

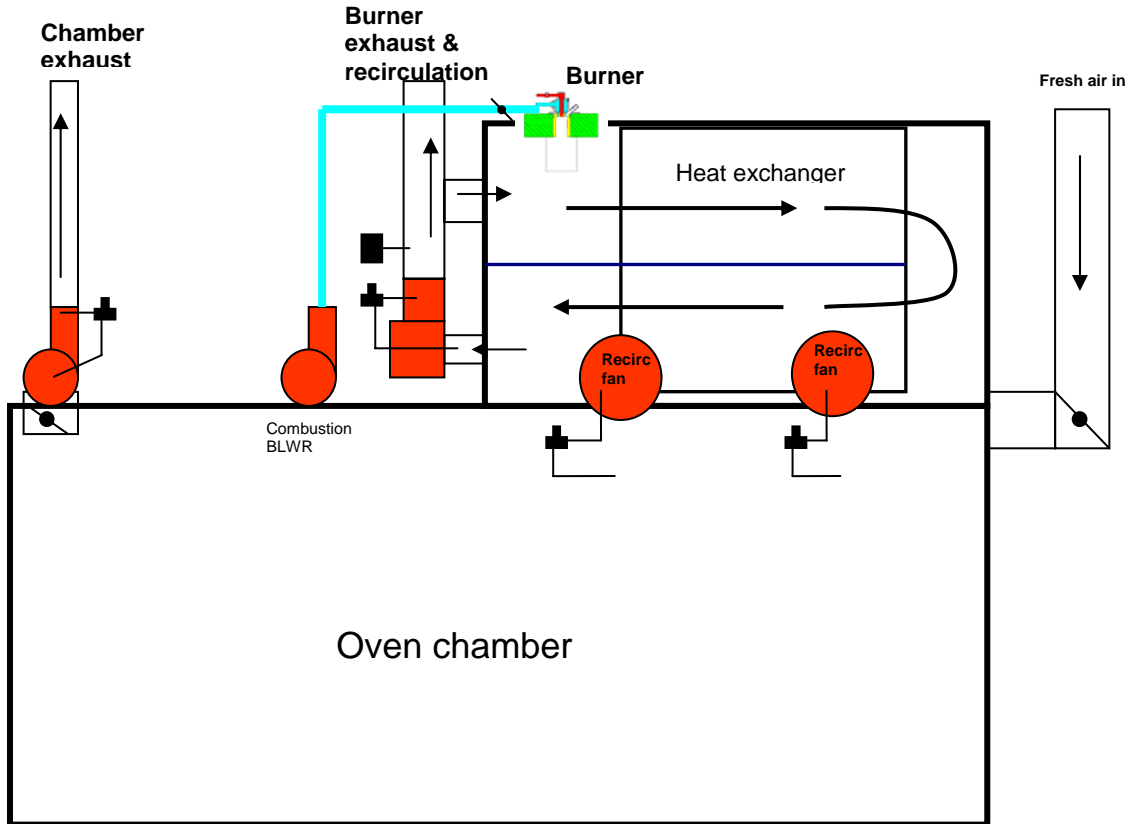
## Energy saving and better heat control.

Bogh Industries LLC has completed a total heater and controls rebuild of a large cure oven. The project was initiated when it was discovered that the existing heat exchangers had reached the end of their duty cycle due to heat damage and numerous repairs over the years. Airflow measurements had also shown that up to 30% of fans capacities were lost by the restriction of these heat exchangers.



The heat exchanger is shown in the picture to the left. The airflow came from the bottom through the top. The very tight spacing of the tubes is a big restriction in the fans ability to re-circulate the air

Fresh air and exhaust was used for low temperature operation due to the low turndown capability of the burners and significant energy losses were obvious.



The figure shows the configuration of the oven in a schematic format.

### **Equipment specifications:**

Oven chamber size: 40' Long x 20' Wide x 12' High

Two heat zones with 10 Mill BTU heat input each.

Heaters: Four Maxon Kinnemax burners firing at up to 5 Mill BTU each.

Certified temperature range 150F-350F +/- 10F

### **Modifications:**

The modifications consist of both burner and control modifications.

1. The heat exchangers was replaced with new 10" diameter "W" burner tubes attached to two easily removed burner plugs in the event of future repairs.
2. Eight (8) 10" Eclipse Tuboflame burners rated at 2.5 Mill BTU each replaces the four (4) 5 Mill BTU Kinedizer burners.
3. Pilot gas train is eliminated with the direct ignition burners.
4. New high resolution control motors controls each burner for precise heat input.
5. The two 50 HP combustion re-circulation fans are eliminated from the design.
6. All fresh air for temperature control is eliminated due to better turn down with the eight burners compared to four burners.
7. Combustion air is controlled with blowers that have VFD and is running at a set pressure which cuts the energy usage by 50%.
8. All temperature control was moved from two Honeywell temperature controllers into the PLC for better control of ramp rates and soak.
9. New easy to use flame safeties is installed.

### **Results:**

The airflow increased with an average of 200FPM measured at the outlets of the supply duct. This resulted in better uniformity in the work zone and the capability to increase certified work temperature to 450F

### **Uniformity**

150F 2.4F spread from highest to lowest TC during soak of 45 placed in the work zone.

250F 3.9F

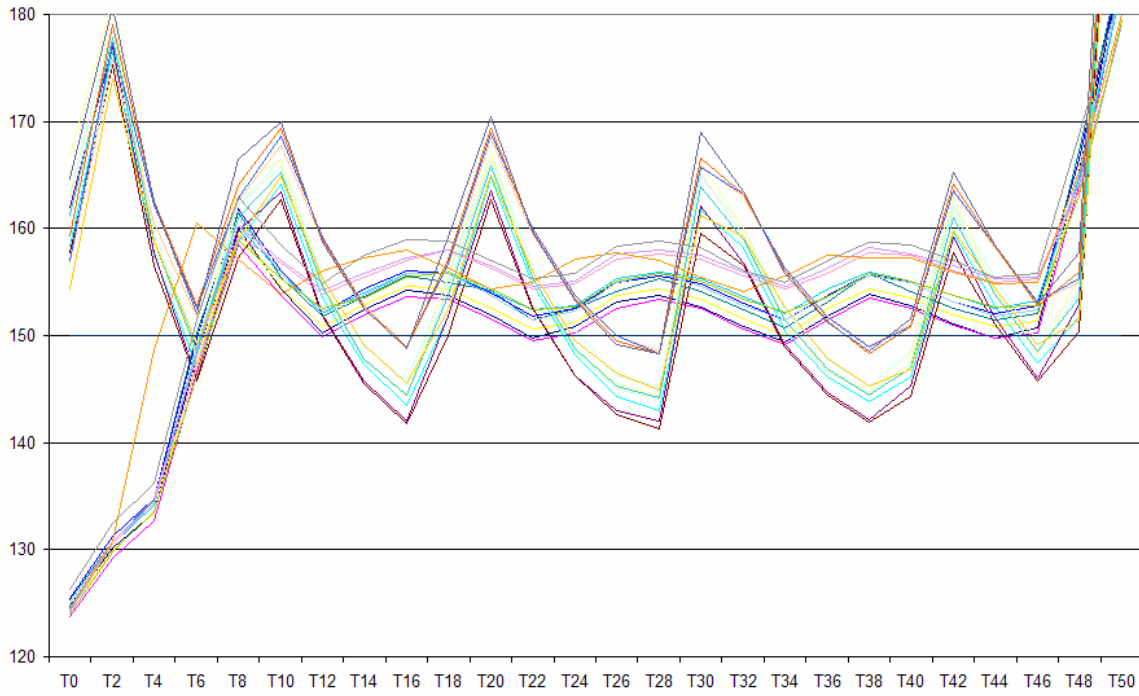
350F 7.0F

450F 11.2F

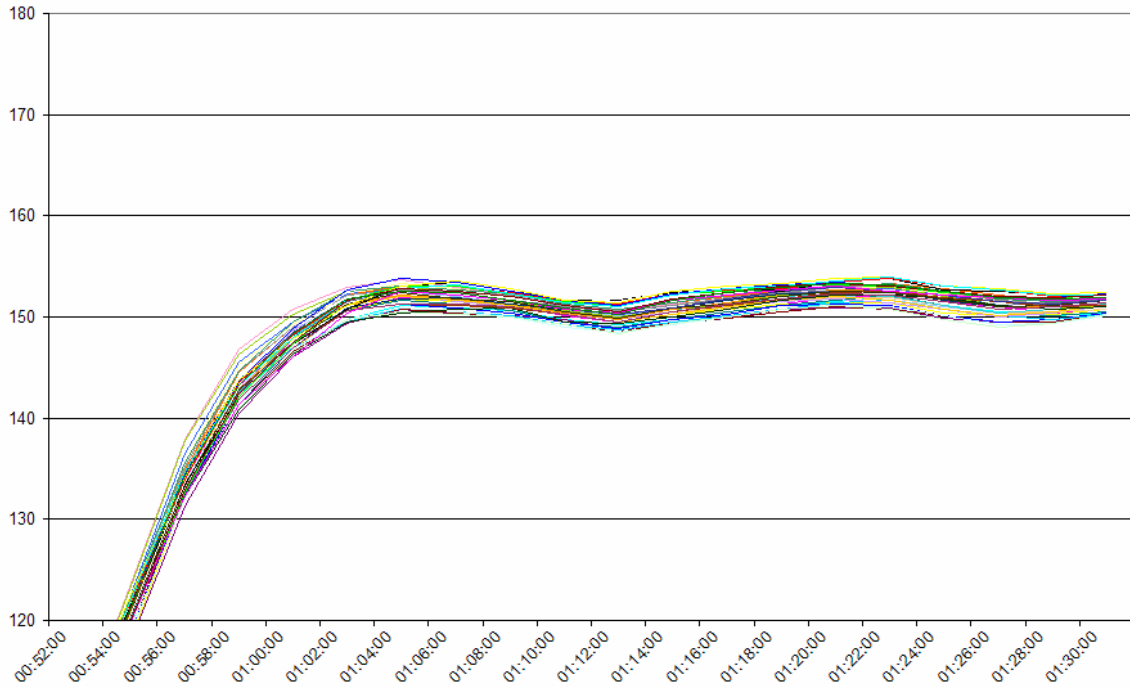
The production spec allows +/- 10F equal to s spread of 20F.

The use of Experture <sup>TM</sup> software is an essential part of the tuning process on an oven this side. Days of tuning was accomplished in a few hours.

The graph below shows how the two zones were controlling prior to the rebuild.



The final graph shows how the oven is now controlling and the significant better uniformity. 40 TC's are graphed. A calibration of the two controls TC's before the final survey made the oven uniformity even better than shown below.



**Energy saving:**

Eliminating two 50 HP combustion recirculation fans, two 15HP exhaust fans (now only used for cool down) and cutting 50% usage from the combustion blowers saves 155HP worth of electricity from every hour of usage on the oven. Estimated \$1,400.00 per year saving.

Eliminating the use of fresh air for low temperature operation is estimated to save \$51,000-\$54,000 per year in natural gas cost. In addition the improved heat transfer has shown that the oven has more heat available than needed for the process.

**Labor saving:**

The updated and simpler maintenance friendly gas train (Pilots is eliminated) and components will save the customer significant in maintenance and reduce down time.

Bogh Industries LLC was the general contractor on this project and with the help of local contractors and the customers maintenance personnel we were able to implement this major rebuild in a little less than five weeks from shutdown to new production.



The picture show the two burner plugs getting the last welding performed during fabrication.

March 16, 2007



This picture show the burner plugs mounted on the machine and the burner train being assembled.

All documentation and gas safety check procedures are now in compliance with the latest NFPA 86 Standard for Ovens and Furnaces.

To obtain additional information regarding retrofits and upgrades. Please contact us through our web site [www.boghindustries.com](http://www.boghindustries.com) or by phone

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