North American StepFire™ Burner Control System General Overview

Bulletin 8061

StepFire™ is an advanced control system that modulates furnace energy input according to demand requirements from a programmable logic controller (PLC), personal computer (PC), or temperature controller. It adjusts the thermal input by cycling multiple burners (within a zone) from high-to-low for controlled periods of time.

Features/Benefits

— Superior Temperature Uniformity

StepFire's high-to-low burner control and produces maximum heat transfer of the furnace gases for optimum temperature uniformity, resulting in better product quality and increased production (see Figure 1).

— Lower Fuel Usage

StepFire operates on-ratio to provide ideal efficiency of heat transfer with minimum fuel.

— High Thermal Turndown

Since StepFire elongates the burner rotation time as heat demand drops, better thermal turndown is produced. StepFire's excess air breakpoint feature throttles the fuel and adjusts burner firing times to achieve further turndown when required.

— Reduced NOx Emissions

At high fire, NOx reduction takes place because of more thorough mixing of the products of combustion with the hot burner gasesand low excess air (XSA).

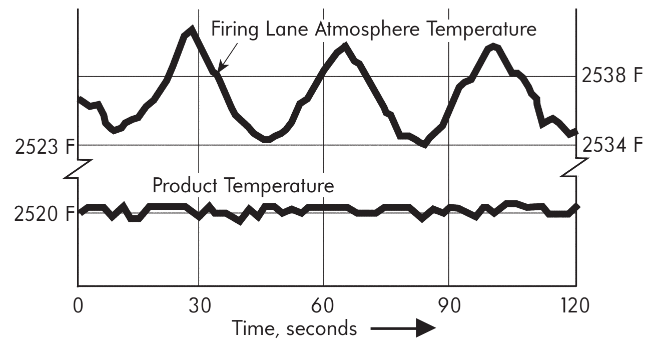


Figure 1. Furnace atmosphere temperature *vs.* product temperature, showing less than 1°F variation in temperature uniformity (reproduced from actual data).

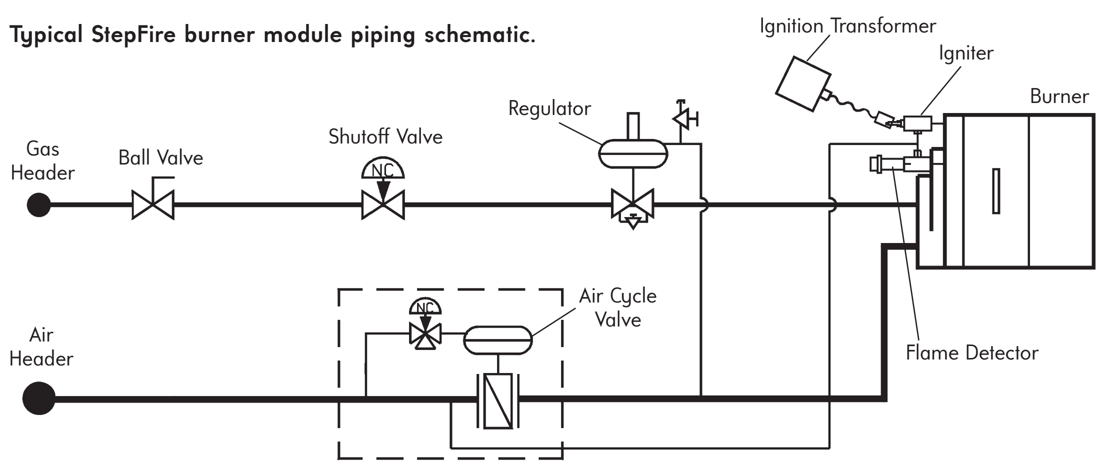
Typical Applications

- **Ceramic Tunnel Kilns**
- **Periodic Kilns**
- **Heat Treat Furnaces**
- **Forge Furnaces**
- **Aluminum Melters/Holders**
- **Galvanizing Tanks**
- **Crucible Furnaces**
- **Reheat Furnaces**
- **Scrap Preheaters**

Typical System

- **Any Burner whose heat release characteristics are optimized at high fire**
- **Air Cycling Valves**
- **High/Low Ratio Regulator**
- **Flame Supervision**
- **StepFire Control System**

Figure 2. Typical StepFire burner module piping schematic.



How it Works

StepFire™ directs the firing of a multiple burner furnace. It adjusts the thermal input by sequentially switching burners from high-to-low for controlled periods of time, providing uniform heat release. As the heat demand decreases, each burner's on-firing time shortens, while its rotation time--the burner's combined high fire and low fire time--lengthens. Conversely, as the demand increases, the burner's on-firing time lengthens, while its rotation time shortens.

Each zone's burners are controlled by solenoids on their air input valve. The fuel valves are pneumatically cross linked to the air via a ratio regulator (see Figure 2).

Example

Burner Firing Operation: 2 burners operating under a (32-second) rotation time at 50% and 75% heat demands.

At 50% demand, burner one is at high fire for 16 seconds, while burner two is at low fire. After 16 seconds, burner one switches to low fire and burner two switches to high fire, as shown in Figure 3.

At 75% demand, burner one runs at high fire at the beginning of the time interval. Burner two gœs to high fire 8 seconds after burner one. Burner one switches to low fire at the 24-second point. Burner two switches to low fire at 32 seconds, the end of the base period, as shown in Figure 4.

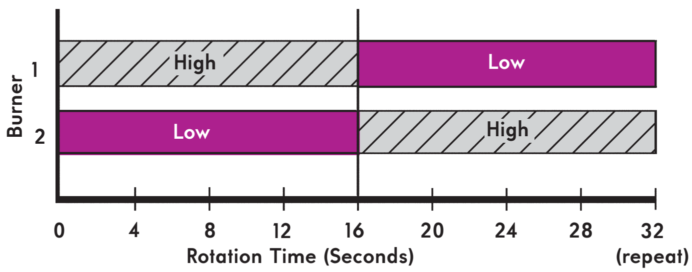


Figure 3. StepFire Operation-2 burners, 50% demand, 32-second rotation time.

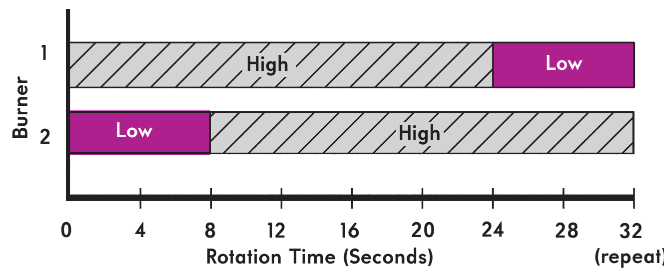


Figure 4. StepFire Operation-2 burners, 75% demand, 32-second rotation time.

Example

Burner Firing Operation: 4 burners operating under a (24-second) rotation time at 50% heat demand.

If step firing four burners in a zone, each burner would be raised to high fire for their 50% time intervals in equal increments within the base rotation period (see Figure 5).

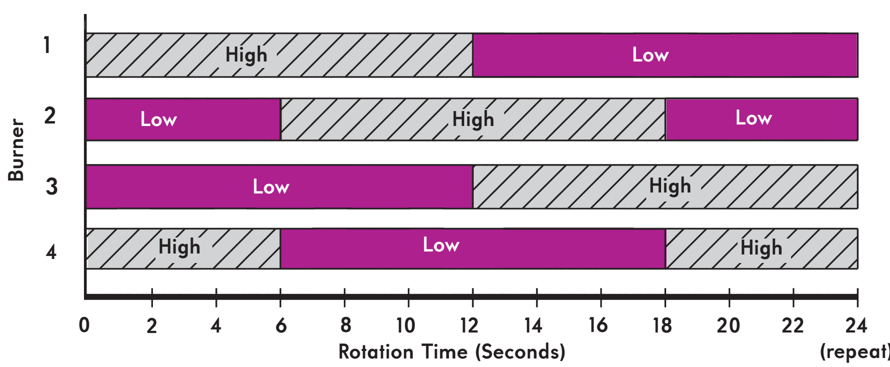


Figure 5. StepFire Operation-4 burners, 50% Demand, 24-second rotation time.

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