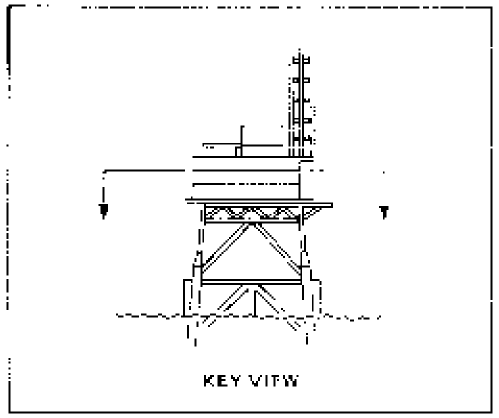
◎ TWO LIFEBUOYS

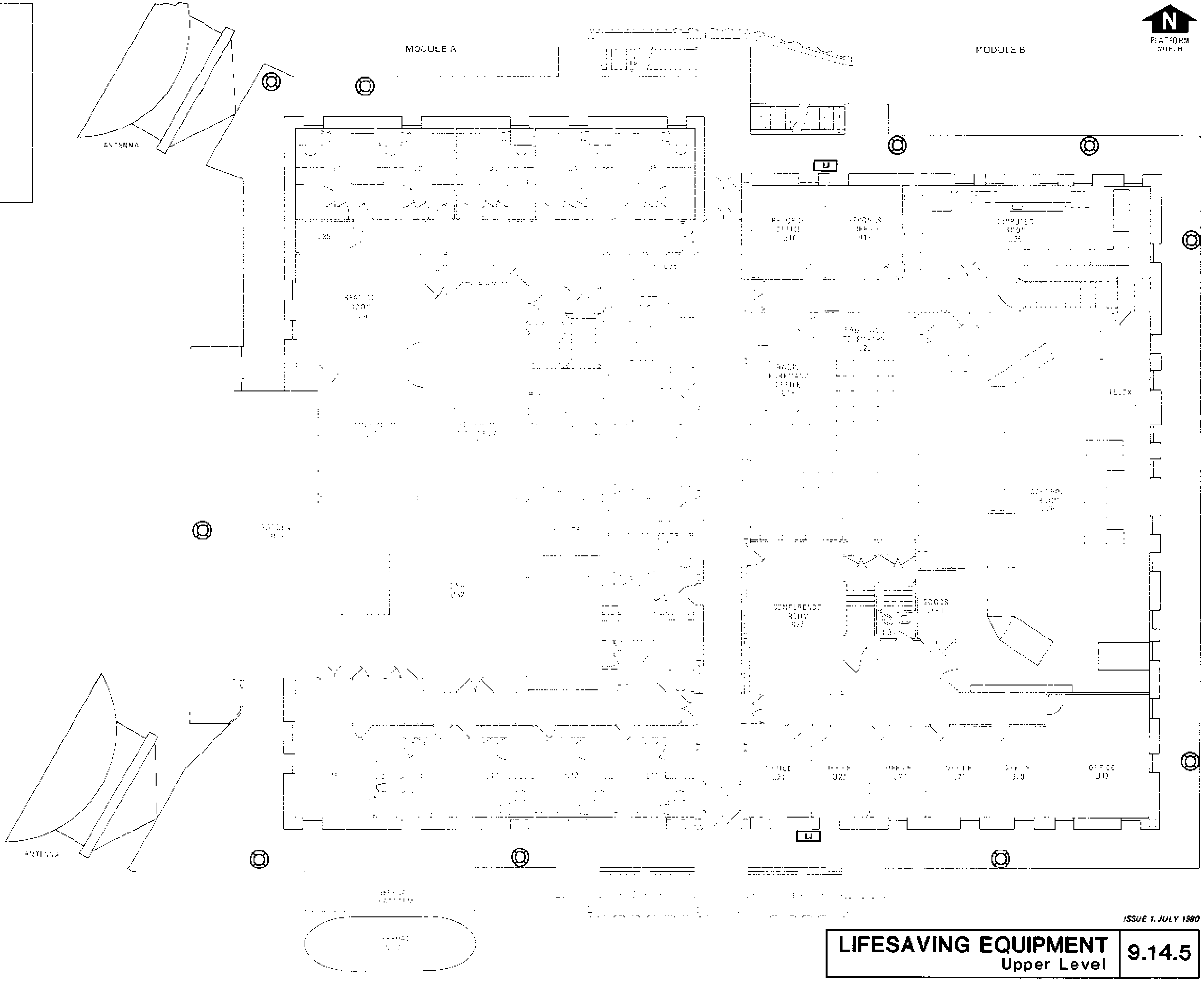
LJ LIFEJACKET CONTAINER

ISSUE 1. JULY 1980

LIFESAVING EQUIPMENT
Middle Level

9.14.4





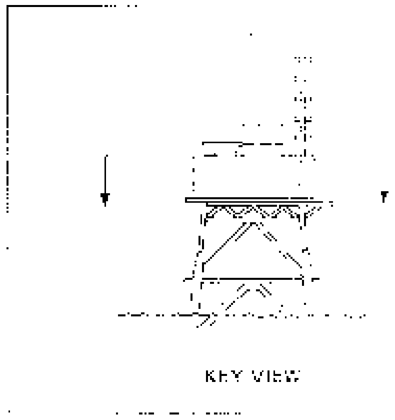
KEY

◎	TWO LIFEBUOYS
LJ	LIFEJACKET CONTAINER

ISSUE 1, JULY 1980

LIFESAVING EQUIPMENT
Upper Level

9.14.5



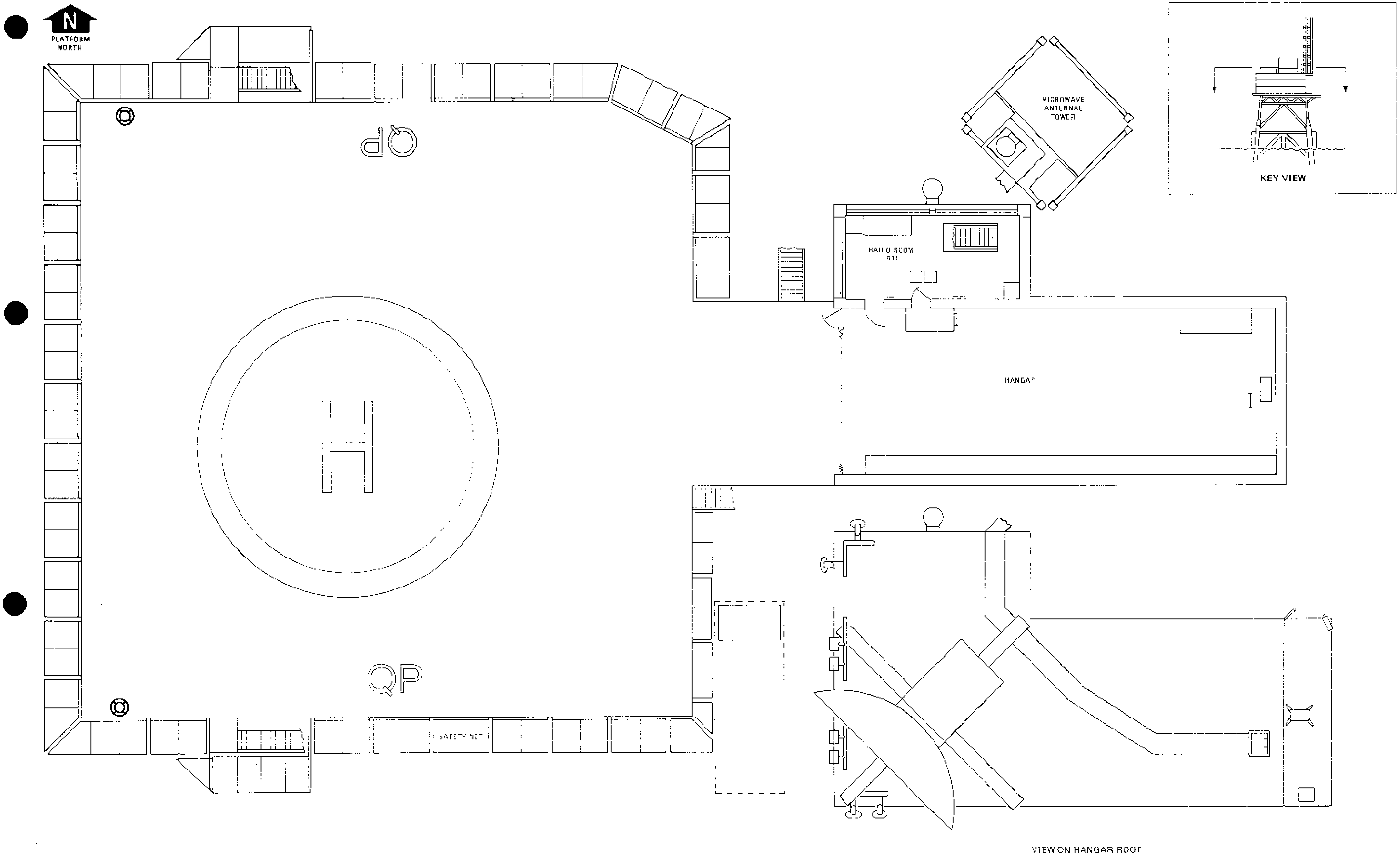
KEY

◎	TWO LIFEBUOYS
LJ	LIFEJACKET CONTAINER

ISSUE 1. JULY 1980

LIFESAVING EQUIPMENT
Roof Level

9.14.6



KEY

◎ TWO LIFEBUOYS

ISSUE 1. JULY 1980

LIFESAVING EQUIPMENT
Helideck Level
9.14.7

elf aquitaine norge a/s

FRIGG FIELD

FP

VOL 1

OPERATIONS MANUAL

Norsk Hydro

statoil

TOTAL

FRIGG FIELD

FLARE PLATFORM

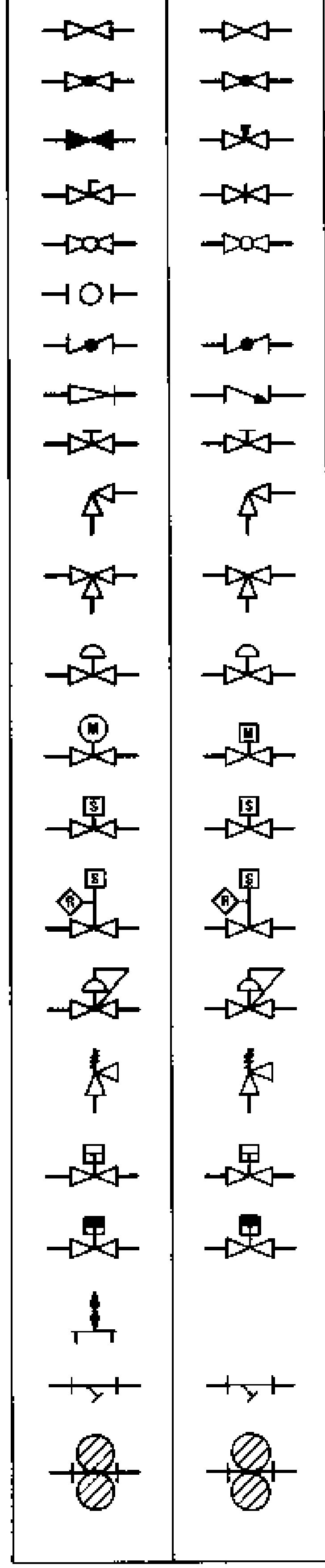
VOLUME 1 OPERATIONS MANUAL

CONTENTS

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.

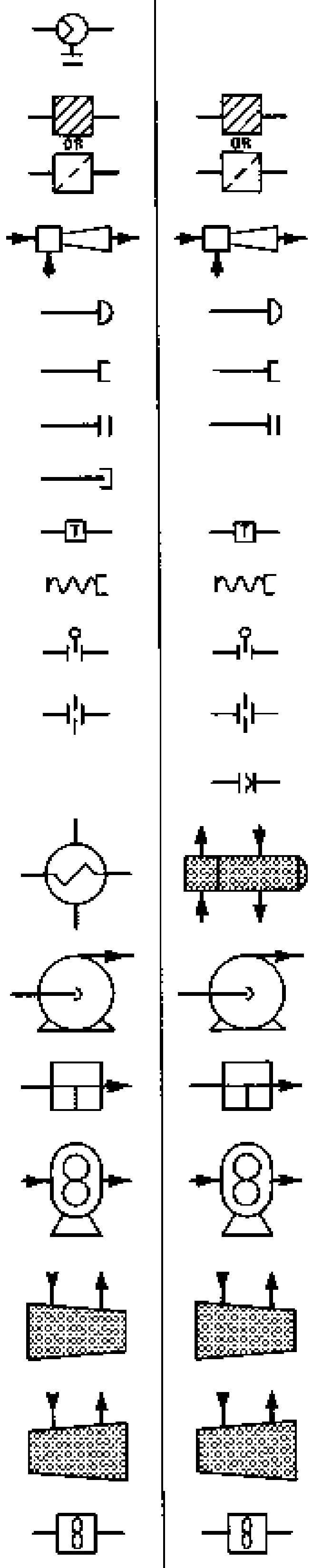
It is also intended to serve the additional purpose of providing the operators with operating philosophies and data, and a summary of machinery systems' layouts and platform safety.

FOR USE WITH TP1, OP, FP AND TCP2	FOR USE WITH DP2 AND CDP1	

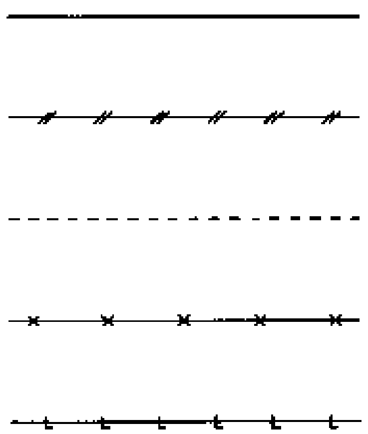


GATE VALVE
GLOBE VALVE
NEEDLE VALVE
PLUG VALVE
BALL VALVE
ROTARY PLUG OR BALL VALVE
BUTTERFLY VALVE
CHECK VALVE
HAND CONTROL VALVE
ANGLE VALVE
THREE-WAY VALVE
DIAPHRAGM-OPERATED CONTROL VALVE
ROTARY MOTOR-OPERATED VALVE
SOLENOID-OPERATED VALVE
SOLENOID-OPERATED VALVE WITH RESET
SELF-ACTUATING CONTROL VALVE
PRESSURE SAFETY RELIEF VALVE
FAIL SAFE OPEN
FAIL SAFE CLOSE
PRESSURE AND VACUUM RELIEF MANHOLE COVER
'Y' TYPE STRAINER
DUPLEX BASKET STRAINER

FOR USE WITH TP1, OP, FP AND TCP2	FOR USE WITH DP2 AND CDP1	



PERMANENT STRAINER
FILTER
EJECTOR/BOOSTER
CAP
HOSE CONNECTION
BLIND FLANGE
SCREWED CAP
TRAP OR DRAINER
FLEXIBLE HOSE
BLIND AND SPACER
ORIFICE PLATE
BURSTING DISC
SHELL AND TUBE HEAT EXCHANGER
ELECTRIC MOTOR-DRIVEN CENTRIFUGAL PUMP
RECIPROCATING PUMP
POSITIVE DISPLACEMENT PUMP
CENTRIFUGAL COMPRESSOR
TURBINE
TURBINE OR PROPELLER TYPE PRIMARY ELEMENT



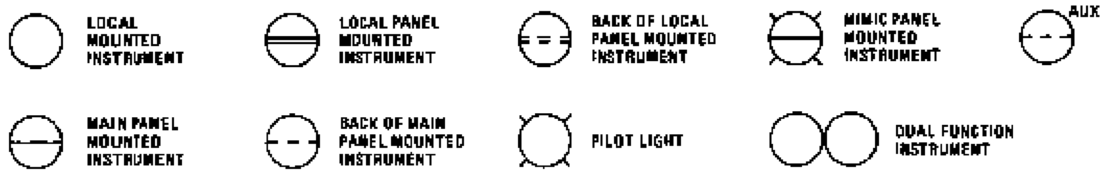
PROCESS LINE
PNEUMATIC SIGNAL
ELECTRIC SIGNAL
CAPILLARY TUBING
HYDRAULIC SIGNAL

FLOW ABBREVIATIONS

BS & W	BASIC SEDIMENT AND WATER	PB	PUSHBUTTON
DR	DRAIN	PCV	PRESSURE CONTROL VALVE
FCV	FLOW CONTROL VALVE	P/I	PRESSURE TO CURRENT
FG	FLOW SIGHT-GLASS	PXS	PRESSURE VALVE LIMIT SWITCH
I/P	CURRENT PRESSURE	RO	RESTRICTION ORIFICE
LC	LOCKED CLOSED	TCV	TEMPERATURE CONTROL VALVE
LCV	LEVEL CONTROL VALVE		
LO	LOCKED OPEN		
NC	NORMALLY CLOSED		
NO	NORMALLY OPEN		

INSTRUMENTS

SYMBOLS



LOCAL MOUNTED INSTRUMENT
LOCAL PANEL MOUNTED INSTRUMENT
BACK OF LOCAL PANEL MOUNTED INSTRUMENT
MIMIC PANEL MOUNTED INSTRUMENT
INSTRUMENT IN INTERFACE ROOM
MAIN PANEL MOUNTED INSTRUMENT
BACK OF MAIN PANEL MOUNTED INSTRUMENT
PILOT LIGHT
DUAL FUNCTION INSTRUMENT

IDENTIFICATION TABLE AND COMBINATION OF LETTERS

INSTRUMENT FUNCTION / MEASURED VARIABLE		T TRANSMITTER	I INDICATING	R RECORDING	C CONTROLLING	AL ALARM LOW	AH ALARM HIGH	Y COMPUTING	E ELEMENT	W WELL	SL SWITCH LOW	SH SWITCH HIGH	Q INTEGRATOR	X SPECIAL COMPONENT	G GAUGE	HC HAND CONTROLLER	HS HAND SWITCH	
ANALYSIS	A	AT	AI	AR														
FLOW	F	FT	FI	FR	FC	FAL	FAH	FY	FE		FSL	FSH	FQ	FX		FHC	FHS	
LEVEL	L	LT	LI	LR	LC	LAL	LAH	LY			LSL	LSH			LG		LHS	
PRESSURE	P	PT	PI	PR	PC	PAL	PAH				PSL	PSH		PX			PHS	
PRESSURE DIFFERENTIAL	Pd	PdT	PdI		PdC	PdAL	PdAH				PdSL	PdSH						
TEMPERATURE	T	TT	TI	TR	TC	TAL	TAH	TY	TE	TW	TSL	TSH		TX			THS	
MISC	X	XT	XI	XR				XY	XE		XSL	XSH						

ISSUE 1. JULY 1980

GLOSSARY OF SYMBOLS

RECORD OF AMENDMENTS

Issue No	Dated	Amended by (Signature)	Date

CHAPTER 1

INTRODUCTION

CONTENTS

DIAGRAMS

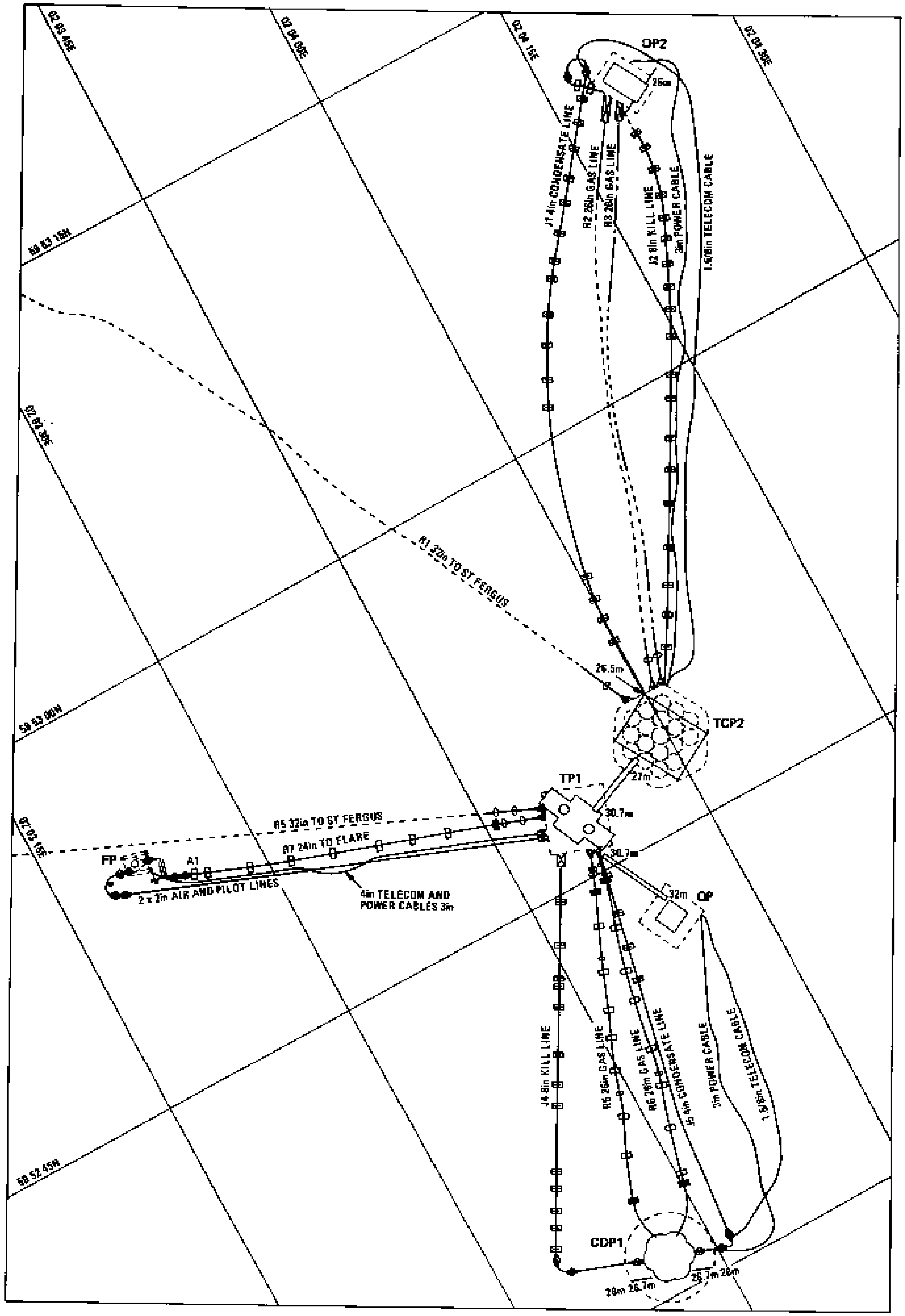
FRIGG FIELD – LOCATION

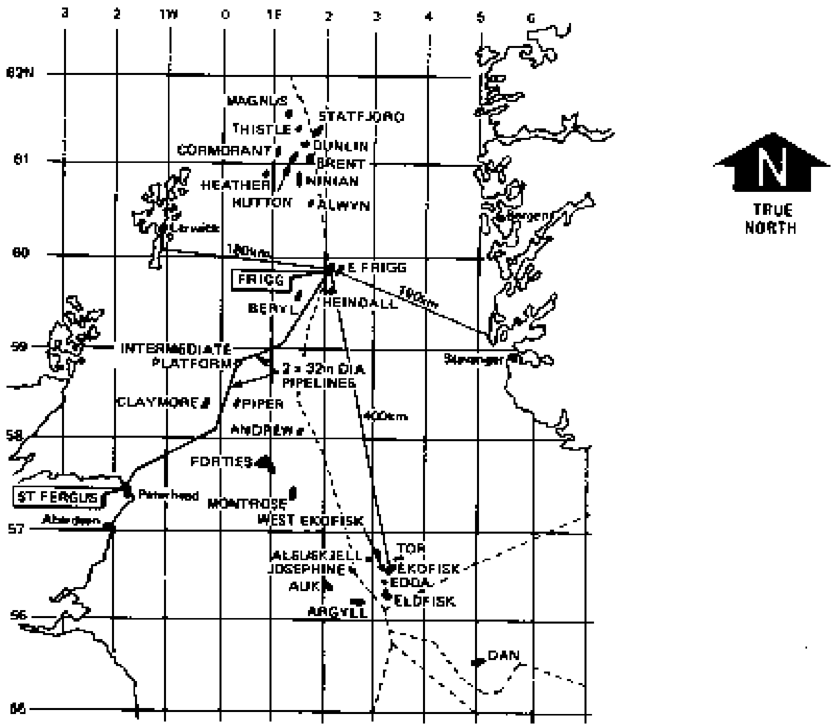
1 GENERAL

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°48' and 60°00' North and between 01°97' and 02°15' East (European datum 1960). It lies some 190km from the Norwegian coast and 370km from the Scottish coast. The location of the field and 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.





PLATFORM CO-ORDINATES

STRUCTURE	GEOGRAPHICAL CO-ORDINATES	UTM CO-ORDINATES	TRUE ORIENTATION
DP1 MAST	59° 52' 40" 719 N 02° 04' 48" 755 E	6 638 334.39 N 448 505.95 E	—
DP2	59° 53' 10" 075 N 02° 04' 20" 604 E	6 638 248 60 N 448 080 90 E	332° 52' 12"
TP1	59° 52' 47" 276 N 02° 03' 51" 386 E	6 638 549 74 N 447 616 39 E	335° 20' 28"
TCP2	59° 52' 48" 446 N 02° 03' 59" 536 E	6 638 584 14 N 447 743 82 E	331° 03' 06"
QP	59° 52' 42" 421 N 02° 03' 53" 825 E	6 638 398 00 N 447 652 50 E	334° 17' 43"
CDP1	59° 52' 31" 389 N 02° 03' 41" 745 E	6 638 060 39 N 447 459 81 E	018° 37' 41"
FP	59° 52' 53" 518 N 02° 03' 21" 293 E	6 638 749 50 N 447 168 50 E	—

KEY

——	UNBURIED LINE	-⊕-	GREASE BOX
- - - -	BURIED LINE OR LINE IN A TRENCH	▷	SEAL PROTECTION
■	CONCRETE BLOCK (25t)	▷	SEAL PROTECTION WITH FLOW LIMITER
□	CONCRETE BLOCK (18t)	▷	SEAL PROTECTION WITH PERMANENT SEAL
☒	CONCRETE SADDLES	▭	HYPERBARIC WELDING POSITION
○ GROUT BAG	⊗ GROUT BAG NOT IN USE	28m	CLEARANCE UNDER BRIDGE
⊟	MATTRESS		

NOTE

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

ISSUE 1, JULY 1980

FRIGG FIELD – LOCATION

1.1

GENERAL DESCRIPTION

1 GENERAL

1.1 The Flare Platform (FP) is a safety feature of the Frigg Field. It is provided to flare blowdown gas at a high flowrate to depressurise treatment platforms TP1 and TCP2 in an emergency.

1.2 The platform is an articulated column consisting of an oscillating structure, with a total weight of 2806 tons, comprising mainly:

(a) Steel base with concrete ballast and auxiliary floats.

(b) Main float.

(c) Tidal tank.

(d) Roof divided into rooms L1, L2 and L3.

(e) Flare bracket and two flare tips with pilots.

1.3 TP1 is connected to FP by a 24in diameter subsea line, while TCP2 blowdown line is connected to the origin of TP1 subsea line, via the inter-platform bridge. The subsea line is maintained dry by periodic manual flushing with sales gas at a maximum rate of 2 MMSCMD.

1.4 Maximum flaring rate of the flare is a nominal 30 to 34 MMSCMD.

1.5 The HP flare is normally used as a cold vent, the system being swept continuously with fuel gas. (Nitrogen will be used at a future date.) For special purposes the flare will be lit, in which case fuel gas will be supplied to the pilot burners.

1.6 Electrical power to FP is supplied from TP1 through a submarine cable. Integral battery systems are also provided.

1.7 The flare tips are monitored by a TV camera located on QP hangar roof, and a receiver in QP Control Room.

1.8 Instruments on FP consist mainly of gas flow, temperature and pressure indicators and system alarms, which indicate on the FP panel in QP Control Room.

END

CHAPTER 2

PLATFORM STRUCTURE

CONTENTS

DIAGRAMS

PLATFORM CONSTRUCTION

1 GENERAL

1.1 The Flare Platform (FP) comprises an articulated steel tower mounted on a steel base. The foot of the tower and the base are both ballasted with concrete to stabilise the platform on the seabed. The buoyancy provided by a submerged float located approximately 15m below the waterline keeps the tower in the nominally upright position, while allowing the tower to tilt to a limited extent in any direction under the influence of wind and current.

1.2 Principal particulars of the platform are as follows:

Overall height including flare nozzles	150m
Water depth	106.3m
Above water height	43.7m
Total weight (including ballast)	2806 tons
Volume of main float	1050m^3
Volume of 2 base floats	949.8m^3
Volume of 2 auxiliary floats	683m^3
Rated gas flow	200 to 250m/s maximum
Gas temperature	40°C minimum

2 PLATFORM BASE

2.1 The base structure is constructed of E26—4 steel and measures 31m by 25m (excluding anti-scour fittings). It comprises a rectangular raft with two buoyancy tanks welded to opposite edges. The tanks were used to float the platform during construction and positioning, and are now flooded and serve only to stiffen the raft.

2.2 Anti-scour baffles are attached to the four edges of the base. These are constructed of E26—2 steel and comprise open rectangular frames supporting longitudinal baffles. Added scour protection is provided by five layers of Terylene yarn attached to the base.

2.3 Also fitted to the base is the bifurcated main gas pipe constructed of SHS—40 steel, with its two hydraulically actuated isolating valves, three pillars to which the articulated joint is attached, and two bell mouths with 8in tube for electrical connections.

3 ARTICULATED JOINT

3.1 This comprises a Cardan coupling, the upper member of which is connected to the tower. The lower member is secured to the platform base by means of a triangular connection plate. This plate is attached to the three support pillars on the base by three bolts, each of which is secured by a locking bolt. The locking and securing bolts are hydraulically operated from float level at elevation 112m. This enables all the bolts to be unlocked and retracted simultaneously, thus releasing the tower from the base. The connection plate is fitted with two joints which seal the base from the flare gas circuit.

3.2 The Cardan coupling hinges about one axis on the lower attachment plate and about the other axis on the tower. It is connected by four bearings, two on the connection plate and two on the tower. Passages in the coupling transfer the gas from the base piping to the tower piping. A pressurised oil system lubricates and seals the hinges to prevent the ingress of water or the egress of gas.

3.3 The complete assembly is rated to withstand a stress of 270 tons vertically and 225 tons horizontally, with a safety factor of x2.

4 TOWER

4.1 Lattice Structure

4.1.1 This forms the tower from above the articulated joint to the base of the main float at elevation +85m. It comprises three vertical members of 24in diameter constructed of SHS–40° steel, which are tied together by means of 16in diameter bracing members of the same grade. Two of the vertical members are used as the main gas pipes; the third is purely structural.

4.1.2 The bottom 10m of the lattice structure is filled with 242 tons of concrete ballast. Two buoyancy tanks similar to those on the base are installed outside at the base of the lattice. These are constructed of E26–4 steel. A third buoyancy tank is incorporated in the lattice above the concrete ballast.

4.1.3 Two 8in diameter tubes made from A333 grade 1 steel to house the electrical cables, and an arrangement of small diameter tubes for hydraulic, lubrication and ballasting services are attached to the lattice. The weight of the structure excluding ballast is 131 tons.

4.2 Main Float

4.2.1 This comprises an external cylinder 10m high and 11.6m in diameter with a concentric internal cylinder of 6 ft diameter, both constructed of HS20 steel. The two gas pipes traverse the float from bottom to top, whereas the third structural pipe terminates midway through the float. A horizontal bulkhead at the mid-point divides the internal cylinder into two sections. The annular space between the two cylinders is subdivided into six circumferential compartments by vertical bulkheads. Each compartment is watertight to provide buoyancy in the event of damage or structural failure causing flooding. Access between compartments is via manholes made from E36–4 steel.

4.2.2 Valves in the central compartments enable the circumferential compartments to be drained in the event of a leak. Water is removed from the lower central compartment by means of portable pumps.

4.2.3 The stability moment imparted to the platform by the float and structural members is a nominal 33569kNm. The change of stability caused by flooding the structural members or float compartments is as follows:

Compartment Flooded		**Stability Moment**
(a)	One vertical 24in member	32513kNm
(b)	Two vertical 24in members	31097kNm
(c)	Three vertical 24in members	29680kNm
(d)	One outer compartment in main float	23756kNm
(e)	Two outer compartments in main float	13944kNm
(f)	Lower central compartment in main float	23941kNm
(g)	Upper central compartment in main float	22923kNm
(h)	Upper and lower central compartments in main float	13296kNm

5 CHIMNEY

5.1 The chimney is mounted on top of the main float. It comprises a cylinder 35.5m high and 6m diameter, constructed of E26–4 steel. The two main gas pipes exit the top of the main float outside the chimney, and enter the chimney via elbows constructed of SHS–40 steel. The gas pipes, in passing through the chimney, increase in diameter from 24in to 42in, effected by nozzles constructed of 18–8 stainless steel. Gas pipes from the nozzles to the flare supports are constructed of ST523N steel.

5.2 Two horizontal bulkheads constructed of E26–4 steel partition the chimney at the 112 and 125.5m levels. A boat landing constructed of E24–4 steel encircles the chimney between elevations 105 and 113m. Processed wood barriers designed to withstand an impact of 5 tons are installed on the landing.

5.3 The lowest compartment in the chimney forms the tidal tank, sea water being admitted to or released from the tank via a submerged pipeline incorporating a remote-controlled valve. Access from the centre compartment to the main float is via a pump guide tube constructed of ST52–3N steel and incorporating an internal ladder constructed of E24–1 steel.

5.4 A watertight door in the outside wall of the chimney permits access to the centre compartment from the boat landing. From the centre compartment a safety-loop ladder constructed of E24–1 steel leads to the top compartment which houses technical equipment.

5.5 The top compartment is divided into three rooms, L1, L2 and L3. Major items of equipment located in each room are as follows:

(a) L1 houses the electric and hydraulic control equipment.

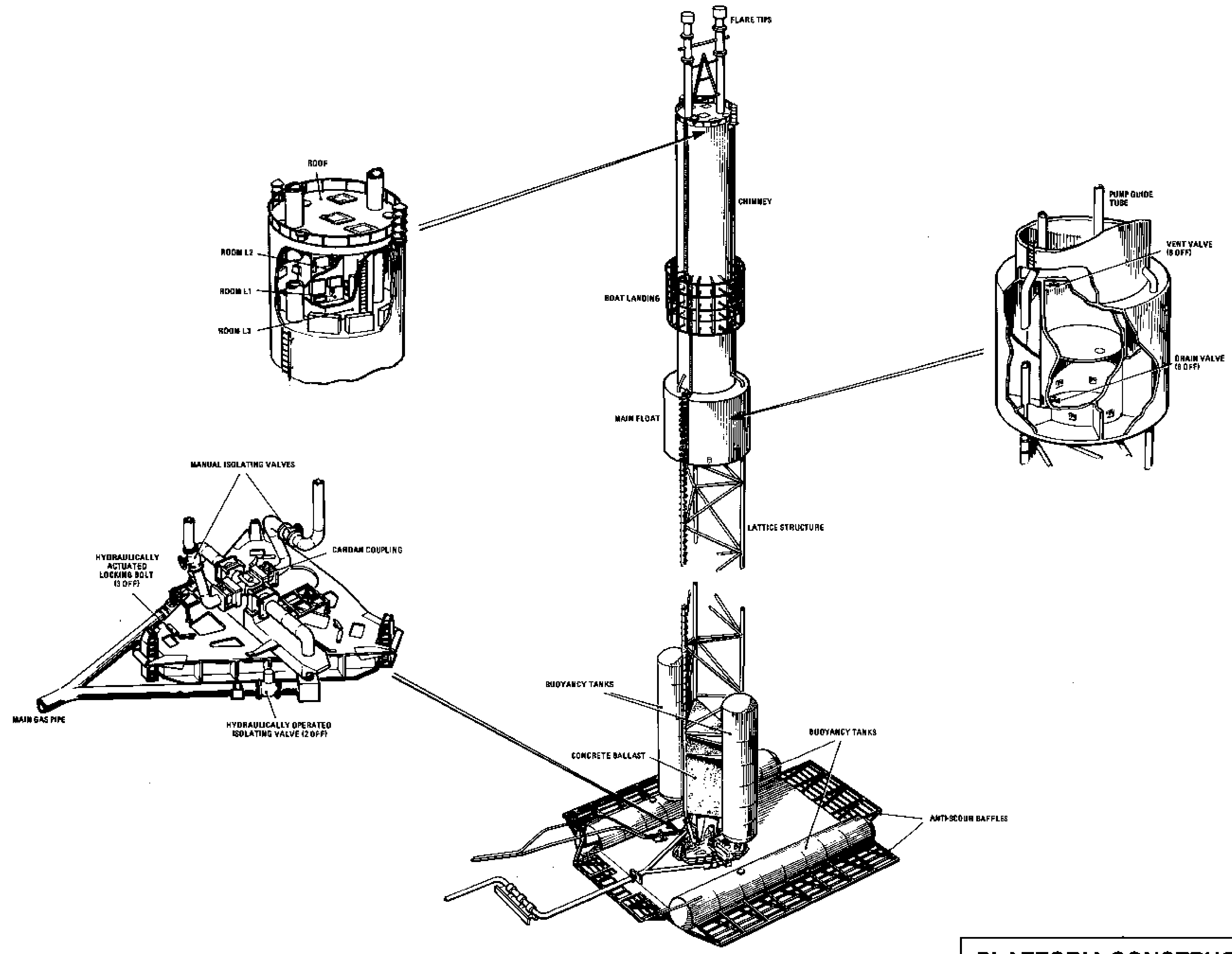
(b) L2 contains the ignition equipment for the flares.

(c) L3 contains the standby batteries for the navigation lights and foghorn.

5.6 The roof of the chimney mounts the navigation lights, foghorn and lifting shears constructed of E24–1 steel. Extending 21m above the roof are the two 42in flare tips and supports, which are constructed of ASTM A516 steel.

5.7 A heat shield constructed of E24–4 steel is installed on the upper part of the chimney to protect it against radiant heat from the flares.

END



ISSUE 1. JULY 1980

PLATFORM CONSTRUCTION

ENVIRONMENTAL DESIGN CRITERIA

1 FOUNDATION

1.1 The results from investigations of the Flare Platform foundation are reported in the following:

(a) Fugro, Report No B–6499,
Field Report, Soil Investigation, Frigg Field.
Dated: August 1st, 1974.

(b) Norwegian Geotechnical Institute Report No 73048–8,
Soil Profile and Laboratory Results, Flare Site, Frigg Field.
Dated: May 23rd, 1975.

(c) Fugro, Report No 14–10071/1,
Cone Penetrometer Tests, Frigg Field.
Dated: May 24th, 1975.

1.2 Soil conditions are summarised as follows:

(a) Top Layer – Dense, fine, uniform sand.

(b) Below Top Layer – Clay with minimum S_v – 8t/m^2.

(c) General knowledge of the soil conditions, supported by seismic profiling, indicate that the above conditions are a suitable foundation for the Flare Platform.

END

ENVIRONMENTAL DESIGN CRITERIA

WIND

		BETWEEN LAT AND +10m	ABOVE +10m (VARIATION)
MAXIMUM SUSTAINED WIND (ONE MINUTE)	10 YEAR STORM CONDITIONS	$V_{10} = 53 m/s$	$V_z^2 = Ch\ V_{10}^2$ V_z = VELOCITY AT ELEVATION$_z$ V_{10} = VELOCITY AT ELEVATION 10m $Ch = 2.5\ \frac{Z+10}{Z+60}$ (Z IN METRES)
	OPERATING CONDITIONS	36 m/s	AS ABOVE
MAXIMUM GUST WIND (THREE SECONDS)	10 YEAR STORM CONDITIONS	62.5m/s	AS ABOVE

RAINFALL

YEARLY AVERAGE	MAX 24 HOUR FALL	YEARLY AVERAGE RAINY DAYS
900mm	88mm	105 DAYS

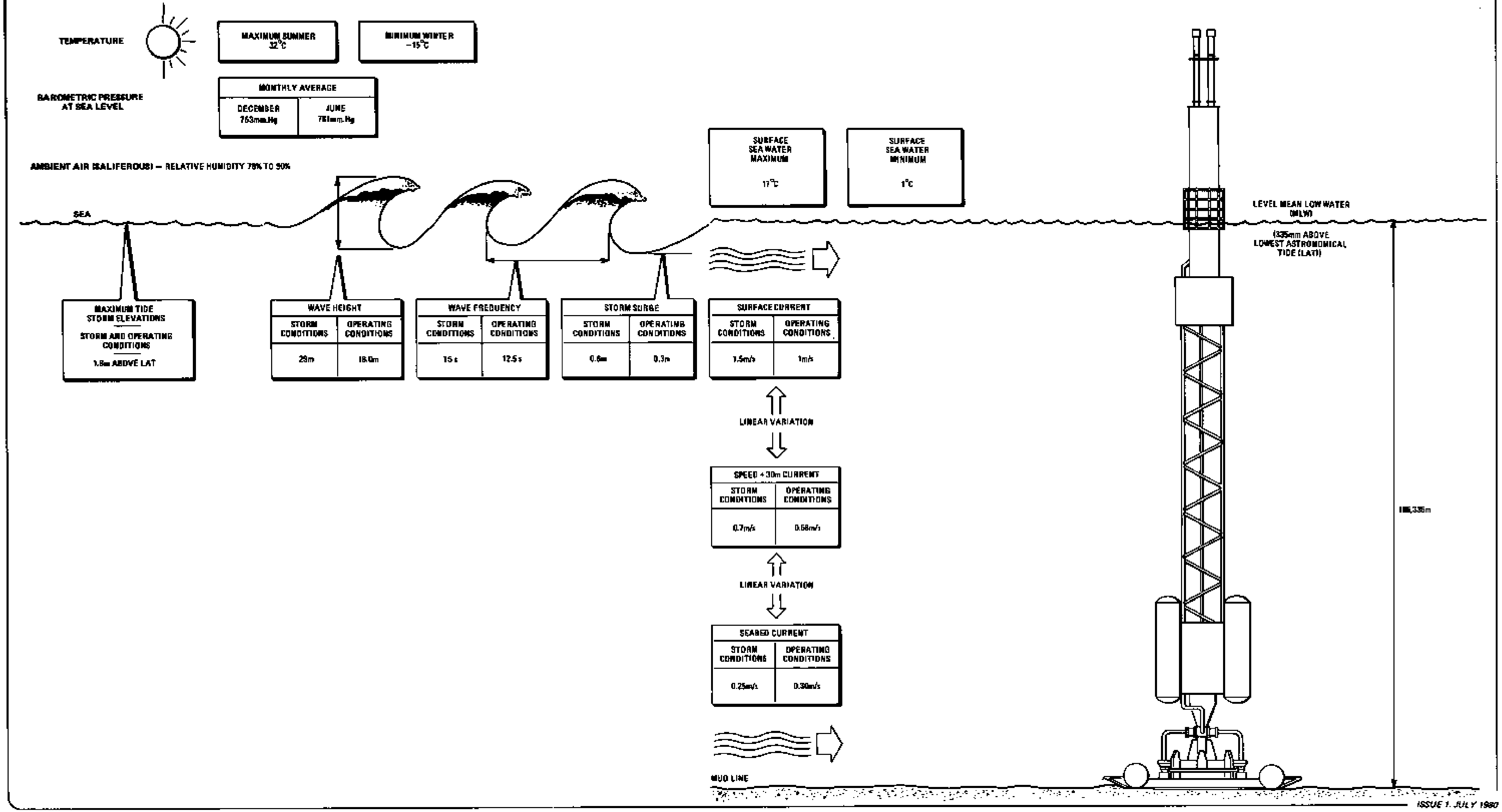
TEMPERATURE

MAXIMUM SUMMER	MINIMUM WINTER
32°C	−15°C

BAROMETRIC PRESSURE AT SEA LEVEL

MONTHLY AVERAGE	
DECEMBER	JUNE
763mm.Hg	761mm.Hg

AMBIENT AIR (SALIFEROUS) – RELATIVE HUMIDITY 70% TO 90%



SURFACE SEA WATER MAXIMUM	SURFACE SEA WATER MINIMUM
17°C	1°C

MAXIMUM TIDE STORM ELEVATIONS
STORM AND OPERATING CONDITIONS
1.8m ABOVE LAT

WAVE HEIGHT	
STORM CONDITIONS	OPERATING CONDITIONS
29m	18.0m

WAVE FREQUENCY	
STORM CONDITIONS	OPERATING CONDITIONS
15 s	12.5 s

STORM SURGE	
STORM CONDITIONS	OPERATING CONDITIONS
0.6m	0.3m

SURFACE CURRENT	
STORM CONDITIONS	OPERATING CONDITIONS
1.5m/s	1m/s

LINEAR VARIATION

SPEED +30m CURRENT	
STORM CONDITIONS	OPERATING CONDITIONS
0.7m/s	0.68m/s

LINEAR VARIATION

SEABED CURRENT	
STORM CONDITIONS	OPERATING CONDITIONS
0.25m/s	0.30m/s

ISSUE 1. JULY 1980

MATERIALS AND CONSTRUCTION

1 FABRICATION

1.1 The main fabrication contractor for the platform was Compagnie Francaise D'Enterprises Metalliques (CFEM). Various subsidiary contractors were as follows:

(a) CFEM, Rouen – Base structure; triangular ballast; main float; chimney; 42in gas pipes

(b) CFEM, Dunkerque – Lattice structure; platform erection

(c) A. Lozai, Rouen – Base buoyancy tanks

(d) CFEM, Lauterbourge – Connecting plate structure

(e) Cockerill SA, Seraing, Belgium – Connecting plate securing bolts

(f) Ateliers et Chantiers de Bretagne, Nantes – Connecting plate locking bolts

(g) Lerry Captain a Bussy, Joinville – Articulated joint

1.2 Criteria for design and construction were obtained from the following:

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

(b) American Petroleum Institute, API RP2A, API Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms. Sixth 1975 and seventh 1976 editions.

(c) American Institute of Steel Construction, Manual of Steel Construction. Seventh, June 1973, edition.

(d) American Welding Society, AWS D1.1–72, Structural Welding Code.

(e) Det norske Veritas, Technical Notes for Fixed Offshore Structures

1.3 Fabrication specifications used for platform construction are as follows:

(a) Steel structure
- Elf Norge, Frigg Field, 1052 No 3–145, Fixed Offshore Structures, Material Specification Rev 4, December 1973.
- Elf Norge, Frigg Field, 1052 No 3–1555, Fixed Offshore Structures, Fabrication Specification Rev 1, May 1973.

(b) Articulated joint
- Noix de Cardan, 25th July 1974.
- Paliers.
- Bride Support Etancheite Palier.
- Bride Logement Joints de Palier.
- Plaque Support Joints Tournants.
- Bride Joint Tournant.
- Joint de Garde Pour Etancheite de Palier.
- Colonnes Entretoises, 30th July 1974.
- Rail de Guidage 31st January 1975.
- Ressorts Pour Joints de Paliers.
- Verins de Compression de Joint Gaz.
- Coussinet.
- Lubrication des Tourillons de la Noix de Cardan.
- Bearing Set-Screw 13th February 1975.

(c)	Connecting plate, locking and securing bolts	– Fourreaux de Verrous de Connection, 17th April 1975 – Bolt connection of 8th April 1975 – Connection Guide Bolt of 17th April 1975 – Locking System between Base and Column of 19th February 1975 – Ensembles Connecteurs of 7th January 1975.
(d)	Gas pipe	– Connecting joint seat on base of 21st February 1975.
(e)	Base	– Pinoches of 7th January 1975.

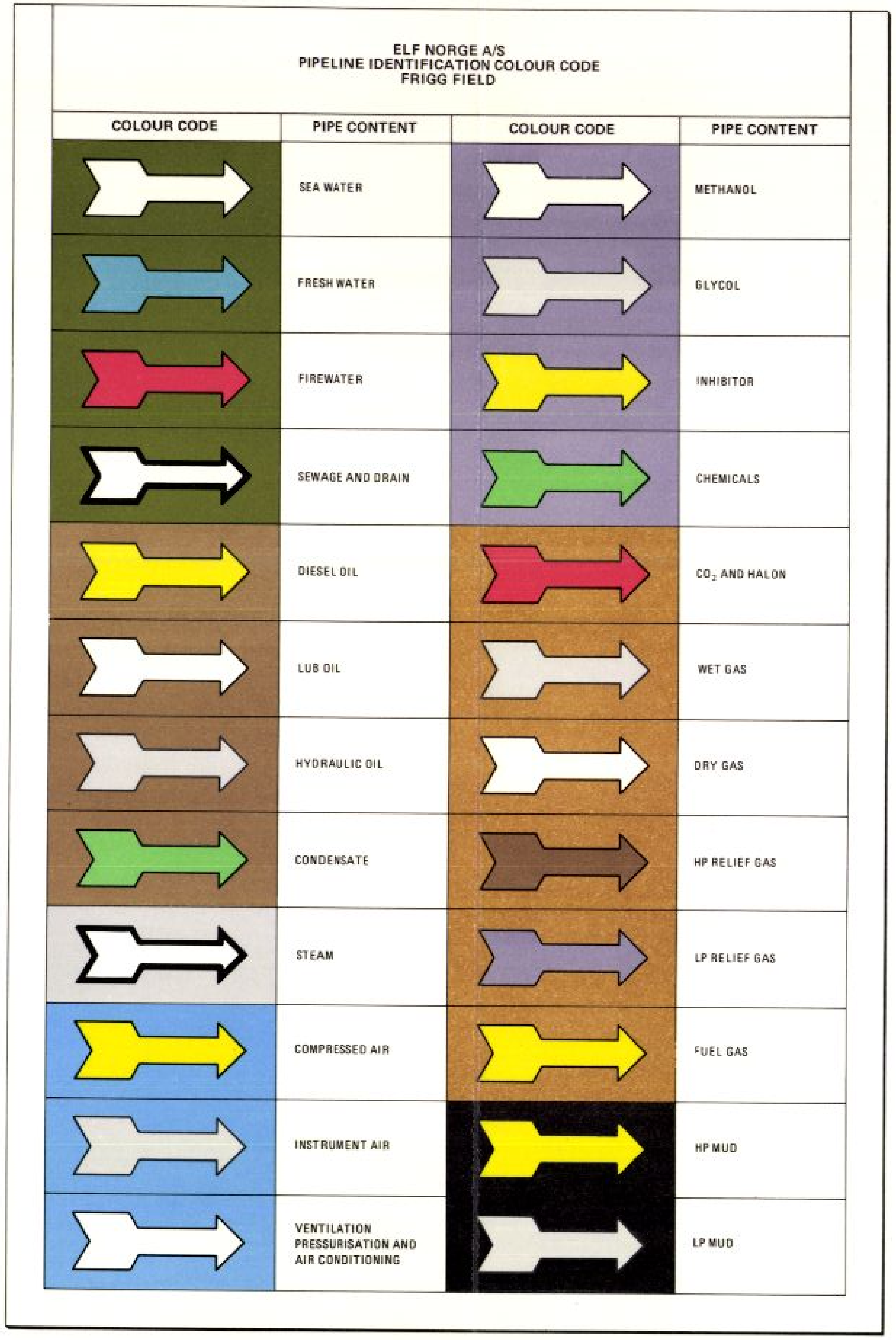
2 MATERIALS

2.1 Materials for structural components are fabricated in accordance with DIN 17100, or the equivalent French standard, with Charpy–V tests at –20 or –40°C. The –40°C temperature was used for heavy components and those carrying gas.

2.2 Gas pipes from midway up the main float are fabricated from American Society for Testing Materials (ASTM) A516 and 333 steel, Charpy–V tested at –40 or –46°C.

2.3 Materials used for fabrication of individual components are described in Section 2.1. The abbreviation SHS–40 used, means Special High Strength Steel with an impact testing temperature of –40°C.

END



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 To prevent corrosion caused by galvanic action, a cathodic protection system comprising strategically located sacrificial anodes is provided.

1.2 Cathodic protection criteria are as follows:

- (a) Design life – 20 years.
- (b) Current density for base steel in sea water – 130mA/m^2.
- (c) Current density for coated steel in splash zone – 50mA/m^2.
- (d) Current density for steel in concrete – 10mA/m^2.
- (e) Resistivity of sea water – 32.9 ohm cm.

1.3 Aluminium anodes (type Alanode of BKL) having the following composition are used:

- (a) Zn – 0.5 to 5 per cent.
- (b) Sn – 0.005 to 0.05 per cent.
- (c) Fe – 0.13 per cent maximum.
- (d) Si – 0.1 per cent maximum.
- (e) Cu – 0.01 per cent maximum.
- (f) Al – remainder.

1.4 Each anode has a potential of 250mV and a capacity of 2640Ah/kg.

2 DESCRIPTION

2.1 To enable system monitoring, pure zinc reference electrodes are fitted to the base and tower structure. A potential indicator, located in Room L1, is provided to compare the reference and sacrificial anode potential.

2.2 Sacrificial anodes are distributed as shown on the following table:

Location	Quantity	Net weight (kg)	Total weight (kg)
Chimney	33	280	9240
	13	120	1560
Main float	20	280	5600
Lattice structure	38	280	10640
Triangular ballast	55	280	15400
Articulated joint	7	280	1960
Connection plate	5	280	1400
	5	120	600
	40	80	3200
Buoyancy floats	42	280	11760
Base	32	280	8960
Total	290		70320

END

CHAPTER 3

PROCESS SYSTEMS

CONTENTS

DIAGRAMS

MAIN GAS SYSTEM

1 GENERAL

1.1 The Main Gas System, incorporated in the Flare Platform, fulfils the following functions:

(a) System purging.

(b) High pressure relief.

(c) Protection of the 32in sales gas pipeline.

(d) Blowdown of TP1 and TCP2.

(e) Manual flushing.

1.2 Total blowdown gas volume is a nominal 1200m^3. Initial maximum blowdown flowrate during a total blowdown is 34 MMSCMD. The time taken to depressurise TP1 and TCP2 is 15 to 20 minutes.

1.3 All gas is treated on TP1 prior to flaring.

2 DESCRIPTION

2.1 Gas enters the platform from TP1 and/or TCP2 through a 24in subsea line, which bifurcates at the platform base into independent gas circuits. Each circuit is fitted with a hydraulically operated isolating valve.

2.2 A spigot and socket joint is incorporated in each circuit line to enable the gas lines to disconnect without damage should the platform release system be operated. Above these joints the gas lines connect to a Cardan coupling, about which the platform articulates. Gas is transferred from the base to the tower through cored passages in the coupling. A manually operated isolating valve is installed in each gas line above the Cardan coupling.

2.3 A patented seal, actuated by tensile distortion caused by mechanical friction, prevents gas leakage at the articulation.

2.4 A 2in parallel circuit is connected to the lowest point of the 24in gas line to facilitate gas bleeding and condensate removal. The drain line is fitted with a hydraulically operated isolating valve.

2.5 The flare line is maintained dry by periodic flushing with sales gas.

2.6 To prevent the formation of an explosive gas/air mixture in the flare lines when the flare is burning and to maintain a stable flame at the flare tip, a nominal 24 000m^3/d of fuel gas is flared through the two stacks. When the flare is cold, the system is swept continuously with fuel gas at a maximum rate of 18 000m^3/d for the two stacks.

2.7 Operation of the gas line isolating valves is from three keyswitches located on the flare panel in QP Control Room. Each switch has three positions, the function of each position is as follows:

(a)	Switch A	– ON, energise valve circuits. OFF, de-energise valve circuits. V50A/B, initiate visual indication of appropriate valve open/closed position.
(b)	Switches B and C (one per valve)	– OPEN, V50A and/or V50B. CLOSE, V50A and/or V50B. OVERRIDE, an electrical interlock prevents simultaneous closure of both valves, setting the switch to OVERRIDE bypasses the interlock, so that both valves may be closed for maintenance.

2.8 The following information is displayed on the flare panel and process mimic in QP Control Room:

(a) Gas to flare flowrate.

(b) Flare line pressure (computer only).

(c) Open/Closed position of hydraulic isolating valves.

(d) Flame-out alarm Stack A.

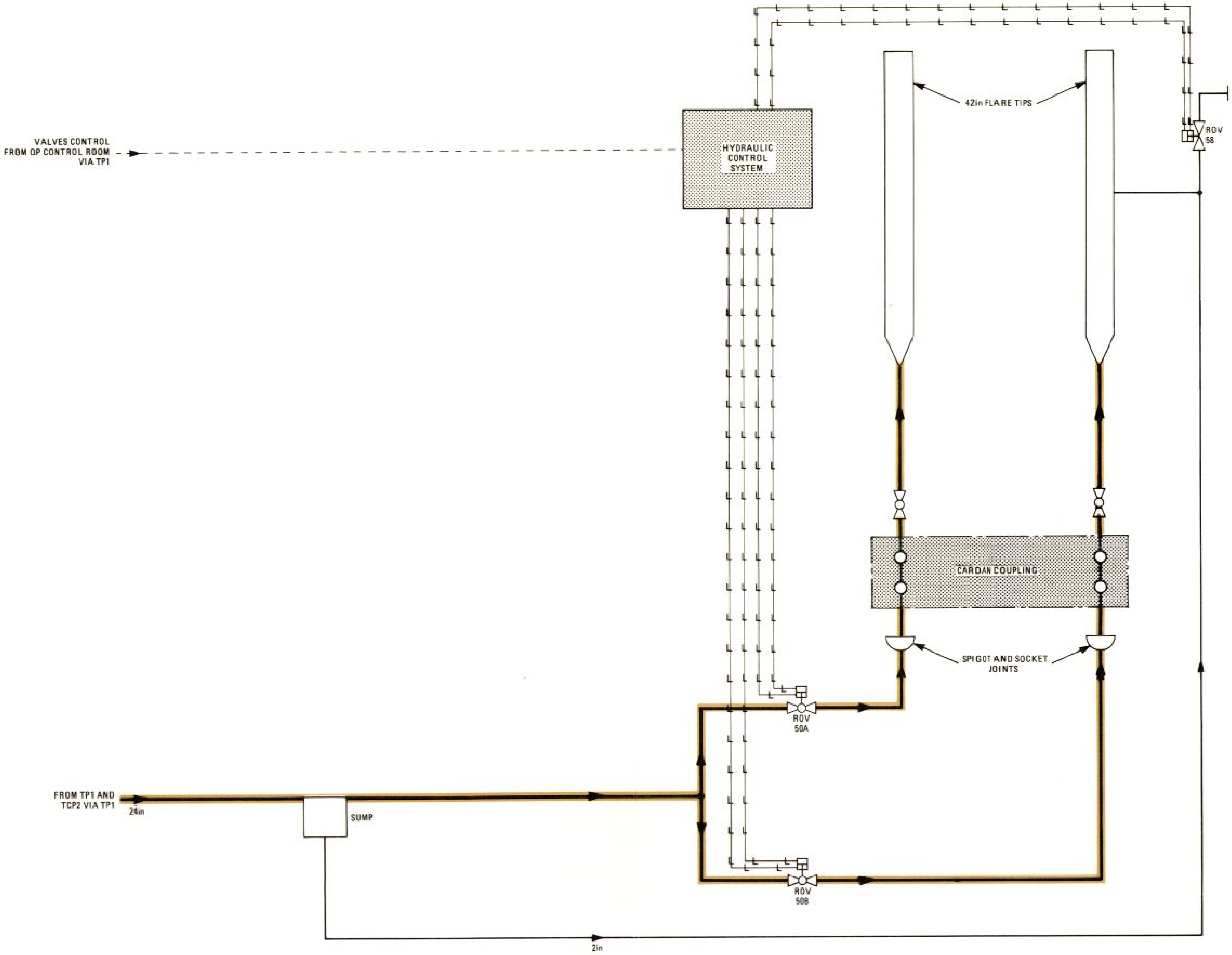
(e) Flame-out alarm Stack B.

(f) Low hydraulic pressure alarm.

(g) Low-Low hydraulic pressure alarm.

(h) Flare tip temperatures.

END



MAIN GAS SYSTEM **3.1**

FLARE PILOTS SYSTEM

1 GENERAL

1.1 The Flare Pilots System ensures constant ignition of the purge gas and, in the event of blowdown/relief, immediate ignition of flare gas.

1.2 Each flare tip is fitted with three pilot burners and their respective igniters and thermocouples. The burners are automatically ignited by individual flame front generators.

1.3 Pilot gas continuously flows to each pilot burner.

2 DESCRIPTION

2.1 Fuel gas (pilot gas) and compressed air are supplied through 2in lines from TP1. Pilot gas is fed to the six flame front generators and pilot burners, air is fed to the flame front generators. Pressure control valves reduce air and gas pressure to each flame front generator and pilot burner to 2.4 bar.

2.2 Each flame front generator contains two solenoid-operated valves which meter the air and gas to a ratio of 10:1. The valves are controlled by associated ignition logics which also actuate the spark plug.

2.3 The ignition logics are actuated by pushbuttons at the flare start-up panel in TP1 Control Room, or locally from Room L2. On operation of a pushbutton air/gas mixture enters the flame front generator where it is ignited by the spark plug. Flame travels up the igniter tube to the pilot burner, where the thermocouple senses ignition and switches off the ignition logic. A failure-to-ignite alarm will indicate on the flare panel in QP Control Room.

2.4 Before initiating pilot burner ignition from TP1, a manual authorisation switch on the flare panel in QP Control Room must be made.

2.5 The following information is displayed on the flare panel in TP1 Control Room:

(a) Electrical power on.

(b) Flare A/B in auto.

(c) Flare A/B pilot on.

(d) Flare A/B pilot failure.

(e) Ignition sequence running.

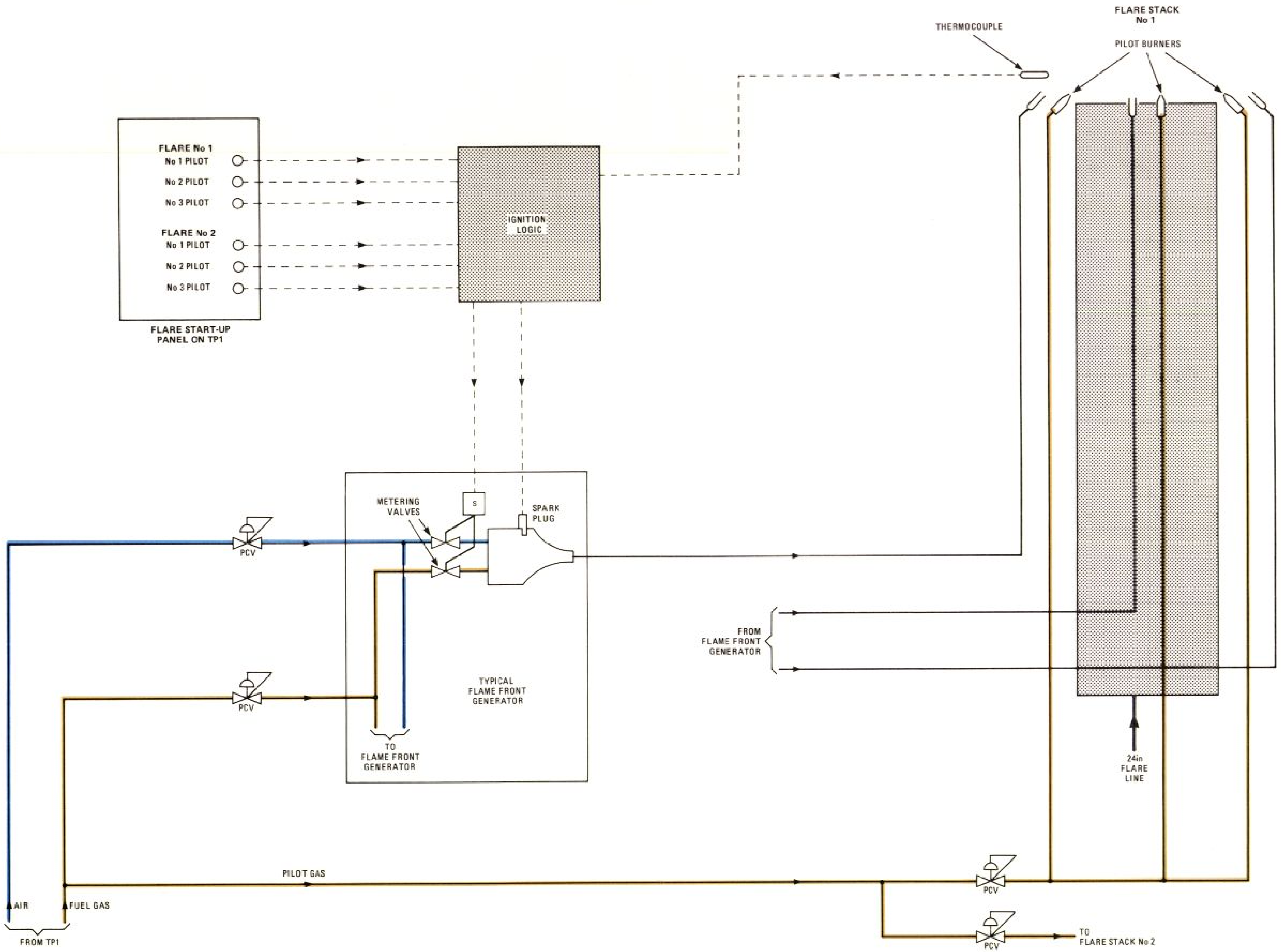
(f) Air on.

(g) Gas on.

(h) Ignition.

(j) Authorisation to ignite from QP

END



ISSUE 1. JULY 1980

FLARE PILOTS SYSTEM

3.2

CHAPTER 4

UTILITIES

CONTENTS

DIAGRAMS

HYDRAULIC SYSTEM

1 GENERAL

1.1 The Hydraulic System provides motive power for operation of gas pipeline isolating valves ROV50A, ROV50B and condensate discharge valve ROV58.

1.2 The system comprises the following major items of equipment:

(a) One 45-litre capacity reservoir.

(b) One 4-litre/min capacity positive displacement pump, installed in the 45-litre reservoir.

(c) One 250-litre capacity reservoir.

(d) Ten 50-litre accumulators, which have a combined capacity of 485 litres.

(e) Four pilot valves, two each for ROV50A and B.

(f) One pilot valve for ROV58.

1.3 Most of the equipment is located in Room L1, the exceptions being eight accumulators which are located on the boat landing structure, and the 250-litre reservoir which is mounted on the roof-top.

1.4 Since access to the platform is prohibited while the field is in production, the system is powered by the energy stored in the accumulators. The accumulators' capacity is sufficient to operate the three valves a nominal twenty times. When access to the platform is permitted during the annual shutdown, the accumulators are manually recharged.

2 DESCRIPTION

2.1 Replenishment of the 45-litre reservoir is from the 250-litre storage reservoir. Fluid is let down under gravity, controlled by a manually operated isolating valve. The supply line incorporates a filter with a spring-loaded check valve arranged to bypass the fluid in the event of filter blockage. Should the level in the 45-litre reservoir fall below a preset point, a switch initiates an alarm at the flare control panel in QP Control Room.

2.2 The pump is connected to the hydraulic fluid supply rail by a manually operated isolating valve. A relief valve installed at the pump discharge relieves pressure in excess of 210 bar to the pump reservoir.

2.3 The accumulators are connected to the hydraulic fluid supply rail to provide hydraulic power for normal operation. They are normally isolated from the supply rail by two interconnected motor-operated valves installed in series. During recharge each accumulator is pressurised to 100 bar with nitrogen; this pressure is then increased to 210 bar with hydraulic fluid by manually operating the pump.

2.4 A pressure switch, installed between the accumulators and the motor-operated valves, initiates alarm at the flare control panel in QP Control Room should accumulator pressure fall to 130 bar.

2.5 To operate ROV50A, ROV50B and ROV58, the motor-operated valves are opened to pressurise the supply rail. On completion of operation the valves are closed to isolate the accumulators, to prevent them being discharged by any small leaks in the system.

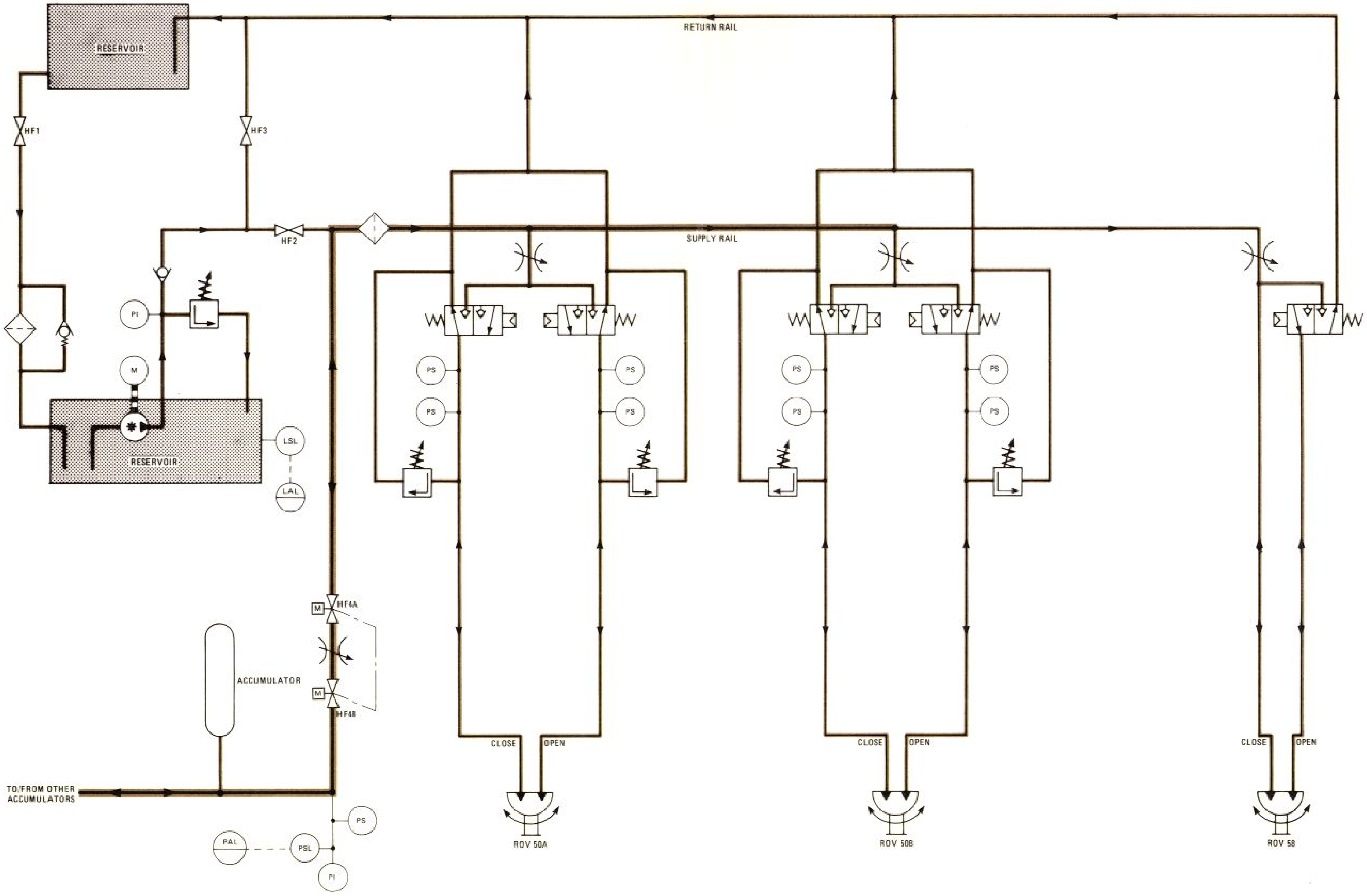
2.6 Operation of ROV50A and B is controlled by two pairs of pilot valves. An electrical interlock, with key-operated override switches, prevents both valves from being closed, except when discharging condensate or in an emergency. To limit speed of operation, each pilot valve is connected to the supply rail via a variable restriction orifice. Relief valves connected to the gas valves' hydraulic lines are set to lift at 130 bar.

2.7 Two pressure switches are connected to each hydraulic line serving the gas valves. These switches, set at 115 bar and 120 bar, transmit line pressures to the flare control panel in QP Control Room giving visual indication of each gas valves open/closed position.

2.8 The pilot valve serving ROV58 is permanently connected to the supply rail on the close side. When the pilot valve on the open side is operated, hydraulic pressure across the pilot valve equalises, enabling the valve to be opened under pipeline pressure.

2.9 The return lines from each pilot valve combine as the return hydraulic fluid rail, which is led to the 250-litre reservoir.

END



HYDRAULIC SYSTEM **4.1**

LUBRICATION SYSTEM

1 GENERAL

1.1 The Lubrication System provides a means of lubricating the four bearings of the Cardan coupling upon which the platform articulates.

1.2 The system comprises the following equipment:

(a) A bladder-type 10.1-litre capacity accumulator, mounted on the coupling spider.

(b) A 100-litre capacity reservoir, located under the floor of the rooms in the roof at elevation +126m.

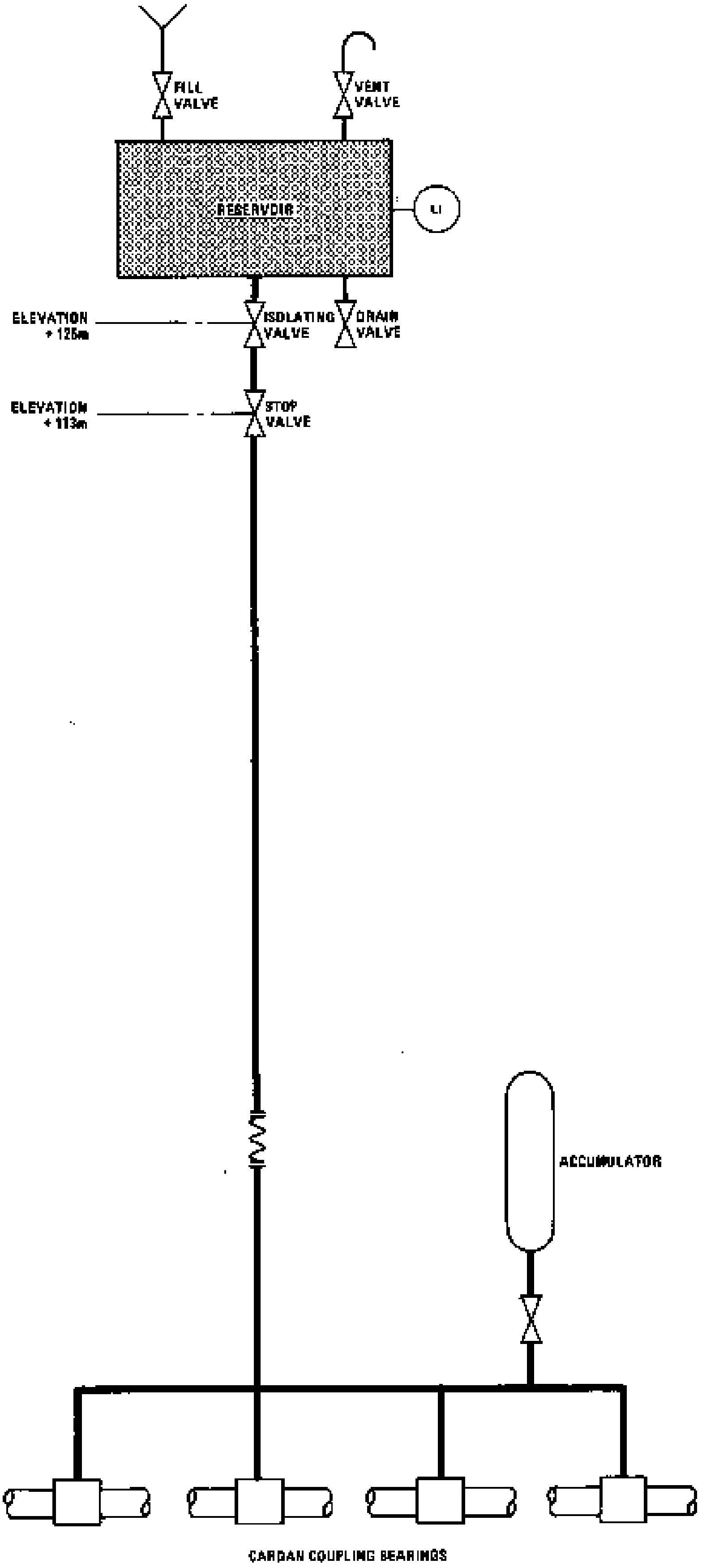
2 DESCRIPTION

2.1 The accumulator is pressurised to a nominal 10 bar by the reservoir head. Oil at this pressure is supplied to the bearings.

2.2 The accumulator is manually recharged when access to the platform is permitted during the annual shutdown. Once pressurised, the supply to the accumulator is isolated. The accumulator stores sufficient oil to maintain lubrication for at least one year.

2.3 The stop valve in the accumulator supply line is located in the chimney, at boat landing level, elevation +113m.

END


FILL VALVE
VENT VALVE
RESERVOIR
LI
ELEVATION + 125m
ISOLATING VALVE
DRAIN VALVE
ELEVATION + 113m
STOP VALVE
ACCUMULATOR
CARDAN COUPLING BEARINGS

MAIN FLOAT DEWATERING SYSTEM

1 GENERAL

1.1 The Main Float Dewatering System is provided to dewater the main float compartments in the event of a leak.

1.2 The system comprises three portable pumps and flexible suction and discharge hoses. Each pump, driven by an 18.7kW electric motor, has a capacity of 135m^3/h against 35m head.

1.3 The pumps are normally stowed in Room L3, and are lowered into the main float via the pump guide tube when required.

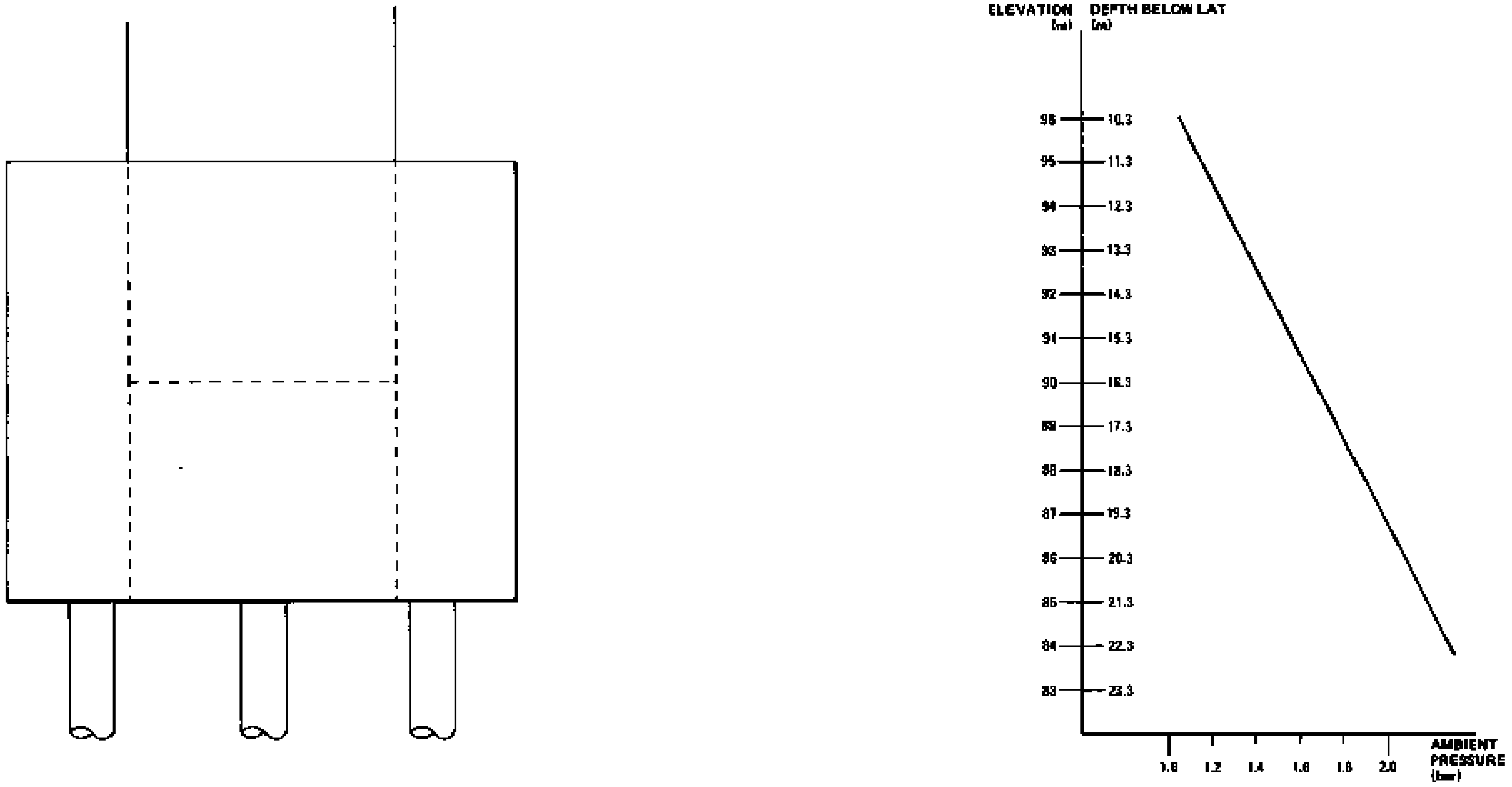
2 DESCRIPTION

2.1 The six peripheral compartments of the main float are each provided with a valved drain connection near the bottom and a valved vent connection near the top. When it is required to dewater a compartment, the pumps are placed in the lower central compartment into which the peripheral compartments can be drained. The pump discharges are led overboard.

2.2 Normal pump operation is with one or two pumps in use as required, and the third primed, checked and on standby.

2.3 Vent connections can be used to check for peripheral compartment flooding. If a leak has occurred, pressure in the compartment will approximate the ambient pressure at the depth of the fissure. Therefore, a pressure indicator connected to the vent connection will give reliable indication of whether a leak has occurred, and if so at approximately what elevation. Diagram 4.3 shows the approximate ambient pressure at various levels of the main float.

END



AMBIENT PRESSURE AT MAIN FLOAT

VENTILATION

1 GENERAL

1.1 A forced draught ventilation system is installed in Room L2 only. This room contains the flare pilots system flame front generators. In order to classify the room as an Electrical Safety Code Area 2, the system provides a minimum of 12 air changes per hour.

1.2 The system comprises two vent fans which are installed in series and operate one running and one standby.

1.3 Room L3 is ventilated naturally through manually operated ventilators installed in the ceiling.

2 DESCRIPTION

2.1 The duty forced draught fan is controlled from an On/Off switch in QP Control Room, a 'Ventilation 1 On' lamp in the control room illuminates when the fan is running.

2.2 In the event of duty fan failure, the standby fan starts automatically, the 'Ventilation 1 On' lamp extinguishes and the 'Ventilation 2 On' lamp illuminates.

2.3 Secondary lamps and a control switch are locally mounted on a panel in Room L2.

END

ELECTRICAL POWER SYSTEM

1 GENERAL

1.1 The electrical power requirement of the Flare Platform is supplied by TP1.

1.2 A single 380V submarine power cable from Emergency Supplies Board DB8 on TP1 supplies a distribution cabinet located in Room L1. The power cable is 4-core, has 95mm^2 tinned copper conductors with double bronze tape and double steel wire armour.

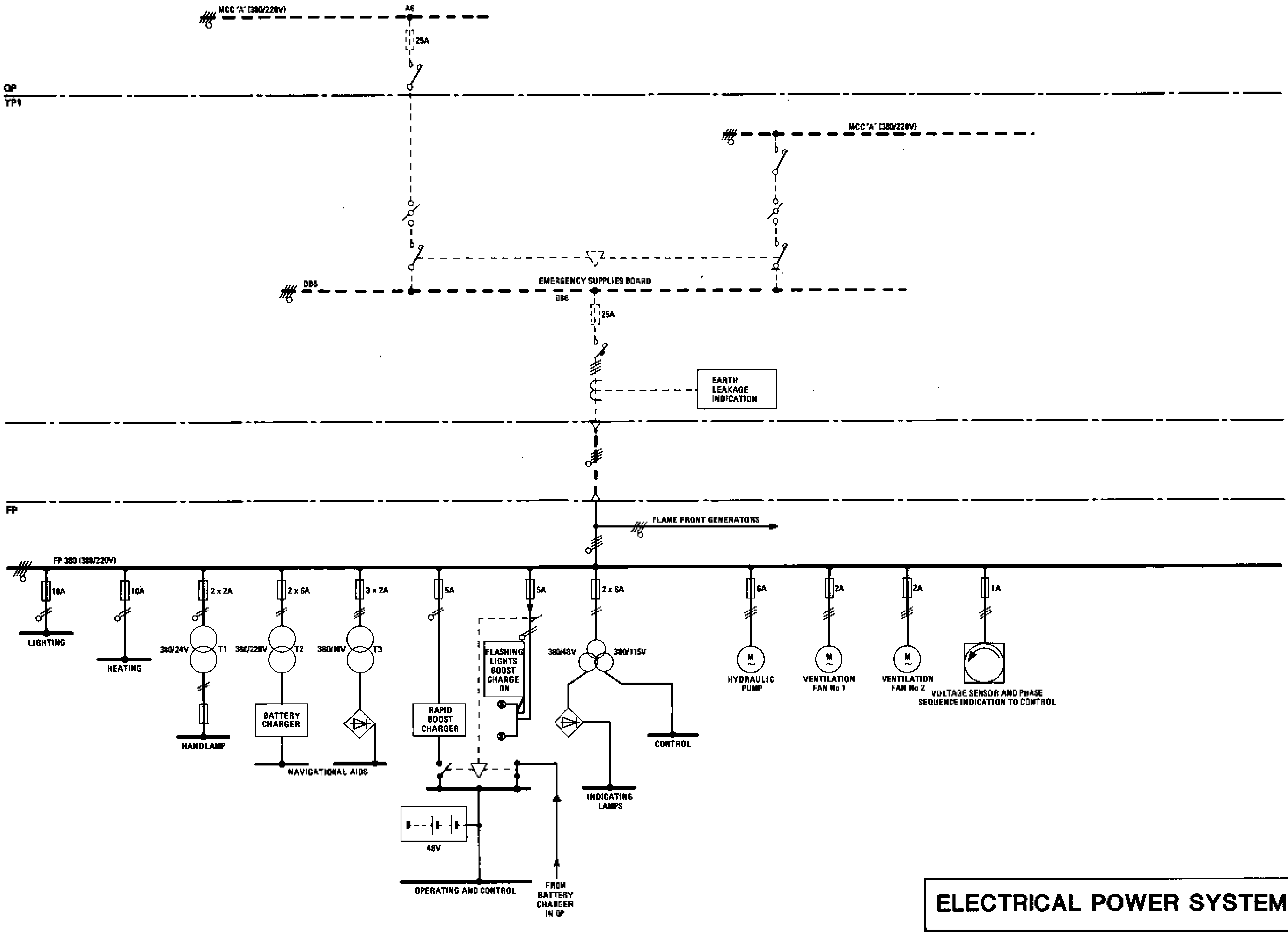
2 DESCRIPTION

2.1 Power supplies are limited to 17kVA, controlled by an MCCB on TP1. In the event of an earth fault in the cable or on the Flare Platform, earth leakage detection equipment will cause an alarm to indicate in QP Control Room.

2.2 The power cable terminates in a junction box containing a 3-pole and neutral isolator. From the isolator a 3-phase and neutral output feeds the distribution cabinet, and a parallel output feeds the flare pilots system flame front generators.

2.3 The distribution cabinet contains the fuses, relays, contactors, transformers and special equipment which enables the Flare Platform to be operated and controlled, either locally or remotely from QP/TP1 control rooms.

END



ELECTRICAL POWER SYSTEM

LIGHTING

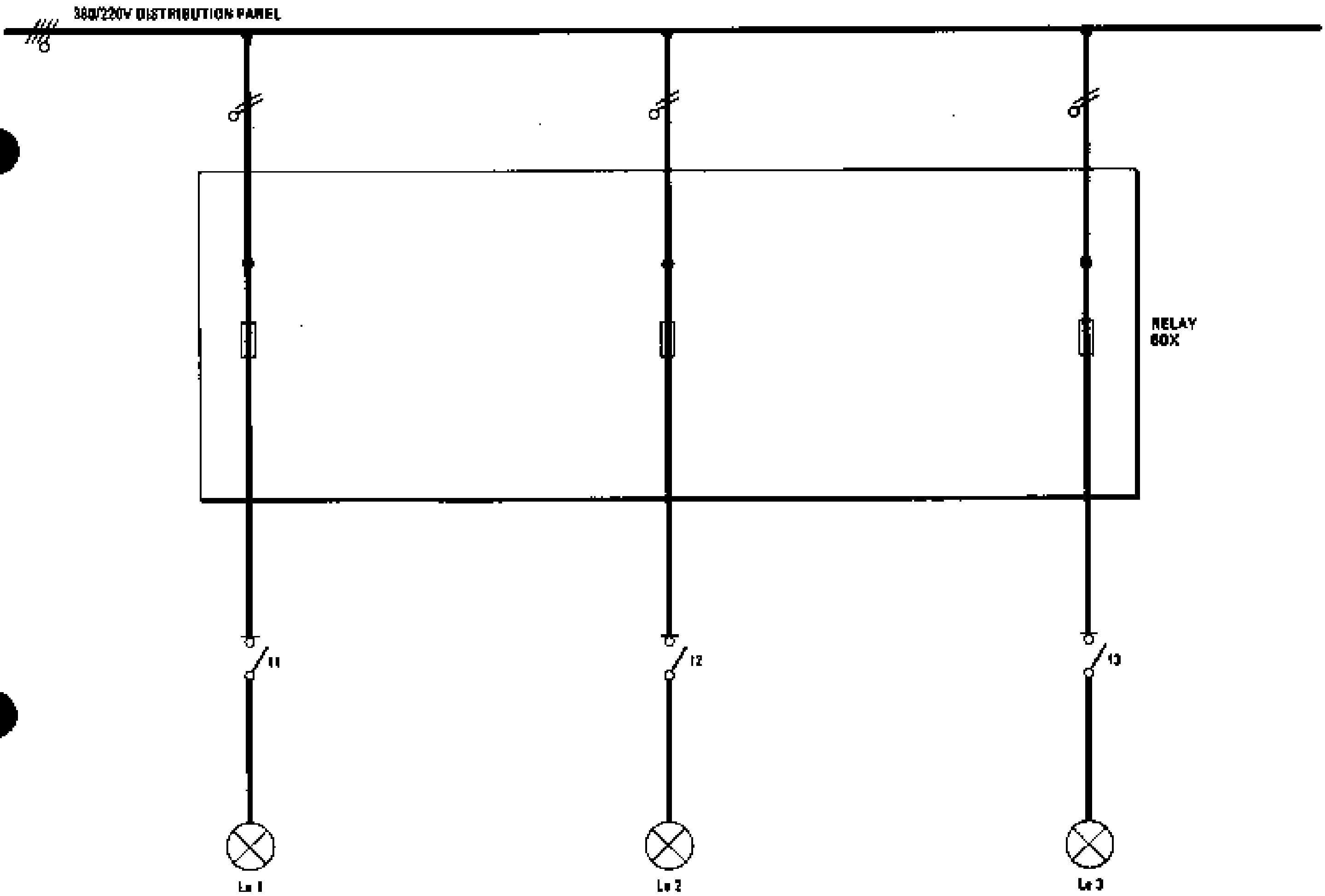
1 GENERAL

1.1 Rooms L1, L2 and L3 are each illuminated by a single ceiling mounted 220V 60W incandescent lamp, actuated by locally mounted switches.

1.2 The lights are fed from the 380V/220V main busbar in the distribution cubicle, via a relay box.

1.3 Each lamp is installed in a cast iron fitting having cooling fins. They are weather and corrosion proof.

END


380/220V DISTRIBUTION PANEL
RELAY BOX
I1
I2
I3
Le 1
Le 2
Le 3

DC SYSTEMS

1 GENERAL

1.1 The Flare Platform is provided with three separate dc systems as follows:

- (a) A 12V system which supplies power to the navigational aids.
- (b) A 48V battery-supported system which supplies power for control and operation.
- (c) A 48V system which supplies power to indicating lamps.

1.2 Major items of system equipment are as follows:

- (a) Control panel located in Room L1.
- (b) Booster charger located in Room L1.
- (c) Rectifier located in Room L1.
- (d) A 48V, 21Ah battery located in Room L2.
- (e) Three 12V batteries located in Room L3.

2 DESCRIPTION

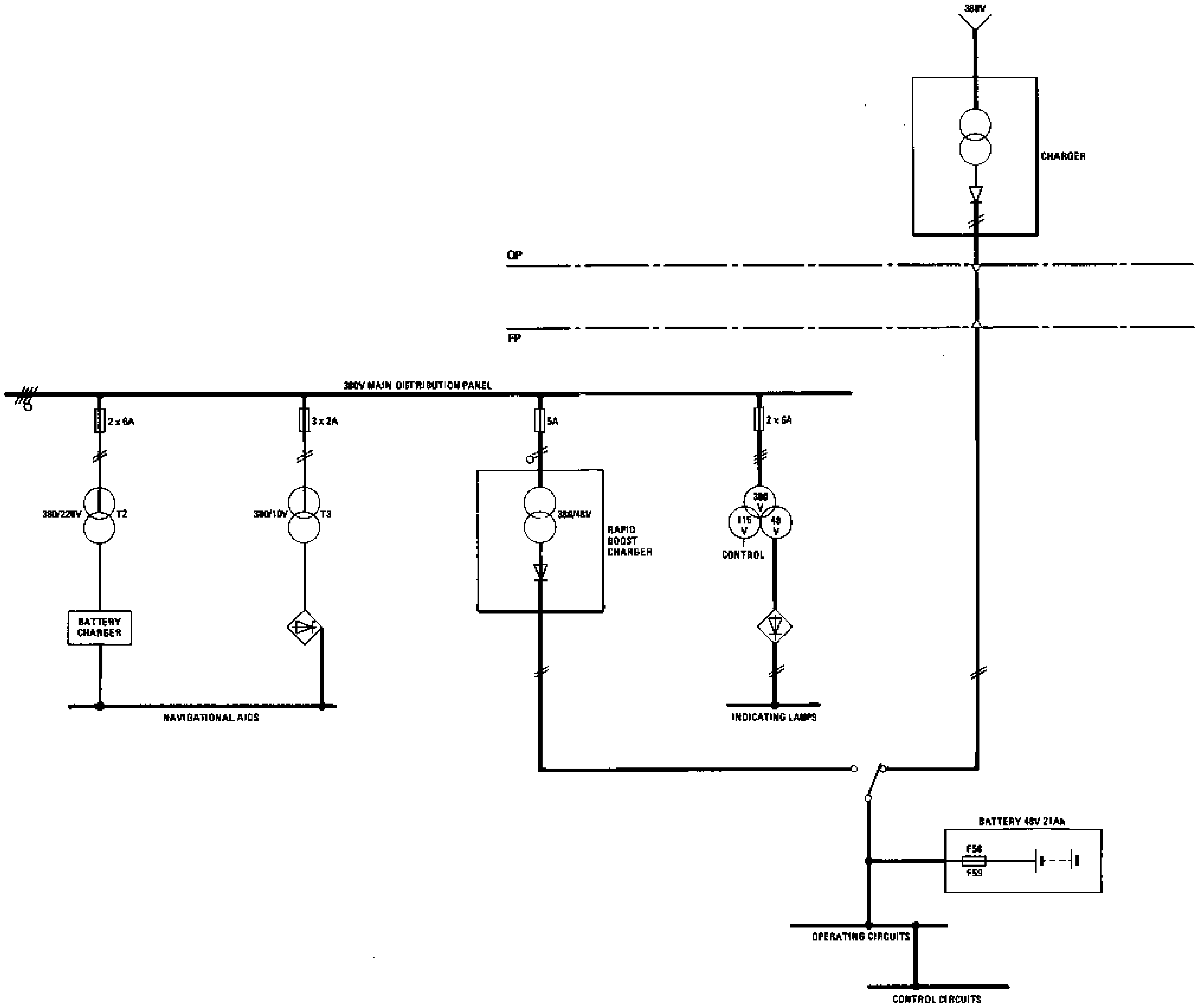
2.1 The 48V battery-supported system is normally supplied through a submarine cable from QP, via a transformer/rectifier. The battery floats across this supply. Actuation of a control panel mounted changeover switch feeds the battery with a rapid charge from the Flare Platform's 380V ac system.

2.2 Power supply to the indicating lamps is from the 380V distribution cubicle, through a transformer and rectifier.

2.3 Power supply to the 12V batteries serving the navigational aids is as follows:

- (a) To the two batteries serving the foghorn through a transformer and battery charger.
- (b) To the battery serving the lights through a transformer and selenium rectifier.

END



KEY No 1 INDICATING LAMPS

VENTILATOR FUNCTIONS : FAULT
No 1 VENTILATOR RUNNING
No 2 VENTILATOR RUNNING
HYDRAULIC PUMP FUNCTIONS: FP CONTROL
OP CONTROL
PUMP RUNNING
FAULT
FOG HORN: OPERATING

KEY No 2. OPERATING CIRCUITS

PRESSURE SWITCH
POWER ON TO VALVE CONTROL AND INDICATION
INDICATION VALVE 'MONTE JUS' OPEN AND CLOSED
LIMIT SWITCHES OF ISOLATING VALVE
CONTROL ISOLATING SWITCH OPEN AND CLOSED
OPERATION VALVE 'MONTE JUS'
MOTOR OPERATION ISOLATING VALVE
OPERATION VALVE 2
POSITION SWITCHING VALVE 1
OPERATION VALVE 1

KEY No 3. CONTROL CIRCUITS

CONTROL VALVE 'MONTE JUS'
POSITION SWITCHING VALVE 2
CONTROL VALVE 2
CONTROL HIGH PRESSURE VALVE 1
CONTROL HIGH PRESSURE VALVE 2

CHAPTER 5

MATERIALS HANDLING

CONTENTS

LIFTING EQUIPMENT

1 GENERAL

1.1 To facilitate the raising and lowering of equipment for maintenance etc, the following equipment is installed on the platform:

(a) A Simia pneumatic hoist.

(b) A Tirfor T35 hand-operated winch.

(c) A Pirelli power winch.

(d) Lifting shears.

(e) Two lightweight pillar cranes.

(f) A lifting frame.

(g) Blocks, tackle, slings, shackles, hooks and lifting beams.

1.2 When not in use the removable equipment is stowed in Room L3.

2 DESCRIPTION

2.1 The pneumatic hoist, fitted with 80m of cable, has a capacity of 1500kg. It is used in conjunction with either the pillar cranes or the lifting shears, and operates at an air pressure of 6 bar.

2.2 The hand-operated winch is used to lift the lifting frame. It has a maximum winch load of 2000kg.

2.3 The power winch, fitted to the roof, was originally used to hoist electric cables.

2.4 The lifting shears, assembled to the flare pipes, have a direct lift capacity of 600kg and a capacity of 2500kg when used with a pulley block.

2.5 The removable pillar cranes each have a capacity of 175kg when used with the hoist and a lazy pulley, and a combined capacity of 350kg when used with the hand winch.

2.6 The lifting frame, which is mounted on the roof and assembled to the flare pipes, enables loads of up to 600kg to be raised at a maximum radius of 8m, as a direct lift. A maximum of 2500kg may be raised when used with additional pulley blocks.

END

CHAPTER 6

COMMUNICATIONS

CONTENTS

DIAGRAMS

NAVIGATIONAL AIDS

1 GENERAL

Navigational equipment installed on the Flare Platform complies with the requirements of the UK Department of Trade (Marine Division) January 1976 'Standard Marking Schedule for Offshore Installations'.

2 DESCRIPTION

2.1 Navigation Lights

2.1.1 Two pairs of vertically mounted white navigation lights are installed as follows:

(a) One pair surmounting the foghorn on the north side of the roof.

(b) A second pair mounted directly on the south side of the roof.

2.1.2 The 12V dc operated lights are each enclosed in a marine lantern fitted with a single-piece fresnel lens.

2.1.3 Each light is visible in clear weather over a range of 10 nautical miles.

2.1.4 Luminous intensity for each pair of lights is a nominal 1400 candelas.

2.1.5 All the lights are equipped with rotating lampholders containing six lamps. If a lamp fails, the next is automatically rotated into its place. The navigation lights must be inspected at each Flare Platform inspection and any burnt-out lamps replaced.

2.1.6 The lights are controlled either manually by switches in QP Control Room, or automatically by a sun switch. In the event of a lights failure, an alarm indicates in QP Control Room.

2.1.7 All four lights are synchronised to transmit the morse letter 'U' once every 15 seconds.

2.2 Foghorn

2.2.1 The foghorn, mounted on the north side of the platform roof, is a vertical array of eight emitters producing a horizontal sound beam through 360°. This sounds over a range of 2 nautical miles in still air.

2.2.2 The horn transmits the morse letter 'U', at a frequency of 645Hz, once every 30 seconds as follows:

Blast:	0.75 sec
Silent:	1.00 sec
Blast:	0.75 sec
Silent:	1.00 sec
Blast:	2.50 sec
Silent:	24.00 sec

2.2.3 The 12V dc operated foghorn is controlled manually from switches located in Room L1 and TP1 Control Room. In the event of foghorn failure, an alarm indicates in QP Control Room.

2.3 Protection

Both the navigation lights and the foghorn are protected from heat radiated from the flares by heat shields.

2.4 Power Supply

2.4.1 The 12V supply for the foghorn and navigation lights is taken from batteries housed in Room L3.

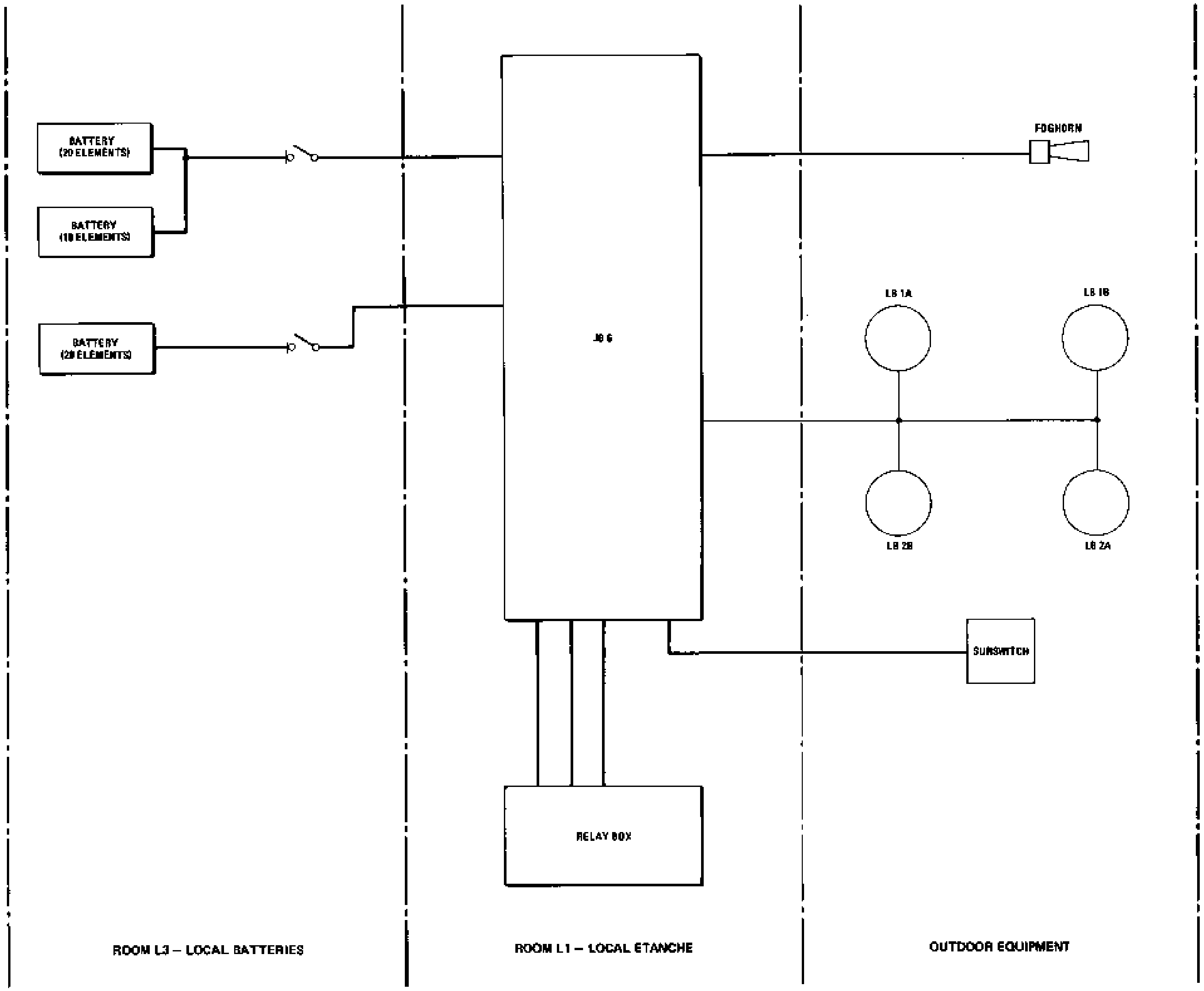
2.4.2 Power supply to the batteries is from TP1 platform's 380V ac distribution cubicle as follows:

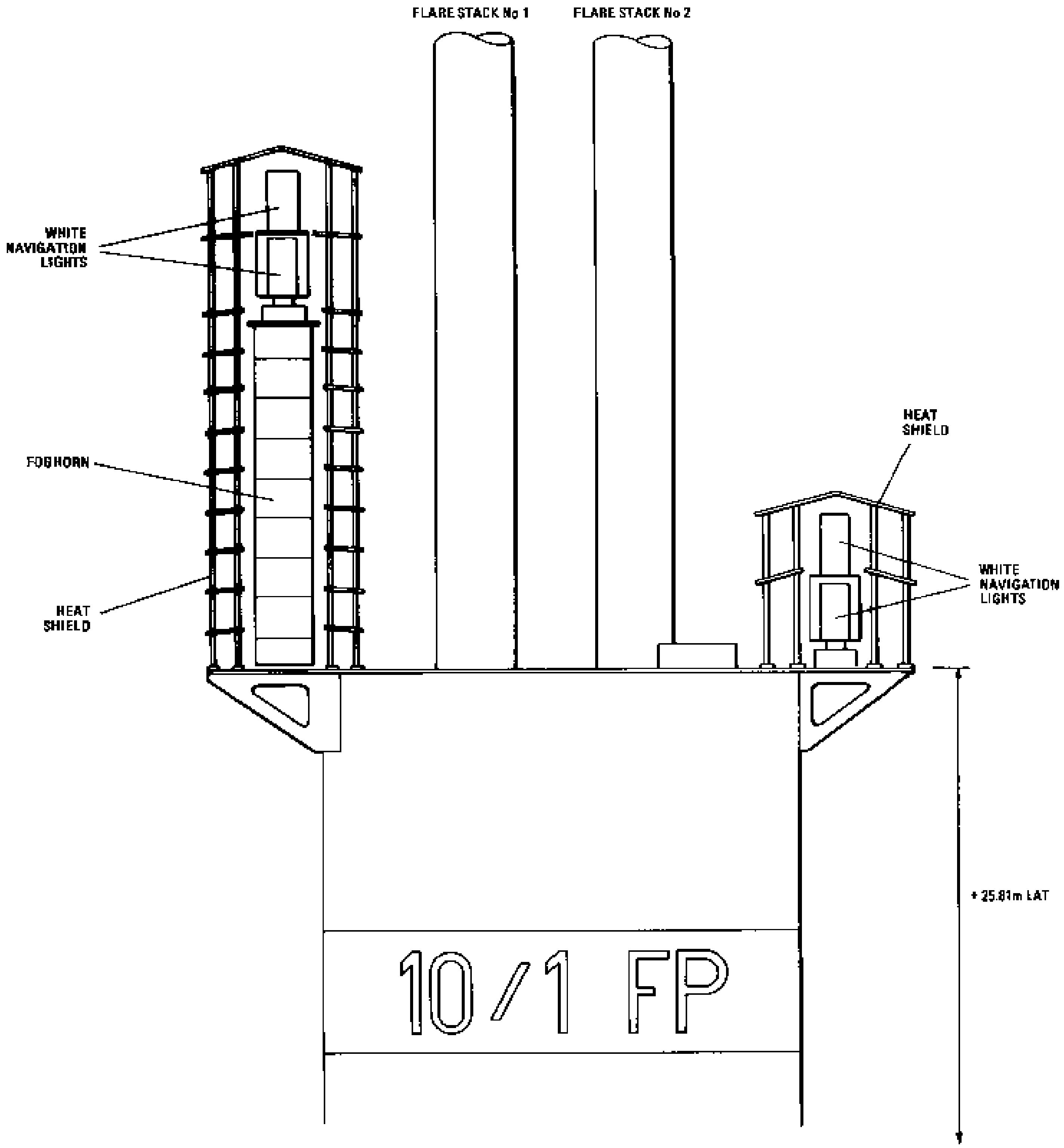
(a) To the two batteries serving the foghorn through a transformer and battery charger.

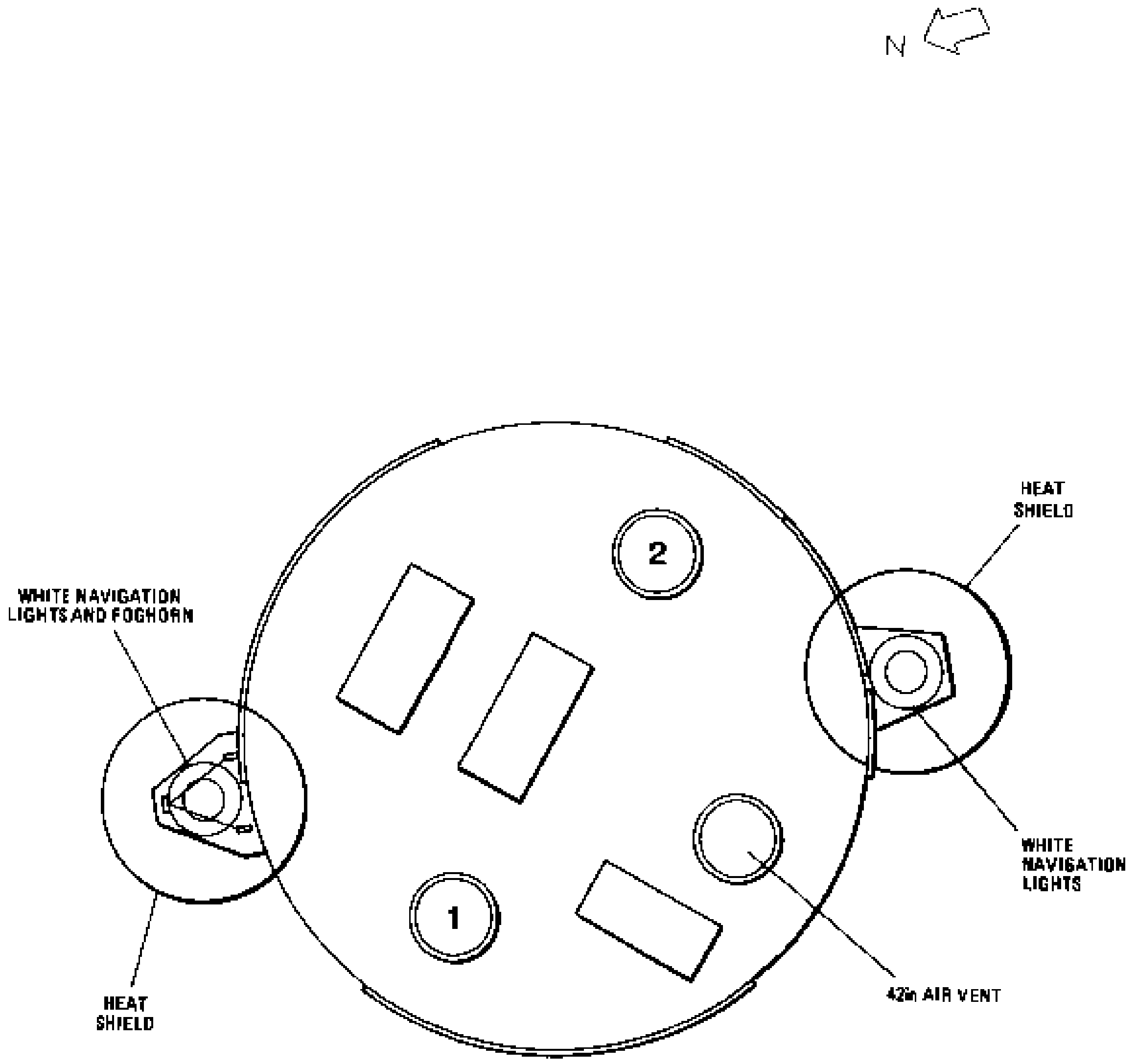
(b) To the battery serving the lights through a transformer and selenium rectifier.

2.4.3 Controls and switchboards controlling operation of the navigational aids are housed in Room L1.

END


BATTERY (20 ELEMENTS)
BATTERY (10 ELEMENTS)
BATTERY (20 ELEMENTS)
JB 6
RELAY BOX
FOGHORN
LB 1A
LB 1B
LB 2B
LB 2A
SUNSWITCH
ROOM L3 – LOCAL BATTERIES
ROOM L1 – LOCAL ETANCHE
OUTDOOR EQUIPMENT





NAVIGATIONAL AIDS
Location

CHAPTER 7

SAFETY

CONTENTS

DIAGRAMS

AREA CLASSIFICATION

1 GENERAL

1.1 Platform areas have been evaluated for risk using the Institute of Petroleum Model Code of Safe Practice, Parts 1 and 8 — Lighter Than Air Gases.

1.2 A dangerous area is one in which there exists or may exist a dangerous atmosphere. These areas are classified Division 0, Division 1, Division 2 or Unclassified as defined below:

ZONE 0	–	An area in which a dangerous atmosphere could continuously be present.
ZONE 1	–	An area in which a dangerous atmosphere is likely to occur under normal operating conditions.
ZONE 2	–	An area in which a dangerous atmosphere is only likely to occur under abnormal operating conditions.
UNCLASSIFIED	–	Exterior areas which are at an adequate distance from any possible gas or vapour escapes so that the gas or vapour will be dispersed before reaching the areas. Areas which are pressurised or force ventilated with air from an unclassified area are also unclassified, but they are classified as Zone 2 in the event of ventilation or pressurisation failure.

2 DESCRIPTION

Platform areas are classified in the following categories:

(a) Zone 1 – the areas surrounding the flare stacks within the following limits:

(i) 4.6m above
(ii) 4.6m below
(iii) 3.05m from the flare stacks peripheries.

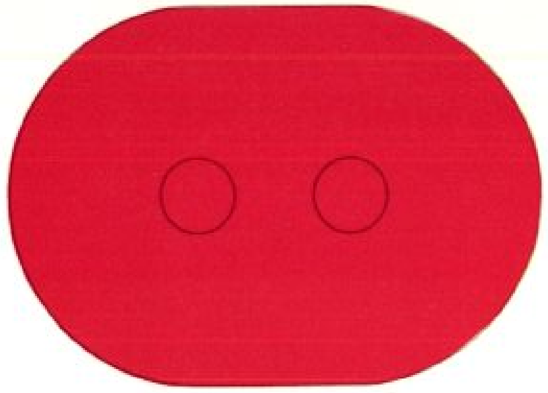
Room L3, which houses batteries, and is ventilated by natural means.

(b) Zone 2 – the areas surrounding the roof top within the following distances from the forced-draught ventilators:

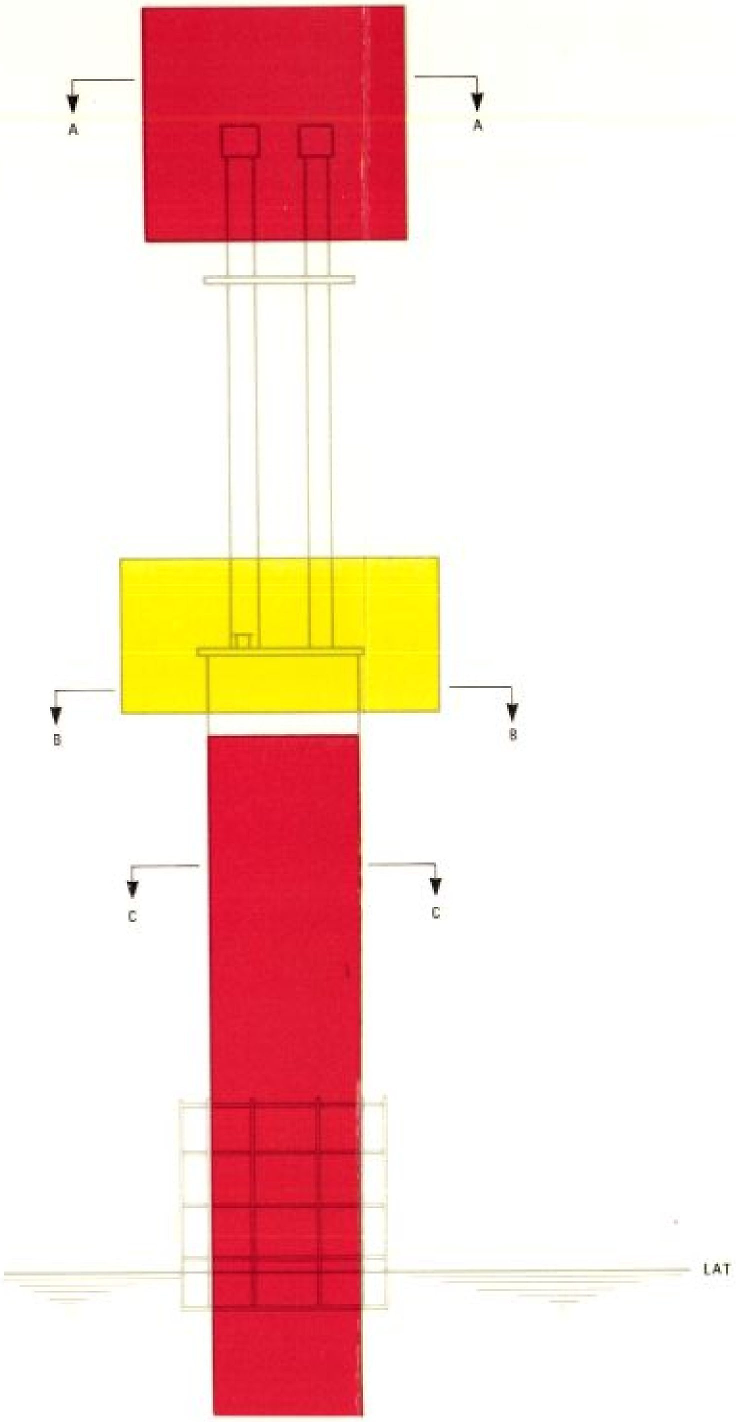
(i) 3.05m above
(ii) 3.05m below
(iii) 3.05m from their peripheries.

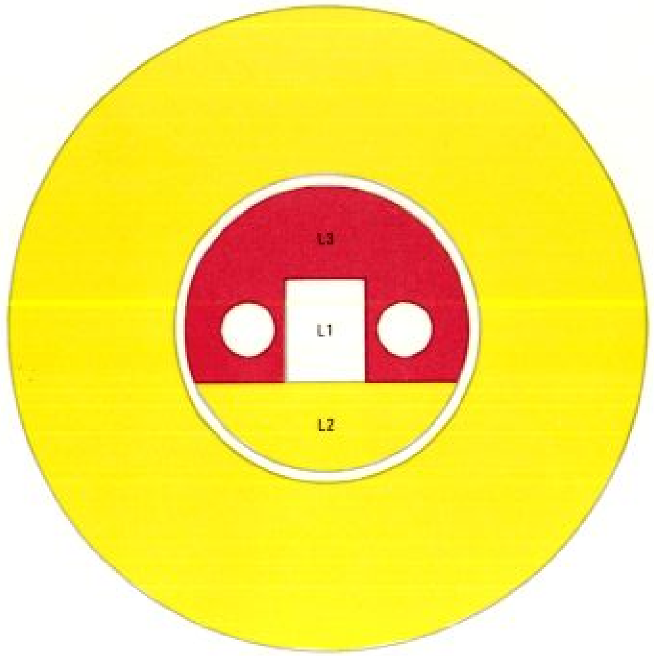
Room L2, which is forced-draught ventilated.

(c) Unclassified – Room L1.
Other areas of the platform not described in (a) and (b) above.



SECTION A–A





SECTION B–B

KEY

🟥	ZONE 1
🟨	ZONE 2

SECTION C–C

ISSUE 1. JULY 1980

AREA CLASSIFICATION | **7.1**

SAFETY EQUIPMENT

On those occasions when the Flare Platform is manned certain items of safety equipment are taken on board. These items will be listed when details are forthcoming from EAN.

END