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## Chemithon Family of Reactors

The "5th generation" Annular Falling Film Reactor (AFFR) is a short (2m high) quill-in-barrel design with a permanently calibrated distribution system, smooth gas distribution and with recycle quench cooling. The AFFR **processes a broader range of feed materials** and **produces higher quality products** from all feeds than competitive designs. The AFFR consistently produces 3-mole ether sulfates at 35 ppm 1,4-dioxane without post treatment. The AFFR meets higher product guarantees worldwide and does not require product bleaching. The patented recycle system ensures low color and completeness of reaction for AES, AOS and other sensitive materials. The recycle system also eliminates SO<sub>3</sub> bypass and reduces product loss to  $\leq 0.1$  wt.%. AFFR reactors produce the best sulfates in the world and have a higher overall yield than other reactor types.

The Compact Falling Film Reactor (CMTR) is also a short (2m high) multi-tube design with a permanently calibrated distribution system, improved gas distribution over conventional multi-tube designs and quench cooling with recycle. As with the AFFR, the recycle system promotes high SO<sub>3</sub> absorption and low peak reaction temperatures. An annular tube arrangement produces excellent gas distribution. Cooling is done by high velocity water channels as with the AFFR. The CMTR is a relatively new design and is generally used in either very small or very large single reactor plants for sulfonates.

The Impact Jet Reactor (Jet) is designed to contact the liquid feedstock with the sulfur trioxide gas stream as an atomized spray. Atomizing the organic feed creates tremendous surface area for reaction with the SO<sub>3</sub>, and the contacting takes place in the convergent portion of a Venturi nozzle. The gas and organic droplets reach very high velocities in the nozzle and are then impacted into a large flow of recycling liquid reaction products which quench cool the reactants. The majority of the small droplets are agglomerated and coalesced into the bulk liquid stream in the scrubbing section of the Jet. The Jet is typically used in the production of lube oil sulfonates or sulfonates for enhanced oil recovery (EOR).

The Turbo Tube™ Reactor (TTR) is a tall (5 to 8m), high pressure multi-tube design with a permanently calibrated distribution system. The TTR is used in the production of high viscosity specialty chemical sulfonates, up to 50,000 cp.