

**SALT LAKE CITY FIRE DEPARTMENT**  
**Study of CO concentrations from Gasoline Blowers**  
**Both with and without an Exhaust Diverter Hose**

**Test Conditions:**

- The tests were conducted during a clear day, temperatures in high 60's.
- The wind was out of the South and steady at 5 mph.
- The PPV opening was on the West side of the building.
- The Exhaust opening was on the East side of the building.

**Carbon Monoxide Evaluation:**

- The building used to evaluate the Carbon Monoxide (CO) concentrations from the blowers was a 4000 square foot office building.
- The exhaust opening was the same size as the opening used for PPV.
- Blowers used were manufactured by Tempest Technology Corporation.
- Tempest Technology manufactured the Exhaust Diverter Tube.
- All blowers were placed 8 feet from the PPV opening.
- Original CFM was taken from literature sent with the blowers.
- The horizontal placement of the hose was tested on the leeward side of the blower as well as the windward side (Tests 3 & 4) with the results being the same.
- The horizontal 90-degree placement placed the hose directly to the rear of the fan. (Test 5)

**Fire Evaluation:**

- The building used to evaluate the performance of the blowers during fire conditions (Test 2) was a live burn training structure. The room dimensions are a 14-foot high by 20 feet wide and 32-feet long (8960 cubic feet).
- Materials used to produce the fire conditions were clean pine pallets.
- In Test 2 the point at which the building was determined to be clear (last line of top chart - 374 seconds 336 seconds) was when a light placed in the same location was visible by two individuals at the same time. This light was 18 feet away from the firefighters.
- Carbon Monoxide readings were taken with a GX-91 detector that was recalibrated at the beginning of each evaluation.

**Hose Evaluation:**

- In the applications tested, the CO introduced into the structure was measured approximately 1/2 of the distance into the building. This distance was 30 feet from the PPV opening, with readings were taken 36” from the floor.
- The maximum amounts of CO introduced into the structure were found to be well below recommended levels for safe operation.

**Summary:**

When utilized, the Exhaust Diverter Hose should be placed to the rear of the blower. This application decreases the amount of CO introduced into the structure to near 0 ppm.

All attempts to eliminate kinking of the hose should be made.

I would recommend that the hose be called the “overhaul hose” emphasizing that the real purpose of PPV is to save life and property while preventing injury to firefighters. Tempest should emphasize that the benefits of it’s use comes in non-fire odor clearing operations, or after the burned building is overhauled and is being cleared to return the property to the owners or fire investigators.

The Exhaust Diverter Hose concept appears to be complicating the primary purpose of PPA/PPV, which is the rapid rescue and fire attack that is in coordination with ventilation. Don’t waist time putting the hose in place until after the fire has been put out!

**Electric pros-**

- Production of no CO.
- Quieter operation.
- Explosion Proof Motor.

**Electric cons-**

- Slower to place into operation.
- Requires electric power supply.
- Lower CFM moved in and out of the building resulting in longer time to clear the structure of smoke and heat.

## HOW THE TESTS WERE CONDUCTED

### **TEST 1**

This test series consisted of three different set ups. One for a Honda powered blower, one for a Tecumseh powered blower and another for the 1hp, electric powered blower. The test room was cleared of CO between each set up and CO concentrations were monitored as the blowers ran. Obviously the electric blower had no CO concentrations, as the figures show, however note that neither of the gasoline-powered blowers concentrated more than 17 ppm of CO even after 20 minutes of running. Note that the gasoline blowers were NOT using the Exhaust Diverter Hose.

### **TEST 2**

This test series consisted of three different set ups. One for a Honda powered blower, one for a Tecumseh powered blower and another for the 1hp, electric powered blower. Fires were built in the test room and CO levels were allowed to reach 700 ppm. At that point the fire was put out and the blower began to remove the smoke, heat, steam and CO. Note that the Gasoline powered blowers were NOT using the Exhaust Diverter Hose during these tests yet the CO levels were reduced to as little as 18 ppm in 20 minutes. The Electric powered blower was still at 58 ppm at 20 minutes into the test. (The quicker CO removal by the Tecumseh engine is explained by it's higher CFM rating as compared to both the Honda powered blower and the Electric powered blower.)

### **TEST 3 & 4**

These tests consisted of four set ups. Each gasoline powered blower was set up twice, once with the Exhaust Hose laid out 90 degrees to the left side of the blower (Test 3) and once with the hose 90 degrees to the right side of the blower (Test 4). Note that the wind was blowing steadily at 5 mph from the right side of the blower. The CO Emissions were the same even with the hose laid out down wind from the blower. Note the drop in CO Emissions build up in the structure to 7.5 ppm as opposed to the 14 to 17 ppm buildup that was recorded in Test series 1 WITHOUT the Exhaust Diverter Hose. While both readings are acceptable, the hose did provide some relief form CO build up in this test.

### **TEST 5**

Test 5 was done exactly like tests 3 & 4 except that the Exhaust Diverter Hose was laid to the rear of the blower (straight off the back of the blower). Note the lower PPM concentration readings here.

## SALT LAKE CITY, UTAH FIRE DEPARTMENT

### CO CONCENTRATION TESTS OF POWER BLOWERS USED IN PPV - OCTOBER 1999

<b>TEST 1 &amp; 2</b>	<b>Honda-clear</b>	<b>Honda-fire</b>	<b>Tec.-clear</b>	<b>Tec.-fire</b>	<b>Elec-clear</b>	<b>Elec-fire</b>
Starting CO	0 ppm	700 ppm	0 ppm	700 ppm	0 ppm	700 ppm
CO @ 5 Min.	15 ppm	230 ppm	11 ppm	186 ppm	0 ppm	268 ppm
CO @ 10 Min.	16 ppm	130 ppm	13 ppm	98 ppm	0 ppm	143 ppm
CO @ 15 Min.	17 ppm	62 ppm	14 ppm	47 ppm	0 ppm	98 ppm
CO @ 20 Min.	17 ppm (Max)	25 ppm	14 ppm (Max)	18 ppm	0 ppm	58 ppm
Clear Atmosphere		374 Sec.		336 Sec.		423 Sec.

#### Exhaust Hose Evaluation Under Clear Conditions ( 90-degrees to right and to left side, both windward & leeward 5mph.)

<b>TEST 3 &amp; 4</b>	<b>Honda</b>	<b>Tecumseh</b>
Starting CO	0 ppm	0 ppm
CO @ 5 Min.	4 ppm	3 ppm
CO @ 10 Min.	5 ppm	4 ppm
CO @ 15 Min.	6.5 ppm	6 ppm
CO @ 20 Min.	7.5 ppm (Max)	7 ppm (Max)

#### Exhaust Hose Evaluation Under Clear Conditions (Horizontal to the rear and Parallel to wind stream)

<b>TEST 5</b>	<b>Honda</b>	<b>Tecumseh</b>
Starting CO	0 ppm	0 ppm
CO @ 5 Min.	1 ppm	0 ppm
CO @ 10 Min.	2 ppm	1 ppm
CO @ 15 Min.	2 ppm	2 ppm
CO @ 20 Min.	3 ppm (Max)	2 ppm (Max)

### AMCA CFM rating of blower

	<b>Honda</b>	<b>Tecumseh</b>	<b>Electric</b>
Lower CFM	12,844 CFM	15,232 CFM	8,748 CFM