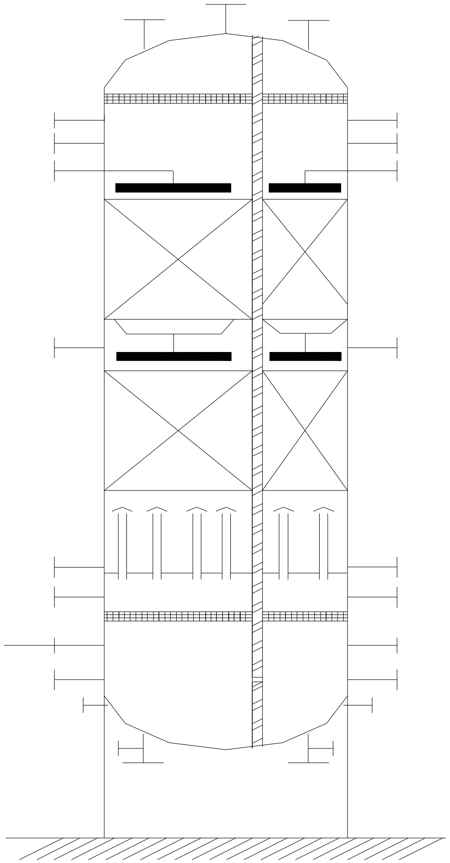
Sime-TIPC Solution

Compact Gas Processing Technologies

Application of Divided Wall Column (DWC) Technology to the Gas Sweetening and Dehydration Processes

Outline

- General
- Case Study
- Case Study Results
- Conclusion



Typical Issues for Offshore O&G Installations

- ✓ Complexity of installation on-board
- ✓ Small & modular footprint required
- ✓ Reduced weight is a plus – easy to lift and to move on-board
- ✓ In case of existing units – difficulties for on site Transportation

Possible solutions

- ✓ Compact Gas Processing Technologies

Compacting Gas Processing Equipment...

Two Approaches

Implement **more unit** operations into **one equipment** obtaining process intensification

Mechanically couple equipment used for different processes or different unit operations

Internally Partitioned Column

(IPC)

for sweetening and dehydration processes

Compact Gas Processing Technologies

We are aware that the Zimmermann, Patent Application *N°US 2008/0161618*, Honeywell Intellectual Property Inc., suggests the use of a totally divided column with a longitudinal w

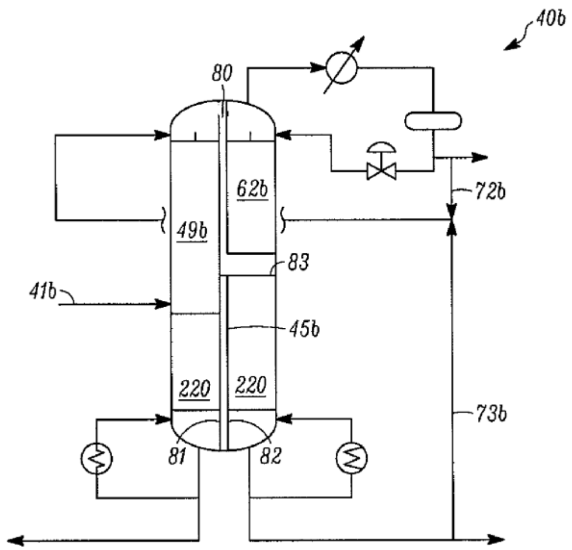


FIG. 4

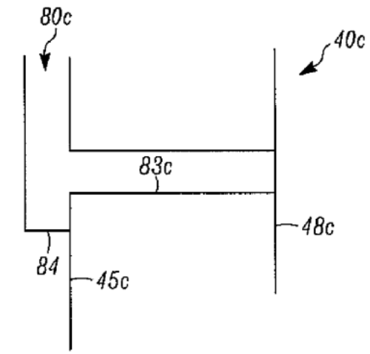
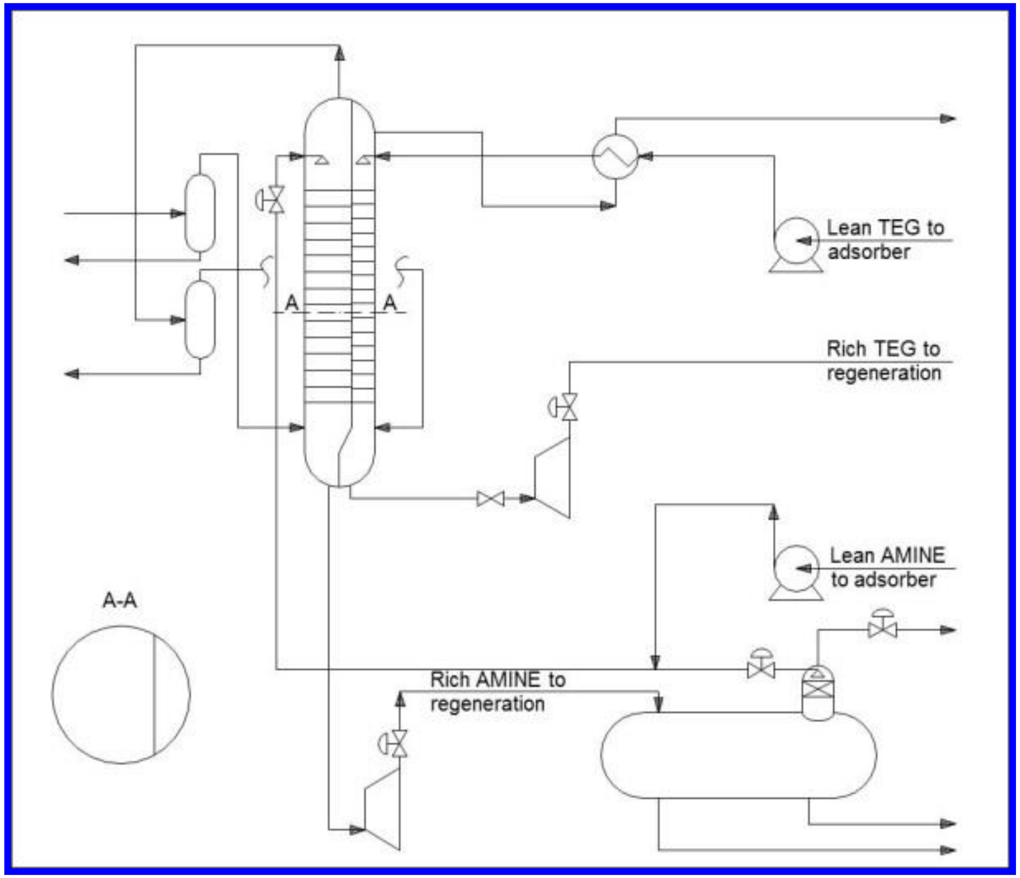


FIG.5

The wall creates two chambers completely isolated from each other.

An internal channel can connect the two chambers.

Starting from **Zimmermann** idea, SIME applied the DWC concept to the gas treatments.



DWC implement in a

More compact

Modular

Lighter

solution
Both

Sweetening and Dehydration Operations

The Basis of idea: The partitioning wall

The partitioning wall system assures the seal between the two chambers.

First of all, we modeled and verified the wall stress values.

The main dimensioning factors are:

- Pressure differences between the chambers
- Temperature differences between the chambers

A single wall baffle can be adopted for low differential pressures ($\Delta P < 1$bar)

STUDIO: For higher ΔP a double wall baffle can be adopted.

The acceptable differential temperature ΔT is about 30°C.

Case Study

To verify the technical and economical feasibility, a specific case was studied focusing on process and mechanical aspects.

For this purpose the study was based on…

REAL DATA of natural GASES

COMMERCIAL SPECIFICATION for industrial or domestic uses

Real Data of natural GAS

	GAS 1	GAS 2	GAS 3
	High Pressure	Medium Pressure	Low Pressure
P [bar(a)]	138	73	21
T (° C)	30	30	30
	Composition (mole percentage)		
N_2	0.93	0.03	0.24
CO_2	0.41	1.82	0.60
H_2S	0.10	2.49	0.63
H_2O	0.01	0.27	0.28
Methane	97.26	72.40	83.74
Ethane	0.88	12.75	7.43
Propane	0.14	5.70	1.87
i-Butane	0.01	0.86	5.20
n-Butane	0.02	1.88	6.40
i-Pentane	0.02	0.50	0.19
n-Pentane	0.02	0.60	0.15
n-Hexane	0.02	0.42	0.08
n-C_7 +	0.01	0.26	0.03
Mercaptans, COS	0.17	0.005	-
Mcyclopentan	-	0.01	-
B,T,X,C9A	-	0.015	-
Cyclohexane	-	0.01	-
TOTAL	100.00	100.00	100.00

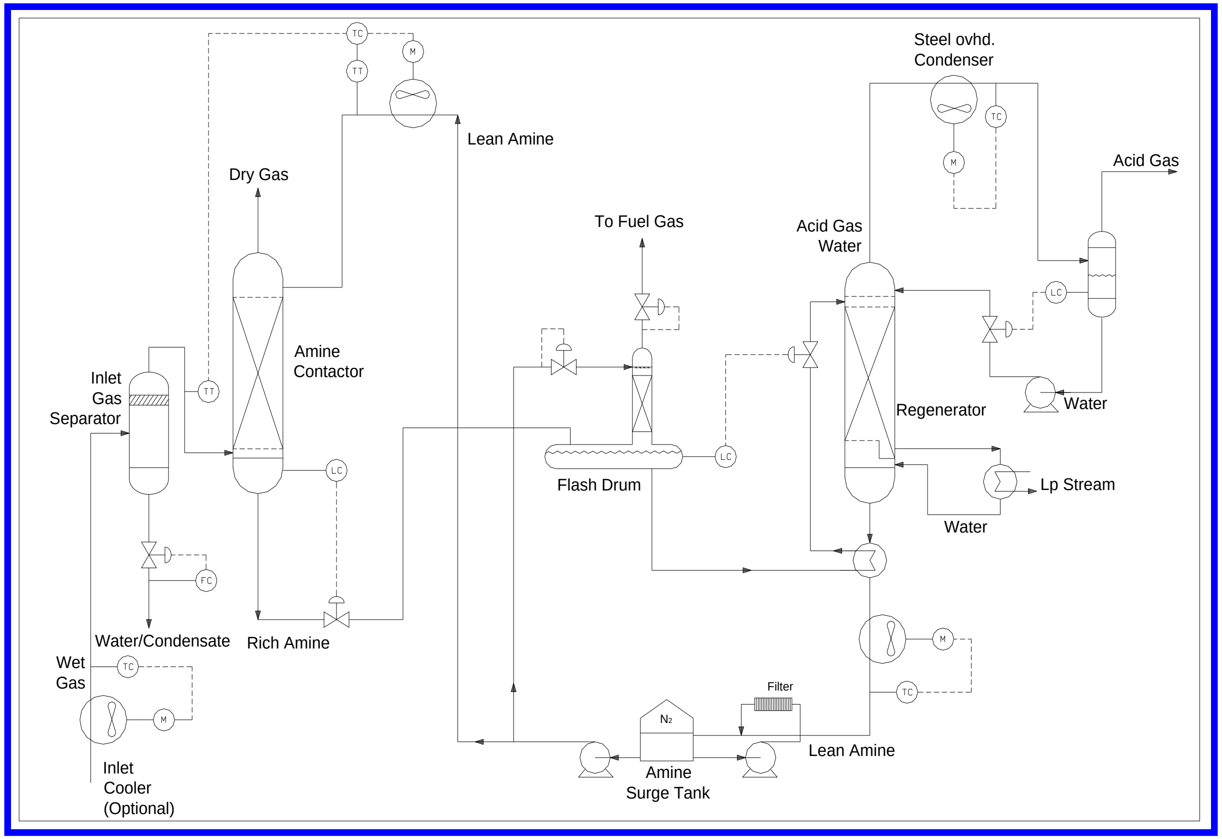
Commercial Specifications for North America and Europe

SPECIFICATION	NORTH AMERICA	EUROPE
Water Content (North America) Water dew point (Europe)	4-7 lbm H_2O / MMscf of gas	-10 to -12° C at 7000 kPa
Hydrocarbon dew point	14 – 40 ° F at specified P	-5 to 0° C at P<7000 kPa
CO_2 concentration	1 – 3 mol%	2 – 3 mol%
N_2 concentration	2 – 3 mol%*	2 – 3 mol%*
Total inert	3 – 5 mol%*	-
H_2S	0.25 – 1.0 grain / 100 scf	5 – 7 mg / Nm^3
Total S	0.5 – 20 grain / 100 scf	120 – 150 mg / Nm^3
Mercaptans	0.25 – 1.0 grain / 100 scf*	6 – 15 mg / Nm^3
Oxygen	10 – 2,000 ppm (mol)	1,000 – 5,000 ppm (mol)
Heating value	950 – 1,200 Btu / scf	40 – 46 MJ / Nm^3
Wobbe number	-	51 – 56 MJ / Nm^3

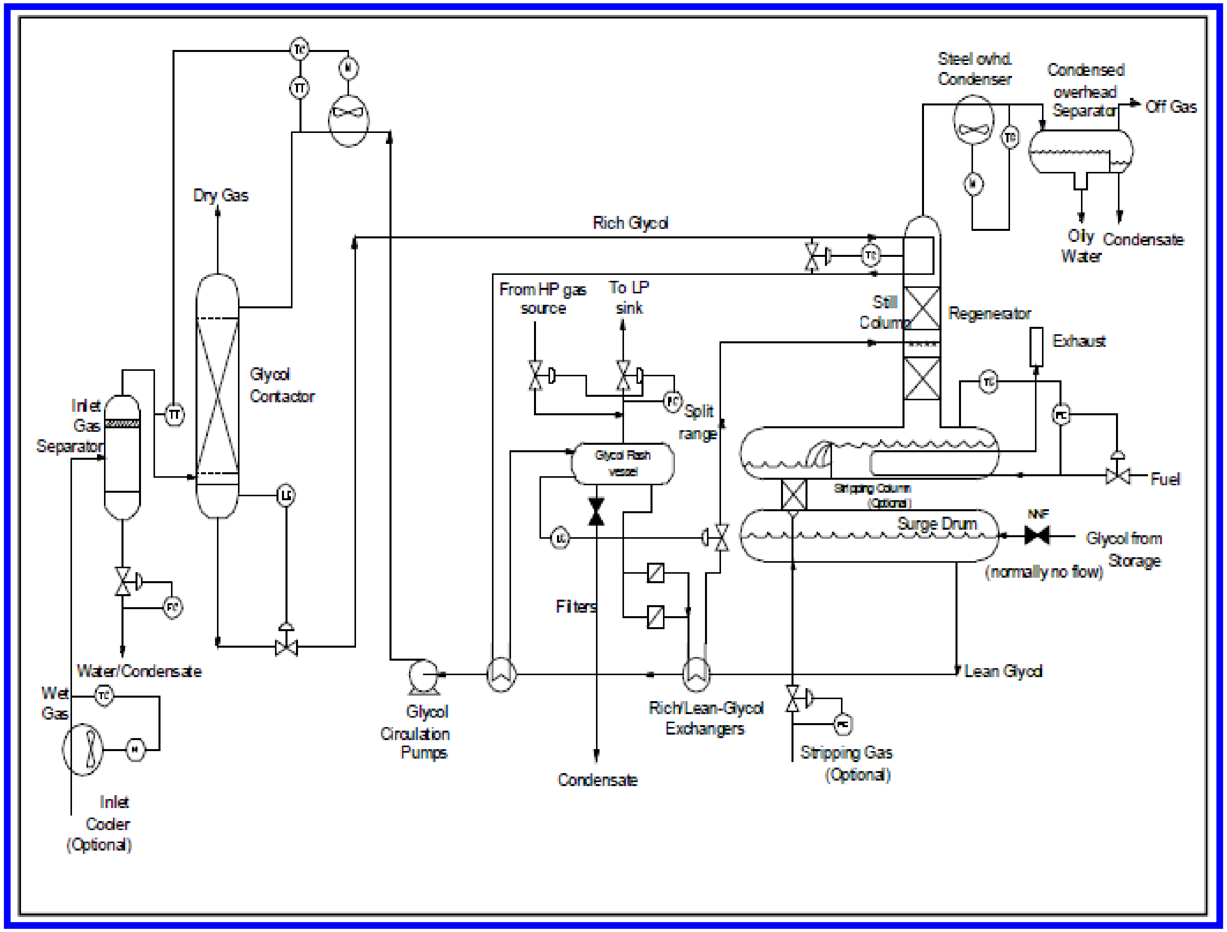
* often not specified

Sweetening Process

The most widely used gas treatments are Sweetening using Amine as absorption Chemicals



Dehydration using TEG as absorption chemicals

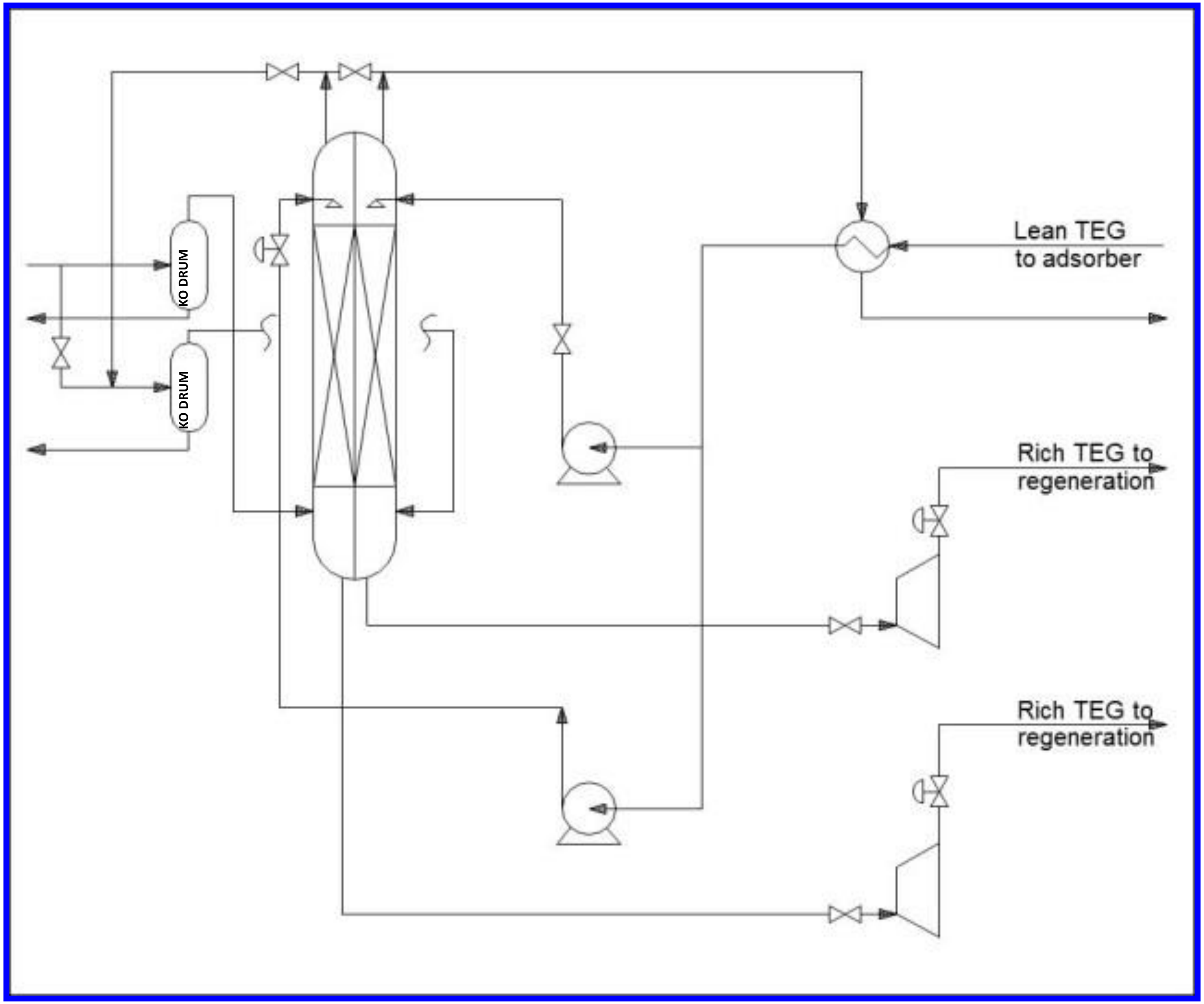


IPC Study

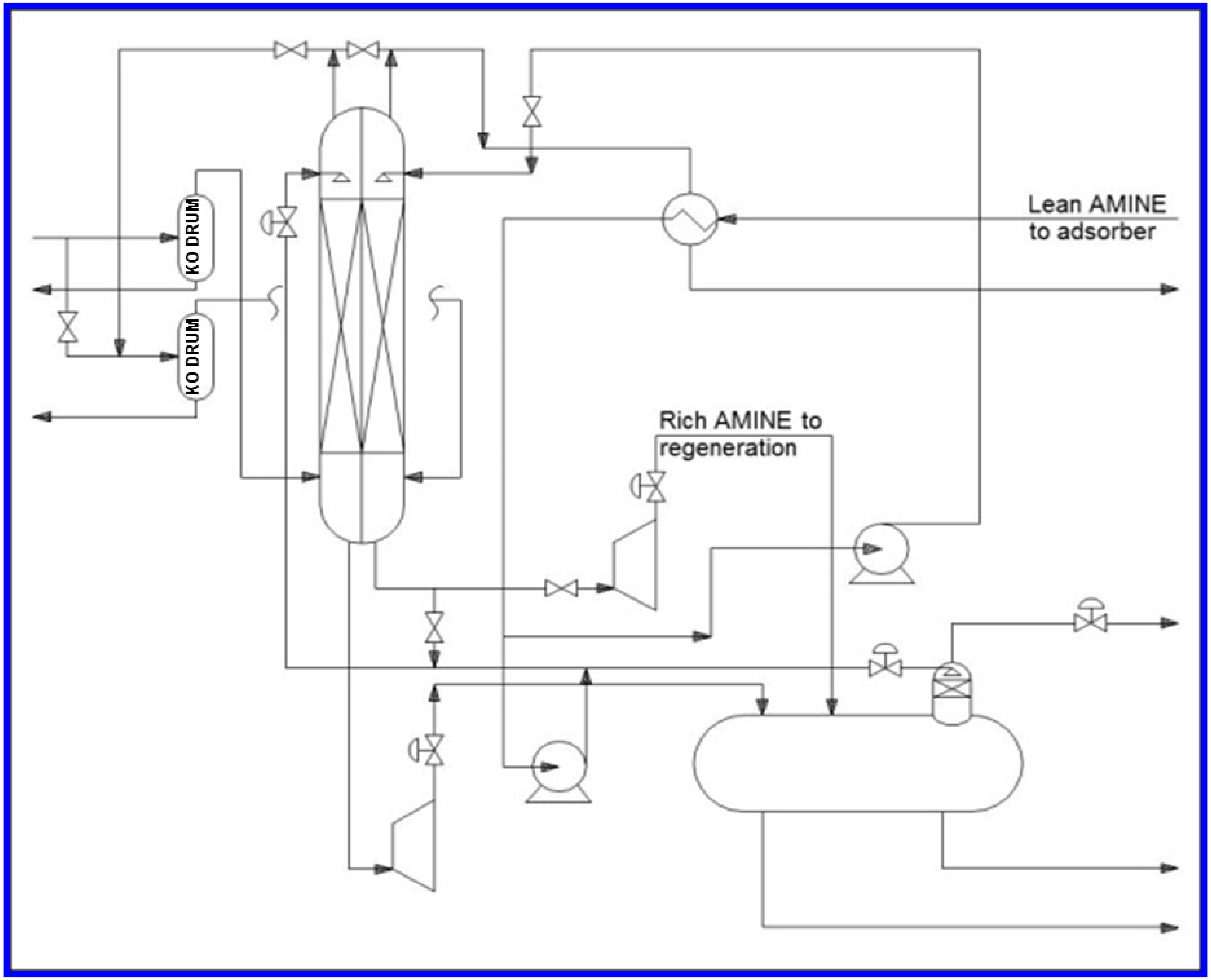
A Study of an Internally Partitioned Column (IPC) was carried out for the three following configurations:

- Dehydration / Dehydration (in parallel)
- Sweetening / Sweetening (in parallel)
- Sweetening + Dehydration (in sequence)

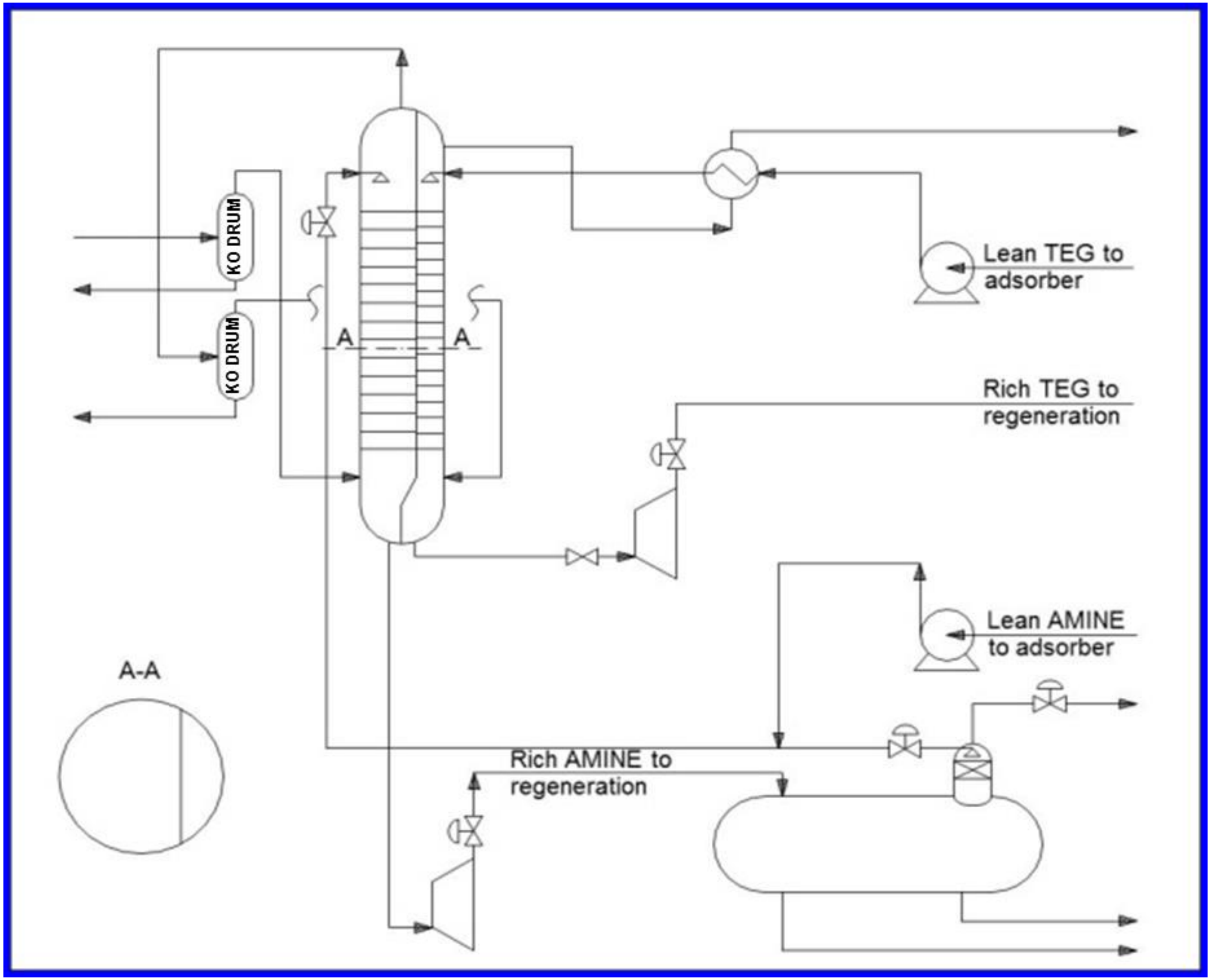
Dehydration / Dehydration



Sweetening / Sweetening



Sweetening + Dehydration

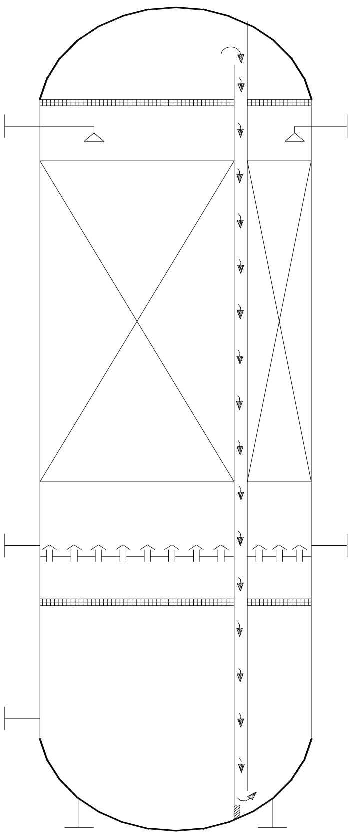


Compact Gas Processing Technologies

The preceding slides show some configurations with external KO Drum separators upstream the absorbers (contactors)

Anyhow, gas/liquid separation can be performed internally, inside the IPC.

The possibility to feed the Dehydration downstream the Sweetening with an internal channel was also considered.



Sweetening and dehydration absorption using an IPC with internal connecting channel

Case Study Results

On the basis of the previous assumptions:

PRESSURE [bar(a)]	MASS FLOW (t/h)	COLUMN WEIGHT (tonn)			
		SW	DHY	SW + DHY	IPC
HP $P_D = 141$	10.4	6.9	6.2	13.1	8.7
	50	10.8	9.3	20.1	19.2
	694	65.3	53.5	118.8	123.8
MP $P_D = 76$	10.4	8.0	6.4	14.3	10.6
	161	24.3	13.1	37.4	35.0
	694	53.3	36.8	90.2	98.5
LP $P_D = 24$	10.4	6.4	6.4	12.8	7.3
	50	9.0	9.0	17.9	12.9
	694	73.2	51.2	124.4	139.0

The table showed that:

- At Low/Intermediate Flowrate of 200-250 ton/h of gas (i.e.1.75-2.20 million ton/year of gas) the IPC solution is preferable
- The pressure (low, medium, high) does not seem to be a crucial factor for the choice determination

Conclusion

- IPC is a competitive and alternative solution to the normal Sweetening and Dehydration Column at medium-low capacity
- Further advantages are related to:
  - ✓ Lower packing and transportation cost
  - ✓ Reduced installation cost
  - ✓ Smaller space occupancy
  - ✓ Reduced weights

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