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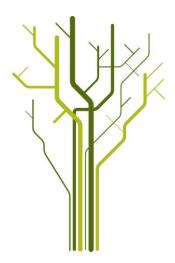
FACULTY OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF ENGINEERING AND SAFETY

CO₂ Absorption and Desorption Simulation with Aspen HYSYS

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Abstract

The last years it has been an increasing global interest to reduce emissions of greenhouse gases to the atmosphere. One of the most important greenhouse gases is CO₂. To reduce CO₂ emissions carbon capture and storage (CCS) is the most realistic approach. With today's technology absorption by an amine solution is the most developed and applicable method for post-combustion CO₂ capture. But this technology is very energy demanding. To reduce the energy demand this technology must be optimized to realize this process as a beneficial method for large scale CO₂ capture.

This thesis considers three different configurations for absorption by an amine mixture aimed to reduce the energy demand. The different configurations are the standard absorption process, a vapour recompression and a lean split with vapour recompression. Aspen HYSYS has been used as the simulation tool. To compare the different models equally the CO₂ removal efficiency was kept at 85% and the minimum temperature approach in the lean/rich heat exchanger was 5K. Kent-Eisenberg was used as the thermodynamic model for the aqueous amine solution and Peng-Robinson for the vapour phase.

All configurations were evaluated due to the energy cost. The lean split with vapour recompression had the lowest energy cost with 81 MNOK/year. However, the vapour recompression had only a slightly higher cost equal to 85 MNOK/year. The standard absorption process was simulated to have an energy cost of 120 MNOK/year. At these values 1.15 M ton CO₂/year are removed.

A capital cost estimation of the configurations has also been conducted. This capital cost estimation has considered equipment, engineering and installation cost. The standard absorption process was estimated to have the lowest capital cost by 514 MNOK. The two other modifications were more expensive. The biggest difference was due to the extra compressor. The lean split with vapour recompression had a cost of 768 MNOK, while the vapour recompression had a cost of 832 MNOK.

Some sensitivity calculations have also been conducted, especially for the vapour recompression. Under these conditions the following parameter values were optimal: CO₂ removal efficiency of 84-86%, flash tank pressure at 110-120 kPa, 14-16 stages in the absorption column.

More research should be done to verify values due to uncertainties in the models and cost estimates.

Keywords	Supervisor
• CO ₂ Absorption, amine	Associate Professor Lars Erik Øi, Telemark
• HYSYS	University College.
Vapour recompression	

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Preface

This Master's thesis was done during the spring semester 2013 at the Faculty of Science and Technology at the University of Tromsø (UiT).

I want to thank my supervisor Associate Professor Lars Erik Øi from Telemark University College for guidance and reliable communication despite the long distance between the working locations.

I also want to thank my fellow graduating student Trond Vegard Sørensen for motivation and for professional and private discussions during this work.

Tromsø, 1st of June, 2013

Nomenclature, abbreviation and symbol list

CCS Carbon capture and storage

KJ/kg KJ for each kg CO₂ removed

DCC Direct contact cooler

MEA Monoethanolamine

TCM Test Centre Mongstad

UiT University of Tromsø

LMTD Logarithmic mean temperature difference

U Overall heat transfer coefficient

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1. Introduction

This master's thesis is about optimization of CO₂ removal processes from a low pressure flue gas from a natural gas combined heat and power plant simulated in Aspen HYSYS. The work is done at the University of Tromsø (UiT).

1.1. Purpose

The aim of this paper:

The purpose with this paper is to optimize the energy demand of CO₂ removal processes in the simulation tool Aspen HYSYS. It is also an objective to estimate the energy and capital cost for the different configurations. The different configurations are the standard absorption process, a vapour recompression modification and a lean split with vapour recompression modification. For the vapour recompression modification sensitivity analysis are conducted to optimize the energy consumption.

Limitations:

For a real process there is some equipment that is necessary for operation which is not considered in this paper. Auxiliary systems like pumps, fans, DCC, a water wash system, or an amine reclaimer are not considered. A short explanation of these parts is presented in section 3.4: Equipment not considered. Pressure drop and heat losses throughout the process equipment are neither considered.

1.2. Background

The last years it has been an increasing international agreement that CO_2 is a dangerous greenhouse gas and that the human made CO_2 emissions to the atmosphere must be managed to control the climate changes. The climate change meetings in Kyoto, Copenhagen, Cancun etc. has been activities to set accepted emissions and a plan of how to control the climate changes. Based on this a new area of focus has grown forth. This area is the focus of carbon capture and storage (CCS). This work is a supplement to the carbon capture part. The idea is that when CO_2 is captured it can be transported to and stored inside geological structures, e.g.

inside produced reservoirs. These geological structures must however have an impermeable layer so the CO₂ is completely isolated from the atmosphere. This storage technology is already implemented on a few existing process facilities in Norway. At the LNG production plant at Hammerfest CO₂ is captured, transported and injected back to the geologic structure beneath the seabed. This technology is also used at Sleipner. However, these capturing processes are from high pressure streams. But because of the increase of focus on CCS other big pollution objects have had an increasing interest. One of these is natural gas power plants. In Norway there are currently a few of these power plants. On some of the offshore facilities a small gas turbine is the only source of electricity. But onshore there are currently three natural gas power plants. One is at Kårstø, another is at Melkøya, and the last one is at Mongstad. The one at Mongstad is a combined power and heat plant. On the concession application Statoil estimated the plant to have a capacity to generate 280 MW electricity and 350 MW heat. And at normal production the plant stands for about 1, 3 million tons of CO₂ each year [1] [2]. Therefore, development of technology for CO₂ removal from power plants will be an important step towards reducing and controlling CO₂ emissions. Today there are several known methods to remove CO₂. Chemical and physical absorption are two different methods, some other methods are; adsorption, use of membranes or cryogenic separation. A short presentation of these possible CO₂ removal processes are presented in chapter 1.4.

When the concession for a power plant at Mongstad was accepted there was not set a requirement that a CO₂ removal process must be in place [1]. However, there were discussions on a political level that this must happen. But CO₂ removal by the known technology is very expensive and the government decided that a test center is going to optimize the known technology of how to extract CO₂ from flue gases. This test centre is called *Technology Centre Mongstad* (TCM). The test center's owners is a joint corporation between Gassnova (75,12%), Statoil (20,00%), Shell (2,44%) and Sasol (2,44%). Gassnova has the share majority and it is through this company the government is managing the research process. TCM started up in May 2012 and has a flue gas feed flow rate about 10% (100 000 ton CO₂/year) of the full scale case [3]. Currently there are two companies with a CO₂ removal technology they want to test. The first company is *Alstom*. They test a technology which is based on absorption with an aqueous ammonia mixture. The second company is *Aker Clean Carbon*. *They are testing a* technology based on absorption with an aqueous amine mixture. With the known technology CO₂ removal from a post combustion

power plant is expected to reduce the total energy efficiency of the plant from about 58% to about 50% [13]. And this excludes transportation and storage of CO₂. Therefore it is necessary to optimize the known technology or invent new technology for this to be accepted as benefitting. Based on this, the main purpose with the technology center is to develop, test and verify technologies to reduce cost, technology, environmental and financial risk of the CO₂ removal process. TCM will be the first step towards commercializing the process as a life worthy product.

Removing CO₂ from a stream has been done for many years. But this is either in small scale or from high pressure petroleum streams. When removing from a high pressure stream the conditions are quite different. The known technology must be adapted to low pressure in big scale. TCM is a pilot plant which has a size that means that the results of this testing can be extrapolated to full scale plants all around the world. There are two different ways of applying a post-combustion CO₂ removal process based on absorption to a power plant. The first way is to include the CO₂ removal process into the design phase. The other way is to apply the process onto an existing plant. Chemical absorption post-combustion can be implemented in both ways, and this is one important factor that makes this way of CO₂ capture very interesting [4]. In addition, it is important to note that one type of technology is not always the best solution. Different operation and investment costs and the planed life-time of a process are factors that may change what is the best choice in a specific case.

It can also be mentioned that most work on this topic is likely not public information. Most companies have no interest in publishing their research on technology which may be a competitive advantage. Therefore it is expected that some scientific work is done but has not been published by companies as Aker Clean Carbon, Alstrom, Fluor, Mitsubishi, HTC Energy and other similar companies with a strong interest in this type of technology. However, there are a few institutions that have an interest in publishing their work, i.e. education institutes.

1.3. Combined heat and power plant

This work is based on a flue gas from a combined power and heat plant. The plant uses natural gas as the energy source. Figure 1 illustrates the process of a power plant. The

combusted air/natural gas is first used directly on the gas turbine, and then the flue gas produce steam which is used in the steam turbine. Both turbines are used to produce electrical power.

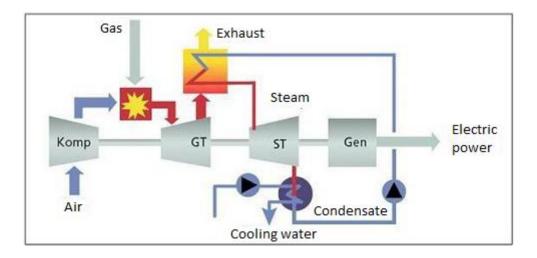


Figure 1: The principal of a combined heat and power plant [5]

1.4. CO_2 removal in general

Traditionally have CO₂ been removed from high pressure streams for many years. It is several reasons why this sour gas is removed:

- CO₂ has no heating value. Therefore removing CO₂ will increase the heating value of a combustible mixture.
- When gas is transported in pipelines to customers CO₂ will increase the load on the compressors.
- CO₂ crystallizes at low temperatures. So when natural gas is liquefied to LNG the CO₂ content must be below a certain value to not plug small channels, i.e. heat exchangers.
- In presents of water CO₂ forms an acid which corrode metal pipes.
- CO_2 is a greenhouse gas.
- Achieve sale gas specifications.

To remove CO₂ a few different technologies are available. These technologies are physical or chemical absorption, adsorption, cryogenic separation, and membranes. Each of these technologies has its field of use.

Adsorption

Adsorption is based on the principle of having a fluid to be adsorbed onto a solid surface. When this process is used there must be two adsorption lines in parallel. This is because the regeneration happens by changing pressure or temperature, and therefore one line must always be able to adsorb while the other regenerates. This process might not be suitable for large scale CO₂ removal from a natural gas based power plant. At this scale, the low adsorption capacity might be a big challenge. In addition, the flue gas that is treated must have a high CO₂ concentration because of the low selectivity of most adsorbents [6].

Physical absorption

Physical absorption is based on absorbing CO₂ into a solvent which may be described by the equation of Henry's law. Henry's law says that the relation between the concentration and the partial pressure of a component in a mixture is directly proportional. Because of this, physical absorption is only suitable if the partial pressure of CO₂ is quite high. According to [7], physical absorption is a more suitable method when CO₂ concentration is higher than 15% and at high partial pressures.

Chemical absorption

This process is based on the principle to have CO_2 from a flue gas to be chemical absorbed by a solvent. The chemical reaction needs to form a weak intermediate compound so that the absorbent may be regenerated. To apply regeneration a pressure reduction or an increase in temperature is required. The solvent can be ammonia, different amines, or a mixture of amines. Since exhaust gas from a power plant is at low pressure, the process will be very heat demanding. According to [8] amine absorption systems are considered to be the best suited technology for removing CO_2 from flue gases in the power sector.

Cryogenic separation

Cryogenic separation is the process where CO_2 is separated from the flue gas by condensing. The principle exploits the difference in the boiling point for the components. According to [6] and [9] this physical process is suitable for flue gas streams with CO_2 concentrations above 90%, and this process is more suitable to capture CO_2 from flue gases from an oxyfuel power plant.

Membranes

Membrane separation is based on two flows that are separated by a membrane. The membrane is most often a thin, nonporous, polymeric film which is semipermeable. Some species move faster through the membrane than others and in this way CO_2 is separated from the feed. However, the selectivity and the fraction CO_2 removed of this process is low. A multistage separation is required to capture a higher amount which leads to a higher investment and operation cost [6] [10].

1.5. Task description

The tasks of this Master's thesis can be found in appendix 1.

2. Literature about different CO₂ absorption processes

The idea with this chapter is to give a short presentation of some general research about CO₂ removal at low pressure conditions, and then mention some research on the different configurations used in this work.

A few years ago there was not done much research on CO₂ removal in big scale from a low pressure flue gas. But the last years the political interest in CO₂ emission management has stimulated and motivated for more extensive research. The aim of most of this research is to reduce the energy and/or cost demand of a process. This can either be done by configuring the physical process equipment or by changing process parameters for optimization of a specific modification. Based on this several possible CO₂ absorption configurations have been theoretically tested and evaluated. Because of the high cost of a large scale process much of the research done are based on work with different simulation tools. These simulation tools are software programs like Aspen HYSYS, Aspen plus, K-Spice and Pro/II. The use of these tools ease the massive calculations required to simulate a close-to-real process. Calculations like material balance, energy balance, vapour/liquid equilibrium, equations of states are solved quickly. These tools are especially practical when complex or large quantities of calculations are required.

General

During the literature review several interesting works was found [11] presents fifteen different process flow sheet modifications. The work does also have a focus on the patent information related to each modification. More interesting work found are [6] which consists of a state-of-the-art review for post-combustion CO_2 capturing, and [12] which considers removal of CO_2 from exhaust gas.

Standard absorption process

In much research found the standard absorption model has been used as a reference case. When different modifications or process parameters have been optimized the improvement has been related to this base case. In the paper [13] a presentation of a combined cycle gas power plant and the standard absorption process are given. In this work the energy consumption of the CO₂ removal process was calculated, and it was concluded that the process reduces the efficiency of the power plant from about 58 to 50%.

Vapour recompression modification

In the paper [14], [15], [16], and [17] it is concluded that a vapour recompression modification is perhaps the most interesting choice of modification because the process achieves a large energy reduction with a limited increase in complexity. Some research is done in [8] about net present value maximization on a vapour recompression model. This paper conclude that the optimum flash tank pressure is at 1,2 bar.

Split stream modification

In several papers found different split stream modifications are presented and simulated. Perhaps the most interesting one are simulated in [15]. In that paper a simulation of a lean split stream with a vapour recompression modification are accomplished. The results are interesting and gave less reboiler and compressor duty compared to the vapour recompression modification.

3. Process description

This chapter is meant to give a presentation of the three configurations used in this work. First is the standard absorption process presented, then a vapour recompression modification, and last a lean split with vapour recompression modification. Principles and the process equipment are also briefly explained. Equipment which is required in a real process but not considered in the model are also mentioned. After this, sections about column stage equilibrium in Aspen HYSYS, the property package, and the solvent are presented.

3.1. Standard absorption process

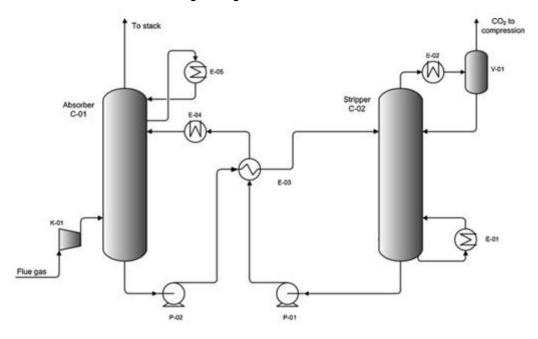


Figure 2: Simplified figure of the standard absorption process [8]

Figure 2 shows the configurations of the standard absorption process. The flue gas enters the absorption column in the bottom part. Here the exhaust is climbing upward due to buoyancy. At the same time an aqueous solution enters at the top and flows downward. This aqueous solution will mainly consist of the solvent and water, but it will also consist of some CO₂. Because of the layout inside the column the exhaust gas and the aqueous solution will have a big contact surface. During this contact CO₂ will be absorbed into the aqueous solution. In this way the exhaust will when exiting at the top of the column have a lower CO₂ content. The aqueous solution will exit the absorption column at the bottom. Inside the column there is an

arrangement that optimize the liquid/vapour contact surface. This arrangement may be plates, structured or random packing. Each plate or a specific high of these may be called a stage, and the number of stages is one of the factors that decide how much CO₂ that will be removed. Theoretical you can assume chemical and vapour/liquid equilibrium over each plate. But in reality there is a deviation between the composition change to equilibrium and the actual composition change of the components. This deviation is what decides the efficiency at each plate. This efficiency may be called the Murphee efficiency. A definition of the Murphee efficiency can be found in chapter 3.5. From the bottom of the absorption column the liquid (rich amine) will be pumped through a lean/rich heat exchanger. In this side of the heat exchanger the rich amine stream will be heated. After this the rich amine will enter the desorption column/stripper. In the desorption column there is a condenser at the top and a boiler in the bottom, and here the CO₂ vaporizes from the aqueous mixture. The vapour rises and the liquid, which mostly consist of the solvent and water, flows downwards. In this way the amine can be reused, while the CO₂ can be extrapolated from the stream as a top product. Furthermore, when CO₂ is captured it is ready for transportation and storage as a link in the chain of CCS. In the desorption column the principle about Murphee efficiency is also valid. From the bottom of the desorption column the liquid part (lean amine) is pumped through the lean/rich heat exchanger. In this heat exchanger the lean amine will be cooled. After leaving this heat exchanger the temperature is still too high, therefore is the stream further cooled by another heat exchanger which uses cheap and available fluids, e.g. water. The lean amine is supposed to be cooled to the wanted/optimal absorption temperature before entering the absorber. At this point the lean amine is mixed with a make-up stream of water and amine. These make-up streams are supposed to fill in the lost amine and water from the product streams leaving the system. When the make-up steams are mixed together with the lean amine stream the mixed stream enters the absorption column to fulfill the cycle.

3.2. A vapour recompression process

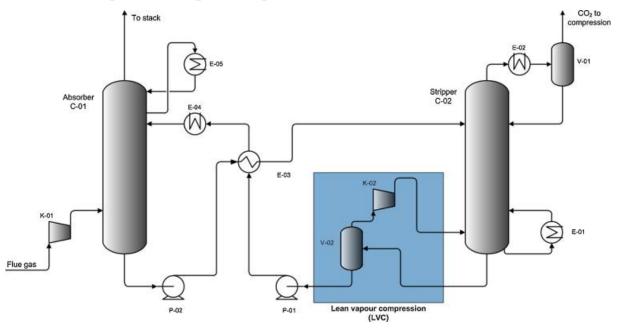


Figure 3: Simplified figure of an absorption process with a vapour recompression modification [8]

There are several differences from a vapour recompression absorption modification and the standard absorption process. The main changes are as follows:

- One extra flash tank, a compressor, a small increase in the complexity of the lean/rich heat exchanger.
- The reboiler duty will decrease due to the extra stream coming from the compressor.
- Some additional electricity is required to operate the compressor.
- Small modifications for the lean/rich heat exchanger may be required.
- The stripper need to accommodate a slightly increase in the vapour flow for a vapour recompression model [8].
- The CO₂ loading (mole CO₂/mole MEA) in the lean amine will decrease. The CO₂ loading in the rich amine stream leaving the absorber will however be on about the same value. This means that a lower lean amine flow rate is required for the same amount of CO₂ removed.

The blue square in figure 3 shows the change in the required physical equipment compared to the standard absorption process. This blue box contains the recompression part of the process.

From the bottom of the stripper the liquid goes through a valve which reduces the pressure in the stream. This pressure reduction causes some of the liquid to vaporize. The vapour/liquid mixture enters then a flash tank where the vapour and the liquid are separated. The vapour is then slightly cooled in the lean/rich heat exchanger (not illustrated in figure 3) and recompressed before it enters the desorption column. By doing this the heat in this stream causes a reduction in the reboiler duty. But while the reboiler duty reduces an extra duty for the compressor is added to the system. While the vapour part is recompressed, the liquid from the flash tank follows the same path as in the standard absorption process.

For a vapour recompression process there is only a small increase in the amount of physical equipment. This increase is only considered to slightly increase the overall acquisition cost for the process. However, due to the reduction in the reboiler duty the total energy required will in spite of the extra electricity demand decrease. In the work [18] the energy demand is considered for a few different configurations. One of these considerations is the vapour recompression process and the basic process. This work conclude that if the vapour recompression model have a temperature approach in the lean/rich heat exchanger of $\Delta 5 K$ the investment cost and energy demand compared to a standard absorption process can be approximately increased and reduced by respectively 2,77% and 9,37%. From these numbers it is quite clear that it is possible to significantly reduce the cost and that it therefore is very important to optimize the process.

3.3. A lean split with vapour recompression process

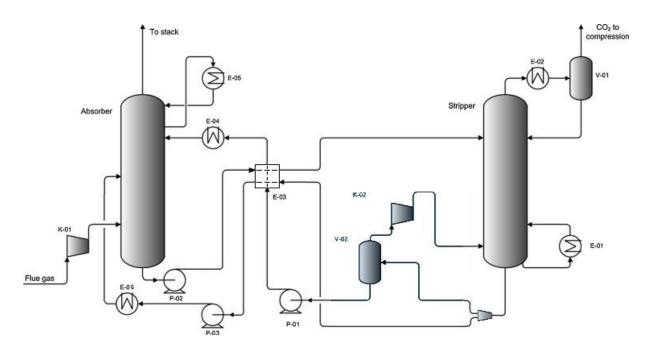


Figure 4: Simplified figure of a lean split with vapour recompression modification [8]

The difference from this modification compared to the vapour recompression modification is that the lean amine stream from the stripper is splitted into two streams. One of the streams goes through the same process as in the vapour recompression modification, but the other stream (called semi-lean) goes directly through the lean/rich heat exchanger then a pump and a cooler brings the medium to the wanted pressure and temperature condition before entering the absorption column. By doing this the high temperature (120 °C) provides additional heating in the lean/rich heat exchanger which will affect the reboiler duty.

As mentioned in chapter 2 this process has been simulated to require less reboiler and compressor duty compared to the vapour recompression modification [15]. This process does however have a more complex lean/rich heat exchanger, one more pump and cooler, more piping, and an extra inlet to the absorption column. This means that investment and operation costs should be evaluated and compared to the standard absorption process and the vapour recompression modification.

3.4. Equipment not considered

In addition to the components that are mentioned above there is some equipment that is necessary for a real process to be operational. The most important equipment is a direct contact cooler (DCC), an amine reclaimer, a fan, and a water wash system:

- DCC: The available pressure and thermal energy in the flue gas are used as the energy source in the power and heat plant, but still the temperature may be as high as 200°C. Since the wanted inlet temperature to the absorber is about 25-40°C the thermal energy need to be reduced. This means that upstream from the absorption column a direct contact cooler is required to chill the flue gas so that the temperature reaches the wanted/optimized operation temperature in the absorption column. This DCC consists of a column and a water circulation system. The column acts as the direct cooler where process water is cooling the flue gas which streams upwards. For the water circuit a pump, cooler and a splitter are required. A splitter is required because of a change in the water saturation limit in the flue gas, i.e. water condenses from the flue gas inside the column.
- Flue gas fan: If the flue gas needs a small pressure increase a fan may be used. A fan will also give the process more stability and a bigger flexibility when considering the pressure operating condition.
- Amine reclaimer: Because the amine solvent degrades over time due to oxidative and thermal reactions a system to reclaim the solvent is necessary. This amine reclaimer bleeds of some of the lean amine stream and vaporizes the solvent. The part of the stream which is not recovered is considered a waste product.
- Water wash section: The solvent in this study is MEA, and this solvent has a relatively high vapour pressure. A high vapour pressure will lead to a significant vaporization loss in the absorption column. This means that the MEA content will be quite high in the pure product stream. To greatly reduce the loss of MEA it is possible to integrate a water wash column.

3.5. Column stage equilibrium in Aspen HYSYS

In Aspen HYSYS the vapour concentration CO₂ entering and leaving each plate may be assumed to be in equilibrium with the liquid. However in a real column the concentration will not be in equilibrium. Therefore the efficiency on each place may be assumed and specified in

the software simulation program. This efficiency is called Murphee efficiency, and is defined as:

$$E_M = \frac{y_{i,n+1} - y_i}{y_{i,n+1} - y_{i}} \tag{3.1}$$

Where $y_{i, n+1}$ is the mole fraction of species i in the vapour phase leaving stage n+1, and y_i is the mole fraction of species i leaving stage n, and $y*_i$ is the mole fraction of species i in equilibrium with the liquid leaving stage n [10].

This Murphee efficiency will not be constant through the columns. In reality the efficiency is slightly different on each plate. The driving force of the absorption is based on the chemical and vapour/liquid equilibrium.

3.6. Property Package

In HYSYS there are several property packages available. A process with water/amine/oxygen/nitrogen/light hydrocarbons/CO₂ mixtures limits the accuracy of most of these models. But HYSYS has a special amine package for this type of mixtures. This Amine Package contains thermodynamic models developed by D.B. Robinson & associates. The chemical and physical property data does however have some restrictions attached to components, amine concentration, pressure and temperature. The relevant restriction ranges are as follows:

- Acid gases: CO₂, H₂S, COS, CS₂.

- Non Hydrocarbons: H₂, N₂, O₂, CO, H₂O.

- MEA: Concentration 0 - 30wt%.

- Pressure: 0,00001 – 300 psia.

- Temperature: 77-260 °F, or 25-126 °C.

- 1.0 mole acid gas/mole alkanolamine.

All these restrictions are fulfilled in the simulations. This package uses Kent-Eisenberg or Li-Mather as the thermodynamic model for the aqueous amine solution. According to [19] Kent-Eisenberg is validated as an approach to correlate the equilibrium solubility of acid gases in a MEA solution. The model chosen is Kent-Eisenberg during the simulations. But Li-Mather

was tested to check the deviation between these two. For the vapour phase it is only expected a small deviation from an ideal solution. This means that the basic ideal gas law could be applied. However, the small deviation may easily be taken care of by considering the phase mixture non-ideal. Therefore the vapour phase is calculated as non-ideal. For this non-ideal vapour phase Aspen HYSYS uses the equation of state Peng-Robinson to calculate the fugacity coefficient. No other choices are available. And for calculation of enthalpy/entropy a curve fit approach is used. This amine package is also capable of simulating blended solvents made up of two of the following amines: MEA, DEA, MDEA, TEA, DGA, and DIPA. The absorption is an exothermic process and the temperature will therefore vary inside the absorption column, and since the heat effects are an important factor in amine treating processes it is worth mentioning that this is properly taken into account in the amines property package [19].

For the vapour phase several other equations of state could have been used. The small deviation expected from an ideal mixture gives a wide range of choices. However, here the most complex equation is used because it is expected to give a slightly more accurate result with no increase in effort. For the liquid phase Li-Mather could have been used as as the thermodynamic model for the aqueous amine solution.

3.7. The solvent

The amine chosen for this work is monoethanolamine (MEA). MEA is also called 2-aminoethanol or ethanolamine. The molecular formula is C_2H_7NO , and it is a primary alkanolamine and alcohol. According to [20] MEA is the preferred solvent when sweetening a stream by removing carbon dioxide (CO_2) or hydrogen sulphide (H_2S) if there are no contaminations of COS or CS_2 . And this is especially true when the sour components are removed from a low pressure gas and if a maximum removal of CO_2 or H_2S is required. In similar research, concerning CO_2 removal by amine absorption, MEA has been the typically used solvent.

The advantages with MEA as solvent are that it has a high reactivity, high absorbing capacity on a mass basis, reasonable thermal stability and degradation rate [21]. But the use of MEA as

the solvent does have some disadvantages. MEA has a relatively high vapour pressure which will lead to a significant vaporization loss. This can however be limited by a simple water wash system. Another disadvantage with MEA is the high heat of reaction. A high heat of reaction means that more energy must be added in the regeneration process [12]. In addition, CO_2 is corrosive if water is present.

It is not easy to find a optimized absorption temperature for MEA. In a chemical reaction a high temperature is favored, but the equilibrium in this process will favor a lower temperature. Therefore it is not easy to optimize the absorber inlet temperature. However, as mentioned does MEA have a high reactivity. This means that MEA does not need as high operation temperature compared to some other amines.

The reaction is between a weak base and a weak acid. CO_2 solved in H_2O is a weak acid, while MEA solved in H_2O is a weak base. The reaction of CO_2 and MEA is considered by [24].

Different solvents

In the work [12] different amines than MEA has been shortly evaluated in a standard absorption model. Dietanolamine (DEA) and methyldiethanolamine (MDEA) in water are two popular solvents when CO₂ are removed at high pressures, but these do not seem to give better results than MEA. Either does a mixture of MEA and MDEA. In addition, most papers found on this topic have been using an MEA, and therefore it is easier to compare different results when based on the same specifications.

4. Energy and economical estimation methods

4.1. Energy estimation method

In this process there are two types of energy demand, thermal heat and electricity. These two cannot be compared on an equal basis. Therefore the electricity and the thermal heat required will be kept separated. But in the sensitivity cases a method to estimate the combined energy demand is very practical. This combined energy is called equivalent thermodynamic work. In this method the thermal energy demand for the system will be recalculated into the amount of electricity lost due to the thermal energy used, and then the compressor and pump duties will be added.

The equivalent thermodynamic work W_E is calculated as [18]:

$$W_E = Q_H \times \left(1 - \frac{T_C}{T_H}\right) \times \eta + W_C + W_P \tag{4.1}$$

Where Q_H is the total heat used in the reboiler, the steam turbine efficiency η is assumed to be 75%, W_C is the duty for the compressor, and W_P is the summarized pump duties. To estimate the thermal energy transformation to work the factor $1 - \frac{T_C}{T_H}$ is used. This factor is the maximum efficiency of a Carnot engine, where work is transformed from thermal heat. If the steam is assumed to be about 10K higher than the temperature in the reboiler, then T_H =130+273K. And if the steam is assumed to condense at 40 °C, T_C = 313K. This method for unifying the different energy values has also been used in literature by [18].

4.2. Economical estimation methods

4.2.1. Electricity and steam cost

To estimate the cost of the electricity and steam demand of the system a transformation to NOK is necessary. This means that the cost for electricity and steam must be set. The electricity cost is set to 0, 4 NOK/kWh. This cost is a typical value used in papers found, e.g. [12]. When the steam cost is estimated a comparison to the electricity cost must be considered. Using the Carnot efficiency formula [28] and [15]:

$$\eta = \left(1 - \frac{T_C}{T_H}\right) = 0.223 \tag{4.2}$$

This means that the low pressure steam can produce electricity for about 0,223 of the thermal energy, and therefore:

- Electricity cost: 0,4 NOK/kWh

- Steam cost: 0,089 NOK/kWh

4.2.2. Investment cost

When estimating the investment cost of the different process modifications a few methods are available. The first and most accurate method is to contact vendors for a prize. When the number of cases is big the investment cost may be extrapolated from earlier projects, or from estimation methods found in literature. Commercial software packages as *Aspen In-Plant Cost Estimator* or handbooks from *Hydrocarbon Processing* may also be used. Since not a commercial software package or handbooks are available the cost estimation will be done by scaling costs from similar research.

4.2.3. Scaling factor

If cost for earlier process plants that uses the same technology is known a scaling can be done by the following equation [22]:

$$C_2 = C_1 \times \left(\frac{S_2}{S_1}\right)^{0.65} \tag{4.3}$$

Where: C_n is the cost with capacity S_n . [22] estimates the values for these type of processes to be between 0,6 and 0,7, and therefore a mid-value of 0,65 is chosen.

4.2.4. Capital cost estimation

When costs of equipment are estimated, equation 4.4 is applied. The result will include cost of equipment, engineering, and installation.

$$C = F\left(\sum C_{\rho}\right) \tag{4.4}$$

The installation factor F equals 5 [22].

4.2.5. Currency index

Converting the currency from US dollar \$ to NOK is done by the following equation:

$$Cost\ NOK = \frac{Cost\ \$}{Exchange\ \$/NOK} \tag{4.5}$$

Exchange \$/NOK equals $\frac{1}{5,8335}$ [25].

4.2.6. Cost index

To update the cost to 2013 equation 4.6 is used [22].

Cost in year 2013 = Cost in year 2010
$$\times \frac{Cost \ index \ in \ year \ 2013}{Cost \ index \ in \ year \ 2010}$$
 (4.6)

Table 1: Cost index for 2010 and 2013 [26]

Year	Cost index
2010	128,8 (average)
2011	130,4 (average)
2013	133,175 (average for the first four months)

5. Aspen HYSYS simulations

This chapter starts with a presentation of the three base cases in this work. The standard absorption process, the vapour recompression modification, and the lean split with vapour recompression modification in Aspen HYSYS. After this, a parameter variation chapter and the sensitivity cases are presented as the last part.

For all the simulation cases the following parameters has been unchanged:

- Sour feed specifications to the absorption column.
- The solver is modified HYSIM Inside-Out.
- Pump efficiency.
- Compressor efficiency.
- Murphee efficiency of 15% in the absorption column.

During the simulations it was experienced that the Modified HYSIM Inside-Out gave the best convergence in both columns. The Murphee efficiency was kept at 15%. The adiabatic efficiency in the pumps and the compressor was set to 75%, this is the default value in Aspen HYSYS. Table 2 shows the feed parameters and values that were held constant in all simulations.

Table 2: Specifications for the sour feed to the absorber

Parameter	Value
Composition	N ₂ : 76,0 mole%
	CO ₂ : 3,3 mole%
	H ₂ O: 6,9 mole%
	O ₂ : 13,8 mole%
Temperature	40 °C
Pressure	101 kPa
Flow rate	1,09141 *10^5 kgmole/h

5.1. Base cases

For all base cases the specifications made and a figure of the model are presented. A picture of the models can be found in appendix 2, 3 and 4. Last for each base case the results are presented. For the three base cases the following parameters was kept constant:

- 85% CO₂ removed from the flue gas.
- The inlet temperature to the absorption column was set to 40 °C for all inlet streams.
- Minimum temperature approach in the lean/rich heat exchanger was set to 5K.

There are set a few general requirements for the base cases. The CO_2 removal efficiency was set to approximately 85%. The inlet temperature to the absorption column for the flue gas and all circulation streams was set to 40 °C.

5.1.1. Process description of the Aspen HYSYS standard base case

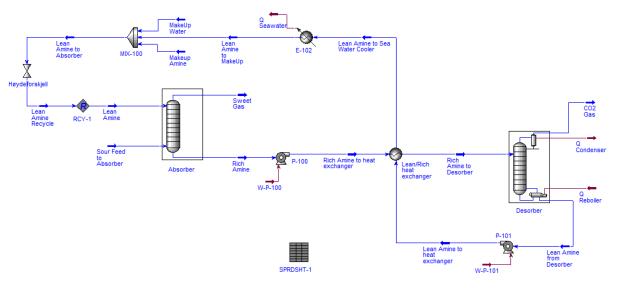


Figure 5: The user interface of the basic absorption model in Aspen HYSYS

A figure of the standard model is shown by figure 5, and a bigger picture is found in appendix 2. The model consists of the following process equipment:

- Absorption column
- Rich amine pump

- Desorption column
- Lean/Rich amine heat exchanger
- Lean amine pump
- Water cooler

Some of the elements shown in figure 5 do only have a software function. These functions are: The recycle functions, called RCY-1 and RCY-2. The mixer, called Mix-100. And the adjust function, called ADJ-1.

5.1.1.1. Specifications for the Aspen HYSYS standard base case

Table 3 shows the specifications for the lean amine feed to the absorption column. Table 4 shows the specifications and data for the rest of the model. The Aspen HYSYS simulation results may be found in appendix 5.

Table 3: Specifications for lean amine to absorber

Parameter	Value
Composition	MEA: 29,0 weight%
	CO ₂ :5,5 weight%
	H ₂ O: 65,5 weight%
Lean amine loading	0,263
Temperature	40 °C
Pressure	101 kPa
Flow rate	1,6 *10^5 kgmole/h

Table 4: Specifications and data for the rest of the model

Parameter	Value
Absorber - stages	14
Absorber - Murphree efficiency	0,15
Desorber - stages	10 + condenser + reboiler
Desorber - Murphree efficiency	1

Reboiler - temperature	120 °C	
Desorber - Reflux ratio	0,1	
Rich amine loading	0,434	
Rich amine pump - inlet pressure	101 kPa	
Rich amine pump - outlet pressure	200 kPa	
Rich amine pump - inlet temperature	43,5 °C	
Rich amine pump - adiabatic efficiency	75%	
Heated rich amine - temperature	104,5 °C	
Lean amine pump - inlet pressure	100 kPa	
Lean amine pump - outlet pressure	400 kPa	
Lean amine pump - adiabatic efficiency	75%	
Make up Amine - Flow rate	45 kgmole/h	
Make up Water - Flow rate	6150 kgmole/h	

5.1.1.2. Results for the Aspen HYSYS standard base case

Results for the standard absorption process simulation are presented in table 5.

Table 5: Results for the Aspen HYSYS standard base case

Modification	Boiler duty,	Boiler duty,	Compressor,	Equivalent
	[MW]	[MJ/kg]	[MW]	work [kJ/kg]
Standard base	161	4,3	-	724
case				

5.1.2. Process description of the Aspen HYSYS vapour recompression base case

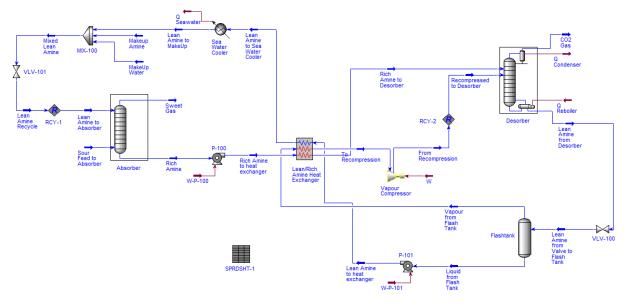


Figure 6: The user interface of the vapour recompression model in Aspen HYSYS

The model layout is presented by figure 6, and a bigger picture of the model is attached in appendix 3. The model consists of the following process equipment:

- Absorption column
- Rich amine pump
- Desorption column
- Valve
- Flash tank
- Lean vapour compressor
- Lean/Rich amine heat exchanger
- Lean amine pump
- Sea water cooler

Some of the elements shown in figure 6 do only have a software function. These functions are: The recycle functions, called RCY-1 and RCY-2. The mixer, called Mix-100. And the adjust function, called ADJ-1.

5.1.2.1. Specifications for the Aspen HYSYS vapour recompression base case

Table 6 contains the lean amine specifications. Table 7 shows the recompression stream specifications. And in table 8 contains specifications and data for the rest of the model. The Aspen HYSYS simulation results may be found in appendix 6.

Table 6: Specifications for lean amine to absorber

Parameter	Value
Composition	MEA: 29,0 weight%
	CO ₂ :5,1 weight%
	H ₂ O: 65,9 weight%
Lean amine loading	24,4
Temperature	40 °C
Pressure	101 kPa
Flow rate	1,23 *10^5 kgmole/h

Table 7: Specifications for the recompressed stream to the stripper

Parameter	Value
Composition	CO ₂ : 10,8 weight%
	H ₂ O: 86,4 weight%
	MEA: 2,8 weight%
Temperature	120 °C
Pressure	200 kPa
Flow rate	3985 kgmole/h

Table 8: Specifications and data for the rest of the model

Parameter	Value
Absorber - stages	16
Absorber - Murphree efficiency	0,15
Desorber - stages	10 + condenser + reboiler
Desorber - Murphree efficiency	1

Reboiler - temperature	120 °C
Desorber - Reflux ratio	0,3
Flash tank - pressure	115 kPa
Rich amine loading	46,8
Rich amine pump - inlet pressure	101 kPa
Rich amine pump - outlet pressure	200 kPa
Rich amine pump - inlet temperature	41,8 °C
Rich amine pump - adiabatic efficiency	75%
Lean amine pump - inlet pressure	115 kPa
Lean amine pump - outlet pressure	200 kPa
Lean amine pump - inlet temperature	105,3 °C
Lean amine pump - adiabatic efficiency	75%
Compressor - adiabatic efficiency	75%
Compressor - inlet pressure	115 kPa
Compressor - outlet pressure	200 kPa
Compressor - inlet temperature	99,4 °C
Compressor - outlet temperature	120 °C
Make up Amine - Flow rate	40 kgmole/h
Make up Water - Flow rate	4980 kgmole/h

5.1.2.2. Results for the Aspen HYSYS vapour recompression base case

Results for the vapour recompression simulation are presented in table 9.

Table 9: Results for the Aspen HYSYS vapour recompression base case

Modification	Boiler duty,	Boiler duty,	Compressor,	Equivalent
	[MW]	[MJ/kg]	[MW]	work [kJ/kg]
Vapour	102	2,7	2,7	538
recompression				
base case				

5.1.3. Process description of the Aspen HYSYS lean split with vapour recompression base case

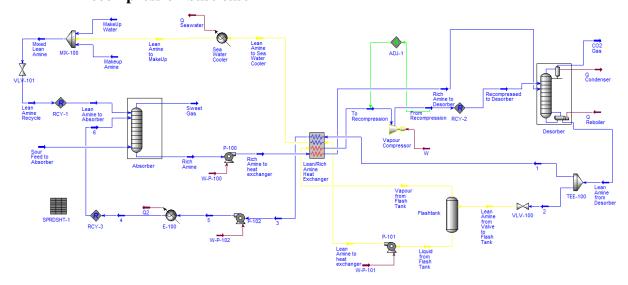


Figure 7: The user interface of the lean split with vapour recompression model in Aspen HYSYS

The model layout is shown by figure 7, and a bigger picture of the model is attached in appendix 4. The model consists of the following process equipment:

- Absorption column
- Rich amine pump
- Desorption column
- Valve
- Flash tank
- Lean vapour compressor
- Lean/Rich amine heat exchanger
- Lean amine pump
- Semi-lean pump
- Two water coolers

Some of the elements shown in figure 7 do only have a software function. These functions are: The recycle functions, called RCY-1, RCY-3, and RCY-2. The mixer and splitter, called Mix-100 and TEE-100. And the adjust function, called ADJ-1.

5.1.3.1. Specifications for the Aspen HYSYS lean split with vapour recompression base case

Table 10, 11, and 12 contains specifications for the recirculation streams. Specifications and data for the rest of the model are presented in table 13. The Aspen HYSYS simulation results may be found in appendix 7.

Table 10: Specifications for lean amine to absorber

Parameter	Value
Composition	MEA: 27,0 weight%
	CO ₂ :4,4 weight%
	H ₂ O: 68,6 weight%
Lean amine loading	
Temperature	40 °C
Pressure	101 kPa
Flow rate	4,55 *10^4 kgmole/h

Table 11: Specifications for the semi-lean stream to absorber

Parameter	Value	
Composition	MEA: 29,0 weight%	
	CO ₂ :5,1 weight%	
	H ₂ O: 65,9 weight%	
Temperature	40 °C	
Pressure	101 kPa	
Flow rate	5,29 *10^4 kgmole/h	

Table 12: Specifications for the recompressed stream to the stripper

Parameter	Value	
Composition	CO ₂ : 7,9 weight%	
	H ₂ O: 89,3 weight%	
	MEA: 2,8 weight%	

Temperature	120 °C
Pressure	200 kPa
Flow rate	1689 kgmole/h

Table 13: Specifications and data for the rest of the model

Parameter	Value
Absorber - stages	24
Absorber - Murphree efficiency	0,15
Desorber - stages	6 + condenser + reboiler
Desorber - Murphree efficiency	1
Reboiler - temperature	120 °C
Desorber - Reflux ratio	0,3
Flash tank - pressure	100 kPa
Rich amine loading	0,537
Rich amine pump - inlet pressure	101 kPa
Rich amine pump - outlet pressure	291 kPa
Rich amine pump - inlet temperature	41,3 °C
Rich amine pump - adiabatic efficiency	75%
Lean amine pump - inlet pressure	100 kPa
Lean amine pump - outlet pressure	300 kPa
Lean amine pump - inlet temperature	101,8 °C
Lean amine pump - adiabatic efficiency	75%
Compressor - adiabatic efficiency	75%
Compressor - inlet pressure	100 kPa
Compressor - outlet pressure	200 kPa
Compressor - inlet temperature	99,4 °C
Compressor - outlet temperature	120 °C
Semi-lean amine pump - inlet pressure	100 kPa
Semi-lean amine pump - outlet pressure	111 kPa
Semi-lean amine pump - inlet temperature	46,5 °C
Semi-lean amine pump - adiabatic efficiency	75%

5.1.3.2. Results for the Aspen HYSYS lean split with vapour recompression base case

Results for the lean split with vapour recompression simulation are presented in table 14.

Table 14: Results for the Aspen HYSYS lean split with vapour recompression base case

Modification	Boiler duty,	Boiler duty,	Compressor,	Equivalent
	[MW]	[MJ/kg]	[MW]	work [kJ/kg]
Lean split with	103	2,7	1,1	485
vapour				
recompression				
base case				

5.2. Parameter variation

Parameter variations for the base cases

Many different parameters have been varied in the base cases to fulfill the requirements for the removal efficiency and the minimum temperature approach in the lean/rich heat exchanger. The removal efficiency was kept at 85%, and the minimum temperature approach was 5K.

To fulfill these requirements there are a few parameters that are more significant than others. These ones are the recirculation flow rate and temperature, number of stages in the absorption and desorption column, Murphee efficiency, and the temperature in the rich amine feed to the stripper. But to reach the required CO_2 removal efficiency the main varied parameter was the circulation rate(s) and composition(s).

Parameter variation for the sensitivity cases

For the sensitivity cases the parameter changes are explained in each sensitivity case chapter. However, the parameter variation was continued until convergence problems occurred or as long as it had a practical/theoretical purpose.

5.3. Sensitivity calculation in the Aspen HYSYS standard absorption model

In each subchapter is the purpose of the case presented. The chapter also contains something about the methodology used.

5.3.1. Variation of lean amine circulation rate in the Aspen HYSYS standard absorption model

For the standard absorption process it has been of interest to simulate the effect of a change in lean amine circulation rate to verify the effect on the energy demand and CO_2 removal efficiency. This simulation may give a better understanding of which circulation rate that will give the optimal CO_2 removal efficiency based on the energy demand.

The lean amine circulation rate was varied from $1,3*10^5$ kgmole/h to $2,9*10^5$ kgmole/h with a $0,1*10^5$ kgmole/h step size.

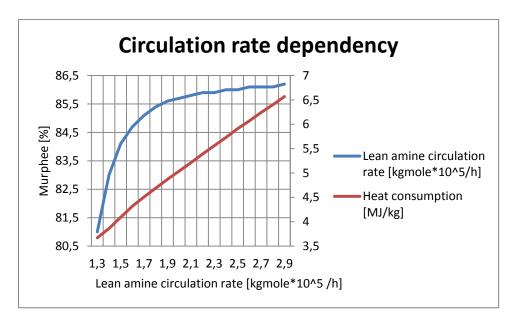


Figure 8: Lean amine circulation rate, CO_2 removal efficiency and heat demand for the Aspen HYSYS standard absorption model

5.4. Sensitivity calculation for the Aspen HYSYS vapour recompression model

In each subchapter is the purpose of the case presented. The chapter also contains something about the methodology used.

5.4.1. Variation of the lean amine circulation rate in the Aspen HYSYS vapour recompression model

For the vapour recompression model it was interesting to vary the lean amine circulation flow rate to the absorption column to find the optimal CO_2 removal efficiency compared to the equivalent thermodynamic work.

The circulation flow rate was varied from 1,10 *10^5 kgmole/h to 1,55 *10^5 kgmole/h with 0,05 *10^5 kgmole/h as the step size. The minimum temperature approach in the lean/rich heat exchanger was kept constant at 5K. The equivalent work and CO_2 efficiency was calculated and noted.

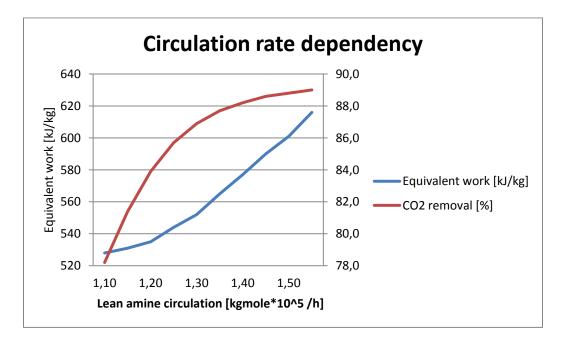


Figure 9: Lean amine circulation rate, CO₂ removal efficiency and heat demand for the Aspen HYSYS vapour recompression model

5.4.2. Variation of number plates in the absorption column in the Aspen HYSYS vapour recompression model

This case is supposed to give a understanding of how the number of plates in the absorption column affect the lean amine circulation rate and the equivalent thermodynamic work demand. This might also give some knowledge about the investment cost (number of plates) compared to operation cost (energy demand).

In this simulation the lean amine circulation rate to the absorption column was varied while the CO₂ removal efficient was kept constant at 85%, and the minimum temperature approach in the lean/rich heat exchanger was kept at 5K. The simulation was done by changing the number of plates from 13 to 21. Below 13 and above 21 the absorption column did not converge.

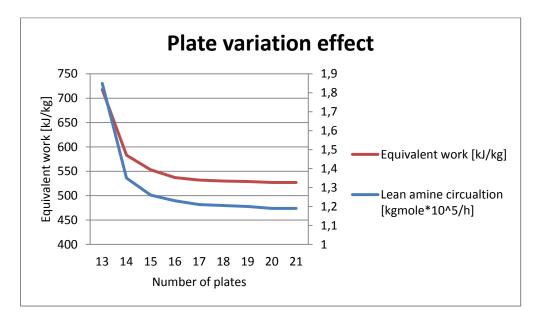


Figure 10: Effect of variation on the number of plates in the absorption column for the Aspen HYSYS vapour recompression model

5.4.3. Variation of the flash tank pressure in the Aspen HYSYS vapour recompression model

The purpose with this case is to verify how a change in the flash tank pressure affects the equivalent thermodynamic work of the process. When the flash tank pressure is changed the potential of heating in the lean/rich heat exchanger will be affected due to a change in flow rate. By keeping the minimum temperature approach constant the temperature to the stripper will be affected.

The valve before the flash tank was used to vary the pressure from 90 to 150 kPa with a 5 kPa step length while the minimum temperature approach was kept constant and the equivalent thermodynamic work was recorded.

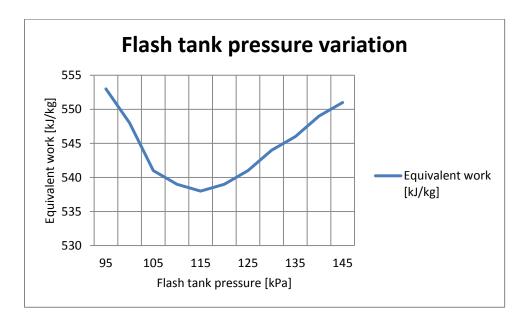


Figure 11: Effect of flash tank pressure variation on the equivalent work for the Aspen HYSYS vapour recompression model

6. Simulation strategy and calculation sequence in Aspen HYSYS

The calculation sequence in these Aspen HYSYS models was based on specified/guessed composition, flow rate, pressure and temperature to the absorption column and to the recompressed stream to the desorption column.

In the calculation sequence for the vapour recompression modification the absorption column was calculated first. The following calculations were on the rich amine pump and then the rich amine side of the heat exchanger. After this, the desorption column was solved, then the pressure reduction in the valve. From here the recycle loop was calculated: Meaning first the compressor and then checking the parameter values to the existing ones. If the aberration was outside the accepted deviation manually iterations was done until the requirement was met (recycle function was on ignore). When a solution is found the lean amine pump was calculated. Then the lean side of the heat exchanger was solved. After this, the cooler was solved, then the mixer and the valve. The last recycle function was also put on ignored while modeling. This means that the composition was manually compared to the specified composition in the lean amine feed to the absorption column.

As mentioned, the adjust functions to the absorption/desorption column was set to ignored. This was basically done because the convergence of the process was eased. The specifications were manually changed in the system until the deviation was within the accepted limits. The sensitivity of these adjust functions was set as default. Furthermore, the number of plates in the absorption and desorption column was based on earlier works and on the try-and-failure method. For both columns the used solver was the Modified HYSIM Inside-Out. This solver method was experienced to give the best column convergence. The amine flow rate to the absorption column was adjusted to achieve the requirement of 85% CO₂ removal. Efficiency in pumps and the compressor was set to 75%. The compositions in the make-up streams are pure water and amine. The mole flow specifications for the two make up streams are imported from the spreadsheet in the model. This spreadsheet sums all the lost amine and water from

the system, and from this spreadsheet the values are manually exported to the stream specifications. For the mixer the outlet pressure is set to lowest inlet.

The simulation strategy concerning the lean split with vapour recompression modification was based on the method of try-and-failure. To get a converged model for both the columns and all recycle functions was very demanding. The specifications connected to the recycle functions were manually updated. The three recycle functions increase the complexity of the model dramatically compared to two recycle functions. The model is converged for all columns and recycle functions. However, the complexity and low flexibility of the model makes any reliable sensitivity analysis hard to achieve.

7. Evaluation of the Aspen HYSYS simulation results

In this chapter the energy demands of the simulation results are evaluated by qualitative and quantitative methods.

7.1. Evaluation of the base cases

Results from the base case simulations are presented in table 15. The boiler duty given by MJ/kg is the energy consumption in the reboiler for each kg removed CO₂. The cost calculation is done as described in chapter 4 with expected operation of 8400 hours/year.

Table 15: The Aspen HYSYS base case simulation results

Modification/	Boiler duty,	Boiler duty,	Compressor,	Equivalent	Energy cost
base case	[MW]	[MJ/kg]	[MW]	work	[MNOK/year]
				[kJ/kg]	
Standard	161	4,3	-	724	120,36
Vapour	102	2,7	2,7	538	85,33
recompression					
Lean split with	103	2,7	1,1	485	80,70
vapour					
recompression					

The boiler duty for each kg CO2 removed is calculated to 4,3 MJ/kg for the standard base case, and 2,7 MJ/kg for both the vapour recompression and lean split with vapour recompression base case. Compared to other research done as [15] and [14] these values are approximately the same and is considered typical values for these types of modifications based on flue gas from a natural gas power and heat plant. By comparing the compressor duty for the base cases it is clear to see that the standard process is the best since it has none. But for the other two modifications the lean split with vapour recompression is the best. It has only about 40% of the compressor duty of the vapour recompression model. When

comparing the equivalent work for these modifications it is clear that the lean split with vapour recompression modification is less energy demanding than the other two models. The two modifications with the lowest equivalent work demand have an increase in the electricity demand because of the compressor. However, the overall efficiency of the system will increase because of the much lower reboiler duty consumption. The boiler uses stream from the combined power and heat plant.

From table 15 it is clear that the energy cost is lowest for the lean split with vapour recompression modification. This modification has 80,70 MNOK per year compared to 85,33 MNOK for the vapour recompression modification, and 120,36 MNOK each year for the standard CO₂ removal process. For these values the amount of CO₂ removed is about 1,15 M ton/year.

7.2. Evaluation of the sensitivity cases

When reading the evaluations and remarks for the sensitivity cases it should be noted that these values are restricted to similar operational conditions and feed values.

7.2.1. Evaluation of the sensitivity calculations for the Aspen HYSYS standard absorption model

7.2.1.1. Evaluation of the case: Variation of lean amine circulation in the Aspen HYSYS standard absorption model

For the lean amine circulation rate in the standard process figure 8 shows that the CO_2 removal efficiency is not increasing much after 85% with increasing circulation rate. At the same time the thermal energy demand is increasing linear with increasing circulation rate. This means that the simulation result indicates that the optimal CO_2 removal efficiency will be about 85% by considering the thermal energy demand in the reboiler.

7.2.2. Evaluation of the sensitivity calculations for the Aspen HYSYS vapour recompression model

7.2.2.1. Evaluation of the case: Variation of the lean amine circulation rate in the Aspen HYSYS vapour recompression model

The effect of vary the lean amine circulation rate in the vapour recompression model is presented in figure 9. The CO_2 removal efficiency does have the same trend as for the standard model; the slope reduces with increasing lean amine circulation rate. The equivalent thermodynamic work does however not follow a linear line, but increases potentially with increasing circulation rate. According to the figure the optimal CO_2 removal efficiency will be around 84-86%. At this efficiency the circulation rate will be about $1,20-1,25*10^5$ kgmole/h, and the equivalent thermodynamic work will be at 580-600 kJ/kg.

7.2.2.2. Evaluation of the case: Variation of number plates in the absorption column in the Aspen HYSYS vapour recompression model

Figure 10 shows the lean amine circulation rate and equivalent work for each number of plate simulated. In this simulation the circulation rate CO₂ removal efficiency was kept constant at 85%. From the lowest amount of plates (13) the equivalent work and circulation rate decreased a lot to the simulation result with 14 plates. From 14 to 16 plates the equivalent work and circulation rate was reduced from respectively 583 kJ/kg and 1,35 *10^5 kgmole/h to 537 kJ/kg and 1,23 *10^5 kgmole/h. This is a 7,9% reduction in the equivalent work. The simulation results with more than 16 plates shows that the reduction in circulation rate and equivalent work will wane. From the values in figure 10 the optimal number of plates will be from 14 to 16. This will be a trade-off between investment and operation cost. It should however be mentioned that these values are restricted to similar operational conditions.

7.2.2.3. Evaluation of the case: Variation of the flash tank pressure in the Aspen HYSYS vapour recompression model

The effect of variation in the flash tank pressure on the equivalent work demand is shown in figure 11. The minimum temperature approach in the lean/rich heat exchanger is kept constant at about 5K for all simulations. The figure shows that the optimal flash tank pressure will be about 110-120 kPa when considering the energy saving. With increasing or decreasing flash

tank pressure from this range the equivalent work demand will increase. This illustrate that the flash tank pressure should be at this value range to minimize the energy cost. However, it should be mentioned that a minimization of the temperature approach will increase the purchase/investment cost of the heat exchanger. In addition, a different temperature approach may change the optimal flash tank pressure.

In paper [8] the optimum flash tank pressure has been evaluated to be at 1,2 bar. This value is in line with the estimated value in this work.

8. Uncertainties in the simulations

Accuracy

When simulations were repeated small deviations in values occurs. This deviation is about 0,5%. This is expected to be because of starting values in the model and the accepted sensitivity deviations in the software functions. This deviation may be reduced if the sensitivities are reduced, i.e. tighter convergence limits.

The simulations were done with Kent-Eisenberg as the model for the aqueous solution. But a test was conducted with Li-Mather to check the difference in calculation results. A change between these two models gave an aberration of more than 2% change in the CO₂ efficiency.

Simplified model

The three simulated models are only simplified processes. Heat losses from equipment are neglected, and so are the pressure drops throughout the process. A real process will consist of more equipment and components which will generate a higher pressure drop and even more heat loss. As mentioned in chapter 3.4 a real process will have more auxiliary systems that will increase the complexity and the electricity demand of the total system, but these are not considered in this work.

One of the important discussions around these kinds of simulations is the complexity versus the simplicity of different process/modification models. A complex model might be slightly more accurate compared to a simplified model, but it will however be more information and detail demanding, time consuming, and more column convergence problems will occur.

Adiabatic efficiencies

The adiabatic efficiency in the pumps was set to 75 %. This is the default value in Aspen HYSYS. This value might not be accurate enough for a detailed pump power study. However, the pump duty is relatively small compared to the compressor duty and the thermal heat

demand of the system, and will therefore not be important in this study. The adiabatic efficiency for the compressor was also set to 75%, which is the default value in Aspen HYSYS.

Property package limitation

The parameter value range limits for the amine package was fulfilled for all calculations except for the lean split with vapour recompression modification. In this simulation some of the streams between the columns were giving a warning. However, the streams connected to the columns were within the amine package range.

9. Capital cost estimation of the Aspen HYSYS base cases

The capital cost is defined as the total cost of equipment, engineering, and installing. The equipment cost estimations made in this chapter are scaled and cost converted by equation 4.3 and 4.6 from table 16. Data not available there are from [27] or [15]. When the costs of the equipment are estimated equation 4.4 are used to estimate the capital cost. All calculation methods used are described in chapter 4. It is used three significant digits in this estimation.

9.1. Pumps, coolers, condenser, reboiler and separator cost

Table 16 contains equipment cost before the cash index converting and scaling are applied.

Table 16: Equipment cost in 2010 currency [23]

List of equipment	Equipment cost, [NOK]
Rich pump	2890000
Reboiler	6120000
Lean pump	1330000
Lean cooler	1430000
Condenser	264000
Separator	1020000
Semi-lean pump	1330000
Semi-lean cooler	1430000

9.2. Compressor costs

The compressor costs for the two relevant cases are estimated by power demand and presented in table 17. The material is assumed to be stainless steel. Currency converting was done by equation 4.5.

Table 17: Compressor cost [27]

Modification	Cost [\$]	Cost [NOK]
Standard	-	-
Vapour recompression	9770000	57000000
Lean split with vapour recompression	4520000	26400000

9.3. Absorption column cost

The method and values of absorption column dimensioning is referred to [15]. That work has close to the same specifications and equal number of stages in the column.

The absorber dimensions and cost for packing and skirt are presented in table 18 and 19.

Table 18: Absorber dimensions

Modification	Packing height	Column height	Column diameter
	[m]	[m]	[m]
Standard	14	16	17,3
Vapour recompression	16	28	17,3
Lean split with vapour recompression	24	35	17,3

Table 19: Absorber cost

Modification	Absorber packing cost	Absorber skirt cost
	[NOK]	[NOK]
Standard	21800000	2430000
Vapour recompression	23800000	2520000
Lean split with vapour	34200000	2980000
recompression		

9.4. Desorption column cost

Costs for the desorption column are scaled and the cost updated from [23].

The desorber packing and skirt costs are presented in table 20.

Table 20: Desorber cost

Modification	Desorber packing cost	Desorber skirt cost
	[NOK]	[NOK]
Standard	7900000	5490000
Vapour recompression	7900000	5490000
Lean split with vapour	5660000	3940000
recompression		

9.5. Lean/rich heat exchanger cost

The lean/rich heat exchanger is scaled with heat transfer area. Heat transfer area is calculated by the following equation:

$$A = \frac{Q}{U \times \Delta T_{LM} \times f} \tag{9.1}$$

- Logarithmic mean temperature difference ΔT_{LM} [K] and Q [kW] is calculated by Aspen HYSYS.
- Temperature correction factor f is set to 1.
- Heat transfer coefficient U is set to 0,5 $\frac{kW}{m^2K}$.

Table 21 contains the lean/rich heat exchanger costs for the different configurations.

 Table 21: Lean/rich heat exchanger cost

Modification	Cost
	[NOK]
Standard	70700000
Vapour recompression	62100000
Lean split with vapour recompression	46600000

9.6. Comparison of capital cost

Table 22 contains the scaled capital costs for each configuration in 2013 currency.

Table 22: Capital cost

	Standard	Vapour	Lean split with
	absorption	recompression	vapour
			recompression
Absorber packing	109000000	119000000	171000000
Absorber skirt	12150000	12600000	14900000
Desorber packing	39500000	39500000	28300000
Desorber skirt	27400000	27400000	19700000
Lean pump	9170000	7710000	3730000
Lean cooler	14000000	6200000	3200000
Rich pump	13300000	11200000	9670000
Semi-lean pump	-	-	4470000
Semi-lean cooler	-	-	3730000
Separator	-	5270000	5270000
Compressor	-	284000000	131000000
Lean/rich heat	254000000	290000000	345000000
exchanger			
Reboiler	34800000	25800000	26000000
Condenser	1510000	2430000	1370000
SUM	515000000	832000000	768000000

10. Evaluation of the capital cost estimation

The capital costs are presented in table 23. These costs include equipment, engineering, and installation costs. In addition, [23] are based on assumed realistic types of materials. This means that the different material costs are included in the capital costs.

It is quite clear that the standard process has the lowest capital cost with 515 MNOK. This is because this process is the simplest with lowest amount of equipment. For the other two cases the compressor cost are the most significant single major equipment which increase the cost dramatically. Since the flow rate in the lean split with vapour recompression modification does have a significant lower rate than the vapour recompression modification the compressor cost is very different. This difference alone makes the vapour recompression modification the most expensive with 832 MNOK, compared to 768 MNOK for the lean split with vapour recompression modification.

The capital cost estimations is based on several methods and sources which has a latent uncertainty attached. According to [22] do some of the methods used expect to have an accuracy of $\pm 50\%$.

In this work there are a few components which are not considered, e.g. a fan, fan motor, DCC and some auxiliary equipment. This means that the capital cost estimation should be lower than similar work. However, these costs will be approximately the same for all the different base cases simulated in this work. And therefore, the costs can still be compared relative to each other.

11. Recommendations for further research

It is of interest to verify results from this work. Therefore more research on the capital and energy cost for these configurations are recommended. However, more simulations and cost analysis for different modifications are also interesting.

The calculations in the lean split with vapour recompression model gave low energy and cost results. Sensitivity calculation cases on this model may be very interesting for verifying and optimize the modification. But to do this an improvement of the robustness/flexibility of the model is necessary.

It is also strongly recommended that future capital cost analyses are done by commercial software programs or handbooks to reduce the uncertainty of calculations as much as possible.

In the future when some real data from a big scale CO₂ removal plant are published verifications of simulation tools and calculations would be very interesting.

12. Conclusion

In this work three different flow sheet configurations have been evaluated for post combustion CO₂ capture from a combined heat and power plant by the use of chemical absorption. The simulations have been conducted in the simulation tool Aspen HYSYS. The configurations evaluated are a standard absorption process, a vapour recompression modification, and a lean split with vapour recompression modification. For all three configurations the energy consumption and the capital cost have been evaluated. In addition, sensitivity cases have been conducted for optimization, especially in the vapour recompression modification. The lean split with vapour recompression was too complex and had too low flexibility to achieve converged calculations in sensitivity cases.

For comparison of all three modifications the CO₂ removal efficiency of 85%, feed parameters, and the minimum temperature approach in the lean/rich heat exchanger of 5K was kept constant. The energy consumption for steam and electricity was converted to energy cost per year.

For all three configurations the lean split with vapour recompression modification had the lowest energy cost with 81 MNOK/year when removing about 1,15 M ton CO₂/year. However, the vapour recompression modification had only a slightly higher cost equal to 85 MNOK/year. The standard absorption process had an energy cost of 120 MNOK/year.

The capital costs estimations for the three configurations gave the lowest cost for the standard process with about 514 MNOK. The two other modifications were more expensive. The biggest difference was due to the extra compressor. The lean split with vapour recompression had a cost of 768 MNOK, while the vapour recompression modification had a cost of 832 MNOK.

Sensitivity calculations for the vapour recompression modification was analyzed to have the following optimal values: CO₂ removal efficiency of 84-86%, flash tank pressure at 110-120 kPa, 14-16 stages in the absorption column. It should however be noted that these values are restricted to similar operational conditions and feed values.

The uncertainties are very high for the capital and energy cost estimations. More accurate estimations are probably necessary to conclude which modification and parameters are the most optimum.

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14. Appendices

Appendix 1	Master's thesis task description
Appendix 2	Figure of the standard absorption base case in Aspen HYSYS
Appendix 3	Figure of the vapour recompression base case in Aspen HYSYS
Appendix 4	Figure of the lean split with vapour recompression base case in Aspen HYSYS
Appendix 5	Aspen HYSYS report for the standard absorption base case
Appendix 6	Aspen HYSYS report for the vapour recompression base case
Appendix 7	Aspen HYSYS report for the lean split with vapour recompression base case



UiT Master's Thesis

<u>Title</u>: CO₂ absorption and desorption simulation with Aspen HYSYS

Supervisor: Associate Professor Lars Erik Øi, Telemark University College

Task Description:

- 1. Evaluation of earlier projects on process simulation of CO₂ capture with emphasis on different process configurations aiming at reduction of energy consumption.
- 2. Simulations of CO₂ capture with Aspen HYSYS absorption and desorption in an amine solution. Evaluation of different options for reducing the energy consumption, especially by using vapour recompression.
- 3. Calculate energy optimum and possibly cost optimum conditions for processes, especially based on vapour recompression.
- 4. Evaluation of uncertainties in the calculations.

Background:

The most studied method for removal of CO_2 from atmospheric exhaust is by the help of amine solutions. HYSYS has been much used in projects for process simulation of CO_2 removal. There are several possibilities to improve the existing models. Vapour recompression is one of the most promising configurations for reducing the energy consumption.



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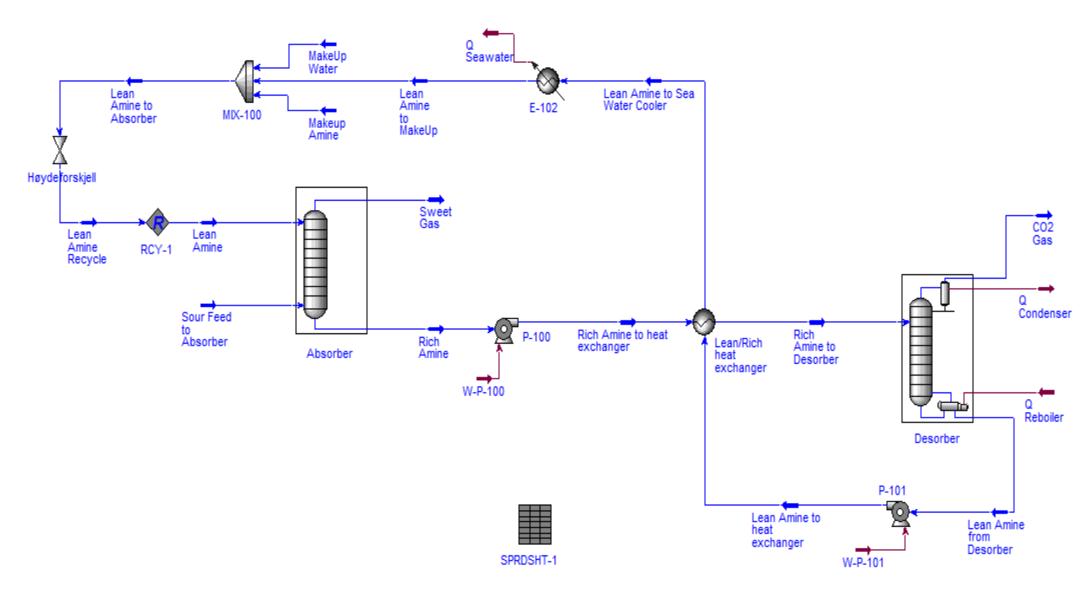
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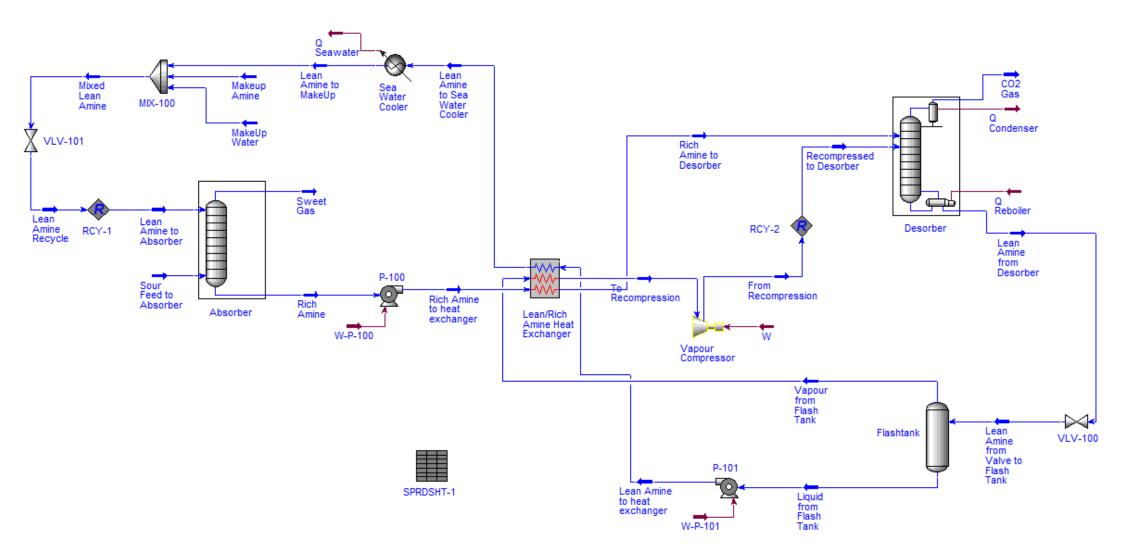
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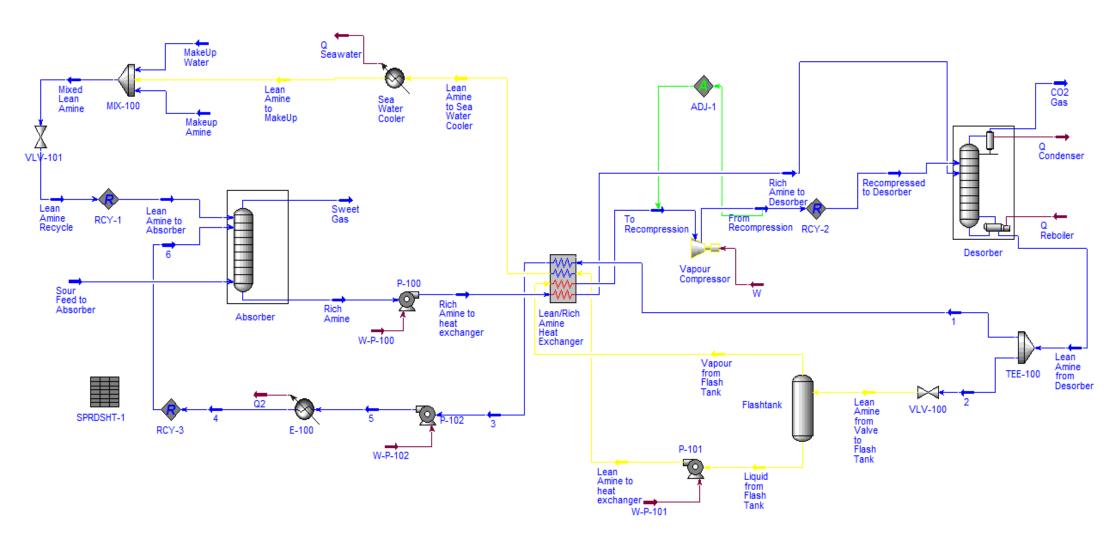
Student: Even Birkelund

Practical arrangements:

The work will mainly be carried out at the University of Tromsø, with a possible visit at the TCM facility at Mongstad.







1		The state of	Case Name:	STANDARD ABSO	RPTION PROCESS.H	SC
3	aspen Surlington, M/		Unit Set:	SI1		
	usa usa		Date/Time:	Fri May 31 13:26:0	8 2013	
	Material Stream	: Sour Fe	ed		Fluid Package: Property Package:	Basis-1 Amine Pkg - KE
1			CONDITIONS			*
1		Overall	Vapour Phase			
2	Vapour / Phase Fraction	1.0000	1.0000			
4	Temperature: (C)	194.0 *	194.0			
4	Pressure: (kPa)	110.0 *	110.0			
1	Molar Flow (kgmole/h) Mass Flow (kg/h)	1.091e+005 ° 3.100e+006	1.091e+005 3.100e+006			
†	Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h)	3633	3633			
†	Molar Enthalpy (kJ/kgmole)	1.383e+004	1,383e+004			
t	Molar Entropy (kJ/kgmole-C)	208.0	208.0			
1	Heat Flow (MW)	419.3	419.3			
ļ	Liq Vol Flow @Std Cond (m3/h)					
2	Material Stream	: Sour Fe	ed to Abso	rber	Fluid Package: Property Package:	Basis-1 Amine Pkg - KE
1			CONDITIONS			
+		Overall				
+	Vapour / Phase Fraction	Overall 1,0000	Vapour Phase 1.0000			
†	Temperature: (C)	40.00	40.00			
	Pressure: (kPa)	101.0 *	101.0			
	Molar Flow (kgmole/h)	1.091e+005	1.091e+005			
1	Mass Flow (kg/h)	3.100e+006	3.100e+006			
10	Std Ideal Liq Vol Flow (m3/h)	3633	3633			
-					_	
ļ	Molar Enthalpy (kJ/kgmole)	9211	9211			
	Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C)	9211 196.6	9211 196.6		1	
3 4 5 7	Molar Enthalpy (kJ/kgmole)	9211	9211			
3	Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW)	9211 196.6 279.3	9211 196.6 279.3		Fluid Package: Property Package:	Basis-1 Amine Pkg - KE
5 6 7	Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h)	9211 196.6 279.3 	9211 196.6 279.3 			
3 3 3	Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream	9211 196.6 279.3 : Sweet G	9211 196.6 279.3 CONDITIONS Vapour Phase			
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	Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C)	9211 196.6 279.3 : Sweet G	9211 196.6 279.3 CONDITIONS Vapour Phase			
	Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C)	9211 196.6 279.3 : Sweet G	9211 196.6 279.3 (as CONDITIONS Vapour Phase 1.0000 47.93			
3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h)	9211 196.6 279.3 : Sweet G	9211 196.6 279.3 6AS CONDITIONS Vapour Phase 1.0000 47.93 101.0			
3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h)	9211 196.6 279.3 : Sweet G Overall 1.0000 47.93 101.0 1.093e+005 3.025e+006 3530	9211 196.6 279.3 2			
3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole)	9211 196.6 279.3 : Sweet G Overall 1.0000 47.93 101.0 1.093e+005 3.025e+006 3530 9483	9211 196.6 279.3 2			
3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C)	9211 196.6 279.3 : Sweet G Overall 1.0000 47.93 101.0 1.093e+005 3.025e+006 3530 9483 197.1	9211 196.6 279.3 2			
3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW)	9211 196.6 279.3 : Sweet G Overall 1.0000 47.93 101.0 1.093e+005 3.025e+006 3530 9483 197.1 287.9	9211 196.6 279.3 2			
4 5 6 7 7 8 9 9 0 1 1 2 3 4 4 5 5	Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C)	9211 196.6 279.3 : Sweet G Overall 1.0000 47.93 101.0 1.093e+005 3.025e+006 3530 9483 197.1 287.9	9211 196.6 279.3		Property Package:	Amine Pkg - KE
3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h)	9211 196.6 279.3 : Sweet G Overall 1.0000 47.93 101.0 1.093e+005 3.025e+006 3530 9483 197.1 287.9	9211 196.6 279.3		Property Package	Amine Pkg - KE
222333333333333333333333333333333333333	Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h)	9211 196.6 279.3 : Sweet G Overall 1.0000 47.93 101.0 1.093e+005 3.025e+006 3530 9483 197.1 287.9 : Rich Am	9211 196.6 279.3 2		Property Package:	Amine Pkg - KE
222233333333333333333333333333333333333	Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MVV) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MVV) Liq Vol Flow @Std Cond (m3/h) Material Stream	9211 196.6 279.3 : Sweet G Overall 1.0000 47.93 101.0 1.093e+005 3.025e+006 3530 9483 197.1 287.9 : Rich Am	9211 196.6 279.3 2		Property Package:	Amine Pkg - KE
3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction	9211 196.6 279.3 : Sweet G Overall 1.0000 47.93 101.0 1.093e+005 3.025e+006 3530 9483 197.1 287.9 : Rich Am	9211 196.6 279.3 2		Property Package:	Amine Pkg - KE
3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MVV) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MVV) Liq Vol Flow @Std Cond (m3/h) Material Stream	9211 196.6 279.3 : Sweet G Overall 1.0000 47.93 101.0 1.093e+005 3.025e+006 3530 9483 197.1 287.9 : Rich Am Overall 0.0000	9211 196.6 279.3 2		Property Package:	Amine Pkg - KE
3 3 4 5 6 7 7 8 8 9 9 9 1	Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MVV) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MVV) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C)	9211 196.6 279.3 : Sweet G Overall 1.0000 47.93 101.0 1.093e+005 3.025e+006 3530 9483 197.1 287.9 : Rich Am Overall 0.0000 43.45	9211 196.6 279.3 2		Property Package:	Amine Pkg - KE
	Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa)	9211 196.6 279.3 : Sweet G Overall 1.0000 47.93 101.0 1.093e+005 3.025e+006 3530 9483 197.1 287.9 : Rich Am Overall 0.0000 43.45 101.0	9211 196.6 279.3 2		Property Package:	Amine Pkg - KE
	Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kPa)	9211 196.6 279.3 : Sweet G Overall 1.0000 47.93 101.0 1.093e+005 3.025e+006 3530 9483 197.1 287.9 : Rich Am Overall 0.0000 43.45 101.0 1.598e+005	9211 196.6 279.3 2		Property Package:	Amine Pkg - KE
	Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole)	9211 196.6 279.3 : Sweet G Overall 1.0000 47.93 101.0 1.093e+005 3.025e+006 3530 9483 197.1 287.9 : Rich Am Overall 0.0000 43.45 101.0 1.598e+005 3.852e+006 3911 -2.805e+004	9211 196.6 279.3 2		Property Package:	Amine Pkg - KE
	Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Enthalpy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Enthalpy (kJ/kgmole) Molar Enthalpy (kJ/kgmole) Molar Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Enthalpy (kJ/kgmole-C)	9211 196.6 279.3 : Sweet G Overall 1.0000 47.93 101.0 1.093e+005 3.025e+006 3530 9483 197.1 287.9 : Rich Am Overall 0.0000 43.45 101.0 1.598e+005 3.852e+006 3911 -2.805e+004 85.83	9211 196.6 279.3 2		Property Package:	Amine Pkg - KE
	Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole)	9211 196.6 279.3 : Sweet G Overall 1.0000 47.93 101.0 1.093e+005 3.025e+006 3530 9483 197.1 287.9 : Rich Am Overall 0.0000 43.45 101.0 1.598e+005 3.852e+006 3911 -2.805e+004	9211 196.6 279.3 2		Property Package:	Amine Pkg - KE

4				Case Name:	STANDARD ABSORE	PTION PROCESS.H	sc
3	(acnonico	Burlington M.	OF TROMSO	Unit Set:	SI1		
5	aspenie	USA		Date/Time: 1	Fri May 31 13:26:08 2	013	
3						Fluid Package:	Basis-1
	Mater	ial Stream	: Lean An	nine		Property Package:	Amine Pkg - KE
1				CONDITIONS			
1		eren i and in	Overall	Aqueous Phase			
2	Vapour / Phase Fraction	on	0.0000	1.0000			
+	Temperature:	(C)	40.01 °	40.01 101.0			
+	Pressure: Molar Flow	(kPa) (kgmole/h)	1.600e+005 °	1.600e+005			
	Mass Flow	(kg/h)	3.777e+006	3.777e+006			
4	Std Ideal Liq Vol Flow	(m3/h)	3808	3808			
+	Molar Enthalpy Molar Entropy	(kJ/kgmole) (kJ/kgmole-C)	-2.783e+004 86.17	-2.783e+004 86.17			
1	Heat Flow	(MW)	-1237	-1237			
+	Liq Vol Flow @Std Cor	nd (m3/h)	3643 •	3643			
1	Mater	ial Stream	: Rich Am	nine to heat	exchange	Fluid Package:	Basis-1
1					onon-un-g	Property Package:	Amine Pkg - KE
ł				CONDITIONS			
			Overall	Aqueous Phase			
Ī	Vapour / Phase Fraction		0.0000	1.0000			
+	Temperature:	(C)	43.49 200.0 °	43.49			
+	Pressure: Molar Flow	(kPa) (kgmole/h)	1.598e+005	200.0 1.598e+005			
$\frac{1}{2}$	Mass Flow	(kg/h)	3.852e+006	3.852e+006			
-	Ctd Ideal Lie Val Flour	(m3/h)	3911	3911		7.60	
٠	Std Ideal Liq Vol Flow		2 2 2 2 2 2 2 2	2222 224		1	
I	Molar Enthalpy	(kJ/kgmole)	-2.805e+004	-2.805e+004			
			-2.805e+004 85.83 -1245	-2.805e+004 85.83 -1245			
3 4 5 6	Molar Enthalpy Molar Entropy	(kJ/kgmole) (kJ/kgmole-C) (MW)	85.83	85.83		Fluid Package:	Racio 1
5 5 5	Molar Enthalpy Molar Entropy Heat Flow Liq Vol Flow @Std Cor	(kJ/kgmole) (kJ/kgmole-C) (MW) nd (m3/h)	85.83 -1245 3648 °	85.83 -1245	orber	Fluid Package: Property Package:	Basis-1 Amine Pkg - KE
	Molar Enthalpy Molar Entropy Heat Flow Liq Vol Flow @Std Cor	(kJ/kgmole) (kJ/kgmole-C) (MW) nd (m3/h)	85.83 -1245 3648 °	85.83 -1245 3648 nine to Desc	orber		
	Molar Enthalpy Molar Entropy Heat Flow Liq Vol Flow @Std Cor	(kJ/kgmole) (kJ/kgmole-C) (MW) nd (m3/h)	85.83 -1245 3648 ·	85.83 -1245 3648 nine to Desc	orber		
	Molar Enthalpy Molar Entropy Heat Flow Liq Vol Flow @Std Cor Mater Vapour / Phase Fractic Temperature:	(kJ/kgmole) (kJ/kgmole-C) (MW) nd (m3/h) rial Stream	85.83 -1245 3648 • 1: Rich Am Overall 0.0006 104.5 •	85.83 -1245 3648 Nine to Desc CONDITIONS Vapour Phase 0.0006 104.5	Aqueous Phase 0.9994 104.5		
	Molar Enthalpy Molar Entropy Heat Flow Liq Vol Flow @Std Cor Mater Vapour / Phase Fractic Temperature: Pressure:	(kJ/kgmole) (kJ/kgmole-C) (MW) nd (m3/h) ial Stream on (C) (kPa)	85.83 -1245 3648 * Pich Am Overall 0.0006 104.5 * 200.0 *	85.83 -1245 3648 Nine to Desc CONDITIONS Vapour Phase 0.0006 104.5 200.0	Aqueous Phase 0.9994 104.5 200.0		
	Molar Enthalpy Molar Entropy Heat Flow Liq Vol Flow @Std Cor Mater Vapour / Phase Fractic Temperature:	(kJ/kgmole) (kJ/kgmole-C) (MW) nd (m3/h) rial Stream	85.83 -1245 3648 • 1: Rich Am Overall 0.0006 104.5 •	85.83 -1245 3648 Nine to Desc CONDITIONS Vapour Phase 0.0006 104.5	Aqueous Phase 0.9994 104.5		
	Molar Enthalpy Molar Entropy Heat Flow Liq Vol Flow @Std Cor Mater Vapour / Phase Fraction Temperature: Pressure: Molar Flow Mass Flow Std Ideal Liq Vol Flow	(kJ/kgmole) (kJ/kgmole-C) (MW) nd (m3/h) ial Stream (C) (kPa) (kgmole/h) (kg/h) (m3/h)	85.83 -1245 3648 * Rich An Overall 0.0006 104.5 * 200.0 * 1.598e+005 3.852e+006 3911	85.83 -1245 3648 Nine to Desc CONDITIONS Vapour Phase 0.0006 104.5 200.0 92.83 2790 3.185	Aqueous Phase 0.9994 104.5 200.0 1.597e+005 3.850e+006 3908		
	Molar Enthalpy Molar Entropy Heat Flow Liq Vol Flow @Std Cor Mater Vapour / Phase Fraction Temperature: Pressure: Molar Flow Mass Flow Std Ideal Liq Vol Flow Molar Enthalpy	(kJ/kgmole) (kJ/kgmole-C) (MW) nd (m3/h) rial Stream (C) (kPa) (kgmole/h) (kg/h) (kJ/kgmole)	85.83 -1245 3648 * 1: Rich An Overall 0.0006 104.5 * 200.0 * 1.598e+005 3.852e+006 3911 -2.258e+004	85.83 -1245 3648 Nine to Desc CONDITIONS Vapour Phase 0.0006 104.5 200.0 92.83 2790 3.185 1.291e+004	Aqueous Phase 0.9994 104.5 200.0 1.597e+005 3.850e+006 3908 -2.260e+004		
	Molar Enthalpy Molar Entropy Heat Flow Liq Vol Flow @Std Cor Mater Vapour / Phase Fraction Temperature: Pressure: Molar Flow Mass Flow Std Ideal Liq Vol Flow	(kJ/kgmole) (kJ/kgmole-C) (MW) nd (m3/h) ial Stream (C) (kPa) (kgmole/h) (kg/h) (m3/h)	85.83 -1245 3648 * Rich An Overall 0.0006 104.5 * 200.0 * 1.598e+005 3.852e+006 3911	85.83 -1245 3648 Nine to Desc CONDITIONS Vapour Phase 0.0006 104.5 200.0 92.83 2790 3.185	Aqueous Phase 0.9994 104.5 200.0 1.597e+005 3.850e+006 3908		
	Molar Enthalpy Molar Entropy Heat Flow Liq Vol Flow @Std Cor Water Vapour / Phase Fraction Temperature: Pressure: Molar Flow Mass Flow Std Ideal Liq Vol Flow Molar Enthalpy Molar Entropy	(kJ/kgmole) (kJ/kgmole-C) (MW) nd (m3/h) rial Stream (C) (kPa) (kgmole/h) (kg/h) (m3/h) (kJ/kgmole) (kJ/kgmole-C) (MW)	85.83 -1245 3648 * 2: Rich An Overall 0.0006 104.5 * 200.0 * 1.598e+005 3.852e+006 3911 -2.258e+004 92.48	85.83 -1245 3648 Nine to Desc CONDITIONS Vapour Phase 0.0006 104.5 200.0 92.83 2790 3.185 1.291e+004 220.7	Aqueous Phase 0.9994 104.5 200.0 1.597e+005 3.850e+006 3908 -2.260e+004 92.40		
	Molar Enthalpy Molar Entropy Heat Flow Liq Vol Flow @Std Cor Mater Vapour / Phase Fractle Temperature: Pressure: Molar Flow Mass Flow Std Ideal Liq Vol Flow Molar Enthalpy Molar Entropy Heat Flow Liq Vol Flow @Std Cor	(kJ/kgmole) (kJ/kgmole-C) (MW) nd (m3/h) rial Stream (C) (kPa) (kgmole/h) (kg/h) (m3/h) (kJ/kgmole) (kJ/kgmole-C) (MW) nd (m3/h)	85.83 -1245 3648 * 1: Rich Am Overall 0.0006 104.5 * 200.0 * 1.598e+005 3.852e+006 3911 -2.258e+004 92.48 -1003 3648 *	85.83 -1245 3648 Nine to Desc CONDITIONS Vapour Phase 0.0006 104.5 200.0 92.83 2790 3.185 1.291e+004 220.7 0.3328	Aqueous Phase 0.9994 104.5 200.0 1.597e+005 3.850e+006 3908 -2.260e+004 92.40 -1003 3646		
	Molar Enthalpy Molar Entropy Heat Flow Liq Vol Flow @Std Cor Mater Vapour / Phase Fractle Temperature: Pressure: Molar Flow Mass Flow Std Ideal Liq Vol Flow Molar Enthalpy Molar Entropy Heat Flow Liq Vol Flow @Std Cor	(kJ/kgmole) (kJ/kgmole-C) (MW) nd (m3/h) rial Stream (C) (kPa) (kgmole/h) (kg/h) (m3/h) (kJ/kgmole) (kJ/kgmole-C) (MW) nd (m3/h)	85.83 -1245 3648 * 1: Rich Am Overall 0.0006 104.5 * 200.0 * 1.598e+005 3.852e+006 3911 -2.258e+004 92.48 -1003 3648 *	85.83 -1245 3648 Nine to Desc CONDITIONS Vapour Phase 0.0006 104.5 200.0 92.83 2790 3.185 1.291e+004 220.7 0.3328 2.643	Aqueous Phase 0.9994 104.5 200.0 1.597e+005 3.850e+006 3908 -2.260e+004 92.40 -1003 3646	Property Package:	Amine Pkg - KE
	Molar Enthalpy Molar Entropy Heat Flow Liq Vol Flow @Std Cor Mater Vapour / Phase Fractle Temperature: Pressure: Molar Flow Mass Flow Std Ideal Liq Vol Flow Molar Enthalpy Molar Entropy Heat Flow Liq Vol Flow @Std Cor	(kJ/kgmole) (kJ/kgmole-C) (MW) nd (m3/h) rial Stream (C) (kPa) (kgmole/h) (kg/h) (m3/h) (kJ/kgmole) (kJ/kgmole-C) (MW) nd (m3/h)	85.83 -1245 3648 * 1: Rich Am Overall 0.0006 104.5 * 200.0 * 1.598e+005 3.852e+006 3911 -2.258e+004 92.48 -1003 3648 *	85.83 -1245 3648 Nine to Desc CONDITIONS Vapour Phase 0.0006 104.5 200.0 92.83 2790 3.185 1.291e+004 220.7 0.3328 2.643 nine to heat	Aqueous Phase 0.9994 104.5 200.0 1.597e+005 3.850e+006 3908 -2.260e+004 92.40 -1003 3646	Property Package:	Amine Pkg - KE
	Molar Enthalpy Molar Entropy Heat Flow Liq Vol Flow @ Std Cor Mater Vapour / Phase Fraction Temperature: Pressure: Molar Flow Mass Flow Std Ideal Liq Vol Flow Molar Enthalpy Molar Entropy Heat Flow Liq Vol Flow @ Std Cor Mater Vapour / Phase Fraction	(kJ/kgmole) (kJ/kgmole-C) (MW) nd (m3/h) rial Stream (C) (kPa) (kgmole/h) (kg/h) (kg/h) (kJ/kgmole-C) (MW) nd (m3/h) rial Stream	85.83 -1245 3648 * 2: Rich An Overall 0.0006 104.5 * 200.0 * 1.598e+005 3.852e+006 3911 -2.258e+004 92.48 -1003 3648 * 1: Lean An	85.83 -1245 3648 nine to Desc CONDITIONS Vapour Phase 0.0006 104.5 200.0 92.83 2790 3.185 1.291e+004 220.7 0.3328 2.643 nine to heat	Aqueous Phase 0.9994 104.5 200.0 1.597e+005 3.850e+006 3908 -2.260e+004 92.40 -1003 3646	Property Package:	Amine Pkg - KE
	Molar Enthalpy Molar Entropy Heat Flow Liq Vol Flow @ Std Cor Mater Vapour / Phase Fraction Temperature: Pressure: Molar Flow Mass Flow Std Ideal Liq Vol Flow Molar Enthalpy Molar Enthalpy Heat Flow Liq Vol Flow @ Std Cor Mater Vapour / Phase Fraction Temperature:	(kJ/kgmole) (kJ/kgmole-C) (MW) nd (m3/h) rial Stream (C) (kPa) (kgmole/h) (kg/h) (kg/h) (kJ/kgmole-C) (MW) nd (m3/h) rial Stream	85.83 -1245 3648 * 1: Rich An Overall 0.0006 104.5 * 200.0 * 1.598e+005 3.852e+006 3911 -2.258e+004 92.48 -1003 3648 * 1: Lean An Overall 0.0000 120.1	85.83 -1245 3648 Nine to Desc CONDITIONS Vapour Phase 0.0006 104.5 200.0 92.83 2790 3.185 1.291e+004 220.7 0.3328 2.643 Nine to heat CONDITIONS Aqueous Phase 1.0000 120.1	Aqueous Phase 0.9994 104.5 200.0 1.597e+005 3.850e+006 3908 -2.260e+004 92.40 -1003 3646	Property Package:	Amine Pkg - KE
	Molar Enthalpy Molar Entropy Heat Flow Liq Vol Flow @ Std Cor Mater Vapour / Phase Fraction Temperature: Pressure: Molar Flow Mass Flow Std Ideal Liq Vol Flow Molar Enthalpy Molar Entropy Heat Flow Liq Vol Flow @ Std Cor Mater Vapour / Phase Fraction Temperature: Pressure:	(kJ/kgmole) (kJ/kgmole-C) (MW) nd (M3/h) rial Stream (C) (kPa) (kgmole/h) (kg/h) (kJ/kgmole-C) (MW) nd (M3/h) rial Stream	85.83 -1245 3648 * 1: Rich An Overall 0.0006 104.5 * 200.0 * 1.598e+005 3.852e+006 3911 -2.258e+004 92.48 -1003 3648 * 1: Lean An Overall 0.0000 120.1 400.0 *	85.83 -1245 3648 Nine to Desc CONDITIONS Vapour Phase 0.0006 104.5 200.0 92.83 2790 3.185 1.291e+004 220.7 0.3328 2.643 Nine to heat CONDITIONS Aqueous Phase 1.0000 120.1 400.0	Aqueous Phase 0.9994 104.5 200.0 1.597e+005 3.850e+006 3908 -2.260e+004 92.40 -1003 3646	Property Package:	Amine Pkg - KE
	Molar Enthalpy Molar Entropy Heat Flow Liq Vol Flow @ Std Cor Mater Vapour / Phase Fraction Temperature: Pressure: Molar Flow Mass Flow Std Ideal Liq Vol Flow Molar Enthalpy Molar Enthalpy Heat Flow Liq Vol Flow @ Std Cor Mater Vapour / Phase Fraction Temperature:	(kJ/kgmole) (kJ/kgmole-C) (MW) nd (m3/h) rial Stream (C) (kPa) (kgmole/h) (kg/h) (kg/h) (kJ/kgmole-C) (MW) nd (m3/h) rial Stream	85.83 -1245 3648 * 1: Rich An Overall 0.0006 104.5 * 200.0 * 1.598e+005 3.852e+006 3911 -2.258e+004 92.48 -1003 3648 * 1: Lean An Overall 0.0000 120.1	85.83 -1245 3648 Nine to Desc CONDITIONS Vapour Phase 0.0006 104.5 200.0 92.83 2790 3.185 1.291e+004 220.7 0.3328 2.643 Nine to heat CONDITIONS Aqueous Phase 1.0000 120.1	Aqueous Phase 0.9994 104.5 200.0 1.597e+005 3.850e+006 3908 -2.260e+004 92.40 -1003 3646	Property Package:	Amine Pkg - KE
	Molar Enthalpy Molar Entropy Heat Flow Liq Vol Flow @ Std Cor Mater Vapour / Phase Fraction Temperature: Pressure: Molar Flow Mass Flow Std Ideal Liq Vol Flow Molar Enthalpy Molar Entropy Heat Flow Liq Vol Flow @ Std Cor Mater Vapour / Phase Fraction Temperature: Pressure: Molar Flow Mass Flow Std Ideal Liq Vol Flow Mass Flow Std Ideal Liq Vol Flow Std Ideal Liq Vol Flow	(kJ/kgmole) (kJ/kgmole-C) (MW) nd (m3/h) ial Stream (C) (kPa) (kgmole/h) (kg/h) (m3/h) (kJ/kgmole) (kJ/kgmole-C) (MW) nd (m3/h) ial Stream on (C) (kPa) (kg/h) (kJ/kgmole)	85.83 -1245 3648 * 1: Rich Am Overall 0.0006 104.5 * 200.0 * 1.598e+005 3.852e+006 3911 -2.258e+004 92.48 -1003 3648 * 1: Lean An Overall 0.0000 120.1 400.0 * 1.538e+005 3.664e+006 3695	85.83 -1245 3648 Nine to Desc CONDITIONS Vapour Phase 0.0006 104.5 200.0 92.83 2790 3.185 1.291e+004 220.7 0.3328 2.643 Nine to heat CONDITIONS Aqueous Phase 1.0000 120.1 400.0 1.538e+005 3.664e+006 3695	Aqueous Phase 0.9994 104.5 200.0 1.597e+005 3.850e+006 3908 -2.260e+004 92.40 -1003 3646	Property Package:	Amine Pkg - KE
	Molar Enthalpy Molar Entropy Heat Flow Liq Vol Flow @Std Cor Mater Vapour / Phase Fraction Temperature: Pressure: Molar Flow Mass Flow Std Ideal Liq Vol Flow Molar Enthalpy Molar Entropy Heat Flow Liq Vol Flow @Std Cor Mater Vapour / Phase Fraction Temperature: Pressure: Molar Flow Mass Flow Std Ideal Liq Vol Flow Mass Flow Std Ideal Liq Vol Flow Mass Flow Std Ideal Liq Vol Flow Molar Enthalpy	(kJ/kgmole) (kJ/kgmole-C) (MW) ial Stream (C) (kPa) (kgmole/h) (kJ/kgmole) (kJ/kgmole-C) (MW) ial Stream (c) (kPa) (kg/h) (m3/h) (kJ/kgmole-C) (MW) ial Stream (C) (kPa) (kg/h) (m3/h) (kJ/kgmole)	85.83 -1245 3648 * 1: Rich Am Overall 0.0006 104.5 * 200.0 * 1.598e+005 3.852e+006 3911 -2.258e+004 92.48 -1003 3648 * 1: Lean An Overall 0.0000 120.1 400.0 * 1.538e+005 3.664e+006 3695 -2.036e+004	85.83 -1245 3648 Nine to Desc CONDITIONS Vapour Phase 0.0006 104.5 200.0 92.83 2790 3.185 1.291e+004 220.7 0.3328 2.643 Nine to heat CONDITIONS Aqueous Phase 1.0000 120.1 400.0 1.538e+005 3.664e+006 3695 -2.036e+004	Aqueous Phase 0.9994 104.5 200.0 1.597e+005 3.850e+006 3908 -2.260e+004 92.40 -1003 3646	Property Package:	Amine Pkg - KE
	Molar Enthalpy Molar Entropy Heat Flow Liq Vol Flow @ Std Cor Mater Vapour / Phase Fraction Temperature: Pressure: Molar Flow Mass Flow Std Ideal Liq Vol Flow Molar Enthalpy Molar Entropy Heat Flow Liq Vol Flow @ Std Cor Mater Vapour / Phase Fraction Temperature: Pressure: Molar Flow Mass Flow Std Ideal Liq Vol Flow Mass Flow Std Ideal Liq Vol Flow Std Ideal Liq Vol Flow	(kJ/kgmole) (kJ/kgmole-C) (MW) nd (m3/h) ial Stream (C) (kPa) (kgmole/h) (kg/h) (m3/h) (kJ/kgmole) (kJ/kgmole-C) (MW) nd (m3/h) ial Stream on (C) (kPa) (kg/h) (kJ/kgmole)	85.83 -1245 3648 * 1: Rich Am Overall 0.0006 104.5 * 200.0 * 1.598e+005 3.852e+006 3911 -2.258e+004 92.48 -1003 3648 * 1: Lean An Overall 0.0000 120.1 400.0 * 1.538e+005 3.664e+006 3695	85.83 -1245 3648 Nine to Desc CONDITIONS Vapour Phase 0.0006 104.5 200.0 92.83 2790 3.185 1.291e+004 220.7 0.3328 2.643 Nine to heat CONDITIONS Aqueous Phase 1.0000 120.1 400.0 1.538e+005 3.664e+006 3695	Aqueous Phase 0.9994 104.5 200.0 1.597e+005 3.850e+006 3908 -2.260e+004 92.40 -1003 3646	Property Package:	Amine Pkg - KE

	UNIVERSITY	OF TROMSO	Case Name:	STANDARD ABSOR	PTION PROCESS.H	SC
	aspen Burlington, M		Unit Set:	SI1		
l	USA		Date/Time:	Fri May 31 13:26:08	2013	
	Manager				Fluid Package:	Basis-1
ł	Material Stream	i: Lean An	nine to Sea	a Water Co	Property Package:	Amine Pkg - KE
ľ			CONDITIONS			
H		Overall	Aqueous Phase	Esperant years		
Ī	Vapour / Phase Fraction	0.0000	1.0000			
L	Temperature: (C)	58.28	58.28			
╀	Pressure: (kPa)	400.0	400.0			
\dagger	Molar Flow (kgmole/h) Mass Flow (kg/h)	1.538e+005 3.664e+006	1.538e+005 3.664e+006			
t	Std Ideal Liq Vol Flow (m3/h)	3695	3695			
l	Molar Enthalpy (kJ/kgmole)	-2.604e+004	-2.604e+004			
I	Molar Entropy (kJ/kgmole-C)	88.57	88.57			
4	Heat Flow (MW)	-1112	-1112			
ŀ	Liq Vol Flow @Std Cond (m3/h)	3532 •	3532			
	Material Stream	: Lean An	nine from I	Desorber	Fluid Package: Property Package:	Basis-1 Amine Pkg - KE
			CONDITIONS			
I		Overall	Aqueous Phase			
4	Vapour / Phase Fraction	0.0000	1.0000			
+	Temperature: (C)	120.0	120,0			
+	Pressure: (kPa) Molar Flow (kgmole/h)	200.0 1.538e+005	200.0 1.538e+005			
+	Mass Flow (kg/h)	3.664e+006	3.664e+006			
	Std Ideal Liq Vol Flow (m3/h)	3695	3695			
Г	Molar Enthalpy (kJ/kgmole)	-2.036e+004				
+-	11 \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	-2.00001001	-2.036e+004			
İ	Molar Entropy (kJ/kgmole-C)	95.29	95.29			
	Molar Entropy (kJ/kgmole-C) Heat Flow (MW)	95.29 -869.9	95.29 -869.9			
	Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h)	95.29 -869.9 3532 °	95.29 -869.9 3532		Fluid Package	Basis-1
	Molar Entropy (kJ/kgmole-C) Heat Flow (MW)	95.29 -869.9 3532 °	95.29 -869.9 3532		Fluid Package: Property Package:	Basis-1 Amine Pkg - KE
	Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h)	95.29 -869.9 3532 ·	95.29 -869.9 3532 S CONDITIONS			
	Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream	95.29 -869.9 3532 *	95.29 -869.9 3532 S CONDITIONS Vapour Phase			
	Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h)	95.29 -869.9 3532 ·	95.29 -869.9 3532 S CONDITIONS			
	Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction	95.29 -869.9 3532 · CO2 Gas Overall 1.0000	95.29 -869.9 3532 S CONDITIONS Vapour Phase 1.0000			
	Molar Entropy (k,J/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h)	95.29 -869.9 3532 * 1: CO2 Gas Overall 1.0000 100.0 200.0 6035	95.29 -869.9 3532 CONDITIONS Vapour Phase 1.0000 100.0 200.0 6035			
	Molar Entropy (k,J/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h)	95.29 -869.9 3532 * CO2 Gas Overall 1.0000 100.0 200.0 6035 1.883e+005	95.29 -869.9 3532 CONDITIONS Vapour Phase 1.0000 100.0 200.0 6035 1.883e+005			
	Molar Entropy (k,J/kgmole-C) Heat Flow (MVV) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h)	95.29 -869.9 3532 * CO2 Gas Overall 1.0000 100.0 200.0 6035 1.883e+005 216.8	95.29 -869.9 3532 CONDITIONS Vapour Phase 1.0000 100.0 200.0 6035 1.883e+005 216.8			
	Molar Entropy (kJ/kgmole-C) Heat Flow (MVV) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole)	95.29 -869.9 3532 * CO2 Gas Overall 1.0000 100.0 200.0 6035 1.883e+005 216.8 1.248e+004	95.29 -869.9 3532 CONDITIONS Vapour Phase 1.0000 100.0 200.0 6035 1.883e+005 216.8 1.248e+004			
	Molar Entropy (k,J/kgmole-C) Heat Flow (MVV) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h)	95.29 -869.9 3532 * CO2 Gas Overall 1.0000 100.0 200.0 6035 1.883e+005 216.8	95.29 -869.9 3532 CONDITIONS Vapour Phase 1.0000 100.0 200.0 6035 1.883e+005 216.8 1.248e+004 219.9			
	Molar Entropy (k,J/kgmole-C) Heat Flow (MVV) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (k,J/kgmole) Molar Entropy (k,J/kgmole-C)	95.29 -869.9 3532 · CO2 Gas Overall 1.0000 100.0 200.0 6035 1.883e+005 216.8 1.248e+004 219.9	95.29 -869.9 3532 CONDITIONS Vapour Phase 1.0000 100.0 200.0 6035 1.883e+005 216.8 1.248e+004			
	Molar Entropy (kJ/kgmole-C) Heat Flow (MVV) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Idea! Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MVV)	95.29 -869.9 3532 * CO2 Gas Overall 1.0000 100.0 200.0 6035 1.883e+005 216.8 1.248e+004 219.9 20.92 178.5 *	95.29 -869.9 3532 CONDITIONS Vapour Phase 1.0000 100.0 200.0 6035 1.883e+005 216.8 1.248e+004 219.9 20.92 178.5	(eUp		
	Molar Entropy (k,J/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (k,J/kgmole) Molar Entropy (k,J/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h)	95.29 -869.9 3532 · CO2 Gas Overall 1.0000 100.0 200.0 6035 1.883e+005 216.8 1.248e+004 219.9 20.92 178.5 · Lean An	95.29 -869.9 3532 S CONDITIONS Vapour Phase 1.0000 100.0 200.0 6035 1.883e+005 216.8 1.248e+004 219.9 20.92 178.5 NINE TO Male CONDITIONS	(eUp	Property Package:	Amine Pkg - KE
	Molar Entropy (k,J/kgmole-C) Heat Flow (MVV) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (k,J/kgmole) Molar Entropy (k,J/kgmole-C) Heat Flow (MVV) Liq Vol Flow @Std Cond (m3/h) Material Stream	95.29 -869.9 3532 · CO2 Gas Overall 1.0000 100.0 200.0 6035 1.883e+005 216.8 1.248e+004 219.9 20.92 178.5 · Lean An	95.29 -869.9 3532 CONDITIONS Vapour Phase 1.0000 100.0 200.0 6035 1.883e+005 216.8 1.248e+004 219.9 20.92 178.5 TIME TO Mal CONDITIONS Aqueous Phase	(eUp	Property Package:	Amine Pkg - KE
	Molar Entropy (k,J/kgmole-C) Heat Flow (MVV) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (k,J/kgmole) Molar Entropy (k,J/kgmole-C) Heat Flow (MVV) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction	95.29 -869.9 3532 ' CO2 Gas Overall 1.0000 100.0 200.0 6035 1.883e+005 216.8 1.248e+004 219.9 20.92 178.5 ' Lean An	95.29 -869.9 3532 CONDITIONS Vapour Phase 1.0000 100.0 200.0 6035 1.883e+005 216.8 1.248e+004 219.9 20.92 178.5 CONDITIONS Aqueous Phase 1.0000	keUp	Property Package:	Amine Pkg - KE
	Molar Entropy (k,J/kgmole-C) Heat Flow (MVV) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (k,J/kgmole) Molar Entropy (k,J/kgmole-C) Heat Flow (MVV) Liq Vol Flow @Std Cond (m3/h) Material Stream	95.29 -869.9 3532 · CO2 Gas Overall 1.0000 100.0 200.0 6035 1.883e+005 216.8 1.248e+004 219.9 20.92 178.5 · Lean An	95.29 -869.9 3532 CONDITIONS Vapour Phase 1.0000 100.0 200.0 6035 1.883e+005 216.8 1.248e+004 219.9 20.92 178.5 TIME TO Mal CONDITIONS Aqueous Phase	(eUp	Property Package:	Amine Pkg - KE
	Molar Entropy (k,J/kgmole-C) Heat Flow (MVV) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (k,J/kgmole) Molar Entropy (k,J/kgmole-C) Heat Flow (MVV) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C)	95.29 -869.9 3532 · CO2 Gas Overall 1.0000 100.0 200.0 6035 1.883e+005 216.8 1.248e+004 219.9 20.92 178.5 · Coverall 0.0000 40.00 ·	95.29 -869.9 3532 S CONDITIONS Vapour Phase 1.0000 100.0 200.0 6035 1.883e+005 216.8 1.248e+004 219.9 20.92 178.5 Inine to Mal CONDITIONS Aqueous Phase 1.0000 40.00	keUp	Property Package:	Amine Pkg - KE
	Molar Entropy (k,J/kgmole-C) Heat Flow (MVV) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (k,J/kgmole) Molar Entropy (k,J/kgmole-C) Heat Flow (MWV) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kgmole/h) Mass Flow (kg/h)	95.29 -869.9 3532 ' CO2 Gas Overall 1.0000 100.0 200.0 6035 1.883e+005 216.8 1.248e+004 219.9 20.92 178.5 ' Lean An Overall 0.0000 40.00 ' 400.0 '	95.29 -869.9 3532 CONDITIONS Vapour Phase 1.0000 100.0 200.0 6035 1.883e+005 216.8 1.248e+004 219.9 20.92 178.5 CONDITIONS Aqueous Phase 1.0000 40.00 400.0	(eUp	Property Package:	Amine Pkg - KE
	Molar Entropy (k,J/kgmole-C) Heat Flow (MVV) Liq Vol Flow @Std Cond (m3/h) Waterial Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kJ/kgmole) Molar Enthalpy (k,J/kgmole-C) Heat Flow (MVV) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kPa) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h)	95.29 -869.9 3532 ' CO2 Gas Overall 1.0000 100.0 200.0 6035 1.883e+005 216.8 1.248e+004 219.9 20.92 178.5 ' Coverall 0.0000 40.00 ' 400.0 ' 1.538e+005 3.664e+006 3695	95.29 -869.9 3532 CONDITIONS Vapour Phase 1.0000 100.0 200.0 6035 1.883e+005 216.8 1.248e+004 219.9 20.92 178.5 Inine to Mal CONDITIONS Aqueous Phase 1.0000 40.00 400.0 1.538e+005	ceUp	Property Package:	Amine Pkg - KE
	Molar Entropy (k,J/kgmole-C) Heat Flow (MVV) Liq Vol Flow @Std Cond (m3/h) Waterial Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Entropy (k,J/kgmole-C) Heat Flow (MWV) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kg/h) Std Ideal Liq Vol Flow (kg/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (k,J/kgmole)	95.29 -869.9 3532 * CO2 Gas Overall 1.0000 100.0 200.0 6035 1.883e+005 216.8 1.248e+004 219.9 20.92 178.5 * Coverall 0.0000 40.00 * 40.00 * 1.538e+005 3.664e+006 3695 -2.764e+004	95.29 -869.9 3532 CONDITIONS Vapour Phase 1.0000 100.0 200.0 6035 1.883e+005 216.8 1.248e+004 219.9 20.92 178.5 The to Mal CONDITIONS Aqueous Phase 1.0000 40.00 40.00 40.00 1.538e+005 3.664e+006 3695 -2.764e+004	(eUp	Property Package:	Amine Pkg - KE
	Molar Entropy (k,J/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Waterial Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (k,J/kgmole) Molar Entropy (k,J/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kgmole/h) Mass Flow (kgmole/h) Molar Flow (kgmole) Molar Enthalpy (k,J/kgmole) Molar Entropy (k,J/kgmole-C)	95.29 -869.9 3532 * CO2 Gas Overall 1.0000 100.0 200.0 6035 1.883e+005 216.8 1.248e+004 219.9 20.92 178.5 * Coverall 0.0000 40.00 * 400.0 * 1.538e+005 3.664e+006 3695 -2.764e+004 86.55	95.29 -869.9 3532 CONDITIONS Vapour Phase 1.0000 100.0 200.0 6035 1.883e+005 216.8 1.248e+004 219.9 20.92 178.5 TIPLE TO Mal CONDITIONS Aqueous Phase 1.0000 40.00 40.00 40.00 1.538e+005 3.664e+006 3695 -2.764e+004 86.55	(eUp	Property Package:	Amine Pkg - KE
	Molar Entropy (k,J/kgmole-C) Heat Flow (MVV) Liq Vol Flow @Std Cond (m3/h) Waterial Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Entropy (k,J/kgmole-C) Heat Flow (MWV) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kg/h) Std Ideal Liq Vol Flow (kg/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (k,J/kgmole)	95.29 -869.9 3532 * CO2 Gas Overall 1.0000 100.0 200.0 6035 1.883e+005 216.8 1.248e+004 219.9 20.92 178.5 * Coverall 0.0000 40.00 * 40.00 * 1.538e+005 3.664e+006 3695 -2.764e+004	95.29 -869.9 3532 CONDITIONS Vapour Phase 1.0000 100.0 200.0 6035 1.883e+005 216.8 1.248e+004 219.9 20.92 178.5 The to Mal CONDITIONS Aqueous Phase 1.0000 40.00 40.00 40.00 1.538e+005 3.664e+006 3695 -2.764e+004	(eUp	Property Package:	Amine Pkg - KE

1	254,00	OF TROUS	Case Name: S	TANDARD ABSORE	PTION PROCESS.H	sc
	aspen Burlington, M	OF TROMSO A	Unit Set: 8	11		
	usa usa		Date/Time: F	ri May 31 13:26:08 2	013	
	Material Stream	: MakeUp	Water		Fluid Package: Property Package:	Basis-1 Amine Pkg - KE
Ī			CONDITIONS			
		Overall	Aqueous Phase			and the state of
2	Vapour / Phase Fraction	0.0000	1.0000			
1	Temperature: (C)	40.00 *	40.00			
4	Pressure: (kPa)	200.0 •	200.0			
4	Molar Flow (kgmole/h)	6380 °	6380 1.149e+005			
+	Mass Flow (kg/h) Std ideal Liq Vol Flow (m3/h)	115.2	115.2			
†	Molar Enthalpy (kJ/kgmole)	-3.298e+004	-3.298e+004			
†	Molar Entropy (kJ/kgmole-C)	75.87	75.87			
1	Heat Flow (MW)	-58.45	-58.45			
I	Liq Vol Flow @Std Cond (m3/h)	115.1 *	115.1			
	Material Stream	n: Makeup	Amine		Fluid Package: Property Package:	Basis-1 Amine Pkg - KE
1			CONDITIONS			
3 7		Overail	Liquid Phase		1 1 1 1 1 1 1 1 1 1	
+	Vapour / Phase Fraction	0.0000	1.0000			
9	Temperature: (C)	40.00 *	40.00			
0	Pressure: (kPa)	200.0 *	200.0			501
1	Molar Flow (kgmole/h)	40.00 *	40.00			
4	Mass Flow (kg/h)	2443	2443			
4	Std Ideal Liq Vol Flow (m3/h)	2.403 2.419e+004	2.403 2.419e+004			
4	Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C)	2.419 0+ 004	2.419e+004 177.5			
4	moiai Liniopy (na/ngillole-0)		177.0		+	
6	Heat Flow (MW)	0.2688	0.2688			
7	Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h)	0.2688 2.379 °	0.2688 2.379		Fluid Deskare	Page 4
7 8 9		2.379 *	2.379	orber	Fluid Package: Property Package:	Basis-1 Amine Pkg - KE
7 8 9 0	Liq Vol Flow @Std Cond (m3/h)	2.379 · n: Lean An	2.379 nine to Abso	orber		
7 8 9 0	Liq Vol Flow @Std Cond (m3/h)	2.379 *	2.379 nine to Abs	orber		
7 8 9 0	Material Stream	2.379* 1: Lean An	2.379 nine to Abs CONDITIONS Aqueous Phase	orber		
7 8 9 0 1 2 3	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa)	2.379 * 1: Lean An Overall 0.0000 40.01 200.0	2.379 CONDITIONS Aqueous Phase 1.0000 40.01 200.0	orber		
7 8 9 0 1 2 3 4	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h)	2.379 * 1: Lean An Overall 0.0000 40.01 200.0 1.602e+005	2.379 CONDITIONS Aqueous Phase 1.0000 40.01 200.0 1.602e+005	orber		
7 8 9 0 1 2 3 4 5 6	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h)	2,379 * 1: Lean An Overall 0.0000 40.01 200.0 1.602e+005 3,781e+006	2.379 CONDITIONS Aqueous Phase 1.0000 40.01 200.0 1.602e+005 3.781e+006	orber		
7 8 9 0 1 2 3 4 5 6 7 8	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h)	2,379 * 1: Lean An Overall 0.0000 40.01 200.0 1.602e+005 3.781e+006 3812	2.379 CONDITIONS Aqueous Phase 1.0000 40.01 200.0 1.602e+005 3.781e+006 3812	orber		
7 8 9 0 1 2 3 4 5 6 7 8	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole)	2,379 * 1: Lean An Overall 0.0000 40.01 200.0 1.602e+005 3.781e+006 3812 -2.784e+004	2.379 CONDITIONS Aqueous Phase 1.0000 40.01 200.0 1.602e+005 3.781e+006 3812 -2.784e+004	orber		
7 8 9 0 1 2 3 4 5 6 7 8	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h)	2,379 * 1: Lean An Overall 0.0000 40.01 200.0 1.602e+005 3.781e+006 3812	2.379 CONDITIONS Aqueous Phase 1.0000 40.01 200.0 1.602e+005 3.781e+006 3812	orber		
7 8 9 0 1 2 3 4 5 6 7 8 9	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C)	2,379 * 1: Lean An Overall 0.0000 40.01 200.0 1.602e+005 3.781e+006 3812 -2.784e+004 86.15	2.379 CONDITIONS Aqueous Phase 1.0000 40.01 200.0 1.602e+005 3.781e+006 3812 -2.784e+004 86.15	orber		
36 37 38 39 40 41 42 43 44 45 50 51 52 55 56	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kgmole/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW)	2,379 * 1: Lean An Overall 0.0000 40.01 200.0 1.602e+005 3.781e+006 3812 -2.784e+004 86.15 -1239 3647 *	2.379 CONDITIONS Aqueous Phase 1.0000 40.01 200.0 1.602e+005 3.781e+006 3812 -2.784e+004 86.15 -1239 3647			
7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 1 1 2 3 4 9 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h)	2,379 * 1: Lean An Overall 0.0000 40.01 200.0 1.602e+005 3.781e+006 3812 -2.784e+004 86.15 -1239 3647 *	2.379 CONDITIONS Aqueous Phase 1.0000 40.01 200.0 1.602e+005 3.781e+006 3812 -2.784e+004 86.15 -1239 3647		Property Package:	Amine Pkg - KE
7 8 9 0 1 2 3 4 5 6 7 8 9	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h)	2.379 · 1: Lean An Overall 0.0000 40.01 200.0 1.602e+005 3.781e+006 3812 -2.784e+004 86.15 -1239 3647 · 1: Lean An	2.379 nine to Abs CONDITIONS Aqueous Phase 1.0000 40.01 200.0 1.602e+005 3.781e+006 3812 -2.784e+004 86.15 -1239 3647 nine Recycl		Property Package:	Amine Pkg - KE
7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 6 7 8 8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Strean	2,379 * 1: Lean An Overall 0.0000 40.01 200.0 1.602e+005 3.781e+006 3812 -2.784e+004 86.15 -1239 3647 *	2.379 CONDITIONS Aqueous Phase 1.0000 40.01 200.0 1.602e+005 3.781e+006 3812 -2.784e+004 86.15 -1239 3647 CONDITIONS Aqueous Phase 1.0000 40.01 200.0 1.602e+005 3.781e+006 3812 -2.784e+004		Property Package:	Amine Pkg - KE
7 8 8 9 0 1 1 2 3 4 5 6 7 8 9 0 1 1 2 9 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h)	2.379 * 1: Lean An Overall 0.0000 40.01 200.0 1.602e+005 3.781e+006 3812 -2.784e+004 86.15 -1239 3647 * 1: Lean An	2.379 nine to Abs CONDITIONS Aqueous Phase 1.0000 40.01 200.0 1.602e+005 3.781e+006 3812 -2.784e+004 86.15 -1239 3647 nine Recycl CONDITIONS Aqueous Phase		Property Package:	Amine Pkg - KE
7 8 9 0 1 1 2 3 4 5 6 7 8 9 0 1 1 2 3 4 5 6 7 8 8 8 9 9 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Strean Vapour / Phase Fraction	2.379 * 1: Lean An Overall 0.0000 40.01 200.0 1.602e+005 3.781e+006 3812 -2.784e+004 86.15 -1239 3647 * 1: Lean An Overall 0.0000	2.379 nine to Abs CONDITIONS Aqueous Phase 1.0000 40.01 200.0 1.602e+005 3.781e+006 3812 -2.784e+004 86.15 -1239 3647 nine Recycl CONDITIONS Aqueous Phase 1.0000		Property Package:	Amine Pkg - KE
7 8 9 0 1 2 3 4 4 5 6 7 8 9 0 1 2 3 3 4 1 5 6 6 7 7 8 8 9 9 9 9 1 8 9 1 8 9 1 8 9 1 8 9 1 8 9 1 8 9 1 8 9 1 8 9 1 8 9 1 8 1 8	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Strean Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h)	2.379 * 1: Lean An Overall 0.0000 40.01 200.0 1.602e+005 3.781e+006 3812 -2.784e+004 86.15 -1239 3647 * 1: Lean An Overall 0.0000 40.01 101.0 * 1.602e+005	2.379 nine to Abs CONDITIONS Aqueous Phase 1.0000 40.01 200.0 1.602e+005 3.781e+006 3812 -2.784e+004 86.15 -1239 3647 nine Recycl CONDITIONS Aqueous Phase 1.0000 40.01 101.0 1.602e+005		Property Package:	Amine Pkg - KE
77	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kJ/kgmole) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Strean Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kgmole/h) Mass Flow (kgmole/h) Mass Flow (kg/h)	2,379 * 1: Lean An Overall 0.0000 40.01 200.0 1.602e+005 3.781e+006 3812 -2.784e+004 86.15 -1239 3647 * 1: Lean An Overall 0.0000 40.01 101.0 * 1.602e+005 3.781e+006	2.379 CONDITIONS Aqueous Phase 1.0000 40.01 200.0 1.602e+005 3.781e+006 3812 -2.784e+004 86.15 -1239 3647 CONDITIONS Aqueous Phase 1.0000 40.01 101.0 1.602e+005 3.781e+006		Property Package:	Amine Pkg - KE
7	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Strean Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kgmole/h) Mass Flow (kgmole/h) Std Ideal Liq Vol Flow (m3/h)	2.379 * 1: Lean An Overall 0.0000 40.01 200.0 1.602e+005 3.781e+006 3812 -2.784e+004 86.15 -1239 3647 * 1: Lean An Overall 0.0000 40.01 101.0 * 1.602e+005 3.781e+006 3812	2.379 CONDITIONS Aqueous Phase 1.0000 40.01 200.0 1.602e+005 3.781e+006 3812 -2.784e+004 86.15 -1239 3647 CONDITIONS Aqueous Phase 1.0000 40.01 101.0 1.602e+005 3.781e+006 3812		Property Package:	Amine Pkg - KE
7 8 8 9 9 9 0 0 1 1 1 2 2 2 3 3 3 4 4 4 4 4 4 4 4 4 4 4 4 4 4	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Strean Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kgmole/h) Mass Flow (kgmole/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole)	2.379 * 1: Lean An Overall 0.0000 40.01 200.0 1.602e+005 3.781e+006 3812 -2.784e+004 86.15 -1239 3647 * 1: Lean An Overall 0.0000 40.01 101.0 * 1.602e+005 3.781e+006 3812 -2.784e+004	2.379 nine to Absection CONDITIONS Aqueous Phase 1.0000 40.01 200.0 1.602e+005 3.781e+006 3812 -2.784e+004 86.15 -1239 3647 CONDITIONS Aqueous Phase 1.0000 40.01 101.0 1.602e+005 3.781e+006 3812 -2.784e+004		Property Package:	Amine Pkg - KE
77	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Entropy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Strean Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kgmole/h) Mass Flow (kgmole/h) Molar Entropy (kJ/kgmole) Molar Entropy (kJ/kgmole) Molar Entropy (kJ/kgmole) Molar Entropy (kJ/kgmole)	2,379 * 1: Lean An Overall 0.0000 40.01 200.0 1.602e+005 3.781e+006 3812 -2.784e+004 86.15 -1239 3647 * 1: Lean An Overall 0.0000 40.01 101.0 * 1.602e+005 3.781e+006 3812 -2.784e+004 86.15	2.379 CONDITIONS Aqueous Phase 1.0000 40.01 200.0 1.602e+005 3.781e+006 3812 -2.784e+004 86.15 -1239 3647 CONDITIONS Aqueous Phase 1.0000 40.01 101.0 1.602e+005 3.781e+006 3812 -2.784e+004 86.15		Property Package:	Amine Pkg - KE
77	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Strean Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kgmole/h) Mass Flow (kgmole/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole)	2.379 * 1: Lean An Overall 0.0000 40.01 200.0 1.602e+005 3.781e+006 3812 -2.784e+004 86.15 -1239 3647 * 1: Lean An Overall 0.0000 40.01 101.0 * 1.602e+005 3.781e+006 3812 -2.784e+004	2.379 nine to Absection CONDITIONS Aqueous Phase 1.0000 40.01 200.0 1.602e+005 3.781e+006 3812 -2.784e+004 86.15 -1239 3647 CONDITIONS Aqueous Phase 1.0000 40.01 101.0 1.602e+005 3.781e+006 3812 -2.784e+004		Property Package:	Amine Pkg - KE

1			Case Name:	STANDARD ARE	SORPTION PROCESS.H	90
2	UNIVERSITY OF TRO	OMSO			SORF HON PROCESS.IT	30
2 3 4 5 6	aspen Burlington, MA USA		Unit Set:	SII		
5			Date/Time:	Fri May 31 13:26	:08 2013	
6	Energy Stroom: O				Fluid Package:	Basis-1
	Energy Stream: Q				Property Package:	Amine Pkg - KE
9 10			CONDITION	3		
10 11	Duty Type: Direct Q	Duty Calculat	tion Operation:	E-100		
12	Duty SP: 140.1 MW	Minimum Ava			Maximum Available Du	ly:
13	Energy Streem, W	4			Fluid Package:	Basis-1
14 15	Energy Stream: W				Property Package:	Amine Pkg - KE
16			CONDITION	3		
17 18	Duty Type: Direct Q	Duty Calculat	tion Operation:	P-100		
19	Duty SP: 0.1345 MW	Minimum Ava			Maximum Available Du	ty:
20 21	Energy Stroom, O	Dahail			Fluid Package:	Basis-1
22	Energy Stream: Q	neboli	er		Property Package:	Amine Pkg - KE
23 24			CONDITION	3		
24 25	Duty Type: Direct Q	Duty Calculat	tion Operation:			
26	Duty SP: 161.0 MW	Minimum Ava		Heymath	Maximum Available Du	ty:
27 28 29	Energy Streem, O	Canda			Fluid Package:	Basis-1
29	Energy Stream: Q	Conde	riser		Property Package:	Amine Pkg - KE
30			CONDITION	3		
31 32	Duty Type: Utility Fluid	Duty Calculat	tion Operation:		Duty SP:	7.361 MW
33	Available UA: 3.600e+005 kJ/C-h	Utility Fluid H		100.0 kgmole	Fluid Heat Capacity:	75.00 kJ/kgmole-C
34	Actual Fluid Flow:	Minimum Flui		45.00.0	Maximum Fluld Flow:	
35 36	Fluid Inlet Temperature: 15.00 C	Fluid Outlet T	emperature:	15.00 C	Temperature Approach: Fiuld Package:	Basis-1
36 37	Energy Stream: W	2			Property Package:	Amine Pkg - KE
38 39					Froperty Fackage	Allille Pkg - KE
40			CONDITION	3		
41 42	Duty Type: Direct Q Duty SP: 0.2744 MW	Duty Calculat Minimum Ava	tion Operation:	P-101	Maximum Avallable Dut	he
					Fluid Package:	Basis-1
43 44 45	Energy Stream: Q	Seawa	ter		Property Package	Amine Pkg - KE
45 46					1 Topony Facinage	Allino Fing Inc
46 47			CONDITION			
48 49	Duty Type: Direct Q Duty SP: 68.37 MW	Duty Calculat Minimum Ava	tion Operation:	E-102	Maximum Available Dut	N'
50	Suly 6: 1	TVIII III TUU TUU	anabio buty.		Wide American Programme Dut	
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50 51 52 53 54 55 56 57 58 60 61 62 63 64 65 66 67 68 69 70						
71	Aspen Technology Inc.	Aspen HYS	SYS Version 7.3	(25,0,0,7336)		Page 5 of 5
	Licensed to: UNIVERSITY OF TROMSO					* Specified by user.

ł	LINIVEDOITY	OF TROMSO	Case Name: VAPOUR	RECOMPRESSION.HSC
١	aspen Burlington, M.		Unit Set: SI1	
١	USA		Date/Time: Fri May 31	13:28:02 2013
1				Fluid Package: Basis-1
┨	Material Stream	: Sour Fe	ed to Absorber	Property Package: Amine Pkg - KE
t			CONDITIONS	
1			CONDITIONS	
1	Vapour / Phase Fraction	Overall 1,0000	Vapour Phase 1.0000	
1	Temperature: (C)	40.00 •	40.00	
I	Pressure: (kPa)	101.0 *	101.0	
1	Molar Flow (kgmole/h)	1.092e+005	1.092e+005	
4	Mass Flow (kg/h)	3.100e+006 °	3.100e+006	
4	Std Ideal Liq Vol Flow (m3/h)	3634	3634	
	Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C)	9211 196.6	9211	
1	Heat Flow (MW)	279.3	279.3	
1	Liq Vol Flow @Std Cond (m3/h)			
1				Fluid Package: Basis-1
4	Material Stream	: Sweet G	ias	Property Package: Amine Pkg - KE
	Marie 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1			reporty i dended. Filmio i ng - NE
1			CONDITIONS	
Ì		Overall	Vapour Phase	
1	Vapour / Phase Fraction	1.0000	1.0000	
익	Temperature: (C)	48.94	48.94	
익	Pressure: (kPa)	101.0	101.0	
1	Molar Flow (kgmole/h)	1.099e+005	1.099e+005	
2 3	Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h)	3.036e+006 3541	3.036e+006 3541	
-	Molar Enthalpy (kJ/kgmole)	9521	9521	
41				
-	7	197.4	197.4	
5	Molar Entropy (kJ/kgmole-C) Heat Flow (MW)	197.4 290.8		
5 6 7	Molar Entropy (kJ/kgmole-C)		197.4	
5 6 7 8 9	Molar Entropy (kJ/kgmole-C) Heat Flow (MW)	290.8	197.4 290.8	Fluid Package: Basis-1 Property Package: Amine Pkg - KE
5 6 7 8 9	Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h)	290.8	197.4 290.8	
5 6 7 8 9	Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream	290.8 : Rich Am	197.4 290.8 	
5 6 7 8 9 0 1 2	Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction	290.8 2: Rich Am Overall 0.0000	197.4 290.8 PINE CONDITIONS Aqueous Phase 1.0000	
5 6 7 8 9 0 1 2 3	Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C)	290.8 2: Rich Am Overall 0.0000 41.65	197.4 290.8 Prine CONDITIONS Aqueous Phase 1.0000 41.65	
5 6 7 8 9 0 1 2 3 4	Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa)	290.8 2: Rich Am Overall 0.0000 41.65 101.0	197.4 290.8 PINE CONDITIONS Aqueous Phase 1.0000 41.65 101.0	
5 6 7 8 9 0 1 2 3 4	Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h)	290.8 2: Rich Am Overall 0.0000 41.65 101.0 1.222e+005	197.4 290.8 PINE CONDITIONS Aqueous Phase 1.0000 41.65 101.0 1.222e+005	
5 6 7 8 9 0 1 2 3 4 5 6 7	Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa)	290.8 2: Rich Am Overall 0.0000 41.65 101.0	197.4 290.8 PINE CONDITIONS Aqueous Phase 1.0000 41.65 101.0	
5 6 7 8 9 0 1 2 3 4 5 6 7	Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h)	290.8 2: Rich Am Overall 0.0000 41.65 101.0 1.222e+005 2.959e+006	197.4 290.8 PINE CONDITIONS Aqueous Phase 1.0000 41.65 101.0 1.222e+005 2.959e+006	
5 6 7 8 9 1 1 8 9	Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @ Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C)	290.8 Ci: Rich Am Overall 0.0000 41.65 101.0 1.222e+005 2.959e+006 3009 -2.827e+004 85.50	197.4 290.8	
5 6 7 8 9 0 1 2 8 9	Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW)	290.8 CVerall 0.0000 41.65 101.0 1.222e+005 2.959e+006 3009 -2.827e+004 85.50 -959.9	197.4 290.8 290.8 290.8 290.8 290.8 200.8 290.8	
5 6 7 8 9 0 1 2 8 9 0 1 2	Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @ Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C)	290.8 Ci: Rich Am Overall 0.0000 41.65 101.0 1.222e+005 2.959e+006 3009 -2.827e+004 85.50	197.4 290.8 290.	Property Package: Amine Pkg - KE
5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 5 6 7 8 8 9 9 1 9 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h)	290.8 Ci: Rich Am Overall 0.0000 41.65 101.0 1.222e+005 2.959e+006 3009 -2.827e+004 85.50 -959.9 2791 •	197.4 290.8 290.8 290.8 290.8 290.8 200.8 290.8	Property Package: Amine Pkg - KE
5	Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h)	290.8 Crich Am Overall 0.0000 41.65 101.0 1.222e+005 2.959e+006 3009 -2.827e+004 85.50 -959.9 2791 Check Am Coverall 0.0000 41.65 101.0 1.222e+005 2.959e+006 3009 -2.827e+004 85.50 -959.9 2791 Check Am Coverall 0.00000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.00000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.00000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.00000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.00000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.00000 0.00000 0.0000 0.0000 0.0000 0.0000 0.00000 0.0000 0.00000 0.00000 0.00000 0.0000 0.00000	197.4 290.8 Prine CONDITIONS Aqueous Phase 1.0000 41.65 101.0 1.222e+005 2.959e+006 3009 -2.827e+004 85.50 -959.9 2791 CONDITIONS	Property Package: Amine Pkg - KE
55 6 6 7 7 7 7 7 7 7 7	Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream	290.8 Crich Am Overall 0.0000 41.65 101.0 1.222e+005 2.959e+006 3009 -2.827e+004 85.50 -959.9 2791 Crean An	197.4 290.8 Prine CONDITIONS Aqueous Phase 1.0000 41.65 101.0 1.222e+005 2.959e+006 3009 -2.827e+004 85.50 -959.9 2791 Prine to Absorber CONDITIONS Aqueous Phase	Property Package: Amine Pkg - KE
	Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Entropy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction	290.8 Crich Am Overall 0.0000 41.65 101.0 1.222e+005 2.959e+006 3009 -2.827e+004 85.50 -959.9 2791 Clean An Overall 0.0000	197.4 290.8 Prine CONDITIONS Aqueous Phase 1.0000 41.65 101.0 1.222e+005 2.959e+006 3009 -2.827e+004 85.50 -959.9 2791 Prine to Absorber CONDITIONS Aqueous Phase 1.0000	Property Package: Amine Pkg - KE
5	Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Entropy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C)	290.8 Crich Am Overall 0.0000 41.65 101.0 1.222e+005 2.959e+006 3009 -2.827e+004 85.50 -959.9 2791 · Lean An Overall 0.0000 40.00 ·	197.4 290.8 Prine CONDITIONS Aqueous Phase 1.0000 41.65 101.0 1.222e+005 2.959e+006 3009 -2.827e+004 85.50 -959.9 2791 Prine to Absorber CONDITIONS Aqueous Phase 1.0000 40.00	Property Package: Amine Pkg - KE
	Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Entropy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction	290.8 Crich Am Overall 0.0000 41.65 101.0 1.222e+005 2.959e+006 3009 -2.827e+004 85.50 -959.9 2791 Clean An Overall 0.0000	197.4 290.8 Prine CONDITIONS Aqueous Phase 1.0000 41.65 101.0 1.222e+005 2.959e+006 3009 -2.827e+004 85.50 -959.9 2791 Prine to Absorber CONDITIONS Aqueous Phase 1.0000	Property Package: Amine Pkg - KE
5 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa)	290.8 Crich Am Overall 0.0000 41.65 101.0 1.222e+005 2.959e+006 3009 -2.827e+004 85.50 -959.9 2791 · Lean An Overall 0.0000 40.00 · 101.0 ·	197.4 290.8 Prine CONDITIONS Aqueous Phase 1.0000 41.65 101.0 1.222e+005 2.959e+006 3009 -2.827e+004 85.50 -959.9 2791 Prine to Absorber CONDITIONS Aqueous Phase 1.0000 40.00 101.0	Property Package: Amine Pkg - KE
5 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h)	290.8 Crich An Overall 0.0000 41.65 101.0 1.222e+005 2.959e+006 3009 -2.827e+004 85.50 -959.9 2791 Clean An Overall 0.0000 40.00 101.0 1.230e+005	197.4 290.8 Prine CONDITIONS Aqueous Phase 1.0000 41.65 101.0 1.222e+005 2.959e+006 3009 -2.827e+004 85.50 -959.9 2791 Prine to Absorber CONDITIONS Aqueous Phase 1.0000 40.00 101.0 1.230e+005	Property Package: Amine Pkg - KE
5 6 6 7 7 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kgmole/h) Mass Flow (kgmole/h) Mass Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole)	290.8 Ci: Rich Am Overall 0.0000 41.65 101.0 1,222e+005 2.959e+006 3009 -2.827e+004 85.50 -959.9 2791 Ci: Lean An Overall 0.0000 40.00 101.0 1.230e+005 2.895e+006 2916 -2.777e+004	197.4 290.8 290.8 CONDITIONS Aqueous Phase 1.0000 41.65 101.0 1.222e+005 2.959e+006 3009 -2.827e+004 85.50 -959.9 2791 CONDITIONS Aqueous Phase 1.0000 40.00 101.0 1.230e+005 2.895e+006 2916 -2.7777e+004	Property Package: Amine Pkg - KE
44 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @ Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @ Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kgmole/h) Mass Flow (kgmole/h) Mass Flow (kgmole/h) Molar Enthalpy (kJ/kgmole) Molar Enthalpy (kJ/kgmole) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C)	290.8 Ci: Rich Am Overall 0.0000 41.65 101.0 1.222e+005 2.959e+006 3009 -2.827e+004 85.50 -959.9 2791 Ci: Lean An Overall 0.0000 40.00 101.0 1.230e+005 2.895e+006 2916 -2.777e+004 86.22	197.4 290.8 Prine CONDITIONS Aqueous Phase 1.0000 41.65 101.0 1.222e+005 2.959e+006 3009 -2.827e+004 85.50 -959.9 2791 Prine to Absorber CONDITIONS Aqueous Phase 1.0000 40.00 101.0 1.230e+005 2.895e+006 2916 -2.777e+004 86.22	Property Package: Amine Pkg - KE
5 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kgmole/h) Mass Flow (kgmole/h) Mass Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole)	290.8 Ci: Rich Am Overall 0.0000 41.65 101.0 1,222e+005 2.959e+006 3009 -2.827e+004 85.50 -959.9 2791 Ci: Lean An Overall 0.0000 40.00 101.0 1.230e+005 2.895e+006 2916 -2.777e+004	197.4 290.8 290.8 CONDITIONS Aqueous Phase 1.0000 41.65 101.0 1.222e+005 2.959e+006 3009 -2.827e+004 85.50 -959.9 2791 CONDITIONS Aqueous Phase 1.0000 40.00 101.0 1.230e+005 2.895e+006 2916 -2.7777e+004	Property Package: Amine Pkg - KE

ł	LIMINEDO	ITY OF TROMSO	Case Name:	VAPOUR RECOMP	RESSION.HSC	
	aspen Burlington		Unit Set:	SI1		
	USA		Date/Time:	Fri May 31 13:28:02	2013	
İ					Fluid Package:	Basis-1
ł	Material Stream	m: Rich A	mine to hea	t exchange	Property Package:	Amine Pkg - KE
İ			CONDITIONS			
1		Overell				
t	Vapour / Phase Fraction	Overall 0.0000	Aqueous Phase			
İ	Temperature: (C)	41.68				
Į	Pressure: (kPa)	200.0				
1	Molar Flow (kgmole/h)	1.222e+005				
ł	Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h)	2.959e+006 3009				
t	Molar Enthalpy (kJ/kgmole)	-2.827e+004				
1	Molar Entropy (kJ/kgmole-C)	85.50	85.50			
J	Heat Flow (MW)	-959.8	-959.8			
4	Liq Vol Flow @Std Cond (m3/h)	2791	2791			
	Material Strea	m: Rich A			Fluid Package: Property Package:	Basis-1 Amine Pkg - KE
1			CONDITIONS			
1	Veneur / Phase Senting	Overall	Vapour Phase	Aqueous Phase		
4	Vapour / Phase Fraction Temperature: (C)	0.0028 99.50		0.9972 99.50		
7	Pressure: (kPa)	200.0		200.0		
1	Molar Flow (kgmole/h)	1.222e+005		1.219e+005		
2	Mass Flow (kg/h)	2.959e+006		2.948e+006		
4	Std Ideal Liq Vol Flow (m3/h)	3009		2996	+	
4	Molar Enthalpy (kJ/kgmole)	-2.300e+004				
. 1	Moles Entropy (L. 1/Lamela C)	00.00		-2.310e+004		
+	Molar Entropy (kJ/kgmole-C) Heat Flow (MW)	92.08 -781.0	220.0	91.72		
8 7	Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h)	92.08 -781.0 2791	220.0 1.188			
8 8 9	Heat Flow (MW)	-781.C 2791	220.0 1.188 10.40	91.72 -782.1 2785 at exchang		Basis-1 Amine Pkg - KE
8 9 0	Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h)	-781.0 2791 nm: Lean A	220.0 1.188 1.10.40 Amine to hea	91.72 -782.1 2785 at exchang	Fluid Package:	
8 9 1 2	Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Strea	-781.0 2791 nm: Lean A	220.0 1.188 1.10.40 Amine to hea CONDITIONS Aqueous Phase	91.72 -782.1 2785 at exchang	Fluid Package:	
8 9 0 1 2	Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Strea Vapour / Phase Fraction	-781.0 2791 nm: Lean A	220.0 1.188 1 10.40 Amine to hea CONDITIONS Aqueous Phase 1.0000	91.72 -782.1 2785 at exchang	Fluid Package:	
3 9 1 2 3	Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Strea	-781.0 2791 nm: Lean A	220.0 1.188 10.40 Amine to hea CONDITIONS Aqueous Phase 1.0000 105.3	91.72 -782.1 2785 at exchang	Fluid Package:	
	Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Streation Vapour / Phase Fraction Temperature: (C)	Overall 0.0000 105.3 200.0 1.180e+005	220.0 1.188 1.188 1.1040 Amine to hea CONDITIONS Aqueous Phase 1.0000 1.180e+005	91.72 -782.1 2785 at exchang	Fluid Package:	
8 9 0 1 2 3 4 6	Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Streat Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h)	Overall 0.0000 105.3 200.0 1.180e+000	220.0 1.188 10.40 Amine to hea CONDITIONS Aqueous Phase 1.0000 1.180e+005 1.180e+006 2.804e+006	91.72 -782.1 2785 at exchang	Fluid Package:	
8 9 1 2 3 6 8	Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Streat Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h)	Overall 0.0000 105.3 200.0 1.180e+006 2.804e+006	220.0 1.188 10.40 Amine to hea CONDITIONS Aqueous Phase 1.0000 1.180e+005 2.804e+006 2825	91.72 -782.1 2785 at exchang	Fluid Package:	
3 7 3 1 3 4 5 6 7 8	Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Streat Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole)	Overall 0.0000 105.3 200.0 1.180e+006 2.804e+006 2.826 -2.168e+004	220.0 1.188 10.40 Amine to hea CONDITIONS Aqueous Phase 1.0000 1.05.3 200.0 1.180e+005 2.804e+006 2825 4 -2.168e+004	91.72 -782.1 2785 at exchang	Fluid Package:	
33 77 33 33 33 33 33 33 33 33 33 33 33 3	Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Streat Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h)	Overall 0.0000 105.3 200.0 1.180e+006 2.804e+006	220.0 1.188 10.40 Amine to hea CONDITIONS Aqueous Phase 1.0000 3.105.3 200.0 1.180e+005 3.2.804e+008 5.2.804e+004 7.93.77	91.72 -782.1 2785 at exchang	Fluid Package:	
3 7 3 9 1 1 5 6 7 8 9	Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Streat Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C)	Overall 0.0000 105.3 200.0 1.180e+006 2.804e+006 2.826 -2.168e+004	CONDITIONS Aqueous Phase 1.0000 3.1.180e+005 3.2.804e+008 5.2.168e+004 7.93.77 6.710.6	91.72 -782.1 2785 at exchang	Fluid Package:	
5 8 8 8 9 9 0 0 1 1 2 2 3 3 3 4 4 4 4 5 5 6 6 6 6 6 6 6 6 6 6 6 6 6 6	Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Streat Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW)	-781.0 2791 Am: Lean A Overall 0.0000 105.3 200.0 1.180e+000 2.804e+000 2.826 -2.168e+004 93.77 -710.6 2708	220.0 1.188 10.40 Amine to hea CONDITIONS Aqueous Phase 1.0000 1.05.3 200.0 1.180e+005 2.804e+006 2825 42.168e+004 7. 93.77 3710.6 3. 2708	91.72 -782.1 2785 at exchang	Fluid Package:	
8 8 9 9 0 0 1 1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Streat Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h)	-781.0 2791 Am: Lean A Overall 0.0000 105.3 200.0 1.180e+006 2.804e+006 2825 -2.168e+004 93.77 -710.6 2706 Am: Lean A	220.0 1.188 10.40 Amine to hea CONDITIONS Aqueous Phase 1.0000 3.1.0000 3.1.180e+005 3.2.804e+006 3.2.804e+004 7.3.77 3.710.6 3.2708 Amine to Sea	91.72 -782.1 2785 at exchang	Fluid Package: Property Package: Fluid Package:	Amine Pkg - KE
33 33 33 33 33 33 33 34 44 55 66 67 77 77 88	Heat Flow (MV) Liq Vol Flow @Std Cond (m3/h) Material Streat Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole-C) Heat Flow (MV) Liq Vol Flow @Std Cond (m3/h) Material Streat	-781.0 2791 Am: Lean A Overall 0.0000 105.3 200.0 1.180e+000 2.804e+000 2.826 -2.168e+004 93.77 -710.6 2708	220.0 1.188 10.40 Amine to hea CONDITIONS Aqueous Phase 1.0000 3.1.0000 3.1.180e+005 3.2.804e+006 3.2.804e+004 7.3.77 3.710.6 3.2708 Amine to Sea	91.72 -782.1 2785 at exchang	Fluid Package: Property Package: Fluid Package:	Amine Pkg - KE
3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Streat Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h)	-781.0 2791 Am: Lean A Overall 0.0000 105.3 200.0 1.180e+006 2.804e+006 2825 -2.168e+004 93.77 -710.6 2708 Am: Lean A	220.0 1.188 10.40 Amine to hea CONDITIONS Aqueous Phase 1.0000 3.105.3 2.00.0 3.1180e+005 3.2804e+006 3.2825 42.168e+004 7.33 -710.6 3.2708 Amine to Sea CONDITIONS Aqueous Phase 1.0000	91.72 -782.1 2785 at exchang	Fluid Package: Property Package: Fluid Package:	Amine Pkg - KE
3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Streation Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Streation	-781.0 2791 Am: Lean A Overall 0.0000 105.3 200.0 1.180e+006 2.804e+006 93.77 -710.6 2708 Am: Lean A Overall 0.0000 46.74 200.6	CONDITIONS Aqueous Phase 1.0000 3.1.180e+005 3.2.804e+006 3.2.168e+004 7.3.2.168e+004 7.3.2.168e+004 7.3.2.168e+004 7.3.3.2.168e+004 7.3.3.2.168e+004 7.3.3.3.2.168e+004 7.3.3.3.3.3.3.3.3.3.3.3.3.3.3.3.3.3.3.3	91.72 -782.1 2785 at exchang	Fluid Package: Property Package: Fluid Package:	Amine Pkg - KE
88 99 11 12 22 23 33 44 44 44 45 56 66 77 77 77 77 77 77 77 77 77 77 77 77	Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Streat Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Streat Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h)	-781.0 2791 Am: Lean A Overall 0.0000 105.3 200.0 1.180e+006 2.804e+006 2825 -2.168e+004 93.77 -710.6 2706 Am: Lean A Overall 0.0000 46.74 200.0 1.180e+006	CONDITIONS Aqueous Phase 1.0000 3.105.3 1.180e+005 4.2.168e+004 7.33 7.710.6 3.2708 Amine to Sea CONDITIONS Aqueous Phase 1.0000 4.4004 6.71 200.0 4.1180e+005 4.72 6.73 6.74 6.74 6.74 6.75 6.75 6.75 6.75 6.75 6.75 6.75 6.75	91.72 -782.1 2785 at exchang	Fluid Package: Property Package: Fluid Package:	Amine Pkg - KE
8 8 9 0 0 1 1 1 2 2 3 3 3 4 4 4 4 5 5 6 6 6 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Streation Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Streation Temperature: (C) Pressure: (kPa) Material Streation Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h)	-781.0 2791 Am: Lean A Overall 0.0000 105.3 200.0 1.180e+006 2.804e+006 2825 -2.168e+004 93.77 -710.6 2706 Am: Lean A Overall 0.0000 46.74 200.0 1.180e+006 2.804e+006	CONDITIONS Amine to hea CONDITIONS Aqueous Phase 1.0000 1.180e+005 2.804e+006 2.804e+006 2.708 Amine to Sea CONDITIONS Aqueous Phase 1.0000 4.1180e+005 4.2168e+004 7.2168e+004 7.3160e+005 8.1180e+005 8.1180e+005 8.1180e+005 8.1180e+005 8.1180e+005 8.1180e+005 8.1180e+005 8.1180e+005 8.1180e+006	91.72 -782.1 2785 at exchang	Fluid Package: Property Package: Fluid Package:	Amine Pkg - KE
33 34 36 37 33 33 34 44 44 45 56 66 67 77 77 77 77 77 77 77 77 77 77 77	Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Streat Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kJ/kgmole) Molar Enthalpy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Streat Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (kg/h) Std Ideal Liq Vol Flow (m3/h)	-781.0 2791 Am: Lean A Overall 0.0000 105.3 200.0 1.180e+006 2.826 -2.168e+004 93.77 -710.6 2708 Am: Lean A Overall 0.0000 46.74 200.0 1.180e+006 2.826	CONDITIONS Amine to hea CONDITIONS Aqueous Phase 1.0000 1.180e+005 2.804e+006 2.825 42.168e+004 7.93.77 3710.6 2.708 Amine to Sea CONDITIONS Aqueous Phase 1.0000 4.446.74 0.200.0 1.180e+005 3.2804e+006 4.2825	91.72 -782.1 2785 at exchang	Fluid Package: Property Package: Fluid Package:	Amine Pkg - KE
3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Streat Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Streat Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole)	Overall Overall 0.0000 105.3 200.0 1.180e+006 2.826 -2.168e+004 93.77 -710.6 2708 Am: Lean Overall 0.0000 46.74 200.0 1.180e+006 2.826 -2.699e+006	CONDITIONS Amine to heat CONDITIONS Aqueous Phase 1.0000 1.180e+005 2.804e+006 2.825 42.168e+004 7.93.77 8710.8 2708 Amine to Sea CONDITIONS Aqueous Phase 1.0000 4.446.74 0.200.0 1.180e+005 3.2804e+006 4.750 4.	91.72 -782.1 2785 at exchang	Fluid Package: Property Package: Fluid Package:	Amine Pkg - KE
88 99 11 12 22 23 33 44 44 44 45 56 66 77 77 77 77 77 77 77 77 77 77 77 77	Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Streat Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kJ/kgmole) Molar Enthalpy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Streat Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (kg/h) Std Ideal Liq Vol Flow (m3/h)	-781.0 2791 Am: Lean A Overall 0.0000 105.3 200.0 1.180e+006 2.826 -2.168e+004 93.77 -710.6 2708 Am: Lean A Overall 0.0000 46.74 200.0 1.180e+006 2.826	CONDITIONS Aqueous Phase 1.0000 1.180+005 2.804e+006 2.814 2.168e+004 2.7 3.2708 Amine to Sea CONDITIONS Aqueous Phase 1.0000 1.180e+005 2.804e+006 2.804e+006 2.804e+006 2.804e+006 2.804e+006 3.2000 4.1180e+005 3.2000 4.1180e+005 3.2000 4.40000 4.400000000000000000000000	91.72 -782.1 2785 at exchang	Fluid Package: Property Package: Fluid Package:	Amine Pkg - KE
2 2 3 3 3 5 5 6 6 7	Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Streation Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Streation Temperature: (C) Pressure: (kPa) Molar Flow (kg/h) Std Ideal Liq Vol Flow (kg/h) Std Ideal Liq Vol Flow (kg/h) Std Ideal Liq Vol Flow (kg/h) Std Ideal Liq Vol Flow (kg/h) Std Ideal Liq Vol Flow (kJ/kgmole) Molar Entropy (kJ/kgmole) Molar Entropy (kJ/kgmole)	Overall Overall 0.0000 105.3 200.0 1.180e+006 2.826 -2.168e+004 93.77 -710.6 2708 Am: Lean Overall 0.0000 46.74 200.0 1.180e+006 2.826 -2.699e+004 87.36	CONDITIONS Aqueous Phase 1.0000 1.180+005 3.105.3 3.0.200.0 3.1180+005 3.2804+006 3.2825 4.2.168e+004 7.33.77 3.710.6 3.2708 Amine to Sea CONDITIONS Aqueous Phase 1.0000 4.46.74 0.200.0 5.1180e+005 6.2825 0.1180e+006 6.2825 0.2804e+006 6.2825 0.2804e+006 6.2825 0.2804e+006 6.2825 0.2804e+006 6.2825 0.2804e+006 6.2825 0.2804e+006	91.72 -782.1 2785 at exchang	Fluid Package: Property Package: Fluid Package:	Amine Pkg - KE

1	LIMIVEDOITY	OF TROMSO	Case Name: \	APOUR RECOM	PRESSION.HSC	
]	aspen Burlington, M		Unit Set:	811		
1	USA		Date/Time: f	ri May 31 13:28:02	2 2013	
ł				, (a), (a)		Peole 4
1	Material Stream	n: Lean An	nine from D	esorber	Fluid Package: Property Package:	Basis-1 Amine Pkg - KE
1			CONDITIONS			
ł		Overall	Aqueous Phase			
1	Vapour / Phase Fraction	0.0000	1.0000			<u> </u>
Ī	Temperature: (C)	120.0	120.0			
Į	Pressure: (kPa)	200.0	200.0			
4	Molar Flow (kgmole/h)	1.220e+005	1.220e+005			
1	Mass Flow (kg/h)	2.882e+006 2905	2.882e+006			
t	Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole)	-2.054e+004	2905 -2.054e+004			
t	Molar Entropy (kJ/kgmole-C)	94.95	94.95			
1	Heat Flow (MW)	-696.0	-696.0			
I	Liq Vol Flow @Std Cond (m3/h)	2780 *	2780			
	Material Stream	n: CO2 Ga	S		Fluid Package: Property Package:	Basis-1 Amine Pkg - KE
			CONDITIONS			
1		Overall	Vapour Phase	DE LE LEMIN		
4	Vapour / Phase Fraction	1.0000	1.0000			
4	Temperature: (C)	84.40	84.40			
<u>?</u>	Pressure: (kPa)	200.0 4239	200.0 4239			
<u>1</u> 2	Molar Flow (kgmole/h) Mass Flow (kg/h)	1.551e+005	1.551e+005			
3	Std Ideal Liq Vol Flow (m3/h)	183.3	183.3		17 E2 10 E	
1	Molar Enthalpy (kJ/kgmole)	1.175e+004	1.175e+004			
5	Molar Entropy (kJ/kgmole-C)	217.4	217.4			
-	Molar Entropy (kJ/kgmole-C) Heat Flow (MW)	217.4 13.83				
в 7			217.4			
8 8 9	Heat Flow (MW)	13.83 147.0 °	217.4 13.83 147.0	eUp	Fluid Package: Property Package:	Basis-1 Amlne Pkg - KE
8 9	Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h)	13.83 147.0 °	217.4 13.83 147.0	еUр	VSSVIIII A LE	
3 3 1 2	Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h)	13.83 147.0 °	217.4 13.83 147.0 nine to Mak	eUp	VSSVIIII A LE	
8 9 1 2	Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h)	13.83 147.0 ·	217.4 13.83 147.0 nine to Mak	eUp	VSSVIIII A LE	
3 7 3 1 2 3	Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C)	13.83 147.0 °	217.4 13.83 147.0 nine to Mak CONDITIONS Aqueous Phase	eUp	VSSVIIII A LE	
8 9 0 1 2 3	Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa)	13.83 147.0 ° 1: Lean An Overall 0.0000 40.00 ° 200.0 °	217.4 13.83 147.0 nine to Mak CONDITIONS Aqueous Phase 1.0000 40.00 200.0	eUp	VSSVIIII A LE	
8 9 0 1 2 3 4 7	Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h)	13.83 147.0 ° 1: Lean An Overall 0.0000 40.00 ° 200.0 ° 1.180e+005	217.4 13.83 147.0 nine to Mak CONDITIONS Aqueous Phase 1.0000 40.00 200.0 1.180e+005	eUp	VSSVIIII A LE	
8 9 0 1 2 3 4 8	Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h)	13.83 147.0 ° 1: Lean An Overall 0.0000 40.00 ° 200.0 ° 1.180e+005 2.804e+006	217.4 13.83 147.0 nine to Mak CONDITIONS Aqueous Phase 1.0000 40.00 200.0 1.180e+005 2.804e+006	eUp	VSSVIIII A LE	
8 9 0 1 2 3 4 8 9	Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h)	13.83 147.0 ° 1: Lean An Overall 0.0000 40.00 ° 200.0 ° 1.180e+005 2.804e+006 2825	217.4 13.83 147.0 nine to Mak CONDITIONS Aqueous Phase 1.0000 40.00 200.0 1.180e+005 2.804e+006 2825	eUp	VSSVIIII A LE	
8 9 0 1 2 3 4 5 6 7 8	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kg/h) Std Ideal Liq Vol Flow (kJ/kgmole) Molar Enthalpy (kJ/kgmole)	13.83 147.0 ° 1: Lean An Overall 0.0000 40.00 ° 200.0 ° 1.180e+005 2.804e+006	217.4 13.83 147.0 nine to Mak CONDITIONS Aqueous Phase 1.0000 40.00 200.0 1.180e+005 2.804e+006	eUp	VSSVIIII A LE	
3 9 1 1 3 4 5 6 7	Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h)	13.83 147.0 ° 1: Lean An Overall 0.0000 40.00 ° 200.0 ° 1.180e+005 2.804e+006 2825 -2.758e+004	217.4 13.83 147.0 nine to Mak CONDITIONS Aqueous Phase 1.0000 40.00 200.0 1.180e+005 2.804e+006 2825 -2.758e+004	eUp	VSSVIIII A LE	
8 9 0 1 2 3 6 7 8 9	Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C)	13.83 147.0 ° 1: Lean An Overall 0.0000 40.00 ° 200.0 ° 1.180e+005 2.804e+006 2825 -2.758e+004 86.61	217.4 13.83 147.0 nine to Mak CONDITIONS Aqueous Phase 1.0000 40.00 200.0 1.180e+005 2.804e+006 2825 -2.758e+004 86.61	eUp	VSSVIIII A LE	
8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3	Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW)	13.83 147.0 ° 1: Lean An Overall 0.0000 40.00 ° 200.0 ° 1.180e+005 2.804e+006 2825 -2.758e+004 86.61 -903.7 2708 °	217.4 13.83 147.0 nine to Mak CONDITIONS Aqueous Phase 1.0000 40.00 200.0 1.180e+005 2.804e+006 2825 -2.758e+004 86.61 -903.7 2708	eUp	VSSVIIII A LE	
8 8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kgmole/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h)	13.83 147.0 ° 1: Lean An Overall 0.0000 40.00 ° 200.0 ° 1.180e+005 2.804e+006 2825 -2.758e+004 86.61 -903.7 2708 ° 1: MakeUp	217.4 13.83 147.0 nine to Mak CONDITIONS Aqueous Phase 1.0000 40.00 200.0 1.180e+005 2.804e+006 2825 -2.758e+004 86.61 -903.7 2708 Water CONDITIONS	eUp	Property Package:	Amine Pkg - KE
3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream	13.83 147.0 ° 1: Lean An Overall 0.0000 40.00 ° 200.0 ° 1.180e+005 2.804e+006 2825 -2.758e+004 86.61 -903.7 2708 ° 1: MakeUp	217.4 13.83 147.0 nine to Mak CONDITIONS Aqueous Phase 1.0000 40.00 200.0 1.180e+005 2.804e+006 2825 -2.758e+004 86.61 -903.7 2708 Water CONDITIONS Aqueous Phase	eUp	Property Package:	Amine Pkg - KE
3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction	13.83 147.0 ° 1: Lean An Overall 0.0000 40.00 ° 200.0 ° 1.180e+005 2.804e+006 2825 -2.758e+004 86.61 -903.7 2708 ° 1: MakeUp Overall 0.0000	217.4 13.83 147.0 nine to Mak CONDITIONS Aqueous Phase 1.0000 40.00 200.0 1.180e+005 2.804e+006 2825 -2.758e+004 86.61 -903.7 2708 Water CONDITIONS Aqueous Phase 1.0000	eUp	Property Package:	Amine Pkg - KE
3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C)	13.83 147.0 ° 1: Lean An Overall 0.0000 40.00 ° 200.0 ° 1.180e+005 2.804e+006 2825 -2.758e+004 86.61 -903.7 2708 ° 1: MakeUp	217.4 13.83 147.0 nine to Mak CONDITIONS Aqueous Phase 1.0000 40.00 200.0 1.180e+005 2.804e+006 2825 -2.758e+004 86.61 -903.7 2708 Water CONDITIONS Aqueous Phase	eUp	Property Package:	Amine Pkg - KE
3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C)	13.83 147.0 ° 1: Lean An Overall 0.0000 40.00 ° 200.0 ° 1.180e+005 2.804e+006 2825 -2.758e+004 86.61 -903.7 2708 ° 1: MakeUp Overall 0.0000 40.00 °	217.4 13.83 147.0 nine to Mak CONDITIONS Aqueous Phase 1.0000 40.00 200.0 1.180e+005 2.804e+006 2825 -2.758e+004 86.61 -903.7 2708 Water CONDITIONS Aqueous Phase 1.0000 40.00	eUp	Property Package:	Amine Pkg - KE
3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa)	13.83 147.0 ° 1: Lean An Overall 0.0000 40.00 ° 200.0 ° 1.180e+005 2.804e+006 2825 -2.758e+004 86.61 -903.7 2708 ° 1: MakeUp Overall 0.0000 40.00 ° 200.0 °	217.4 13.83 147.0 nine to Mak CONDITIONS Aqueous Phase 1.0000 40.00 200.0 1.180e+005 2.804e+006 2825 -2.758e+004 86.61 -903.7 2708 Water CONDITIONS Aqueous Phase 1.0000 40.00 200.0	eUp	Property Package:	Amine Pkg - KE
3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h)	13.83 147.0 ° 1: Lean An Overall 0.0000 40.00 ° 200.0 ° 1.180e+005 2.804e+006 2825 -2.758e+004 86.61 -903.7 2708 ° 1: MakeUp Overall 0.0000 40.00 ° 200.0 ° 4365 °	217.4 13.83 147.0 nine to Mak CONDITIONS Aqueous Phase 1.0000 40.00 200.0 1.180e+005 2.804e+006 2825 -2.758e+004 86.61 -903.7 2708 Water CONDITIONS Aqueous Phase 1.0000 40.00 200.0 4365	eUp	Property Package:	Amine Pkg - KE
3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kgmole/h) Mass Flow (kgmole/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole)	13.83 147.0 ° 1: Lean An Overall 0.0000 40.00 ° 200.0 ° 1.180e+005 2.804e+006 2825 -2.758e+004 86.61 -903.7 2708 ° 1: MakeUp Overall 0.0000 40.00 ° 200.0 ° 4365 ° 7.864e+004	217.4 13.83 147.0 nine to Mak CONDITIONS Aqueous Phase 1.0000 40.00 200.0 1.180e+005 2.804e+006 2825 -2.758e+004 86.61 -903.7 2708 Water CONDITIONS Aqueous Phase 1.0000 40.00 200.0 4365 7.864e+004 78.79 -3.298e+004	eUp	Property Package:	Amine Pkg - KE
5 8 8 9 9 0 0 1 1 1 2 2 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kgmole/h) Mass Flow (kgmole/h) Molar Enthalpy (kJ/kgmole) Molar Enthalpy (kJ/kgmole) Molar Enthalpy (kJ/kgmole) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole)	13.83 147.0 ° 1: Lean An Overall 0.0000 40.00 ° 200.0 ° 1.180e+005 2.804e+006 2825 -2.758e+004 86.61 -903.7 2708 ° 1: MakeUp Overall 0.0000 40.00 ° 200.0 ° 4365 ° 7.864e+004 78.79 -3.298e+004 75.87	217.4 13.83 147.0 nine to Mak CONDITIONS Aqueous Phase 1.0000 40.00 200.0 1.180e+005 2.804e+006 2825 -2.758e+004 86.61 -903.7 2708 Water CONDITIONS Aqueous Phase 1.0000 40.00 200.0 4365 7.864e+004 78.79 -3.298e+004 75.87	eUp	Property Package:	Amine Pkg - KE
B B B B B B B B B B B B B B B B B B B	Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kgmole/h) Mass Flow (kgmole/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole)	13.83 147.0 ° 1: Lean An Overall 0.0000 40.00 ° 200.0 ° 1.180e+005 2.804e+006 2825 -2.758e+004 86.61 -903.7 2708 ° 1: MakeUp Overall 0.0000 40.00 ° 200.0 ° 4365 ° 7.864e+004 78.79 -3.298e+004	217.4 13.83 147.0 nine to Mak CONDITIONS Aqueous Phase 1.0000 40.00 200.0 1.180e+005 2.804e+006 2825 -2.758e+004 86.61 -903.7 2708 Water CONDITIONS Aqueous Phase 1.0000 40.00 200.0 4365 7.864e+004 78.79 -3.298e+004	eUp	Property Package:	Amine Pkg - KE

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1	aspenlech	UNIVERSITY O	T INUMSU	Unit Set: S	п		
1		USA		Date/Time: F	ri May 31 13:28:02 2	013	
1	Material	Stream:	Makeup	Amine		Fluid Package:	Basis-1
+						Property Package:	Amine Pkg - KE
7				CONDITIONS			
1			Overall	Liquid Phase			
킦	Vapour / Phase Fraction	(0)	0.0000	1.0000			
3 4	Temperature: Pressure:	(C) (kPa)	40.00 °	40.00			_
5		(gmole/h)	35.00 •	35.00			
Б	Mass Flow	(kg/h)	2138	2138			
7	Std Ideal Liq Vol Flow	(m3/h)	2.102	2.102			
릭		J/kgmole)	2.419e+004	2.419e+004			
1		gmole-C)	177.5	177.5			
4	Heat Flow Liq Vol Flow @Std Cond	(MW)	0.2352 2.081 ·	0.2352			
2	Liq voi Flow & Sta Cona	(m3/h)	2.081	2.081		Cold Control	Desir 4
	Material	Stream:	Mixed L	ean Amine		Fluid Package: Property Package:	Basis-1 Amine Pkg - KE
5 6				CONDITIONS			
7			Overall	Aqueous Phase			
В	Vapour / Phase Fraction		0.0000	1.0000			
9	Temperature:	(C)	40.01	40.01			
힉	Pressure:	(kPa)	200.0	200.0			
1		kgmole/h)	1.224e+005	1.224e+005			
2 3	Mass Flow Std Ideal Liq Vol Flow	(kg/h) (m3/h)	2.885e+006 2906	2.885e+006 2906			
-		J/kgmole)	-2.775e+004	-2.775e+004			
4							
4			86.26	86.26			
5		gmole-C) (MW)					
15 18 17	Molar Entropy (kJ/k	gmole-C)	86.26	86.26			
15 18 17 18	Molar Entropy (kJ/k Heat Flow Liq Vol Flow @Std Cond	(MW) (m3/h)	86.26 -943.5 2787 *	86.26 -943.5	e	Fluid Package: Property Package:	Basis-1 Amine Pkg - KE
5 8 9 0	Molar Entropy (kJ/k Heat Flow Liq Vol Flow @Std Cond	(MW) (m3/h)	86.26 -943.5 2787 *	86.26 -943.5 2787	e		
5 8 7 8 9 0	Molar Entropy (kJ/k Heat Flow Liq Vol Flow @Std Cond	(MW) (m3/h)	86.26 -943.5 2787 *	86.26 -943.5 2787	e		
5 8 7 8 9 0 1 2	Molar Entropy (kJ/k Heat Flow Liq Vol Flow @Std Cond	(MW) (m3/h)	86.26 -943.5 2787 · Lean An	86.26 -943.5 2787 Tine Recycle CONDITIONS	e		
5 8 7 8 9 0 1 2 3 4	Molar Entropy (kJ/k Heat Flow Liq Vol Flow @Std Cond Material Vapour / Phase Fraction Temperature:	gmole-C) (MW) (m3/h) Stream:	86.26 -943.5 2787 • Lean An Overall 0.0000 40.01	86.26 -943.5 2787 Prine Recycle CONDITIONS Aqueous Phase 1.0000 40.01	e		
5 8 7 8 9 0 1 2 3 4	Molar Entropy (kJ/k Heat Flow Liq Vol Flow @Std Cond Material Vapour / Phase Fraction Temperature: Pressure:	gmole-C) (MW) (m3/h) Stream:	86.26 -943.5 2787 • Lean An Overall 0.0000 40.01 101.0 •	86.26 -943.5 2787 Prine Recycle CONDITIONS Aqueous Phase 1.0000 40.01 101.0	e		
5 8 7 8 9 0 1 2 3 4 5 6	Molar Entropy (kJ/k Heat Flow Liq Vol Flow @Std Cond Material Vapour / Phase Fraction Temperature: Pressure: Molar Flow (kJ/k	(C) (kPa) kgmole-C) (MW) (m3/h) Stream:	86.26 -943.5 2787 • Lean An Overall 0.0000 40.01 101.0 • 1.224e+005	86.26 -943.5 2787 PINE RECYCL CONDITIONS Aqueous Phase 1.0000 40.01 101.0 1.224e+005	e		
5 8 7 8 9 0 1 2 3 4 5 6 7	Molar Entropy (kJ/k Heat Flow Liq Vol Flow @Std Cond Naterial Vapour / Phase Fraction Temperature: Pressure: Molar Flow (kMass Flow	(C) (kPa) (kg/h)	86.26 -943.5 2787 • Lean An Overall 0.0000 40.01 101.0 • 1.224e+005 2.885e+006	86.26 -943.5 2787 PINE RECYCL CONDITIONS Aqueous Phase 1.0000 40.01 101.0 1.224e+005 2.885e+006	e		
15 18 17 18 19 10 11 12 13 14 14 15 16 17 18 19	Molar Entropy (kJ/k Heat Flow Liq Vol Flow @Std Cond Naterial Vapour / Phase Fraction Temperature: Pressure: Molar Flow Mass Flow Std Ideal Liq Vol Flow	(C) (kPa) (kg/h) (m3/h)	86.26 -943.5 2787 • Lean An Overall 0.0000 40.01 101.0 • 1.224e+005	86.26 -943.5 2787 PINE RECYCL CONDITIONS Aqueous Phase 1.0000 40.01 101.0 1.224e+005	e		
5 8 9 0 1 2 3 4 5 6 7 8 9	Molar Entropy (kJ/k Heat Flow Liq Vol Flow @Std Cond Material Vapour / Phase Fraction Temperature: Pressure: Molar Flow Mass Flow Std Ideal Liq Vol Flow Molar Enthalpy (k.	(C) (kPa) (kg/h)	86.26 -943.5 2787 * Lean An Overall 0.0000 40.01 101.0 * 1.224e+005 2.885e+006 2906	86.26 -943.5 2787 PINE RECYCL CONDITIONS Aqueous Phase 1.0000 40.01 101.0 1.224e+005 2.885e+006 2906	e		
5 8 7 8 9 0 1 2 3 4 5 6 7 8 9	Molar Entropy (kJ/k Heat Flow Liq Vol Flow @Std Cond Material Vapour / Phase Fraction Temperature: Pressure: Molar Flow Mass Flow Std Ideal Liq Vol Flow Molar Enthalpy (k.	(C) (kPa) (kg/h) (m3/h) (kg/h) (kg/h) (J/kgmole)	86.26 -943.5 2787 ' Lean An Overall 0.0000 40.01 101.0 ' 1.224e+005 2.885e+006 2906 -2.775e+004	86.26 -943.5 2787 PINE RECYCL CONDITIONS Aqueous Phase 1.0000 40.01 101.0 1.224e+005 2.885e+006 2906 -2.775e+004	e		
5 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3	Molar Entropy (kJ/k Heat Flow Liq Vol Flow @Std Cond Naterial Vapour / Phase Fraction Temperature: Pressure: Molar Flow Std Ideal Liq Vol Flow Molar Entropy (kJ/k Molar Entropy (kJ/k)	(C) (kPa) (kg/h) (m3/h) (m3/h)	86.26 -943.5 2787 * Lean An Overall 0.0000 40.01 101.0 * 1.224e+005 2.885e+006 2906 -2.775e+004 86.26	86.26 -943.5 2787 PINE RECYCL CONDITIONS Aqueous Phase 1.0000 40.01 101.0 1.224e+005 2.885e+006 2906 -2.775e+004 86.26	e		
5 8 9 0 1 1 2 1 3 1 4 1 5 1 5 1 5 1 5 1 5 1 5 1 5 1 5 1 5	Molar Entropy (kJ/k Heat Flow Liq Vol Flow @Std Cond Naterial Vapour / Phase Fraction Temperature: Pressure: Molar Flow Std Ideal Liq Vol Flow Molar Entropy (kJ/k Heat Flow Liq Vol Flow @Std Cond	(C) (kPa) (kg/h) (m3/h) (kg/h) (m3/h) (kg/h) (m3/h) (kg/mole) (kg/mole) (kg/mole) (kg/mole) (kg/mole)	86.26 -943.5 2787 * Lean An Overall 0.0000 40.01 101.0 * 1.224e+005 2.885e+006 2906 -2.775e+004 86.26 -943.5 2787 *	86.26 -943.5 2787 PINE RECYCL CONDITIONS Aqueous Phase 1.0000 40.01 101.0 1.224e+005 2.885e+006 2906 -2.775e+004 86.26 -943.5	e alve to Fl		
94 95 98 99 90 90 90 90 90 90 90 90 90 90 90 90	Molar Entropy (kJ/k Heat Flow Liq Vol Flow @Std Cond Naterial Vapour / Phase Fraction Temperature: Pressure: Molar Flow Std Ideal Liq Vol Flow Molar Entropy (kJ/k Heat Flow Liq Vol Flow @Std Cond	(C) (kPa) (kg/h) (m3/h) (kg/h) (m3/h) (kg/h) (m3/h) (kg/mole) (kg/mole) (kg/mole) (kg/mole) (kg/mole)	86.26 -943.5 2787 · Lean An Overall 0.0000 40.01 101.0 · 1.224e+005 2.885e+006 2906 -2.775e+004 86.26 -943.5 2787 · Lean An	86.26 -943.5 2787 Prine Recycle CONDITIONS Aqueous Phase 1.0000 40.01 101.0 1.224e+005 2.885e+006 2906 -2.775e+004 86.26 -943.5 2787 Prine from Value Conditions	alve to Fl	Property Package:	Amine Pkg - KE
5 8 8 8 9 9 0 0 1 1 1 2 2 3 3 3 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	Molar Entropy (kJ/k Heat Flow Liq Vol Flow @Std Cond Material Vapour / Phase Fraction Temperature: Pressure: Molar Flow (kMass Flow Std Ideal Liq Vol Flow Molar Entropy (kJ/k Heat Flow Liq Vol Flow @Std Cond Material	(C) (kPa) (kg/h) (m3/h) (kg/h) (m3/h) (kg/h) (m3/h) (kgmole-C) (MW) (m3/h)	86.26 -943.5 2787 Lean An Overall 0.0000 40.01 101.0 1.224e+005 2.885e+006 2906 -2.775e+004 86.26 -943.5 2787 Lean An	86.26 -943.5 2787 Prime Recycle CONDITIONS Aqueous Phase 1.0000 40.01 101.0 1.224e+005 2.885e+006 2906 -2.775e+004 86.26 -943.5 2787 Prime from V CONDITIONS Vapour Phase	alve to Fl	Property Package:	Amine Pkg - KE
5 8 8 8 9 9 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Molar Entropy (k.J/k Heat Flow Liq Vol Flow @Std Cond Material Vapour / Phase Fraction Temperature: Pressure: Molar Flow Std Ideal Liq Vol Flow Molar Enthalpy (k.J/k Heat Flow Liq Vol Flow @Std Cond Material Vapour / Phase Fraction	(C) (kPa) (kg/h) (m3/h) Stream:	86.26 -943.5 2787 * Lean An Overall 0.0000 40.01 101.0 * 1.224e+005 2.885e+006 2906 -2.775e+004 86.26 -943.5 2787 * Lean An Overall 0.0327	86.26 -943.5 2787 Prime Recycle CONDITIONS Aqueous Phase 1.0000 40.01 101.0 1.224e+005 2.885e+006 2906 -2.775e+004 86.26 -943.5 2787 Prime from V CONDITIONS Vapour Phase 0.0327	alve to Fl	Property Package:	Amine Pkg - KE
5 8 8 8 8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	Molar Entropy (k.J/k Heat Flow Liq Vol Flow @Std Cond Material Vapour / Phase Fraction Temperature: Pressure: Molar Flow Std Ideal Liq Vol Flow Molar Enthalpy (k.J/k Heat Flow Liq Vol Flow @Std Cond Material Vapour / Phase Fraction Temperature:	(C) (kPa) (kg/h) (m3/h) Stream: (C) (kPa) (kg/h) (m3/h) (J/kgmole) (gmole-C) (MW) (m3/h) Stream:	86.26 -943.5 2787 Lean An Overall 0.0000 40.01 101.0 1.224e+005 2.885e+006 2906 -2.775e+004 86.26 -943.5 2787 Lean An Overall 0.0327 105.3	86.26 -943.5 2787 Prime Recycle CONDITIONS Aqueous Phase 1.0000 40.01 101.0 1.224e+005 2.885e+006 2906 -2.775e+004 86.26 -943.5 2787 Prime from V CONDITIONS Vapour Phase 0.0327 105.3	Aqueous Phase 0.9673 105.3	Property Package:	Amine Pkg - KE
5 8 8 8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	Molar Entropy (kJ/k Heat Flow Liq Vol Flow @Std Cond Material Vapour / Phase Fraction Temperature: Pressure: Molar Flow Std Ideal Liq Vol Flow Molar Enthalpy (kJ/k) Heat Flow Liq Vol Flow @Std Cond Material Vapour / Phase Fraction Temperature: Pressure:	(C) (kPa) (kgmole-C) (MW) (m3/h) Stream: (C) (kPa) (kgmole/h) (kg/h) (m3/h) J/kgmole) (gmole-C) (MW) (m3/h) Stream:	86.26 -943.5 2787 Lean An Overall 0.0000 40.01 101.0 1.224e+005 2.885e+006 2906 -2.775e+004 86.26 -943.5 2787 Lean An Overall 0.0327 105.3 115.0 •	86.26 -943.5 2787 Prime Recycle CONDITIONS Aqueous Phase 1.0000 40.01 101.0 1.224e+005 2.885e+006 2906 -2.775e+004 86.26 -943.5 2787 Prime from V CONDITIONS Vapour Phase 0.0327 105.3 115.0	Aqueous Phase 0.9673 105.3 115.0	Property Package:	Amine Pkg - KE
5 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	Molar Entropy (k.J/k Heat Flow Liq Vol Flow @Std Cond Material Vapour / Phase Fraction Temperature: Pressure: Molar Flow Std Ideal Liq Vol Flow Molar Enthalpy (k.J/k Heat Flow Liq Vol Flow @Std Cond Material Vapour / Phase Fraction Temperature: Pressure:	(C) (kPa) (kg/h) (m3/h) Stream: (C) (kPa) (kg/h) (m3/h) (J/kgmole) (gmole-C) (MW) (m3/h) Stream:	86.26 -943.5 2787 Lean An Overall 0.0000 40.01 101.0 1.224e+005 2.885e+006 2906 -2.775e+004 86.26 -943.5 2787 Lean An Overall 0.0327 105.3	86.26 -943.5 2787 Prime Recycle CONDITIONS Aqueous Phase 1.0000 40.01 101.0 1.224e+005 2.885e+006 2906 -2.775e+004 86.26 -943.5 2787 Prime from V CONDITIONS Vapour Phase 0.0327 105.3	Aqueous Phase 0.9673 105.3	Property Package:	Amine Pkg - KE
55	Molar Entropy (kJ/k Heat Flow Liq Vol Flow @Std Cond Material Vapour / Phase Fraction Temperature: Pressure: Molar Flow Std Ideal Liq Vol Flow Molar Entropy (kJ/k Heat Flow Liq Vol Flow @Std Cond Material Vapour / Phase Fraction Temperature: Pressure: Molar Flow (t	(C) (kPa) kgmole-C) (MW) (m3/h) Stream: (C) (kPa) kgmole/h) (kg/h) (m3/h) J/kgmole) (m3/h) Stream: (C) (kPa) kgmole-C) (kW) (m3/h)	86.26 -943.5 2787 Lean An Overall 0.0000 40.01 101.0 1.224e+005 2.885e+006 2906 -2.775e+004 86.26 -943.5 2787 Lean An Overall 0.0327 105.3 115.0 1.220e+005	86.26 -943.5 2787 Prime Recycle CONDITIONS Aqueous Phase 1.0000 40.01 101.0 1.224e+005 2.885e+006 2906 -2.775e+004 86.26 -943.5 2787 Prime from V CONDITIONS Vapour Phase 0.0327 105.3 115.0 3983	Aqueous Phase 0.9673 105.3 115.0 1.180e+005	Property Package:	Amine Pkg - KE
5 8 8 8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	Molar Entropy (k.J/k Heat Flow Liq Vol Flow @Std Cond Material Vapour / Phase Fraction Temperature: Pressure: Molar Flow Std Ideal Liq Vol Flow Molar Entropy (k.J/k Heat Flow Liq Vol Flow @Std Cond Material Vapour / Phase Fraction Temperature: Pressure: Molar Flow (the Material) Vapour / Phase Fraction Temperature: Pressure: Molar Flow (the Mass Flow Std Ideal Liq Vol Flow Std Ideal Liq Vol Flow	(C) (kPa) kgmole-C) (m3/h) Stream: (C) (kPa) kgmole/h) (kg/h) (m3/h) Stream: (C) (kPa) kgmole-C) (MW) (m3/h) Stream:	86.26 -943.5 2787 Lean An Overall 0.0000 40.01 101.0 1.224e+005 2.885e+006 2906 -2.775e+004 86.26 -943.5 2787 Lean An Overall 0.0327 105.3 115.0 1.220e+005 2.882e+006	86.26 -943.5 2787 Prine Recycle CONDITIONS Aqueous Phase 1.0000 40.01 101.0 1.224e+005 2.885e+006 2906 -2.775e+004 86.26 -943.5 2787 Prine from V CONDITIONS Vapour Phase 0.0327 105.3 115.0 3983 7.826e+004	Aqueous Phase 0.9673 105.3 115.0 1.180e+005 2.804e+006	Property Package:	Amine Pkg - KE
15 18 18 19 10 11 12 13 14 15 16 17 18 19 19 10 11 11 12 13 14 15 16 17 18 19 19 19 19 19 19 19 19 19 19	Molar Entropy (kJ/k Heat Flow Liq Vol Flow @Std Cond Naterial Vapour / Phase Fraction Temperature: Pressure: Molar Flow Std Ideal Liq Vol Flow Molar Entropy (kJ/k Heat Flow Liq Vol Flow @Std Cond Naterial Vapour / Phase Fraction Temperature: Pressure: Molar Flow (imperature) Mass Flow Std Ideal Liq Vol Flow Molar Entropy (kJ/k Heat Flow Liq Vol Flow @Std Cond Naterial Vapour / Phase Fraction Temperature: Pressure: Molar Flow Std Ideal Liq Vol Flow Molar Entropy (kJ/k Molar Entropy (kJ/k)	(C) (kPa) kgmole-C) (MW) (m3/h) Stream: (C) (kPa) kgmole/h) (kg/h) (m3/h) Stream: (C) (kPa) kgmole-C) (MW) (m3/h) Stream:	86.26 -943.5 2787 Lean An Overall 0.0000 40.01 101.0 1.224e+005 2.885e+006 2906 -2.775e+004 86.26 -943.5 2787 Lean An Overall 0.0327 105.3 115.0 1.220e+005 2.882e+006 2905	86.26 -943.5 2787 Prime Recycle CONDITIONS Aqueous Phase 1.0000 40.01 101.0 1.224e+005 2.885e+006 2906 -2.775e+004 86.26 -943.5 2787 Prime from V CONDITIONS Vapour Phase 0.0327 105.3 115.0 3983 7.826e+004 80.14 1.330e+004 221.1	Aqueous Phase 0.9673 105.3 115.0 1.180e+005 2.804e+006 2825	Property Package:	Amine Pkg - KE
5 8 8 8 8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	Molar Entropy (k.J/k Heat Flow Liq Vol Flow @Std Cond Material Vapour / Phase Fraction Temperature: Pressure: Molar Flow Std Ideal Liq Vol Flow Molar Entropy (k.J/k Heat Flow Liq Vol Flow @Std Cond Material Vapour / Phase Fraction Temperature: Pressure: Molar Flow (t.g., w.g.,	(C) (kPa) kgmole-C) ((MW) (m3/h) Stream: (C) (kPa) kgmole/h) (kg/h) (m3/h) Stream: (C) (kPa) kgmole-C) (MW) (m3/h) Stream:	86.26 -943.5 2787 Lean An Overall 0.0000 40.01 101.0 1.224e+005 2.885e+006 2906 -2.775e+004 86.26 -943.5 2787 Lean An Overall 0.0327 105.3 115.0 1.220e+005 2.882e+006 2905 -2.054e+004	86.26 -943.5 2787 Prime Recycle CONDITIONS Aqueous Phase 1.0000 40.01 101.0 1.224e+005 2.885e+006 2906 -2.775e+004 86.26 -943.5 2787 Prime from V CONDITIONS Vapour Phase 0.0327 105.3 115.0 3983 7.826e+004 80.14 1.330e+004	Aqueous Phase 0.9673 105.3 115.0 1.180e+005 2.804e+006 2825 -2.169e+004	Property Package:	Amine Pkg - KE

LINIVEDOR	V OF TROMPO	Case Name:	VAPOUR RECOMPR	RESSION.HSC	
aspen Burlington, I	Y OF TROMSO MA	Unit Set:	SI1		
asperrason usa		Date/Time:	Fri May 31 13:28:02 2	2013	
					Basis-1
Material Stream	n: Vapour	from Flash	Tank	Property Package:	Amine Pkg - KE
		CONDITIONS			
	Overall	Vapour Phase	Aqueous Phase		
Vapour / Phase Fraction	1.0000	1.0000	0.0000		
Temperature: (C)	105.3	105.3	105.3		
Pressure: (kPa)	115.0	115.0	115.0	11197	
Molar Flow (kgmole/h)					
	14.72	14.72	0.0000		
Lig Vol Flow @Std Cond (m3/h)	74.14 *	74.14	0.0000		
Material Stream	n: Liquid 1	rom Flash	Tank	Fluid Package: Property Package:	Basis-1 Amine Pkg - KE
		CONDITIONS			
	0 "	1			
Vancus / Phone Francisco					
	-				
	1.180e+005	0.0000			
Mass Flow (kg/h)	2.804e+006	0.0000	2.804e+006		
Std Ideal Liq Vol Flow (m3/h)	2825	0.0000	2825		
Molar Enthalpy (kJ/kgmole)	-2.169e+004	1.330e+004	-2.169e+004		
Molar Entropy (kJ/kgmole-C)	93.36	221.1	93.36		
Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h)	-710.7 2708 •	0.0000	-710.7 2708		Regie-1
	2708 ·	0.0000	2708		Basis-1 Amine Pkg - KE
Liq Vol Flow @Std Cond (m3/h)	n: To Rec	o.0000 ompression conditions	2708	Fluid Package:	
Liq Vol Flow @Std Cond (m3/h) Material Stream	n: To Rec	0.0000 ompression conditions Vapour Phase	2708 Aqueous Phase	Fluid Package:	
Liq Vol Flow @Std Cond (m3/h)	n: To Rec	o.0000 ompression conditions	2708	Fluid Package: Property Package:	
Material Stream Vapour / Phase Fraction	2708 · m: To Rec Overail 0.8999	0.0000 Ompression CONDITIONS Vapour Phase 0.8999	Aqueous Phase 0.1001	Fluid Package: Property Package:	
Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h)	Overail 0.8999 99.45 100.0 3983	0.0000 CONDITIONS Vapour Phase 0.8999 99.45 100.0 3584	Aqueous Phase 0.1001 99.45 100.0 398.9	Fluid Package: Property Package:	
Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h)	Overail 0.8999 99.45 100.0 3983 7.826e+004	0.0000 CONDITIONS Vapour Phase 0.8999 99.45 100.0 3584 6.995e+004	Aqueous Phase 0.1001 99.45 100.0 398.9 8316	Fluid Package: Property Package:	
Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h)	Overail 0.8999 99.45 100.0 3983 7.826e+004 80.14	0.0000 CONDITIONS Vapour Phase 0.8999 99.45 100.0 3584 6.995e+004 71.78	Aqueous Phase 0.1001 99.45 100.0 398.9 8316 8.365	Fluid Package: Property Package:	
Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole)	Overail 0.8999 99.45 100.0 3983 7.826e+004 80.14	0.0000 CONDITIONS Vapour Phase 0.8999 99.45 100.0 3584 6.995e+004 71.78 1.268e+004	Aqueous Phase 0.1001 99.45 100.0 398.9 8316 8.365 -2.543e+004	Fluid Package: Property Package:	
Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kg/n) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C)	Overail 0.8999 99.45 100.0 3983 7.826e+004 80.14 8865 207.5	0.0000 CONDITIONS Vapour Phase 0.8999 99.45 100.0 3584 6.995e+004 71.78 1.268e+004 221.6	Aqueous Phase 0.1001 99.45 100.0 398.9 8316 8.365 -2.543e+004 80.90	Fluid Package: Property Package:	
Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW)	Overail 0.8999 99.45 100.0 3983 7.826e+004 80.14	0.0000 CONDITIONS Vapour Phase 0.8999 99.45 100.0 3584 6.995e+004 71.78 1.268e+004 221.6 12.63	Aqueous Phase 0.1001 99.45 100.0 398.9 8316 8.365 -2.543e+004	Fluid Package: Property Package:	
Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kg/n) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C)	Overail 0.8999 99.45 100.0 3983 7.826e+004 80.14 8865 207.5 9.809 74.14	0.0000 CONDITIONS Vapour Phase 0.8999 99.45 100.0 3584 6.995e+004 71.78 1.268e+004 221.6 12.63 66.30	Aqueous Phase 0.1001 99.45 100.0 398.9 8316 8.365 -2.543e+004 80.90 -2.818 8.033	Fluid Package: Property Package:	
Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h)	Overail 0.8999 99.45 100.0 3983 7.826e+004 80.14 8865 207.5 9.809 74.14	0.0000 CONDITIONS Vapour Phase 0.8999 99.45 100.0 3584 6.995e+004 71.78 1.268e+004 221.6 12.63 66.30	Aqueous Phase 0.1001 99.45 100.0 398.9 8316 8.365 -2.543e+004 80.90 -2.818 8.033	Fluid Package: Property Package: Fluid Package:	Amine Pkg - KE
Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h)	Overail 0.8999 99.45 100.0 3983 7.826e+004 80.14 8865 207.5 9.809 74.14	0.0000 CONDITIONS Vapour Phase 0.8999 99.45 100.0 3584 6.995e+004 71.78 1.268e+004 221.6 12.63 66.30 Cecompress	Aqueous Phase 0.1001 99.45 100.0 398.9 8316 8.365 -2.543e+004 80.90 -2.818 8.033	Fluid Package: Property Package: Fluid Package:	Amine Pkg - KE
Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h)	Overall 0.8999 99.45 100.0 3983 7.826e+004 80.14 8865 207.5 9.809 74.14	0.0000 CONDITIONS Vapour Phase 0.8999 99.45 100.0 3584 6.995e+004 71.78 1.268e+004 221.6 12.63 66.30 CONDITIONS	Aqueous Phase 0.1001 99.45 100.0 398.9 8316 8.365 -2.543e+004 80.90 -2.818 8.033	Fluid Package: Property Package: Fluid Package: Property Package:	Amine Pkg - KE
Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Streat Vapour / Phase Fraction Temperature: (C)	Overall Overall Overall Overall Overall Overall Overall	0.0000 CONDITIONS Vapour Phase 0.8999 99.45 100.0 3584 6.995e+004 71.78 1.268e+004 221.6 12.63 66.30 CONDITIONS Vapour Phase	Aqueous Phase	Fluid Package: Property Package: Fluid Package: Property Package:	Amine Pkg - KE
Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Streat Vapour / Phase Fraction Temperature: (C) Pressure: (kPa)	Overall Overall Overall Overall Overall Overall Overall Overall Overall Overall Overall Overall	0.0000 CONDITIONS Vapour Phase 0.8999 99.45 100.0 3584 6.995e+004 71.78 1.268e+004 221.6 12.63 66.30 CONDITIONS Vapour Phase 0.9390 120.0	Aqueous Phase	Fluid Package: Property Package: Fluid Package: Property Package:	Amine Pkg - KE
Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Streat Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h)	Overall Overall	0.0000 CONDITIONS Vapour Phase 0.8999 99.45 100.0 3584 6.995e+004 71.78 1.268e+004 221.6 12.63 66.30 CONDITIONS Vapour Phase 0.9390 120.0 200.0 3740	Aqueous Phase	Fluid Package: Property Package: Fluid Package: Property Package:	Amine Pkg - KE
Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Molar Enthalpy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Streat Vapour / Phase Fraction Material Streat Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Enthalpy (kJ/kgmole-C)	Overail 0.8999 99.45 100.0 3983 7.826e+004 80.14 8865 207.5 9.809 74.14 T: From R Overall 0.9390 120.0 200.0 3983 7.826e+004	0.0000 CONDITIONS Vapour Phase 0.8999 99.45 100.0 3584 6.995e+004 71.78 1.268e+004 221.6 12.63 66.30 CONDITIONS Vapour Phase 0.9390 120.0 200.0 3740 7.314e+004	Aqueous Phase	Fluid Package: Property Package: Fluid Package: Property Package:	Amine Pkg - KE
Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Molar Enthalpy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Streat Vapour / Phase Fraction Material Streat Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Enthalpy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h)	Overail 0.8999 99.45 100.0 3983 7.826e+004 80.14 8865 207.5 9.809 74.14 T: From R Overail 0.9390 120.0 200.0 3983 7.826e+004 80.14	0.0000 CONDITIONS Vapour Phase 0.8999 99.45 100.0 3584 6.995e+004 71.78 1.268e+004 221.6 12.63 68.30 CONDITIONS Vapour Phase 0.9390 120.0 3740 7.314e+004 75.00	Aqueous Phase	Fluid Package: Property Package: Fluid Package: Property Package:	Amine Pkg - KE
Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kJ/kgmole) Molar Enthalpy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Streat Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Enthalpy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole)	Overail 0.8999 99.45 100.0 3983 7.826e+004 80.14 8865 207.5 9.809 74.14 T: From R Overall 0.9390 120.0 200.0 3983 7.826e+004 80.14 1.131e+004	0.0000 CONDITIONS Vapour Phase 0.8999 99.45 100.0 3584 6.995e+004 71.78 1.268e+004 221.6 12.63 66.30 CONDITIONS Vapour Phase 0.9390 120.0 200.0 3740 7.314e+004 75.00 1.354e+004	Aqueous Phase 0.1001 99.45 100.0 398.9 8316 8.365 -2.543e+004 80.90 -2.818 8.033 ION Aqueous Phase 0.0610 120.0 200.0 242.8 5120 5.143 -2.305e+004	Fluid Package: Property Package: Fluid Package: Property Package:	Amine Pkg - KE
Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Molar Enthalpy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Streat Vapour / Phase Fraction Material Streat Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Enthalpy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h)	Overail 0.8999 99.45 100.0 3983 7.826e+004 80.14 8865 207.5 9.809 74.14 T: From R Overail 0.9390 120.0 200.0 3983 7.826e+004 80.14	0.0000 CONDITIONS Vapour Phase 0.8999 99.45 100.0 3584 6.995e+004 71.78 1.268e+004 221.6 12.63 68.30 CONDITIONS Vapour Phase 0.9390 120.0 3740 7.314e+004 75.00	Aqueous Phase	Fluid Package: Property Package: Fluid Package: Property Package:	Amine Pkg - KE
	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @ Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole)	Vapour / Phase Fraction	Date/Time: Date/Time: Date/Time: Date/Time: Date/Time: Date/Time: Date/Time: Date/Time: Date/Time: Date/Time: Date/Time: Date/Time: Date/Time: Date/Time: Date/Time: Date/Ti	Date/Time: Fri May 31 13:28:02 2	Date/Time: Fri May 31 13:28:02 2013 Fluid Package: Property Pa

1				Case Name:	VAPOUR RECO	MPRESSION.HSC	
3	aspen	UNIVERSITY Burlington, MA		Unit Set:	SI1		
5	demark dopoils	USA		Date/Time:	Fri May 31 13:28	:02 2013	
6 7 8	Material	Stream	: Recom	pressed to	Desorbe	Fluid Package: Property Package:	Basis-1 Amine Pkg - KE
9 10				CONDITIONS	3		
11			Overall	Vapour Phase	Aqueous Pha	se	
12	Vapour / Phase Fraction		0.9393	0.9393		607	
13 14	Temperature: Pressure:	(C) (kPa)	120.0 200.0	• 120.0 • 200.0		20.0	
15		kgmole/h)	3983	3741		41.9	
16	Mass Flow	(kg/h)	7.827e+004	7.317e+004	5	101	
17	Std Ideal Liq Vol Flow	(m3/h)	80.15	75.03		124	
18 19		J/kgmole) gmole-C)	1.132e+004 209.6	1.354e+004 217.8	-2.304e+	2.91	
20	Heat Flow	(MW)	12.52	14.07		548	
21	Liq Vol Flow @Std Cond	(m3/h)	74.15	• 69.34	4.	965	
22		04	W D 40			Fluid Package	Basis-1
23 24	Energy	Stream	: W-P-10	U		Property Package:	Amine Pkg - KE
25						,,	
26				CONDITIONS	3		
27	Duty Type:	Dire		culation Operation:	P-100		
28 29	Duty SP:	0.1029	MVV Minimum	Available Duty:		Maximum Available Du	
30	Energy	Stream	: Q Rebo	oiler		Fluid Package:	Basis-1
31	Literay	Otrouin	. Gilloot		1110	Property Package:	Amine Pkg - KE
32				CONDITIONS			
33	Duty Type	Dise	n O Duty Cal				
34 35	Duty Type: Duty SP:	Dire 101.5		culation Operation: F Available Duty:	Reboiler @COL2	Maximum Available Du	tv
36 37						Fluid Package:	Basis-1
37 38	Energy	Stream	: Q Cond	denser		Property Package:	Amine Pkg - KE
39 40				CONDITIONS			
41	Duty Type:	Utility F	luid Duty Cale	culation Operation: Cor	ndenser @COL2	Duty SP:	15.34 MW
42	Available UA:	3.600e+005 kJ		ıld Holdup:	100.0 kgmole	Fluid Heat Capacity:	75.00 kJ/kgmole-C
43	Actual Fluid Flow:			Fluid Flow:		Maximum Fluid Flow:	
44 45	Fluid Inlet Temperature:	15.0	00 C Fluid Out	let Temperature:	15.00 C	Temperature Approach	: 10.00 C
45 46	Energy	Stream	: W-P-10	1		Fluid Package: Property Package:	Basis-1
47 48						Froperty Fackage.	Amine Pkg - KE
48 49				CONDITIONS	3		
50	Duty Type:	Dire		culation Operation:	P-101		
51	Duty SP:	8.848e-002	MW Minimum	Available Duty:		Maximum Avallable Du	ty:
52 53 54	Energy	Stream	: Q Seav	vater		Fiuld Package: Property Package:	Basis-1 Amine Pkg - KE
55 56				CONDITIONS			
57	Duty Type:	Dire	ct Q Duty Cale	culation Operation: S	ea Water Cooler		
58	Duty SP:	19.22		Available Duty:		Maximum Available Du	ty:
59	Enouer	Chrom	. \\/			Fluid Package:	Basis-1
60 61	Energy	Stream	. **			Property Package:	Amine Pkg - KE
62 63				CONDITIONS			
64	Duty Type:	Dire	ct Q Duty Cal	culation Operation: Vap	our Compressor		
65	Duty SP:	2.701		Available Duty:		Maximum Available Du	ty:
66							
67 68							
69							
70							
71	Aspen Technology Inc.		Aspen	HYSYS Version 7.3	(25.0.0,7336)		Page 6 of 6

l	UNIVERSITY	OF TROMSO	Case Name:	LEAN SPLIT WITH V	APOUR RECOMPR	ESSION.HSC
	aspen Burlington, M/		Unit Set:	911		
ł	USA		Date/Time:	Fri May 31 13:29:22 2	013	
	Material Stream	: Sour Fee	ed to Abso	rber	Fluid Package:	Basis-1
+					Property Package:	Amine Pkg - KE
ł			CONDITIONS			
l		Overall	Vapour Phase	nyakatia se	na manthum	THE STREET
2	Vapour / Phase Fraction	1.0000	1.0000			
4	Temperature: (C)	40.00 *	40.00			
+	Pressure: (kPa) Molar Flow (kgmole/h)	101.0 °	101.0 1.092e+005			
;	Mass Flow (kg/h)	3.100e+006 °	3.100e+006			
,	Std Ideal Liq Vol Flow (m3/h)	3634	3634			
1	Molar Enthalpy (kJ/kgmole)	9211	9211			
9	Molar Entropy (kJ/kgmole-C)	196.6	196.6			
익	Heat Flow (MW)	279.3	279.3			-
1	Liq Voi Flow @ Std Cond (m3/h)					
	Material Stream	: Sweet G	as		Fluid Package: Property Package:	Basis-1 Amine Pkg - KE
5			CONDITIONS			
7		Overail	Vapour Phase	Aqueous Phase		
в	Vapour / Phase Fraction	0.9998	0.9998	0.0002		
9	Temperature: (C)	49.55	49.55	49.55		
익	Pressure: (kPa)	101.0	101.0	101.0		
1	Molar Flow (kgmole/h)	1.106e+005	1.105e+005 3.045e+006	21.12 480.2		
2 3	Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h)	3.046e+006 3550	3.0458+006	0.4856		
-	Moiar Enthalpy (kJ/kgmole)	9534	9542	-2.836e+004		
41			9042	~2.03001004		
-+		197.6	197.6	83.13		
5						
5 6 7	Molar Entropy (kJ/kgmole-C)	197.6	197.6	83.13		
5 6 7 8 9	Molar Entropy (kJ/kgmole-C) Heat Flow (MW)	197.6 292.8	197.6 293.0 	83.13 -0.1664	Fiuld Package:	Basis-1 Amlne Pkg - KE
5 6 7 8 9	Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h)	197.6 292.8	197.6 293.0 	83.13 -0.1664		
5 6 7 8 9 0	Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h)	197.6 292.8	197.6 293.0 	83.13 -0.1664		
5 6 7 8 9 0 1 2	Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h)	197.6 292.8 	197.6 293.0 ine	83.13 -0.1664 0.4582		
5 6 7 8 9 0 1 2	Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C)	197.6 292.8 2: Rich Am	197.6 293.0 ine CONDITIONS Vapour Phase 0.0000 41.26	83.13 -0.1664 0.4582 Aqueous Phase 1.0000 41.28		
5 6 7 8 9 0 1 2 3 4 5	Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa)	197.6 292.8 2: Rich Am Overall 0.0000 41.26 101.0	197.6 293.0 ine CONDITIONS Vapour Phase 0.0000 41.26 101.0	83.13 -0.1664 0.4582 Aqueous Phase 1.0000 41.28 101.0		
5 6 7 8 9 0 1 2 3 4 5 6	Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h)	197.6 292.8 2: Rich Am Overall 0.0000 41.26 101.0 9.705e+004	197.6 293.0 ine CONDITIONS Vapour Phase 0.0000 41.26 101.0 0.3267	83.13 -0.1664 0.4582 Aqueous Phase 1.0000 41.28 101.0 9.705e+004		
5 6 7 8 9 0 1 2 3 4 5 6 7	Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h)	197.6 292.8 2: Rich Am Overall 0.0000 41.26 101.0 9.705e+004 2.349e+008	197.6 293.0 ine CONDITIONS Vapour Phase 0.0000 41.26 101.0 0.3267 10.42	83.13 -0.1664 0.4582 Aqueous Phase 1.0000 41.28 101.0 9.705e+004 2.349e+006		
5 6 7 8 9 0 1 2 3 4 5 6 7	Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h)	197.6 292.8 2: Rich Am Overall 0.0000 41.26 101.0 9.705e+004	197.6 293.0 ine CONDITIONS Vapour Phase 0.0000 41.26 101.0 0.3267	83.13 -0.1664 0.4582 Aqueous Phase 1.0000 41.28 101.0 9.705e+004		
5 6 7 8 9 0 1 2 3 4 5 6 7 8	Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h)	197.6 292.8 2: Rich Am Overall 0.0000 41.26 101.0 9.705e+004 2.349e+006 2394	197.6 293.0 ine CONDITIONS Vapour Phase 0.0000 41.26 101.0 0.3267 10.42 1.228e-002	83.13 -0.1664 0.4582 Aqueous Phase 1.0000 41.28 101.0 9.705e+004 2.349e+006		
5 6 7 8 9 0 1 2 3 4 5 6 7 8 9	Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW)	197.6 292.8 292.8 292.8 292.8 292.8 292.8 202.8	197.6 293.0 ine CONDITIONS Vapour Phase 0.0000 41.26 101.0 0.3267 10.42 1.228e-002 9458	83.13 -0.1664 0.4582 Aqueous Phase 1.0000 41.28 101.0 9.705e+004 2.349e+006 2394 -2.856e+004 84.88 -769.9		
5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 1 2 3	Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C)	197.6 292.8 292.8 292.8 292.8 292.8 292.8 202.8	197.6 293.0 ine CONDITIONS Vapour Phase 0.0000 41.26 101.0 0.3267 10.42 1.228e-002 9458 205.1	83.13 -0.1664 0.4582 Aqueous Phase 1.0000 41.28 101.0 9.705e+004 2.349e+006 2394 -2.856e+004 84.88		
5 6 7 8 9 0 1 1 2 3 4 4 5 6 7 8 9 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW)	197.6 292.8 292.8 292.8 292.8 292.8 20000 41.26 101.0 9.705e+004 2.349e+008 2394 -2.856e+004 84.88 -769.9 2209 •	197.6 293.0 ine CONDITIONS Vapour Phase 0.0000 41.26 101.0 0.3267 10.42 1.228e-002 9458 205.1 8.583e-004	83.13 -0.1664 0.4582 Aqueous Phase 1.0000 41.28 101.0 9.705e+004 2.349e+006 2394 -2.856e+004 84.88 -769.9 2209		
5 6 6 7 7 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Entropy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h)	197.6 292.8 2: Rich Am Overall 0.0000 41.26 101.0 9.705e+004 2.349e+008 2394 -2.856e+004 84.88 -769.9 2209 • 1: Lean An	197.6 293.0 ine CONDITIONS Vapour Phase 0.0000 41.26 101.0 0.3267 10.42 1.228e-002 9458 205.1 8.583e-004 nine to Abs	83.13 -0.1664 0.4582 Aqueous Phase 1.0000 41.28 101.0 9.705e+004 2.349e+006 2394 -2.856e+004 84.88 -769.9 2209	Property Package:	Amine Pkg - KE
566 689 990 11122 333 44 666 677 788 899	Molar Entropy (k.J/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (k.J/kgmole) Molar Entropy (k.J/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream	197.6 292.8 2: Rich Am Overall 0.0000 41.26 101.0 9.705e+004 2.349e+008 2394 -2.856e+004 84.88 -769.9 2209 • 1: Lean An	197.6 293.0 ine CONDITIONS Vapour Phase 0.0000 41.26 101.0 0.3287 10.42 1.228e-002 9458 205.1 8.583e-004 nine to Abs CONDITIONS Aqueous Phase	83.13 -0.1664 0.4582 Aqueous Phase 1.0000 41.28 101.0 9.705e+004 2.349e+006 2394 -2.856e+004 84.88 -769.9 2209	Property Package:	Amine Pkg - KE
5 B B B B B B B B B B B B B B B B B B B	Molar Entropy (k.J/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Entropy (k.J/kgmole) Molar Entropy (k.J/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction	197.6 292.8 292.8 292.8 292.8 292.8 292.8 202.8	197.6 293.0 ine CONDITIONS Vapour Phase 0.0000 41.26 101.0 0.3287 10.42 1.228e-002 9458 205.1 8.583e-004 nine to Abs CONDITIONS Aqueous Phase 1.0000	83.13 -0.1664 0.4582 Aqueous Phase 1.0000 41.28 101.0 9.705e+004 2.349e+006 2394 -2.856e+004 84.88 -769.9 2209	Property Package:	Amine Pkg - KE
33 33 33 33 33 33 33 33 33 33 33 33 33	Molar Entropy (k.J/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (k.J/kgmole) Molar Entropy (k.J/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C)	197.6 292.8 2: Rich Am Overall 0.0000 41.26 101.0 9.705e+004 2.349e+008 2394 -2.856e+004 84.88 -769.9 2209 • 1: Lean An	197.6 293.0 ine CONDITIONS Vapour Phase 0.0000 41.26 101.0 0.3287 10.42 1.228e-002 9458 205.1 8.583e-004 nine to Abs CONDITIONS Aqueous Phase	83.13 -0.1664 0.4582 Aqueous Phase 1.0000 41.28 101.0 9.705e+004 2.349e+006 2394 -2.856e+004 84.88 -769.9 2209	Property Package:	Amine Pkg - KE
5 6 6 6 6 7 7 9 9 9 9 9 9 9 9 9 9 9 9 9 9	Molar Entropy (k.J/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Entropy (k.J/kgmole) Molar Entropy (k.J/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction	197.6 292.8 292.8 2: Rich Am Overall 0.0000 41.26 101.0 9.705e+004 2.349e+008 2394 -2.856e+004 84.88 -769.9 2209 • 1: Lean An Overall 0.0000 40.01 •	197.6 293.0 ine CONDITIONS Vapour Phase 0.0000 41.26 101.0 0.3267 10.42 1.228e-002 9458 205.1 8.583e-004 nine to Abs CONDITIONS Aqueous Phase 1.0000 40.01	83.13 -0.1664 0.4582 Aqueous Phase 1.0000 41.28 101.0 9.705e+004 2.349e+006 2394 -2.856e+004 84.88 -769.9 2209	Property Package:	Amine Pkg - KE
5 6 6 7 7 7 8 8 8 9 9 9 0 0 1 1 1 2 2 2 3 3 3 4 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8 9 9 9 9 9 9 9 9 9 9 9 9 9 9	Molar Entropy (k.J/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Entropy (k.J/kgmole) Molar Entropy (k.J/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa)	197.6 292.8 292.8 2: Rich Am Overall 0.0000 41.26 101.0 9.705e+004 2.349e+008 2394 -2.856e+004 84.88 -769.9 2209 • 1: Lean An Overall 0.0000 40.01 • 101.0 •	197.6 293.0 ine CONDITIONS Vapour Phase 0.0000 41.26 101.0 0.3267 10.42 1.228e-002 9458 205.1 8.583e-004 nine to Abs CONDITIONS Aqueous Phase 1.0000 40.01 101.0	83.13 -0.1664 0.4582 Aqueous Phase 1.0000 41.28 101.0 9.705e+004 2.349e+006 2394 -2.856e+004 84.88 -769.9 2209	Property Package:	Amine Pkg - KE
56666677 7788888888888888888888888888888	Molar Entropy (k.J/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (k.J/kgmole) Molar Entropy (k.J/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h)	197.6 292.8 292.8 292.8 292.8 292.8 292.8 292.8 20000 41.26 101.0 9.705e+004 2.349e+006 2394 -2.856e+004 84.88 -769.9 2209 • 2209 • 20000 40.01 • 101.0 • 4.551e+004 •	197.6 293.0 ine CONDITIONS Vapour Phase 0.0000 41.26 101.0 0.3287 10.42 1.228e-002 9458 205.1 8.583e-004 nine to Abs CONDITIONS Aqueous Phase 1.0000 40.01 101.0 4.551e+004	83.13 -0.1664 0.4582 Aqueous Phase 1.0000 41.28 101.0 9.705e+004 2.349e+006 2394 -2.856e+004 84.88 -769.9 2209	Property Package:	Amine Pkg - KE
5 6 6 6 7 7 7 8 8 8 9 9 9 0 0 1 1 1 2 2 2 2 3 3 4 4 4 5 5 6 6 6 6 7 7 7 8 8 8 9 9 9 0 0 0 1 1 1 2 2 2 2 2 3 3 3 4 4 4 5 5 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	Molar Entropy (k.J/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (k.J/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Enthalpy (kgmole/h) Mass Flow (kgmole/h) Mass Flow (kgmole/h) Mass Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole)	197.6 292.8 292.8 292.8 21: Rich Am Overall 0.0000 41.26 101.0 9.705e+004 2.349e+006 2394 -2.856e+004 84.88 -769.9 2209 • 11: Lean An Overall 0.0000 40.01 • 101.0 • 4.551e+004 • 1.046e+006 1053 -2.819e+004	197.6 293.0 ine CONDITIONS Vapour Phase 0.0000 41.26 101.0 0.3267 10.42 1.228e-002 9458 205.1 8.583e-004 nine to Abs CONDITIONS Aqueous Phase 1.0000 40.01 101.0 4.551e+004 1.046e+006 1053 -2.819e+004	83.13 -0.1664 0.4582 Aqueous Phase 1.0000 41.28 101.0 9.705e+004 2.349e+006 2394 -2.856e+004 84.88 -769.9 2209	Property Package:	Amine Pkg - KE
44 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Entropy (kJ/kgmole) Molar Entropy (kJ/kgmole) Molar Entropy (kJ/kgmole-C)	197.6 292.8 292.8 292.8 292.8 292.8 292.8 292.8 20000 41.26 101.0 9.705e+004 2.349e+006 2394 -2.856e+004 84.88 -769.9 2209 2209 2209 2209 2209 2209 2209 2	197.6 293.0 ine CONDITIONS Vapour Phase 0.0000 41.26 101.0 0.3267 10.42 1.228e-002 9458 205.1 8.583e-004 nine to Abs CONDITIONS Aqueous Phase 1.0000 40.01 101.0 4.551e+004 1.046e+006 1053 -2.819e+004 85.31	83.13 -0.1664 0.4582 Aqueous Phase 1.0000 41.28 101.0 9.705e+004 2.349e+006 2394 -2.856e+004 84.88 -769.9 2209	Property Package:	Amine Pkg - KE
5 6 6 7 7 8 8 8 9 9 0 0 1 1 1 1 5 5 6 6 6 6 6 6 6 6 6 6 6 6 6 6	Molar Entropy (k.J/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (k.J/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Enthalpy (kgmole/h) Mass Flow (kgmole/h) Mass Flow (kgmole/h) Mass Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole)	197.6 292.8 292.8 292.8 21: Rich Am Overall 0.0000 41.26 101.0 9.705e+004 2.349e+006 2394 -2.856e+004 84.88 -769.9 2209 • 11: Lean An Overall 0.0000 40.01 • 101.0 • 4.551e+004 • 1.046e+006 1053 -2.819e+004	197.6 293.0 ine CONDITIONS Vapour Phase 0.0000 41.26 101.0 0.3267 10.42 1.228e-002 9458 205.1 8.583e-004 nine to Abs CONDITIONS Aqueous Phase 1.0000 40.01 101.0 4.551e+004 1.046e+006 1053 -2.819e+004	83.13 -0.1664 0.4582 Aqueous Phase 1.0000 41.28 101.0 9.705e+004 2.349e+006 2394 -2.856e+004 84.88 -769.9 2209	Property Package:	Amine Pkg - KE

7	LIMIVERGITY	OF TROMSO	Case Name:	LEAN SPLIT WITH V	APOUR RECOMPR	ESSION.HSC
٦	aspen Burlington, M.		Unit Set:	SII		
	USA		Date/Time:	Fri May 31 13:29:22 2	2013	
ì					Fluid Package:	Basis-1
	Material Stream	: Rich An	nine to hea	t exchange	Property Package:	Amine Pkg - KE
1			CONDITIONS			
1		Overail	Aqueous Phase			
2	Vapour / Phase Fraction	0.0000	1.0000			
3	Temperature: (C)	41.33	41.33			
4 5	Pressure: (kPa) Molar Flow (kgmole/h)	291.0 9.705e+004	9.705e+004			
6	Mass Flow (kg/h)	2.349e+006	2.349e+006			
7	Std Ideal Liq Vol Flow (m3/h)	2394	2394			
В	Molar Enthalpy (kJ/kgmole)	-2.856e+004	-2.856e+004			-1
	Molar Entropy (kJ/kgmole-C)	84.88	84.88			
익	Heat Flow (MW)	-769.8	-769.8			
1 2	Liq Vol Flow @Std Cond (m3/h)	2209 •	2209		Fluid Package:	Basis-1
	Material Stream	: Rich Am		orber	Property Package:	Amine Pkg - KE
6			CONDITIONS			
<u>7</u> 8	Vapour / Phase Fraction	Overall 0.0148	Vapour Phase 0.0148	Aqueous Phase		
틹	Temperature: (C)	98.40 *	98.40	0.9852 98.40	-	
0	Pressure: (kPa)	200.0	200.0	200.0		
1	Moiar Flow (kgmole/h)	9.705e+004	1438	9.561e+004		
2	Mass Flow (kg/h)	2.349e+006	4.734e+004	2.301e+006		
<u> </u>	Std Ideal Liq Vol Flow (m3/h)	2394	54.95	2339		
4 5	Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C)	-2.279e+004	1.259e+004	-2.332e+004		
<u>မ</u> ရ	Heat Flow (MW)	92.89 -614.3	219.8 5.028	90.99		
7	Liq Vol Flow @Std Cond (m3/h)	2209 *	44.85	2173		
٨ĺ					Child Dealers	Basis-1
9 0	Material Stream	: Lean An	nine to hea	t exchang	Fluid Package: Property Package:	Amine Pkg - KE
9 0 1	Material Stream	: Lean An	conditions	t exchang		
9 0 1 2		: Lean An		t exchang		
9 0 1 2 3	Vapour / Phase Fraction	Overali 0.0000	CONDITIONS Aqueous Phase 1.0000	t exchang		
9 0 1 2 3	Vapour / Phase Fraction Temperature: (C)	Overali 0.0000 101.8	CONDITIONS Aqueous Phase 1.0000 101.8	t exchang		
9 0 1 2 3 6	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa)	Overall 0.0000 101.8 300.0	CONDITIONS Aqueous Phase 1.0000 101.8 300.0	t exchang		
9 0 1 2 3 4 5 6	Vapour / Phase Fraction Temperature: (C)	Overali 0.0000 101.8	CONDITIONS Aqueous Phase 1.0000 101.8	t exchang		
9 0 1 2 3 4 5 6 7	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Moiar Flow (kgmole/h)	Overali 0.0000 101.8 300.0 3.865e+004	CONDITIONS Aqueous Phase 1.0000 101.8 300.0 3.865e+004	t exchang		
9 0 1 2 3 4 5 6 7 8	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Moiar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Moiar Enthalpy (kJ/kgmole)	Overali 0.0000 101.8 300.0 3.865e+004 9.188e+005 925.2 -2.189e+004	CONDITIONS Aqueous Phase 1.0000 101.8 300.0 3.865e+004 9.188e+005 925.2 -2.189e+004	t exchang		
9 0 1 2 3 4 5 6 7 8	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Moiar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Moiar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C)	Overali 0.0000 101.8 300.0 3.865e+004 9.188e+005 925.2 -2.189e+004 93.56	CONDITIONS Aqueous Phase 1.0000 101.8 300.0 3.865e+004 9.188e+005 925.2 -2.189e+004 93.56	t exchang		
9 0 1 2 3 4 5 6 7 8 9	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Moiar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Moiar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW)	Overali 0.0000 101.8 300.0 3.865e+004 9.188e+005 925.2 -2.189e+004 93.56 -235.0	CONDITIONS Aqueous Phase 1.0000 101.8 300.0 3.865e+004 9.188e+005 925.2 -2.189e+004 93.56 -235.0	t exchang		
19 10 11 12 13 14 15 16 17 18 19 19 19 19 19 19 19 19 19 19 19 19 19	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Moiar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Moiar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C)	Overall 0.0000 101.8 300.0 3.865e+004 9.188e+005 925.2 -2.189e+004 93.56 -235.0 888.8 *	CONDITIONS Aqueous Phase 1.0000 101.8 300.0 3.865e+004 9.188e+005 925.2 -2.189e+004 93.56 -235.0 888.8		Property Package:	Amine Pkg - KE
19 10 11 12 13 14 15 16 16 17 18 19 19 19 19 19 19 19 19 19 19 19 19 19	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Moiar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Moiar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MVV) Liq Vol Flow @Std Cond (m3/h)	Overali 0.0000 101.8 300.0 3.865e+004 9.188e+005 925.2 -2.189e+004 93.56 -235.0 888.8 *	CONDITIONS Aqueous Phase 1.0000 101.8 300.0 3.865e+004 9.188e+005 925.2 -2.189e+004 93.56 -235.0 888.8 CONDITIONS		Property Package:	Amine Pkg - KE
9 0 0 1 1 1 5 6 6 6 7 7 8 8 8 8 8 9 9 9 9 9 9 9 9 9 9 9 9 9	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Moiar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Moiar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream	Overali 0.0000 101.8 300.0 3.865e+004 9.188e+005 925.2 -2.189e+004 93.56 -235.0 888.8 • Coverali	CONDITIONS Aqueous Phase		Property Package:	Amine Pkg - KE
9 0 1 1 1 1 2 2 3 3 3 3 3 3 3 3 3 7 7 7 7 7 7 7 7 7	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Moiar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Moiar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction	Overali 0.0000 101.8 300.0 3.865e+004 9.188e+005 925.2 -2.189e+004 93.56 -235.0 888.8 * I: Lean An Overali 0.0000	CONDITIONS Aqueous Phase		Property Package:	Amine Pkg - KE
9 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Moiar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Moiar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream	Overali 0.0000 101.8 300.0 3.865e+004 9.188e+005 925.2 -2.189e+004 93.56 -235.0 888.8 • Coverali	CONDITIONS Aqueous Phase		Property Package:	Amine Pkg - KE
9 0 1 1 2 2 3 3 3 4 4 6 6 6 6 6 7 7 7 7 7 7 7 7 7 7 7 7 7	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Moiar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Moiar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C)	Overali 0.0000 101.8 300.0 3.865e+004 9.188e+005 925.2 -2.189e+004 93.56 -235.0 888.8 • Coverali 0.0000 47.47	CONDITIONS Aqueous Phase		Property Package:	Amine Pkg - KE
9 0 1 1 2 2 3 3 4 4 4 7 7 7 8 8 8 8 8 9 9 9 9 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Moiar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Moiar Enthalpy (kJ/kgmole) Moiar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa)	Overali 0.0000 101.8 300.0 3.865e+004 9.188e+005 925.2 -2.189e+004 93.56 -235.0 888.8 • Coverali 0.0000 47.47 200.0 •	CONDITIONS Aqueous Phase		Property Package:	Amine Pkg - KE
9 0 1 1 2 2 3 3 4 4 6 6 6 6 7 7 7 7 7 7 7 7 8 8 8 9 9 9 9 9 9 0 0 0 0 0 0 0 0 0 0 0	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Moiar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Moiar Enthalpy (kJ/kgmole) Moiar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Moiar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h)	Overali 0.0000 101.8 300.0 3.865e+004 9.188e+005 925.2 -2.189e+004 93.56 -235.0 888.8 * I: Lean An Overali 0.0000 47.47 200.0 * 3.865e+004 9.188e+005 925.2	CONDITIONS Aqueous Phase 1.0000 101.8 300.0 3.865e+004 9.188e+005 925.2 -2.189e+004 93.56 -235.0 888.8 CONDITIONS Aqueous Phase 1.0000 47.47 200.0 3.865e+004 9.188e+005 925.2		Property Package:	Amine Pkg - KE
99 00 11 22 33 35 55 66 67 77 77 77 77 77 77 77 77 77 77 77	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Moiar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Moiar Enthalpy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Moiar Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole)	Overali 0.0000 101.8 300.0 3.865e+004 9.188e+005 925.2 -2.189e+004 93.56 -235.0 888.8 * I: Lean An Overali 0.0000 47.47 200.0 * 3.865e+004 9.188e+005 925.2 -2.681e+004	CONDITIONS Aqueous Phase 1.0000 101.8 300.0 3.865e+004 9.188e+005 925.2 -2.189e+004 93.56 -235.0 888.8 CONDITIONS Aqueous Phase 1.0000 47.47 200.0 3.865e+004 9.188e+005 925.2 -2.681e+004		Property Package:	Amine Pkg - KE
88 88 89 99 99 99 99 99 99 99 99 99 99 9	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Entropy (kJ/kgmole-C) Heat Flow (MVV) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Entropy (kJ/kgmole) Molar Entropy (kJ/kgmole-C)	Overali 0.0000 101.8 300.0 3.865e+004 9.188e+005 925.2 -2.189e+004 93.56 -235.0 888.8 * Cean An Overali 0.0000 47.47 200.0 * 3.865e+004 9.188e+005 925.2 -2.681e+004 87.60	CONDITIONS Aqueous Phase 1.0000 101.8 300.0 3.865e+004 9.188e+005 925.2 -2.189e+004 93.56 -235.0 888.8 CONDITIONS Aqueous Phase 1.0000 47.47 200.0 3.865e+004 9.188e+005 925.2 -2.681e+004 87.60		Property Package:	Amine Pkg - KE
9 0 0 1 1 5 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Moiar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Moiar Enthalpy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Moiar Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole)	Overali 0.0000 101.8 300.0 3.865e+004 9.188e+005 925.2 -2.189e+004 93.56 -235.0 888.8 * I: Lean An Overali 0.0000 47.47 200.0 * 3.865e+004 9.188e+005 925.2 -2.681e+004	CONDITIONS Aqueous Phase 1.0000 101.8 300.0 3.865e+004 9.188e+005 925.2 -2.189e+004 93.56 -235.0 888.8 CONDITIONS Aqueous Phase 1.0000 47.47 200.0 3.865e+004 9.188e+005 925.2 -2.681e+004		Property Package:	Amine Pkg - KE

4			Case Name: LEAN SPLIT WITH VAPOUR RECOMPRESSION.HSC			
	aspen Sharington, MA		Unit Set: Si1 Date/Time: Fri May 31 13:29:22 2013			
-	USA					
2	Material Stream	: Lean An	nine from Desorb	Fluid Package: Property Package:	Basis-1 Amine Pkg - KE	
,			CONDITIONS	roporty racitage.	7. Marine Files	
		0	CONDITIONS			
1	Vapour / Phase Fraction	Overall 0.0000	Aqueous Phase 1,0000	31.0-1		
1	Temperature: (C)	120.5	120.5			
I	Pressure: (kPa)	200.0	200.0			
4	Molar Flow (kgmole/h)	9.359e+004	9.359e+004			
+	Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h)	2.207e+006 2223	2.207e+006 2223			
†	Molar Enthalpy (kJ/kgmole)	-2.043e+004	-2.043 e+ 004			
1	Molar Entropy (kJ/kgmole-C)	95.08	95.08			
4	Heat Flow (MW)	-531.0	-531.0			
+	Liq Vol Flow @Std Cond (m3/h)	2133 •	2133	Eleda Dealessa	Posis 4	
	Material Stream	: CO2 Gas	S	Fluid Package: Property Package:	Basis-1 Amine Pkg - KE	
			CONDITIONS			
3 7		Overall	Vapour Phase			
1	Vapour / Phase Fraction	1.0000	1.0000			
1	Temperature: (C)	93.44	93.44			
4	Pressure: (kPa)	200.0	200.0			
+	Molar Flow (kgmole/h) Mass Flow (kg/h)	5146 1.742e+005	5146 1.742e+005			
J.	Std Ideal Liq Vol Flow (m3/h)	203.5	203.5			
ıſ	Stu lueal Liu voi Flow Illia/Ill I	200.0				
+	Molar Enthalpy (kJ/kgmole)	1.217e+004	1.217e+004			
1	Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C)	1.217e+004 219.0	1.217e+004 219.0			
3 4 5 6	Moiar Enthalpy (kJ/kgmole)	1.217e+004	1.217e+004			
6 7 8	Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW)	1.217e+004 219.0 17.40 165.2 *	1.217e+004 219.0 17.40 185.2	Fluid Package: Property Package:	Basis-1 Amine Pkg - KE	
5 6 7 8	Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h)	1.217e+004 219.0 17.40 165.2 *	1.217e+004 219.0 17.40 165.2 nine to MakeUp			
5 7 8	Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h)	1.217e+004 219.0 17.40 165.2 *	1.217e+004 219.0 17.40 165.2 nine to MakeUp			
3 3 3	Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C)	1.217e+004 219.0 17.40 165.2 *	1.217e+004 219.0 17.40 185.2 nine to MakeUp CONDITIONS Aqueous Phase 1.0000 40.00			
	Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa)	1.217e+004 219.0 17.40 165.2 * Lean An Overall 0.0000 40.00 * 200.0 *	1.217e+004 219.0 17.40 185.2 nine to MakeUp CONDITIONS Aqueous Phase 1.0000 40.00 200.0			
6	Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C)	1.217e+004 219.0 17.40 165.2 *	1.217e+004 219.0 17.40 185.2 nine to MakeUp CONDITIONS Aqueous Phase 1.0000 40.00			
3 3 3 4 5 8	Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h)	1.217e+004 219.0 17.40 165.2 * Lean An Overall 0.0000 40.00 * 200.0 * 3.865e+004	1.217e+004 219.0 17.40 185.2 nine to MakeUp CONDITIONS Aqueous Phase 1.0000 40.00 200.0 3.865e+004			
3 3 3 4 5 7	Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole)	1.217e+004 219.0 17.40 165.2 * Lean An Overall 0.0000 40.00 * 200.0 * 3.865e+004 9.188e+005 925.2 -2.746e+004	1.217e+004 219.0 17.40 185.2 nine to MakeUp CONDITIONS Aqueous Phase 1.0000 40.00 200.0 3.865e+004 9.188e+005 925.2 -2.746e+004			
3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C)	1.217e+004 219.0 17.40 165.2 * Lean An Overall 0.0000 40.00 * 200.0 * 3.865e+004 9.188e+005 925.2 -2.746e+004 86.77	1.217e+004 219.0 17.40 185.2 nine to MakeUp CONDITIONS Aqueous Phase 1.0000 40.00 200.0 3.865e+004 9.188e+005 925.2 -2.746e+004 86.77			
3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW)	1.217e+004 219.0 17.40 165.2 * Lean An Overall 0.0000 40.00 * 200.0 * 3.865e+004 9.188e+005 925.2 -2.746e+004 86.77 -294.9	1.217e+004 219.0 17.40 185.2 nine to MakeUp CONDITIONS Aqueous Phase 1.0000 40.00 200.0 3.865e+004 9.188e+005 925.2 -2.746e+004 86.77 -294.9			
4 5 6 7 7 8 9 0 1 1 2 2 3 4 4 5 5	Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C)	1.217e+004 219.0 17.40 165.2 * Lean An Overall 0.0000 40.00 * 200.0 * 3.865e+004 9.188e+005 925.2 -2.746e+004 86.77 -294.9 888.8 *	1.217e+004 219.0 17.40 185.2 nine to MakeUp CONDITIONS Aqueous Phase 1.0000 40.00 200.0 3.865e+004 9.188e+005 925.2 -2.746e+004 86.77 -294.9 888.8			
4 5 6 7 8 9 1 1 2 3 4	Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h)	1.217e+004 219.0 17.40 165.2 * Lean An Overall 0.0000 40.00 * 200.0 * 3.865e+004 9.188e+005 925.2 -2.746e+004 86.77 -294.9 888.8 *	1.217e+004 219.0 17.40 185.2 nine to MakeUp CONDITIONS Aqueous Phase 1.0000 40.00 200.0 3.865e+004 9.188e+005 925.2 -2.746e+004 86.77 -294.9 888.8 Water	Property Package:	Amine Pkg - KE	
5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h)	1.217e+004 219.0 17.40 165.2 * Lean An Overall 0.0000 40.00 * 200.0 * 3.865e+004 9.188e+005 925.2 -2.746e+004 86.77 -294.9 888.8 * MakeUp	1.217e+004 219.0 17.40 185.2 nine to MakeUp CONDITIONS Aqueous Phase 1.0000 40.00 200.0 3.865e+004 9.188e+005 925.2 -2.746e+004 86.77 -294.9 888.8 Water CONDITIONS	Property Package:	Amine Pkg - KE	
	Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @ Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @ Std Cond (m3/h) Material Stream	1.217e+004 219.0 17.40 165.2 * Lean An Overall 0.0000 40.00 * 200.0 * 3.865e+004 9.188e+005 925.2 -2.746e+004 86.77 -294.9 888.8 * MakeUp	1.217e+004 219.0 17.40 185.2 nine to MakeUp CONDITIONS Aqueous Phase 1.0000 40.00 200.0 3.865e+004 9.188e+005 925.2 -2.746e+004 86.77 -294.9 888.8 Water CONDITIONS Aqueous Phase	Property Package:	Amine Pkg - KE	
	Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h)	1.217e+004 219.0 17.40 165.2 * Lean An Overall 0.0000 40.00 * 200.0 * 3.865e+004 9.188e+005 925.2 -2.746e+004 86.77 -294.9 888.8 * MakeUp	1.217e+004 219.0 17.40 185.2 nine to MakeUp CONDITIONS Aqueous Phase 1.0000 40.00 200.0 3.865e+004 9.188e+005 925.2 -2.746e+004 86.77 -294.9 888.8 Water CONDITIONS	Property Package:	Amine Pkg - KE	
3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @ Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @ Std Cond (m3/h) Material Stream Vapour / Phase Fraction	1.217e+004 219.0 17.40 165.2 * Lean An Overall 0.0000 40.00 * 200.0 * 3.865e+004 9.188e+005 925.2 -2.746e+004 86.77 -294.9 888.8 * MakeUp Overall 0.0000	1.217e+004 219.0 17.40 185.2 nine to MakeUp CONDITIONS Aqueous Phase 1.0000 40.00 200.0 3.865e+004 9.188e+005 925.2 -2.746e+004 86.77 -294.9 888.8 Water CONDITIONS Aqueous Phase 1.0000	Property Package:	Amine Pkg - KE	
3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @ Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @ Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h)	1.217e+004 219.0 17.40 165.2 * Lean An Overall 0.0000 40.00 * 200.0 * 3.865e+004 9.188e+005 925.2 -2.746e+004 86.77 -294.9 888.8 * MakeUp Overall 0.0000 40.00 * 200.0 * 6600 *	1.217e+004 219.0 17.40 185.2 nine to MakeUp CONDITIONS Aqueous Phase 1.0000 40.00 200.0 3.865e+004 9.188e+005 925.2 -2.746e+004 86.77 -294.9 888.8 Water CONDITIONS Aqueous Phase 1.0000 40.00 200.0 6600	Property Package:	Amine Pkg - KE	
3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @ Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @ Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kg/h) Mass Flow (kg/h)	1.217e+004 219.0 17.40 165.2 * Lean An Overall 0.0000 40.00 * 200.0 * 3.865e+004 9.188e+005 925.2 -2.746e+004 86.77 -294.9 888.8 * MakeUp Overall 0.0000 40.00 * 200.0 * 6600 * 1.189e+005	1.217e+004 219.0 17.40 165.2 nine to MakeUp CONDITIONS Aqueous Phase 1.0000 40.00 200.0 3.865e+004 9.188e+005 925.2 -2.746e+004 86.77 -294.9 888.8 Water CONDITIONS Aqueous Phase 1.0000 40.00 200.0 6600 1.189e+005	Property Package:	Amine Pkg - KE	
5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @ Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @ Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (kg/h) Std Ideal Liq Vol Flow (kg/h)	1.217e+004 219.0 17.40 165.2 * Lean An Overall 0.0000 40.00 * 200.0 * 3.865e+004 9.188e+005 925.2 -2.746e+004 88.77 -294.9 888.8 * MakeUp Overall 0.0000 40.00 * 200.0 * 6600 * 1.189e+005 119.1	1.217e+004 219.0 17.40 165.2 nine to MakeUp CONDITIONS Aqueous Phase 1.0000 40.00 200.0 3.865e+004 9.188e+005 925.2 -2.746e+004 86.77 -294.9 888.8 Water CONDITIONS Aqueous Phase 1.0000 40.00 200.0 6600 1.189e+005 119.1	Property Package:	Amine Pkg - KE	
	Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @ Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @ Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kg/h) Mass Flow (kg/h)	1.217e+004 219.0 17.40 165.2 * Lean An Overall 0.0000 40.00 * 200.0 * 3.865e+004 9.188e+005 925.2 -2.746e+004 86.77 -294.9 888.8 * MakeUp Overall 0.0000 40.00 * 200.0 * 6600 * 1.189e+005	1.217e+004 219.0 17.40 165.2 nine to MakeUp CONDITIONS Aqueous Phase 1.0000 40.00 200.0 3.865e+004 9.188e+005 925.2 -2.746e+004 86.77 -294.9 888.8 Water CONDITIONS Aqueous Phase 1.0000 40.00 200.0 6600 1.189e+005	Property Package:	Amine Pkg - KE	
1	Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kgmole/h) Mass Flow (kgmole/h) Molar Flow (kgmole/h) Molar Flow (kgmole/h) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole)	1.217e+004 219.0 17.40 165.2 * Lean An Overall 0.0000 40.00 * 200.0 * 3.865e+004 9.188e+005 925.2 -2.746e+004 88.77 -294.9 888.8 * MakeUp Overall 0.0000 40.00 * 200.0 * 6600 * 1.189e+005 119.1 -3.298e+004	1.217e+004 219.0 17.40 165.2 nine to MakeUp CONDITIONS Aqueous Phase 1.0000 40.00 200.0 3.865e+004 9.188e+005 925.2 -2.746e+004 86.77 -294.9 888.8 Water CONDITIONS Aqueous Phase 1.0000 40.00 200.0 6600 1.189e+005 119.1 -3.298e+004	Property Package:	Amine Pkg - KE	

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1			Case Name:	LEAN SPLIT WITH V	APOLIE RECOMPR	ESSION HSC
2	UNIVERSITY OF Purilington MA		1.12.5.2000 (Shinar 1)		APOUN RECOMPR	LGSION.HSC
4	aspen Burlington, MA		Unit Set:	Si1	1012	
5			Date/Time:	Fri May 31 13:29:22 2		
6 7 8	Material Stream	: Makeup	Amine		Fiuld Package: Property Package:	Basis-1 Amine Pkg - KE
9			CONDITIONS		. , ,	
10 11		Overall	Liquid Phase			
12	Vapour / Phase Fraction	0.0000	1.0000	1		
13	Temperature: (C)	40.00 •	40.00			
14 15	Pressure: (kPa) Molar Flow (kgmole/h)	200.0 °	200.0 44.00			
16	Mass Flow (kg/h)	2688	2688	-		
17	Std Ideal Liq Vol Flow (m3/h)	2.643	2.643			
18	Molar Enthalpy (kJ/kgmole)	2.419e+004	2.419e+004			
19 20	Molar Entropy (kJ/kgmole-C) Heat Flow (MW)	177.5 0.2956	177.5 0.2956			
21	Liq Voi Flow @Std Cond (m3/h)	2.617 •	2.617			
22		Yasack Kan			Fluid Package:	Basis-1
23 24	Material Stream	: Mixed L	ean Amine		Property Package:	Amine Pkg - KE
25 26			CONDITIONS			
26 27		Overali	Aqueous Phase			
28	Vapour / Phase Fraction	0.0000	1.0000			
29	Temperature: (C)	40.01	40.01			
30	Pressure: (kPa)	200.0	200.0			
31	Molar Flow (kgmole/h) Mass Flow (kg/h)	4.530e+004 1.040e+006	4.530e+004 1.040e+006			
33	Std Ideal Liq Vol Flow (m3/h)	1047	1.04061000			
34	Molar Enthalpy (kJ/kgmole)	-2.822e+004	-2.822e+004			
35	Molar Entropy (kJ/kgmole-C)	85.27	85.27			
36 37	Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h)	-355.0 1008 °	-355.0 1008			
38 39 40 41 42	Material Stream	: Lean An	conditions	ele	Fluid Package: Property Package:	Basis-1 Amine Pkg - KE
43		Overali	Aqueous Phase			
44	Vapour / Phase Fraction	0.0000	1.0000			
45	Temperature: (C)	40.01	40.01			
46	Pressure: (kPa)	101.0 *	101.0			
47 48	Molar Flow (kgmole/h) Mass Flow (kg/h)	4.530e+004 1.040e+006	4.530e+004 1.040e+006			
49	Std ideal Liq Vol Flow (m3/h)	1047	1047			
50	Molar Enthalpy (kJ/kgmole)	-2.822e+004	-2.822e+004			
51	Molar Entropy (kJ/kgmole-C)	85.27	85.27			
52 53	Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h)	-355.0 1008 °	-355.0 1008		-	
54 55 56				ine from Valve to Fi		
57			CONDITIONS		, ,	
58 59		Overail	Vapour Phase	Aqueous Phase		
60	Vapour / Phase Fraction	0.0419	0.0419	0.9581		
61	Temperature: (C)	101.8	101.8	101.8		
62	Pressure: (kPa)	100.0 •	100.0	100.0		
63	Molar Flow (kgmole/h)	4.034e+004	1689	3.865e+004		
64 65	Mass Flow (kg/h) Std Ideal Lig Vol Flow (m3/h)	9.514e+005 958.4	3.260e+004 33.19	9.188e+005		
66	Molar Enthalpy (kJ/kgmole)	-2.043e+004	1.316e+004	925.2 -2.189e+004		
67	Molar Entropy (kJ/kgmole-C)	98.44	221.6	93.05		
68	Heat Flow (MW)	-228.9	6.177	-235.1		
69	Liq Vol Flow @Std Cond (m3/h)	919.3 •	30.88	888.8	11111111	
70		7 3 4 4 4				
71	Aspen Technology Inc.	Aspen H	YSYS Version 7.3 (25.0.0.7336)		Page 4 of 8

1	UNIVERSITY	OF TROMSO	Case Name:	LEAN SPLIT WITH V	APOUR RECOMPRI	ESSION.HSC
	aspen Burlington, MA		Unit Set:	Si1		
1	USA		Date/Time:	Fri May 31 13:29:22 2	013	
-					Fluid Package:	Basis-1
1	Material Stream	: Vapour	from Flash	Tank	Property Package:	Amine Pkg - KE
			CONDITIONS			
l		Overail	Vapour Phase	Aqueous Phase		
1	Vapour / Phase Fraction	1.0000	1.0000	0.0000		
4	Temperature: (C)	101.8	101.8	101.8		
#	Pressure: (kPa) Molar Flow (kgmole/h)	100.0	100.0 1689	100.0 0.0000		
†	Mass Flow (kg/h)	3.260e+004	3.260e+004	0.0000		
İ	Std Ideal Liq Vol Flow (m3/h)	33.19	33.19	0.0000		
1	Molar Enthalpy (kJ/kgmole)	1.316e+004	1.316e+004	-2.189 e+ 004		
4	Molar Entropy (kJ/kgmole-C)	221.6	221.6	93.05		
4	Heat Flow (MW)	6.177	6.177	0.0000		
l	Liq Vol Flow @Std Cond (m3/h)	30.88 *	30.88	0.0000	F) 118 -1	D-1-1
I	Material Stream	: Liquid 1	rom Flash	Tank	Fluid Package: Property Package:	Basis-1 Amine Pkg - KE
			CONDITIONS			
l		Overali	Vapour Phase	Aqueous Phase	U.S. EUNEL R	
İ	Vapour / Phase Fraction	0.0000	0.0000	1.0000		
1	Temperature: (C)	101.8	101.8	101.8		
4	Pressure: (kPa)	100.0	100.0	100.0	1 1115	
4	Moiar Flow (kgmole/h)	3.865e+004	0.0000	3.865e+004		
2 3	Mass Flow (kg/h) Std Ideai Liq Voi Flow (m3/h)	9.188e+005 925.2	0.0000	9.188e+005 925.2		
1	Molar Enthalpy (kJ/kgmole)	-2.189e+004	1.316e+004	-2.189e+004		
5	Molar Entropy (kJ/kgmole-C)	93.05	221.6	93.05		
7						
Ы	Heat Flow (MW)	-235.1	0.0000	-235.1		
7	Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h)	-235.1 888.8 *	0.0000	-235.1 888.8		
6 7 8 9		888.8 *	0.0000	888.8	Fluid Package: Property Package:	Basis-1 Amine Pkg - KE
7 8 9 0	Liq Vol Flow @Std Cond (m3/h)	888.8 *	0.0000	888.8		
7 8 9 0	Liq Vol Flow @Std Cond (m3/h)	888.8 *	o.oooo ompression	888.8		
7 8 9 0 1 2	Liq Vol Flow @Std Cond (m3/h)	: To Rec	o.oooo ompression conditions	888.8		
7 3 1 2 4	Vapour / Phase Fraction Temperature: (C)	888.8 · : To Rec Overall 0.8529 99.45 ·	0.0000 CONDITIONS Vapour Phase 0.8529 99.45	Aqueous Phase 0.1471 99.45		
7 8 9 0 1 2 3 4	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa)	Overall 0.8529 99.45	0.0000 CONDITIONS Vapour Phase 0.8529 99.45 100.0	Aqueous Phase 0.1471 99.45 100.0		
7 8 9 0 1 2 3 4 7	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h)	Overall 0.8529 99.45 100.0 1689	0.0000 CONDITIONS Vapour Phase 0.8529 99.45 100.0 1441	Aqueous Phase 0.1471 99.45 100.0 248.4		
7 3 0 1 3 4 5 6 7 8	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h)	Overall 0.8529 99.45 100.0 1689 3.260e+004	0.0000 CONDITIONS Vapour Phase 0.8529 99.45 100.0 1441 2.759e+004	Aqueous Phase 0.1471 99.45 100.0 248.4 5009		
7 8 9 0 1 2 3 4 6 7 8	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h)	Overall 0.8529 99.45 100.0 1689	0.0000 CONDITIONS Vapour Phase 0.8529 99.45 100.0 1441	Aqueous Phase 0.1471 99.45 100.0 248.4 5009 5.033		
7 3 9 1 9 1 9 1 9	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h)	Overall 0.8529 99.45 100.0 1689 3.260e+004 33.19	0.0000 CONDITIONS Vapour Phase 0.8529 99.45 100.0 1441 2.759e+004 28.15	Aqueous Phase 0.1471 99.45 100.0 248.4 5009		
7 3 3 3 3 3 3 3 3 3 3 1 1	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole)	Overall 0.8529 99.45 100.0 1689 3.260e+004 33.19 6924	0.0000 CONDITIONS Vapour Phase 0.8529 99.45 100.0 1441 2.759e+004 28.15 1.261e+004	Aqueous Phase 0.1471 99.45 100.0 248.4 5009 5.033 -2.607e+004		
7 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C)	Overall 0.8529 99.45 100.0 1689 3.260e+004 33.19 6924 200.7	0.0000 CONDITIONS Vapour Phase 0.8529 99.45 100.0 1441 2.759e+004 28.15 1.261e+004 221.2	Aqueous Phase 0.1471 99.45 100.0 248.4 5009 5.033 -2.607e+004 81.42		
77 33 33 33 33 33 33 33 34 44	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW)	Overall 0.8529 99.45 100.0 1689 3.260e+004 33.19 6924 200.7 3.249 30.88	0.0000 CONDITIONS Vapour Phase 0.8529 99.45 100.0 1441 2.759e+004 28.15 1.261e+004 221.2 5.048 26.15	Aqueous Phase 0.1471 99.45 100.0 248.4 5009 5.033 -2.607e+004 81.42 -1.799 4.854	Property Package:	
7 3 3 3 1 1 1 1 2 2 2 3 3 3 3 3 3 3 3 3 3	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h)	Overall 0.8529 99.45 100.0 1689 3.260e+004 33.19 6924 200.7 3.249 30.88	0.0000 CONDITIONS Vapour Phase 0.8529 99.45 100.0 1441 2.759e+004 28.15 1.261e+004 221.2 5.048 26.15	Aqueous Phase 0.1471 99.45 100.0 248.4 5009 5.033 -2.607e+004 81.42 -1.799 4.854	Property Package:	Amine Pkg - KE
7	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h)	Overall 0.8529 99.45 100.0 1689 3.260e+004 33.19 6924 200.7 3.249 30.88	0.0000 CONDITIONS Vapour Phase 0.8529 99.45 100.0 1441 2.759e+004 28.15 1.261e+004 221.2 5.048 26.15	Aqueous Phase 0.1471 99.45 100.0 248.4 5009 5.033 -2.607e+004 81.42 -1.799 4.854	Property Package:	Amine Pkg - KE
7 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	Vapour / Phase Fraction Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction	Overall 0.8529 99.45 100.0 1689 3.260e+004 33.19 6924 200.7 3.249 30.88 From R	0.0000 Ompression CONDITIONS Vapour Phase 0.8529 99.45 100.0 1441 2.759e+004 28.15 1.261e+004 221.2 5.048 26.15 CONDITIONS Vapour Phase 0.8902	Aqueous Phase 0.1471 99.45 100.0 248.4 5009 5.033 -2.607e+004 81.42 -1.799 4.854	Property Package:	Amine Pkg - KE
2 2 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C)	Overall 0.8529 99.45 100.9 3.260e+004 33.19 6924 200.7 3.249 30.88 From R	0.0000 Ompression CONDITIONS Vapour Phase 0.8529 99.45 100.0 1441 2.759e+004 28.15 1.261e+004 221.2 5.048 26.15 CONDITIONS Vapour Phase 0.8902 119.9	Aqueous Phase 0.1471 99.45 100.0 248.4 5009 5.033 -2.607e+004 81.42 -1.799 4.854 Aqueous Phase 0.1098 119.9	Property Package:	Amine Pkg - KE
	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa)	Overall 0.8529 99.45 100.9 3.260e+004 33.19 6924 200.7 3.249 30.88 From R	0.0000 Ompression CONDITIONS Vapour Phase 0.8529 99.45 100.0 1441 2.759e+004 28.15 1.261e+004 221.2 5.048 26.15 CONDITIONS Vapour Phase 0.8902 119.9 200.0	Aqueous Phase 0.1471 99.45 100.0 248.4 5009 5.033 -2.607e+004 81.42 -1.799 4.854 Aqueous Phase 0.1098 119.9 200.0	Property Package:	Amine Pkg - KE
7 8 8 9 9 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kg/h)	Overall 0.8529 99.45 100.0 1689 3.260e+004 33.19 6924 200.7 3.249 30.88 Coverall 0.8902 119.9 200.0 1689	0.0000 Ompression CONDITIONS Vapour Phase 0.8529 99.45 100.0 1441 2.759e+004 28.15 1.261e+004 221.2 5.048 26.15 CONDITIONS Vapour Phase 0.8902 119.9 200.0 1504	Aqueous Phase 0.1471 99.45 100.0 248.4 5009 5.033 -2.607e+004 81.42 -1.799 4.854 Aqueous Phase 0.1098 119.9 200.0 185.4	Property Package:	Amine Pkg - KE
2 2 2 3 3 3 3 4 4 4 4 4 4 4 4 4 4 4 4 4	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kg/h)	Overall 0.8529 99.45 100.0 1689 3.260e+004 33.19 6924 200.7 3.249 30.88 From R Overall 0.8902 119.9 200.0 1689 3.260e+004	0.0000 Ompression CONDITIONS Vapour Phase 0.8529 99.45 100.0 1441 2.759e+004 28.15 1.261e+004 221.2 5.048 26.15 CONDITIONS Vapour Phase 0.8902 119.9 200.0 1504 2.884e+004	Aqueous Phase 0.1471 99.45 100.0 248.4 5009 5.033 -2.607e+004 81.42 -1.799 4.854 Aqueous Phase 0.1098 119.9 200.0 185.4 3760	Property Package:	Amine Pkg - KE
7 3 3 3 3 1 1 1 1 1 2 2 2 3 3 3 3 3 3 4 4 5 5 6 6 6 6 6 7 7 7 7 8 7 8 7 7 7 7 7 7 7 7	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kg/h) Std Ideal Liq Vol Flow (m3/h)	Overall 0.8529 99.45 100.0 1689 3.260e+004 33.19 6924 200.7 3.249 30.88 Coverall 0.8902 119.9 200.0 1689 3.260e+004 33.19	0.0000 CONDITIONS Vapour Phase 0.8529 99.45 100.0 1441 2.759e+004 28.15 1.261e+004 221.2 5.048 26.15 CONDITIONS Vapour Phase 0.8902 119.9 200.0 1504 2.884e+004 29.41	Aqueous Phase 0.1471 99.45 100.0 248.4 5009 5.033 -2.607e+004 81.42 -1.799 4.854 Aqueous Phase 0.1098 119.9 200.0 185.4 3760 3.773	Property Package:	Amine Pkg - KE
7 8 9 0 1 2 3 4	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kg/h) Std Ideal Liq Vol Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole)	Overall 0.8529 99.45 100.0 1689 3.260e+004 33.19 6924 200.7 3.249 30.88 From R Overall 0.8902 119.9 200.0 1689 3.260e+004	0.0000 Ompression CONDITIONS Vapour Phase 0.8529 99.45 100.0 1441 2.759e+004 28.15 1.261e+004 221.2 5.048 26.15 CONDITIONS Vapour Phase 0.8902 119.9 200.0 1504 2.884e+004	Aqueous Phase 0.1471 99.45 100.0 248.4 5009 5.033 -2.607e+004 81.42 -1.799 4.854 Aqueous Phase 0.1098 119.9 200.0 185.4 3760	Property Package:	Amine Pkg - KE
77 8 8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kg/h) Std Ideal Liq Vol Flow (m3/h)	Overall 0.8529 99.45 100.0 1689 3.260e+004 33.19 6924 200.7 3.249 30.88 From R Overall 0.8902 119.9 200.0 1689 3.260e+004 33.19 9318	0.0000 CONDITIONS Vapour Phase 0.8529 99.45 100.0 1441 2.759e+004 28.15 1.261e+004 221.2 5.048 26.15 CONDITIONS Vapour Phase 0.8902 119.9 200.0 1504 2.884e+004 29.41 1.342e+004	Aqueous Phase 0.1471 99.45 100.0 248.4 5009 5.033 -2.607e+004 81.42 -1.799 4.854 ION Aqueous Phase 0.1098 119.9 200.0 185.4 3760 3.773 -2.392e+004	Property Package: Fluid Package: Property Package:	Amine Pkg - KE
2 2 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Material Stream Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C)	Overall 0.8529 99.45 * 100.0 * 1689 3.260e+004 33.19 6924 200.7 3.249 30.88 * From R Overall 0.8902 119.9 200.0 * 1689 3.260e+004 33.19 9318 202.7	0.0000 CONDITIONS Vapour Phase 0.8529 99.45 100.0 1441 2.759e+004 28.15 1.261e+004 221.2 5.048 26.15 CONDITIONS Vapour Phase 0.8902 119.9 200.0 1504 2.884e+004 29.41 1.342e+004 217.4	Aqueous Phase 0.1471 99.45 100.0 248.4 5009 5.033 -2.607e+004 81.42 -1.799 4.854 Aqueous Phase 0.1098 119.9 200.0 185.4 3760 3.773 -2.392e+004 83.44	Property Package: Fluid Package: Property Package:	Amine Pkg - KE

(A) ac		UNIVERSITY	OF TROMSO	Case Name:	LEAN SPLIT WITH V	APOUR RECOMPR	ESSION.HSC
as	pen	Burlington, M		Unit Set:	SII	中国的大型等企业	
	P	USA		Date/Time: Fri May 31 13:29:22 2013			
1) in the 1-2	Subsession.				Les percent	Fluid Package:	Basis-1
	Mater	ial Stream	n: Recomp	ressed to	Desorber	Property Package:	Amine Pkg - KE
				CONDITIONS			
me at a			Overall	Vapour Phase	Aqueous Phase		
Vapour / F	hase Fractio	on	0.8904	0.8904	0.1096		
Temperati	ıre:	(C)	119.9 *	119.9	119.9		
Pressure:		(kPa)	200.0 *	200.0	200.0		
Molar Flow Mass Flow		(kgmole/h)	3.260e+004	1504 2.884e+004	185.2 3755	-	
	iq Vol Flow	(kg/h) (m3/h)	33.19	29.42	3,768		
Molar Enti		(kJ/kgmoie)	9324	1.342e+004	-2.392e+004		
Molar Enti Molar Enti		(kJ/kgmole-C)	202.7	217.4	83.44		, HILLS
Heat Flow		(MW)	4.375	5.606	-1.230		
Liq Vol Flo	w @Std Co	nd (m3/h)	30.88 •	27.34	3.668		
	Mater	ial Strean	n: 1			Fluid Package: Property Package:	Basis-1 Amine Pkg - KE
3				CONDITIONS			
			Overali	Aqueous Phase			
1	hase Fractio		0.0000	1.0000			
Pressure:	ure:	(C) (kPa)	120.5 200.0	120.5 200.0			
Molar Flow	v	(kgmole/h)	5.325e+004	5.325e+004			
Mass Flov		(kg/h)	1.256e+006	1.256e+006			
	iq Vol Flow	(m3/h)	1265	1265			
Molar Enti		(kJ/kgmole)	-2.043e+004	-2.043e+004			
				210 100 100 1			
Molar Ent	ору	(kJ/kgmole-C)	95.08	95.08			
Heat Flow		(MW)	-302.1	95.08 -302.1			
Heat Flow		(MW)		95.08		Eluid Reclies	Perio 4
Heat Flow	ow @Std Co	(MW)	-302.1 1213 °	95.08 -302.1		Fluid Package: Property Package:	Basis-1 Amine Pkg - KE
Heat Flow Liq Vol Flo	ow @Std Co	(MW) nd (m3/h)	-302.1 1213 ·	95.08 -302.1			
Heat Flow	w @Std Col	(MW) nd (m3/h) rial Stream	-302.1 1213 ·	95.08 -302.1 1213 CONDITIONS Aqueous Phase			
Heat Flow Liq Vol Flo	Mater Phase Fraction	(MW) nd (m3/h) rial Stream	-302.1 1213 * 2 Overall 0.0000	95.08 -302.1 1213 CONDITIONS Aqueous Phase 1.0000			
Heat Flow Liq Vol Flo	Mater Phase Fraction	(MW) nd (m3/h) rial Stream on (C)	-302.1 1213 * 12	95.08 -302.1 1213 CONDITIONS Aqueous Phase 1.0000 120.5			
Heat Flow Liq Vol Flo Vapour / F Temperate Pressure:	Mater Phase Fraction	(MW) nd (m3/h) rial Stream	-302.1 1213 * 2 Overall 0.0000	95.08 -302.1 1213 CONDITIONS Aqueous Phase 1.0000			
Heat Flow Liq Vol Flo Vapour / F Temperate Pressure: Molar Flox	Mater Phase Fraction	(MW) nd (m3/h) rial Stream on (C) (kPa)	-302.1 1213 * 12	95.08 -302.1 1213 CONDITIONS Aqueous Phase 1.0000 120.5 200.0			
Heat Flow Liq Vol Flo Vapour / F Temperate Pressure: Molar Flox Mass Flow	Mater Phase Fraction	(MW) nd (m3/h) rial Stream on (C) (kPa) (kgmole/h) (kg/h) (m3/h)	-302.1 1213 * 12	95.08 -302.1 1213 CONDITIONS Aqueous Phase 1.0000 120.5 200.0 4.034e+004			
Vapour / F Temperate Pressure: Molar Flow Mass Flow Molar Ent	Mater Phase Fractioner: V Liq Vol Flow halpy	(MW) nd (m3/h) rial Stream on (C) (kPa) (kgmole/h) (kg/h) (m3/h) (kJ/kgmole)	-302.1 1213 * 12	95.08 -302.1 1213 CONDITIONS Aqueous Phase 1.0000 120.5 200.0 4.034e+004 9.514e+005 958.4 -2.043e+004			
Vapour / F Vapour / F Temperate Pressure: Molar Flow Mass Flow Molar Ent Molar Ent	Mater Phase Fractioner: V Liq Vol Flow halpy	(MW) nd (m3/h) rial Stream (C) (kPa) (kgmole/h) (kg/h) (m3/h) (kJ/kgmole) (kJ/kgmole-C)	-302.1 1213 * 12	95.08 -302.1 1213 CONDITIONS Aqueous Phase 1.0000 120.5 200.0 4.034e+004 9.514e+005 958.4 -2.043e+004 95.08			
Vapour / F Temperate Pressure: Molar Flov Std Ideal I Molar Ent Heat Flow	Phase Fractioner:	(MW) nd (m3/h) rial Stream (C) (kPa) (kgmole/h) (kg/h) (m3/h) (kJ/kgmole) (kJ/kgmole-C) (MW)	-302.1 1213 * 12	95.08 -302.1 1213 CONDITIONS Aqueous Phase 1.0000 120.5 200.0 4.034e+004 9.514e+005 958.4 -2.043e+004 95.08 -228.9			
Vapour / Find Va	Mater Phase Fractioner: V Liq Vol Flow halpy	(MW) nd (m3/h) rial Stream (C) (kPa) (kgmole/h) (kg/h) (m3/h) (kJ/kgmole) (kJ/kgmole-C) (MW)	-302.1 1213 * 12	95.08 -302.1 1213 CONDITIONS Aqueous Phase 1.0000 120.5 200.0 4.034e+004 9.514e+005 958.4 -2.043e+004 95.08		Property Package:	Amine Pkg - KE
Heat Flow Liq Vol Flo Vapour / F Temperate Pressure: Molar Flow Std Ideal Molar Ent Molar Ent Heat Flow Heat Flow	Phase Fractioner: V V Liq Vol Flow halpy ropy ow @Std Con	(MW) nd (m3/h) rial Stream (C) (kPa) (kgmole/h) (kg/h) (m3/h) (kJ/kgmole) (kJ/kgmole-C) (MW)	-302.1 1213 * 12	95.08 -302.1 1213 CONDITIONS Aqueous Phase 1.0000 120.5 200.0 4.034e+004 9.514e+005 958.4 -2.043e+004 95.08 -228.9			
Heat Flow Liq Vol Fid Vapour / Fig Vapour / Fig Temperate Pressure: Molar Flow Mass Flow Std Ideal I Molar Ent Molar Ent Heat Flow Liq Vol Fid	Phase Fractioner: V V Liq Vol Flow halpy ropy ow @Std Con	(MW) nd (m3/h) rial Stream (C) (kPa) (kgmole/h) (kg/h) (m3/h) (kJ/kgmole) (kJ/kgmole-C) (MW) nd (m3/h)	-302.1 1213 * 12	95.08 -302.1 1213 CONDITIONS Aqueous Phase 1.0000 120.5 200.0 4.034e+004 9.514e+005 958.4 -2.043e+004 95.08 -228.9		Property Package:	Amine Pkg - KE
Vapour / Formal Pressure: Molar Flow Mass Flow Std Ideal I Molar Ent Heat Flow Liq Vol Flow	Phase Fraction of the Phase Fraction of the	(MW) nd (m3/h) rial Stream (C) (kPa) (kgmole/h) (kg/h) (m3/h) (kJ/kgmole) (kJ/kgmole-C) (MW) nd (m3/h) rial Stream	-302.1 1213 * 1: 2 Overall 0.0000 120.5 200.0 4.034e+004 9.514e+005 958.4 -2.043e+004 95.08 -228.9 919.3 * 1: 3	95.08 -302.1 1213 CONDITIONS Aqueous Phase 1.0000 120.5 200.0 4.034e+004 9.514e+005 958.4 -2.043e+004 95.08 -228.9 919.3		Property Package:	Amine Pkg - KE
Vapour / From Pressure: Molar Flow Mass Flow Std Ideal I Molar Ent Heat Flow Liq Vol Flow Vapour / From Pressure:	Phase Fraction Phase Fraction Phase Fraction Phase Fraction Phase Fraction Phase Fraction	(MW) nd (m3/h) rial Stream (C) (kPa) (kgmole/h) (kg/h) (kJ/kgmole) (kJ/kgmole-C) (MW) nd (m3/h) rial Stream	-302.1 1213 * 1: 2 Overall 0.0000 120.5 200.0 4.034e+004 9.514e+005 958.4 -2.043e+004 95.08 -228.9 919.3 * 1: 3	95.08 -302.1 1213 CONDITIONS Aqueous Phase 1.0000 120.5 200.0 4.034e+004 9.514e+005 958.4 -2.043e+004 95.08 -228.9 919.3 CONDITIONS Aqueous Phase 1.0000		Property Package:	Amine Pkg - KE
Heat Flow Liq Vol Flo Vapour / F Temperate Pressure: Molar Flow Std Ideal Molar Ent Heat Flow Liq Vol Flo Vapour / F Temperate	Phase Fraction Phase Fraction Phase Fraction Phase Fraction Phase Fraction Phase Fraction	(MW) nd (m3/h) rial Stream (C) (kPa) (kgmole/h) (kg/h) (kJ/kgmole) (kJ/kgmole-C) (MW) nd (m3/h) rial Stream	-302.1 1213 * 1: 2 Overall 0.0000 120.5 200.0 4.034e+004 9.514e+005 958.4 -2.043e+004 95.08 -228.9 919.3 * 1: 3	95.08 -302.1 1213 CONDITIONS Aqueous Phase 1.0000 120.5 200.0 4.034e+004 9.514e+005 958.4 -2.043e+004 95.08 -228.9 919.3 CONDITIONS Aqueous Phase 1.0000 46.50		Property Package:	Amine Pkg - KE
Vapour / F Temperate Molar Flow Molar Ent Molar Ent Heat Flow Liq Vol Flo Vapour / F Temperate Pressure:	Phase Fraction of the Phase Fraction of the	(MW) nd (m3/h) rial Stream (C) (kPa) (kgmole/h) (kg/h) (kJ/kgmole-C) (MW) nd (m3/h) rial Stream on (C) (kPa)	-302.1 1213 * 1: 2 Overall 0.0000 120.5 200.0 4.034e+004 9.514e+005 958.4 -2.043e+004 95.08 -228.9 919.3 * 1: 3	95.08 -302.1 1213 CONDITIONS Aqueous Phase 1.0000 120.5 200.0 4.034e+004 9.514e+005 958.4 -2.043e+004 95.08 -228.9 919.3 CONDITIONS Aqueous Phase 1.0000 46.50 100.0		Property Package:	Amine Pkg - KE
Heat Flow Liq Vol Flo Liq Vol Flo Vapour / F Temperate Pressure: Molar Flow Mass Flow Molar Ent Heat Flow Liq Vol Flo Vapour / F Temperate Pressure: Molar Flow Molar Flow	Phase Fraction of the Phase Fraction of the	(MW) nd (m3/h) rial Stream (C) (kPa) (kgmole/h) (kJ/kgmole) (kJ/kgmole-C) (MW) nd (m3/h) rial Stream (C) (kPa) (kgmole/h)	-302.1 1213 * 1: 2 Overall 0.0000 120.5 200.0 4.034e+004 9.514e+005 958.4 -2.043e+004 95.08 -228.9 919.3 * 1: 3 Overall 0.0000 46.50 * 100.0 * 5.325e+004	95.08 -302.1 1213 CONDITIONS Aqueous Phase 1.0000 120.5 200.0 4.034e+004 9.514e+005 958.4 -2.043e+004 95.08 -228.9 919.3 CONDITIONS Aqueous Phase 1.0000 46.50 100.0 5.325e+004		Property Package:	Amine Pkg - KE
Vapour / F Temperate Pressure: Molar Flow Mass Flow Std Ideal I Molar Ent Heat Flow Liq Vol Flo Vapour / F Temperate Pressure: Molar Flow Molar Flow Molar Flow Molar Flow Molar Flow Molar Flow Mass Flow Mass Flow Mass Flow	Phase Fraction of the Phase Fraction of the	(MW) nd (m3/h) rial Stream (C) (kPa) (kgmole/h) (kJ/kgmole) (kJ/kgmole-C) (MW) nd (m3/h) rial Stream (C) (kPa) (kgmole/h)	-302.1 1213 * 1: 2 Overall 0.0000 120.5 200.0 4.034e+004 9.514e+005 958.4 -2.043e+004 95.08 -228.9 919.3 * Overall 0.0000 46.50 * 100.0 * 5.325e+004 1.256e+006	95.08 -302.1 1213 CONDITIONS Aqueous Phase 1.0000 120.5 200.0 4.034e+004 9.514e+005 958.4 -2.043e+004 95.08 -228.9 919.3 CONDITIONS Aqueous Phase 1.0000 46.50 100.0 5.325e+004 1.256e+006		Property Package:	Amine Pkg - KE
Heat Flow Liq Vol Flo Liq Vol Flo Vapour / F Temperate Pressure: Molar Flow Molar Ent Heat Flow Liq Vol Flo Vapour / F Temperate Pressure: Molar Ent Molar Ent Std Ideal	Phase Fraction of the Phase Fraction of the	(MW) nd (m3/h) rial Stream (C) (kPa) (kgmole/h) (kJ/kgmole) (kJ/kgmole-C) (MW) nd (m3/h) rial Stream (C) (kPa) (kgmole/h)	-302.1 1213 * 1: 2 Overall 0.0000 120.5 200.0 4.034e+004 9.514e+005 958.4 -2.043e+004 95.08 -228.9 919.3 * 1: 3 Overall 0.0000 46.50 * 100.0 * 5.325e+004 1.256e+006 1265	95.08 -302.1 1213 CONDITIONS Aqueous Phase 1.0000 120.5 200.0 4.034e+004 9.514e+005 958.4 -2.043e+004 95.08 -228.9 919.3 CONDITIONS Aqueous Phase 1.0000 46.50 100.0 5.325e+004 1.256e+006 1265		Property Package:	Amine Pkg - KE
Heat Flow Liq Vol Flo Vapour / F Temperate Pressure: Molar Flow Molar Ent Molar Ent Liq Vol Flo Vapour / F Temperate Molar Ent	Phase Fraction of the Phase Fraction of the	(MW) nd (m3/h) rial Stream (C) (kPa) (kgmole/h) (kJ/kgmole) (kJ/kgmole-C) (MW) nd (m3/h) rial Stream (c) (kPa) (kgmole/h) (kJ/kgmole)	-302.1 1213 * 1: 2 Overall 0.0000 120.5 200.0 4.034e+004 9.514e+005 958.4 -2.043e+004 95.08 -228.9 919.3 * 1: 3 Overall 0.0000 46.50 * 100.0 * 5.325e+004 1.256e+006 1265 -2.716e+004	95.08 -302.1 1213 CONDITIONS Aqueous Phase 1.0000 120.5 200.0 4.034e+004 9.514e+005 958.4 -2.043e+004 95.08 -228.9 919.3 CONDITIONS Aqueous Phase 1.0000 46.50 100.0 5.325e+004 1.256e+006 1265 -2.716e+004		Property Package:	Amine Pkg - KE
Heat Flow Liq Vol Flo Vapour / Flo Vapour / Flo Mass Flow Molar Ent Molar Ent Molar Ent Heat Flow Liq Vol Flo Vapour / Flo Vapour / Flo Mass Flow Liq Vol Flo Molar Ent Molar Ent Molar Ent Molar Ent Molar Ent Molar Ent Molar Ent Std Ideal Vapour / Flo Mass Flow Std Ideal Molar Flo Mass Flow Std Ideal	Phase Fraction of the Phase Fraction of the	(MW) nd (m3/h) rial Stream (C) (kPa) (kgmole/h) (kJ/kgmole) (kJ/kgmole-C) (MW) nd (m3/h) rial Stream (C) (kPa) (kgmole/h)	-302.1 1213 * 1: 2 Overall 0.0000 120.5 200.0 4.034e+004 9.514e+005 958.4 -2.043e+004 95.08 -228.9 919.3 * 1: 3 Overall 0.0000 46.50 * 100.0 * 5.325e+004 1.256e+006 1265	95.08 -302.1 1213 CONDITIONS Aqueous Phase 1.0000 120.5 200.0 4.034e+004 9.514e+005 958.4 -2.043e+004 95.08 -228.9 919.3 CONDITIONS Aqueous Phase 1.0000 46.50 100.0 5.325e+004 1.256e+006 1265		Property Package:	Amine Pkg - KE
Vapour / F Temperate Pressure: Molar Flow Mass Flow Std Ideal It Molar Ent Heat Flow Liq Vol Flo Vapour / F Temperate Pressure: Molar Ent Holar Ent Holar Ent Holar Ent Holar Ent Holar Ent Holar Ent Holar Ent Holar Ent Holar Ent Holar Ent Holar Ent Holar Ent Holar Ent Holar Ent Holar Ent Heat Flow	Phase Fraction of the Phase Fraction of the	(MW) nd (m3/h) rial Stream (C) (kPa) (kgmole/h) (kg/h) (m3/h) (kJ/kgmole) (kJ/kgmole-C) (MW) nd (m3/h) rial Stream (kgmole/h) (kg/h) (kg/h) (kg/h) (kg/h) (kg/h) (kg/h) (kg/h) (kg/kgmole) (kJ/kgmole) (kJ/kgmole) (kJ/kgmole) (kJ/kgmole) (kJ/kgmole)	-302.1 1213 * 1: 2 Overall 0.0000 120.5 200.0 4.034e+004 9.514e+005 958.4 -2.043e+004 95.08 -228.9 919.3 * 1: 3 Overall 0.0000 46.50 * 100.0 * 5.325e+004 1.256e+006 1265 -2.716e+004 87.02	95.08 -302.1 1213 CONDITIONS Aqueous Phase 1.0000 120.5 200.0 4.034e+004 9.514e+005 958.4 -2.043e+004 95.08 -228.9 919.3 CONDITIONS Aqueous Phase 1.0000 46.50 100.0 5.325e+004 1.256e+006 1265 -2.716e+004 87.02		Property Package:	Amine Pkg - KE

LINIVERSI	TY OF TROMSO	Case Name:	LEAN SPLIT WIT	TH VAPOUR RECOMPR	ESSION.HSC
asnen Burlington,		Unit Set:	SI1		
. 094		Date/Time: Fri May 31 13:29:22 2013			
Material Stream	m: 4			Fluid Package:	Basis-1
				Property Package:	Amine Pkg - KE
		CONDITIONS			
	Overall	Aqueous Phase			
Moiar Flow (kgmole/h)	5.325e+004	5.325e+004			
Mass Flow (kg/h)	1.256e+006	1.256e+006			
	1265	1265			
Heat Flow (MW)	-410.1	-410.1			
Lig Vol Flow @Std Cond (m3/h)	1213 •	1213			
Material Strea	m: 5			Fluid Package: Property Package:	Basis-1 Amine Pkg - KE
		CONDITIONS	10.47 112		
	Overall	Aqueous Phase			
Vapour / Phase Fraction	0.0000	1.0000			
Temperature: (C)	46.50	46.50			
Mass Flow (kg/h)	1.256e+006	1.256e+006		I I	
Std Ideal Liq Vol Flow (m3/h)	1265	1265			
Molar Enthalpy (kJ/kgmole)	-2.716e+004	-2.716e+004			
	87.02	87.02			
				Fluid Package:	Basis-1
Material Strea	m: 6			Property Package:	Amine Pkg - KE
Material Strea	m: 6	CONDITIONS			Amine Pkg - KE
	Overall	Aqueous Phase			Amine Pkg - KE
Vapour / Phase Fraction	Overall 0.0000	Aqueous Phase 1.0000			Amine Pkg - KE
Vapour / Phase Fraction Temperature: (C)	Overall 0.0000 40.00 °	Aqueous Phase 1.0000 40.00			Amine Pkg - KE
Vapour / Phase Fraction	Overall 0.0000	Aqueous Phase 1.0000			Amine Pkg - KE
Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h)	Overall 0.0000 40.00 ° 111.0 °	Aqueous Phase 1.0000 40.00 111.0			Amine Pkg - KE
Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h)	Overall 0.0000 40.00 * 111.0 * 5.295e+004 * 1.248e+006 1257	Aqueous Phase 1.0000 40.00 111.0 5.295e+004 1.248e+006			Amine Pkg - KE
Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole)	Overall 0.0000 40.00 * 111.0 * 5.295e+004 * 1.248e+006 1257 -2.774e+004	Aqueous Phase 1.0000 40.00 111.0 5.295e+004 1.248e+006 1257 -2.774e+004			Amine Pkg - KE
Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h)	Overall 0.0000 40.00 * 111.0 * 5.295e+004 * 1.248e+006 1257	Aqueous Phase 1.0000 40.00 111.0 5.295e+004 1.248e+006			Amine Pkg - KE
Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C)	Overall 0.0000 40.00 * 111.0 * 5.295e+004 * 1.248e+006 1257 -2.774e+004 86.28	Aqueous Phase 1.0000 40.00 111.0 5.295e+004 1.248e+006 1257 -2.774e+004 86.28			Amine Pkg - KE
Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW)	Overall 0.0000 40.00 * 111.0 * 5.295e+004 * 1.248e+006 1257 -2.774e+004 86.28 -407.9 1206 *	Aqueous Phase 1.0000 40.00 111.0 5.295e+004 1.248e+006 1257 -2.774e+004 86.28 -407.9		Property Package:	Basis-1
Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h)	Overall 0.0000 40.00 * 111.0 * 5.295e+004 * 1.248e+006 1257 -2.774e+004 86.28 -407.9 1206 *	Aqueous Phase 1.0000 40.00 111.0 5.295e+004 1.248e+006 1257 -2.774e+004 86.28 -407.9		Property Package:	
Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Energy Strea	Overall 0.0000 40.00 * 111.0 * 5.295e+004 * 1.248e+006 1257 -2.774e+004 86.28 -407.9 1206 *	Aqueous Phase 1.0000 40.00 111.0 5.295e+004 1.248e+006 1257 -2.774e+004 86.28 -407.9 1206		Property Package:	Basis-1
Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Energy Strea	Overall 0.0000 40.00 * 111.0 * 5.295e+004 * 1.248e+006 1257 -2.774e+004 86.28 -407.9 1206 * This is a second of the control o	Aqueous Phase 1.0000 40.00 111.0 5.295e+004 1.248e+006 1257 -2.774e+004 86.28 -407.9 1206	P-100	Property Package:	Basis-1 Amine Pkg - KE
Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Energy Strea Duty Type: Duty SP: 0.15	Overall 0.0000 40.00 * 111.0 * 5.295e+004 * 1.248e+006 1257 -2.774e+004 86.28 -407.9 1206 * The control of the	Aqueous Phase 1.0000 40.00 111.0 5.295e+004 1.248e+006 1257 -2.774e+004 86.28 -407.9 1206 CONDITIONS lation Operation:	P-100	Property Package: Fluid Package: Property Package:	Basis-1 Amine Pkg - KE
Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Energy Strea Duty Type:	Overall 0.0000 40.00 * 111.0 * 5.295e+004 * 1.248e+006 1257 -2.774e+004 86.28 -407.9 1206 * The control of the	Aqueous Phase 1.0000 40.00 111.0 5.295e+004 1.248e+006 1257 -2.774e+004 86.28 -407.9 1206 CONDITIONS lation Operation:	P-100	Property Package: Fluid Package: Property Package: Maximum Available Du	Basis-1 Amine Pkg - KE
Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Energy Strea Duty Type: Duty SP: 0.15	Overall 0.0000 40.00 * 111.0 * 5.295e+004 * 1.248e+006 1257 -2.774e+004 86.28 -407.9 1206 * The control of the	Aqueous Phase 1.0000 40.00 111.0 5.295e+004 1.248e+006 1257 -2.774e+004 86.28 -407.9 1206 CONDITIONS lation Operation:	P-100	Property Package: Fluid Package: Property Package: Maximum Available Du Fluid Package:	Basis-1 Amine Pkg - KE
Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Energy Strea Duty Type: Duty SP: 0.19	Overall 0.0000 40.00 * 111.0 * 5.295e+004 * 1.248e+006 1257 -2.774e+004 86.28 -407.9 1206 * The control of the	Aqueous Phase 1.0000 40.00 111.0 5.295e+004 1.248e+006 1257 -2.774e+004 86.28 -407.9 1206 CONDITIONS lation Operation: vailable Duty:	P-100	Property Package: Fluid Package: Property Package: Maximum Available Du Fluid Package:	Basis-1 Amine Pkg - KE
Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Energy Strea Duty Type: Duty Type: Duty Type:	Overall 0.0000 40.00 * 111.0 * 5.295e+004 * 1.248e+006 1257 -2.774e+004 86.28 -407.9 1206 * The control of the	Aqueous Phase 1.0000 40.00 111.0 5.295e+004 1.248e+006 1257 -2.774e+004 86.28 -407.9 1206 CONDITIONS lation Operation: vailable Duty:	P-100	Property Package: Fluid Package: Property Package: Maximum Available Du Fluid Package: Property Package:	Basis-1 Amine Pkg - KE
Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Enthalpy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Energy Strea Duty Type: Duty Type: Duty Type:	Overall 0.0000 40.00 * 111.0 * 5.295e+004 * 1.248e+006 1257 -2.774e+004 86.28 -407.9 1206 * The control of the	Aqueous Phase 1.0000 40.00 111.0 5.295e+004 1.248e+006 1257 -2.774e+004 86.28 -407.9 1206 CONDITIONS lation Operation: vailable Duty:	P-100	Property Package: Fluid Package: Property Package: Maximum Available Du Fluid Package:	Basis-1 Amine Pkg - KE
	Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Entropy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h) Vapour / Phase Fraction Temperature: (C) Pressure: (kPa) Molar Flow (kgmole/h) Mass Flow (kg/h) Std Ideal Liq Vol Flow (m3/h) Molar Entropy (kJ/kgmole) Molar Entropy (kJ/kgmole) Molar Entropy (kJ/kgmole-C) Heat Flow (MW) Liq Vol Flow @Std Cond (m3/h)	Vapour / Phase Fraction	Date/Time: Dat	Date/Time: Fri May 31 13:29:	Date/Time: Fri May 31 13:29:22 2013

		asc					
1				Case Name:	LEAN SPLIT WI	TH VAPOUR RECOMPR	ESSION.HSC
3	aspen	aspen SCHOOL UNIVERSITY OF TROMSO Burlington, MA USA		Unit Set:	SI1		
4 5	054			Date/Time: Fri May 31 13:29:22 2013			
6 7 8	Energy	Stream: C	Conde	nser		Fluid Package: Property Package:	Basis-1 Amine Pkg - KE
9				CONDITIONS			
10 11	Duty Type:	Utility Fluid	Duty Calcula	tion Operation: Cond	tonear @COL2	Duty SP:	6.363 MW
12	Available UA:	3.600e+005 kJ/C-h	Utility Fluid H		100.0 kgmole	Fluid Heat Capacity:	75.00 kJ/kgmole-C
13	Actual Fluid Flow:		Minimum Flu			Maximum Fluid Flow:	
14	Fluid Inlet Temperature:	15.00 C	Fluid Outlet	Temperature:	15.00 C	Temperature Approach	: 10.00 C
15 16 17	Energy	Stream: V	V-P-101			Fiuld Package: Property Package:	Basis-1 Amine Pkg - KE
18 19				CONDITIONS			
20	Duty Type:	Direct Q	Duty Calcula	tion Operation:	P-101		
21	Duty SP:	6.817e-002 MW	Minimum Ava	ailable Duty:		Maximum Available Du	ty:
22 23 24	Energy	Stream: C	Seawa	iter		Fluid Package: Property Package:	Basis-1 Amlne Pkg - KE
25	te - Te			CONDITIONS			
26	D. b. T. a.e.	Discret O	D. A. Oalauta		- 1M-1 OI		
27 28	Duty Type: Duty SP:	Direct Q 6.988 MW	Minimum Ava	tion Operation: Se	a Water Cooler	Maximum Available Du	tv:
29	Duty or .	0.000 11111	THE TAX A SECOND PORT OF THE PART OF THE P	anabio baty.		Fiuld Package:	Basis-1
30 31	Energy	Stream: V	V			Property Package:	Amine Pkg - KE
32 33				CONDITIONS			
34	Duty Type:	Direct Q	Duty Calcula	tion Operation: Vapo	ur Compressor		
35	Duty SP:	1.123 MW	Minimum Ava			Maximum Avallable Du	ty:
36 37	Energy	Stream: V	V-P-102			Fluid Package: Property Package:	Basis-1 Amine Pkg - KE
38 39						1 Toperty Lackage.	Annie Lug-ILL
40				CONDITIONS			
41	Duty Type: Duty SP:	Direct Q		tlon Operation:	P-102		
42 43	Duty SP:	4.977e-003 MW	Minimum Av	allable Duty:		Maximum Available Du	
44 45	Energy	Stream: C	22			Fluid Package: Property Package:	Basis-1 Amine Pkg - KE
46 47				CONDITIONS			
48	Duty Type:	Direct Q	Duty Caicula	tion Operation:	E-100		
49	Duty SP:	8.336 MW	Minimum Av	ailabie Duty:		Maximum Available Du	ty:
50 51 52 53 54 55							
56 57 58 59							
61							
62 63 64							
62 63 64 65 66							
68 69							
70 71	Aspen Technology Inc.	K+ - 0.200	Aspen HY	SYS Version 7.3 (25,0.0.7336)		Page 8 of 8



