Appliance®

Engineering Ignition Systems

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by Gordon Swanson, general manager (Controls), Fenwal Controls

EMI and Gas Ignition: The Impact of Electrical Noise

Gas-fired systems can benefit greatly by using direct spark ignition (DSI), provided engineers know how to address potential electrical noise challenges.

Direct Spark Ignition (DSI) is fast, straightforward, and cost-effective, making it the method of choice for the majority of gas-fired systems. But it is not without its challenges. Because the DSI process works by creating a high-voltage spark, DSI controls inevitably generate small to significant amounts of electromagnetic interference (EMI), or "noise," during their trial for ignition. This electrical noise can interfere with both the ignition control and nearby electronic components, affecting overall system performance and reliability.

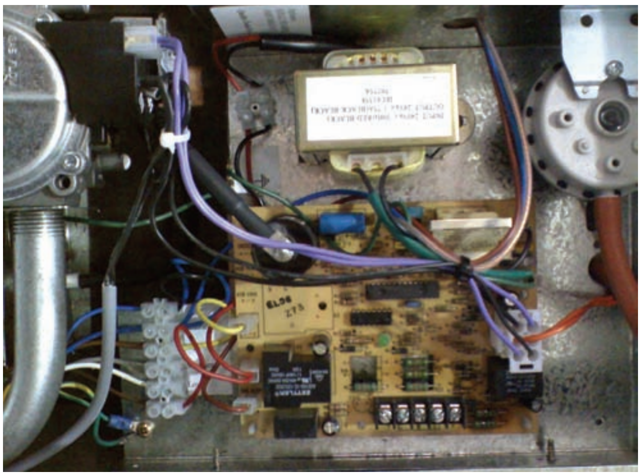

Figure 1. Before: Appliance wiring inducing EMI-related operational and reliability issues.

Design for EMI

Because the effects of EMI can vary with environmental conditions and seemingly small physical changes, EMI is not easy to observe or predict, making it difficult to troubleshoot appliance performance. Proper system design and installation consistency are crucial to avoid the need for extensive (and expensive) testing and trouble-shooting both on the assembly line and in the field. Fortunately, it is possible to create reliable systems that minimize the naturally occurring noise created by the lighting phase of the control.

Best Practices

The techniques used to effectively minimize EMI will depend upon the available space and internal configuration of a given system. The main considerations are cable length, cable type, cable positioning, and grounding. To prevent generating excessive spark energy, engineers must also consider the total time needed to light the burner.

Because high-voltage cables radiate electrical interference, direct-spark installations should use the shortest practical cable length for the specific application. This also has the added benefit of maximizing the energy provided to the spark gap. Although they are more costly, suppression-type spark cables are preferable to copper high-voltage wires, as they significantly reduce noise emission. Keep in mind that the resistive nature of suppression cables also reduces available spark energy. Suppression cables should be kept as short as possible (less than 60 in.).

Modern gas ignition controls are not position-sensitive, so they should be mounted in the orientation that facilitates the most direct wiring and shortest runs. High-voltage and low-voltage cables should be run separately, and not cross over the control or other electrical components and wiring.

When high voltage and control cables must cross paths, make sure they do so at right angles to minimize their contact with one another. Provide as much air gap as practical. To reduce the possibility of signal interaction, avoid long parallel runs and bundled wires. The shortest, straightest distance to the control is always preferable.

In appliances such as ovens and griddles that require more than one ignition control system, install them as independent systems utilizing the aforementioned best practices. Provide space between the controls and orient them to allow optimal wiring configurations for each unit. The power and ground to each control should be run separately—avoid daisy-chaining—with each ground line tied back individually to a common ground point.

Other factors that can greatly affect the proper operation of a direct spark, or any ignition control system include:

1. Provide a single path from each control to a common ground point. This avoids

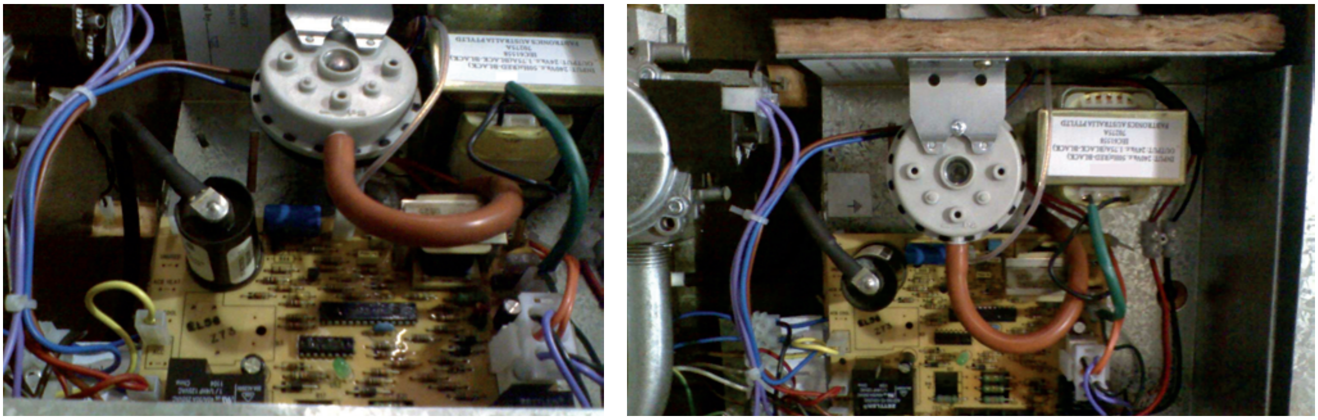

Figure 2. After: Appliance wiring using best practices to minimize EMI issues.

ground loops, which are a common source of electrical noise.

2. Burners and electrodes should have their own ground wire rather than relying on sheet metal or pipe, which can loosen up or corrode over time.
3. Ensure that the common ground point is a solid, stable structure uninterrupted by paint, hinges, or potentially unreliable mechanical connections.
4. High-voltage spark cables should not be tucked against or lay directly on sheet metal, as the energy will couple into the ground system, reduce spark energy, and create noise. This is particularly noticeable on long parallel cable runs along sheet metal surfaces.
5. A burner system optimized to provide the shortest lighting time also generates the least amount of noise. A system that takes 10 sec to light creates more electrical interference than a system that lights in 3 sec.
6. Once an ignition system design and layout is finalized, provide detailed manufacturing documentation to ensure correct installation in the finished product, resulting in consistent performance in the field.
7. Be sure to include instructions for best practices regarding the external wiring for power, communications, and other field-wired devices. Long runs of unprotected connection wires, especially low-voltage control wiring, can introduce losses or noise to the system. Where long runs cannot be avoided, using an isolation relay or other control device is an effective way to minimize potential field wiring issues.
8. Isolate noisy components on a separate power supply or transformer rather than supplying the entire system from one source. This practice can help in two ways: It may prevent noisy components from sharing wiring with sensitive components, and, second, and it may allow all of the wiring for the noisy component to be segregated in one smaller compartment of the system.

Confirming Ignition System Performance

Most direct-spark applications will perform reliably when the design team follows the best practices listed above. Regardless, it is important to conduct thorough testing of each application under a variety of conditions to validate system performance. These tests include but are not limited to:

- Performance over the specified range of input voltages
- Performance over the expected range of spark electrode gaps
- Confirming performance at both cold-start and hot-relight conditions
- Testing with gas supply shut-off to confirm that no noise issues exist over the full ignition cycle through to lockout
- Accounting for expected production variations such as control placement, cable spacing, cable routing, or grounding
- Inspecting for any component issues related to variations from multiple suppliers for high-voltage cable, electrodes, gas valves, etc.
- Testing of each system configuration over the entire model range.

Summary

Designing reliable ignition systems for industrial and residential applications requires adherence to best practices and thorough performance validation. Often, the ignition system is an afterthought in the combustion design process, and this can lead to unnecessary manufacturing trouble-shooting, field issues, and customer dissatisfaction. Utilizing a systems approach and working with controls suppliers early in the design process is one way to reduce manufacturing and service costs and result in reliable products that consistently meet customer requirements. ■

About the Author

Gordon Swanson

Gordon Swanson is the general manager of Fenwal Controls (www.fenwalcontrols.com) in Ashland, MA, U.S. He has more than 25 years of experience in temperature controls, climate controls, and high-volume manufacturing in both the USA and overseas. He received his BSME from Worcester Polytechnic Institute in 1982. If you wish to contact Mr. Swanson, e-mail tim.somheil@cancom.com.