

# TOPGUN service

Making **optimal** performance possible



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## 1. Introduction to TOPGUN service

The execution of a TOPGUN is a co-operation between the customer and the Topsoe service engineer, where all required equipment for executing the TOPGUN will be supplied by one of Topsoe's experienced service engineers. The only requirements to the plant for an optimum TOPGUN service are accessible sample points, assistance during the sampling and access to operating data and catalyst loading.

To obtain the maximum benefit of the visit and service, we recommend that the person who is dedicated to assist during the TOPGUN service has read and carried out the preparations listed in this manual prior to the arrival of the Topsoe service engineer.

## 2. Prior to TOPGUN service

### 2.1 Availability of gas sample points

To get a complete picture of the overall converter performance as well as the performance of each catalytic pass individually, it is important that a sufficient number of gas sample points are available. Typical sample points are represented by:

- Converter wall sample points inlet and outlet each bed or duct work immediately before and after each bed.
- Inlet and outlet waste heat boilers, steam super-heaters, economizers.
- Inlet and outlet tube and shell sides of gas/gas heat exchangers.
- Inlet and outlet intermediate and final absorption towers.

It is our experience that sample points on the converter wall, especially where the wall is brick-lined, produce non-representative gas samples, as tiny streams of lower converted gas are often channeled along the wall, polluting the samples obtained here. More reliable results can be obtained when sampling from points on the ducts after the gas has been allowed to mix.

For this reason, it is preferable if sample points, before and after each catalyst bed, are accessible on the ducts.

### 2.2 Preparing the sample points

Prior to the TOPGUN service, it is important that all sample points are tested and unplugged or repaired, if necessary, so that a free gas flow is ensured. For fitting, the TOPGUN equipment to the sample points, Topsoe's service engineer carries along a variety of teflon fittings to fit most sample point nozzles in the range 6-14 mm. However, a uniform-sized nozzle with an outer diameter of 10



mm is preferred. To be sure that a tight connection is made between the sample pipe and the hose and to minimize the risk of erroneous gas samples due to absorption/ desorption of  $\text{SO}_2$ , it is preferable that the last part of the sample pipe is also cleaned for impurities on the outside.

### 2.3 Flow sheet

Before the TOPGUN service, we would be pleased to receive a flow sheet or P/I diagram of the plant, preferably with all available sample points indicated. This will enable us to carry out more thorough preparations and thus spend time more efficiently during the hours of testing.

### 2.4 Catalyst loading

We would like to be updated regarding your present catalyst loadings, catalyst types and installation dates. This information will be used in our simulations of your converter and help us give proper recommendations for further use of the catalysts.

## 3. During the TOPGUN service

### 3.1 Requirements

For setting up the analyzer and preparing the sampling equipment, Topsoe's service engineer requires a room with a table and electricity, preferably as close to the converter as possible. The exhaust from the analyzer is directed to the exterior via a hose.



*Setup of TOPGUN analyzer in laboratory*

The service engineer brings all the necessary equipment for collecting the gas samples. The sampling line consists of a fitting to the plant sample point, a glass tube containing an  $\text{SO}_3$  absorbent, a mist filter for removing possible acid mist escaping the  $\text{SO}_3$  absorption tube and finally a sample bag for collecting the gas.

After collecting several gas samples, the bags are brought to the analyzer to measure the  $\text{SO}_2$  and  $\text{O}_2$  concentrations.

All gas analyses are carried out on  $\text{SO}_3$  free basis, i.e. the  $\text{SO}_3$  is removed from the gas prior to entering our sampling device. The  $\text{SO}_3$  is removed by means of a specially developed filter, which allows all gas components except  $\text{SO}_3$  to pass through. This procedure, however, does not allow for a quantitative determination of  $\text{SO}_3$ .

During the TOPGUN service, the presence of  $\text{SO}_3$  is judged visually at the critical locations, i.e. especially after the intermediate absorption tower and exiting the shell sides of the cold and hot inter-pass gas/gas heat exchangers.

### 3.2 Gas sampling

The actual gas sampling, i.e. operation of the sample point valves and filling of the sample bags, is carried out by plant personnel. The personnel assigned to this task should be persons who know the process well and are familiar with the individual sample points.

Prior to the sampling, the Topsoe service engineer will duly instruct the assigned personnel in the assembling and use of the sampling equipment mentioned above.



*Simultaneously sampling in bags across a heat exchanger*

The sampling operations are supervised by the Topsoe engineer throughout the testing.

### 3.3 Plant stability

Prior to and during gas sampling, the operation of the plant should be kept as stable as possible. In order to have the best possible basis for assessing the converter performance, we recommend operating the plant as close to maximum production rates as possible, of course without exceeding any statutory emission limits.

The following operating data from the plant should be collected at appropriate intervals during the TOPGUN analysis:

All available thermocouple readings inlet and outlet each bed. Both readings from in-bed and duct thermocouples should be included.

Flow rates: blower rate, sulfur feed rate.

Possible SO<sub>2</sub> analysis made by the plant (typically at the inlet to the 1st pass and in the stack).

Sulfuric acid production rate of the day or night shift.

At which intervals operating data should be collected depends on the plant stability. For a stably operated sulfur burning acid plant, hourly intervals will suffice. For acid plants downstream certain types of smelter operations, data should be recorded more frequently.

## 4. After the TOPGUN service

The SO<sub>2</sub> and O<sub>2</sub> analyses obtained will be used in Topsoe's advanced computer programs to provide a reliable simulation of the converter performance. From the simulation, we derive the performance of each catalyst pass.

From analyses inlet and outlet gas/gas heat exchangers, where the gas passing the tube and shell sides has different SO<sub>2</sub> concentrations, we are able to evaluate the presence of possible leaks.

All analysis results, including a discussion of our findings, conclusions and recommendations, will be presented in a final report, which will be forwarded to you shortly after the visit.

If you have any questions or comments regarding the above, you are welcome to contact us.

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