

## Gas Appliances: 30 Second Dropout

By Steve Frederickson, President, Allied Fireside

One of the purposes of a continuous safety pilot system is to provide a constant ignition source for any combustible concentration of gas that enters the combustion chamber. This includes burning off gas from the main burner that might otherwise accumulate and possibly cause a forceful explosion.

In order to perform this function, it is essential that a standing pilot remains lit and that the pilot safety shutoff system interrupts the flow of all gas if the pilot flame fails. In most systems, the pilot flame causes a thermocouple or thermopile (or both) to generate a millivolt DC current that operates an electromagnet in the main gas control valve. When the thermocouple/thermopile is hot enough, sufficient voltage is generated for the electromagnet to hold open the valve that permits gas flow to the pilot and main burner control valve.

If the pilot flame becomes extinguished the thermocouple or thermopile immediately begins to cool and generate less voltage. After a certain period of time the voltage will no longer be sufficient to hold open the valve. The electromagnet will “drop out” and close the valve, stopping the flow of all gas.

The time between loss of the pilot flame and dropout of the safety valve is critical, because during this period gas can flow, unsupervised and unignited, through both the pilot burner and the main burner. If the dropout time is too long, a dangerous concentration of gas can accumulate in the combustion chamber.

Until recently, the ANSI (in the US) and CGA (in Canada) safety test standards for gas hearth appliances permitted the dropout time to be as long as three minutes. Unfortunately, there have been instances of delayed ignition of unburned gas in appliances in the field. Many of these incidents have occurred in direct vent appliances which, because of their completely sealed combustion systems, may be more susceptible to accumulation of a large quantity of gas and to a destructive buildup of pressure during an explosion. Although many of these incidents are not related to loss of the pilot flame, the committees responsible for writing the test standards have found it prudent to reduce the permissible dropout time for direct vent appliances to 30 seconds.

The 30-second dropout is already in the new ANSI Z21.50/CGA 2.22 standard for vented gas fireplaces, which replaces previous standards for “vented decorative appliances.” The committee has also requested that laboratories immediately begin testing vented gas fireplace heaters to the 30-second dropout, even though the new standard for them will not be out for about a year.

The new provisions apply only to direct vent appliances. The allowed dropout time for non-direct vent appliances (i.e. “B-vent” appliances) in both standards remains at three minutes.

Compliance with the 30-second dropout requirement, though not difficult to attain, does add some cost to the appliance. Both major suppliers of the combination control valves to the hearth industry (Robertshaw and SIT) offer millivolt controls that use both a thermocouple and a thermopile. The lower mass of the thermocouple controlling the pilot safety electromagnet causes faster cooling after loss of the pilot flame than that of a thermopile, thereby reaching dropout sooner.

Many service technicians and installers perform a pilot dropout test as part of putting a gas appliance into operation for the first time, a useful confirmation that the control system is operating properly before turning it over to the customer. However, such a test must be done carefully. The standard procedure is to light the pilot, turn the main burner by the control valve knob to “On,” and then turn up the thermostat or set the On/Off switch to “On.” The main gas control on the valve is then turned to “Off” to extinguish the main burner and pilot flames, and then turned back to Pilot”, while starting timing. The technician listens for an audible “click” or

“thunk” indicating that the electromagnet has released the safety shutoff valve, and notes the time. (This procedure is not possible on an SIT valve, which prevents the control knob from being turned back to “Pilot” after being turned to “Off” until the safety valve has dropped out. Instead, turn the knob to “Pilot,” turn off all gas with the appliance gas shutoff valve until all flames are extinguished, then turn the gas back on.)

When extinguishing the flame, it is important that the thermostat is turned down, or the On/Off switch is turned to “Off” and the control knob is turned only to “Pilot,” not to the “On” position. If the thermostat or switch is left on, and the main control knob is turned too far, unburned gas will flow from the main burner into the combustion chamber. This can be a lot of gas. For instance, a 35,000 BTU propane burner will allow about 0.25 cubic feet of gas to escape in a little more than a minute. In a 4 cubic foot firebox this will produce a little more than 6 percent concentration of gas in the air, an excellent recipe for an explosion. If the service person or homeowner relights the pilot soon thereafter, damage or injury could result.

Even a 30-second dropout time can allow enough gas to escape to support an explosion. This test must be done purposefully, without distractions, and only by a qualified technician.

Source: HPA Journal, 2000