White Paper

Title: Troubleshooting Probe Air Leaks
TSN Number: 03
File:S:\Bridge_Analyzers\Customer_Service_Documentation\White_Papers\EGA\03 Troubleshooting Probe Air Leaks.docx
Created by: R. Schrader
Last Revision Date: 27-Sept-06

Air leaks in general:

Due to sample gas air dilution, an air leak will cause the CO, HC, and CO2 readings all to be low by an identical ratio. That is, if you see that CO is 5% low, (like 1.00% CO actual reading 0.95%) and also see that the HC and CO2 readings are likewise all 5% too low - then you should suspect that there is an air leak that is diluting all of the gases the same amount.

Another even stronger indicator of an air leak is a high Oxygen reading - as an air leak contains 20.9% Oxygen. A 5% air leak as above will cause the Oxygen reading to be 1.0% higher than it should. This should be very obvious - as vehicles equipped with a CAT use up all but about 0.5% Oxygen in the natural combustion process. If you see abnormally high Oxygen values being reported by the gas analyzer, you should suspect that there is an air leak somewhere in the sample gas input system.

About the Bridge probe systems:

The Bridge probe is more complex than usual because we have the gas filters and water trap at the probe, not at the analyzer as console or portable systems do. This keeps the dirt and water condensate out of the sample line, and also allows us to have the automatic Zero and condensation purge features, increasing the practical utility of the analyzers. The downside of this arrangement is that the more complex probe/filter/water trap assembly creates an additional potential for air leaks.

There are three areas of potential leaks that should be inspected periodically - the 50mm primary filter, the fittings on the handle/water trap, and the water trap purge valve. The primary cause of air leaks is contamination of the water trap purge valve. This is easily tested by simply placing a thumb over the bottom end of the water trap (where the purge port check valve is located) and seeing if the gas values change. If the O2 reading goes down and the CO, HC, and CO2 readings go up – then there probably is an air leak at this valve.

Troubleshooting the water trap purge port check valve:

Check the water trap purge valve in the base of the water bowl by un-screwing the water bowl and filling it 1/3 way with tap water, and then reinstalling it. (The top rim of the

Bridge Analyzers, Inc.
PO Box 39325
Solon, Ohio 44139 USA

(510) 337-1605 office
(216) 274-9262 fax
support@bridgeanalyzers.com

water bowl seals against an O-ring in the housing, so you should feel a resistance as it make contact in the final ¼ turn.) Connect the probe to the analyzer sample line (the analyzer should be running at this point and pulling in sample gas) and see if the purge valve does not leak under the vacuum of the analyzer pump. Small bubbles may be seen, and if they are less than one per second, the valve is sealing correctly. If bubbles are seen rising from the base of the water trap, then the purge valve is not sealing correctly, and should be cleaned.

Cleaning the check valve of debris:

To physically clean the purge valve of debris, remove the water trap and inspect the lower end from the outside. There is a small round low pressure valve there, and it is generally self cleaning, but there could be debris between the valve and its seat. The valve / seat interface can be cleaned by gently lifting the edge of the valve itself and wiping it clean with a toothpick or similar device.

Flush the water trap purge valve:

The water trap purge valve may also be cleaned of residue by filling the water bowl with tap water, and flushing the one-way valve by blowing directly in the bowl to expel the water from the bowl through the purge valve. After completing this flushing, confirm the valve is air tight by pulling a vacuum on the water bowl or by means of the 'bubble test' above. Generally this valve creates a tight seal under vacuum, and works even better if it is slightly wet.

Periodic Checking:

The water trap purge valve should be checked periodically by looking for bubbles in the water bowl. If an excess are seen, perform the cleaning function(s) as above as required.

Leak-testing the probe assembly:

This unit has a quick release fitting on the probe end of the flexible tip. Using a small wrench, remove the flexible tip. Block the quick release fitting at the front end of the 'S'-bend, and draw a vacuum on the gas output quick release fitting on the water trap. (Normally you can easily create about 10" of Hg vacuum by sucking against the fitting, and then test to see if the handle assembly is gas-tight by simply stopping the gas flow at the water trap fitting using your tongue.) The assembly should hold a steady vacuum for at least 10 seconds. If it does not, then there is a leak in the assembly.

First, check to make sure that the 50 mm dia input filter (P/N 10119) is tightly installed in the 'S'-bend and bottomed-out in the brass fitting at the water trap.

Examine the plastic threads , which seal better than brass ones, but are more sensitive to cross-threading and stripping if they are overtightened. If they look stripped, or galled, replace the filter with a new one. You should also look to see if there is residual plastic

Bridge Analyzers, Inc.
PO Box 39325
Solon, Ohio 44139 USA

(510) 337-1605 office
(216) 274-9262 fax
support@bridgeanalyzers.com

in the brass female 1/8 NPT fittings that the filter screws into. If it is there, clean the threads with a pointed object before installing a new filter. The other plumbing interfaces on the water trap should also be inspected to make sure they are gas tight. (We have also found that Teflon paste seals these threads if necessary.)

When complete, you can put the 'S'-bend back on the probe handle make sure it seals well, and proceed with the functional test below.

Functional Test:

Once the probe assembly has passed the tests above and you are convinced that the probe assembly is gas-tight, fill the water bowl 1/3 the way and connect the probe to a running analyzer (make sure that it has been previously turned on and Zeroed, or the test will not work - as the first thing you do after power up is to Zero the analyzer, and this will automatically empty the water bowl.) - and look for bubbles in the water bowl.

If you see none, Zero the analyzer and make sure that the backflush (water trap emptying function) is operating. You should see the analyzer empty the water bowl in the first 3 seconds of the Zero command.

Then, flow calibration gas or check a known-good vehicle exhaust and observe the oxygen level for correct reading. It should go down to a very low level, generally less than 1.0% O2. Once you are convinced that there are no physical air leaks, nor signs of air dilution in the gas being measured, you can make exhaust gas measurements with greater confidence.

Bridge Analyzers, Inc.
PO Box 39325
Solon, Ohio 44139 USA

(510) 337-1605 office
(216) 274-9262 fax
support@bridgeanalyzers.com