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Prepared by:\_\_\_\_\_ Date:\_\_\_\_\_


Reviewed by:\_\_\_\_\_ Date:\_\_\_\_\_

Approved by:\_\_\_\_\_ Date:\_\_\_\_\_

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### **Purpose**

To describe the procedure to be followed for performing special maintenance and calibration of the EC9841B NOx analysers in the monitoring network.

### **Principle**

This SOP applies to EC9841B NOx analysers.

### **Staff involved**


This SOP is intended for the staff of the maintenance company who performs the activities described.

### **Equipment**

- Nitrogen oxides monitor (Ecotech EC9841B)
- Station data processor (Ecotech)
- Calibrated flow meters, ranges 5-500 mL/min and 0.5-50 L/min (BIOS)

### **Documentation and forms**

This SOP requires the form *DLI-F-38 NOx Analyser Maintenance Report*.  
The completed form is stored in electronic form in the file *DLI-F-38 NOx Analyser Maintenance Report-sn-yyyy-mm-dd.xls*, where *sn* denotes the analyser serial number, *yyyy* the year, *mm* the month and *dd* the date of the maintenance.  
The paper copy of the form is stored in the history log book of the analyser.

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## Procedure

### *General*

Perform the scheduled maintenance as required by the maintenance schedule DLI-QD-103.

### *Registration of general information and status parameters*

#### Registration of general information:


- Enter name of customer, analyser model, analyser serial number and job number in **Customer**, **Instrument**, **ID No.** and **System/Job No.** fields respectively.
- Enter name of operator, date of test, start time and where the test was performed in **Maintenance Performed by**, **Date**, **Time Begin** (left field) and **Location** fields respectively.

#### Registration of reference information (section Calibration Equipment, where applicable):

- Enter flow calibrator model, calibrator serial number, pressure calibrator model and calibrator serial number in **Flow Calibrator Model**, **ID/Serial No.**, **Pressure Calibrator Model** and **ID/Serial No.** fields respectively.

#### Registration of analyser status parameters (section Displayed Instrument Parameters):

- On the analyser keyboard hit **<Exit>** to return to the primary screen.
- Push the **Select** button to enter the main menu. Use the **Up** and **Down** arrows on the keyboard to navigate in the main menu. Push **<Return>** to select a menu item.
- Choose **INSTRUMENT STATUS**.
- From the **INSTRUMENT STATUS** menu read the status parameters and enter them into their respective fields in the **Displayed Instrument Parameters** section of the form.
- Hit **<Exit>** to return to the primary screen.
- Hit **Select** to enter the main menu, choose **SYSTEM TEMPERATURES**.
- From the **SYSTEM TEMPERATURES** menu read the status parameters and enter them into their respective fields in the **Displayed Instrument Parameters** section of the form.
- Hit **<Exit>** to return to the primary screen.
- Hit **Select** to enter the main menu, choose **TEST MENU**.
- In the **TEST MENU** choose **OUTPUT TEST** menu.
- In the **OUTPUT TEST** menu choose **PREPROCESSOR POTS**.
- From the **PREPROCESSOR POTS** menu read the status parameters and enter them into their respective fields in the **Displayed Instrument Parameters** section of the form.

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- Hit <Exit> to return to the primary screen.
- From the primary screen record the measurement units in the **Instrument units** field.
- Compare the recorded values with the acceptance limits. If any values are outside the limits the cause must be investigated.

### *Pressure and flow calibration*

The pressure and flow calibration procedure is taken from the EC9841B Series Nitrogen Oxides Analyzer Service Manual. The pressure calibration menu is accessed from the hidden menu. It is assumed that the analyser has been running for at least one hour for the temperature of the flow block to stabilise at 50 °C.


#### To access the pressure calibration menu:

- From the primary screen press simultaneously press the keys <Up arrow> + <Pg Up> + <Enter> to enter the Hidden menu.
- From the Hidden menu, select the **PRESSURE CALIBRATION MENU**.

#### Pressure calibration:

- From the **TEST MENU** select **OZONATOR: OFF**.
- After 15 minutes turn off the pump.
- From the Hidden menu, set the **FLOW BLOCK TYPE TO ISO**, and press <Enter>.
- Press Reset on the analyzer secondary panel.
- Disconnect the Teflon line from the O<sub>3</sub> generator to the measurement cell and connect a calibrated pressure transducer to this port on the measurement cell.
- From the Hidden menu, select the **PRESSURE CALIBRATION MENU**.
- Allow 30 seconds for the pressure reading to stabilise to ambient pressure on both the calibrated pressure transducer and the analyzer. This reading (in TORR) should be the ambient pressure. Set this value as **PRESSURE 1 HIGH** and press <Enter>. Note: to convert from millibar to TORR, multiply the pressure by 0.75.
- Enter the **PRESSURE 1 HIGH** value in the **Pressure and Flow Calibration - PRESSURE 1 HIGH** field.
- Connect the pump to the exhaust port and turn it on.
- From the **PRESSURE CALIBRATION MENU** set the **VALVE SEQUENCING OFF** and press <Enter>.
- Allow the pump to evacuate the cell and the pressure reading to stabilize. This reading should be low (typically 100 to 200 torr), and is dependent upon the capacity of the pump. Set this value as **PRESSURE 1 LOW** and press <Enter>.
- Enter the **PRESSURE 1 LOW** value in the **PRESSURE 1 LOW** field.
- Press Reset on the analyzer secondary panel
- From the **TEST MENU** select **OZONATOR: ON**.

Continue with the flow calibration.

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Flow calibration:

- From the Hidden menu, select the **FLOW CALIBRATION MENU**.
- Set the **CRITICAL ORIFICE** to 0.640 and press <Enter>.
- Press Reset on the analyzer secondary panel.
- The actual flow should now be checked by turning on the pump and connecting a flow meter to the sample inlet of the analyzer. The flow should read approximately 0.64 slpm. If the flow is too low, perform the sintered filter/orifice replacement procedure. If flow is too high, there is probably a leak.
- Enter the observed gas flow in the **Gas flow** field.

***DFU Replacement***

The DFU replacement procedure is taken from the EC9841B Nitrogen Oxides Analyzer Service Manual. For figures and details on part numbers consult this manual.

The zero air entering the perma-pure drier is filtered by a disposable filtration unit (DFU) to prevent contamination of the pneumatics and Rx cell. Failure of the DFU could result in loss of dry air to the O3 generator, damaging the generator. The DFU is located inside the rear corner of the analyser.

Change DFU:

- Turn off the analyzer and turn off the pump.
- Remove and retain the Kynar nut from the end of the DFU.
- Remove and replace the DFU, ensuring that direction of flow is correct (from rear to front of analyzer).
- Reinstall the Kynar nut, ensuring that the ferrules are properly installed in the nuts.
- Turn on the pump.
- Enter **Y** in the **DFU changed** field if it was changed. Otherwise enter **N**.


***Cleaning and replacing parts***

References are made to the **Maintenance** section of the form.

Cleaning the lines:

- The pneumatic lines (sample and exhaust) may be cleaned by removing and washing with a methanol cotton swab pushed through and dried by blowing with zero air or dry nitrogen. Do not clean the scrubber.
- Enter **Y** in the **Lines cleaned** field if it was changed. Otherwise enter **N**.

Changing the sintered filter:

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1. Refer to chapter 3.3.6 Sintered Filter Replacement of the 9841 A & B Series Nitrogen Oxides Analyzer Service Manual for instructions on replacement.
2. Enter **Y** in the **Sintered filter changed** field if it was changed. Otherwise enter **N**.

Cleaning the reaction cell:

- Refer to chapter 3.3.9 Reaction Cell cleaning of the 9841 A & B Series Nitrogen Oxides Analyzer Service Manual for instructions on replacement.
- Enter **Y** in the **Rx cell cleaned** field if it was changed. Otherwise enter **N**.

### Finalizing the visit and completing the form

- Enter the end time of the calibration in the **Time Begin/End** field (right field) in the form.
- Sign the form in the **Technicians Signature** and **Date** fields.
- Before leaving the station record the visit in the station visit log.
- After returning to the lab store the form in the instrument history log book.

### Relevant documentation

DLI-QD-102 Initial Installation and Acceptance Test of Equipment in the DLI AQMN Form *DLI-F-38 NOx Analyser Maintenance Report*

### Reference Procedures

Nitrogen oxides monitor (Ecotech EC9841B) manual

### Revision History

Revision 0