



**NOTES:**

1) TOX IS USED TO OXIDIZE RESIDUAL GASES FROM ENERKEM PROCESS IN ORDER TO MEET ENVIRONMENTAL REQUIREMENTS. DURING START-UP, THE GASIFIER OPERATES IN COMBUSTION MODE AT 50% OF PLANT THROUGHPUT; THE AREAS DOWNSTREAM OF GAS CONDITIONING (INCLUDING AGR AND MEOH PRODUCTION) ARE NOT IN SERVICE AND, EVEN IF ONLY AT 50% THROUGHPUT, MORE GAS THAN DURING STEADY STATE IS SENT TO TOX. THE TOX IS SIZED FOR START-UP AND UPSET CASES AND PROVIDES ENOUGH RESIDENCE TIME FOR COMPLETE DESTRUCTION OF THE CONTAMINANTS.

2) THE TOX IS EQUIPPED WITH A WASTE HEAT RECOVERY UNIT TO GENERATE STEAM.

3) THE FGD UNIT COMPRISES OF 2 STAGES CAUSTIC SCRUBBING DOWNSTREAM OF A QUENCH SECTION. THE 1<sup>ST</sup> STAGE OPERATES IN ACIDIC CONDITIONS TO FAVOR THE BISULFITE REACTION (SBS). THE 2<sup>ND</sup> STAGE OPERATES IN ALKALI CONDITIONS TO FAVOR THE SULFITE REACTION (MORE REACTIVE) IN ORDER TO MEET THE SO<sub>2</sub> EMISSION LIMIT. THE FLUE GAS EXITING THE 2<sup>ND</sup> STAGE IS SATURATED WITH WATER AND CONTAINS LESS THAN 40 mg SO<sub>2</sub>/Nm<sup>3</sup>. THE 38% SBS SOLUTION IS PUMPED OUT FROM THE 1<sup>ST</sup> STAGE, FILTERED AND COOLED BEFORE STORAGE. THE STORAGE TANK IS ELECTRICALLY TRACED TO PREVENT CRYSTALLIZATION AND THE SBS SOLUTION IS SHIPPED ON THE MARKET THROUGH A TRUCK LOADING STATION. IF OFFSPEC SBS SOLUTION IS PRODUCED, THE FLOW WILL BE DIRECTED TO OFFSITE WWTP AFTER AN OXIDATION STEP TO PRODUCE SODIUM SULFATE (NA<sub>2</sub>SO<sub>4</sub>).

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DESIGN CASE – (230,000 T/y, Dry Basis)  
Waste to Chemical - Rotterdam

**TOX & FLUE GAS DESULFURISATION  
BLOCK FLOW DIAGRAM**

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## Nederlandse vertaling tekening 1702-D901-003 (4).pdf

### Tox & Flue Gas Desulfurisation, Block Flow Diagram

#### Installatie

Liquid seal drum #1	Gasdichte opslageenheid
Liquid seal drum #2	Gasdichte opslageenheid
Thermal Oxidizer (TOX)	Thermal Oxidizer
Burner	Brander
Waste heat recovery unit (WHRU)	Warmteterugwininstallatie
Flue gas desulfurisation unit	Rookgasontzwavelingseenheid
Stack	Schoorsteen

#### Inputs

Waste gas steady state	Restgas
Start-up/ upset	Opstarten
NH3 stripper line	Ammoniastripper
MEOH liq. purge	Methanol vloeistofspui
Combustion air	Verbrandingslucht
Natural gas	Aardgas
Odorous air	Geurhoudende lucht
BFW	Ketelvoedingswater
Demin water	Demi water

#### Output

Steam	Condense, Stoom
FG to ATM	Rookgas naar atmosfeer
Offspec sbs to WWT	Off spec SBS naar afvalwaterzuivering
38% SBS	38% Natriumbisulfiet oplossing (SBS)
Blowdown	Ketelwaterspui

#### Notes

1) TOX is used to oxidize residual gases from Enerkem process in order to meet environmental requirement. During start-up the gasifier operates in combustion mode at 50% of plant throughput; the areas downstream of gas conditioning (including AGR and MEOH production) are not in service and, even if only at 50% throughput, more gas than during steady state is sent to TOX. The TOX is sized for start-up and upset cases and provides enough residence time for complete destruction of the contaminants.

1) De thermische naverbrander (TOX) wordt gebruikt om restgassen uit het Enerkem proces te oxideren om zo aan de milieueisen te voldoen. Tijdens het opstarten werkt de vergasser in de verbrandingsmodus op 50% van de doorvoer van de installatie; de gebieden na de gasconditionering (inclusief verwijdering zure gassen en methanol productie) zijn niet in bedrijf en, zelfs met slechts 50% doorvoer, wordt meer gas dan tijdens een normale bedrijfstoestand verzonden naar de TOX. De TOX is berekend op opstart- en inregelsituaties en biedt voldoende verblijfstijd voor de volledige afbraak van verontreinigingen.

2) The TOX is equipped with a waste heat recover unit to generate steam.

2) De TOX is uitgerust met een warmteterugwinunit waarmee stoom wordt gegenereerd.

3) The FGD unit comprises of 2 stages caustic scrubbing downstream of a quench section. The 1st stage operates in acidic conditions to favor the bisulfite reaction (SBS). The 2nd stage operates in alkali conditions to favor the sulfite reaction (more reactive) in order to meet the SO<sub>2</sub> emission limit.

3) De rookgasontzwavelings-eenheid bestaat uit 2 fasen caustic scrubbing stroomafwaarts van de quench sectie.

The flue gas exiting the 2nd stage is saturated with water and contains less than 40 mg SO<sub>2</sub>/Nm<sup>3</sup>.

De 1ste stap werkt in zure omstandigheden om de bisulfite reactie (SBS) te bevorderen. De 2de stap werkt onder alkalische omstandigheden om de sulfite reactie te bevorderen (meer reactief) om zo aan de SO<sub>2</sub>-emissiegrens te voldoen. Het rookgas dat de 2de stap verlaat, is verzadigd met water en bevat minder dan 40 mg SO<sub>2</sub>/Nm<sup>3</sup>.

The 38% SBS solution is pumped out from the 1st stage, filtered and cooled before storage. The storage tank is electrically traced to prevent crystallization and the SBS solution is shipped on the market through a truck loading station. If offspec SBS solution is produced, the flow will be directed to offsite wwtp after an oxidation step to produce sodium sulfate (Na<sub>2</sub>SO<sub>4</sub>).

Het rookgas dat de 2de stap verlaat, is verzadigd met water en bevat minder dan 40 mg SO<sub>2</sub>/Nm<sup>3</sup>. De 38% SBS oplossing wordt uit de 1ste stap gepompt, gefilterd en gekoeld voor opslag. De opslagtank is kathodisch beschermd om kristallisatie te voorkomen en de SBS oplossing wordt verladen via een laadplaats voor vrachtwagens. Als de off spec SBS oplossing wordt geproduceerd, wordt het, na een oxidatiestap om natriumbisulfaat (Na<sub>2</sub>SO<sub>4</sub>) te maken, naar de externe afvalwaterzuivering afgevoerd.