



# SPECIAL FURNACE CO INC

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## GAS VS ELECTRIC

### PRODUCT PURITY AND REPEATABILITY

Electric operation adds nothing to the product. There are no products of combustion. Gas can change the carbon potential; it may have sulfur and other impurities present which could get into the work load. If excess air is used for uniformity there may be more oxidizing potential than you would get if you were firing an electric furnace in air. Electric provides the peace of mind that there are no unknown variables being introduced to the process.

### ATMOSPHERE CAPABILITY

The FN Series furnaces are atmosphere capable. Even when not ordered with that option, the basic design allows for easy and effective conversion at a later date. That means that even if you do not anticipate atmosphere use now you can add it later at little additional cost. In today's changing and volatile economy, flexibility and adaptability should be part of any major purchasing decision. In particular, process quality, repeatability and certifiability are becoming increasingly important. Atmosphere capability is part of this. A furnace is expensive and has a long life. Make sure it can be adapted for your changing requirements.

### INFINITE CONTROLLABILITY

Gas burners have typical turn down ratios of 40:1. This means that they may be overpowered in the lower temperature range or that they may cycle with even the best proportional controls. Ramping may also be difficult to control well. The electric FN furnaces typically use SCR power controls with virtually infinite proportional adjustment. This means that they have almost perfect response to the control output.

### UNIFORMITY

The FN Series, with its multizoning, fan circulation, even distribution of radiant heat source around all four sides, provides guaranteed temperature uniformity over the full range of 300°F to the maximum use temperature of the furnace. This simply is not an issue or question. Gas fired furnaces can have hot spots. It is very difficult to zone a gas furnace, particularly smaller ones. Also, to provide good uniformity with a gas furnace, they often must be designed with excess air capability. This means that all that excess air must be heated up which will reduce the energy efficiency of the furnace.

### INSTALLATION SAVINGS

Attach compressed air and one single point power connection to the FN Series furnace (and atmosphere if you are using it) and you are done. There is no flue or ventilation to install and no gas piping.

### QUIETNESS

The electric FN furnace is almost completely quiet (you can just about hear the fan operating.) Gas furnaces can be very noisy and can add significantly to plant sound pollution which will be subject to increasing regulation in the future. Gas furnaces generate noise with their combustion blowers and from the burners themselves.

### NO SAFETY OR INSURANCE ISSUES

Electric furnaces typically do not have to be reviewed by your insurance underwriter. There are no gas safety issues to be concerned with.

### MAINTENANCE AND ADJUSTMENT

There are no gas burners to adjust. Electric operation is very straightforward. The most complicated adjustment is the initial and one time set up of the SCRs which L&L typically does on start up or at the factory. This is simple enough that most in house maintenance people can do this easily with the most minimal of instruction. Gas systems, on the other hand, particularly multi-burner systems that require balancing for uniformity, can take days of painstaking adjustment by an experienced technician. If fuel composition changes (which can happen during winter or during fuel shortages) this may change the necessary adjustments when uniformity is a critical issue. There is very little routine maintenance on the FN Series.

### AUTOMATIC START UP

An electric furnace can be designed to start up automatically without any people being present. The furnace can be at operating temperature when your shift begins, saving you man hours and/or overtime for a skilled start up person on a gas furnace.

### POLLUTION FREE

There is no pollution from an electric furnace.

### A REVIEW OF THE OPERATING COSTS

Typically the reason people want to use gas is because gas is cheaper than electricity in their area. It is important to analyze this carefully to see how much of an impact this truly has on costs. In some cases it will be significant and may outweigh the many advantages of electric. On the other hand it may be minor or may not even be a factor. Keep in mind flue losses which can be significant in the higher ranges.

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## COMPARISONS BETWEEN FIRING FURNACES WITH GAS AND ELECTRIC

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# HEAT, TIME AND GAS REQUIREMENT CALCULATIONS

## LOAD REQUIREMENTS

The formula for calculating K.W. or BTU requirements is (load in pounds) x (specific heat of the load) x (temperature rise in F) That equals the total number of BTUs required to heat up the load. The specific heat of steel (and most alloys) is .12. The specific heat of most ceramics is .2. Divide this total by 3412 to convert it to K.W.

## FLUE GASSES AND LOSSES IN A GAS FURNACE

Gas furnaces typically operate at a 10:1 gas to fuel ratio. Natural gas typically has a BTU rating of 1,000 BTU's per cubic foot of natural gas. This means if you need 300,000 BTU's to do a job you will use 300 cubic feet of natural gas and 3000 cubic feet of air. This all has to be heated.

Assume 300,000 BTU's total needed with a 10:1 air/gas ratio. 300 (CFH gas) + 3,000 (CFH air):3,300 CFH total x 4 (approximate factor for expansion of gas at 1000F):13,200 / 60 (minutes):220 ACFM (Actual CFM). 3,300 (total CFH) / 60 (minutes):55 SCFM (Standard CFM). The formula for BTU requirements is SCFM x 1.1 x Delta T in F. Requirements to heat up flue gasses: 55 (SCFM) x 1.1 (Factor) x 1120 (Delta T):67,760 (BTU's/hr)

Operating BTU's per hour after first initial heat up:

## FIGURING COSTS OF ELECTRIC

There are two ways you typically get billed for electric power, although it varies from area to area. The first is in K.W. charges; the second is in demand charge. Some areas calculate your peak use of electricity for a time interval of, for instance, 1/2 hour; some areas survey your facility for ratings of equipment. If used at full power during your peak use, a 100 K.W. furnace will add that much to your demand charge. If demand charge are calculated by the peak use method it is possible with modern program controls to prevent use at peak power. It is also possible with the control and SCRs on the FN Series to electronically cap the maximum power output and tailor it exactly to your actual need. It may be more economical to live with a longer heat up time. If your demand charges are calculated by actual K.W. ratings of equipment, L&L can engineer the K.W. fairly exactly to meets your needs so that you are not paying a demand charge for K.W. capacity that you don't need.

The second cost of electricity, K.W. charges, is fairly straightforward. However, the cost per K.W. often changes with the amount you are using. Sometimes larger amounts of K.W. will be discounted. It is possible from the above formulas to figure K.W. needs per load. Based on this and your expected use of the furnace you should be able to figure K.W. use per month. With this information and the K.W. rating of the furnace, your electric company representative should be able to tell you what to expect in electrical operating costs.

## FIGURING COST OF GAS

Once you have your total BTU requirement per load you can divide by 1000 (typical BTU per cubic feet of natural gas) to get your natural gas consumption. Just multiply that times your cost per cubic foot. If you are using propane figure xxx BTU per cubic foot or xxx BTU per gallon of propane.

## EXAMPLES

**Example #1:** You are heating a 1000 pound load in an cold FN 545 furnace to 1500F and soaking it for two hours and then cooling it down in the furnace.

$1000 \times .12 \times (1500-75):171,000$  BTUs to heat load

From table: BTUs to heat furnace =

From table: Heat loss for two hours =

Total BTUs required to do job=

Divide by 3412 to get K.W. (xxx/3412=

To figure potential flue losses in a similar furnace:

CFH natural gas required for job:xxxx / 1000 =

Combustion air required for job:xxxx X 10 =

**Example #2:** You are maintaining the furnace at temperature for 16 hours a day at 1800°F and heating a 500 pound load every 3 hours.