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## Sampling with a DDL CIS Portable Hygrometer & Bottled Gas Dryer

### 1) Hygrometer Pre-Sample Validation Test on “Zero” Gas

On receiving the analyser a dry gas check should be performed to confirm the “zero” reading of the sensor prior to commencement of testing.

- a) Connect a regulated low flow of nitrogen or (oil-free) instrument air to the inlet port of the MCM Bottled Gas Dryer (BGD) and establish a continuous flow from the BGD of approximately 500 cc / minute. NB:- the BGD is shipped from MCM in a ready to use condition and, if properly sealed between uses, should not require regeneration for a period of several weeks or months. If in doubt then follow the recommended procedure for regenerating the BGD (refer to the BGD Operating Manual for detailed instructions).
- b) Switch the hygrometer on.
- c) Wait for one minute whilst the sensor stabilises at its normal operating temperature (45°C).
- d) With the desiccant seals in place on the inlet and outlet ports, observe and record the first moisture value that is displayed (this should ideally be <10 ppmV).
- e) Press and hold the Push Purge<sup>®</sup> button for 45 seconds. Observe that the Push Purge<sup>®</sup> LED begins to blink at a faster rate, indicating that the sensor temperature has increased to 135°C (Push Purge<sup>®</sup> temperature).
- f) Observe that the displayed moisture value drops to an under range reading (needle indicates <1 ppmV, or <-80°C dew point).
- g) Release the Push Purge<sup>®</sup> button and watch the reading recover to a stable on-scale value, whilst the sensor cools to its standard operating temperature of 45°C. The Push Purge<sup>®</sup> LED will blink at a constant rate once the sensor control temperature has been reached.
- h) Look for signs of sensor contamination; for example, the reading being unable to drop below 1 ppmV (i.e. under range) during Push Purge<sup>®</sup>. If the reading drops below 1 ppmV during Push Purge<sup>®</sup> and recovers to low value then continue to Section 2.





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*If the reading does not drop below 1 ppmV during Push Purge<sup>®</sup> or reads too high following recovery, then:*

- i) Loosen the desiccant seal on the instrument vent port but do not remove completely (if the inlet and vent ports are not indicated on your instrument then you may choose to vent through either port). Loosen and remove the desiccant seal from the inlet port and connect the purging dry nitrogen / instrument air from the BGD as quickly as possible.
- j) Observe the displayed reading and, once settled, log the displayed value. Allow a settling time of about five minutes prior to recording the value.
- k) Activate the Push Purge<sup>®</sup> function as per Section 1.e) and wait for the recovery of the reading to a settled value. Allow about five minutes to achieve a stable reading and log the displayed value again.
- l) If the displayed reading is falling with time, then leave the instrument connected to the BGD until results are stable and within acceptable tolerances on dry gas values. If extended purging is required then the hygrometer can be switched off to conserve the battery.
- m) If the value from the BGD exceeds 10 ppmV and cannot be lowered by continuous purging from the BGD, then check the span value of the hygrometer with an appropriate span gas (if available) to check the response speed of the sensor.
- n) Additionally, failure to produce a reading of <10 ppmV could suggest that the BGD is in need of regeneration. Regenerate the BGD and attempt the test again once complete.
- o) If the reading from the BGD continues to be outside acceptable tolerances (or of the response speed to span gas step changes takes longer than ten minutes), then reattach the desiccant seals and return the instrument to MCM for service inspection and calibration.

## 2) Site Preparation

- a) Locate a suitable connection point to perform the sample testing.



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- b) Connect 1/8" stainless steel fittings, flow control (needle) valve and pipework to the selected sample point, ensuring that there are no other components such as flow meters, filters or gauges installed between the pressure reducing valve (if necessary) and test point.
  - c) If possible, a continuous gas purge should be established, tied to a suitable vent. However, if this is not practical then perform a blast purge of the sample loop for at least 20 minutes at a higher flow than that required for the analysis.
  - d) Check that the sample system is clean and dry, by using a clean white cloth / rag placed over the open end of the sample loop tubing, and check for any contamination.
  - e) Once satisfied that the sample gas is clean, adjust the flow-rate down to the test flow-rate (max 0.5 litre / minute).

### 3) Hygrometer Preparation

These tests can be carried out at the same time as the Site Preparation tests in Section 2.

- a) Repeat Sections 1.b) to 1.h).
- b) You are now ready to take your first measurement.

### 4) Sample Gas Moisture Measurement

- a) If possible connect the outlet port of the hygrometer to the atmospheric vent line. If this is not available then loosen, but do not remove, the desiccant seal on the outlet port.

*Note: Failure to loosen the desiccant seal on the outlet port whilst undertaking a moisture test will result in the sensor chamber and desiccant seal becoming pressurised, which may cause the plastic cap to blow off and the desiccant medium to blow out.*

- b) Once satisfied that the sample loop has been purged sufficiently, swiftly remove the desiccant seal from the inlet port and connect the sample loop tubing to the hygrometer.

*Note: Ensure that the tubing fitting is finger-tight before using a spanner to tighten fully. This is to prevent any damage to the analyser fittings.*

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- c) If the analyser is switched off, then switch on, perform the Push Purge<sup>®</sup> routine and allow time for the moisture reading to stabilise.

If the instrument was already switched on then activate Push Purge<sup>®</sup> and allow the measurement about 5 minutes to reach a steady reading.

- d) Activate the Push Purge<sup>®</sup> feature for a second time and wait for the recovery of the reading to a steady display. Allow the measurement about 5 minutes to reach a steady reading.

*Note: Check that the sample system has stabilised by adjusting the flow. If the sample system is in equilibrium with the process gas, then adjusting the flow will not affect the displayed moisture reading. However, if the flow is increased (and the moisture value falls) or if the flow is decreased (and the displayed moisture value rises) then this indicates that the sample system is contributing moisture to the process and further time should be allowed in order to achieve a balanced condition.*

- e) If the sample system is in balance, then take a note of the reading for moisture in ppmV at this point.

- f) Activate Push Purge<sup>®</sup> again and repeat steps 4.d) and 4.e).

- g) Take a second reading for moisture in ppmV at this point.

- h) If there is close agreement between the first and second readings, this confirms that the readings for the moisture content of the sample gas are valid.

*Note: A difference of 1 or 2 ppmV at low levels (i.e. <10 ppmV) is acceptable and an average between the two readings can be taken as the moisture content.*

- i) Quickly disconnect the sample loop tubing to the hygrometer and replace the desiccant seals.

- j) Operate the Push Purge<sup>®</sup> feature and allow the hygrometer to complete the cycle. Record the displayed value in ppmV.

- k) Power off the hygrometer.



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## 5) Post Sample Checks

- a) If available, purge the hygrometer with nitrogen at sample flow-rate. Operate Push Purge<sup>®</sup> during this run. This allows any contaminants to be burnt off the sensor and provides a post-sample reading.
- b) If nitrogen is not available then return unit to base for a “Dry Gas Validation” using the Bottled Gas Dryer, or return to MCM for assessment and calibration.

## 6) Dry Gas Validation

- a) On return to a safe area, set up the hygrometer with a flow of clean, dry nitrogen or air at the correct flow of 0.5 litre / minute. Use of the BGD is required for these checks.
- b) Turn the hygrometer on and follow the initial procedure for achieving a stable reading of the moisture content. Activate Push Purge<sup>®</sup> and look for any signs of contamination; an indication of this is the reading not being able to drop below 1 ppmV during the Push Purge<sup>®</sup> cycle. If the reading cannot go below 1 ppmV, reads off-scale WET or is unusually slow to respond, then carry out the following:-
- c) Observe and log the moisture reading in ppmV.
- d) Activate Push Purge<sup>®</sup>, wait for the reading to stabilise and log the reading again.
- e) Compare the readings taken in Sections 6.c) and 6.d).
- f) Repeat if necessary.
- g) If the readings are coming down with each Push Purge<sup>®</sup> cycle, then leave the unit switched on and purge with either nitrogen or clean, oil-free air fed through the BGD until the results are stable and within acceptable tolerance on the declared dry gas values.

