

Carbon Monoxide – The Silent Killer

SHOULD WE TEST FOR CARBON MONOXIDE ON A TUNE UP CALL?

Yes! Obviously, we need to be concerned about the safe operation of the customer's fuel burning equipment. We also need to be certain that technicians are not working in a contaminated environment.

"IS IT SAFE FOR ME TO BE WORKING HERE?"

Don't just use a carbon monoxide (CO) detector when you suspect a problem. It should be used on every job where you will be working indoors to be certain that the atmosphere is not contaminated with this odorless, colorless, combustible, and deadly gas..

It is important to be aware of the dangers and to understand how a particular manufacturer's CO analyzer calibrates when turned on in ambient air which is contaminated with CO. Some instruments calibrate to zero irregardless of existing ambient CO levels, some to the actual levels, and some allow the user to choose. Most detector manufacturers recommend "zeroing" your CO detector outdoors and then progressing into the building. Read the operating manual for your detector.

HEAT EXCHANGER TESTING

Cracked Heat Exchangers — The industry has tried many field tests for cracked heat exchangers over the years. Most of which assume the flue gases are going to leak out of a crack or a rust hole. This may be the case when the unit first fires up, but when the blower comes on, it is more likely that distribution air will be blown into the heat exchanger. The danger a crack poses to human safety is typically not that flue gases will leak through a crack, it's that if sufficient distribution air is blown in, the vent system will not exhaust the larger, cooler volume of flue gases which will then spill out the furnace or boiler. Modern equipment has roll out switches and blocked flue switches to shut off the appliance before a catastrophe occurs - older equipment does not have these safety devices. Condensing furnaces may encounter a suspected problem with the pressure switch.

Watching the flue gas readout on an analyzer when

the blower comes on, and a crack is present, may result in the oxygen (O₂) or CO readings changing. This may provide information as to whether you have a cracked heat exchanger, a hole, or bad gasket which allows supply air to enter the inside of the exchanger, however, it will not quantify the leak.

AGA RECOMMENDED TEST PROCEDURE

Heat exchangers are not air tight. Gaskets used on many appliances are foil backed fiberglass. If you test for heat exchanger integrity and your test is too sensitive, you can find brand new furnaces which will fail your "test".

There is a 3 part test procedure recommended by the American Gas Association (AGA):

1. *Visual inspection*
2. *Flame disturbance inspection when the furnace fan starts*
3. *Repeatable test for excessive heat exchanger leakage (Het Kit)*

Failing test 1 or 2 lets the technician know that a hole (test 1) or a leak (test 2) exists. Such failures do not tell how bad the situation is. Not all holes or leaks are an immediate danger to the customer. However, Omega Energy Consultants, Ltd. recommends replacement of any heat exchanger or furnace which fails test 1, test 2, or test 3.

The only way to tell if a leak exceeds the limits established by AGA is to use test procedure 3 if procedures 1 and 2 pass.

Suppose the heat exchanger fails any of the above tests. You can shut off the disconnect, but what is the homeowner going to do, in cold weather, just as soon as you leave? Turn the appliance back on. If you dismantle the appliance by disconnecting the gas line and plugging it, a freeze up may occur leaving you or your company liable. Failure to shut off the appliance may result in injury or death to customers. With the assistance of an attorney, HVAC business owners need to determine in advance how to handle systems which fail test 1, 2, or 3 and pass this information

along in writing to each of their employees.

ACCEPTABLE EMISSIONS

For furnaces and boilers, the AGA and other sanctioning bodies allow up to 400 ppm *air free* carbon monoxide concentration in the flue products. If analysis of flue products determines that CO exceeds 400 ppm air free, the system is either badly out of tune, combustion air is contaminated, or you have insufficient combustion air. Air free CO is based on a mathematical calculation which subtracts excess air from the flue gas sample. Some CO detectors read out "air free" without the technician making any calculations. To find out more about CO air free, refer to the Carbon Monoxide Zone in the Training Room. This a bacharach website. The address of their site is: www.bacharach-training.com

EARLY WARNING SYSTEMS

All building occupants, commercial and residential, should protect themselves with UL listed carbon monoxide detectors. They are available from Home Depot, Lowes, Sears, etc. Contractors can improve their profitability by testing these detectors with the Aprilaire test dispenser, or sell and install new detectors where none existed before.

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Carbon Monoxide Levels and Associated Symptoms

CO Concentration Parts Per Million (ppm)	Symptoms Developed
0 - 1 ppm	Normal background levels
9 ppm	Maximum allowable concentration short term in living area (ASHRAE)
25 ppm	Maximum exposure TWA (Time Weighted Average) in the workplace for any 8 hour period. This is the limit established by National Institute for Occupational Safety and Health (NIOSH)
50 ppm	Maximum allowable concentration for continuous exposure in any 8 hour period, according to federal law. This is the O.S.H.A. personal exposure limit (PEL).
200 ppm	Slight headache, tiredness, dizziness, nausea after 2 -3 hours.
400 ppm	Frontal headache within 1-2 hours, life threatening after 3 hours, also maximum parts per million in flue gas (on an air free basis) according to EPA and AGA.
800 ppm	Dizziness, nausea and convulsions within 45 minutes. Unconscious within 2 hours, dead within 2 -3 hours.
1600 ppm	Headache, dizziness and nausea within 20 minutes. Death within 1 hour.
3200 ppm	Headache, dizziness and nausea within 5 - 10 minutes. Death within 30 minutes.
6400 ppm	Headache, dizziness and nausea in 1-2 minutes. Death within 10 - 15 minutes.
12,800 ppm	Death within 1 - 3 minutes.

Source: O.S.H.A.