

MINISTRY OF
ELECTRICITY & WATER

دولة الكويت
STATE OF KUWAIT

وزارة الكهرباء والماء

POWER STATION AND
DISTILLATION PLANT
PROJECTS SECTOR



قطاع مشاريع محطات القوى
الكهربائية وتقطير المياه

SHUAIBA NORTH

DESALINATION PLANT

RECARBONATION PLANT

OPERATION TRAINING

SYSTEM DESCRIPTION

RECARBONATION PLANT

PURPOSE OF THE SHUAIBA NORTH RECARBONATION PLANT:

TO INCREASE THE ALKALINITY OF
DISTILLED WATER FROM DISTILLERS

- Distillate Alkalinity: ~ 0
- Recarbonated
Water Alkalinity: up to 80
ppm as CaCO_3

RECARBONATION PLANT

MAIN CHEMICAL REACTION INVOLVED IN RECARBONATION:



Calcium Carbonate

Carbon Dioxide

Calcium (ion)

Bicarbonate (ion)



By adding
LIMESTONE
(1÷5 mm)

Recovered from VENT GAS
gathered from vacuum
systems

Ca-ALKALINITY

RECARBONATION PLANT

pH CORRECTION:



Residual Carbon Dioxide

Caustic Soda

Sodium (ion)

Bicarbonate (ion)

From dosing system
(30% solution)

RECARBONATION PLANT



- Alkalinity increase



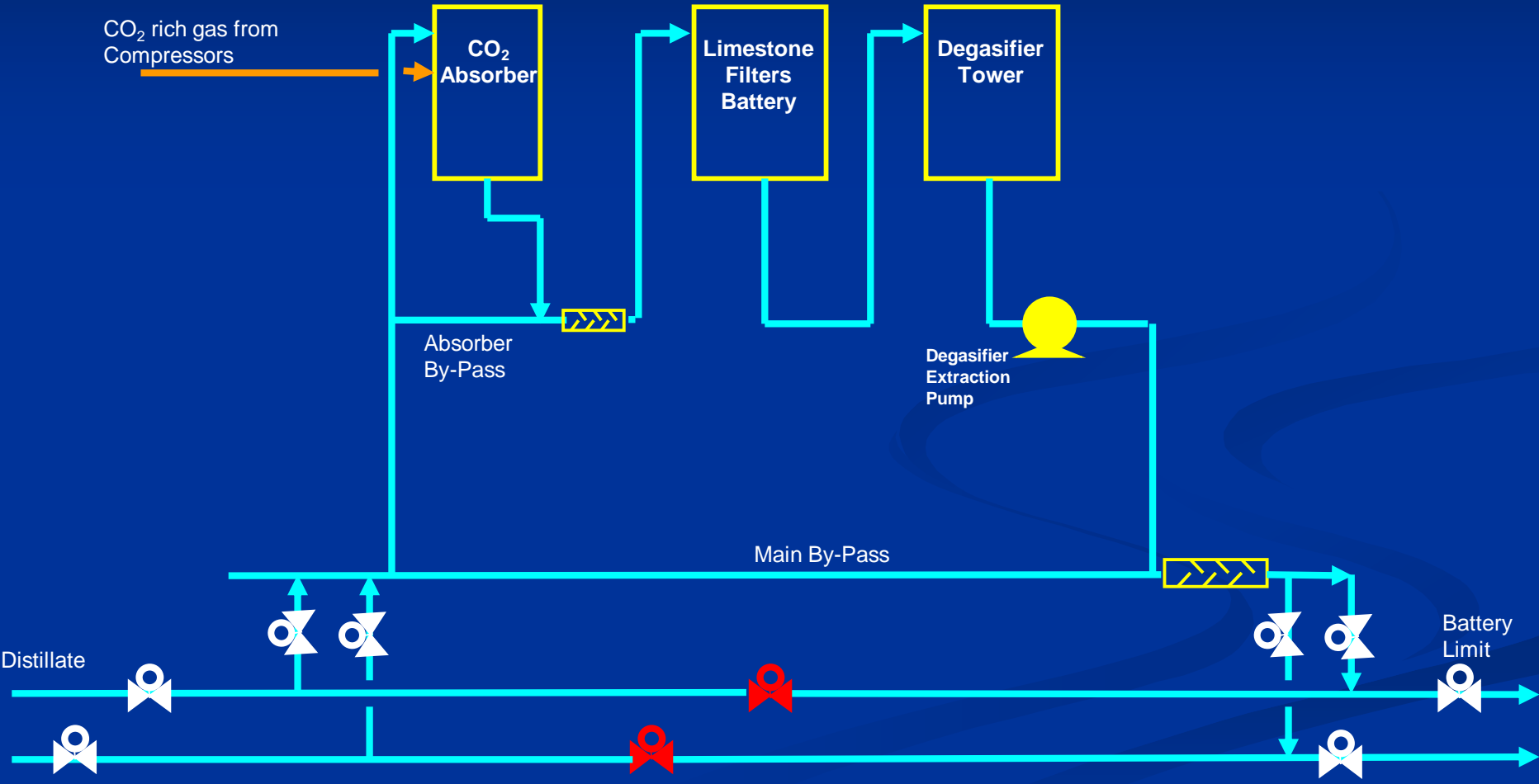
- pH increase

RECARBONATION PLANT

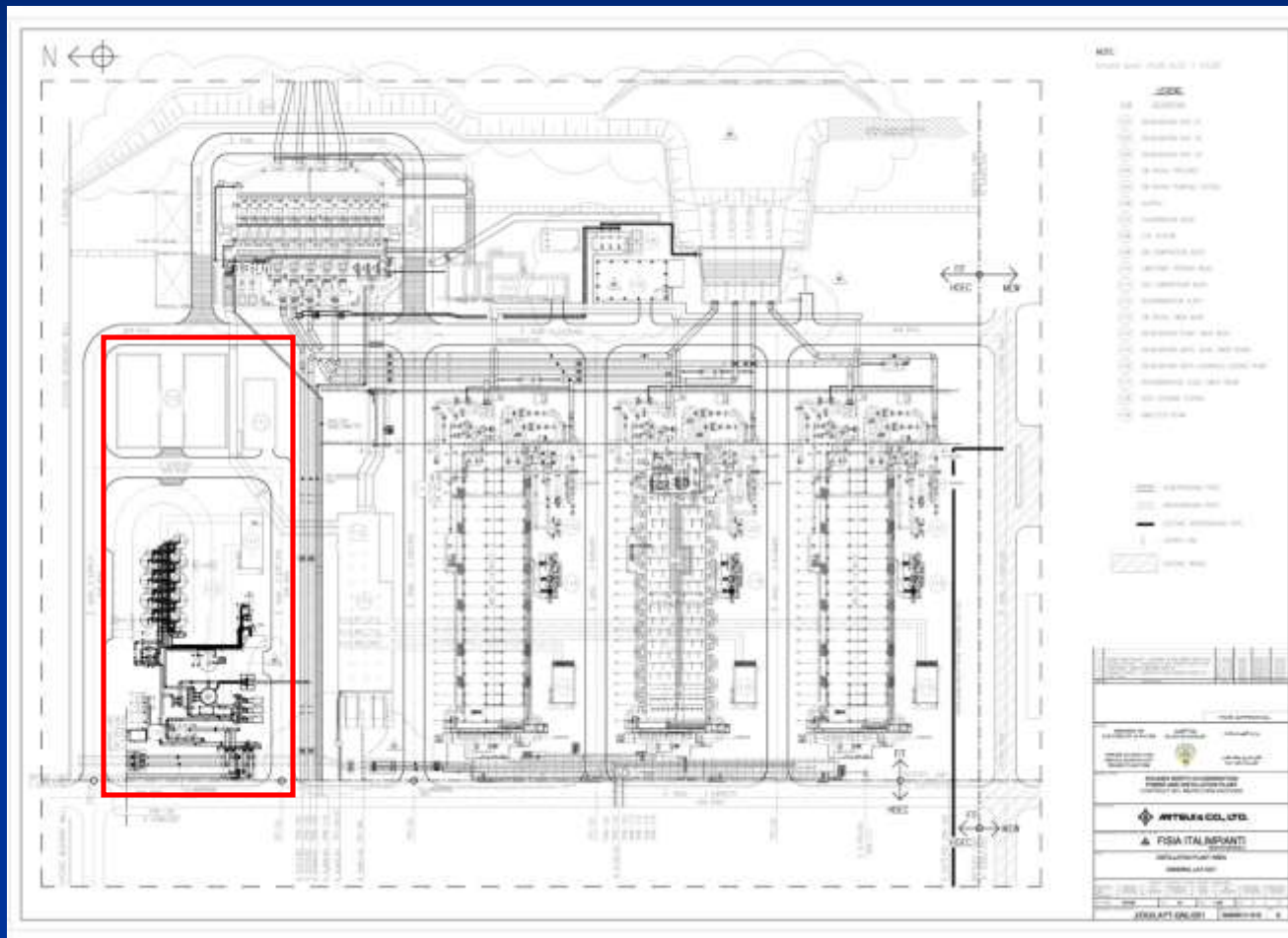
MAIN SYSTEMS

- **VENT GAS (CARBON DIOXIDE) RECOVERY**
- **CARBON DIOXIDE COMPRESSION**
- **CARBON DIOXIDE ABSORPTION**
- **LIMESTONE DISSOLUTION**
- **DEGASSING**
- **CHEMICAL DOSING**
- **BACKWASH & WATER RECOVERY**

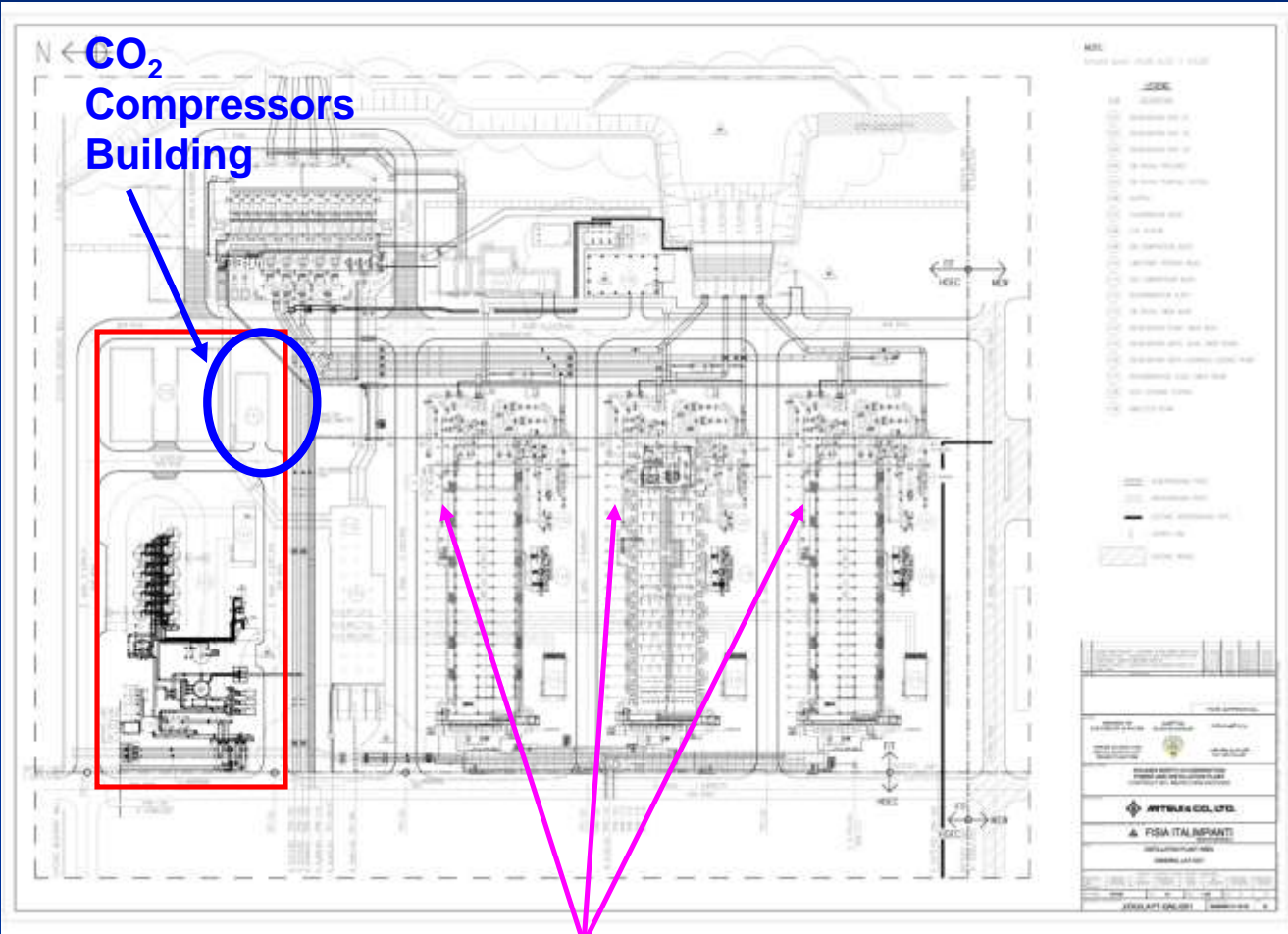
RECARBONATION PLANT



RECARBONATION PLANT

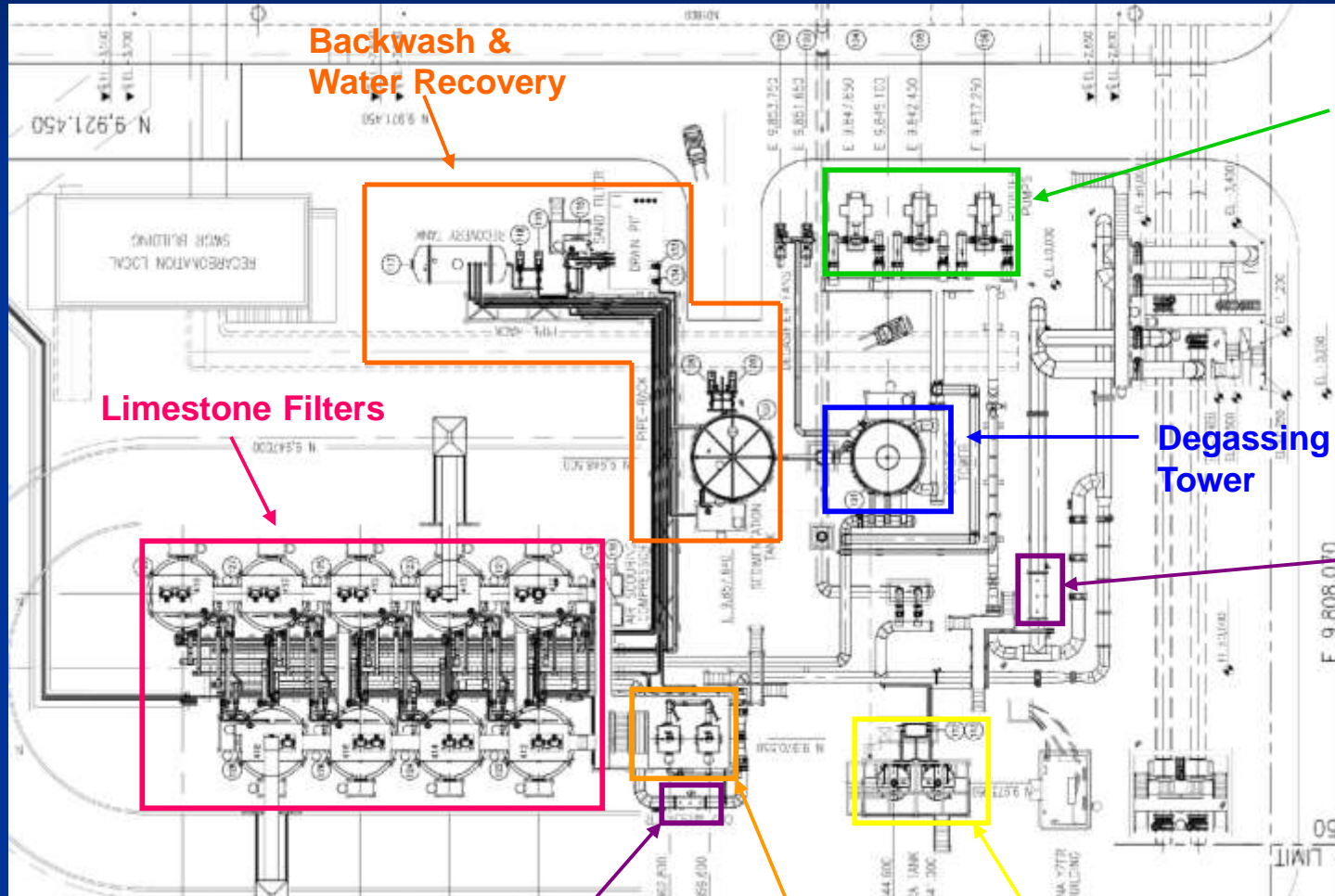


RECARBONATION PLANT



CO₂ Booster
Vacuum Pump

RECARBONATION PLANT



Degasifier
Extraction
Pumps

Degassing
Tower

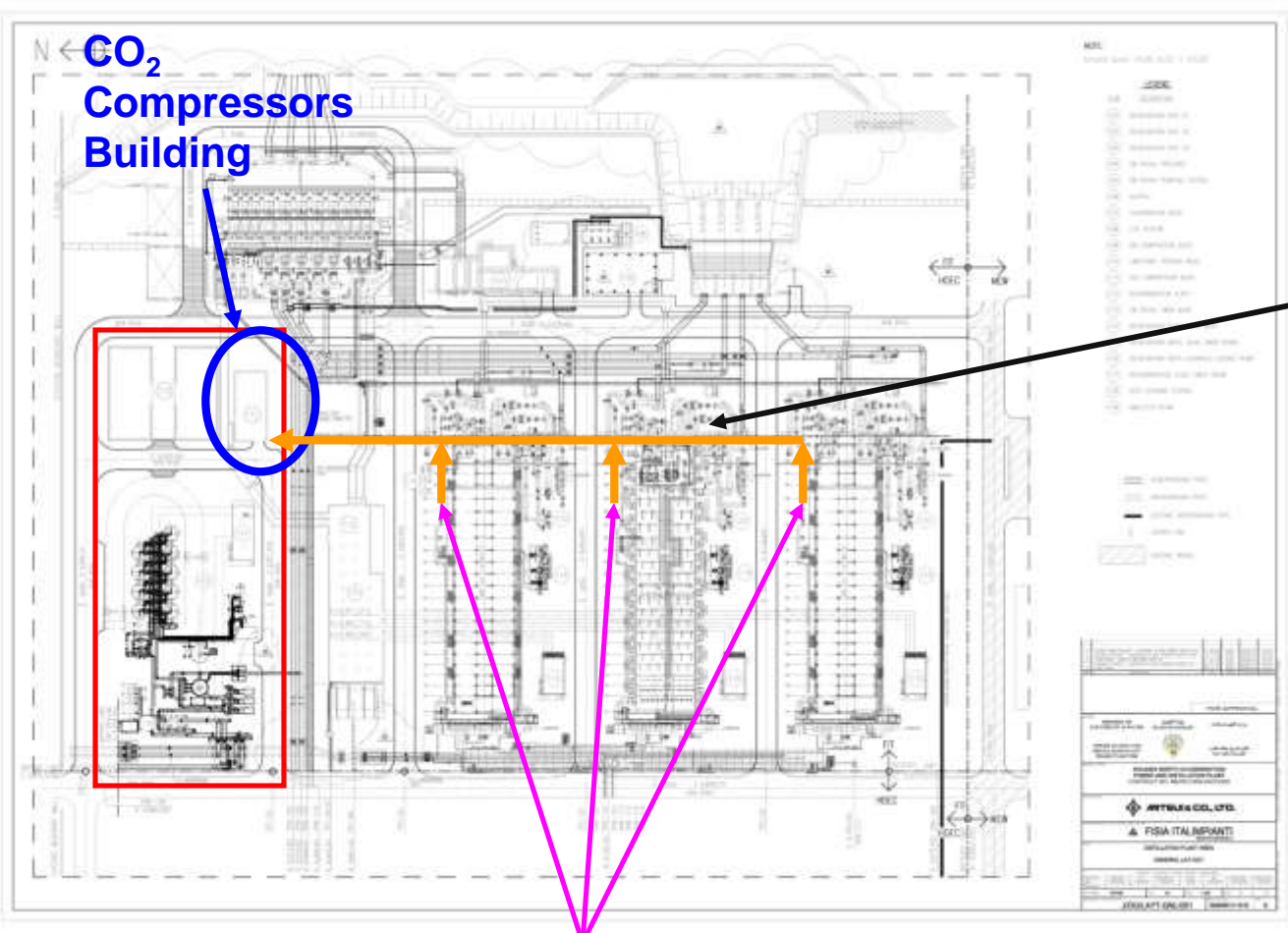
Main
Static
Mixer

Abs. Static Mixer

Absorbers

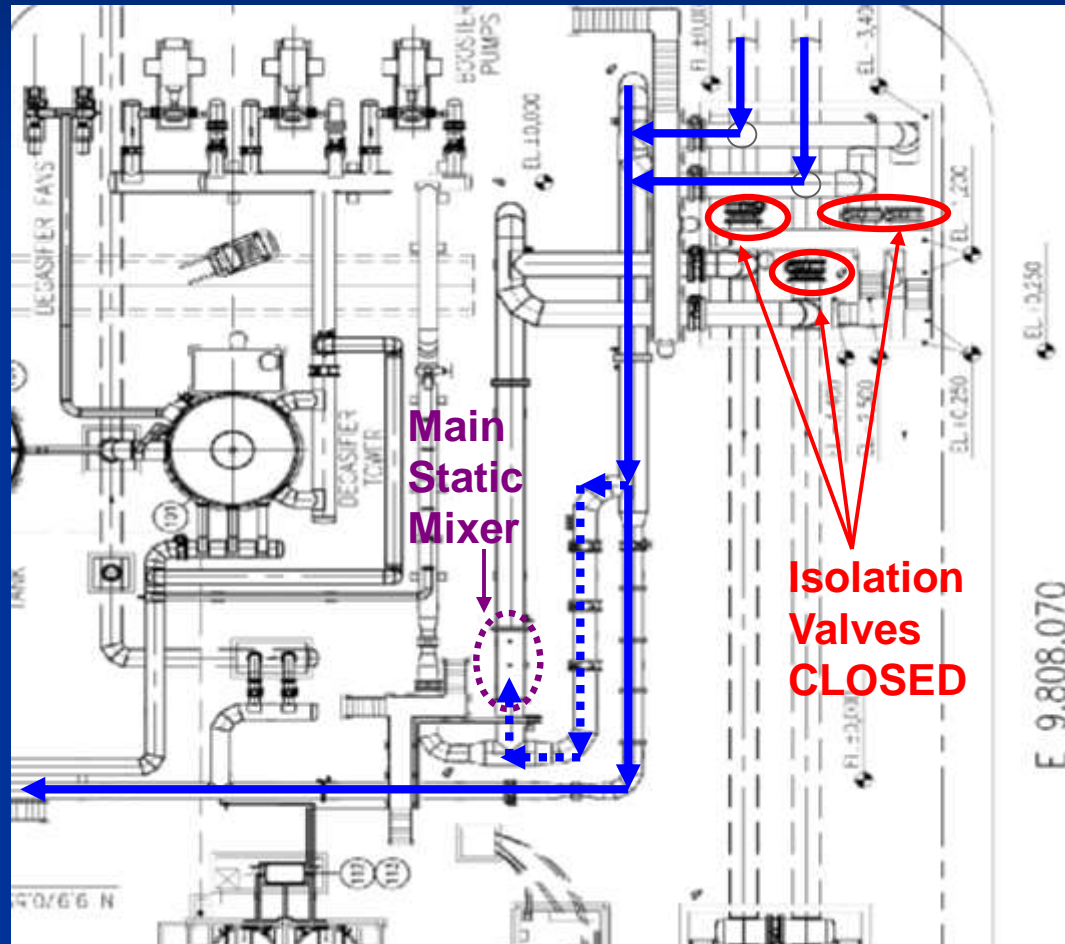
NaOH Dosing

RECARBONATION PLANT



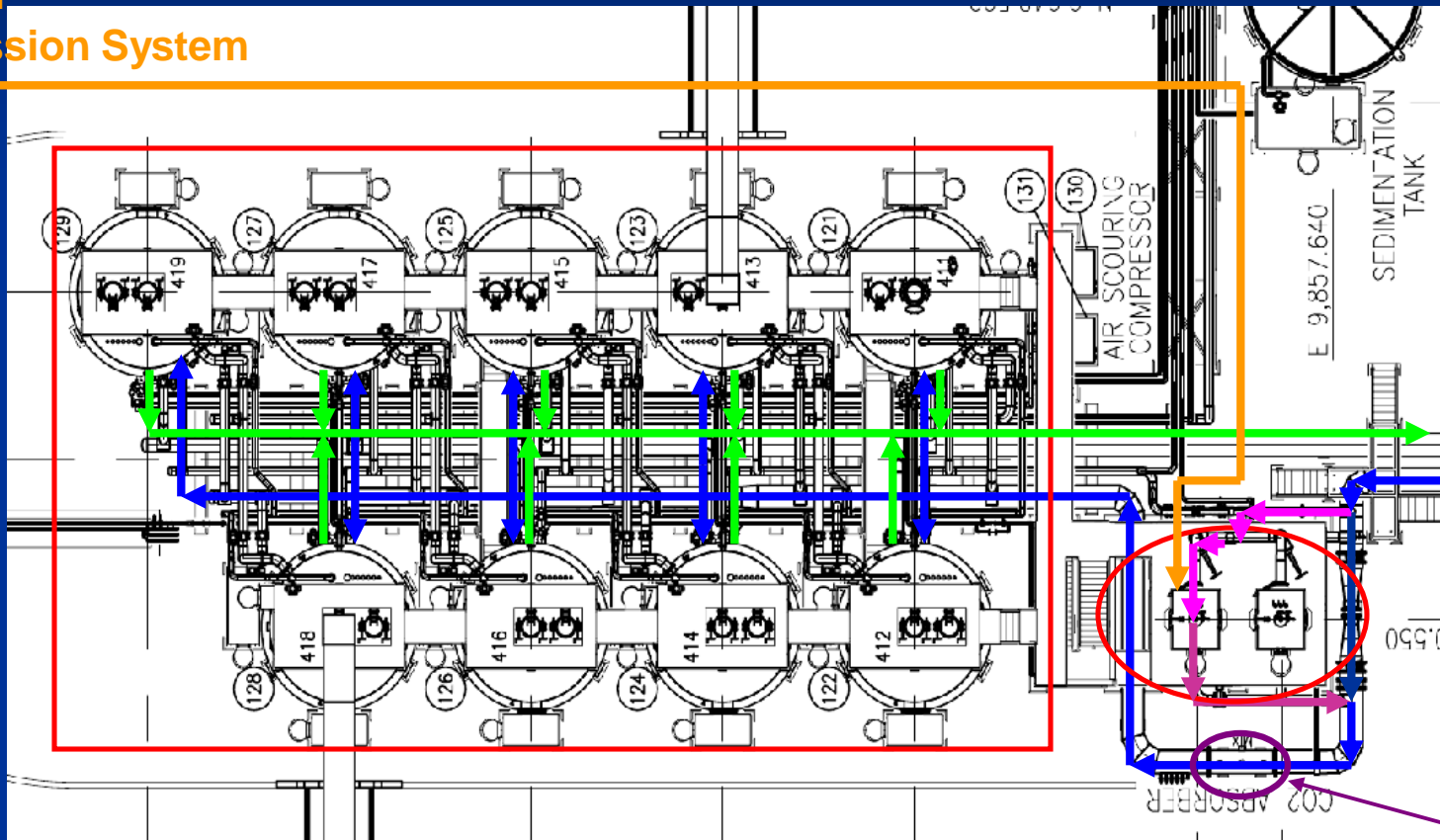
CO₂ Booster Vacuum Pump

RECARBONATION PLANT



RECARBONATION PLANT

CO₂ from
Compression System



LIMESTONE
FILTERS

CO₂
ABSORBERS

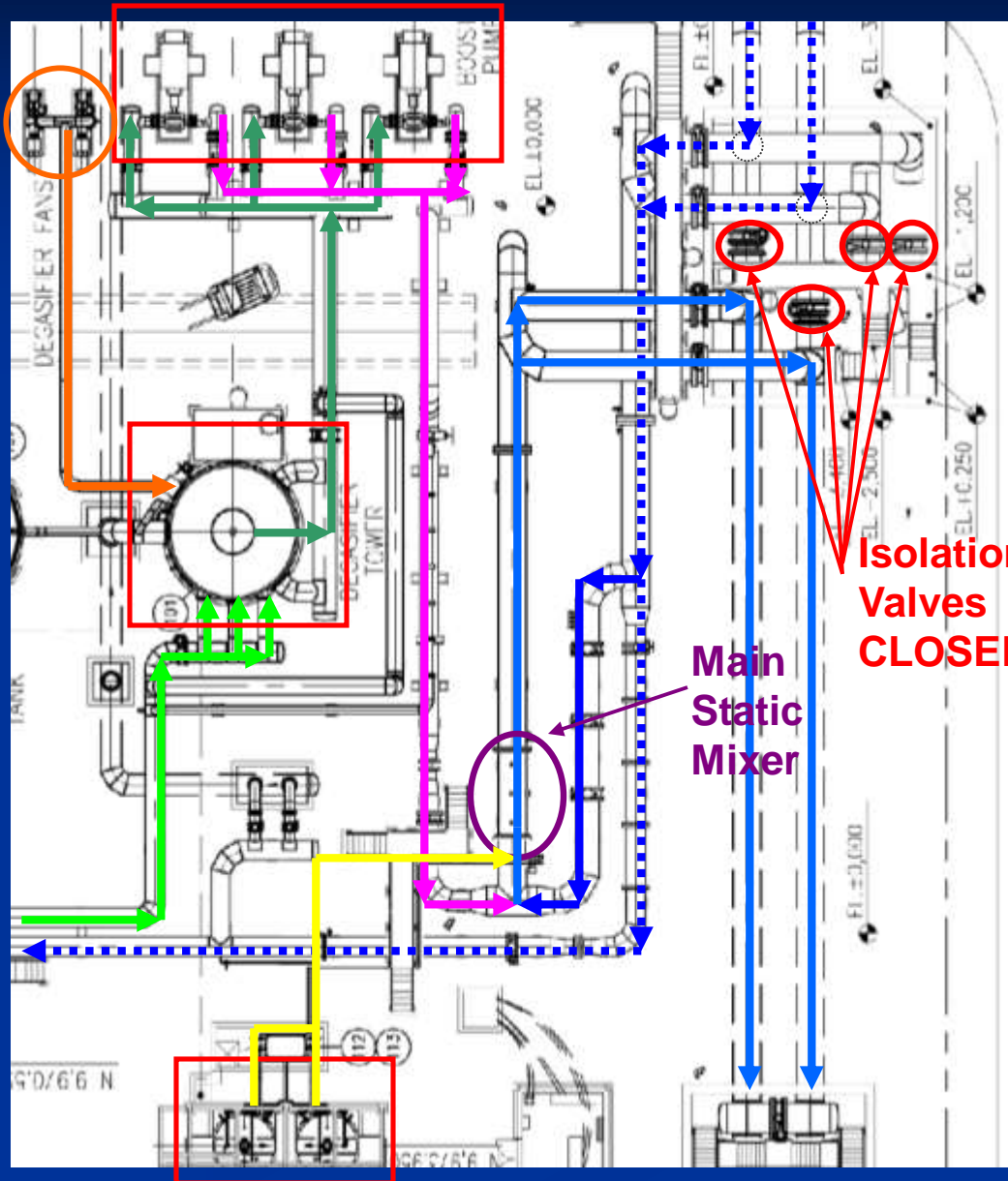
Abs.
Static
Mixer

RECARBONATION PLANT

DEGASIFIER
FANS

DEGASSING
TOWER

NaOH
DOSING



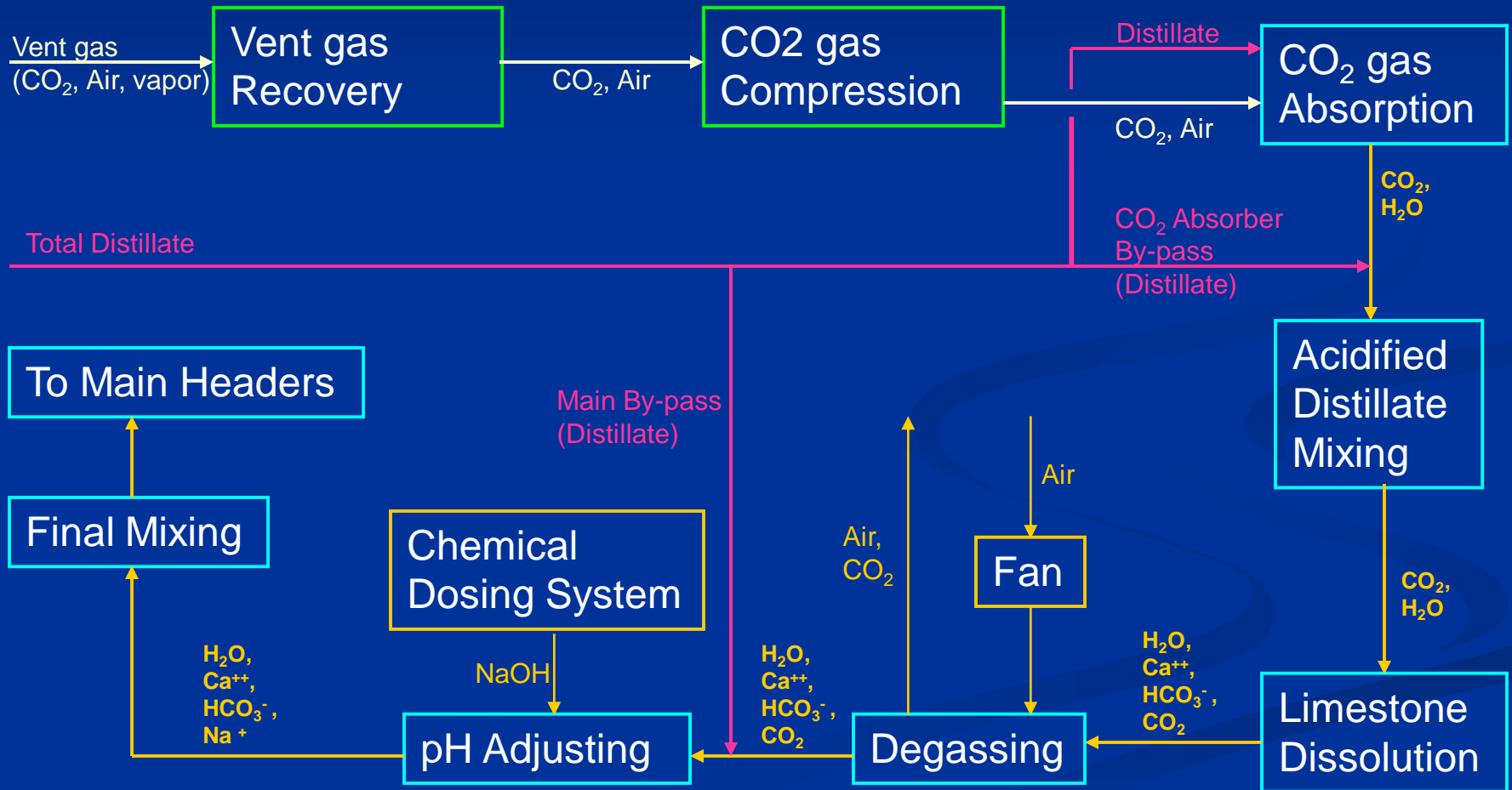
DEGASIFIER
EXTRACTION
PUMPS

Isolation
Valves
CLOSED

Main
Static
Mixer

TO BATTERY
LIMIT

RECARBONATION PLANT

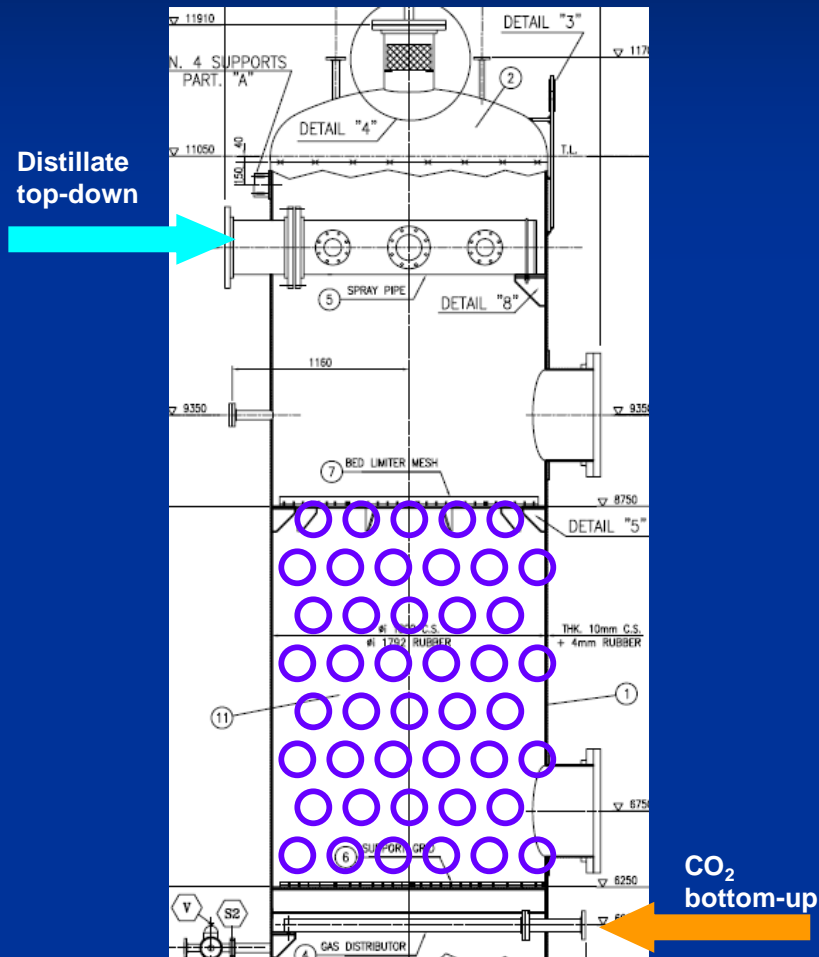


RECARBONATION PLANT

MAIN VESSELS AND TANKS

- **CO₂ ABSORBERS**
- **LIMESTONE FILTERS**
- **DEGASSING TOWER**

RECARBONATION PLANT



CO2 ABSORBER

2 UNITS

1 IN OPERATION

1 IN STAND BY

OPERATING PRESSURE: 3.5 barG

MATERIAL: CS RUBBER LINED

HEIGHT: approx 12m

DIAMETER: approx 1.8m

PACKING: POLYPROPYLENE

RECARBONATION PLANT

CO₂ ABSORBERS

2 X 100%



RECARBONATION PLANT

CO₂ ABSORBERS

2 X 100%

CO₂ Gas Line from
CO₂ Compressors

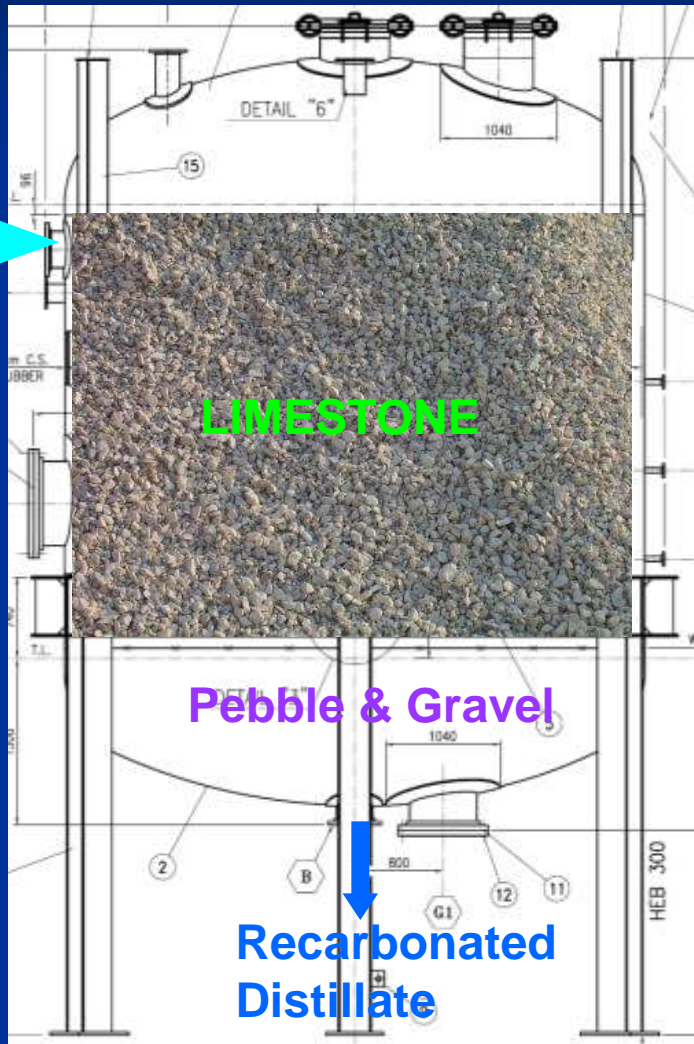
Acidified Distillate
to L.F.

Distillate from
Absorber's By-pass



RECARBONATION PLANT

Acidified
Distillate



LIMESTONE FILTERS

9 UNITS

7 IN NORMAL OPERATION

1 IN RECHARGING

1 IN STAND BY

OPERATING PRESSURE:
3.5barG

MATERIAL: CS RUBBER
LINED

HEIGHT: approx 9 m

DIAMETER: approx 5.2 m

RECARBONATION PLANT

LIMESTONE
FILTER

FLOW CONTROL
VALVE

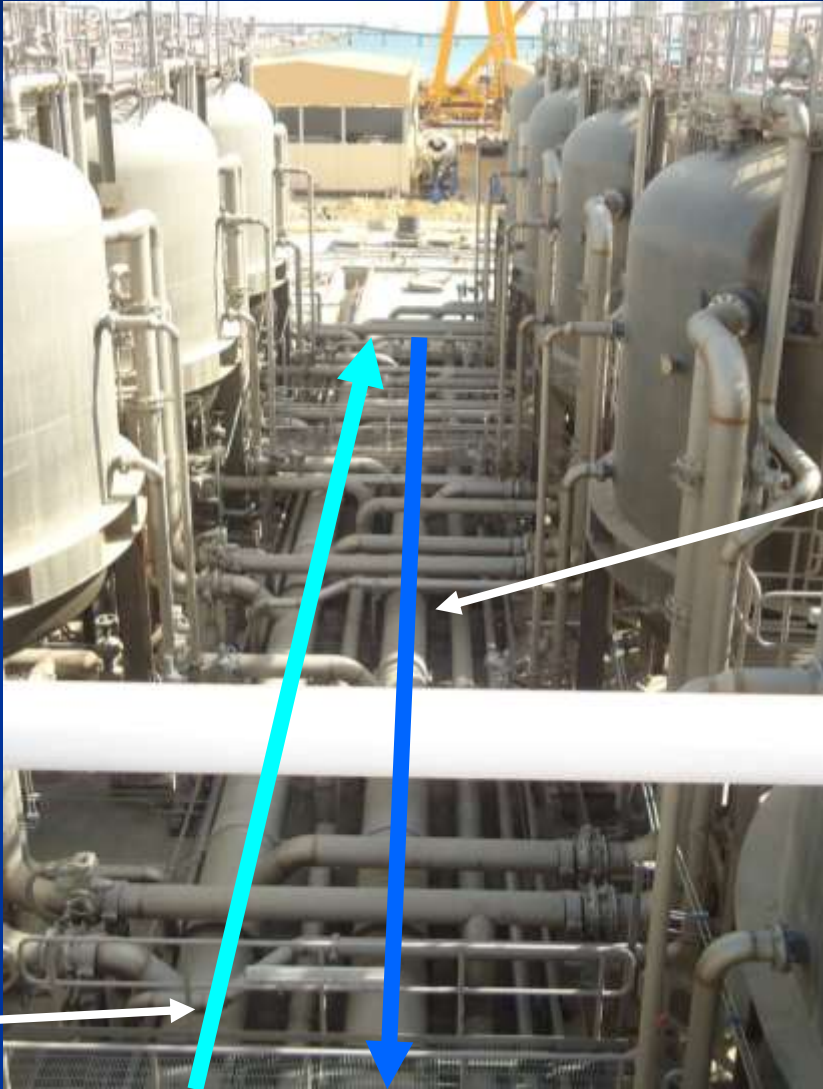
RECARBONATED
WATER
OUTLET



ACIDIFIED
DISTILLATE
INLET

RECARBONATION PLANT

LIMESTONE
FILTERS



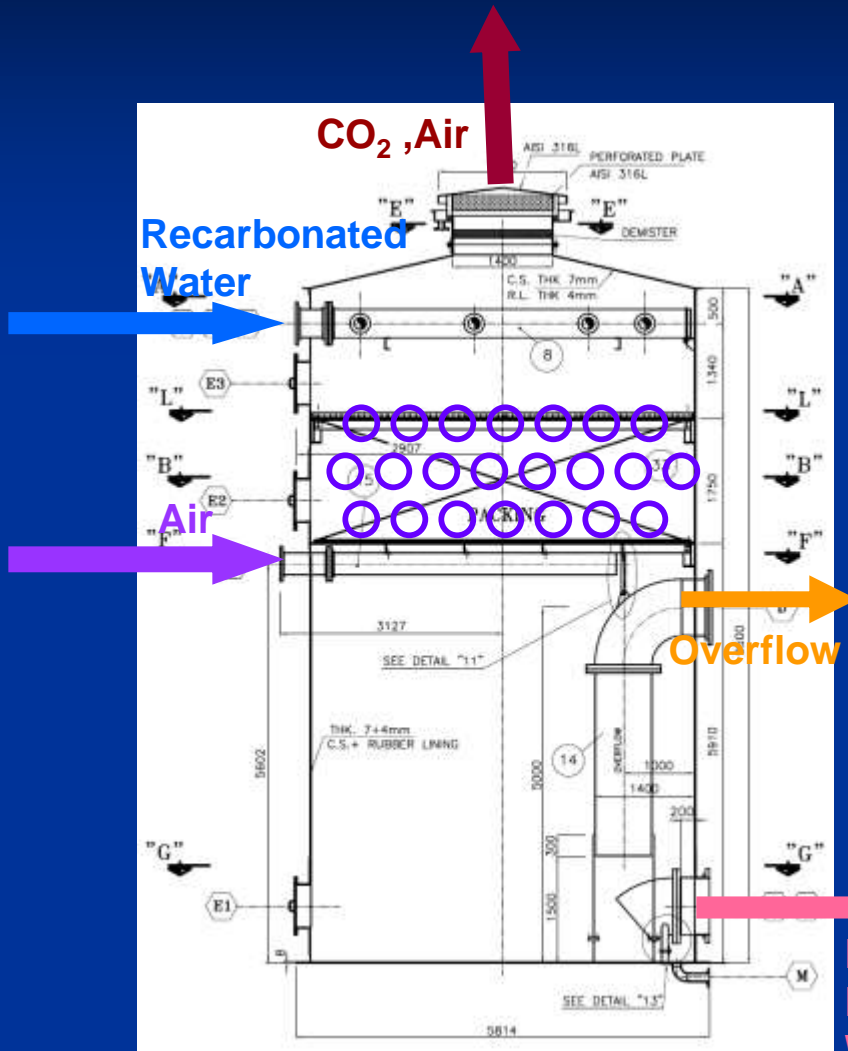
Sea

RECARBONATED
WATER
FROM L.F.

ACIDIFIED
DISTILLATE
TO L.F.

CO₂ Absorbers

RECARBONATION PLANT



DEGASIFIER TOWER

1 UNIT WITH BY-PASS

OPERATING PRESSURE: Atm

MATERIAL: CS rubber lined

HEIGHT: approx 9 m

DIAMETER: approx 5.4 m

PACKING: POLYPROPYLENE

Degassed
Recarbonated
Water

RECARBONATION PLANT

DEGASSING
TOWER

OVERFLOW

CO₂, Air

RECARBONATED
WATER
INLET



RECARBONATION PLANT

DEGASSING TOWER

RECARBONATED WATER INLET

AIR

DEGASSED WATER OUTLET

OVERFLOW



RECARBONATION PLANT

MAIN PUMPS AND COMPRESSORS

- DEGASIFIER EXTRACTION PUMPS
- CO₂ BOOSTER PUMPS
- CO₂ COMPRESSORS

RECARBONATION PLANT

DEGASIFIER EXTRACTION PUMPS (3 X 50%)

HORIZONTAL CENTRIFUGAL – DOUBLE SUCTION

FLOW 1540 m³/h

HEAD 150 m

POW. 950 KW

MAT. DUPLEX
S.S.



RECARBONATION PLANT

CO2 BOOSTER PUMPS

DRAIN
SEPARATOR

CO₂
BOOSTER
VACUUM
PUMP

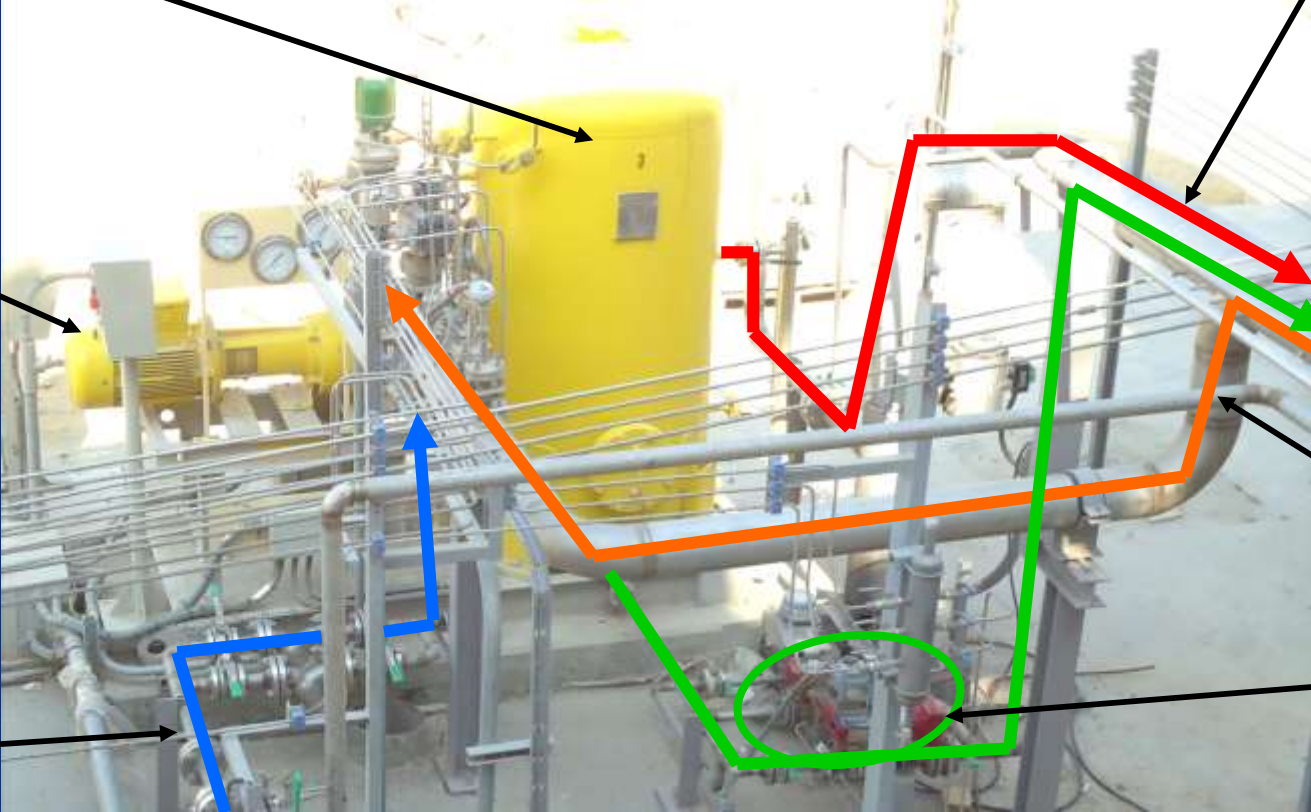
SEALING
WATER

CO₂ GAS TO
COMPRESSORS

DRAIN TO MSF

CO₂ GAS
FROM
VACUUM
SYSTEM

LEVEL
CONTROL
VALVE

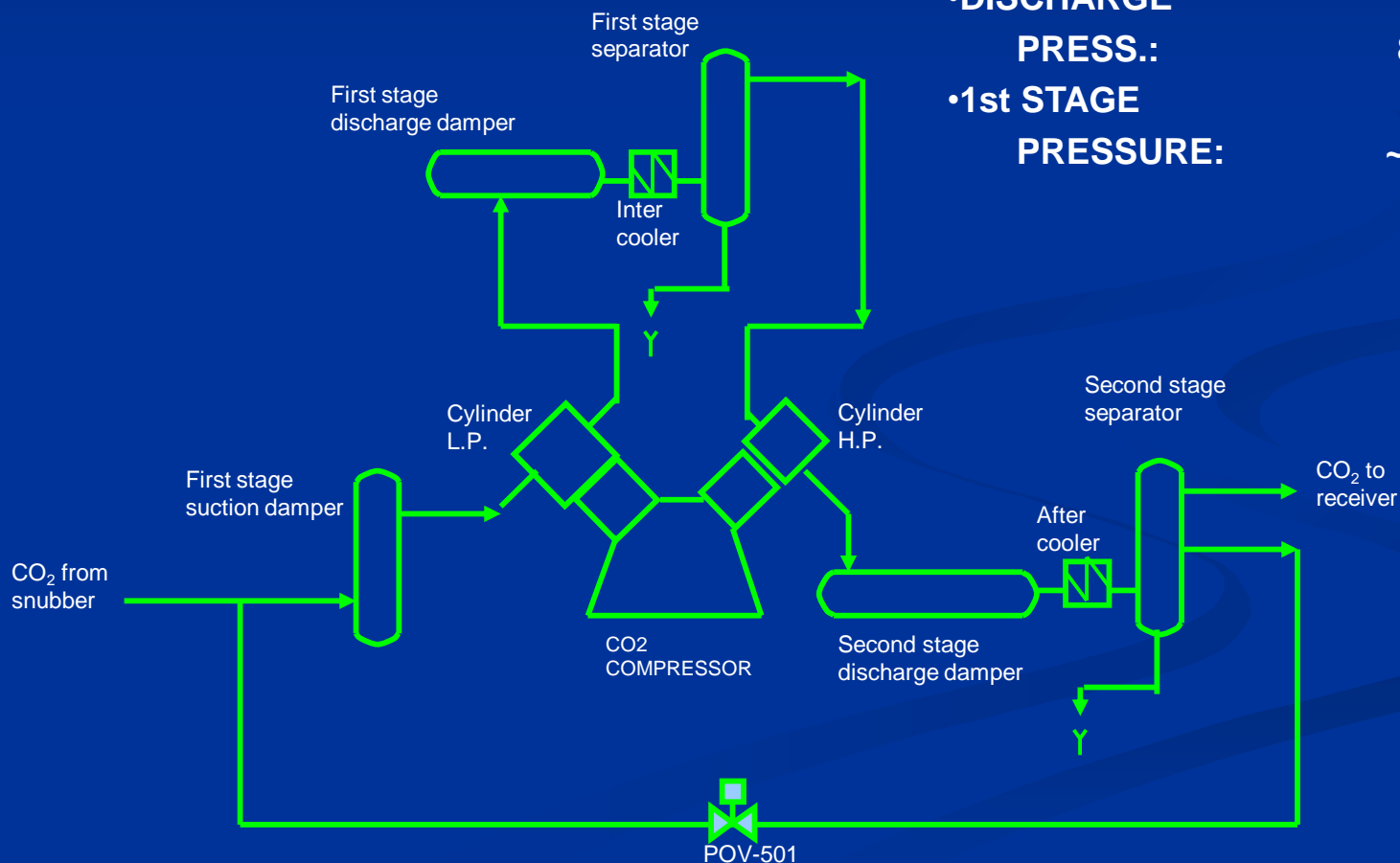


RECARBONATION PLANT

CO₂ COMPRESSORS

RECIPROCATING TYPE
2 STAGES

- CAPACITY: 650 Nm³/h
- DISCHARGE PRESS.: 8 bar (a)
- 1st STAGE PRESSURE: ~ 3 bar (a)



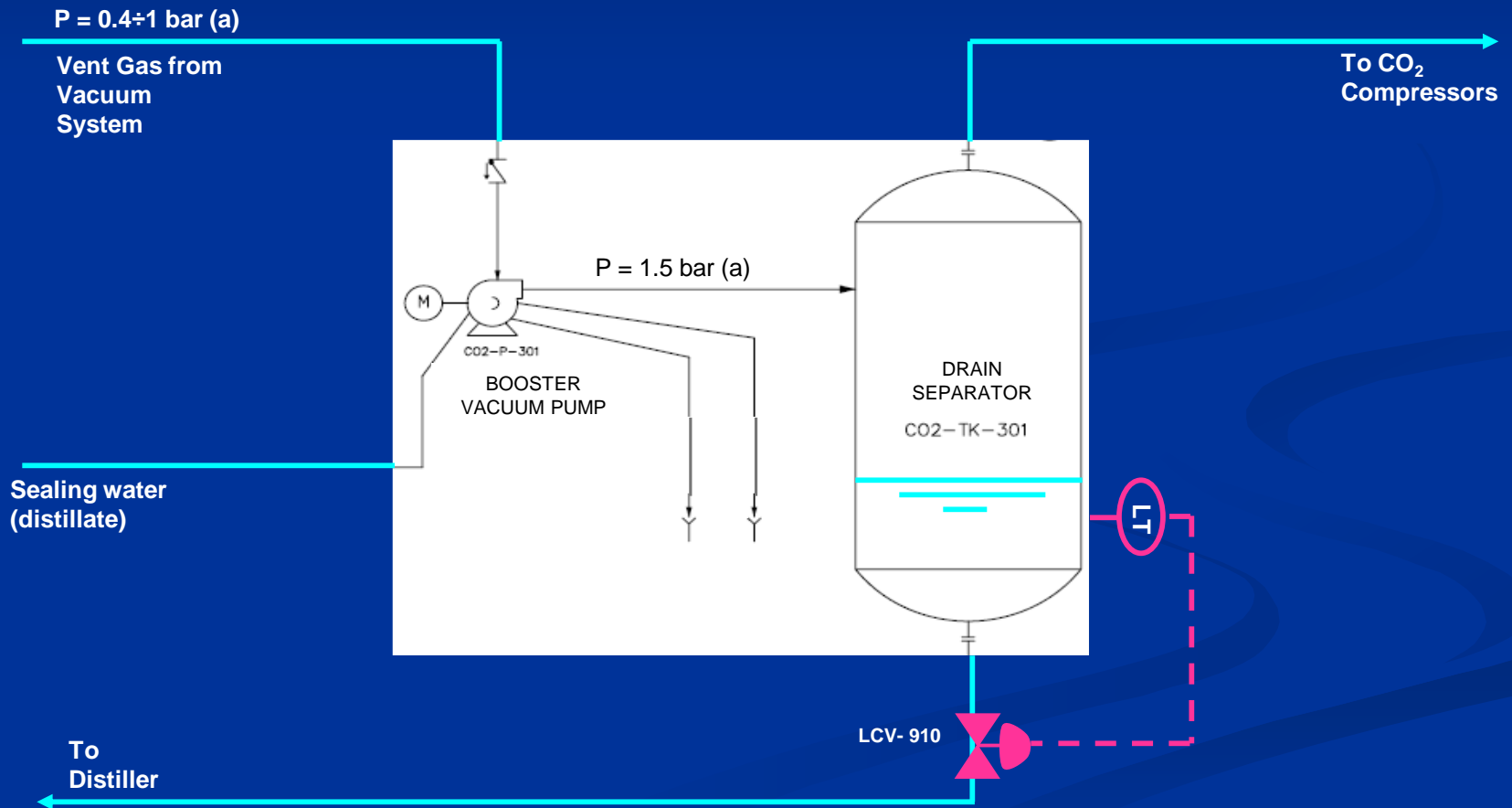
RECARBONATION PLANT

CO₂ COMPRESSORS



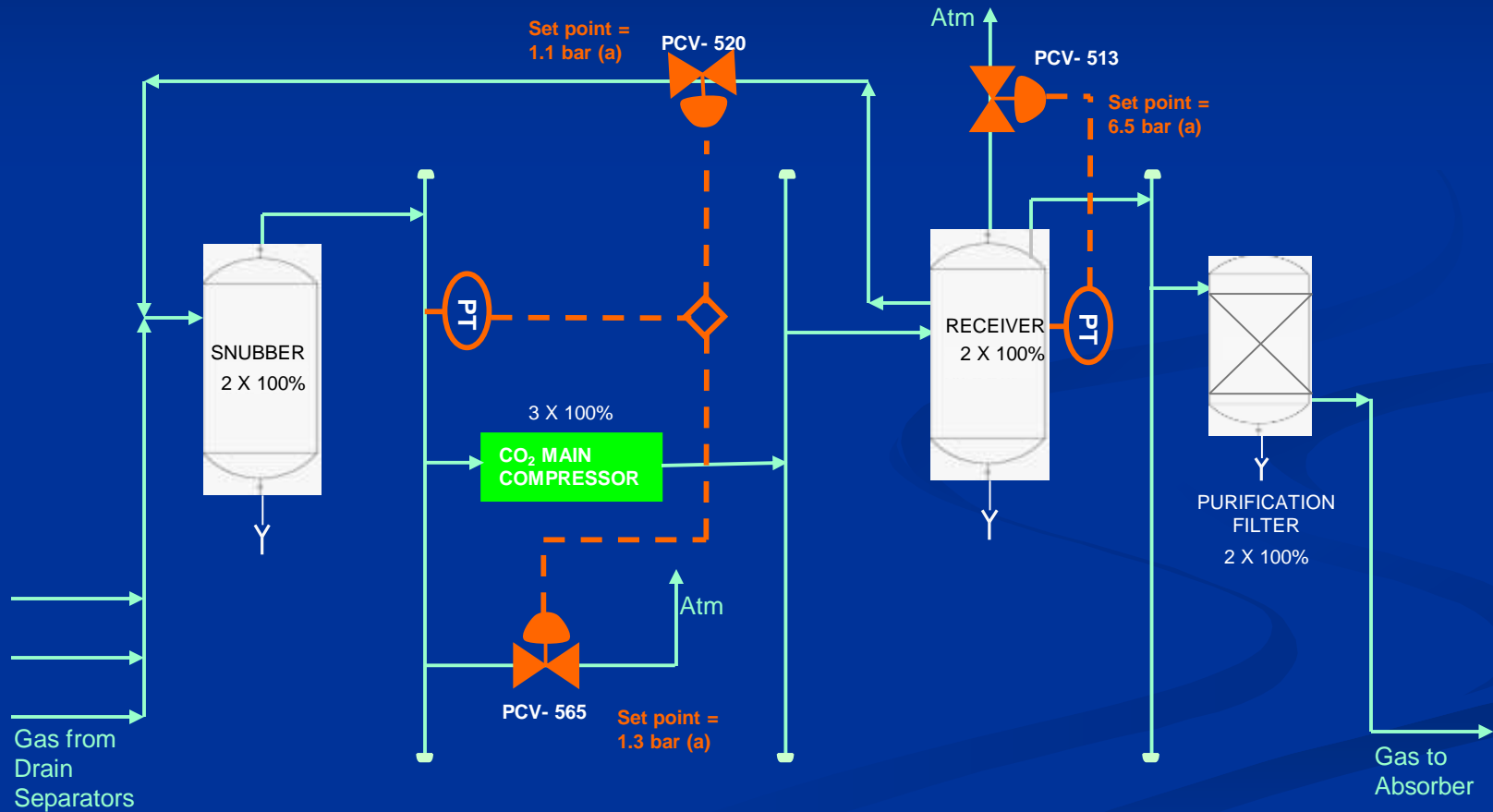
RECARBONATION PLANT

GAS RECOVERY SYSTEM



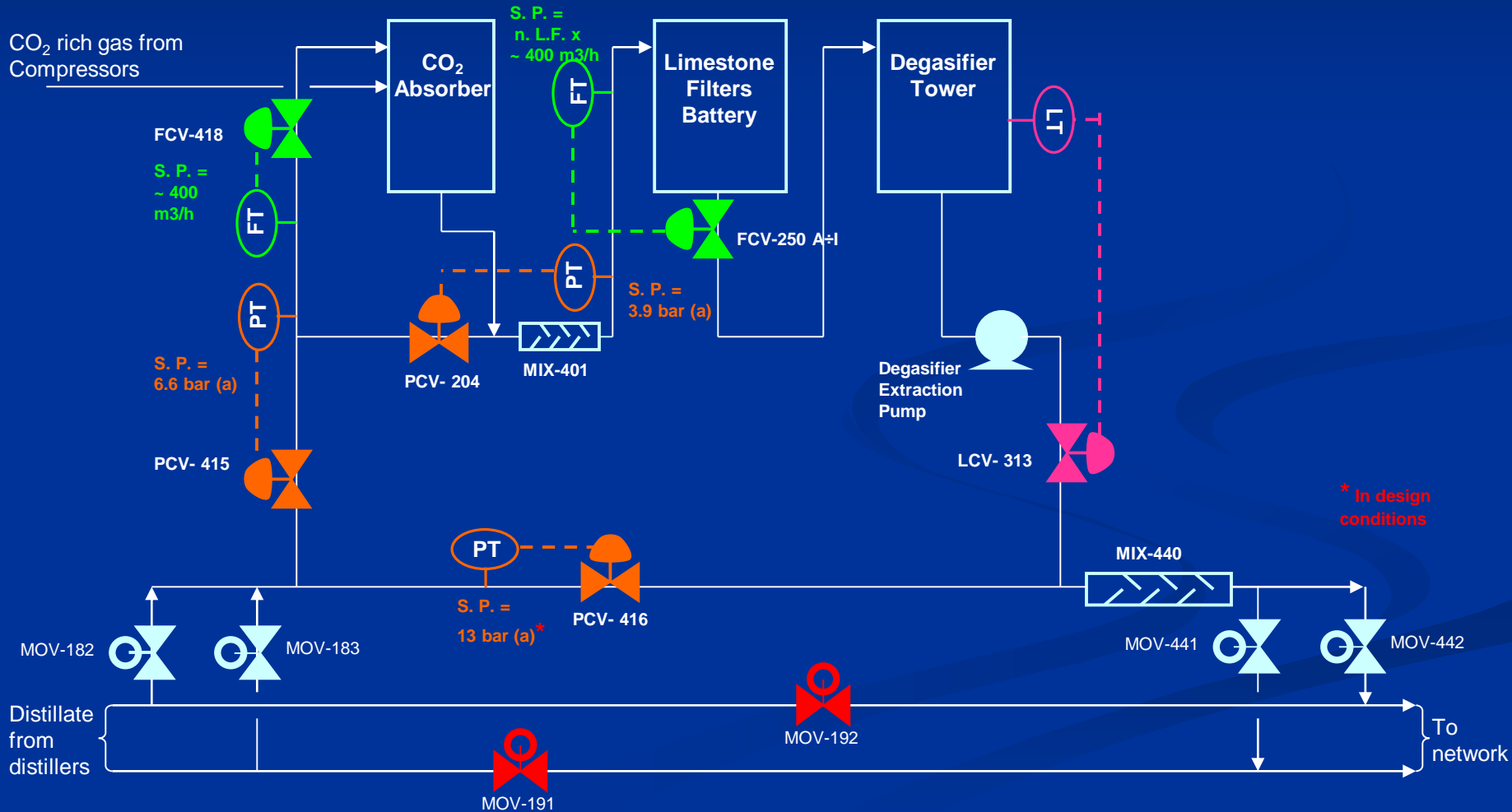
RECARBONATION PLANT

GAS COMPRESSION SYSTEM



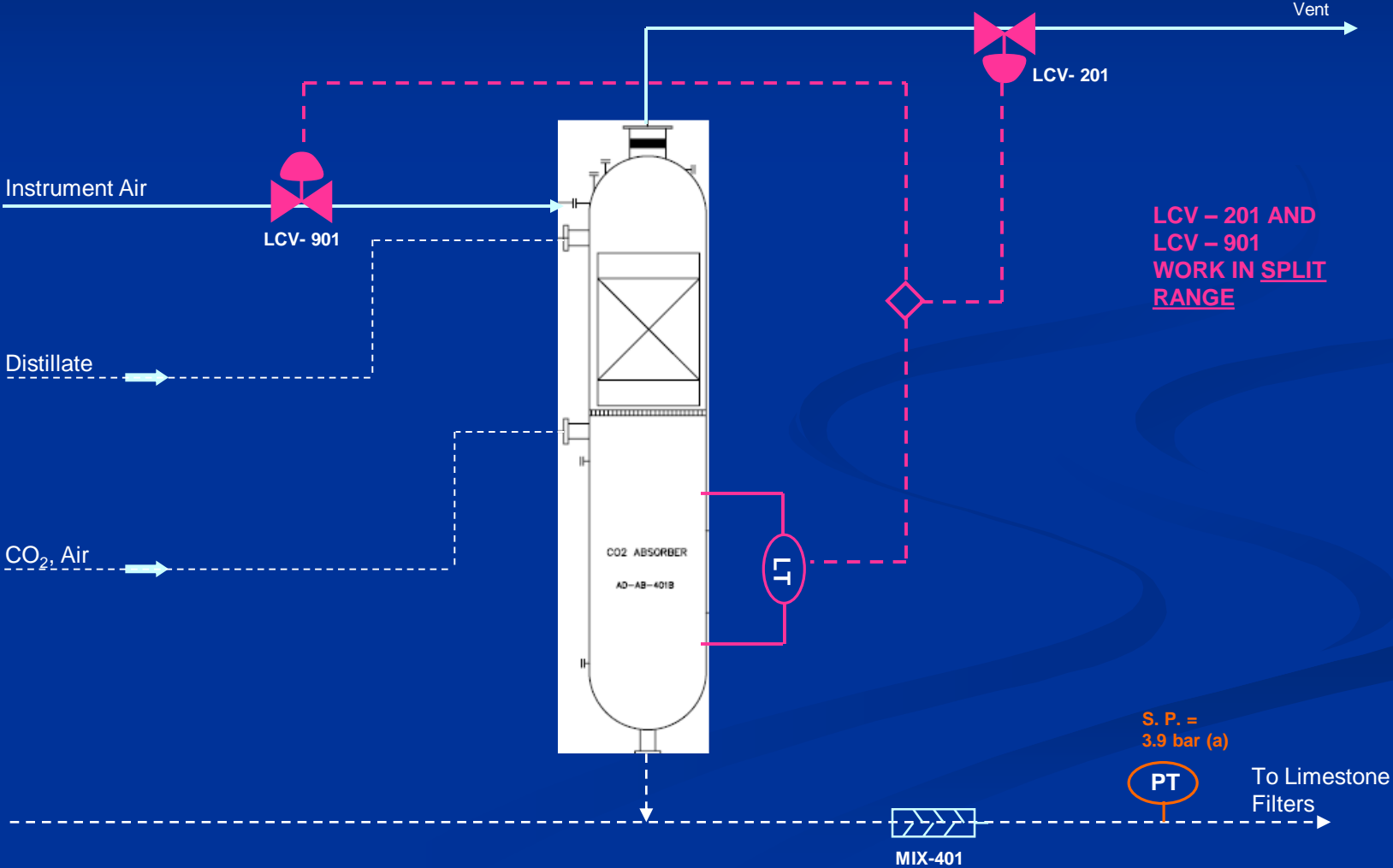
RECARBONATION PLANT

PLANT CONTROL SYSTEM



RECARBONATION PLANT

CO₂ ABSORBER CONTROL SYSTEM



RECARBONATION PLANT

WATER ALKALINITY CONTROL SYSTEM

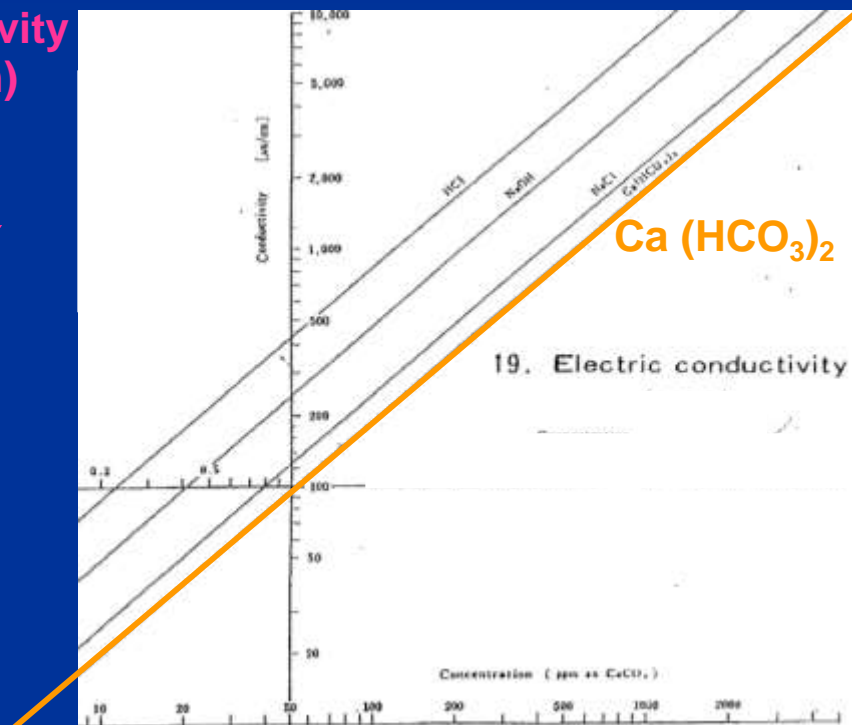
ALKALINITY ↔ CONDUCTIVITY

Conductivity
($\mu\text{S/cm}$)

CONDUCTIVITY

=

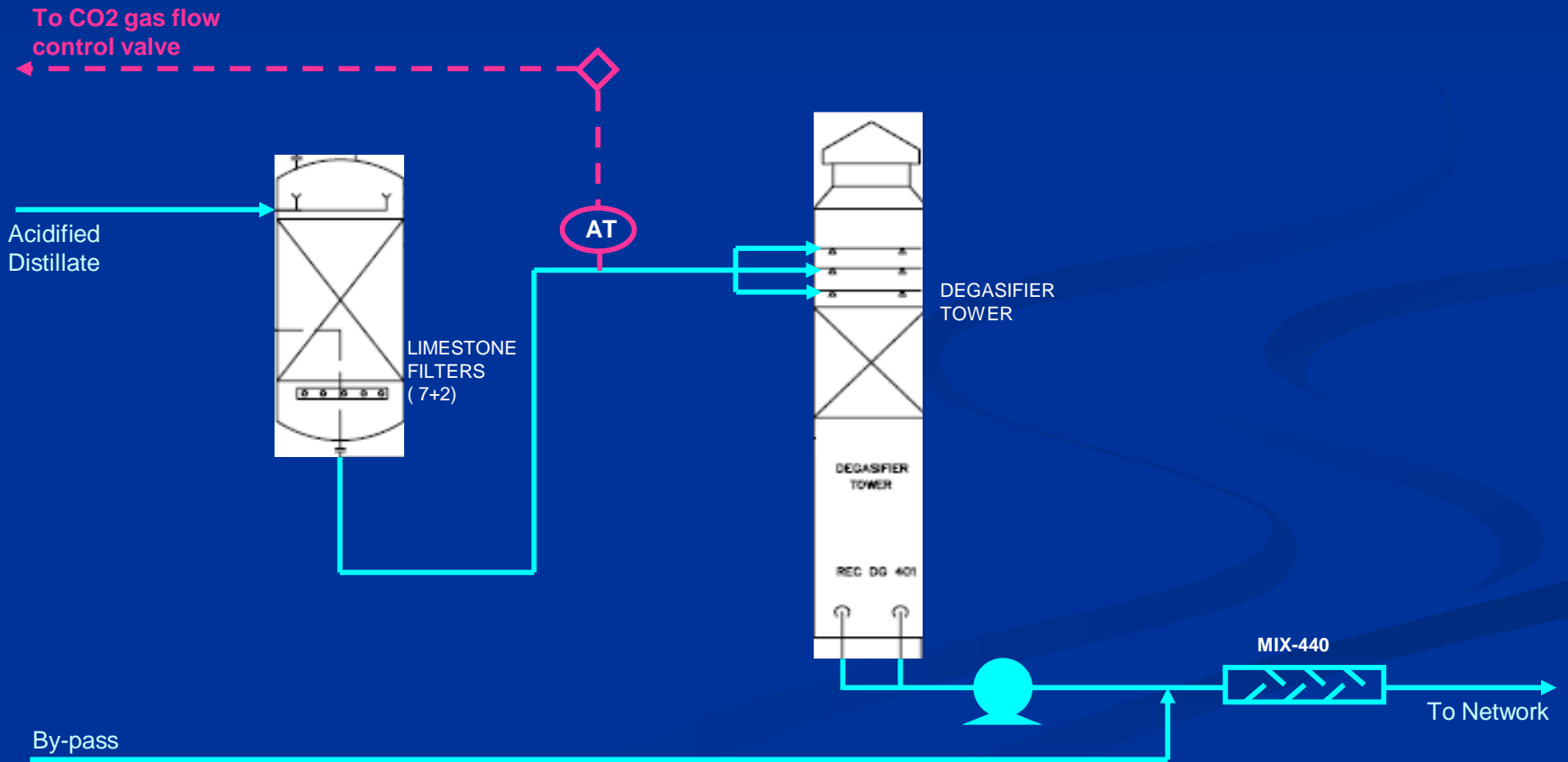
F(ALKALINITY)



Alkalinity
(ppm as CaCO₃)

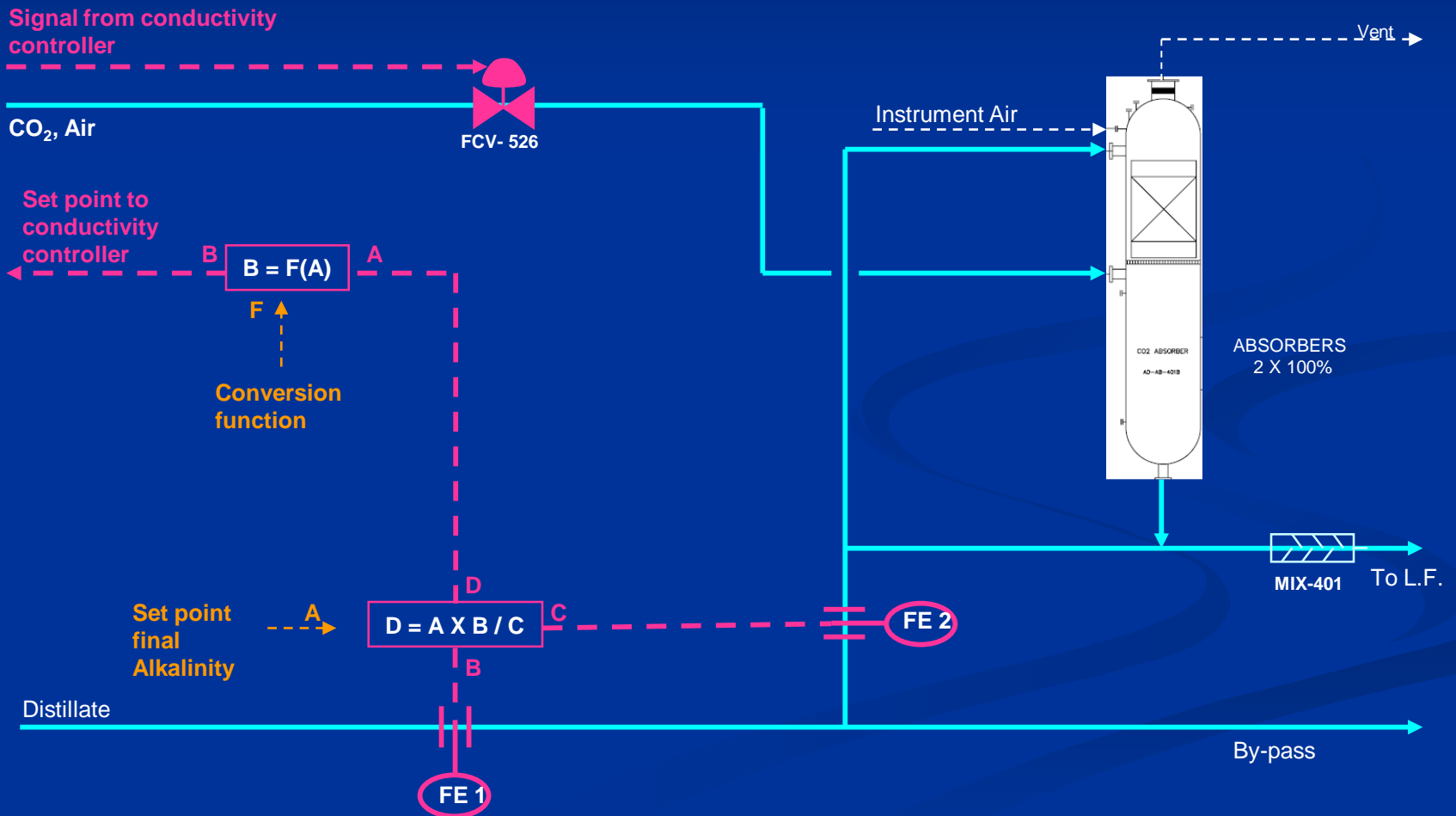
RECARBONATION PLANT

WATER CONDUCTIVITY CONTROL SYSTEM



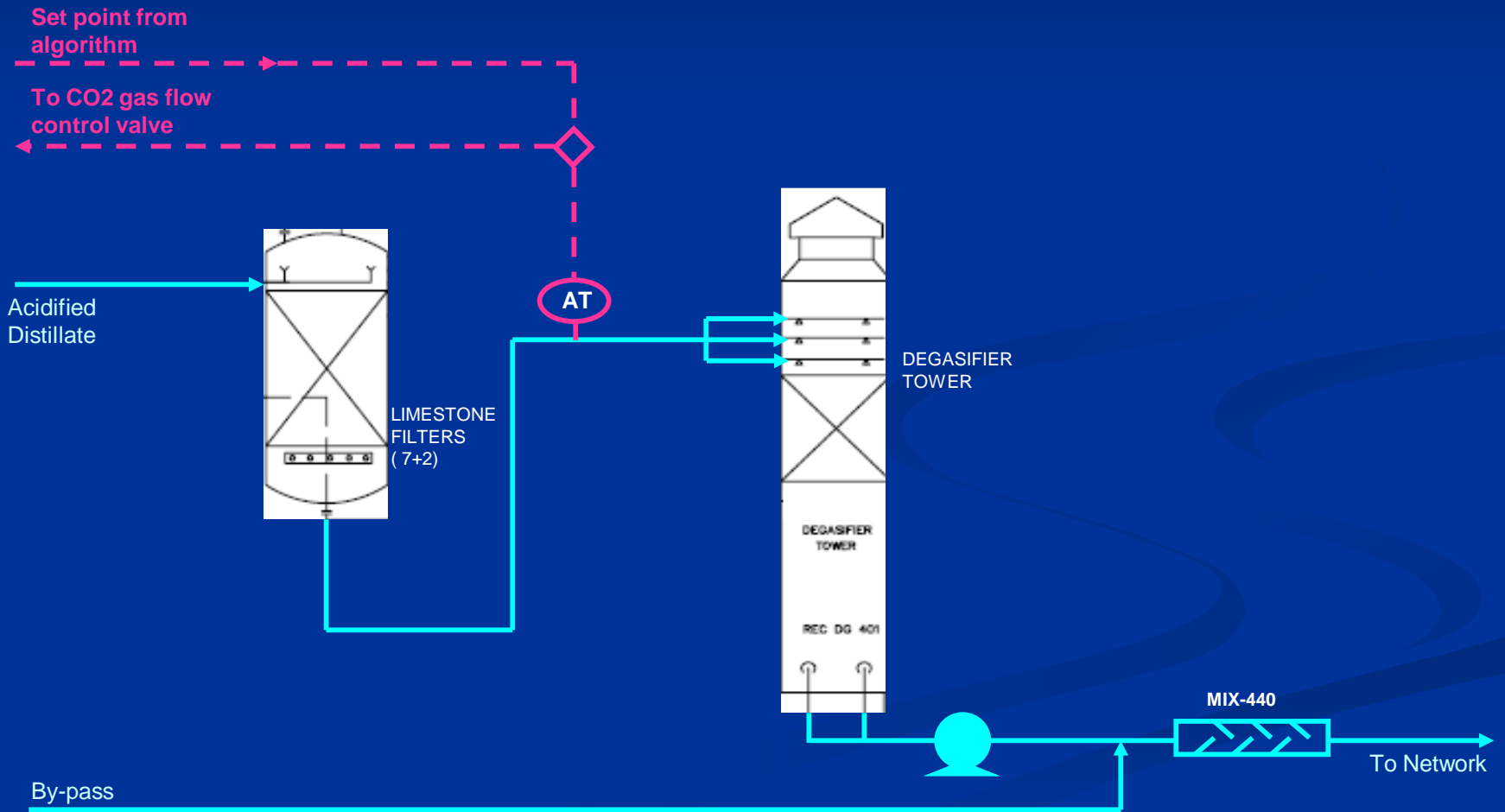
RECARBONATION PLANT

WATER CONDUCTIVITY CONTROL SYSTEM



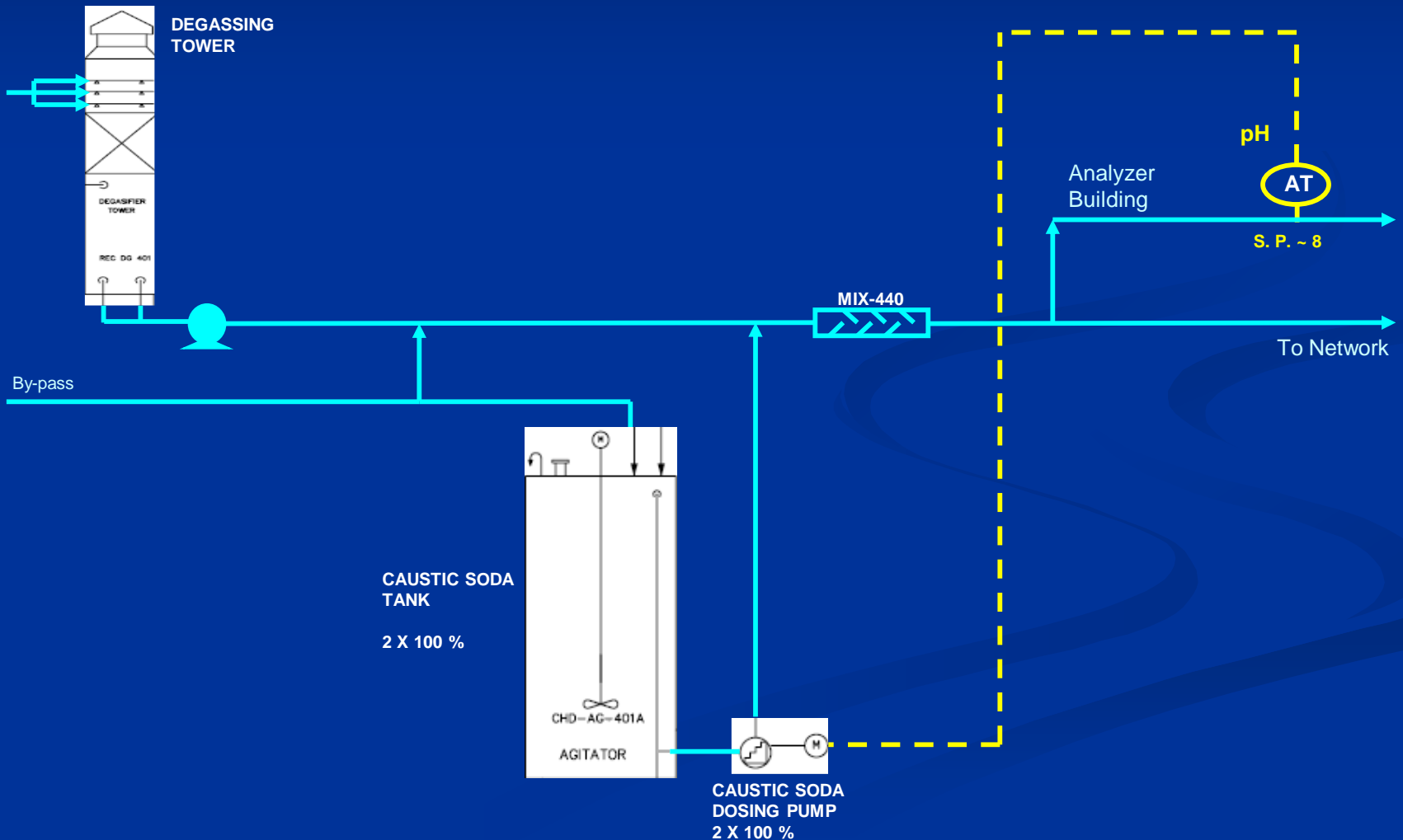
RECARBONATION PLANT

WATER CONDUCTIVITY CONTROL SYSTEM



RECARBONATION PLANT

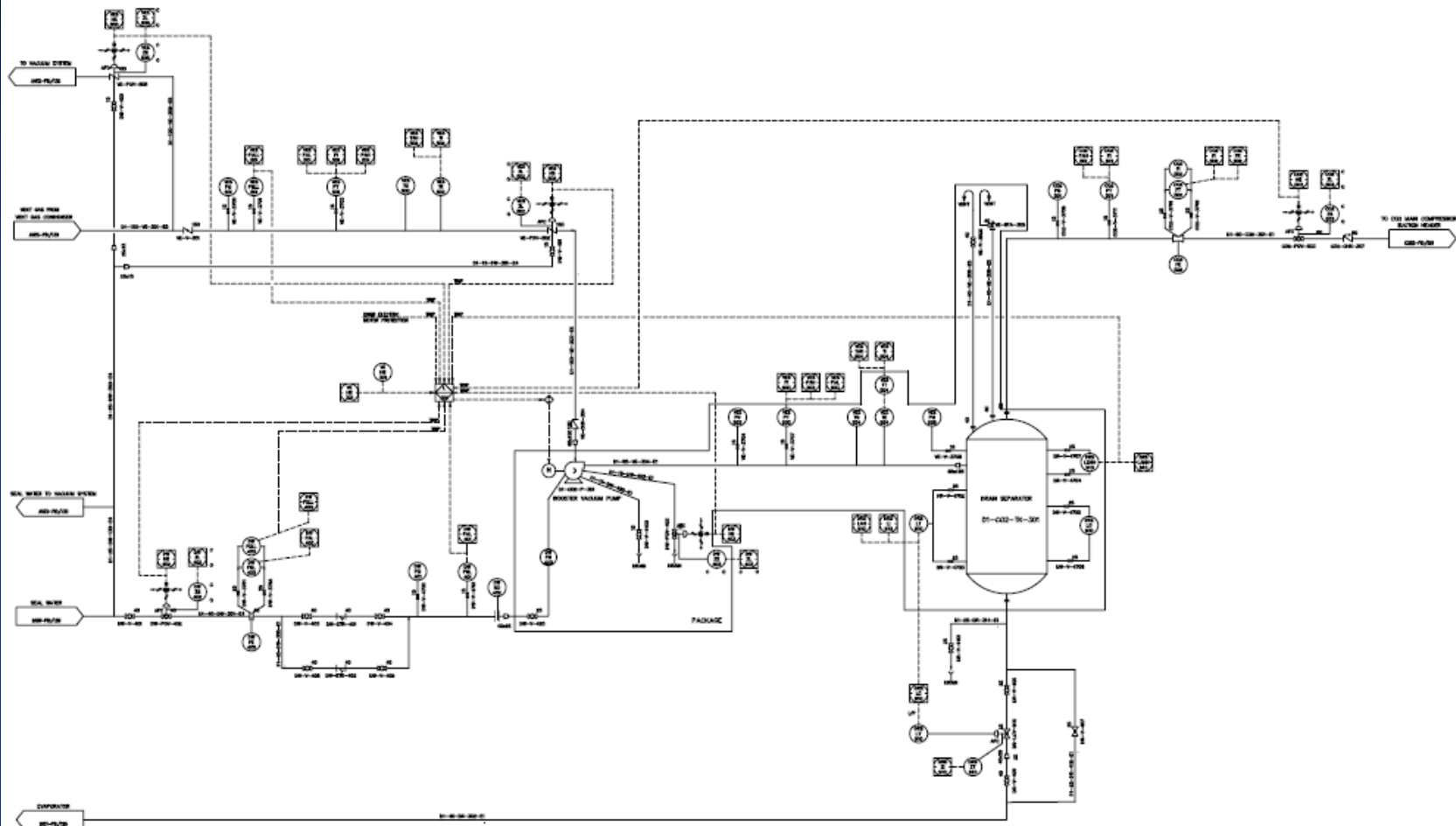
pH CONTROL SYSTEM

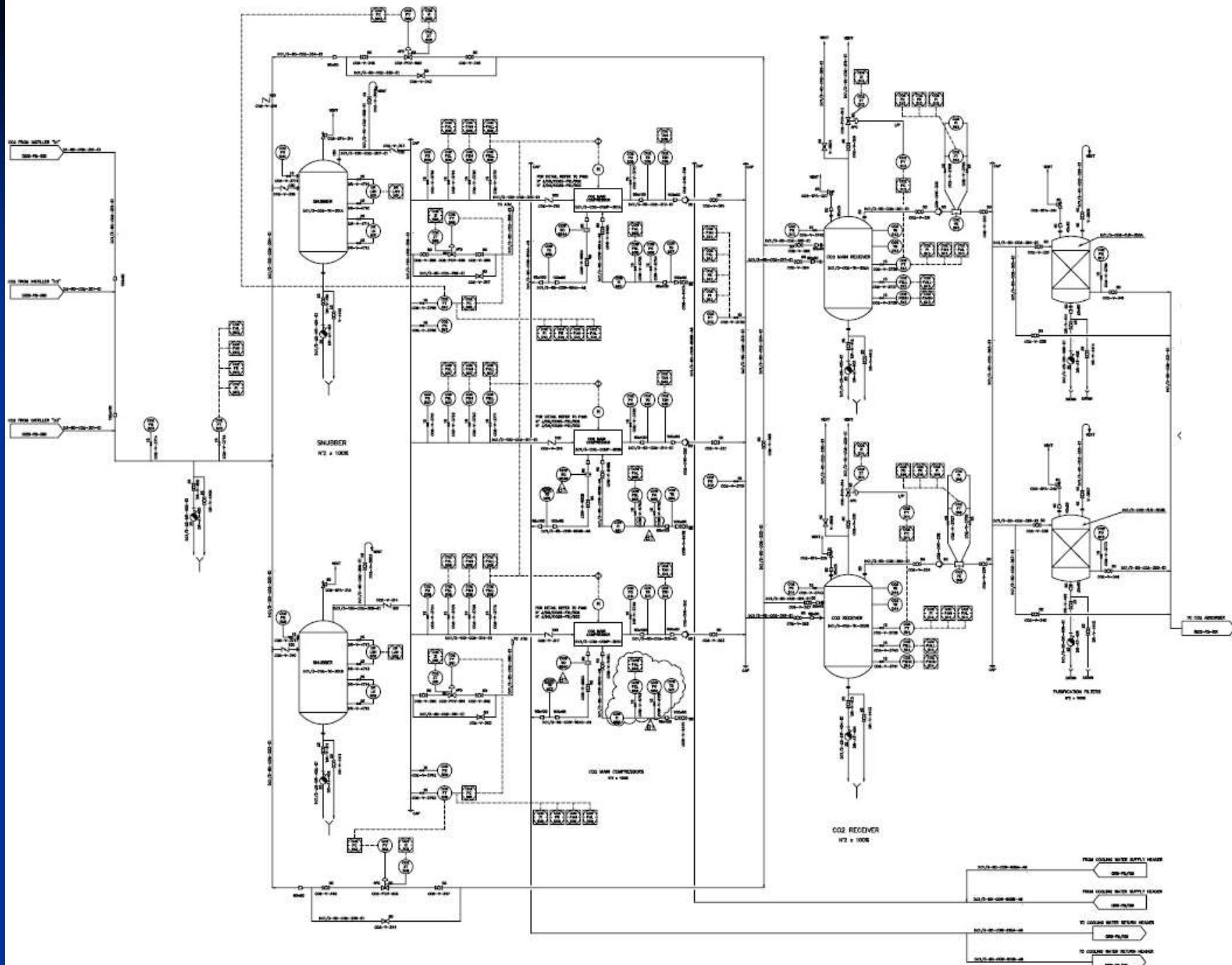


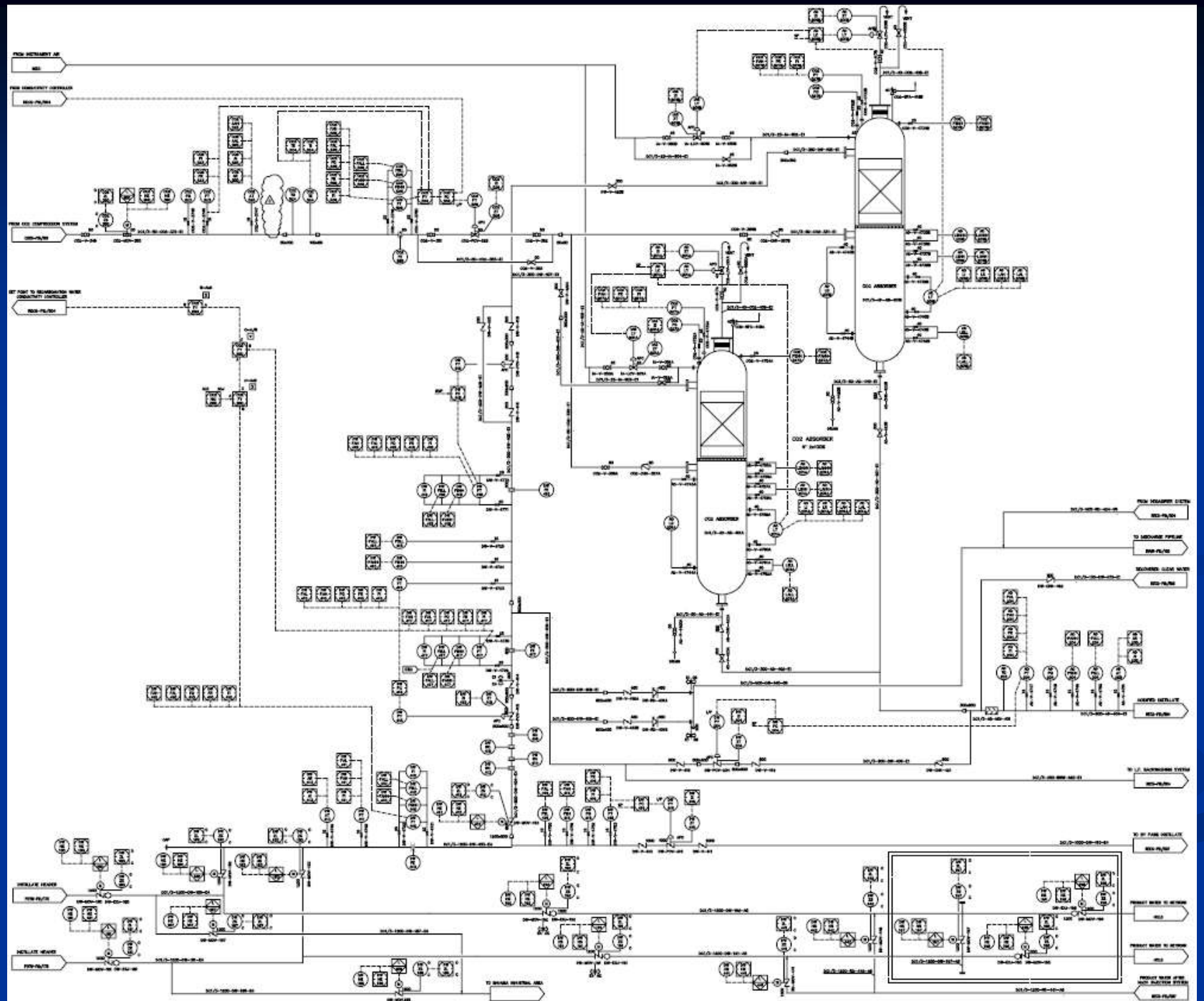
RECARBONATION PLANT

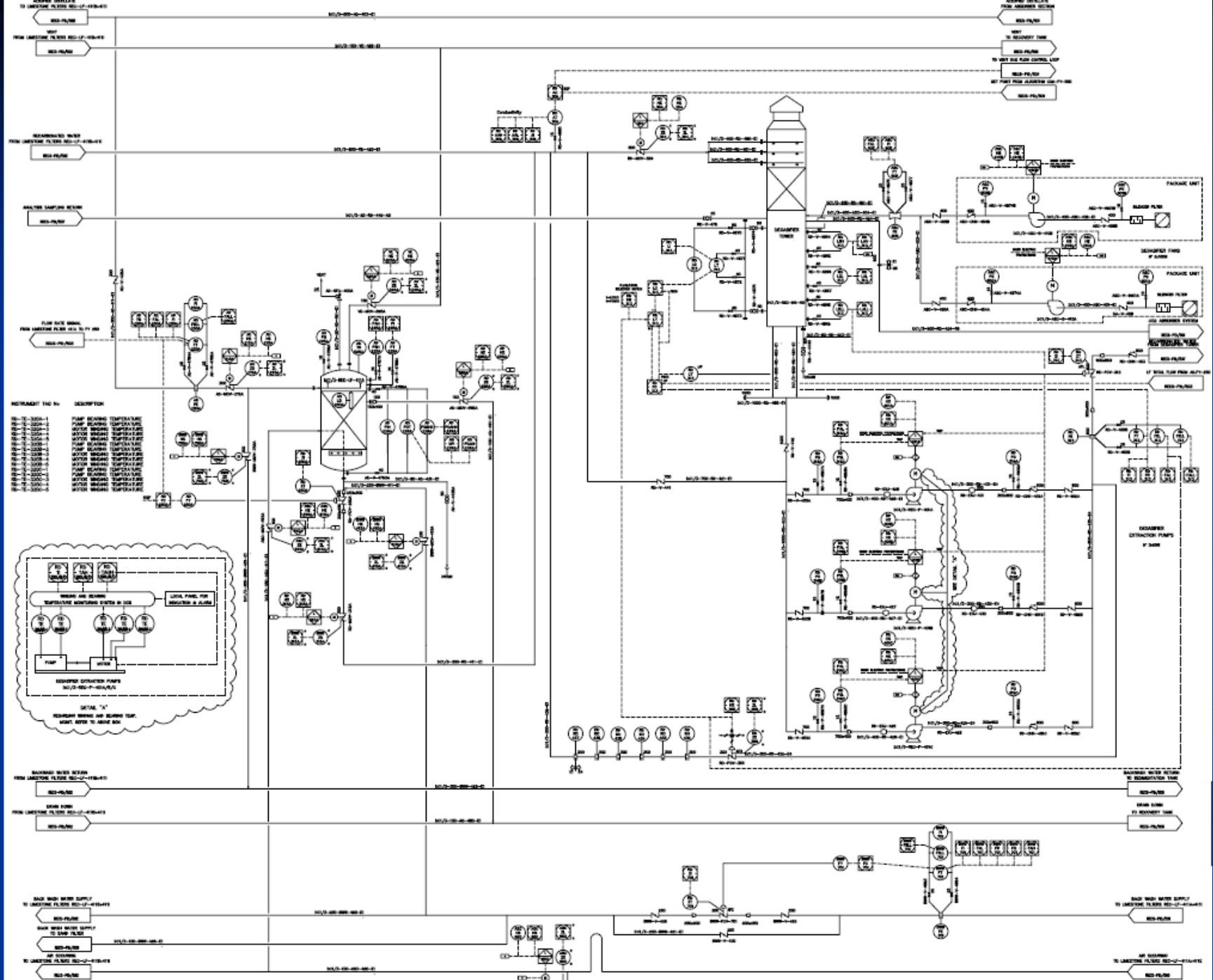
P. I. D.

PROCESS &
INSTRUMENTATION
DIAGRAM







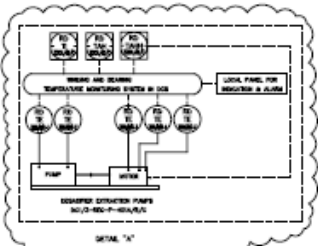


REGENERATOR WATER FROM LAKEVIEW FLEETS NO. 17-118-41

WATER TREATMENT SYSTEM

FLOW RATE SIGNAL FROM LAKEVIEW FLEETS NO. 17-118-41

INSTRUMENT TAG NO.	DESCRIPTION
W-10-1000-1	PUMP BEARING SUPERVISORY
W-10-1000-2	PUMP BEARING SUPERVISORY
W-10-1000-3	MOTOR BEARING SUPERVISORY
W-10-1000-4	MOTOR BEARING SUPERVISORY
W-10-1000-5	PUMP BEARING SUPERVISORY
W-10-1000-6	MOTOR BEARING SUPERVISORY
W-10-1000-7	MOTOR BEARING SUPERVISORY
W-10-1000-8	PUMP BEARING SUPERVISORY
W-10-1000-9	MOTOR BEARING SUPERVISORY
W-10-1000-10	MOTOR BEARING SUPERVISORY
W-10-1000-11	MOTOR BEARING SUPERVISORY
W-10-1000-12	MOTOR BEARING SUPERVISORY
W-10-1000-13	MOTOR BEARING SUPERVISORY
W-10-1000-14	MOTOR BEARING SUPERVISORY
W-10-1000-15	MOTOR BEARING SUPERVISORY
W-10-1000-16	MOTOR BEARING SUPERVISORY
W-10-1000-17	MOTOR BEARING SUPERVISORY
W-10-1000-18	MOTOR BEARING SUPERVISORY
W-10-1000-19	MOTOR BEARING SUPERVISORY
W-10-1000-20	MOTOR BEARING SUPERVISORY
W-10-1000-21	MOTOR BEARING SUPERVISORY
W-10-1000-22	MOTOR BEARING SUPERVISORY
W-10-1000-23	MOTOR BEARING SUPERVISORY
W-10-1000-24	MOTOR BEARING SUPERVISORY
W-10-1000-25	MOTOR BEARING SUPERVISORY
W-10-1000-26	MOTOR BEARING SUPERVISORY
W-10-1000-27	MOTOR BEARING SUPERVISORY
W-10-1000-28	MOTOR BEARING SUPERVISORY
W-10-1000-29	MOTOR BEARING SUPERVISORY
W-10-1000-30	MOTOR BEARING SUPERVISORY
W-10-1000-31	MOTOR BEARING SUPERVISORY
W-10-1000-32	MOTOR BEARING SUPERVISORY
W-10-1000-33	MOTOR BEARING SUPERVISORY
W-10-1000-34	MOTOR BEARING SUPERVISORY
W-10-1000-35	MOTOR BEARING SUPERVISORY
W-10-1000-36	MOTOR BEARING SUPERVISORY
W-10-1000-37	MOTOR BEARING SUPERVISORY
W-10-1000-38	MOTOR BEARING SUPERVISORY
W-10-1000-39	MOTOR BEARING SUPERVISORY
W-10-1000-40	MOTOR BEARING SUPERVISORY
W-10-1000-41	MOTOR BEARING SUPERVISORY
W-10-1000-42	MOTOR BEARING SUPERVISORY
W-10-1000-43	MOTOR BEARING SUPERVISORY
W-10-1000-44	MOTOR BEARING SUPERVISORY
W-10-1000-45	MOTOR BEARING SUPERVISORY
W-10-1000-46	MOTOR BEARING SUPERVISORY
W-10-1000-47	MOTOR BEARING SUPERVISORY
W-10-1000-48	MOTOR BEARING SUPERVISORY
W-10-1000-49	MOTOR BEARING SUPERVISORY
W-10-1000-50	MOTOR BEARING SUPERVISORY



BACKWASH WATER RETURN FROM LAKEVIEW FLEETS NO. 17-118-41

SEWER FLOW FROM LAKEVIEW FLEETS NO. 17-118-41

BACK WASH WATER SUPPLY TO LAKEVIEW FLEETS NO. 17-118-41

BACK WASH WATER SUPPLY TO SUMP FLEETS

SEWER FLOW FROM LAKEVIEW FLEETS NO. 17-118-41

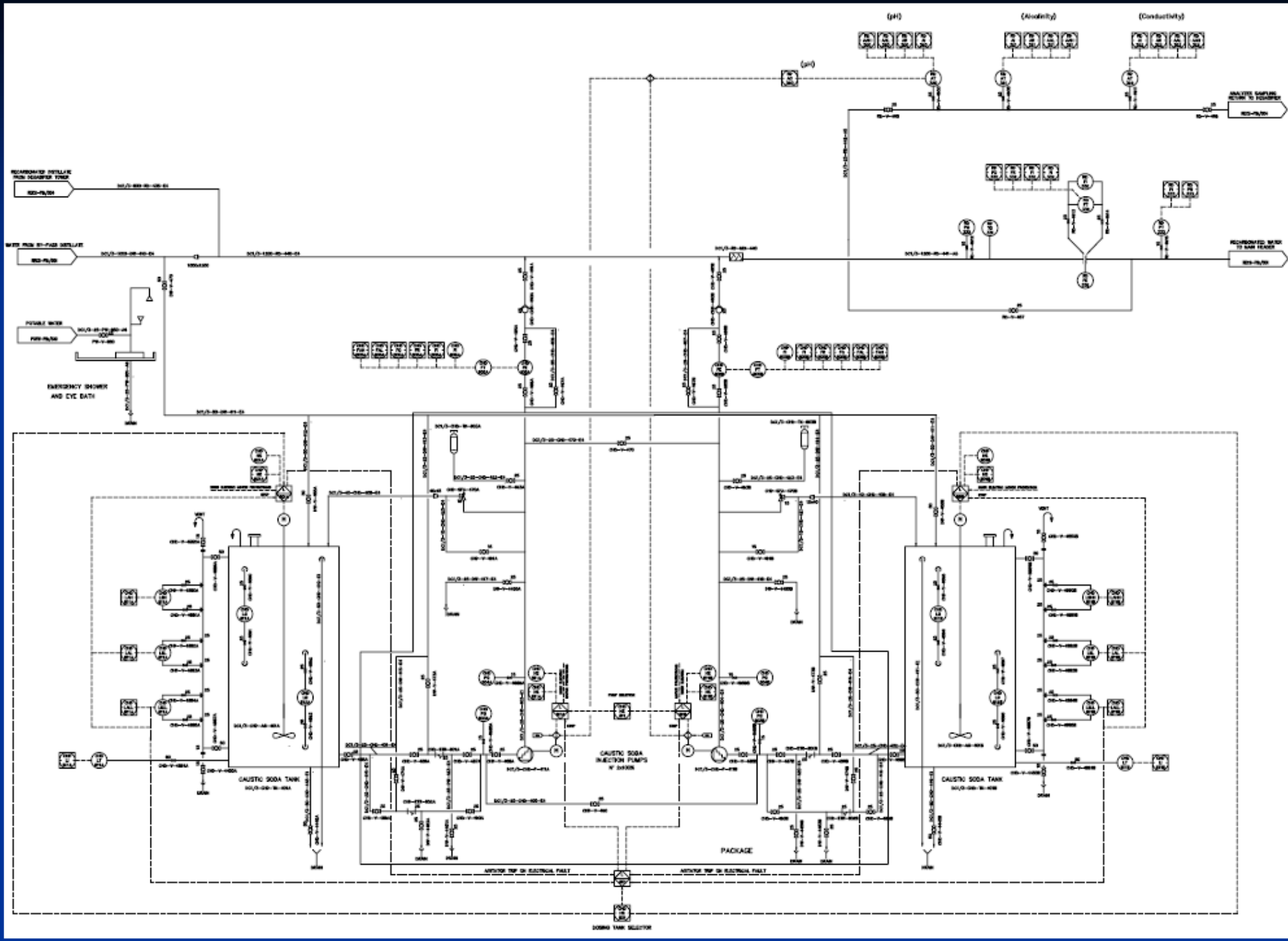
BACKWASH WATER RETURN TO SEWERATION TANK

SEWER FLOW TO SEWERATION TANK

BACK WASH WATER SUPPLY TO LAKEVIEW FLEETS NO. 17-118-41

SEWER FLOW TO LAKEVIEW FLEETS NO. 17-118-41

SEWER FLOW TO LAKEVIEW FLEETS NO. 17-118-41



RECARBONATION PLANT

