A

Thesis titled

" SIMULATION OF HYDROCRACKING REACTION NETWORK"

Submitted in partial fulfillment of the requirements for the award of Degree of
Master of Technology
In
Refining & Petrochemical Engineering

Submitted By

Uttara sakuntala simhadri

R080207013

M.Tech (Refining and Petrochemical Engineering)

Under the guidance of

B. Uma Shankar.
Assist. Prof, COE,
UPES, DDN.

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UTTARA SAKUNTALA SIMHADRI

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Under the guidance of

Mr. UMA SHANKAR

Asst. Professor

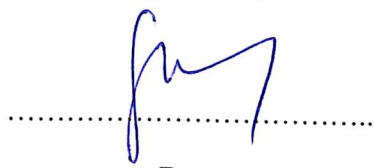
University of Petroleum & Enegy Studies, Dehradun

Mr. S.K.Balwant

Manager (Process)

BPCL

Approved By



Dean

College of Engineering

University of Petroleum & Energy Studies

Dehradun

May, 2008

CERTIFICATE

This is to certify that the work contained in this thesis titled "**SIMULATION OF HYDROCRACKING REACTION NETWORK**" has been carried out by **Uttara Sakuntala Simhadri** under my supervision.

Signature Uvasantay 12/5/09.

BHARAT OMAN
REFINERIES LIMITED

(A Company promoted by Bharat Petroleum Corporation Limited and Oman Oil Company Limited)

Mailing Address : Mahul, Mumbai - 400 074, India.
Phones : 2554 3151, 2554 2990 Fax : 91-22-2554 8818, 2554 3904

P&A.2.01.1

21 04 2009

TO WHOMSOEVER IT MAY CONCERN

This serves to certify that Ms. Sakuntala is a member of our management cadre. Presently she is undergoing in-plant training at BPCL- Refinery, Mumbai.
She has completed a project on the "Modeling and Simulation on Hydro cracking Unit" as a part of the training.

Yours faithfully,
For BHARAT OMAN REFINERIES LIMITED

RAJESH SHUKLA
MANAGER- HR

21/4/09

BHARAT OMAN REFINERIES LTD.

Registered Office : 'A' Block, Office Complex, Gautam Nagar, Bhopal - 462023, India.
Phones : 0755-5203179 Fax : 0091-0755-5203178

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I finally thanked my friends who had helped me in every aspect of my project

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NOMENCLATURE

LPG	Liquified Petroleum Gas
SKO	Superior Kerosene Oil
ATF	Aviation Turpentine Oil
FCC	Fluidized Catalytic Cracking
TC	Thermal Cracking
RHP	Residue Hydro Processing
HC	Hydro Cracking
GRM	Gross Refinery Margin
RON	Road Octane Number
H_2S	Hydrogen Sulphide
NH_3	Ammonia
H_2O	Water
HDS	Hydrogen Desulphurization
PNA	Paraffins, Naphthenes, Aromatics
HCU	Hydro Cracking Unit
CHPS	Cold High Pressure Separator
CLPS	Cold Low Pressure Separator
HHPS	Hot High Pressure Separator
HLPS	Hot Low Pressure Separator

HP	High Pressure
TLP	Total Liquid Product
TBP	True Boiling Product
a_v	Gas Liquid interfacial area per unit reactor volume, m_i^2/ m_r^2
C_i^G	Molar concentration of i in gas bulk, Kmol/ m_G^3
C_i^L	Molar concentration of i in liquid bulk, Kmol/ m_L^3
C_{sat}	Saturation surface concentration of physisorbed hydrocarbons, Kmol/Kg of catalyst
C_{H+}	Surface concentrationof vacant acid sites Kmol/Kg of catalyst
C_r	Total surface concentration of acid sites, Kmol/ Kg of catalyst
F_i^G	Molar flow rate of i in gas phase, Kmol/hr
F_i^L	Molar flow rate of i in liquid phase, Kmol/hr
h	Planck's constant KJ hr/ molcule
H_i	Henry's law coefficient of i
$\Delta H^{\Delta Z}$	Standard entropy of activation, KJ/ Kmol
k	Rate coefficient of an eelementary step, 1/hr
$\tilde{k}$	Single event rate coefficient, 1/hr
$\tilde{k}_{isom}$ (m;n)	Single event rate coefficient for the isomerization of m type of carbenium ion to n type of carbenium ion, 1/hr
$\tilde{k}_{cr}$ (m;n,no)	Single event rate coefficient for the cracking of m typeof carbenium ion to n type of carbenium ion, 1/hr
K_B	Boltzmann constant, KJ/ Kmolecule

$K_{o,i}$	Overall mass transfer coefficient of i in terms of liquid concentration gradient, m_L^3 / m_i^2 hr
K_G	Mass transfer coefficient from gas bulk to gas – liquid interface, based on concentration driving force, m_G^3 / m_i^2 hr
K_L	Mass transfer coefficient from gas – liquid interface to liquid bulk, based on concentration driving force, m_L^3 / m_i^2 hr
$K_{L,Pi}$	Langmuir physisorption equilibriumconstant of paraffin P_i m_i^3/ Kmol
n_c	Number of single events
N_c	Number of components in the model
N_i	Mass transfer flux of i from gas bulk to the liquid bulk, Kmol/ m_i^2hr
r_i	Net rate of formation of i, Kmol/m_i^3/hr
R	Gas constant, KJ/Kmol^{0}K
$\Delta S^{\Delta Z}$	Standard entropy of activation, KJ/Kmol^{0}K
T	Temperature, ^{0}K
X	Cracking Conversion %

SYNOPSIS

Objective:

To generate a reaction network for the hydro cracking unit. After that simulating the total hydro cracking unit using this reaction network to prepare the simulation base for further calculations during revamping.

Abstract:

The current project deals mainly as such that the current refinery is under commissioning. The heart of the refinery is the hydro cracking unit which has demonstrated a broad diversity in upgrading a wide range of feed stocks ranging from atmospheric gas oil through heavy vacuum gas oil; conversion products from cat crackers and cokers; and product streams from lube plants and deasphalters.

The over 100 units now operating around the world provide a broad spectrum of products from light gasoline to heavy diesel fuels, as well as feedstock for olefin plants and cat crackers. Modeling of the process and then finding out the optimum operable parameters. Checking these values with ASPEN HYSYS.

Purpose Of The Project :

The present project is validating the results of the BORL Refinery as such it is in the stage of commissioning so it should require the design data along with the mathematical modeling of the design data of the reactor and also the simulation base for further expansion and to know the inflow and out flow of the reactor.

The main aim lays generation of reaction network of the hydrocracking reactons for n-hexadecane for future expansion purposes as now the hydro cracking unit is of full conversion where it does not release bottoms for maximization of middle distillates. After full operating of the refinery then the plant can be expanded for producing the lighters also by converting it into once through hydrocracker by connecting an FCC unit for producing gasoline.

Conclusion:

This project is presently going in the refinery as such that they are validating the results from BPCL Mumbai Refinery.

1. INTRODUCTION

1.1 SITE LOCATION:

Bharat Oman Refineries Limited is located at "Bina", Dist. Sagar in Madhya Pradesh and it is 135 km from "Bhopal". Nearest important railway junction to the refinery is "Bina", which is 9 km from the site. The nearest airport is "Bhopal", which is 135 km away from the Bina Refinery site. Bhopal is well connected by rail & road to Bina.

1.2 PROJECT INFORMATION:

Bharat Oman Refineries Limited (BORL), a company promoted by Bharat Petroleum Corporation Limited (BPCL) and Oman Oil Company Limited (OOCL), is setting up a **6 MMTPA** grass root refinery at Bina, District – Sagar, Madhya Pradesh along with crude supply system consisting of **Single Point Mooring System (SPM).** Crude Oil Storage Terminal (COT) is at "Vadinar", District – Jamnagar, Gujarat and 935km long cross country crude pipeline from "Vadinar to Bina". 3 X 33 MW CPP – Coke based CFBC technology is also available and other infrastructure facilities are available at the Refinery as well as at COT, Townships, Water and Power supply system, etc.).

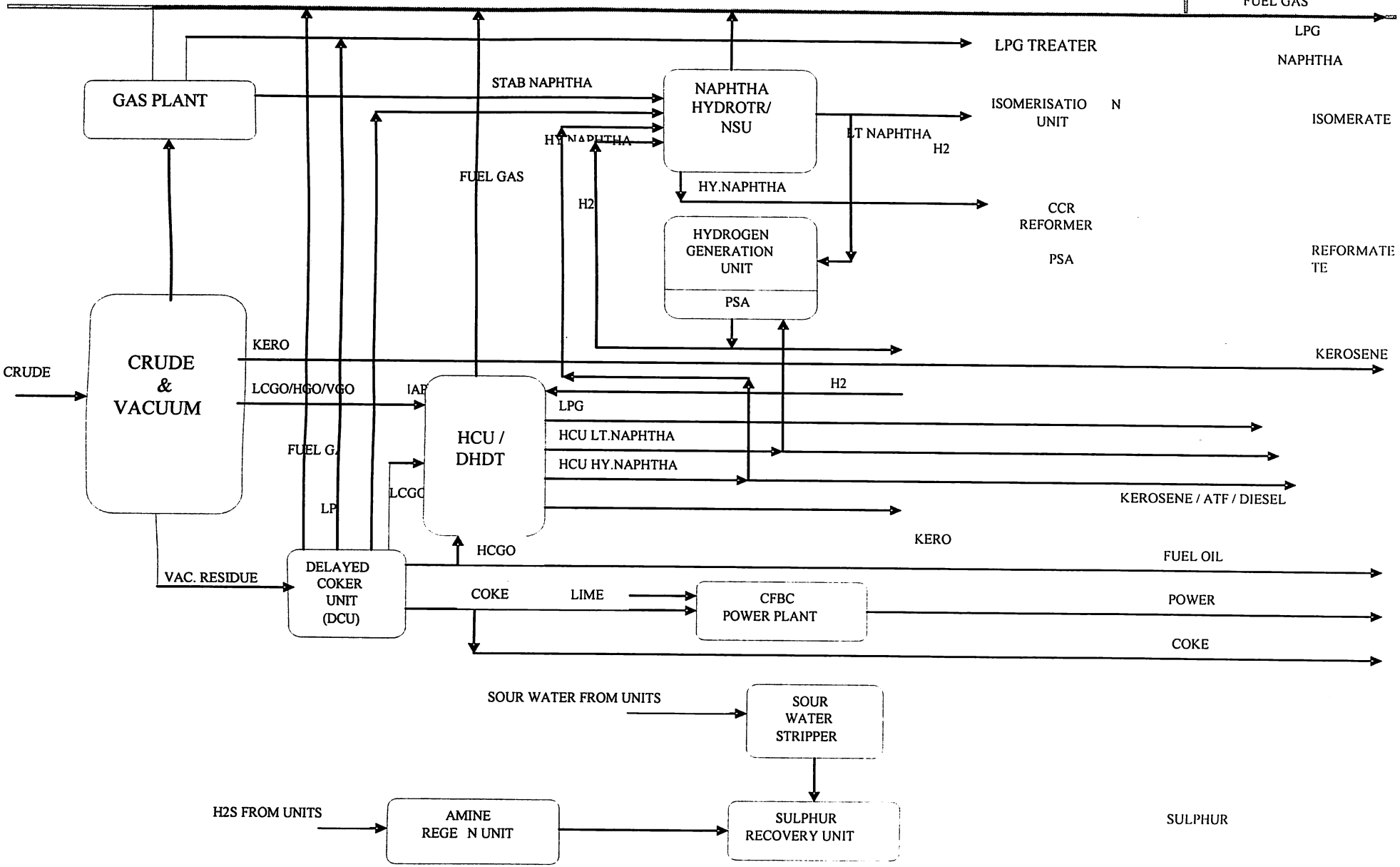
The process of separating Crude Oil into the useful products with desired set of properties and purities is called Refining. In general, Refinery performs three different functions:

- ✓ Separate Crude Oil into different streams such as LPG, Naphtha, Kerosene, Diesel components etc by Fractional Distillation.
- ✓ Chemically convert some of the lower valued fractions into more desirable products in Secondary units; and
- ✓ Treat intermediate products by removing unwanted elements and compounds for blending into final end products.
- ✓ Various hydrocarbon fractions which are separated by distillation and upgraded in secondary units, are blended to make desired products like Petrol, Diesel.
- ✓ Unlike Chemical manufacturing, petroleum products almost never have a specific chemical composition, but rather are complex mixture of thousands of

compounds, which are neither separated nor identified individually. Instead , these mixtures are characterized by their physical properties such as Boiling ranges, Freezing points, Sulphur content etc

- ✓ Each step in the Refining process is designed to add value to its inputs.

Bina refinery is designed to process 6 MMTPA of "Arab Mix" crude (65 % crude Arab Light and 35% crude Arab Heavy), but it also has the flexibility to process other types of Middle East crudes, adopting the State of Art Technologies with configuration of following units **see appendix I.**



BRIEF OVERVIEW OF BORL - REFINERY

2. LITERATURE SURVEY

Hydro cracking has demonstrated a broad diversity in upgrading a wide range of feedstock ranging from Atmospheric gas oil through heavy vacuum gas oil; conversion products from cat crackers and cokers; and product streams from Lube plants and Deasphalters. Over 100 units now operating around the world provide a broad spectrum of products from light Gasoline to Heavy diesel fuels, as well as feedstock for olefin plants and cat crackers.

The 90's bring many challenges to the Refining Industry with more stringent environmental specifications on fuels and a general trend for conversion units such as hydrocrackers to process more difficult/low value feedstock at higher throughputs. These changes are making hydrogen availability and catalyst stability a limiting factor in many Refineries. There is an ever increasing incentive to develop catalyst technology to meet the challenges of the 1990's.

2.1 HYDROCRACKING BASICS

The main objective in hydro cracking is to reduce the boiling point of the feedstock by increasing the hydrogen content and hence reducing the average carbon number per molecule. This is achieved using a catalyst at high pressure and temperature in a hydrogen-rich atmosphere. Under these conditions, hydrogenation reactions remove heteroatom as well as saturating aromatic and olefinic molecules. The large majority of heteroatom is sulphur, nitrogen and oxygen and hydrogenation of these elements produces H_2S, NH_3 and H_2O. The removal of the heteroatom has, in general, a positive effect on product quality.

2.1.1 Reaction Mechanisms & Deactivation

Given the range of reactions which are possible in a hydro cracking unit, a complete chemical description of all reactions is not possible; however there are several general principles. Catalysis in hydro cracking is classified as bifunctional i.e. two different types of catalytic chemistry are required to bring about the desired reactions. On the one hand, hydrogenation/dehydrogenation reactions are required, which are catalyzed by the hydrogenation function (metal or metal-sulphides). On the other hand cracking of hydrocarbon chains is catalyzed by acid sites. Both catalytic sites (metals and acid) must be present.

Heteroatom removal and hydrogenation reactions are catalyzed by the metal (or metal sulphides) function. Cracking will occur over the acid function but requires the hydrogenation function for the first step in the reaction mechanism. The cracking is characterized by

carbenium ion chemistry, which gives rise to highly branched hydrocarbon molecules. This results in product properties such as high i/n ratio and low cloud/freezing characteristics relative to straight-run material. Also the low C1 - C2 yields are also the result of the carbenium ion chemistry.

In the hydrogen-rich environment, hydrogenation of the cracked products is also promoted, resulting in minimum coke (carbon) formation on the catalyst sites. Over time, as the coke levels on the catalyst sites increase, higher operating temperatures are required to sustain the hydrogenation and cracking reactions. If temperature is not increased, the reactions diminish and this is generally referred to as coke deactivation of catalyst. After a certain period of operation, or run length, when the operating temperature nears the design temperature limit of the reactor, the hydrocracker has to be shut down for replacement of the spent catalyst with fresh or regenerated catalyst. This allows a new run or cycle to commence.

The study of reaction rates is known as kinetics, and the fastest reactions are the hydrogenation of heteroatom such as sulphur, oxygen and nitrogen (in order of decreasing rate of reaction). The hydrogenation of aromatics and cracking reactions are much slower. The rate of cracking depends on the chemical form and carbon number of the molecule involved. For example, aromatic compounds are converted more easily than paraffinic ones. Generally, the higher the boiling point (longer molecules), the higher the reaction rate at a given temperature.

Apart from kinetics, thermodynamic considerations also come into play for hydrogenation reactions. Thermodynamics determine the maximum hydrogen saturation level that is, in principle, possible at a given temperature and hydrogen partial pressure. Higher hydrogen partial pressures and lower temperatures promote higher hydrogenation levels of especially nitrogen and aromatics, which in turn allows more conversion of the feed to lighter products at a given temperature. It is generally accepted that the presence of aromatics in the feed, to a large extent, determines the catalyst deactivation rate by coke deposition. Higher hydrogen partial pressures reduce the rate of catalyst coke deactivation.

The hydrogenation and cracking reactions promoted by hydro cracking catalysts are highly exothermic and require special measures to control the rate of reaction and the energy of heat generated. Usually the total catalyst volume is staged or divided into a number of catalyst beds with inter bed quenching facilities. If the heat generated cannot be controlled or dissipated,

then the temperature of successive catalyst beds will escalate resulting in even higher rates of reaction and heat generation. In the extreme case where the heat balance can no longer be brought under control, the temperature excursion will lead to a temperature "runaway", requiring an emergency shutdown of the unit and depressurizing of reactants from the reactor in order not to exceed the design temperature and pressure limits of the unit.

2.1.2Feedstock Types

Hydrocracker feedstocks vary considerably in boiling range. Traditionally, in the U.S., where large-scale hydro cracking was first applied, relatively light gas oils were hydro cracked to produce naphtha/gasoline. Heavier feedstocks cause faster deactivation of the catalyst, but improved catalyst technology has allowed an increase in feed heaviness in the U.S. over the years. Elsewhere, heavier feeds are commonly used, such as flashed distillate (VGO) in the 370 - 540 °C range. Another difference between N. America & the Rest of the World is that many North American refineries have both a Hydrocracker and Fluid Catalytic Cracker or Coker and Hydro cracking is often used as a complementary process to FCC and coking to dispose of the cycle oils and coker gas oils. Elsewhere, refineries tend to have either an FCC or a HC, and the Hydrocrackers process straight-run material.

Straight-run flashed distillates of different origins can vary greatly in composition as shown in Figure 1.4 in (appendix II). The typical composition of two feeds, Bombay High and Arabian Light, are indicated. The hydrocarbons in the feed are divided into (PNA). As mentioned before, the presence of more aromatics promote more coke lay down on the catalyst sites. In extreme feedstocks with very high levels of aromatics, the rate of deactivation can be so high that the cycle length becomes considerably shortened such that it does not become economically attractive to process the feedstock.

Novel feedstocks now include thermally cracked flashed distillate and deasphalted oils, both of which provide challenges as a result of their aromaticity and heaviness. These feedstocks are which provide challenges as a result of their aromaticity and heaviness. These feedstocks are usually co-processed in limited ratios with straight-run flashed distillates for acceptable cycle lengths.

2.2 HYDROCRACKING SCHEMES

2.2.1 Introduction

Three schemes in **hydro cracking** are commonly applied. Over the years, the relative importance of the schemes has changed. The oldest configuration is the two stages HCU. With advances in high pressure/high temperature vessel manufacture, catalyst development, and changes in the product slate desired by the refiner, single stage and series flow hydro cracking have become more prominent nowadays.

2.2.2 Single Stage Hydrocracking

2.2.2.1 Single Stage Once-through

The simplest configuration is the Single Stage "Once-through" unit with only one reactor. If only one catalyst type is used in the reactor, it is called a Single Stage Single Catalyst unit, while with two or more different catalyst types it is called a Single Stage Stacked Bed unit. The feed is heated up and passed over the reactor and converted. After heat exchange and depressurizing in Cold High Pressure and Cold Low Pressure Separators (CHPS, CLPS), the total product is fractionated. The unconverted feed or fractionator bottoms (hydro wax) are not routed back to the reactor. Hydro wax can be used as feedstock to other processes (ethylene steam crackers or cat crackers), routed to lube oil facilities or used for fuel oil blending. Most of the vapors from the CHPS is compressed (recycle gas compressor), hydrogen-enriched with fresh gas, heated (recycle gas furnace) and recycled back to the reactor. Some of the cold recycle gas is routed to the reactor as quench gas to control the heat release and temperatures of successive catalyst beds in the reactor.

A stacked-bed configuration is often preferable to a single catalyst system. The first amorphous catalyst desulphurises, deoxygenates and denitrifies the feed, i.e. promotes hydrogenation of the heteroatom in the feed, with some cracking of hydrocarbons. This catalyst is also referred to as the pretreated catalyst. The majority of the cracking is then typically achieved over the second, cracking catalyst. The cracking catalyst typically contains zeolite. Zeolite-containing catalysts are more active and very stable i.e. they require lower temperatures for a given duty and usually deactivate more slowly compared to amorphous catalysts. Therefore, if a zeolite containing catalyst is included, the cycle length between catalyst change outs can be much longer. In terms of yield slate, zeolite-containing catalysts are typically more naphtha selective than amorphous catalysts.

2.2.2.2 Single Stage with Recycle

A more complex unit is the Single Stage with Recycle where most of the hydro wax from the fractionator bottoms is recycled back to the reactor. Recycling has some advantages; in that the recycled unconverted hydrowax gets another chance to be cracked, thereby increasing the overall conversion of the feedstock to lighter products. The fraction of the hydro wax that is not recycled is referred to as the Bleed. In a full-conversion unit, all of the hydro wax is recycled and the bleed is zero.

2.2.3 Series Flow Hydro cracking

In Series Flow hydro cracking the treated first stage effluent is further cracked in a successive, dedicated reactor. Thus, the first stage effluent is directly routed to the conversion catalyst, without any separation. The reactor temperature level of the first and second stages can be relatively independent. The hydro wax can also be recycled directly back to the reactor with the cracking catalyst, unlike the Single Stage with Recycle scheme, where the hydro wax has to be recycled back to the pretreated catalyst.

2.2.4 Two Stage Hydro cracking

The old generation of hydrocrackers is based on the Two Stage configuration. Traditionally in this line-up, the feed is deeply denitrogenated in the first reactor or stage. In view of the high required severity, some hydro cracking will take place as well. Subsequently the effluent is routed to the fractionator, where products, including NH_3 and H_2S are removed. Unconverted feed (normally the majority) is then converted in the second reactor or stage. Since, in a large number of units the recycle gas facilities are common for both stages, H_2S generated in the first stage and remaining in the recycle gas will be routed to the second stage. Most of the NH_3, however, will be removed from the recycle gas using a water wash upstream the effluent air cooler and cold HP separator.

Thus, the main difference between the two-stage configuration and the others are:

- In Single Stage and Series Flow units, the unconverted nitrogen from the pretreated catalyst (N slip) is typically high - from 50 to perhaps as high as 300 ppmw. In Two Stage

hydrocrackers, the feed is typically deeply denitrified to below 20 ppmw.

- Single Stage and Series Flow cracking catalysts operate in the presence of ammonia produced by denitrification of the feed. In Two Stage units ammonia is almost absent from the second stage.

2.3 SURVEY OF UNITS

2.3.1 Hydro cracking in a Global Perspective

From data in Oil and Gas Journal, the 1999 world hydro cracking capacity was about 4 million barrels per day. This represents a significant increase of 450,000 barrels per day compared to 1998, with the largest increases in North America and Asia Pacific. Of this total capacity, about 80% is distillate hydro cracking. It is projected that in 2001 there will be a further hydro cracking capacity increase of more than 200,000 barrels per day.

The world hydro cracking capacity has increased on average by about 7% p.a. over the six years from 1993. It is of note that only Western Europe and Africa did not show a significant increase over this period. The hydro cracking capacity relative to crude capacity for Middle East and North America both show a ratio of nearly 10% which is significantly higher than other regions.

Current projections for the period 1999 to 2003 indicate that the rate of capacity increase will decline with only an additional 600,000 kb/d total new capacity over this period. In line with current ratios, approximately 75% of this increase will be in distillate hydro cracking. The highest growth rate in this period is expected to be in the Asia-Pacific zone, Latin America and Eastern Europe.

The main driving forces for the expansion of the hydro cracking process continue to be: sustained growth in middle distillates consumption

Introduction of more stringent automotive fuel specifications (sulphur, aromatics, T95)

Processing synergy in combining catalytic cracking with hydro cracking, exploited in large scale refineries .

Increasing development of mild hydro cracking technology.

Unocal/UOP, who merged in 1990, is by far the dominant hydrocracker licensor with

over 50% of the market. As a process licensor, SIOP, who had previously designed hydrocrackers only for Shell companies, affiliates and SIOP-advised refineries, occupies a modest third position in the market after UOP and Chevron.

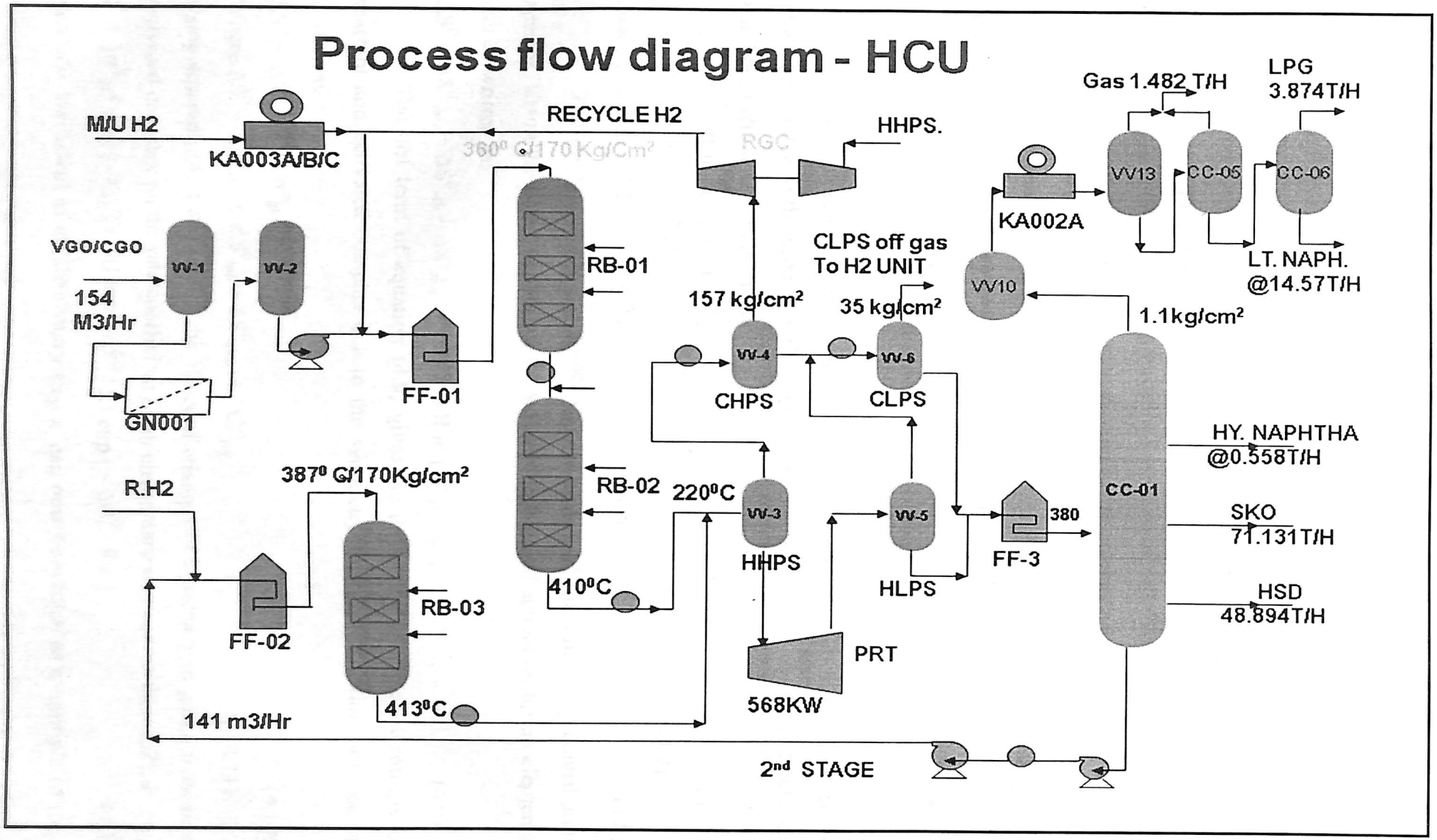
2.3.2 Shell Global Solutions in Hydro cracking (SIOP-OGRH Group)

SIOP's world-wide position as a technical service provider in hydro cracking is strong. With the start-up of Rayong (Thailand, March 1996) and Pernis (Netherlands, May 1997), SIOP provides technical service and advice to 11 distillate hydro cracking units with a total nameplate capacity of more than 18 Million tons per annum. This represents a little less than 10% of the world hydro cracking capacity with an annual upgrading margin of some US$ 250-700 millions. Technical service is also provided to some 11 base oil hydro processing units in support of the core activity of the Shell Global Solutions Base Oil group.

3. DESCRIPTION OF HYDROCRACKING UNIT

The process of hydro cracking mainly consists of series of reactors in two stage for better conversion. From the list of different types of hydrocrackers we choose " **TWO STAGE HYDRO CRACKING**" for complete conversion of feed. Since the refinery doesn't need bottoms for disposal it has been suggested this type in which it consists of two stage hydro cracking process. In the first stage there is a series of three reactors in which the feed is first heat exchanged with the effluent coming from the third reactor and also again heated up to required temperature for the inlet of the feed to the reactor. The bottom of the fractionators is sent back to the second stage for complete conversion of the unconverted oil obtained from the fractionators. This is the reason it is called as "Full Conversion Hydro Cracking Unit" which is integrated to "Diesel Hydro treater Unit". This unit is integrated to get the diesel free from sulphur.

In the first stage, the feed is first heat exchanged with the effluent coming out of the third reactor from the first stage. Then again, the feed is heated to the required temperature and hydrogen is added before entering in to the reactor and it is sent to the reactor from top. The bottoms of the reactor are again sent to the second and then to third and finally the obtained products are sent to separators. Meanwhile the effluent obtained from the second stage also is collected along with the first stage effluent and sent to a series of separators. Then the collected effluent is sent to first HHPS (Hot High Pressure Separator) to remove the vapors present in the liquid and the vapors obtained are hot so it is sent to CHPS (Cold High Pressure Separator). In this separator the at most vapors are recovered and the bottom liquid is passed to HLPS (Hot Low Pressure Separator) and then to CLPS (Cold Low Pressure Separator). In this process of separators the total vapors from the liquid is separated and is sent to off gases condenser to use as off gases for furnace fuel. The obtained liquid is sent to the fractionators and the desired products like Light Naphtha, Heavy Naphtha, Kerosene, High Speed Diesel. In this the bottoms Unconverted Oil is sent back to the second stage reactor system and the obtained diesel is sent to "Diesel Hydrotreating Unit" to make the diesel free from sulphur. The obtained naphtha is sent to Penex and CCR(Continous Catalytic Reformer) to produce MS(Motor Spirit).


Process flow diagram - HCU
M/U H2
KA003A/B/C
RECYCLE H2
360⁰ G/170 Kg/Cm²
RGC
HHPS.
Gas 1.482 T/H
LPG
3.874T/H
VV13
CC-05
CC-06
KA002A
LT. NAPH.
@14.57T/H
VGO/CGO
VV-1
VV-2
154
M3/Hr
GN001
FF-01
RB-01
157 kg/cm²
CLPS off gas
To H2 UNIT
35 kg/cm²
VV10
1.1kg/cm²
VV-4
VV-6
CHPS
CLPS
HY. NAPHTHA
@0.558T/H
CC-01
R.H2
387⁰ G/170Kg/cm²
RB-02
220⁰C
VV-3
VV-5
380
SKO
71.131T/H
FF-02
RB-03
HHPS
HLPS
FF-3
410⁰C
HSD
48.894T/H
PRT
568KW
413⁰C
141 m3/Hr
2nd STAGE

4. GENERATION OF REACTION NETWORK

The rate coefficient of an elementary step is given by transition state theory as,

$$K = [(K_B T) / h] \exp [\Delta S^0 / R] \exp [- \Delta H^0 / RT] \quad (4.1)$$

According to statistical thermodynamics, the entropy of a species can be determined by adding the contribution from different types of motion viz. transnational, rotational, vibrational and electronic, i.e.,

$$S^0 = S^0_{trans} + S^0_{vib} + S^0_{rot} + S^0_{elec} \quad (4.2)$$

$$\text{Where } S^0_{rot} = S^0_{extrot} + S^0_{introt} \quad (4.3)$$

The rotational part of the entropy is composed of an intrinsic term, $\hat{S}^0$ and a contribution from the symmetry of the molecule, R ln σ, i.e.,

$$S^0_{extrot} = \hat{S}^0_{extrot} - R \ln (\sigma_{ext}) \quad (4.4)$$

$$S^0_{introt} = \hat{S}^0_{introt} - R \ln (\sigma_{int}) \quad (4.5)$$

For racemic mixtures of optically active species, an additional entropy contribution of $R \ln (2^n)$ due to the mixing of different enantiomers has to be considered, where n is the number of chiral centers in the molecule.

$$S^0_{rot} = \hat{S}^0_{rot} - R \ln [(\sigma_{ext} \sigma_{int}) / 2^n] \quad (4.6)$$

$$\text{Where } \hat{S}^0_{rot} = \hat{S}^0_{extrot} + \hat{S}^0_{introt} \quad (4.7)$$

$$\text{And } [(\sigma_{ext} \sigma_{int}) / 2^n] = \sigma_{gl} [\text{ Global Symmetry Number }] \quad (4.8)$$

The global symmetry number σ_{gl} quantifies all the symmetry contributions of a species. Using the above equations, the standard entropy of activation for an elementary step can be written as:

$$\Delta S^0 = \Delta S^0_{trans} + \Delta S^0_{vib} + \Delta S^0_{elec} + \Delta S^0_{rot} + R \ln [\sigma^R_{gl} / \sigma_{gl}] \quad (4.9)$$

The last term of equation (4.9) gives the difference in standard entropy between reactant and activated complex due to the symmetry changes. Equation (4.9) can also be written as

$$\Delta S^0 = \Delta \hat{S}^0 + R \ln \sigma^R_{gl} / \sigma_{gl}] \quad (4.10)$$

$$\text{Where } \Delta \hat{S}^0 = \Delta S^0_{trans} + \Delta S^0_{vib} + \Delta S^0_{elec} + \Delta S^0_{rot} \quad (4.11)$$

Using equation (4.1) and (4.10), the effect of changes in symmetry in going from reactant to activated complex on the rate coefficient of an elementary step can be factored out. i.e.,

$$K = [\sigma^R_{gl} / \sigma_{gl}] [(K_B T) / h] \exp [\Delta \hat{S}^0 / R] \exp [- \Delta H^0 / RT] \quad (4.12)$$

The rate coefficient of an elementary step k, can now be written as a multiple of the single-

event rate coefficient $\tilde{k}$ as

$$K = n_e \tilde{k} \quad (4.13)$$

where the number of single events n_e and single event rate coefficient $\tilde{k}$ can be defined as

$$n_e = [\sigma^R_{gl} / \sigma_{gl}] \quad (4.14)$$

$$\tilde{k} = [(K_B T) / h] \exp [\Delta\hat{S}^0 / R] \exp [- \Delta H^0 / RT] \quad (4.15)$$

Since the difference in symmetry, i.e. the difference in structure between the reactant and the activated complex has been factored out by introducing the number of single events n_e, the single-event rate coefficient $\tilde{k}$ is independent of the structure of the reactant.

4.1 RULES FOR GENERATING THE REACTION NETWORK

The generation of the reaction network for paraffins is based on certain predefined rules. These rules are derived from the carbenium ion chemistry and from the experimental evidences obtained from the hydro cracking of paraffinic species. The summary of these rules and their explanation is given as follows:

- ✓ Generation of primary and methyl carbenium ions is not considered. This rule came from the stability study of the carbenium ions. Considering the high energy required to form the primary and methyl carbenium ions and their highly unstable nature as compared to secondary and tertiary carbenium ions, no elementary step generating primary and methyl carbenium ions has been considered in the reaction network.
- ✓ It has been found from analysis of oil fractions that the species with more than three side chains are present in very low concentrations. Therefore, species having more than three side chains are not considered in the network generation.
- ✓ Species with only methyl side chains are considered. Therefore, no species with ethyl or longer side chains are generated in the reaction network. This rule is also based on the experimental studies of hydro cracking.
- ✓ The contribution of protonated cycloalkanes to the formation of branched isomers rapidly decreases as the ring size increases above three carbon atoms and therefore, only protonated cyclo propane (PCP) elementary steps are considered for the isomerization steps introducing the degree of branching. This rule makes sure that no species having ethyl or bigger side chains are generated.
- ✓ Bimolecular hydrogen transfer steps are not considered.

4.2 REACTION NETWORK FOR N-HEXADECANE

The reaction network has been generated for the hydro cracking of n-hexadecane and for a heavy paraffinic feed up to C_{33}. The number of different type of elementary steps, and the number of olefin species and carbenium ions involved for these two feed stocks.

The details of different type of elementary steps and the number of single event rate coefficient required for their modeling are discussed below:

4.2.1 Isomerization Steps

Based on the energy levels of the reactant and the product carbenium ions, only four single event rate coefficient isomerization $\dot{k}_{isom}$ (s;s) , $\dot{k}_{isom}$ (s;t) , $\dot{k}_{isom}$ (t;s) , $\dot{k}_{isom}$ (t;t). It should be noted that the degree of branching of a carbenium ion in hydride shift and methyl shift isomerization remains the same in contrast to PCP isomerization in which the degree of branching changes. Because of lesser changes in the molecular structure in HS and MS isomerization as compared to PCP, the former isomerization steps are much faster than the latter, and thus for any particular carbon number, all the isomers with same degree of branching rapidly reach reaction equilibrium.

Because of this equilibrium between the isomers of same degree of branching, a partial lumping is introduced in this kinetic model based on the degree of branching per carbon number. This eliminates the need to estimate the rate parameters for HS and MS leaving out only four rate parameters for PCP isomerization, namely and $\ddot{k}_{PCP}$(s;s) , $\ddot{k}_{PCP}$ (s;t) , $\tilde{k}_{PCP}$ (t;s) , $\tilde{k}_{PCP}$ (t;t) . The further reduction in the number of isomerization parameters has been discussed later using the thermodynamic relationships.

4.2.2 Cracking Steps

Until recently, the elementary steps for cracking were modeled similar to that for isomerization steps, i.e., four single event rate coefficients $\dot{k}_{cr}$ (s;s) , $\dot{k}_{cr}$ (s;t) , $\dot{k}_{cr}$ (t;s) , $\dot{k}_{cr}$ (t;t) and, were used irrespective of the type of the olefin produced for any carbon number of the reactant carbenium ion. On the other hand it is introduced to the dependency of the produced olefin on the single event rate coefficient of cracking. The basis of introducing this dependency, however, is thus far empirical in nature.

4.2.3 Protonation / Deprotonation Steps :

Protonation/deprotonation steps are very fast as compared to PCP and cracking steps, and therefore, it is assumed that protonation/deprotonation steps are always at reaction equilibrium.

The equilibrium constant for the isomerization between these two olefins can be expressed as the product of the protonation/deprotonation equilibrium constants for the pathways connecting the olefins through the common carbenium ion. i.e.,

$$\vec{k}^{O_1=O_2}{}_{isom} = \vec{k}^{O_1=R^-}{}_{\frac{pr}{de}} \; \vec{k}^{R^-=O_2}{}_{\frac{de}{pr}} \qquad (4.16)$$

Expressing the equilibrium constant by the ratio of the forward to the backward rate coefficient and identifying that R_I^+ is a secondary carbenium ion, the above equation becomes,

$$\vec{k}^{O_1=O_2}{}_{isom} = \frac{K_{pr}(O_1;S)\; K_{de}(S;O_2)}{K_{de}(S;O_1)\; K_{pr}(O_2;S)} \qquad (4.17)$$

To simplify this equation, it is assumed that the activated complex in a protonation/deprotonation step has a structure resembling the olefin structure but with the double bond not yet broken/formed completely. This line of thought makes it possible to consider that the differences in the stability between the olefin isomers are maintained in the corresponding activated complexes.

Assuming that physical adsorption is in quasi-equilibrium, the concentration of the adsorbed paraffins can be given in terms of the measurable paraffin concentrations using the Langmuir isotherm as,

$$C_{p_i}^{ads} = \frac{C_{sat}\, K_{LP_i}\, C_{p_i}^{liq}}{1 + \sum_i K_{lp_i} C_{p_i}^{liq}} \qquad (4.18)$$

These adsorbed paraffins are dehydrogenated at the metal sites of the catalyst. A particular paraffinic molecule P_i can produce several olefins O_{ij} on dehydrogenation at the metal site of the catalyst, i.e.,

$$P_i^{ads} = O_{ij}^{liq} + H_2^{liq} \qquad (4.19)$$

Here it is assumed that olefins and hydrogen remains in the liquid phase and hydrogenation

/dehydrogenation steps are at quasi-equilibrium. This assumption allows calculating the equilibrium concentration of olefins in terms of the concentration of the adsorbed paraffins.

$$C_{O_g}^{liq} = \frac{K_{DH}^{P_i=O_g} C_{p_i}^{ads}}{C_{H_2}^{liq}} \quad (4.20)$$

Combining equations (4.18) and (4.20) gives,

$$C_{O_g}^{liq} = \frac{K_{DH}^{P_i=O_g} C_{sat} K_{lp_i} C_{p_i}^{liq}}{C_{H_2}^{liq}\left(1 - \sum_i K_{lp_i} C_{p_i}^{liq}\right)} \quad (4.21)$$

The olefins produced at the metal site are protonated at the acid sites to give the carbenium ions.

$$O_{ij}^{liq} + H^+ \leftrightarrows R_{ik}^+ \quad (4.22)$$

It should be noted that one particular olefin can produce a maximum of two carbenium ions, depending upon the location of the double bond. If the double bond is in the terminal position, one of the produced carbenium ion will be primary and will not be considered in the reaction network. The index *k* in equation (4.22) is used to describe all the possible carbenium ions that can be produced by protonation of all the olefins obtained from *Pi* on dehydrogenation. As discussed above, protonation/deprotonation steps are in quasi-equilibrium giving the concentrations of the carbenium ions in terms of the olefin concentrations as follows:

$$C_{R_{ik}^+} = K_{\frac{pr}{d\theta}}^{O_g = R_g^+} C_{O_g}^{liq} C_{H^+} \quad (4.23)$$

If there are n olefins in equilibrium with a single carbenium ion R^+_{ik}, n equations can be written similar to equation (4.18), each describing the equilibrium of R^+_{ik} with a different olefin. The average concentration of R^+_{ik} can therefore be given as

$$C_{R^+} = \frac{1}{n}\sum_{j=1}^{n} K_{\frac{pr}{d\theta}}^{O_g = R_g^+} C_{O_g}^{liq} C_{H^+} \quad (4.24)$$

The number *n* will be 2 in case of a secondary carbenium ion and 3 in case of a tertiary carbenium ion. Substituting the concentration of olefins in equation (4.20) from equation (4.24) gives the concentration of the carbenium ions in terms of the liquid phase concentration of paraffins,

$$C_{R_{ik}^{+}} = \frac{\frac{1}{n}\sum_{j=1}^{n}\frac{K_{\frac{pr}{de}}^{O_g=R_g^{-}} K_{DH}^{P_i=O_g} C_{sat} K_{lp_i} C_{p_i}^{liq} C_{H^+}}{C_{H_2}^{liq}\left(1-\sum_i K_{lp_i} C_{p_i}^{liq}\right)}}{} \qquad (4.25)$$

The (de)protonation and (de)hydrogenation equilibrium constants can now be expressed in terms of the respective single event equilibrium constants, using the following two equations:

$$K_{\frac{pr}{de}}^{O_g=R_g^{+}} = \frac{\sigma_{O_{ij}}^{gl}}{\sigma_{R^+}^{gl}} K_{\frac{pr}{de}}^{O_g=R_g^{+}} \qquad (4.26)$$

$$K_{DH}^{P_i=O_g} = \frac{\frac{\sigma_{p_i}^{gl}}{\sigma_{O_{ij}}^{gl}\sigma_{H_2}^{gl}} K_{DH}^{P_i=O_g}}{} \qquad (4.27)$$

Substituting equations (4.26) and (4.27) in equation (4.25) gives,

$$C_{R_{ik}^{+}} = \frac{1}{n}\left[\frac{\sigma_{p_i}^{gl}}{\sigma_{R^+}^{gl}\sigma_{H_2}^{gl}}\right]\sum_{j=1}^{n}\frac{K_{\frac{pr}{de}}^{O_g=R_g^{-}} K_{DH}^{P_i=O_g} C_{sat} K_{lp_i} C_{p_i}^{liq} C_{H^+}}{C_{H_2}^{liq}\left(1+\sum_i K_{lp_i} C_{p_i}^{liq}\right)} \qquad (4.28)$$

By using equation (4.28), the single event protonation/deprotonation equilibrium constant $\tilde{k}_{\frac{pr}{de}}^{O_g=R_{ik}^{-}}$ can be expressed in terms of the single event protonation / deprotonation equilibrium constant of R_{ik}^{-} with reference olefin, $\tilde{k}_{\frac{pr}{de}}^{r=R_{ik}^{-}}$ i.e., , as

$$\tilde{k}_{\frac{pr}{de}}^{O_g=R_{ik}^{-}} = \tilde{k}_{\frac{pr}{de}}^{O_r=m_{ik}} \tilde{k}_{isom}^{O_g=O_r} \qquad (4.29)$$

where m_{ik} can be secondary or tertiary depending on the type of carbenium ion R_{ik}^{-}. Substituting equation (4.27) in (4.28) gives the concentration of the carbenium ions as per equation (4.29). This concentration can be used in equation (4.30) to get the rate of consumption of the carbenium ion through an elementary step in which a product carbenium ion R_{il}^{+} of type w (s or t) is formed.

$$C_{R_{ik}^{+}} = \frac{1}{n}\left[\frac{\sigma_{p_i}^{gl}}{\sigma_{R^+}^{gl}\sigma_{H_2}^{gl}}\right]\frac{\tilde{k}_{\frac{pr}{de}}^{O_r=m_{ik}} C_{sat} K_{lp_i} C_{p_i}^{liq} C_{H^+}}{C_{H_2}^{liq}\left(1+\sum_i K_{lp_i} C_{p_i}^{liq}\right)} \sum_{j=1}^{n} \tilde{k}_{isom}^{O_g=O_r} K_{DH}^{P_i=O_g} \qquad (4.30)$$

$$r_{R_{ik}^{+}} = n_e \tilde{k}_{e} \left(m_i(ik) + w_i il\right) C_i(R^{+}) \qquad (4.31)$$

Equations (4.30) and (4.31) can be combined to give the rate of consumption of carbenium

ions as,

$$r_{R+_{ik}} = n_e \tilde{k}_e \left(m_1(ik) - w_1 il\right) \frac{1}{n}\left[\frac{\sigma_{p_i}^{gl}}{\sigma_{R^+}^{gl}\,\sigma_{H_2}^{gl}}\right] \frac{k_{pr}^{i,O_g = m_{ik}} C_{sat}\, K_{lp_i} C_{p_i}^{liq}\, C_{H^-}}{C_{H_2}^{liq}\left(1 - \sum_i K_{lp_i} C_{p_i}^{liq}\right)} \sum_{j=1}^{n} k_{isom}^{i,O_g = O_r} K_{DH}^{P_i = O_g} \quad (4.32)$$

4.3 MASS TRANSFER CONSIDERATIONS:

Accounting that the continuity equations for the gas phase will be only in the mass transfer between the gas and the liquid phase, the interphase mass transfer flux is described in terms of the two film model

$$N_i = K_{o,i}\left[\frac{C_i^G}{H_i} - C_i^l\right] \quad (4.33)$$

$$\text{with } \frac{1}{K_{o,i}} = \frac{1}{K_G H_i} + \frac{1}{K_L} \quad (4.34)$$

The interphase mass transfer flux is calculated for each component/lump and the continuity equations for the gas phase components are formulated as follows,

$$\frac{1}{\Omega}\frac{dF_i^G}{dz} = -K_{o,i}\, a_v\left[\frac{C_i^G}{H_i} - C_i^l\right] \text{ where i = 1,2,3-------}N_c \quad (4.35)$$

The continuity equations for liquid phase components also take into account the net rate of formation of component/lump *i.e,*

$$\frac{1}{\Omega}\frac{dF_i^L}{dz} = \left(K_{o,i}\, a_v\left[\frac{C_i^G}{H_i} - C_i^l\right] + r_i\right) \text{ where i = 1,2,3-------}N_c \quad (4.36)$$

The molar flow rates of component in the gas phase and in the liquid phase are obtained from the continuity equations and are added to get the total molar flow rates of the component. The total molar flow rate of component thus obtained ys converted into the percent molar flow rate based on the total hydro carbons at the reactor exit(on hydrogen free basis) and are finally used as responses in the parameter estimates as

$$y_i = \frac{F_i^G - F_i^l}{\sum_{j=1}^{N_c-1}\left(F_j^G - F_j^l\right)} * 100 \quad (4.37)$$

With the initial boundary conditions given by the feed composition as,

$$F_i^G = F_i^{G,o} \text{ and } F_i^l = F_i^{l,o} \text{ at z =0, where i = 1,2,3-------}N_c \quad (4.38)$$

These set of differential equations can be solved using Peng-Robinson equation of state.

5. SIMULATION OF HYDROCRACKING REACTOR

5.1 EXPERIMENTAL / COMPUTATIONAL:

5.1.1 Simulation:

For the process of Hydro Cracking, simulation is to be done n order to estimate the product, and for reaction extents with given stoichimetries. But during these some assumptions are to be considered for the software compatibility. The software used is ASPEN – HYSYS.

5.1.2 Flow Sheet Development:

The mixed feed consisting of C_{16} – C_{33} cut from Vacuum Distillation Unit after preheating through a series of heat exchangers and a furnace is entered into the reaction section. In this section there are series of 3 reactors for better conversions as each reactor is of 66% efficiency where products from one reactor enters into the other. Similarly there is another set of two reactors where the preheated feed through heat exchangers and a furnace into this reaction section. Then the products in vapor phase coming from both the reactor sections are distilled for separation of required products.

5.2 ASSUMPTIONS AND EXPLANATIONS:

In terms of chemistry the compounds being handled in this simulation are not pure components of molecules. So being a mixture with varying properties, and HYSYS is not having this facility of handling such components. But it can handle in terms of pure component compositions in each compound. We need to consider liquid hypothetical components for this. Where few molecular properties like, molecular weight, densities, boiling points are used to estimate the other molecular properties. Information or details about all the properties are not required, but few important properties are sufficient for estimating the rest of properties basing on these.

In actual processes the process includes catalysts. But ASPEN – HYSYS require rate of forward and backward reaction in case of catalytic reactions which is difficult to obtain. So during simulation conversion reactors are considered where we will be obtaining the reaction extents of each individual molecule. This data can be used for developing new catalyst for better conversions. We can understand what exactly the cracking chemistry being involved here. If the catalyst properties in terms of reactions extents or rate of reactions are known the can used directly.

5.3 VALIDATION WITH COMMERCIAL UNITS:

This entire simulation is done in steady state mode. But on comparing with the plant data the results obtained are almost very similar including the graphs. These results can now be used to vary the operating conditions for better conversions and efficiencies. And even for the

development of new catalysts for better selectivity and conversions. But a close observation on these are to be made even in pilot plant studies. As the current simulation is made in steady state mode where as the actual process will be in dynamic mode. But yet these results can be used for comparisons and to know what and how of the process.

The simulated values and reports are included and also graphs related to the values are in **appendix III.**

6. RESULTS AND DISCUSSIONS

6.1 OBSERVATIONS AND MODEL VALIDATIONS:

The feed entering in to the reactor industrially was a mixed feed for which all the parameters like a compound cannot be preformed / pre estimated. But yet for compatibility there are few properties that will be periodically checked. These will generally be the physical parameters. ASPEN – HYSYS is the simulator is used to handle these compounds by creating a hypothetical component. These hypothetical compounds in order to estimate the other required properties of the mixture the known physical parameters are given and a hypothetical component is created.

ASPEN HYSYS is not having the in built catalysts properties. But yet it can handle them by using the rate constants. These rate constants cannot be very specific for a process they will depend upon the feed type, catalyst nature, type and many process parameters. Else stoichiometry is needed. So for these the outlets of each reacts are considered and are giving. So now a balance between the inlet and outlet compositions was taken and then the reaction stoichiometry was developed. On analyzing this stoichiometry we can balance the gross consumption and formation of a production. According to the values of dynamic case a mismatch with the stoichiometry and the feed and the desired products are accordingly modified. Though the practical reaction was 66% conversion in first reactor. But yet 99% conversion is achieved by adding second stage of reactors. Now the simulator is used to back calculate each stream and given the results in terms of the reaction extents. Now according to this data it will be helpful in preparing a particular catalyst recipe and can even alter the existing catalyst depending upon the reaction extents. The out let streams obtained with these reactions are seen without any error. This is done to observe whether the feed entering to the next reactor is fixed constant and as the reaction extents are changed these will be automatically changed. And the same process was used for the other reactors also.

6.2 RESULTS:

The obtained results are compared with the existing plant data and were found that the obtained graphs are almost same to that of the existing process and the considered model is valid to compare the plant data and make necessary modification with respect to process parameters or catalysts.

7. CONCLUSION

Among all the units in primary and secondary processing "HYDROCRACKER" is the one of the efficient secondary process unit. The demand to the hydro cracking is increasing day by day because of the stringent conditions to follow in environment norms. Refineries prefer in hydrogen addition at lower temperatures rather than much more carbon reduction because this might lead to more coke formation. So an equilibrium based model has been performed to study the kinetics of the data along with simulating the input plant data to these kinetics that it is giving the same output with these kinetics considering a conversion reactor instead of catalytic reactor.

The project finally gives us the idea about the kinetics of the hydro cracking unit and also about the stoichiometry of the hydro cracking unit. This leads to rough estimate of the physical parameters of the reactor at steady state conditions.

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APPENDIX I

Table 1.1 CONFIGURATION OF BORL REFINERY UNITS.

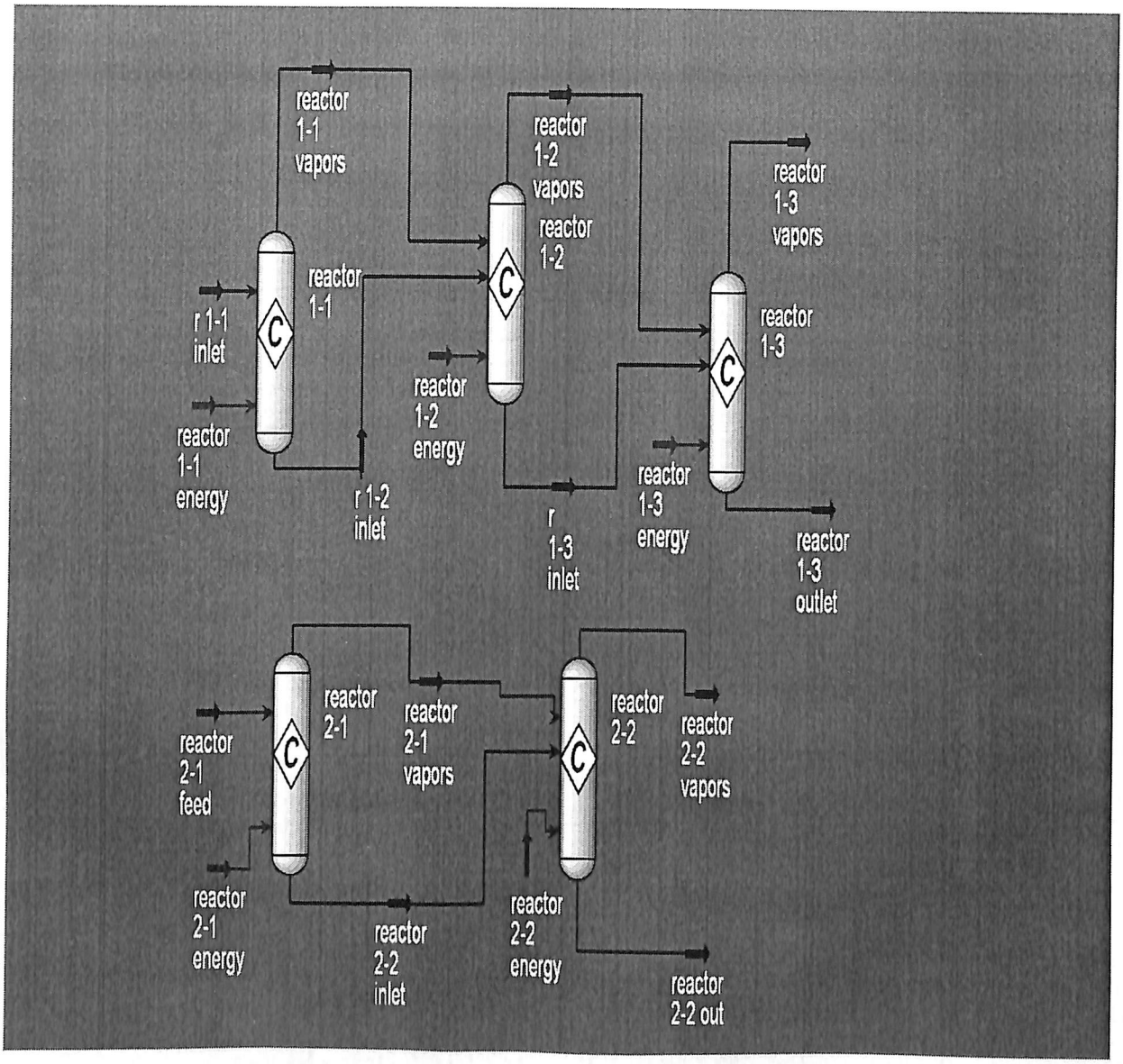
S.No	UNITS	CAPACITY (MMTPA)
1	Crude / Vacuum Distillation Unit	6.0
2	Full Conversion Hydrocracker (HCU)	1.95
3	Diesel Hydrotreator	1.63
4	Delayed Coker Unit	1.36
5	Hydrogen Unit	0.07
6	Naphtha Hydrotreater	1.0
7	CCR Reformer Unit	0.5
8	Isomerization Unit	0.3
9	Sulphur Recovery Unit	2 * 180 MTPD

APPENDIX II

TABLE 3.1: Results of Network Generation for C_{16} and C_{33} Feedstocks

Type of Elementary Steps	Number of Elementary Steps	
	C16 Feed	C33 Feed
Protonation	12831	836693
Deprotonation	12845	837015
Hydride shift	10470	761712
Methyl shift	2670	89960
Protonated cyclo propane	8485	275176
Total Elementary Steps	2335	851602
Carbenium Ions Involved	49636	2886158 (~ 3 Million)
β- scission	6167	396354
Olefins Involved	7601	448395

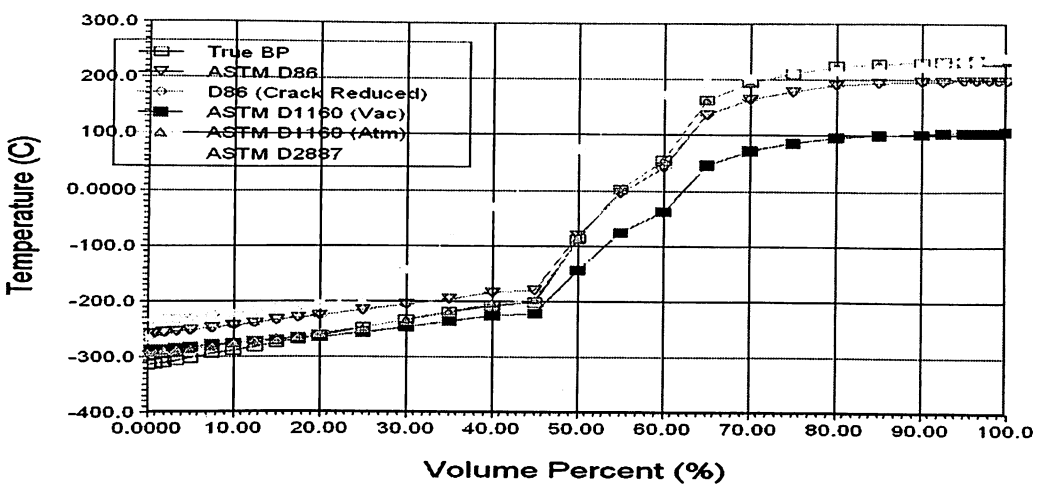
SIMULATION FLOWSHEET WITH CODE NAMES



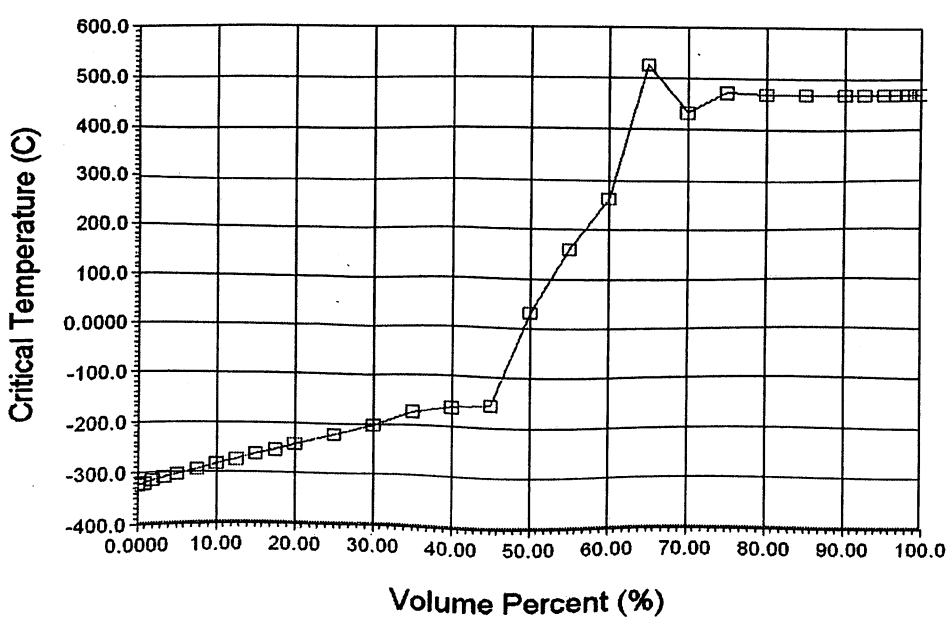
Graphs:

Reactor 1-1

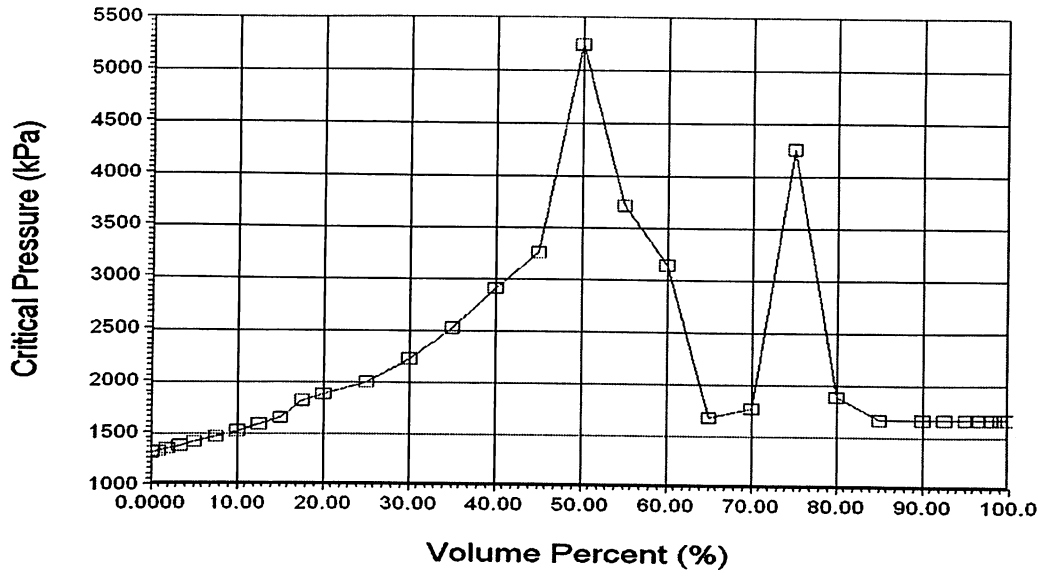
Boiling curves



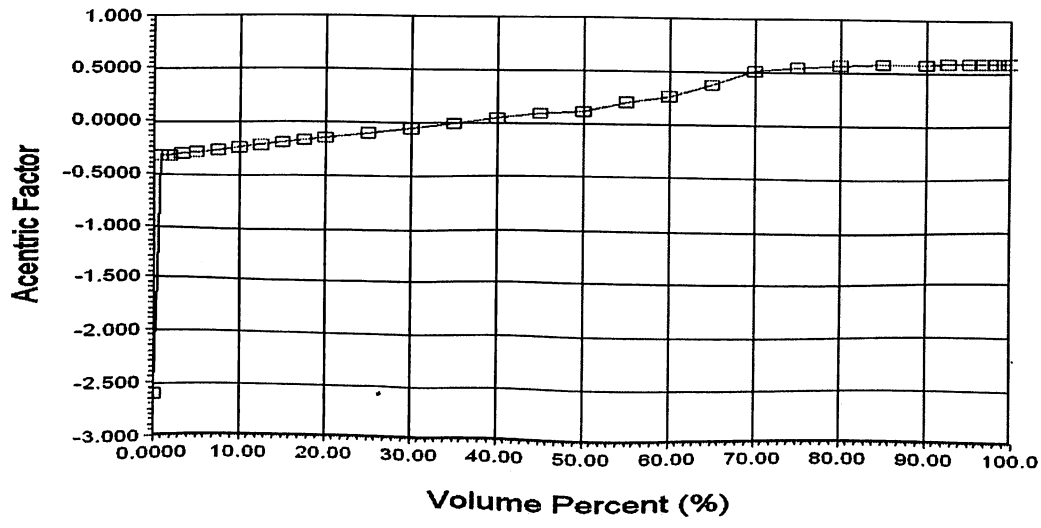
Critical temperature



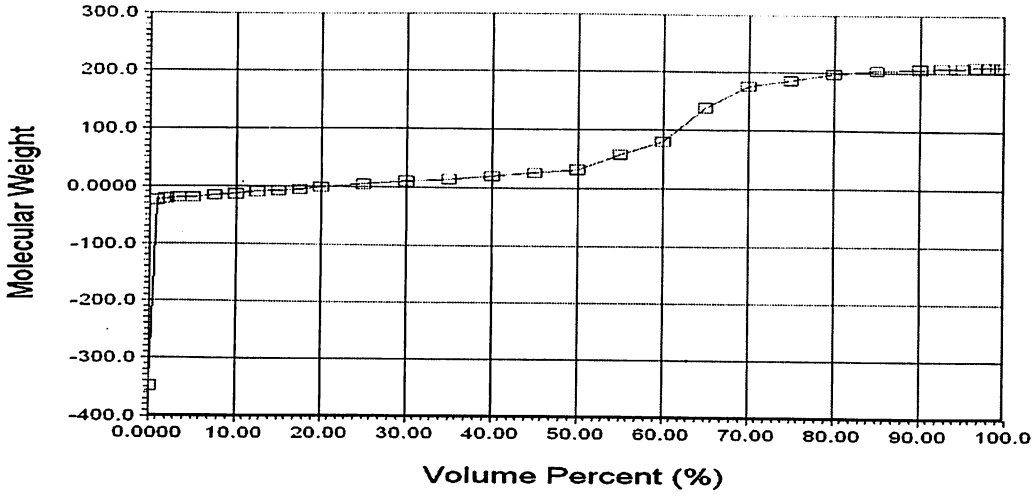
Critical pressure



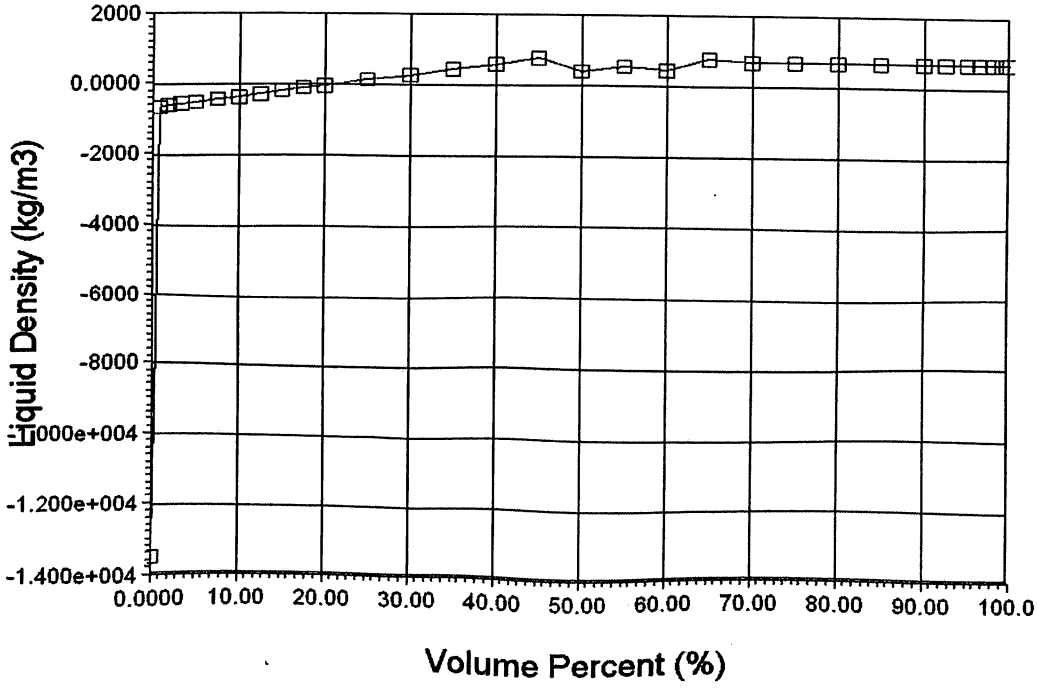
Accentric factor



Molecular weights

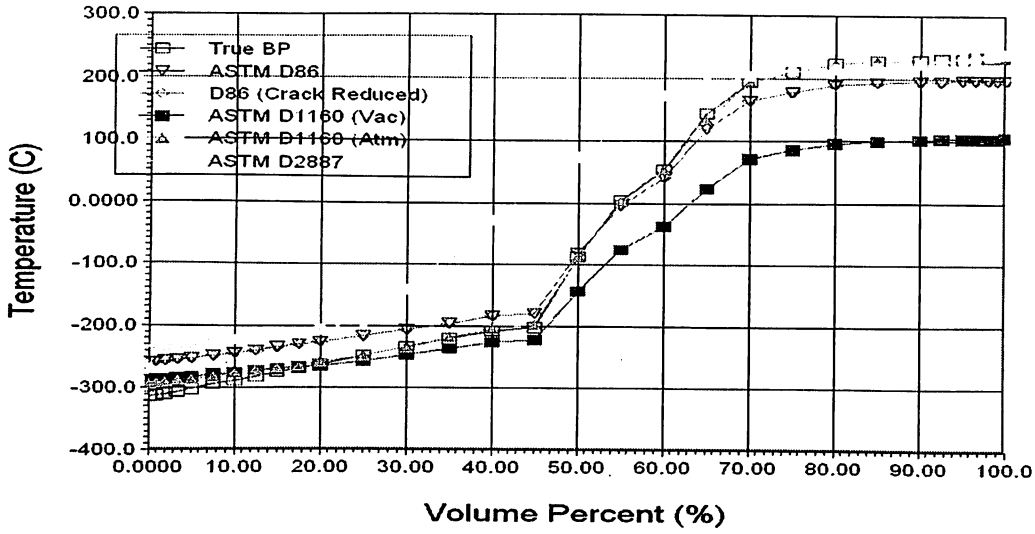


Liquid denstity

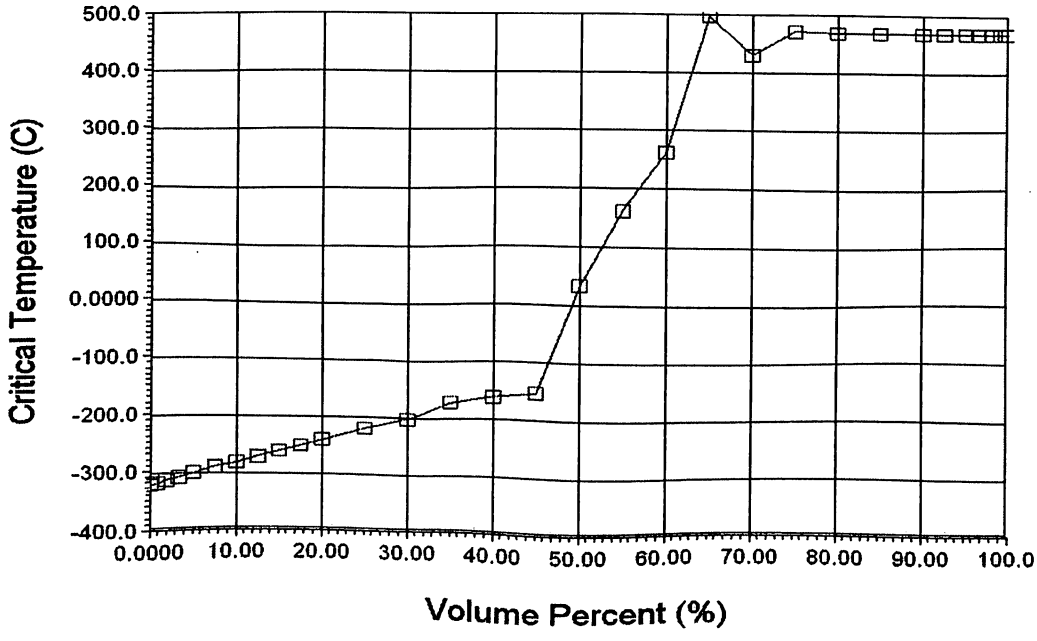


Reactor 1-2 vapors:

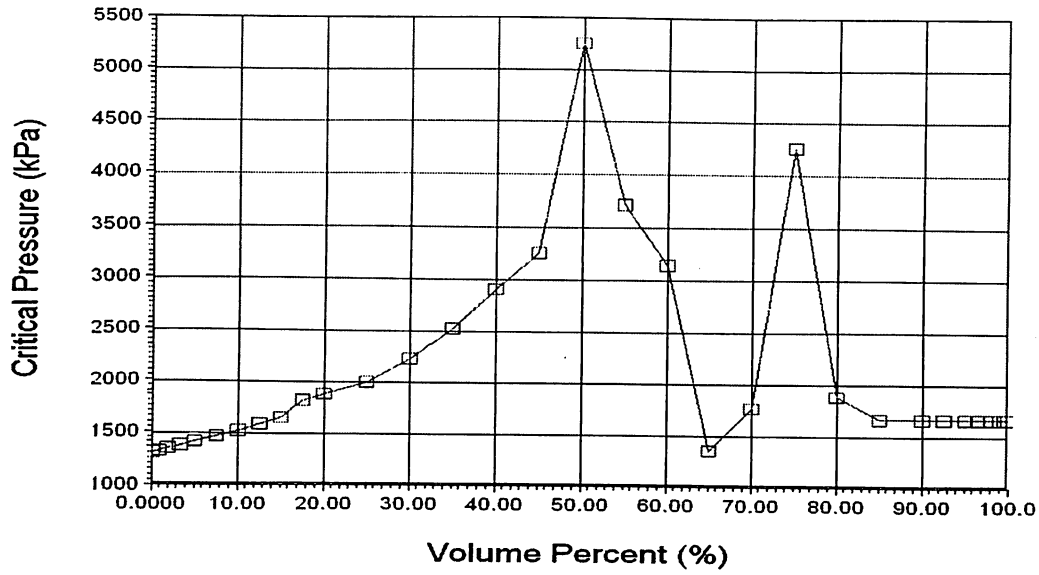
Boiling point



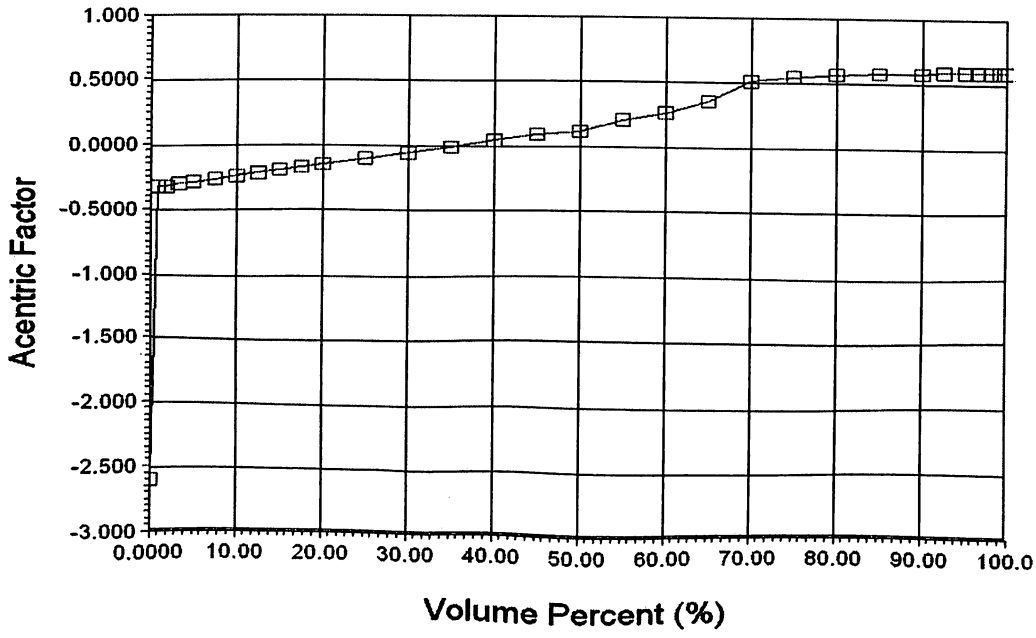
Critical temperature



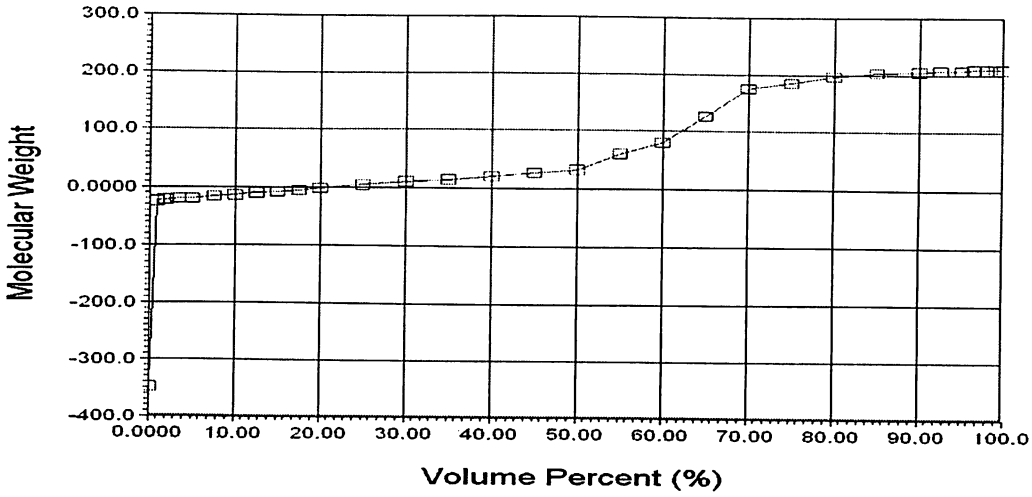
Critical pressure



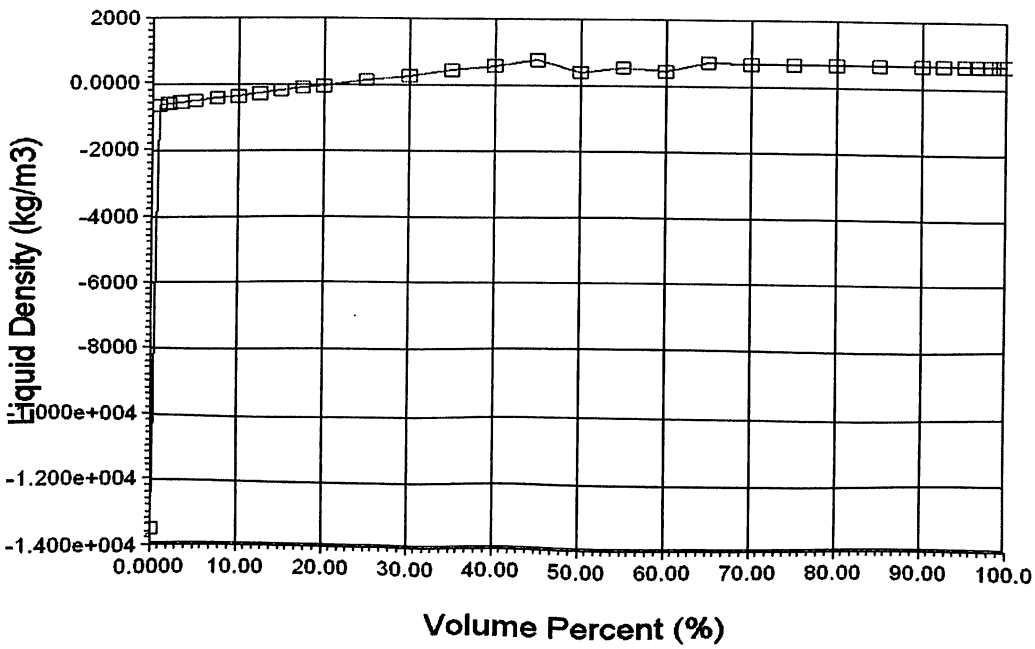
Acentric factor



Molecular weight

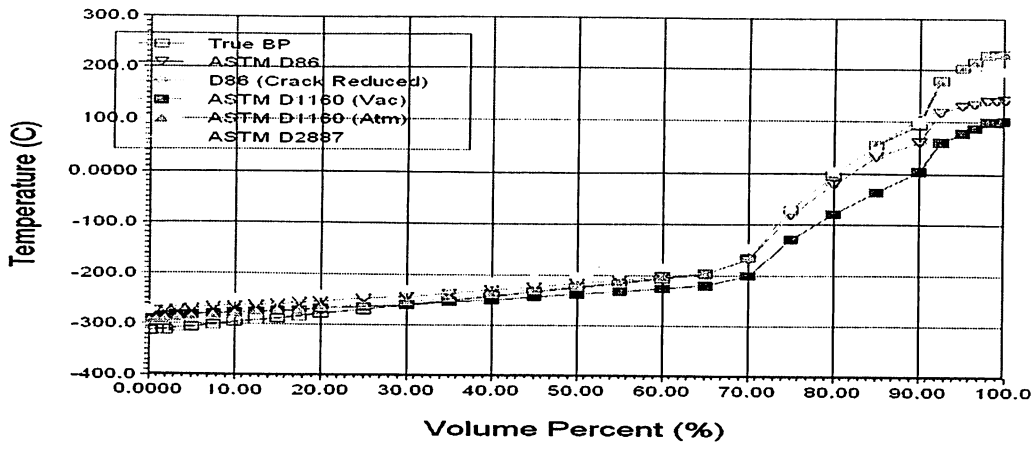


Liquid density

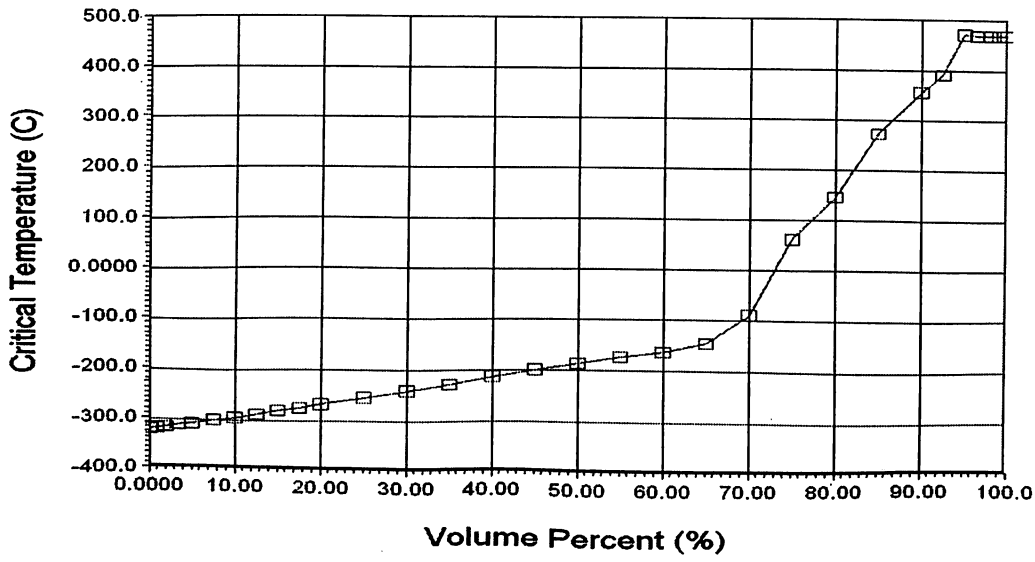


Reactor 1-3:

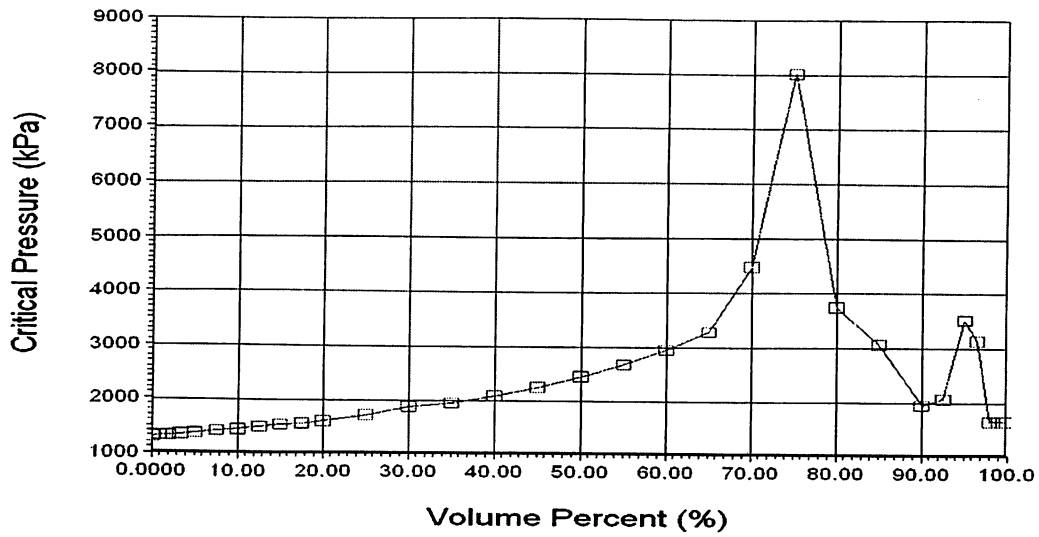
Boiling point



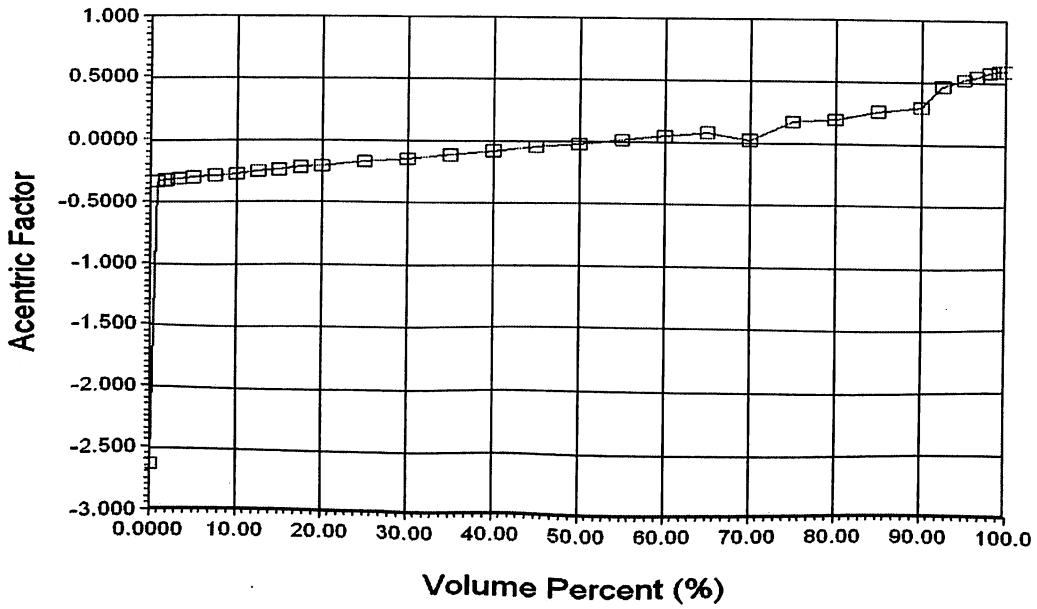
Critical tempearture



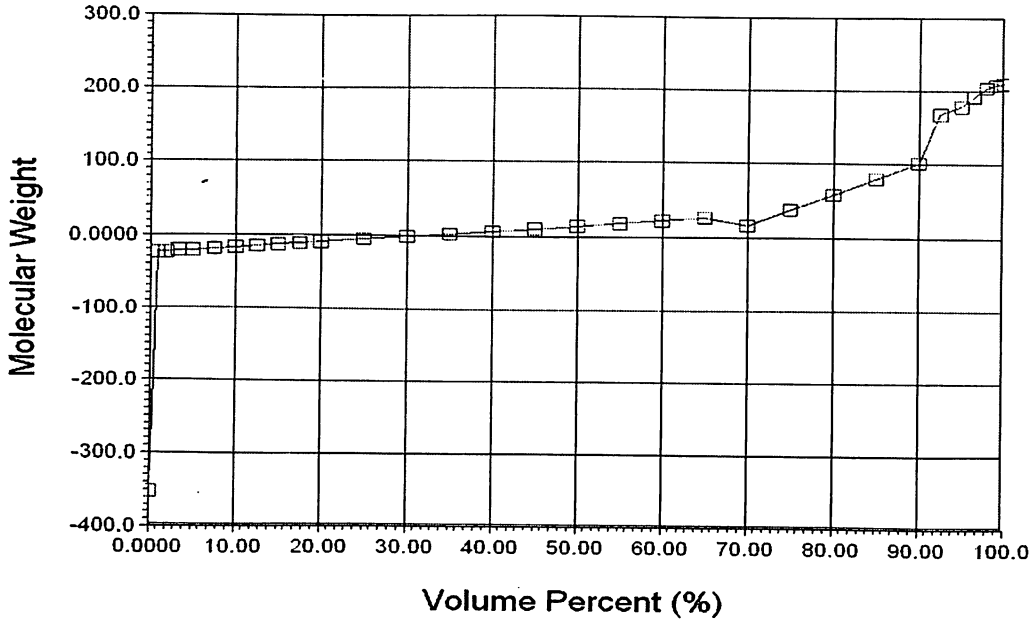
Critical pressure



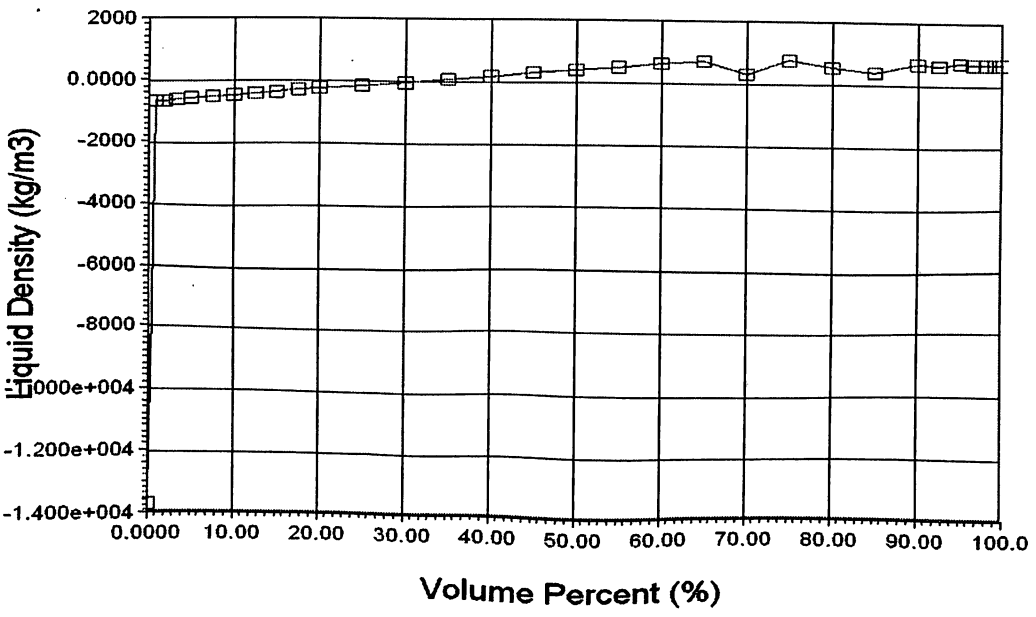
Acentric factor



Molecular weight

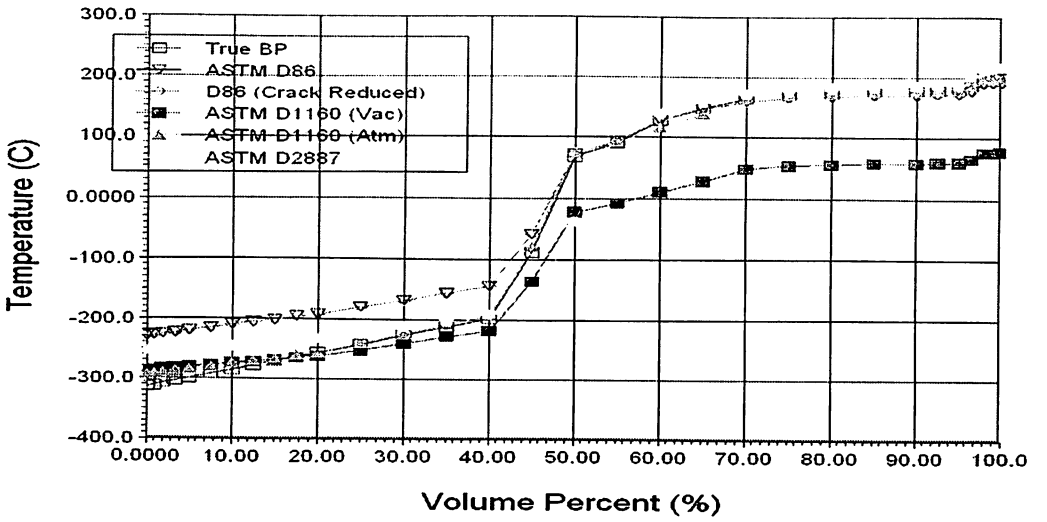


Liquid density

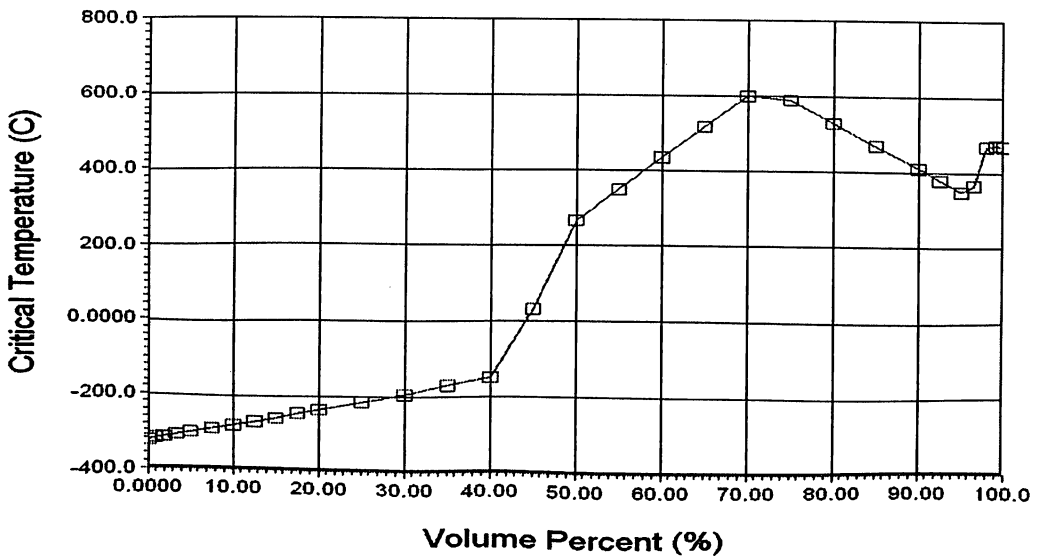


Reactor 2-1:

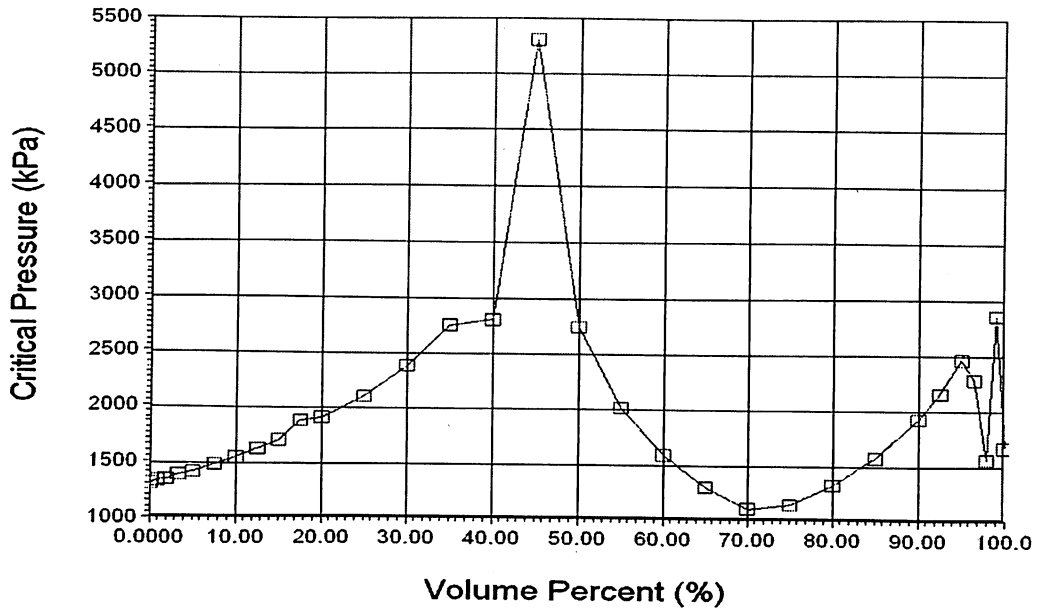
Boiling point



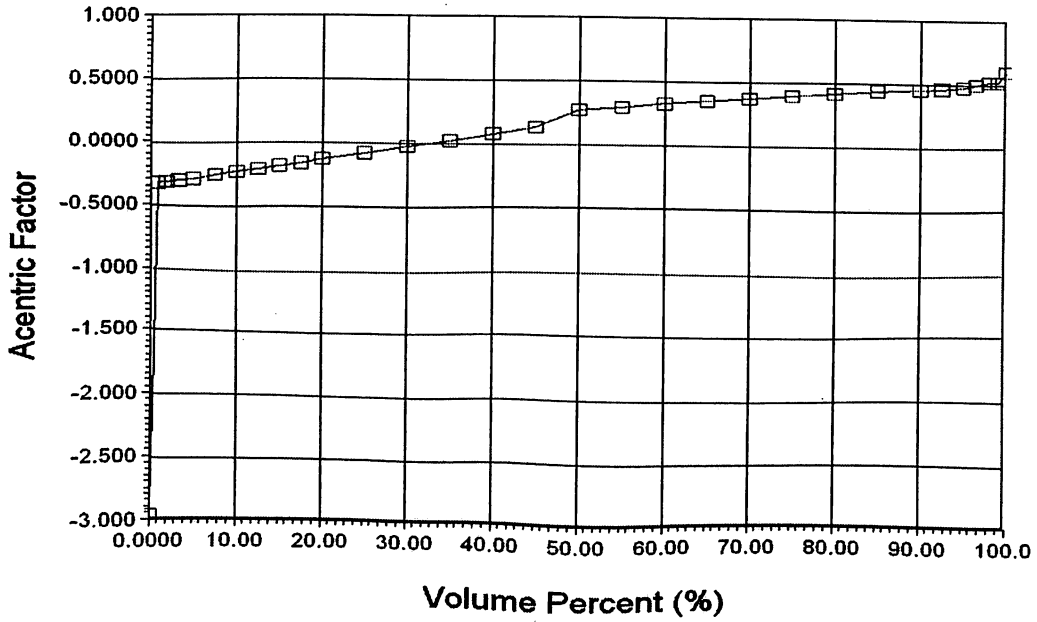
Critical temperature



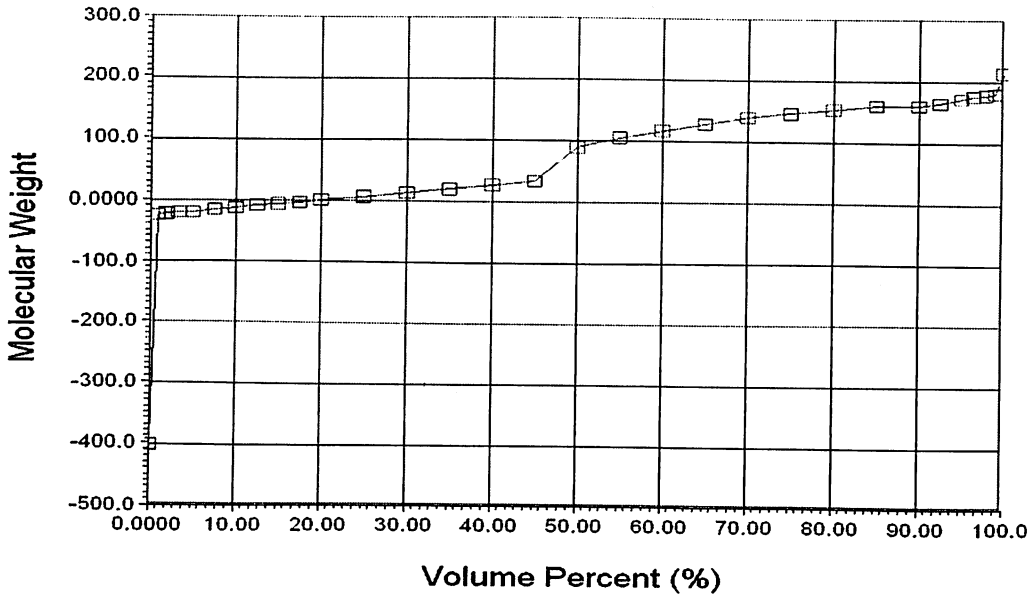
Critical pressure



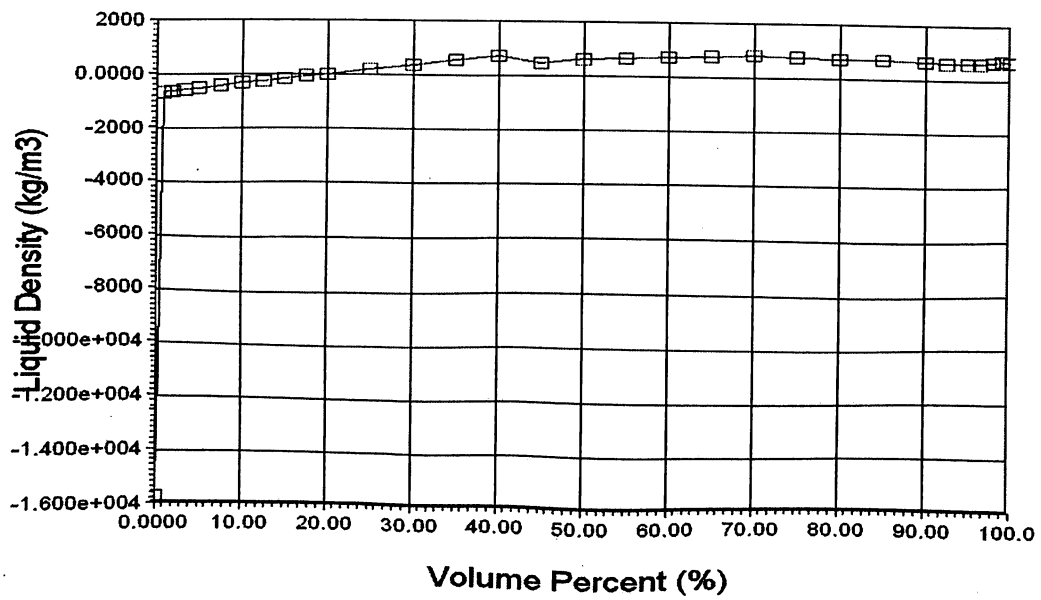
Acentric factor



Molecular weight

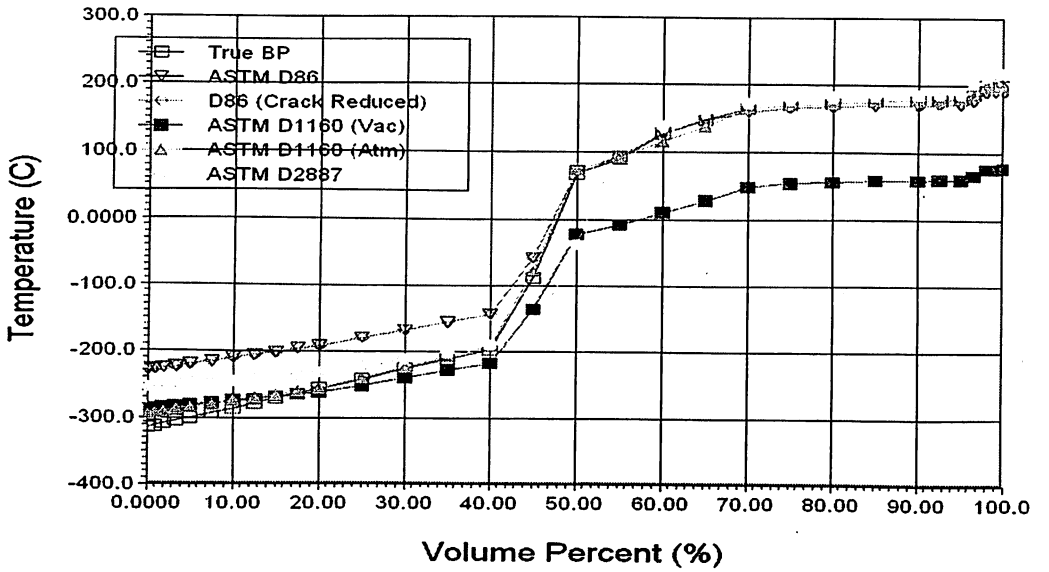


Liquid density

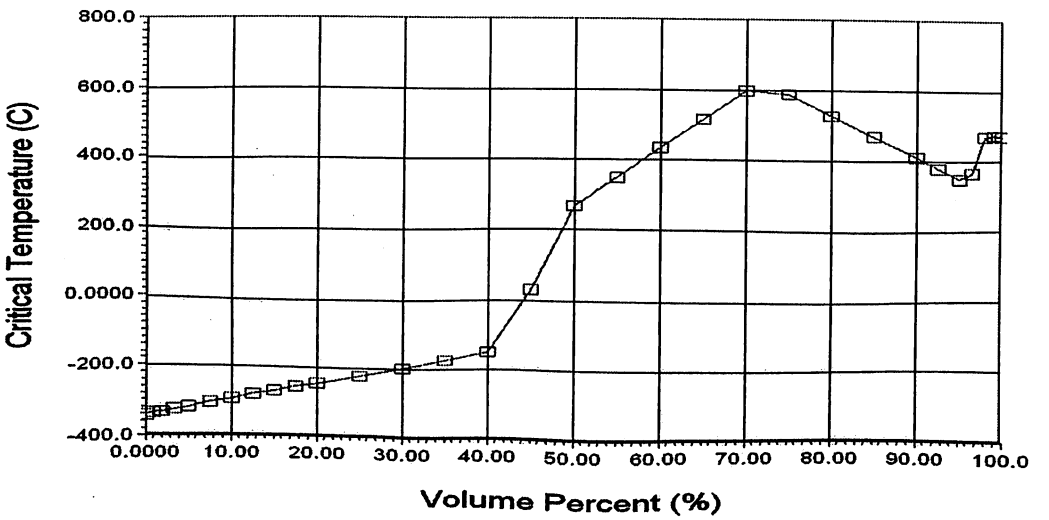


Reactor 2-2:

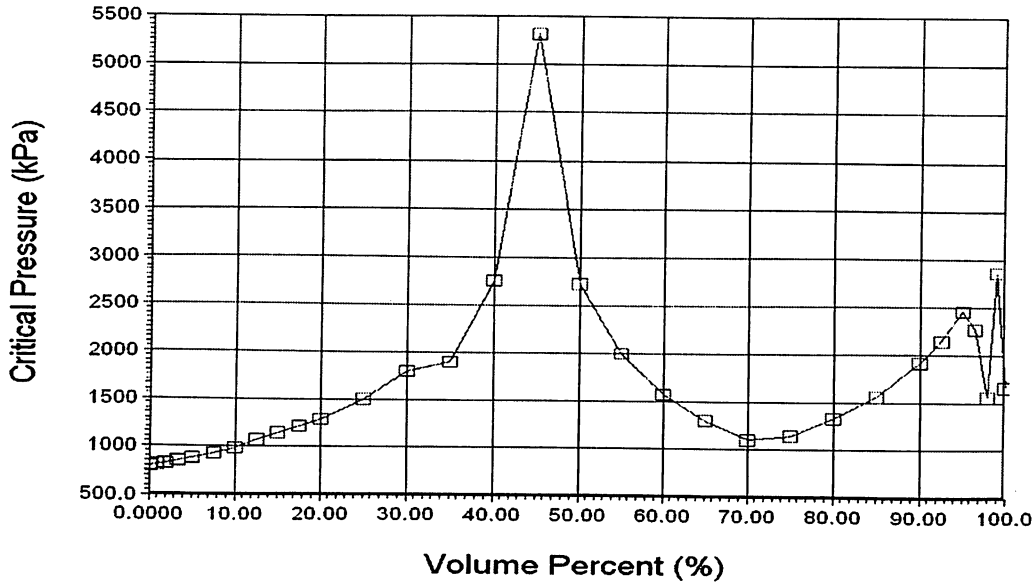
Boiling point



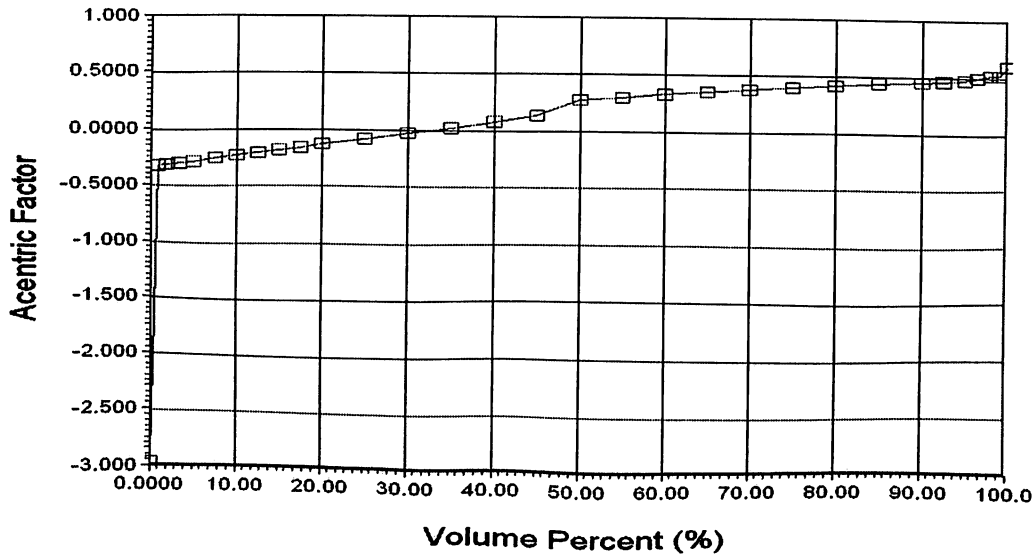
Critical temperature



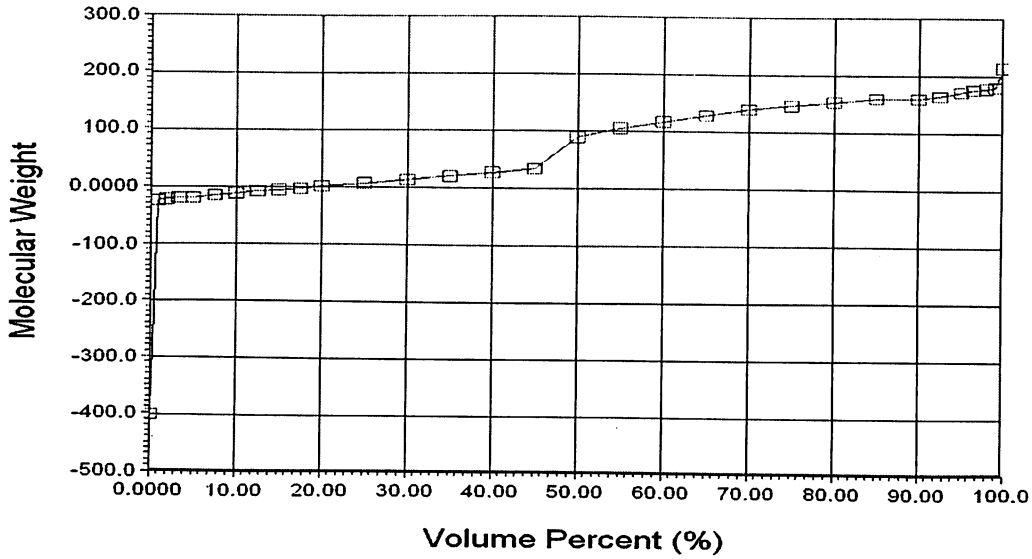
Critical pressure



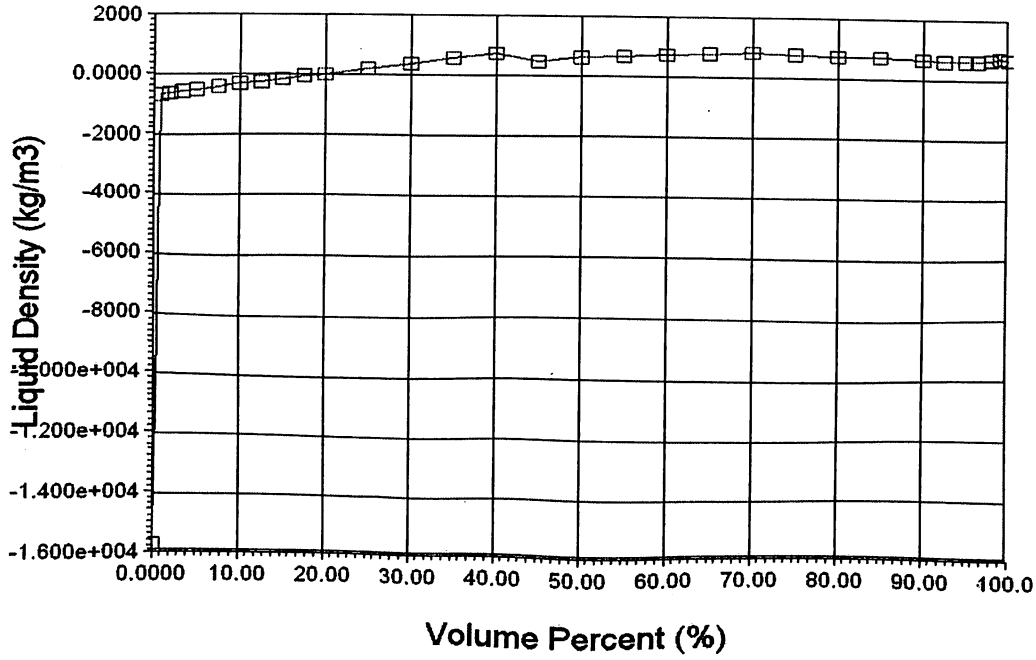
Acentric factor



Molecular weight



Liquid density



University Of Petroleum And Energy
UPES,
Bidholi,
Dehradun,
Uttarakhand

Case Name: D:\RAKI\SIMULATION\SIRI SIMULATION\SIRI 1.HSC
Unit Set: SI
Date/Time: Thu Apr 23 15:14:10 2009

Material Stream: r 1-1 inlet

Fluid Package: Basis-1
Property Package: SRK

CONDITIONS

		Overall	Vapour Phase	Liquid Phase		
Vapour / Phase Fraction		0.7837	0.7837	0.2163		
Temperature:	(C)	385.0 *	385.0	385.0		
Pressure:	(kPa)	1.673e+004 *	1.673e+004	1.673e+004		
Molar Flow	(kgmole/h)	1.101e+004 *	8632	2383		
Mass Flow	(kg/h)	2.748e+005 *	6.255e+004	2.122e+005		
Std Ideal Liq Vol Flow	(m3/h)	588.7	301.6	287.2		
Molar Enthalpy	(kJ/kgmole)	-2.300e+004	2263	-1.145e+005		
Molar Entropy	(kJ/kgmole-C)	158.2	120.6	294.4		
Heat Flow	(kJ/h)	-2.534e+008	1.953e+007	-2.729e+008		
Liq Vol Flow @Std Cond	(m3/h)	—	—	286.5		

COMPOSITION

Overall Phase

Vapour Fraction 0.7837

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
Hydrogen	8794.2037 *	0.7984 *	17729.1149 *	0.0645 *	253.7839 *	0.4311 *
H2S	0.0587 *	0.0000 *	2.0000 *	0.0000 *	0.0025 *	0.0000 *
Ammonia	0.0000 *	0.0000 *	0.0000 *	0.0000 *	0.0000 *	0.0000 *
H2O	8.5484 *	0.0008 *	154.0010 *	0.0006 *	0.1543 *	0.0003 *
Methane	323.5720 *	0.0294 *	5191.0337 *	0.0189 *	17.3385 *	0.0295 *
Ethane	46.1262 *	0.0042 *	1387.0090 *	0.0050 *	3.8996 *	0.0066 *
Propane	41.9986 *	0.0038 *	1852.0120 *	0.0067 *	3.6552 *	0.0062 *
i-Butane	29.6437 *	0.0027 *	1723.0112 *	0.0063 *	3.0660 *	0.0052 *
n-Butane	15.1229 *	0.0014 *	879.0057 *	0.0032 *	1.5072 *	0.0026 *
CO	0.1785 *	0.0000 *	5.0000 *	0.0000 *	0.0063 *	0.0000 *
CO2	0.0682 *	0.0000 *	3.0000 *	0.0000 *	0.0036 *	0.0000 *
MIXED FEED*	1732.2912 *	0.1573 *	243997.5818 *	0.8880 *	302.0894 *	0.5131 *
LIGHT NAPHT*	17.6725 *	0.0016 *	1431.0093 *	0.0052 *	2.2582 *	0.0038 *
HEAVY NAPHT*	4.3595 *	0.0004 *	353.0023 *	0.0013 *	0.8948 *	0.0015 *
LIGHT DIESE*	0.0763 *	0.0000 *	16.0001 *	0.0001 *	0.0233 *	0.0000 *
DHT HY DIES*	0.0000 *	0.0000 *	0.0000 *	0.0000 *	0.0000 *	0.0000 *
KEROSINE*	0.1733 *	0.0000 *	30.0002 *	0.0001 *	0.0479 *	0.0001 *
DHT LT DIES*	0.0392 *	0.0000 *	7.0000 *	0.0000 *	0.0099 *	0.0000 *
UC OIL*	0.0000 *	0.0000 *	0.0000 *	0.0000 *	0.0000 *	0.0000 *
DHT FEED*	0.0000 *	0.0000 *	0.0000 *	0.0000 *	0.0000 *	0.0000 *
HEAVY DIESE*	0.0000 *	0.0000 *	0.0000 *	0.0000 *	0.0000 *	0.0000 *
MDEthnlAmine	0.0000 *	0.0000 *	0.0000 *	0.0000 *	0.0000 *	0.0000 *
Total	11014.1330	1.0000	274759.7812	1.0000	588.7406	1.0000

Vapour Phase

Phase Fraction 0.7837

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
Hydrogen	7960.1114	0.9222	16047.5849	0.2565	229.7136	0.7618
H2S	0.0487	0.0000	1.6608	0.0000	0.0021	0.0000
Ammonia	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
H2O	7.3077	0.0008	131.6497	0.0021	0.1319	0.0004
Methane	285.9688	0.0331	4587.7681	0.0733	15.3235	0.0508
Ethane	39.1294	0.0045	1176.6175	0.0188	3.3081	0.0110
Propane	34.2308	0.0040	1509.4751	0.0241	2.9792	0.0099
i-Butane	23.2668	0.0027	1352.3609	0.0216	2.4065	0.0080
n-Butane	11.7248	0.0014	681.4932	0.0109	1.1685	0.0039
CO	0.1622	0.0000	4.5438	0.0001	0.0057	0.0000

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* Specified by user.

Material Stream: r 1-1 inlet (continued)

Fluid Package: Basis-1
Property Package: SRK

COMPOSITION

Vapour Phase (continued)

Phase Fraction 0.7837

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
CO2	0.0594	0.0000	2.6126	0.0000	0.0032	0.0000
MIXED FEED*	254.1803	0.0294	35801.9405	0.5723	44.3258	0.1470
LIGHT NAPHT*	12.5762	0.0015	1018.3392	0.0163	1.6070	0.0053
HEAVY NAPHT*	2.6898	0.0003	217.8034	0.0035	0.5521	0.0018
LIGHT DIESE*	0.0171	0.0000	3.5785	0.0001	0.0052	0.0000
DHT HY DIES*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
KEROSINE*	0.0922	0.0000	15.9547	0.0003	0.0255	0.0001
DHT LT DIES*	0.0087	0.0000	1.5584	0.0000	0.0022	0.0000
UC OIL*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
DHT FEED*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
HEAVY DIESE*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
MDEthnlAmine	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	8631.5744	1.0000	62554.9412	1.0000	301.5599	1.0000

Liquid Phase

Phase Fraction 0.2163

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
Hydrogen	834.0923	0.3501	1681.5300	0.0079	24.0703	0.0838
H2S	0.0100	0.0000	0.3392	0.0000	0.0004	0.0000
Ammonia	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
H2O	1.2407	0.0005	22.3513	0.0001	0.0224	0.0001
Methane	37.6033	0.0158	603.2656	0.0028	2.0150	0.0070
Ethane	6.9967	0.0029	210.3915	0.0010	0.5915	0.0021
Propane	7.7678	0.0033	342.5369	0.0016	0.6760	0.0024
i-Butane	6.3769	0.0027	370.6503	0.0017	0.6596	0.0023
n-Butane	3.3981	0.0014	197.5125	0.0009	0.3387	0.0012
CO	0.0163	0.0000	0.4562	0.0000	0.0006	0.0000
CO2	0.0088	0.0000	0.3875	0.0000	0.0005	0.0000
MIXED FEED*	1478.1108	0.6204	208195.6412	0.9811	257.7636	0.8976
LIGHT NAPHT*	5.0964	0.0021	412.6701	0.0019	0.6512	0.0023
HEAVY NAPHT*	1.6697	0.0007	135.1989	0.0006	0.3427	0.0012
LIGHT DIESE*	0.0593	0.0000	12.4216	0.0001	0.0181	0.0001
DHT HY DIES*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
KEROSINE*	0.0811	0.0000	14.0455	0.0001	0.0224	0.0001
DHT LT DIES*	0.0305	0.0000	5.4417	0.0000	0.0077	0.0000
UC OIL*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
DHT FEED*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
HEAVY DIESE*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
MDEthnlAmine	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	2382.5586	1.0000	212204.8400	1.0000	287.1806	1.0000

Material Stream: r 1-2 inlet

Fluid Package: Basis-1
Property Package: SRK

CONDITIONS

		Overall	Vapour Phase	Liquid Phase		
Vapour / Phase Fraction		0.0000	0.0000	1.0000		
Temperature:	(C)	417.0 *	417.0	417.0		
Pressure:	(kPa)	1.673e+004	1.673e+004	1.673e+004		
Molar Flow	(kgmole/h)	0.0000	0.0000	0.0000		

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* Specified by user.

Material Stream: r 1-2 inlet (continued)

Fluid Package: Basis-1
Property Package: SRK

CONDITIONS

		Overall	Vapour Phase	Liquid Phase		
Mass Flow	(kg/h)	0.0000	0.0000	0.0000		
Std Ideal Liq Vol Flow	(m3/h)	0.0000	0.0000	0.0000		
Molar Enthalpy	(kJ/kgmole)	-5874	-5848	-5874		
Molar Entropy	(kJ/kgmole-C)	215.1	214.9	215.1		
Heat Flow	(kJ/h)	0.0000	0.0000	0.0000		
Liq Vol Flow @Std Cond	(m3/h)	0.0000 *	0.0000	0.0000		

COMPOSITION

Overall Phase

Vapour Fraction 0.0000

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
Hydrogen	0.0000	0.8262	0.0000	0.0874	0.0000	0.4557
H2S	0.0000	0.0144	0.0000	0.0258	0.0000	0.0119
Ammonia	0.0000	0.0017	0.0000	0.0016	0.0000	0.0009
H2O	0.0000	0.0011	0.0000	0.0011	0.0000	0.0004
Methane	0.0000	0.0359	0.0000	0.0302	0.0000	0.0367
Ethane	0.0000	0.0074	0.0000	0.0116	0.0000	0.0119
Propane	0.0000	0.0077	0.0000	0.0178	0.0000	0.0128
i-Butane	0.0000	0.0065	0.0000	0.0197	0.0000	0.0128
n-Butane	0.0000	0.0038	0.0000	0.0117	0.0000	0.0073
CO	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CO2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
MIXED FEED*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LIGHT NAPHT*	0.0000	0.0142	0.0000	0.0602	0.0000	0.0346
HEAVY NAPHT*	0.0000	0.0167	0.0000	0.0710	0.0000	0.0655
LIGHT DIESE*	0.0000	0.0162	0.0000	0.1788	0.0000	0.0949
DHT HY DIES*	0.0000	0.0300	0.0000	0.3225	0.0000	0.1704
KEROSINE*	0.0000	0.0075	0.0000	0.0681	0.0000	0.0396
DHT LT DIES*	0.0000	0.0010	0.0000	0.0093	0.0000	0.0048
UC OIL*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
DHT FEED*	0.0000	0.0056	0.0000	0.0524	0.0000	0.0263
HEAVY DIESE*	0.0000	0.0041	0.0000	0.0308	0.0000	0.0136
MDEthnlAmine	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	0.0000	1.0000	0.0000	1.0000	0.0000	1.0000

Vapour Phase

Phase Fraction 0.0000

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
Hydrogen	0.0000	0.8264	0.0000	0.0876	0.0000	0.4561
H2S	0.0000	0.0144	0.0000	0.0258	0.0000	0.0119
Ammonia	0.0000	0.0017	0.0000	0.0016	0.0000	0.0009
H2O	0.0000	0.0011	0.0000	0.0011	0.0000	0.0004
Methane	0.0000	0.0359	0.0000	0.0302	0.0000	0.0367
Ethane	0.0000	0.0074	0.0000	0.0117	0.0000	0.0119
Propane	0.0000	0.0077	0.0000	0.0178	0.0000	0.0128
i-Butane	0.0000	0.0065	0.0000	0.0197	0.0000	0.0128
n-Butane	0.0000	0.0038	0.0000	0.0117	0.0000	0.0073
CO	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CO2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
MIXED FEED*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LIGHT NAPHT*	0.0000	0.0142	0.0000	0.0602	0.0000	0.0346
HEAVY NAPHT*	0.0000	0.0167	0.0000	0.0710	0.0000	0.0655

Material Stream: r 1-2 inlet (continued)

Fluid Package: Basis-1
Property Package: SRK

COMPOSITION

Vapour Phase (continued)

Phase Fraction 0.0000

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
LIGHT DIESE*	0.0000	0.0162	0.0000	0.1787	0.0000	0.0948
DHT HY DIES*	0.0000	0.0300	0.0000	0.3223	0.0000	0.1701
KEROSINE*	0.0000	0.0075	0.0000	0.0681	0.0000	0.0396
DHT LT DIES*	0.0000	0.0010	0.0000	0.0093	0.0000	0.0048
UC OIL*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
DHT FEED*	0.0000	0.0056	0.0000	0.0524	0.0000	0.0262
HEAVY DIESE*	0.0000	0.0041	0.0000	0.0308	0.0000	0.0135
MDEthnlAmine	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	0.0000	1.0000	0.0000	1.0000	0.0000	1.0000

Liquid Phase

Phase Fraction 1.000

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
Hydrogen	0.0000	0.8262	0.0000	0.0874	0.0000	0.4557
H2S	0.0000	0.0144	0.0000	0.0258	0.0000	0.0119
Ammonia	0.0000	0.0017	0.0000	0.0016	0.0000	0.0009
H2O	0.0000	0.0011	0.0000	0.0011	0.0000	0.0004
Methane	0.0000	0.0359	0.0000	0.0302	0.0000	0.0367
Ethane	0.0000	0.0074	0.0000	0.0116	0.0000	0.0119
Propane	0.0000	0.0077	0.0000	0.0178	0.0000	0.0128
i-Butane	0.0000	0.0065	0.0000	0.0197	0.0000	0.0128
n-Butane	0.0000	0.0038	0.0000	0.0117	0.0000	0.0073
CO	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CO2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
MIXED FEED*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LIGHT NAPHT*	0.0000	0.0142	0.0000	0.0602	0.0000	0.0346
HEAVY NAPHT*	0.0000	0.0167	0.0000	0.0710	0.0000	0.0655
LIGHT DIESE*	0.0000	0.0162	0.0000	0.1788	0.0000	0.0949
DHT HY DIES*	0.0000	0.0300	0.0000	0.3225	0.0000	0.1704
KEROSINE*	0.0000	0.0075	0.0000	0.0681	0.0000	0.0396
DHT LT DIES*	0.0000	0.0010	0.0000	0.0093	0.0000	0.0048
UC OIL*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
DHT FEED*	0.0000	0.0056	0.0000	0.0524	0.0000	0.0263
HEAVY DIESE*	0.0000	0.0041	0.0000	0.0308	0.0000	0.0136
MDEthnlAmine	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	0.0000	1.0000	0.0000	1.0000	0.0000	1.0000

Material Stream: r 1-3 inlet

Fluid Package: Basis-1
Property Package: SRK

CONDITIONS

		Overall	Vapour Phase	Liquid Phase		
Vapour / Phase Fraction		0.0000	0.0000	1.0000		
Temperature:	(C)	408.6 *	408.6	408.6		
Pressure:	(kPa)	1.592e+004 *	1.592e+004	1.592e+004		
Molar Flow	(kgmole/h)	0.0000	0.0000	0.0000		
Mass Flow	(kg/h)	0.0000	0.0000	0.0000		
Std Ideal Liq Vol Flow	(m3/h)	0.0000	0.0000	0.0000		
Molar Enthalpy	(kJ/kgmole)	-8.072e+004	-6556	-8.072e+004		
Molar Entropy	(kJ/kgmole-C)	599.3	214.3	599.3		

Material Stream: r 1-3 inlet (continued)

Fluid Package: Basis-1
Property Package: SRK

CONDITIONS

		Overall	Vapour Phase	Liquid Phase		
Heat Flow	(kJ/h)	0.0000	0.0000	0.0000		
Liq Vol Flow @Std Cond	(m3/h)	0.0000 *	0.0000	0.0000		

COMPOSITION

Overall Phase

Vapour Fraction 0.0000

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
Hydrogen	0.0000	0.4613	0.0000	0.0106	0.0000	0.0943
H2S	0.0000	0.0125	0.0000	0.0048	0.0000	0.0038
Ammonia	0.0000	0.0015	0.0000	0.0003	0.0000	0.0003
H2O	0.0000	0.0009	0.0000	0.0002	0.0000	0.0001
Methane	0.0000	0.0232	0.0000	0.0042	0.0000	0.0088
Ethane	0.0000	0.0058	0.0000	0.0020	0.0000	0.0035
Propane	0.0000	0.0072	0.0000	0.0036	0.0000	0.0045
i-Butane	0.0000	0.0070	0.0000	0.0046	0.0000	0.0051
n-Butane	0.0000	0.0043	0.0000	0.0028	0.0000	0.0030
CO	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CO2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
MIXED FEED*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LIGHT NAPHT*	0.0000	0.0199	0.0000	0.0184	0.0000	0.0181
HEAVY NAPHT*	0.0000	0.0318	0.0000	0.0292	0.0000	0.0462
LIGHT DIESE*	0.0000	0.1057	0.0000	0.2520	0.0000	0.2290
DHT HY DIES*	0.0000	0.1949	0.0000	0.4537	0.0000	0.4101
KEROSINE*	0.0000	0.0181	0.0000	0.0356	0.0000	0.0354
DHT LT DIES*	0.0000	0.0066	0.0000	0.0134	0.0000	0.0118
UC OIL*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
DHT FEED*	0.0000	0.0098	0.0000	0.0200	0.0000	0.0171
HEAVY DIESE*	0.0000	0.0895	0.0000	0.1446	0.0000	0.1089
MDEthnlAmine	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	0.0000	1.0000	0.0000	1.0000	0.0000	1.0000

Vapour Phase

Phase Fraction 0.0000

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
Hydrogen	0.0000	0.8264	0.0000	0.0876	0.0000	0.4561
H2S	0.0000	0.0144	0.0000	0.0258	0.0000	0.0119
Ammonia	0.0000	0.0017	0.0000	0.0016	0.0000	0.0009
H2O	0.0000	0.0011	0.0000	0.0011	0.0000	0.0004
Methane	0.0000	0.0359	0.0000	0.0302	0.0000	0.0368
Ethane	0.0000	0.0073	0.0000	0.0116	0.0000	0.0119
Propane	0.0000	0.0077	0.0000	0.0178	0.0000	0.0128
i-Butane	0.0000	0.0065	0.0000	0.0197	0.0000	0.0128
n-Butane	0.0000	0.0038	0.0000	0.0117	0.0000	0.0073
CO	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CO2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
MIXED FEED*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LIGHT NAPHT*	0.0000	0.0142	0.0000	0.0603	0.0000	0.0346
HEAVY NAPHT*	0.0000	0.0167	0.0000	0.0710	0.0000	0.0655
LIGHT DIESE*	0.0000	0.0162	0.0000	0.1787	0.0000	0.0948
DHT HY DIES*	0.0000	0.0300	0.0000	0.3223	0.0000	0.1701
KEROSINE*	0.0000	0.0075	0.0000	0.0681	0.0000	0.0396
DHT LT DIES*	0.0000	0.0010	0.0000	0.0093	0.0000	0.0048

Material Stream: r 1-3 inlet (continued)

Fluid Package: Basis-1
Property Package: SRK

COMPOSITION

Vapour Phase (continued)

Phase Fraction 0.0000

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
UC OIL*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
DHT FEED*	0.0000	0.0055	0.0000	0.0524	0.0000	0.0262
HEAVY DIESE*	0.0000	0.0041	0.0000	0.0308	0.0000	0.0135
MDEthnlAmine	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	0.0000	1.0000	0.0000	1.0000	0.0000	1.0000

Liquid Phase

Phase Fraction 1.000

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
Hydrogen	0.0000	0.4613	0.0000	0.0106	0.0000	0.0943
H2S	0.0000	0.0125	0.0000	0.0048	0.0000	0.0038
Ammonia	0.0000	0.0015	0.0000	0.0003	0.0000	0.0003
H2O	0.0000	0.0009	0.0000	0.0002	0.0000	0.0001
Methane	0.0000	0.0232	0.0000	0.0042	0.0000	0.0088
Ethane	0.0000	0.0058	0.0000	0.0020	0.0000	0.0035
Propane	0.0000	0.0072	0.0000	0.0036	0.0000	0.0045
i-Butane	0.0000	0.0070	0.0000	0.0046	0.0000	0.0051
n-Butane	0.0000	0.0043	0.0000	0.0028	0.0000	0.0030
CO	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CO2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
MIXED FEED*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LIGHT NAPHT*	0.0000	0.0199	0.0000	0.0184	0.0000	0.0181
HEAVY NAPHT*	0.0000	0.0318	0.0000	0.0292	0.0000	0.0462
LIGHT DIESE*	0.0000	0.1057	0.0000	0.2520	0.0000	0.2290
DHT HY DIES*	0.0000	0.1949	0.0000	0.4537	0.0000	0.4101
KEROSINE*	0.0000	0.0181	0.0000	0.0356	0.0000	0.0354
DHT LT DIES*	0.0000	0.0066	0.0000	0.0134	0.0000	0.0118
UC OIL*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
DHT FEED*	0.0000	0.0098	0.0000	0.0200	0.0000	0.0171
HEAVY DIESE*	0.0000	0.0895	0.0000	0.1446	0.0000	0.1089
MDEthnlAmine	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	0.0000	1.0000	0.0000	1.0000	0.0000	1.0000

Material Stream: reactor 1-1 vapors

Fluid Package: Basis-1
Property Package: SRK

CONDITIONS

		Overall	Vapour Phase	Liquid Phase		
Vapour / Phase Fraction		1.0000	1.0000	0.0000		
Temperature:	(C)	417.0	417.0	417.0		
Pressure:	(kPa)	1.673e+004	1.673e+004	1.673e+004		
Molar Flow	(kgmole/h)	1.444e+004	1.444e+004	0.0000		
Mass Flow	(kg/h)	2.748e+005	2.748e+005	0.0000		
Std Ideal Liq Vol Flow	(m3/h)	755.2	755.2	0.0000		
Molar Enthalpy	(kJ/kgmole)	-5848	-5848	-5874		
Molar Entropy	(kJ/kgmole-C)	214.9	214.9	215.1		
Heat Flow	(kJ/h)	-8.448e+007	-8.448e+007	0.0000		
Liq Vol Flow @Std Cond	(m3/h)	—	—	0.0000		

* Specified by user.

Material Stream: reactor 1-1 vapors (continuec

Fluid Package: Basis-1
Property Package: SRK

COMPOSITION

Overall Phase

Vapour Fraction 1.0000

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
Hydrogen	11936.5256	0.8264	24064.0361	0.0876	344.4653	0.4561
H2S	208.0087	0.0144	7088.1045	0.0258	8.9904	0.0119
Ammonia	25.1010	0.0017	427.4704	0.0016	0.6939	0.0009
H2O	16.2909	0.0011	293.4831	0.0011	0.2941	0.0004
Methane	517.9392	0.0359	8309.2474	0.0302	27.7536	0.0367
Ethane	106.5603	0.0074	3204.2578	0.0117	9.0087	0.0119
Propane	110.8558	0.0077	4888.4065	0.0178	9.6480	0.0128
i-Butane	93.3373	0.0065	5425.1352	0.0197	9.6538	0.0128
n-Butane	55.3525	0.0038	3217.3076	0.0117	5.5164	0.0073
CO	0.2708	0.0000	7.5856	0.0000	0.0095	0.0000
CO2	0.1266	0.0000	5.5709	0.0000	0.0067	0.0000
MIXED FEED*	0.0017	0.0000	0.2440	0.0000	0.0003	0.0000
LIGHT NAPHT*	204.4165	0.0142	16552.3389	0.0602	26.1201	0.0346
HEAVY NAPHT*	240.9190	0.0167	19508.0775	0.0710	49.4501	0.0655
LIGHT DIESE*	234.1666	0.0162	49089.0130	0.1787	71.5792	0.0948
DHT HY DIES*	432.6512	0.0300	88547.7594	0.3223	128.4790	0.1701
KEROSINE*	108.1067	0.0075	18711.5680	0.0681	29.8907	0.0396
DHT LT DIES*	14.3433	0.0010	2560.7857	0.0093	3.6128	0.0048
UC OIL*	0.0004	0.0000	0.1063	0.0000	0.0001	0.0000
DHT FEED*	80.1706	0.0056	14399.8412	0.0524	19.8208	0.0262
HEAVY DIESE*	59.5787	0.0041	8459.4423	0.0308	10.2254	0.0135
MDEthnlAmine	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	14444.7235	1.0000	274759.7812	1.0000	755.2191	1.0000

Vapour Phase

Phase Fraction 1.000

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
Hydrogen	11936.5256	0.8264	24064.0361	0.0876	344.4653	0.4561
H2S	208.0087	0.0144	7088.1045	0.0258	8.9904	0.0119
Ammonia	25.1010	0.0017	427.4704	0.0016	0.6939	0.0009
H2O	16.2909	0.0011	293.4831	0.0011	0.2941	0.0004
Methane	517.9392	0.0359	8309.2474	0.0302	27.7536	0.0367
Ethane	106.5603	0.0074	3204.2578	0.0117	9.0087	0.0119
Propane	110.8558	0.0077	4888.4065	0.0178	9.6480	0.0128
i-Butane	93.3373	0.0065	5425.1352	0.0197	9.6538	0.0128
n-Butane	55.3525	0.0038	3217.3076	0.0117	5.5164	0.0073
CO	0.2708	0.0000	7.5856	0.0000	0.0095	0.0000
CO2	0.1266	0.0000	5.5709	0.0000	0.0067	0.0000
MIXED FEED*	0.0017	0.0000	0.2440	0.0000	0.0003	0.0000
LIGHT NAPHT*	204.4165	0.0142	16552.3389	0.0602	26.1201	0.0346
HEAVY NAPHT*	240.9190	0.0167	19508.0775	0.0710	49.4501	0.0655
LIGHT DIESE*	234.1666	0.0162	49089.0130	0.1787	71.5792	0.0948
DHT HY DIES*	432.6512	0.0300	88547.7594	0.3223	128.4790	0.1701
KEROSINE*	108.1067	0.0075	18711.5680	0.0681	29.8907	0.0396
DHT LT DIES*	14.3433	0.0010	2560.7857	0.0093	3.6128	0.0048
UC OIL*	0.0004	0.0000	0.1063	0.0000	0.0001	0.0000
DHT FEED*	80.1706	0.0056	14399.8412	0.0524	19.8208	0.0262
HEAVY DIESE*	59.5787	0.0041	8459.4423	0.0308	10.2254	0.0135
MDEthnlAmine	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	14444.7235	1.0000	274759.7812	1.0000	755.2191	1.0000

Material Stream: reactor 1-1 vapors (continuec

Fluid Package: Basis-1
Property Package: SRK

COMPOSITION

Liquid Phase

Phase Fraction 0.0000

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
Hydrogen	0.0000	0.8262	0.0000	0.0874	0.0000	0.4557
H2S	0.0000	0.0144	0.0000	0.0258	0.0000	0.0119
Ammonia	0.0000	0.0017	0.0000	0.0016	0.0000	0.0009
H2O	0.0000	0.0011	0.0000	0.0011	0.0000	0.0004
Methane	0.0000	0.0359	0.0000	0.0302	0.0000	0.0367
Ethane	0.0000	0.0074	0.0000	0.0116	0.0000	0.0119
Propane	0.0000	0.0077	0.0000	0.0178	0.0000	0.0128
i-Butane	0.0000	0.0065	0.0000	0.0197	0.0000	0.0128
n-Butane	0.0000	0.0038	0.0000	0.0117	0.0000	0.0073
CO	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CO2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
MIXED FEED*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LIGHT NAPHT*	0.0000	0.0142	0.0000	0.0602	0.0000	0.0346
HEAVY NAPHT*	0.0000	0.0167	0.0000	0.0710	0.0000	0.0655
LIGHT DIESE*	0.0000	0.0162	0.0000	0.1788	0.0000	0.0949
DHT HY DIES*	0.0000	0.0300	0.0000	0.3225	0.0000	0.1704
KEROSINE*	0.0000	0.0075	0.0000	0.0681	0.0000	0.0396
DHT LT DIES*	0.0000	0.0010	0.0000	0.0093	0.0000	0.0048
UC OIL*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
DHT FEED*	0.0000	0.0056	0.0000	0.0524	0.0000	0.0263
HEAVY DIESE*	0.0000	0.0041	0.0000	0.0308	0.0000	0.0136
MDEthnlAmine	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	0.0000	1.0000	0.0000	1.0000	0.0000	1.0000

Material Stream: reactor 1-2 vapors

Fluid Package: Basis-1
Property Package: SRK

CONDITIONS

		Overall	Vapour Phase	Liquid Phase		
Vapour / Phase Fraction		1.0000	1.0000	0.0000		
Temperature:	(C)	408.6	408.6	408.6		
Pressure:	(kPa)	1.592e+004	1.592e+004	1.592e+004		
Molar Flow	(kgmole/h)	1.444e+004	1.444e+004	0.0000		
Mass Flow	(kg/h)	2.748e+005	2.748e+005	0.0000		
Std Ideal Liq Vol Flow	(m3/h)	755.2	755.2	0.0000		
Molar Enthalpy	(kJ/kgmole)	-6556	-6556	-8.072e+004		
Molar Entropy	(kJ/kgmole-C)	214.3	214.3	599.3		
Heat Flow	(kJ/h)	-9.470e+007	-9.470e+007	0.0000		
Liq Vol Flow @Std Cond	(m3/h)	—	—	0.0000		

COMPOSITION

Overall Phase

Vapour Fraction 1.0000

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
Hydrogen	11936.5983	0.8264	24064.1826	0.0876	344.4674	0.4561
H2S	208.0110	0.0144	7088.1838	0.0258	8.9905	0.0119
Ammonia	25.1013	0.0017	427.4756	0.0016	0.6939	0.0009
H2O	16.2910	0.0011	293.4834	0.0011	0.2941	0.0004
Methane	517.9459	0.0359	8309.3550	0.0302	27.7539	0.0368

Material Stream: reactor 1-2 vapors (continuec

Fluid Package: Basis-1
Property Package: SRK

COMPOSITION

Overall Phase (continued)

Vapour Fraction 1.0000

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
Ethane	105.9634	0.0073	3186.3094	0.0116	8.9583	0.0119
Propane	110.8439	0.0077	4887.8832	0.0178	9.6469	0.0128
i-Butane	93.3365	0.0065	5425.0893	0.0197	9.6538	0.0128
n-Butane	55.3517	0.0038	3217.2643	0.0117	5.5164	0.0073
CO	0.2708	0.0000	7.5855	0.0000	0.0095	0.0000
CO2	0.1266	0.0000	5.5711	0.0000	0.0068	0.0000
MIXED FEED*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LIGHT NAPHT*	204.5376	0.0142	16562.1395	0.0603	26.1356	0.0346
HEAVY NAPHT*	240.9154	0.0167	19507.7861	0.0710	49.4494	0.0655
LIGHT DIESE*	234.1681	0.0162	49089.3226	0.1787	71.5796	0.0948
DHT HY DIES*	432.6469	0.0300	88546.8806	0.3223	128.4778	0.1701
KEROSINE*	108.1692	0.0075	18722.3910	0.0681	29.9080	0.0396
DHT LT DIES*	14.3421	0.0010	2560.5777	0.0093	3.6126	0.0048
UC OIL*	0.0000	0.0000	0.0025	0.0000	0.0000	0.0000
DHT FEED*	80.1641	0.0055	14398.6690	0.0524	19.8192	0.0262
HEAVY DIESE*	59.5800	0.0041	8459.6290	0.0308	10.2256	0.0135
MDEthnlAmine	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	14444.3639	1.0000	274759.7812	1.0000	755.1991	1.0000

Vapour Phase

Phase Fraction 1.000

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
Hydrogen	11936.5983	0.8264	24064.1826	0.0876	344.4674	0.4561
H2S	208.0110	0.0144	7088.1838	0.0258	8.9905	0.0119
Ammonia	25.1013	0.0017	427.4756	0.0016	0.6939	0.0009
H2O	16.2910	0.0011	293.4834	0.0011	0.2941	0.0004
Methane	517.9459	0.0359	8309.3550	0.0302	27.7539	0.0368
Ethane	105.9634	0.0073	3186.3094	0.0116	8.9583	0.0119
Propane	110.8439	0.0077	4887.8832	0.0178	9.6469	0.0128
i-Butane	93.3365	0.0065	5425.0893	0.0197	9.6538	0.0128
n-Butane	55.3517	0.0038	3217.2643	0.0117	5.5164	0.0073
CO	0.2708	0.0000	7.5855	0.0000	0.0095	0.0000
CO2	0.1266	0.0000	5.5711	0.0000	0.0068	0.0000
MIXED FEED*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LIGHT NAPHT*	204.5376	0.0142	16562.1395	0.0603	26.1356	0.0346
HEAVY NAPHT*	240.9154	0.0167	19507.7861	0.0710	49.4494	0.0655
LIGHT DIESE*	234.1681	0.0162	49089.3226	0.1787	71.5796	0.0948
DHT HY DIES*	432.6469	0.0300	88546.8806	0.3223	128.4778	0.1701
KEROSINE*	108.1692	0.0075	18722.3910	0.0681	29.9080	0.0396
DHT LT DIES*	14.3421	0.0010	2560.5777	0.0093	3.6126	0.0048
UC OIL*	0.0000	0.0000	0.0025	0.0000	0.0000	0.0000
DHT FEED*	80.1641	0.0055	14398.6690	0.0524	19.8192	0.0262
HEAVY DIESE*	59.5800	0.0041	8459.6290	0.0308	10.2256	0.0135
MDEthnlAmine	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	14444.3639	1.0000	274759.7812	1.0000	755.1991	1.0000

Liquid Phase

Phase Fraction 0.0000

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
Hydrogen	0.0000	0.4613	0.0000	0.0106	0.0000	0.0943

Material Stream: reactor 1-2 vapors (continuec

Fluid Package: Basis-1
Property Package: SRK

COMPOSITION

Liquid Phase (continued)

Phase Fraction 0.0000

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
H2S	0.0000	0.0125	0.0000	0.0048	0.0000	0.0038
Ammonia	0.0000	0.0015	0.0000	0.0003	0.0000	0.0003
H2O	0.0000	0.0009	0.0000	0.0002	0.0000	0.0001
Methane	0.0000	0.0232	0.0000	0.0042	0.0000	0.0088
Ethane	0.0000	0.0058	0.0000	0.0020	0.0000	0.0035
Propane	0.0000	0.0072	0.0000	0.0036	0.0000	0.0045
i-Butane	0.0000	0.0070	0.0000	0.0046	0.0000	0.0051
n-Butane	0.0000	0.0043	0.0000	0.0028	0.0000	0.0030
CO	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CO2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
MIXED FEED*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LIGHT NAPHT*	0.0000	0.0199	0.0000	0.0184	0.0000	0.0181
HEAVY NAPHT*	0.0000	0.0318	0.0000	0.0292	0.0000	0.0462
LIGHT DIESE*	0.0000	0.1057	0.0000	0.2520	0.0000	0.2290
DHT HY DIES*	0.0000	0.1949	0.0000	0.4537	0.0000	0.4101
KEROSINE*	0.0000	0.0181	0.0000	0.0356	0.0000	0.0354
DHT LT DIES*	0.0000	0.0066	0.0000	0.0134	0.0000	0.0118
UC OIL*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
DHT FEED*	0.0000	0.0098	0.0000	0.0200	0.0000	0.0171
HEAVY DIESE*	0.0000	0.0895	0.0000	0.1446	0.0000	0.1089
MDEthnlAmine	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	0.0000	1.0000	0.0000	1.0000	0.0000	1.0000

Material Stream: reactor 1-3 outlet

Fluid Package: Basis-1
Property Package: SRK

CONDITIONS

		Overall	Vapour Phase	Liquid Phase		
Vapour / Phase Fraction		0.0000	0.0000	1.0000		
Temperature:	(C)	250.0 *	250.0	250.0		
Pressure:	(kPa)	1.569e+004 *	1.569e+004	1.569e+004		
Molar Flow	(kgmole/h)	1232	0.0000	1232		
Mass Flow	(kg/h)	1.661e+005	0.0000	1.661e+005		
Std Ideal Liq Vol Flow	(m3/h)	256.2	0.0000	256.2		
Molar Enthalpy	(kJ/kgmole)	-2.035e+005	-4381	-2.035e+005		
Molar Entropy	(kJ/kgmole-C)	799.5	132.7	799.5		
Heat Flow	(kJ/h)	-2.508e+008	0.0000	-2.508e+008		
Liq Vol Flow @Std Cond	(m3/h)	252.5 *	0.0000	252.5		

COMPOSITION

Overall Phase

Vapour Fraction 0.0000

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
Hydrogen	257.3771	0.2088	518.8722	0.0031	7.4274	0.0290
H2S	15.6321	0.0127	532.6800	0.0032	0.6756	0.0026
Ammonia	2.0218	0.0016	34.4308	0.0002	0.0559	0.0002
H2O	0.9182	0.0007	16.5407	0.0001	0.0166	0.0001
Methane	19.2695	0.0156	309.1386	0.0019	1.0325	0.0040
Ethane	6.5774	0.0053	197.7820	0.0012	0.5561	0.0022

Material Stream: reactor 1-3 outlet (continued)

Fluid Package: Basis-1
Property Package: SRK

COMPOSITION

Overall Phase (continued)

Vapour Fraction 0.0000

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
Propane	10.1825	0.0083	449.0159	0.0027	0.8862	0.0035
i-Butane	11.4423	0.0093	665.0703	0.0040	1.1835	0.0046
n-Butane	7.4245	0.0060	431.5445	0.0026	0.7399	0.0029
CO	0.0068	0.0000	0.1911	0.0000	0.0002	0.0000
CO2	0.0061	0.0000	0.2673	0.0000	0.0003	0.0000
MIXED FEED*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LIGHT NAPHT*	44.3910	0.0360	3594.4963	0.0216	5.6722	0.0221
HEAVY NAPHT*	85.2174	0.0691	6900.3584	0.0415	17.4914	0.0683
LIGHT DIESE*	215.1609	0.1746	45104.7968	0.2715	65.7696	0.2567
DHT HY DIES*	396.8738	0.3220	81225.4556	0.4890	117.8547	0.4599
KEROSINE*	58.3392	0.0473	10097.6076	0.0608	16.1304	0.0630
DHT LT DIES*	13.0760	0.0106	2334.5344	0.0141	3.2936	0.0129
UC OIL*	0.0000	0.0000	0.0023	0.0000	0.0000	0.0000
DHT FEED*	29.8137	0.0242	5354.9881	0.0322	7.3709	0.0288
HEAVY DIESE*	58.7167	0.0476	8337.0574	0.0502	10.0774	0.0393
MDEthnlAmine	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	1232.4471	1.0000	166104.8302	1.0000	256.2346	1.0000

Vapour Phase

Phase Fraction 0.0000

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
Hydrogen	0.0000	0.8840	0.0000	0.2167	0.0000	0.6755
H2S	0.0000	0.0146	0.0000	0.0603	0.0000	0.0167
Ammonia	0.0000	0.0017	0.0000	0.0036	0.0000	0.0013
H2O	0.0000	0.0012	0.0000	0.0025	0.0000	0.0006
Methane	0.0000	0.0377	0.0000	0.0736	0.0000	0.0536
Ethane	0.0000	0.0075	0.0000	0.0273	0.0000	0.0167
Propane	0.0000	0.0076	0.0000	0.0408	0.0000	0.0176
i-Butane	0.0000	0.0062	0.0000	0.0438	0.0000	0.0170
n-Butane	0.0000	0.0036	0.0000	0.0256	0.0000	0.0096
CO	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000
CO2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
MIXED FEED*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LIGHT NAPHT*	0.0000	0.0121	0.0000	0.1194	0.0000	0.0410
HEAVY NAPHT*	0.0000	0.0118	0.0000	0.1160	0.0000	0.0640
LIGHT DIESE*	0.0000	0.0014	0.0000	0.0367	0.0000	0.0116
DHT HY DIES*	0.0000	0.0027	0.0000	0.0674	0.0000	0.0213
KEROSINE*	0.0000	0.0038	0.0000	0.0795	0.0000	0.0276
DHT LT DIES*	0.0000	0.0001	0.0000	0.0021	0.0000	0.0006
UC OIL*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
DHT FEED*	0.0000	0.0038	0.0000	0.0832	0.0000	0.0249
HEAVY DIESE*	0.0000	0.0001	0.0000	0.0011	0.0000	0.0003
MDEthnlAmine	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	0.0000	1.0000	0.0000	1.0000	0.0000	1.0000

Liquid Phase

Phase Fraction 1.000

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
Hydrogen	257.3771	0.2088	518.8722	0.0031	7.4274	0.0290
H2S	15.6321	0.0127	532.6800	0.0032	0.6756	0.0026

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* Specified by user.

Material Stream: reactor 1-3 outlet (continued)

Fluid Package: Basis-1
Property Package: SRK

COMPOSITION

Liquid Phase (continued)

Phase Fraction 1.000

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
Ammonia	2.0218	0.0016	34.4308	0.0002	0.0559	0.0002
H2O	0.9182	0.0007	16.5407	0.0001	0.0166	0.0001
Methane	19.2695	0.0156	309.1386	0.0019	1.0325	0.0040
Ethane	6.5774	0.0053	197.7820	0.0012	0.5561	0.0022
Propane	10.1825	0.0083	449.0159	0.0027	0.8862	0.0035
i-Butane	11.4423	0.0093	665.0703	0.0040	1.1835	0.0046
n-Butane	7.4245	0.0060	431.5445	0.0026	0.7399	0.0029
CO	0.0068	0.0000	0.1911	0.0000	0.0002	0.0000
CO2	0.0061	0.0000	0.2673	0.0000	0.0003	0.0000
MIXED FEED*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LIGHT NAPHT*	44.3910	0.0360	3594.4963	0.0216	5.6722	0.0221
HEAVY NAPHT*	85.2174	0.0691	6900.3584	0.0415	17.4914	0.0683
LIGHT DIESE*	215.1609	0.1746	45104.7968	0.2715	65.7696	0.2567
DHT HY DIES*	396.8738	0.3220	81225.4556	0.4890	117.8547	0.4599
KEROSINE*	58.3392	0.0473	10097.6076	0.0608	16.1304	0.0630
DHT LT DIES*	13.0760	0.0106	2334.5344	0.0141	3.2936	0.0129
UC OIL*	0.0000	0.0000	0.0023	0.0000	0.0000	0.0000
DHT FEED*	29.8137	0.0242	5354.9881	0.0322	7.3709	0.0288
HEAVY DIESE*	58.7167	0.0476	8337.0574	0.0502	10.0774	0.0393
MDEthnlAmine	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	1232.4471	1.0000	166104.8302	1.0000	256.2346	1.0000

Material Stream: reactor 1-3 vapors

Fluid Package: Basis-1
Property Package: SRK

CONDITIONS

		Overall	Vapour Phase	Liquid Phase		
Vapour / Phase Fraction		1.0000	1.0000	0.0000		
Temperature:	(C)	250.0	250.0	250.0		
Pressure:	(kPa)	1.569e+004	1.569e+004	1.569e+004		
Molar Flow	(kgmole/h)	1.321e+004	1.321e+004	0.0000		
Mass Flow	(kg/h)	1.087e+005	1.087e+005	0.0000		
Std Ideal Liq Vol Flow	(m3/h)	498.9	498.9	0.0000		
Molar Enthalpy	(kJ/kgmole)	-4381	-4381	-2.035e+005		
Molar Entropy	(kJ/kgmole-C)	132.7	132.7	799.5		
Heat Flow	(kJ/h)	-5.788e+007	-5.788e+007	0.0000		
Liq Vol Flow @Std Cond	(m3/h)	—	—	0.0000		

COMPOSITION

Overall Phase

Vapour Fraction 1.0000

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
Hydrogen	11679.2905	0.8840	23545.4500	0.2167	337.0420	0.6755
H2S	192.3810	0.0146	6555.5755	0.0603	8.3150	0.0167
Ammonia	23.0798	0.0017	393.0497	0.0036	0.6380	0.0013
H2O	15.3728	0.0012	276.9429	0.0025	0.2775	0.0006
Methane	498.6829	0.0377	8000.3203	0.0736	26.7217	0.0536
Ethane	98.7924	0.0075	2970.6777	0.0273	8.3520	0.0167
Propane	100.6496	0.0076	4438.3438	0.0408	8.7597	0.0176

Material Stream: reactor 1-3 vapors (continuec

Fluid Package: Basis-1
Property Package: SRK

COMPOSITION

Overall Phase (continued)

Vapour Fraction 1.0000

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
i-Butane	81.8934	0.0062	4759.9692	0.0438	8.4702	0.0170
n-Butane	47.9264	0.0036	2785.6742	0.0256	4.7763	0.0096
CO	0.2640	0.0000	7.3943	0.0001	0.0093	0.0000
CO2	0.1205	0.0000	5.3039	0.0000	0.0064	0.0000
MIXED FEED*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LIGHT NAPHT*	160.2667	0.0121	12977.3700	0.1194	20.4787	0.0410
HEAVY NAPHT*	155.6942	0.0118	12607.1162	0.1160	31.9572	0.0640
LIGHT DIESE*	19.0084	0.0014	3984.7749	0.0367	5.8104	0.0116
DHT HY DIES*	35.7681	0.0027	7320.4147	0.0674	10.6216	0.0213
KEROSINE*	49.8920	0.0038	8635.5150	0.0795	13.7948	0.0276
DHT LT DIES*	1.2649	0.0001	225.8314	0.0021	0.3186	0.0006
UC OIL*	0.0000	0.0000	0.0002	0.0000	0.0000	0.0000
DHT FEED*	50.3437	0.0038	9042.4867	0.0832	12.4466	0.0249
HEAVY DIESE*	0.8644	0.0001	122.7404	0.0011	0.1484	0.0003
MDEthnlAmine	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	13211.5557	1.0000	108654.9510	1.0000	498.9444	1.0000

Vapour Phase

Phase Fraction 1.000

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
Hydrogen	11679.2905	0.8840	23545.4500	0.2167	337.0420	0.6755
H2S	192.3810	0.0146	6555.5755	0.0603	8.3150	0.0167
Ammonia	23.0798	0.0017	393.0497	0.0036	0.6380	0.0013
H2O	15.3728	0.0012	276.9429	0.0025	0.2775	0.0006
Methane	498.6829	0.0377	8000.3203	0.0736	26.7217	0.0536
Ethane	98.7924	0.0075	2970.6777	0.0273	8.3520	0.0167
Propane	100.6496	0.0076	4438.3438	0.0408	8.7597	0.0176
i-Butane	81.8934	0.0062	4759.9692	0.0438	8.4702	0.0170
n-Butane	47.9264	0.0036	2785.6742	0.0256	4.7763	0.0096
CO	0.2640	0.0000	7.3943	0.0001	0.0093	0.0000
CO2	0.1205	0.0000	5.3039	0.0000	0.0064	0.0000
MIXED FEED*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LIGHT NAPHT*	160.2667	0.0121	12977.3700	0.1194	20.4787	0.0410
HEAVY NAPHT*	155.6942	0.0118	12607.1162	0.1160	31.9572	0.0640
LIGHT DIESE*	19.0084	0.0014	3984.7749	0.0367	5.8104	0.0116
DHT HY DIES*	35.7681	0.0027	7320.4147	0.0674	10.6216	0.0213
KEROSINE*	49.8920	0.0038	8635.5150	0.0795	13.7948	0.0276
DHT LT DIES*	1.2649	0.0001	225.8314	0.0021	0.3186	0.0006
UC OIL*	0.0000	0.0000	0.0002	0.0000	0.0000	0.0000
DHT FEED*	50.3437	0.0038	9042.4867	0.0832	12.4466	0.0249
HEAVY DIESE*	0.8644	0.0001	122.7404	0.0011	0.1484	0.0003
MDEthnlAmine	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	13211.5557	1.0000	108654.9510	1.0000	498.9444	1.0000

Liquid Phase

Phase Fraction 0.0000

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
Hydrogen	0.0000	0.2088	0.0000	0.0031	0.0000	0.0290
H2S	0.0000	0.0127	0.0000	0.0032	0.0000	0.0026
Ammonia	0.0000	0.0016	0.0000	0.0002	0.0000	0.0002

Licensed to: TEAM LND
* Specified by user.

Material Stream: reactor 1-3 vapors (continuec

Fluid Package: Basis-1
Property Package: SRK

COMPOSITION

Liquid Phase (continued)

Phase Fraction 0.0000

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
H2O	0.0000	0.0007	0.0000	0.0001	0.0000	0.0001
Methane	0.0000	0.0156	0.0000	0.0019	0.0000	0.0040
Ethane	0.0000	0.0053	0.0000	0.0012	0.0000	0.0022
Propane	0.0000	0.0083	0.0000	0.0027	0.0000	0.0035
i-Butane	0.0000	0.0093	0.0000	0.0040	0.0000	0.0046
n-Butane	0.0000	0.0060	0.0000	0.0026	0.0000	0.0029
CO	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CO2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
MIXED FEED*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LIGHT NAPHT*	0.0000	0.0360	0.0000	0.0216	0.0000	0.0221
HEAVY NAPHT*	0.0000	0.0691	0.0000	0.0415	0.0000	0.0683
LIGHT DIESE*	0.0000	0.1746	0.0000	0.2715	0.0000	0.2567
DHT HY DIES*	0.0000	0.3220	0.0000	0.4890	0.0000	0.4599
KEROSINE*	0.0000	0.0473	0.0000	0.0608	0.0000	0.0630
DHT LT DIES*	0.0000	0.0106	0.0000	0.0141	0.0000	0.0129
UC OIL*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
DHT FEED*	0.0000	0.0242	0.0000	0.0322	0.0000	0.0288
HEAVY DIESE*	0.0000	0.0476	0.0000	0.0502	0.0000	0.0393
MDEthnlAmine	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	0.0000	1.0000	0.0000	1.0000	0.0000	1.0000

Material Stream: reactor 2-1 feed

Fluid Package: Basis-1
Property Package: SRK

CONDITIONS

		Overall	Vapour Phase	Liquid Phase		
Vapour / Phase Fraction		0.7372	0.7372	0.2628		
Temperature:	(C)	316.0 *	316.0	316.0		
Pressure:	(kPa)	1.806e+004 *	1.806e+004	1.806e+004		
Molar Flow	(kgmole/h)	7790	5743	2047		
Mass Flow	(kg/h)	2.056e+005 *	1.977e+004	1.859e+005		
Std Ideal Liq Vol Flow	(m3/h)	426.6	178.0	248.6		
Molar Enthalpy	(kJ/kgmole)	-3.345e+004	4556	-1.401e+005		
Molar Entropy	(kJ/kgmole-C)	144.3	107.0	248.8		
Heat Flow	(kJ/h)	-2.606e+008	2.617e+007	-2.868e+008		
Liq Vol Flow @Std Cond	(m3/h)	—	—	245.2		

COMPOSITION

Overall Phase

Vapour Fraction 0.7372

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
Hydrogen	6170.6348 *	0.7921 *	12440.0000 *	0.0605 *	178.0727 *	0.4174 *
H2S	0.0293 *	0.0000 *	1.0000 *	0.0000 *	0.0013 *	0.0000 *
Ammonia	0.0000 *	0.0000 *	0.0000 *	0.0000 *	0.0000 *	0.0000 *
H2O	5.9950 *	0.0008 *	108.0000 *	0.0005 *	0.1082 *	0.0003 *
Methane	227.0786 *	0.0291 *	3643.0000 *	0.0177 *	12.1679 *	0.0285 *
Ethane	32.3579 *	0.0042 *	973.0000 *	0.0047 *	2.7356 *	0.0064 *
Propane	29.4805 *	0.0038 *	1300.0000 *	0.0063 *	2.5657 *	0.0060 *
i-Butane	20.8004 *	0.0027 *	1209.0000 *	0.0059 *	2.1514 *	0.0050 *

Material Stream: reactor 2-1 feed (continued)

Fluid Package: Basis-1
Property Package: SRK

COMPOSITION

Overall Phase (continued)

Vapour Fraction 0.7372

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
n-Butane	10.6152 *	0.0014 *	617.0000 *	0.0030 *	1.0579 *	0.0025 *
CO	0.1071 *	0.0000 *	3.0000 *	0.0000 *	0.0038 *	0.0000 *
CO2	0.0454 *	0.0000 *	2.0000 *	0.0000 *	0.0024 *	0.0000 *
MIXED FEED*	0.0000 *	0.0000 *	0.0000 *	0.0000 *	0.0000 *	0.0000 *
LIGHT NAPHT*	0.0000 *	0.0000 *	0.0000 *	0.0000 *	0.0000 *	0.0000 *
HEAVY NAPHT*	12.3991 *	0.0016 *	1004.0000 *	0.0049 *	2.5450 *	0.0060 *
LIGHT DIESE*	1.1830 *	0.0002 *	248.0000 *	0.0012 *	0.3616 *	0.0008 *
DHT HY DIES*	0.1026 *	0.0000 *	21.0000 *	0.0001 *	0.0305 *	0.0001 *
KEROSINE*	0.0693 *	0.0000 *	12.0000 *	0.0001 *	0.0192 *	0.0000 *
DHT LT DIES*	64.8833 *	0.0083 *	11584.0000 *	0.0563 *	16.3431 *	0.0383 *
UC OIL*	0.0211 *	0.0000 *	5.0000 *	0.0000 *	0.0059 *	0.0000 *
DHT FEED*	0.0000 *	0.0000 *	0.0000 *	0.0000 *	0.0000 *	0.0000 *
HEAVY DIESE*	1214.6261 *	0.1559 *	172462.0000 *	0.8387 *	208.4637 *	0.4886 *
MDEthnlAmine	0.0000 *	0.0000 *	0.0000 *	0.0000 *	0.0000 *	0.0000 *
Total	7790.4289	1.0000	205632.0000	1.0000	426.6358	1.0000

Vapour Phase

Phase Fraction 0.7372

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
Hydrogen	5458.3069	0.9504	11003.9469	0.5565	157.5163	0.8849
H2S	0.0222	0.0000	0.7552	0.0000	0.0010	0.0000
Ammonia	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
H2O	4.7873	0.0008	86.2436	0.0044	0.0864	0.0005
Methane	191.9158	0.0334	3078.8867	0.1557	10.2837	0.0578
Ethane	25.4541	0.0044	765.4026	0.0387	2.1519	0.0121
Propane	21.5123	0.0037	948.6286	0.0480	1.8723	0.0105
i-Butane	14.0891	0.0025	818.9120	0.0414	1.4572	0.0082
n-Butane	7.0262	0.0012	408.3897	0.0207	0.7002	0.0039
CO	0.0942	0.0000	2.6395	0.0001	0.0033	0.0000
CO2	0.0372	0.0000	1.6352	0.0001	0.0020	0.0000
MIXED FEED*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LIGHT NAPHT*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
HEAVY NAPHT*	5.2423	0.0009	424.4851	0.0215	1.0760	0.0060
LIGHT DIESE*	0.0731	0.0000	15.3264	0.0008	0.0223	0.0001
DHT HY DIES*	0.0064	0.0000	1.3097	0.0001	0.0019	0.0000
KEROSINE*	0.0209	0.0000	3.6169	0.0002	0.0058	0.0000
DHT LT DIES*	4.0050	0.0007	715.0327	0.0362	1.0088	0.0057
UC OIL*	0.0012	0.0000	0.2874	0.0000	0.0003	0.0000
DHT FEED*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
HEAVY DIESE*	10.5553	0.0018	1498.7199	0.0758	1.8116	0.0102
MDEthnlAmine	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	5743.1494	1.0000	19774.2181	1.0000	178.0011	1.0000

Liquid Phase

Phase Fraction 0.2628

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
Hydrogen	712.3279	0.3479	1436.0531	0.0077	20.5564	0.0827
H2S	0.0072	0.0000	0.2448	0.0000	0.0003	0.0000
Ammonia	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
H2O	1.2077	0.0006	21.7564	0.0001	0.0218	0.0001

* Specified by user.

Material Stream: reactor 2-1 feed (continued)

Fluid Package: Basis-1
Property Package: SRK

COMPOSITION

Liquid Phase (continued)

Phase Fraction 0.2628

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
Methane	35.1628	0.0172	564.1133	0.0030	1.8842	0.0076
Ethane	6.9038	0.0034	207.5974	0.0011	0.5837	0.0023
Propane	7.9681	0.0039	351.3714	0.0019	0.6935	0.0028
i-Butane	6.7113	0.0033	390.0880	0.0021	0.6941	0.0028
n-Butane	3.5891	0.0018	208.6103	0.0011	0.3577	0.0014
CO	0.0129	0.0000	0.3605	0.0000	0.0005	0.0000
CO2	0.0083	0.0000	0.3648	0.0000	0.0004	0.0000
MIXED FEED*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LIGHT NAPHT*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
HEAVY NAPHT*	7.1568	0.0035	579.5149	0.0031	1.4690	0.0059
LIGHT DIESE*	1.1099	0.0005	232.6736	0.0013	0.3393	0.0014
DHT HY DIES*	0.0962	0.0000	19.6903	0.0001	0.0286	0.0001
KEROSINE*	0.0484	0.0000	8.3831	0.0000	0.0134	0.0001
DHT LT DIES*	60.8783	0.0297	10868.9673	0.0585	15.3343	0.0617
UC OIL*	0.0199	0.0000	4.7126	0.0000	0.0055	0.0000
DHT FEED*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
HEAVY DIESE*	1204.0708	0.5881	170963.2801	0.9199	206.6521	0.8311
MDEthnlAmine	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	2047.2795	1.0000	185857.7819	1.0000	248.6348	1.0000

Material Stream: reactor 2-1 vapors

Fluid Package: Basis-1
Property Package: SRK

CONDITIONS

		Overall	Vapour Phase	Liquid Phase		
Vapour / Phase Fraction		1.0000	1.0000	0.0000		
Temperature:	(C)	357.0	357.0	357.0		
Pressure:	(kPa)	171.6	171.6	171.6		
Molar Flow	(kgmole/h)	7790	7790	0.0000		
Mass Flow	(kg/h)	2.056e+005	2.056e+005	0.0000		
Std Ideal Liq Vol Flow	(m3/h)	426.6	426.6	0.0000		
Molar Enthalpy	(kJ/kgmole)	-2.244e+004	-2.244e+004	-2.181e+005		
Molar Entropy	(kJ/kgmole-C)	199.4	199.4	327.7		
Heat Flow	(kJ/h)	-1.748e+008	-1.748e+008	0.0000		
Liq Vol Flow @Std Cond	(m3/h)	—	—	0.0000		

COMPOSITION

Overall Phase

Vapour Fraction 1.0000

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
Hydrogen	6170.6500	0.7921	12440.0306	0.0605	178.0732	0.4174
H2S	0.0300	0.0000	1.0219	0.0000	0.0013	0.0000
Ammonia	0.0001	0.0000	0.0015	0.0000	0.0000	0.0000
H2O	5.9950	0.0008	108.0001	0.0005	0.1082	0.0003
Methane	227.0806	0.0291	3643.0321	0.0177	12.1680	0.0285
Ethane	32.1767	0.0041	967.5499	0.0047	2.7203	0.0064
Propane	29.4770	0.0038	1299.8484	0.0063	2.5654	0.0060
i-Butane	20.8005	0.0027	1209.0101	0.0059	2.1514	0.0050
n-Butane	10.6152	0.0014	616.9976	0.0030	1.0579	0.0025

Material Stream: reactor 2-1 vapors (continuec

Fluid Package: Basis-1
Property Package: SRK

COMPOSITION

Overall Phase (continued)

Vapour Fraction 1.0000

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
CO	0.1071	0.0000	3.0000	0.0000	0.0038	0.0000
CO2	0.0454	0.0000	2.0000	0.0000	0.0024	0.0000
MIXED FEED*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LIGHT NAPHT*	0.0390	0.0000	3.1561	0.0000	0.0050	0.0000
HEAVY NAPHT*	12.3996	0.0016	1004.0360	0.0049	2.5451	0.0060
LIGHT DIESE*	1.1857	0.0002	248.5580	0.0012	0.3624	0.0008
DHT HY DIES*	0.1126	0.0000	23.0377	0.0001	0.0334	0.0001
KEROSINE*	0.0917	0.0000	15.8724	0.0001	0.0254	0.0001
DHT LT DIES*	64.8836	0.0083	11584.0581	0.0563	16.3432	0.0383
UC OIL*	0.0000	0.0000	0.0008	0.0000	0.0000	0.0000
DHT FEED*	0.0018	0.0000	0.3295	0.0000	0.0005	0.0000
HEAVY DIESE*	1214.6293	0.1559	172462.4593	0.8387	208.4642	0.4886
MDEthnlAmine	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	7790.3209	1.0000	205632.0000	1.0000	426.6310	1.0000

Vapour Phase

Phase Fraction 1.000

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
Hydrogen	6170.6500	0.7921	12440.0306	0.0605	178.0732	0.4174
H2S	0.0300	0.0000	1.0219	0.0000	0.0013	0.0000
Ammonia	0.0001	0.0000	0.0015	0.0000	0.0000	0.0000
H2O	5.9950	0.0008	108.0001	0.0005	0.1082	0.0003
Methane	227.0806	0.0291	3643.0321	0.0177	12.1680	0.0285
Ethane	32.1767	0.0041	967.5499	0.0047	2.7203	0.0064
Propane	29.4770	0.0038	1299.8484	0.0063	2.5654	0.0060
i-Butane	20.8005	0.0027	1209.0101	0.0059	2.1514	0.0050
n-Butane	10.6152	0.0014	616.9976	0.0030	1.0579	0.0025
CO	0.1071	0.0000	3.0000	0.0000	0.0038	0.0000
CO2	0.0454	0.0000	2.0000	0.0000	0.0024	0.0000
MIXED FEED*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LIGHT NAPHT*	0.0390	0.0000	3.1561	0.0000	0.0050	0.0000
HEAVY NAPHT*	12.3996	0.0016	1004.0360	0.0049	2.5451	0.0060
LIGHT DIESE*	1.1857	0.0002	248.5580	0.0012	0.3624	0.0008
DHT HY DIES*	0.1126	0.0000	23.0377	0.0001	0.0334	0.0001
KEROSINE*	0.0917	0.0000	15.8724	0.0001	0.0254	0.0001
DHT LT DIES*	64.8836	0.0083	11584.0581	0.0563	16.3432	0.0383
UC OIL*	0.0000	0.0000	0.0008	0.0000	0.0000	0.0000
DHT FEED*	0.0018	0.0000	0.3295	0.0000	0.0005	0.0000
HEAVY DIESE*	1214.6293	0.1559	172462.4593	0.8387	208.4642	0.4886
MDEthnlAmine	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	7790.3209	1.0000	205632.0000	1.0000	426.6310	1.0000

Liquid Phase

Phase Fraction 0.0000

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
Hydrogen	0.0000	0.0075	0.0000	0.0001	0.0000	0.0013
H2S	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
H2O	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Methane	0.0000	0.0004	0.0000	0.0000	0.0000	0.0001

Material Stream: reactor 2-1 vapors (continuec

Fluid Package: Basis-1
Property Package: SRK

COMPOSITION

Liquid Phase (continued)

Phase Fraction 0.0000

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
Ethane	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000
Propane	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000
i-Butane	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000
n-Butane	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CO	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CO2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
MIXED FEED*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LIGHT NAPHT*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
HEAVY NAPHT*	0.0000	0.0001	0.0000	0.0001	0.0000	0.0002
LIGHT DIESE*	0.0000	0.0001	0.0000	0.0002	0.0000	0.0002
DHT HY DIES*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
KEROSINE*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
DHT LT DIES*	0.0000	0.0067	0.0000	0.0085	0.0000	0.0099
UC OIL*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
DHT FEED*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
HEAVY DIESE*	0.0000	0.9848	0.0000	0.9909	0.0000	0.9881
MDEthnlAmine	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	0.0000	1.0000	0.0000	1.0000	0.0000	1.0000

Material Stream: reactor 2-2 inlet

Fluid Package: Basis-1
Property Package: SRK

CONDITIONS

		Overall	Vapour Phase	Liquid Phase		
Vapour / Phase Fraction		0.0000	0.0000	1.0000		
Temperature:	(C)	357.0 *	357.0	357.0		
Pressure:	(kPa)	171.6 *	171.6	171.6		
Molar Flow	(kgmole/h)	0.0000	0.0000	0.0000		
Mass Flow	(kg/h)	0.0000	0.0000	0.0000		
Std Ideal Liq Vol Flow	(m3/h)	0.0000	0.0000	0.0000		
Molar Enthalpy	(kJ/kgmole)	-2.181e+005	-2.244e+004	-2.181e+005		
Molar Entropy	(kJ/kgmole-C)	327.7	199.4	327.7		
Heat Flow	(kJ/h)	0.0000	0.0000	0.0000		
Liq Vol Flow @Std Cond	(m3/h)	0.0000 *	0.0000	0.0000		

COMPOSITION

Overall Phase

Vapour Fraction 0.0000

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
Hydrogen	0.0000	0.0075	0.0000	0.0001	0.0000	0.0013
H2S	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
H2O	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Methane	0.0000	0.0004	0.0000	0.0000	0.0000	0.0001
Ethane	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000
Propane	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000
i-Butane	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000
n-Butane	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CO	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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* Specified by user.

Material Stream: reactor 2-2 inlet (continued)

Fluid Package: Basis-1
Property Package: SRK

COMPOSITION

Overall Phase (continued)

Vapour Fraction 0.0000

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
CO2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
MIXED FEED*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LIGHT NAPHT*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
HEAVY NAPHT*	0.0000	0.0001	0.0000	0.0001	0.0000	0.0002
LIGHT DIESE*	0.0000	0.0001	0.0000	0.0002	0.0000	0.0002
DHT HY DIES*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
KEROSINE*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
DHT LT DIES*	0.0000	0.0067	0.0000	0.0085	0.0000	0.0099
UC OIL*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
DHT FEED*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
HEAVY DIESE*	0.0000	0.9848	0.0000	0.9909	0.0000	0.9881
MDEthnlAmine	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	0.0000	1.0000	0.0000	1.0000	0.0000	1.0000

Vapour Phase

Phase Fraction 0.0000

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
Hydrogen	0.0000	0.7921	0.0000	0.0605	0.0000	0.4174
H2S	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
H2O	0.0000	0.0008	0.0000	0.0005	0.0000	0.0003
Methane	0.0000	0.0291	0.0000	0.0177	0.0000	0.0285
Ethane	0.0000	0.0041	0.0000	0.0047	0.0000	0.0064
Propane	0.0000	0.0038	0.0000	0.0063	0.0000	0.0060
i-Butane	0.0000	0.0027	0.0000	0.0059	0.0000	0.0050
n-Butane	0.0000	0.0014	0.0000	0.0030	0.0000	0.0025
CO	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CO2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
MIXED FEED*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LIGHT NAPHT*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
HEAVY NAPHT*	0.0000	0.0016	0.0000	0.0049	0.0000	0.0060
LIGHT DIESE*	0.0000	0.0002	0.0000	0.0012	0.0000	0.0008
DHT HY DIES*	0.0000	0.0000	0.0000	0.0001	0.0000	0.0001
KEROSINE*	0.0000	0.0000	0.0000	0.0001	0.0000	0.0001
DHT LT DIES*	0.0000	0.0083	0.0000	0.0563	0.0000	0.0383
UC OIL*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
DHT FEED*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
HEAVY DIESE*	0.0000	0.1559	0.0000	0.8387	0.0000	0.4886
MDEthnlAmine	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	0.0000	1.0000	0.0000	1.0000	0.0000	1.0000

Liquid Phase

Phase Fraction 1.000

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
Hydrogen	0.0000	0.0075	0.0000	0.0001	0.0000	0.0013
H2S	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
H2O	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Methane	0.0000	0.0004	0.0000	0.0000	0.0000	0.0001
Ethane	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000

Material Stream: reactor 2-2 inlet (continued)

Fluid Package: Basis-1
Property Package: SRK

COMPOSITION

Liquid Phase (continued)

Phase Fraction 1.000

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
Propane	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000
i-Butane	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000
n-Butane	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CO	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CO2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
MIXED FEED*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LIGHT NAPHT*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
HEAVY NAPHT*	0.0000	0.0001	0.0000	0.0001	0.0000	0.0002
LIGHT DIESE*	0.0000	0.0001	0.0000	0.0002	0.0000	0.0002
DHT HY DIES*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
KEROSINE*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
DHT LT DIES*	0.0000	0.0067	0.0000	0.0085	0.0000	0.0099
UC OIL*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
DHT FEED*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
HEAVY DIESE*	0.0000	0.9848	0.0000	0.9909	0.0000	0.9881
MDEthnlAmine	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	0.0000	1.0000	0.0000	1.0000	0.0000	1.0000

Material Stream: reactor 2-2 out

Fluid Package: Basis-1
Property Package: SRK

CONDITIONS

		Overall	Liquid Phase	Vapour Phase		
Vapour / Phase Fraction		0.0000 *	1.0000	0.0000		
Temperature:	(C)	370.0 *	370.0	370.0		
Pressure:	(kPa)	1.273e+005	1.273e+005	1.273e+005		
Molar Flow	(kgmole/h)	0.0000	0.0000	0.0000		
Mass Flow	(kg/h)	0.0000	0.0000	0.0000		
Std Ideal Liq Vol Flow	(m3/h)	0.0000	0.0000	0.0000		
Molar Enthalpy	(kJ/kgmole)	-7479	-7479	5140		
Molar Entropy	(kJ/kgmole-C)	150.9	150.9	112.0		
Heat Flow	(kJ/h)	0.0000	0.0000	0.0000		
Liq Vol Flow @Std Cond	(m3/h)	0.0000 *	0.0000	0.0000		

COMPOSITION

Overall Phase

Vapour Fraction 0.0000 *

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
Hydrogen	0.0000 *	0.8367 *	0.0000 *	0.0914 *	0.0000 *	0.4888 *
H2S	0.0000 *	0.0000 *	0.0000 *	0.0000 *	0.0000 *	0.0000 *
Ammonia	0.0000 *	0.0000 *	0.0000 *	0.0000 *	0.0000 *	0.0000 *
H2O	0.0000 *	0.0008 *	0.0000 *	0.0008 *	0.0000 *	0.0003 *
Methane	0.0000 *	0.0335 *	0.0000 *	0.0291 *	0.0000 *	0.0363 *
Ethane	0.0000 *	0.0048 *	0.0000 *	0.0077 *	0.0000 *	0.0081 *
Propane	0.0000 *	0.0061 *	0.0000 *	0.0146 *	0.0000 *	0.0108 *
i-Butane	0.0000 *	0.0075 *	0.0000 *	0.0238 *	0.0000 *	0.0158 *
n-Butane	0.0000 *	0.0035 *	0.0000 *	0.0111 *	0.0000 *	0.0071 *
CO	0.0000 *	0.0000 *	0.0000 *	0.0000 *	0.0000 *	0.0000 *
CO2	0.0000 *	0.0000 *	0.0000 *	0.0000 *	0.0000 *	0.0000 *

Material Stream: reactor 2-2 out (continued)

Fluid Package: Basis-1
Property Package: SRK

COMPOSITION

Overall Phase (continued)

Vapour Fraction 0.0000 *

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
MIXED FEED*	0.0000 *	0.0000 *	0.0000 *	0.0000 *	0.0000 *	0.0000 *
LIGHT NAPHT*	0.0000 *	0.0000 *	0.0000 *	0.0000 *	0.0000 *	0.0000 *
HEAVY NAPHT*	0.0000 *	0.0169 *	0.0000 *	0.0743 *	0.0000 *	0.0704 *
LIGHT DIESE*	0.0000 *	0.0074 *	0.0000 *	0.0838 *	0.0000 *	0.0457 *
DHT HY DIES*	0.0000 *	0.0026 *	0.0000 *	0.0284 *	0.0000 *	0.0154 *
KEROSINE*	0.0000 *	0.0100 *	0.0000 *	0.0940 *	0.0000 *	0.0561 *
DHT LT DIES*	0.0000 *	0.0010 *	0.0000 *	0.0101 *	0.0000 *	0.0053 *
UC OIL*	0.0000 *	0.0000 *	0.0000 *	0.0000 *	0.0000 *	0.0000 *
DHT FEED*	0.0000 *	0.0000 *	0.0000 *	0.0000 *	0.0000 *	0.0000 *
HEAVY DIESE*	0.0000 *	0.0690 *	0.0000 *	0.5308 *	0.0000 *	0.2398 *
MDEthnlAmine	0.0000 *	0.0000 *	0.0000 *	0.0000 *	0.0000 *	0.0000 *
Total	0.0000	1.0000	0.0000	1.0000	0.0000	1.0000

Liquid Phase

Phase Fraction 1.000

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
Hydrogen	0.0000	0.8367	0.0000	0.0914	0.0000	0.4888
H2S	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
H2O	0.0000	0.0008	0.0000	0.0008	0.0000	0.0003
Methane	0.0000	0.0335	0.0000	0.0291	0.0000	0.0363
Ethane	0.0000	0.0048	0.0000	0.0077	0.0000	0.0081
Propane	0.0000	0.0061	0.0000	0.0146	0.0000	0.0108
i-Butane	0.0000	0.0075	0.0000	0.0238	0.0000	0.0158
n-Butane	0.0000	0.0035	0.0000	0.0111	0.0000	0.0071
CO	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CO2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
MIXED FEED*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LIGHT NAPHT*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
HEAVY NAPHT*	0.0000	0.0169	0.0000	0.0743	0.0000	0.0704
LIGHT DIESE*	0.0000	0.0074	0.0000	0.0838	0.0000	0.0457
DHT HY DIES*	0.0000	0.0026	0.0000	0.0284	0.0000	0.0154
KEROSINE*	0.0000	0.0100	0.0000	0.0940	0.0000	0.0561
DHT LT DIES*	0.0000	0.0010	0.0000	0.0101	0.0000	0.0053
UC OIL*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
DHT FEED*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
HEAVY DIESE*	0.0000	0.0690	0.0000	0.5308	0.0000	0.2398
MDEthnlAmine	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	0.0000	1.0000	0.0000	1.0000	0.0000	1.0000

Vapour Phase

Phase Fraction 0.0000

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
Hydrogen	0.0000	0.9226	0.0000	0.2804	0.0000	0.7483
H2S	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000
Ammonia	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
H2O	0.0000	0.0008	0.0000	0.0022	0.0000	0.0004
Methane	0.0000	0.0337	0.0000	0.0815	0.0000	0.0508
Ethane	0.0000	0.0042	0.0000	0.0191	0.0000	0.0100
Propane	0.0000	0.0049	0.0000	0.0327	0.0000	0.0120

Material Stream: reactor 2-2 out (continued)

Fluid Package: Basis-1
Property Package: SRK

COMPOSITION

Vapour Phase (continued)

Phase Fraction 0.0000

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
i-Butane	0.0000	0.0056	0.0000	0.0491	0.0000	0.0163
n-Butane	0.0000	0.0026	0.0000	0.0225	0.0000	0.0072
CO	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000
CO2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
MIXED FEED*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LIGHT NAPHT*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
HEAVY NAPHT*	0.0000	0.0089	0.0000	0.1089	0.0000	0.0515
LIGHT DIESE*	0.0000	0.0019	0.0000	0.0589	0.0000	0.0160
DHT HY DIES*	0.0000	0.0006	0.0000	0.0200	0.0000	0.0054
KEROSINE*	0.0000	0.0045	0.0000	0.1185	0.0000	0.0353
DHT LT DIES*	0.0000	0.0003	0.0000	0.0071	0.0000	0.0019
UC OIL*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
DHT FEED*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
HEAVY DIESE*	0.0000	0.0093	0.0000	0.1987	0.0000	0.0448
MDEthnlAmine	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	0.0000	1.0000	0.0000	1.0000	0.0000	1.0000

Material Stream: reactor 2-2 vapors

Fluid Package: Basis-1
Property Package: SRK

CONDITIONS

		Overall	Vapour Phase	Liquid Phase		
Vapour / Phase Fraction		1.0000	1.0000	0.0000		
Temperature:	(C)	370.0	370.0	370.0		
Pressure:	(kPa)	1.273e+005	1.273e+005	1.273e+005		
Molar Flow	(kgmole/h)	7790	7790	0.0000		
Mass Flow	(kg/h)	2.056e+005	2.056e+005	0.0000		
Std Ideal Liq Vol Flow	(m3/h)	426.6	426.6	0.0000		
Molar Enthalpy	(kJ/kgmole)	-1.655e+004	-1.655e+004	7810		
Molar Entropy	(kJ/kgmole-C)	138.5	138.5	94.65		
Heat Flow	(kJ/h)	-1.289e+008	-1.289e+008	0.0000		
Liq Vol Flow @Std Cond	(m3/h)	—	—	0.0000		

COMPOSITION

Overall Phase

Vapour Fraction 1.0000

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
Hydrogen	6170.6501	0.7921	12440.0308	0.0605	178.0732	0.4174
H2S	0.0300	0.0000	1.0220	0.0000	0.0013	0.0000
Ammonia	0.0001	0.0000	0.0015	0.0000	0.0000	0.0000
H2O	5.9950	0.0008	108.0001	0.0005	0.1082	0.0003
Methane	227.0807	0.0291	3643.0323	0.0177	12.1680	0.0285
Ethane	32.1758	0.0041	967.5223	0.0047	2.7202	0.0064
Propane	29.4770	0.0038	1299.8476	0.0063	2.5654	0.0060
i-Butane	20.8005	0.0027	1209.0100	0.0059	2.1514	0.0050
n-Butane	10.6152	0.0014	616.9976	0.0030	1.0579	0.0025
CO	0.1071	0.0000	3.0000	0.0000	0.0038	0.0000
CO2	0.0454	0.0000	2.0000	0.0000	0.0024	0.0000
MIXED FEED*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Material Stream: reactor 2-2 vapors (continuec

Fluid Package: Basis-1
Property Package: SRK

COMPOSITION

Overall Phase (continued)

Vapour Fraction 1.0000

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
LIGHT NAPHT*	0.0392	0.0000	3.1712	0.0000	0.0050	0.0000
HEAVY NAPHT*	12.3995	0.0016	1004.0355	0.0049	2.5451	0.0060
LIGHT DIESE*	1.1857	0.0002	248.5584	0.0012	0.3624	0.0008
DHT HY DIES*	0.1126	0.0000	23.0365	0.0001	0.0334	0.0001
KEROSINE*	0.0918	0.0000	15.8891	0.0001	0.0254	0.0001
DHT LT DIES*	64.8836	0.0083	11584.0578	0.0563	16.3432	0.0383
UC OIL*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
DHT FEED*	0.0018	0.0000	0.3278	0.0000	0.0005	0.0000
HEAVY DIESE*	1214.6293	0.1559	172462.4596	0.8387	208.4642	0.4886
MDEthnlAmine	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	7790.3204	1.0000	205632.0000	1.0000	426.6310	1.0000

Vapour Phase

Phase Fraction 1.000

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
Hydrogen	6170.6501	0.7921	12440.0308	0.0605	178.0732	0.4174
H2S	0.0300	0.0000	1.0220	0.0000	0.0013	0.0000
Ammonia	0.0001	0.0000	0.0015	0.0000	0.0000	0.0000
H2O	5.9950	0.0008	108.0001	0.0005	0.1082	0.0003
Methane	227.0807	0.0291	3643.0323	0.0177	12.1680	0.0285
Ethane	32.1758	0.0041	967.5223	0.0047	2.7202	0.0064
Propane	29.4770	0.0038	1299.8476	0.0063	2.5654	0.0060
i-Butane	20.8005	0.0027	1209.0100	0.0059	2.1514	0.0050
n-Butane	10.6152	0.0014	616.9976	0.0030	1.0579	0.0025
CO	0.1071	0.0000	3.0000	0.0000	0.0038	0.0000
CO2	0.0454	0.0000	2.0000	0.0000	0.0024	0.0000
MIXED FEED*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LIGHT NAPHT*	0.0392	0.0000	3.1712	0.0000	0.0050	0.0000
HEAVY NAPHT*	12.3995	0.0016	1004.0355	0.0049	2.5451	0.0060
LIGHT DIESE*	1.1857	0.0002	248.5584	0.0012	0.3624	0.0008
DHT HY DIES*	0.1126	0.0000	23.0365	0.0001	0.0334	0.0001
KEROSINE*	0.0918	0.0000	15.8891	0.0001	0.0254	0.0001
DHT LT DIES*	64.8836	0.0083	11584.0578	0.0563	16.3432	0.0383
UC OIL*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
DHT FEED*	0.0018	0.0000	0.3278	0.0000	0.0005	0.0000
HEAVY DIESE*	1214.6293	0.1559	172462.4596	0.8387	208.4642	0.4886
MDEthnlAmine	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	7790.3204	1.0000	205632.0000	1.0000	426.6310	1.0000

Liquid Phase

Phase Fraction 0.0000

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
Hydrogen	0.0000	0.9503	0.0000	0.4628	0.0000	0.8676
H2S	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
H2O	0.0000	0.0008	0.0000	0.0034	0.0000	0.0004
Methane	0.0000	0.0305	0.0000	0.1181	0.0000	0.0517
Ethane	0.0000	0.0036	0.0000	0.0259	0.0000	0.0095
Propane	0.0000	0.0028	0.0000	0.0300	0.0000	0.0078
i-Butane	0.0000	0.0018	0.0000	0.0248	0.0000	0.0058

Material Stream: reactor 2-2 vapors (continuec

Fluid Package: Basis-1
Property Package: SRK

COMPOSITION

Liquid Phase (continued)

Phase Fraction 0.0000

COMPONENTS	MOLAR FLOW (kgmole/h)	MOLE FRACTION	MASS FLOW (kg/h)	MASS FRACTION	LIQUID VOLUME FLOW (m3/h)	LIQUID VOLUME FRACTION
n-Butane	0.0000	0.0009	0.0000	0.0122	0.0000	0.0027
CO	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000
CO2	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000
MIXED FEED*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LIGHT NAPHT*	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000
HEAVY NAPHT*	0.0000	0.0006	0.0000	0.0122	0.0000	0.0041
LIGHT DIESE*	0.0000	0.0000	0.0000	0.0010	0.0000	0.0002
DHT HY DIES*	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000
KEROSINE*	0.0000	0.0000	0.0000	0.0002	0.0000	0.0000
DHT LT DIES*	0.0000	0.0011	0.0000	0.0462	0.0000	0.0085
UC OIL*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
DHT FEED*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
HEAVY DIESE*	0.0000	0.0077	0.0000	0.2629	0.0000	0.0416
MDEthnlAmine	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	0.0000	1.0000	0.0000	1.0000	0.0000	1.0000

Energy Stream: reactor 1-1 energy

Fluid Package: Basis-1
Property Package: SRK

CONDITIONS

Duty Type:	Direct Q	Duty Calculation Operation:	reactor 1-1	
Duty SP:	1.689e+008 kJ/h	Minimum Available Duty:	—	Maximum Available Duty: —

Energy Stream: reactor 1-2 energy

Fluid Package: Basis-1
Property Package: SRK

CONDITIONS

Duty Type:	Direct Q	Duty Calculation Operation:	reactor 1-2	
Duty SP:	-1.023e+007 kJ/h	Minimum Available Duty:	—	Maximum Available Duty: —

Energy Stream: reactor 1-3 energy

Fluid Package: Basis-1
Property Package: SRK

CONDITIONS

Duty Type:	Direct Q	Duty Calculation Operation:	reactor 1-3	
Duty SP:	-2.140e+008 kJ/h	Minimum Available Duty:	—	Maximum Available Duty: —

Energy Stream: reactor 2-1 energy

Fluid Package: Basis-1
Property Package: SRK

CONDITIONS

Duty Type:	Direct Q	Duty Calculation Operation:	reactor 2-1	
Duty SP:	8.583e+007 kJ/h	Minimum Available Duty:	—	Maximum Available Duty: —

Energy Stream: reactor 2-2 energy

Fluid Package: Basis-1
Property Package: SRK

CONDITIONS

Duty Type:	Direct Q	Duty Calculation Operation:	reactor 2-2	
Duty SP:	4.586e+007 kJ/h	Minimum Available Duty:	—	Maximum Available Duty: —

University Of Petroleum And Energy
UPES,
Bidholi,
Dehradun,
Uttarakhand

Case Name: D:\RAKI\SIMULATION\SIRI SIMULATION\SIRI 1.HSC
Unit Set: SI
Date/Time: Thu Apr 23 15:14:15 2009

Conversion Reactor: reactor 1-1

CONNECTIONS

Inlet Stream Connections

Stream Name	From Unit Operation
r 1-1 inlet	

Outlet Stream Connections

Stream Name	To Unit Operation	
reactor 1-1 vapors	Conversion Reactor:	reactor 1-2
r 1-2 inlet	Conversion Reactor:	reactor 1-2

Energy Stream Connections

Stream Name	From Unit Operation
reactor 1-1 energy	

PARAMETERS

Physical Parameters		Optional Heat Transfer: Heating	
Delta P	Vessel Volume	Duty	Energy Stream
0.0000 kPa *	—	1.689e+008 kJ/h	reactor 1-1 energy

User Variables

REACTION DETAILS

Reaction: reactor 1-1

Component	Mole Weight	Stoichiometric Coeff.
Hydrogen	2.016	2529 *
H2S	34.08	161 *
Ammonia	17.03	19 *
H2O	18.02	6 *
Methane	16.04	150 *
Ethane	30.07	47 *
Propane	44.10	50 *
i-Butane	58.12	42 *
n-Butane	58.12	28 *
CO	28.01	0 *
CO2	44.01	0 *
MIXED FEED*	140.9	-1341 *
LIGHT NAPHT*	80.97	108 *
HEAVY NAPHT*	80.97	157 *
LIGHT DIESE*	209.6	144 *
HEAVY DIESE*	142.0	0 *
KEROSINE*	173.1	28 *
DHT LT DIES*	178.5	0 *
UC OIL*	236.7	339 *
DHT FEED*	179.6	0 *
DHT HY DIES*	204.7	151 *
MDEthnlAmine	119.2	0 *

Reaction: reactor 1-2

Component	Mole Weight	Stoichiometric Coeff.
Hydrogen	2.016	1349 *
H2S	34.08	80 *
Ammonia	17.03	10 *
H2O	18.02	3 *
Methane	16.04	120 *

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* Specified by user.

Conversion Reactor: reactor 1-1 (continued)

REACTION DETAILS

Reaction: reactor 1-2

Component	Mole Weight	Stoichiometric Coeff.
Ethane	30.07	26 *
Propane	44.10	28 *
i-Butane	58.12	23 *
n-Butane	58.12	15 *
CO	28.01	0 *
CO2	44.01	0 *
MIXED FEED*	140.9	-641 *
LIGHT NAPHT*	80.97	54 *
HEAVY NAPHT*	80.97	78 *
LIGHT DIESE*	209.6	67 *
HEAVY DIESE*	142.0	0 *
KEROSINE*	173.1	14 *
DHT LT DIES*	178.5	0 *
UC OIL*	236.7	170 *
DHT FEED*	179.6	0 *
DHT HY DIES*	204.7	54 *
MDEthnlAmine	119.2	0 *

Reaction: reactor 2-1

Component	Mole Weight	Stoichiometric Coeff.
Hydrogen	2.016	-521 *
H2S	34.08	-0 *
Ammonia	17.03	0 *
H2O	18.02	0 *
Methane	16.04	2 *
Ethane	30.07	2 *
Propane	44.10	16 *
i-Butane	58.12	38 *
n-Butane	58.12	17 *
CO	28.01	0 *
CO2	44.01	-0 *
MIXED FEED*	140.9	0 *
LIGHT NAPHT*	80.97	200 *
HEAVY NAPHT*	80.97	141 *
LIGHT DIESE*	209.6	200 *
HEAVY DIESE*	142.0	250 *
KEROSINE*	173.1	300 *
DHT LT DIES*	178.5	60 *
UC OIL*	236.7	-1840 *
DHT FEED*	179.6	336 *
DHT HY DIES*	204.7	1000 *
MDEthnlAmine	119.2	0 *

Reaction: reactor 2-2

Component	Mole Weight	Stoichiometric Coeff.
Hydrogen	2.016	-197 *
H2S	34.08	0 *
Ammonia	17.03	0 *
H2O	18.02	-1 *
Methane	16.04	-11 *
Ethane	30.07	-3 *
Propane	44.10	-6 *

Conversion Reactor: reactor 1-1 (continued)

REACTION DETAILS

Reaction: reactor 2-2

Component	Mole Weight	Stoichiometric Coeff.
i-Butane	58.12	-10 *
n-Butane	58.12	-5 *
CO	28.01	0 *
CO2	44.01	0 *
MIXED FEED*	140.9	0 *
LIGHT NAPHT*	80.97	40 *
HEAVY NAPHT*	80.97	30 *
LIGHT DIESE*	209.6	100 *
HEAVY DIESE*	142.0	100 *
KEROSINE*	173.1	7 *
DHT LT DIES*	178.5	0 *
UC OIL*	236.7	-356 *
DHT FEED*	179.6	245 *
DHT HY DIES*	204.7	0 *
MDEthnlAmine	119.2	0 *

Reaction: reactor 1-3

Component	Mole Weight	Stoichiometric Coeff.
Hydrogen	2.016	0 *
H2S	34.08	0 *
Ammonia	17.03	0 *
H2O	18.02	0 *
Methane	16.04	0 *
Ethane	30.07	-1 *
Propane	44.10	-0 *
i-Butane	58.12	-0 *
n-Butane	58.12	-0 *
CO	28.01	-0 *
CO2	44.01	0 *
MIXED FEED*	140.9	0 *
LIGHT NAPHT*	80.97	0 *
HEAVY NAPHT*	80.97	-0 *
LIGHT DIESE*	209.6	0 *
HEAVY DIESE*	142.0	0 *
KEROSINE*	173.1	0 *
DHT LT DIES*	178.5	-0 *
UC OIL*	236.7	0 *
DHT FEED*	179.6	-0 *
DHT HY DIES*	204.7	-0 *
MDEthnlAmine	119.2	0 *

REACTION RESULTS FOR : reactor 1

Extents

Name	Rank	Specified % Conversion	Use Default	Actual % Conversion	Base Component	Reaction Extent (kgmole/h)
reactor 1-1	0 *	99.90	Yes	99.90	MIXED FEED*	1.290
reactor 1-2	1 *	99.90	Yes	9.990e-002	MIXED FEED*	2.698e-003
reactor 2-1	2 *	99.90	Yes	—	UC OIL*	0.2378
reactor 2-2	3 *	99.90	Yes	—	UC OIL*	1.230e-003
reactor 1-3	4 *	99.90	Yes	—	DHT FEED*	1.201

Conversion Reactor: reactor 1-1 (continued)

REACTION RESULTS FOR : reactor 1

Balance

Components	Total Inflow (kgmole/h)	Total Reaction (kgmole/h)	Total Outflow (kgmole/h)
Hydrogen	8794	3142	1.194e+004
H2S	5.869e-002	208.0	208.0
Ammonia	0.0000	25.10	25.10
H2O	8.548	7.743	16.29
Methane	323.6	194.4	517.9
Ethane	46.13	60.43	106.6
Propane	42.00	68.86	110.9
i-Butane	29.64	63.69	93.34
n-Butane	15.12	40.23	55.35
CO	0.1785	9.230e-002	0.2708
CO2	6.817e-002	5.842e-002	0.1266
MIXED FEED*	1732	-1732	1.732e-003
LIGHT NAPHT*	17.67	186.7	204.4
HEAVY NAPHT*	4.359	236.6	240.9
LIGHT DIESE*	7.632e-002	234.1	234.2
DHT HY DIES*	0.0000	432.7	432.7
KEROSINE*	0.1733	107.9	108.1
DHT LT DIES*	3.921e-002	14.30	14.34
UC OIL*	0.0000	4.489e-004	4.489e-004
DHT FEED*	0.0000	80.17	80.17
HEAVY DIESE*	0.0000	59.58	59.58
MDEthnlAmine	0.0000	0.0000	0.0000

Conversion Reactor: reactor 1-2

CONNECTIONS

Inlet Stream Connections

Stream Name	From Unit Operation	
r 1-2 inlet	Conversion Reactor	reactor 1-1
reactor 1-1 vapors	Conversion Reactor	reactor 1-1

Outlet Stream Connections

Stream Name	To Unit Operation	
reactor 1-2 vapors	Conversion Reactor:	reactor 1-3
r 1-3 inlet	Conversion Reactor:	reactor 1-3

Energy Stream Connections

Stream Name	From Unit Operation
reactor 1-2 energy	

PARAMETERS

Physical Parameters		Optional Heat Transfer: Heating	
Delta P	Vessel Volume	Duty	Energy Stream
814.0 kPa *	—	-1.023e+007 kJ/h	reactor 1-2 energy

User Variables

Conversion Reactor: reactor 1-2 (continued)

REACTION DETAILS

Reaction: reactor 1-1

Component	Mole Weight	Stoichiometric Coeff.
Hydrogen	2.016	2529 *
H2S	34.08	161 *
Ammonia	17.03	19 *
H2O	18.02	6 *
Methane	16.04	150 *
Ethane	30.07	47 *
Propane	44.10	50 *
i-Butane	58.12	42 *
n-Butane	58.12	28 *
CO	28.01	0 *
CO2	44.01	0 *
MIXED FEED*	140.9	-1341 *
LIGHT NAPHT*	80.97	108 *
HEAVY NAPHT*	80.97	157 *
LIGHT DIESE*	209.6	144 *
HEAVY DIESE*	142.0	0 *
KEROSINE*	173.1	28 *
DHT LT DIES*	178.5	0 *
UC OIL*	236.7	339 *
DHT FEED*	179.6	0 *
DHT HY DIES*	204.7	151 *
MDEthnlAmine	119.2	0 *

Reaction: reactor 1-2

Component	Mole Weight	Stoichiometric Coeff.
Hydrogen	2.016	1349 *
H2S	34.08	80 *
Ammonia	17.03	10 *
H2O	18.02	3 *
Methane	16.04	120 *
Ethane	30.07	26 *
Propane	44.10	28 *
i-Butane	58.12	23 *
n-Butane	58.12	15 *
CO	28.01	0 *
CO2	44.01	0 *
MIXED FEED*	140.9	-641 *
LIGHT NAPHT*	80.97	54 *
HEAVY NAPHT*	80.97	78 *
LIGHT DIESE*	209.6	67 *
HEAVY DIESE*	142.0	0 *
KEROSINE*	173.1	14 *
DHT LT DIES*	178.5	0 *
UC OIL*	236.7	170 *
DHT FEED*	179.6	0 *
DHT HY DIES*	204.7	54 *
MDEthnlAmine	119.2	0 *

Reaction: reactor 2-1

Component	Mole Weight	Stoichiometric Coeff.
Hydrogen	2.016	-521 *
H2S	34.08	-0 *

Conversion Reactor: reactor 1-2 (continued)

REACTION DETAILS

Reaction: reactor 2-1

Component	Mole Weight	Stoichiometric Coeff.
Ammonia	17.03	0 *
H2O	18.02	0 *
Methane	16.04	2 *
Ethane	30.07	2 *
Propane	44.10	16 *
i-Butane	58.12	38 *
n-Butane	58.12	17 *
CO	28.01	0 *
CO2	44.01	-0 *
MIXED FEED*	140.9	0 *
LIGHT NAPHT*	80.97	200 *
HEAVY NAPHT*	80.97	141 *
LIGHT DIESE*	209.6	200 *
HEAVY DIESE*	142.0	250 *
KEROSINE*	173.1	300 *
DHT LT DIES*	178.5	60 *
UC OIL*	236.7	-1840 *
DHT FEED*	179.6	336 *
DHT HY DIES*	204.7	1000 *
MDEthnlAmine	119.2	0 *

Reaction: reactor 2-2

Component	Mole Weight	Stoichiometric Coeff.
Hydrogen	2.016	-197 *
H2S	34.08	0 *
Ammonia	17.03	0 *
H2O	18.02	-1 *
Methane	16.04	-11 *
Ethane	30.07	-3 *
Propane	44.10	-6 *
i-Butane	58.12	-10 *
n-Butane	58.12	-5 *
CO	28.01	0 *
CO2	44.01	0 *
MIXED FEED*	140.9	0 *
LIGHT NAPHT*	80.97	40 *
HEAVY NAPHT*	80.97	30 *
LIGHT DIESE*	209.6	100 *
HEAVY DIESE*	142.0	100 *
KEROSINE*	173.1	7 *
DHT LT DIES*	178.5	0 *
UC OIL*	236.7	-356 *
DHT FEED*	179.6	245 *
DHT HY DIES*	204.7	0 *
MDEthnlAmine	119.2	0 *

Reaction: reactor 1-3

Component	Mole Weight	Stoichiometric Coeff.
Hydrogen	2.016	0 *
H2S	34.08	0 *
Ammonia	17.03	0 *
H2O	18.02	0 *

Conversion Reactor: reactor 1-2 (continued)

REACTION DETAILS

Reaction: reactor 1-3

Component	Mole Weight	Stoichiometric Coeff.
Methane	16.04	0 *
Ethane	30.07	-1 *
Propane	44.10	-0 *
i-Butane	58.12	-0 *
n-Butane	58.12	-0 *
CO	28.01	-0 *
CO2	44.01	0 *
MIXED FEED*	140.9	0 *
LIGHT NAPHT*	80.97	0 *
HEAVY NAPHT*	80.97	-0 *
LIGHT DIESE*	209.6	0 *
HEAVY DIESE*	142.0	0 *
KEROSINE*	173.1	0 *
DHT LT DIES*	178.5	-0 *
UC OIL*	236.7	0 *
DHT FEED*	179.6	-0 *
DHT HY DIES*	204.7	-0 *
MDEthnlAmine	119.2	0 *

REACTION RESULTS FOR : reactor 1

Extents

Name	Rank	Specified % Conversion	Use Default	Actual % Conversion	Base Component	Reaction Extent (kgmole/h)
reactor 1-1	0 *	99.90	Yes	99.90	MIXED FEED*	1.290e-006
reactor 1-2	1 *	99.90	Yes	9.990e-002	MIXED FEED*	2.698e-009
reactor 2-1	2 *	99.90	Yes	100.0	UC OIL*	4.815e-007
reactor 2-2	3 *	99.90	Yes	0.1974	UC OIL*	2.490e-009
reactor 1-3	4 *	99.90	Yes	8.343e-003	DHT FEED*	1.194

Balance

Components	Total Inflow (kgmole/h)	Total Reaction (kgmole/h)	Total Outflow (kgmole/h)
Hydrogen	1.194e+004	7.267e-002	1.194e+004
H2S	208.0	2.325e-003	208.0
Ammonia	25.10	3.092e-004	25.10
H2O	16.29	1.729e-005	16.29
Methane	517.9	6.708e-003	517.9
Ethane	106.6	-0.5969	106.0
Propane	110.9	-1.187e-002	110.8
i-Butane	93.34	-7.890e-004	93.34
n-Butane	55.35	-7.447e-004	55.35
CO	0.2708	-2.295e-006	0.2708
CO2	0.1266	3.640e-006	0.1266
MIXED FEED*	1.732e-003	-1.732e-003	1.732e-009
LIGHT NAPHT*	204.4	0.1210	204.5
HEAVY NAPHT*	240.9	-3.598e-003	240.9
LIGHT DIESE*	234.2	1.477e-003	234.2
DHT HY DIES*	432.7	-4.294e-003	432.6
KEROSINE*	108.1	6.253e-002	108.2
DHT LT DIES*	14.34	-1.165e-003	14.34

Conversion Reactor: reactor 1-2 (continued)

REACTION RESULTS FOR : reactor 1

Balance

Components	Total Inflow (kgmole/h)	Total Reaction (kgmole/h)	Total Outflow (kgmole/h)
UC OIL*	4.489e-004	-4.382e-004	1.075e-005
DHT FEED*	80.17	-6.526e-003	80.16
HEAVY DIESE*	59.58	1.315e-003	59.58
MDEthnlAmine	0.0000	0.0000	0.0000

Conversion Reactor: reactor 1-3

CONNECTIONS

Inlet Stream Connections

Stream Name	From Unit Operation	
r 1-3 inlet	Conversion Reactor	reactor 1-2
reactor 1-2 vapors	Conversion Reactor	reactor 1-2

Outlet Stream Connections

Stream Name	To Unit Operation
reactor 1-3 vapors	
reactor 1-3 outlet	

Energy Stream Connections

Stream Name	From Unit Operation
reactor 1-3 energy	

PARAMETERS

Physical Parameters		Optional Heat Transfer:	Heating
Delta P	Vessel Volume	Duty	Energy Stream
225.2 kPa	—	-2.140e+008 kJ/h	reactor 1-3 energy

User Variables

REACTION DETAILS

Reaction: reactor 1-1

Component	Mole Weight	Stoichiometric Coeff.
Hydrogen	2.016	2529 *
H2S	34.08	161 *
Ammonia	17.03	19 *
H2O	18.02	6 *
Methane	16.04	150 *
Ethane	30.07	47 *
Propane	44.10	50 *
i-Butane	58.12	42 *
n-Butane	58.12	28 *
CO	28.01	0 *
CO2	44.01	0 *
MIXED FEED*	140.9	-1341 *
LIGHT NAPHT*	80.97	108 *
HEAVY NAPHT*	80.97	157 *
LIGHT DIESE*	209.6	144 *
HEAVY DIESE*	142.0	0 *

Conversion Reactor: reactor 1-3 (continued)

REACTION DETAILS

Reaction: reactor 1-1

Component	Mole Weight	Stoichiometric Coeff.
KEROSINE*	173.1	28 *
DHT LT DIES*	178.5	0 *
UC OIL*	236.7	339 *
DHT FEED*	179.6	0 *
DHT HY DIES*	204.7	151 *
MDEthnlAmine	119.2	0 *

Reaction: reactor 1-2

Component	Mole Weight	Stoichiometric Coeff.
Hydrogen	2.016	1349 *
H2S	34.08	80 *
Ammonia	17.03	10 *
H2O	18.02	3 *
Methane	16.04	120 *
Ethane	30.07	26 *
Propane	44.10	28 *
i-Butane	58.12	23 *
n-Butane	58.12	15 *
CO	28.01	0 *
CO2	44.01	0 *
MIXED FEED*	140.9	-641 *
LIGHT NAPHT*	80.97	54 *
HEAVY NAPHT*	80.97	78 *
LIGHT DIESE*	209.6	67 *
HEAVY DIESE*	142.0	0 *
KEROSINE*	173.1	14 *
DHT LT DIES*	178.5	0 *
UC OIL*	236.7	170 *
DHT FEED*	179.6	0 *
DHT HY DIES*	204.7	54 *
MDEthnlAmine	119.2	0 *

Reaction: reactor 2-1

Component	Mole Weight	Stoichiometric Coeff.
Hydrogen	2.016	-521 *
H2S	34.08	-0 *
Ammonia	17.03	0 *
H2O	18.02	0 *
Methane	16.04	2 *
Ethane	30.07	2 *
Propane	44.10	16 *
i-Butane	58.12	38 *
n-Butane	58.12	17 *
CO	28.01	0 *
CO2	44.01	-0 *
MIXED FEED*	140.9	0 *
LIGHT NAPHT*	80.97	200 *
HEAVY NAPHT*	80.97	141 *
LIGHT DIESE*	209.6	200 *
HEAVY DIESE*	142.0	250 *
KEROSINE*	173.1	300 *
DHT LT DIES*	178.5	60 *

Conversion Reactor: reactor 1-3 (continued)

REACTION DETAILS

Reaction: reactor 2-1

Component	Mole Weight	Stoichiometric Coeff.
UC OIL*	236.7	-1840 *
DHT FEED*	179.6	336 *
DHT HY DIES*	204.7	1000 *
MDEthnlAmine	119.2	0 *

Reaction: reactor 2-2

Component	Mole Weight	Stoichiometric Coeff.
Hydrogen	2.016	-197 *
H2S	34.08	0 *
Ammonia	17.03	0 *
H2O	18.02	-1 *
Methane	16.04	-11 *
Ethane	30.07	-3 *
Propane	44.10	-6 *
i-Butane	58.12	-10 *
n-Butane	58.12	-5 *
CO	28.01	0 *
CO2	44.01	0 *
MIXED FEED*	140.9	0 *
LIGHT NAPHT*	80.97	40 *
HEAVY NAPHT*	80.97	30 *
LIGHT DIESE*	209.6	100 *
HEAVY DIESE*	142.0	100 *
KEROSINE*	173.1	7 *
DHT LT DIES*	178.5	0 *
UC OIL*	236.7	-356 *
DHT FEED*	179.6	245 *
DHT HY DIES*	204.7	0 *
MDEthnlAmine	119.2	0 *

Reaction: reactor 1-3

Component	Mole Weight	Stoichiometric Coeff.
Hydrogen	2.016	0 *
H2S	34.08	0 *
Ammonia	17.03	0 *
H2O	18.02	0 *
Methane	16.04	0 *
Ethane	30.07	-1 *
Propane	44.10	-0 *
i-Butane	58.12	-0 *
n-Butane	58.12	-0 *
CO	28.01	-0 *
CO2	44.01	0 *
MIXED FEED*	140.9	0 *
LIGHT NAPHT*	80.97	0 *
HEAVY NAPHT*	80.97	-0 *
LIGHT DIESE*	209.6	0 *
HEAVY DIESE*	142.0	0 *
KEROSINE*	173.1	0 *
DHT LT DIES*	178.5	-0 *
UC OIL*	236.7	0 *
DHT FEED*	179.6	-0 *

Conversion Reactor: reactor 1-3 (continued)

REACTION DETAILS

Reaction: reactor 1-3

Component	Mole Weight	Stoichiometric Coeff.
DHT HY DIES*	204.7	-0 *
MDEthnlAmine	119.2	0 *

REACTION RESULTS FOR : reactor 1

Extents

Name	Rank	Specified % Conversion	Use Default	Actual % Conversion	Base Component	Reaction Extent (kgmole/h)
reactor 1-1	0*	99.90	Yes	99.90	MIXED FEED*	1.290e-012
reactor 1-2	1*	99.90	Yes	9.990e-002	MIXED FEED*	2.698e-015
reactor 2-1	2*	99.90	Yes	99.90	UC OIL*	5.833e-009
reactor 2-2	3*	99.90	Yes	9.990e-002	UC OIL*	3.017e-011
reactor 1-3	4*	99.90	Yes	8.296e-003	DHT FEED*	11.187

Balance

Components	Total Inflow (kgmole/h)	Total Reaction (kgmole/h)	Total Outflow (kgmole/h)
Hydrogen	1.194e+004	6.926e-002	1.194e+004
H2S	208.0	2.105e-003	208.0
Ammonia	25.10	2.826e-004	25.10
H2O	16.29	9.498e-006	16.29
Methane	517.9	6.476e-003	518.0
Ethane	106.0	-0.5936	105.4
Propane	110.8	-1.187e-002	110.8
i-Butane	93.34	-8.569e-004	93.34
n-Butane	55.35	-7.846e-004	55.35
CO	0.2708	-2.374e-006	0.2708
CO2	0.1266	3.562e-006	0.1266
MIXED FEED*	1.732e-009	-1.732e-009	1.732e-015
LIGHT NAPHT*	204.5	0.1201	204.7
HEAVY NAPHT*	240.9	-3.847e-003	240.9
LIGHT DIESE*	234.2	1.188e-003	234.2
DHT HY DIES*	432.6	-4.937e-003	432.6
KEROSINE*	108.2	6.200e-002	108.2
DHT LT DIES*	14.34	-1.187e-003	14.34
UC OIL*	1.075e-005	-6.107e-008	1.068e-005
DHT FEED*	80.16	-6.649e-003	80.16
HEAVY DIESE*	59.58	1.189e-003	59.58
MDEthnlAmine	0.0000	0.0000	0.0000

Conversion Reactor: reactor 2-1

CONNECTIONS

Inlet Stream Connections

Stream Name	From Unit Operation
reactor 2-1 feed	

Outlet Stream Connections

Stream Name	To Unit Operation

Conversion Reactor: reactor 1-3 (continued)

REACTION DETAILS

Reaction: reactor 1-3

Component	Mole Weight	Stoichiometric Coeff.
DHT HY DIES*	204.7	-0 *
MDEthnlAmine	119.2	0 *

REACTION RESULTS FOR : reactor 1

Extents

Name	Rank	Specified % Conversion	Use Default	Actual % Conversion	Base Component	Reaction Extent (kgmole/h)
reactor 1-1	0 *	99.90	Yes	99.90	MIXED FEED*	1.290e-012
reactor 1-2	1 *	99.90	Yes	9.990e-002	MIXED FEED*	2.698e-015
reactor 2-1	2 *	99.90	Yes	99.90	UC OIL*	5.833e-009
reactor 2-2	3 *	99.90	Yes	9.990e-002	UC OIL*	3.017e-011
reactor 1-3	4 *	99.90	Yes	8.296e-003	DHT FEED*	1.187

Balance

Components	Total Inflow (kgmole/h)	Total Reaction (kgmole/h)	Total Outflow (kgmole/h)
Hydrogen	1.194e+004	6.926e-002	1.194e+004
H2S	208.0	2.105e-003	208.0
Ammonia	25.10	2.826e-004	25.10
H2O	16.29	9.498e-006	16.29
Methane	517.9	6.476e-003	518.0
Ethane	106.0	-0.5936	105.4
Propane	110.8	-1.187e-002	110.8
i-Butane	93.34	-8.569e-004	93.34
n-Butane	55.35	-7.846e-004	55.35
CO	0.2708	-2.374e-006	0.2708
CO2	0.1266	3.562e-006	0.1266
MIXED FEED*	1.732e-009	-1.732e-009	1.732e-015
LIGHT NAPHT*	204.5	0.1201	204.7
HEAVY NAPHT*	240.9	-3.847e-003	240.9
LIGHT DIESE*	234.2	1.188e-003	234.2
DHT HY DIES*	432.6	-4.937e-003	432.6
KEROSINE*	108.2	6.200e-002	108.2
DHT LT DIES*	14.34	-1.187e-003	14.34
UC OIL*	1.075e-005	-6.107e-008	1.068e-005
DHT FEED*	80.16	-6.649e-003	80.16
HEAVY DIESE*	59.58	1.189e-003	59.58
MDEthnlAmine	0.0000	0.0000	0.0000

Conversion Reactor: reactor 2-1

CONNECTIONS

Inlet Stream Connections

Stream Name	From Unit Operation
reactor 2-1 feed	

Outlet Stream Connections

Stream Name	To Unit Operation

Conversion Reactor: reactor 2-1 (continued)

CONNECTIONS

reactor 2-1 vapors	Conversion Reactor:	reactor 2-2
reactor 2-2 inlet	Conversion Reactor:	reactor 2-2

Energy Stream Connections

Stream Name	From Unit Operation
reactor 2-1 energy	

PARAMETERS

Physical Parameters		Optional Heat Transfer:	Heating
Delta P	Vessel Volume	Duty	Energy Stream
1.789e+004 kPa	—	8.583e+007 kJ/h	reactor 2-1 energy

User Variables

REACTION DETAILS

Reaction: reactor 1-1

Component	Mole Weight	Stoichiometric Coeff.
Hydrogen	2.016	2529 *
H2S	34.08	161 *
Ammonia	17.03	19 *
H2O	18.02	6 *
Methane	16.04	150 *
Ethane	30.07	47 *
Propane	44.10	50 *
i-Butane	58.12	42 *
n-Butane	58.12	28 *
CO	28.01	0 *
CO2	44.01	0 *
MIXED FEED*	140.9	-1341 *
LIGHT NAPHT*	80.97	108 *
HEAVY NAPHT*	80.97	157 *
LIGHT DIESE*	209.6	144 *
HEAVY DIESE*	142.0	0 *
KEROSINE*	173.1	28 *
DHT LT DIES*	178.5	0 *
UC OIL*	236.7	339 *
DHT FEED*	179.6	0 *
DHT HY DIES*	204.7	151 *
MDEthnlAmine	119.2	0 *

Reaction: reactor 1-2

Component	Mole Weight	Stoichiometric Coeff.
Hydrogen	2.016	1349 *
H2S	34.08	80 *
Ammonia	17.03	10 *
H2O	18.02	3 *
Methane	16.04	120 *
Ethane	30.07	26 *
Propane	44.10	28 *
i-Butane	58.12	23 *
n-Butane	58.12	15 *
CO	28.01	0 *
CO2	44.01	0 *
MIXED FEED*	140.9	-641 *

Conversion Reactor: reactor 2-1 (continued)

REACTION DETAILS

Reaction: reactor 1-2

Component	Mole Weight	Stoichiometric Coeff.
LIGHT NAPHT*	80.97	54 *
HEAVY NAPHT*	80.97	78 *
LIGHT DIESE*	209.6	67 *
HEAVY DIESE*	142.0	0 *
KEROSINE*	173.1	14 *
DHT LT DIES*	178.5	0 *
UC OIL*	236.7	170 *
DHT FEED*	179.6	0 *
DHT HY DIES*	204.7	54 *
MDEthnlAmine	119.2	0 *

Reaction: reactor 2-1

Component	Mole Weight	Stoichiometric Coeff.
Hydrogen	2.016	-521 *
H2S	34.08	-0 *
Ammonia	17.03	0 *
H2O	18.02	0 *
Methane	16.04	2 *
Ethane	30.07	2 *
Propane	44.10	16 *
i-Butane	58.12	38 *
n-Butane	58.12	17 *
CO	28.01	0 *
CO2	44.01	-0 *
MIXED FEED*	140.9	0 *
LIGHT NAPHT*	80.97	200 *
HEAVY NAPHT*	80.97	141 *
LIGHT DIESE*	209.6	200 *
HEAVY DIESE*	142.0	250 *
KEROSINE*	173.1	300 *
DHT LT DIES*	178.5	60 *
UC OIL*	236.7	-1840 *
DHT FEED*	179.6	336 *
DHT HY DIES*	204.7	1000 *
MDEthnlAmine	119.2	0 *

Reaction: reactor 2-2

Component	Mole Weight	Stoichiometric Coeff.
Hydrogen	2.016	-197 *
H2S	34.08	0 *
Ammonia	17.03	0 *
H2O	18.02	-1 *
Methane	16.04	-11 *
Ethane	30.07	-3 *
Propane	44.10	-6 *
i-Butane	58.12	-10 *
n-Butane	58.12	-5 *
CO	28.01	0 *
CO2	44.01	0 *
MIXED FEED*	140.9	0 *
LIGHT NAPHT*	80.97	40 *
HEAVY NAPHT*	80.97	30 *

Conversion Reactor: reactor 2-1 (continued)

REACTION DETAILS

Reaction: reactor 2-2

Component	Mole Weight	Stoichiometric Coeff.
LIGHT DIESE*	209.6	100 *
HEAVY DIESE*	142.0	100 *
KEROSINE*	173.1	7 *
DHT LT DIES*	178.5	0 *
UC OIL*	236.7	-356 *
DHT FEED*	179.6	245 *
DHT HY DIES*	204.7	0 *
MDEthnlAmine	119.2	0 *

Reaction: reactor 1-3

Component	Mole Weight	Stoichiometric Coeff.
Hydrogen	2.016	0 *
H2S	34.08	0 *
Ammonia	17.03	0 *
H2O	18.02	0 *
Methane	16.04	0 *
Ethane	30.07	-1 *
Propane	44.10	-0 *
i-Butane	58.12	-0 *
n-Butane	58.12	-0 *
CO	28.01	-0 *
CO2	44.01	0 *
MIXED FEED*	140.9	0 *
LIGHT NAPHT*	80.97	0 *
HEAVY NAPHT*	80.97	-0 *
LIGHT DIESE*	209.6	0 *
HEAVY DIESE*	142.0	0 *
KEROSINE*	173.1	0 *
DHT LT DIES*	178.5	-0 *
UC OIL*	236.7	0 *
DHT FEED*	179.6	-0 *
DHT HY DIES*	204.7	-0 *
MDEthnlAmine	119.2	0 *

REACTION RESULTS FOR : reactor 1

Extents

Name	Rank	Specified % Conversion	Use Default	Actual % Conversion	Base Component	Reaction Extent (kgmole/h)
reactor 1-1	0 *	99.90	Yes	—	MIXED FEED*	0.0000
reactor 1-2	1 *	99.90	Yes	—	MIXED FEED*	0.0000
reactor 2-1	2 *	99.90	Yes	99.90	UC OIL*	1.147e-005
reactor 2-2	3 *	99.90	Yes	9.990e-002	UC OIL*	5.930e-008
reactor 1-3	4 *	99.90	Yes	—	DHT FEED*	0.3625

Balance

Components	Total Inflow (kgmole/h)	Total Reaction (kgmole/h)	Total Outflow (kgmole/h)
Hydrogen	6171	1.517e-002	6171
H2S	2.935e-002	6.426e-004	2.999e-002
Ammonia	0.0000	8.628e-005	8.628e-005

Conversion Reactor: reactor 2-1 (continued)

REACTION RESULTS FOR : reactor 1

Balance

Components	Total Inflow (kgmole/h)	Total Reaction (kgmole/h)	Total Outflow (kgmole/h)
H2O	5.995	2.867e-006	5.995
Methane	227.1	2.003e-003	227.1
Ethane	32.36	-0.1812	32.18
Propane	29.48	-3.439e-003	29.48
i-Butane	20.80	1.736e-004	20.80
n-Butane	10.62	-4.089e-005	10.62
CO	0.1071	-7.251e-007	0.1071
CO2	4.544e-002	1.077e-006	4.545e-002
MIXED FEED*	0.0000	0.0000	0.0000
LIGHT NAPHT*	0.0000	3.898e-002	3.898e-002
HEAVY NAPHT*	12.40	4.441e-004	12.40
LIGHT DIESE*	1.183	2.662e-003	1.186
DHT HY DIES*	0.1026	9.956e-003	0.1126
KEROSINE*	6.933e-002	2.237e-002	9.170e-002
DHT LT DIES*	64.88	3.254e-004	64.88
UC OIL*	2.112e-002	-2.112e-002	3.284e-006
DHT FEED*	0.0000	1.835e-003	1.835e-003
HEAVY DIESE*	1215	3.235e-003	1215
MDEthnlAmine	0.0000	0.0000	0.0000

Conversion Reactor: reactor 2-2

CONNECTIONS

Inlet Stream Connections

Stream Name	From Unit Operation	
reactor 2-2 inlet	Conversion Reactor	reactor 2-1
reactor 2-1 vapors	Conversion Reactor	reactor 2-1

Outlet Stream Connections

Stream Name	To Unit Operation
reactor 2-2 vapors	
reactor 2-2 out	

Energy Stream Connections

Stream Name	From Unit Operation
reactor 2-2 energy	

PARAMETERS

Physical Parameters		Optional Heat Transfer: Heating	
Delta P	Vessel Volume	Duty	Energy Stream
-1.271e+005 kPa	—	4.586e+007 kJ/h	reactor 2-2 energy

User Variables

REACTION DETAILS

Reaction: reactor 1-1

Component	Mole Weight	Stoichiometric Coeff.
Hydrogen	2.016	2529 *

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* Specified by user.

Conversion Reactor: reactor 2-2 (continued)

REACTION DETAILS

Reaction: reactor 1-1

Component	Mole Weight	Stoichiometric Coeff.
H2S	34.08	161 *
Ammonia	17.03	19 *
H2O	18.02	6 *
Methane	16.04	150 *
Ethane	30.07	47 *
Propane	44.10	50 *
i-Butane	58.12	42 *
n-Butane	58.12	28 *
CO	28.01	0 *
CO2	44.01	0 *
MIXED FEED*	140.9	-1341 *
LIGHT NAPHT*	80.97	108 *
HEAVY NAPHT*	80.97	157 *
LIGHT DIESE*	209.6	144 *
HEAVY DIESE*	142.0	0 *
KEROSINE*	173.1	28 *
DHT LT DIES*	178.5	0 *
UC OIL*	236.7	339 *
DHT FEED*	179.6	0 *
DHT HY DIES*	204.7	151 *
MDEthnlAmine	119.2	0 *

Reaction: reactor 1-2

Component	Mole Weight	Stoichiometric Coeff.
Hydrogen	2.016	1349 *
H2S	34.08	80 *
Ammonia	17.03	10 *
H2O	18.02	3 *
Methane	16.04	120 *
Ethane	30.07	26 *
Propane	44.10	28 *
i-Butane	58.12	23 *
n-Butane	58.12	15 *
CO	28.01	0 *
CO2	44.01	0 *
MIXED FEED*	140.9	-641 *
LIGHT NAPHT*	80.97	54 *
HEAVY NAPHT*	80.97	78 *
LIGHT DIESE*	209.6	67 *
HEAVY DIESE*	142.0	0 *
KEROSINE*	173.1	14 *
DHT LT DIES*	178.5	0 *
UC OIL*	236.7	170 *
DHT FEED*	179.6	0 *
DHT HY DIES*	204.7	54 *
MDEthnlAmine	119.2	0 *

Reaction: reactor 2-1

Component	Mole Weight	Stoichiometric Coeff.
Hydrogen	2.016	-521 *
H2S	34.08	-0 *
Ammonia	17.03	0 *

Conversion Reactor: reactor 2-2 (continued)

REACTION DETAILS

Reaction: reactor 2-1

Component	Mole Weight	Stoichiometric Coeff.
H2O	18.02	0 *
Methane	16.04	2 *
Ethane	30.07	2 *
Propane	44.10	16 *
i-Butane	58.12	38 *
n-Butane	58.12	17 *
CO	28.01	0 *
CO2	44.01	-0 *
MIXED FEED*	140.9	0 *
LIGHT NAPHT*	80.97	200 *
HEAVY NAPHT*	80.97	141 *
LIGHT DIESE*	209.6	200 *
HEAVY DIESE*	142.0	250 *
KEROSINE*	173.1	300 *
DHT LT DIES*	178.5	60 *
UC OIL*	236.7	-1840 *
DHT FEED*	179.6	336 *
DHT HY DIES*	204.7	1000 *
MDEthnlAmine	119.2	0 *

Reaction: reactor 2-2

Component	Mole Weight	Stoichiometric Coeff.
Hydrogen	2.016	-197 *
H2S	34.08	0 *
Ammonia	17.03	0 *
H2O	18.02	-1 *
Methane	16.04	-11 *
Ethane	30.07	-3 *
Propane	44.10	-6 *
i-Butane	58.12	-10 *
n-Butane	58.12	-5 *
CO	28.01	0 *
CO2	44.01	0 *
MIXED FEED*	140.9	0 *
LIGHT NAPHT*	80.97	40 *
HEAVY NAPHT*	80.97	30 *
LIGHT DIESE*	209.6	100 *
HEAVY DIESE*	142.0	100 *
KEROSINE*	173.1	7 *
DHT LT DIES*	178.5	0 *
UC OIL*	236.7	-356 *
DHT FEED*	179.6	245 *
DHT HY DIES*	204.7	0 *
MDEthnlAmine	119.2	0 *

Reaction: reactor 1-3

Component	Mole Weight	Stoichiometric Coeff.
Hydrogen	2.016	0 *
H2S	34.08	0 *
Ammonia	17.03	0 *
H2O	18.02	0 *
Methane	16.04	0 *

Conversion Reactor: reactor 2-2 (continued)

REACTION DETAILS

Reaction: reactor 1-3

Component	Mole Weight	Stoichiometric Coeff.
Ethane	30.07	-1 *
Propane	44.10	-0 *
i-Butane	58.12	-0 *
n-Butane	58.12	-0 *
CO	28.01	-0 *
CO2	44.01	0 *
MIXED FEED*	140.9	0 *
LIGHT NAPHT*	80.97	0 *
HEAVY NAPHT*	80.97	-0 *
LIGHT DIESE*	209.6	0 *
HEAVY DIESE*	142.0	0 *
KEROSINE*	173.1	0 *
DHT LT DIES*	178.5	-0 *
UC OIL*	236.7	0 *
DHT FEED*	179.6	-0 *
DHT HY DIES*	204.7	-0 *
MDEthnlAmine	119.2	0 *

REACTION RESULTS FOR : reactor 1

Extents

Name	Rank	Specified % Conversion	Use Default	Actual % Conversion	Base Component	Reaction Extent (kgmole/h)
reactor 1-1	0 *	99.90	Yes	—	MIXED FEED*	—
reactor 1-2	1 *	99.90	Yes	—	MIXED FEED*	—
reactor 2-1	2 *	99.90	Yes	—	UC OIL*	—
reactor 2-2	3 *	99.90	Yes	—	UC OIL*	—
reactor 1-3	4 *	99.90	Yes	—	DHT FEED*	—

Balance

Components	Total Inflow (kgmole/h)	Total Reaction (kgmole/h)	Total Outflow (kgmole/h)
Hydrogen	—	—	—
H2S	—	—	—
Ammonia	—	—	—
H2O	—	—	—
Methane	—	—	—
Ethane	—	—	—
Propane	—	—	—
i-Butane	—	—	—
n-Butane	—	—	—
CO	—	—	—
CO2	—	—	—
MIXED FEED*	—	—	—
LIGHT NAPHT*	—	—	—
HEAVY NAPHT*	—	—	—
LIGHT DIESE*	—	—	—
DHT HY DIES*	—	—	—
KEROSINE*	—	—	—
DHT LT DIES*	—	—	—
UC OIL*	—	—	—

Conversion Reactor: reactor 2-2 (continued)

REACTION RESULTS FOR : reactor 1

Balance

Components	Total Inflow (kgmole/h)	Total Reaction (kgmole/h)	Total Outflow (kgmole/h)
DHT FEED*	—	—	—
HEAVY DIESE*	—	—	—
MDEthnlAmine	—	—	—

University Of Petroleum And Energy
UPES,
Bidholi,
Dehradun,
Uttarakhand

Case Name: D:\RAKI\SIMULATION\SIRI SIMULATION\SIRI 1.HSC

Unit Set: SI

Date/Time: Thu Apr 23 15:14:17 2009

Stream: reactor 1-1 vapors

Boiling Point Curves: reactor 1-1 vapors

BOILING POINT CURVES

Basis	Stream
Liquid Volume	reactor 1-1 vapors

RESULTS

BP Curves Results

Cut Point (%)	TBP (C)	ASTM D86 (C)	D86 Crack Reduced (C)	ASTM D1160(Vac) (C)	ASTM D1160(Atm) (C)	ASTM D2887 (C)
0.00	-313.74	-259.20	-259.20	-287.04	-293.54	-267.98
1.00	-311.06	-257.52	-257.52	-285.82	-291.74	-233.68
2.00	-308.38	-255.83	-255.83	-284.59	-289.94	-232.33
3.50	-304.36	-253.30	-253.30	-282.76	-287.25	-230.30
5.00	-300.34	-250.77	-250.77	-280.93	-284.55	-228.28
7.50	-293.64	-246.55	-246.55	-277.87	-280.07	-224.92
10.00	-286.94	-242.33	-242.33	-274.82	-275.59	-221.48
12.50	-280.24	-238.11	-238.11	-271.76	-271.12	-217.38
15.00	-273.54	-233.89	-233.89	-268.71	-266.66	-213.18
17.50	-266.84	-229.67	-229.67	-265.65	-262.20	-208.99
20.00	-260.14	-225.45	-225.45	-262.60	-257.75	-204.79
25.00	-246.74	-215.94	-215.94	-254.83	-246.46	-192.53
30.00	-233.34	-205.04	-205.04	-244.92	-232.12	-142.98
32.50	-219.94	-194.13	-194.13	-235.02	-217.86	-84.70
40.00	-206.54	-183.23	-183.23	-225.11	-203.66	-28.42
45.00	-200.44	-178.46	-178.46	-220.38	-196.90	23.47
50.00	-87.33	-81.79	-81.79	-142.15	-87.28	74.36
55.00	3.98	-2.42	-2.42	-75.56	2.93	126.98
60.00	55.00	43.36	43.36	-36.18	55.00	172.26
65.00	162.95	137.78	137.78	47.78	162.98	193.52
70.00	195.31	165.55	165.55	73.54	195.32	203.97
75.00	211.50	179.31	179.31	86.55	211.50	213.95
80.00	224.32	190.12	190.12	96.91	224.33	216.43
85.00	229.97	194.85	194.85	101.49	229.97	218.77
90.00	231.94	196.49	196.49	103.08	231.94	224.58
92.50	233.64	197.92	197.92	104.46	233.63	228.58
95.00	233.95	198.18	198.18	104.72	233.95	232.48
96.50	234.49	198.62	198.62	105.15	234.49	234.81
98.00	235.08	199.11	199.11	105.63	235.08	237.22
99.00	235.26	199.26	199.26	105.78	235.26	238.89
100.00	235.86	199.76	199.76	106.27	235.86	240.63

CRITICAL PROPERTIES

Cut Point (%)	Critical Temperature (C)	Critical Pressure (kPa)	Acentricity Factor	Molecular Weight	Liquid Density (kg/m3)
0.00	-339.22	810.04	-2.5991	-346.916	-13491.48
1.00	-334.85	823.92	-0.3238	-22.839	-627.67
2.00	-330.49	838.28	-0.3145	-21.699	-595.70
3.50	-323.95	860.78	-0.3005	-19.990	-547.74
5.00	-317.41	884.53	-0.2865	-18.281	-499.77
7.50	-306.50	927.15	-0.2631	-15.433	-419.83
10.00	-295.60	974.09	-0.2398	-12.584	-339.89
12.50	-284.70	1026.04	-0.2164	-9.736	-259.95
15.00	-273.79	1083.85	-0.1931	-6.888	-180.02
17.50	-262.89	1148.55	-0.1697	-4.039	-100.08
20.00	-251.99	1221.47	-0.1464	-1.191	-20.14

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* Specified by user.

Stream: reactor 1-1 vapors (continue

Boiling Point Curves: reactor 1-1 vapors (contir

Cut Point (%)	Critical Temperature (C)	Critical Pressure (kPa)	Acentricity Factor	Molecular Weight	Liquid Density (kg/m3)
25.00	-230.18	1399.13	-0.0997	4.506	139.74
30.00	-208.37	1637.27	-0.0530	10.203	299.62
35.00	-174.84	1670.74	-0.0063	15.900	459.50
40.00	-164.76	2121.47	0.0404	21.597	619.37
45.00	-154.99	3238.33	0.0871	27.293	779.25
50.00	32.06	5247.60	0.1181	32.046	431.71
55.00	162.71	3716.98	0.2057	59.970	567.97
60.00	262.53	3136.24	0.2577	80.974	473.53
65.00	526.91	1670.96	0.3823	139.869	802.98
70.00	432.24	1763.28	0.5180	177.935	685.11
75.00	472.85	4263.77	0.5475	186.789	715.82
80.00	470.54	1874.55	0.5729	198.516	694.42
85.00	470.00	1657.32	0.5841	205.785	688.43
90.00	470.00	1657.32	0.5881	207.660	687.15
92.50	470.00	1657.32	0.5900	208.598	686.51
95.00	470.00	1657.32	0.5920	209.536	685.87
96.50	470.00	1657.32	0.5932	210.098	685.48
98.00	470.00	1657.32	0.5943	210.661	685.10
99.00	470.00	1657.32	0.5951	211.036	684.84
100.00	470.00	1657.32	0.5959	211.411	684.58

COLD PROPERTIES

True VP at 37.8 C	(kPa)	—	Cetane Index		—
Reid VP at 37.8 C	(kPa)	—	Research Octane Number		—
ASTM D93 Flash Point	(C)	—	Viscosity at 37.8 C	(cP)	—
ASTM D97 Pour Point	(C)	—	Viscosity at 97.8 C	(cP)	—
Refractive Index		—			

P:N:A

Paraffins [mol%]	33.3333	Naphthas [mol%]	33.3333	Aromatics [mol%]	33.3333

Stream: reactor 1-2 vapors

Boiling Point Curves: reactor 1-2 vapors

BOILING POINT CURVES

Basis	Stream
Liquid Volume	reactor 1-2 vapors

RESULTS

BP Curves Results

Cut Point (%)	TBP (C)	ASTM D86 (C)	D86 Crack Reduced (C)	ASTM D1160(Vac) (C)	ASTM D1160(Atm) (C)	ASTM D2887 (C)
0.00	-313.74	-259.20	-259.20	-287.04	-293.54	-267.98
1.00	-311.06	-257.51	-257.51	-285.82	-291.74	-233.65
2.00	-308.38	-255.82	-255.82	-284.59	-289.94	-232.29
3.50	-304.36	-253.29	-253.29	-282.76	-287.25	-230.25
5.00	-300.34	-250.76	-250.76	-280.93	-284.55	-228.22
7.50	-293.64	-246.54	-246.54	-277.87	-280.07	-224.84
10.00	-286.94	-242.32	-242.32	-274.82	-275.59	-221.39
12.50	-280.24	-238.10	-238.10	-271.76	-271.12	-217.25
15.00	-273.54	-233.88	-233.88	-268.71	-266.66	-213.03
17.50	-266.84	-229.66	-229.66	-265.65	-262.20	-208.82
20.00	-260.14	-225.45	-225.45	-262.60	-257.75	-204.61

Streamactor 1-2 vapors (continue

Boiling Point Curves: reactor 1-2 vapors (contir

BP Curves Results

Cut Point (%)	TBP (C)	ASTM D86 (C)	D86 Crack Reduced (C)	ASTM D1160(Vac) (C)	ASTM D1160(Atm) (C)	ASTM D2887 (C)
25.00	-246.74	-215.93	-215.93	-254.83	-246.46	-191.44
30.00	-233.34	-205.03	-205.03	-244.93	-232.13	-141.68
35.00	-219.94	-194.13	-194.13	-235.02	-217.86	-83.35
40.00	-206.54	-183.22	-183.22	-225.11	-203.66	-27.32
45.00	-200.46	-178.47	-178.47	-220.39	-196.92	24.44
50.00	-87.30	-81.75	-81.75	-142.12	-87.24	75.29
55.00	4.06	-2.35	-2.35	-75.51	2.99	127.75
60.00	55.00	43.37	43.37	-36.18	55.00	172.81
65.00	144.65	121.74	121.74	25.24	134.40	193.66
70.00	195.31	165.56	165.56	73.55	195.32	204.09
75.00	211.50	179.32	179.32	86.55	211.51	213.98
80.00	224.33	190.12	190.12	96.91	224.33	216.45
85.00	229.97	194.86	194.86	101.49	229.97	218.79
90.00	231.94	196.50	196.50	103.08	231.94	224.61
92.50	233.64	197.93	197.93	104.46	233.63	228.60
95.00	233.95	198.18	198.18	104.72	233.95	232.50
96.50	234.49	198.63	198.63	105.15	234.49	234.82
98.00	235.08	199.12	199.12	105.63	235.08	237.23
99.00	235.26	199.27	199.27	105.78	235.26	238.90
100.00	235.86	199.77	199.77	106.27	235.86	240.64

CRITICAL PROPERTIES

Cut Point (%)	Critical Temperature (C)	Critical Pressure (kPa)	Acentricity Factor	Molecular Weight	Liquid Density (kg/m3)
0.00	-321.83	1315.39	-2.5991	-346.914	-13491.39
1.00	-317.85	1333.63	-0.3238	-22.839	-627.68
2.00	-313.87	1352.38	-0.3145	-21.700	-595.70
3.50	-307.90	1381.52	-0.3005	-19.991	-547.74
5.00	-301.93	1411.94	-0.2865	-18.282	-499.78
7.50	-291.97	1465.73	-0.2631	-15.433	-419.84
10.00	-282.02	1523.78	-0.2398	-12.585	-339.90
12.50	-272.07	1586.62	-0.2164	-9.737	-259.97
15.00	-262.12	1654.86	-0.1931	-6.888	-180.03
17.50	-252.17	1819.00	-0.1697	-4.040	-100.09
20.00	-242.22	1876.61	-0.1464	-1.192	-20.16
25.00	-222.32	1998.75	-0.0997	4.505	139.71
30.00	-202.42	2230.50	-0.0530	10.202	299.59
35.00	-172.61	2523.05	-0.0063	15.898	459.46
40.00	-162.61	2903.92	0.0404	21.595	619.33
45.00	-154.99	3256.13	0.0871	27.292	779.21
50.00	32.06	5256.38	0.1186	32.094	433.49
55.00	162.89	3715.64	0.2058	60.002	567.71
60.00	262.46	3136.64	0.2577	80.974	473.75
65.00	499.62	1353.65	0.3495	126.198	761.04
70.00	432.29	1763.01	0.5180	177.936	685.14
75.00	472.85	4263.30	0.5475	186.790	715.81
80.00	470.54	1874.49	0.5729	198.518	694.42
85.00	470.00	1657.32	0.5841	205.785	688.43
90.00	470.00	1657.32	0.5881	207.660	687.15
92.50	470.00	1657.32	0.5900	208.598	686.51
95.00	470.00	1657.32	0.5920	209.536	685.87
96.50	470.00	1657.32	0.5932	210.098	685.48

Stream: reactor 1-2 vapors (continue

Boiling Point Curves: reactor 1-2 vapors (contir

Cut Point (%)	Critical Temperature (C)	Critical Pressure (kPa)	Acentricity Factor	Molecular Weight	Liquid Density (kg/m3)
98.00	470.00	1657.32	0.5943	210.661	685.10
99.00	470.00	1657.32	0.5951	211.036	684.84
100.00	470.00	1657.32	0.5959	211.411	684.58

COLD PROPERTIES

True VP at 37.8 C	(kPa)	—	Cetane Index		—
Reid VP at 37.8 C	(kPa)	—	Research Octane Number		—
ASTM D93 Flash Point	(C)	—	Viscosity at 37.8 C	(cP)	—
ASTM D97 Pour Point	(C)	—	Viscosity at 97.8 C	(cP)	—
Refractive Index		—			

P:N:A

Paraffins [mol%]	33.3333	Naphthas [mol%]	33.3333	Aromatics [mol%]	33.3333

Stream: reactor 1-3 vapors

Boiling Point Curves: reactor 1-3 vapors

BOILING POINT CURVES

Basis	Stream
Liquid Volume	reactor 1-3 vapors

RESULTS

BP Curves Results

Cut Point (%)	TBP (C)	ASTM D86 (C)	D86 Crack Reduced (C)	ASTM D1160(Vac) (C)	ASTM D1160(Atm) (C)	ASTM D2887 (C)
0.00	-313.74	-273.68	-273.68	-286.02	-292.04	-273.68
1.00	-311.93	-272.65	-272.65	-285.11	-290.70	-257.86
2.00	-310.12	-271.61	-271.61	-284.20	-289.36	-256.93
3.50	-307.41	-270.06	-270.06	-282.83	-287.35	-255.54
5.00	-304.69	-268.51	-268.51	-281.46	-285.34	-254.15
7.50	-300.17	-265.92	-265.92	-279.19	-282.00	-251.85
10.00	-295.65	-263.33	-263.33	-276.91	-278.66	-249.54
12.50	-291.12	-260.74	-260.74	-274.63	-275.32	-247.20
15.00	-286.60	-258.16	-258.16	-272.35	-271.99	-244.83
17.50	-282.08	-255.57	-255.57	-270.08	-268.66	-242.40
20.00	-277.55	-252.98	-252.98	-267.80	-265.33	-239.89
25.00	-268.51	-247.80	-247.80	-263.24	-258.69	-234.51
30.00	-259.46	-242.63	-242.63	-258.69	-252.06	-228.34
35.00	-250.41	-236.99	-236.99	-253.85	-245.04	-220.88
40.00	-241.37	-229.91	-229.91	-248.13	-236.76	-213.25
45.00	-232.32	-222.82	-222.82	-242.41	-228.50	-206.68
50.00	-223.27	-215.73	-215.73	-236.69	-220.26	-201.23
55.00	-214.23	-208.64	-208.64	-230.97	-212.04	-194.49
60.00	-205.18	-201.55	-201.55	-225.25	-203.85	-183.03
65.00	-196.14	-194.47	-194.47	-219.52	-195.67	-169.44
70.00	-165.46	-166.57	-166.57	-198.25	-165.48	-144.18
75.00	-70.45	-81.39	-81.39	-129.87	-70.44	-68.05
80.00	-3.50	-20.60	-20.60	-79.29	-2.05	4.41
85.00	55.00	32.10	32.10	-36.18	55.00	44.28
90.00	94.17	60.24	60.24	4.57	107.93	100.49
92.50	179.96	119.18	119.18	61.24	179.92	148.34
95.00	203.01	131.00	131.00	79.71	203.01	182.25
96.50	214.59	134.77	134.77	89.06	214.61	192.10

Stream: reactor 1-3 vapors (continue

Boiling Point Curves: reactor 1-3 vapors (contir

BP Curves Results

Cut Point (%)	TBP (C)	ASTM D86 (C)	D86 Crack Reduced (C)	ASTM D1160(Vac) (C)	ASTM D1160(Atm) (C)	ASTM D2887 (C)
98.00	229.11	141.35	141.35	100.79	229.11	196.42
99.00	230.47	141.82	141.82	101.89	230.47	197.09
100.00	231.83	142.30	142.30	103.00	231.83	197.76

CRITICAL PROPERTIES

Cut Point (%)	Critical Temperature (C)	Critical Pressure (kPa)	Acentricity Factor	Molecular Weight	Liquid Density (kg/m3)
0.00	-321.83	1315.39	-2.6322	-351.767	-13693.32
1.00	-319.14	1327.65	-0.3269	-23.209	-638.06
2.00	-316.45	1340.14	-0.3206	-22.440	-616.48
3.50	-312.42	1359.32	-0.3111	-21.286	-584.10
5.00	-308.39	1379.05	-0.3016	-20.132	-551.72
7.50	-301.67	1413.25	-0.2859	-18.209	-497.75
10.00	-294.96	1449.19	-0.2701	-16.286	-443.78
12.50	-288.24	1487.00	-0.2544	-14.363	-389.82
15.00	-281.52	1526.84	-0.2386	-12.440	-335.85
17.50	-274.80	1568.88	-0.2228	-10.517	-281.88
20.00	-268.08	1613.29	-0.2071	-8.594	-227.91
25.00	-254.65	1710.12	-0.1755	-4.748	-119.98
30.00	-241.21	1882.50	-0.1440	-0.903	-12.05
35.00	-227.78	1943.39	-0.1125	2.943	95.89
40.00	-214.34	2085.64	-0.0810	6.789	203.82
45.00	-200.90	2250.36	-0.0494	10.635	311.75
50.00	-187.47	2443.33	-0.0179	14.481	419.69
55.00	-174.03	2672.49	0.0136	18.327	527.62
60.00	-164.41	2949.09	0.0451	22.173	635.55
65.00	-147.16	3289.56	0.0767	26.019	743.49
70.00	-89.43	4486.17	0.0197	17.247	349.72
75.00	62.22	8026.62	0.1679	39.540	808.72
80.00	145.92	3755.65	0.1965	58.124	577.55
85.00	272.11	3074.35	0.2577	80.974	438.27
90.00	358.32	1950.73	0.2984	103.768	693.34
92.50	392.30	2052.56	0.4720	168.752	663.69
95.00	473.08	3514.73	0.5308	179.230	720.18
96.50	471.62	3128.78	0.5540	193.525	704.97
98.00	470.00	1657.32	0.5832	205.357	688.72
99.00	470.00	1657.32	0.5895	209.387	686.66
100.00	470.00	1657.32	0.5959	211.390	684.60

COLD PROPERTIES

True VP at 37.8 C	(kPa)	—	Cetane Index		—
Reid VP at 37.8 C	(kPa)	—	Research Octane Number		—
ASTM D93 Flash Point	(C)	—	Viscosity at 37.8 C	(cP)	—
ASTM D97 Pour Point	(C)	—	Viscosity at 97.8 C	(cP)	—
Refractive Index		—			

P:N:A

Paraffins [mol%]	33.3333	Naphthas [mol%]	33.3333	Aromatics [mol%]	33.3333

Stream: reactor 2-1 vapors

Boiling Point Curves: reactor 2-1 vapors

BOILING POINT CURVES

BOILING POINT CURVES

Basis	Stream
Liquid Volume	reactor 2-1 vapors

RESULTS

BP Curves Results

Cut Point (%)	TBP (C)	ASTM D86 (C)	D86 Crack Reduced (C)	ASTM D1160(Vac) (C)	ASTM D1160(Atm) (C)	ASTM D2887 (C)
0.00	-313.74	-228.73	-228.73	-286.35	-292.53	-252.12
1.00	-310.81	-226.85	-226.85	-285.06	-290.63	-248.44
2.00	-307.88	-224.98	-224.98	-283.77	-288.72	-247.99
3.50	-303.49	-222.17	-222.17	-281.82	-285.87	-247.31
5.00	-299.09	-219.36	-219.36	-279.88	-283.02	-246.65
7.50	-291.77	-214.68	-214.68	-276.65	-278.27	-245.70
10.00	-284.45	-210.00	-210.00	-273.41	-273.53	-244.43
12.50	-277.13	-205.32	-205.32	-270.17	-268.80	-241.80
15.00	-269.80	-200.63	-200.63	-266.94	-264.07	-238.42
17.50	-262.48	-195.95	-195.95	-263.70	-259.36	-234.68
20.00	-255.16	-191.27	-191.27	-260.47	-254.65	-230.95
25.00	-240.51	-179.62	-179.62	-250.05	-239.53	-222.11
30.00	-225.87	-167.49	-167.49	-238.80	-223.29	-211.85
35.00	-211.22	-155.35	-155.35	-227.54	-207.13	-201.24
40.00	-196.58	-143.22	-143.22	-216.29	-191.06	-188.80
45.00	-86.07	-57.26	-57.26	-134.44	-76.70	-174.04
50.00	68.21	72.95	72.95	-21.46	74.23	-37.61
55.00	91.74	94.45	94.45	-7.31	92.59	112.50
60.00	128.23	128.06	128.06	10.92	116.08	139.73
65.00	149.07	147.05	147.05	29.16	139.38	161.91
70.00	165.56	161.97	161.97	49.90	165.66	173.98
75.00	171.52	167.06	167.06	54.55	171.52	178.89
80.00	173.77	168.70	168.70	56.34	173.77	183.00
85.00	176.02	170.33	170.33	58.13	176.02	185.43
90.00	178.27	171.96	171.96	59.92	178.27	187.54
92.50	179.39	172.78	172.78	60.82	179.39	188.70
95.00	180.52	173.60	173.60	61.71	180.52	189.88
96.50	186.72	179.13	179.13	66.67	186.73	204.91
98.00	200.01	191.25	191.25	77.30	200.01	215.58
99.00	200.78	192.09	192.09	77.93	200.78	217.29
100.00	201.56	192.92	192.92	78.55	201.56	218.66

CRITICAL PROPERTIES

Cut Point (%)	Critical Temperature (C)	Critical Pressure (kPa)	Acentricity Factor	Molecular Weight	Liquid Density (kg/m3)
0.00	-321.83	1315.39	-2.9642	-400.417	-15719.02
1.00	-317.48	1335.35	-0.3230	-22.733	-624.71
2.00	-313.13	1355.92	-0.3128	-21.488	-589.76
3.50	-306.60	1388.00	-0.2974	-19.620	-537.34
5.00	-300.08	1421.63	-0.2821	-17.752	-484.92
7.50	-289.20	1481.46	-0.2566	-14.639	-397.55
10.00	-278.32	1546.55	-0.2311	-11.526	-310.19
12.50	-267.45	1617.62	-0.2056	-8.413	-222.82
15.00	-256.57	1695.53	-0.1801	-5.300	-135.45
17.50	-245.70	1881.99	-0.1545	-2.187	-48.09
20.00	-234.82	1910.16	-0.1290	0.926	39.28
25.00	-213.07	2100.16	-0.0780	7.153	214.02

Stream: reactor 2-1 vapors (continue

Boiling Point Curves: reactor 2-1 vapors (contir

Cut Point (%)	Critical Temperature (C)	Critical Pressure (kPa)	Acentricity Factor	Molecular Weight	Liquid Density (kg/m3)
30.00	-191.32	2384.71	-0.0269	13.379	388.75
35.00	-169.57	2758.45	0.0241	19.605	563.48
40.00	-147.82	2800.24	0.0751	25.831	738.22
45.00	31.96	5319.08	0.1326	33.128	469.60
50.00	265.97	2740.83	0.2738	89.501	655.93
55.00	349.65	2004.97	0.3016	103.716	695.54
60.00	433.33	1580.61	0.3283	116.678	735.15
65.00	517.01	1304.51	0.3539	128.388	813.80
70.00	600.69	1110.52	0.3784	138.846	826.68
75.00	588.03	1153.81	0.4002	146.273	799.56
80.00	528.71	1330.38	0.4211	152.635	758.38
85.00	469.38	1570.75	0.4420	158.997	717.20
90.00	410.05	1917.13	0.4628	160.204	676.01
92.50	380.39	2154.71	0.4733	164.784	655.42
95.00	350.72	2459.50	0.4837	170.353	634.83
96.50	367.42	2274.14	0.4986	174.628	650.09
98.00	470.02	1565.47	0.5250	178.541	708.88
99.00	472.11	2863.75	0.5291	179.104	718.12
100.00	470.00	1657.32	0.6017	214.183	682.69

COLD PROPERTIES

True VP at 37.8 C	(kPa)	—	Cetane Index		—
Reid VP at 37.8 C	(kPa)	—	Research Octane Number		—
ASTM D93 Flash Point	(C)	—	Viscosity at 37.8 C	(cP)	—
ASTM D97 Pour Point	(C)	—	Viscosity at 97.8 C	(cP)	—
Refractive Index		—			

P:N:A

Paraffins [mol%]	33.3333	Naphthas [mol%]	33.3333	Aromatics [mol%]	33.3333

Stream: reactor 2-2 vapors

Boiling Point Curves: reactor 2-2 vapors

BOILING POINT CURVES

Basis	Stream
Liquid Volume	reactor 2-2 vapors

RESULTS

BP Curves Results

Cut Point (%)	TBP (C)	ASTM D86 (C)	D86 Crack Reduced (C)	ASTM D1160(Vac) (C)	ASTM D1160(Atm) (C)	ASTM D2887 (C)
0.00	-313.74	-228.73	-228.73	-286.35	-292.53	-252.12
1.00	-310.81	-226.85	-226.85	-285.06	-290.63	-248.44
2.00	-307.88	-224.98	-224.98	-283.77	-288.72	-247.99
3.50	-303.49	-222.17	-222.17	-281.82	-285.87	-247.31
5.00	-299.09	-219.36	-219.36	-279.88	-283.02	-246.65
7.50	-291.77	-214.68	-214.68	-276.65	-278.27	-245.70
10.00	-284.45	-210.00	-210.00	-273.41	-273.53	-244.43
12.50	-277.13	-205.32	-205.32	-270.17	-268.80	-241.80
15.00	-269.80	-200.63	-200.63	-266.94	-264.07	-238.42
17.50	-262.48	-195.95	-195.95	-263.70	-259.36	-234.68
20.00	-255.16	-191.27	-191.27	-260.47	-254.65	-230.95
25.00	-240.51	-179.62	-179.62	-250.05	-239.53	-222.11

Streamactor 2-2 vapors (continue

Boiling Point Curves: reactor 2-2 vapors (contir

BP Curves Results

Cut Point (%)	TBP (C)	ASTM D86 (C)	D86 Crack Reduced (C)	ASTM D1160(Vac) (C)	ASTM D1160(Atm) (C)	ASTM D2887 (C)
30.00	-225.87	-167.49	-167.49	-238.80	-223.29	-211.85
35.00	-211.22	-155.35	-155.35	-227.54	-207.13	-201.24
40.00	-196.58	-143.22	-143.22	-216.29	-191.06	-188.80
45.00	-86.07	-57.26	-57.26	-134.44	-76.70	-174.04
50.00	68.21	72.95	72.95	-21.46	74.23	-37.61
55.00	91.74	94.45	94.45	-7.31	92.59	112.50
60.00	128.23	128.06	128.06	10.92	116.08	139.73
65.00	149.07	147.05	147.05	29.16	139.38	161.91
70.00	165.56	161.97	161.97	49.90	165.66	173.98
75.00	171.52	167.06	167.06	54.55	171.52	178.89
80.00	173.77	168.70	168.70	56.34	173.77	183.00
85.00	176.02	170.33	170.33	58.13	176.02	185.43
90.00	178.27	171.96	171.96	59.92	178.27	187.54
92.50	179.39	172.78	172.78	60.82	179.39	188.70
95.00	180.52	173.60	173.60	61.71	180.52	189.88
96.50	186.72	179.13	179.13	66.67	186.73	204.91
98.00	200.01	191.25	191.25	77.30	200.01	215.58
99.00	200.78	192.09	192.09	77.93	200.78	217.29
100.00	201.56	192.92	192.92	78.55	201.56	218.66

CRITICAL PROPERTIES

Cut Point (%)	Critical Temperature (C)	Critical Pressure (kPa)	Acentricity Factor	Molecular Weight	Liquid Density (kg/m3)
0.00	-321.83	1315.39	-2.9642	-400.417	-15719.02
1.00	-317.48	1335.35	-0.3230	-22.733	-624.71
2.00	-313.13	1355.92	-0.3128	-21.488	-589.76
3.50	-306.60	1388.00	-0.2974	-19.620	-537.34
5.00	-300.08	1421.63	-0.2821	-17.752	-484.92
7.50	-289.20	1481.46	-0.2566	-14.639	-397.55
10.00	-278.32	1546.55	-0.2311	-11.526	-310.19
12.50	-267.45	1617.62	-0.2056	-8.413	-222.82
15.00	-256.57	1695.53	-0.1801	-5.300	-135.45
17.50	-245.70	1881.99	-0.1545	-2.187	-48.09
20.00	-234.82	1910.16	-0.1290	0.926	39.28
25.00	-213.07	2100.16	-0.0780	7.153	214.01
30.00	-191.32	2384.71	-0.0269	13.379	388.75
35.00	-169.57	2758.45	0.0241	19.605	563.48
40.00	-147.82	2800.24	0.0751	25.831	738.22
45.00	31.96	5319.12	0.1326	33.128	469.61
50.00	265.97	2740.83	0.2738	89.501	655.93
55.00	349.65	2004.97	0.3016	103.716	695.54
60.00	433.33	1580.61	0.3283	116.678	735.15
65.00	517.01	1304.51	0.3539	128.388	813.80
70.00	600.69	1110.52	0.3784	138.846	826.68
75.00	588.03	1153.81	0.4002	146.273	799.56
80.00	528.71	1330.38	0.4211	152.635	758.38
85.00	469.38	1570.75	0.4420	158.997	717.20
90.00	410.05	1917.13	0.4628	160.204	676.01
92.50	380.39	2154.71	0.4733	164.784	655.42
95.00	350.72	2459.50	0.4837	170.353	634.83
96.50	367.42	2274.13	0.4986	174.628	650.09
98.00	470.02	1565.47	0.5250	178.541	708.88

Stream: reactor 2-2 vapors (continue

Boiling Point Curves: reactor 2-2 vapors (contir

Cut Point (%)	Critical Temperature (C)	Critical Pressure (kPa)	Acentricity Factor	Molecular Weight	Liquid Density (kg/m3)
99.00	472.11	2863.75	0.5291	179.104	718.12
100.00	470.00	1657.32	0.6017	214.183	682.69

COLD PROPERTIES

True VP at 37.8 C	(kPa)	—	Cetane Index		—
Reid VP at 37.8 C	(kPa)	—	Research Octane Number		—
ASTM D93 Flash Point	(C)	—	Viscosity at 37.8 C	(cP)	—
ASTM D97 Pour Point	(C)	—	Viscosity at 97.8 C	(cP)	—
Refractive Index		—			

P:N:A

Paraffins [mol%]	33.3333	Naphthas [mol%]	33.3333	Aromatics [mol%]	33.3333