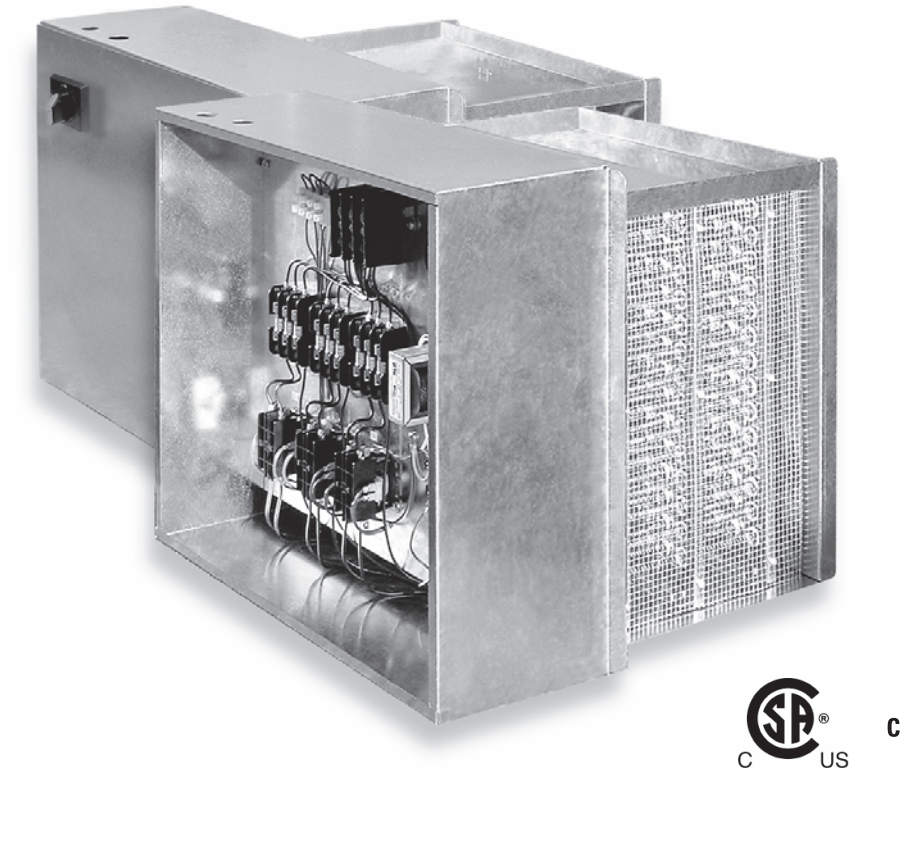
section II

Overview & Mechanical Construction



C SP US C UL US LISTED

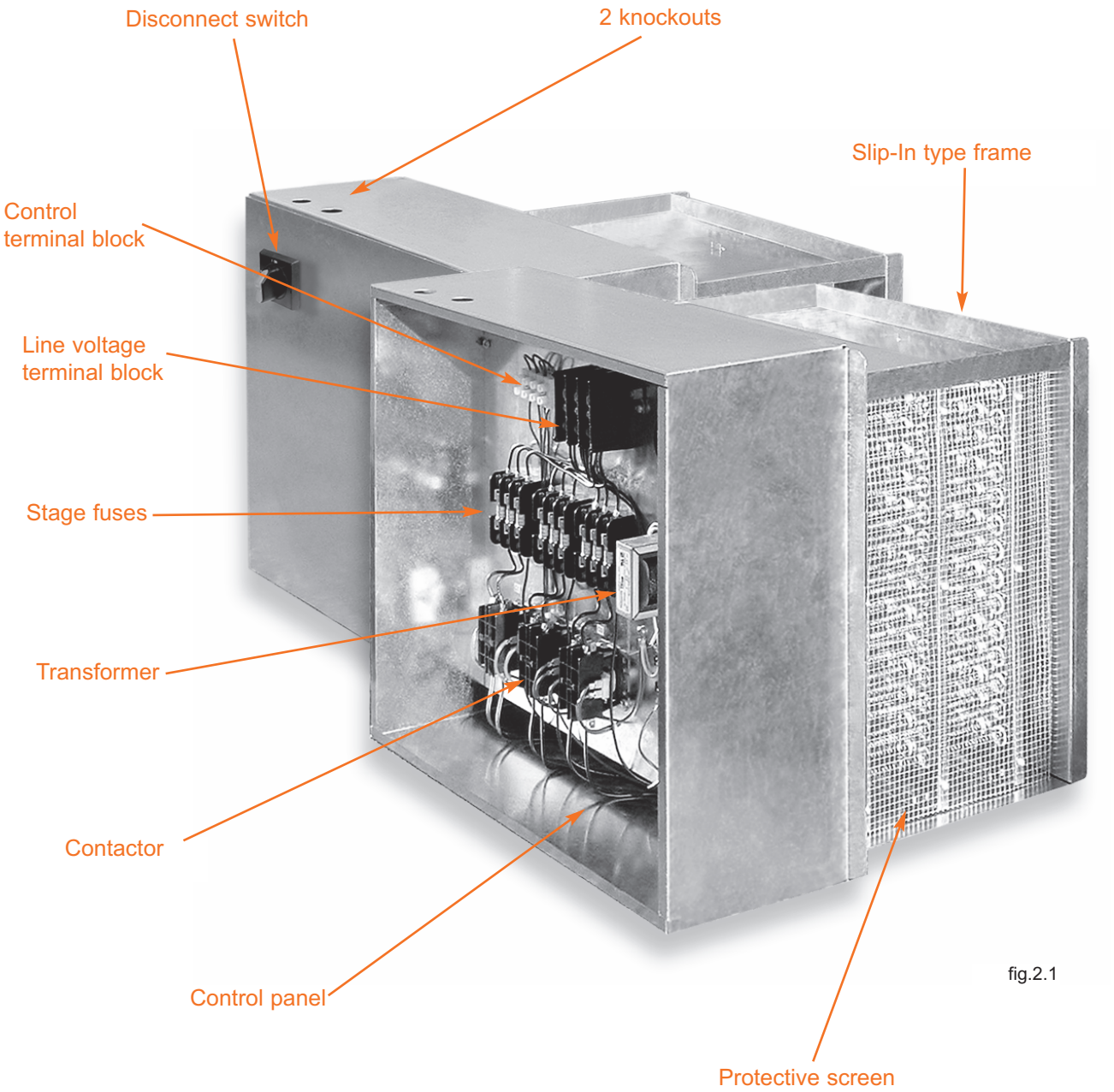


fig.2.1

C SA US C UL US LISTED

Magnetic Contactor

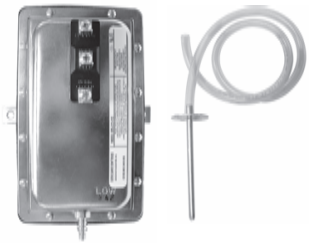
Provides power to the individual stages of the heater.
Standard

Transformer

Supplies power to the control circuit. Supplied with a fuse.
Standard

Automatic Reset Thermal Cut-Out

An automatic reset, primary safety device. Removes power from elements if overheating occurs.
Standard



Airflow Switch

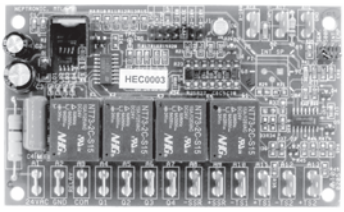
Safety component used to prevent a heater from operating if there is no airflow.
Standard for ON/OFF heaters

Solid State Relay (SSR)

Proportionally controls the amount of power transmitted to the heating elements. Allows quiet operation and is exceptionally reliable.
Standard for proportional heaters

Manual Reset Thermal Cut-Out

A secondary safety device which removes power to the elements if overheating occurs.
Standard when required by code, otherwise optional

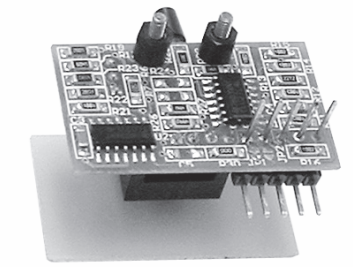


Neptronic HEC Electronic Controller

A unique control and safety component. Controls and optimizes the power transmitted to the heating elements according to the duct temperature and air flow.
Standard for proportional heaters.

Pneumatic Electric Switch

Converts a pneumatic ON/OFF signal to an electric signal.
Standard for heaters with pneumatic ON/OFF signal



Pneumatic Electric Control

Converts a proportional pneumatic control signal to a proportional electric signal.
Standard for proportional units with pneumatic signal

Disconnect Switch

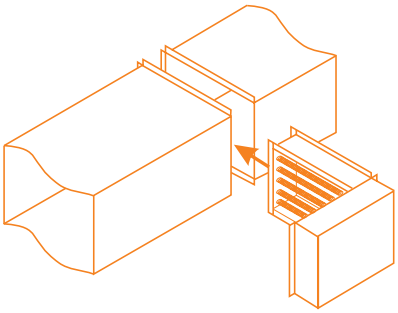
Cuts the power supply to the heater in order to safely perform installation and maintenance tasks.
Standard when required by code, otherwise optional

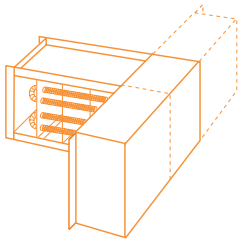
Fuses

Protect the total load and/or the individual heater stages.
Standard when required by code, otherwise optional

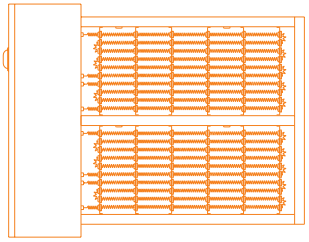
Mercury Contactor

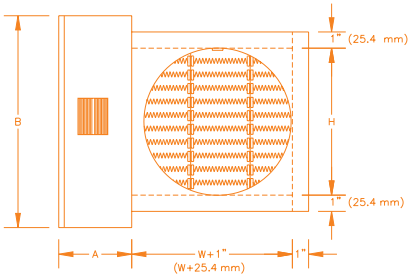
Provides power to the individual stages of the heater. Allows quiet, reliable operation.
Optional

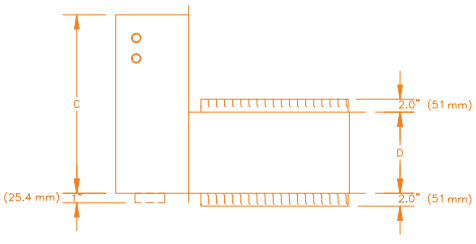


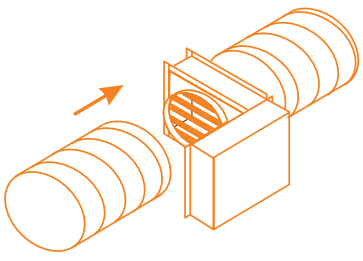


Mechanical Construction









Slip-In Electric Heater - Type I

The slip-in type electric heaters are designed so that the entire frame can be inserted into the duct.

Advantages of slip-in electric heaters:
A system using a slip-in heater permits the installation of the entire ventilation duct system before the heaters become available. Retrofits are much simpler, smaller dimension slip-in heaters require no extra supports.

To order a Neptronic slip-in heater, specify the dimensions of the duct and the selection software will automatically calculate the optimum heater dimensions.

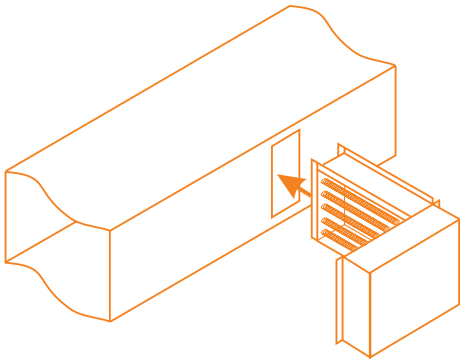


fig.2.2

Installation:

Allow for a proper sized opening on one side of the duct, see fig. 2.2, as well as installation clearances to avoid any obstructions around the duct. The Neptronic slip-in heater has a standard 1" (25.4mm) flange on each side of the control box and can be attached directly to the duct with sheet metal screws.

Flanged Electric Heater - Type F

Flanged heaters are designed so that the heater is an integral part of the duct work. The heater frame is attached to matching duct flanges, see fig. 2.3. Standard 1" (25.4mm) on the heater frame are used to attach it to the duct.

Flanged heater dimensions match the dimensions of the duct. Heaters requiring extra support or for large heaters, custom flanges can be provided.

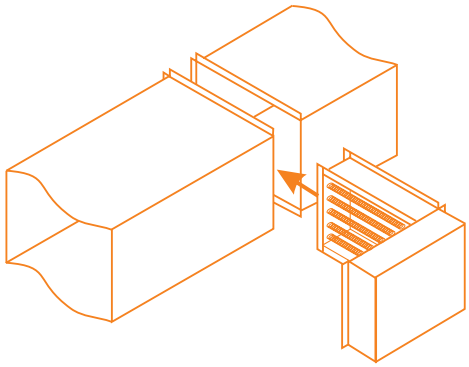


fig.2.3

Installation:

The Neptronic electric heater comes with 1" (25.4mm) standard flanges installed around the frame and on each side of the control box. It can be attached directly onto the duct with sheet metal screws.

Note: Round collar option available with flanged electric heater type F

Round Collar option

Round collar electric heaters are available for installation on round duct systems with a standard diameter of 6" to 24" (152mm to 609mm). They are provided with one male and one female adapter for ease of installation.

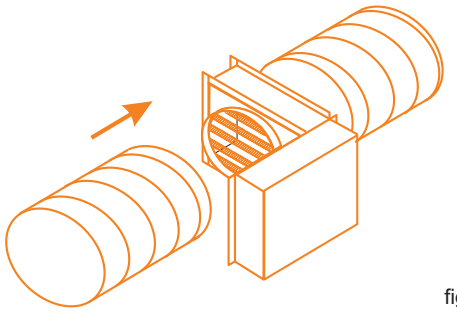


fig.2.4

Installation:

The Neptronic round collar electric heater comes with a 1" (25.4mm) extension on each side of the frame. The heater is attached directly onto the duct using sheet metal screws.

Zero Clearance Construction

All Neptronic heaters are designed and approved for zero clearance to combustible material. Zero clearance construction means that there is no restriction on the distance between combustible materials and the section of the duct housing the heater, or the heater itself. The control panel must be accessible for servicing.

Horizontal or Vertical Mounting

Neptronic electric heaters are designed to be installed in either horizontal or vertical ducts. Please specify the airflow direction with an H for horizontal and a V for vertical to ensure correct orientation of the components in the control panel.

Vertical

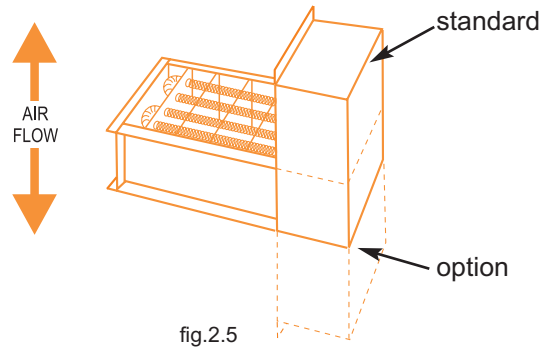


fig.2.5

Horizontal

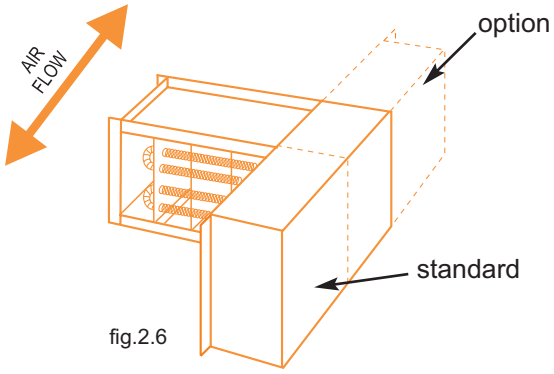


fig.2.6

Optional Accessories:

Protective Screens

Optional protective screens are available to prevent accidental contact with the heating elements.

Option 10 or 01: Protective screens on one side only - 10 left of the control panel, 01 right of the control panel.
Option 11: Protective screens on both sides of the heater.

Standard Control Panel

The control panel attached to the heater exceeds the frame dimensions by 1" (25.4mm) on the top and bottom. If installation conditions do not allow for this standard extension a control panel with dimensions equal to the heater frame can be provided.
The standard extension of the control panel is to the left. If installation conditions do not permit the extension to the left you must specify the direction for the extension of the control panel.

Control Panel Options

Bottom Control Panel

A bottom control panel can be supplied, when required for easy installation and maintenance.
This option is available for all heaters (Slip-in, flanged and round collar) of small dimensions.

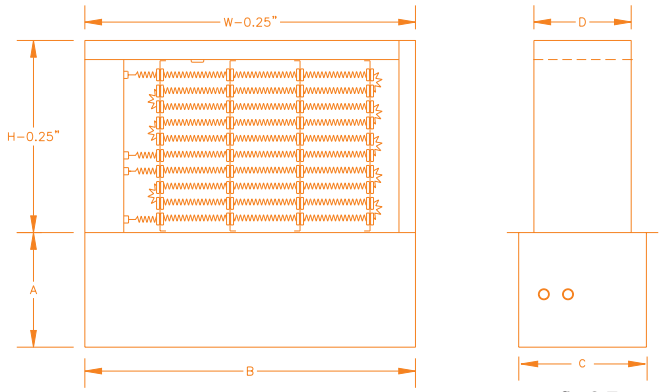


fig.2.7

Insulated Control Panel

An insulated control panel is recommended for high duct temperatures.
Insulation material, 1" (25.4mm) thick is installed between the panel and the hot area to prevent condensation on electrical components.

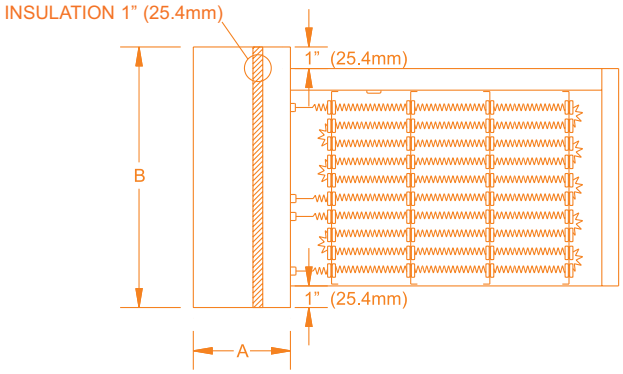


fig.2.8

Remote Control Panel

In certain cases it may be more convenient to install the control panel remotely from the heater or in a separate room. A remote control panel can be supplied upon request.

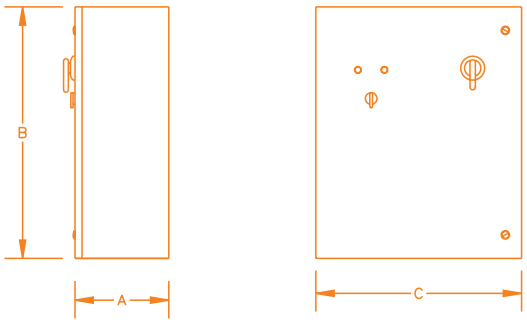


fig.2.9

Enclosure Types (control panels)

Nema 1

(IP 10)

Protected against access

Enclosures constructed for indoor use to provide a degree of protection to personnel against incidental contact with the enclosed equipment and to provide a degree of protection against falling dirt.

This enclosure type is standard on Neptronic electric heaters.

Nema 12

(IP 52)

Dust-protected

Enclosures constructed (without knockouts) for indoor use to provide a degree of protection to personnel against incidental contact with the enclosed equipment; to provide a degree of protection against falling dirt; against circulating dust, lint, fibers, as well as water spray and light splashing of liquids, water infiltration, oil or non corrosive liquid refrigerant.

Nema 4

(IP 56)

Protected against splashing water

Enclosures constructed for either indoor or outdoor use to provide a degree of protection to personnel against incidental contact with the enclosed equipment; to provide a degree of protection against falling dirt, rain, sleet, snow, windblown dust, splashing water, and hose-directed water; and that will be undamaged by the external formation of ice on the enclosure.

Nema 4X

(IP 65)

Protected against corrosion

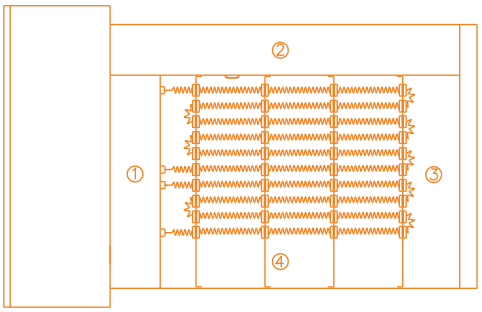
Enclosures constructed for either indoor or outdoor use to provide a degree of protection to personnel against incidental contact with the enclosed equipment; to provide a degree of protection against falling dirt, rain, sleet, snow, windblown dust, splashing water, and hose-directed water, and corrosion; and that will be undamaged by the external formation of ice on the enclosure.

The control panel and/or the electric heater are constructed in stainless steel for this option.

Special electric heaters

Heater with Cold Section

In special cases a cold section in the air duct is required. For example, when air flow has been altered near the area where the heater is located. In this case the heater will be built in order to adapt to this constraint.
Specify the location and dimensions of the cold section(s) using the control panel as your reference point.
(see fig. 2.10)



① COLD SECTION ON THE SIDE OF CONTROL PANEL
② COLD SECTION ON TOP
③ COLD SECTION OPPOSITE THE CONTROL PANEL
④ COLD SECTION ON THE BOTTOM

fig.2.10

Large Heaters

Heaters whose dimensions exceed 40" (1.0m), will be reinforced by NEP to assure proper rigidity. Multiple thermal cut-outs will be installed and evenly distributed to obtain the same level of safety as for a standard size heater.
In some cases, the large heater will be constructed in two sections to simplify the installation.

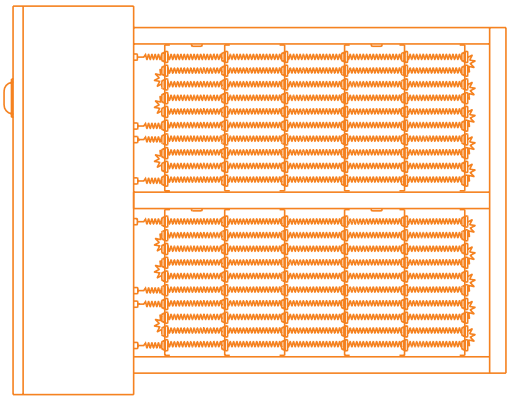


fig.2.11

Process Heaters

Special application heaters for baking, drying or other processes up to a temperature of 1,200ºF (648ºC) and 1,000kW can be designed and built to NEP's proven standards.

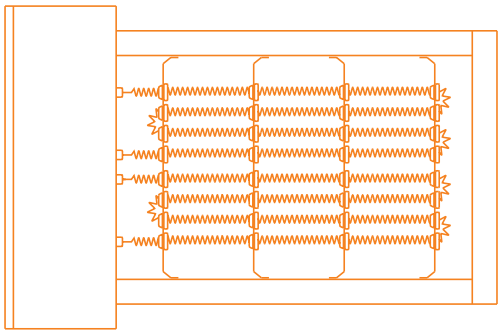


fig.2.12

Materials

Neptronic heaters are manufactured with the appropriate galvanized steel gauge to assure rigidity and corrosion protection.
Neptronic heaters can be constructed with 304 stainless steel for special applications.

Typical Dimensions

Type I (slip-in)

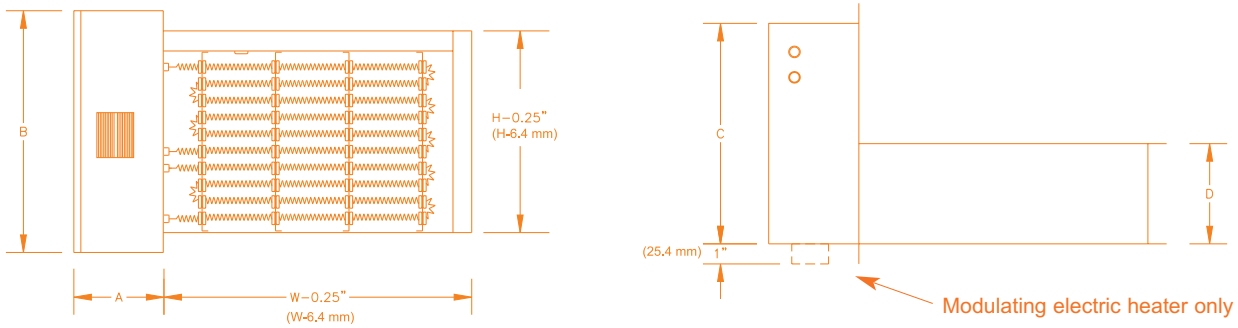


fig.2.13

Type F (flanged)

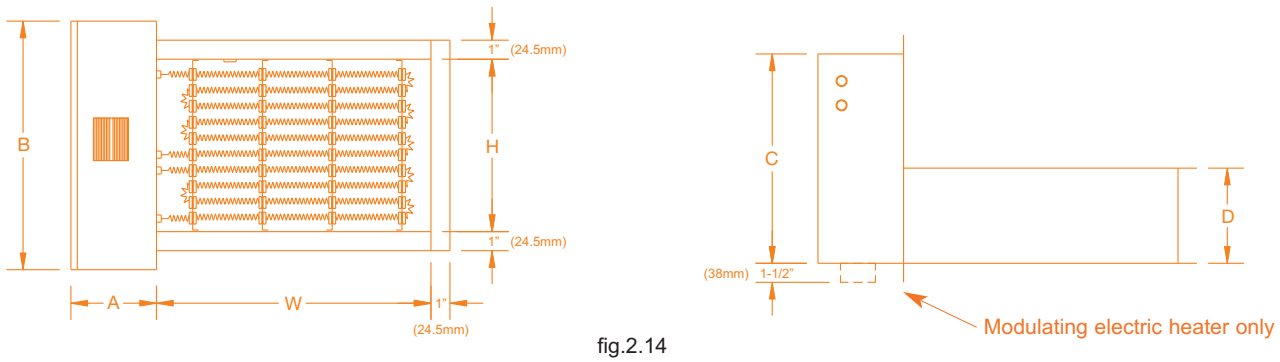


fig.2.14

round collar option with type F

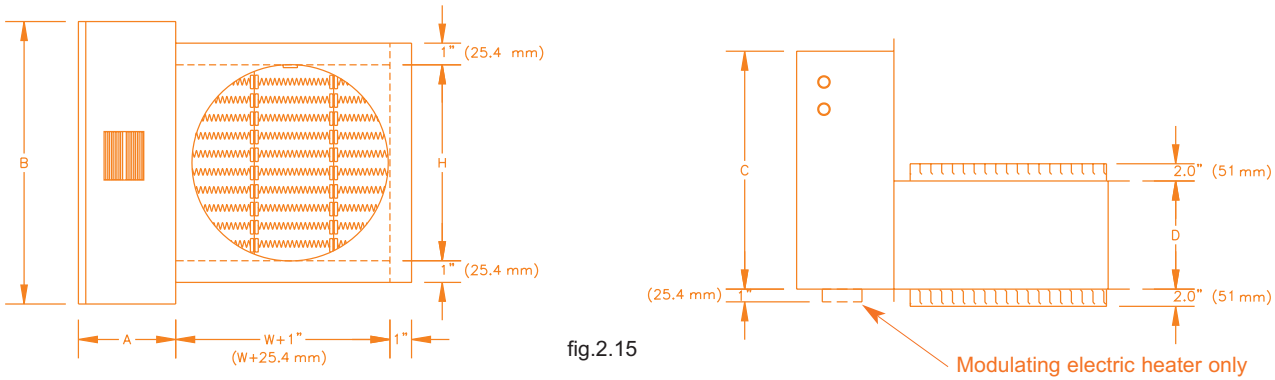


fig.2.15

W: Width of air duct H: Height of air duct

Open Coil Elements - Model C

Standard open coil elements are NiCr 60 (grade C). They are composed of 60% Nickel, 16% Chrome and the balance is Iron. The maximum operating temperature is 1,850ºF (1,000ºC).
For applications in a humid environment, we recommend the optional NiCr 80 (grade A) elements. They are composed of 80% Nickel and 20 % Chrome (does not contain iron). This will allow a maximum operating temperature of 2,100º F (1,150ºC) and installation where condensation may be present in the air duct.

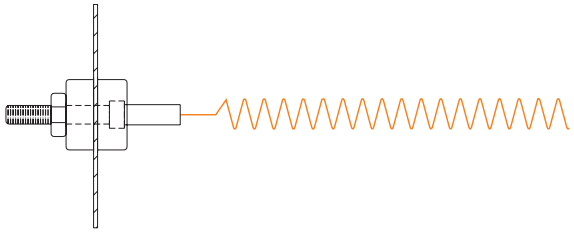


fig.2.16

fig.2.17

Standard Tubular Elements - Model T

Tubular elements are made of Incoloy 800 (Nickel alloy) tube with a diameter of 3/8" (9.5mm) containing a heating coil in magnesium oxide powder. Connections are made with two terminals (10-32).
The U or W shape of the tubular elements is determined by the heater dimensions.

Option: Tubular element can be made in stainless steel upon request

Finned Tubular Elements - Model F

Finned tubular elements are made of Incoloy 800 (Nickel alloy) tube with a diameter of 3/8" (9.5mm) containing a heating coil in magnesium oxide powder. The tube is equipped with steel fins and available with stainless steel fins as an option to allow for more efficient heat dissipation.
Attachments are made with two terminals (10-32). The U or W shape of the tubular elements is determined by the heater dimensions.

Option: Fins can be supplied in stainless steel upon request

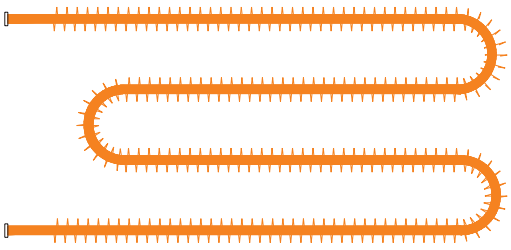


fig.2.18

Selection Guide

Element Types	Advantages	Disadvantages
Open Coil	- Excellent heat dissipation - Minimal pressure drop - Fast response time - More kilowatts per sq.ft. - Quick delivery	- Elements in direct contact with air - Cannot be installed in humid environments - Cannot be installed in dusty environments
Standard Tubular	- Less sensitive to humidity and dust - Suited for demanding environments - Excellent mechanical resistance - Heating element not in direct contact with air	- Increase in pressure drop - Slower response time - Less heat dissipation - Less kilowatt per sq.ft. - Longer delivery
Finned Tubular	- Good heat dissipation - Less sensitive to humidity and dust - Suited for demanding environments - Excellent mechanical resistance - Heating element not in direct contact with air	- Increase in pressure drop - Slower response time - Less kilowatt per sq.ft. - Longer delivery

table 2.1

Static Pressure Loss

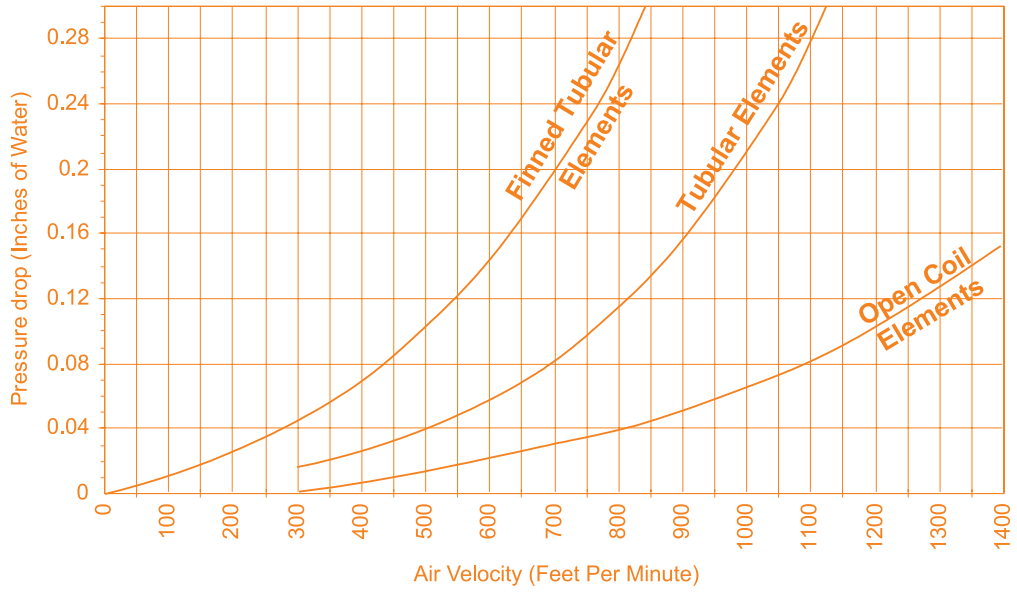


fig.2.19

Calculation of required capacity

Imperial

$$kW = \frac{CFM \times (T°2 - T°1) \times 1.08}{3413}$$

kW : Power in kW
CFM : Air volume in cubic feet per minute
T°2 : Temperature of air leaving heater in °F
T°1 : Temperature of air entering heater in °F

Metric

$$P = \frac{Q \times (T°2 - T°1) \times 1,21}{3600}$$

P : Power in kW
Q : Air volume in m^3/hr
T°2 : Temperature of air leaving heater in °C
T°1 : Temperature of air entering heater in °C

Minimum Air Velocity

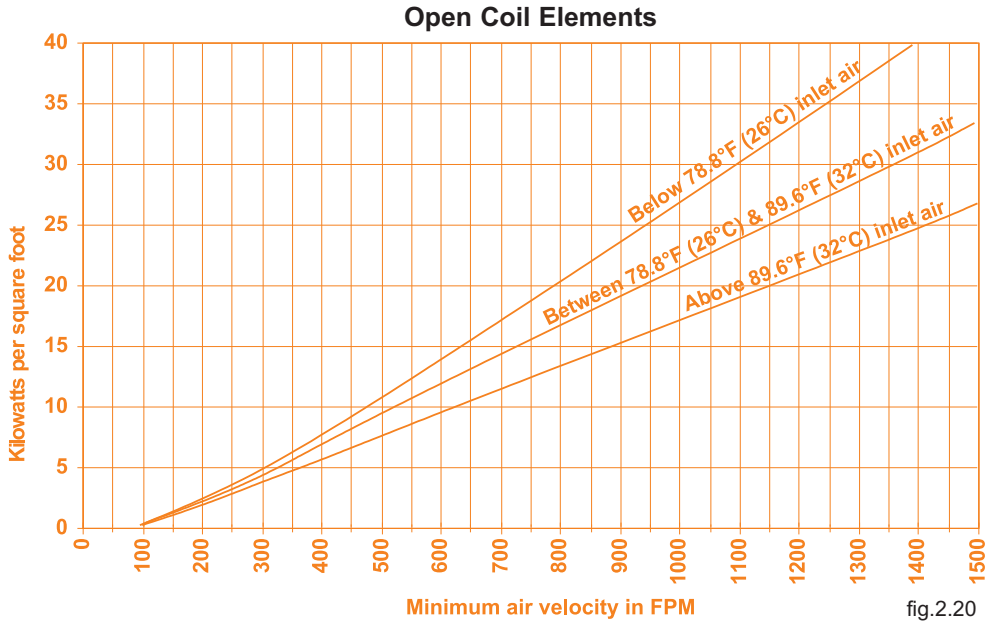


fig.2.20

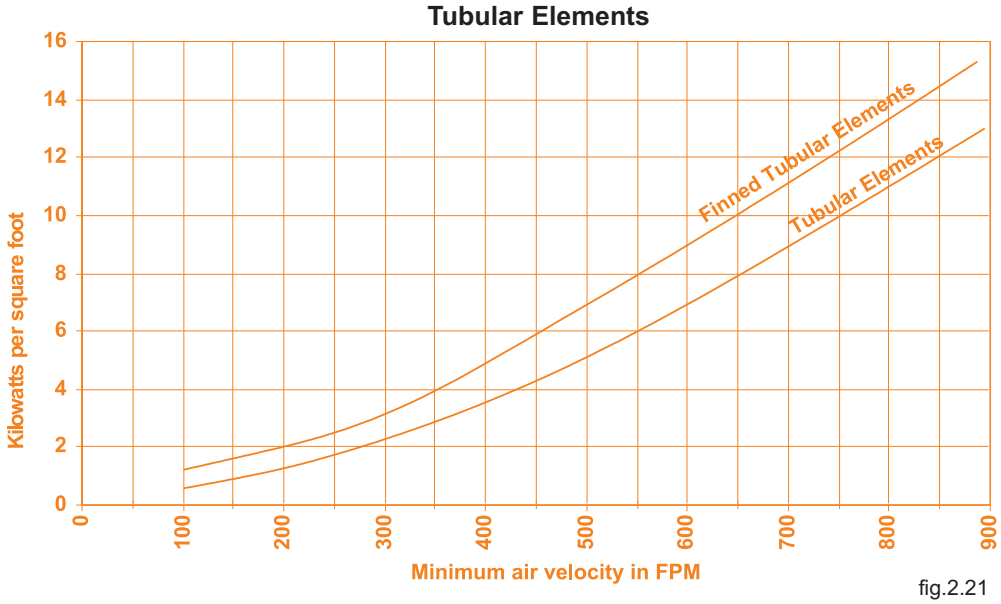


fig.2.21

Air Flow Conditions

Basic rules:

- Allow a minimum distance of 48" (1.2m) between any obstacle or elbow and the electric heater.
- Airflow must be evenly distributed across the duct.

If these basic rules are not respected overheating may result.

⚠ If the electric heater is located too close to a filter or diffuser, 3 overheating areas may occur (fig. 2.22).

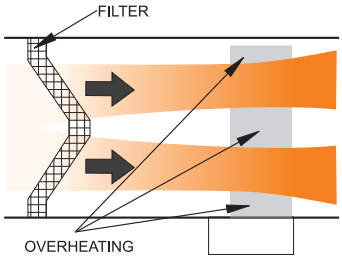


fig.2.22

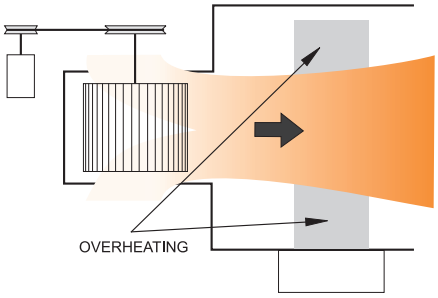


fig.2.23

⚠ If the electric heater is located too close to a fan, 2 overheating areas may occur (fig2.23).

⚠ If the electric heater is located to close to an elbow, 1 overheating area may occur (fig. 2.24).

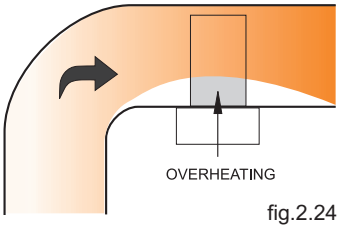


fig.2.24

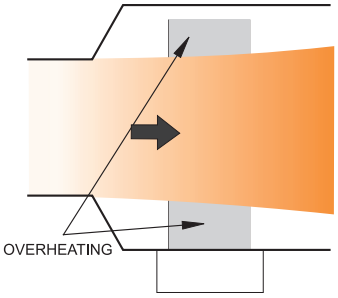


fig.2.25

⚠ If the electric heater is located too close to a transition, 2 overheating areas at the edges of the heater may occur (fig 2.25).

If one of these overheating conditions exists the life expectancy of the heating elements will be affected. We advise that the basic rules stated above be followed. If these conditions cannot be avoided, NEP can provide cold sections in the appropriate areas of the electric heater (see the section on special electric heaters fig.2.10).

Electric Heater current calculation

Single phase

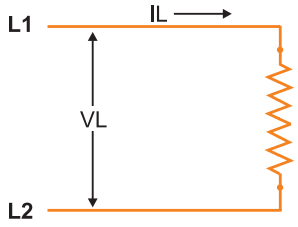
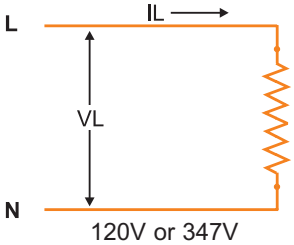


fig.2.26



120V or 347V only

fig.2.27

IE = Current through element in Amps
VE = Element Voltage in Volts
IL = Line Current in Amps
VL = Line Voltage in Volts
P = Power in Watts

Three phases

Delta connection

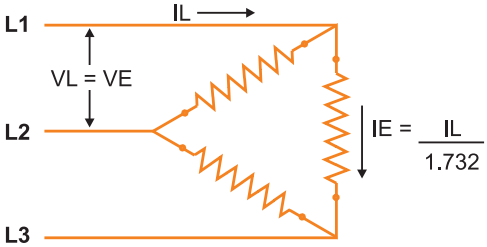


fig.2.28

Wye connection

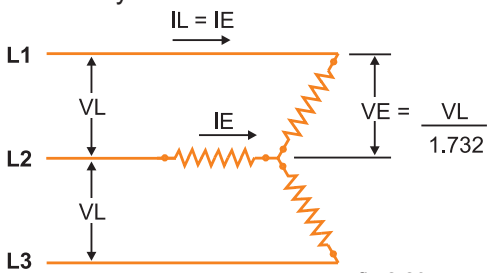


fig.2.29

Voltage Selection

In order to avoid overheating due to inappropriate voltage, we recommend selecting Neptronic standard voltages as listed below:

Single phase

Common Voltages	110V	208V	220V	230V	277V	318V	380V	416V	440V	550V
	115V			240V		332V			460V	575V
	120V					347V			480V	600V
Neptronic Standard Voltages	**120V**	**208V**	**220V**	**240V**	**277V**	**347V**	**380V**	**416V**	**480V**	**600V**

table 2.2

Three phases

Common Voltages	208V	230V	380V	400V	440V	550V
		240V		416V	460V	575V
					480V	600V
Neptronic Standard Voltages	**208V**	**240V**	**380V**	**416V**	**480V**	**600V**

table 2.3

Please carefully select the supply voltage of the electric heater. Over estimation of the supply voltage may result in inadequate performance of the electric heater due to under capacity. Any under-estimation of the supply voltage may cause an increase in current and power and by consequence safety issues. Please consult your Neptronic representative for any non-standard voltage.