Overview
Over the last 15 years oil production at Tengizchevroil’s facility in Tengiz, Kazakhstan has steadily increased and today it has the potential to produce nearly 600,000 bpd. Given the highly sour nature of the well fluids, sour gas processing, sulphur recovery and sulphur management have been key factors in the expansion of oil production at Tengiz. The most recent expansion at Tengiz boasts the world’s largest single-train sour crude processing train, which includes a single-train 2350 t/d sulphur recovery and tail gas treatment unit.

The huge petroleum reservoir at Tengiz is tied to the Black Sea by a 935-mile pipeline

Tengiz is one of the world’s largest oil fields and contains between 6 billion and 9 billion barrels (1 km³ and 1.4 km³) of recoverable oil. It is also the world’s deepest operating super-giant oil field. The Tengiz field is located in a remote region of Kazakhstan, approximately 350 km by road from the city of Atyrau. The original facility at Tengiz consisted of five oil production trains feeding four sulphur recovery and tail gas units. In 1998 the concept development, feasibility study, front-end engineering and execution phases were carried out for revamping the existing Sulphur Plants servicing the crude oil and gas processing facilities in Tengiz. The project included the upgrading of four Sulphur Recovery Units, both in terms of capacity (increased to 4000 tpd) and reliability, in order to handle the increase in acid gas resulting from the crude oil and gas units debottlenecking and expansion. The oil production increased from somewhere below 235,000 bpd to approximately 300,000 bpd. Following concept development and feasibility study, contractors joined forces contractors to execute the front-end engineering and execution phases for Second Gene-

Worldscale Design Features
The H2S concentration in the incoming well fluids is approximately 16%, which means that in order to produce 12 mmtpy of crude oil, approximately 88,300 Nm³/h of acid gas is required to be processed in the amines in the TGTU.

For this demanding amine filtration job Royal Dahlman special particle removal technology has been selected after an intensive evaluation process for this supersize TGTU filter unit. It was taught to the project team that many filter cartridges cause operating problems in amine units. Cartridges constructed from paper and fabrics that have been chemically treated, can cause foaming in the amine solution. Cartridges that have a glue or binder can be even destroyed in amine service. Oils in the virgin cotton and the bleaches that are used to remove the oil and whiten the cotton, can cause amine foaming if the cartridge manufacturer does not know how to prepare the cartridges properly before use. Some cartridges do not have the thermal stability required for amine service.
Arbitrarily choosing a type of cartridge and a flow rate per cartridge can be very costly. The flow rate per element is dependent on several factors such as the type of cartridge, micron rating, fluid viscosity, length and diameter of the cartridge and other factors.

A better knowledge of filtration can help lower the filtration costs and solve unit problems. The costs for filter cartridges in some amine units are higher than the annual amine cost. This is a unacceptable waste of cartridges and manpower. Part of the confusion is due to a lack of industry standards on cartridges. For example, nominal micron ratings can be very confusing and misleading. A cartridge with a nominal rating of five microns may capture only 50 percent of the five micron particles while other cartridges with the same five micron rating may remove 76 to 99+ percent of the five micron particles. Until the filter cartridge manufacturers develop common performance standards to show both micron rating and the percent capture of the rated particle size, confusion will continue.

Other important information that is needed to compare cartridges is the chemical resistance, the dirt holding capacity, the optimum flow rate through the cartridge and the maximum pressure differential that the cartridge can tolerate before change out. Some cartridges start releasing the dirt back into the system at a low pressure differential and thus the filtration costs are much higher. Cost can play a major role in the cartridge selection. The real cost of a filter cartridge is determined by the dollars per gallon filtered, including the labor and disposal costs, not the cost per cartridge. The real cost can only be determined by actual plant test or proven by extensive field experience of the filter vendor. Users should focus more on cartridge life and filtering capability rather than the first cost of the cartridge. A cartridge that lasts longer in service minimizes the labor costs needed to replace cartridges and reduces the cost of disposal of the dirty cartridges. It will also probably improve filtration because many operators will bypass the filters if change outs are too frequent and they do not have the time to constantly change cartridges. With rising labor, disposal and cartridge costs, the overall filtration efficiency should become more important in the cost equation and, hopefully, the first cost of the cartridge will become less important than performance.

Royal Dahlman’s terraced filter technology is well known for its excellent performance in the filtration of gas treating solvents. The advanced filter technology of Royal Dahlman’s particle and hydrocarbon removal technology are supported and selected by major world wide operating oil & gas companies.

Supportive Tools
DAHLMAN has a variety of test filters available for on-site testing. Sample analyses can be performed for supportive filter design. Computer software has been developed to predict amine filtration behavior and to calculate filtration cycle times before the maximum delta-P is achieved. Also for applications other than gas treating, DAHLMAN’s pilot testing units can be used to obtain the required design parameters.

Related Documents
Dahlman INFO Amine Filtration, Dahlman Technical Information Paper DAHLMAN Terraced Filters in Amine applications, Dahlman Reference List Terraced Filters.