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133-691 Service Note

Solving boiler control inductive and capacitive coupled noise issues

Using Noise Reduction Kit 129-179

Under certain circumstances, during or after a burner cycle, the Boiler Control may 'lose its memory' and revert back to its factory defaults. Erratic operation can occur at the point of **Pilot Trial For Ignition** when the spark transformer is powered. Field experience has shown methods to improve boiler control operation by the following changes.

1. Control cabinet wiring

The routing of low voltage wiring to the Boiler Controller's pressure/temperature sensors and modulating motor 4-20 mA output in relation to the high voltage wiring can be critical. Sensor wires wire-tied to high transient generating wires, such as fuel valves and blower motor contactors, can generate 1500-volt spikes or more. These energy spikes could easily be coupled onto the sensor leads and cause erratic operation or 'loss of memory'.

A. One thing that can be done is to separate the low voltage Boiler Controller's analog sensor cables from the high voltage, high current wires as much as possible. Under ideal conditions, it is best to have the sensor cables enter from one side of the cabinet and have the high voltage leads enter from the other side. It is **NOT** advisable to have both share the same terminal block as this leads to coupling them together. Another solution is to have low voltage wires run continuously into the Boiler Controller's wiring base than to have them closely coupled to other high voltage wires on a terminal block. It is acceptable to share the same terminal block if the high voltage loads are on one end and the low voltage leads on the other end separated from each other. Within a cabinet, it is best to route the low voltage wires separately from the high voltage wires. The rule of thumb is to never have the low voltage cables share the same wiring tray of conduit as the high voltage wires. On exiting the cabinet, it is also imperative to **NOT** share the same conduit as the high voltage leads. Some

installers have found it convenient to bring high and low voltage into the same junction box as well. This is inadvisable.

- B. Separate the 4-20 mA cables for mod motors from the high energy generated by the spark transformer or transients generated by the fuel valves and/or motor starter coil. Energy is transmitted from both the body of the transformer as well as the ignition cable. This becomes apparent at the beginning of the **Pilot Trial For Ignition** when the transformer is first powered or at the end of cycle when the blower motor is de-energized. One solution is to physically separate the 4-20 mA cable from being in close proximity to the transformer and motor starter coil.

In some installations the spark transformer is mounted outside of the cabinet with the 4-20 mA lead wires routed behind the transformer on the inside. The metal wall of the cabinet does **NOT** act as an insulator so locate the cable away from transformer body.

- C. Use shielded cable along with good separation of low and high voltage signals. Using shielded cable to carry the 4-20 mA signals to the modulator motor is also recommended. This is particularly important when the Boiler Controllers are used to control the high and low purge positions and then released to automatic mode. **The accompanying figure on page #4 details various modulator configurations and the suggested wiring methods that should be used to connect the system components.**
- D. 24 Volt power transformers should be located as close to the Boiler Controller as possible. It is better to have a longer run of the primary 120 VAC leads than to have a long run of the secondary 24 VAC leads.

2. Transient Reducers.

- A. To eliminate, or at least tolerate, the transients being generated by the fuel valves, pilot solenoids, and/or blower motor contactors, it is good practice to install MOV's (metal-oxide varistor) across these devices. When MOV's are exposed to high-energy voltage transients, the impedance changes from a very high value to a very low conducting value, thus clamping the transient voltage to a safe and tolerable level. The preferred place to install MOV's is at the transient generating devices themselves rather than on the Boiler Controller's terminals. Transients suppressed at the voltage transient generating device rather than allowing the transient to travel into the cabinet or be coupled onto adjacent cables. The pilot and main fuel valves usually have a junction box. This is a convenient location for connecting MOV's. The coil of the blower motor contactor usually has terminals that also allow easy installation of the MOV's. Use MOV's rated for 220-260 VAC and a power dissipation of 20 joules or higher for 120VAC service.

Fireye provides kit 129-179. The kit contains MOV's that should be installed as described above.

3. Shielding

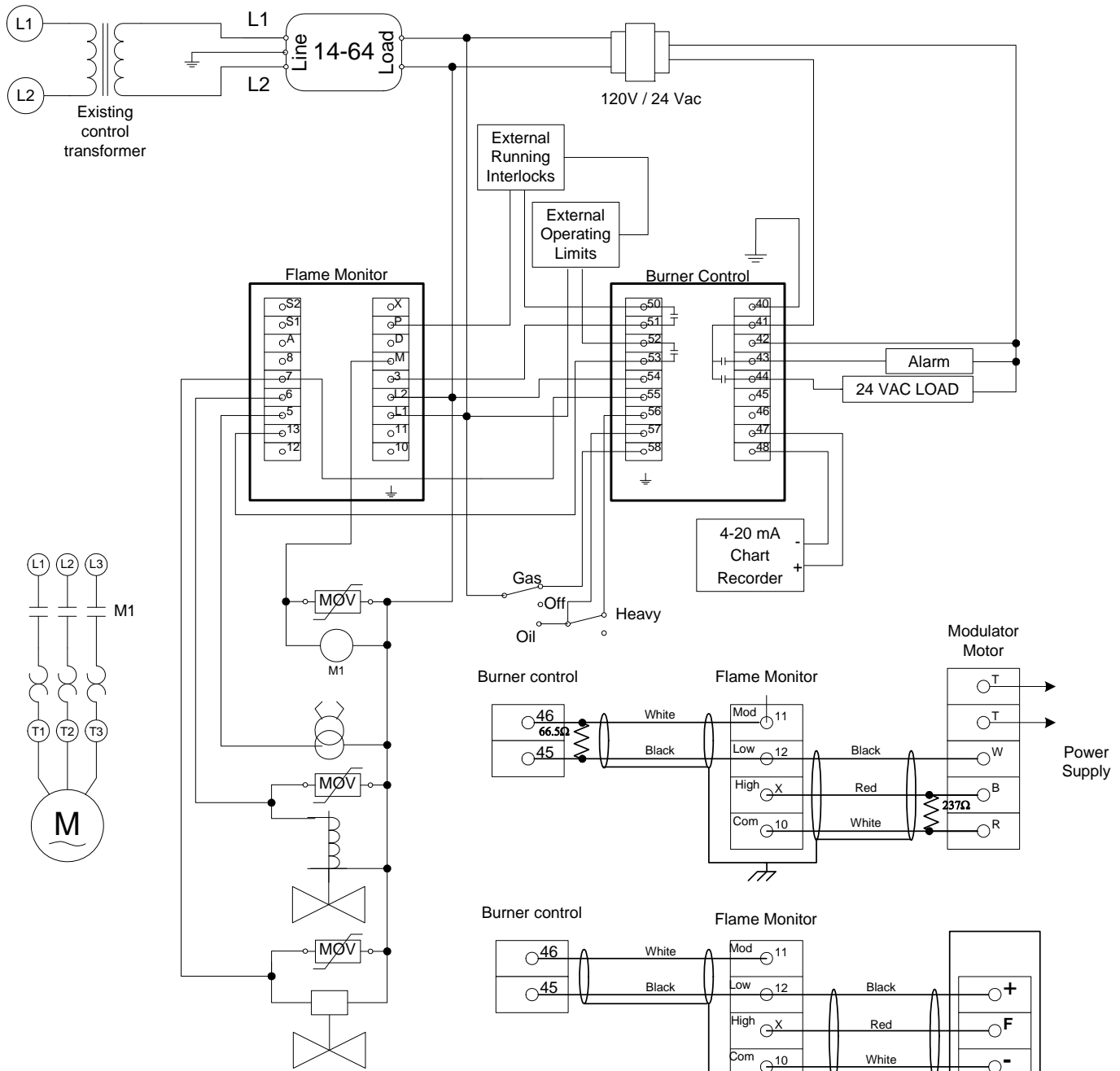
- A. The shields of the sensor wiring must be tied together at the Boiler Controller's end. Simply tie all the shields together. Make sure they are connected to earth ground in the cabinet.
- B. Make the lead wires for the modulation motor circuit of shielded cable. An Auto/Manual switch causes transients on these wires during service or running. **See accompanying figure on page #4 for details.**

4. Miscellaneous

- A. The ignition transformer is a noise-generating device. Normal precautions must be taken to assure the body of the transformer is electrically connected to a grounded frame. Ensure that the high-energy wire is not interfering with any of the low voltage sensor wiring or 4-20mA wiring.

As you can see the Boiler Controller operation can be easily improved. It takes some common sense regarding low voltage and high voltage wiring. Most of the problems occur when the burner either just turns on, ignition transformer is activated, fuel valves are energized or, at the conclusion of post purge, when the blower motor de-energizes. After implementing these easy procedures, the burner should be cycled as many times to examine how effective these solutions are in reducing noise related issues.

RECOMMEND WIRING PRACTICE EXAMPLES



NOTE: Belden 9365 or equivalent must be used when shielded cable is required

