

## Application

DOC043.52.03141

APR02

>>astroTOC UV turbo

Power Plants



## TOC measurement of high-purity boiler feed water in power plants

The astroTOC UV turbo analyzer has several advanced features that facilitate boiler water analysis. The astroTOC UV and the astroTOC HT are recommended for the following applications in chemical and petrochemical plants:

- **Unsurpassed response time** requiring less than 5 minutes for T90. This response time is not achievable by any other traditional TOC analyzer.
- **Versatility** - the dual-stream feature enables the analyzer to simultaneously measure two independent sample streams. It also serves as an on-demand laboratory analyzer by introducing a manual grab sample or validation standard.
- **Correct Calibration** by using an advanced analyzer calibration utility offering multi-point TOC Added calibration of up to 10 points. This compensates for TOC background contribution commonly found in make-up water.
- **Reliable**, the astroTOC UV turbo is the only analyzer on the market capable of measuring TOC (in form of NPOC) in the µg/l level with 100 percent reliability.

# >>astroTOC UV turbo Description

## Description

High-pressure boilers require high purity feedwater to limit the effect of corrosion and deposits that damage steam circuits. Typical corrosives are acid salts such as chlorides or sulfates, which form corrosive compounds. Chlorides are usually present in raw water, residual trace chlorine, and in the haloorganic form present in deionized water. The most common sulfate ion producer is the decomposition of sulfonic acid-based cationic resins.

## Objective

The objective is to prevent sulfate ions generated in the demineralization plant or the condensate polishing plant from contaminating the high-purity circuit. Sulfate ion concentration is difficult to measure in a plant environment, especially in low  $\mu\text{g/l}$  levels. The only effective technology is ion chromatography, which does not respond quickly enough. However, if sulfates are a result of the decomposition of the resins, and the decomposition also causes a release of organic molecules, then TOC can be used as a tracer. This method will infer the presence of sulfates and detect the formation of corrosive carbon dioxide gas (caused by the destruction of organic molecules in the boiler). An additional benefit of this approach is the ability to monitor the presence of contaminating lubricants. This alerts plant personnel of turbine or pump rotating seal leakage before the situation becomes critical.

## Solution

In a typical operation, it is assumed that a sulfate peak of about 5 to 6  $\mu\text{g/l}$  occurs each time two resin columns are switched. This is verified in the lab using liquid chromatography. Therefore, TOC is also expected to increase proportionally. The astroTOC UV turbo confirms this assumption: a peak of about 10  $\mu\text{g/l}$  TOC above background TOC is observed during a 20 minute period after switching from one resin column to another. The TOC peak and the duration of the rise may increase with the age of the resin. In a nuclear plant installation, the astroTOC UV turbo analyzer verifies that water quality in different parts of the piping system vary by 75 % - from around 120 to 150  $\mu\text{g/l}$  in one section to below 10  $\mu\text{g/l}$  in a new condensate polishing installation.

The astroTOC UV turbo analyzer has several advanced features that facilitate boiler water analysis.

- **Unsurpassed response time** requiring less than 5 minutes for T90. This response time is not achievable by any other traditional TOC analyzer
- **Versatility** - the dual-stream feature enables the analyzer to simultaneously measure two independent sample streams. It also serves as an on-demand laboratory analyzer by introducing a manual grab sample or validation standard.
- **Correct Calibration** by using an advanced analyzer calibration utility offering multi-point TOC Added calibration of up to 10 points. This compensates for TOC background contribution commonly found in make-up water.

## >astroTOC UV turbo Features

→ **Reliable**, the astroTOC UV turbo is the only analyzer on the market capable of measuring TOC (in form of NPOC) in the  $\mu\text{g/l}$  level with 100 percent reliability. Other analyzers capable of measuring  $\mu\text{g/l}$  levels use the differential conductivity method (measuring TC and TIC, calculating the difference  $\text{TC}-\text{TIC}=\text{TOC}$ ). This method combines the inaccuracies of the two measurements whereas the astroTOC UV turbo direct method removes the TIC from the sample prior to directly measuring the TOC, resulting in superior accuracy.

Another error can occur when nonorganic chemical species, such as sulfide ion ( $\text{S}_2^-$ ), nitrite ion ( $\text{NO}_2^-$ ), hypochlorous acid ( $\text{HClO}$ ), and iodine ( $\text{I}_2$ ), originally present in the sample or formed during the acidification stage, which have a dissolved gas phase at low pH, will cross the membrane of the analyzers using differential conductivity. These species will then be measured as TIC and subsequently will make the TOC measurement incorrect.

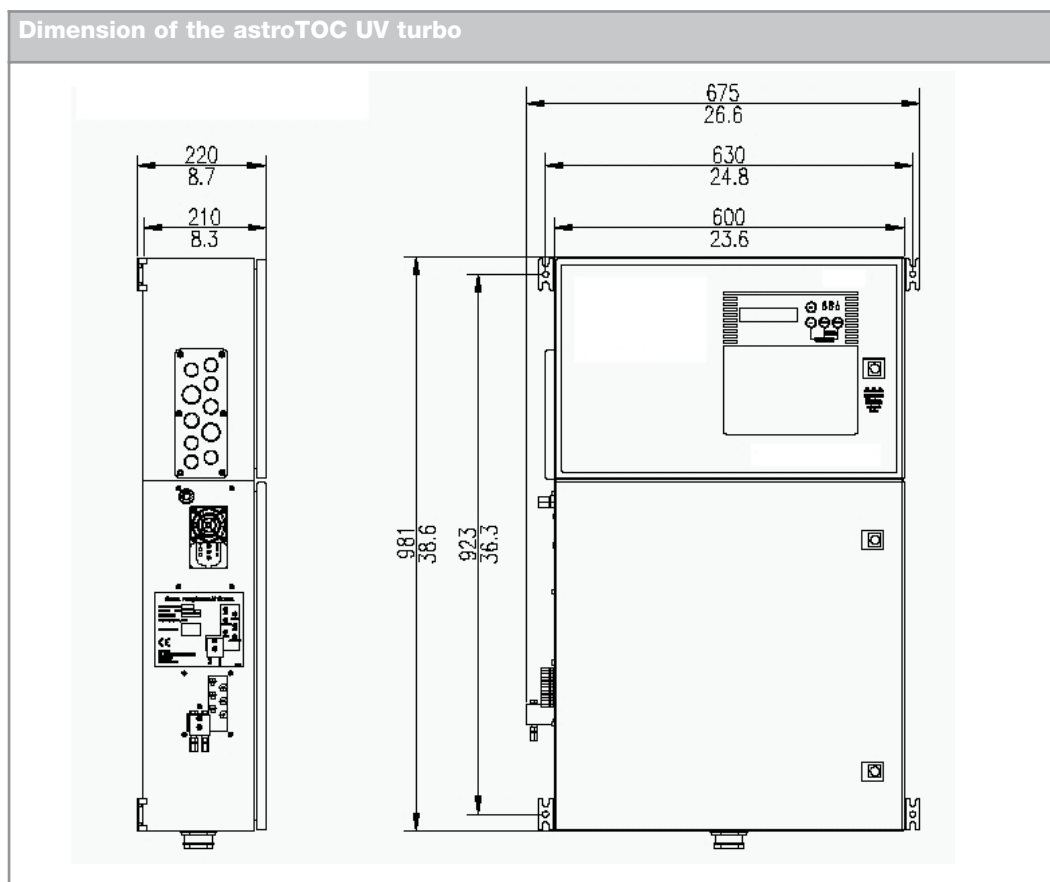


Figure 1

# >astroTOC UV turbo Recommended system

## Recommended system

astroTOC UV turbo analyzer, 0 to 5,000 µg/l. One-year spare parts kit. Carrier gas: Clean, CO<sub>2</sub>-free or air or Nitrogen, 0.5 l/min maximum, 2,8-6,2 bar (40-90 psig). If carrier gas is not available, the use of the AAS 300 Purge Gas Generator is recommended.



Further Information:  
 Technical Data Sheet  
 astroTOC UV turbo  
 Order No. DOC053.52.03098  
 Technical Data Sheet  
 AAS 300  
 Order No. DOC053.52.03109



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### AAS 300



Figure 2

### Dimension of the AAS 300

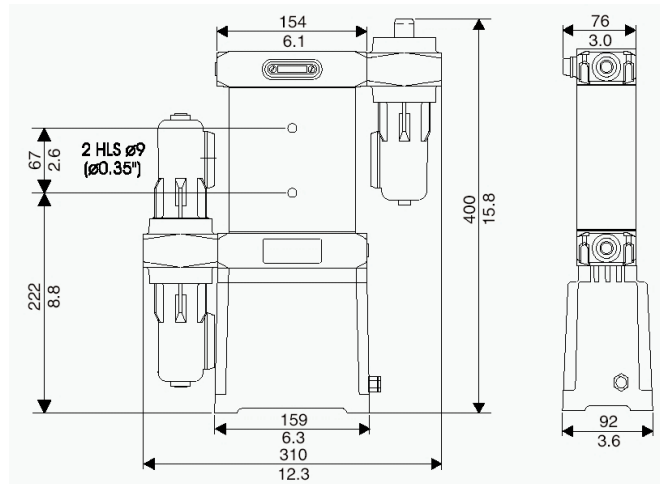


Figure 3