GENERAL METHODOLOGY FOR THE IMPLEMENTATION OF DIVIDING WALL COLUMN TECHNOLOGY IN GAS PROCESSING PLANTS AND CRUDE REFINERIES

By

Mostafa Kamel Taher Ali

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree of
MASTER OF SCIENCE
In
Interdisciplinary MSc. - Petroleum & Natural Gas Technology

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
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Title of Thesis:
General Methodology For The Implementation Of Dividing Wall Column Technology In Gas Processing Plants And Crude Refineries.

Key Words:
Distillation; Dividing wall column; Energy saving; FTCDS; Petyluk.

Summary:

The present research work tends to study the technical and economical possibility of designing dividing wall column unit, which is characterized by lower energy consumption, less capital cost, high products purity and less construction volume comparing with conventional separation technique, Through development a general methodology for implementation of DWC technology in refinery, gas and petrochemical plants and test the validity of this methodology by implementation in actual cases.

This specific research will focus on thoroughly studying all parameters that affected on the DWC design, then compare the conventional separation column with DWC to quantify the potential energy savings and capital cost saving. Complete design of DWC is created on the HYSYS simulation software and calculation sheets, including the operating conditions, energy requirements, unit sizing, products specifications, equipment specification, the capital and operating cost.

Disclaimer

I hereby declare that this thesis is my own original work and that no part of it has been submitted for a degree qualification at any other university or institute.

I further declare that I have appropriately acknowledged all sources used and have cited them in the references section.

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Dedication

I owe a special thanks to my family, my mom and dad, my brothers and sisters who supported me and helped me throughout my life and during this study; I dedicate this work to you all.

I dedicated this master thesis to Dalia Amin that helped me in some parts of this thesis.

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Nomenclature

A	=	Area, ft^2.
ASORC	=	Assuit Oil Refinery Company.
AD	=	Azeotropic distillation.
C-DWC	=	Catalytic dividing-wall column.
Cp	=	Heat capacity, Btu/(lb • °F).
Cg	=	Gravity correction factor for water content.
Css	=	Saturation correction factor for sieve.
CT	=	Temperature correction factor.
CEPCI	=	Chemical Engineer Plant Cost Index.
CO2	=	Carbon dioxide.
CPI	=	Corrugated plate interceptors.
C-Box	=	Cold Box.
DEG	=	Diethylene glycol.
D	=	Diameter, ft.
DWC	=	Dividing wall column.
DOF	=	Degree of freedom.
De-C2	=	De-ethanizer.
De-C3	=	De-propanizer.
De-C4	=	De-butanizer.
ECN	=	European Chemical News.
EOS	=	Equation of State.
EC	=	Equipment Cost.
F	=	Feed.
FTCDS	=	Fully Thermally Coupled Distillation System.
FUGK	=	Fenske-Underwood-Gilliland-Kirkbridge.
G	=	Mass velocity, lb /(ft^2 • hr).
GHG	=	Greenhouse gas emissions.
H	=	Enthalpy, BTU/lb.
H2O	=	Hater.
H2S	=	Hydrogen sulfide.
HCs	=	Hydrocarbons.
ΔH	=	Latent heat of vaporization, Btu/lb.
H.V	=	Heating value.
i	=	Inlet.
IJChE	=	Iranian Journal of Chemical Engineering.
LAB	=	Linear alkylbenzene.
LPG	=	Liquefied petroleum gas.
L	=	Liquid.
m	=	Mass flow rate, lb/hr.
MW	=	Molecular weight.
MTOE	=	Million Tons of Oil Equivalents.
NGL	=	Natural gas liquid.