19-21.09-84

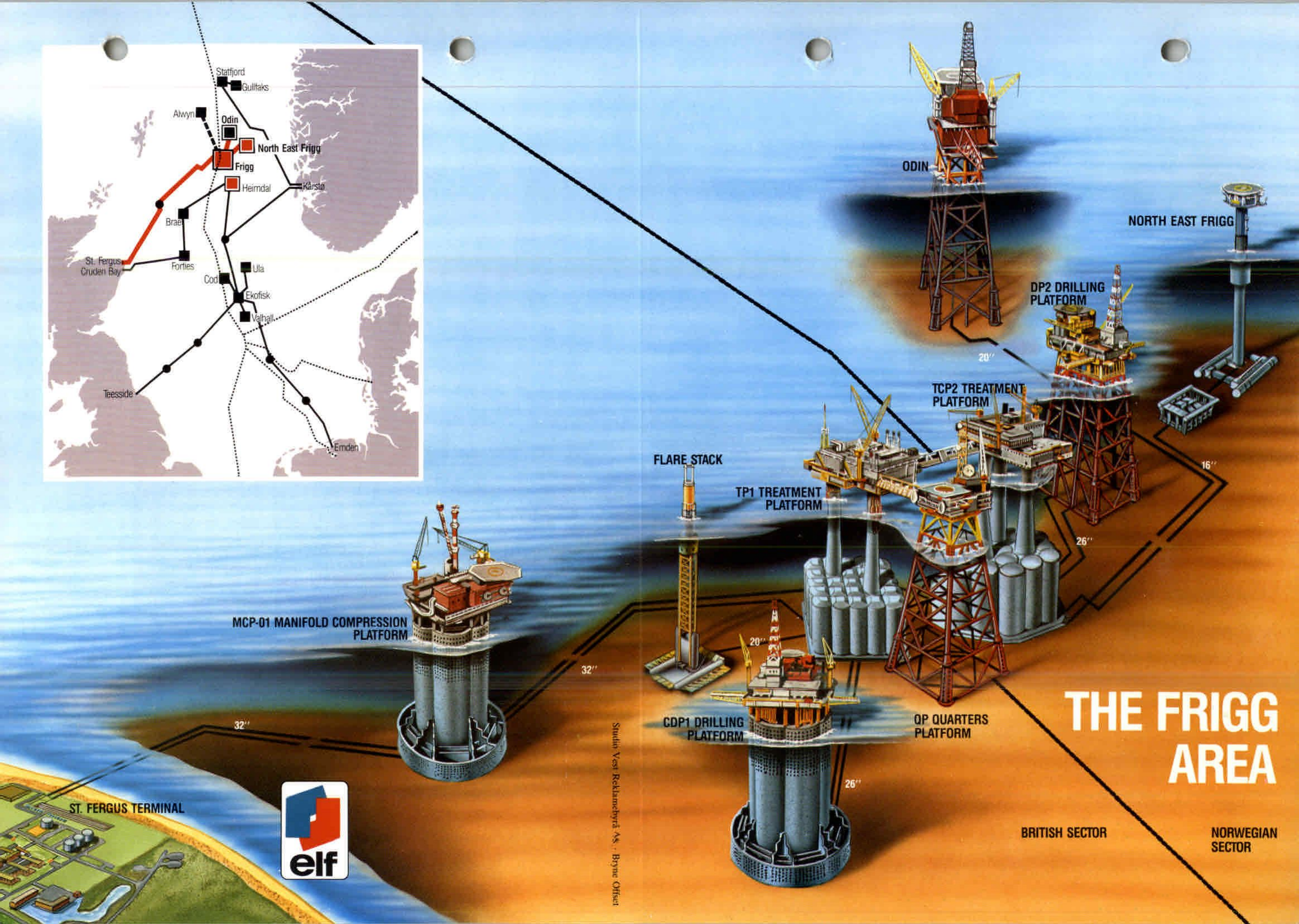
elf aquitaine norge a/s

FRIGG FIELD

TCP2 EXTENSION

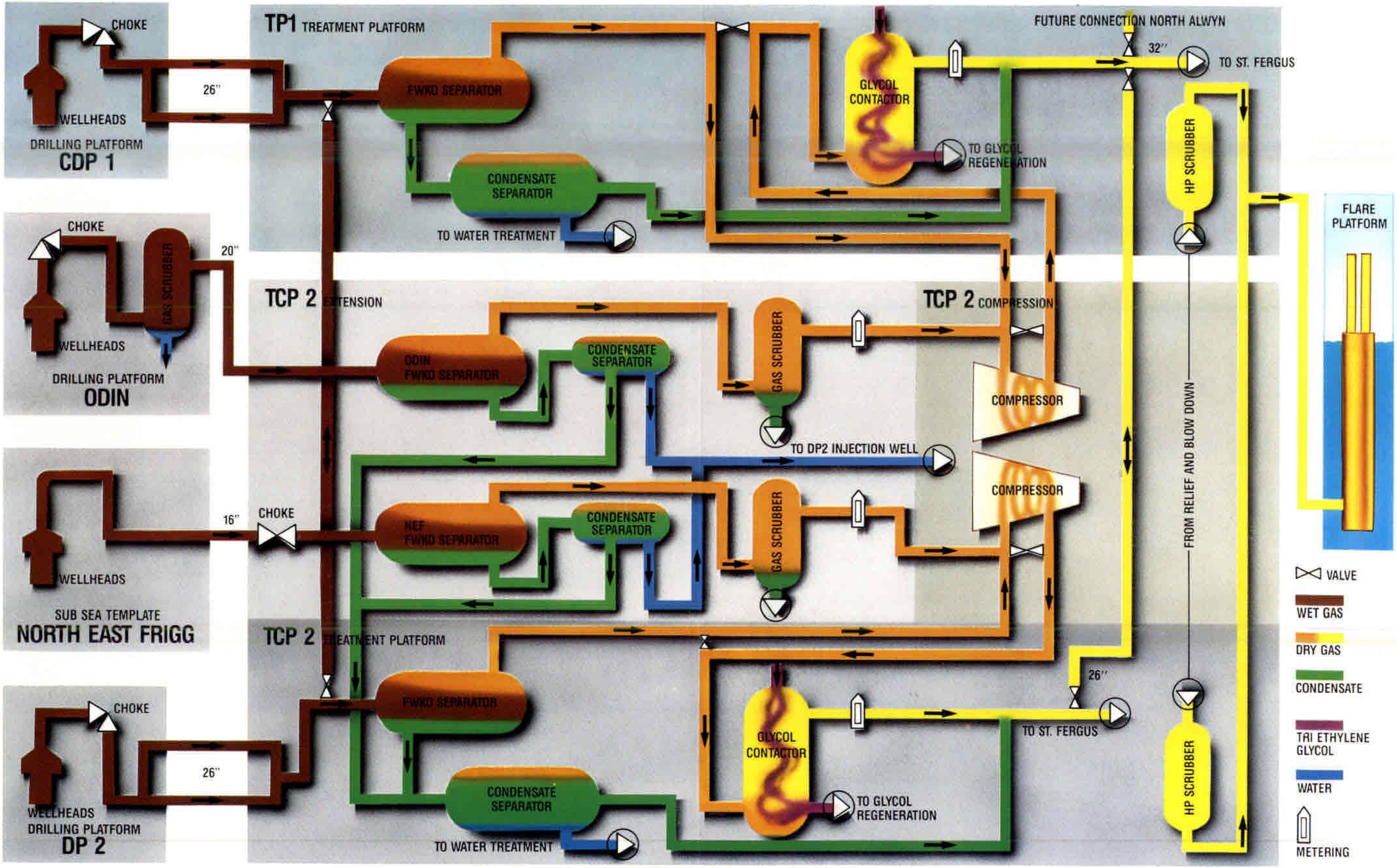
TRAINING MANUAL

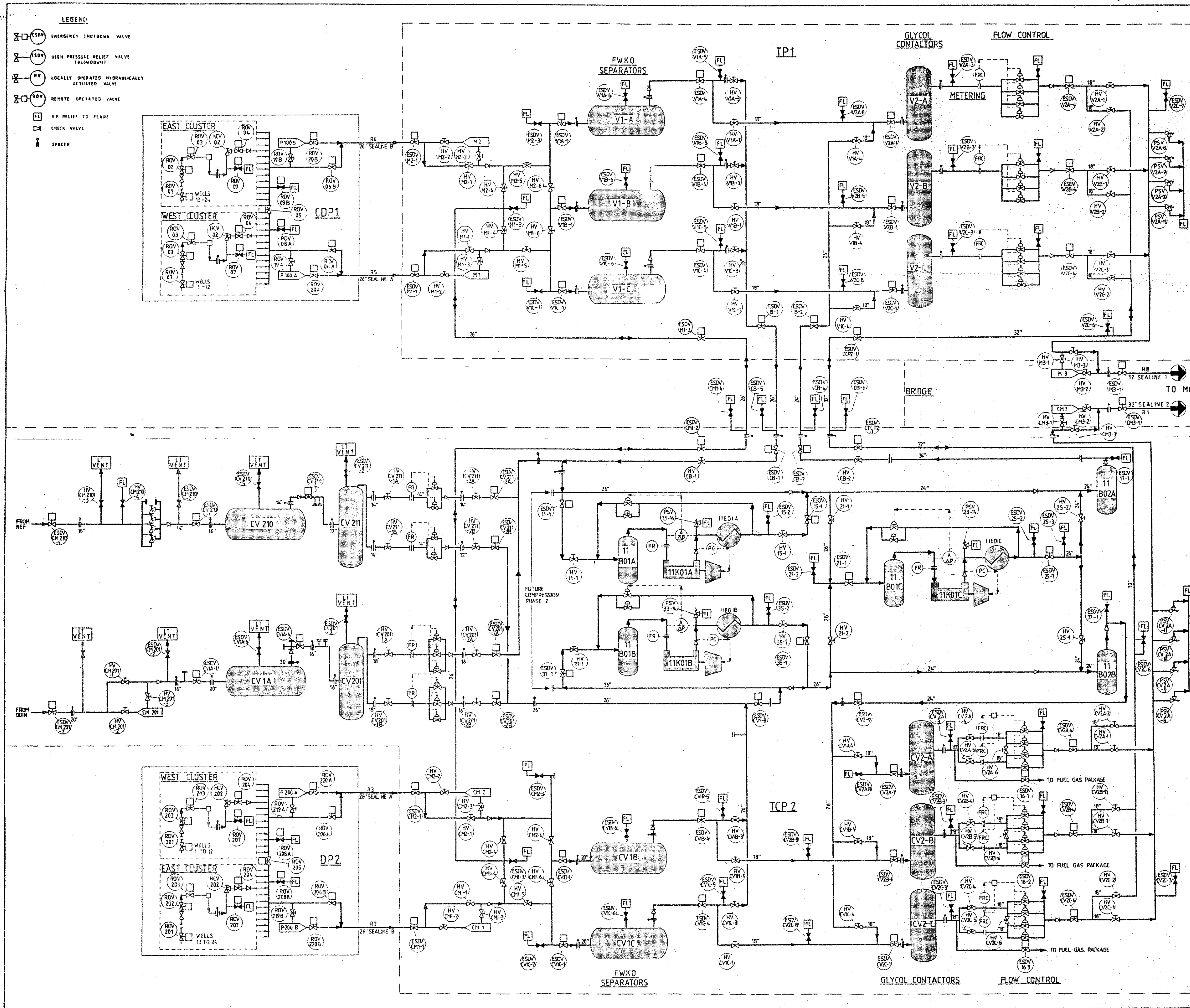
PREPARED BY
TEROTECH A/S



Studio Vest Reklamebyrå A/s - Bryne Offset

FRIGG FIELD PROCESS FLOW





BLOWDOWN VALVES GROUP

ALL BLOWDOWN VALVES TP1: GROUP W (TP1)
ALL BLOWDOWN VALVES TCP2, TREATMENT: GROUP W (TCP2
ALL BLOWDOWN VALVES TCP2, COMPRESSION GROUP W (TC
ESDV CB-4 & ESDV CB-5 GROUP Z TCP 2-T
ESDV CB-6 & ESDV CM1-4 GROUP X TCP 2-T

GROUP			
U	ESDV M1-1 M2-1 M3-1 V1A-1 V1A-2 V1A-3 V1A-4 V1B-1 V1B-2 V1B-3 V1B-4 V1C-1 V1C-2 V1C-3 V1C-4	ESDV CM1-1 CM2-1 CM3-1 CV1A-2 CV1A-3 CV1B-1 CV1B-2 CV1B-3 CV1B-4 CV1C-1 CV1C-2 CV1C-3 CV1C-4	ESDV CM210 CM201 CV1A CV1A CV210 CV210 CV210 CV201 CV211 CV211
A	ESDV V2A-1 V2A-2 V2A-4	CV2A-1 CV2A-2 CV2A-4	
B	ESDV V2B-1 V2B-2 V2B-4	CV2B-1 CV2B-2 CV2B-4	
C	ESDV V2C-1 V2C-2 V2C-4	CV2C-1 CV2C-2 CV2C-4	
Y	ESDV B1 B2	CB-1 CB-2	
V	ESDV TCP2-1 M1-2 B3 B7	CTCP2-1 CM1-2 CB3 CB7	
T		CV1-8 CV1-9	

GROUP	TCP2 COMPRESSION
A	ESDV 15-1 11-1 12-2
B	ESDV 35-1 31-1 32-2
	ESDV 25-1 21-1 22-2 IF LINE C INSTEAD OF LINE A 50 ESDV 16-4 11 ESDV 16-2 IF LINE C INSTEAD OF LINE A 11 ESDV 36-2
FG/A	50 ESDV 11-5 11-6 30-3
FG/A	50 ESDV 11-7 11-8 31-3
	150 ESDV 50-5
	150 ESDV 52-5
	150 ESDV 54-5

THIS DRWG SUPERSEDE FF 00 16 00 5803 REV 1

REV	DATE	DESCRIPTION
03	13 5 83	NEF AND ODIN EXTENSION ADDED
02	25 2 81	REDRAWN BY OMS AND RENUMBERED
01	12 5 80	REVISED AS NOTED
0	29 5 79	ISSUED FOR COMPRESSION INTEGRATION

elf aquitaine norge a/s

GENERAL SCHEME (
MAIN GAS
PROCESS LINES

NTS

FRIGG FIELD FF 00 00 00 5000 03

TCP2 EXTENSION TRAINING MANUAL

CONTENT LIST

1. INTRODUCTION

1. INTRODUCTION

The gas to be treated on TCP2 Extension comes from the North East Frigg (NEF) Field and the ODIN Field.

1.1 The NEF Field (Fig. 1.1)

The equipment and techniques developed for the use on the NEF project, represents the very latest technical advances in the offshore oil industry. This is partly due to the fact that NEF is a marginal field, satelite of the Frigg Field, situated 18 kilometres north east of the Frigg Field. The recoverable reserves does not justify the cost involved in a traditional development scheme.

The six producing wells have been drilled through a template and will be completed on the sea bottom, by the use of a floating drilling rig. The water depth is 110 m.

An articulated column will be installed 150 meters from the sub-sea station. The function of the Field Control Station (FCS) is to house the equipment required for:

(a) The conversion of electrical control signals from the Frigg Field into hydraulic pressures for operating the sub-sea gas production valves.

(b) Control of wells through individual 2" kill lines.

(c) Periodic leak testing of the production tubing safety valves.

(d) Continuous injection of methanol to prevent hydrate formation in the subsea line to the Frigg Field.

Gas from the six subsea x-mastrees is sent, via the manifold, in a 16" gas line to the TCP2 Extension on the Frigg Field.

1.2 The ODIN Field (Fig. 1.1.)

The ODIN Field is located in block 30/10, 22 kilometers north east of the Frigg Field. The water depth is 103 m.

For Hook-up, drilling and installation a semi-submersible rig will be used for a period of two years.

1.4 General (contd.)

ODIN Gas

C_1	94,8 mole %
C_2	3.9 mole %
N_2	0.9 mole %
CO_2	0.2 mole %
$C_3 - C_6$	0.2 mole %

The NEF and ODIN gas may eventuelly have to be compressed in the future. This will be done downstream the FWKO vessel. The possible future compression depends on the reservoir pressure decline. There is two possibilities for each field:

(a) Slow pressure decline (corresponding to a water drive in the reservoir).

(b) Steep pressure decline (corresponding to no water drive in the reservoir).

In the case of water drive, no compression of the NEF or ODIN gas is required to rise the pressure up to Frigg gas pressure. In the case of no water drive, compression is required.

The gas leaving the FWKO vessel will contain little methanol. Due to the low temperature of the gas it may be necessary in the future, to inject methanol downstream the FWKO vessel, to avoid hydrate formation.

The TCP2 Extension is designed to use the existing service systems on TCP2. These include:

- Triethylene glycol (TEG)
- Process drainage from HP-vessel
- Fuel gas
- Safety systems excl. LT relief
- Electrical distribution
- Utility systems

The HP (high pressure) and LP (low pressure) relief system on the TCP2 Extension are connected to the existing system on the TCP2. The LT (low temperature) relief system is however specially designed for the TCP2 Extension, and is connected to the LP vent system on TCP2 compression.

The NEF and ODIN streams will be metered prior to entering the Frigg gas treatment. The reason for this is to know where the gas is produced, because:

1. INTRODUCTION

1.4 General (contd.)

(a) The Frigg Field is located on both sides of the boarder between Norway and United Kingdom. The gas produced on the Frigg Field is split between Norway and UK on an approximately 60:40 basis.

(b) The gas from NEF and ODIN is produced in Norway, with Norwegian royalties only.

(c) ESSO is the operator and the only participant in ODIN.

(d) NEF is operated by Elf Aquitaine Norge A/S. The participating interest in NEF are:
Elf Aquitaine Norge A/S: 24.9
Esso: 40%, Norsk Hydro A/S: 19.7%,
Total: 12.4% and Statoil: 3.0%.

The emergency shutdown (ESD) systems on the TCP2 Extension are integrated with the existing systems on TCP2. Two systems are however new to the TCP2 Extension. These are Group 'N', NEF stream isolation, and Group 'O', ODIN stream isolation.

All the alarms from TCP2 Extension which are connected to the switches activated by abnormal pressure, level or temperature, are located in the Central Control Room (CCR) on QP.

Most of the TCP2 Extension is located in Module 50 and Pancake 53.

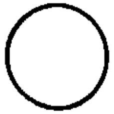
1.5 LEGEND

A	=	Alarm
AC	=	Alternating Current
AE	=	Analysing Element
CCM	—	Central Control Microcomputer
CCR	=	Central Control Room (at QP)
CSP	=	Piping Speciality
CV	=	Vessel, Located on TCP2
DB	=	Distribution Board
DBM	=	Data Base Microcomputer
DC	=	Direct Current
DSD	=	Disaster Shut Down
DP	=	Differential Pressure
DP2	=	Drilling Platform No. 2
ESD	=	Emergency Shut Down
F	=	Flow
FCS	=	Field Control Station (NEF)
FCV	=	Flow Control Valve
FE	=	Flow Element
FR	=	Flow Recorder
FRC	=	Flow Recorder Control
FT	=	Flow Transmitter
FWKO	=	Free Water Knock Out
FY	=	Flow Relay
FYX	=	Flow Signal Amplifier
H	=	High
HH	=	High High
HIC	=	Hand Indicator Controller
HP	=	High Pressure
HS	=	Hand Switch
HV	=	Hand Operated Valve
L	=	Level
L	=	Low
LL	=	Low Low
LC	=	Level Control
LI	=	Level Indicator
LP	=	Low Pressure
LT	=	Low Temperature
M	=	1000
MCC	=	Motor Control Centre
MM	=	1000.000
mm	=	Millimetre
MW	=	Methanolated Water
NEF	=	North East Frigg
P	=	Pressure
PA	=	Public Adress
PCV	=	Pressure Control Valve
PRC	=	Pressure Recorder Controller
PSV	=	Pressure Safety Valve
PT	=	Pressure Transmitter
PY	=	Pressure Relay
QP	=	Quarter Platform
SMM	=	Stream Metering Microcomputer
T	=	Temperature
TCP2	=	Treatment and Compression Platform No. 2.
TE	=	Temperature Element
TEG	=	Triethylene Glycol
TI	=	Temperature Indicator
TR	=	Temperature Recorder
TT	=	Temperature Transmitter
UV	=	Ultra Violet
V	=	Volt

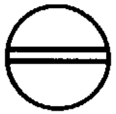
LEGEND

		LOW LOW	LOW	HIGH	HIGH HIGH
PRESSURE	SWITCH	PSLL	PSL	PSH	PSHH
	ALARM	PALL	PAL	PAH	PAHH
LEVEL	SWITCH	LSLL	LSL	LSH	LSHH
	ALARM	LALL	LAL	LAH	LAHH
TEMPERATURE	SWITCH	TSLL	TSL	TSH	TSHH
	ALARM	TALL	TAL	TAH	TAHH
FLOW	SWITCH	FSLL	FSL	FSH	FSHH
	ALARM	FALL	FAL	FAH	FAHH

INSTRUMENT BALLON SYMBOLS

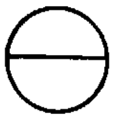


LOCAL MOUNTED INSTRUMENT

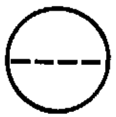


LOCAL BOARD MOUNTED INSTRUMENT

INSTRUMENT MOUNTED BEHIND LOCAL BOARD



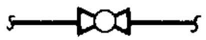
INSTRUMENT MOUNTED ON QP MAIN BOARD



INSTRUMENT MOUNTED BEHIND QP MAIN BOARD

VALVE SYMBOLS CONTROL

GATE



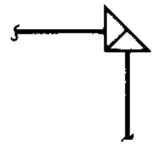
BALL

ROTARY PLUG OR BALL

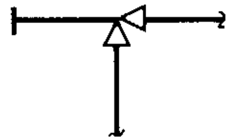
BUTTERFLY

GLOBE

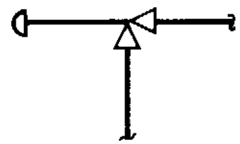
VALVE BODY SYMBOLS



ANGLE

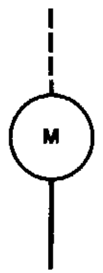


HAND ACTUATED CHOKE VALVE



DIAPHRAGM ACTUATED CHOKE VALVE

VALVE ACTUATOR SYMBOLS

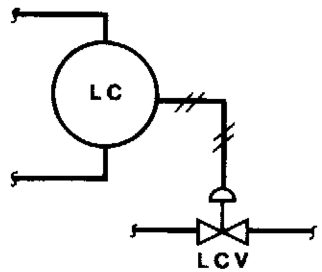


ROTARY MOTOR

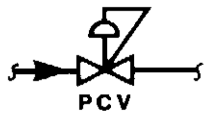
SPRING WEIGHT
OR INTEGRAL PILOT
FOR PSV'S

SINGLE - ACTING
CYLINDER

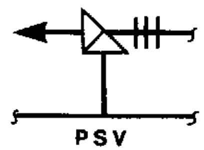
SYMBOLS FOR SELFACTUATED REGULATION VALVES



LEVEL REGULATOR
WITH PNEUMATIC
LINKAGE

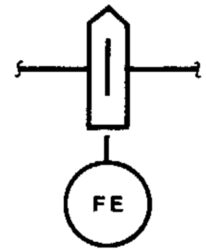


PRESSURE
CONTROLLER
VALVE

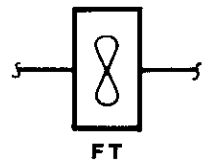


PRESSURE
SAFETY VALVE

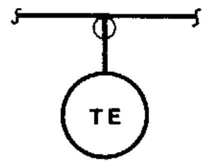
PRIMARY ELEMENT SYMBOLS



ORIFICE PLATE
IN QUIK FITTING

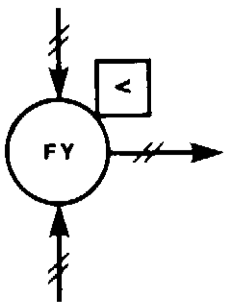


FLOW ELEMENT
(TURBINE METER)

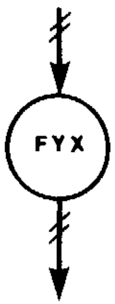


TEMPERATURE
ELEMENT WITH
WELL

RELAYS AND COMPUTE SYMBOLS

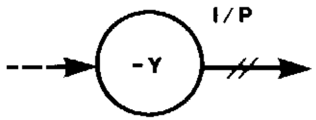


LOW SIGNAL SELECTOR

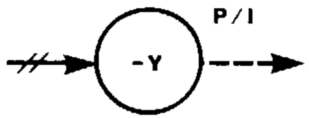


SIGNAL AMPLIFIER RATIO OF 1 TO 2

DIFFERENTIAL RELAY



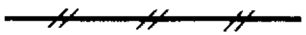
ELECTRO-PNEUMATIC CONVERTER



PNEUMATIC-ELECTRO CONVERTER

LINE AND PIPING SYMBOLS

MAJOR PROCESS LINE



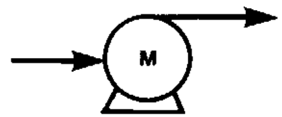
INSTRUMENT PNEUMATIC SIGNAL

ELECTRICAL SIGNAL

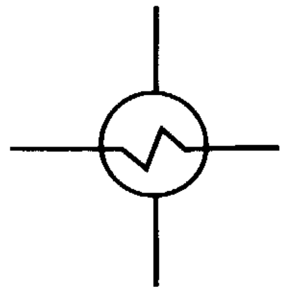
INSTRUMENT CAPILLARY TUBING (FILLED SYSTEM)

MINOR PROCESS LINE

EQUIPMENT SYMBOLS

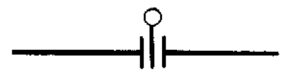


ELECTRICAL MOTOR DRIVEN CENTRIFUGAL PUMP

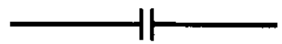


SHELL AND TUBE HEAT EXCHANGER

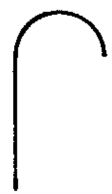
CAP



BLIND AND SPACER



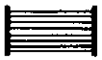
FLANGE



VENT

EQUIPMENT SYMBOLS

PIPING SPECIALITY



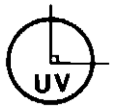
FIRE HOSE REEL

FLOW DIRECTION

SPRINKLER HEAD (OPEN TYPE)

MISCELLANEOUS INSTRUMENT SYMBOLS

GAS DETECTOR

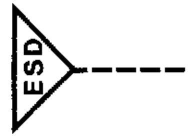


ULTRA VIOLET DETECTOR

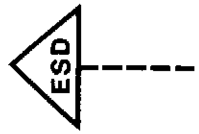
SMOKE DETECTOR

END OF LINE UNIT

MANUAL FIRE ALARM BUTTON



FROM EMERGENCY SHUTDOWN SYSTEM



TO EMERGENCY SHUTDOWN SYSTEM

ELECTRICAL SYMBOLS

MAIN FUSES

DISCONNECTOR

CIRCUIT BREAKER
W/TERM. MAGN.
PROTECTION

CONTACTOR
W/TERM. MAGN.
PROTECTION

CIRCUIT BREAKER
W/EARTHFAULT TRIP

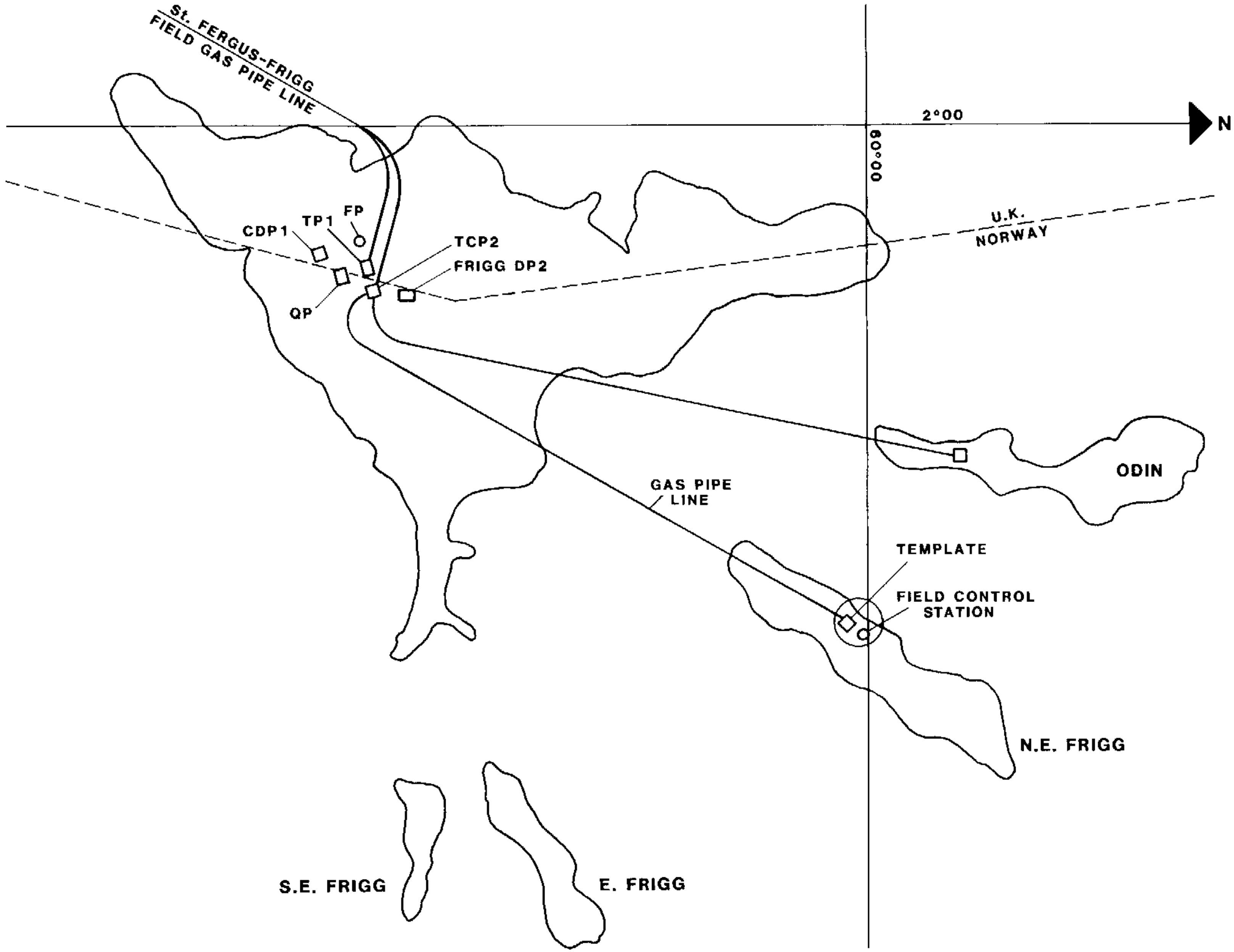
TERMINAL

REDRAWABLE
CELL

THERMOSTAT

COLOUR SYMBOLS

- WET GAS
- METHANOL
- CONDENSATE HYDROCARBON
- WATER
- TRI ETHYLENE GLYCOL
- METHANOLATED WATER
- ESDV SYMBOLS



FIELD LOCATION FIG. 1.1

SIMPLIFIED PROCESS AND INSTRUMENT DIAGRAM FOR TCP2 EXTENSION FIG. 1.3

2. SYSTEM DESCRIPTION

2.1 NEF Gas Treatment

2.2 ODIN Gas Treatment

2.3A NEF Condensate Separation

2.3B ODIN Condensate Separation

2.4 Methanolated Water System

2.5 Methanol Injection System

2.6 Triethylene Glycol (TEG) System

2.7 Prosess Drainage System

2.8 Fuel Gas

2.9 Safety Systems

2.10 Electrical Power Distribution

2.11 Utility Systems

2.1. NEF GAS TREATMENT

1. INTRODUCTION (Fig. 2.1.1)

The gas/liquid comes from North East Frigg in a 17,4 km long 16" OD pipeline.
The stream contains gas, hydrocarbon liquid and methanolated water. The methanol has been injected at North East Frigg to prevent hydrate formation.

The purpose of the NEF gas treatment is:

- Separate the gas from the liquids
- Meter the gas
- Inject the gas into the Frigg gas production system for final treatment.

2. SYSTEM DESCRIPTION (Fig. 2.1.2)

The flowrate of the gas/liquid coming from NEF is 6.4 MMSCM/D. This corresponds to the start-up year and no water drive in the reservoir. Max capacity is 7.7 MMSCM/D.

When the gas/liquid arrives at TCP2 Extension the pressure is adjusted by four choke valves (HCV M2101A/1B/1C/1D). The gas/liquid then enters the vessel CV 210 which is the NEF FWKO vessel.

In the FWKO vessel the gas is separated from the condensate and methanolated water.

When entering the vessel CV 210 the gas/liquid has a temperature of 5°C, due to transportation through the sealine (For details of the FWKO vessel see section 3.)

The liquid consists of condensate and methanolated water and is sent through the heat exchanger CE 211 to vessel CV 213 for separation. (See chapter 2.3 Condensate Treatment and chapter 2.4 Methanolated Water Treatment.)

The gas from the FWKO vessel is sent to NEF Gas Scrubber, see section 3.

The purpose of the scrubber is to make sure that the gas is maintained in single phase at the metering station.

The gas coming from the gas scrubber is split into two separate lines. One going to compression module A or C, the other going to compression module B or C. During normal operation the flow control valves (FCV V211. 1A/2A 1B/2B) are set to devide the flow into two equal parts. The reason for this is to have an even distribution of flow on the main Frigg compressors 11 K01 A/B/C. The compressors will not be run during the summer period. During normal operation the compressors 11 K01 A/B will be working, while 11 K01C is used as stand-by.

2. SYSTEM DESCRIPTION (Fig. 2.1.2) (contd.)

In order to have a good flow control rangeability the flow control valves are connected in split range for each of the lines. The normal operation condition for this station, will be one line under pressure control, and one line under flow control. This is done to obtain a constant pressure on the metering tubes which is important for the metering accuracy. This set up is in conformity with the existing facilities on Frigg TCP2 and TP1 platforms.

It may happen, however, that only one of the metering tubes is used, i.e. in case of maintenance, calibration etc. The total flow will then have to go through just one of the tubes. This means that they will have to be designed for a flow rate of 6.4 MMSCM/D which is equal to the average daily production rate.

3. MAIN COMPONENT DESCRIPTION

3.1 NEF FWKO vessel CV 210 (Fig. 2.1.3/4)

In the FWKO vessel the gas is separated from the condensate and the methanolated water. The FWKO vessel is also designed to work as a slug catcher. If a large amount of liquid slug enters the vessel it will go through the vessel, and LCV V210.5 will open and send the slug to CV3 or V3.

In order to get a good separation the vessel contains deflector plates, dixon plates and mist extractor. Most of the liquid is separated out of the gas when the gas hits the deflector plates. The dixon plates arrangement reduce the chance of foaming because the liquid is well airrated by giving it a greater surface.

Some of the liquid droplets will not settle out of the gas stream due to little or no gravity difference between them and the gas phase. They would be entrained and carried out of the FWKO vessel by the gas. In order to avoid this a mist extractor has been installed near the gas outlet. Here small liquid droplets will coalesce and form larger droplets which will by gravity be drained back into the liquid phase. The liquid carry-over in the gas phase will only contain droplets in the 20 micron size or smaller.

The gas from the FWKO vessel is sent to the gas scrubber CV 211. The liquid is sent to the condensate separation system through the heat exchanger CE 211 (chapter 2.3).

The vessel CV 210 is provided with an automatic flush valve LCV V210.5, which will open if the liquid increases to a high level. This can be the case if liquid slug enters the vessel. This valve is sized to handle slugs. The liquid is sent to CV3 or V3.

3. MAIN COMPONENT DESCRIPTION

3.1 NEF FWKO Vessel CV 210 (Fig. 2.1.3/4) (contd.)

The liquid is normally sent through LCV V210.1 to the heat exchanger CE 211, which is part of the condensate treatment. If the liquid level is further increased the FWKO vessel is provided with a high high level switch (LSHH V210.8), which will close the vessel inlets and outlets, (valves nos. ESDV V210.1 and ESDV V210.4).

The FWKO vessel is also provided with a low low level switch (LSLL V210.7) which will close the outlets to the condensate separation system and the hydrocarbon dump header, (valve no. ESDV V210.2/3)

Before these two events can happen, the CCR-operator will be warned by a respectively low level alarm or a high level alarm (LAL V210.2 and LAH V210.6), both located in CCR on QP.

The vessel is protected from overpressure by two pressure safety valves. (PSV V210.1/2). The gas then relieves into the LT (Low Temperature) relief system. The design pressure of the vessel is however higher than the maximum allowable wellhead pressure, so the only cause of overpressure will be in case of fire.

A pressure switch low (PSL V210.1) gives group 'N' ESD in case of a leakage. This means that both CV210 and CV 211 will be isolated by the ESD valves around them.

If necessary the FWKO vessel can be depressurized through valve ESDV V210.5. The gas will then be sent to the LT relief system. This might be required in case of a fire where the vessel elsewhere would be weakened by exessive heating when exposed to a fire.

Drainage of the FWKO vessel is done by opening the 4" manual drain valves. The liquid is then sent to the process drainage system, (see chapter 2.7)

- Design Data:

Design Pressure:	177.5 Bara
Design Temperature:	$50^{\circ}C/-28^{\circ}C$
Capacity:	7.7 MMSCM/D
Diameter:	2443 mm
Length:	9432 mm

Level switches	Tag No.	Alarm level
LSHH	V 210.8	1650 mm
LSH	V 210.6	1500 mm
LSL	V 210.2	400 mm
LSLL	V 210.7	300 mm

3. MAIN COMPONENT DESCRIPTION

3.2 Gas Scrubber CV 211 (Fig. 2.1.5/6)

The purpose of the scrubber is to make sure that the gas is maintained in single phase at the metering station.

The scrubber is equipped with small cyclones. Due to the cyclones, the stream is divided into a great many streams in parallel. The strong centrifugal forces exerted on suspended particles throw them outwards and downwards to the wall of each cyclone. From there the liquid particles go into the cone and out into the storage chamber from where it is dumped. The dried gas goes in the reverse direction, rises, still spinning, up the centre of the vortex, and out via the gas outlet of the vessel.
The scrubber is provided with a wire mesh located at the gas outlet. The liquid content in the gas is reduced so that 95% of the droplets will be in the 10 micron size or smaller.

The gas from the scrubber is sent to the metering tubes. The condensate and methanolated water, which are separated from the gas in vessel CV 211, are sent together with the liquid from the FWKO vessel to the condensate separation, through heat exchanger CE 211.

If the liquid level increases the scrubber is provided with a high high level switch LSHH V211.4 which will close the vessel inlet. This is to prevent liquid carry-over into the metering system. The scrubber is also provided with low low level switch LSLL V211.5 which will close the liquid outlets to the condensate separation system, (see chapter 2.3)

Before these two events can happen the CCR operator will be warned by a low level alarm LAL V211.3 or a high level alarm LAH V211.2, both located in CCR.

The vessel is protected from overpressure by two pressure safety valves. (PSV V211.1/2) The gas then relieves into the LT relief system. The design pressure of the vessel CV 211 is however higher than the maximum allowable wellhead pressure, so the only overpressure cause will be in case of fire.

A pressure switch low (PSL V211.3) gives group 'N' ESD in case of a leakage. This means that both CV V210 and CV 211 will be isolated by the ESD valves around them.

If required the vessel can be depressurized through ESDV V211.2 and the gas sent to the LT relief system.

3.2 Gas Scrubber CV 211 (Fig. 2.1.5/6) (contd.)

Drainage of the gas scrubber is done by opening the 2" manual drain valves. The liquid will then be sent to the process drainage system, (see chapter 2.7).

- Design data:

Design Pressure:	177,5 Bara
Design Temperature:	$65^oC/-28^oC$
Capacity:	7.7 MMSCM/D
Diameter:	655, mm
Length:	7863 mm

Level switches	Tag No.	Alarm level
LSHH	V 211.4	1860 mm
LSH	V 211.2	1250 mm
LSL	V 211.3	550 mm
LSLL	V 211.5	300 mm

3.3 Metering (Fig. 2.1.7/8)

All gas production on Frigg, exclusive NEF and ODIN, is split between Norway and U.K. approximately on a 60:40 basis. The purpose of the metering station on NEF will therefore be to distinguish this production rate from the FRIGG production rate. It is here important to notice that NEF/ODIN gas metered are wet gas, or water saturated gas, while the gas on FRIGG are dry.

The gas coming from the gas scrubber (CV 211) is split in two separate lines. Each line is equipped with a metering station located upstream the flow control valves (FCV V211 1A/2A / 1B/2B).

In order to get a reliable gas characteristic of the NEF gas, a sampling will be done shortly after start-up.

(a) Principles of orifice metering

The principles of orifice metering are based upon conservation of energy and mass. This means that a gas flow in a pipeline will remain uneffected of restrictions in flow area available, with respect to mass flow and total amount of energy.

Constant mass flow at the restricted flow area (orifice) is maintained through an increase of gas velocity, and thereby an increase of kinetic energy. Due to conservation of energy, this means a loss of pressure, hence an increase of one form of energy entails a reduction of another.

The flow rate through the orifice, i.e. production rate on ODIN, may be calculated knowing the pressure drop over the orifice, gas density, gas characteristics and characteristics of the spesific orifice in service.

3. MAIN COMPONENT DESCRIPTION

3.3 Metering (Fig. 2.1.3.7/8) (contd.)

(b) Metering Station
The orifice is a Daniel 'Senior Orifice Fitter'. The fittings of this orifice are of a type which facilitates the changing of plates whilst the line is still pressurized.

The metering station is equipped with a differential pressure transmitter, absolute pressure transmitter and platinum resistance thermometer.

These measured parameters will be sent to the Spectra-Tek gas stream metering microcomputers (SMM) mentioned below.

(c) Gas stream metering microcomputer (SMM)
The computers used for calculation of the production rate on the satellite field NEF will be Spectra- Tek SMM's (Tag No. FIY V211.2A/2B). The function of these SMM's are:

- To measure following parameters of the individual meter tube by receiving and processing the signals from the primary measurement transducers of:
  - Temperature
  - Pressure
  - Differential Pressure
- To calculate the gas density using measured values of the temperature, pressure and gas characteristics held in memory.
- To calculate the mass flowrate and accumulated mass flow through the tube.
- To transfer data, on demand, to the two central control microcomputers (CCM) located on separate platforms (TP1 and TCP2).
- To operate in a number of modes, i.e. stream metering, calibration, change of orifice and initialisation.
- To operate independently to one or both of the CCM's in the event of communication failure.
- To operate in conjunction with front panel keyboard and display, particularly when under local control.

3.3 Metering (Fig. 2.1.3.7/8) (contd.)

(d) Principal description of flow control station
The parameters measured by the metering stations are distributed to the flow control stations. Speaking about flow control stations we could equally well speak about pressure control stations. We use the same valves for two different purposes. During normal operation conditions the set point of the valves (FCV V211.1A/2A / 1B/2B) are such that the flow is equally distributed to the two parallel lines. The reason for this is to have an even distribution of the flow to the main FRIGG compressors 11 K01A/B/C.

For each station we have two controllers, a PRC (pressure recorder and controller) and a FRC (flow recorder and controller). Normal operation condition will be on line in pressure control and the other in flow control. If one of the lines is out of service (i.e. maintenance etc.), the other must be in pressure control.

(e) Pressure Controller (PRC V211.1A or B
The function of the pressure controller is to achieve a constant pressure at the metering stations. This is obtained by regulating the flow. By using HIC's (hand indicator and controllers) we pre-set a desired value of the pressure, which the PRC automatically keeps constant (within certain limits), independent of process changes.
This is done by comparing values measured at the metering station to the set point of the HIC's. If these equals each other no adjusting signal will be sent from the PRC to the flow control valves (FCV's). But if there is only slightly difference in reading the two values, signals will be sent to the FCV's to equalize them.

Let's say that the pressure at the station increases and exceeds the set point.

Signals will then be sent from PRC to open the FCV's.

Respectively if the pressure decreases below the set point, the PRC will close the FCV's. The pressure controller might be of local (TCP2) or remote (QP) auto, depending on which HIC is in control.

(f) Flow Controller (FRC V211.1A or B)
The function of the flow controller (FRC) is to achieve constant flow at the metering

3. MAIN COMPONENT DESCRIPTION

3.3 Metering (contd.)

station, i.e. constant DP over the orifice plate. The FRC works principally as the PRC, thus controlling the differential pressure over the orifice plate to a pre-set value. As the PRC, the FRC might be of local (TCP2) or remote (QP) auto, depending on which HIC is in control.

(g) Signal Selector (FY V211.1A/B)
Since there are two different signals for the same set of valves, a signal selector is needed. This selector always let the lowest signal pass through, thus blocking the highest. Therefore, it is important to increase the output signal from the regulator not in service to a maximum value. Otherwise, we may have a incorrect regulation of the regulator which is in service.

(h) Signal amplifier (FYX V211.1A/B)
The flow control valves work on the output signal of the controllers (FRC or PRC). Because the controllers work on the 0,2-1 bar principle and the valves on the 0,4-2 bar principle, a booster is needed on the airline between them.

This booster amplifies the output signal to a double value before entering the valve actuators.

4. OPERATION

The inlet choke valves may have to be adjusted due to uncertainty of the reservoir behaviour. The Operation Manual have attached different graphs which show the profile of the reservoir in case of water drive and the pressure drop available for choking.

For start up, please see Operation Manual: 'Operating Conditions and Controls for NEF Gas Treatment', This includes: 'Indicator and Recorder Check List', and 'Alarm and Shut Down Points'.

For start up and adjustment of the metering system, please see: 'Indicator and Recorder Check List'. 'NEF Gas Metering System'.

For normal operation the operator has to check that all instrument isolation valves are open. Drain valves should be closed. Sampling valve on CV 211 should be closed. For setting of prosess valves see list of setting of process valves in Operation Manual.

4. OPERATION

The operators tasks and responsibilities during normal operation are as follows:

(a) Check that valves are set in the configuration described in the 'Equipment Setting List'.

(b) Check that indicators and recorders listed in the Indicator and Recorder Check List' are operating.

(c) Ensure that all pressure, temperature and flow data are within the normal range and do not reach critical values.

(d) Adjust the NEF Choke Valves to obtain the right suction pressure required by the Compression Modules.

(e) Check levels of NEF gas treatment vessels.

(f) If necessary adjust the set point of the local controllers.

(g) Adjust gas metering pressure control or flow control according to requirements.

(h) Upon Alarm initiation find the cause of trip and start the proper action accordingly, to restore good operating conditions as indicated in the Alarm and Shut Down Points List.

Schedule and Report Sheets

The operator is supposed to make a round trip in the NEF gas treatment plant every four hours and record the main parameters as well as abnormal operating situations.

All the information collected by the operator must be logged in the NEF gas treatment log book.

The 'QP Control Room Report' should include the following parameters:

NEF SEA LINE	:	PR-M210.3	TI-M210.1
CV 210	:	PR. V210.3	TR-V210.1

5. EMERGENCY SHUTDOWN (Fig. 2.1.9)

For complete information on the ESD system please see chapter 2.9.3.

The emergency shutdown (ESD-system) on the NEF stream consists of three different groups:
Group 'N' isolates the NEF stream and is spesific for the NEF system.
Group 'U' which closes the sealines, and
Group 'W' which initiates a blow-down (de-compression) are existing systems on TCP2.

(a) 4th level shutdown signal from NEF or NEF MODULE or INTERFACE ROOM or signal from PSL M210.1 low pressure on the gas inlet or PSL V210.1 low pressure in FWKO vessel or PSL V211.3 low pressure in gas scrubber will cause an isolation of the NEF stream Group 'N'. In addition a signal from PSL M210.1 will cause the closing of NEF sealine.

(b) Signal from LSHH V210.8 high high level in FWKO vessel will close ESDV V210.1 and ESDV V210.4, FWKO vessel gas inlet and outlet.

(c) Signal from LSHH V211.4 high high level in gas scrubber will close ESDV V210.4 and ESDV V211.1A and B, gas scrubber gas inlet and outlet.

(d) Signal from LSLL V210.7 low low level in FWKO vessel will close ESDV V210.2 and ESDV V201.3 condensate outlets from FWKO vessel.

(e) Signal from LSLL V211.5 low low level in gas scrubber will close ESDV V211.3 condensate outlet from gas scrubber.

(f) Signal from LSL V213.2 or PSL V213.3 low level or low pressure in condensate/MW separator will close ESDV V213.1 and ESDV V213.2 outlet of condensate and MW from CV 213.

(g) Signals from PSL V213.3 or PSH V213.5 low or high pressure in CV 213 or LSH V213.5 high level in CV 213 will close ESDV V210.2 and ESDV V211.3 condensate outlet from CV 210 and CV 211, and stop TEG pump CP 220B if running, and stop TEG pump CP 220C if running for CP 220B.

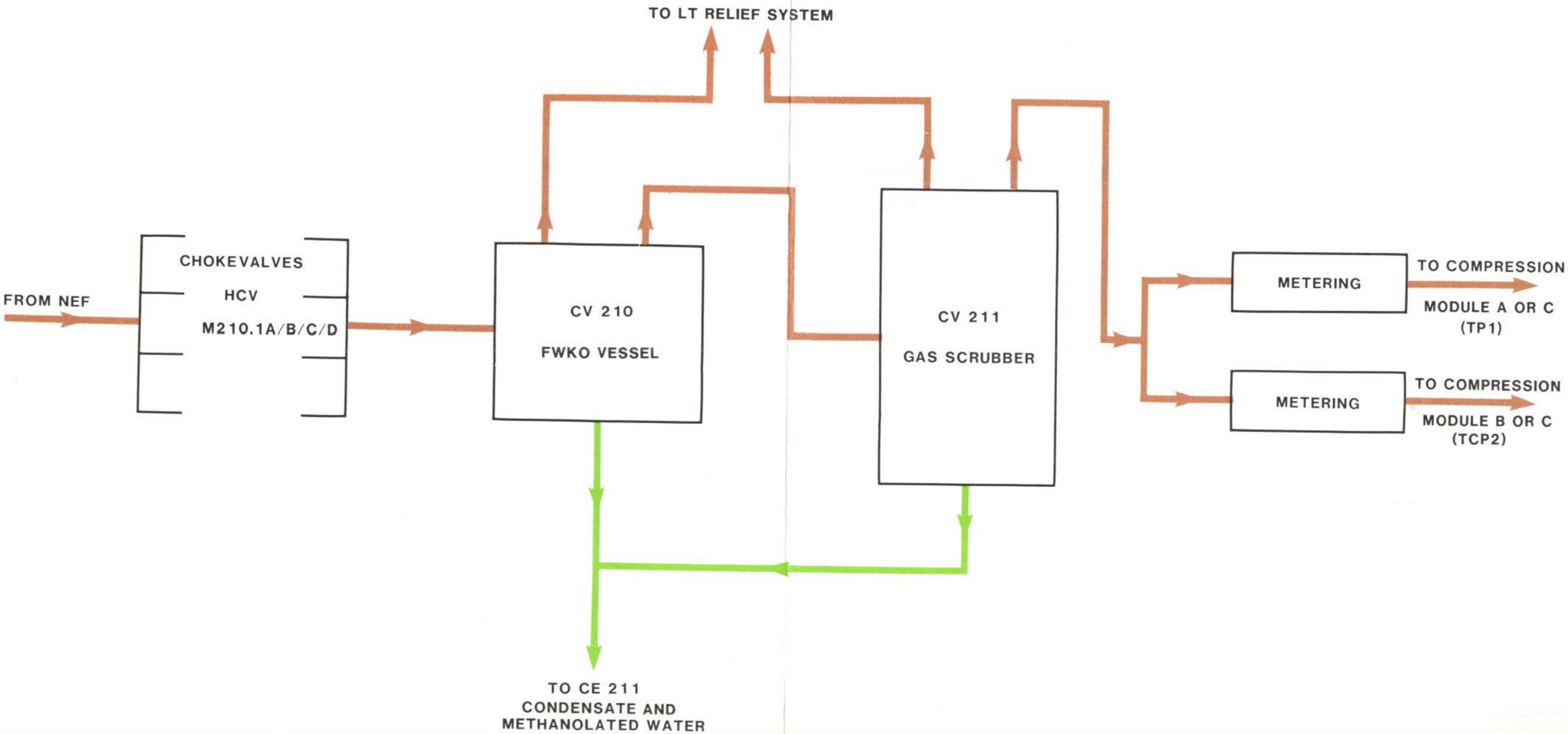
(h) Signals from PSL P220B.1 low pressure in pump CP 220B or TSH E211.5 high temperature in CE 211 will stop TEG pump CP 220B if running.
In addition signal from TSH E211.5 will stop TEG pump CP 220C if running for CP 220B.

(j) Signal from PSL P220.C1 low pressure in pump CP 220C will stop TEG pump CP 220C if running.

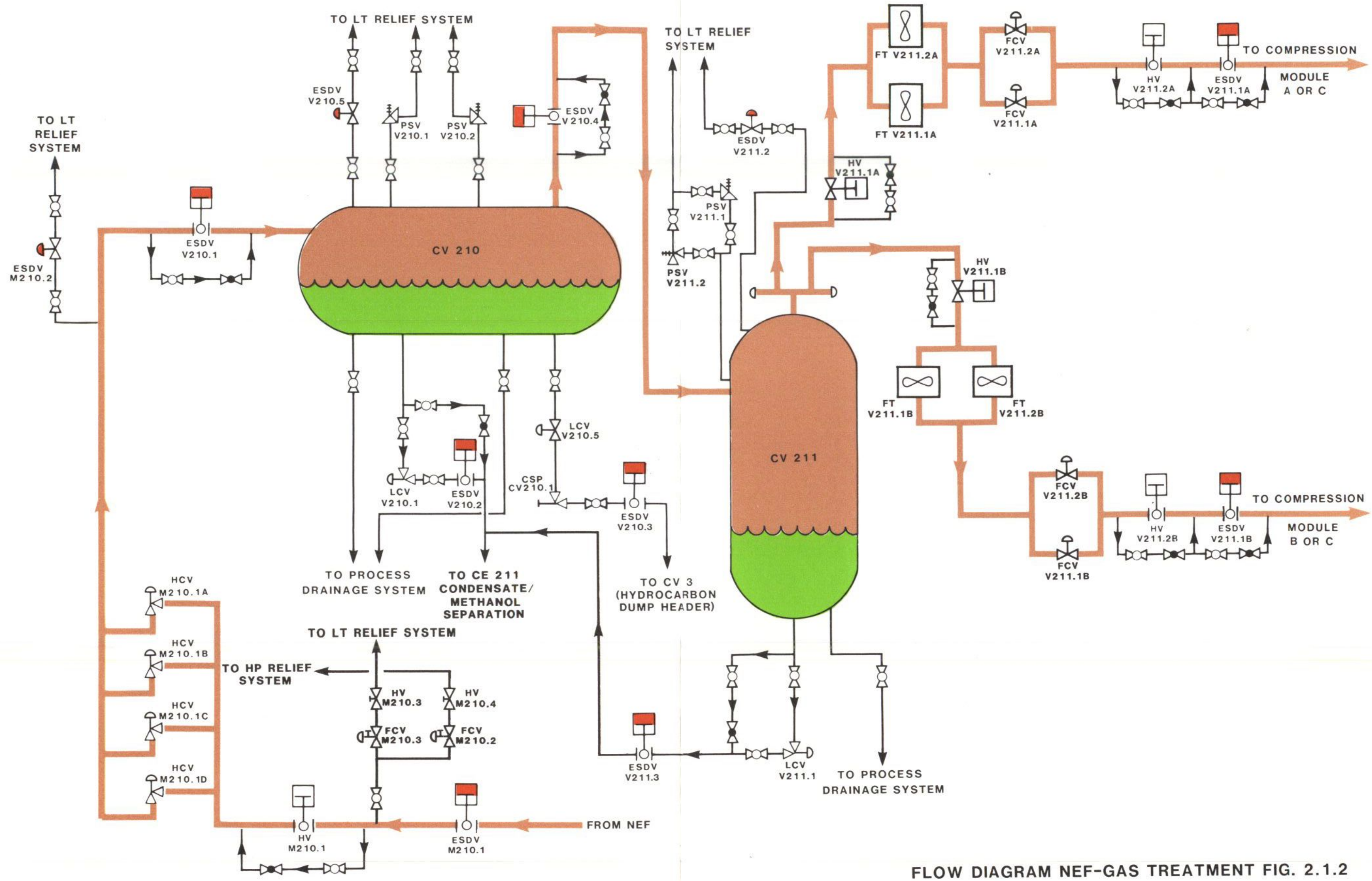
5. EMERGENCY SHUTDOWN (Fig. 2.1.9)

(k) Signal from PSH V220.3 high pressure in CV 220 or LSH V220.6 high level in CV 220 or PSL V220.4 low pressure in CV 220 will close ESDV V213.2 outlet of MW from CV 213.

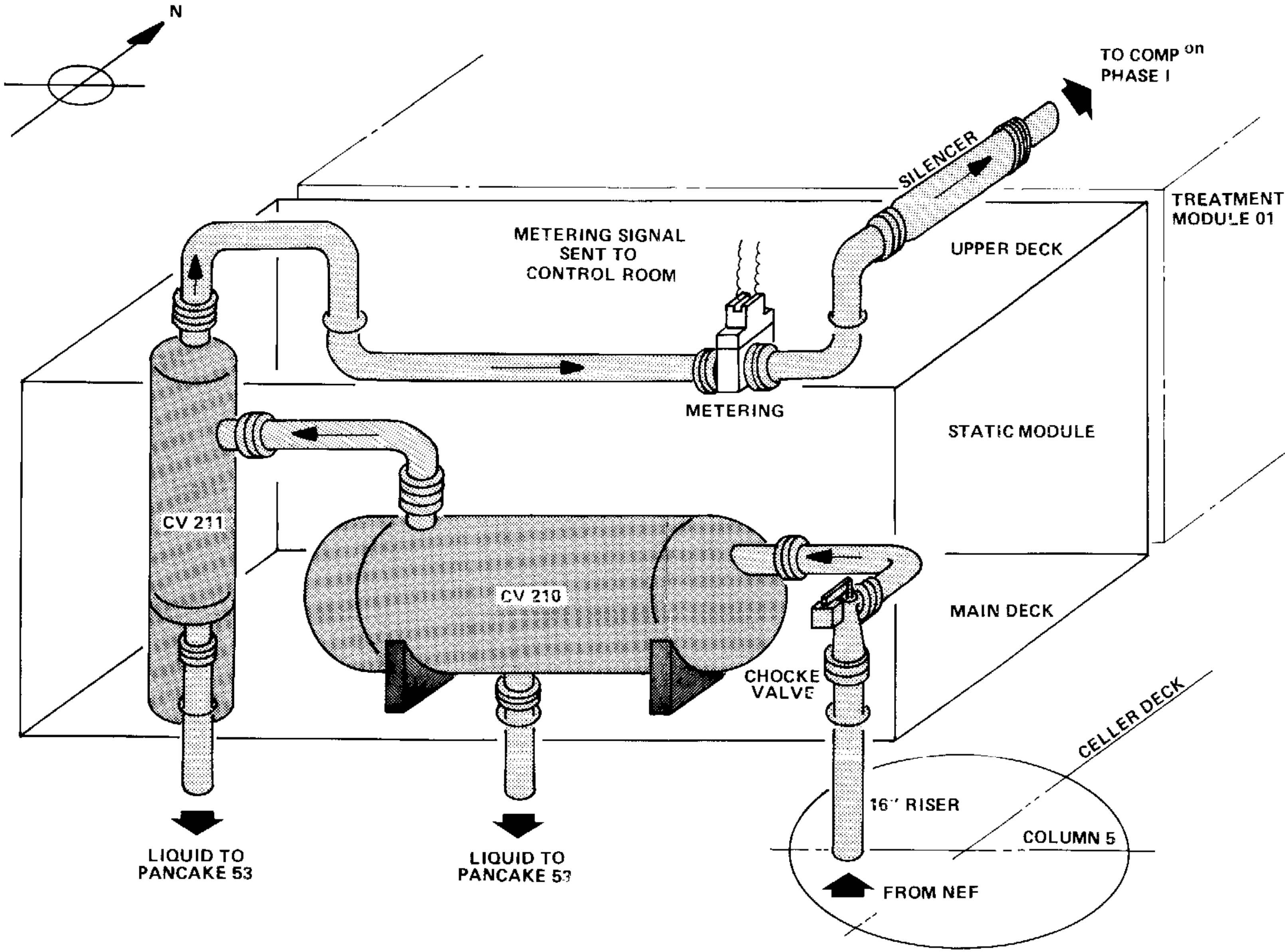
(l) Signal from FCS NEF or PSH M210.2 high pressure on gas inlet will close ESDV M210.1, closing the NEF sealine.



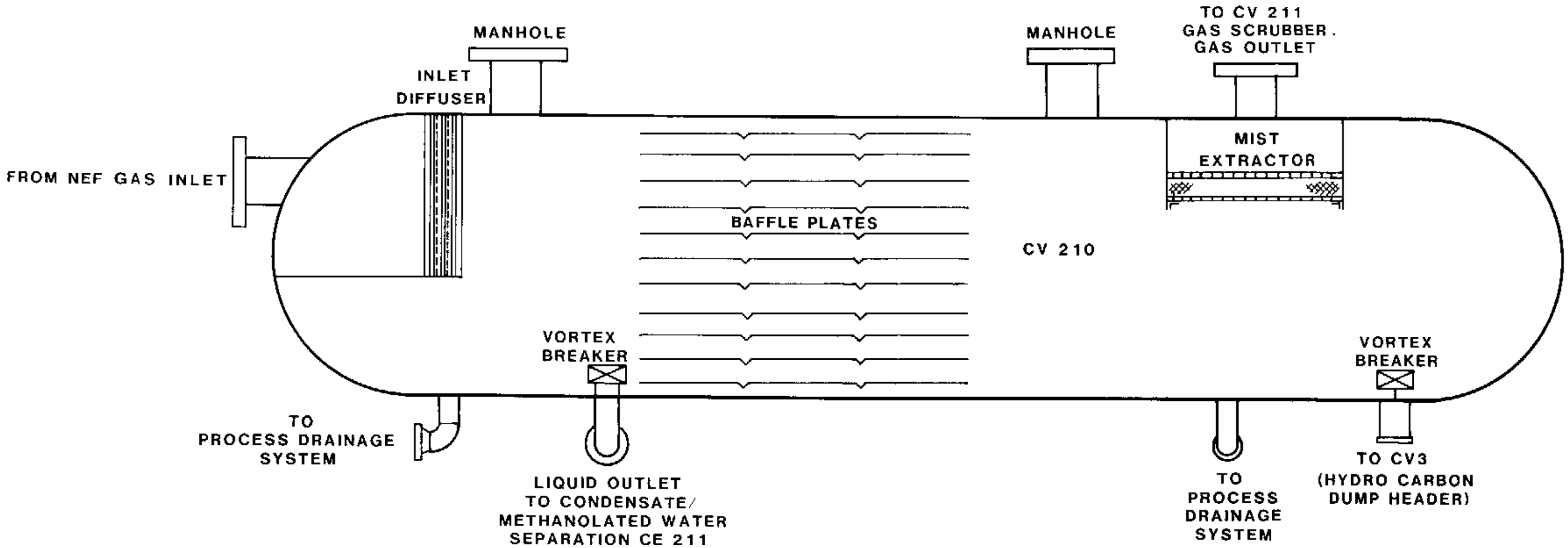
BLOCK DIAGRAM FIG. 2.1.1



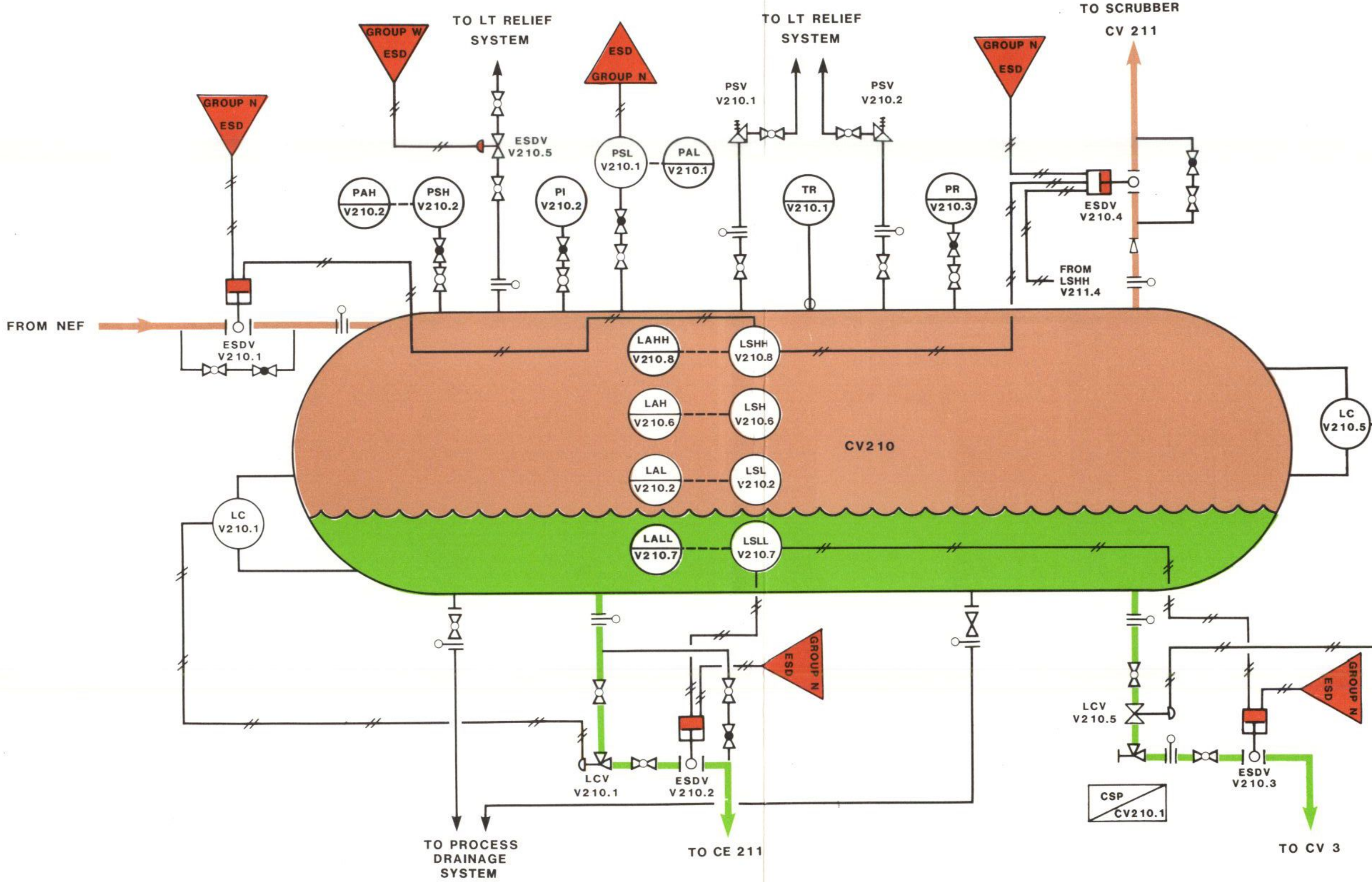
FLOW DIAGRAM NEF-GAS TREATMENT FIG. 2.1.2



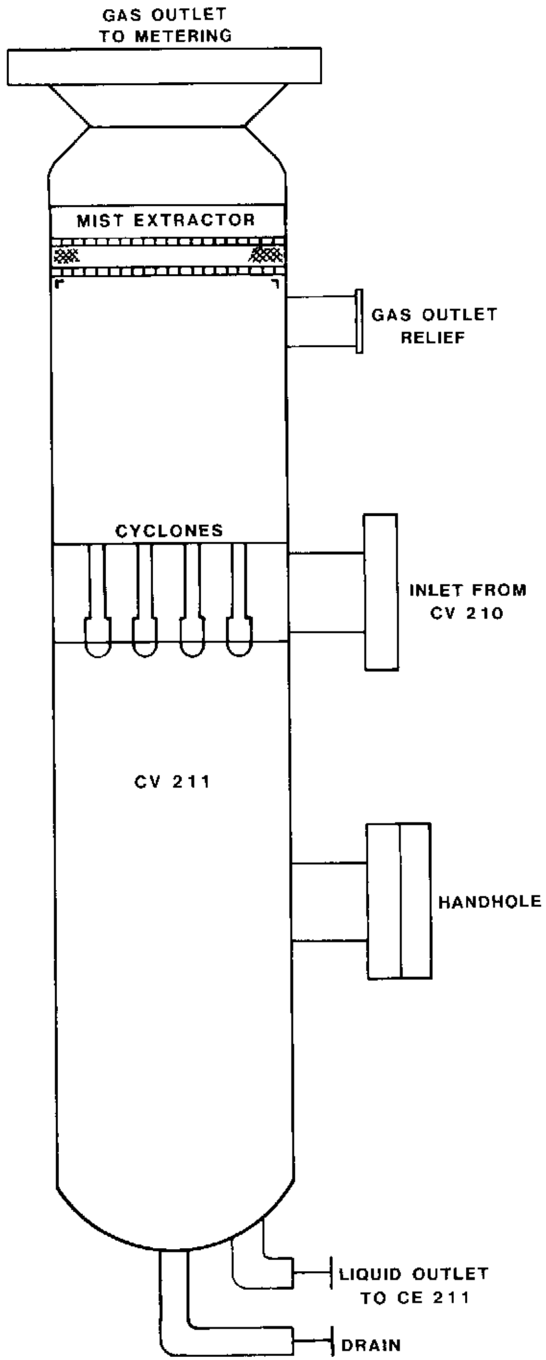
TCP2 EXTENSION NEF GAS
TREATMENT STATIC MODULE FIG. 2.1.0

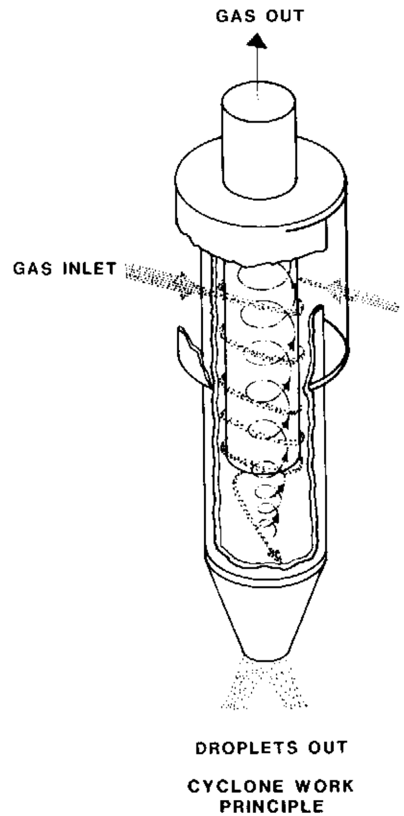


FREE WATER KNOCK OUT VESSEL CV210 FIG. 2.1.3

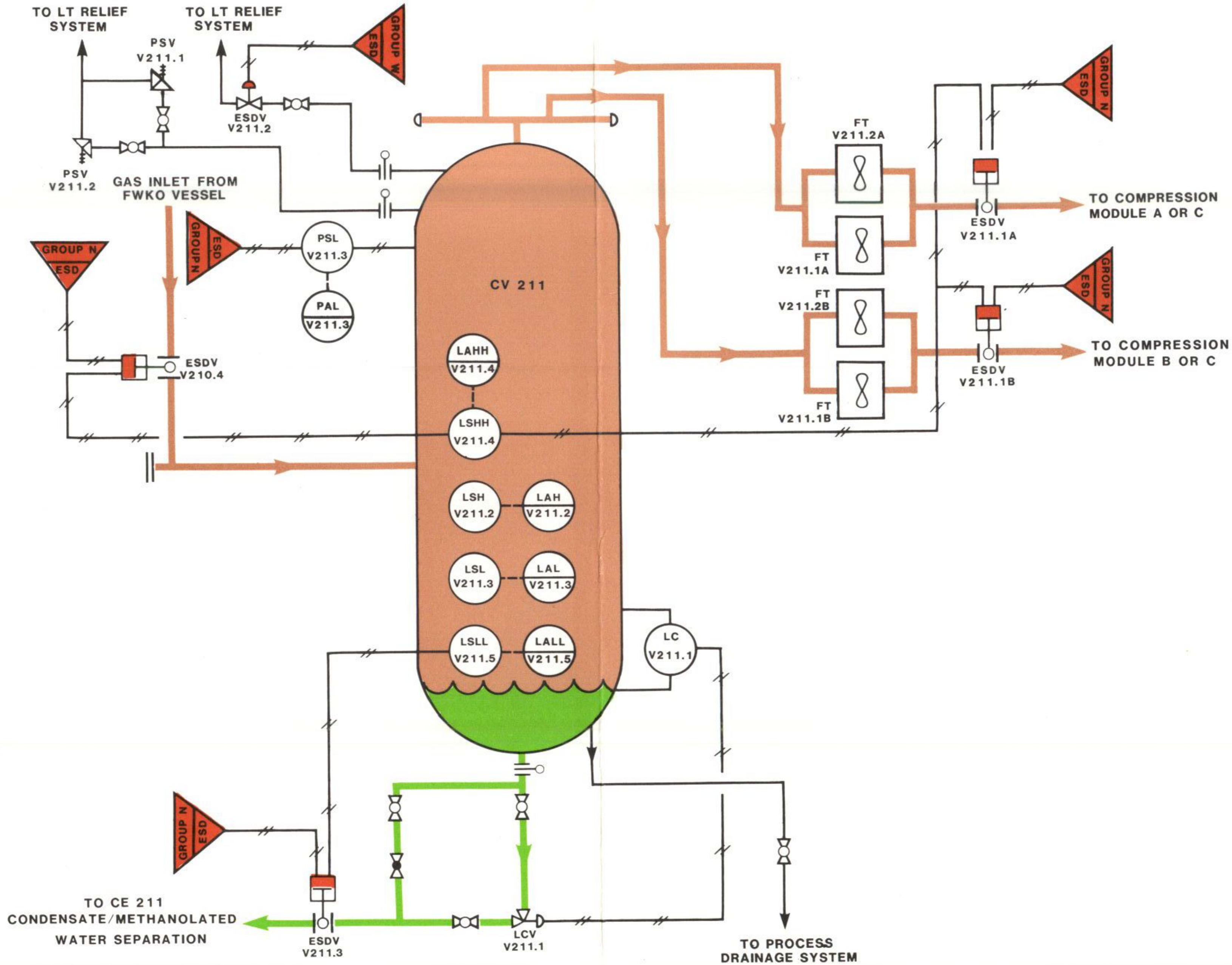


FWKO VESSEL CV 210 INSTRUMENTATION FIG. 2.1.4

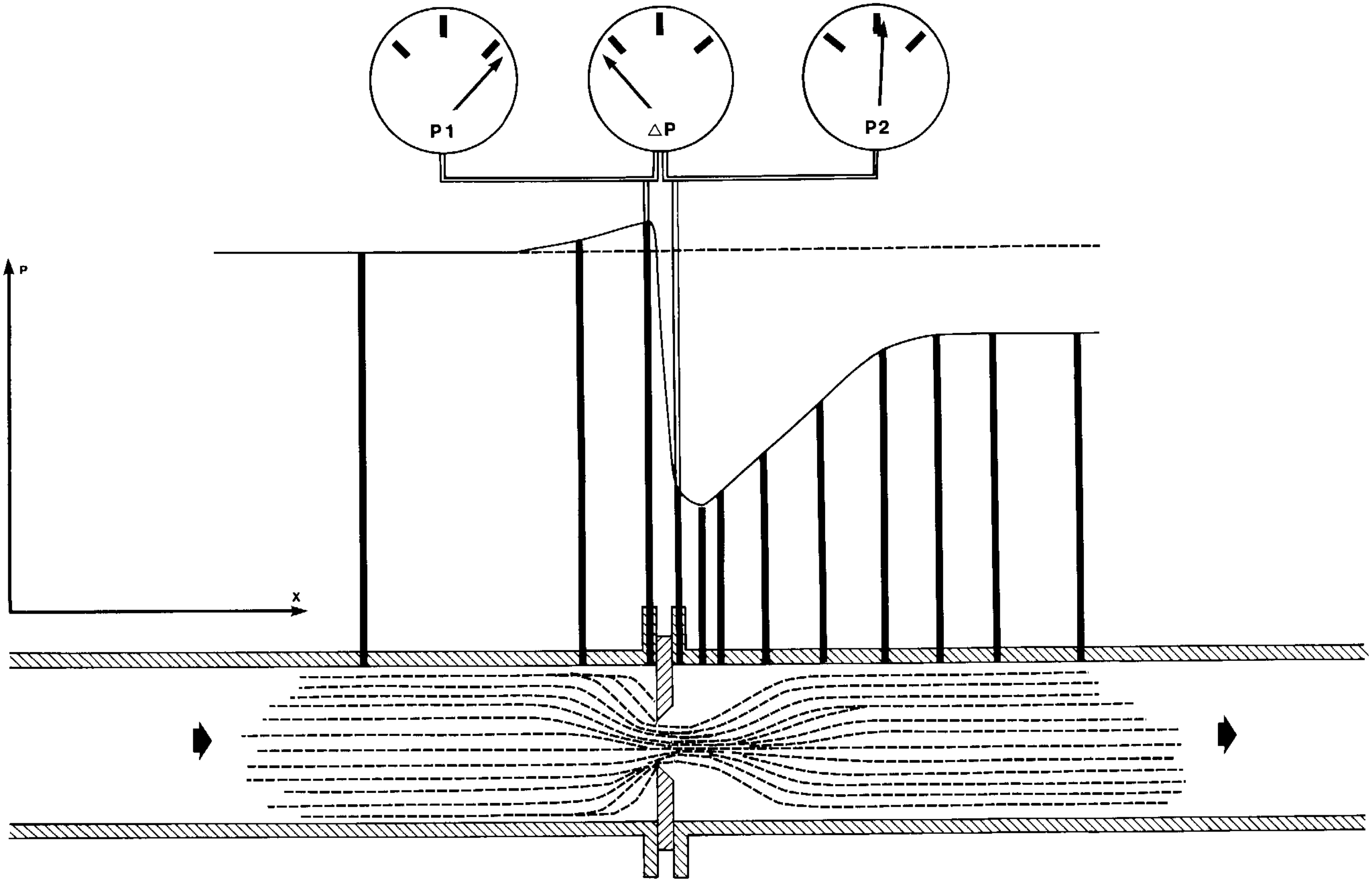




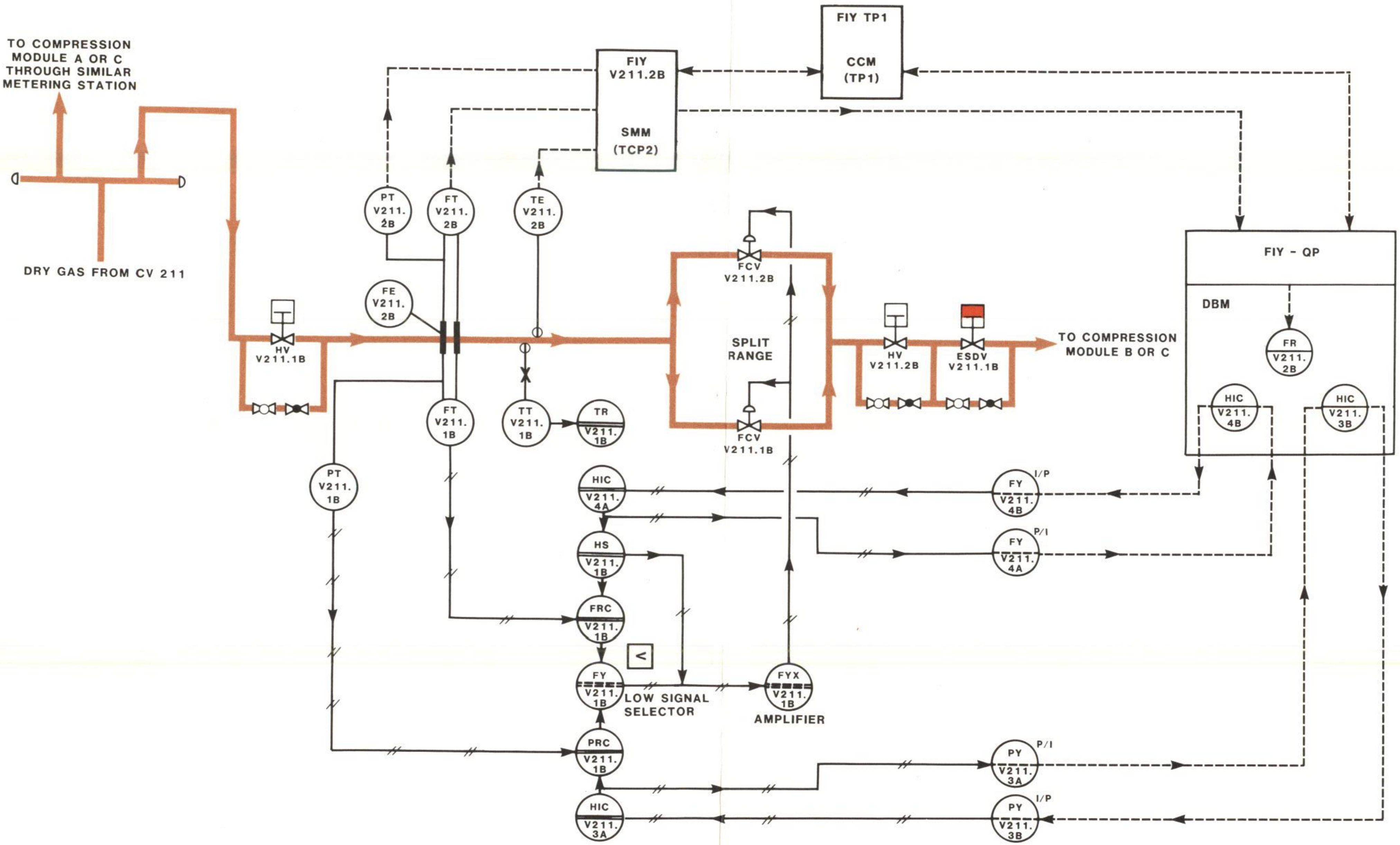
GAS SCRUBBER CV 211 FIG. 2.1.5



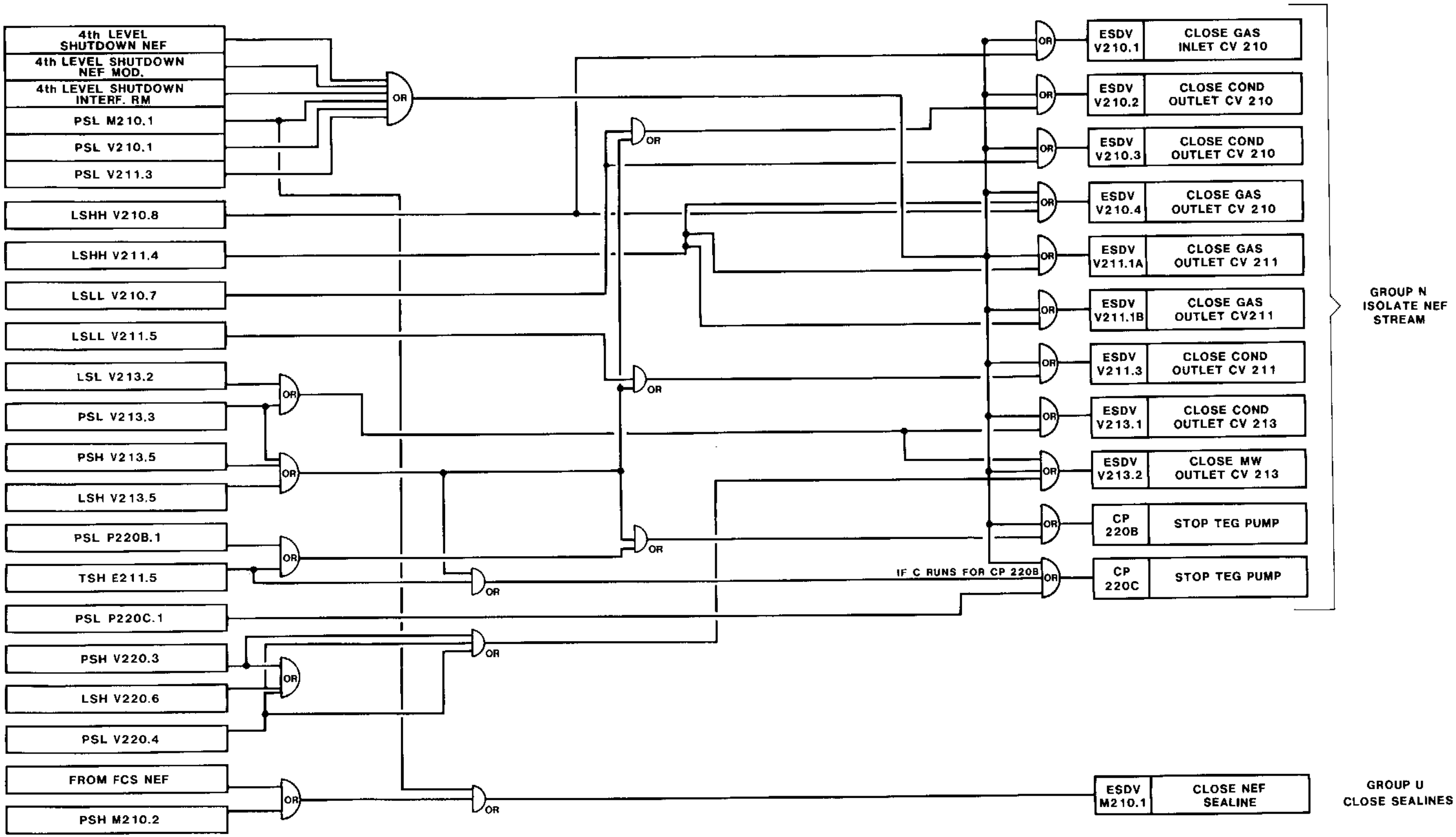
GAS SCRUBBER CV 211 INSTRUMENTATION FIG. 2.1.6



HEAD FLOWMETER PRINCIPLE FIG. 2.1.7



SIMPLIFIED GAS FLOW AND PRESSURE REGULATION LOOPS FOR NEF FIG. 2.1.8
(SIMILAR FOR BOTH TRAINS)



* FOR FULL DETAILS FIG. 2.9.5

NEF PROCESS SAFETY LOGIC DIAGRAM FIG. 2.1.9

2.2. ODIN GAS TREATMENT

Fig. No.

1. INTRODUCTION (Fig. 2.2.1)

The gas/liquid comes from Odin Field in a 22 km long 20" OD pipeline.

The stream contains gas, hydrocarbon liquid and methanolated water. The methanol has been injected at Odin to prevent hydrate formation.

The purpose of the Odin gas treatment is:

- Separate the gas from the liquids
- Meter the gas
- Inject the gas into the Frigg gas production system for final treatment.

2.2 SYSTEM DESCRIPTION (Fig. 2.2.2)

The flowrate of the gas/liquid comming from Odin is 10.2 MMSCM/D. This corresponds to the start-up year and no water drive in the reservoir. Max capacity is 11.2 MMSCM/D

Upstream to the FWKO vessel a permanent pig receiver CM201 is provided for the pigs which will be launched from the Odin platform.

The gas/liquid enters the Odin FWKO vessel CV 1A, which is the existing Frigg FWKO vessel vessel, at 5^{o}C. The low temperature is due to the gas transportation through the sea-line.

In the FWKO vessel the gas is separated from the condensate and methanolated water. The operating pressure will vary between 11 and 149 bara depending on the reservoir pressure decline and the time elapsed after start-up. (For details of the FWKO vessel see section3.)

The liquid from the FWKO vessel consist of condensate and methanolated water and is sent through the heat exchanger CE 203 to vessel CV 204 for separation. (See chapter 2.3 Condensate Treatment and chapter 2.4 Methanolated Water Treatment.)

The gas from the FWKO vessel is sent to the Odin Gas Scrubber CV201, which will later become the compression outlet scrubber if Odin Gas Compression is required.

The purpose of the scrubber is to make sure that the gas is maintained in single phase at the metering station.

The liquid from the gas scrubber is sent together with the liquid from FWKO vessel for separation.

2. SYSTEM DESCRIPTION (Fig. 2.2.2)

The gas from the gas scrubber is split into two separate lines. One going to compression module A or C, while the other is going to compression module B or C. During normal operation the flow control valves are set to devide the flow into two equal parts. The reason for this is to have an even distribution of flow on the main Frigg compressors 11K01 A/B/C. The compressors will not be run in the summer period. During normal operation the compressors 11K01 A/B will be working while 11K01 C is used as stand-by.

In order to have a good flow control rangeability the flow control valves are connected in split range for each of the lines. The normal operation condition for this station, will be one line under pressure control, and one line under flow control. This is done to obtain a constant pressure on the metering tubes which is important for the metering accuracy. This set up is in conformity with the existing facilities on Frigg TCP2 and TP1 platforms.

It may happen, however, that only one of the metering tubes is used, i.e. in case of maintenance, calibration etc. The total flow will then have to go through just one of the tubes. This means that they will have to be designed for flow rate of 10.2 MMSCM/D which is equal to the average daily production rate.

3. MAIN COMPONENT DESCRIPTION

3.1 ODIN FWKO Vessel CV 1A (Fig. 2.2.3/4)

In the FWKO vessel the gas is separated from the condensate and the methanolated water. The FWKO vessel is also designed to work as a slug-catcher. If a large amount of liquid slug enters the vessel it will go through the vessel, and LCV V1A.5 will open and send the slug to CV3 or V3.

In order to get a good separation the vessel contains deflector plates, dixon plates and mist extractor. Most of the liquid is separated out of the gas when the gas hits the deflector plates. The dixon plates arrangement reduce the chance of foaming because the liquid is well airrated by giving it a greater surface.

Some of the liquid droplets will not settle out of the gas stream due to little or no gravity difference between them and the gas phase. They would be entrained and carried out of the FWKO vessel by the gas. In order to avoid this a mist extractor has been installed near the gas outlet. Here small liquid droplets will coalesce and form larger droplets which will by gravity be drained back into the liquid phase. The liquid carry-over in the gas phase will only contain droplets in the 20 micron size or smaller.

3. MAIN COMPONENT DESCRIPTION

3.1 ODIN FWKO Vessel CV 1A (Fig. 2.2.3/4) (contd.)

The gas from the FWKO vessel is sent to the gas scrubber CV 201. The vessel CV 1A is provided with an automatic flush valve, LCV V 1A.5, which will open if the liquid increase to a high level. This can be the case if liquid slug enters the vessel. This valve is sized to handle slugs. The liquid is sent to CV 3. The liquid is normally sent through LCV CV 1A.5 to the heat exchanger CE 203, which is part of the condensate treatment.

The vessel CV1A is provided with a high high level switch (LSHH V1A.8), which will close the vessel inlets and outlets.

The FWKO vessel is also provided with a low low level switch (LSLL V1A.7) which will close the outlets to the condensate separation system and the hydrocarbon dump header.

Before this two events can happen, the CCR-operator will be warned by a respectively low level alarm or a high level alarm (LAL V1A.2 and LAH V1A.6), both located in CCR on QP.

The vessel is protected from overpressure by two pressure safety valves. The design pressure of the vessel is however higher than the maximum allowable wellhead pressure, so the only cause of overpressure will be in case of fire.

A pressure switch low PSL V1A 2A will give an ESD group 'O' in case of a leakage.

Drainage of the FWKO vessel is done by opening the manual drain valves. The liquid is then sent to the process drainage system.

- Design Data:

Design Pressure:	177.5 Bara
Design Temperature:	$50^oC/-28^oC$
Capacity:	7.7 MMSCM/D
Diameter:	2443 mm
Length:	9432 mm

Level switches	Tag No.	Alarm level
LSHH	V 210.8	1650 mm
LSH	V 210.6	1500 mm
LSL	V 210.2	400 mm
LSLL	V 210.7	300 mm

3.2 Gas Scrubber CV 201 (Fig. 2.2.5/6)

The purpose of the scrubber is to make sure that the gas is maintained in single phase at the metering station.

3. MAIN COMPONENT DESCRIPTION

3.2 Gas Scrubber CV 201 (Fig. 2.2.5/6) (contd.)

The scrubber is equipped with small cyclones. Due to the cyclones, the stream is divided into a great many streams in parallel. The strong centrifugal forces exerted on suspended particles throw them outwards and downwards to the wall of each cyclone. From there the liquid particles go into the cone and out into the storage chamber from where it is dumped. The dried gas goes in the reverse direction, rises, still spinning, up the centre of the vortex, and out via the gas outlet of the vessel.

The scrubber is provided with a wire mesh located at the gas outlet. The liquid content in the gas is reduced so that 95% of the droplets will be in the 10 micron size or smaller.

The gas from the scrubber is sent to the metering tubes. The condensate and methanolated water which are separated from the gas in vessel CV 201, are sent together with the liquid from the FWKO vessel to the condensate separation system through heat exchanger CE 203, (see chapter 2.3).

If the liquid level increases the scrubber is provided with high high level switches LSHH V201.4 which will close the vessel inlet. This is to prevent liquid carry- over into the metering system. The scrubber is also provided with very low level switches LSLL V201.5 which will close the liquid outlets to the condensate separation system.

Before these two events can happen the CCR operator will be warned by a low level alarm LAL V201.3 or a high level alarm LAH V201.2, both located in CCR.

The vessel is protected from overpressure by two pressure safety valves. The design pressure of the vessel CV 201 is however higher than the maximum allowable wellhead pressure, so the only cause of overpressure will be in case of fire.

A pressure switch low PSL V201.3 will close the inlet ESDV V1A.4 and give group 'O' ESD in case of a leakage.

If required the vessel can be depressurized through ESDV V201.2 and the gas sent to the LT relief system.

Drainage of the gas scrubber is done by opening the 2" manual drain valves. The liquid will then be sent to the process drainage system, (see chapter 2.7)

3. MAIN COMPONENT DESCRIPTION

3.2 Gas Scrubber CV 201 (Fig. 2.2.5/6) (contd.)

- Design data:

Design Pressure:	177,5 Bara
Design Temperature:	$65^{o}C/-28^{o}C$
Capacity:	11.2 MMSCM/D
Diameter:	735 mm
Length:	7744 mm

Level switches	Tag no.	Alarm level
LSHH	V 201.4	1860 mm
LSH	V 201.2	1250 mm
LSL	V 201.3	550 mm
LSLL	V 201.5	300 mm

3.3 Metering (Fig. 2.1.7/8)

All gas production on Frigg, exclusive NEF and ODIN, is split between Norway and U.K. approximately on a 60:40 basis. The purpose of the metering station on ODIN will therefore be to distinguish this production rate from the FRIGG production rate. It is here important to notice that NEF/ODIN gas metered is wet gas, or water saturated gas, while the gas on FRIGG is dry.

The gas coming from the gas scrubber (CV 201) is split in two separate lines. Each line is equipped with a metering station located upstream the flow control valves (FCV V201 1A/2A/3A / 1B/2B/3B).

In order to get a reliable gas characteristic of the ODIN gas, a sampling will be done shortly after start-up.

(a) Principles of orifice metering
The principles of orifice metering are based upon conservation of energy and mass. This means that a gas flow in a pipeline will remain uneffected of restrictions in flow area available, with respect to mass flow and total amount of energy.

Constant mass flow at the restricted flow areas (orifice) is maintained through an increase of gas velocity, and thereby an increase of kinetic energy. Due to conservation of energy, this means a loss of pressure, hence an increase of one form of energy entails a reduction of another.

The flow rate through the orifice, i.e. production rate on ODIN, may be calculated knowing the pressure drop over the orifice, gas density, gas characteristics and characteristics of the spesific orifice in service.

3.3 Metering (Fig. 2.1.3.7/8) (contd.)

(b) Metering Station
The orifice is a Daniel 'Senior' Orifice Fitter. The fittings of this orifice are of a type which facilitates the changing of plates whilst the line is still pressurized.

The metering station is equipped with a differential pressure transmitter, absolute pressure transmitter and platinum resistance thermometer.

These measured parameters will be sent to the Spectra-Tek gas stream metering microcomputers (SMM) mentioned below.

(c) Gas stream metering microcomputer (SMM)
The computers used for calculation of the production rate on the satellite field ODIN will be Spectra- Tek SMM's (Tag No. FIY V201.2A/2B). The function of these SMM's are:

- To measure following parameters of the individual meter tube by receiving and processing the signals from the primary measurement transducers of:

  - Temperature
  - Pressure
  - Differential Pressure

- To calculate the gas density using measured values of the temperature, pressure and gas characteristics held in memory.

- To calculate the mass flowrate and accumulated mass flow through the tube.

- To transfer data, on demand, to the two central control microcomputers (CCM) located on separate platforms (TP1 and TCP2).

- To operate in a number of modes, i.e. stream metering, calibration, change of orifice and initialisation.

- To operate independently to one or both of the CCM's in the event of communication failure.

- To operate in conjunction with front panel keyboard and display, particularly when under local control.

(d) Principal description of flow control station
The parameters measured by the metering stations are distributed to the flow control stations. Speaking about flow con trol stations we could equally well speak about pressure control stations. We use the same valves for two different purposes.

3. MAIN COMPONENT DESCRIPTION

3.3 Metering (Fig. 2.1.3.7/8) (contd.)

During normal operation conditions the set point of the valves (FCV V201.1A/2A/3A / 1B/2B/3B) are such that the flow is equally distributed to the two parallel lines. The reason for this is to have an even distribution of the flow to the main FRIGG compressors 11 K01A/B/C.

For each station we have two controllers, a PRC (pressure recorder and controller) and a FRC (flow recorder and controller). Normal operation condition will be one line in pressure control and the other in flow control. If on line is out of service i.e, in case of maintenance, etc, the line in service must be in pressure control,

(e) Pressure Controller (PRC V201.1A or B
The function of the pressure controller is to achieve a constant pressure at the metering stations. This is obtained by regulating the flow. By using HIC's (hand indicator and controllers) we pre-set a desired value of the pressure, which the PRC automatically keeps constant (within certain limits), independent of process changes.

This is done by comparing values measured at the metering station to the set point of the HIC's. If these equals each other no adjusting signal will be sent from the PRC to the flow control valves (FCV's). But if there is only slightly difference in reading the two values, signals will be sent to the FCV's to equalize them.

Let's say that the pressure at the station increases and exceeds the set point.
Signals will then be sent from PRC to open the FCV's.

Respectively if the pressure decreases below the set point, the PRC will close the FCV's. The pressure controller might be of local (TCP2) or remote (QP) auto, depending on which HIC is in control.

(f) Flow Controller (FRC V201A or B)
The function of the flow controller (FRC) is to achieve constant flow at the metering station, i.e. constant DP over the orifice plate. The FRC works principally as the PRC, thus controlling the differential pressure over the orifice plate to a pre-set value. As the PRC, the FRC might be of local (TCP2) or remote (QP) auto, depending on which HIC is in control.

3. MAIN COMPONENT DESCRIPTION

3.3 Metering (contd.)

(g) Signal Selector (FY V201.1A/B)
Since there are two different signals for the same set of valves, a signal selector is needed. This selector always let the lowest signal pass through, thus blocking the highest. Therefore, it is important to increase the output signal from the regulator not in service to a maximum value. Otherwise, we may have a incorrect regulation of the regulator which is in service.

(h) Signal amplifier (FYX V201.1A/B)
The flow control valves work on the output signal of the controllers (FRC or PRC). Because the controllers work on the 0,2-1 bar principle and the valves on the 0,4-2 bar principle, a booster is needed on the airline between them. This booster amplifies the output signal to a double value before entering the valve actuators.

4. OPERATION

The chokes are located on the ODIN Platform and will be operated from there.

For start up, please see Operation Manual: 'Operating Conditions and Controls for ODIN Gas Treatment', This include: 'Indicator and Recorder Check List', and 'Alarm and Shut Down Points'.

For start up and adjustment of the metering system, please see: 'Indicator and Recorder Check List'. 'ODIN Gas Metering System'.

For normal operation the operator has to check that all instrument isolation valves are open. Drain valves should be closed. Sampling valve on CV 201 should be closed. For setting of prosess valves see list of setting of process valves in Operation Manual.

The operators tasks and responsibilities during normal operation are as follows:

(a) Check that valves are set in the configuration described in the 'Equipment Setting List'.

(b) Check that indicators and recorders listed in the 'Indicator and Recorder Check List' are operating.

4. OPERATION

(c) Ensure that all pressure, temperature and flow data are within the normal range and do not reach critical values.

(d) Check levels of ODIN gas treatment vessels.

(e) If necessary adjust the set point of the local controllers.

(f) Adjust gas metering pressure control or flow control according to requirements.

(g) Upon Alarm initiation find the cause of trip and start the proper action accordingly, to restore good operating conditions as indicated in the Alarm and Shut Down Points List.

Schedule and Report Sheets

The operator is supposed to make a round trip in the ODIN gas treatment plant every four hours and record the main parameters as well as abnormal operating situations.

All the information collected by the operator must be logged in the ODIN gas treatment log book.

The QP CONTROL ROOM REPORT should include the following parameters:

ODIN SEA LINE	:	PR-M201.4	TI-M201.2
CV 1A	:	PR. V1A.5	TIT-V1A.1

5. EMERGENCY SHUTDOWN (Fig. 2.2.9)

For complete information on the ESD system please see chapter 2.9.3.

The ESD system on the ODIN stream consists of three groups:

Group 'O' isolates the ODIN stream and is spesific for the ODIN system.

Group 'U' which closes the sealines, and Group 'W' which initiates a blow-down (decompression) are systems on TCP2.

(a) 4th level shutdown signal from ODIN or ODIN MODULE or INTERFACE ROOM or signal from PSL M201.1 low pressure in sealine or PSL V1A.2A low pressure in FWKO vessel or PSL V201.3 low pressure in gas scrubber will cause an isolation of the ODIN stream group 'O'.

In addition a signal from PSL M201.1 low pressure in sealine will cause the closing of ODIN sealine.

5. EMERGENCY SHUTDOWN (Fig. 2.2.9)

(b) Signal from LSHH V1A.8A high high level in CV 1A will close ESDV V1A.1 and ESDV V1A.4 gas inlet and outlet from CV 1A.

(c) Signal from LSHH V201.4 high high level in CV 201 will close ESDV V201.1B and ESDV V201.1A gas outlets from CV 201 and ESDV V1A.4 gas outlet from CV1A.

(d) Signal from LSLL V1A.7A low low level in CV 1A will close ESDV V1A.3 and ESDV V1A.2 condensate outlets from CV1A.

(e) Signal from LSLL V201.5 low low level in CV 201 will close ESDV V201.3 condensate outlet CV 201.

(f) Signal from LSL V204.2 or PSL V204.3 low level or low pressure in CV 204 will close ESDV V204.1 and ESDV V204.2 condensate and MW outlets from CV 204.

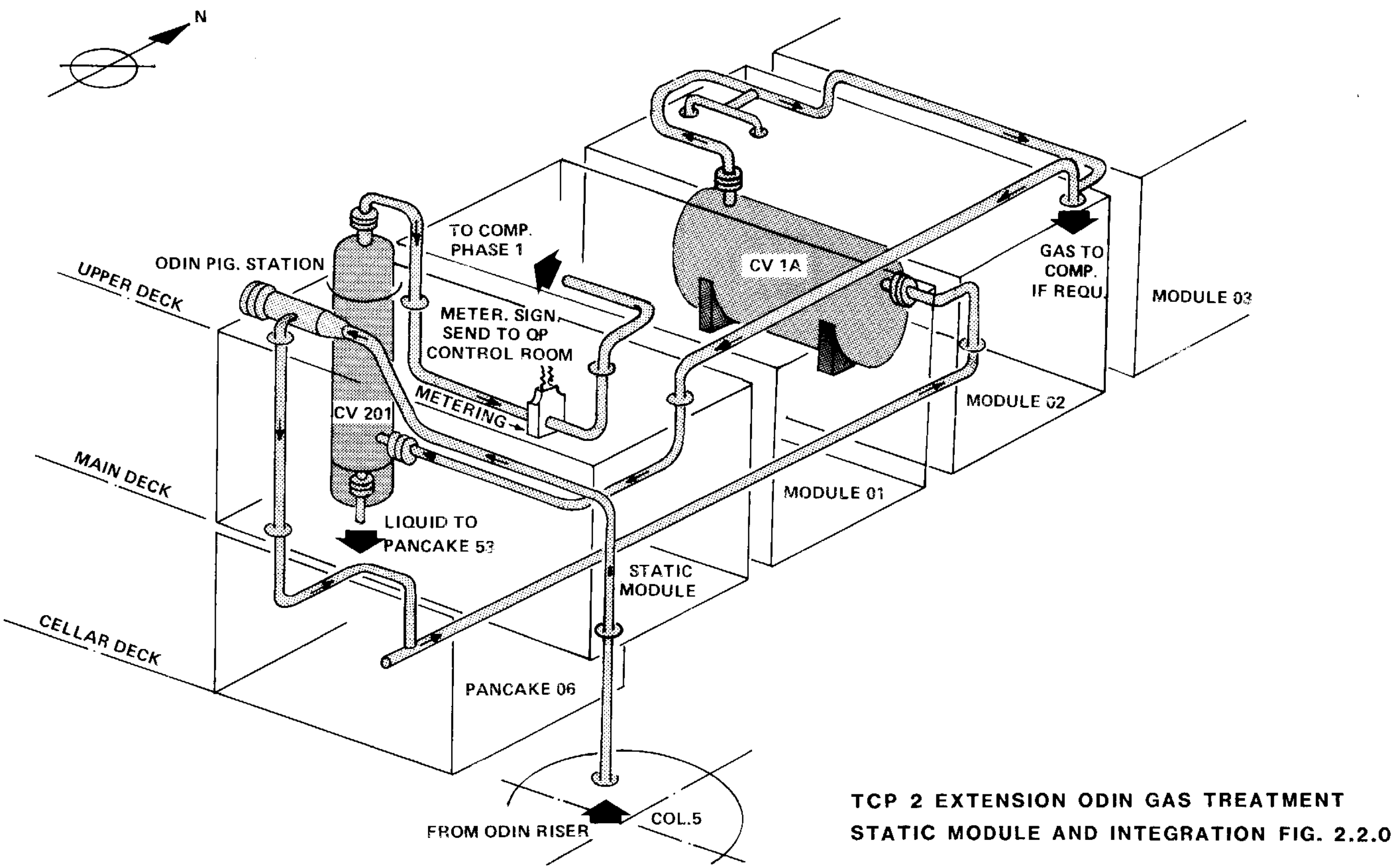
(g) Signals from LSH V204.5 high level in CV 204 or PSH V204.5 high pressure in CV 204 or PSL V204.3 low pressure in CV 204 will close ESDV V201.3 and ESDV V1A.2, condensate outlets from CV 201 and CV 1A and stop TEG pump CP 220A if running, and stop TEG pump CP 220C if running for CP 220A.

(h) Signals from PSL P220A.1 low pressure in CV 220 and TSH E203.5 high temperature in condensate heater CE 203 will top TEG pump CP 220A if running.
In addition signal from TSH E203.5 will stop TEG pump CP 220C if running for CP 220A.

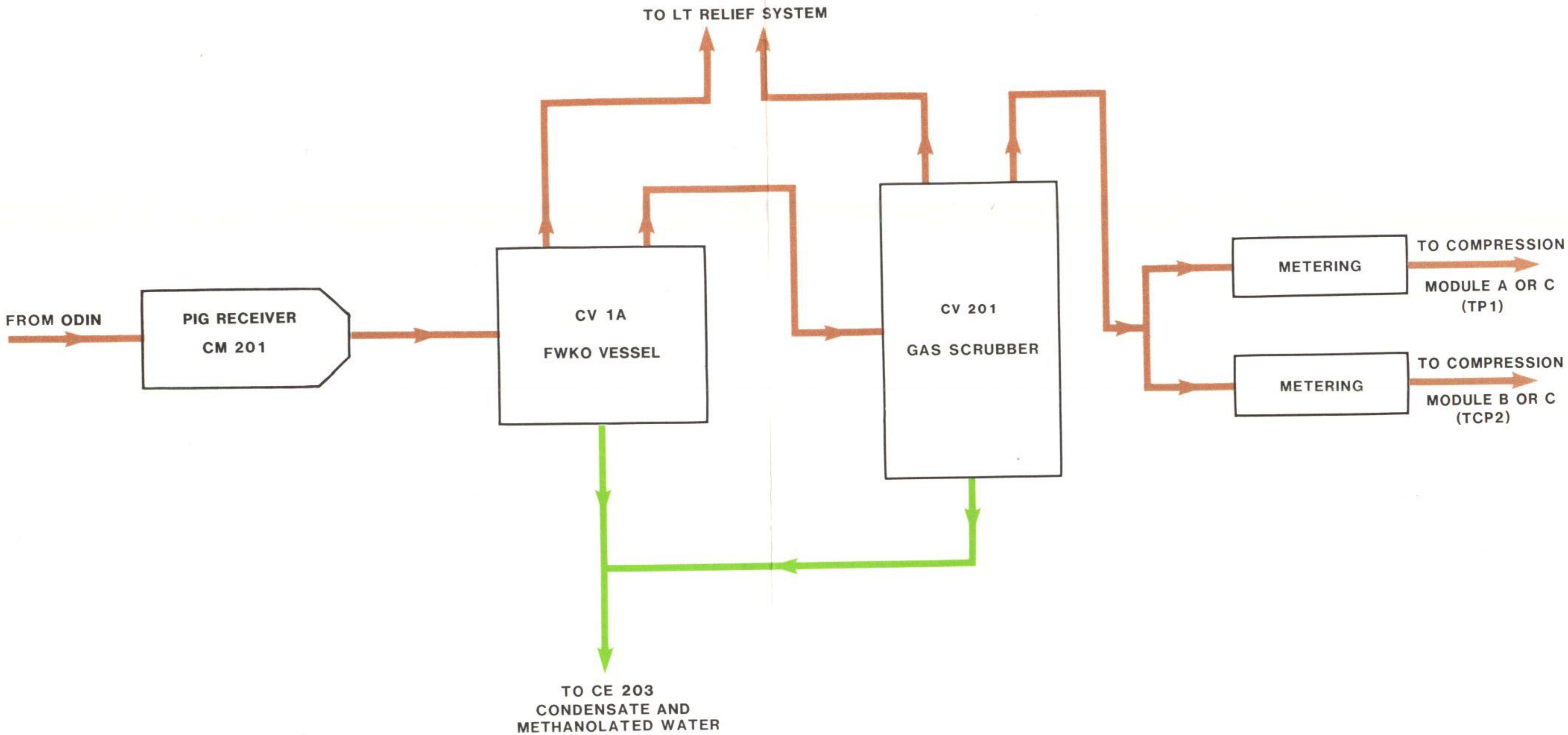
(j) Signal from PSL P220C.1 will stop TEG pump CP 220C if running.

(k) Signal from PSH V220.3 high pressure in CV 220 or LSH V220.6 high level in CV 220 or PSL V220.4 low pressure in CV 220 will close ESDV V204.2 MW outlet from CV 204.

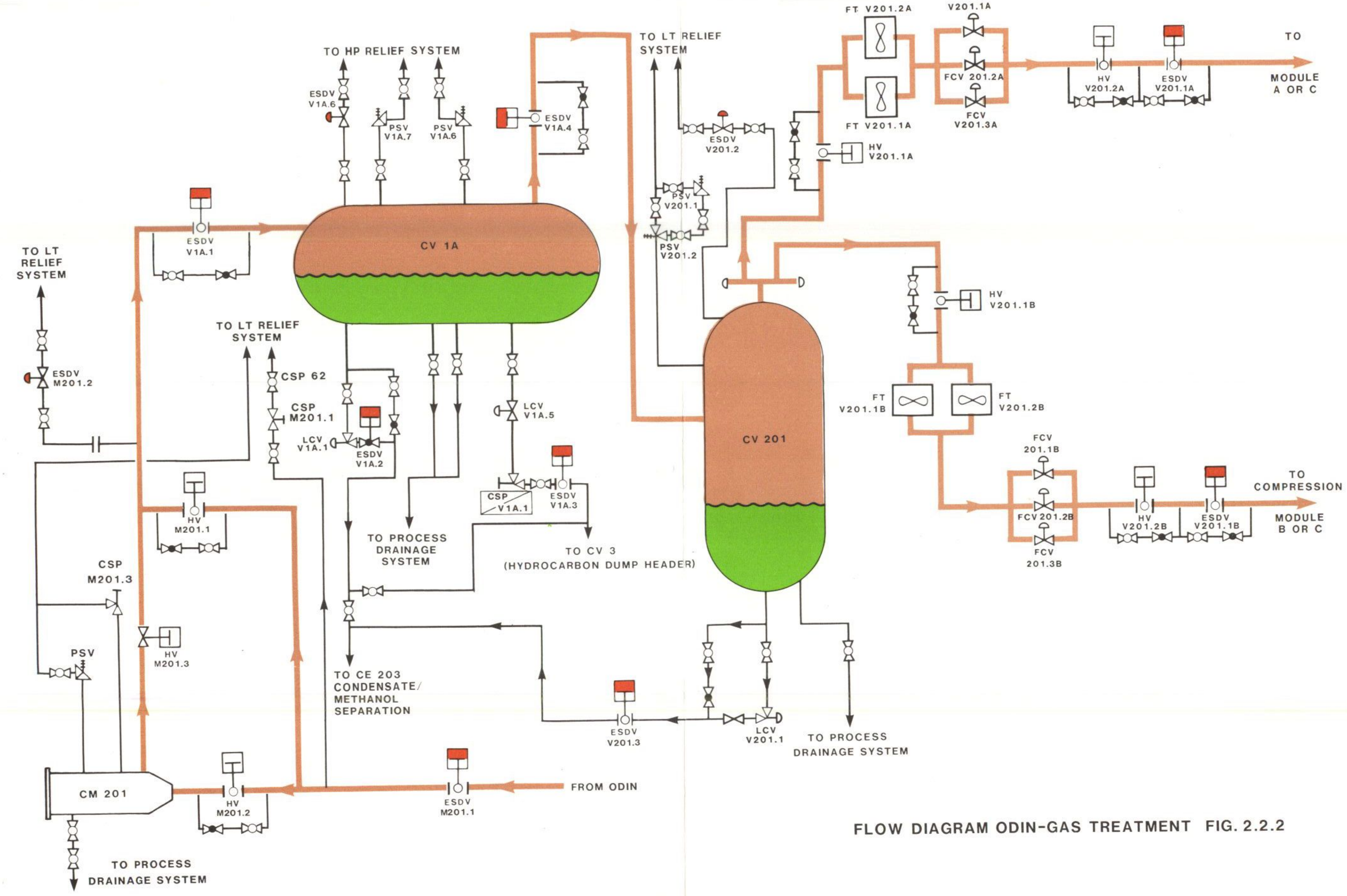
(l) Signal from FCS ODIN or PSH M201.2 high pressure in sealine will close ESDV M201.1, closing the ODIN sealine.



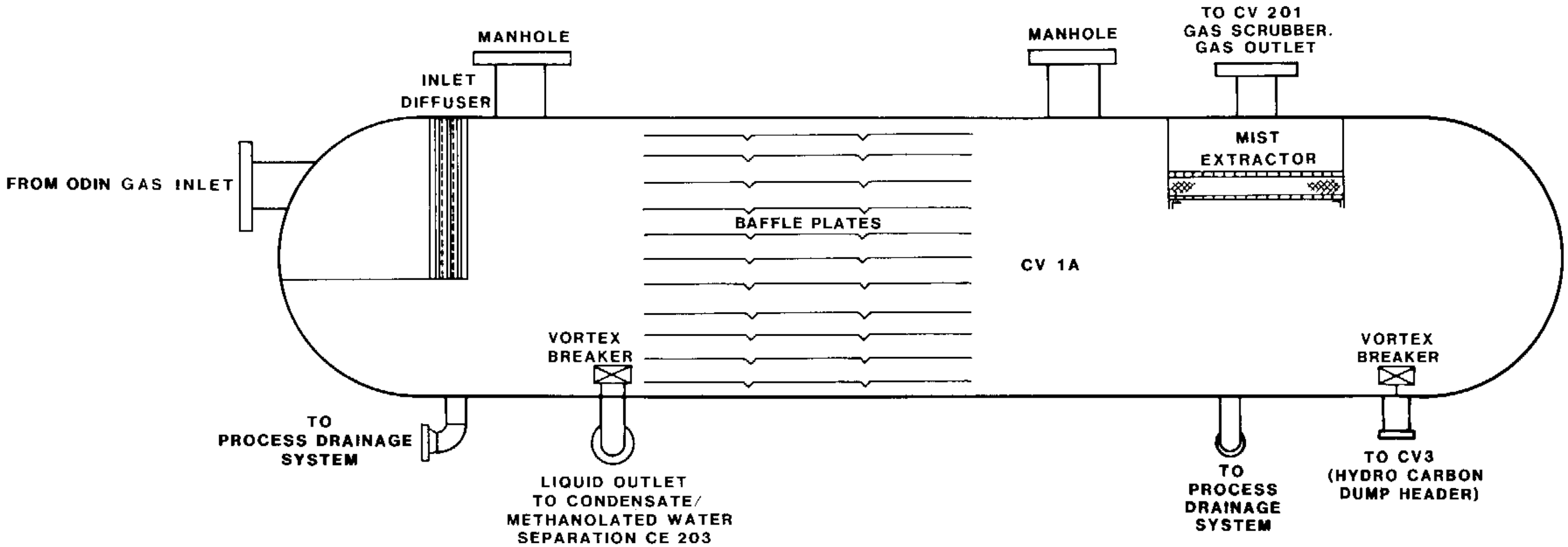
TCP 2 EXTENSION ODIN GAS TREATMENT STATIC MODULE AND INTEGRATION FIG. 2.2.0



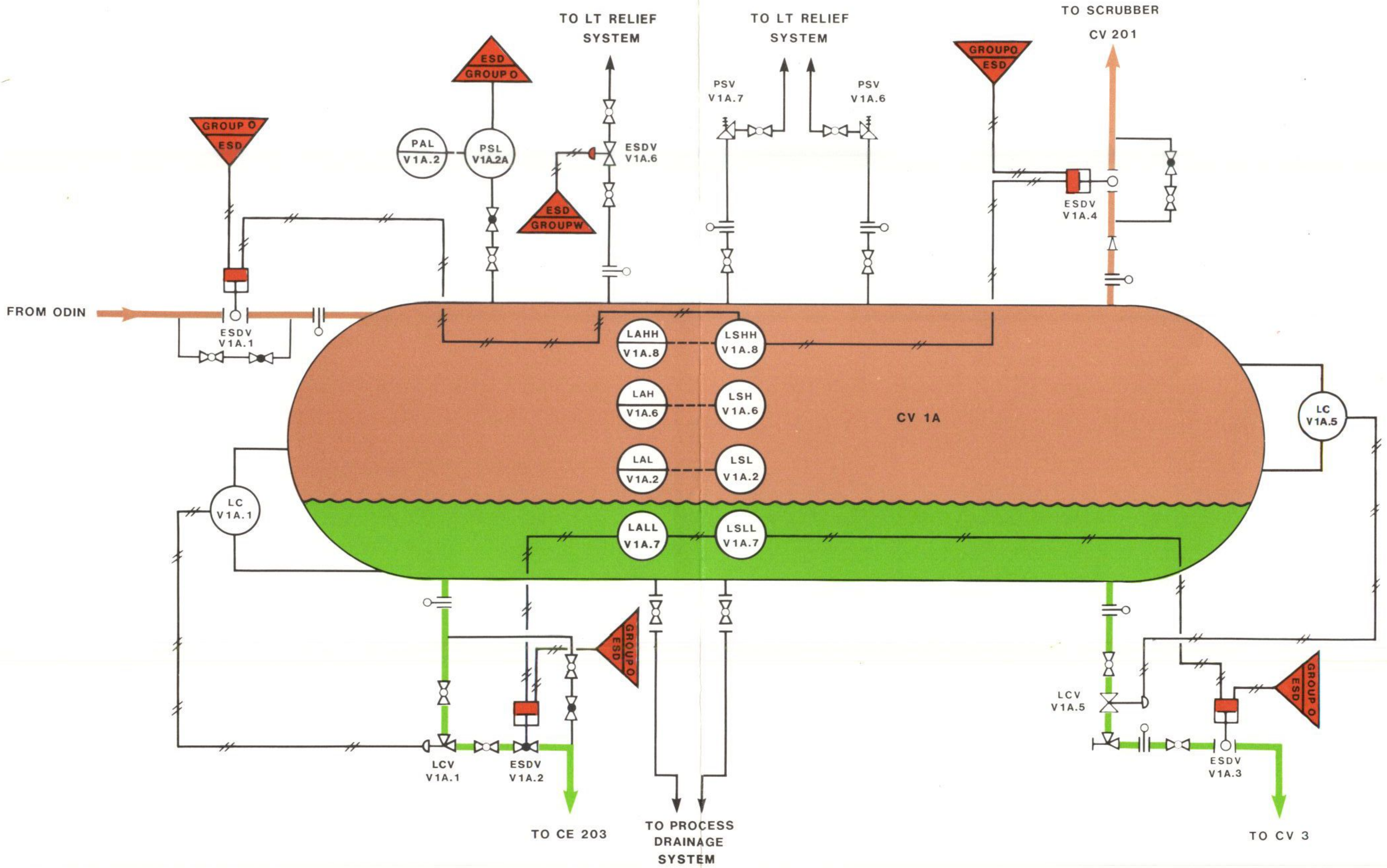
BLOCK DIAGRAM FIG. 2.2.1



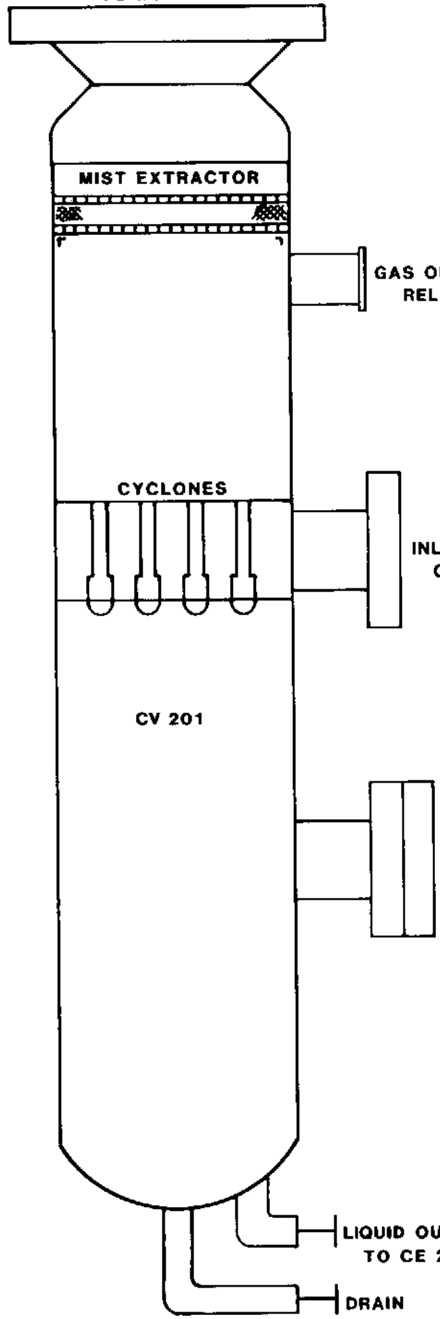
FLOW DIAGRAM ODIN-GAS TREATMENT FIG. 2.2.2

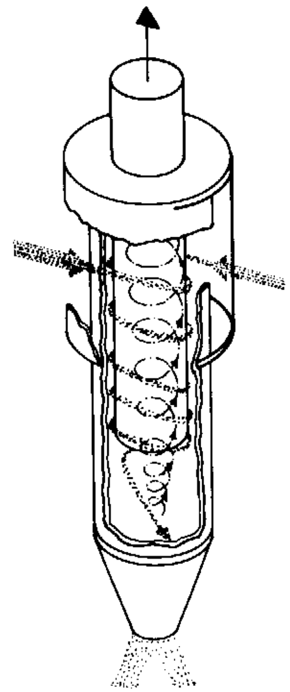


FREE WATER KNOCK OUT VESSEL CV 1A FIG. 2.2.3



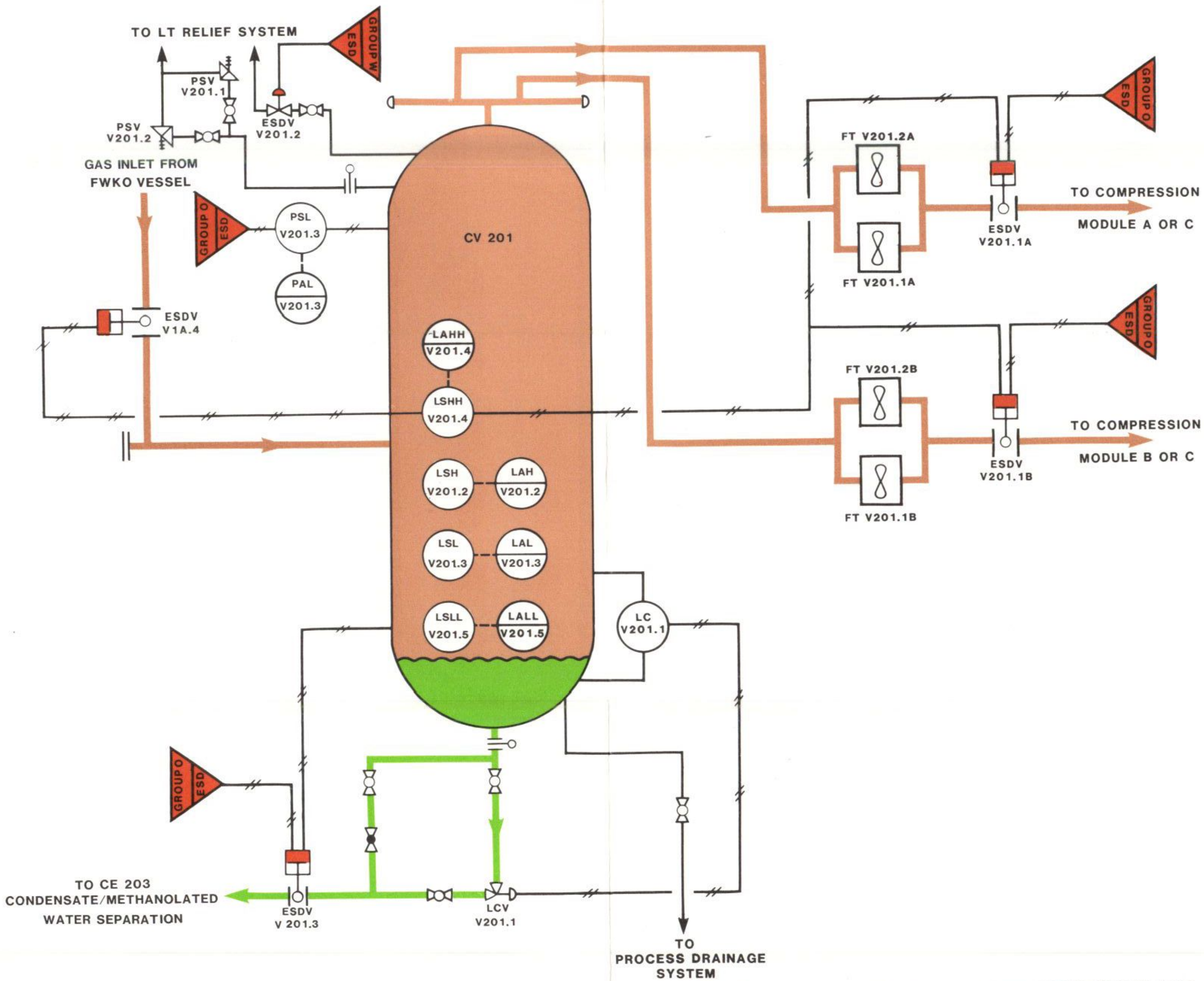
FWKO VESSEL CV 1A INSTRUMENTATION FIG. 2.2.4



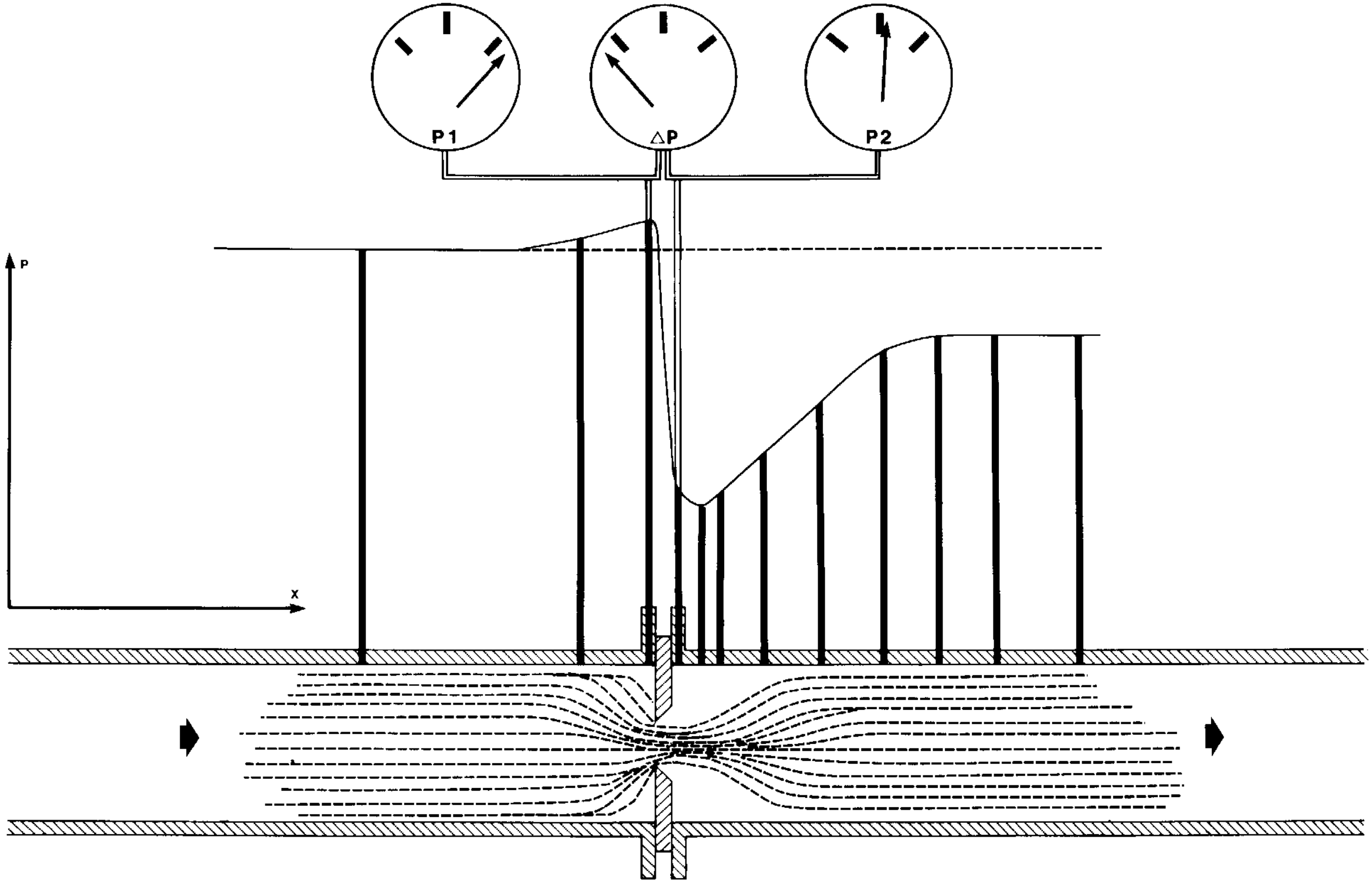


CYCLONE WORK
PRINCIPLE

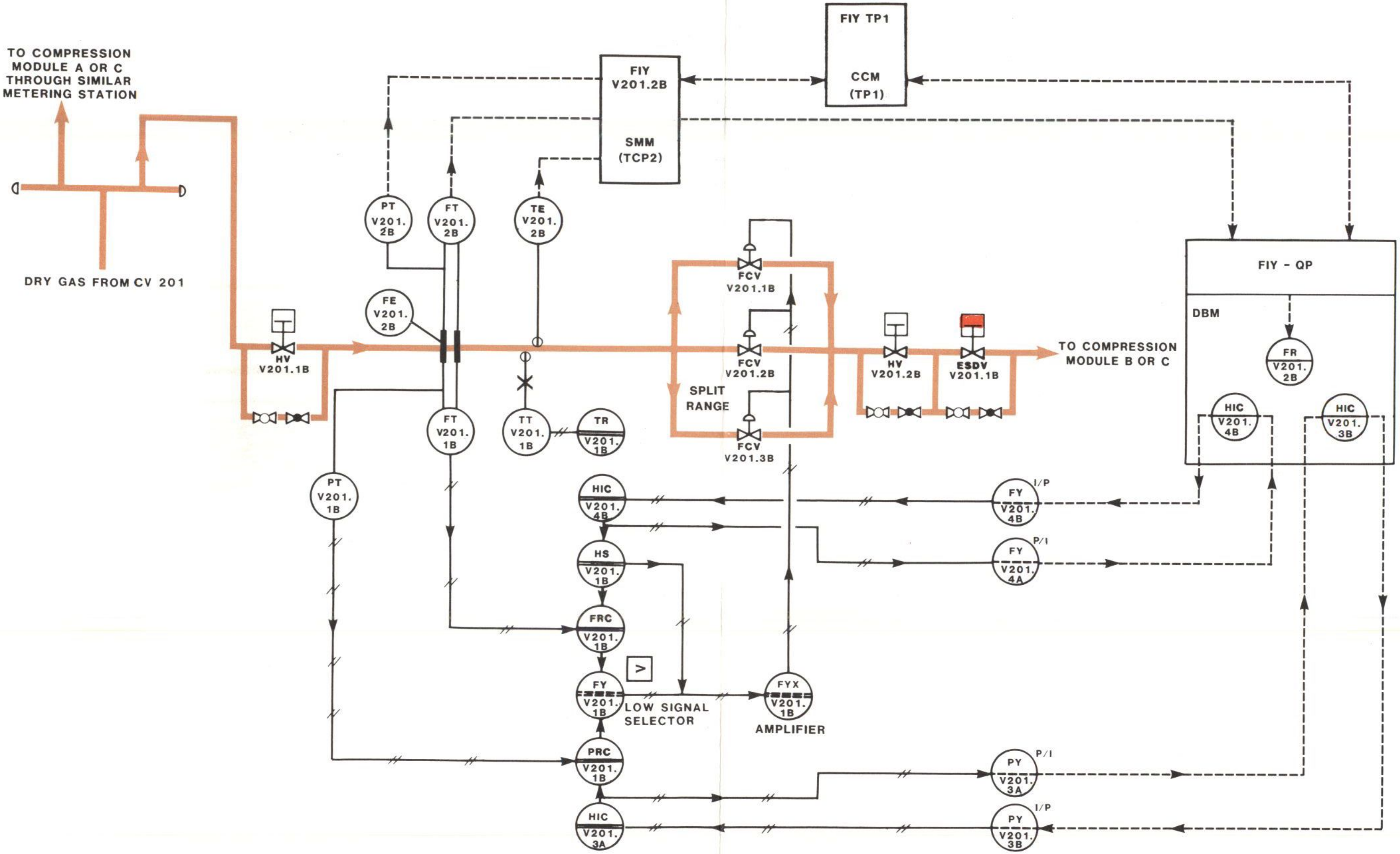
GAS SCRUBBER CV 201 FIG. 2.2.5



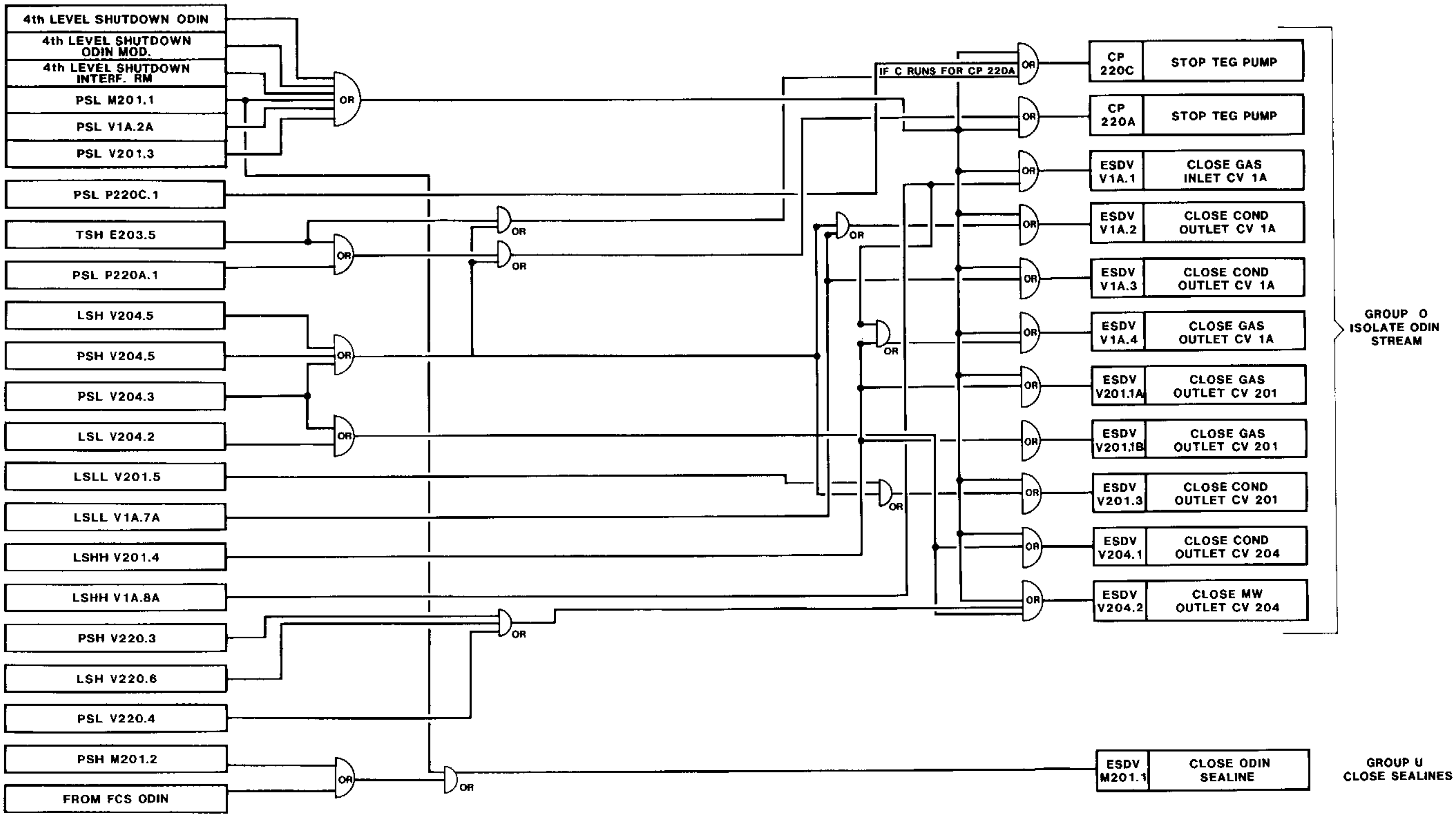
GAS SCRUBBER CV 201 INSTRUMENTATION FIG. 2.2.6



HEAD FLOWMETER PRINCIPLE FIG. 2.2.7



SIMPLIFIED GAS FLOW AND PRESSURE REGULATION LOOPS FOR ODIN FIG 2.2.8
(SIMILAR FOR BOTH TRAINS)



* FOR FULL DETAILS FIG. 2.9.5

ODIN PROCESS SAFETY LOGIC DIAGRAM FIG. 2.2.9

2.3 CONDENSATE TREATMENT

2.3A NEF Condensate Treatment

2.3B ODIN Condensate Treatment

2.3A. NEF CONDENSATE TREATMENT

1. INTRODUCTION

The purpose of this unit is to separate the condensate and the methanolated water.
Due to different specific gravity the condensate and methanolated water are separated.

2. SYSTEM DESCRIPTION (Fig. 2.3.1A/B)

The liquid which comes from the FWKO vessel CV 210 and gas scrubber CV 211 consists of condensate and methanolated water. The liquid is heated in heat exchanger CE 211. After heating, the liquid is sent to condensate/methanol separator CV 213.

The effluent gas which is produced due to the pressure drop across level control valve LCV V210.1 and LCV V211.1, is sent to the LP (low pressure) vent system under pressure control. The condensate is sent to the vessel CV 3 or V3 after being metered. The methanolated water from CV 213 is sent to vessel CV 220, methanolated water system, (see chapter 2.4).

Fuel gas injection is provided as blanket gas in order to prevent a pressure decrease in the vessel. This blanket gas does not, however, give a high enough pressure to flush condensate to CV 3.

3. MAIN COMPONENT DESCRIPTION

3.1 Heat Exchanger CE 211 (Fig. 2.3.A.2)

The reason for the heat exchanger is to speed up the rate of separation between gas and liquid in the three phase separation downstream the heat exchanger.

The liquid temperature is increased from 2°C to 20°C at 20 bara. Thriethylene glycol (TEG) is used as heating medium. The temperature of the TEG drops from 58°C to 50°C, over the heat exchanger.

The condensate heater is a shell and tube exchanger where condensate and methanolated water are going on the tube side, and TEG on the shell side.

A temperature switch (TSH E211.5) located downstream the condensate heater will close pump CP 220B or C if the temperature of the condensate/ methanolated water increases to a high value.

Any pressure built up in the tube side, due to heating, will be evacuated through a pressure control valve (PCV V213.2). The valve is connected to the LP vent system. In case of a tube side failure, liquid will leak into the shell side where the operating

3. MAIN COMPONENT DESCRIPTION

3.1 Heat exchanger C211 (Fig. 2.3A.2) (contd.)

pressure is lower than on the tube side. The glycol return line going to vessels CV17A/B/C, will thus be used as relief system.

Design Data:
CE 211 Heat Exchanger
Shell side:
- Design pressure 25 bara
- Design temperature 107°C
Tube side:
- Design pressure 177.5 bara
- Design temperature 107°C
Diameter: 168 mm
Length: 3911 mm

3.2 Condensate/Methanol separator CV 213 (Fig. 2.3A.2/3)

After heating to 20°C the liquid enters the separator and is separated in three phases:

- Gas
- Condensate, and
- Methanolated water

The separator is equipped with anti-wave plates and a wire mesh at the gas outlet to remove liquid droplets above the 20 micron range.

The vessel is equipped with a high level switch (LSH V213.5) which will shut down the inlets to the vessel (ESDV V211.3 and ESDV V210.2), and stop the TEG pump CP 220 B or C.
These ESD valves will also be closed and the pump stopped by pressure switch PSH V213.5 in case of overpressure and PSL V213.3 in case of a leakage or other failure. In addition the vessel CV 213 is protected by pressure safety valves which are connected to the LP vent system.

Drainage of the vessel is done by opening of the 2" manual drain valves, and the liquid is sent to the process drainage system.

Design Data:
CV 213 Condensate/Methanol Separator
Design pressure: 25 bara
Design temperature: 50°C
Capacity 3.1 m^3
Diameter: 1000 mm
Length: 4000 mm

4. OPERATION

For start up of the NEF condensate separation please see Operating Manual: 'Operating Conditions and Controls for Condensate Separation'. This include: 'Indicator and Recorder Check List NEF Condensate', 'Adjustment and Controls' and 'Alarm and Shutdown Points'.

For normal operation the operator has to check that all instrument isolation valves are open. Drain valves should be closed. The sampling valves AE V213.3, AE V213.1 and AE V213.2 should be closed. For setting of process valves see list of 'Equpment Setting' in the Operating Manual.

The operators tasks and responsibilities during normal operation will be:

(a) Check that valves are set in the configuration described in the 'Equipment Settings List'.

(b) Check that indicators and recorders listed in the 'Indicator and Recorder Check List' are operating.

(c) Ensure that all pressure, temperature and flow data are within the normal range and do not reach critical values.

(d) Check level of the condensate treatment vessel CV 213.

(e) If required adjust the set point of the local controllers

(f) Upon alarm initiation find the cause of trip and start the proper action accordingly, to restore good operating conditions as indicated in the 'Alarm and Shut-down Points List'.

The block valve, provided for high pressure gas, connected upstream the PSV V213.2 should be closed.

Schedule and Report Sheets.

(a) The operator is supposed to make a round trip in the NEF condensate treatment plant every four hours and record the main parameters as well as abnormal operating conditions.

(b) All information collected by the operator must be logged into the NEF condensate treatment log book.

(c) The QP control room report should include the following parameter:

NEF CV 213: PR-V213.1, TR-V213.1, FR-V213.5

5. EMERGENCY SHUTDOWN (Fig. 2.3.A.4)

For complete information on the ESD system please see chapter 2.9.3.

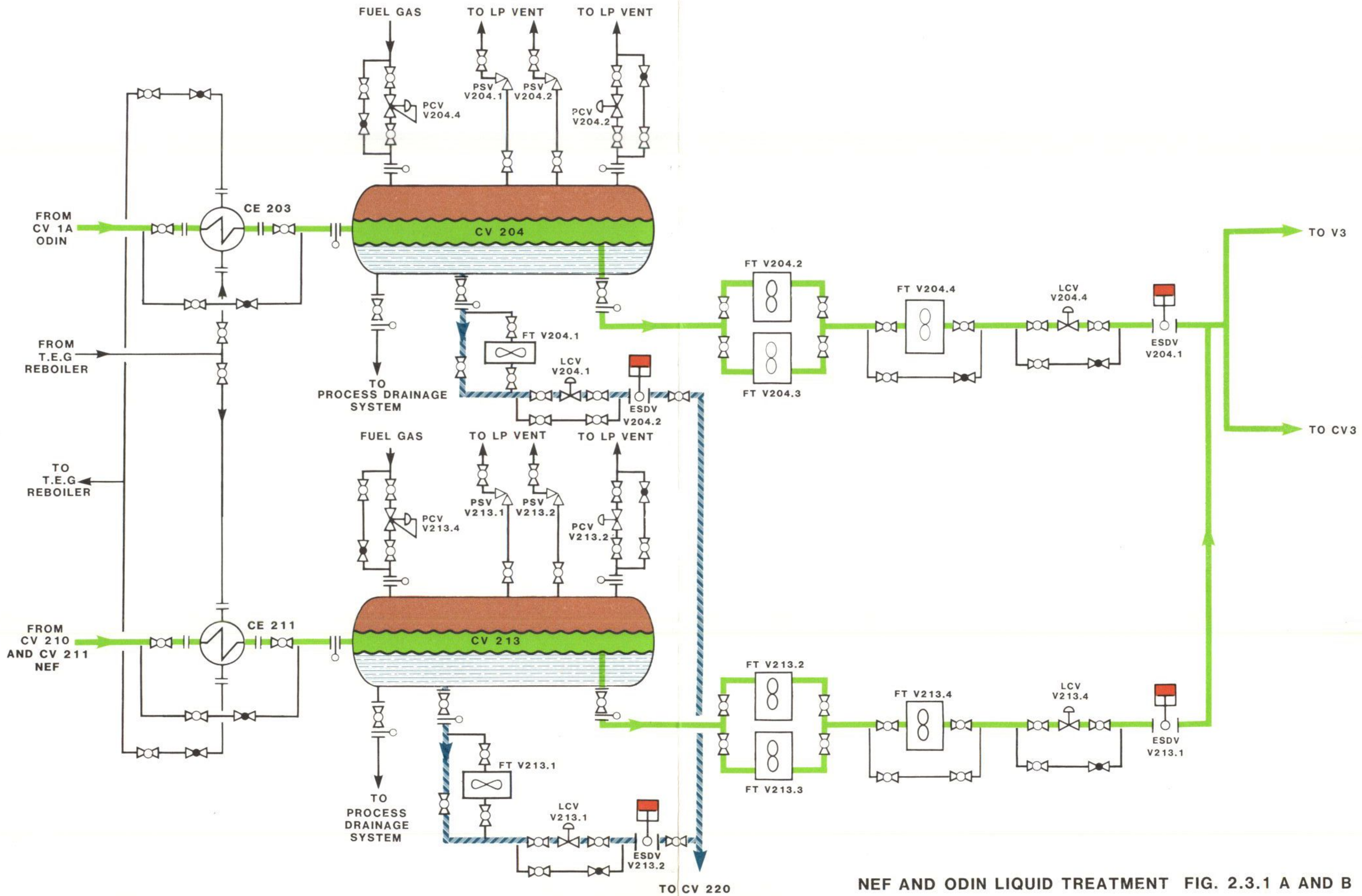
The safety system is a part of the 'N' group.

(a) 4th level shutdown signals from NEF or NEF MODULE or INTERFACE ROOM or signal from PSL M210.1 low pressure in sealine or PSL V210.1 low pressure in FWKO vessel or PSL V211.3 low pressure in gas scrubber will cause an isolation of NEF stream.

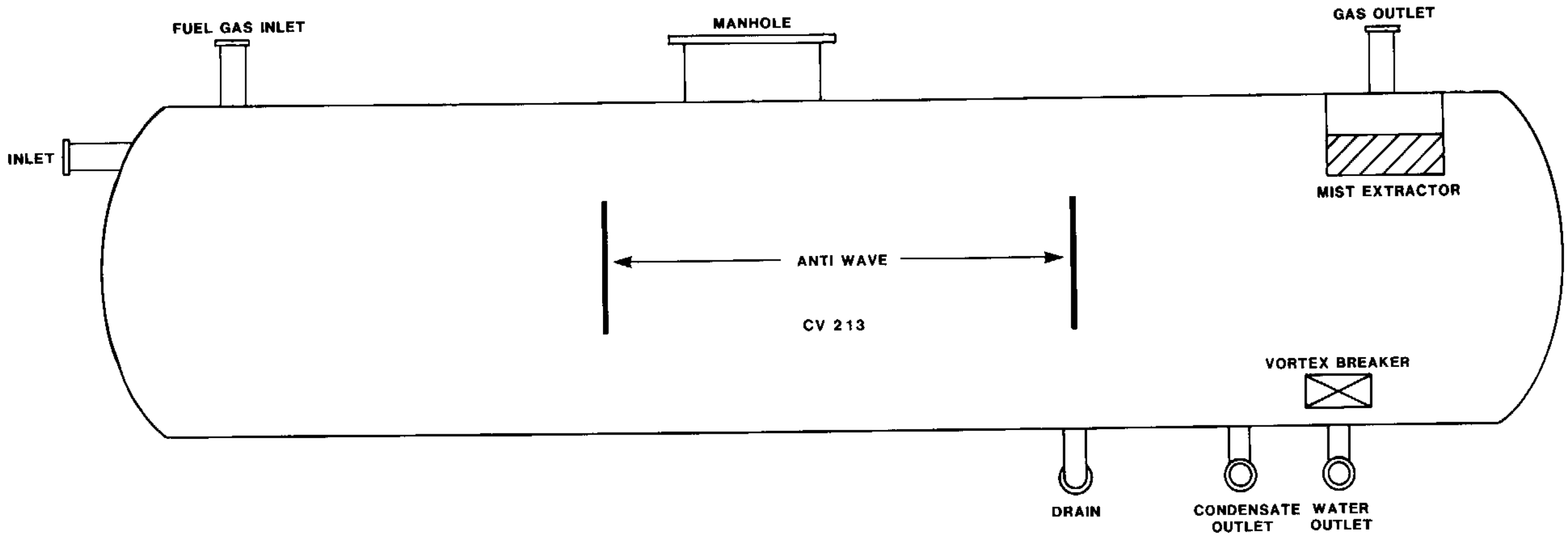
(b) Signal from LSH V213.5 low level in condensate/MW separator or PSH V213.5 or PSL V213.3 high or low pressure in condensate/MW separator will close ESDV V210.2 and ESDV V211.3 condensate outlet from CV 210 and CV 211, and also stop TEG pump CP 220B and, if CP 220C runs for CP 220B, stop TEG pump CP 220C.

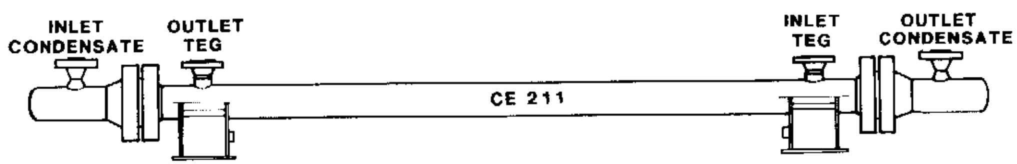
(c) Signal from LSL V213.2 or PSL V213.3 low level or low pressure in CV 213 will close ESDV V213.1 and ESDV V213.2, outlets of CV 213.

(d) Signal from PSH V220.3 or LSH V220.6 or PSL V220.4 all signals from MW Flash Drum will close ESDV V213.2 MW outlet from CV 213.

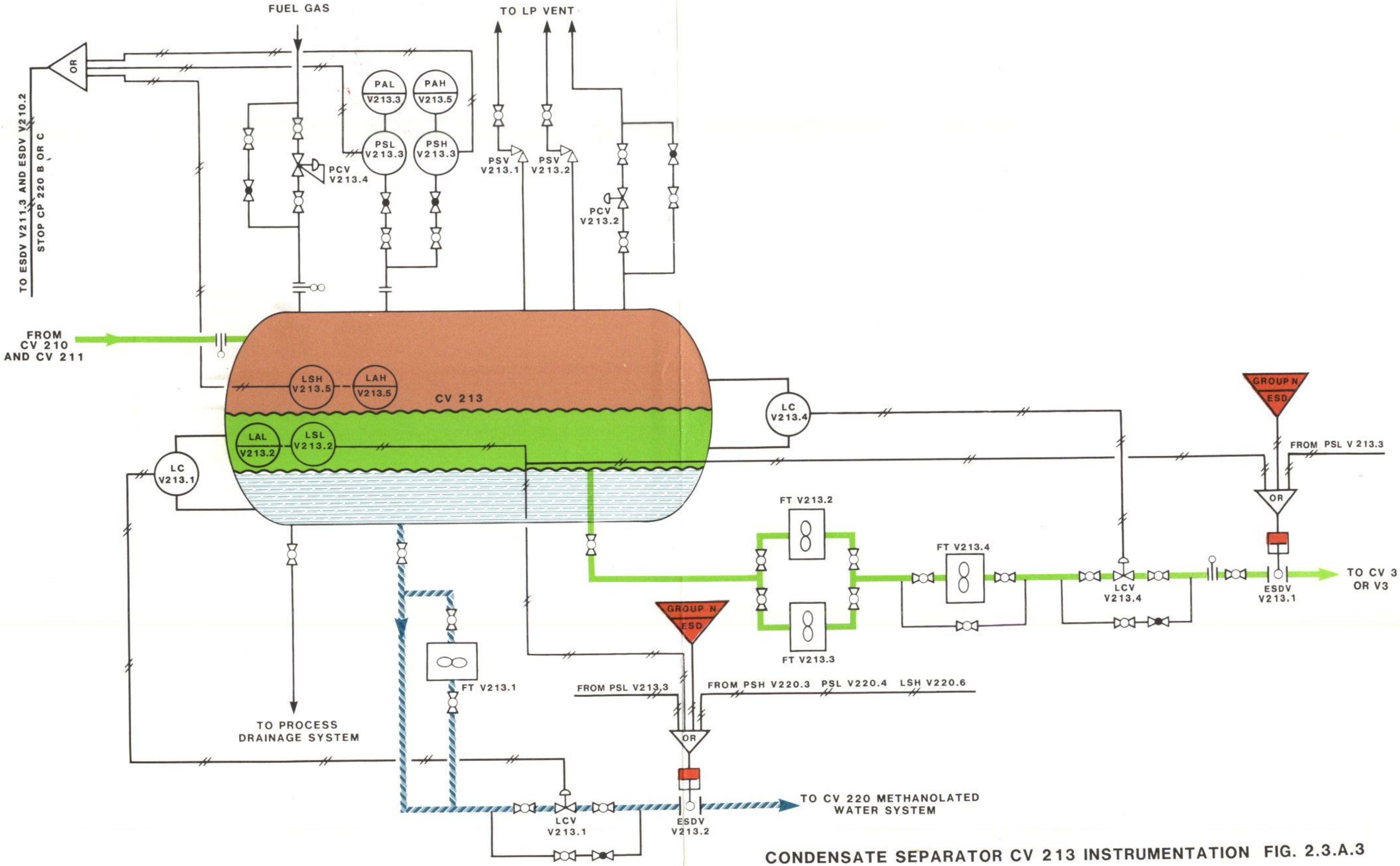


NEF AND ODIN LIQUID TREATMENT FIG. 2.3.1 A AND B

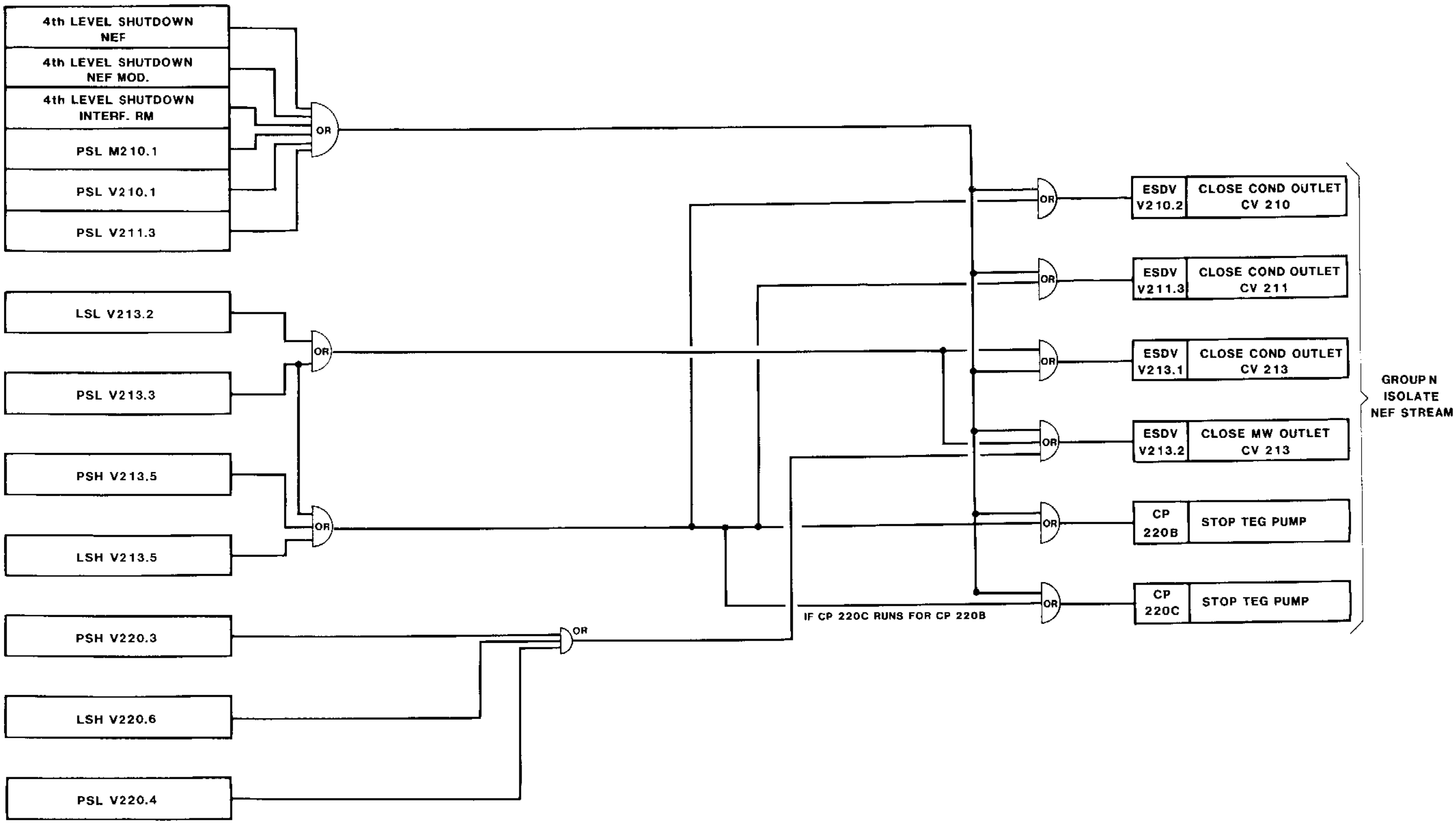




NEF CONDENSATE METHANOL SEPARATOR CV 213 AND CONDENSATE HEATER CE 211 FIG. 2.3.A.2



CONDENSATE SEPARATOR CV 213 INSTRUMENTATION FIG. 2.3.A.3



* FOR FULL DETAILS FIG. 2.9.5

NEF CONDENSATE/METHANOL PROCESS
SAFETY LOGIC DIAGRAM FIG. 2.3.A.4

2.3B. ODIN CONDENSATE TREATMENT

1. INTRODUCTION

The purpose of this unit is to separate the condensate and the methanolated water.
Due to different specific gravity the condensate and methanolated water are separated.

2. SYSTEM DESCRIPTION (Fig. 2.3.1A/B)

The liquid which comes from the FWKO vessel CV 1A and gas scrubber CV 201 consists of condensate and methanolated water. The liquid is heated in heat exchanger CE 203. After heating, the liquid is sent to condensate/methanol separator CV 204.

The effluent gas which is produced due to the pressure drop across level control valve LCV V1A.1 and LCV V201.1, is sent to the LP (low pressure) vent system under pressure control. The condensate is sent to the vessel CV 3 or V3 after being metered. The methanolated water from CV 204 is sent to vessel CV 220, methanolated water system, (see chapter 2.4).

Fuel gas injection is provided as blanket gas in order to prevent a pressure decrease in the vessel. This blanket gas does not, however, give a high enough pressure to flush condensate to CV 3.

3. MAIN COMPONENT DESCRIPTION

3.1 Heat Exchanger CE 203 (Fig. 2.3B.2)

The reason for the heat exchanger is to speed up the rate of separation between gas and liquid in the three phase separation downstream the heat exchanger.

The liquid temperature is increased from 2^oC to 20^oC at 20 bara. Triethylene glycol (TEG) is used as heating medium. The temperature of the TEG drops from 58^oC to 50^oC, over the heat exchanger.

The condensate heater is a shell and tube exchanger where condensate and methanolated water are going on the tube side, and TEG on the shell side.

A temperature switch (TSH E203.5) located downstream the condensate heater will close pumps CP 220A or C if the temperature of the condensate/ methanolated water increases to a high value.

Any pressure built up in the tube side, due to heating, will be evacuated through a pressure control valve (PCV V204.2). The valve is connected to the LP vent system. In case of a tube side failure, liquid will leak into the shell side where the operating pressure

3. MAIN COMPONENT DESCRIPTION

3.1 Heat exchanger CE203 (Fig. 2.3B.2) (contd.)

is lower than on the tube side. The glycol return line going to vessels CV17A/B/C, will thus be used as relief system.

Design Data:
CE 203 Heat Exchanger
Shell side:

- Design pressure 25 bara
- Design temperature 107°C

Tube side:

- Design pressure 177.5 bara
- Design temperature 107°C

Diameter: 194 mm
Length: 3941 mm

3.2 Condensate/Methanol separator CV 204 (Fig. 2.3B.2/3)

After heating to 20°C the liquid enters the separator and is separated in three phases:

- Gas
- Condensate, and
- Methanolated water

The separator is equipped with anti-wave plates and a wire mesh at the gas outlet to remove liquid droplets above the 20 micron range.

The vessel is equipped with a high level switch (LSH V204.5) which will shut down the inlets to the vessel (ESDV V201.3 and ESDV V1A.2), and stop the TEG pump CP 220 A or C. These ESD valves will also be closed and the pump stopped by pressure switch PSH V204.5 in case of overpressure and PSL V204.3 in case of a leakage or other failure. In addition the vessel CV 204 are protected by pressure safety valves which are connected to the LP vent system.

Drainage of the vessel is done by opening of the 2" manual drain valves, and the liquid is sent to the process drainage system.

Design Data:
CV 204 Condensate/Methanol Separator
Design pressure: 25 bara
Design temperature: 50°C
Capacity: 3.1 m^3
Diameter: 1000 mm
Length: 4000 mm

4. OPERATION

For start up of the ODIN condensate separation please see Operating Manual: 'Operating Conditions and Controls for Condensate Separation'. This include: 'Indicator and Recorder Check List ODIN Condensate', 'Adjustment and Controls' and 'Alarm and Shutdown Points'.

For normal operation the operator has to check that all instrument isolation valves are open. Drain valves should be closed. The sampling valves AE V204.3, AE V204.1 and AE V204.2 should be closed. For setting of process valves see list of 'Equpment Sitting' in the Operating Manual.

The operators tasks and responsibilities during normal operation will be:

(a) Check that valves are set in the configuration described in the 'Equipment Settings List'.

(b) Check that indicators and recorders listed in the 'Indicator and Recorder Check List' are operating.

(c) Ensure that all pressure, temperature and flow data are within the normal range and do not reach critical values.

(d) Check level of the condensate treatment vessel CV 204.

(e) If required adjust the set point of the local controllers

(f) Upon alarm initiation find the cause of trip and start the proper action accordingly, to restore good operating conditions as indicated in the 'Alarm and Shut-down Points List'.

The block valves, provided for high pressure gas, connected upstream the and PSV V204.2 should be closed.

<u>Schedule and Report Sheets.</u>

(a) The operator is supposed to make a round trip in the ODIN condensate treatment plant every four hours and record the main parameters as well as abnormal operating conditions.

(b) All information collected by the operator must be logged into the ODIN condensate treatment log book.

(c) The QP control room report should include the following parameter:

ODIN CV 204: PR-V204.1, TR-V204.1, FR-V204.5

5. EMERGENCY SHUTDOWN (Fig. 2.3.B.4)

For complete information on the ESD system, please see chapter 2.9.3.

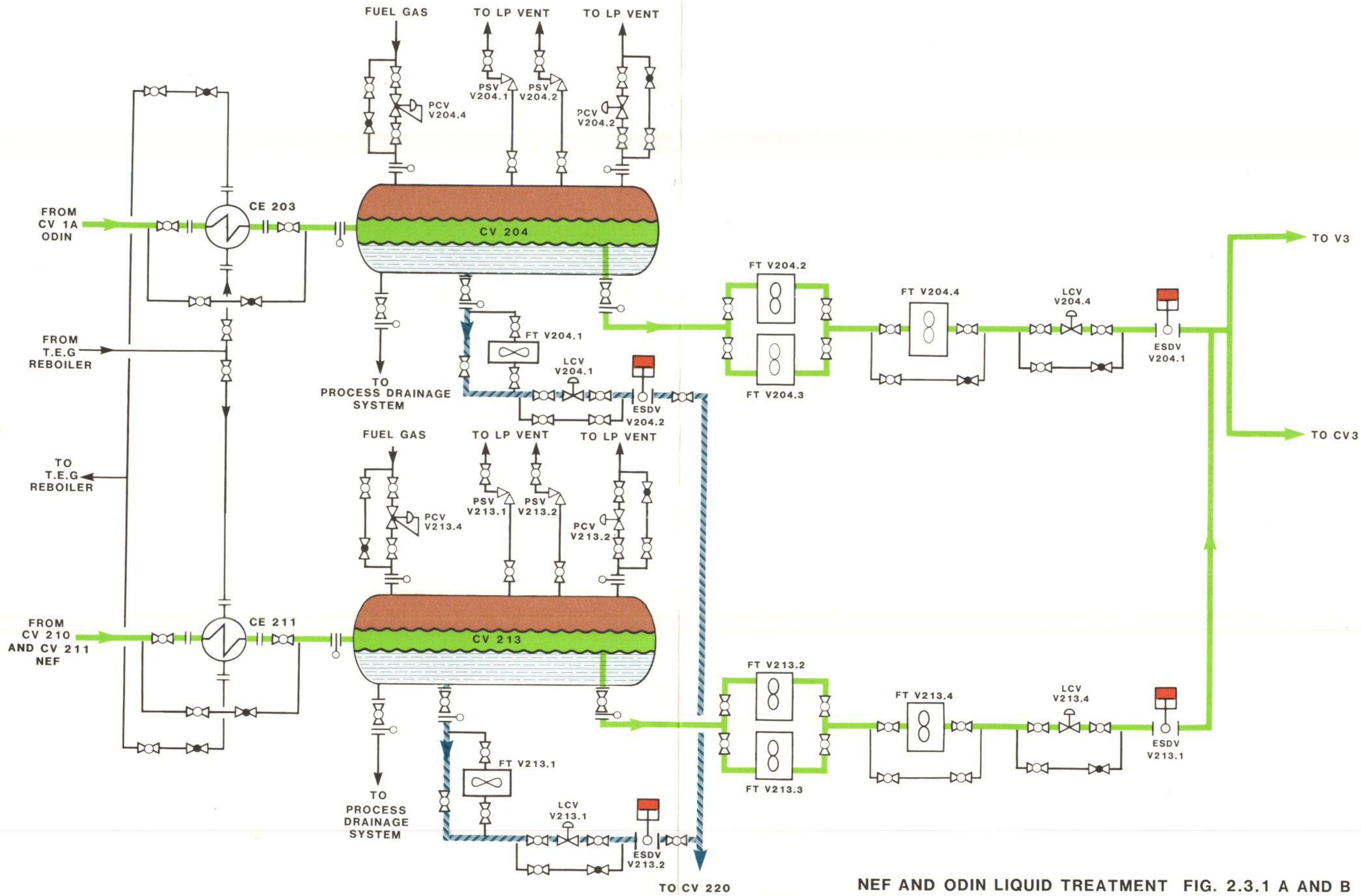
The safety system is a part of the 'O' group.

(a) 4th level shutdown signal from ODIN or ODIN MODULE or INTERFACE ROOM or signal from PSL M201,1 low pressure in sealine or PSL V1A.2A low pressure in FWKO vessel or PSL V201.3 low pressure in gas scrubber, will cause an isolation of the ODIN stream.

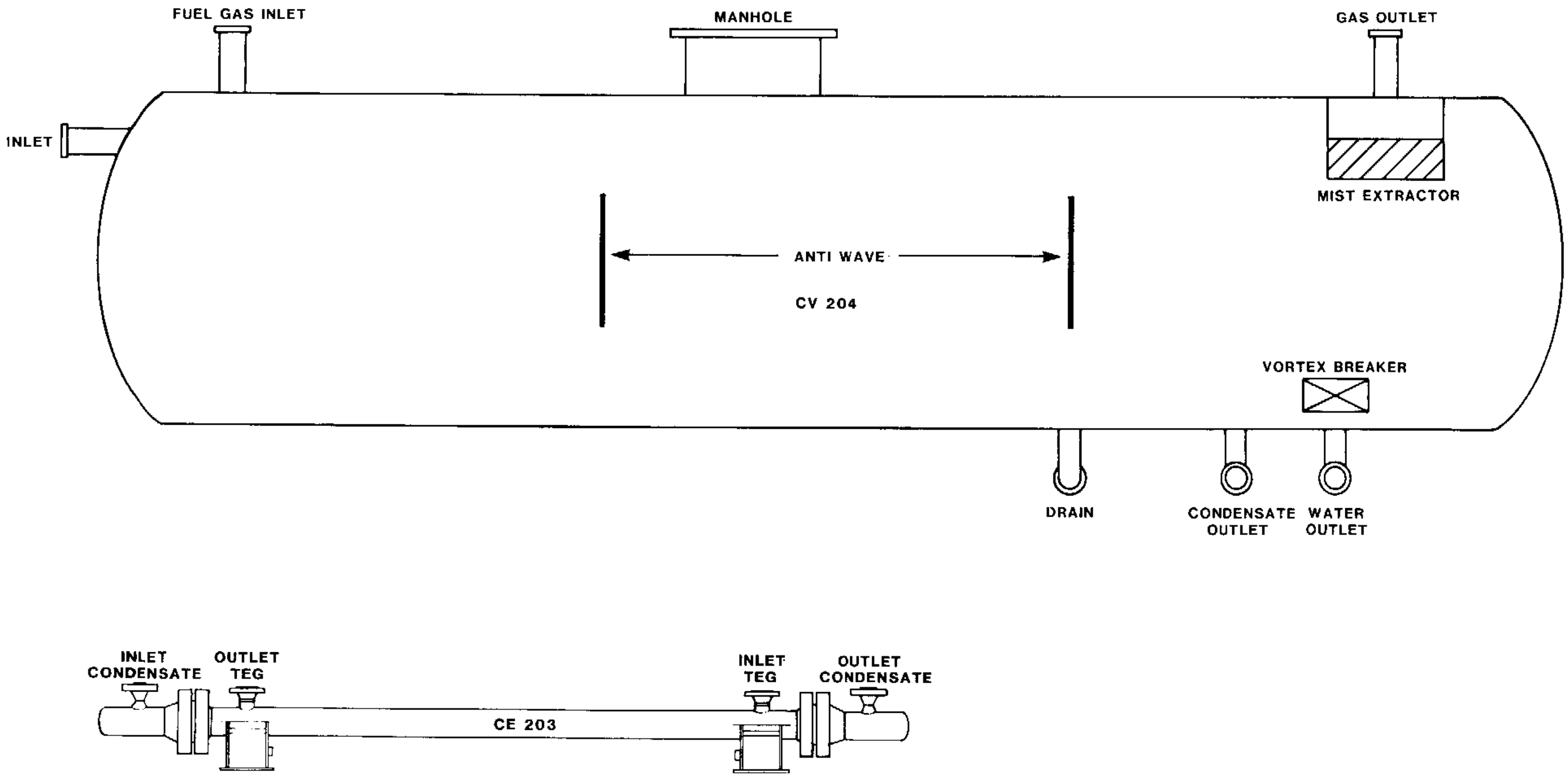
(b) Signal from LSH V204.5 high level in condensate/MW separator or PSH V204.5 or PSL V204.3 high or low pressure in CV 204 will close ESDV V1A.2 and ESDV V201.3 condensate outlet from CV 1A and CV 201, and also stop TEG pump CP 220A and, if CP 220C runs for CP 220A, stop TEG pump CP 220C.

(c) Signal from PSL V204.3 or LSL V204.2 low pressure or low level in CV 204 will close ESDV V204.1 and ESDV V204.2, outlets from CV 204.

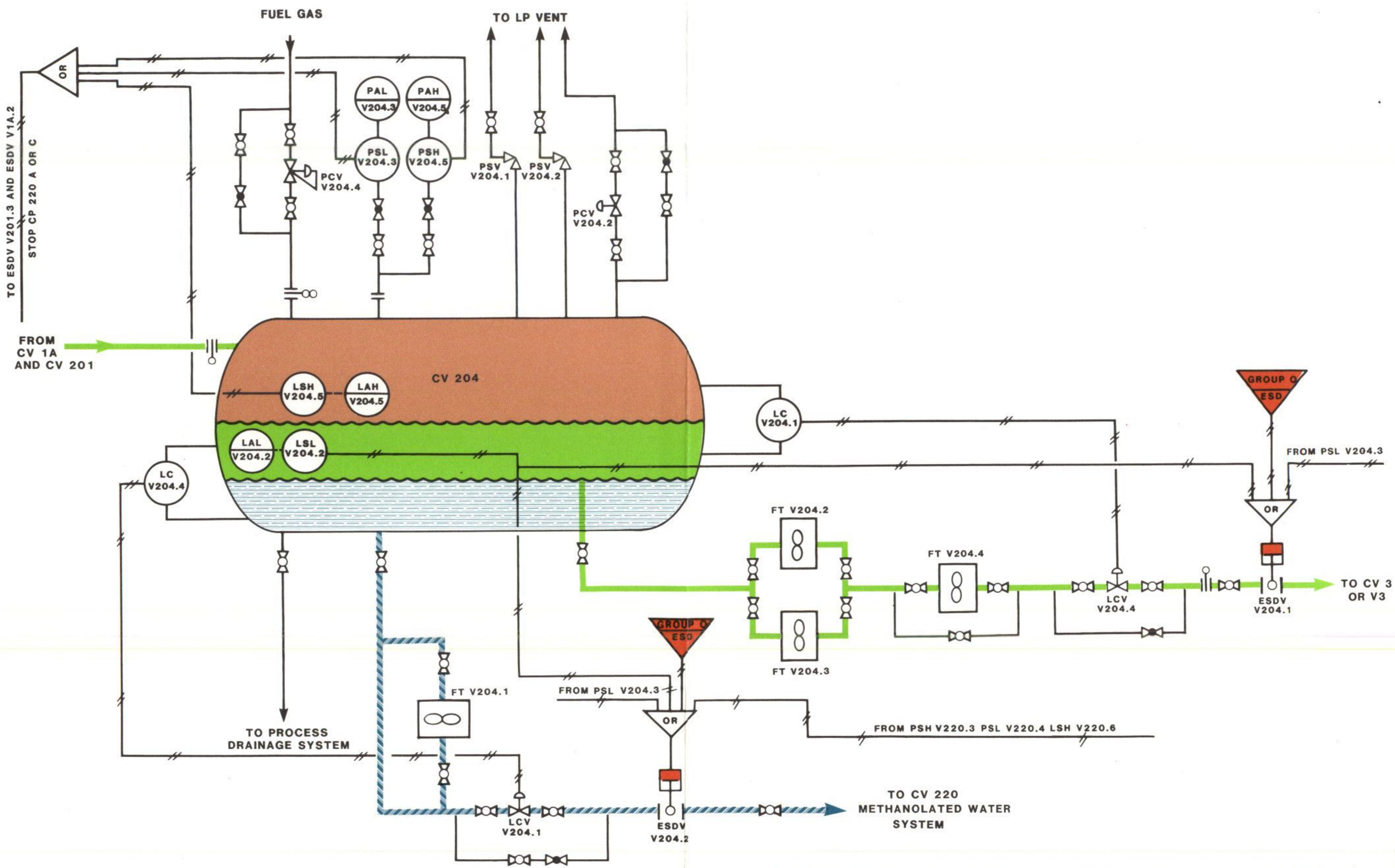
(d) Signal from PSH V220.3 or LSH V220.6 or PSL V220.4 all signals from MW Flash Drum will close ESDV V204.2, MW outlet from CV 204.



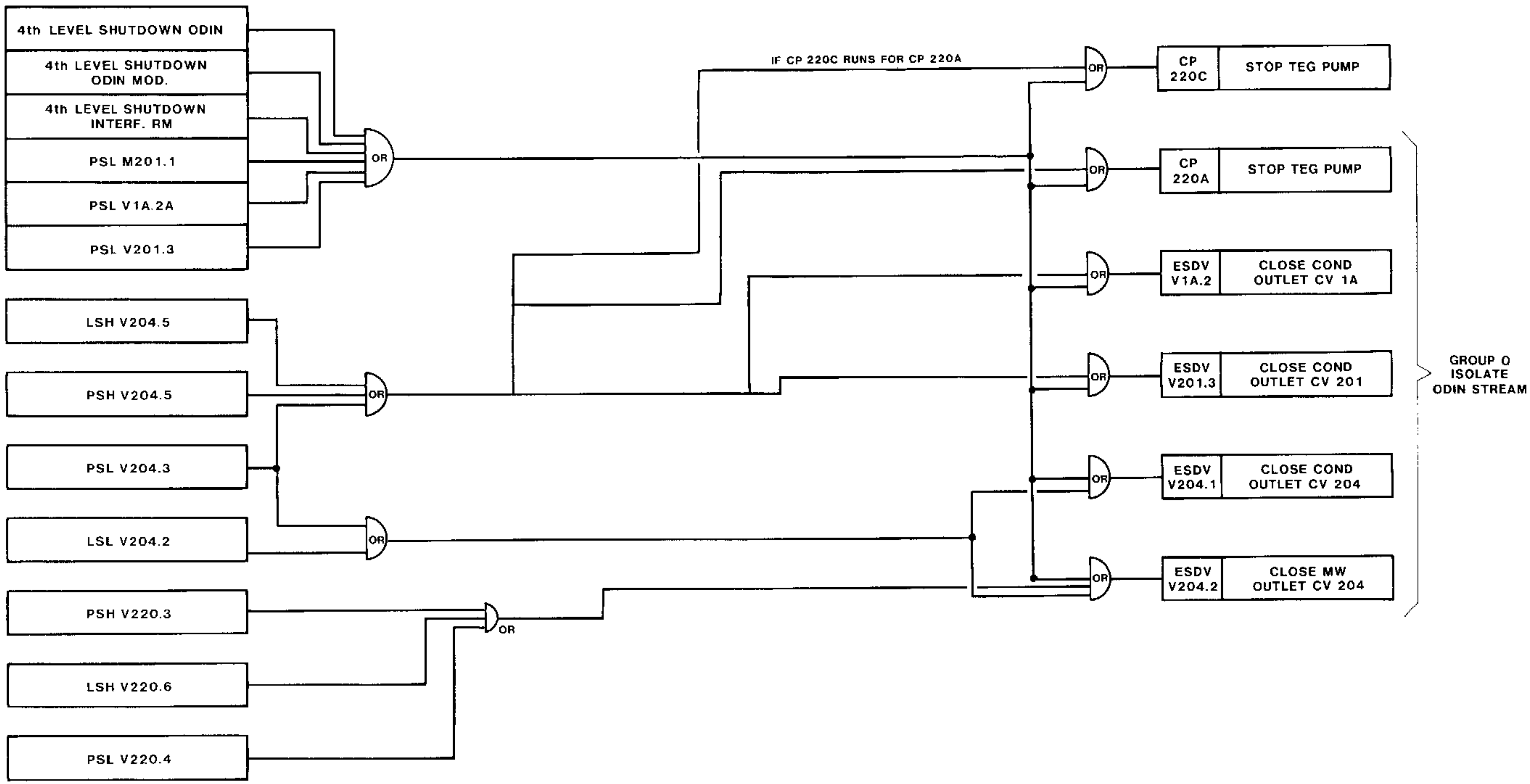
NEF AND ODIN LIQUID TREATMENT FIG. 2.3.1 A AND B



ODIN CONDENSATE METHANOL SEPARATOR CV 204 AND CONDENSATE HEATER CE 203 FIG. 2.3.B.2



CONDENSATE SEPARATOR CV 204 INSTRUMENTATION FIG. 2.3.B.3



* FOR FULL DETAILS FIG. 2.9.5

ODIN CONDENSATE/METHANOL
PROCESS SAFETY LOGIC DIAGRAM FIG. 2.3.B.4

2.4. METHANOLATED WATER SYSTEM

1. INTRODUCTION

The purpose of this unit is to separate the rest of condensate and gas from the methanolated water.

2. SYSTEM DESCRIPTION (Fig. 2.4.1)

The methanolated water disposal system is common to NEF and ODIN.

The methanolated water comes from vessels C V 204 and C V 213 and is sent to the Methanolated Water Flash Drum C V 220 which operates at 10 bara and 20°C.

In the Flash Drum CV 220 the condensate is separated from the methanolated water.

Fuel gas is used as blanket gas. The drain is sent to the drainage system.

3. MAIN COMPONENT DESCRIPTION

3.1 Methanol Water Flash Drum C V 220 (Fig. 2.4.2/3.)

The flow going into the vessel consist of methanolated water and about 14 litres of condensate per hour at a normal flowrate of 2.2 m^3/hr. The flash drum is divided into two parts. The condensate having the lowest specific gravity will be located on the top of the methanolated water and flow into the condensate part of the vessel.

The condensate is sent under level control (LCV V220.4) to the oil skimmer C V5, which is part of the existing condensate recovery system. The methanolated water is flowing under level control (LCV V220.1) to DP2, in a 4" sealine, where it is injected into the well 22.

When the methanolated water for some reason cannot be injected into the well, it will be sent to the Methanol Water Storage Tank C V 9 until the injection again can take place.

Due to the pressure decline from C V 204 and C V 213 to C V 220, gas is evolved. This gas is sent to the LT relief system.

Design data:

Design Pressure:	16.2 Bara
Design Temperature:	- 12/+50 °C
Capacity:	3.05 m^3
Diameter:	900 mm
Length:	2900 mm

4. OPERATION

For start up of the methanolated water system please see the Operating Manual: 'Operating Conditions and Controls for Methanolated Water System' which includes: 'Indicator and Recorder Check List', 'Adjustments and Controls' and 'Alarm and Shutdown Points'.

For normal operation the operator has to check that all instrument isolation valves are open. Drain valves should be closed.

Sampling valves AE V220.1, CV 220 outlet to CV5, and AE V220.2, CV 220 outlet to DP2 should be closed.

For setting of process valves see 'Equipment Setting' in the Operation Manual.

The operators tasks and responsibilities during normal operation will be:

(a) check that valves are set in the configuration described in the 'Equipment Setting List'.

(b) Check that indicators and recorders listed in the 'Indicator and Recorder Check List' are operating

(c) Ensure that all pressure, temperature and flow data are within the normal range and do not reach critical values.

(d) Check levels in the methanolated water flash drum.

(e) If required adjust the set point of the local controllers

(f) Upon alarm initiation find the cause of trip and start the proper action accordingly, to restore good operating conditions as indicated in the alarm and shut-down points list.

(g) In the case of DP 2 Shut-down the methanolated water must be sent to CV 9.

(h) Check that chemical injection is operating.

Schedule and Report Sheets

(a) The operator is supposed to make a round trip in the Methanolated Water System Plant every four hours and record the main parameters as well as abnormal operating conditions.

(b) All information collected by the operator must be logged into the methanolated water system treatment log book.

(c) The QP control room report should include the following parameters:

4. OPERATION

CV 220: PI V220.1, TC V220.1, FQI V220.1A/B.
Volume of inhibitor injection LG-V225.1
FA-106 A/B: PI 284 TI 213.

5. EMERGENCY SHUTDOWN (Fig. 2.4.4)

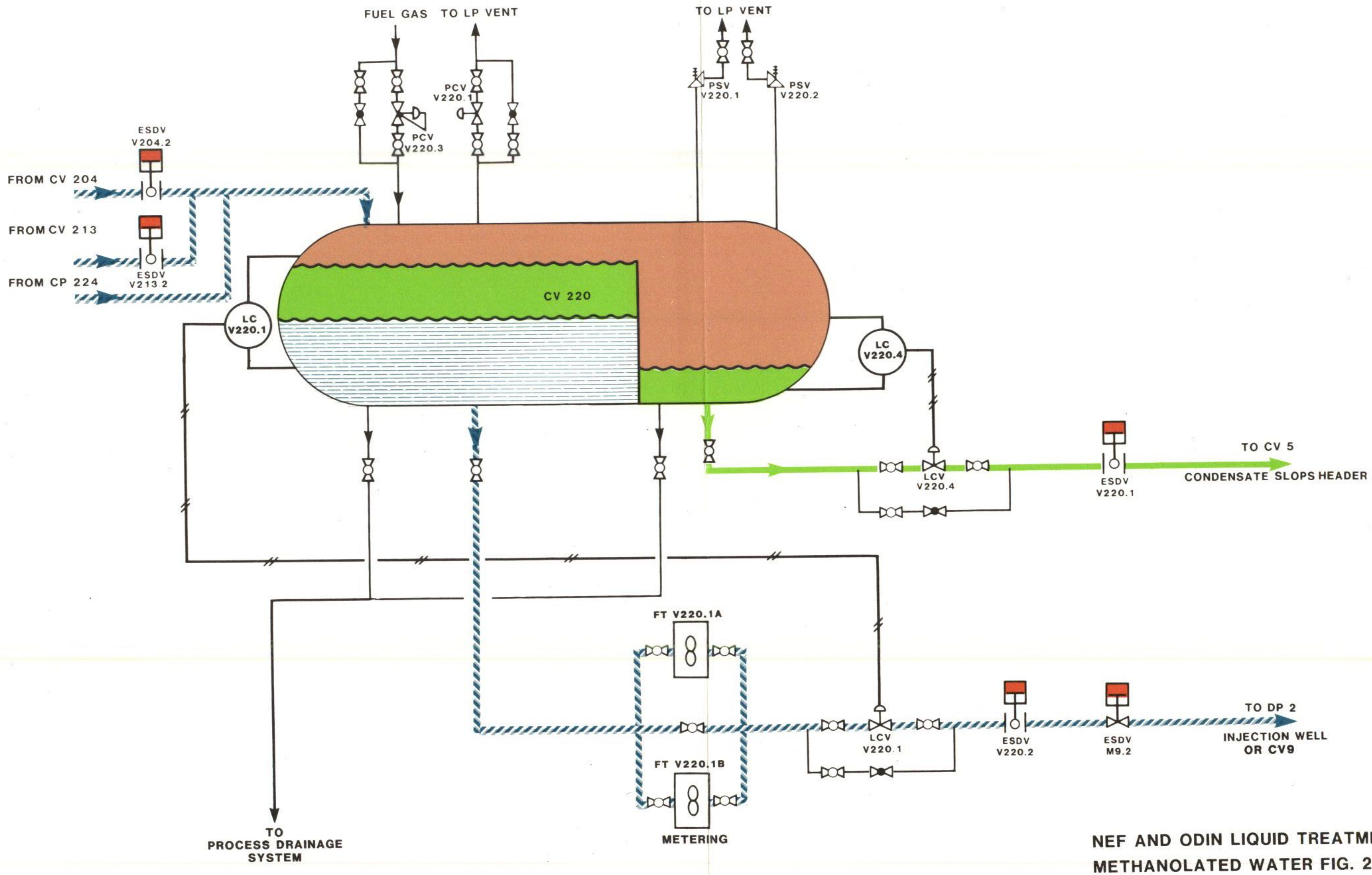
For complete information on the ESD system please see chapter 2.9.3.

(a) Signal from PSH V220.3 high pressure in MW Flash Drum or LSH V220.6 high level in CV 220 or PSL V220.4 low pressure in CV 220, will close ESDV V213.2 MW outlet from CV 213, and ESD V204.2 MW outlet from CV 204, and also stop drainage tank pump CP 224.

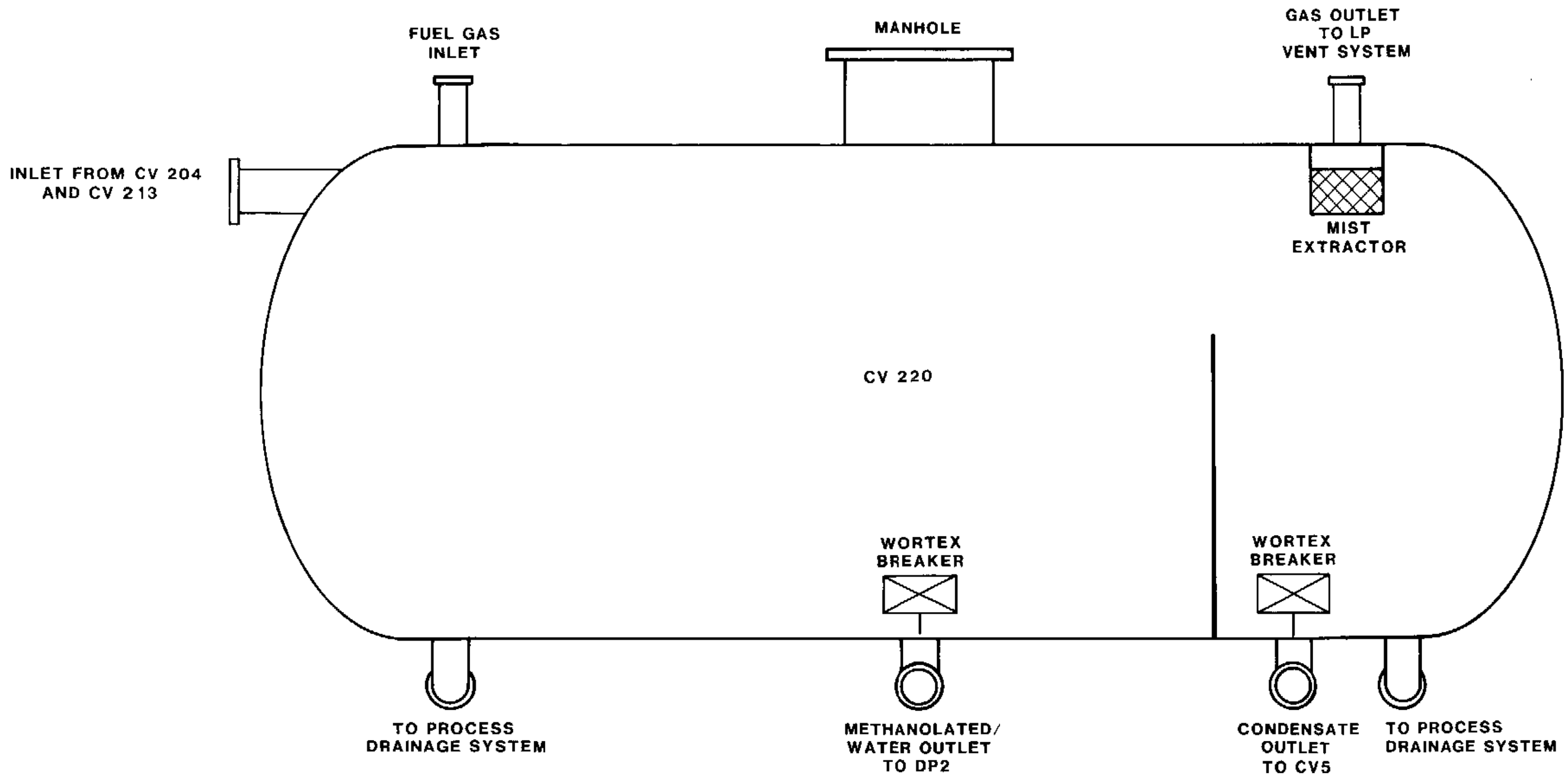
(b) Signal from PSL V220.4 low pressure in CV 220 or LSL V220.7 low level in the condensate part of CV 220, will close ESDV V220.1, condensate outlet from CV 220.

(c) Signal from PSL V220.4 low pressure in CV 220 or LSL V220.2 low level in the MW part of CV 220, will close ESDV V220.2 MW outlet from CV 220.

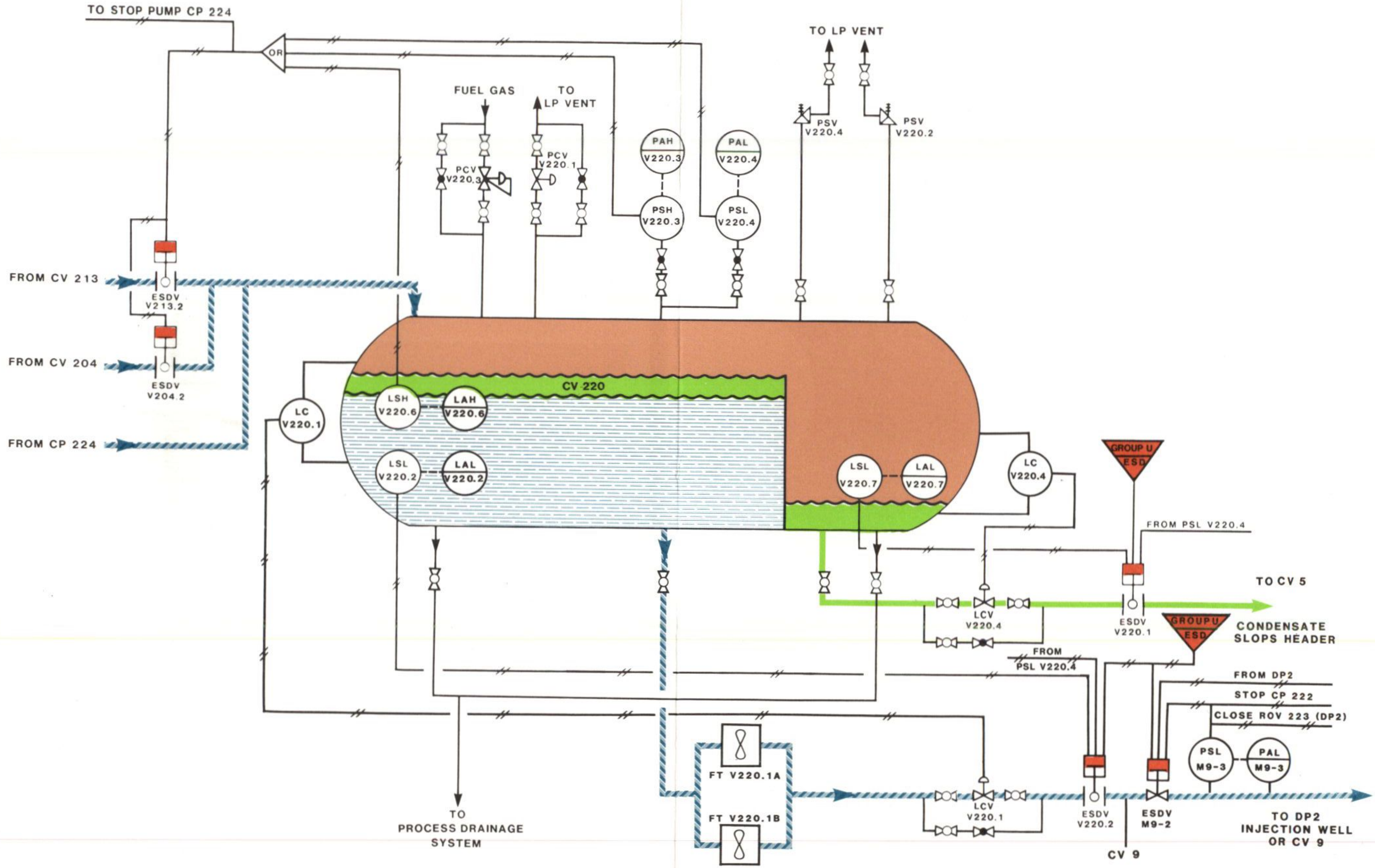
(d) ESD signal from DP2 or signal from PSL M9.3 will close ESDV M9.2 MW line to DP2 and stop MW pump CP 222 A or B.



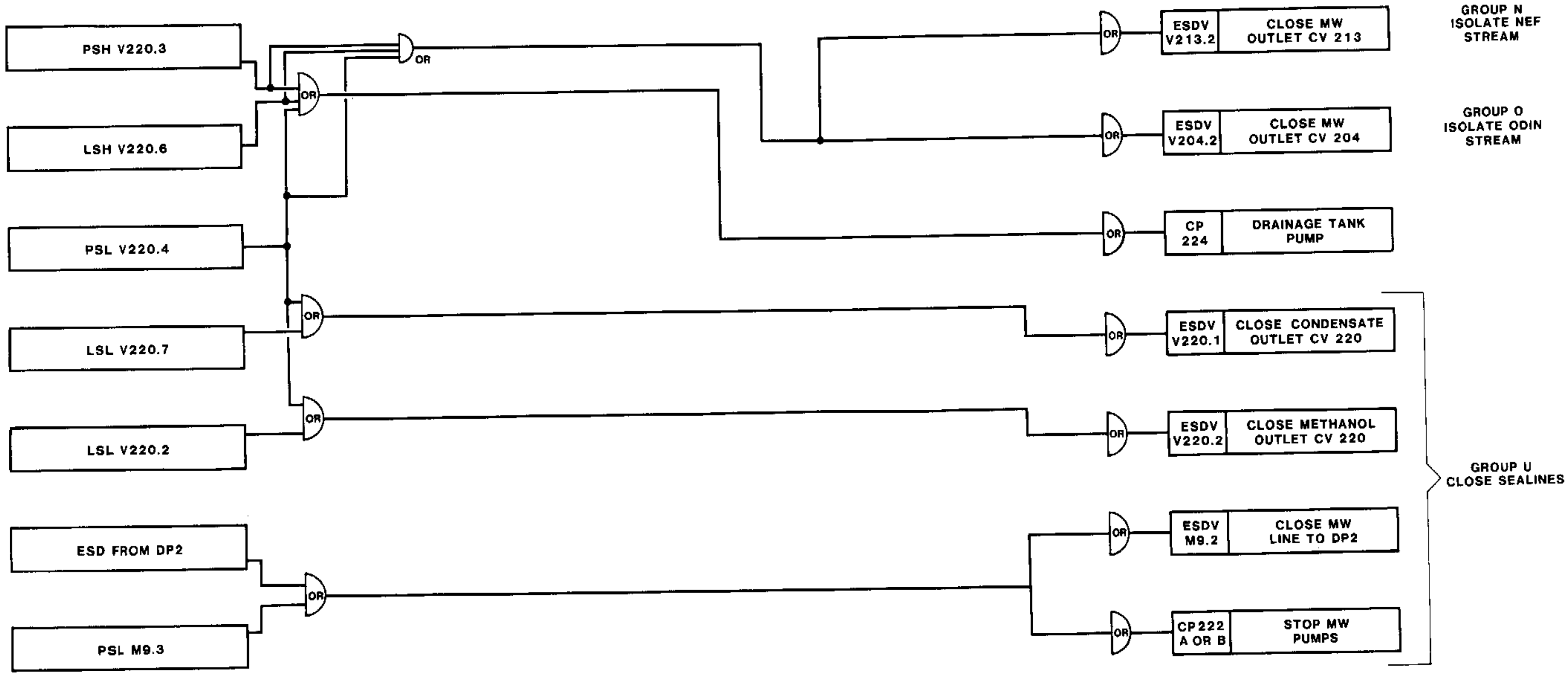
NEF AND ODIN LIQUID TREATMENT
METHANOLATED WATER FIG. 2.4.1



METHANOLATED WATER FLASH DRUM CV 220 FIG. 2.4.2



METHANOLATED WATER FLASH DRUM CV 220 INSTRUMENTATION FIG. 2.4.3



* FOR FULL DETAILS FIG. 2.9.5

METHANOLATED WATER PROCESS
SAFETY LOGIC DIAGRAM FIG. 2.4.4

2.5. METHANOL INJECTION SYSTEM

1. INTRODUCTION (Fig. 2.5.1)

Methanol is injected into the NEF and ODIN streams to prevent hydrate formation in the sealine.

2. METHANOL INJECTION AT NEF AND ODIN

2.1 Methanol injection to NEF

The methanol stored in Methanol Storage Tank CV 23 is sent to NEF articulated column through a $1\frac{1}{2}$" line using methanol injection pumps CP 12A/B. The pump flow rate is manually adjusted according to the needs from the field control station located on NEF.

2.2 Methanol Injection at ODIN

The methanol needed for injection on ODIN will be provided at the ODIN platform.

3. FUTURE POSSIBLE METHANOL INJECTION

3.1 Downstream ODIN and NEF FWKO

The gas, which is separated from the condensate and methanolated water in vessels CV1A and CV210, is not in contact with methanol any longer. A small amount of water condensation could therefore initiate formation of hydrates. In order to prevent this, provisions are made for future methanol injection downstream the FWKO.

Two reciprocating pumps CP 223A/B can be used to inject methanol in gas lines downstream the FWKO, CV 1A / CV 210.

These pumps will take suction from CV 23. This package can be provided later if necessary.

Equipment Design:

CV 23 Methanol Storage Tank:

Design Pres.:	1.35 bara at 21°C
Capacity:	100 cbm
Length:	7300 mm
Weight:	3550 mm
Hight:	4000 mm

CP 12A/B Methanol Injection Pumps:

Capacity:	0 - 10^3 l/hr at 153 bar P

CP 223A/B Methanol Injection Pumps:

Design pres.:	177.5 bara
Design temp.:	21°C

4. OPERATION

The methanol injection pumps CP 12A/B will only be run when there is a low level in the methanol tank at NEF. They will be manually started and the flowrate adjusted according to the needs from FCS on NEF.

The maximum flowrate is obtained by the two pumps CP 12A/B working in parallel.

The future possible injection of methanol downstream FWKO's CV 1A and CV 210 will be performed by the pumps CP 223A/B respectively. One may replace the other when it is required.

For start up of the methanol injection system, please see the Operation Manual: 'Operating Conditions and Controls for Methanol Injection System' which includes 'Indicator and Recorder Check List' and 'Alarm and Shutdown Points'. See also the 'Adjustments and Controls'.

For normal operation the operator has to check that all the instrument isolation valves are open along the injection line.
All drain valves to be closed.

Adjust tank level when LI V23.1 indicates a low level. When methanol injection is not required the pumps CP 12A/B and CP 223A/B should be 'OFF' and the valves should be set according to the 'Equipment Setting List'.

When methanol injection is required at NEF articulated column, check the following valves and pumps:

- Open CP 12A or B, inlet block valve
- Open CP 12A or B, outlet block valve
- Open ESDV P12.1
- Start pump CP 12A or B as indicated in adjustments and controls.

For possible future injection downstream FWKOs CV 210 and CV 1A check the following valves and pumps:

To inject methanol to the FWKO CV 210:
- Open CP 223B, inlet block valve
- Open CP 223B, outlet block valve
- Operate pump CP 223B.

To inject methanol to the FWKO CV 1A:
- Open CP 223A, inlet block valve
- Open CP 223A, outlet block valve
- Operate pump CP 223A.

The operators taskes and responsibilities during routine operation are:

4. OPERATION

(a) Check that valves are set in the configuration desribed in the 'Equipment Setting List'.

(b) Check that indicators and recorders listed in the 'Indicator and Recorder Check List' are operating.

(c) Check methanol level in CV 23.

(d) Start methanol injection when this is required.

(e) Ensure that all pressure and flow data are within the normal range and do not reach critical values.

(f) Upon alarm initiation find the cause of trip and start the proper action accordingly, to restore good operating conditions as indicated in the alarm and shut-down points list.

Schedule and Report Sheets:

(a) The operator is supposed to check the methanol injection system every four hours during operation, and record the main parameters as well as abnormal operating conditions.

(b) All information collected by the operator must be logged into the methanol injection log book.

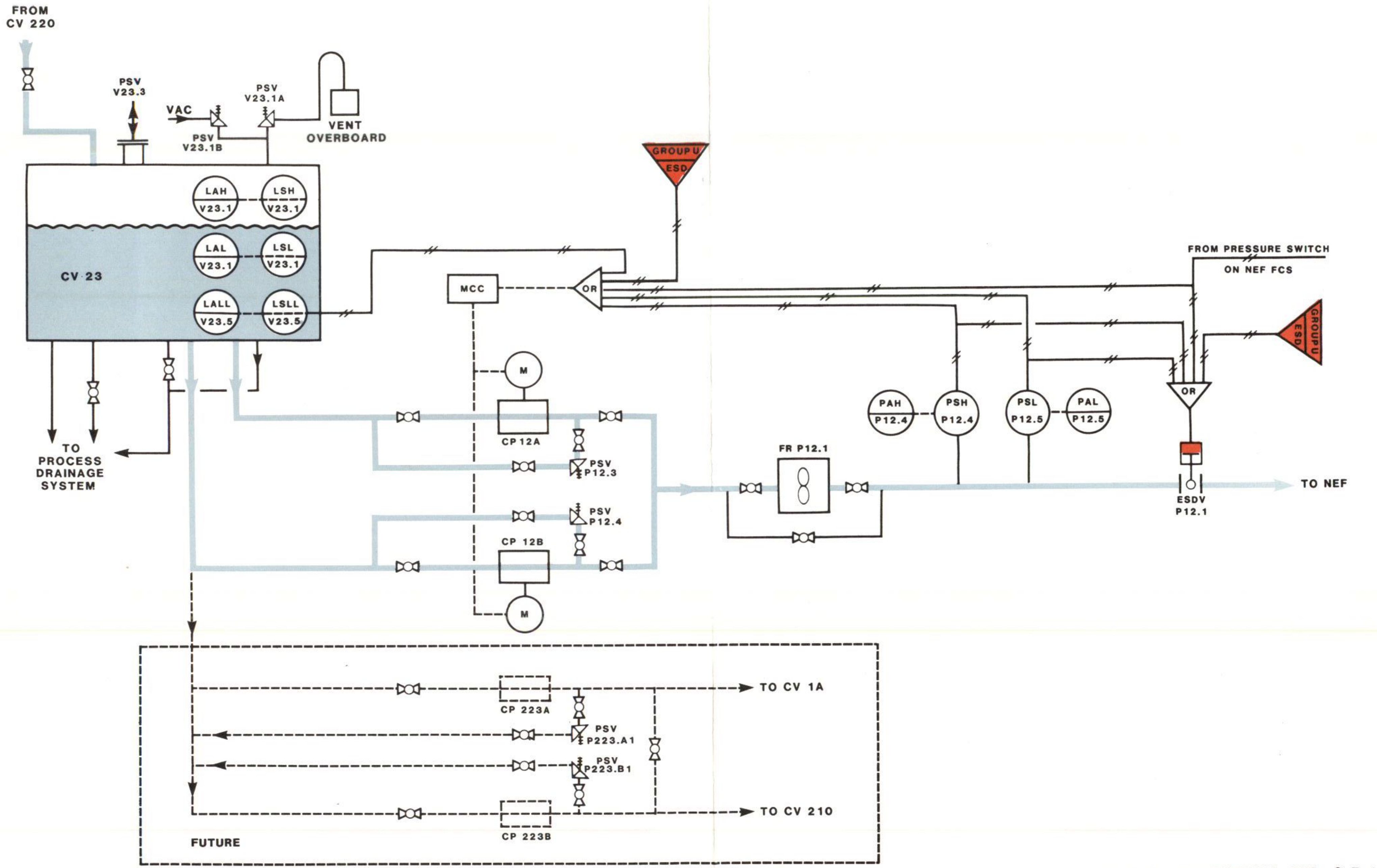
(c) The QP control room report should include the daily methanol consumption.

5. EMERGENCY SHUTDOWN

For complete information on ESD system, please see chapter 2.9.3.

Signals from PSH P12.4, PSL P12.5, group 'U' shutdown or signals from pressure switch on NEF, will all close ESDV. P12.1 and thereby stop the methanol stream to NEF.

Signals from PSH P12.4, PSL P12.5, group 'U' shutdown, LSLL V23.5 low low level in methanol storage tank CV 23, or signal from NEF, will activate the MCC and stop the methanol injection pumps CP 12A/B.



METHANOL INJECTION FIG. 2.5.1

2.6. TRIETHYLENE GLYCOL (TEG) SYSTEM

Fig. No.

1. INTRODUCTION

The purpose of the triethylene glycol system is to heat the condensate/methanolated water before it enters the separators CV 213/CV 204.

2. SYSTEM DESCRIPTION (Fig. 2.6.1)

A closed hot TEG loop will be used to heat the condensate and methanolated water from $2^{o}C$ to $20^{o}C$. The hot glycol is pumped through TEG circulation pumps CP 220A/B/C.

The pumps take suction from Glycol Surge Tanks CV 17A,B, or C, which are existing vessels.

The hot TEG is pumped through the heat exchangers CE 203/CE 211 on the shell side, and heat the condensate/methanol water on the tube side.

The TEG is then returned to the glycol surge tanks CV 17A, B or C. The TEG should be returned to the very same vessel it came from. The reason for this is to have control with the level in the tank and thereby preventing it from overfilling. In addition a level switch is installed which will give an alarm in the CCR upon high liquid level in the vessel.

3. MAIN COMPONENT DESCRIPTION

3.1 TEG Circulation Pumps

There are three pumps CP 220A/B/C.
Pump CP 220A will be used for the ODIN stream in heat exchanger CE 203, and pump CP 220B will be used for the NEF stream in heat exchanger CE 211. Pump CP 220C will be used as a stand-by and can serve either stream as required.

Equipment Design CP 220A/B/C
Design Pressure: 25 bara
Design Temperature: $107^{o}C$

3.2 Heat Exchangers

See chapters 2.3A.3 and 2.3B.3 and Fig. nos 2.3A.2 and 2.3B.2.

4. OPERATION

For start up and operating of the TEG system, please see Operation Manual 'Operating Conditions and Controls for TEG System', which includes 'Indicator and Recorder Check List' and 'Alarm and Shut Down Points'.

4. OPERATION

The operator has to open the inlet and outlet block valves on the TEG surge tank to be used, and close inlets and outlets on the other tanks. This is to prevent overfilling the surge tank.

No particular adjustment has to be done on the TEG system. The only operation to be performed is the restart of the pumps after a shut-down and to obtain the required temperature on TI E221.2 and TI E203.2

The glycol level may be adjusted using the glycol drainage system and the pumps CP 13A/B which transfer glycol to another glycol surge tank.
The operator has to check that all instrument isolation valves are open.

The operators tasks and responsibilities during routine operation will be to:

(a) Check that valves are set in the configuration described in the 'Equipment Setting List'.

(b) Check that indicators set in the 'Indicator and Recorder Check List' are operating.

(c) Ensure that all pressure, temperature and flow data are within the normal range and do not reach critical values.

(d) Upon alarm initiation find the cause of trip and start the proper action accordingly, to restore good operating conditions as indicated in the alarm and shut-down points list.

Schedule and Report Sheets

(a) The operator is supposed to check the TEG system every four hours and record the main parameters as well as abnormal operating conditions.

(b) All the information collected by the operator must be logged into the TEG system log book.

5. EMERGENCY SHUTDOWN

For complete information on the ESD system, please see chapter 2.9.3.

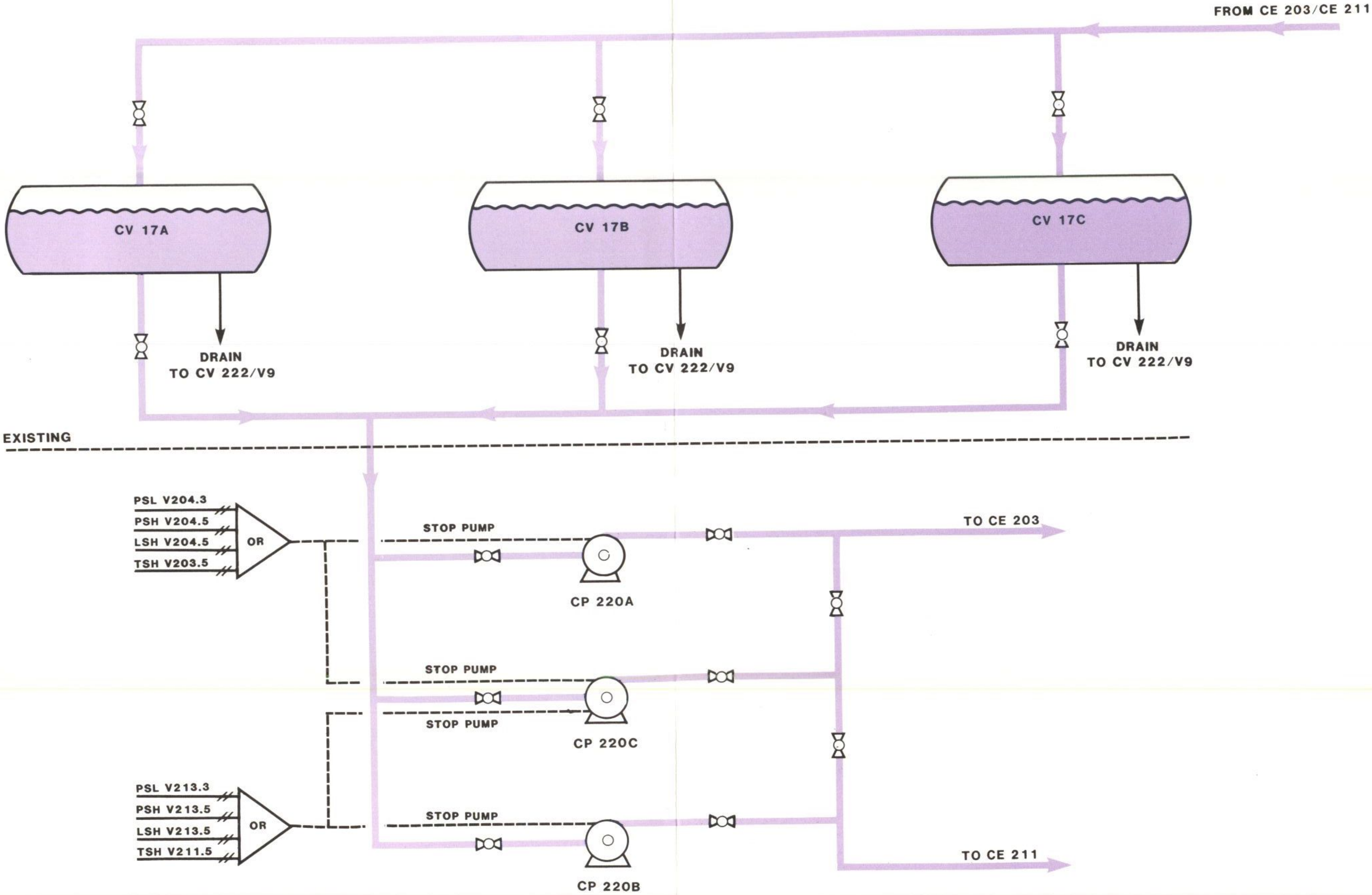
(a) Pumps CP 220A/C will be stopped by activation of PSL V204.3, low pressure, PSH V204.5, high pressure or LSH V204.5, high level, all in vessel CV 204, ODIN condensate/methanol separator. They will also be stopped by activation of TSH 203.5, high temperature in the TEG.

5. EMERGENCY SHUTDOWN

(b) Pumps CP 220B/C will be stopped by activation of PSL V213.3 low pressure, PSH V213.5 high pressure, or LSH 213.5, high level in vessel CV213, NEF condensate/methanol separator. They will also be stopped by activation of TSH 211.5, high temperature in the TEG.

(c) If the methanol/water is allowed to stay within the pipe without being withdrawn, any pressure built up in the system will be evacuated through the pressure control valves PCV V204.2, for the ODIN separator and PCV V213.2, for the NEF separator.

(d) In case of a tube failure in the exchanger, the three phases; gas, condensate and methanolated water, will leak into the shell side of the exchanger. This is due to a lower operating pressure on the shell side than on the tube side (5 bara and 20 bara respectively). From the shell, the liquid enters the TEG pipe which is designed for 25 bara. From there it will go to the drainage system via pumps CP 13A/B



TRIETHYLENEGLYCOL TEG SYSTEM FIG. 2.6.1.

2.7. PROCESS DRAINAGE SYSTEM

1. INTRODUCTION

The closed drainage system is divided into two separate systems:

- drains from high pressure vessels
- drains from low pressure vessels

2. DRAINS FROM GAS TREATMENT PLANT

Drains from the gas treatment plant, including LT Relief Scrubber, includes drains from the following vessels;

- CV 1A ODIN FWKO
- CV 201 ODIN gas scrubber
- CV 210 NEF FWKO
- CV 211 NEF gas scrubber
- CM 201 ODIN pig receiver
- CV 226 LT relief scrubber

All drains from these high pressure vessels are sent to the already existing system on the TCP2.

3. DRAINS FROM LIQUID TREATMENT PLANT (Fig. 2.7.1)

Methanolated water drainage system is added to drain all low pressure vessels containing methanolated water. The following vessels are included in the system:

- CV 204 ODIN condensate/methanol separator
- CV 213 NEF condensate/methanol separator
- CV 220 Methanolated water flash drum
- CP 13A/B Glycol drainage system

The drains are gathered into a header going to the methanolated water drainage tank CV 222.

When the liquid reach a set high level in vessel CV 222, the drainage tank pump CP 224 will start, and send the liquid to vessel CV 220 Methanol Water Flash Drum. When the liquid reach a set low level in CV 222 the pump will stop. The pump will also stop at a high level in vessel CV 220

<u>Equipment Design:</u>

CV 222 Methanolated Water Drainage Tank:

Design pressure:	3 bara
Design temperature:	50°C
Capacity:	3,46 cbm
Diameter:	800 mm
Length:	7026 mm

3. DRAINS FROM LIQUID TREATMENT PLANT (Fig. 2.7.1)

Equipment Design: (contd.)

CP 224 Drainage Tank Pump:

Design pressure:	16 bara
Design temperature:	50°C
Capacity:	3 m^3

4. OPERATION

For start up and operating of the process drainage system please see Operating Manual: 'Operating conditions and Controls for Process Drainage System' which includes: 'Indicator and Recorder Check List' and 'Alarm and Shutdown Points'.

No special adjustment has to be done for the process drainage system. When required, open the vessel drainage valves and start pumps. Drainage valves for each vessel should normally be closed. For setting of valves in the methanol water drainage system, please see 'Equipment Setting List'.

The operator's tasks and responsibilities during routine operation will be to:

(a) Check that valves are set in the configuration described in the 'Equipment Setting List'.

(b) Check that indicators listed in the 'Indicator and Recorder Check List' are operating.

(c) Ensure that the pressure data is within normal range and do not reach critical values.

(d) Check liquid level in CV 222.

(e) Drain vessels when necessary.

(f) Upon alarm initiation, find the cause of trip and start the proper action accordingly, to restore good operating conditions as indicated in the 'Alarm and Shut-down Points List'.

Schedule and Report Sheets

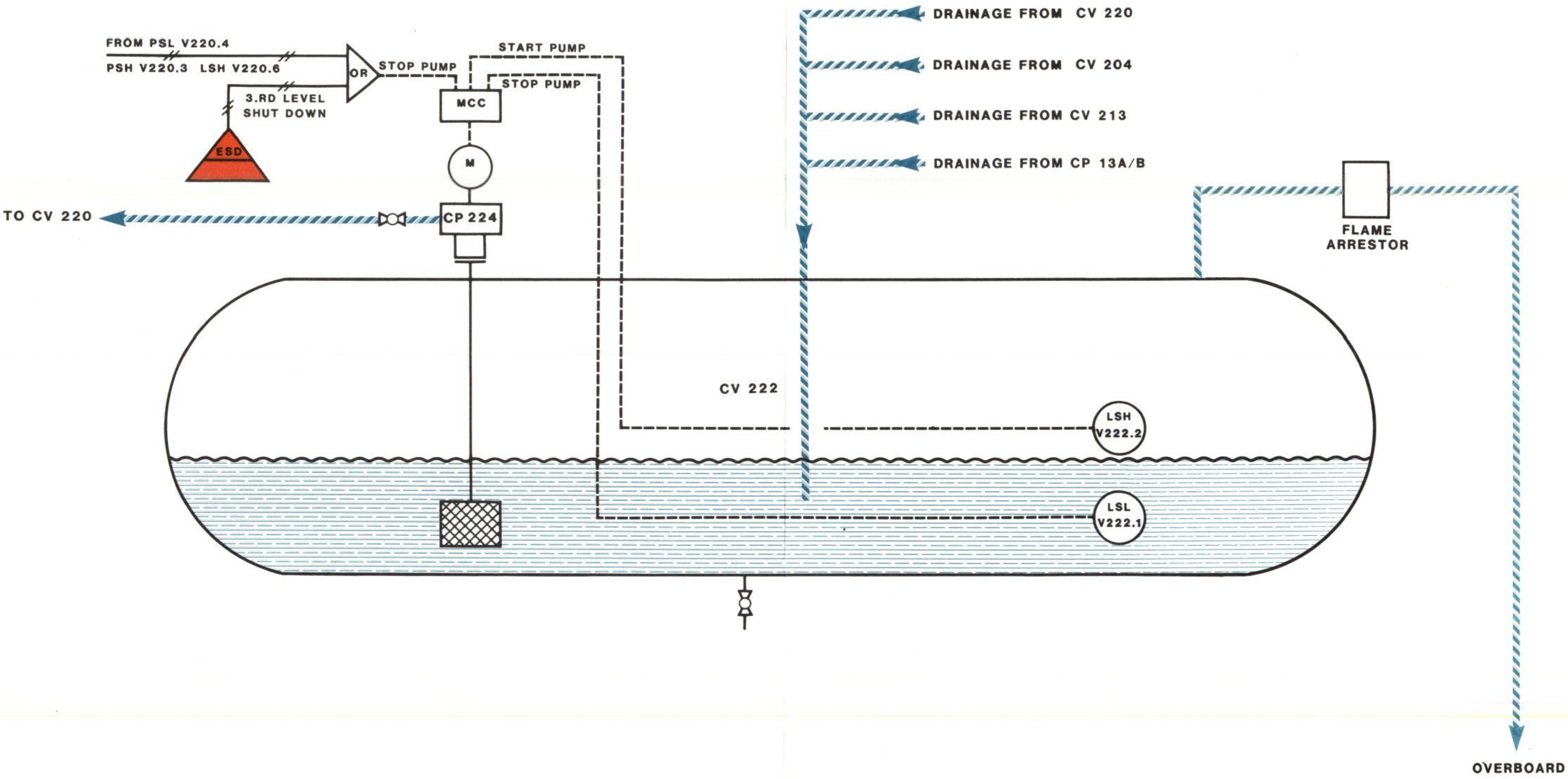
(a) The operator has to make a regular check on the liquid level in CV 222, as well as record any abnormal operating conditions.

5. EMERGENCY SHUTDOWN

For complete information on the ESD system, please see chapter 2.2.9.

(a) The pump CP 224 will start upon LSH V222.2, high level in CV 222.

(b) The pump will stop upon PSL V220.4, PSH V220.3, low and high pressure in vessel CV 220, LSH V220.6, high level in vessel CV 220, or 3. level shutdown on TCP2. It will also stop upon LSL V222.1, low level in CV 222.



PROCESS DRAINAGE SYSTEM FIG. 2.7.1

2.8. FUEL GAS

2.8.1 Introduction

2.8.2 Fuel Gas for Blanketing

2.8.3 Fuel Gas used as Start-up Gas

2.8.4 Operation

1. INTRODUCTION

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

2. FUEL GAS FOR BLANKETING

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

- CV 213 NEF condensate/methanolated water separator
- CV 204 ODIN condensate/methanolated water separator
- CV 220 Methanolated water flash drum.

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

3. FUEL GAS USED AS START UP GAS

The ODIN sealine pressurization will be performed from the ODIN field.

The NEF sealine cannot be pressurized from the field because of the submarine wellheads. A high pressure start up gas line is provided for this purpose.

This gas is taken from the existing fuel gas supply header C852 EF 3 FG.

4. OPERATION

The fuel gas comes from the existing fuel gas system on TCP2. For start up and operating, please see the Operating Manual for TCP2.

For operating on TCP2 Extension, please see the Operating Manual: 'Operating Conditions and Controls for the Fuel Gas System'.

The operators tasks and responsibilities during normal will be to:

(a) Check that the valves are set in the configuration described in the 'Equipment Setting List'.

2.9. SAFETY SYSTEMS

2.9.1A High Pressure Relief System

2.9.1B Low Temperature Relief System

2.9.2 Low Pressure Relief System

2.9.3 Shutdown System

2.9.4 Fire and Gas Detection System

2.9.5 Fire Water and Deluge System

2.9.1A. High Pressure Relief System

1. INTRODUCTION

The high pressure equipment and feed lines on TCP2 Extension are equipped with gas relief systems for safe operation. These systems are the existing high pressure (HP) relief system and the low temperature (LT) relief system, for high and low temperature gas release respectively.

2. SYSTEM DESCRIPTION (Fig. 2.9.1)

High pressure relief gases from TCP2 Extension are released through the existing HP relief system on TCP2.

The gas release to HP relief system originates from:

(a) Fire safety valves (PSV V1A 6/7) on CV 1A (ODIN FWKO)

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

Due to the depressurization of NEF sealine, the pressure (in the sea line) should be equal to or lower than 100 bara, and the temperature downstream the blowdown valve should be equal to or higher than - 40°C. This is to protect the HP relief system from conditions exceeding the design conditions.

The advantage of depressurizing this way, is that the blowdown flow rate can be increased due to the capacity of the HP relief system.

The gas which have to be relieved is collected in the existing HP headers and sent to the HP relief scrubber (CV 24).

The gas phase from the scrubber is sent to the articulated flare, while the liquid phase is sent to process drainage system under level control.

Design data for CV 24:

Pressure:	59.3 bara
Temperature:	- 55°C
Capacity:	34 MMSCM/D
Diameter:	1552 mm
Length:	4050 mm

2. SYSTEM PROTECTION (Fig. 2.9.1)

Protection against external malfunction of the HP relief system is done by:

- overruling authorization signal from CCR
- PSL M210.5
- TSL M210.2

Before any depressurization through to the HP system is possible, an authorization signal has to be given from CCR. This does not however, apply for the PSV's.

The pressure swich low (PSL M210.5) is located upstream the depressurization valve (FCV M210.2) to the HP relief system. The PSL will not pass any gas through to the HP relief system before the pressure is less or equal to 100 bara.

The temperature swich low (TSL M210.2) is located downstream the depressurization valve (FCV M210.2) to the HP relief system. The TSL protects the HP piping from too low temperatures, by closing FCV M210.2 if temperature is less than - 40°C.

The HP relief scrubber is protected against malfunction by:

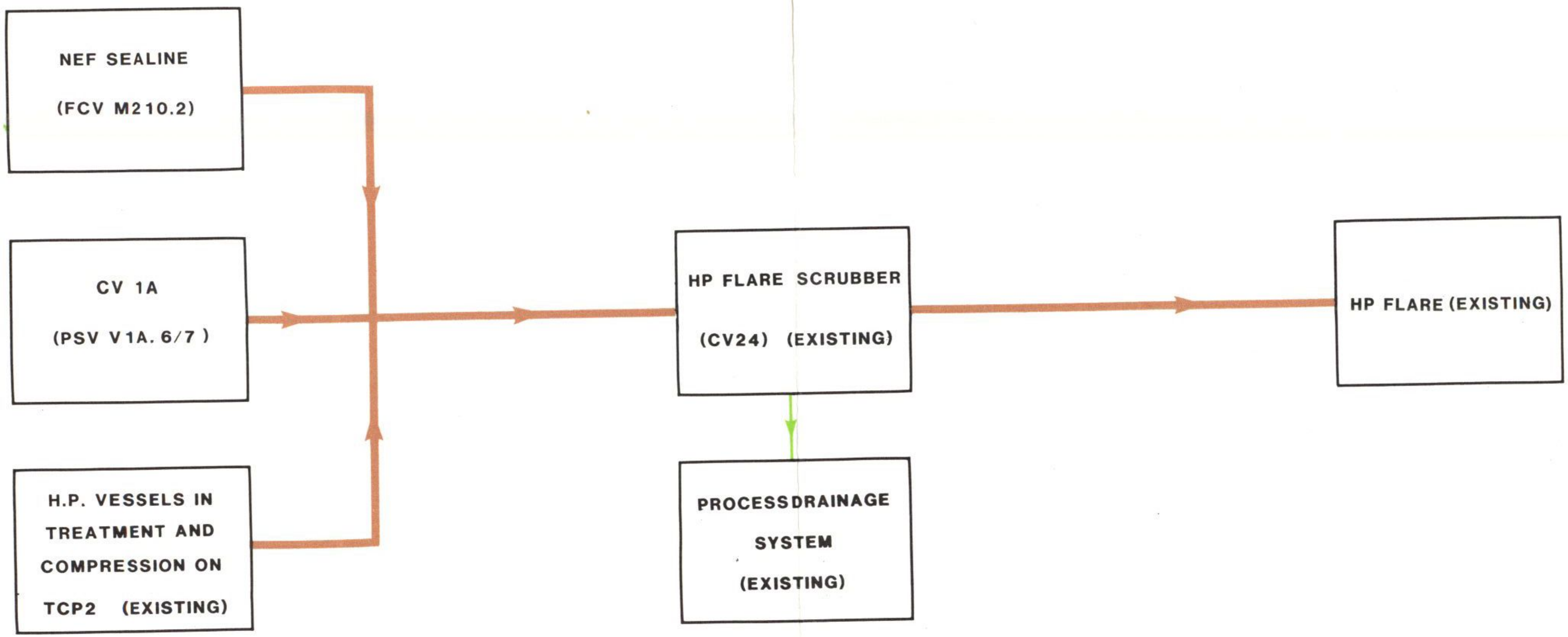
- 24" by-pass header
- LC V24.1/4
- LSH V24.3/4
- LSL V24.8/9

The 24" by-pass header protects the scrubber from overpressure, by means of a rupture disc installed in the header. This rupture disc bursts if the pressure drop across CV 24 exceeds 3.14 bar. Thereby the gas flows through the by-pass header instead of through the scrubber. An alarm (FAH V24.4) indicates this in CCR.

The level controllers (LC V24.1/4) controls the liquid level in CV 24, by means of level controller valves (LCV V24.1/4).

If the level controllers fail in service, the level switch high (LSH V24.3/4) and level switch low (LSL V24.8/9) protect CV 24 from increasing or decreasing liquid level respectively.
The LSH V24.3/4 give alarm in QP.

The LSL V24.8/9 give both alarm on QP and close level controller valves (LCV V24.8/9)



BLOCK DIAGRAM HP FLARE SYSTEM FIG. 2.9.1

2.9.1B Low Temperature Relief System

1. System Description
2. System Protection

Fig. No.
2.9.2 Block Diagram LT Relief System
2.9.3 LT Relief Scrubber CV 226 Instrumentation

1. SYSTEM DESCRIPTION (Fig. 2.9.2/3)

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

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

- High pressure vessels and lines via PSV's (except CV 1A) and ESDV's
- NEF and ODIN sealines via FCV M210.3 and CSP M201.3 respectively.

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

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

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

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

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

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

1. SYSTEM DESCRIPTION (Fig. 2.9.2/3)

(b) Depressurization of Sealines

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

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

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

As pressure drops below 100 bara the depressurization will be transferred to HP relief system, through depressurization valve FCV M210.2 and manually operated isolation valve HV M210.4. (The corresponding valves for LT relief system will be closed). The advantage of depressurizing this way is the increased blow down flow rate.

Intitial depressurization periode:

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

Final depressurization periode:

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

Depressurization of ODIN sea line will be operated from ODIN platform. Provisions have however been made to depressurize partially the ODIN sealine from TCP2 in case of plugging of the line by pigs or other unusual situations.
The blowdown is performed by opening of the choke valve CSP M201.3

Depressurization conditions:

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

2. SYSTEM PROTECTION (Fig. 2.9.2/3)

Protection against external malfunction of LT relief system is done by:
- authorization signal from CCR
- FSH V226.1

Before any depressurization of NEF sealine to LT relief system is possible, an authorization signal has to be given from CCR.

During blow down periode the LT relief system will be protected from excessive flow by means of a flow switch high (FSH V226.1). The flow rate will be measured by two annular elements (FE V226.1/2) located downstream vessel CV 226. If the flow rate by some means should exceed the design flowrate (2.8 MMSCM/D), the FSH will close the NEF depressurization valve (FCV M210.3). Before any further depressurization is possible, a new authorization signal has to be given from CCR.

The LT relief scrubber CV 226 is protected against malfunction by:
- LC V226.1
- LSH V226.2
- LSL V226.3

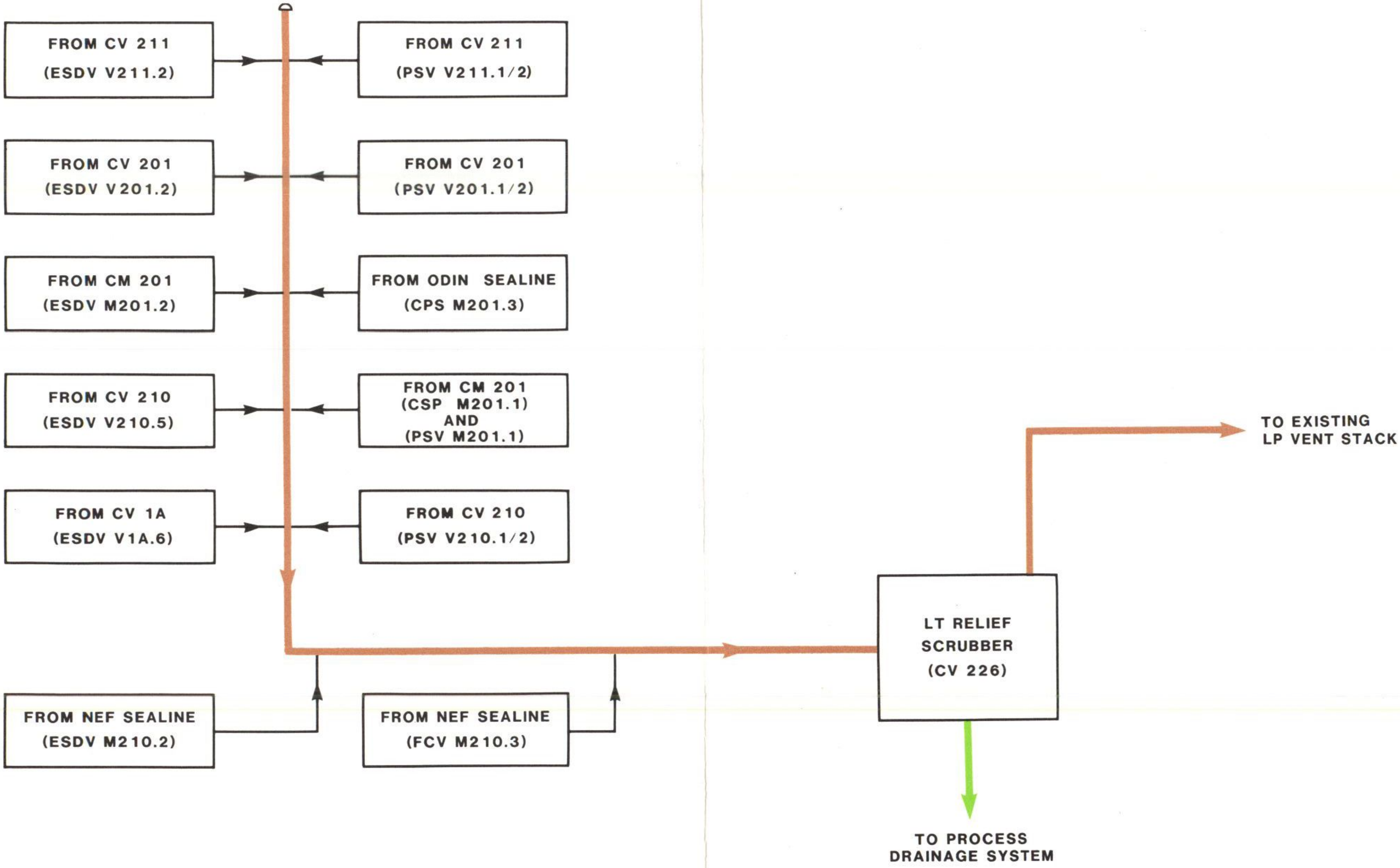
The level controller (LC V226.1) controls the liquid level in CV 226, by means of an on/off level controller valve (LCV V226.1).

If the level controller fails, the scrubber is further protected for both increasing and decreasing liquid level.

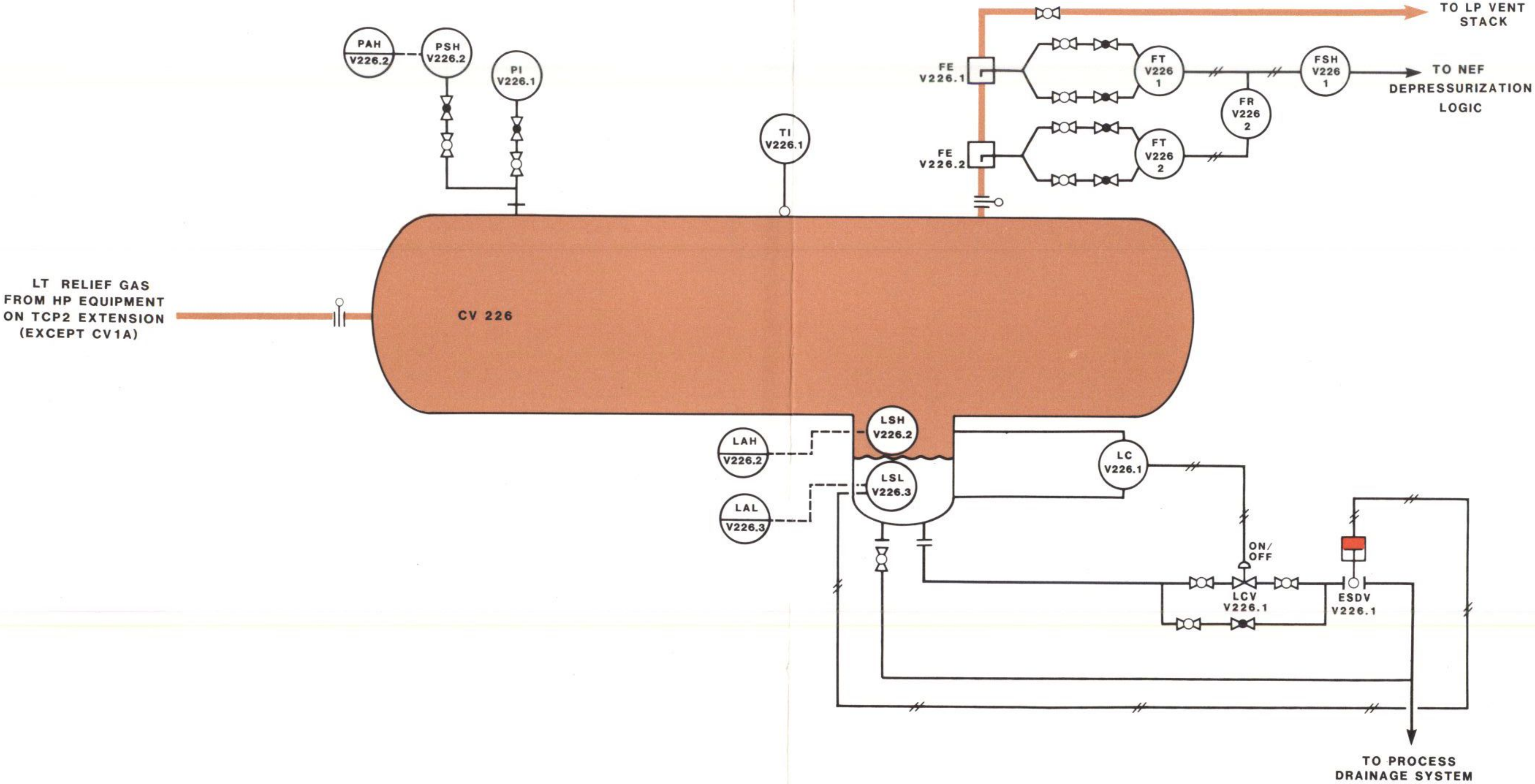
The level switch high (LSH V226.2) will give an alarm (LAH V226.2) in CCR if liquid level in CV 226 exceeds a set value.

The level switch low (LSL V226.3) will give both alarm (LAL V226.3) in CCR and close emergency shutdown valve (ESDV V226.1) if liquid level in CV 226 falls below a set value.

The ESDV V226.1 is located on drainage line downstream CV 226.



BLOCK DIAGRAM LT RELIEF SYSTEM FIG. 2.9.2



LT RELIEF SCRUBBER CV 226 INSTRUMENTATION FIG. 2.9.3

2.9.2. Low Pressure Relief System

1. INTRODUCTION

Low pressure gas or liquid equipment on TCP2 Extension is protected against excessive pressure by low pressure ventilation system (LP vent)

2. SYSTEM DESCRIPTION (Fig. 2.9.4)

Low pressure ventilation gases are released from low pressure equipment through existing LP ventilation system on TCP2.

Gas release orginates from:
- pressure safety valves (PSV's)
- pressure controller valves (PCV's)

The gas released through PSV's or PCV's is collected in headers and sent to LP ventilation scrubber (CV7).

The gas phase from the scrubber is further sent to the LP ventilation stack, (CSP 24) for ventilation to the atmosphere. The liquid phase is sent to the process drainage system under level control.

Design data for CV7:

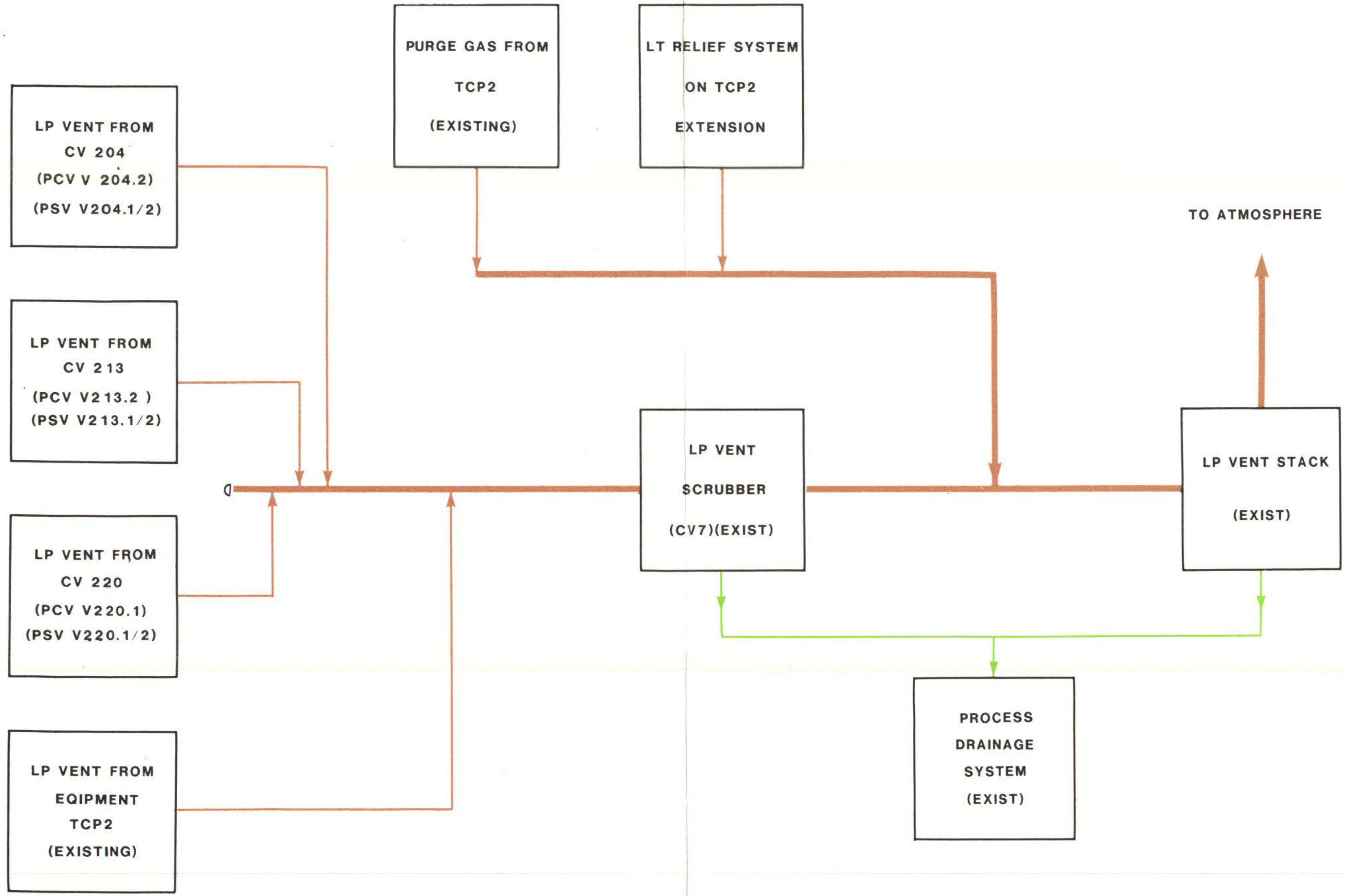
Pressure:	4,46 bara
Temperature:	100^{o}C

3. SYSTEM PROTECTION

The low pressure ventilation scrubber is protected against internal malfunction by:
- LC V7.2
- LSH V7.4

The level controller (LC V7.2) controls the liquid level in vessel CV 7, by means of a level controller valve (LCV V7.2) located on process drainage line downstream CV 7.

If the level controller fails in service, a level switch high (LSH V7.4) protects CV 7 from increasing liquid level. An alarm (LAH V7.4) indicates this in CCR.



BLOCK DIAGRAM LP VENT SYSTEM FIG.2.9.4

2.9.3. Shutdown System

1. INTRODUCTION

The emergency shutdown system (ESD) for TCP2 Extension is fully integrated in the existing ESD system for the TCP2 platform and is based on the same philosophy.

The intention of the ESD system is to avoid dangerous situations or to limit the consequences of the same, to avoid disturbances in part of the process or damage to process equipment.

All vessels, heat exchangers, pumps and the following lines:

- incoming sealines from NEF/ODIN fields
- methanol injection line to NEF articulated column
- methanolated water well injection to DP2

all protected against undesireable events as described in API Recommended Practice 14 C.

The only exceptions from this practice is the fuel gas system used as blanket gas for vessels CV 204, CV 213 and CV 220. These vessels are protected against leakage by PSL sensors.

1.1 Auxiliary Systems, - Release

Three auxiliary systems are utilized to operate the ESD system. These are as follows:

- hydraulic power system with back-up bottles
- instrument air with back-up bottles
- electric power with battery back-up.

The ESD system can be released either manually by pushbuttons, or automatically by fire/gas detection or by process faults. The ESD valves can only be opened again when the reason for ESD action is eliminated, and an authorized signal is given from the control centre.

The time response for the system will be within 45 seconds i.e. the time from the signal is initiated by the sensor until the ESD valve is fully closed shall not exceed 45 seconds.

2. SYSTEM DESCRIPTION

The ESD system is divided into 5 levels, 1st, 2nd, 3rd, 4th, and 5th level respectively. Level 4 and 5 are defined as the process safety system and is an integrated part of the total ESD system. Thus, a process safety function is to be defined as closing of an ESD valve/valves or a pump to be switched off.

1st level

1st level shutdown can only be released manually by using the pushbutton in QP Central Control Room (CCR). The action is shutdown of the whole field, including isolation of the platforms by closing ESD valves on the bridge lines. It also includes Disaster Shutdown signal (DSD) on DP2 and CDP1. There is no cascade action to level 2 and hence no decompression. The 5.5 kV generators G01A, G01B, TA4, 5 and 6 will be shut down. Non essential electrical consumers are isolated and firewater pumps CP6A and CP6B will start.

2nd level

2nd level shutdown of TCP2 treatment and compression is also manually released only by pushbuttons located in QP, CCR and TCP2 Interface Room.

The action is the same as for 1st level with the following exceptions:

- the 5.5 kV generators are not affected
- ESD signal only to DP2
- decompression of bridge lines and treatment lines.

3rd level

3rd level shutdown can be released either manually by pushbuttons or automatically by fire or gas detection. Action on 3rd level is similar to that of 2nd level with following exceptions:

- no decompression and no ESD signal to DP2.

Automatic release of Deluge valves for relevant fire/gas affected area in parallel with 3rd level shutdown.

4th & 5th level - The Process Safety System

Release on 4th level is both manually and automatically, whilst 5th level is automatically released only, by process faults.

2.1 TCP2 Extension - Grouping of ESD Valves (Fig. 2.9.5/6)

On TCP2 Extension the ESD valves are grouped together in three groups as follows:

- group 'O' is ODIN stream isolation
- group 'N' is NEF stream isolation
- group 'U' is closing of sealines.

In addition a group 'W' is for blow-down (decompression) of vessels and pipelines.

2. SYSTEM DESCRIPTION

2.1 TCP2 Extension - Grouping of ESD Valves (Fig. 2.9.5/6) (contd.)

(a) Group 'O' - ODIN stream isolation

3rd level shutdown signals or higher levels will cause isolation of the group 'O' ODIN stream.

4th level shutdown ODIN will also cause isolation of group 'O'.
The following conditions will cause 4th level shutdown group 'O':

- low pressure in sealine - PSL M201.1
- low pressure in FWKO CV 1A - PSL V1A.2A
- low pressure in gas scrubber CV 201 PSL 201.3
- 4th level shutdown signal from ODIN MODULE
- 4th level shutdown signal from INTERFACE ROOM.

This 4th level shutdown ODIN will cause isolation of all ESD valves in group 'O' which consists of following ESD valves:

FWKO CV1A

- gas inlet CV 1A:	ESDV V1A.1
- condensate outlet CV 1A:	ESDV V1A.2
- condensat outlet CV 1A:	ESDV V1A.3
- gas outlet CV 1A:	ESDV V1A.4

Gas scrubber CV 201

- gas outlet CV 201:	ESDV V201.1A
- gas outlet CV 201:	ESDV V201.1B
- condensate outlet CV 201:	ESDV V201.3

Condensate/methanol separator CV204

- MW outlet CV 204:	ESDV V204.2
- condensate outlet CV204:	ESDV V204.1

The above ESD valves represent group 'O' of the ESD system on the 4th and 5th level. The 5th level represents a selective shut down for one part or one single valve in the process.

A temporary isolation of the ODIN Gas Treatment will not require an overall shutdown unless intended for a longer period, and the process may continue.

According to the capacities of the condensate separation equipment, CV 204 and CV 213, and the respective flowrates, the isolation time must not exceed one hour. If longer isolation period is required, shutdown of the process line will be necessary.

2. SYSTEM DESCRIPTION

2.1 TCP2 Extension - Grouping of ESD Valves (Fig. 2.9.5/6) (contd.)

(b) Group 'N' - NEF stream isolation
3rd level shutdown signals or higher levels will cause isolation of the group 'N' NEF stream.

4th level shutdown NEF will also cause isolation of group 'N'.
The following conditions will cause 4th level shutdown group 'N':

- low pressure in sealine - PSL M210.1
- low pressure in FWKO CV 210 PSL V210.1
- low pressure in gas scrubber CV 211 PSL 211.3
- 4th level shutdown signal from NEF MODULE
- 4th level shutdown signal from INTERFACE ROOM

This 4th level shutdown NEF will cause isolation of all ESD valves in group 'N' which consists of following ESD valves:

FWKO CV 210

- gas inlet CV 210:	ESDV V210.1
- condensate outlet CV 210:	ESDV V210.2
- condensat outlet CV 210:	ESDV V210.3
- gas outlet CV 210:	ESDV V210.4

Gas scrubber CV 211

- gas outlet CV 211:	ESDV V211.1A
- gas outlet CV 211:	ESDV V211.1B
- condensate outlet CV 211:	ESDV V211.3

Condensate/methanol separator CV213

- MW outlet CV 213:	ESDV V213.2
- condensate outlet CV213:	ESDV V213.1

The above ESD valves represent group 'N' of the ESD system on the 4th and 5th level. The 5th level represents a selective shut down for one part or one single valve in the process.

A temporary isolation of the NEF Gas Treatment will not require an overall shutdown unless intended for a longer period, and the process may continue.

According to the capacities of the condensate separation equipment, CV 204 and CV 213, and the respective flowrates, the isolation time must not exceed one hour. If longer isolation period is required, shutdown of the process line will be necessary.

2. SYSTEM DESCRIPTION

2.1 TCP2 Extension - Grouping of ESD Valves (Fig. 2.9.5/6) (contd.)

(c) Group 'U' - Closing of Sealines
3rd level shutdown signals or higher levels will cause isolation of group 'U', closing of sealines.
4th level shutdown signal on either ODIN or NEF will not affect group 'U'.

The group 'U' consists of following ESD valves:

Methanolated water flash drum CV 220
- condensate outlet CV 220 : ESDV V220.1
- MV outlet CV 220 : ESDV V220.2

NEF pipeline : ESDV M10.1

ODIN pipeline : ESDV M210.1

Methanol injection NEF
- methanol injection pump CP 12A/B : ESDV P12.1

Methanolated water after inhibitor injection
- methanolated water line: ESDV M9.2

The above ESD-valves represents group 'U'. The 5th level represents a selective shut down for one part or one single valve in the process.

Isolation of CV 220 must be on temporary basis only: less than one hour. If a longer isolation time is required, shutdown of the whole system, NEF and ODIN will be necessary.

Isolation of the methanol injection system will increase the risk of hydrate formation in the sealine. There is two injection pumps CP 12A/B, available where one is kept as stand-by.

(f) Group 'W' - Blow Down (decompression)
High pressure process equipment located in Module 50, is sectionalized by means of isolation ESD valves. In case of emergency these ESD-valves can be closed upon signals from the control rooms.

After isolation of the various sections, it is possible to blowdown theses sections manually or the whole treatment plant from the control room by 2nd level shutdown. By doing this, one thereby reduces the pressure by removing gases from the high pressure vessels and lines. Otherwise the equipment would be weakened by exessive heating when exposed to fire.

2. SYSTEM DESCRIPTION

2.1 TCP2 Extension - Grouping of ESD Valves (Fig. 2.9.5/6) (contd.)

All blow down ESD valves are connected to the L.T. Relief System.

Depressurization time is 1.5 hour which is identical to TCP2 Treatment Plant.

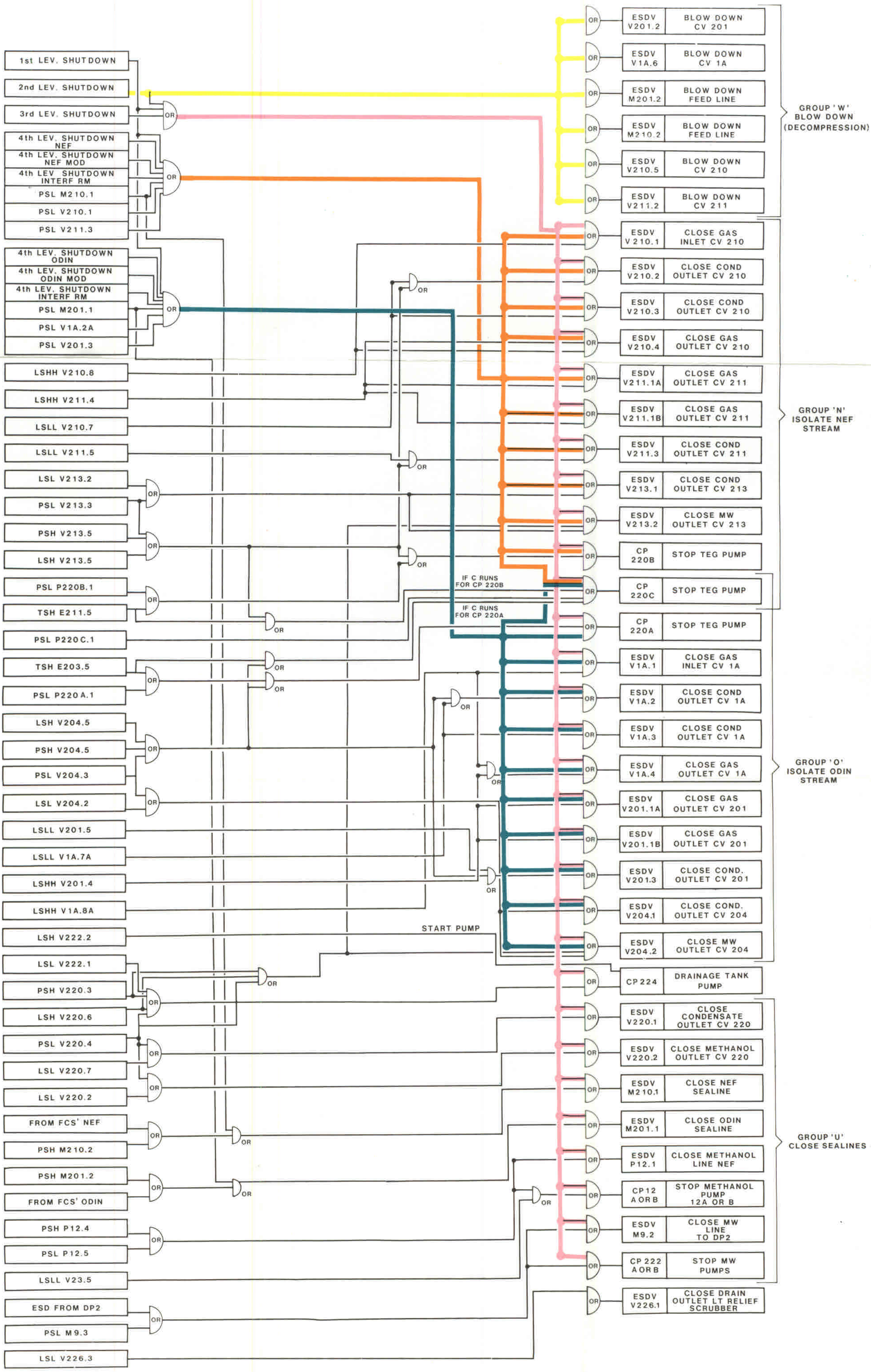
The group 'W' consists of following blow down ESD valves:

- ODIN feed line	:	ESDV M201.2
- FWKO CV 1A	:	ESDV V1A.6
- Gas scrubber CV 201	:	ESDV V201.2
- NEF feed line	:	ESDV M210.2
- FWKO CV 210	:	ESDV V210.5
- Gas scrubber CV 211	:	ESDV V211.2

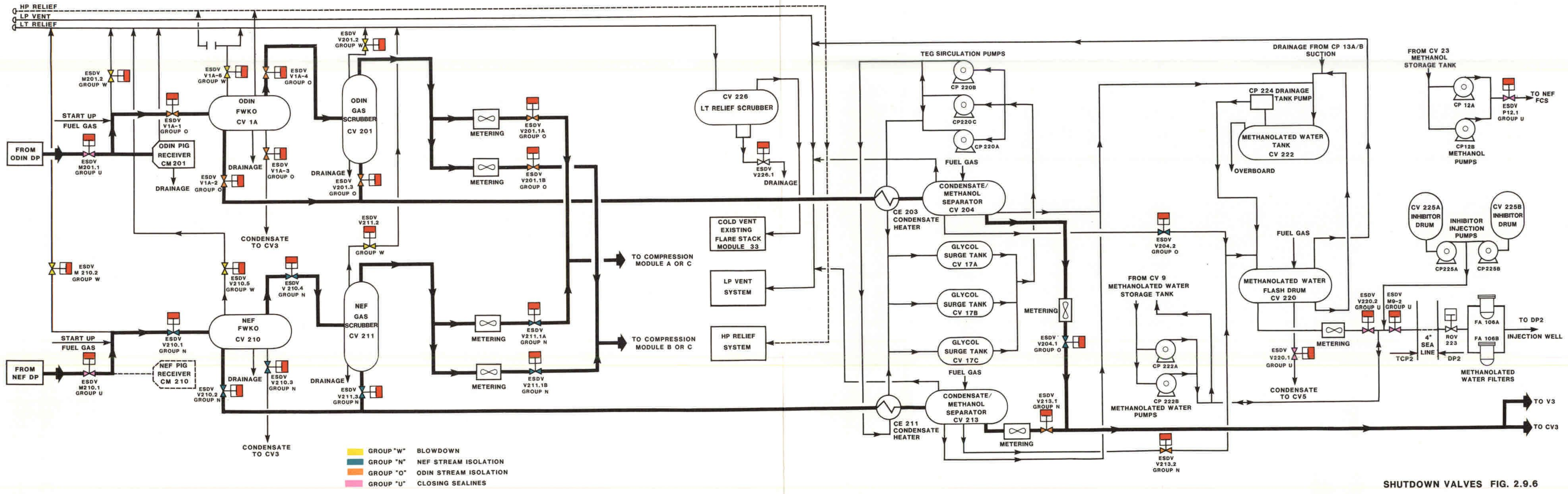
The sealine blowdown is not connected to the ESD system. This blowdown action is voluntary which is performed whenever operation conditions and valve positions are satisfactory.

2.2 T.E.G. System

Shutdown of the TEG system does not have a severe effect on the process. Utilization of the by-pass enables the process to continue in the case of shutdown of the TEG system.



SHUTDOWN LOGIC DIAGRAM FIG. 2.2.5



SHUTDOWN VALVES FIG. 2.9.6

2.9.4. Fire and Gas Detection System

1. INTRODUCTION

The TCP2 Extension is provided with gas and fire detection system in order to obtain the required level of safety and against explosion and fire risk.

The gas and fire detection system which is installed in Module 50 and in Pancake 53 is an extension to the existing system on TCP2.

The gas and fire detection system consists of following sections:

(a) field mounted gas and fire detectors and manual fire alarm buttons

(b) control units with a control module for each detector. The control unit is located in the interface room

(c) interface to ESD system on 3rd level

(d) electrical supply of 220V AC no-break and 24V DC emergency

(e) an alarm annunciator panel located in the central control room on QP platform

(f) a mimic panel located in the central control room on the QP platform.

2. SYSTEM DESCRIPTION (Fig. 2.9.7/8)

2.1 Gas and Fire Detectors

The gas detectors will sence the presence of hydrocarbon gases, thus indicating a potentially dangerous inflammable atmosphere. The gas detector loop will be working in coincidence, two out of two.

The fire detectors will sence the presence of flame and/or smoke, thus indicating a potentially dangerous occurance of fire.

2.2 Control Units

For each gas detector the control unit provides the following:

(a) continous meter indicating of gas concentration in percentage of LEL

(b) visual 1st and 2nd level alarm indications

(c) visual fault indication

(d) automatic relay switching facility in alarm and fault conditions

(d) intergral alarm level adjustment and test facility.

2. SYSTEM DESCRIPTION

2.2 Control Units (contd.)

For each fire detector the control unit provides the following:

(a) a red lamp indicating detection of fire or activation of manual fire alarm button

(b) indication of zone of dangerous occurance

(c) individual test facility for each control module

(d) individual isolation facility for each control module

(e) indication of zone fault

(f) indication of power failures.

2.3 Interface to ESD system on 3rd level

Upon detection of a fire or gas a 3rd level shutdown will be initiated as a result of the interface connection between ESD system and fire and gas detection system. The result of a 3rd level shutdown is described in section 9.3 Shutdown System of this manual.

2.4 Electrical Supply

TCP2 Extension will be fed by TCP2 Compression, 220 V no-break system. It consists of an emergency diesel generator, a static switch, an inverter, a charger and a battery bank which compensates for the loss of power during start up of the emergency diesel.

The battery bank will last for at least 30 mins. The capacity of the fuel tank in connection with the emergency power supply is sufficient for 24 hours operation 24V DC emergency will be fed by TCP2 Treatment.

2.5 Alarm Annunciator

The alarm annunciator panel indicates the following:

(a) a gas alarm condition and the zone and level of incident

(b) whether it is a fire detector or a manual fire alarm button which has been initiated and the zone and level of incident.

(c) low pressure (discharge) on deluge system plus the zone and level of incident.

2. SYSTEM DESCRIPTION

2.5 Alarm Annunciator (contd.)

(d) 60% LEL condition

(e) fault on gas detection system

(f) fault of fire detection system.

2.6 Mimic Panel

The mimic panel will give quick reference to the zone and level of incident.

2.7 The Gas and Fire Detection System

The gas detection system will be of a normal fail safe type (normally energized relay) and it will sense the following faults:

- sensor cable open circuit
- open circuit detector element
- power supply failure

The fire detection system will be of a normal fail safe type. Any leaks or breaks in detection loop, will result in a visual and audible alarm. All vital relays will upon a failure either give a visual and audible alarm or be monitored for coil failure. The fire detection system will in case of AC supply failure and/or DC supply failure give visual and audible alarms. Detection system integrity will be constantly monitored in QP central control room.

2.8 The Gas Detection System

The positioning of the gas detector heads have been evaluated in accordance with following assumptions:

(a) strategic positions where there is a possibility of a leak

(b) whether the gas to be detected is heavier than air

(c) the leaking gas is drifting due to air movements

(d) the leaking gas is 'pocketing' due to the structure

(e) the space limit between two detectors working in coincidence is 3 meters

All detector heads, except four, are mounted at high level due to light gases.

Two heads in Module 50 lower level (CV 210) and two in Pancake 53 (CV 204 - CV 213) are mounted at low level to detect the possible release of condensate containing heavy gases.

2. SYSTEM DESCRIPTION

2.8 The Gas Detection System (contd.)

The detector/control module will be calibrated according to the composition of the gas to be measured.

The two levels of gas to be detected are 20% and 60% of the lower explosion level (LEL).

When 20% LEL is detected an audible and visual alarm in the CCR will occur and 20% LEL indicated.

When 60% LEL is detected an audible and visual alarm in the CCR will occur and 60% LEL indicated.

If this 60% LEL is confirmed by the detector working in coincidence the following will occur automatically:

(a) 3rd level shutdown will be initiated

(b) fire water pump starts

(c) deluge is released in the affected area.

2.9 The Fire Detection System

Two types of fire detectors are installed, smoke and flame detectors.

Ultra violet (U.V.) flame detectors have been selected as the main system due to environment loads and influence on other available systems (open space areas and semi open space areas having adequate natural ventilation). As a further protection to the semi enclosed areas smoke detectors have been installed to detect smoky fires from such sources as condensate or other sources.

U.V. flame detectors are used to scan all hazardous areas. The scanning angle are approx. 90°, and the sensivity of the detectors is preset according to the area to be covered.

Should an U.V. flame detector be activated there will be an audible alarm, on indication of the alarm annunciator and on indication of the mimic panel in the QP control room. If the U.V. flame detector remain activated for a preset period of 5 - 30 seconds the following will occur automatically:

- the P.A. fire alarm will sound
- 3rd level shutdown will be initiated
- fire water pumps starts
- deluge is released in the affected area.

2. SYSTEM DESCRIPTION

2.9 The Fire Detection System (contd.)

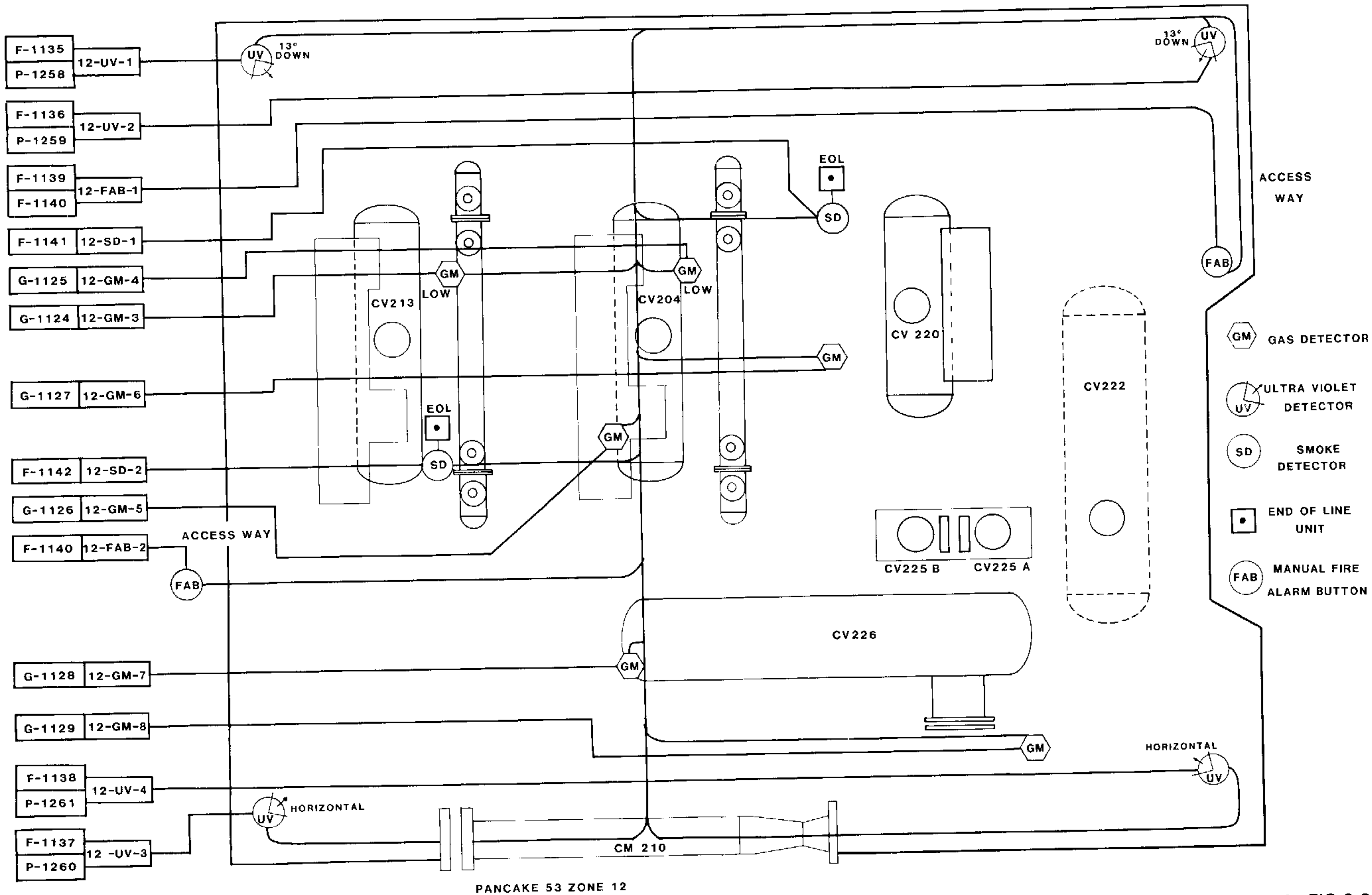
Smoke detectors are installed in Module 50, lower level and Pancake 53.

The smoke detectors are connected into loops. One smoke detector loop is connected in coincidence with a second loop. Activation of one loop results in an audible alarm, indication on the alarm annunciator and an indication on the mimic panel in the QP control room.

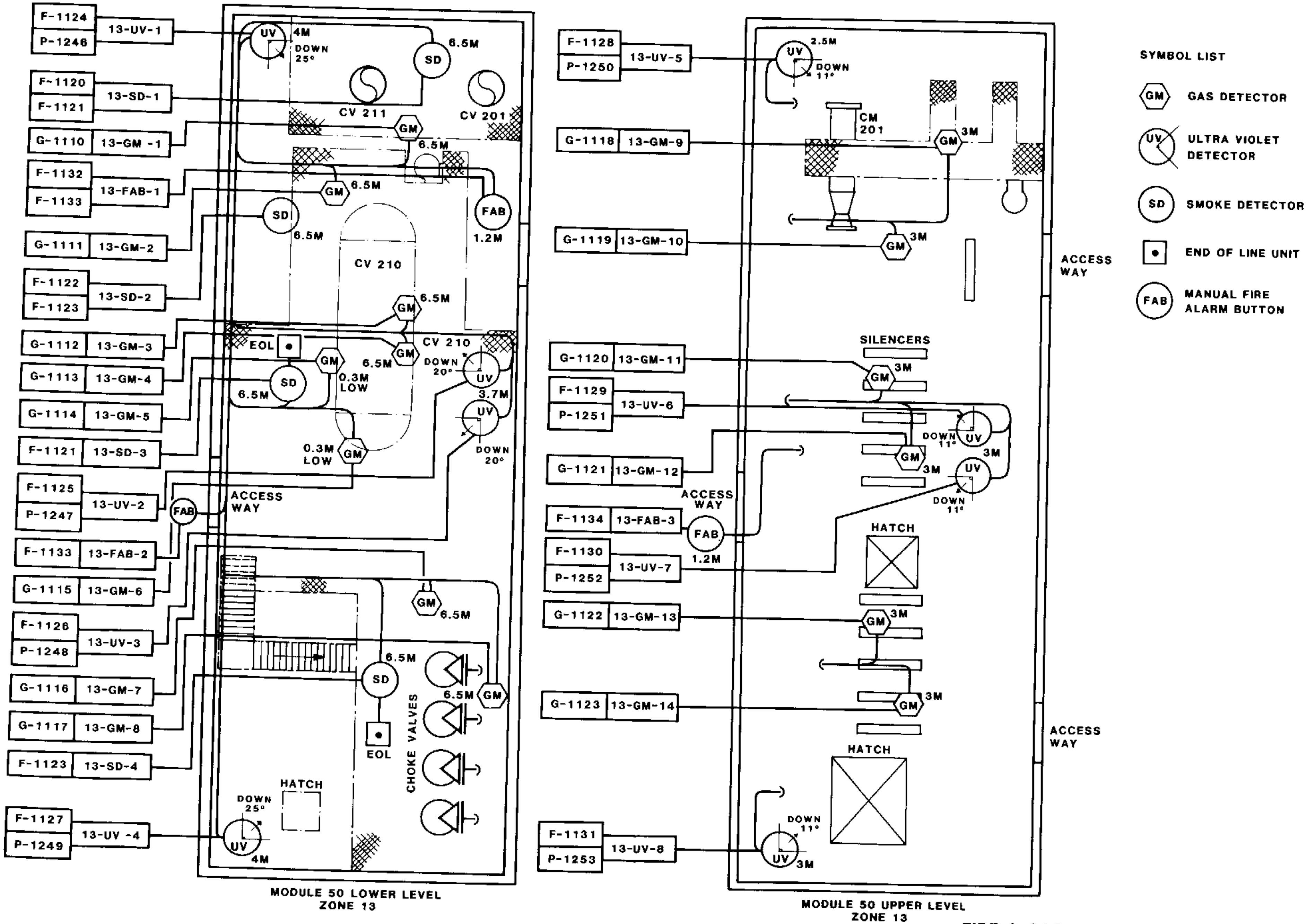
If a confirmation of the second loop occurs, an initiation of the described sequence as for the U.V. flame detectors occurs.

Manual fire alarm buttons are installed near access ways in Module 50, lower level and in Pancake 53.

The use of manual fire alarm buttons results in the same sequence as described for U.V. flame detectors and smoke detectors except that the deluge will not be released.



FIRE & GAS DETECTION PANCAKE 53 ZONE 12 FIG.2.9.7



FIRE & GAS DETECTION FIG. 2.9.8

2.9.5 Fire Water and Deluge System

1. Introduction
2. System Description

Fig. No.
2.9.9 Firewater and Deulge System

1. INTRODUCTION

The Fire Water System on TCP2 Extension is connected to the Main Distribution of the TCP2 Fire Water System, and hence no Fire water pumps on TCP2 Extension.

The fire water system consists of:

- deluge system
- hose reels
- monitors
- foam units

The purpose of the fire water system is:

- to extinguish a fire
- to protect essential equipment.

2. SYSTEM DESCRIPTION (Fig. 2.9.9)

As TCP2 Extension have no separate fire water pumps, the supply of water is mainly provided from treatment ring mains, and the water systems for QP, TP1 and TCP2 are fully interconnected.

The general fire water header is always kept under pressure of 5.5 bara by means of two brine pumps, P4A and P4B located on QP, and one of the fire pumps will start if this pressure drops below 2.1 bara.

The fire water discharge the water through 10" pipes to the respective ring mains, the discharge pressure being limited to 10.66 bara by a pressure control valve.

2.1 Fire Water Headers

A 12" Ring Main, located underneath the upper deck, encircles Module 50 and is fed as follows:

(a) From the ring main encircling the main/upper deck level of treatment section.

(b) From the ring main encircling the cellar deck level of treatment section through the Pancake 53 header.

In principle the Pancake 53 header is part of the ring main. This header consists of:

(a) A part of cellar and main/upper deck levels ring mains of treatment modules

(b) Cross connections of the two ring mains

(c) The ring main encircling Module 50 and the cross connecting to Pancake 53.

On the extension headers are installed sectional manual valves for isolating purposes.

2 SYSTEM DESCRIPTION

2.2 Deluge Systems

There is one deluge system in Pancake 53 and one on each deck in Module 50.

They all cover general areas as well as local protection of essential equipment, like pressure vessels.

The deluge systems have water supplied from two sides. Pancake 53 has one supply from the pancake header, the other is from the compression ring main. Module 50 has one supply from its own ring main and the other from the 12" cross connection to the pancake.

Each local deluge system, intended for vessel protection, can be isolated from the main system using the shut-off valves.

Each deluge valve operates on:

(a) Manual release using hydraulic manual emergency pull box.

(b) Manual release using the local release panel.

(c) Fire detection in relevant area causing 3rd level SD.

(d) Gas detection causing 3rd level SD.

The layout of the spray nozzles have been carefully studied in order to give the best equal distribution on the vessels and especially on NEF FWKO CV 210.

2.3 Hose Reels

There is two fire hose reels and two wash down reels on each deck in Module 50. Pancake 53 is equipped with two fire hose reels and one wash down reel.

The fire hose reels are fed from the fire water system which has 4" back up lines from the wash down water system. The wash down reels are fed from the wash down system only.

The nozzles are a combination of jet/spray/shut-off nozzles. The capacity is 360 l/min. at 8 bara.

2.4 Fire Monitors

Six fire monitors are installed on TCP2 Extension, two on each deck in Module 50 and 2 in Pancake 53.

The fire monitors are fed through a 4" line equipped with a shut-off valve and a fire hydrant.

2 SYSTEM DESCRIPTION

2.2 Deluge Systems

There is one deluge system in Pancake 53 and one on each deck in Module 50.

They all cover general areas as well as local protection of essential equipment, like pressure vessels.

The deluge systems have water supplied from two sides. Pancake 53 has one supply from the pancake header, the other is from the compression ring main. Module 50 has one supply from its own ring main and the other from the 12" cross connection to the pancake.

Each local deluge system, intended for vessel protection, can be isolated from the main system using the shut-off valves.

Each deluge valve operates on:

(a) Manual release using hydraulic manual emergency pull box.

(b) Manual release using the local release panel.

(c) Fire detection in relevant area causing 3rd level SD.

(d) Gas detection causing 3rd level SD.

The layout of the spray nozzles have been carefully studied in order to give the best equal distribution on the vessels and especially on NEF FWKO CV 210.

2.3 Hose Reels

There is two fire hose reels and two wash down reels on each deck in Module 50. Pancake 53 is equipped with two fire hose reels and one wash down reel.

The fire hose reels are fed from the fire water system which has 4" back up lines from the wash down water system. The wash down reels are fed from the wash down system only.

The nozzles are a combination of jet/spray/shut-off nozzles. The capacity is 360 l/min. at 8 bara.

2.4 Fire Monitors

Six fire monitors are installed on TCP2 Extension, two on each deck in Module 50 and 2 in Pancake 53.

The fire monitors are fed through a 4" line equipped with a shut-off valve and a fire hydrant.

2. SYSTEM DESCRIPTION

2.4 Fire Monitors (contd.)

The fire monitors are manually operated with 360° rotation and equipped with nozzle type Akron Aquastream and have a capacity of 1100 l/min. at 8 bara.

2.5 Foam Units

There is three fixed foam units in the extension areas. One on each deck in Module 50 and one in Pancake 53.

Each foam unit is connected to a fire hose reel, and is equipped with a shut-off valve which is normally closed.

The foam is mainly used to fight liquid hydrocarbon fires and to seal liquids to prevent reignition.

The foam units consists of tank, injector and foam liquid. The tank, made of stainless steel, has a capacity of approximately 120 l. The injector is mounted on top of the tank, and the liquid used is the AFFF (Aqueous Film Forming Foam).

2. SYSTEM DESCRIPTION

2.4 Fire Monitors (contd.)

The fire monitors are manually operated with 360^{o} rotation and equipped with nozzle type Akron Aquastream and have a capacity of 1100 l/min. at 8 bara.

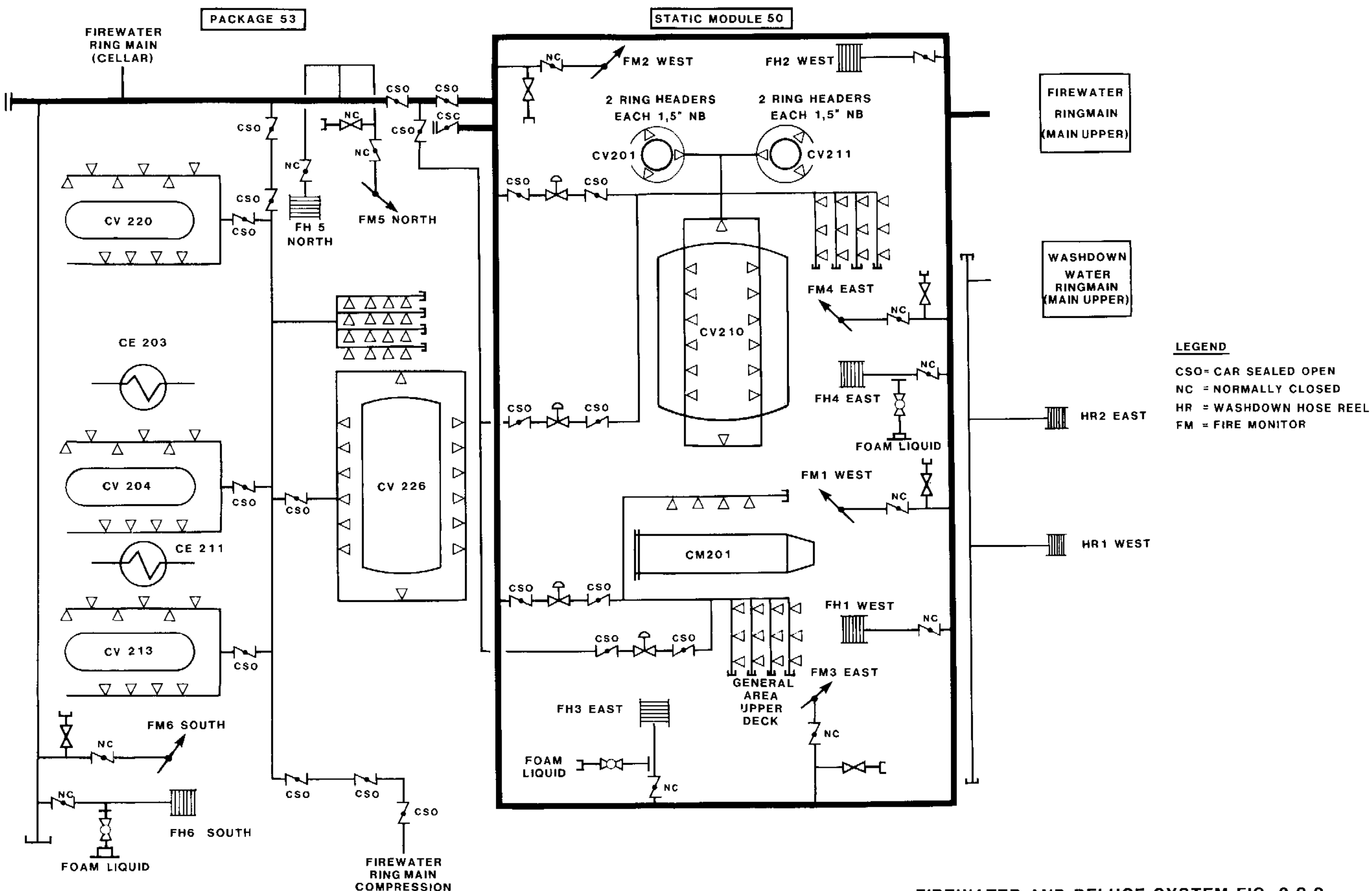
2.5 Foam Units

There is three fixed foam units in the extension areas. One on each deck in Module 50 and one in Pancake 53.

Each foam unit is connected to a fire hose reel, and is equipped with a shut-off valve which is normally closed.

The foam is mainly used to fight liquid hydrocarbon fires and to seal liquids to prevent reignition.

The foam units consists of tank, injector and foam liquid. The tank, made of stainless steel, has a capacity of approximately 120 l. The injector is mounted on top of the tank, and the liquid used is the AFFF (Aqueous Film Forming Foam).



FIREWATER AND DELUGE SYSTEM FIG. 2.9.9

2.10. ELECTRICAL POWER DISTRIBUTION

Fig. No.

1. INTRODUCTION (Fig. 2.10.1/2/3)

The electrical power distribution on TCP2 Extension is supplied by existing systems on TCP2.

There is only distributed low voltage power. The distribution is split in three systems:

- Normal distribution system
- Emergency distribution system
- Battery supported emergency distribution system

2. NORMAL DISTRIBUTION SYSTEM

2.1 380V (AC) Switchboard

The 380V (AC) distribution system on TCP2 Extension consists of two switchboards. The switchboards are extensions of existing MCC 'A' (S.52.32.2.2) and MCC 'B' (S.52.32.2.3), located in Module 32.

Consumers supplied by S.53.32.2.2:

- TEG circulation pumps (CP 220A/C)
- Methanolated water injection pump (CP 222A)
- Methanolated water drainage pump (CP 224)
- Welding Socket in Module 50.

Consumers supplied by S.53.32.2.3:

- TEG circulation pump (CP 220B)
- Methanolated water injection pump (CP 222B)
- Welding Socket in Pancake 53.
- Normal lighting Panel (DB 321)

2.2 220V (AC) Normal Lighting Panel

The normal lighting panel (DB 321) is supplied by MCC'B'.

DB 321 is located in the cabling room in Pancake 08 at TCP2 Treatment Area.

Consumers supplied by DB 321:

- Lightings
- Sockets
- Heating Element

2.3 220V (AC) Trace Heating Panel

The trace heating panel (DB 316) is an extension of the existing panel on TCP2.

DB 316 is located in cabling room in Pancake 08.

2. NORMAL DISTRIBUTION SYSTEM

2.3 220V (AC) Trace Heating Panel (contd.)

Consumers supplied by DB 316:

- Trace heat (M50, P53)
- Trace heat deluge control (M50, P53)
- Trace heat piping (M02)
- Trace heat instrument (M50, Column 5).

3. EMERGENCY DISTRIBUTION SYSTEM

3.1 220V (AC) Maintained lighting panel

If failure in normal power supply, emergency power will be distributed through the maintained lighting panel (DB 322). DB 322 will be supplied by the existing DB 308.

Emergency power will be provided by Frigg Field Emergency System, which again receives stand-by supply from Emergency Generator on QP.

DB 322 is located in the cabling room in Pancake 08 at TCP2 Treatment area.

Consumers supplied by DB 322:

- Emergency lighting fixtures
- Anti-Panic lighting fixtures
- Heating element

4. BATTERY SUPPORTED EMERGENCY DISTRIBUTION SYSTEM

Battery-supported supplies are needed for any load that cannot tolerate a short interruption of its power supply.

4.1 220V (AC) No-Break Emergency Panel

In the event of normal failure of AC power, the AC load will be maintaned without interruption through the no-break emergency panel (DB 323).

DB 323 is located in the instrument interface room in Pancake 13.

Consumers supplied by DB 323:
- Instruments
- Fire detection cabinet
- Gas detection cabinet
- Telemetry interface cabinet
- ODIN and NEF metering instrument box heating
- Zener barrier rack
- Heating element in DB 324
- Electro signalling in DB 324

4.2 24V (DC) Emergency Panel

If failure in 24V DC power, the DC load will be maintained without interruption through the emergency panel (DB 324).

4. BATTERY SUPPORTED EMERGENCY DISTRIBUTION SYSTEM

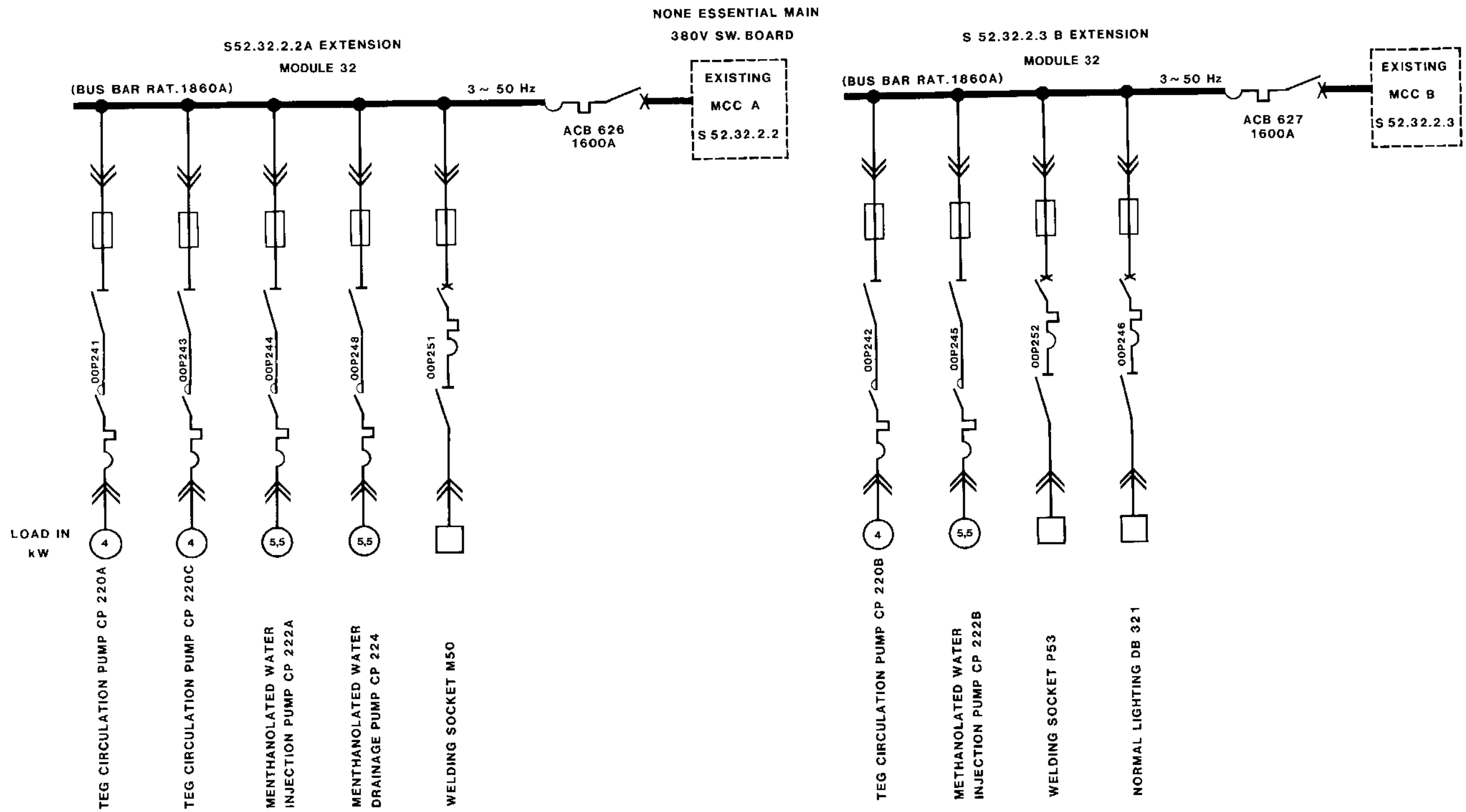
4.2 24V (DC) Emergency Panel (contd.)

DB 324 is supplied by the existing emergency 24V (DC) DB 310, located in the instrument interface room. DB 310 is normally fed by the TCP2 Treatment Emergency panel, DB 308, through a no-break 24V, DC inverter system.

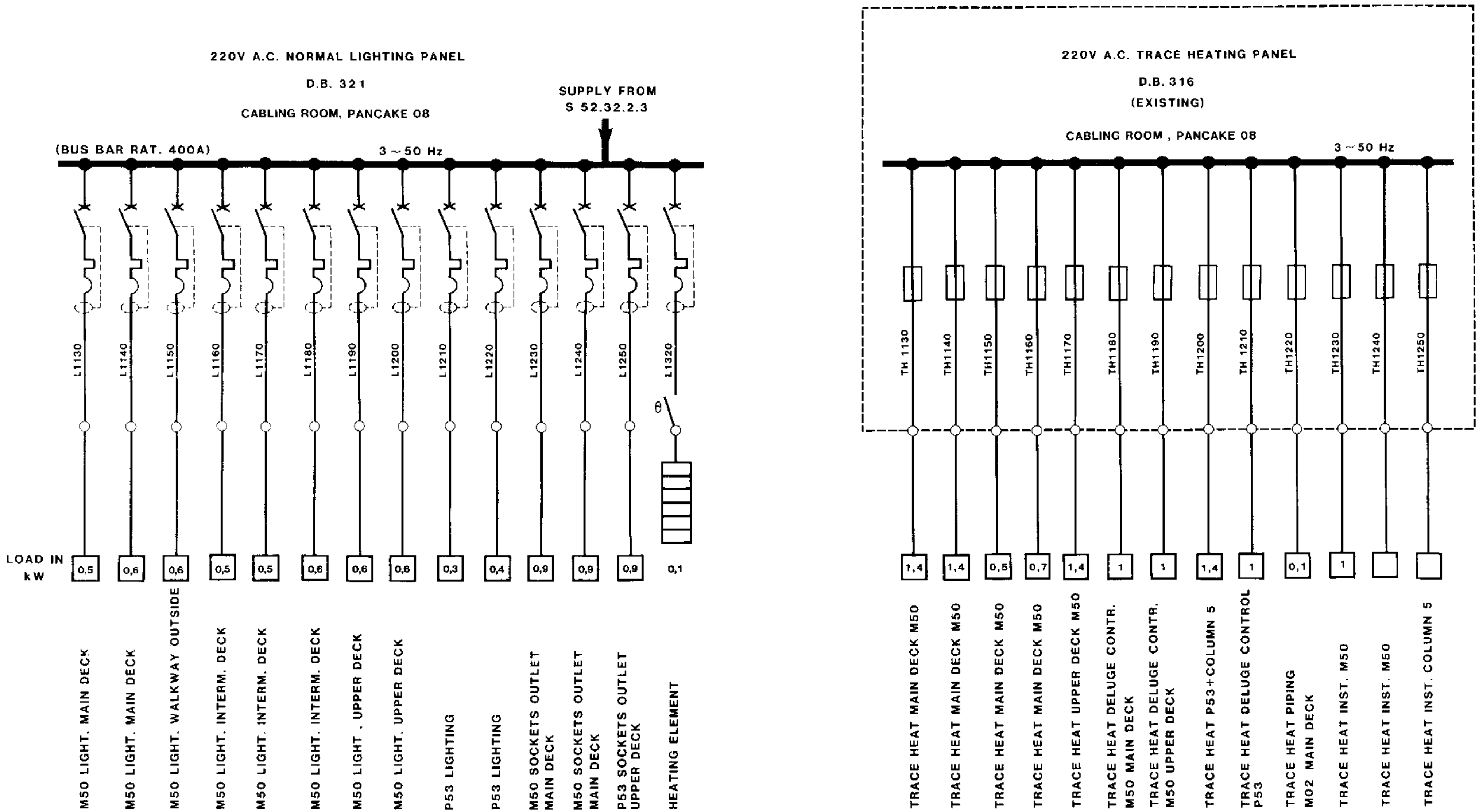
DB 324 is located in the instrument interface room in Pancake 13.

Consumers supplied by DB 324:

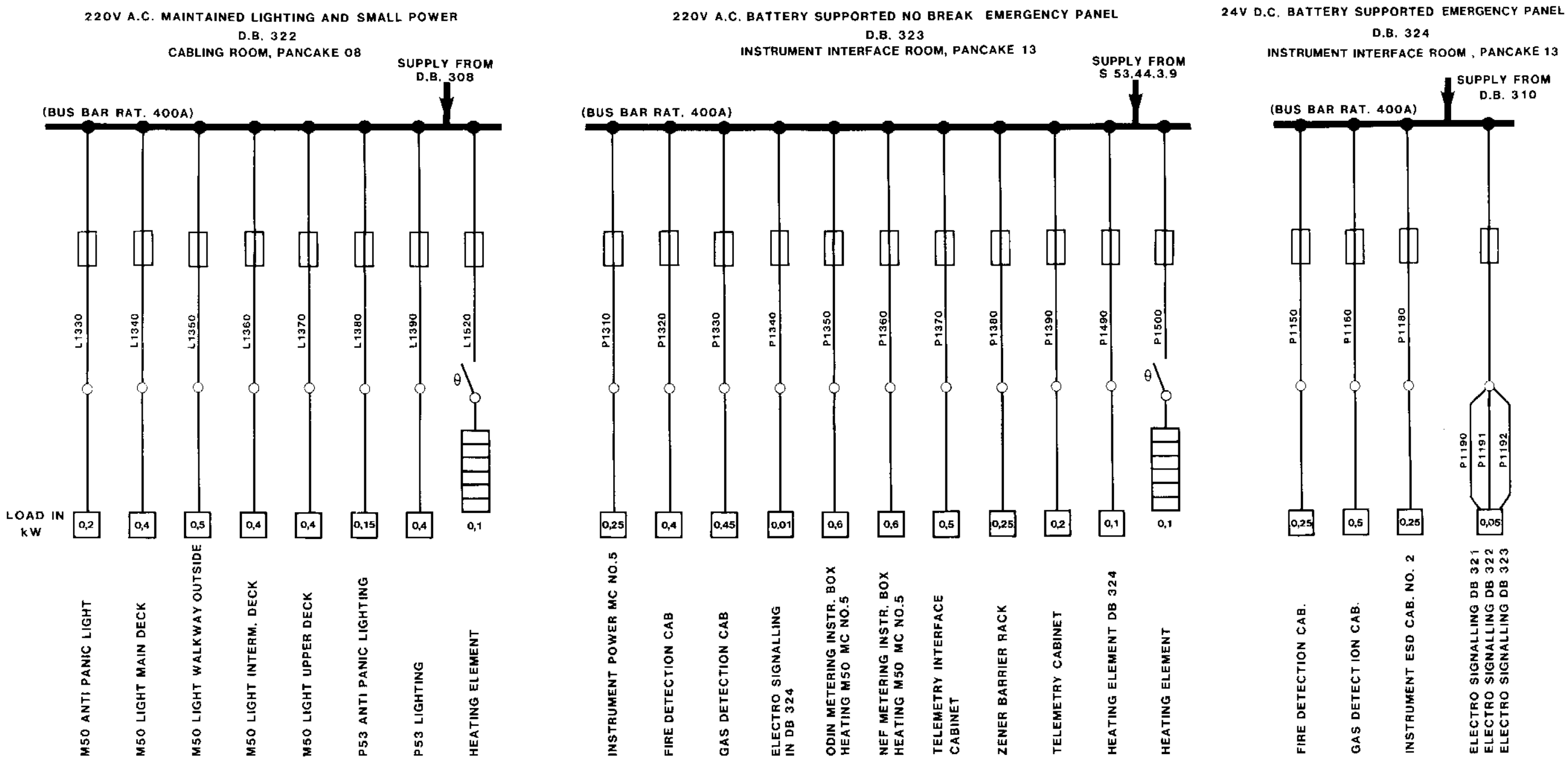
- Fire detection cabinet
- Gas detection cabinet
- Instrument ESD cabinet No. 2
- Electro signalling DB 321/322/323



SINGLE LINE DIAGRAM
FOR NORMAL POWER DISTRIBUTION FIG. 2.10.1



SINGLE LINE DIAGRAM
FOR NORMAL POWER DISTRIBUTION FIG. 2.10.2



SINGLE LINE DIAGRAM
FOR EMERGENCY POWER DISTRIBUTION SYSTEMS FIG. 2.10.3

2.11. UTILITY SYSTEMS

2.11.1 Washdown System

2.11.2 Air Instrument and Plant Air

2.11.3 Hydraulic Power System

2.11.4 Communication

Fig. No.
2.11.1 Block Diagram Hydraulic System

1. WASHDOWN SYSTEM

1.1 Introduction

The washdown system on TCP2 Extension is connected to the TCP2 Washdown System as an extension.

The washdown water system consists of:
- two 2" sea water headers
- 3 washdown hosereels

The purpose of the washdown system is to supply seawater for general washdown purposes.

1.2 System Description

The supply of water is provided from the existing washdown water pump unit (CP 7 located in Central Area).

The washdown water pump has a rated discharge of 1892 l/min at a pressure of 9.6 bara.

There is one sea water header for each of Module 50 and Pancake 53.

(a) Module 50
The sea water header for Module 50 is fed from the ring main encircling the main/upper deck.

The system terminates in two 1½" hosereels, each equipped with spray/jet/shut-off nozzles, rated to deliver 379 l/min.

(b) Pancake 53
The utility water header for Pancake 53 is fed from the ring main encircling the cellar deck.

The system terminates in a 1½" hosereel, equipped with spray/jet/shut-off nozzle, rated to deliver 379 l/min.

2. AIR INSTRUMENT AND PLANT AIR

2.1 Introduction

The compressed air system on TCP2 Extension is connected to the existing system on TCP2, as an extension.

The compressed air system consists of:

(a) an instrument air system, operating pneumatic instruments and controllers.

(b) a plant air system, operating pneumatic power tools, inhibitor pumps etc.

2. AIR INSTRUMENT AND PLANT AIR

2.2 System Description

The compressed air supply is provided from the existing compressor package CQ 5A/B, located in Module 04.

The compressor package CQ 5A/B delivers compressed air to the two distribution systems via a common header.

The two compressed air systems are fed as follows:

(a) Instrument air
The instrument air system on TCP2 Extension is connected to the existing instrument air system on TCP2.

The tie-in connections for Module 50 and Pancake 53 are located in Module 01 and Pancake 06 respectively.

The ring mains consists of:
- 10 instrument air headers for Module 50.
- 5 instrument air headers for Pancake 53.

Each header has an outlet connection to a pneumatic instrument.
The instrument air line is controlled at 6,5 bara.

Air bottles are provided for safe operation in case of failure in air supply.

(b) Plant Air
The plant air system on TCP2 Extension is connected to the plant air system on TCP2.

The tie-in connections for Module 50 and Pancake 53 are both located in Pancake 06.

The ring mains terminates in:
- 4 utility air stations in Module 50
- 3 utility air stations and connections outlets to inhibitor pumps CP 225A/B in Pancake 53.

Each utility air station is equipped with isolation valves, filter regulator lubricator sets, and quick release hose coupling.

The plant air line is controlled at 9.0 bara.

3. HYDRAULIC POWER SYSTEM (Fig. 2.11.1)

3.1 Introduction

Hydraulic power for Module 50 will be provided from TCP2 by extending the existing ring main.

3. HYDRAULIC POWER SYSTEM (Fig. 2.11.1)

3.1 Introduction (contd.)

The extended hydraulic power system consists of:

- local accumulator sets for ESD V's
- local control station
- valve controllers and actuators
- two 1½" supply lines
- two 2" return lines

The purpose of the hydraulic power system is to provide the motive power for:

- the hydraulically operated hand isolating (H V) valves
- the hydraulically operated emergency shutdown (ESD V) block valves.

3.2 System Description

The hydraulic power is provided from the existing power unit CQ 7 on TCP2, located in Module 01.

The existing system capacity is:

- Max. pressure 139 bara
- Min. pressure 126 bara
- Pumping rate 100 l/min.

There are two distribution systems, one for upper deck, and one for lower deck. Each comprises supply and return lines, to which each valve actuator is connected, via its controller.

Each emergency shutdown (ESD V) block valve is equipped with an accumulator and a nitrogen storage bottle charged to 139 bara These are used to provide back-up pressure in the event of system pressure failure. The back-up accumulators are capable of providing 2 cycle operations of the valve.

According to the extended load of the existing hydraulic power system the recovery time, if a full ESD V back-up is utilized, is increased from 7 up to 9 minutes.

3.3 System Protection

An alarm will indicate on QP in CCR if the system pressure should fall to 119 bara.

There is no shut down devices in the system.

4. COMMUNICATIONS

4.1 Telephone System

There will be installed one additional telephone, complete with acoustic hood outside Module 50. This will be tied into the existing system as an extension.

4. COMMUNICATIONS

4.2 Alarm and Public Address System

(a) Introduction
The alarm and public address system will be an extension to the already existing system installed on the QP platform.

The alarm and public address system consists of 10 loud speakers with red and blue flashing lights.

These are installed as follows:
- 4 on upper level in Module 50
- 4 on lower level in Module 50
- 2 in Pancake 53

(b) System description
Access to the system will be through existing microphones. It is not proposed to provide microphones facilities in either Pancake 53 or Module 50.

The loudspeakers on each level will be fed from not less than two separate amplifiers to provide a minimum of 50% redundancy on a failure of any of these circuits.

A sound level will be provided such that both alarm and public address system will be capable of being heard distinctly on all parts of the installation.

The alarm system is able to generate two alarms:
- Muster alarm: consisting of a continous signal.
- Fire alarm: consisting of an intermittent signal.

In addition to loudspeakers, due to noise, flashing lights will be installed on all levels.

These are:
- blue light: for public address
- red light: for fire and muster alarm.

(c) Operation
The alarm and public address system is controlled by a priority system regarding the importance of message.

- 1st priority:
  Red microphones in CCR for warning and messages (inhibited the first ten seconds after alarm starts)

- 2nd priority:
  Fire and muster alarm.

4.2 Alarms and Public Address System (contd.)

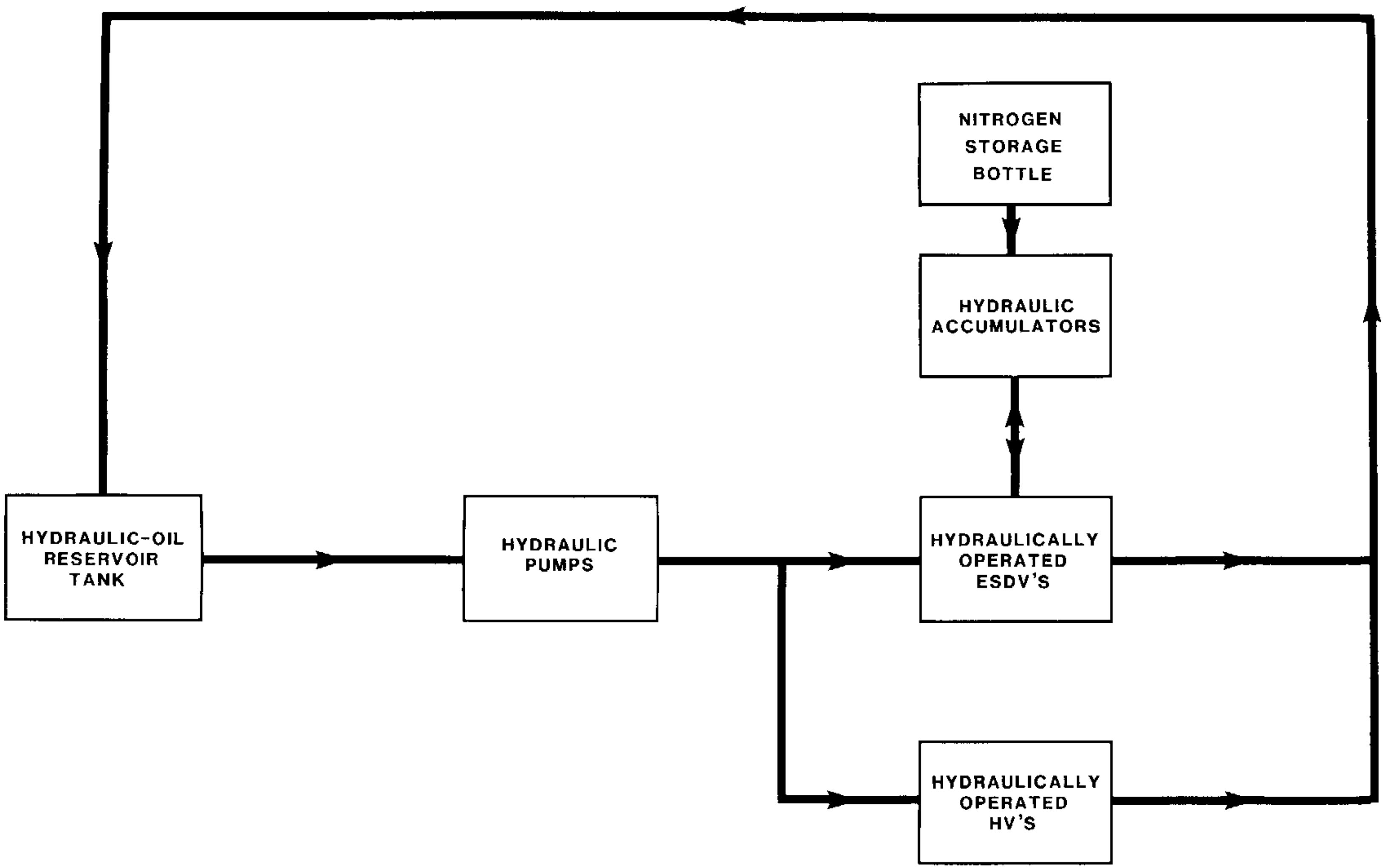
- 3rd priority:
  Normal messages from microphones

The red microphone in CCR will when activated, except for the first ten seconds after a muster or fire alarm has started, overrule all other signals transmitted to the alarm and public address system.

The muster alarm can only be initiated, when fire, manually from CCR.

The fire alarm is automatically initiated by fire detectors and manually by the fire alarm push buttons on TCP2 or from CCR.

The first microphone for manual messages to be activated will inhibit all other microphones to operate until the push-button is released.



BLOCK DIAGRAM HYDRAULIC SYSTEM FIG. 2.11.1