

**Info icon** The webpage cannot be found

Most likely causes:

- There might be a typing error in the address.
- If you clicked on a link, it may be out of date.

What you can try:

- Retype the address.
- Go back to the previous page.
- Go to [www.platformbrokers.com](http://www.platformbrokers.com) and look for t want.

**More information** [More information](#)

#### Froy Wellhead Platform

- Jacket
- Template
- Topsides

#### TCP 2 Based

- M 35
- P 48
- M 52

#### Lille Frigg

[Home](#)



## CONTENTS

1. [Module M35 Description](#)
  - 
  - 1.2 [Process description](#)
    - 1.2.1 General
    - 1.2.2 M35 pipelines
    - 1.2.3 Gas system
    - 1.2.4 Oil system
    - 1.2.5 DEG recovery
    - 1.2.6 Fuel gas compression
    - 1.2.7 Water injection system
      - 1.2.7.1 Electrochlorination system
      - 1.2.7.2 Fine filter system
      - 1.2.7.3 Dearation system
      - 1.2.7.4 Water injection pumps
      - 1.2.7.5 Produced water system
      - 1.2.7.6 Heating medium system
      - 1.2.7.7 Chemical injection system
      - 1.2.7.8 Electrical system
      - 1.2.7.9 Miscellaneous
  - 1.3 [M35 Module data](#)
    - 1.3.1 Design life
    - 1.3.2 Module dimensions
    - 1.3.3 Piping headers
    - 1.3.4 Main equipment
    - 1.3.5 Main connections

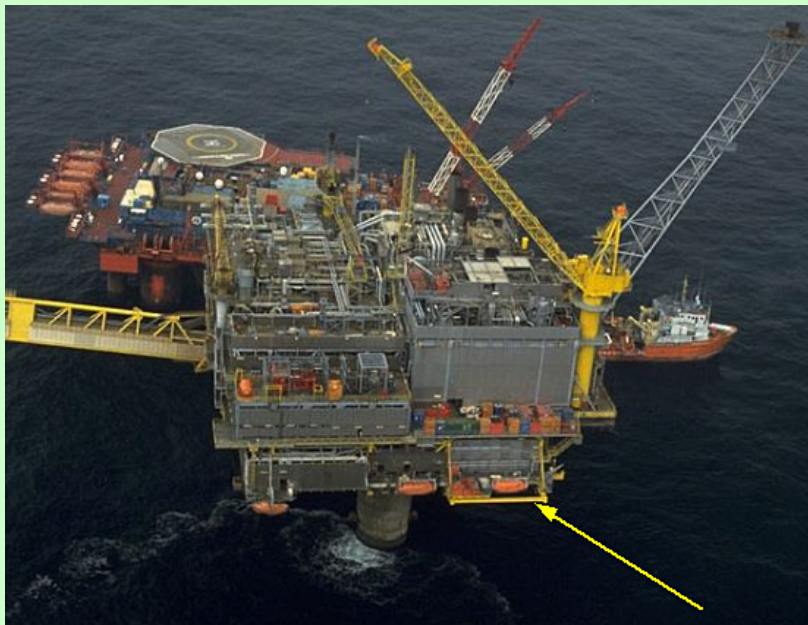
### 1.3.6 Piping material

Basic Data For the M35 and P48 modules on Frigg

#### 1. Module M35 Description

The module contains equipment for treatment of oil and gas comprising the following main functions:

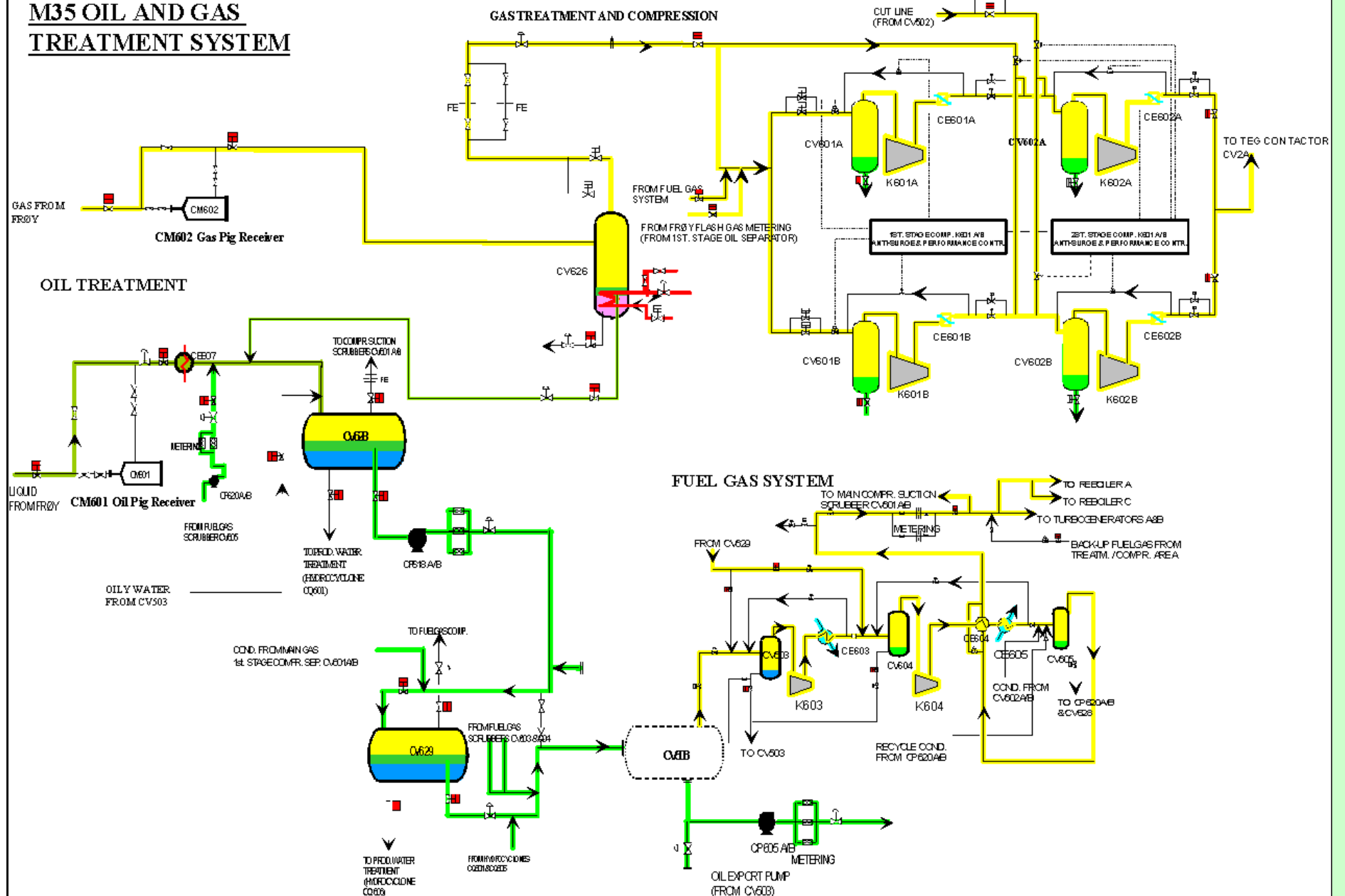
- ... Pig Traps
- ... Heat Exchangers, Oil Heaters
- ... Separators
- ... Oil Export Pumps
- ... Gas and Oil Metering
- ... Gas Compression
- ... Fuel Gas Compression
- ... Produced Water Treatment
- ... Injection Water Treatment and Pumps



The module is also equipped with a pedestal crane at the SE corner of the module. The crane has the following working radius and SWL:

- ... 36 tons between a radius of 9 ñ 30 m
- ... 12 tons with a maximum radius of 60 m

# M35 OIL AND GAS TREATMENT SYSTEM



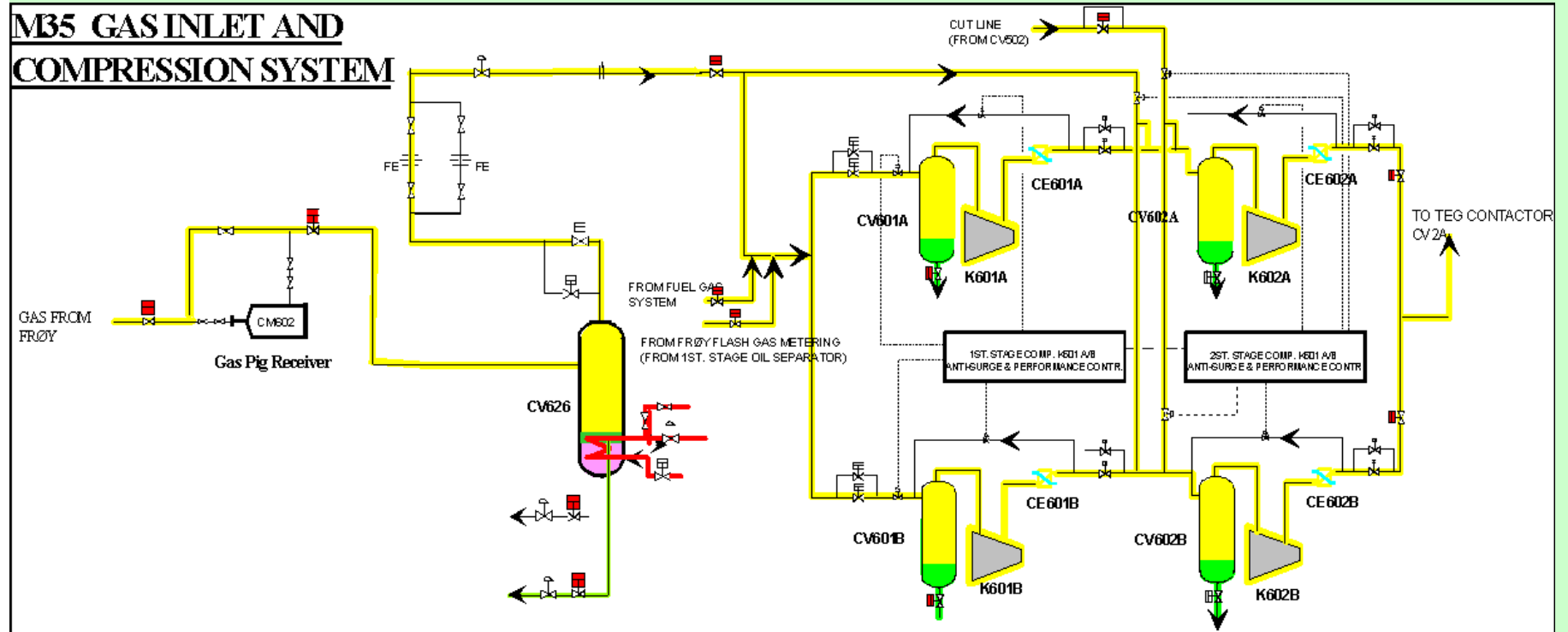
1.2 Process description

1.2.1 General

1.2.2 The M35 module receives the inhibited gas and the oil by 2 separate 12" pipelines. The module is equipped with one pig receiver for each line.

1.2.3 Gas system

The gas is routed to vertical three-phase separators with a heating coil in the liquid phase and is heated from 5 °C to 20 °C to enhance the separation of rich DEG condensate. The gas from the separator is metered before it goes to compression. The compression is done in two stages, the first from approx. 14 bar to 44 bar, the second from 44 bar to 99 bar, and there are two parallel trains with 100% capacity each.



#### 1.2.4 Oil system

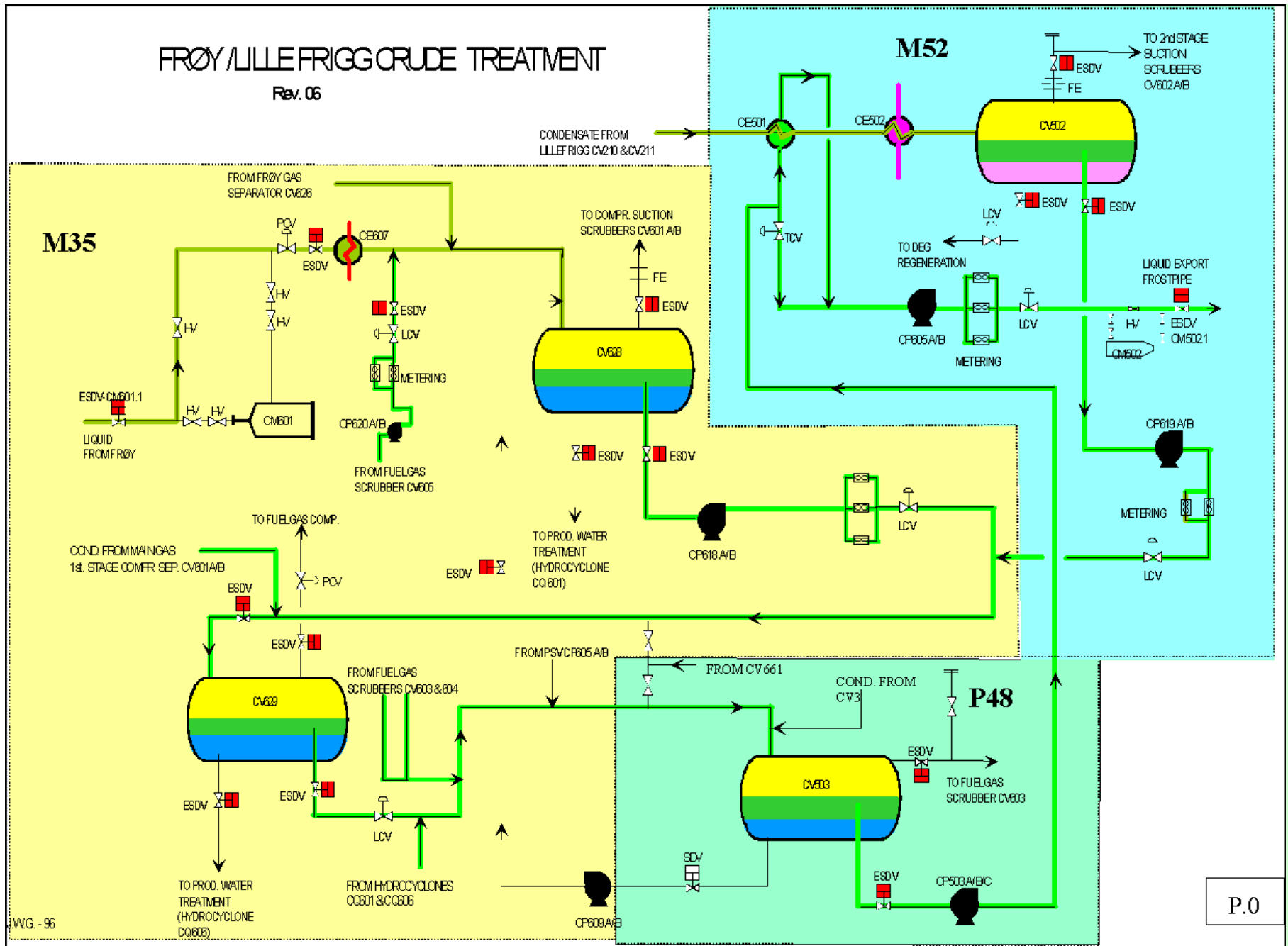
The oil is heated to approx. 60 to 70 °C in an inlet heater before going through three phase separators at 14 bars.

The flash gas from the first stage separation is metered before it enters the first stage main gas compressors. The water is routed to the produced water system. The oil is sent via transfer pumps and metering and today mixed with condensate from another field before entering the second stage separation at about 4.2 bars and 60 °C.

Today the oil then leaves the module and is further stabilised in another separator at 0.4 bar and 46 °C. (could for a new case be performed by a separator located in module M52). Oil export pumps and metering is however located in the module.

# FRØY/LILLEFRIGG CRUDE TREATMENT

Rev. 06



11WG - 96

P.0

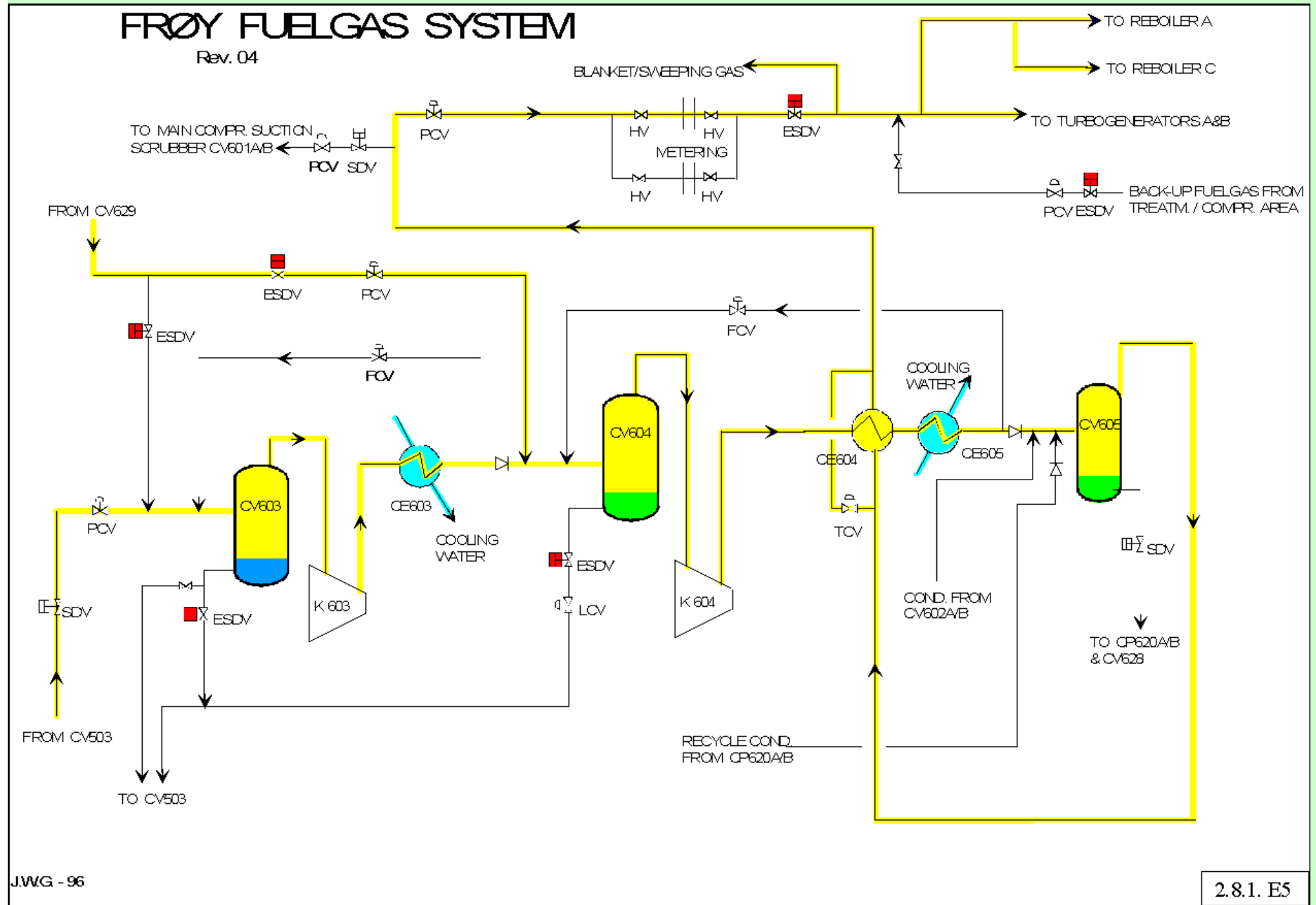
## 1.2.5 DEG recovery

Glycol with pH stabiliser collected in the gas inlet separator is routed outside the module for regeneration.

## 1.2.6 Fuel gas compression

A fuel gas compression package is also in the module and the purpose of the fuel gas compression system is to increase the pressure of the fuel gas from CV503 and CV269 so it can be used as fuel gas. On one skid there are two electrical driven, fixed speed centrifugal compressor on one shaft. The speed of the electrical motor is 1486 rpm. A gear is installed to increase the speed to 8262 rpm of the compressors.

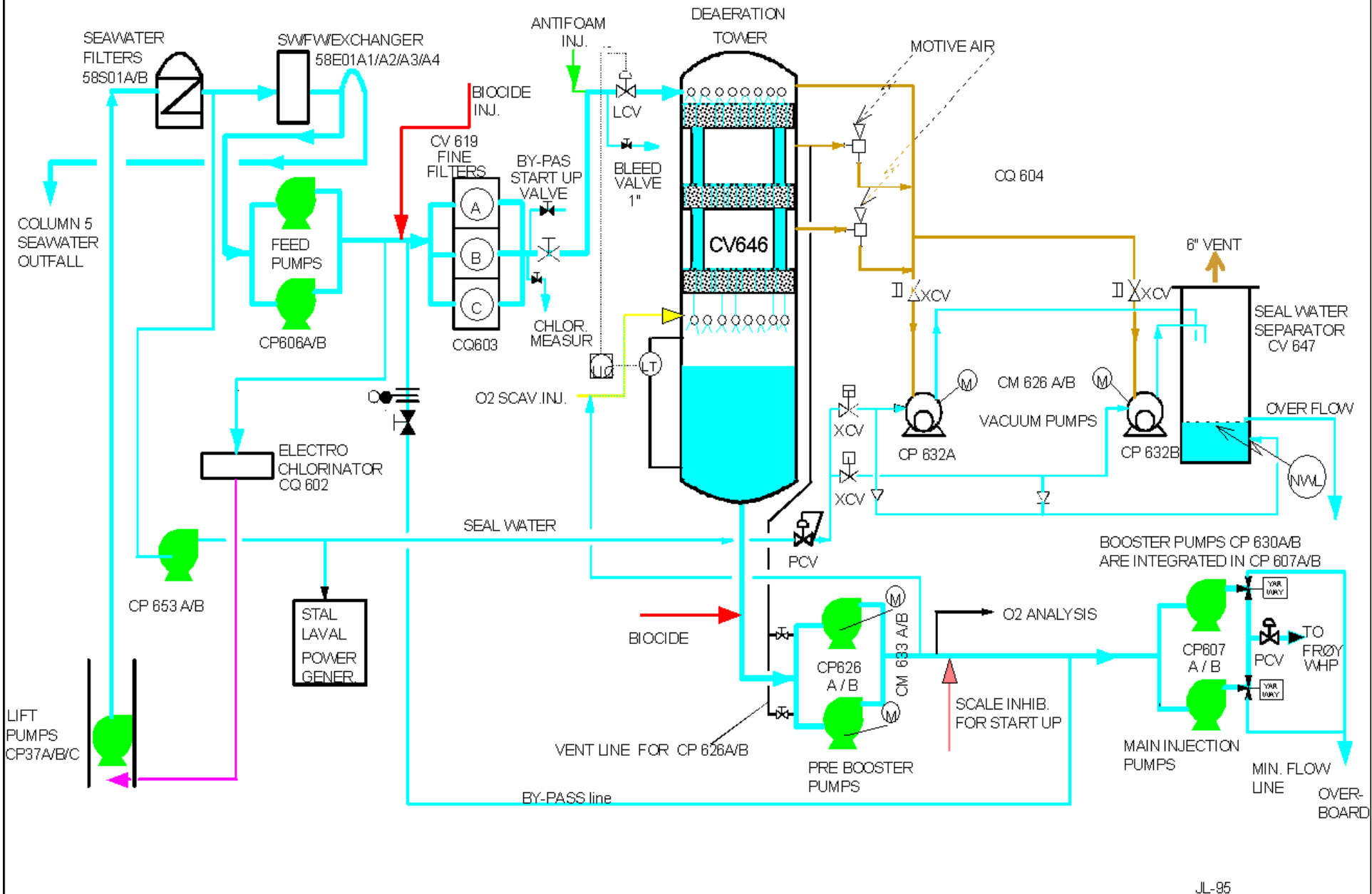
The two compressors compress the gas from 1.4 to 5.7 bara, at first stage, and from 5.7 bara to 21 bara at the second stage which is required feed pressure for fuel gas consumers.



### 1.2.7 Water injection system

The module does also contain a complete water treatment system with filters, vacuum deaeration, electrochlorination for treatment of injection water and the module also contains 2 injection pumps. The water injection facilities are designed to remove the oxygen from the water (less than 10 ppm O<sub>2</sub>), filter and chemical treat the water. The water injection can be split into 4 packages:

# FRØY WATER INJECTION FACILITY ON FRIGG



## 1.2.7.1 Electrochlorination system

One electrochlorination unit CQ602 is producing hypochlorite by electrolysis of seawater for injection into 3 seawater liftpumps (outside M35). The feed is taken from the outlet of the water injection feed pumps. The system is designed to give a chlorination level of up to 2 ppm and the flowrate of the unit is 10.8 m3/hr.

The injection of hypochlorite will kill 90% of the organic microbes and the rest will be removed fine filters and injection of biocide.

#### 1.2.7.2 Fine filter system

The water injection feed pumps feed the water injection fine filter package for removal of particles larger than 5 microns in 3 x 50% parallel cartridge filters. The flowrate is 480 m<sup>3</sup>/hr at 6.5 barg and 5 to 25\_C. The filters are generated by using sulphuric acid, supplied from a storage tank within the system.

#### 1.2.7.3 Dearation system

The dearation system consists of a dearation tower, a seal water separator, vacuum pumps, 2nd stage ejector and 3rd stage ejector. The flowrate is 480 m<sup>3</sup>/hr. The dearator tower is 3 stage vacuum dearator vessel operating at 0.991 barg (0.009 bara). The oxygen content at the bottom of the tower is less than 10 ppb. Operating temp. Is between 5 to 25\_C.

#### 1.2.7.4 Water injection pumps

After dearation the water is routed to the two 100% water injection prebooster pumps at a pressure of 2.1 barg. The water then passes through a 2 x 50% pump sets in two stages. In the first from 2.1 to 21 barg and the second up to 156 barg. The water is exported in a 161 pipeline.

#### 1.2.7.5 Produced water system

The produced water is collected from 2 sources, 1st stage separators CV628 and 2nd stage separator CV629 in addition to water re-circulated from the final stage separator. The water is then sent to the 2 hydrocyclone vessels CV658 and CV659 where oil with as much as 99% water is reinjected and clean water is sent to the degassing tank CV630. The system is designed to treat water to a HC level less than 440 ppm.

#### 1.2.7.6 Heating medium system

From an external waste treat heat recovery unit. The total system is closed loop working at pressure of 20 bar and a temperature of 180\_C. The heating medium is a solution of 15%-30% TEG and 85% - 70% water.

#### 1.2.7.7 Chemical injection system

The module has chemical injection system for: acid, wax inhibitor, bactericide inhibitor, scale inhibitor, liquid export pipelines corrosion inhibitor, antifoam inhibitor and oxygen scavenger inhibitor. The system, is split in two packages: one named CQ605 for the water injection system and another named CQ608 for the process systems. The chemical are supplied by 4.5 m<sup>3</sup> tot tanks.

#### 1.2.7.8 Electrical system

The M35 main switchboard is supplied by an external source by a HV system of 5.5 kV. The HV switchboard feeds the following consumers:

... HV motors for:

Crude oil export pumps	1100 kW
Oil transfer pumps	150 kW
Water injection pumps	1900 kW
1st stage compr.	2850 Kw
2nd stage compr. trains	2850 kW
Fuel gas compressor	1850 kW
Water inj. feed pump	180 kW

... The M35 LV distribution board via parallel transformers

... The 5.5/22 kV Froy WHP transformers

... The 4.4 kV A and B startbusbars via autotransformers

#### 1.2.7.9 Miscellaneous

In addition the system above the has: drain system, vent/flare system, hydraulic system, Fire and Gas system etc.

The module is also equipped with the following technical rooms:

... Instrument room

... Low voltage room

... Low voltage emergency room

... High voltage room

### 1.3 M35 Module data

#### 1.3.1 Design life

The module has a design life of 30 years, with a start of production in 1993.

#### 1.3.2 Module dimensions

Dimensions 40.5 m x 24m x 24.8 mH

Lifting weights (t) 3216

#### 1.3.3 Piping headers

Gas inlet and compr. 12i/10i ANSI 600/900#, 35/149 b des.

Oil inlet 12i ANSI 900#, 149 bar design pressure

Oil treatment 12i ANSI 150#, 18.5 bar design pressure

Water de-oxygenation 16i ANSI 150#, 10 bar design pressure

Water injection manifold 16i ANSI 1500#, 185 bar design pressure



1.3.4 Main equipment

TAG No	No	Equipment type	Size		Rating	Des. press	Des. temp
CM601	1	Oil pig receiver	L=7200 x 800 x 1060	H	12i ANSI 1500#	149b	-10/90
CM602	1	Gas pig receiver	L=7200 x 800 x 1060	H	12i ANSI 1500#	149b	-30/35
CV626	1	Gas inlet separator	L=5200 (T-T) x 1521 ID	H	10i ANSI 900#	149b	-30/35
CV626	1	Oil 1st stage sep.	L=8600 (T-T) x 2800 ID	H	12i ANSI 150#	18.5 b	-10/75
CV629	1	Oil 2nd stage sep.	L=8600 (T-T) x 2800 ID	H	12i ANSI 300#	18.5 b	-10/75
CV630	1	Prod. water degassing	L=3000 (T-T) x 1700 ID	H	6i ANSI 150#	3.7 b	-10/80
CV601A/B	2	1st st suct scrubberA	H=1995 (T-T) x 990 ID	V	12i ANSI 300#	35 b	-20/90
CV602A/B	2	2nd suct scrubberA	H=2815 (T-T) x 900 ID	V	8i ANSI 600#	60 b	-20/70
CV603	1	Fuel gas suct. Scrub	H=1845 (T-T) x 900 ID	V	16i ANSI 150#	18.5 b	-20/75
CV604	1	Fuel gas int st. scrub	H=3000 (T-T) x 1000 ID	V	12i ANSI 150#	18.5 b	-20/70
CV605	1	Fuel gas disc scrubber	H=4450 (T-T) x 1370 ID	V	6i ANSI 300#	27 b	-20/55
CQ603	1	Water inj fine filter	Lxwxh=800x3750x5550	V	8i ANSI 150#	10 b	-10/60
CV646	1	Dearation tower	H=16300 (T-T) x2750 ID	V	12i ANSI 150#	Vac./0.5	-10/35
CQ602	1	Electrochlorination pk.	Lxwxh=4600x2100x3100	H	2i ANSI 150#	10 b	-10/40
CQ604	1	Vacuum pump skid	Lxwxh=3900x3100x1780	H	8i ANSI 150#	10 b	-10/60
CQ605	1	WI chem inj package	Lxwxh=5200x3250x3250	H	2i ANSI 150#	Atm	-20/35
CQ606	1	Chem inj package	Lxwxh=6300x3500x3130	H	2i ANSI 150#	3.5 b	N/a
CV658	1	Hydrocyclone vessel	L=2700 (T-T) x 500	H	6i ANSI 150#	18.5 b	75
CV659	1	Hydrocyclone vessel	L=2700 (T-T) x 600	H	3i ANSI 150#	18.5 b	75
CE601A/B	2	1st stage aftercooler	Lxwxh=1130x810x1130	H	3082 kW	60 b	-20/170
CE602A/B	2	2nd stage aftercooler	Lxwxh=930x1100x1500	H	4615 kW	150 b	-20/135
CE607	1	Oil inlet heater	L=3220 x 891	H	5413 kW	28 b	-20/205
CE603	1	1st st FG aftercooler	L=8100 x 651	H	1611 kW	18.5 b	-20/135
CE604	1	FG gas/gas heat exch.	L=550 x 310 520	H	71.5 kW	18.5 b	-20/135
CE605	1	2nd st FG aftercooler	L=1050 x 960 x 1170	H	3050 kW	27 b	-20/130
K601A/B	2	1st st compressor	Lxwxh=7000x2500x3200	H	2850 kW	130 b	-45/120
K602A/B	2	2nd st compressor	Lxwxh=7000x2500x3200	H	2850 kW	150 b	-45/120
K603	1	1st st FG compressor	Lxwxh=7000x2500x3200	H	824 kW	27 b	-45/130
K604	2	2nd st FG compressor	Lxwxh=7000x2500x3190	H	486 kW	27 b	-45/130
CP605A/B	2	Oil export pump	Lxwxh=5300x1700x2450	H	964 kW	99.3	-20/55
CP607A/B	2	Water inj pump	Lwxh=4630x2100x3100	H	1900 kW	205 b	50
CP618A/B	2	Oil transfer pump	Lxwxh=1150x1150x2950	H	170 kW	23.5 b	-10/5
CP620A/B	2	Recycled cond. Pump	Lxwxh=560x730x1650	H	8.3 kW	33 b	-20/45

1.3.5 Main connections

Import	Untreated gas and oil	12i
	Untreated injection water	10i
Export	Rich gas/fuel gas	8i/4i
	Partly treated oil	16i
	Deoxygenated water	16i

1.3.6 Piping material

Gas and oil riser	API 5XL X65 with 0.5% Cr
Gas piping system	CS ASTM A333 Grade 6 and CS ASTM A106 B with Exception of gas piping out of aftercooler K601 A and B Which is in SS ASTM A312 TP 316L
Oil piping system	CS ASTM A333 Grade 6 and CS ASTM A106 B
Fuel gas piping	CS ASTM A333 Grade 6 and CS ASTM A106 B. Liquid out of CV 605 and recycle fuel gas in SS ASTM 312 TP 316L.
Prod. Water piping	CS ASTM A120 Galv.
Water injection	GRE and ASTM B337 grade 2 upstream of booster pumps. API-5L GR X 52 downstream.

YYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYY