Case story #7 : After years, finally saving of more than 50K$ per year

INDUSTRY	FINE CHEMICAL
MEDIA – COND	H2SO4 80-85%, HF 10-12%, water 105°C
MATERIALS	GT TOYO OXY FLON
EQUIPMENT	SHELL & BLOCKS BOILER THERMOSIPHON
YEAR	2016

A leading chemical American company in JV with a state owned company produce fluorinated gas for air conditioning applications. The factory is located 60km from Shanghai.

The process operated in the plant is very similar to the process from USA and face the same short life time of graphite equipment.

The critical process is the boiler to separate HF from sulfuric acid stream of the column. The boiler is a rising film evaporator with graphite tubes with steam at 140-170°C on service side. The evaporator is connected to a flash tank where the HF is pushed to a column and finally to a condenser.

The boiler inlet composition is;

- H2SO4 72.1%
- HF 14.8%
- H2O 12.8%
- Temperature 60°C

The outlet composition is ;

- H2SO4 80-85%
- HF 5%
- H2O 10-15%
- Temperature 102-105°C

Graphite boiler provided by leading supplier had an average lifetime of 8-9 months which lead to high maintenance cost and need of backup equipment installed constantly on the line. Corrosion of graphite lead to process media charged with carbon powder material which plugged other heat exchangers in the process line. The situation is very similar in USA plant and more or less “tolerated” by customer as no successful technical solution was provided to them from the market leaders.

GT was invited to propose a solution to remedy the situation. GT made an expertise on the existing equipment and discovered that all the graphite tubes were already severely cracked on 30% of their thickness after only 5 months of operations. The lifetime expectancy will be only few weeks then.

Due to high oxidative media, phenolic resin is corroded and is not recommended for such process.

GT proposed to replace shell and tubes rising film evaporator by a blocks rising film evaporator. GT is the only manufacturer of GT-TOYO OXYFLON material. An ultra fine grain graphite with high corrosion resistance to oxidative media, manufactured by TOYO TANSO in Japan. GT impregnates, with unique technology, this high quality graphite with PTFE resin to seal the porosity of graphite without solvent.

The equipment was designed to be able to evaporate 1000kg/h of vapor of 72% HF and 18% water. The heat transfer area installed of 47m2.

Blocks adopted “HP” (high pressure) design with thick ligament to prevent damage from steam hammer and instabilities issues in boiling process.

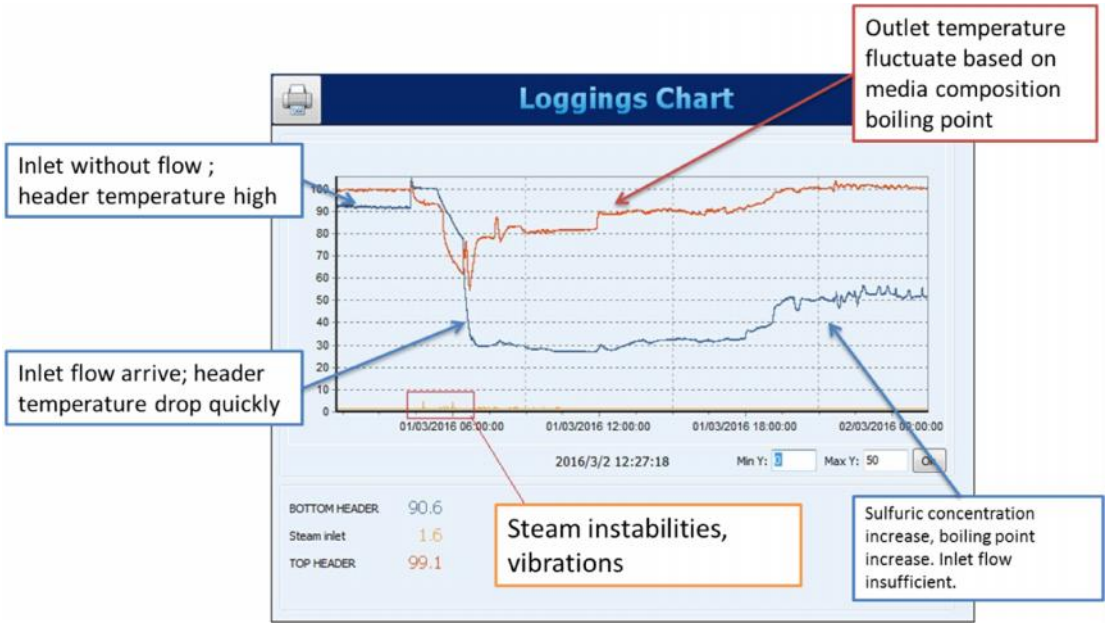
The equipment used the new technology of GT, STABLE LOAD © to avoid cycling of stress during heating and cooling cycles. This system able equipment to reduce stress variation on graphite and gaskets by 94% compared to competition equipment. This is particularly critical for equipment using steam and with long metal shell (in this case 5,1m length).

To help customer to identify possible source of stress from process, GT equipped the boiler with LOG-DATAS® equipment.

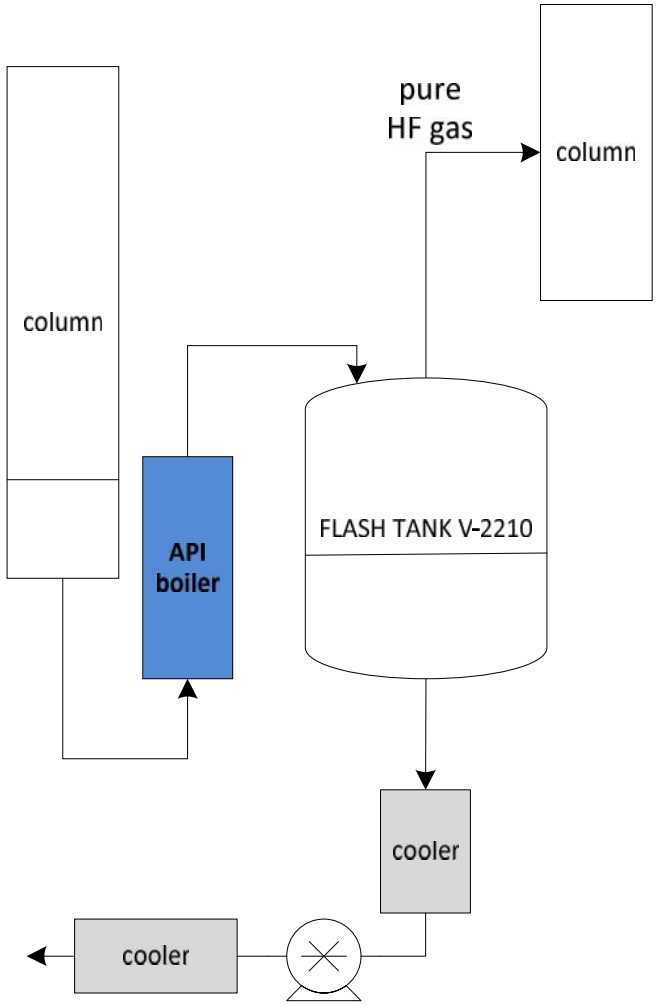
The boiler is equipped with 2 temperature sensors in the inlet and outlet header and with 1 vibration sensor connected to steam inlet chamber. Data’s are recorded in a data logger and collected on monthly basis for analysis. Customer use modern process supervision software but the type sensor and location could not reflect efficiently what happen in the heat exchanger.

After only 1 month of data’s collected, the analysis showed that the flow coming from the column into the boiler was irregular. This leaded to thermal shock and possible wide variations of composition due to lack of fresh water inflow. Discussion with the process team helped them to avoid such situation.

The equipment is operating well so far potentially help to save ~500K$ over 10 years period (see value analysis hereafter).



Sketch principle



After 1 year of GT's equipment operation, customer ordered a second equipment to replace the last competitor boiler.

VALUE ANALYSIS

		Competitor	GT	Remarks
CAPEX	Cost of acquisition ($)	205,882	176,471	
	Average lifetime (years)	5	10	

OPEX	Event	shut down process, cleaning unit, by-pass unit, disconnection piping, unerect equipment, shipment, reparation, shipment, erect equipment, piping connection, pressure test		
	Event frequency / year	1.5	0.2	1 inspection/5 years at least
	Crane service ($/operation)	441	441	
	Labor cost ($/operation)	245	245	
	Production stop (hours)	3	3	By-pass line to backup unit
	Production stop cost ($/hour)	6,127	6,127	
	Production stop cost ($)	18,382	18,382	
	Repair cost ($/operation)	3,676	1,765	
	Total cost/operation ($)	22,745	20,833	
	Total yearly cost of operation ($)	34,117	4,167	

CAPEX + OPEX over 10 years ($)	**752,933**	**218,136**	RATIO x 3.5

Graphite Technology manufactures a wide range of equipment with a wide range of graphite materials for all chemical processes industries.

Heat exchangers, column, reactors, piping & fittings, fuel cells,…adapted to pressure, highest corrosion and wide temperature range up to 1500°C (2730°F).

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