Selected Article

Environmental Analyzer Maintenance and Service Techniques

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HORIBA Techno Service Co., LTD. (HTS) operates to serve the diverse and advanced needs of customers who use HORIBA products, by providing technical support for installation and set-up, as well as maintenance, management and where necessary, repair in a timely manner. The continuous production of reliable and stable analysis is the purpose of an environmental analyzer and thus we believe that service techniques including daily maintenance are as important as the product itself. At HTS, in order to improve our service techniques, we concentrate heavily on organizing training programs about product services, building product databases, and developing various tools.

Introduction

To preserve the global environment it is crucial to establish a monitoring system that constantly and quantitatively tracks levels of harmful substances. The need for global standards to address current environmental issues is growing, and in much the same way as other pollution problems such as global warming and carbon dioxide emission called for development of countermeasures, today's monitoring systems require high reliability for analyzers on an international basis. To enhance the reliability and quality of analyzers, in addition to improving their functions and performance, it is necessary to carry out daily maintenance. This is especially true for analyzers employed in the environmental field, where they must tolerate continuous operation to carry out constant monitoring under severe conditions.

HORIBA Techno Service Co., LTD. (HTS) provides maintenance and repair services for HORIBA products. From our standpoint as maintenance experts on environmental analyzers, I will introduce our service techniques and the activities we engage in to strengthen our product skills.

Corporate Profile of HORIBA Techno Service Co., LTD.

HTS emerged from the Service Department of HORIBA as a 100-percent subsidiary on March 21, 2000, and launched operations on July 1 of the same year. As of November 2006, HTS has 24 Service Stations in major cities and industrial zones across the country. The Service Stations are put under the control of company blocks in eastern, central, and western Japan, and conduct maintenance and repair of HORIBA analyzers and address customer needs in each area in cooperation with headquarters in Kyoto.

To better serve customers and surrounding communities, HTS established Tsukuba Service Station in March 2000, Yamaguchi Service Station in September 2005, and Nishitokyo Service Station in December 2005. In addition, the main Service Station in Kyoto was relocated to a new headquarters (Figure 1) in October 2004, to consolidate its operations and better coordinate the exchange of information with, and provide logistic support for the other 24 Service Stations situated across the country.

Figure 1 New Headquarters

Environmental Analyzer Maintenance and Troubleshooting Case Study

The intended operational fields of the environmental analyzers involve vast expanses of atmosphere, water, and soil. Measuring objects include a wide variety of materials and properties, and a multitude of analytical instruments with different measurement principles exist depending on the characteristics of the sample and the measuring objects.

To perform quantitative or qualitative analysis, analytical instruments use various kinds of chemical and physical reactions on the test sample. When problems occur with the analytical instruments, we identify the cause by collecting objective data based on measurement principles as well as the structure and characteristics of the product, and by referring to past records of problems. Nevertheless, if the problem involves multiple causes or there is no past case example to refer to, searching for the cause may take a long time. In addition, many problems require on-site examinations by experienced service technicians. It should be kept in mind that because of the necessity for continuous operation, environmental analyzers must be returned to normal operation as quickly as possible to prevent loss of measurement data even when problems occur.

For this purpose, we make every effort to create methods whereby we can collect large amounts of data in a short period of time, using computers and other electronic devices, so as to quickly identify the location or cause of faults. Below are some of our service techniques and examples of on-site troubleshooting experiences.

A Service Technique Example (Automated Total Nitrogen/Total Phosphorus Analyzer)

The TPNA-300 Automated Total Nitrogen/Total Phosphorus Analyzer is used to prevent over-concentration of nutrients in enclosed sea areas in compliance with the Fifth Water Quality Total Pollution Control Regulations, by measuring the total nitrogen and total phosphorus in industrial waste water. Figure 2 is a photograph taken at a facility where a TPNA-300 is installed.

Figure 2 Installation of the TPNA-300 Automated Total Nitrogen/ Total Phosphorus Analyzer

The Automated Total Nitrogen/Total Phosphorus Analyzer measures, in the form of nitrate and phosphate ions, nitrogen and phosphorus compounds dissolved in water in various forms, by performing oxidative breakdown using temperature or ultraviolet light, and oxidizing reagent.

This analytical method is known as the potassium peroxodisulfate oxidative breakdown method, and is an official analytical method of JIS for total nitrogen and total phosphorus. Although it is a widely used method, the oxidative breakdown process is likely to be adversely affected when the sample contains a large amount of seawater, and therefore to use the automatic monitor effectively it is necessary to identify impure substances such as seawater in the sample in advance. If identification prior to operation is inadequate, and an error-ridden analysis is obtained, it is difficult to determine from the analysis results whether the source of trouble is the impure substances in the sample or a malfunction of the analyzer. When the source of trouble is in the analyzer itself, analysis takes an hour to produce results, and thus it requires time to search for the source of trouble. Searching for the cause is especially difficult when analytical processes involve oxidative breakdown and optical absorption (nitrogen analysis: ultraviolet absorption; phosphorus analysis: infrared absorption), because visual observation is impossible with these processes.

Given these conditions, we created a method whereby we used a combination of a computer and a data logger (automatic logger) to retrieve raw signals of light intensity from the analyzer's optical system and compare them against a normal signal pattern. By doing so, it is possible to quickly determine whether the oxidative breakdown and optical absorption analysis processes are normal or not. If an error exists, the signals will show patterns that are distinctly different from normal patterns. Analysis of these patterns allows us to identify the source of problems in the otherwise invisible processes of oxidative breakdown and optical absorption analysis.

Figure 3 shows the optical intensity signal pattern when there is an error indication.

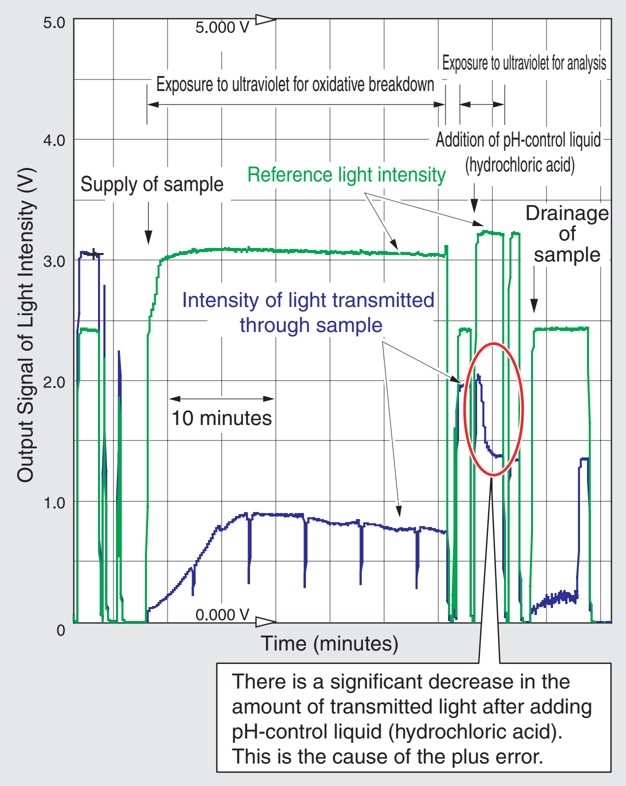


Figure 3 Example of a Light Intensity Signal Pattern when there is an Error Indication during an Analysis of Total Nitrogen

Examples of On-site Troubleshooting

The structure of analysis equipment in the environmental field depends on installation conditions and the characteristics of the sample. Analyzer installation requires close attention to match field conditions. To illustrate the importance of field conditions in which the analyzers are to be used, we will provide examples of trouble related to analytical environment.

Air-conditioning at Monitoring Station

The SO_2 analyzer for monitoring air pollution experienced a failure when the incident light level at the monitor's optical system decreased because of moisture covering its monitor's lamp. Since the monitoring station had high humidity and an unsteady temperature we solved this problem by setting up an air-conditioning system to control humidity and temperature.

In general, in order to maintain stable conditions, monitoring station offices with air pollution analyzers are air-conditioned at a constant temperature throughout the year. However, in some offices the temperature is kept under 25 ℃, and in summer, especially during times when humidity and temperature are at their highest, the sample air brought into the office from outside cool to the point that condensation forms. Sometimes the condensation makes its way inside the analyzer where it exerts an adverse effect on analysis.

The following are the most important points to follow when using air-conditioning in monitoring station:

- Use air-conditioning to keep monitoring stations in the temperature range of 20 to 30 ℃ throughout the year, and maintain strict controls on humidity and temperature.
- Tighten control of humidity when humidity and temperatures are high (during summer). In summer, temperature must be kept relatively high (about 28 ℃).

Interference from Rainwater, Insects and Sand in the Sample Air Intake

In addition to the installation environment, care must be taken with regard to field conditions.

Figure 4 is a photograph of an air pollution analyzer's sample air intake, set up outside a monitoring station. In 2004 a number of strong typhoons hit Japan in a short period of time. As shown in Figure 4, the sample air intake was set up with an upside-down funnel shape cover, but because the cover was short, rainwater made its way inside the analyzer through the intake when the strong typhoon winds hit. This led to the analyzer being damaged. Moreover, in addition to rainwater during rainstorm, there are instances where insects or sand have found their way into the analyzer. It is therefore clear that the cover for the sample air intake must extend far enough to prevent foreign substances such as rainwater or sand from entering.

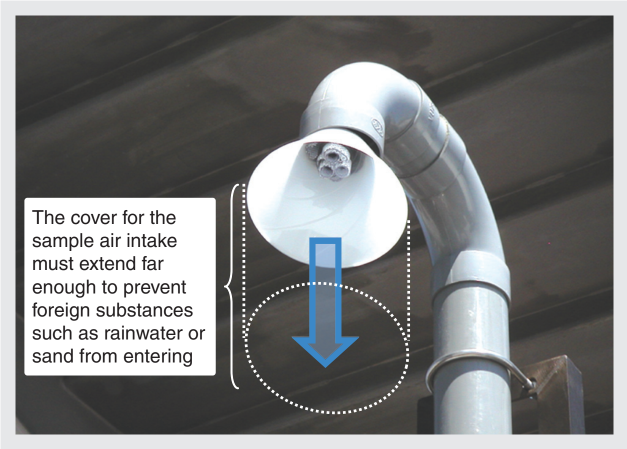


Figure 4 Cover for the Sample Air Intake

Accumulation of Dust inside the Sample Air Intake Pipe

Figure 5 shows tubes from the sample air intake being bent at one point, which became the cause of an error in an analysis because dust from the sample air accumulated at the bend. This became apparent through an on-site investigation when analysis results showed an erroneous deviation in the normal measured value. As might be expected, when installation requires piping, care must be taken to avoid any bends.

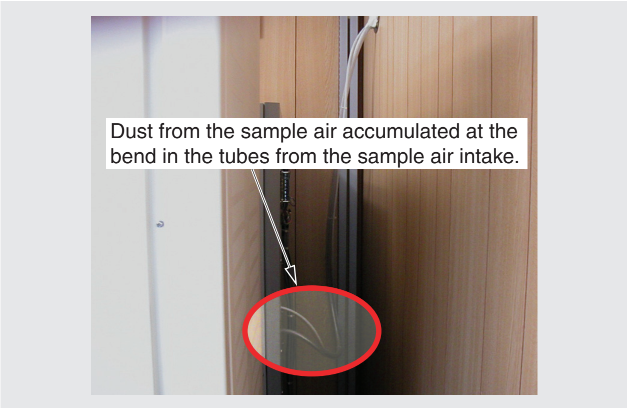


Figure 5 Accumulation of Dust at the Bend of the Sample Air Intake Pipe found in a Monitoring Station

The above examples of past problems indicate that the installation of analytical instruments requires careful management to take into account both the relevant conditions and the characteristics of the sample materials. As described above, a considerable amount of information can only be acquired through on-site investigations, and the responsibility of our service engineers is to collect accurate information from the scene and pass it on to the technical department quickly.

Analytical instruments, which measure materials and properties quantitatively and qualitatively, are designed to adapt to field conditions, but deterioration over time is inevitable. For this reason, preventive and periodic maintenance of the instruments must be performed to assure stability of performance and to shorten the down time when trouble occurs.

To assure stable performance of our analyzers, not only do we provide repair service, we lay emphasis on maintenance check service by promoting maintenance contracts.

Enhancement/Training System for Service Techniques

As mentioned in the beginning, solid movement towards globalization and growing competition in our market are raising the demand for reliable analytical techniques, reduction of running costs, and advancement of functions. At HTS, to improve our product knowledge and service techniques to match with the analyzer's upgrades and advancement of functions, we have been organizing service-training programs at headquarters and Service Stations across Japan using annual training plan (Figure 6). We utilize a facility specially designed for training programs (commonly called "Techno Plaza") to hold workshops for service technicians from Service Stations across Japan. Workshops concentrate on hands-on training using the actual products, so as to master the operation of new products and improve the service techniques of existing products.

Figure 6 A Service Workshop held at a "Techno Plaza"

Because the environment field is extensive, and the principle and function of the analyzers are becoming complex, it is absolutely necessary to acquire skills. In addition to the training programs organized by our headquarters, we have made self-training materials as shown in Figure 7, so that the service technicians across the country can prepare themselves at their offices before participating in the training programs.

Figure 7 Self-training Materials (Videos, CD-ROMs, etc.)

Moreover, to strengthen collaboration between the headquarters and Service Stations, a TV conference system between the offices was setup in July 2005 (Figure 8). Due to the establishment of a TV conference network, the information exchanged between the Service Stations and the headquarters has increased using such methods as TV conference workshops.

Figure 8 TV Conference Network (Image)
HORNET:Intranet in HORIBA Group

Product Database Management

HTS receives many inquiries from customers about technical issues and requests for repair (on-call) or inspection of products, as well as inquiries from sales agencies and sales representatives. As a result we have developed a database called “Data Warehouse”. In the Data Warehouse, records of previous practice runs, repairs, and inspections can be searched according to customer name, product type, product number, and so forth. In addition, it is possible to quickly retrieve a list of parts used for individual products, or those used for inspection and repair, sorted by individual customers, therefore enabling us to provide appropriate and timely customer support.

Development of Products for Service (Converter Checker)

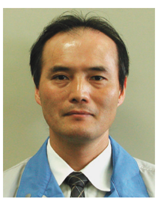
A gas analyzer for nitrogen oxide has an NO_X converter that deoxidizes nitrogen dioxide to nitrogen monoxide. To verify whether the total NO_X value is correct or not, it is necessary to check the performance of the NO_X converter. Based upon a suggestion from the service technicians, HTS developed and commercialized a small, lightweight converter checker CEC-Pro, shown in Figure 9.

Figure 9 Converter Checker, CEC-Pro

Conclusion

Environmental analyzers play an important role in preserving the global environment. Service techniques for the maintenance of these analyzers are indispensable in sustaining and improving their reliability. As service technicians, this is the mindset we carry with us as we perform our day-to-day operations.

It is our hope to keep improving our service skills, and to present positive proposals from the standpoint of the field engineer to make products (analyzers) that have the ability to better adapt to field conditions and produce reliable results.



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