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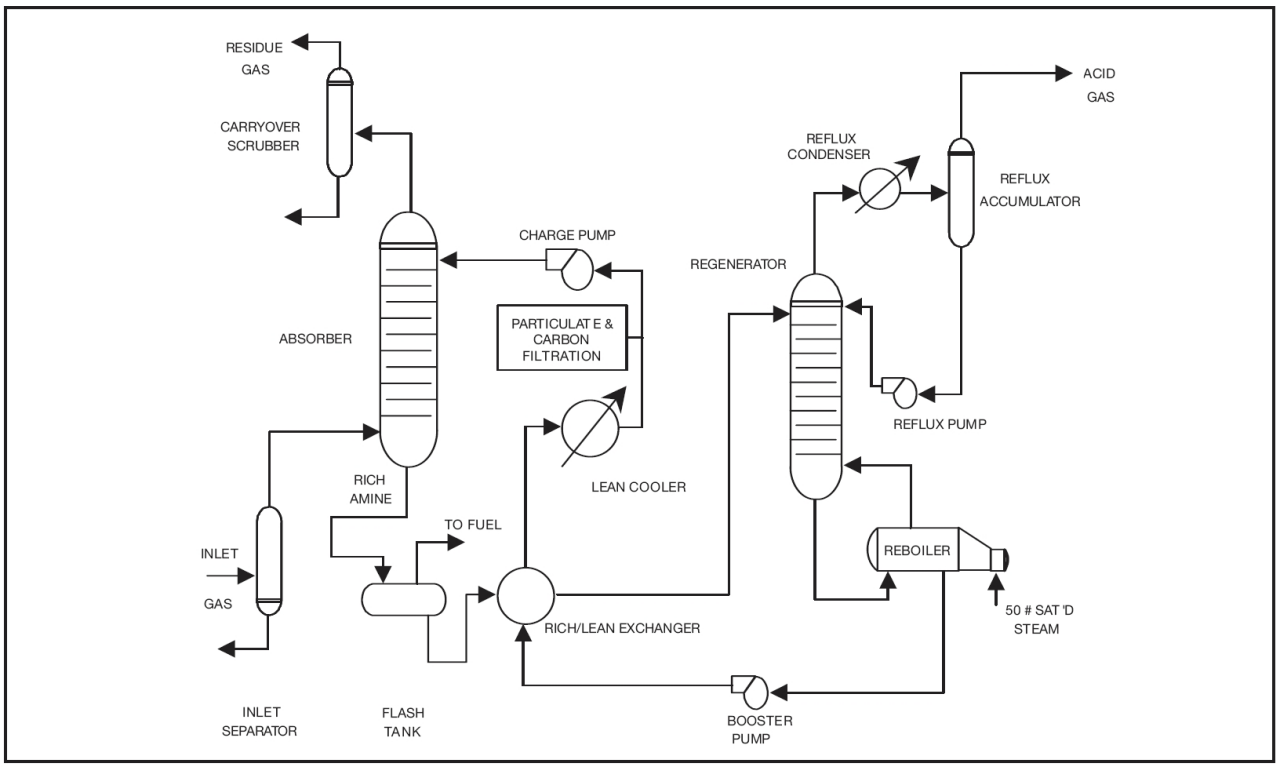
QUICKTREAT® Owner's Manual

GENERAL INFORMATION

The program is menu driven to be as user friendly as possible. As stated earlier, the more familiar the user is with various gas treating applications, the more benefit the program will be. An attempt has been made to cover a wide range of gas treating applications by not placing tight limits on the input to the program. A few internal limits have been set to avoid unrealistic conditions that may cause the program to calculate unusual results. Should any of these limits prevent you from modeling an existing system to match current operations, this may indicate that you are "pushing" the system beyond generally accepted guidelines. Please contact a Gas Treating Team engineer for a detailed evaluation.

Internal calculations follow the generally accepted procedures for gas treating applications and several "rule-of-thumb" types of parameters. The program attempts to incorporate the most accurate information available while maintaining program simplicity. If any problems or questions arise from the use of this program, please contact your Gas Treating Team representative.

Figure 1
Gas Treating Plant Process Flow Diagram



MENU SYSTEM

QUICKTREAT® is a totally menu-driven program and supports mouse usage. If no mouse is used, then move around the menu and input screens by using the scroll arrows. The program will automatically determine the type of graphics driver installed for your system. Although not required, the program supports a math coprocessor and will use it if one is installed.

CALCULATION METHOD OPTIONS

FLOWRATE - Select this option if you wish to have QUICKTREAT® calculate the estimated circulation rate with a given net acid gas pick-up required to treat a particular gas stream.

LOADINGS - Select this option if you wish to have QUICKTREAT® calculate the estimated rich amine loading for a given circulation rate required to treat a particular gas stream.

INPUT DATA REQUIREMENTS

The QUICKTREAT® program can be used to calculate the estimated circulation rate or the rich loading required to treat a given volume of gas utilizing any one of four common amines. The user inputs basic information such as volume of gas, mole % CO2 & mole % H2S and other pertinent values and the program will calculate required GPM or loading, and estimate the required heat duties for the cross-exchanger, lean cooler, condenser and reboiler. The calculated values generally agree quite closely with actual values, however, in cases where the rich amine is heavily loaded with acid gas and/or hydrocarbons, flashing may occur in the cross-exchanger, thereby affecting actual heat duties. This occurrence is one such parameter that exceeds generally accepted guidelines, as excessive corrosion may be experienced due to acid gas flash. The following is a list of input parameters with a brief discussion where appropriate.

AMINE TYPE - One of the four following types of amine can be chosen.

1. MEA - Monoethanolamine
2. DEA - Diethanolamine
3. DGA® Agent - DIGLYCOLAMINE® Agent
4. JEFFTREAT® M - Methyldiethanolamine

INLET GAS VOLUME - The user should input the inlet (SOUR) gas volume in Million Standard Cubic Feet per Day (MMSCFD). (Standard conditions are assumed to be 14.65 psia & 60°F).

PERCENT CO_2 - The amount of CO_2 (carbon dioxide) present in the inlet gas on a mole percent basis.

PERCENT H_2S - The amount of H2S (hydrogen sulfide) present in the inlet gas on a mole percent basis.

INLET GAS TEMPERATURE - Temperature of the inlet gas in °F or °C.

INLET GAS PRESSURE - Pressure of the inlet gas to the contactor/absorber. This pressure should be in PSIA or KPa.

INLET GAS GRAVITY - Specific gravity of the gas (Air = 1.0).

AMINE CONCENTRATION - The weight percent concentration for the type of amine being utilized. The normal recommended operating ranges for the various amines is as follows:

MEA - Monoethanolamine 15-18%
DEA - Diethanolamine 25-30%
DGA - DIGLYCOLAMINE Agent 50-65%
JEFFTREAT M (MDEA) - 40-50%

LEAN AMINE TEMPERATURE - The lean amine temperature feeding the absorber in °F or °C. It is a recommended practice to maintain this temperature at least 10 °F above the inlet gas temperature to avoid hydrocarbon condensation, which can lead to foaming and/or other operational problems.

LEAN AMINE LOADINGS - The program displays the "normal" lean loading generally achieved when using the selected type of amine. The user may input a more optimum value but must keep in mind that this will affect the regeneration requirements. Lean loadings less than the normal value will generally require a higher reflux ratio, while higher lean loadings may not meet treated gas specifications. Generally, the "normal" lean loading will achieve 4 ppm(v) H2S specifications when an adequate CO2/H2S ratio is available.

FLOWRATE vs. LOADING - At this point, the user will either input the actual circulation rate in GPM (gallons per minute) or the requested net acid gas pick-up, depending on the mode of calculations.

LOADINGS - The circulation rate should be input as lean amine feed to the contactor/absorber in Actual Gallons Per Minute or Liters Per Minute. The program will then calculate the rich amine loading and estimated energy requirements.

FLOWRATE - Another choice is to input the net acid gas pick-up, for which the program will then calculate the required circulation rate in Actual GPM/LPM to achieve the stated pick-up, and estimate the energy requirements for the calculated circulation rate.

STRIPPER OVERHEAD PRESSURE - The normal operating or design overhead pressure of the acid gas stripper/regenerator in PSIA or KPa.

REBOILER PRESSURE - The normal operating or design pressure of the reboiler in PSIA or KPa. Rather than make a generalized statement about the stripper pressure drop, the user is asked to decide and input the tower delta P, either from tower hydraulic estimates or from actual operations. A general estimate would be 2 - 3 psi for a 20 tray tower, however higher pressure drops are not unusual in some instances. This pressure MUST always be higher than the stripper overhead pressure.

REGENERATOR FEED TEMPERATURE - The rich amine feed temperature to the stripper in ºF or ºC. This is generally the same as the rich amine outlet temperature and should range between 190-220ºF. A generally accepted number is 200ºF. A higher temperature can give excessive acid gas flash and excessive corrosion while lower temperatures indicate possible inadequate cross-exchanger area and/or exchanger fouling or possibly excessive entrained hydrocarbons.

REFLUX TEMPERATURE - This is the stripper overhead condenser outlet temperature in Degree Fahrenheit. This should range between 100-135ºF [38-57ºC]. A generally accepted number is 120ºF [49ºC]. A higher temperature can cause excessive water loss, indicate possible inadequate condenser area and/or exchanger fouling or possibly excessive entrained hydrocarbons. Lower temperatures increase ammonia concentrations in refinery applications and also change the stripper "pinch" point, leading to inadequately regenerated solvents and/or excessive energy consumption

REFLUX RATIO - This is the moles of water per mole of acid gas in the stripper overhead. This variable is a primary design criterion to set the level of regeneration. Normal range for this variable is between 1 and 3, with 1.5-2.0 being a generally acceptable value for "normal" regenerated solvents. Lower values can be found, but often higher values are used when "tight" specifications are placed on the treated (SWEET) gas outlet. Treating units in Tail-gas and unusually low-pressure applications can see values as high as 10 and in extreme cases even higher. A guideline is that the lower the rich amine loading or the lower the treated gas specifications, the higher the required reflux ratio. This parameter along with the stripper overhead pressure gives a calculated overhead temperature that is a key control point in maintaining proper regeneration. The user should note that as with any distillation, the overhead temperature is a key parameter and can be used as a sensing point for controlling and optimizing energy requirements.

TARGET PERCENT CO2 SLIP - A selective MDEA solvent such as one of Huntsman's JEFFTREAT® solvents is able to slip carbon dioxide (i.e. not all CO_2 is recovered). Tertiary amines like MDEA do not react directly with CO_2; instead it reacts first with the water present to form bicarbonate that will then react with the amine. This feature gives MDEA the ability to "slip" CO_2. The amount of CO_2 slippage is highly dependent on several parameters such as the gas/liquid residence or contact time, operating pressure and driving force and several other key parameters. This program estimates the amount of CO_2 slippage, but the user can also calculate the required circulation rate or rich amine loading for a user supplied CO_2 slippage. The user is therefore CAUTIONED that the amount of slippage is NOT guaranteed by any calculations, only that IF such slippage is achievable, then the circulation rate or loading will be calculated and the estimated energy requirements will be stated. It is HIGHLY RECOMMENDED that a Huntsman Corporation Gas Treating engineer verify any estimates using an MDEA-based solvent.

CALCULATIONS AND OUTPUT

The program calculates several values key to the design and operation of gas treating units. The following is a list of the calculated values (NOTE: Input data is included in the printout and will not be discussed in this section).

SWEET GAS VOLUME - This is volume of sweet residue gas exiting the top of the absorber.

OUTLET GAS TEMPERATURE - NOTE: This temperature and the rich amine temperature are calculated by assuming that there are 20 trays or an equivalent amount of packing. Should the system under consideration be substantially different, then the user should note the temperature difference potential and the possible effect on exchanger duties.

TOTAL ACID GAS - This is the calculated total moles/hour of CO_2 and/or H_2S.

RICH AMINE LOADING - This is the rich amine loading in moles acid gas per mole amine. The program does have generalized rich loading vapor/liquid equilibrium (VLE) data that may limit this value. The VLE data is not guaranteed, however in most cases the calculated VLE limits will be satisfactory to maintain the system within acceptable limits.

RICH AMINE TEMPERATURE - This is the temperature of the rich loaded solvent exiting the bottom of the absorber.

STRIPPER OVERHEAD TEMPERATURE - This temperature is highly affected by the requested Reflux Ratio, since this temperature and the regeneration pressure determine the amount of water present in the acid gas overhead.

REBOILER TEMPERATURE - This value is dependent on the system pressure as well as the amine concentration.

WARM LEAN AMINE TEMPERATURE - This is the lean amine outlet temperature from the Rich/Lean cross-exchanger and it is this value along with the lean amine feed temperature that determines the lean solution cooler heat duty.

EXCHANGER DUTIES - The program will estimate the rich/lean exchanger, lean cooler, condenser and reboiler heat duties. The user is cautioned to the fact that the calculations are for systems, which follow generally accepted engineering guidelines, and variations from such guidelines can affect the actual system heat requirements.

A FINAL NOTE

As stated several times throughout this manual, the QUICKTREAT® program is a tool only. It is not intended as a rigorous simulation model. Please be cautioned as to its limits and capabilities. We hope you find this program useful and if you have any questions concerning your gas treating needs, please be sure to call:

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