CONTENTS

CONTENTS

1. GENERAL

The Quarters and Treatment platforms QP, TP1 and TCP2 are joined by bridges which carry interconnection cables. Submarine cables links TCP2 with DP2.

The normal power for the whole complex is generated at 5.5 kV by two 16 MW gas turbine-driven generators in the TCP2 compression area. Motor Control Centres on all the platforms are fed with 380V from 5500/380V transformers. Smaller diesel-driven generators on DP2, QP and TCP2 compression areas provide 380V standby supplies (DP2), or emergency supplies (QP, TCP2).

Dual interconnections between TCP2 (compression) Module 35, QP, TP1 and TCP2 (treatment) busbars are provided by 5.5kV radial feeders so that, in the event of one cable failing power can be maintained to each switchboard. Supply to DP2 is a radial feeder from TCP2 5.5kV busbar. Special arrangements are provided for isolation and earthing-down interconnecting cables between platforms.

2. DESCRIPTION

Reference diagram: DocsOpen no. 969

Generation

Main power is generated at 5.5kV, 3 phase, 50Hz by two gas turbines driving 16 MW (19.23MVA) Stal.Laval/ASEA generators 52G01 A and B in Pancake 44 on TCP2. These are duel fuelled, able to run on gas or diesel oil. Only one machine is running at a time, and this is capable of supplying all the electrical power for the whole field. The second machine is in standby position.

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

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

52G01A and B are air started from a discrete air system consisting of two air receivers and three small compressors. One air receiver and electric driven compressor supports each turbine. A third diesel driven compressor is used in emergency and can be used to charge either air receiver.

Both the main generators are capable of being synchronised and operated in parallel.

2. DESCRIPTION (conts.)

Switchboards and Switchgear

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

(a) TCP2 - Module 35 New main switchboard

(b) TCP2 Compression Area - Main Substation Module 32

(c) TCP2 Treatment Area - Switchroom, Cellar Deck, Mezzanine

(d) TP1 - Switchboard Room, Cellar Deck, Zone 06

(e) QP -Switchboard room L26, Lower Level

(f) DP2 -Substation, Module 4, First Level.

3. CONTROL

The control of the whole of the Frigg Field electrical system is exercised from the central electrical control board in the MCC Room in the treatment area of the platform.

A mimic panel on the electrical control board represents the layout of the system and discrepancy switches, set in the mimic, this together with an Baily operating station remotely control the various circuit-breakers.

Synchronising of incoming generators is carried out automatically or by manual control. Where synchronising is carried out between different parts of the network (eg, interconnector feeders) a synchronising trolley is used.

The main turbine-driven generator sets are monitored from a local control room located within the generator module. Each of the two main generators may be controlled from remote control boards located in the MCC Room in the treatment area.

CONTENTS

1. GENERAL

For an overall description of power generation and high voltage distribution in the Frigg Field complex refer to Section 5.1.

2. DESCRIPTION

5.5 kV Supplies

The main supply for TP1 is drawn from TCP2 Compression. The main supply feeds a 5 kV switchboard (termed TP1 5500) consisting of 13 panels arranged as follows:

Section	Panel	Breaker	Service
A	1	ACB 105	1600A Incomer feeder from TCP-C
	2	ACB 108	1600A Feeder breaker to transformer T1
	3	ACB 101	1600A
	4	--	
B	5	ACB 106	1600A Bus section breaker between section A and B
	6	ACB 102	1600A
	7	--	
	8	ACB 110	1600A Feeder breaker to 5.5kV Motor Control Centre (future use)
C	9	ACB 107	1600A Bus section breaker between sections B and C
	10	ACB 103	1600A
	11	--	
	12	ACB 109	1600A Feeder breaker to transformer T2
	13	ACB 104	1600A Incomer breaker from TCP2-C

The switchboard is located in the Switchgear Room on the Cellar Deck of Zone 06. The busbar is divided into three sections (A, B and C) by two bus section circuit breakers. Busbar section A and busbar section C are interconnected with busbar sections A and B respectively of the main 5.5kV switchboard on TCP2-C.

Busbar sections A and C each feed a 5500/380V transformer (T1 and T2) which in turn feed the Motor Control Centre. The transformers are located in the Transformer Room in Zone 6 of the Cellar Deck. Each is rated at 1500KVA and is delta/star connected. These are dry type transformers. Overtemperature protection is provided, and the neutrals are solidly earthed. An off-load tap changer permits adjustment of the primary winding turns in 2 1/2 per cent steps from - 5 per cent to +5 per cent of nominal.

2. DESCRIPTION (conts.)

All circuit breakers are of the air break type, solenoid operated and have a design breaking capacity of 290MVA rating which is adequate to deal with the system fault level of 81MVA. Each panel carries the necessary protection equipment for the circuit it controls.

380V Supplies

The output from transormer T1 and T2 is 380V, 3-phase, 4 wire to a 380 switchboard (termed TP1 380) also called the Motor Control Centre (MCC). This board is divided into two by a section switch, each transformer supplying one half through a 1600A incomer air-break circuit breaker. The design fault level of the MV board and switchgear is 500MVA to handle the combined output of the two transformers.

Numerous outgoing feeder panels from the two parts of the MCC switchboard A and B control the supplies to motors and distribution boards. Those controlling motors are provided with isolating switches, contactors and HRC back-up fuses; those feeding the distribution boards have in the main moulded case circuit breakers (MCCB's) and HRC back-up fuses.

Most of the distribution boards connected to the MCC switchboard are supplied at 380/220V 4-wire from MCC A or B. Their outputs are mainly 220V single-phase balanced between phases and the neutrals earthed, but there are also some 380V 3-phase outputs.

Additional outgoing circuits are provided by two extra MCC units, 380V MCC A Extension and 380V MCC B Extension; these are connected through to the busbars of TP1 380 MCC Section A and Section B respectively.

The isolating switches are capable of breaking the full stalled current of the motor. The contactors provide normal overcurrent and undervoltage protection and remote-start switching, but as their fault capacity is well below the system's 500MVA, HRC back-up fuses are provided, and blow first if the fault current exceeds a contactor's capacity.

Fuses provide a similar back-up to the MCCBs. These breakers have a maximum breaking capacity of only 13MVA; the fuses deal with all fault currents between this and the design system limit of 50MVA.

Apart from feeding individual motors and heaters, the TP1 380 switchboard feeds a number of distribution boards. These include a Standby Supplies board, which is further described in Section 5.3.

3. SYSTEM CONTROL

The 5.5kV switchboard is controlled as described in Section 5.1.

Switchboard TP1 380 (the Motor Control Centre) in the MCC Room, Zone 05 (mezzanine), is locally controlled (unmanned)

CONTENTS

1. GENERAL

TP1 has no standby generators: in the event of a failure of main generation it is dependent upon standby supplies fed from QP.

2. DESCRIPTION

A limited standby 380V supply is automatically fed from Platform QP if the main generation should fail. The limit is 65kVA, and the supply is therefore confined to those services fed from TP1's Standby Distribution Board, DB8.

The arrangement is illustrated in Diagram 5.3 and shows the standby power supply interrelationships of the three platforms, QP/TP1/TCP2.

During normal operation, distribution board DB8 (Standby Supplies) takes its input from the 380V Motor Control Centre TP1 380. The pressure of an input is monitored by a changeover contactor. If the normal input should fail, the contactor operates to select the alternative input from Motor Control Centre QP380 on Platform QP.

The alternative (standby) input from QP380 is always present at the changeover contactor as long as normal generation and distribution arrangements are in force, but the operation of the contactor prevents the inputs from being paralleled. When main generation fails, however, the alternative input from QP380 fails too, so that DB8 suffers a supply interruption until the QP standby generators have started. When this has occurred the standby supply to DB8 from QP380 is automatically connected.

Where such an interruption cannot be tolerated a battery-supported supply is provided.

The MCC extension board on TP1 can be supplied in an emergency from QP.

CONTENTS

1. GENERAL

Alternative supplies are provided on Platform TP1 for use in the event of a failure of the normal 5.5kV supply. These supplies are as follows:

- Standby supplies
- Battery supported DC supplies
- Battery supported AC supplies.

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

Some maintained supplies are used under emergency conditions.

2. DESCRIPTION

Battery supported DC Supplies - General

There are four separate battery supported dc supplies on TP1. Each is fed from the platform's ac distribution system via a transformer/rectifier. They are shown in diagram 5.4 and are numbered after their battery numbers.

Under normal conditions each transformer/rectifier supplies the full dc load of its associated system while its standby battery floats across the dc output on a trickle charge. Upon failure of the ac input, or of the rectifier, the battery takes over the full dc load without interruption.

When the ac input is restored the transformer/rectifier takes over the load again. At the same time it recharges the battery, with a boost charge if necessary, to its full capacity.

3. PLATFORM CENTRAL DC SUPPLIES

Two separate dc systems are associated with the platform central 24V dc supplies. Their outputs are paralleled, and normally the two systems share the dc load, each carrying 50 %. If one system, or its supply, should fail, the other can carry the full 100% load. If both ac inputs should fail, the batteries take over the dc load without interruption, sharing it equally. Either can carry the load alone if the other is out of service.

One system is supplied from the main MCC, TP1 380; the other is supplied from DB8 - standby distribution board - which is itself supported by the 380V ac standby supply from Platform QP.

When ac power is restored after failure, system No.11 is automatically disconnected from the load and gives its battery a boost charge, while system No. 12 takes over the load and trickle charges its battery. The roles can be reversed by pressing the Select Load Charger pushbutton on transformer/rectifier No. 12.

This action should be taken, in any event, after battery No. 11 has been recharged while battery No. 12 still needs a boost. The system are interlocked so that the batteries cannot both be boosted at the same time.

4. BATTERY SUPPORTED AC SUPPLIES

There is one battery supported ac supply on TP1. It is supplied from the platform's ac distribution system via a transformer/rectifier followed by an inverter. It is numbered after its battery number.

Under normal operating conditions a static switch connects a 220V ac single phase supply from DB8 direct to the maintained ac distribution boards DB 10A, DB 10B and DB 10C. The same ac input from DB8 energises the transformer/rectifier/inverter and keeps the floating battery trickle-charged. Upon failure of the ac input the static switch automatically switches over to the inverter output, which is now maintained by the battery. In addition, there is also a no brake feeder (220V) from Cyberex inverters on TCP2 to switchbox 1 and 2 in TP1 interface room no. 1.

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

When the ac input is restored the static switch reconnects the DB8 output direct to DB 10A, DB 10B and DB 10C, the changeover, as before, being controlled by the synchronising circuit. At the same time the transformer/rectifier reverts to charging the battery, if necessary at the boost rate. Reversion to trickle-charge is automatic.

CONTENTS

1. GENERAL

Glycol storage tank V9 is passivated.

2. GLYCOL FILL PUMPS P13 A AND B

Two centrifugal pumps, P13A and B is passivated.

The pumps are piped in parallel and are normally operated one duty and one standby, controlled from local pushbuttons. They discharge into the 4in glycol fill header for cross-connection with TCP2 through line G611 (2in).

TOTAL FINA ELF

TP1 OPERATIONS MANUAL	Ref. No.: DocsOpen no. 77358
VOLUME 1 - TP1 PLATFORM	Date effective : 27/01/97
SECTION 5 - UTILITIES	Revision No. : 4
5.6 - COLD VENT SYSTEM	Date revised : 01.10.01
	Page : 1/2

CONTENTS

DIAGRAM

1. GENERAL

Low temperature gas from ESDV Blowdown Valves, Pressure Relief Valves and Pressure Safety Valves is collected and discharged to atmosphere via the Cold Vent System.

The collected gas, having a minimum temperature of-80°C is cold flared via a vent stack. Any hydrocarbon liquids are collected in the Knock Out Drum (V47) and transferred to CV5-oil skimmer tank on TCP2 via a 3in line, 2033EA-3"-DR.

The Knock Out Drum (V47) and Cold Vent Stack (SP45) are located on TP1 - upper deck module 01, west.

2. DESCRIPTION

Process equipment and associated piping systems which contain high pressure, low temperature gas may be blown down into the 20" Cold Vent Header via ESDV Blowdown Valves, Pressure Relief Valves and pressure Safety Valves.

The 20" Cold Vent Header also receives blowdown gas from TCP2 via line 2022.EAR.16" (Refer to TCP2 Operation Manual or attached system drawing).

The following equipment and piping systems on TP1 may be relieved via the cold vent system:
- scraper pig launcher M3
- Dry Gas Interconnection Line, incl. lines across the bridge TP1/TCP2
- TP1/TCP2 Sales Gas Header
- Alwyn Tie-In Process piping
- Manual blowdown of header/sea line

To prevent the ingress of air leading to the formation of a potentially explosive mixture, the Knock Out Drum and Cold Vent Stack are continuously swept with nitrogen gas.

Provision is made for injection of Halon in case vented gas catches fire.

CONTENTS

1. GENERAL

A Methanol injection package has been installed to inject Methanol just upstream of the three depacking valves in Alwyn Tie-In gas System. The injection package includes storage tank V48 and separate HP injection pumps P34 A&B. The system is supplied by transportable tanks.

2. METHANOL TRANSFER PUMPS P17A AND B (Passivated)

CONTENTS

1. GENERAL

All lighting fittings operate at 220V single-phase derived between phase and neutral of 380V distribution boards fed from the platform's motor Control Centre (MCC) TP1 380, as shown in Diagram 5.10.

Lighting systems are of the following three types:

a) Normal lighting Supplied from distribution board DB2", which is fed from TP1 380

b) Standby lighting Supplied from distribution board DB8, which is fed from TP1 380 and has a standby input from platform QP (includes lifeboat and boat landing and floodlighting)

c) Emergency Supplied via DB1 and TP1 380. Certain selected fittings are provided with their own rechargeable back-up batteries and automatic changeover facilities.

Building lighting and outside lighting are on separate circuits.

It should be noted that all the lighting mentioned above is in use under normal operating conditions. If main generation should fail, only (c) is operative until the standby generators on Platform QP start and come on load. The lighting fed from DB8 "(b) above" then becomes available.

Normal lighting via DB2 "(a)" above is available only when the 5.5kV ring main is energised, i.e. when the TCP2 main generators are running.

2. LIGHTING FITTINGS

a) For indoor use lighting fittings are of the twin 40W cold-cathode fluorescent tube type. For outdoor use both fluorescent and floodlight fittings are used. Incandescent lighting is included at walkways to provide light during loss of fluorescent lighting due to voltage dips. All fittings are enclosed for Zone 1 areas.

b) For module 01 upper level, Glamox lighting fittings are used and supplied from DB2.

Refer to Section 9.14 for details of the Emergency Maintained Fittings.

Lighting of certain external areas is by floodlight, those of most importance being fed from Standby Supplies Board DB8. the floodlights used are of three kinds:

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

All the floodlights are weatherproof, but not all are explosion-proof, and these are therefore not used in hazardous areas.

CONTENTS

1. GENERAL

The washdown System is provided for deck washing etc., using sea water.

The washdown water ring main is normally pressurised by washdown pump P7.

2. WASHDOWN RING MAIN

The washdown ring main is a 4in line encircling the platform at Lower Deck level.

Thirteen branch lines off the ring main serve 22 washdown hosereels.

Two cross-connections with the firewater ring main enable the Washdown System to be used as a secondary firefighting system, or allow the washdown ring main to be pressurised from the firewater system should the washdown pump fail.

3. WASHDOWN PUMPS

Washdown pump P7 is a vertical centrifugal pump located in Zone 07 on the Cellar Deck.

The pump is driven by an 89kW electric motor and is rated at 113.5M3/h at a pressure of 8.6 barg.

The pump takes suction from a stilling tube and discharges through a 6in line to the washdown ring main.

The pump is manually operated from pushbuttons located at each hosereel station.

Washdown pump P33 is a vertical centrifugal type, driven by an 89 kW electric motor. It has a capacity of 113 m3/h at 9,6 barg, and supplies TCPT washdown facilities. Located in zone 07.

4. WASHDOWN HOSEREELS

Each hosereel comprises 31m of 1.1/2in hose terminating in a spray/jet/shut-off nozzle and is rated to deliver 379 litres/min at normal operating pressure.

CONTENTS

1. GENERAL

Open and closed systems are provided both of which terminate in sump caisson V13.

Each zone is provided with an open drainage system generally consisting of drain gullies which discharge through seal boxes and manifolds into the 12in general drain header.

This main header discharges into the sump caisson via a check valve and water seal loop.

Process drainage flows into the 4in closed drain header which joins the general drain header downstream of the water seal.

2. SUMP CAISSON V13

Sump caisson V13 is located in Zone 07 on the Cellar Deck and extends down to 34m below seal level. The bottom of the caisson is open to the sea.

Water and oil drainage separate out within the caisson - the oil floats to the top and the water is dispersed into the sea.

The oil/water interface level is indicated by the differential pressure between two bubbler tubes terminating at different levels within the caisson. The differential pressure between the two levels decreases as the interface level drops.

When sufficient oil has collected in the caisson, sump pump P3 is used to discharge it to TCP2 platform via a 2in line.

3. SUMP PUMP P3

Sump pump P3 is a submersible type pump driven by a 3.75kW electric motor and is rated at 5.7M3/h at a differential pressure of 5.7 bar.

The pump takes suction from within the caisson at elevation - 6.196m and discharges via a 2in line to TCP2.

The pump is controlled from pushbuttons located on the cellar deck in Zone 09.

CONTENTS

CONTENTS

1. GENERAL

Diesel fuel is stored in bulk storage tank V10 located in the central support on the Cellar Deck between Zones 09 and 11.

The fuel is distributed to the various platforms consumers by diesel pumps P8A and B.

2. DIESEL BULK STORAGE TANK V10

Diesel bulk storage tank V10 has a capacity of 390M3 and is rated at a maximum working pressure of 1.08 bara.

The tank may be filled via 4in lines from either TCP2 or the boat landing stations in Zones 08 and 11 on the Lower Deck.

Indication of the tank contents are displayed at level gauges installed locally and at the diesel control panels on TCP2 and QP.

The tank is purged with N2 blanket gas to reduce the risk of a fire/explosion.

3. DIESEL PUMPS P8A AND B

Diesel fuel is distributed by two centrifugal pumps P8A and B which take their suction from the bulk storage tank via a 2in line.

Each pump is driven by a 4.1kW electric motor and is rated at 6.8M3/h at a pressure of 4.15 barg.

Installed in parallel, the pumps are normally operated as one duty and the other standby.

The pumps are manually controlled from the diesel control panels on TP1, TCP2 and QP.

Diesel fuel is discharged from the pumps via a common 2in line to the 4in diesel header for distribution to the various platform consumers.

4. DISTRIBUTION

Diesel fuel from the 4in diesel header is distributed to consumer as follows:

- Firewater pumps P6A day tank V11A
- Firewater pump P6B day tank V11B
- Crane M7 day tank
- Crane M8 day tank
- Quarters Platform
- Treatment and Compression Platform No. 2

With the exception of the lines to the remote platforms the first block valves to each user are located at a manifold installed near the local control panel. The local panel has indication of the level in the bulk storage tank and the four day tanks (V10, V11A, V11B, V12A and V12B) and receives high and low level alarm signals therefrom. Thus one man is able to control day tank filling from a central location.

CONTENTS

DIAGRAM

Compressed Air - DocsOpen no. 25244

1. GENERAL

Compressed air is supplied from TCP 2 via separate 3" lines for plant and instrument air.

2. DISTRIBUTION

Compressed air from TCP2 is routed into existing net work on TP1. On TCP2 the set point for instr. air is set at 7.8 bar, for plant air at 9.3 bar.

The plant air header has outlets for the various consumers on the platform. There is also 2in offtake to supply air to QP and a 3in offtake to TCP2.

The instrument air ring main supplies pneumatic instruments throughout the platform. Cross-connections can be made with QP through a 2 in line and TCP2 through a 3in line.

3. AIR RESERVOIR

A dry air reservoir, comprising the two 26" and the 4" TP1/CDP1 sealines, the previous 26" wet gas TP1/TCP2 interconnection line, plus the 26" sealine B between TCP2 and DP2, is acting as a buffer in case of air compressor shutdown on TCP2. All reservoir is supplied from the new air compressors on TCP2. The 26" TCP2/DP2 sea line is functioning both as a supply line to DP2 and as a reservoir line.

CONTENTS

1. GENERAL

The system is divided into a number of ventilation packages as follows:

- Q9 which serves Zones 05 and 06.
- Q11 which serves the Workshop and Stores Area Zone 08.
- Q12A and Q12B which supply Fire Pump Houses A and B in Zones 07 and 12 respectively.

The ventilation system supply sufficient changes of air heated as required to pressurise and ventilate Safe areas within a Hazardous area.

2. DESCRIPTION - VENTILATION PACKAGE Q9

Summary

Zones 05 and 06 are served by air conditioning/ventilation package Q9, which comprises the following systems:

(a) Q9A which provides environmental heating and pressurisation to Zone 05 Battery Room.

(b) Q9B which provides ventilation/pressurisation and environmental heating to Zone 05 Generator Room.

(c) Q9C which provides ventilation/pressurisation to Zone 06 Transformer Room.

(d) Q9D air conditioning/pressurisation and heating installation serving Zone 05 Motor Control Centre and Cabling Room, plus Zone 06 Instrument Interface Rooms, Switchgear Room and Heating, Ventilation and Air Conditioning (HVAC) Room.

Operation of the air conditioning/ventilation/pressurisation package Q9 is through a central control panel, fitted with Master Start/Stop pushbuttons located in Zone 06 HVAC Plant Room. Q9 main fans and heaters are fed from a 380V 100A contactor located in the MCC into electrically separated control sections of the main control panel. The contactor is automatically tripped by the fire and gas detection system, and requires manual resetting. Initiation of the control panel Master Start pushbuttons automatically activates selected "duty" fan motors, electric heater batteries, the air conditioning compressor, condenser cooling fans, damper control motors and associated control systems.

An emergency Master Stop pushbutton (break-glass type) is located at the entrance to the HVAC Plant Room.

2. DESCRIPTION - VENTILATION PACKAGE Q9 (conts.)

Q9A Battery Room

Fresh air from a "Safe" area is supplied to the Battery Room at a rate of 30 changes per hour. The air is filtered, monitored by a gas detector and heated by a thermostatically controlled 20kW electric heater battery. The heater battery is interlocked with supply fans to prevent heater battery operation without air flow. The heater battery is protected by an integral high limit cut-out thermostat.

Two axial flow supply fans, one duty and one standby, are located in the Generator Room. Each fan has capacity of 0.528M3/s and is directly driven by a 0.37kW electric motor. In the event of duty fan failure (including failure to start) the standby fan will be automatically started by changeover facilities working in conjunction with pressure switches which operate in response to suction and discharge pressure. Indication of standby fan operation is given at air conditioning unit Q9 local control panel and at the Quarters Platform ventilation annunciator panel.

Manually operated isolation dampers are provided in the fan inlet ducts, and servomotor-operated isolation dampers are provided in the fan outlet ducts. The servomotors are interlocked with the duty supply fan selector switch and automatic changeover switches. The fan discharge dampers are automatically positioned to suit the operational fan. Air is supplied to the Battery Room through a duct located at low level in the Battery Room wall. The duct is provided with a fire damper which is closed by a solenoid-operated release mechanism activated by a signal from the fire detection system.

Two axial flow extractor fans, one duty and one standby, are provided. Each fan has a capacity of 0.528M3/s and is directly driven by a 0.12kW electric motor. In the event of fan failure (including failure to start) the standby fan will be automatically started by a changeover facilities working in conjunction with the flow switches which operate in response to fan discharge pressure. Indication of standby fan operation is given at air conditioning unit Q9 local control panel and at the QP ventilation annunciator panel. The fans are provided with an emergency supply connected so that automatic switching will occur in the event of Q9 shutdown. This automatic switching will not occur if Q9 shutdown is initiated by Battery Room fire or gas detection.

Manually operated isolation dampers are provided in the fan inlet ducts and servomotor-operated isolation dampers are provided in the fan outlet ducts. The servomotors are interlocked with the duty supply fan selector switch and automatic changeover switches. The fan discharge dampers are automatically positioned to suit the operational fan.

Air is extracted from the Battery Room through two high level ducts located in the Battery Room roof. Both extract ducts are fitted with fire dampers which are closed by solenoid-operated release mechanisms activated by a signel from the fire detection system. The release arms incorporate a fusible link to provide fail-safe operation in the event of an in-duct fire.

A positive pressure of 5mmWG is maintained within the room, monitored by a differential switch set at 2.5mmWG. In the event of the pressure falling below this set-point, the 380V MCC contactor is tripped, and an alarm will be initiated at the annunciator panel in HVAC Plant Room and also at the QP annunciator panel. A 2-minute time-delay relay is provided to cater for start-up conditions, and a 30-second time-delay relay for momentary losses of pressure.

2. DESCRIPTION - VENTILATION PACKAGE Q9 (conts.)

Air is discharged to atmosphere via an exhaust air wind protection cowl. The ductwork incorporates a motor-operated pressure control damper assembly, actuated by a static pressure regulator.

Operation of the ventilation and pressurisation unit is through the local control panel of Q9 within Zone 06. An Emergency Stop pushbutton is located in the Battery Room, and a Shut-down/Reset pushbutton at the Battery Room section of the HVAC control Panel.

Q9B - Generator Package

Fresh air from a common intake plenum chamber is supplied to the generator room at a rate of 12.5 changes per hour by two axial flow fans (one duty and one standby). Each fan has a capacity of 35.97M3/s, and is directly driven by a 40.5kW electric motor. Fans are variable duty, each equipped with mechanical linkage to adjust the blade pitch which automatically reduces the supplied air volume.

Non-return isolation dampers are provided in each supply fan discharge duct. The non-return dampers are operated by an electro servomotor, interlocked with the fan selector switch and automatic changeover switches. The non-return dampers are automatically positioned to suit the operational fan. In the event of duty fan failure (including failure to start) the standby supply fan will be automatically started by changeover switches working in conjunction with pressure switches, which operate in response to fan suction and discharge pressures. These pressure switches are automatically bypassed by a time-delay relay in order to permit the start sequence. Indication of standby fan operation is given at the HVAC annunciator panel, and at the QP ventilation annunciator panel.

Both fans discharge into a common generator area supply duct, which divides into four separate ducts in Zone 05; one which serves the Generator Room. The other three, which used to serve the generator acoustic enclosures, are blanked off.

The room supply is equipped with a thermostatically controlled 108kW electric heater battery. The heater battery handles an air volume of 9.722M3/s and increases the air temperature to 15°C. Heater operation is interlocked with the supply fans to prevent battery operation without air flow. The battery is equipped with an integral high limit safety cut-out thermostat. High level supply ducting incorporates an air volume manual regulating damper and an automatic shut-off damper. The shut-off damper is driven by an electro-servomotor, fitted with return spring, which automatically closes on interruption of the electrical power supply.

A pressure of 18 mmWG is maintained within the Generator Room by the duty fan working in conjunction with two pressure control exhaust louvres in the floor. Exhaust louvre dampers are operated by an electro-servomotor, activated by a static pressure regulator. The damper automatically opens or closes in order to maintain the required room differential pressure, and the motor is equipped with a return spring to shut the louvre in the event of interruption of the electrical power supply.

2. DESCRIPTION - VENTILATION PACKAGE Q9 (conts.)

Room pressure is monitored by a differential switch set at 2.5mmWG. In the event of pressure falling below this set-point, the 380V MCC contactor is tripped, and an alarm will be initiated at the HVAC annunciator panel and also at the QP ventilation annunciator panel. A 2-minute time-delay relay is provided to cater for start-up conditions and a 30-second time-delay relay for momentary losses of pressure.

Operation of the generator area ventilation and pressurisation system is through the HVAC control panel within Zone 06. An Emergency Stop pushbutton is located near each acoustic enclosure and Reset pushbuttons at the generator section of the HVAC control panel.

Q9C - Transformer Room

Fresh air from the common inlet plenum chamber is supplied at a rate of 59 changes per hour to the Transformer Room by two axial flow fans (one duty and one standby) located in the HVAC Plant Room. Each fan has a capacity of 2.38M3/s and is directly driven by a 2.2kW electric motor. Manually operated suction isolating dampers are provided in the fan inlet ducts, and servomotor-operated isolation dampers are provided in the fan outlet ducts. The servomotors are interlocked with the supply fan selector switch and automatic changeover switches.

Fan discharge non-return dampers are automatically positioned to suit the operational fan. In the event of duty fan failure (including failure to start) the standby supply fan will be automatically started by changeover switches working in conjuction with pressure switches, which operate in response to fan suction and discharge pressures. These pressure switches are automatically bypassed by a time-delay relay in order to permit the start sequence. Indication of standby fan operation is given at air conditioning unit Q9 local control panel and at the QP ventilation annunciator panel.

Incoming air is monitored by a gas detector and distributed throughout the room via high level ducting. The supply ducting is provided with an automatic isolating damper driven by an electroservo-motor, fitted with a return spring.

Air is extracted from the Transformer Room by two axial flow extracts fans (one duty and one standby) through high level ducting. Each fan has a capacity of 2.38M3/s and is directly driven by a 2.2kW electric motor. Manually operated isolating dampers are provided in the fan discharge ducts and servomotor-operated dampers are provided in the fan inlet ducts. The servomotor-operated non-return dampers are interlocked with the duty extractor fan selector switch and automatic changeover switches. The fan inlet dampers are automatically positioned to suit the duty fan. Air is discharged through the floor of the HVAC Plant Room via a motorised damper and exhaust cowl.

A positive static pressure of 6mmWG is maintained within the Transformer Room by the duty supply and extract fans working in conjunction with a pressure-controlled exhaust damper installed in the extract fans discharge ducting. The ventilation system provides sufficient cooling air to limit the internal temperature to a maximum of 35°C when the transformers are operational.

2. DESCRIPTION - VENTILATION PACKAGE Q9 (conts.)

Room pressure is monitored by a differential switch set at 2.5mmWG. In the event of pressure falling below this set-point, the 380V MCC contactor is tripped, and an alarm will be initiated at the annunciator panel in HVAC Plant Room and also at the QP ventilation annunciator panel. A 2-minute time-delay relay is provided to cater for start-up conditions and a 30-second time-delay relay for momentary losses of pressure.

Operation of the ventilation and pressurisation unit is through the local control panel of Q9 within Zone 06. An emergency Stop pushbutton is located in the Transformer Room, and a shutdown/Reset pushbutton at the Transformer Room section of the HVAC control panel.

Q9D - Air Conditioning

The common air intake plenum chamber is privided with acoustic insulation, air filters and a gas detector. Two automatic shut-off dampers are also provided each operated by an electro-servomotor incorporating a return spring. Filtered air is taken from the intake plenum chamber by an air conditioning handling unit comprising the following sections:

(a) Mixing Section. With manually operated fresh/recirculation air regulation damper, plus secondary filter panels (for recirculation air)

(b) Coil Section. Containing 137 kW (operational capacity) direct expansion cooling coil, with copper tubes and fins.

(c) Fan Section. Incorporating two axial flow fans (one duty and one standby). Each fan has a capacity of 5.44M3/s, and is directly driven by an 11kW electric motor.

(d) Damper Section. Non-return discharge dampers operated by electro-servomotors which are interlocked with the fan selector switch and automatic changeover facilities. The fan suction side is fitted with manually operated isolating dampers. Automatic changeover facilities of the supply fans, activated by pressure switches, are as previously described.

Conditioned air from the package unit is discharged into a supply plenum chamber prior to distribution to three air conditioned zones which serve the various areas as follows:

(a) Zone 1 serves the Cable Room at 9.5 to 19 air changes per hour and the MCC at 6.5 to 13 air changes per hour via a thermostatically controlled 78kW heater handling an air volume of 2.482M3/s, maintaining room temperatures at 22°C.

(b) Zone 2 serves Interface Room No 1 at 9 to 18 air changes per hour via a thermostatically controlled 54kW heater handling an air volume of 0.758M3/s, maintaining a room temperature of 22°C.

(c) Zone 3 serves the Switchgear Room at 1.5 to 3 air changes per hour, and Interface Room No 2 at 12 to 24 air changes per hour via thermostatically controlled 108kW heater handling an air volume of 2.204M3/s, maintaining room temperature at 22°C.

2. DESCRIPTION - VENTILATION PACKAGE Q9 (conts.)

Heaters are equipped with an integral high limit safety cut-out thermostat, and are also interlocked with the air conditioning unit supply fans to prevent heater operation in the event of airflow failure.

The air conditioning supply duct serving Interface Room No 1 and the three outlets serving Interface Room No 2 are each provided with fire dampers. The fire dampers are equipped with solenoid-release mechanisms, activated by the fire detection system, and incorporating a fusible link to ensure fail-safe operation in the event of an in-duct fire.

Each zone supply duct incorporates a manually operated regulating damper, acoustic attenuator, and shut-off damper. The branch ducting to Interface Room No 2 is also provided with a shut-off damper. These shut-off dampers are operated by electro-servomotors fitted with return springs which automatically close the damper upon interruption of the electrical power supplies. The MCC Room supply duct is provided with a manually operated damper.

Air for recirculation is extracted from the conditioned zones through a high level duct. A maximum of 50 per cent of the supply air volume may be recirculated via the mixing box in the air conditioning unit.

The recirculating ducts from Instrument Interface Rooms 1 and 2 incorporate fire dampers, similar in construction and operation to those described for the supply system.

Servomotor-operated shut-off dampers are provided in the recirculating duct from each air conditioned room with the exception of the MCC Room. The MCC Room recirculating duct is provided with a manually operated damper.

Manually operated dampers are provided in the recirculation ducts at the mixing box for balancing purposes.

A positive static pressure of 12 mmWG is maintained within the areas by the duty supply fan working in conjunction with pressure controlled exhaust dampers, within the floors of the Cable, Switchgear and Instrument Interface Rooms. Exhaust air from the MCC is discharged via the Cable Room. The HVAC Plant Room is pressurised by virtue of being open to Zone 06 Switchgear Room.

Exhaust dampers are operated by electro-servomotors. The dampers automatically open or close in order to maintain the required room differential pressure, which is detected by a static pressure regulator. The motor is equipped with return spring and automatically closes the damper in the event of the electrical power being interrupted.

Air pressure is monitored by differential switches set at 2.5mmWG. In the event of pressure falling below the set point, the 380V contactor is tripped, alarm indication being given at both the annunciator panel in HVAC Plant Room and the QP ventilation annunciator panel. A 2-minute time-delay relay is provided to cater for start-up conditions and a 30-second time-delay relay for momentary losses of pressure. Operation of the air conditioned area ventilation system is through the HVAC control panel within Zone 06. Emergency Stop pushbuttons are located each room, excluding the HVAC Plant Room. Start/Stop and Reset pushbuttons are provided at the Air Conditioning section of the HVAC control panel.

2. DESCRIPTION - VENTILATION PACKAGE Q9 (conts.)

Q9 - Refrigeration Unit

The refrigerant equipment employed is of the direct expansion type utilising R22 and comprises: compressor/receiver unit; air-cooled condenser, evaporator and associated refrigerant pipework, valves and controls.

The refrigerant compressor/receiver is a package unit comprising an open-type compressor (197kW cooling capacity). The evaporating and condensing temperatures are 5°C and 45°C respectively, and the saturated suction and discharge temperatures are 7°C and 80°C respectively. The compressor is belt-driven by a 55kW electric motor.

The evaporators are located in the coil section of the air conditioning handling package unit. The total capacity of the two cooling coils is 180kW (maximum required operational capacity is 137kW), and the handled air volume of 5.44 m3/s is cooled from 22°C and 18°C wet bulb, to the off-coil temperature of 12°C. The evaporating temperature is 5°C.

The air-cooled condenser, located on the roof of zone 05 Generator Room, has a total heat rejection capacity of 209kW, and the condensing temperature is 45°C. The condenser is equipped with two fans; each fan has a capacity of 25m3/s and is directly driven by a 3kW electric motor.

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

3. DESCRIPTION - VENTILATION PACKAGE Q11

The Workshop and Stores, located in a Hazardous area are pressurised by ventilation package Q11, to provide safe operating conditions for the Workshop equipment and personnel. A separate extract system, within the area, is provided for ventilation of the Welding Area.

Fresh air from a Safe area under the platform is introduced through an intake grille, located in the floor of the Stores Area. Incoming air is monitored by a gas detector and enters a mixing section, where recirculated room air may be introduced. The mixing section incorporates a motor.operated shut-off damper, which (by means of a return spring) automatically closes on interruption of the electrical power supply. Operation of the dampers during winter months or when the external ambient is below 6°C, allows a minimum of 5 percent room air to be recirculated in orde to reduce winter heating requirements.

Supply air at 9 to 18 changes per hour is heated by a thermostatically controlled 160kW electric hater battery, to maintain a temperature of 18°C. Heater operation is interlocked with the supply fan pressure differential switches, to prevent the battery working without air flow. The heater is also equipped with an integral high limit safety cut-out thermostat.

3. DESCRIPTION - VENTILATION PACKAGE Q11 (conts.)

Two axial flow supply fans (one duty and one standby) each with a capacity of 5.0 m3/s, and each directly driven by a 5.5kW electric motor, draw air through an acoustically insulated intake section incorporating manually operated suction isolating dampers. Servomotor-operated dampers are provided in the fan outlet ducts. The servomotor-operated isolation dampers are interlocked with the supply fan selector switch, and automatic changeover switches. The fan discharge dampers are automatically positioned to suit the duty fan.

In the event of a duty fan failure (including failure to start) the standby supply fan will be automatically started by changeover facilities working in conjuction with pressure switches which measure fan suction and discharge pressures. These pressure switches are automatically bypassed by a time-delay relay in order to permit the start sequence. Indication of standby fan operation is both at the local control panel and remote at the QP ventilation annunciator panel common alarm XA-Q11-1.

Two axial flow extract fans (one duty and one standby) are provided to extract air from the Welding Area of the workshop; each fan has a capacity of 0.833m3/s and is directly driven by a 0.37kW electric motor. The fans are provided with discharge non-return dampers which are operated by an electro-servomotor, interlocked with the fan selector switch and automatic changeover facilities. Changeover facilities of the extract fans are identical to the supply fans described above.

Fan discharge air is passed through a sound attenuator and exhausted to atmosphere. The discharge duct is fitted with an automatic shut-off damper driven by an electro-servomotor, provided with return spring which automatically closes the damper in the event of interruption of the electrical power supply.

A positive pressure of 12mmWG is maintained within the area by the duty supply fan working in conjunction with two pressure control exhaust louvres, one located on the Workshop floor and the other in the Stores floor. Each exhaust louvre control damper is driven by an electro-servomotor, activated by a static pressure regulator. The dampers automatically open or close in order to maintain the required pressure differential, and the control motor return spring ensures shut-off of the louvres in the event of failure or interruption of the power supply.

Room pressure is monitored by a differential switch set at 2.5mmWG. In the event of the pressure falling below this set-point, the 380V MCC contactor is tripped and an audible alarm will be initiated. A 3-minute time-delay is provided to cater for start-up conditions, and a 30-second time-delay relay for momentary losses of pressure.

Failure of both the supply duty and standby fans will shut down the ventilation package via the room pressure differential detection system.

4. DESCRIPTION - VENTILATION PACKAGE Q12

Each Pump House is served by its own ventilation package, Q12A or Q12B. These provide environmental heating and pressurization in order to ensure safe operating conditions for the fire pump equipment, which is located within a Hazard classification area.

Fresh air from a Safe area under the platform is introduced through an intake grille in the Pump House floor. Incoming air is monitored by a gas detector and passes into a mixing section where room air may be recirculated, in order to reduce winter heating loads. Fresh and recirculated air quantities are controlled by a damper assembly. During normal conditions, full fresh air is supplied; however, when the external ambient temperature falls below 6°C, fresh air volume may be reduced to 50 percent. The damper control motor, equipped with return spring, automatically closes the fresh air damper on interruption of the power supply.

Room supply air at 12 to 21 changes per hour is heated by a thermostatically controlled 40kW electric heater battery. The heater battery maintains an internal temperature of 22°C and is interlocked with the supply fans to prevent operation without air flow; the battery is also equipped with an integral high limit cut-out safety thermostat.

Treated air is drawn by supply fans into an acoustically insulated intake section incorporating isolating dampers. Two axial flow fans are provided (one duty and one standby), each directly driven by a 1.1kW electric motor and having a capacity of 0.917m3/s. Manually operated isolating dampers are provided in the fan inlet duct, and servomotor-operated isolation dampers are provided in the fan outlet ducts; the servomotors are interlocked with the duty supply fan selector switch and automatic changeover switches.

Fan discharge non-return dampers are automatically positioned to suit the operational fan. In the event of duty fan failure (including failure to start) the standby supply fan will be automatically started by changeover facilities working in conjunction with pressure switches which operate in response fan suction and discharge pressures. These pressure switches are automatically bypassed by a time-delay relay in order to permit the start sequence. Indication of standby fan operation is both at the local control panel and at the QP ventilation annunciator panel.

A positive pressure of 6mmWG is maintained within the Pump House by the duty fan working in conjunction with a pressure control exhaust damper on the Pump House floor. The exhaust control damper is driven by an electro-servomotor, activated by a static pressure regulator. The damper automatically opens or closes in order to maintain the required pressure differential, and the control motor return spring ensures shut-off of the damper in the event of failure or interruption of the power supply.

Room pressure is monitored by a differential switch set at 2.5mmWG. In the event of the pressure falling below this set-point, the 380V MCC contactor is tripped. A 2-minute time-delay relay is provided to cater for start-up conditions and a 30-second time-delay relay for momentary losses of pressure due to either opening of the Fire Pump House door, or failure of the duty fan unit.

Failure of both the duty and standby fans will shut down the ventilation package via the room pressure differential detection system.

Each Pump House ventilation system is provided with a control panel, located in the Pump House, and a Start/Reset pushbutton located in Zone 01 enclosure.

CONTENTS

1. GENERAL

This system provides motive power for the hydraulic actuated valves on the Platform. It comprises a central hydraulic unit (Q7), four distribution circuits, local accumulators and local control stations for the valves.

The central hydraulic unit is located in Zone 02. Fluid is stored in a 4500-litre reservoir (V42); a low level switch in the vessel initiates an alarm if the fluid content drops below 1000 litres. Two gear-type pumps (P22A and B) are provided to pressurise the system. Each is driven by a 30kW electric motor and is rated to deliver 100 litres/min at a pressure of 150 bar. Excess pressure is relieved to the reservoir via a relief valve (set at 110 barg).

The pumps normally operate one duty and one standby, the duty pump starting and stopping in response to pressure switches connected to the discharge manifold. Cut-in and cut-out pressures are 90 and 100 bar respectively. A third pressure switch connected to the manifold initiates an alarm should the pressure fall below 80 bar.

An emergency hand pump, installed in parallel with the motordriven pumps, can be used in the event of pump failure or for maintenance purposes. It has a capacity of 0.045 litre per double stroke.

Seventeen accumulator sets are incorporated in the unit. Each comprises a 50-litre accumulator and a nitrogen bottle, and is protected against overpressure due to fire by a fusible plug which melts at 145°C.

The return lines from the valve controllers discharge into the reservoir via four strainers. Three spring-loaded check valves provide relief should the strainers become partially blocked.

The four distribution circuits each comprise 1.1/2" supply and 2" return lines, to which each valve actuator is connected via its controller. Two groups of accumulator sets, one of six and the other of thirteen, are provided as a standby supply for certain of the ESDVs. Other ESDVs have standby accumulators incorporated in their controllers. Distribution circuit no. 2, line HF-1605, also include circuit line no. HF 2095 which supplies part of the Alwyn Tie-in hydraulically operated valves.

Four main types of valve controllers are used, namely :

a) Type A. Movement of the valve actuator is determined by the directional control valve, the position of which is controlled either locally, or remotely via a pneumatic circuit.

b) Type B. These are similar to the Type A controllers, differing only in that the supply line incorporates an integral accumulator (5 litre/min controllers), or is connected to a local accumulator group (100 and 50 litre/min controllers).

1. GENERAL (conts.)

c) Type C. These are used for locally controlled valves. The actuator is positioned directly (50 litre/min controllers), or via a directional control valve (100 litre/min controllers).

d) Type D. These are used for locally controlled valves. The actuator is positioned via a directional control valve and with no accumulator back-up except for valves HV-M28-4 and HV-M28-5. These have each a local back-up accumulator and are also remotely controlled via electrical signals. Also note that HV-M28-6 is remote controlled.

e) Type E. These are used for automatic pig launching sequence unit Q8 (not in operation). No local accumulators are installed.

CONTENTS

DIAGRAM

Nitrogen System - DocsOpen no. 25578 & 86299

1. GENERAL

The purpose of the system is to face all needs for high and low pressure nitrogen.

2. NITROGEN UNIT

Nitrogen gas is used as blanket gas and to sweep the LT-vent stack SP45 to prevent the ingress of air and the formation of a potentially explosive mixture.

The Nitrogen flow is provided by the Nitrogen generator unit Q16 located in Zone 11 on the Cellar Deck.

The unit operates on the adsorption principle. Oxygen, carbondioxide and water have a higher adsorption velocity than nitrogen and when air is passed through a carbon molecular sieve, the nitrogen passes through the adsorber while O2, CO2 and H2O remains. After a certain period of time, the bed is saturated and regeneration is needed. To obtain a continuous flow two absorber filters are required together with a buffer vessel. In operation one adsorber is in use with the other regenerating. The buffer vessel provides the flow during the changeover period. An analyser continuously monitors nitrogen quality; if out-of-specification gas is produced the flow is diverted to atmosphere automatically. During regeneration the absorber depressurizes to athosphere. The vented gas is oxygen enriched and is ducted to a safe area outside the platform structure.

Compressed air for the nitrogen is provided from the compressed air reservoir at 5.5 bar(g). Output of the niitrogen unit is 150Nm³/hr at 3 bar(g).

3. H.P. COMPRESSION UNIT

The nitrogen compression unit is filling the H.P. reservoir (8" network) from time to time depending on the consumption forecast.

Performance of the compressor unit

Suction pressure	3	bar
Discharge pressure	180	bar
Temperature after cooling	30-40	°C.

The gas is produced in an air separation plant and is totally oil free.

4. CONNECTION COMPRESSION/MUDLINE

The connection from the H.P. compressor to mudline (H.P. reservoir) is equipped with a pressure safety valve set to a pressure less than the M.W.A.P. of the 8" mudline.

5. H.P. RESERVOIR (mudline) STORAGE:

8" mudline volume: Approx. $60m^3$
(CDP1 - TP1 - TCP2 - DP2)

CONTENTS

1. FLOODING AND DEWATERING SYSTEM

For necessary maintenance and inspection at the riser and "J" tubes, which are routed up the inside of the support columns to the process areas, there are installed flooding and dewatering systems for emptying and flooding of the columns. The columns are normally filled with water to the sea level.

Dewatering system

The dewatering system consists of two 6" pipes routed from the bottom of the column to a level fourteen meters above sea level. Each pipe is equipped with a remote operated valve at the outlet level and a submerged dewatering pump at the bottom of the column.
The emptying time is approximately 50 hours at a rate of 120M3/hr. for each column.

Flooding system

The method is performed by utilizing the gravity of the sea water. Waters enters the 8" GRP-pipes and is allowed to enter the column under a full rate of flow.
The flooding system consists of two 8" pipes routed from a level six meters below the sea level to the bottom of the column. Each pipe is equipped with a diffuser at the bottom level and a flooding valve at the inlet level.
The filling time is approximately 6 hours at a rate of 1000$M^{3/}$hr.

Interconnection line

The columns are interconnected with a 10" pipe at the bottom level. This pipe is equipped with two remote operated valves placed in different columns.

CONTENTS

1. GENERAL

The recirculation system is installed to keep the temperature difference between the sea and the water inside the column below a maximum of 12 degrees C.
This is done to avoid stress in the concrete.

Recirculation system

The water is entering the recirculation pumps at a level 3M below the surface of the water in the column. Flooding lines are kept open to refill the column from the bottom.

During normal production two recirculation pumps are required to cool column 1, and one recirculation pump to cool column 2.

Operation of circulation pumps is done by the Production Department. Temperature difference is recorded every day.

The recirculation system (refer following sketch) in each column consists of two 6" pipes routed from the pumps at a level 3M below the surface and connected to the dewatering line at a level of 14M above the sea.