

# process air heaters



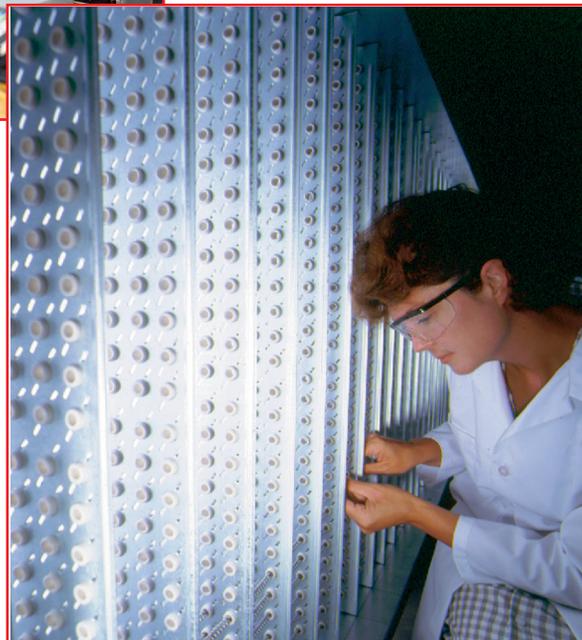
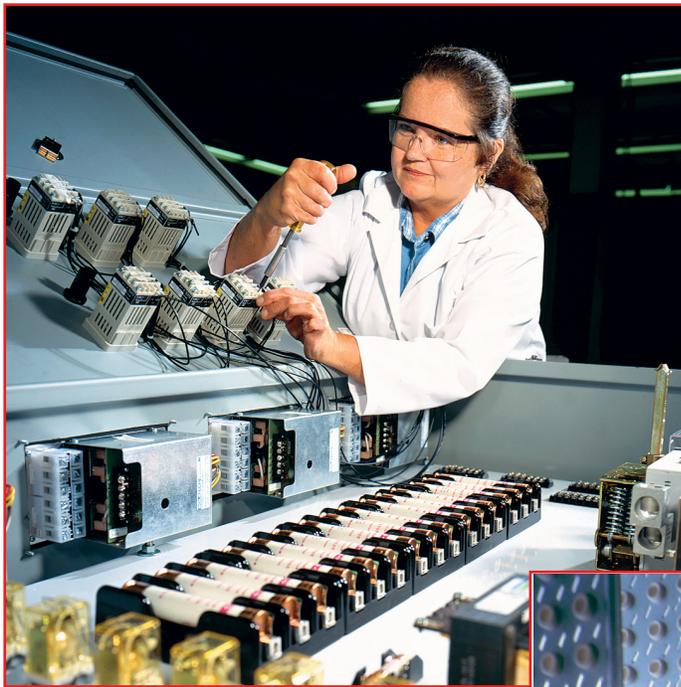
**INDEECO** 

*electric heating and controls*

# Introduction

INDEECO designs and manufactures commercial and industrial electric heating and control systems that set the industry standard for excellence. The company's heating solutions reflect more than 75 years of innovation, product quality and efficient service.

INDEECO Process Air Heaters are your solution for heating forced air in industrial systems efficiently and economically. Our reputation has been built on custom designed heaters where we control the complete design and manufacturing process. This includes the manufacture of heating elements; complex metal framing; control enclosures and electronic controls. Whatever your application, INDEECO can design and provide a high quality process air heater to meet your requirements.



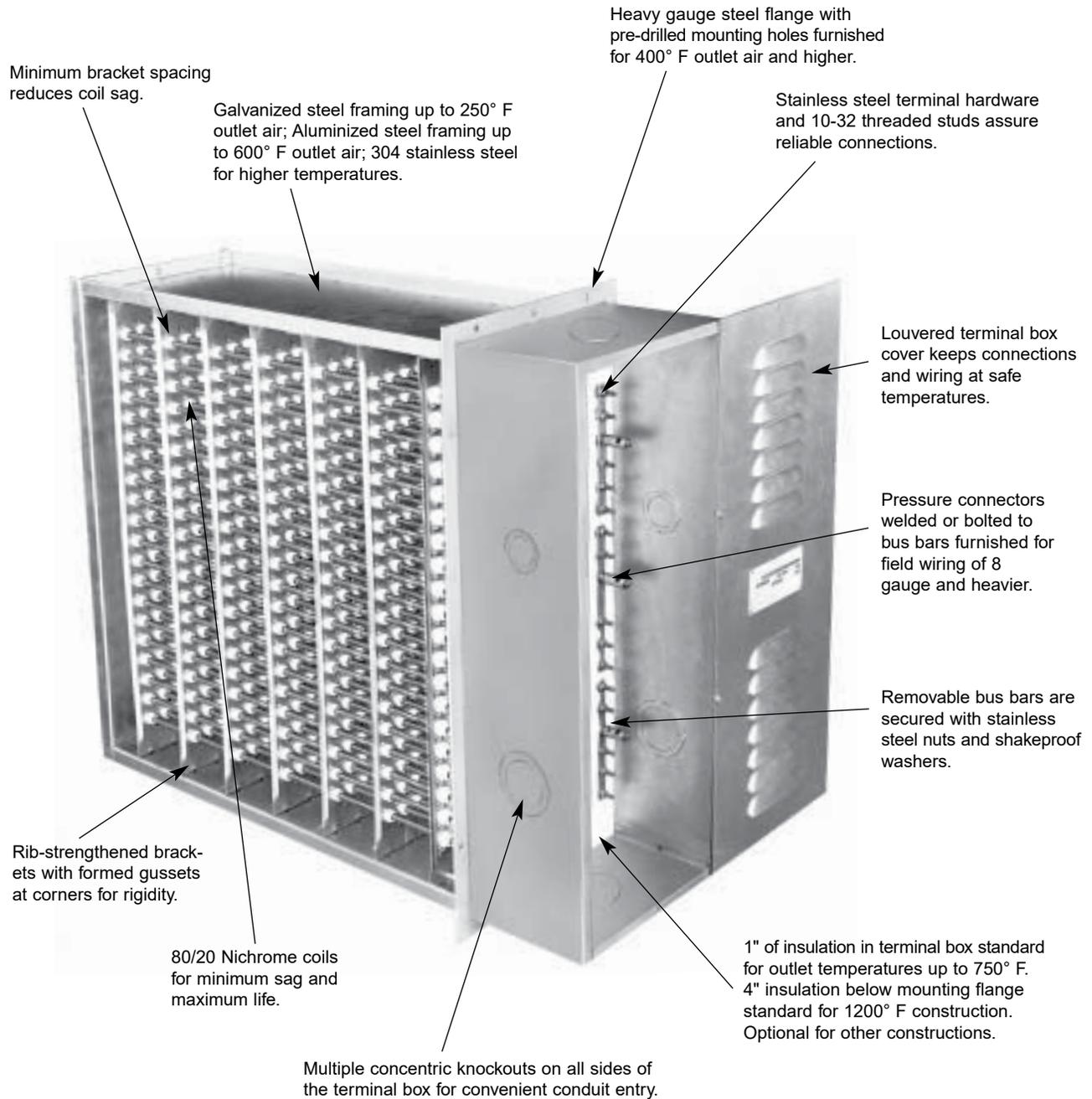
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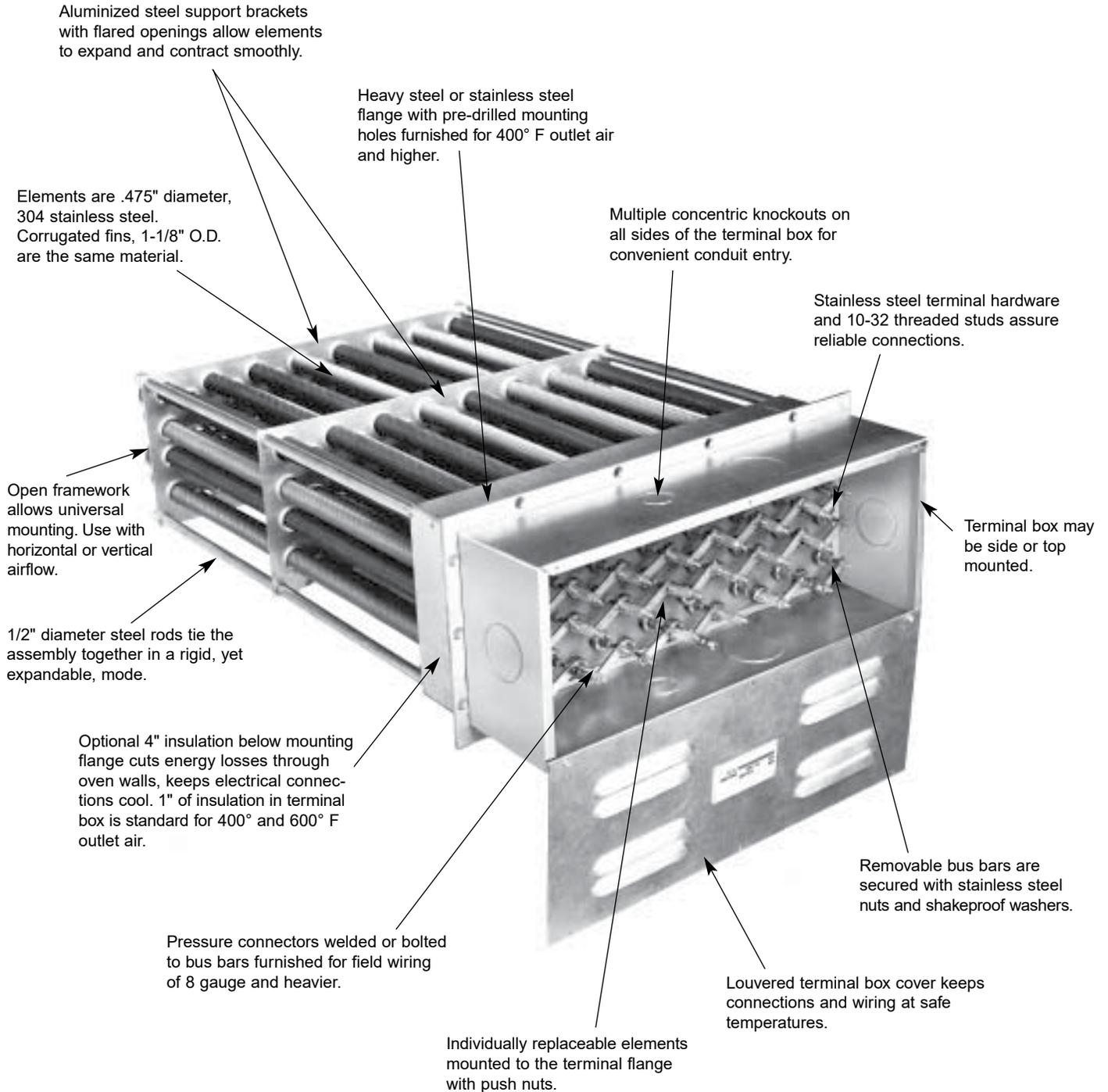
# Construction

All INDEECO process air heaters are designed and built with the following construction features to assure the highest quality and long service life.

## Open Coil Heaters

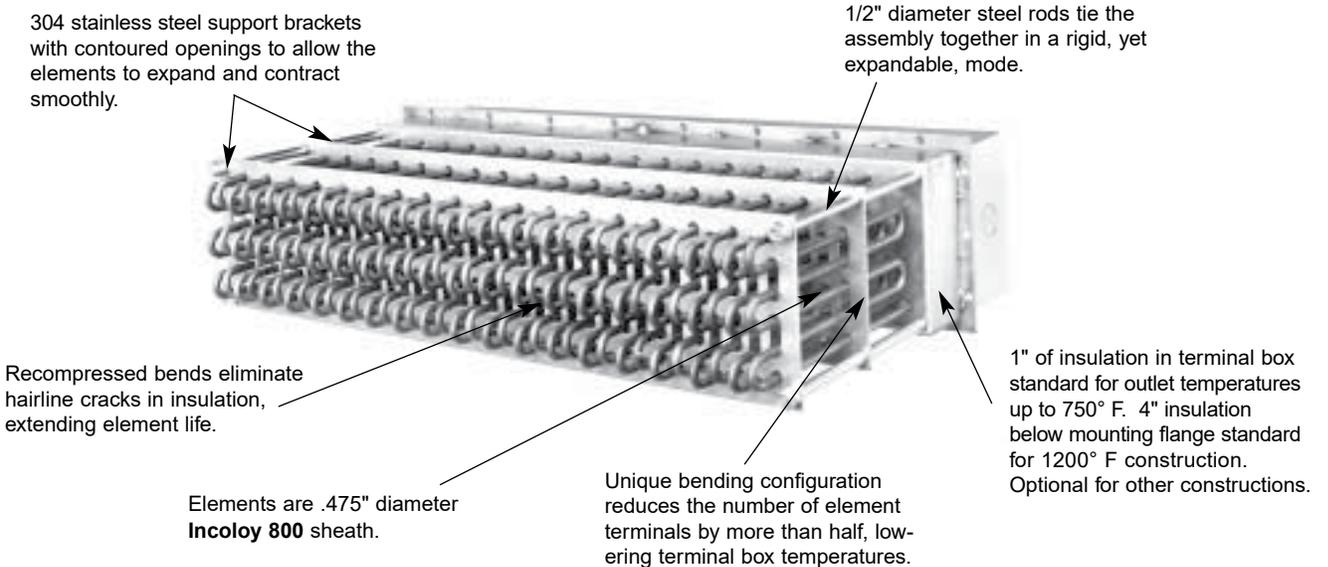
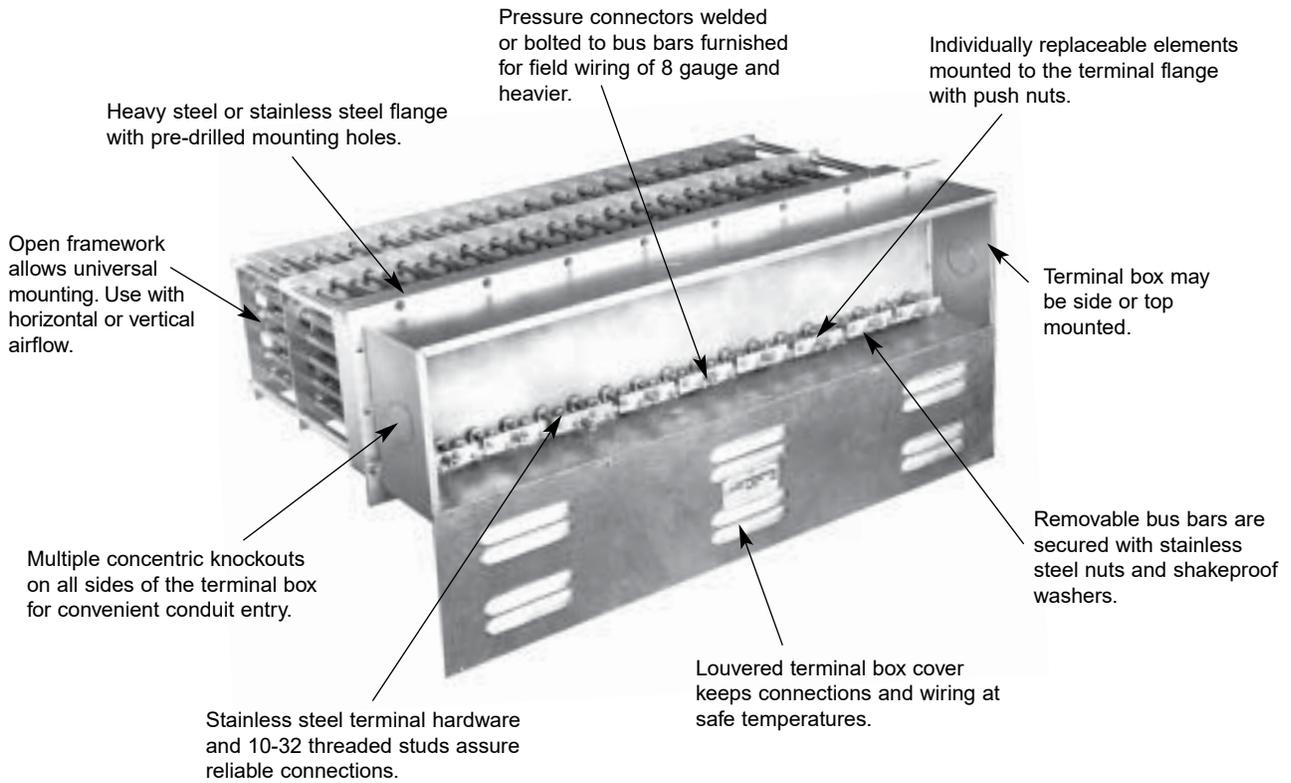


## Finned Tubular Heaters



# Construction

## Tubular Heaters



# Construction/Typical Applications

## 250° F Construction

Low temperature heaters, suitable for 250° F maximum outlet air, are available in both open coil and finned tubular constructions. They are identical to the heaters described on pages 2 and 3 except for the following features.

- The steel flange is omitted. The heater is attached to the oven or duct wall with sheet metal screws through the base of the terminal box.
- Individually replaceable finned tubular elements are flange mounted.
- The terminal box has 1" of insulation.
- A galvanized steel channel frame is provided on three sides, with the element support brackets welded to the frame.



## Typical Applications

INDEECO Process Air Heaters are installed in plenums, ducts or pipes to heat forced air in industrial equipment and systems. A wide variety of heater designs and sizes are available to provide outlet air temperatures up to 1200° F. The air can be either recirculated or fresh. Recirculated air is used to reduce power consumption and heater size.

Fresh air is used when ventilation of the process is necessary. Process air heaters are installed in ovens, furnaces, autoclaves, dryers, conveyor systems, pressure vessels, and other equipment to supply the precise amount of clean heat for:

- Aircraft Manufacturing
- Air Curtains
- Air Drying
- Annealing
- Booster Heating
- Baking
- Batch Heating
- Chemical Processing
- Cooking
- Core Drying
- Cryogenic Exhaust Gas Heating
- Curing
- Dehumidification
- Dehydrating
- Drying
- Exhaust Gas Heating
- Film Drying
- Finishing Systems
- Food Processing
- Fruit Ripening
- Heat Recovery Supplement
- Heat Treating
- Hopper Heating
- Ink Drying
- Laboratory Testing
- Make-up Air Heating
- Metal Finishing
- Motor Winding Burnoff
- Paint Baking/Drying
- Pharmaceutical Manufacturing
- Plastic Curing
- Preheating
- Reheating
- Roasting (nut, coffee, corn, etc.)
- Semi-Conductor Manufacturing
- Sterilizing
- Standby Heating
- Textile Drying
- Varnish Drying
- Wire Manufacturing

# Engineering Information

## Selection Guide

Table I

Factor	Open Coil	Finned Tubular	Tubular
Outlet Air Temperature	1200° F maximum	600° F maximum	1200° F maximum
Weight	The lightest of all three types.	Heavier than open coil. Additional support required for horizontally mounted units, especially for extra long heaters.	Heavier than open coil. Additional support required for horizontally mounted units, especially for extra long heaters.
Coil Temperature	Resistance coils, exposed directly to airstream, run cooler than coils imbedded in sheathed elements.	Coils run hotter than open coil, but cooler than tubular due to heat transfer effect of fins.	Coils run hotter than open coil or finned tubular. Temperatures are kept within safe limits by reducing watt densities.
Pressure Drop	Lowest pressure drop due to large percentage of open space.	Lower pressure drop than tubular, but higher than open coil.	Highest pressure drop because of high percentage of space occupied by tubes.
Electrical Clearance	Large clearances between live parts and ground enable open coil heaters to withstand severe applications.	Clearances between live parts and sheath are small, but filled with compacted insulation.	Clearances between live parts and sheath are small, but filled with compacted insulation.
Safety	Since element is electrically live, do not use if element may be touched by conductive material or personnel.	Because the coil is enclosed in a metal sheath, shock hazard due to contact is eliminated.	Because the coil is enclosed in a metal sheath, shock hazard due to contact is eliminated.
Air Quality	Use only with clean air free of conductive particles or water spray.	Can be used with air containing water droplets or conductive particles unless particles are likely to build up between fins.	Can be used with virtually any type of air quality.
Mechanical Stability	Open coil heaters are most susceptible to damage due to physical abuse.	Finned tubular heaters can withstand more physical abuse than open coil.	Tubular heaters are least susceptible to damage due to physical abuse.
Airflow Uniformity	Airflow must be uniformly distributed to prevent hot spots. Pressure plates can help even out airflow.	Finned tubular heaters are most tolerant of nonuniform airflow. Hot spots tend to be dissipated by sheath and fins.	Less susceptible to hot spots than open coil, but more susceptible than finned tubular.
Velocity	Maximum air velocity of 2500 SFPM	Maximum air velocity of 5000 SFPM	Maximum air velocity of 8000 SFPM
Controllability	Open coil heaters respond quickly to step control because of low thermal inertia. This can produce temperature fluctuations if control system does not compensate.	High thermal inertia makes finned tubular heaters slower to respond, but can produce more uniform temperatures if control system is properly designed.	Thermal inertia is greater than open coil, but less than finned tubular.
Cost	For most applications, open coil heaters are more economical because manufacturing operations are simpler.	Generally more expensive than open coil, but less expensive than tubular because watt densities are higher.	Generally most expensive of the three because of conservative, high temperature design.

## Choosing the Correct Watt Density

Watt density (watts/sq. in. of element surface area) is a critical factor in heater selection. If the watt density is too high for the application, the heater will fail prematurely. If the watt density is too low, the heater cost will be high. Proper watt density is a function of three variables: Heater construction, maximum outlet air temperature and air velocity. Having chosen the construction, watt density can be determined from Table II below, based on temperature and velocity.

The heater listings are labeled for various outlet air temperatures. The assumed minimum velocity and design watt density are shown at the top of each table. If the velocity in your application is lower than indicated in the heater listing, choose a lower watt density from Table II. If your velocity is substantially higher than shown in the heater listing, check it against the values in the table. You may be able to use a higher watt density at a lower price.

**Table II**

Maximum Watt Densities At Outlet Temperatures And Velocities Shown											
Minimum Velocity In Standard FPM	Open Coil Construction							Finned Tubular Construction			
	Outlet Temperature							Outlet Temperature			
	250° F	400° F	500° F	600° F	750° F	1000° F	1200° F	250° F	400° F	500° F	600° F
300	55	45	35	30	25	15	10	45	40	35	30
600	60	55	50	45	30	20	10	55	50	40	35
900	65	65	60	55	35	25	15	65	65	55	45
1200	65	65	65	65	40	30	20	65	65	60	55
1600	65	65	65	65	55	40	25	65	65	65	65
2000	65	65	65	65	65	50	30	65	65	65	65

Maximum Watt Densities At Outlet Temperatures And Velocities Shown							
Minimum Velocity In Standard FPM	Tubular Construction						
	Outlet Temperature						
	250° F	400° F	500° F	600° F	750° F	1000° F	1200° F
300	30	30	28	23	13	6	3
600	30	30	30	25	22	12	7
900	35	30	30	25	25	18	12
1200	35	30	30	30	30	22	16
1600	40	40	40	40	40	30	22
2000	45	45	45	45	45	35	25

## Circuit Sizing

All standard heaters in the listings have circuits that draw a maximum of 48 amps. This enables the use of 50 amp contactors and 60 amp fuses which are generally less expensive than higher rated devices.

For certain applications, however, it may be desirable to have larger circuits – e.g. for use with large SCR controls or to reduce the number of incoming power conductors. In these cases, larger circuits up to approximately 300 amps can be provided. However, in the tubular and finned tubular constructions, circuiting must be consistent with the number of elements shown in the listings.

# Engineering Information

## Pressure Drop Curves

Static pressure drop as a function of air velocity is shown below. Open coil heaters have the lowest pressure drop. Smaller fan motors can often be used with this design. Pressure drop values provided in Charts A through C are

based on the airflow being parallel to the heater C dimension. For tubular design only, consult factory for pressure drop when airflow is parallel to the H dimension.

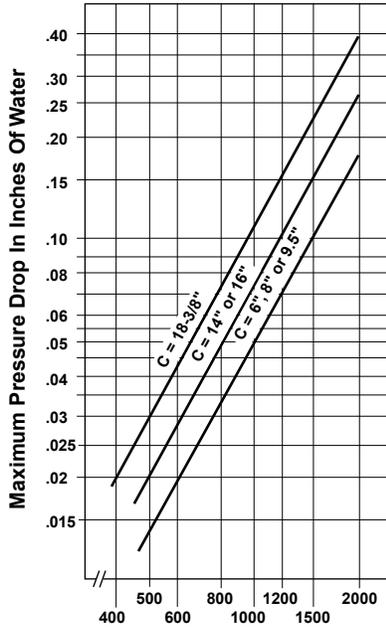


Chart A  
Open Coil Design

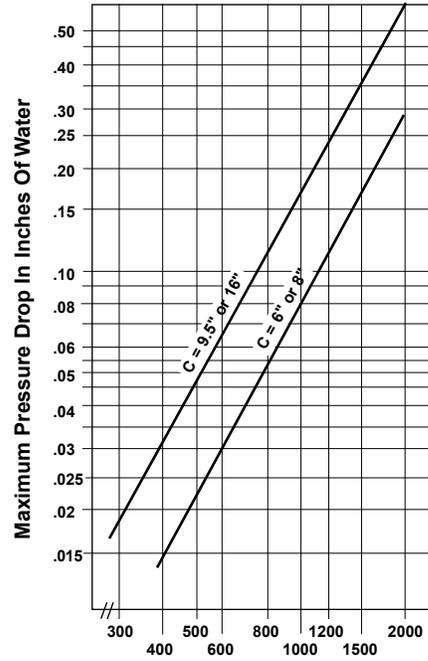


Chart B  
Finned Tubular Design

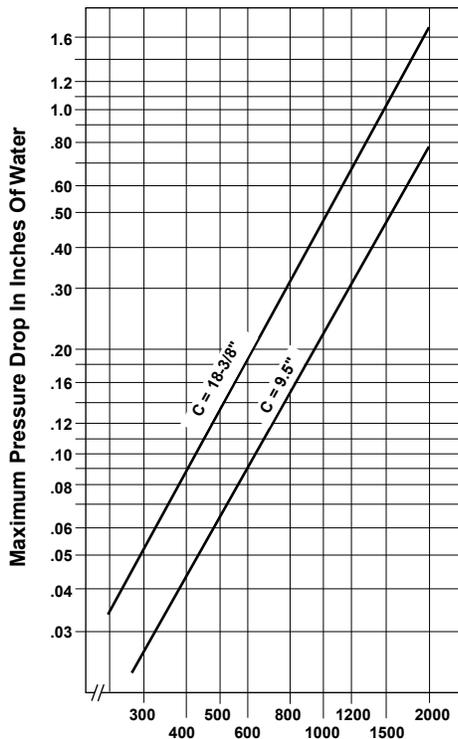


Chart C  
Tubular Design

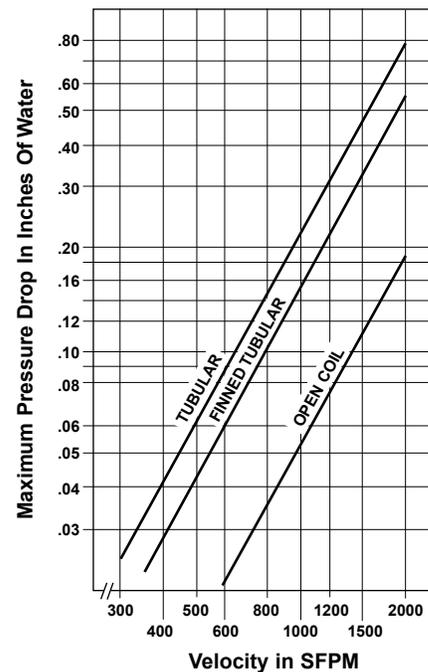


Chart D  
Comparative Pressure Drop Through All Three Designs at 9.5" C Dimension

## Calculating KW Requirements

Once the volume of air in standard cubic feet per minute (SCFM) and the required temperature rise in °F ( $\Delta T$ ) are known, the required kilowatt rating (KW) of the heater can be determined from the following formula:

$$KW = \frac{SCFM \times \Delta T}{3193}$$

Note that CFM is given at standard conditions (SCFM): 80° F and normal atmospheric pressure of 15 psi. The CFM at a higher pressure (P) and inlet air temperature (T) may be calculated as follows:

$$SCFM = CFM \times \frac{P}{15} \times \frac{540}{(T+460)}$$

### Example:

A drying oven, operating at 25 psia (10 psi gauge pressure), recirculates 3000 cubic feet of air per minute through a heater which raises its temperature from 350 to 400° F.

### To select an appropriate heater:

**Step 1:** Convert 3000 CFM at 25 psia and 350° F to CFM at standard conditions using the above formula:

$$SCFM = 3000 \times \frac{25 \text{ psia}}{15} \times \frac{540}{(350^\circ \text{ F} + 460)} = 3333 \text{ SCFM}$$

**Step 2:** Calculate the required KW:

$$KW = \frac{3333 \times (400^\circ \text{ F} - 350^\circ \text{ F})}{3193} = 52 \text{ KW}$$

**Step 3:** Calculate the maximum heater face area (WxH) that will result in an air velocity above the minimum required for standard heater listings:

The 400° F listing on pages 25 through 28 are based on 900 SFPM velocity. Thus, the

$$\text{Maximum Face Area} = \frac{3333 \text{ SCFM}}{900 \text{ SFPM}} = 3.7 \text{ sq. ft.}$$

**Step 4:** Select a heater rated for at least 52 KW with a face area of 3.7 sq. ft. or less.

On page 26 is a group of 54 KW heaters, the first of which has an area of 12" x 30" = 1.0' x 2.5' = 2.5 sq. ft. This item is therefore appropriate. Select either Catalog No. 166N-635-401U (finned tubular) or 165N-335-401U (open coil). Both are rated 65 watts/sq. in.

**Note:** If a larger face area is required, a lower watt density must be selected. For example, if the heater face is 24" wide x 30" high, the velocity will be:

$$\frac{3333 \text{ SCFM}}{24" \times 30"} = \frac{3333 \text{ SCFM}}{2.0' \times 2.5'} = 667 \text{ SFPM}$$

Per Table II, 400° F outlet air and 600 SFPM velocity require maximum watt densities of 55 watts/sq. in. for open coil and 50 watts/sq. in. for finned tubular. Since the 600° F listings on pages 29 through 32 are based upon watt densities of 55 and 45 for open coil and finned tubular respectively, a heater may be selected from this table. The 54 KW item, Catalog No. 166N-848-601U (finned tubular) or Catalog No. 165N-148-601U (open coil) may be used.

# Special Features

A wide variety of special features can be incorporated into INDEECO process air heaters. Please contact us if you have other requirements.

## Built-in Controls

*(Available for heaters operating up to 150° F outlet air temperature.)*

Built-in contactors, fuses, control transformers, and disconnect switches save installation labor and provide single source responsibility for the heater-control package.



## Built-in Thermostat

*(Available for heaters operating up to 150° F outlet air temperature.)*



For automatic control of outlet air temperature. Adjustable over a range of 60-250° F. Outlet temperature will be lower than set point as the thermostat senses heat from elements as well as outlet air. Do not use where outlet air temperature will exceed 150° F. May also be used as an automatic high temperature thermal cutout.

## Built-in Combination Thermostat/Thermal Cutout

*(Available for heaters operating up to 150° F outlet air temperature.)*



Control normally cycles the heater on and off, but shuts the heater down until reset button is pressed if temperature rise is more than 50° F above the control set point. (60-250° F range).

## Remote Mounted Thermostats

For air temperature control or high temperature thermal cutout protection, a bulb and capillary type thermostat can be mounted in a cool location up to 8' away from the heater. A well is provided to mount the thermostat bulb into the airstream. Two models are available:

DA1-6E96: 200-550° F  
DA1-6F96: 300-700° F



## Built-in Thermocouple

Built-in sheathed thermocouple available for high temperature limit. This can be mounted in the airstream or clamped to a tubular/finned tubular element to prevent overheating.

## Built-in Airflow Switch

*(Available for heaters operating up to 150° F outlet air temperature.)*

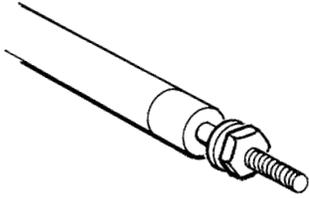
A diaphragm-operated differential pressure switch normally prevents the heater from operating unless the air is flowing. It senses pressure between process air and the terminal housing.



# Special Features

## Moisture-Resistant Element Seal

RTV or epoxy seals are inserted into each end of tubular or finned tubular elements. Recommended when heater may be stored in high humidity or where terminals are exposed to high humidity during operation.



## Angle Iron Frame

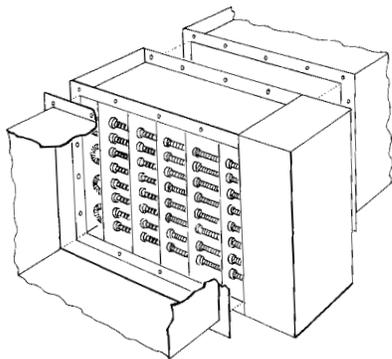
(Available for all tubular and finned tubular heaters except those with 250° F Construction.)

Support rods are replaced by heavy angle iron welded to element supports and terminal box. May increase C and H dimensions. Specify steel or stainless steel angle iron.



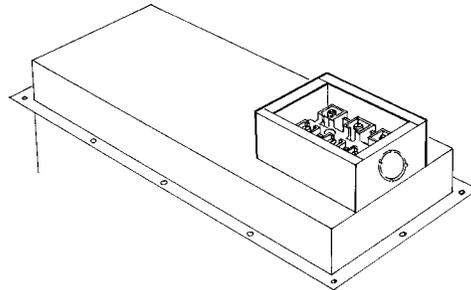
## Flanged Duct Mounting

For attaching heater to external duct flanges. No internal support required. Note that heater face dimensions W and H match the inside dimensions of the duct. While integral flange design is standard on the 250° F Construction, other heaters can be supplied with separate flange mounted plenum sections where required.



## Isolated Junction Box

Power connections are housed in a separate isolated junction box, factory connected to heating element terminals. Used where field wiring is not suitable for high ambient temperatures.



## Flanged Terminal Box

A 1" full flange at end of terminal box is available for mounting heater. Especially useful when heater is mounted inside an oven, where ready access to electrical connections and minimum terminal box size are desirable. No terminal box cover is supplied.

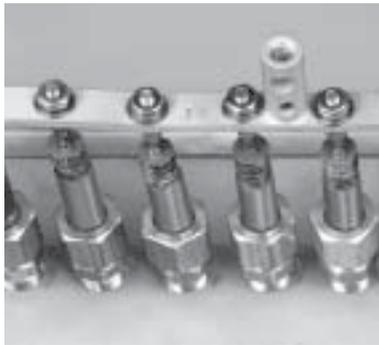


# Special Features

## Airtight Terminal Box

(Available for all tubular and finned tubular heaters except those with 250° F Construction.)

Terminal box isolated from the duct or oven with compression fittings on each element to prevent leakage of process air into terminal box.



## Dust-Tight Terminal Box

For dirty environments. Boxes are welded, stainless steel with hinged, latched cover and Scru-tite hubs for incoming power.

Insulation under the mounting flange is required for all heaters operating above 250° F outlet air.

## Special Wattage, Voltage and Dimensions

INDEECO specializes in custom designed process air heaters.

Voltages up to 600V are available in single or three phase.

## Special Materials

Nonstandard fin, sheath and frame materials available for special applications.

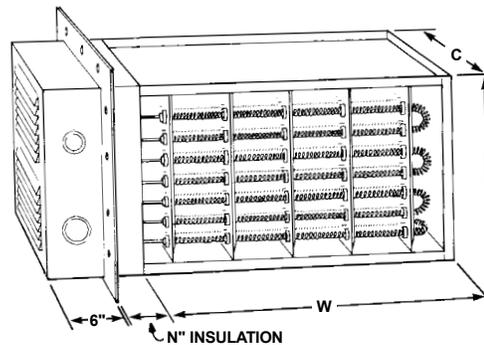
Finned tubular elements available with Monel sheath and fins. Tubular elements available in Monel, 304 and 316 stainless steel and Inconel sheath. Stainless steel frames available for all constructions.

## Nonstandard Circuiting

Additional circuits available on standard heaters. However, number of circuits must be consistent with number of elements in tubular and finned tubular constructions. Number of circuits shown in standard listings can also be reduced for high amperage SCR control.

## Insulation Under Mounting Flange

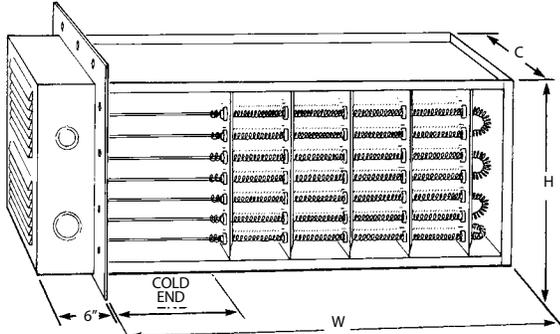
Insulation is furnished under mounting flange to save energy and reduce terminal housing temperatures. This is standard on 1200° F Construction and optional on all others.



# Special Features

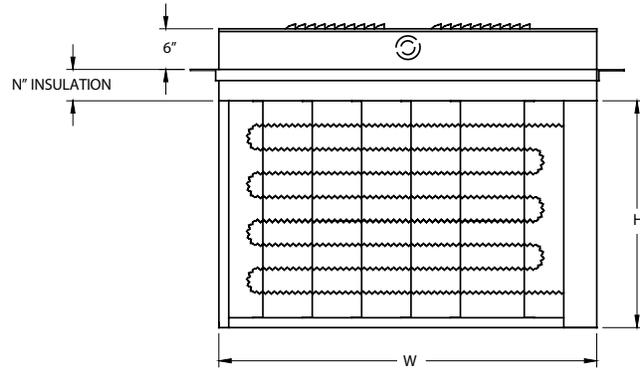
## Special Cold Ends

To clear oven wall or to place active portion of heating element well into airstream, long cold ends may be provided. All heaters have 2" cold ends as standard.



## Top Mounted Heater Construction

A special top mounted design is available on open coil heaters. This feature allows easier installation when there are space restrictions on the sides of the heater but access is available from the top. In these applications, the coils are strung horizontally for proper heating of the airflow.



Front View

## Pressure Plate

A 40% open pressure plate on the inlet side of the heater evens out the airflow pattern where it is not normally uniform. A pressure plate significantly increases the pressure drop across the heater, as shown in the chart.

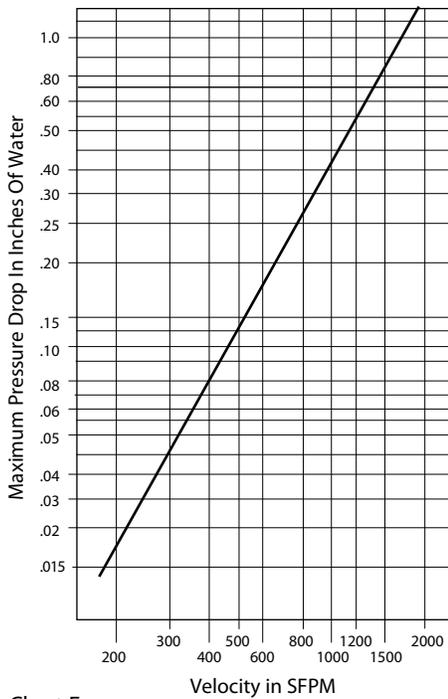
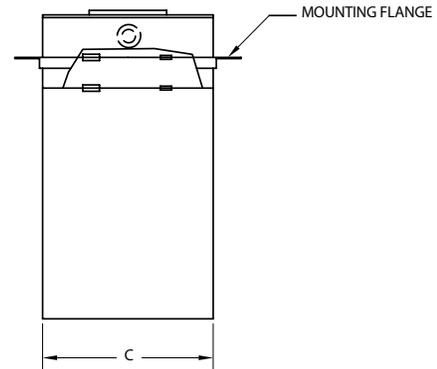


Chart E  
Pressure Drop



Side View

# Custom Designs

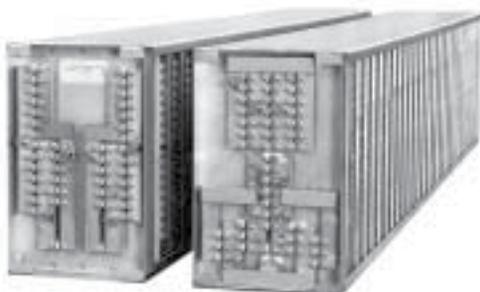
INDEECO has the ability to customize heaters for unusual or special applications. The following are a few examples of our construction and design capabilities.

## Autoclave Heater

This 1500 KW heater accommodates a fan in the center that can either draw or blow air through the open coils. The assembly is typically mounted on the door of an airtight batch oven, eliminating duct work. The design assures uniform air distribution over the coils without a pressure plate or other air straightening device. Units can be built to customer-specified KW ratings, inside and outside diameters, and for outlet temperatures up to 750° F. Field power connections are made to terminals inside the donut.



Two of 15 modules, each rated 624 KW, producing a total of 9360 KW in an autoclave installed in an aircraft facility. Structural components of the aircraft are made from light-weight composites such as boron or graphite fibers bonded with epoxy. Thin sheets of the metal are cut with computerized cutting equipment, layered in a crisscross pattern, then bonded together in the autoclave at pressures up to 300 psi and temperatures up to 1300° F. A nitrogen atmosphere prevents combustion of volatile vapors given off as the epoxy cures. Severe space limitations dictated a unique bus bar pattern, resulting in terminals at both ends of each module.



## Crucible Preheater

Four flanged tubular heaters are mounted into an insulated cap and factory wired to a common junction box (not shown) in the center. The heaters preheat the air in a crucible to 1000° F before molten aluminum is poured into it. This energy saving design replaced an open gas flame which was shot into the crucible before pouring. The low watt density elements generate no heat in the U-bent portions so as to concentrate the heat in the crucible's vertical walls. Terminal boxes are ventilated to prevent overheating of internal wiring. One set of incoming power lines feeds the entire 60 KW load.



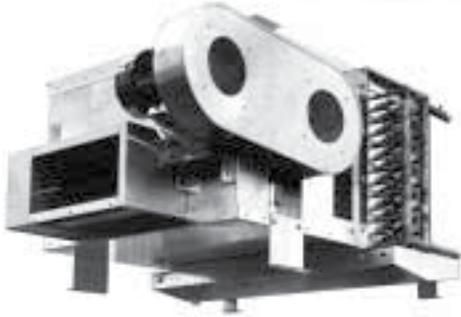
## Processing Agricultural Products

This assembly of heaters, angle iron rack frame and panelboards is typical of systems built to process agricultural products. Applications include drying barley for malt production and dehydrating alfalfa for animal feed. Ratings up to 4300 KW in a single assembly and multi-heater installations up to 72,000 KW have been furnished. The finned tubular design is usually recommended because of environmental job conditions. INDEECO designs and builds all components of the system, giving the owner a turn-key installation. Electric heat is normally preferred over gas since there are no products of combustion, making the end product suitable for human consumption.



## Ripening Room Heater

Heater installed in a package unit that maintains proper temperature and humidity in produce storage rooms. Typical applications include banana ripening and potato or apple storage. Stainless steel finned tubular elements, complete with moisture-proof seals, withstand corrosion caused by water carry-over from the cooling coil and gases released in the ripening process. Heater has built-in controls.



## Environmental Test Chamber Heater

This 543 KW heater operates in an environmental chamber where aircraft components are tested at temperatures up to 1475° F. Stainless steel rods are welded to the bus bars linking the elements together to form circuits of various KW ratings. The rods are bent at 90° and project through the wall of the test chamber so that incoming power connections can be made in a cool location. The entire unit is made from stainless steel.



## Ink Drying

Filtered room air passes over this open coil heater (terminal box only shown) through a high speed blower. The 250° F pressurized air is then piped to a printing press where it bombards the web at a high velocity to evaporate and scrub off ink solvents. Solvent laden air is vacuumed away from the press and back to the dryer by a second high speed blower, then exhausted through a vent.



## Paint Curing System

Part of a shipment of 26 identical tubular oven heaters, rated 240 KW each, to dry paint at temperatures ranging from 300° F to 700° F. Eighteen heaters are installed in a 4320 KW electro-coat cure oven and the remaining eight in a 1920 KW flow-coat cure oven at a tractor fabrication plant. Factory furnished vertical bus bars connect directly to bus duct feeding the entire system. Heating elements are individually replaceable and are secured to the insulated terminal box with compression fittings to prevent air leakage. Each heater slides into the oven on roller bearings to facilitate maintenance. Each oven is divided into several zones and the entire load is SCR controlled.



# Custom Designs

## Bonding Oven

This 13 foot long, 550 KW heater is installed in a batch oven for drying sealants and curing adhesives on parts wrapped in fiberglass for the aerospace industry. This unit replaced a series of open coil heaters, whose coils shorted out due to fiberglass filings in the airstream. It heats 39,000 SCFM of air to 610° F.



## High Temperature Core Construction

This unit produces 1400° F air for hot forming titanium used in aircraft components. Open coil elements are wound on grooved, ceramic cores, resulting in an extremely compact design: The heated chamber produces 60 KW, but measures only 18" cubed. The heater slips through the top of the furnace, with an insulation plug under the mounting flange that matches the thickness of the furnace wall. Electrical connections are made externally to stainless steel lugs, factory welded to stainless bus bars that interconnect the elements below.



## Load Bank

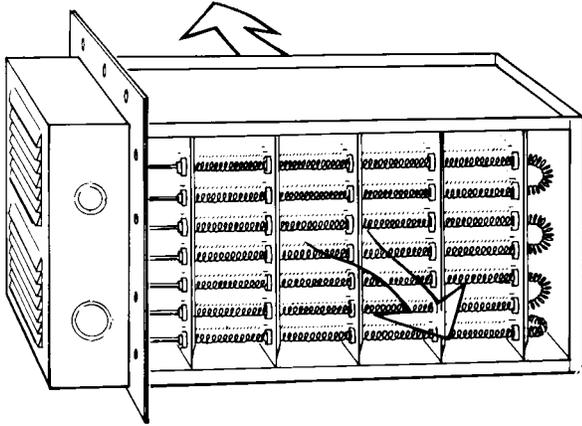
This 126 KW open coil load bank was built to test large stand-by generators. With the use of a separate control panel, the 22 circuit design allows for testing of variable resistance loads at different RPM levels. Routine testing with load banks confirms that generators are functioning properly and are ready for use when needed. This is critical for facilities that cannot be without power, such as hospitals, police stations, fire stations or prisons. Load banks are also used in the testing of main or stand-by generators found on commercial or military aircraft and nuclear submarines.



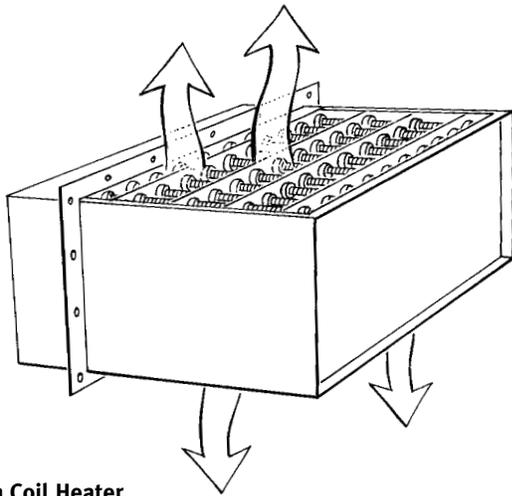
# Installation Guidelines

## Mounting

**Open Coil Heaters** must be mounted horizontally for either horizontal or vertical airflow.

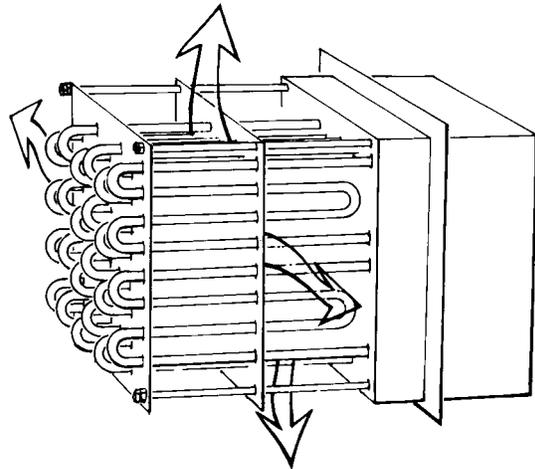


**Open Coil Heater Mounted For Horizontal Airflow**

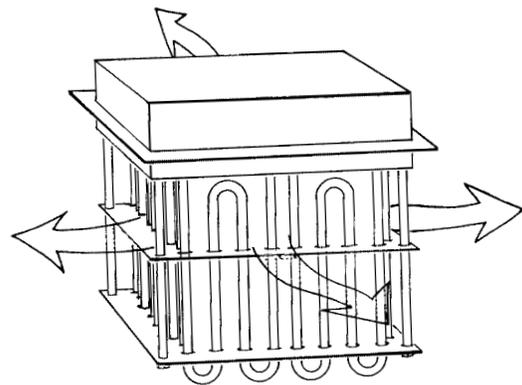


**Open Coil Heater Mounted For Vertical Airflow**

**Tubular and Finned Tubular Heaters** may be mounted either horizontally or vertically. When mounted horizontally, the airflow may be either horizontal or vertical. When mounted vertically, the airflow must be horizontal. All tubular and finned tubular heaters, except those rated for 250° F air, may be rotated 90° about a horizontal axis to fit the available space. For example, a heater 16" high (H dimension) and 9.5" deep (C dimension) may be mounted with either the 9.5" dimension or the 16" dimension parallel to the airflow.



**Horizontally Mounted Tubular Or Finned Tubular Heater**

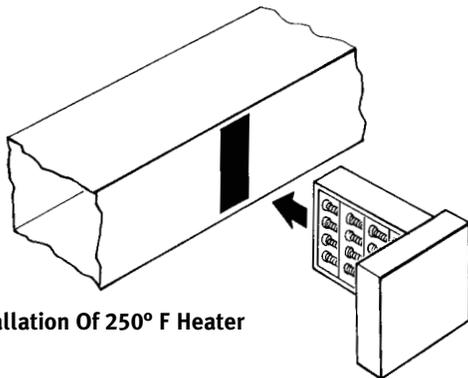


**Vertically Mounted Tubular Or Finned Tubular Heater**

# Installation Guidelines

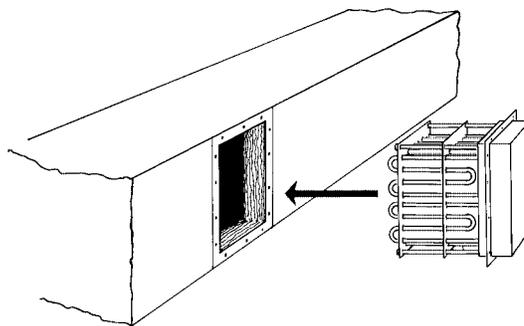
## Support

**Low Temperature Heaters**, suitable for 250° F maximum outlet air, are attached to the ductwork or oven wall with sheet metal screws through the base of the terminal box, as shown.



Installation Of 250° F Heater

**Higher Temperature Heaters**, those rated for 400° F air and higher, must be bolted to the duct or oven wall using the bolt holes provided in the steel flange at the base of the terminal box. Weld nuts or captive nuts may be provided in the wall or a mating flange can be provided in the field.



Installation Of Heater  
Rated For 400° F And Higher

**All Horizontally Mounted Heaters**, except those weighing less than 25 lbs., should be supported inside the oven or duct with rails or hangers. Heaters mounted vertically through the top of the oven or duct need not be supported internally. However, the structure should be adequate to carry the entire heater weight.

## Insulation

If the heater is mounted through an opening in an insulated wall, special precautions must be taken to insure that the entire heated length is in the airstream. Otherwise, the elements shadowed by the insulation will overheat and burn out.

**Open Coil** heaters designed for 1200° F air are provided with 4" of insulation under the mounting plate. If the insulated oven wall is thicker than 4", additional insulation should be provided in the heater. Heaters rated for lower outlet air temperatures may also be provided with insulation under the mounting plate or with extended terminal cold sections to clear the oven wall. The standard open coil construction will clear up to 2" of insulation without modification.

**Finned Tubular** heaters may also be provided with insulation under the mounting plate or extended cold sections. Heaters will clear 2" of insulation without modification.

**Tubular** heaters rated for 1200° F outlet air are provided with 4" of insulation under the mounting flange, which should be extended for heavier oven walls. Heaters rated for 750° F outlet air may also be provided with 4" of insulation under the mounting plate, or may safely be installed through a wall up to 2" thick without modification.

# Installation Guidelines

## Overtemperature Protection

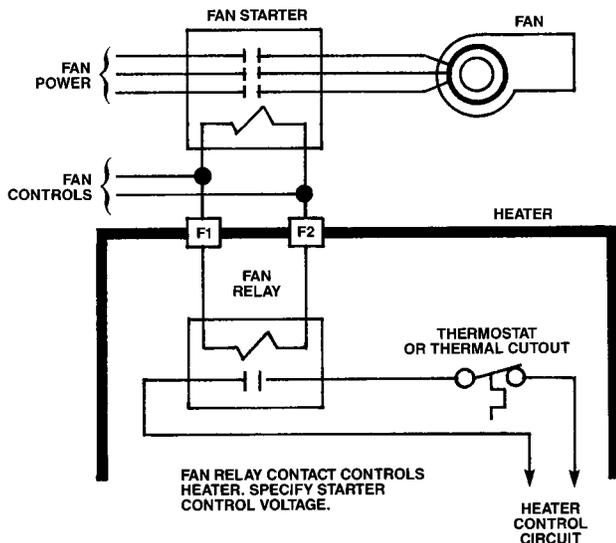
To prevent overheating under adverse conditions, overtemperature protection is recommended. Four types of protective devices are available:

**Thermal Cutout** – A thermostat, set approximately 50° higher than normal operating temperature, can be built into heaters rated for 250° F maximum outlet air. The built-in thermostat or built-in combination thermostat/thermal cutout can be used for this purpose. For higher temperature heaters, a remote thermostat may be used as a thermal cutout.

**Built-in Thermocouple** – A thermocouple, sensing sheath or air temperature, can be wired to a remotely mounted thermocouple controller, set approximately 50° F above normal operating temperature. The controller then acts as a thermal cutout.

**Built-in Airflow Switch** – A differential pressure type airflow switch may be built into 150° F heaters. By sensing the difference in pressure between the process air and the outside atmosphere, it will shut down the heater when there is a sudden drop in process pressure.

**Fan Interlock Relay** – A relay interlocking the fan motor with the heater control circuit will shut down the heater if there is no power to the fan. Note, however, that this device does not protect against a stalled motor nor against a blockage in the airstream that would result in little or no airflow, even though the fan is running.



## Field Wiring

All heaters in the listings are designed for 480 volts, three phase. Therefore, three power leads must be brought into the heater for each circuit through the knockouts provided in the terminal box. The number of circuits is shown in the listings. The current drawn by each circuit is calculated as follows:

$$\text{Line Current} = \frac{\text{Circuit KW} \times 1000}{\text{Voltage} \times 1.73}$$

All wiring should be per the National Electrical Code and any special provisions in local codes. Wiring insulation must be suitable for the terminal box ambient temperature as determined from Chart F. Note that lower temperature wiring insulation may be used on heaters with insulation under the mounting flange.

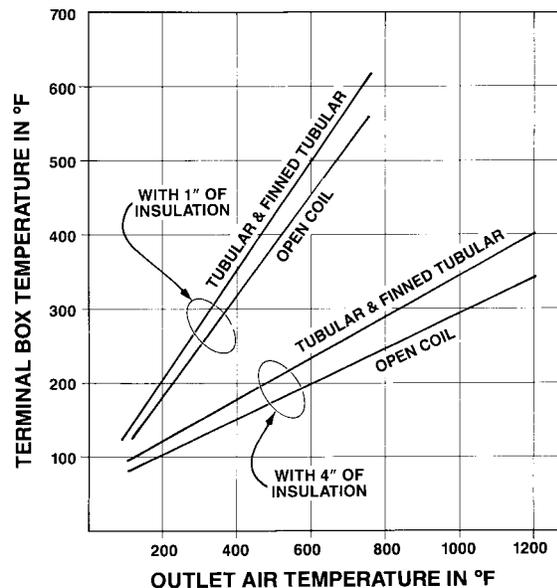
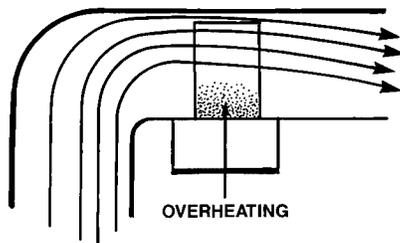


Chart F  
Terminal Box Temperature

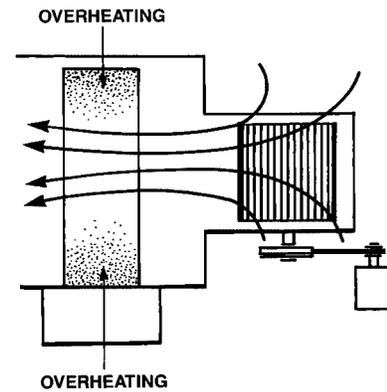
# Installation Guidelines

## Airflow Uniformity

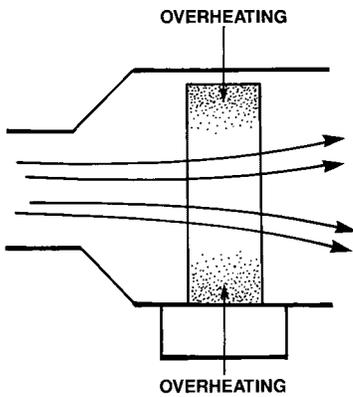
To prevent hot spots, airflow must be uniformly distributed across the heater face. These drawings illustrate typical heater misapplications which result in nonuniform airflow. If one or more of these conditions cannot be avoided, consult INDEECO for assistance. In most cases we can provide a pressure plate or nonheated zones in the heater to overcome these problems.



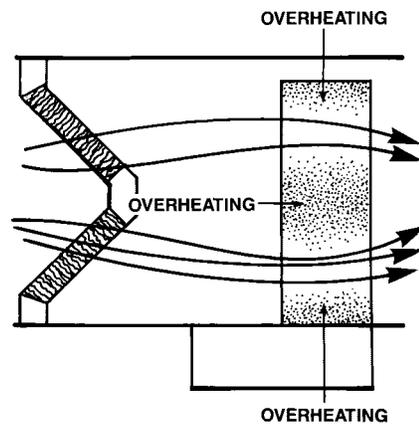
Heater Too Close To Elbow



Heater Adjacent To Transition



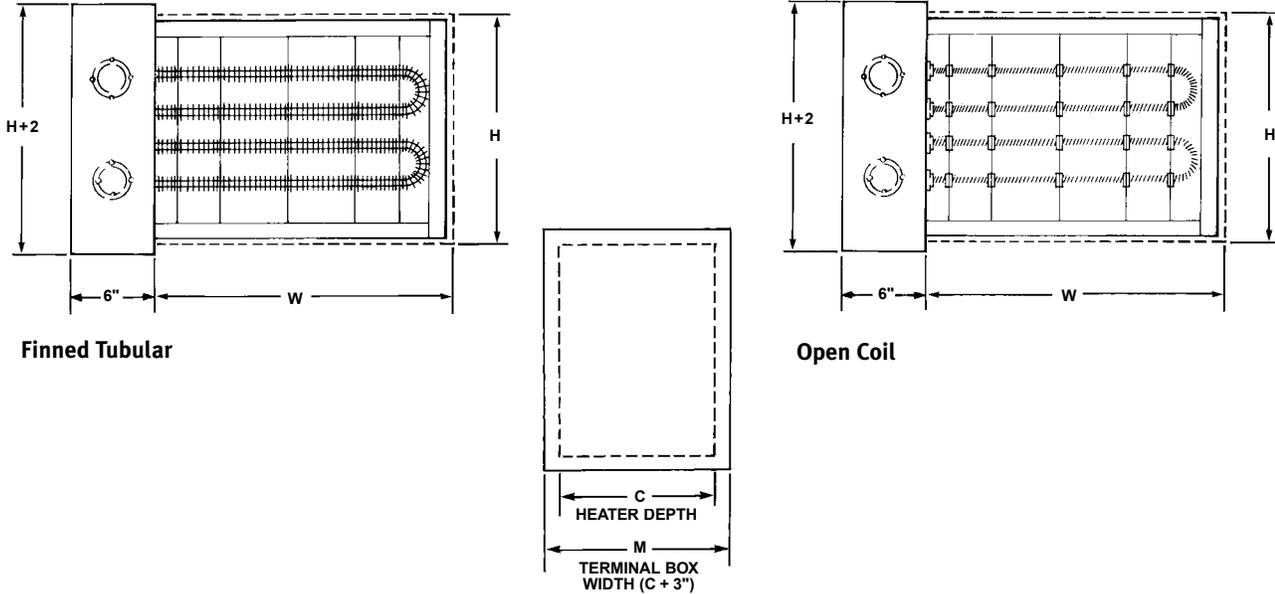
Heater Too Close To Fan



Heater Partially Blocked  
By Filter Or Frame Member

# Heater Listings

## 250° F Maximum Outlet Air Temperature



Heater Listings - 250° F at 900 SFPM Minimum Airflow										
KW	Dimensions (Inches)			Finned Tubular Construction 65 Watts/Sq. In.				Open Coil Construction 65 Watts/Sq. In.		
	W	H	C	Catalog Number	No. Of Elements	No. Of Circuits	Weight (Lbs.)	Catalog Number	No. Of Circuits	Weight (Lbs.)
4.5	12	8	8	166N-401-201U	3	1	10	165N-501-201U	1	10
6	16	8	8	166N-402-201U	3	1	15	165N-502-201U	1	10
9	12	12	8	166N-403-201U	6	1	20	165N-503-201U	1	10
9	20	8	8	166N-404-201U	3	1	15	165N-504-201U	1	10
9	24	8	8	166N-405-201U	3	1	15	165N-505-201U	1	10
12	16	12	8	166N-406-201U	6	1	20	165N-506-201U	1	10
13	12	16	8	166N-407-201U	9	1	25	165N-507-201U	1	15
13	30	8	8	166N-408-201U	3	1	20	165N-508-201U	1	10
18	12	20	8	166N-409-201U	12	1	30	165N-509-201U	1	15
18	16	16	8	166N-410-201U	9	1	30	165N-510-201U	1	15
18	20	12	8	166N-411-201U	6	1	25	165N-511-201U	1	15
18	24	12	8	166N-412-201U	6	1	25	165N-512-201U	1	15
18	36	8	8	166N-413-201U	3	1	25	165N-513-201U	1	15
22	12	24	8	166N-414-201U	15	1	35	165N-514-201U	1	20
24	16	20	8	166N-415-201U	12	1	35	165N-515-201U	1	20
27	12	30	8	166N-416-201U	18	1	45	165N-516-201U	1	25
27	20	16	8	166N-417-201U	9	1	35	165N-517-201U	1	20

Heaters are rated at 480 volts, 3 phase.

# Heater Listings

## 250° F Maximum Outlet Air Temperature

Heater Listings - 250° F at 900 SFPM Minimum Airflow										
KW	Dimensions (Inches)			Finned Tubular Construction 65 Watts/Sq. In.				Open Coil Construction 65 Watts/Sq. In.		
	W	H	C	Catalog Number	No. Of Elements	No. Of Circuits	Weight (Lbs.)	Catalog Number	No. Of Circuits	Weight (Lbs.)
27	24	16	8	166N-418-201U	9	1	35	165N-518-201U	1	20
27	30	12	8	166N-419-201U	6	1	35	165N-519-201U	1	15
30	16	24	8	166N-420-201U	15	1	40	165N-520-201U	1	20
31	12	34	8	166N-421-201U	21	1	50	165N-521-201U	1	25
36	12	38	8	166N-422-201U	24	1	55	165N-522-201U	1	30
36	16	30	8	166N-423-201U	18	1	50	165N-523-201U	1	25
36	20	20	8	166N-424-201U	12	1	40	165N-524-201U	1	20
36	24	20	8	166N-425-201U	12	1	45	165N-525-201U	1	25
36	36	12	8	166N-426-201U	6	1	40	165N-526-201U	1	20
40	12	42	8	166N-427-201U	27	2	60	165N-527-201U	2	35
40	30	16	8	166N-428-201U	9	2	45	165N-528-201U	2	25
42	16	34	8	166N-429-201U	21	2	55	165N-529-201U	2	30
45	12	24	16	166N-430-201U	30	2	65	165N-530-201U	2	25
45	20	24	8	166N-431-201U	15	2	50	166N-531-201U	2	25
45	24	24	8	166N-432-201U	15	2	50	165N-532-201U	2	30
48	16	38	8	166N-433-201U	24	2	65	165N-533-201U	2	35
50	12	30	16	166N-434-201U	33	2	70	165N-534-201U	2	35
54	12	30	16	166N-435-201U	36	2	75	165N-535-201U	2	35
54	16	42	8	166N-436-201U	27	2	70	165N-536-201U	2	40
54	20	30	8	166N-437-201U	18	2	60	165N-537-201U	2	30
54	24	30	8	166N-438-201U	18	2	60	165N-538-201U	2	35
54	30	20	8	166N-439-201U	12	2	55	165N-539-201U	2	30
54	36	16	8	166N-440-201U	9	2	55	165N-540-201U	2	25
58	12	34	16	166N-441-201U	39	2	85	165N-541-201U	2	35
60	16	24	16	166N-442-201U	30	2	75	165N-542-201U	2	30
63	12	34	16	166N-443-201U	42	2	90	165N-543-201U	2	35
63	20	34	8	166N-444-201U	21	2	70	165N-544-201U	2	35
63	24	34	8	166N-445-201U	21	2	70	165N-545-201U	2	40
66	16	30	16	166N-446-201U	33	2	80	165N-546-201U	2	40
67	12	38	16	166N-447-201U	45	2	95	165N-547-201U	2	40
67	30	24	8	166N-448-201U	15	3	65	165N-548-201U	2	35
72	12	38	16	166N-449-201U	48	2	100	165N-549-201U	2	40
72	16	30	16	166N-450-201U	36	2	90	165N-550-201U	2	40
72	20	38	8	166N-451-201U	24	2	80	165N-551-201U	2	40
72	24	38	8	166N-452-201U	24	2	80	165N-552-201U	2	45
72	36	20	8	166N-453-201U	12	2	65	165N-553-201U	2	30
76	12	42	16	166N-454-201U	51	3	65	165N-554-201U	2	45
78	16	34	16	166N-455-201U	39	3	105	165N-555-201U	2	45

Heaters are rated at 480 volts, 3 phase.

# Heater Listings

## 250° F Maximum Outlet Air Temperature

Heater Listings - 250° F at 900 SFPM Minimum Airflow										
KW	Dimensions (Inches)			Finned Tubular Construction 65 Watts/Sq. In.				Open Coil Construction 65 Watts/Sq. In.		
	W	H	C	Catalog Number	No. Of Elements	No. Of Circuits	Weight (Lbs.)	Catalog Number	No. Of Circuits	Weight (Lbs.)
81	12	42	16	166N-456-201U	54	3	110	165N-556-201U	3	45
81	20	42	8	166N-457-201U	27	3	85	165N-557-201U	3	45
81	24	42	8	166N-458-201U	27	3	85	165N-558-201U	3	50
81	30	30	8	166N-459-201U	18	3	80	165N-559-201U	3	45
84	16	34	16	166N-460-201U	42	3	100	165N-560-201U	3	45
90	16	38	16	166N-461-201U	45	3	110	165N-561-201U	3	50
90	20	24	16	166N-462-201U	30	3	95	165N-562-201U	3	40
90	24	24	16	166N-463-201U	30	3	95	165N-563-201U	3	45
90	36	24	8	166N-464-201U	15	3	80	165N-564-201U	3	40
95	30	34	8	166N-465-201U	21	4	90	165N-565-201U	3	50
95	16	38	16	166N-466-201U	48	3	115	165N-566-201U	3	50
100	20	30	16	166N-467-201U	33	3	105	165N-567-201U	3	45
100	24	30	16	166N-468-201U	33	3	105	165N-568-201U	3	55
102	16	42	16	166N-469-201U	51	3	120	165N-569-201U	3	55
108	16	42	16	166N-470-201U	54	3	130	165N-570-201U	3	55
108	20	30	16	166N-471-201U	36	3	110	165N-571-201U	3	45
108	24	30	16	166N-472-201U	36	3	110	165N-572-201U	3	55
108	30	38	8	166N-473-201U	24	4	100	165N-573-201U	3	55
108	36	30	8	166N-474-201U	18	3	95	165N-574-201U	3	50
117	20	34	16	166N-475-201U	39	4	120	165N-575-201U	3	50
117	24	34	16	166N-476-201U	39	4	120	165N-576-201U	3	60
122	30	42	8	166N-477-201U	27	5	110	165N-577-201U	4	60
126	20	34	16	166N-478-201U	42	4	125	165N-578-201U	4	55
126	24	34	16	166N-479-201U	42	4	130	165N-579-201U	4	60
126	36	34	8	166N-480-201U	21	4	110	165N-580-201U	4	55
135	20	38	16	166N-481-201U	45	4	135	165N-581-201U	4	60
135	20	38	16	166N-482-201U	45	4	135	165N-582-201U	4	55
135	24	38	16	166N-483-201U	45	4	135	165N-583-201U	4	65
135	30	24	16	166N-484-201U	30	5	125	165N-584-201U	4	55
144	20	38	16	166N-485-201U	48	4	145	165N-585-201U	4	55
144	24	38	16	166N-486-201U	48	4	145	165N-586-201U	4	65
144	36	38	8	166N-487-201U	24	4	125	165N-587-201U	4	60
150	30	30	16	166N-488-201U	33	6	135	165N-588-201U	4	65
153	20	42	16	166N-489-201U	51	5	155	165N-589-201U	4	60
153	24	42	16	166N-490-201U	51	5	155	165N-590-201U	4	70
162	20	42	16	166N-491-201U	54	5	160	165N-591-201U	5	60
162	24	42	16	166N-492-201U	54	5	160	165N-592-201U	5	70
162	30	30	16	166N-493-201U	36	6	145	165N-593-201U	5	65
162	36	42	8	166N-494-201U	27	5	135	165N-594-201U	5	65

Heaters are rated at 480 volts, 3 phase.

# Heater Listings

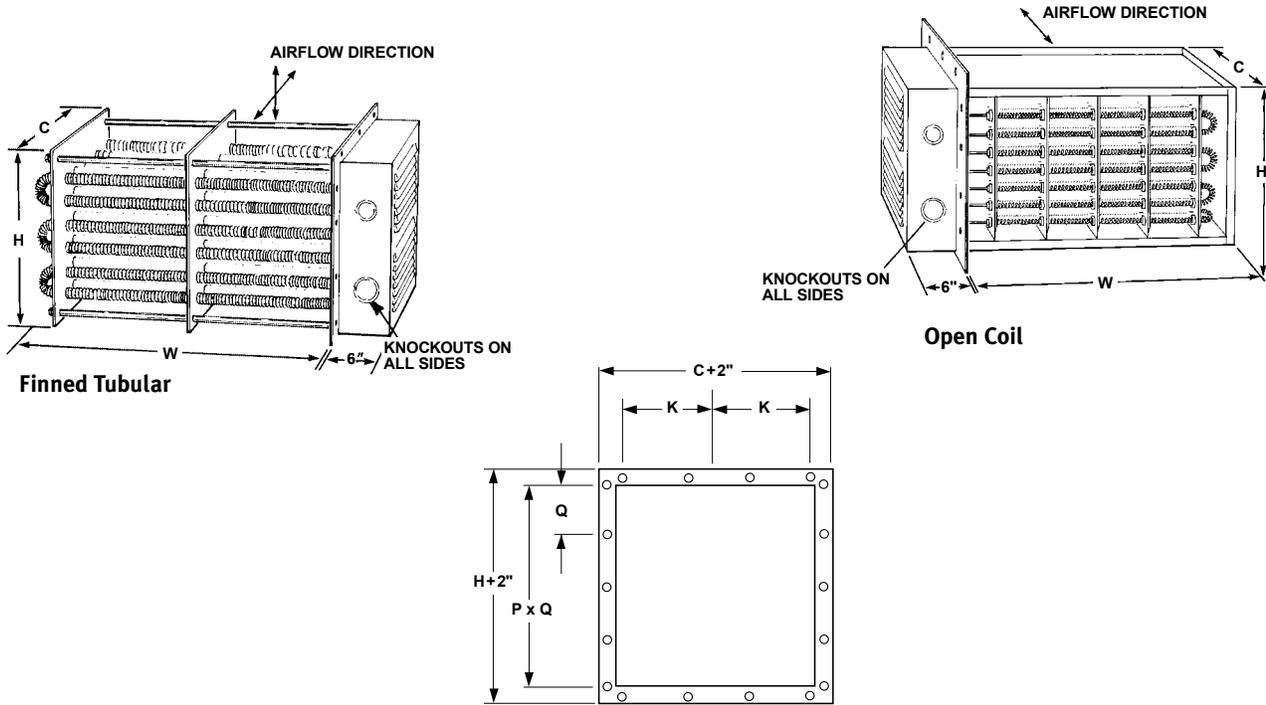
## 250° F Maximum Outlet Air Temperature

Heater Listings - 250° F at 900 SFPM Minimum Airflow										
KW	Dimensions (Inches)			Finned Tubular Construction 65 Watts/Sq. In.				Open Coil Construction 65 Watts/Sq. In.		
	W	H	C	Catalog Number	No. Of Elements	No. Of Circuits	Weight (Lbs.)	Catalog Number	No. Of Circuits	Weight (Lbs.)
175	30	34	16	166N-495-201U	39	7	155	165N-595-201U	5	70
180	36	24	16	166N-496-201U	30	5	150	165N-596-201U	5	60
189	30	34	16	166N-497-201U	42	7	165	165N-597-201U	5	70
198	36	30	16	166N-498-201U	33	6	165	165N-598-201U	5	75
202	30	38	16	166N-499-201U	45	8	180	165N-599-201U	6	80
216	30	38	16	166N-500-201U	48	8	190	165N-600-201U	6	80
216	36	30	16	166N-501-201U	36	6	180	165N-601-201U	6	75
230	30	42	16	166N-502-201U	51	9	200	165N-602-201U	6	85
234	36	34	16	166N-503-201U	39	7	195	165N-603-201U	6	85
243	30	42	16	166N-504-201U	54	9	210	165N-604-201U	7	85
252	36	34	16	166N-505-201U	42	7	205	165N-605-201U	7	85
270	36	38	16	166N-506-201U	45	8	220	165N-606-201U	7	90
288	36	38	16	166N-507-201U	48	8	235	165N-607-201U	8	95
306	36	42	16	166N-508-201U	51	9	245	165N-608-201U	8	100
324	36	42	16	166N-509-201U	54	9	260	165N-609-201U	9	100

Heaters are rated at 480 volts, 3 phase.

# Heater Listings

## 400° F Maximum Outlet Air Temperature



Heater Depth C	6"	9.5"							
Mtg. Hole Centers K	2"	3.5"							
Heater Height H	8"	12"	16"	20"	24"	30"	34"	38"	42"
No. of Spaces P	2	3	3	3	3	5	7	7	7
Mtg. Hole Centers Q	3"	3.75"	4.25"	5.25"	5.75"	4.88"	4.38"	4.88"	5.25"

**Mounting Hole Details** – Mounting hole patterns depend on heater C and H dimensions. Mounting holes are 9/32" diameter, centered 3/8" from the outside edge of the plate.

Heater Listings - 400° F at 900 SFPM Minimum Airflow										
KW	Dimensions (Inches)			Finned Tubular Construction 65 Watts/Sq. In.				Open Coil Construction 65 Watts/Sq. In.		
	W	H	C	Catalog Number	No. Of Elements	No. Of Circuits	Weight (Lbs.)	Catalog Number	No. Of Circuits	Weight (Lbs.)
4.5	12	8	6	166N-601-401U	3	1	15	165N-301-401U	1	10
6	16	8	6	166N-602-401U	3	1	15	165N-302-401U	1	10
9	12	12	6	166N-603-401U	6	1	20	165N-303-401U	1	10
9	20	8	6	166N-604-401U	3	1	15	165N-304-401U	1	15
9	24	8	6	166N-605-401U	3	1	15	165N-305-401U	1	15
12	16	12	6	166N-606-401U	6	1	25	165N-306-401U	1	15
13	12	16	6	166N-607-401U	9	1	30	165N-307-401U	1	15
13	30	8	6	166N-608-401U	3	1	20	165N-308-401U	1	15
18	12	20	6	166N-609-401U	12	1	35	165N-309-401U	1	15
18	16	16	6	166N-610-401U	9	1	30	165N-310-401U	1	15
18	20	12	6	166N-611-401U	6	1	25	165N-311-401U	1	15
18	24	12	6	166N-612-401U	6	1	25	165N-312-401U	1	20
18	36	8	6	166N-613-401U	3	1	20	165N-313-401U	1	20

Heaters are rated at 480 volts, 3 phase.

# Heater Listings

## 400° F Maximum Outlet Air Temperature

Heater Listings - 400° F at 900 SFPM Minimum Airflow										
KW	Dimensions (Inches)			Finned Tubular Construction 65 Watts/Sq. In.				Open Coil Construction 65 Watts/Sq. In.		
	W	H	C	Catalog Number	No. Of Elements	No. Of Circuits	Weight (Lbs.)	Catalog Number	No. Of Circuits	Weight (Lbs.)
22	12	24	6	166N-614-401U	15	1	45	165N-314-401U	1	15
24	16	20	6	166N-615-401U	12	1	40	165N-315-401U	1	20
27	12	30	6	166N-616-401U	18	1	55	165N-316-401U	1	20
27	20	16	6	166N-617-401U	9	1	35	165N-317-401U	1	20
27	24	16	6	166N-618-401U	9	1	35	165N-318-401U	1	20
27	30	12	6	166N-619-401U	6	1	30	165N-319-401U	1	20
30	16	24	6	166N-620-401U	15	1	50	165N-320-401U	1	20
31	12	34	6	166N-621-401U	21	1	60	165N-321-401U	1	20
36	12	38	6	166N-622-401U	24	1	70	165N-322-401U	1	25
36	16	30	6	166N-623-401U	18	1	60	165N-323-401U	1	25
36	20	20	6	166N-624-401U	12	1	45	165N-324-401U	1	20
36	24	20	6	166N-625-401U	12	1	45	165N-325-401U	1	25
36	36	12	6	166N-626-401U	6	1	35	165N-326-401U	1	25
40	12	42	6	166N-627-401U	27	2	75	165N-327-401U	2	25
40	30	16	6	166N-628-401U	9	2	45	165N-328-401U	2	25
42	16	34	6	166N-629-401U	21	2	65	165N-329-401U	2	30
45	12	24	9.5	166N-630-401U	30	2	75	165N-330-401U	2	25
45	20	24	6	166N-631-401U	15	2	55	165N-331-401U	2	25
45	24	24	6	166N-632-401U	15	2	55	165N-332-401U	2	30
48	16	38	6	166N-633-401U	24	2	75	165N-333-401U	2	30
50	12	30	9.5	166N-634-401U	33	2	90	165N-334-401U	2	30
54	12	30	9.5	166N-635-401U	36	2	95	165N-335-401U	2	30
54	16	42	6	166N-636-401U	27	2	85	165N-336-401U	2	35
54	20	30	6	166N-637-401U	18	2	70	165N-337-401U	2	30
54	24	30	6	166N-638-401U	18	2	70	165N-338-401U	2	35
54	30	20	6	166N-639-401U	12	2	55	165N-339-401U	2	30
54	36	16	6	166N-640-401U	9	2	50	165N-340-401U	2	30
58	12	34	9.5	166N-641-401U	39	2	100	165N-341-401U	2	30
60	16	24	9.5	166N-642-401U	30	2	85	165N-342-401U	2	30
63	12	34	9.5	166N-643-401U	42	2	105	165N-343-401U	2	30
63	20	34	6	166N-644-401U	21	2	80	165N-344-401U	2	35
63	24	34	6	166N-645-401U	21	2	80	165N-345-401U	2	40
66	16	30	9.5	166N-646-401U	33	2	95	165N-346-401U	2	35
67	12	38	9.5	166N-647-401U	45	2	115	165N-347-401U	2	35
67	30	24	6	166N-648-401U	15	3	70	165N-348-401U	2	35
72	12	38	9.5	166N-649-401U	48	2	120	165N-349-401U	2	35
72	16	30	9.5	166N-650-401U	36	2	105	165N-350-401U	2	35
72	20	38	6	166N-651-401U	24	2	90	165N-351-401U	2	35
72	24	38	6	166N-652-401U	24	2	90	165N-352-401U	2	40
72	36	20	6	166N-653-401U	12	2	65	165N-353-401U	2	35

Heaters are rated at 480 volts, 3 phase.

# Heater Listings

## 400° F Maximum Outlet Air Temperature

Heater Listings - 400° F at 900 SFPM Minimum Airflow										
KW	Dimensions (Inches)			Finned Tubular Construction 65 Watts/Sq. In.				Open Coil Construction 65 Watts/Sq. In.		
	W	H	C	Catalog Number	No. Of Elements	No. Of Circuits	Weight (Lbs.)	Catalog Number	No. Of Circuits	Weight (Lbs.)
76	12	42	9.5	166N-654-401U	51	3	130	165N-354-401U	2	35
78	16	34	9.5	166N-655-401U	39	3	110	165N-355-401U	2	40
81	12	42	9.5	166N-656-401U	54	3	135	165N-356-401U	3	35
81	20	42	6	166N-657-401U	27	3	100	165N-357-401U	3	40
81	24	42	6	166N-658-401U	27	3	100	165N-358-401U	3	45
81	30	30	6	166N-659-401U	18	3	85	165N-359-401U	3	45
84	16	34	9.5	166N-660-401U	42	3	120	165N-360-401U	3	40
90	16	38	9.5	166N-661-401U	45	3	130	165N-361-401U	3	45
90	20	24	9.5	166N-662-401U	30	3	100	165N-362-401U	3	35
90	24	24	9.5	166N-663-401U	30	3	100	165N-363-401U	3	45
90	36	24	6	166N-664-401U	15	3	80	165N-364-401U	3	40
95	30	34	6	166N-665-401U	21	4	95	165N-365-401U	3	45
95	16	38	9.5	166N-666-401U	48	3	135	165N-366-401U	3	45
100	20	30	9.5	166N-667-401U	33	3	115	165N-367-401U	3	45
100	24	30	9.5	166N-668-401U	33	3	115	165N-368-401U	3	50
102	16	42	9.5	166N-669-401U	51	3	145	165N-369-401U	3	45
108	16	42	9.5	166N-670-401U	54	3	150	165N-370-401U	3	45
108	20	30	9.5	166N-671-401U	36	3	120	165N-371-401U	3	45
108	24	30	9.5	166N-672-401U	36	3	120	165N-372-401U	3	50
108	30	38	6	166N-673-401U	24	4	110	165N-373-401U	3	50
108	36	30	6	166N-674-401U	18	3	100	165N-374-401U	3	50
117	20	34	9.5	166N-675-401U	39	4	135	165N-375-401U	3	50
117	24	34	9.5	166N-676-401U	39	4	135	165N-376-401U	4	55
122	30	42	6	166N-677-401U	27	5	120	165N-377-401U	4	55
126	20	34	9.5	166N-678-401U	42	4	140	165N-378-401U	4	50
126	24	34	9.5	166N-679-401U	42	4	140	165N-379-401U	4	55
126	36	34	6	166N-680-401U	21	4	115	165N-380-401U	4	55
135	20	38	9.5	166N-681-401U	45	4	150	165N-381-401U	4	55
135	20	38	9.5	166N-682-401U	45	4	150	165N-382-401U	4	55
135	24	38	9.5	166N-683-401U	45	4	150	165N-383-401U	4	65
135	30	24	9.5	166N-684-401U	30	4	125	165N-384-401U	4	55
144	20	38	9.5	166N-685-401U	48	4	160	165N-385-401U	4	55
144	24	38	9.5	166N-686-401U	48	4	160	165N-386-401U	4	65
144	36	38	6	166N-687-401U	24	4	130	165N-387-401U	4	60
150	30	30	9.5	166N-688-401U	33	4	140	165N-388-401U	4	65
153	20	42	9.5	166N-689-401U	51	5	170	165N-389-401U	4	60
153	24	42	9.5	166N-690-401U	51	5	170	165N-390-401U	4	70
162	20	42	9.5	166N-691-401U	54	5	180	165N-391-401U	5	60
162	24	42	9.5	166N-692-401U	54	5	180	165N-392-401U	5	70
162	30	30	9.5	166N-693-401U	36	4	150	165N-393-401U	5	65

Heaters are rated at 480 volts, 3 phase.

# Heater Listings

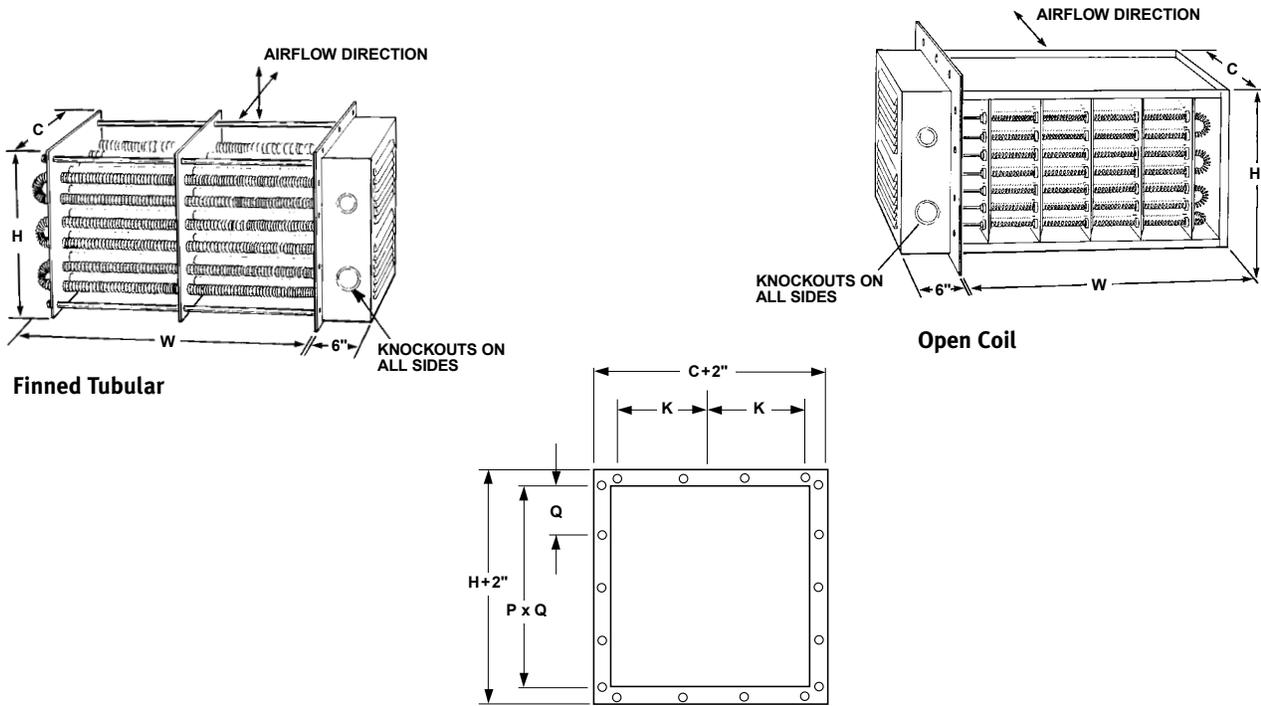
## 400° F Maximum Outlet Air Temperature

Heater Listings - 400° F at 900 SFPM Minimum Airflow										
KW	Dimensions (Inches)			Finned Tubular Construction 65 Watts/Sq. In.				Open Coil Construction 65 Watts/Sq. In.		
	W	H	C	Catalog Number	No. Of Elements	No. Of Circuits	Weight (Lbs.)	Catalog Number	No. Of Circuits	Weight (Lbs.)
162	36	42	6	166N-694-401U	27	5	145	165N-394-401U	5	65
175	30	34	9.5	166N-695-401U	39	7	165	165N-395-401U	5	70
180	36	24	9.5	166N-696-401U	30	5	150	165N-396-401U	5	60
189	30	34	9.5	166N-697-401U	42	5	175	165N-397-401U	5	70
198	36	30	9.5	166N-698-401U	33	6	170	165N-398-401U	5	75
202	30	38	9.5	166N-699-401U	45	5	190	165N-399-401U	6	80
216	30	38	9.5	166N-700-401U	48	6	200	165N-400-401U	6	80
216	36	30	9.5	166N-701-401U	36	6	180	165N-401-401U	6	75
230	30	42	9.5	166N-702-401U	51	6	215	165N-402-401U	6	85
234	36	34	9.5	166N-703-401U	39	7	195	165N-403-401U	6	85
243	30	42	9.5	166N-704-401U	54	7	220	165N-404-401U	7	85
252	36	34	9.5	166N-705-401U	42	7	210	165N-405-401U	7	85
270	36	38	9.5	166N-706-401U	45	8	225	165N-406-401U	7	90
288	36	38	9.5	166N-707-401U	48	8	240	165N-407-401U	8	95
306	36	42	9.5	166N-708-401U	51	9	255	165N-408-401U	8	100
324	36	42	9.5	166N-709-401U	54	9	265	165N-409-401U	9	100

Heaters are rated at 480 volts, 3 phase.

# Heater Listings

## 600° F Maximum Outlet Air Temperature



Heater Depth C	6"	9.5"							
Mtg. Hole Centers K	2"	3.5"							
Heater Height H	8"	12"	16"	20"	24"	30"	34"	38"	42"
No. of Spaces P	2	3	3	3	3	5	7	7	7
Mtg. Hole Centers Q	3"	3.75"	4.25"	5.25"	5.75"	4.88"	4.38"	4.88"	5.25"

**Mounting Hole Details** – Mounting hole patterns depend on heater C and H dimensions. Mounting holes are 9/32" diameter, centered 3/8" from the outside edge of the plate.

Heater Listings - 600° F at 900 SFPM Minimum Airflow										
KW	Dimensions (Inches)			Finned Tubular Construction 45 Watts/Sq. In.				Open Coil Construction 55 Watts/Sq. In.		
	W	H	C	Catalog Number	No. Of Elements	No. Of Circuits	Weight (Lbs.)	Catalog Number	No. Of Circuits	Weight (Lbs.)
4	12	8	6	166N-801-601U	3	1	15	165N-101-601U	1	10
5	16	8	6	166N-802-601U	3	1	20	165N-102-601U	1	10
7.5	20	8	6	166N-803-601U	3	1	20	165N-103-601U	1	15
8	12	12	6	166N-804-601U	6	1	25	165N-104-601U	1	10
9	24	8	6	166N-805-601U	3	1	20	165N-105-601U	1	15
10	16	12	6	166N-806-601U	6	1	30	165N-106-601U	1	15
10	26	8	6	166N-807-601U	3	1	20	165N-107-601U	1	15
12	12	16	6	166N-808-601U	9	1	35	165N-108-601U	1	15
12	32	8	6	166N-809-601U	3	1	25	165N-109-601U	1	15
15	16	16	6	166N-810-601U	9	1	40	165N-110-601U	1	15
15	20	12	6	166N-811-601U	6	1	35	165N-111-601U	1	15

Heaters are rated at 480 volts, 3 phase.

# Heater Listings

## 600° F Maximum Outlet Air Temperature

Heater Listings - 600° F at 900 SFPM Minimum Airflow										
KW	Dimensions (Inches)			Finned Tubular Construction 45 Watts/Sq. In.				Open Coil Construction 55 Watts/Sq. In.		
	W	H	C	Catalog Number	No. Of Elements	No. Of Circuits	Weight (Lbs.)	Catalog Number	No. Of Circuits	Weight (Lbs.)
15	40	8	6	166N-812-601U	3	1	25	165N-112-601U	1	20
16	12	20	6	166N-813-601U	12	1	45	165N-113-601U	1	15
18	24	12	6	166N-814-601U	6	1	35	165N-114-601U	1	20
20	12	24	6	166N-815-601U	15	1	55	165N-115-601U	1	15
20	16	20	6	166N-816-601U	12	1	50	165N-116-601U	1	20
20	26	12	6	166N-817-601U	6	1	35	165N-117-601U	1	20
22	20	16	6	166N-818-601U	9	1	45	165N-118-601U	1	20
24	12	30	6	166N-819-601U	18	1	70	165N-119-601U	1	20
24	32	12	6	166N-820-601U	6	1	40	165N-120-601U	1	20
25	16	24	6	166N-821-601U	15	1	60	165N-121-601U	1	20
27	24	16	6	166N-822-601U	9	1	50	165N-122-601U	1	20
28	12	34	6	166N-823-601U	21	1	80	165N-123-601U	1	20
30	16	30	6	166N-824-601U	18	1	75	165N-124-601U	1	25
30	20	20	6	166N-825-601U	12	1	60	165N-125-601U	1	20
30	26	16	6	166N-826-601U	9	1	50	165N-126-601U	1	25
30	40	12	6	166N-827-601U	6	1	45	165N-127-601U	1	25
32	12	38	6	166N-828-601U	24	1	85	165N-128-601U	1	25
35	16	34	6	166N-829-601U	21	1	85	165N-129-601U	1	25
36	12	42	6	166N-830-601U	27	1	95	165N-130-601U	1	25
36	24	20	6	166N-831-601U	12	1	65	165N-131-601U	1	25
36	32	16	6	166N-832-601U	9	1	55	165N-132-601U	1	25
37	20	24	6	166N-833-601U	15	1	70	165N-133-601U	1	25
40	12	24	9.5	166N-834-601U	30	1	95	165N-134-601U	1	25
40	16	38	6	166N-835-601U	24	1	95	165N-135-601U	1	30
40	26	26	6	166N-836-601U	12	1	65	165N-136-601U	1	25
45	12	30	9.5	166N-837-601U	33	2	110	165N-137-601U	2	30
45	16	42	6	166N-838-601U	27	2	105	165N-138-601U	2	35
45	20	30	6	166N-839-601U	18	2	85	165N-139-601U	2	30
45	24	24	6	166N-840-601U	15	2	75	165N-140-601U	2	30
45	40	16	6	166N-841-601U	9	2	65	165N-141-601U	2	35
48	12	30	9.5	166N-842-601U	36	2	115	165N-142-601U	2	30
48	32	20	6	166N-843-601U	12	2	75	165N-143-601U	2	30
50	16	24	9.5	166N-844-601U	30	2	105	165N-144-601U	2	30
50	26	24	6	166N-845-601U	15	2	80	165N-145-601U	2	30
52	12	34	9.5	166N-846-601U	39	2	130	165N-146-601U	2	30
52	20	34	6	166N-847-601U	21	2	100	165N-147-601U	2	35
54	24	30	6	166N-848-601U	18	2	95	165N-148-601U	2	35
55	16	30	9.5	166N-849-601U	33	2	120	165N-149-601U	2	35
56	12	34	9.5	166N-850-601U	42	2	135	165N-150-601U	2	30

Heaters are rated at 480 volts, 3 phase.

# Heater Listings

## 600° F Maximum Outlet Air Temperature

Heater Listings - 600° F at 900 SFPM Minimum Airflow										
KW	Dimensions (Inches)			Finned Tubular Construction 45 Watts/Sq. In.				Open Coil Construction 55 Watts/Sq. In.		
	W	H	C	Catalog Number	No. Of Elements	No. Of Circuits	Weight (Lbs.)	Catalog Number	No. Of Circuits	Weight (Lbs.)
60	12	38	9.5	166N-851-601U	45	2	145	165N-151-601U	2	35
60	16	30	9.5	166N-852-601U	36	2	125	165N-152-601U	2	35
60	20	38	6	166N-853-601U	24	2	110	165N-153-601U	2	35
60	26	30	6	165N-854-601U	18	2	100	165N-154-601U	2	35
60	32	24	6	166N-855-601U	15	2	90	165N-155-601U	2	35
60	40	20	6	166N-856-601U	12	2	85	165N-156-601U	2	40
64	24	34	6	166N-857-601U	21	2	105	165N-157-601U	2	40
64	12	38	9.5	166N-858-601U	48	2	150	165N-158-601U	2	35
64	16	34	9.5	166N-859-601U	39	2	140	165N-159-601U	2	40
68	20	42	6	166N-860-601U	27	2	125	165N-160-601U	2	40
68	12	42	9.5	166N-861-601U	51	2	160	165N-161-601U	2	35
70	16	34	9.5	166N-862-601U	42	2	145	165N-162-601U	2	40
70	26	34	6	166N-863-601U	21	3	115	165N-163-601U	2	40
72	12	42	9.5	166N-864-601U	54	3	170	165N-164-601U	2	35
72	24	38	6	166N-865-601U	24	2	120	165N-165-601U	2	40
72	32	30	6	166N-866-601U	18	2	110	165N-166-601U	2	45
75	16	38	9.5	166N-867-601U	45	5	160	165N-167-601U	2	45
75	20	24	9.5	166N-868-601U	30	5	125	165N-168-601U	2	35
75	40	24	6	166N-869-601U	15	5	105	165N-169-601U	2	45
80	16	38	9.5	166N-870-601U	48	2	165	165N-170-601U	2	45
80	26	38	6	166N-871-601U	24	2	130	165N-171-601U	2	45
80	24	42	9.5	166N-872-601U	27	3	155	165N-172-601U	2	70
82	20	30	9.5	166N-873-601U	33	11	145	165N-173-601U	3	45
85	32	34	6	166N-874-601U	21	3	125	165N-174-601U	3	50
85	16	42	9.5	166N-875-601U	54	3	175	165N-175-601U	3	45
90	16	42	9.5	166N-876-601U	54	3	185	165N-176-601U	3	45
90	20	30	9.5	166N-877-601U	36	3	150	165N-177-601U	3	45
90	24	24	9.5	166N-878-601U	30	5	140	165N-178-601U	3	45
90	26	42	6	166N-879-601U	27	3	145	165N-179-601U	3	50
90	40	30	6	166N-880-601U	18	3	125	165N-180-601U	3	55
96	20	34	9.5	166N-881-601U	24	4	140	165N-181-601U	3	55
98	20	34	9.5	166N-882-601U	42	7	165	165N-182-601U	3	50
100	24	30	9.5	166N-883-601U	33	11	155	165N-183-601U	3	50
100	26	24	9.5	166N-884-601U	30	5	145	165N-184-601U	3	45
105	20	34	9.5	166N-885-601U	42	7	175	165N-185-601U	3	50
105	40	34	6	166N-886-601U	21	7	145	165N-186-601U	3	60
108	24	30	9.5	166N-887-601U	36	3	165	165N-187-601U	3	50
108	32	42	9.5	166N-888-601U	27	3	175	165N-188-601U	3	90
110	26	30	9.5	166N-889-601U	33	11	165	165N-189-601U	3	55

Heaters are rated at 480 volts, 3 phase.

# Heater Listings

## 600° F Maximum Outlet Air Temperature

Heater Listings - 600° F at 900 SFPM Minimum Airflow										
KW	Dimensions (Inches)			Finned Tubular Construction 45 Watts/Sq. In.				Open Coil Construction 55 Watts/Sq. In.		
	W	H	C	Catalog Number	No. Of Elements	No. Of Circuits	Weight (Lbs.)	Catalog Number	No. Of Circuits	Weight (Lbs.)
112	20	38	9.5	166N-890-601U	45	5	190	165N-190-601U	3	55
117	24	34	9.5	166N-891-601U	42	7	185	165N-191-601U	3	55
120	20	38	9.5	166N-892-601U	48	4	200	165N-192-601U	3	55
120	26	30	9.5	166N-893-601U	36	3	175	165N-193-601U	3	55
120	32	24	9.5	166N-894-601U	30	5	165	165N-194-601U	3	55
120	40	38	6	166N-895-601U	24	4	160	165N-195-601U	3	65
125	24	34	9.5	166N-896-601U	42	7	195	165N-196-601U	4	55
127	20	42	9.5	166N-897-601U	54	6	215	165N-197-601U	4	60
130	26	34	9.5	166N-898-601U	42	7	195	165N-198-601U	4	60
132	32	30	9.5	166N-899-601U	33	11	185	165N-199-601U	4	65
135	20	42	9.5	166N-900-601U	54	6	220	165N-201-601U	4	60
135	24	38	9.5	166N-901-601U	45	5	210	165N-202-601U	4	65
135	40	42	6	166N-902-601U	27	9	180	165N-203-601U	4	75
140	26	34	9.5	166N-903-601U	42	7	205	165N-204-601U	4	60
145	24	38	9.5	166N-904-601U	48	4	220	165N-205-601U	4	65
145	32	30	9.5	166N-905-601U	36	4	200	165N-206-601U	4	65
150	26	38	9.5	166N-906-601U	45	5	220	165N-207-601U	4	70
150	40	24	9.5	166N-907-601U	30	5	190	165N-208-601U	4	70
155	24	42	9.5	166N-908-601U	54	5	235	165N-209-601U	4	70
155	32	34	9.5	166N-909-601U	42	7	215	165N-210-601U	4	75
160	26	38	9.5	166N-910-601U	48	4	230	165N-211-601U	4	70
160	24	42	9.5	166N-911-601U	54	5	245	165N-212-601U	5	70
165	40	30	9.5	166N-912-601U	33	11	215	165N-213-601U	5	85
170	32	34	9.5	166N-913-601U	42	7	230	165N-214-601U	5	75
170	26	42	9.5	166N-914-601U	54	6	250	165N-215-601U	5	75
180	26	42	9.5	166N-915-601U	54	6	260	165N-216-601U	5	75
180	32	38	9.5	166N-916-601U	45	5	245	165N-217-601U	5	80
180	40	30	9.5	166N-917-601U	36	6	230	165N-218-601U	5	85
190	32	38	9.5	166N-918-601U	48	8	260	165N-219-601U	5	80
195	40	34	9.5	166N-919-601U	42	7	250	165N-220-601U	5	90
205	32	42	9.5	166N-920-601U	51	6	280	165N-221-601U	6	90
210	40	34	9.5	166N-921-601U	42	7	265	165N-222-601U	6	95
215	32	42	9.5	166N-922-601U	54	6	290	165N-223-601U	6	90
225	40	38	9.5	166N-923-601U	48	8	285	165N-224-601U	6	100
240	40	38	9.5	166N-924-601U	48	8	300	165N-225-601U	7	100
255	40	42	9.5	166N-925-601U	54	9	320	165N-226-601U	7	110
270	40	42	9.5	166N-926-601U	54	9	335	165N-227-601U	7	110

Heaters are rated at 480 volts, 3 phase.



# Heater Listings

## 750° F Maximum Outlet Air Temperature

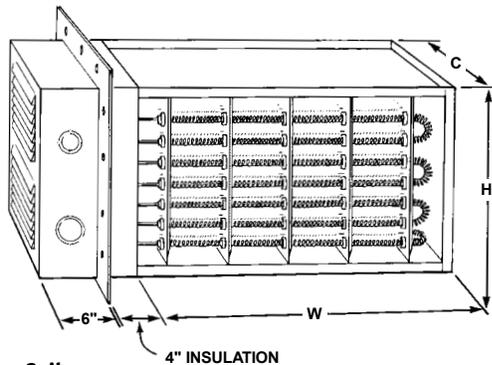
Heater Listings - 750° F at 1200 SFPM Minimum Airflow										
KW	Dimensions (Inches)			Tubular Construction 30 Watts/Sq. In.				Open Coil Construction 40 Watts/Sq. In.		
	W	H	C	Catalog Number	No. Of Elements	No. Of Circuits	Weight (Lbs.)	Catalog Number	No. Of Circuits	Weight (Lbs.)
40	35	8	9.5*	164N-312-701U	6	2	45	165N-712-701U	2	30
45	20-3/8	20	9.5	164N-313-701U	9	3	65	165N-713-701U	2	35
45	44	8	9.5	164N-314-701U	6	2	45	165N-714-701U	2	35
45	60	6	9.5	164N-315-701U	9	3	45	165N-715-701U	2	40
50	20-3/8	22	9.5	164N-316-701U	15	5	75	165N-716-701U	2	40
60	20-3/8	26	9.5	164N-317-701U	12	2	85	165N-717-701U	2	45
60	35	14	9.5	164N-318-701U	9	3	65	165N-718-701U	2	45
60	60	8	9.5	164N-319-701U	12	2	60	165N-719-701U	2	50
67	44	14	9.5	164N-320-701U	9	3	70	165N-720-701U	2	55
70	20-3/8	26	9.5	164N-321-701U	21	3	95	165N-721-701U	2	45
75	20-3/8	26	9.5	164N-322-701U	15	5	95	165N-722-701U	2	45
75	60	8	9.5*	164N-323-701U	15	5	70	165N-723-701U	2	50
80	20-3/8	34	9.5	164N-324-701U	24	4	115	165N-724-701U	3	55
80	35	18	9.5	164N-325-701U	12	3	85	165N-725-701U	2	50
90	20-3/8	38	9.5	164N-326-701U	18	3	125	165N-726-701U	3	60
90	44	18	9.5	164N-327-701U	12	4	95	165N-727-701U	3	65
90	60	10	9.5	164N-328-701U	18	3	85	165N-728-701U	3	55
100	20-3/8	42	9.5	164N-329-701U	30	5	140	165N-729-701U	3	65
100	39	22	9.5	164N-330-701U	15	3	105	165N-730-701U	3	60
105	60	10	9.5*	164N-331-701U	21	3	95	165N-731-701U	3	55
110	20-3/8	42	9.5	164N-332-701U	33	11	150	165N-732-701U	3	65
112	44	22	9.5	164N-333-701U	15	5	115	165N-733-701U	3	75
120	35	22	9.5	164N-334-701U	18	6	120	165N-734-701U	4	60
120	39	26	9.5	164N-335-701U	18	6	125	165N-735-701U	4	70
120	60	12	9.5	164N-336-701U	24	4	110	165N-736-701U	4	65
135	44	22	9.5	164N-337-701U	18	6	130	165N-737-701U	4	75
135	60	14	9.5	164N-338-701U	27	3	125	165N-738-701U	4	70
140	35	26	9.5	164N-339-701U	21	3	140	165N-739-701U	4	70
140	35	34	9.5	164N-340-701U	21	3	150	165N-740-701U	4	85
150	60	14	9.5	164N-341-701U	30	5	135	165N-741-701U	4	70
157	44	22	9.5	164N-342-701U	21	7	145	165N-742-701U	4	75
160	35	26	9.5	164N-343-701U	24	6	155	165N-743-701U	5	70
160	35	34	9.5	164N-344-701U	33	6	150	165N-744-701U	5	85
165	60	16	9.5*	164N-345-701U	27	11	180	165N-745-701U	5	80
180	35	34	9.5	164N-346-701U	27	9	180	165N-746-701U	5	85
180	44	22	9.5	164N-347-701U	24	8	160	165N-747-701U	5	75
180	60	18	9.5	164N-348-701U	36	6	165	165N-748-701U	5	85
195	60	18	9.5	164N-349-701U	42	7	175	165N-749-701U	5	85
200	35	34	9.5	164N-350-701U	30	5	195	165N-750-701U	6	85

Heaters are rated at 480 volts, 3 phase.

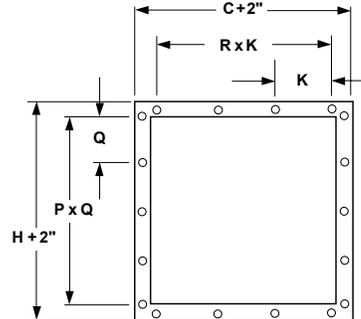
\* On this item the C dimension is 14 inches for open coil.

# Heater Listings

## 1200° F Maximum Outlet Air Temperature



Open Coil



Heater Depth C	9.5"	14"	18.38"																	
No. of Spaces R	2	3	4																	
Mtg. Hole Centers K	3.5"	3.88"	3.88"																	
Heater Height H	4"	6"	8"	10"	12"	14"	16"	18"	20"	22"	24"	26"	28"	30"	32"	34"	36"	38"	40"	42"
No. of Spaces P	1	1	2	3	3	3	3	3	3	3	3	5	5	5	5	7	7	7	7	7
Mtg. Hole Centers Q	2.5"	3.5"	3"	2.75"	3.25"	3.75"	4.25"	4.75"	5.25"	5.75"	5.75"	4.5"	5.25"	4.88"	4.88"	4.38"	4.88"	4.88"	5.38"	5.25"

**Mounting Hole Details** – Mounting hole patterns depend on heater C and H dimensions. Mounting holes are 9/32" diameter, centered 3/8" from the outside edge of the plate.

Heater Listings - 1200° F at 1600 SFPM Minimum Airflow										
KW	Dimensions (Inches)			Tubular Construction 22 Watts/Sq. In.				Open Coil Construction 25 Watts/Sq. In.		
	W	H	C	Catalog Number	No. Of Elements	No. Of Circuits	Weight (Lbs.)	Catalog Number	No. Of Circuits	Weight (Lbs.)
5	20-3/8	4	9.5	164N-101-101U	3	1	25	-	-	-
10	20-3/8	6	9.5*	164N-102-101U	3	1	30	165N-802-101U	1	20
10	56	4	9.5*	164N-103-101U	3	1	25	165N-803-101U	1	35
12	35	6	9.5	164N-104-101U	3	1	30	165N-804-101U	1	30
15	20-3/8	8	9.5*	164N-105-101U	6	1	40	165N-805-101U	1	20
15	44	6	9.5	164N-106-101U	3	1	35	165N-806-101U	1	30
20	20-3/8	10	9.5*	164N-107-101U	6	1	50	165N-807-101U	1	25
20	56	4	9.5	164N-108-101U	6	1	55	-	-	-
24	35	8	9.5	164N-109-101U	6	1	50	165N-809-101U	1	35
25	20-3/8	12	9.5*	164N-110-101U	9	1	60	165N-810-101U	1	25
30	20-3/8	14	9.5	164N-111-101U	9	1	65	165N-811-101U	1	30
30	44	8	9.5	164N-112-101U	6	1	55	165N-812-101U	1	40
30	56	6	9.5	164N-113-101U	9	1	50	165N-813-101U	1	40
35	20-3/8	16	9.5*	164N-114-101U	12	1	80	165N-814-101U	1	30

Heaters are rated at 480 volts, 3 phase.

All 1200° F heaters come with 4" of insulation below flange.

\* On this item the C dimension is 14 inches for open coil.

# Heater Listings

## 1200° F Maximum Outlet Air Temperature

Heater Listings - 1200° F at 1600 SFPM Minimum Airflow										
KW	Dimensions (Inches)			Tubular Construction 22 Watts/Sq. In.				Open Coil Construction 25 Watts/Sq. In.		
	W	H	C	Catalog Number	No. Of Elements	No. Of Circuits	Weight (Lbs.)	Catalog Number	No. Of Circuits	Weight (Lbs.)
40	20-3/8	18	9.5*	164N-116-101U	12	2	85	165N-816-101U	2	35
40	56	8	9.5*	164N-117-101U	12	2	65	165N-817-101U	2	50
45	20-3/8	20	9.5	164N-118-101U	15	5	95	165N-818-101U	2	40
45	44	14	9.5	164N-119-101U	9	3	80	165N-819-101U	2	55
48	35	18	9.5	164N-120-101U	12	2	95	165N-820-101U	2	55
50	20-3/8	22	9.5	164N-121-101U	15	5	105	165N-821-101U	2	40
50	56	8	9.5*	164N-122-101U	15	5	75	165N-822-101U	2	50
60	20-3/8	26	9.5	164N-123-101U	18	2	125	165N-823-101U	2	45
60	35	22	9.5	164N-124-101U	15	5	115	165N-824-101U	2	65
60	44	18	9.5	164N-125-101U	12	2	105	165N-825-101U	2	65
60	56	10	9.5	164N-126-101U	18	2	90	165N-826-101U	2	55
70	20-3/8	26	9.5*	164N-127-101U	24	4	135	165N-827-101U	2	45
70	56	10	9.5*	164N-128-101U	24	4	100	165N-828-101U	2	55
72	35	22	9.5	164N-129-101U	18	2	125	165N-829-101U	2	65
75	44	22	9.5	164N-130-101U	15	5	130	165N-830-101U	3	80
80	20-3/8	34	9.5	164N-131-101U	24	4	160	165N-831-101U	3	55
80	56	12	9.5	164N-132-101U	24	4	115	165N-832-101U	3	65
85	35	22	9.5	164N-133-101U	24	4	140	165N-833-101U	3	65
90	20-3/8	38	9.5	164N-134-101U	27	3	180	165N-834-101U	3	60
90	44	22	9.5	164N-135-101U	18	3	140	165N-835-101U	3	80
90	56	14	9.5	164N-136-101U	27	3	130	165N-836-101U	3	70
95	35	22	9.5	164N-137-101U	24	4	150	165N-837-101U	3	65
100	20-3/8	42	9.5	164N-138-101U	30	5	200	165N-838-101U	3	65
100	56	14	9.5*	164N-139-101U	30	5	140	165N-839-101U	3	70
105	44	22	9.5	164N-140-101U	24	4	155	165N-840-101U	3	80
108	35	26	9.5	164N-141-101U	27	3	170	165N-841-101U	3	75
110	20-3/8	42	9.5*	164N-142-101U	33	11	210	165N-842-101U	3	65
110	56	16	9.5	164N-143-101U	33	11	155	165N-843-101U	4	75
120	35	26	9.5	164N-144-101U	30	5	180	165N-844-101U	4	75
120	44	22	9.5	164N-145-101U	24	4	170	165N-845-101U	4	80
120	56	18	9.5	164N-146-101U	24	4	170	165N-846-101U	4	85
130	56	18	9.5	164N-147-101U	42	7	180	165N-847-101U	4	85
130	35	34	9.5	164N-148-101U	36	4	210	165N-848-101U	4	90
135	44	26	9.5	164N-149-101U	27	3	195	165N-849-101U	4	90
140	56	20	9.5	164N-150-101U	42	7	195	165N-850-101U	4	90
150	56	22	9.5	164N-151-101U	45	5	205	165N-851-101U	4	100
155	35	38	9.5	164N-152-101U	42	7	245	165N-852-101U	4	100
160	56	22	9.5*	164N-153-101U	48	8	220	165N-853-101U	5	100
165	44	34	9.5	164N-154-101U	36	6	240	165N-854-101U	5	110
170	35	38	9.5	164N-155-101U	42	7	255	165N-855-101U	5	100
170	56	24	18-3/8	164N-156-101U	54	6	230	165N-856-101U	5	105
180	35	42	9.5	164N-157-101U	45	5	275	165N-857-101U	5	110

Heaters are rated at 480 volts, 3 phase.

\*On this item the C dimension is 14 inches for open coil.

# Heater Listings

## 1200° F Maximum Outlet Air Temperature

Heater Listings - 1200° F at 1600 SFPM Minimum Airflow										
KW	Dimensions (Inches)			Tubular Construction 22 Watts/Sq. In.				Open Coil Construction 25 Watts/Sq. In.		
	W	H	C	Catalog Number	No. Of Elements	No. Of Circuits	Weight (Lbs.)	Catalog Number	No. Of Circuits	Weight (Lbs.)
180	56	24	9.5	164N-158-101U	54	5	240	165N-858-101U	5	105
190	56	26	9.5	164N-159-101U	60	5	255	165N-859-101U	5	110
190	35	42	9.5	164N-160-101U	48	8	290	165N-860-101U	5	110
195	44	38	9.5	164N-161-101U	42	7	280	165N-861-101U	5	120
200	56	28	9.5	164N-162-101U	60	5	270	165N-862-101U	6	120
205	35	26	18-3/8	164N-163-101U	54	6	310	165N-863-101U	6	135
210	44	38	9.5	164N-164-101U	42	7	295	165N-864-101U	6	125
210	56	30	9.5	164N-165-101U	63	7	285	165N-865-101U	6	125
215	35	26	18-3/8	164N-166-101U	54	6	325	165N-866-101U	6	135
220	56	30	9.5	164N-167-101U	66	11	295	165N-867-101U	6	125
225	44	42	9.5	164N-168-101U	45	9	315	165N-868-101U	6	135
230	35	26	18-3/8	164N-172-101U	60	5	335	165N-872-101U	6	130
230	56	32	9.5	164N-173-101U	72	6	310	165N-873-101U	6	130
240	35	26	18-3/8	164N-174-101U	60	5	345	165N-874-101U	7	135
240	44	42	9.5	164N-175-101U	48	8	330	165N-875-101U	7	135
240	56	32	9.5	164N-176-101U	72	6	320	165N-876-101U	7	135
250	56	34	9.5	164N-177-101U	81	9	335	165N-877-101U	7	140
250	35	32	18-3/8	164N-178-101U	63	7	380	165N-878-101U	7	155
255	44	26	18-3/8	164N-179-101U	54	9	355	165N-879-101U	7	165
260	56	36	9.5	164N-180-101U	78	7	350	165N-880-101U	7	145
265	35	32	18-3/8	164N-181-101U	66	11	395	165N-881-101U	7	155
270	44	26	18-3/8	164N-182-101U	54	9	370	165N-882-101U	7	165
270	56	38	9.5	164N-183-101U	81	9	365	165N-883-101U	7	155
275	35	32	18-3/8	164N-184-101U	72	8	405	165N-884-101U	7	155
280	56	38	9.5	164N-185-101U	84	7	375	165N-885-101U	7	155
285	44	26	18-3/8	164N-186-101U	60	5	385	165N-886-101U	8	165
290	35	32	18-3/8	164N-187-101U	72	8	415	165N-887-101U	8	155
290	56	40	9.5	164N-188-101U	90	10	390	165N-888-101U	8	160
300	35	38	18-3/8	164N-189-101U	81	9	450	165N-889-101U	8	180
300	44	26	18-3/8	164N-190-101U	60	10	400	165N-890-101U	8	165
300	56	40	9.5	164N-191-101U	90	10	400	165N-891-101U	8	160
315	35	38	18-3/8	164N-192-101U	81	9	465	165N-892-101U	8	180
315	44	32	18-3/8	164N-193-101U	63	7	435	165N-893-101U	8	195
325	35	38	18-3/8	164N-194-101U	81	9	475	165N-894-101U	9	180
330	44	32	18-3/8	164N-195-101U	66	11	450	165N-895-101U	9	195
335	35	38	18-3/8	164N-196-101U	84	7	485	165N-896-101U	9	180
345	44	32	18-3/8	164N-197-101U	72	12	480	165N-897-101U	9	195
360	44	32	18-3/8	164N-198-101U	72	12	480	165N-898-101U	10	195
375	44	38	18-3/8	164N-199-101U	78	13	515	165N-899-101U	10	225
390	44	38	18-3/8	164N-200-101U	78	13	530	165N-900-101U	10	225
405	44	38	18-3/8	164N-201-101U	84	14	545	165N-901-101U	11	225
420	44	38	18-3/8	164N-202-101U	84	14	560	165N-902-101U	11	225

Heaters are rated at 480 volts, 3 phase.

# Control Panels

INDEECO can provide a control system for any electric process air heating application. Our experienced engineering staff can design control systems ranging from ON/OFF to full SCR with PID logic. Optional features include ramp/soak, computer interface capability and various control schemes as required.

INDEECO offers two standard control panel designs: Full SCR PID control and ON/OFF contactor control. All components are factory mounted and wired in compliance with the National Electrical Code.

These charts provide a sample of standard control panel designs. Custom control panels, designed specifically for your application, are available.

A Vernier control panel can also be supplied. Vernier control utilizes contactors, one SCR controller, and a microprocessor-based sequencer. The sequencer controls the staging of the contactors and the SCR controller. The SCR controller serves to fill in the gaps between the step-controlled stages. Vernier control is not quite as accurate as full SCR control, but more accurate than contactor (step) control.

## Contactor Control Panels

This contactor-based system with ON/OFF process temperature control is recommended for less demanding applications. Systems with two or more heating stages utilize an INDEECO Controls electronic sequencer (step controller), driven by an analog output PID temperature controller to minimize the amount of load cycling while providing good outlet temperature control.

### Standard Features:

- INDEECO microprocessor-based sequencer (for panels with two or more heating stages)
- Indicating PID temperature controller (adjustable process temperature with thermocouple input)
- NEMA 12 painted steel enclosure, wall mount unless otherwise noted
- Overtemperature controller (adjustable temperature limit with thermocouple input)
- Door interlock disconnect switch
- Manual reset pushbutton with built-in pilot light (red) for visual "OVERTEMPERATURE" alarm
- Selector switch – ON/OFF with built-in pilot light (green) for "POWER ON" indication
- Control power transformer
- Disconnecting magnetic contactors
- Circuit fusing

Amps	Number Of Circuits	Amps Per Circuit	Maximum KW		Approximate Dimensions (Inches)			Estimated Weight (Lbs.)
			240V/3PH	480V/3PH	Height	Width	Depth	
48	1	48	19	39	24	24	8	85
96	2	48	39	79	30	24	8	105
144	3	48	59	119	36	30	8	160
192	4	48	79	159	42	30	8	175
240	5	48	99	199	48	36	8	260
288	6	48	119	239	48	36	8	265
336	7	48	139	279	60	36	8	320
384	8	48	159	319	60	36	8	330
432*	9	48	179	359	60	48	12	585
480*	10	48	199	399	60	48	12	600
528*	11	48	219	438	60	60	12	680
576*	12	48	239	478	60	60	12	685
624*	13	48	259	518	72	60	12	800
672*	14	48	279	558	72	60	12	805
720*	15	48	299	598	72	60	12	815
768*	16	48	319	638	72	72	12	930
816*	17	48	339	678	72	72	12	945
864*	18	48	359	718	72	72	12	950
912*	19	48	379	758	72	72	12	960
960*	20	48	399	798	72	72	12	965

\*These panels have double doors and 12" high floor stands.

# Control Panels

## SCR Control Panels

A full SCR control system with PID temperature control is recommended for industrial heating applications which must accommodate material flow changes and provide the highest degree of accuracy for outlet temperature control.

**Standard Features:**

- PID self-tuning temperature controller (adjustable process temperature, with thermocouple input)
- INDEECO three-phase, zero cross-fired, SCR power controllers
- NEMA 12 painted steel enclosure, wall mount unless otherwise noted
- Overtemperature controller (adjustable temperature limit with thermocouple input)
- Door interlock disconnect switch
- Manual reset pushbutton with built-in pilot light (red) for visual "OVERTEMPERATURE" alarm
- Selector switch – ON/OFF with built-in pilot light (green) for "POWER ON" indication
- Control power transformer
- Safety contactors
- Circuit fusing
- Ventilating fan and filter when required

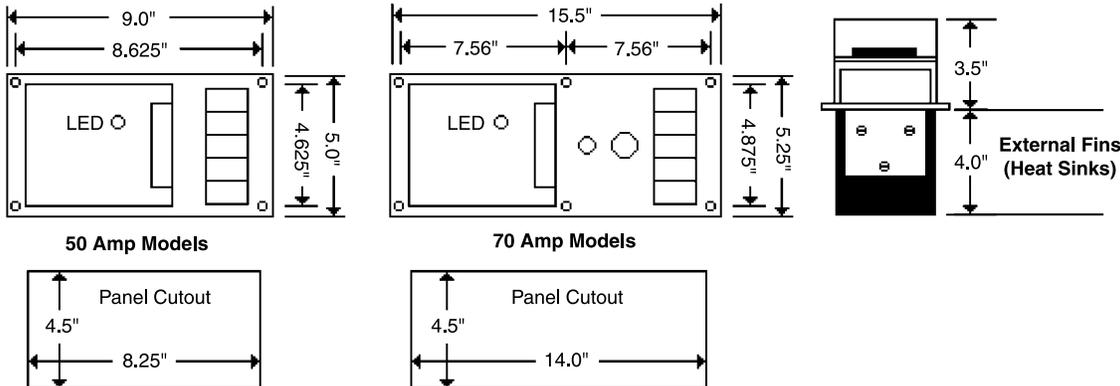
Amps	Number Of Circuits	Amps Per Circuit	Maximum KW		Approximate Dimensions (Inches)			Estimated Weight (Lbs.)
			240V/3PH	480V/3PH	Height	Width	Depth	
SCR panels with externally mounted heat sinks								
48	1	48	19	39	24	24**	8	95
70	1	70	29	58	30	24**	8	115
96	2	48	39	79	30	24**	8	125
140	2	70	58	116	42	30**	8	205
144	3	48	59	119	36	30**	8	195
210	3	70	87	174	48	36**	8	310
192	4	48	79	159	42	30**	8	225
280	4	70	116	232	60	36**	8	385
240	5	48	99	199	48	36**	8	320
350	5	70	145	290	60	36**	8	415
SCR panels with internally mounted heat sinks, fan and filter								
295	6	48	119	239	60	36	16	405
425*	9	47	175	351	60	48	16	660
590*	12	48	239	478	60	60	16	750
850*	18	47	351	703	72	72	16	1090

\*These panels have double doors and 12" high floor stands.  
 \*\*Additional 9" clearance required for externally mounted heat sinks which may be mounted on one or both sides of the enclosure for proper convection cooling.

**SCR Power Controllers** modulate the entire heater load directly, varying the heater output from 0 to 100% of the total heater KW. Working on a four second time base, the heater will be energized only for the number of AC cycles necessary to produce the exact amount of heat required. The resulting precision control and rapid response make the INDEECO Controls SCR the choice for many heating applications. For example, multi-stage discharge temperature control of a heater can produce unacceptable temperature swings,

resulting in inefficient energy use. The same heater with SCR control will produce stable, even heat for maximum performance and efficiency.

The SCR's power switching devices are mounted on a large finned heat sink which extends outside the heater terminal box or control panel. The conservative SCR rating and the generous heat sink insure against overheating and SCR failure.



# Control Panels

## Special Features

**Control Relays** – These relays are activated by safety devices, such as a flow switch or remote shutoff.

**Remote Interlock Terminals** – Control circuit terminals are supplied so the heater can be de-energized from remote contacts.

**Indicator Lights** – Additional indicator lights may be specified for visual indication of system status, such as "LOW TEMPERATURE".

**Audible Alarm Package** – This package includes a horn, pilot light, latching relay and a push button for silencing the horn.

**Low Liquid Cutoff** – The relay is mounted and wired with sensing probe shipped loose for field installation.

**Special Controllers** – The customer may specify the use of special process or overtemperature controllers for a different temperature range, sensor input, control mode, etc.

**Panel Heater** – A heater and thermostat are provided to prevent condensation and maintain minimum ambient temperature for electrical components.

**Wire Markers** – Identification markers are attached to both ends of all control and power wires.

**Tagging of Internal Parts** – Permanent tags are attached to the subpanel near internal parts and marked with component titles as noted on the wiring diagram.

**UL Listing** – Available on most designs.

**Special Coatings** – Epoxy or other paints may be specified.

**12" High Floor Stand** – This construction allows the control panel to be floor mounted.

**NEMA 4 Panel Enclosure** – Features a gasketed weatherproof construction.

**NEMA 4 Instrument Window** – This feature allows for access to a control instrument without opening the control panel door.

**Stainless Steel Panel Enclosure (NEMA 4X)** – This construction provides extra corrosion resistance for harsh environments.

## How To Order

### Standard Heater Construction

#### Specify:

<u>Element Type</u>	<u>Catalog No. Prefix</u>
Open Coil	165N
Finned Tubular	166N
Tubular	164N

For complete INDEECO catalog number see pages 21-39.

### Custom Designs

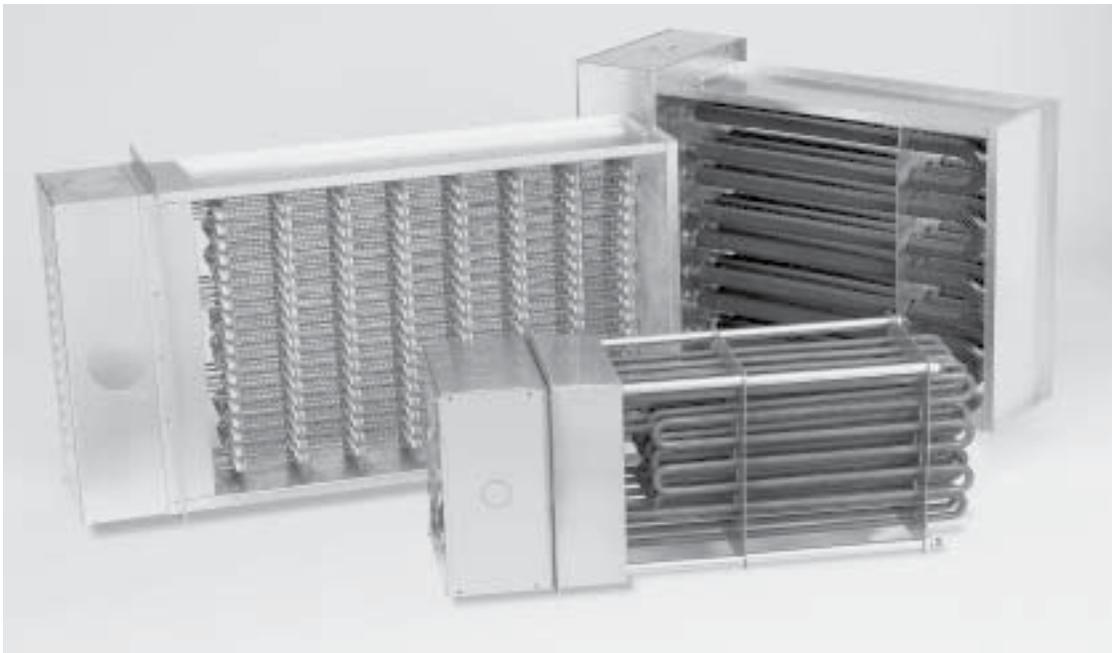
Required application information:

- Required temperature rise ( $\Delta T$ )° F through the heater
- Maximum outlet air temperature
- Minimum air velocity through heater (SFPM)
- Flow rates (minimum and maximum SCFM)
- Duct or plenum size (width x height)
- Method of mounting/installation
- Maximum allowable pressure drop through the heater
- Heater environment (hazardous, corrosive, wet, dusty, etc.)
- Temperature control requirements

#### Specify\*

- KW
- Voltage and phase
- Element type (open coil, finned tubular, tubular)
- Number of heater circuits
- Element watt density
- Inches of insulation
- Mounting configuration (horizontal or vertical)
- Airflow direction
- Method of temperature/power control
- Special features – pages 10-13

\*INDEECO can help determine custom design specifications or may advise a better choice to reduce cost and delivery time.



# Limited Warranty

Industrial Engineering and Equipment Company (INDEECO) products are warranted against defects in workmanship, material, design, labeling and packaging. No other warranty, expressed or implied, written or oral, applies. No person other than an officer or the general manager of INDEECO is authorized to give any other warranty or assume any liability.

**Warranty Period:** This warranty is effective for eighteen months from the date of shipment of the product from INDEECO's factory, or for twelve months from the date the product is first placed in service, whichever period lapses first.

**Conditions of Warranty:** INDEECO products must be installed, operated and maintained in accordance with INDEECO's instructions. INDEECO is not liable for damage or unsatisfactory performance of the product resulting from accident, negligence, alteration, unauthorized repair, improper application or installation of the product, improper specifications or corrosion. INDEECO IS NOT LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES. Claims against carriers for damage in transit must be filed by the purchaser with the carrier.

**Remedy:** The part or product in question should be returned, freight prepaid, to:

**INDEECO**

425 Hanley Industrial Court  
St. Louis, Missouri 63144  
Attention: Return Goods Manager

If after receipt of the product and the claim, INDEECO finds to its reasonable satisfaction that the product is defective in workmanship, material, design, labeling or packaging, the product will be repaired or replaced or the purchase price refunded at INDEECO's option. There will be no charge to the purchaser for parts or labor. Removal and reinstallation of the product, and shipment of the product to INDEECO for repair or inspection shall be at the purchaser's risk and expense.

THE REPAIR, REPLACEMENT OR REFUND PROVIDED FOR IN THIS LIMITED WARRANTY IS THE EXCLUSIVE REMEDY OF THE PURCHASER. THIS WARRANTY IS EXPRESSLY IN LIEU OF ANY OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE TERMS OF THIS LIMITED WARRANTY.



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