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**Introduction** ..... I.1  
**Heater Selection Software** ..... I.2  
**Manufacturing** ..... I.3

**Overview** ..... II.1  
 Description of Components ..... II.3  
**Mechanical Construction** ..... II.5  
     Frame ..... II.6  
     Control Panel ..... II.8  
     Special Electric Heaters ..... II.10  
     Materials & Dimensions ..... II.11  
**Heating Elements** ..... II.12  
**Selection & Installation Tips** ..... II.14

**Electrical Construction** ..... III.1  
     Electric Control ..... III.2  
     Pneumatic Control ..... III.3  
     Electrical Components ..... III.4  
     Neptronic HEC Controller ..... III.7  
     Typical Wiring Diagrams ..... III.8  
     Legend ..... III.10

**Thermostats** ..... IV.1  
 ON/OFF Thermostats ..... IV.2  
     White Rogers ..... IV.2  
     Honeywell ..... IV.3  
 Modulating Thermostats ..... IV.4  
     X100 ..... IV.4  
     DS100 ..... IV.4  
     PTA ..... IV.5

**Option Summary Sheet & Nomenclature** ..... V.1  
**Specification Form** ..... V.3  
     Open Coil Element Heater ..... V.3  
     Tubular Element Heater ..... V.5  
**General Conditions of Sales & Warranty** ..... V.7  
**Formulas & Conversions** ..... V.8  
**Installation Instructions** ..... annex 1



# *A Wide Range of HVAC Products*

Founded over 30 years ago, the company occupies a modern 80,000 square foot facility on 200,000 square feet of land. Located in the heart of Montreal, Canada, with easy access to the main throughways and international airports. Over 130 people are employed at the Head Office and Factory.

Neptronic is the trade name for a complete range of products available for heating, ventilation and air conditioning applications. Along with electric heaters, NEP designs, manufactures and distributes electric and gas steam humidifier, as well as electronic damper actuators, actuated valves and controls.

NEP holds several patents, notably for the ENERDRIVE system, a fail safe device available in selected damper actuator models as well as for the AFEC system in the SK300 series electric humidifier.

Currently, 3 important patents are pending, one for the siphon system for the SKR residential humidifier, another for the SKG gas humidifier and the latest for the unique HEC electric heater controller.



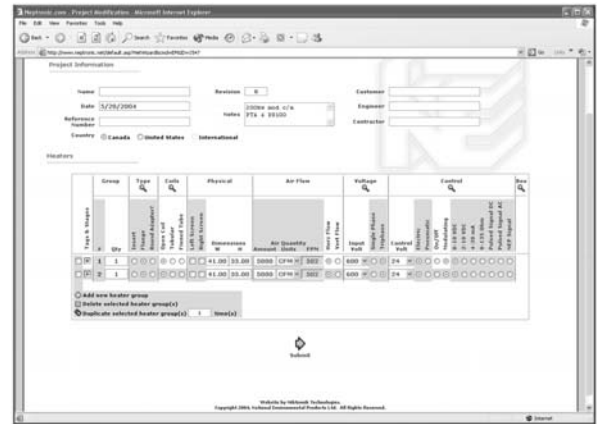
# *A Neptronic Innovation: Heater Selection Software*

Neptronic is the first and only manufacturer of electric heaters to offer to its clients, the possibility to obtain specifications directly on our web site: [www.neptronic.com](http://www.neptronic.com).

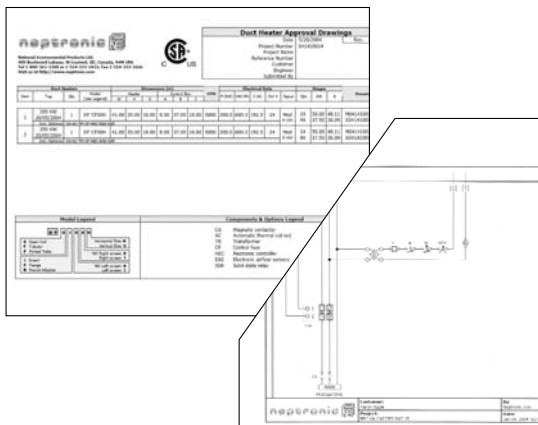
Our selection software allows access to technical data and formulas to specify Neptronic heaters and much more.

Whether you are an engineer or a contractor, our software allows you to very easily select the required electric heater by entering the basic data (duct dimensions, airflow, power, voltage, number of stages, control signals, etc.) from a user friendly window. The selection software then calculates the optimum specifications for each electric heater.

The complete and precise heater specifications, as well as the approval list, may be edited or inserted in the project file.



## *Easy to Select*



You are in control of all your projects and will be able to assign your own reference numbers. Modifications are made directly from your computer.

To obtain a price, forward the selected list of heaters to one of our representatives for fast and efficient service.

The unique selection software allows data to be transferred automatically between the representatives and our manufacturing plant, eliminating errors that can arise during data transfer.

## *State-of-the-Art Technology*



The Neptronic electric heater is manufactured using the most advanced technologies available:

- Total automation from design to production using integrated CAD/CAM systems not only assures maximum efficiency, but also prevents errors in the transfer of plans and specification data between the client, the R&D department and manufacturing personnel.
- The most advanced CNC technology for sheet metal fabrication is used in manufacturing the heaters.

All these factors were key in designing a complete line of electric heaters that are sturdy, easy to install and which include standard features that our competitors offer only as options, such as control panel doors with removable hinges.

## *Fast and Efficient Manufacturing*

### *Neptronic: A Guarantee of Quality*

Modern equipment allows us to respond in record time to your needs and to the most demanding specifications.

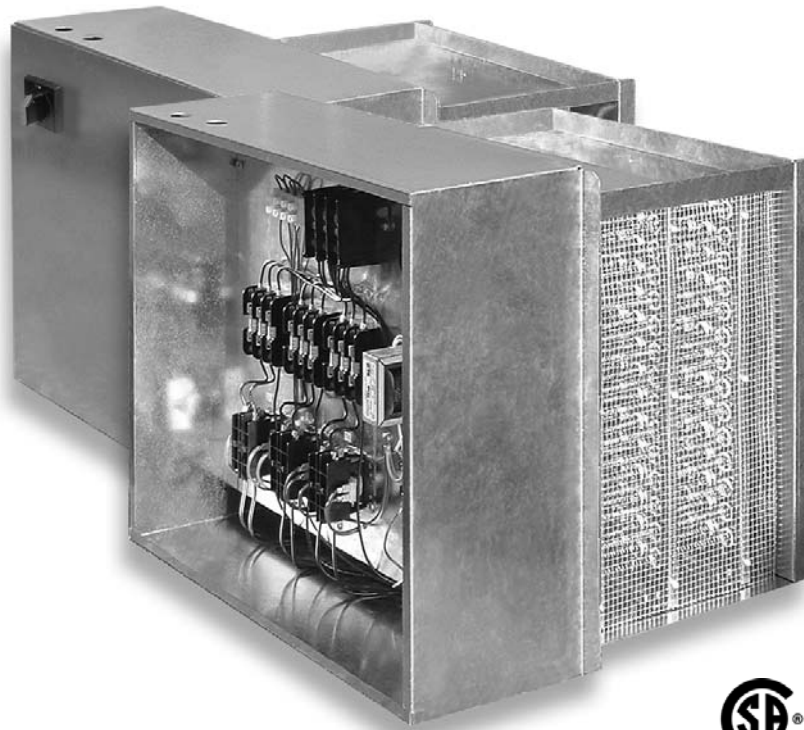
This infrastructure is supported and managed by our highly skilled specialists to whom quality workmanship is of utmost importance.





*section II*

*Overview  
&  
Mechanical  
Construction*



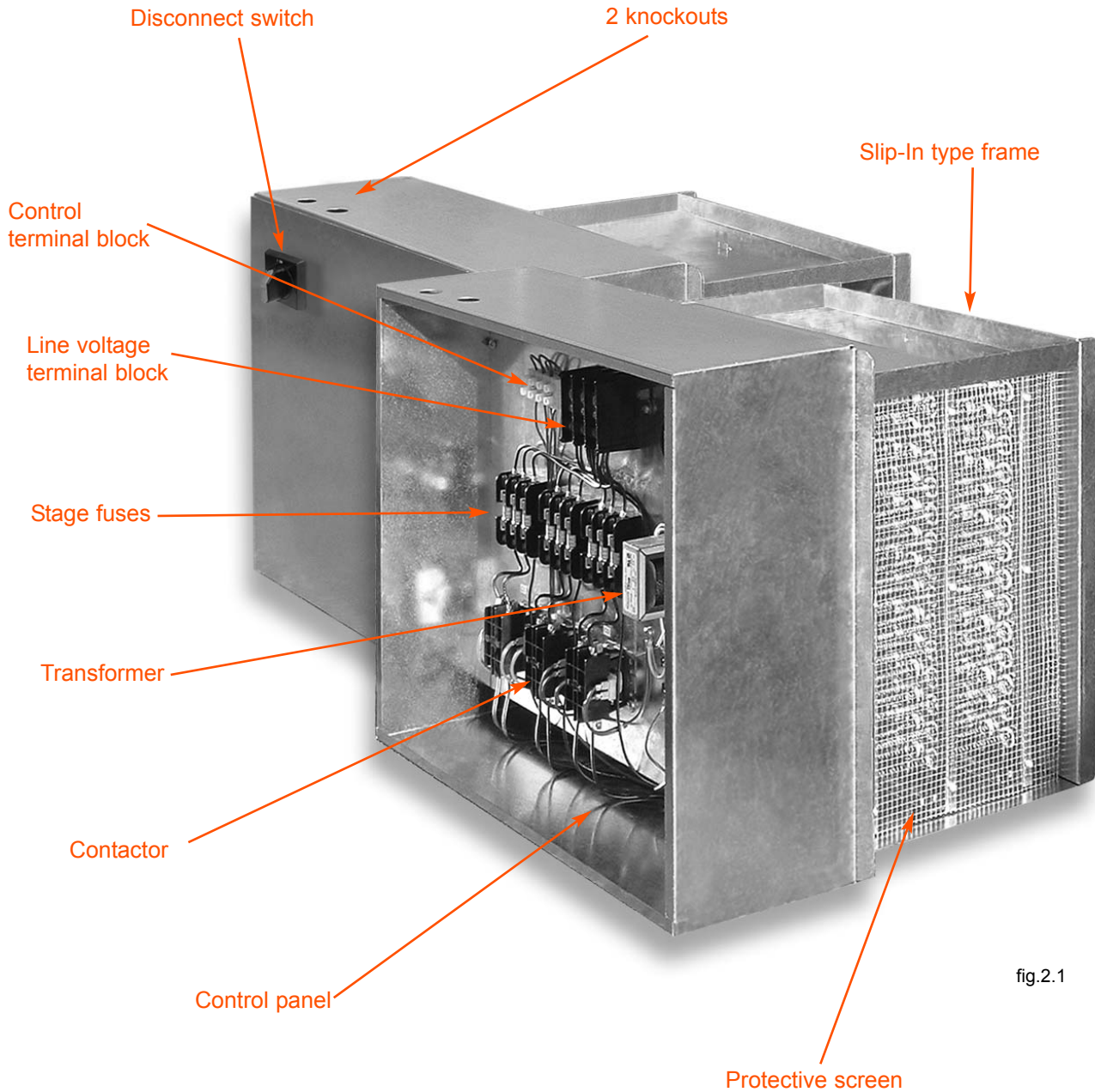


fig.2.1







**Magnetic Contactor**

Provides power to the individual stages of the heater.  
Standard



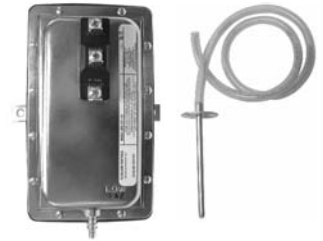
**Transformer**

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



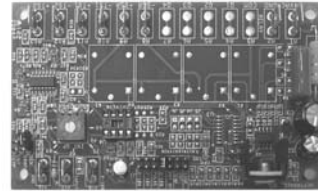
**Solid State Relay (SSR)**

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



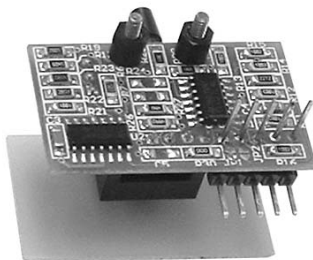
**Neptronic HEC Electronic Controller**

A unique control and safety component. Controls and optimizes the 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**

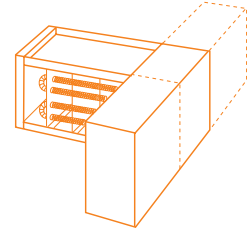
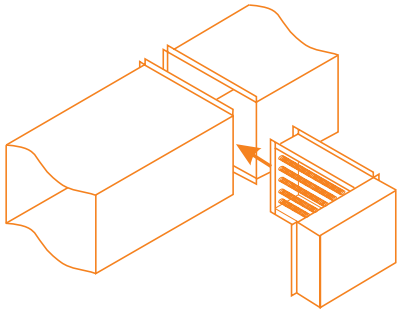
Protect the total load and/or the individual heater stages.  
Standard when required by code, otherwise optional



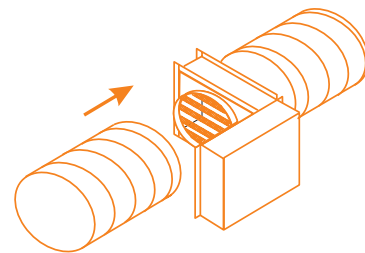
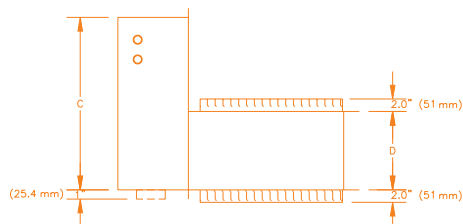
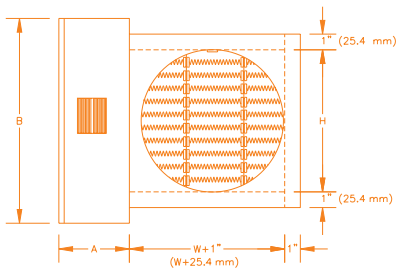
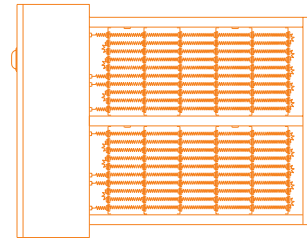
**Mercury Contactor**

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.

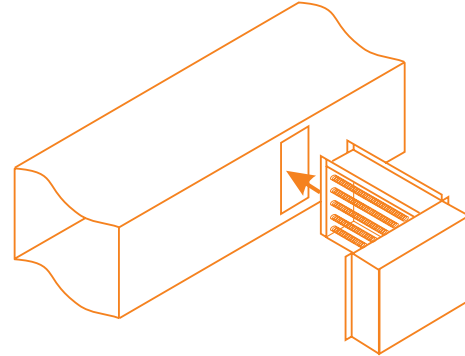


fig.2.2

#### 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.

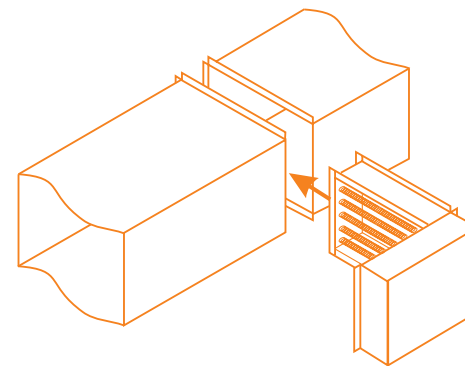


fig.2.3

#### 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.

**Round Collar Electric Heater - Type R**

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.

**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.

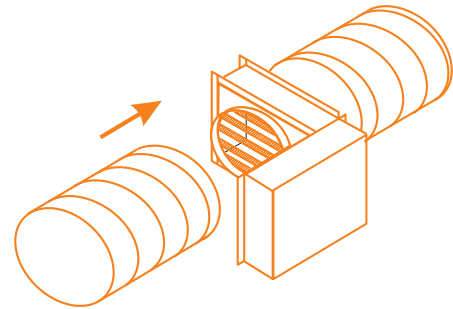


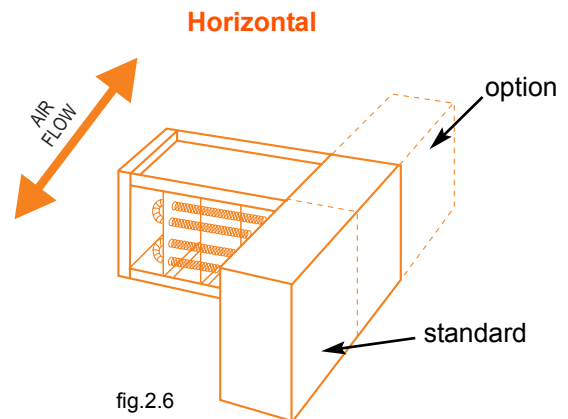
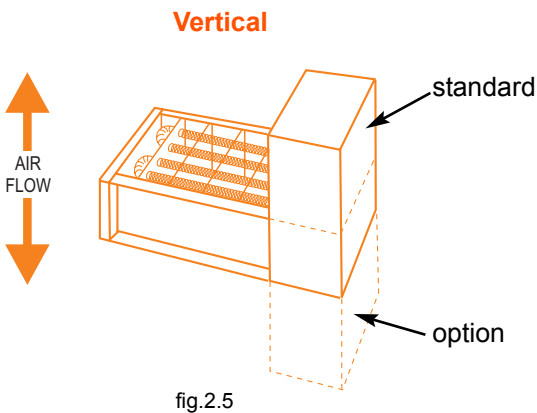
fig.2.4

**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.



**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.

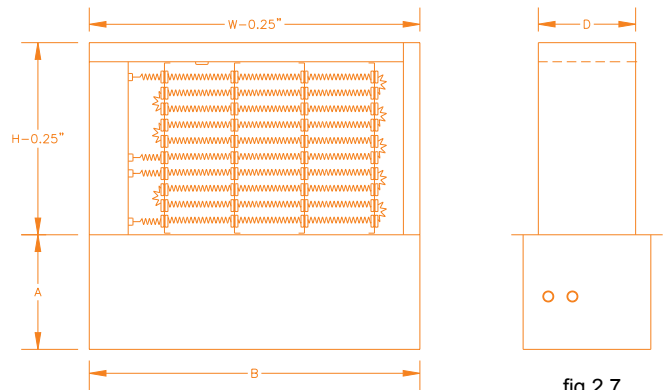


fig.2.7

**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.

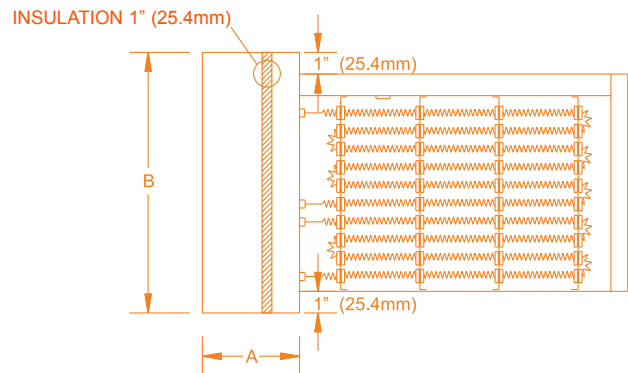


fig.2.8

**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.

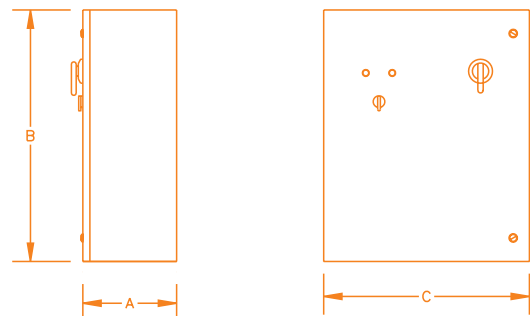


fig.2.9

**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.

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**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.

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**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.

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**Nema 4X****(IP 56)**

Protected against corrosion

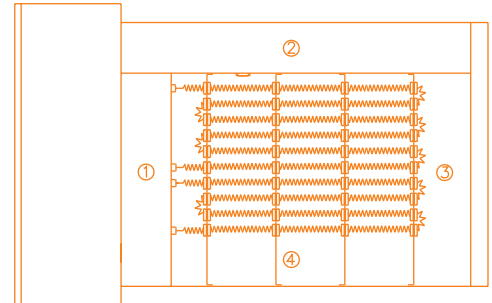
Enclosures constructed for either indoor or outdoor use to provide a degree of protection to personnel against incidental contact with the enclosed equipment; to provide a degree of protection against falling dirt, rain, sleet, snow, windblown dust, splashing water, and hose-directed water, and corrosion; 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.

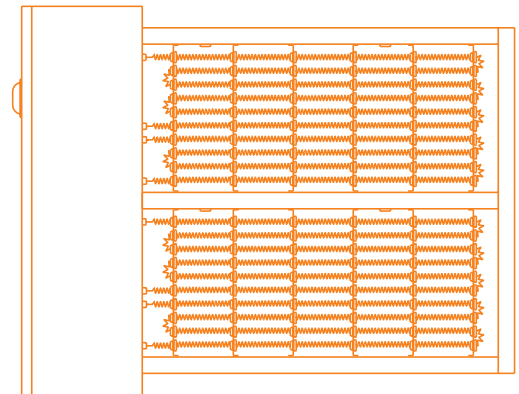


fig.2.11

Process Heaters

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

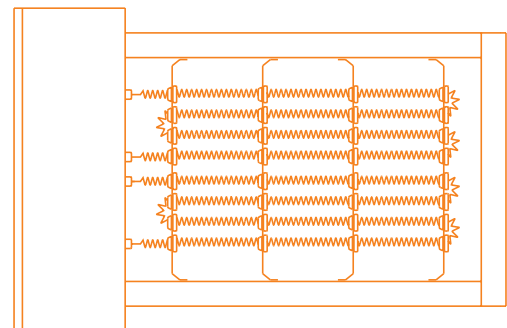


fig.2.12



**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)**

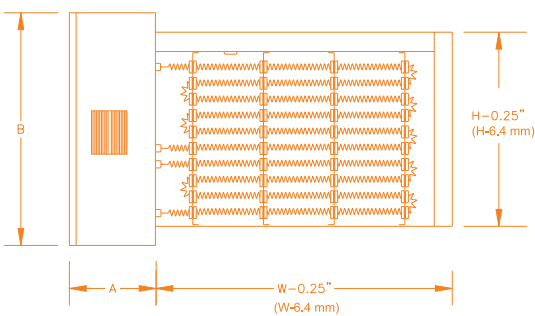
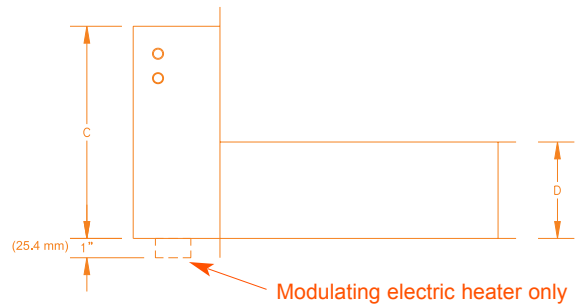


fig.2.13



**Type F (flanged)**

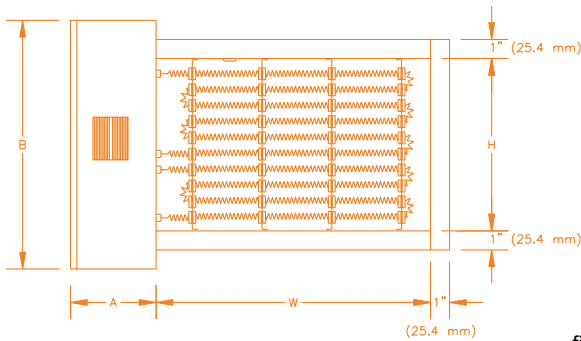
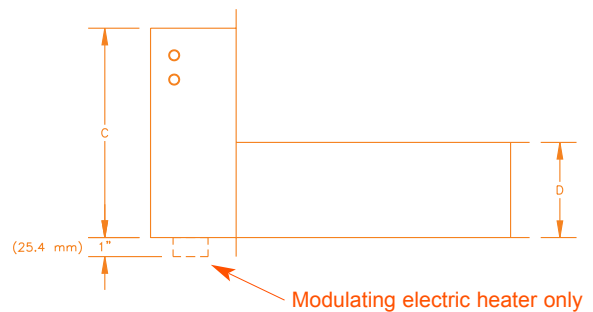


fig.2.14



**Type R (round collar)**

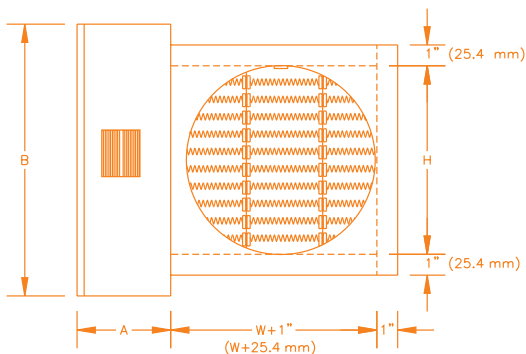
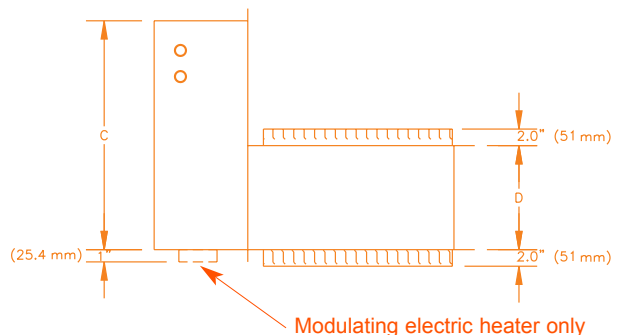


fig.2.15



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 1,850°F (1,000°C).

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 2,100° F (1,150°C) and installation where condensation may be present in the air duct.

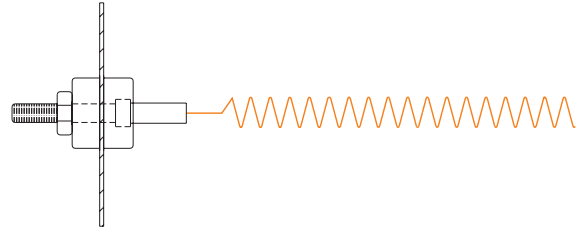


fig.2.16



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 aluminum fins 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
<b>Open Coil</b>	<ul style="list-style-type: none"> <li>- Excellent heat dissipation</li> <li>- Minimal pressure drop</li> <li>- Fast response time</li> <li>- More kilowatts per sq.ft.</li> <li>- Quick delivery</li> </ul>	<ul style="list-style-type: none"> <li>- Elements in direct contact with air</li> <li>- Cannot be installed in humid environments</li> <li>- Cannot be installed in dusty environments</li> </ul>
<b>Standard Tubular</b>	<ul style="list-style-type: none"> <li>- Less sensitive to humidity and dust</li> <li>- Suited for demanding environments</li> <li>- Excellent mechanical resistance</li> <li>- Heating element not in direct contact with air</li> </ul>	<ul style="list-style-type: none"> <li>- Increase in pressure drop</li> <li>- Slower response time</li> <li>- Less heat dissipation</li> <li>- Less kilowatt per sq.ft.</li> <li>- Longer delivery</li> </ul>
<b>Finned Tubular</b>	<ul style="list-style-type: none"> <li>- Good heat dissipation</li> <li>- Less sensitive to humidity and dust</li> <li>- Suited for demanding environments</li> <li>- Excellent mechanical resistance</li> <li>- Heating element not in direct contact with air</li> </ul>	<ul style="list-style-type: none"> <li>- Increase in pressure drop</li> <li>- Slower response time</li> <li>- Less kilowatt per sq.ft.</li> <li>- Longer delivery</li> </ul>

table 2.1

Static Pressure Loss

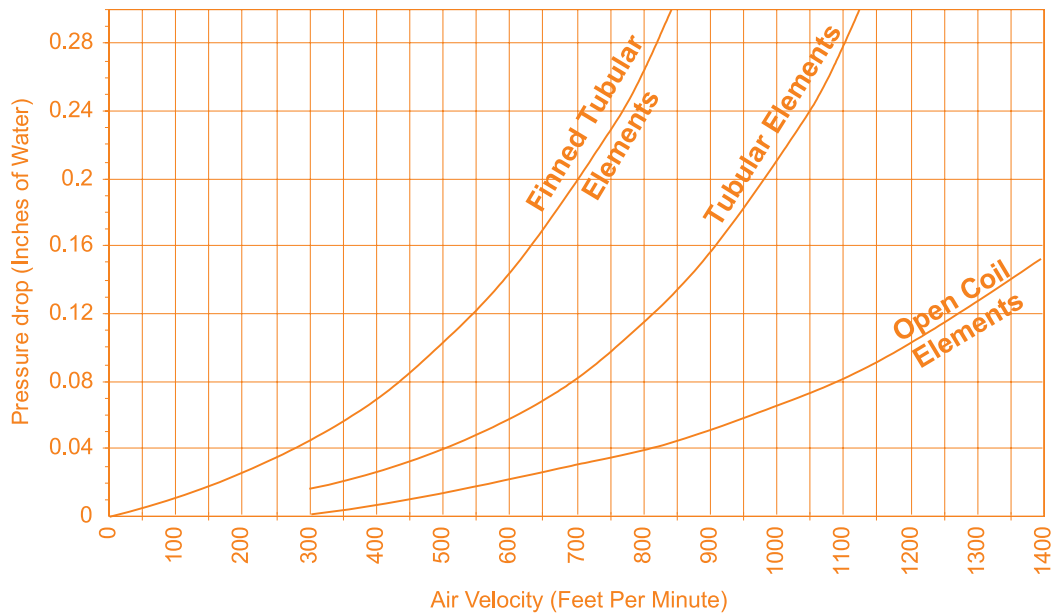


fig.2.19

Calculation of required capacity

Imperial

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

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

Metric

$$P = \frac{Q \times (T^{\circ}2 - T^{\circ}1) \times 1,3}{3600}$$

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

Minimum Air Velocity

Open Coil Elements

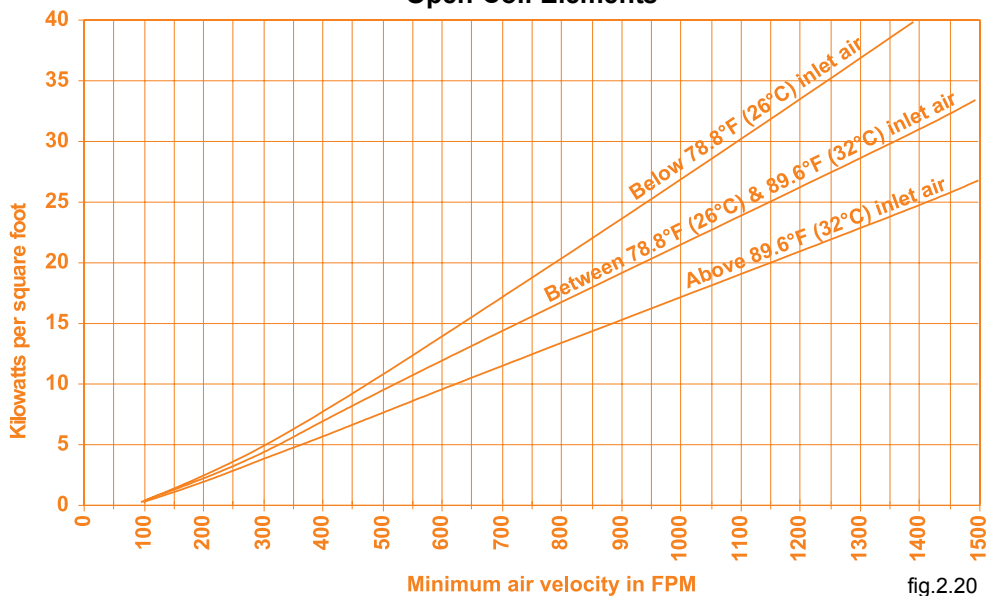


fig.2.20

Tubular Elements

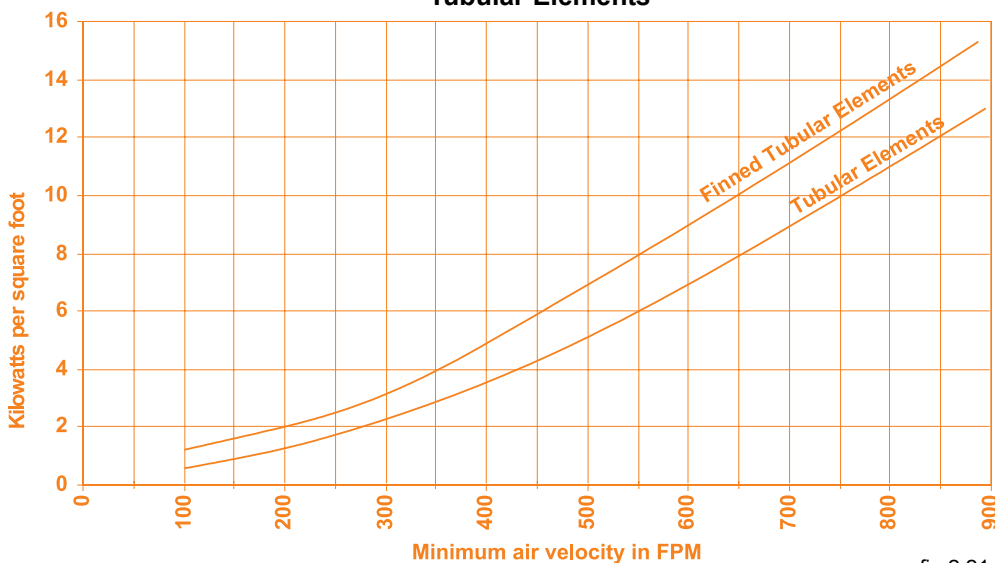


fig.2.21

**Air Flow Conditions**

Basic rules:

- Allow a minimum distance of 36" (914mm) 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).

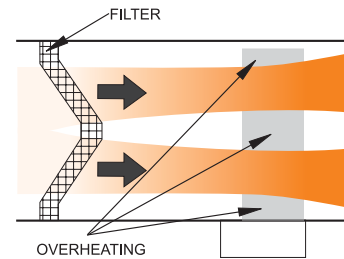


fig.2.22

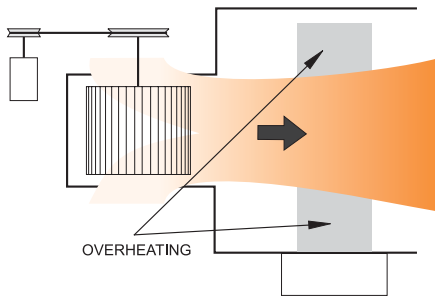


fig.2.23

⚠ If the electric heater is located too close to a fan, 2 overheating areas may occur (fig.2.23).

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

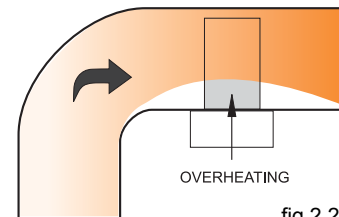


fig.2.24

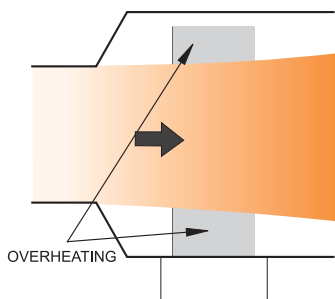


fig.2.25

⚠ 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**

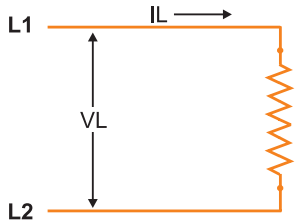


fig.2.26

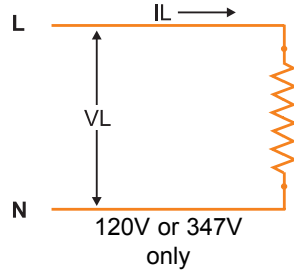


fig.2.27

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**

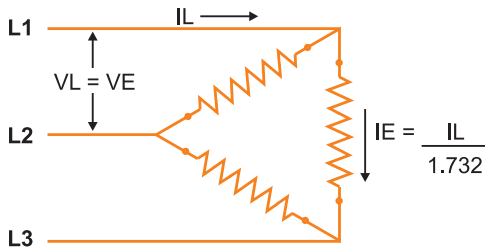


fig.2.28

**Wye connection**

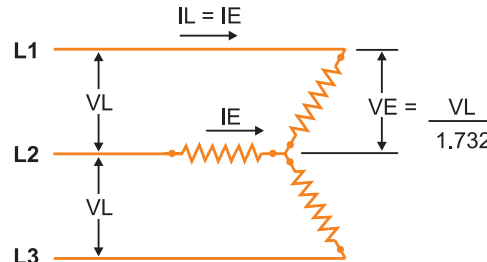


fig.2.29

**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	<b>120V</b>	<b>208V</b>	<b>220V</b>	<b>240V</b>	<b>277V</b>	<b>347V</b>	<b>380V</b>	<b>416V</b>	<b>480V</b>	<b>600V</b>

table 2.2

**Three phases**

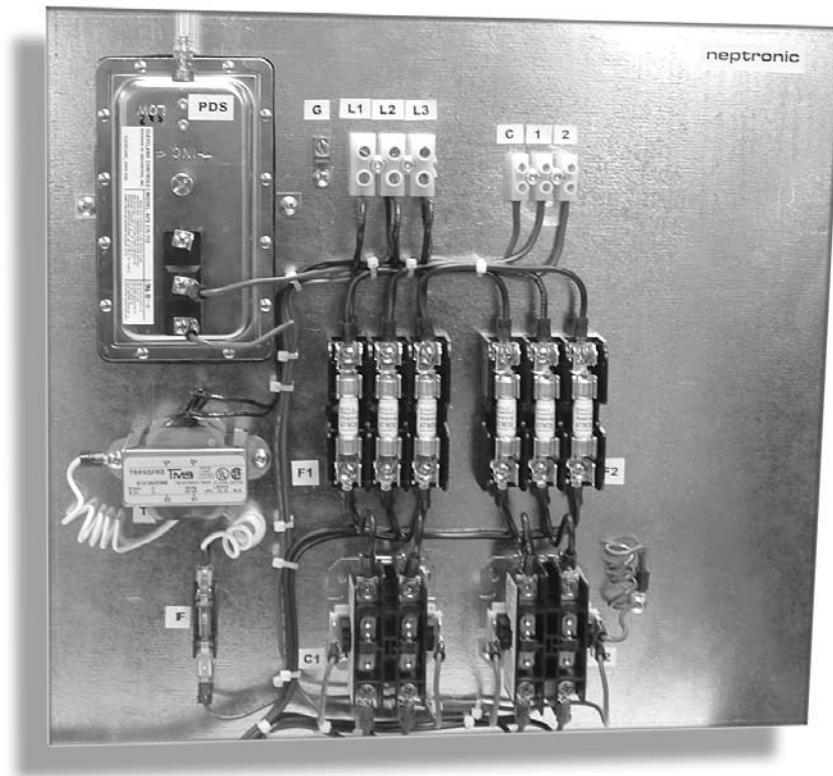
Common Voltages	208V	230V	380V	400V	440V	550V
		240V		416V	460V	575V
					480V	600V
Neptronic Standard Voltages	<b>208V</b>	<b>240V</b>	<b>380V</b>	<b>416V</b>	<b>480V</b>	<b>600V</b>

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.

**section III**

***Electrical Construction***



## Electric Control

### ON/OFF Control

The control panel of an ON/OFF electric heater includes the following components:

- Transformer and control fuse
- Automatic reset thermal cutout
- Manual reset thermal cutout when required by code, otherwise optional
- Airflow switch
- Contactor(s)
- Fuses when required by code, otherwise, optional
- Disconnect switch when required by code, otherwise optional

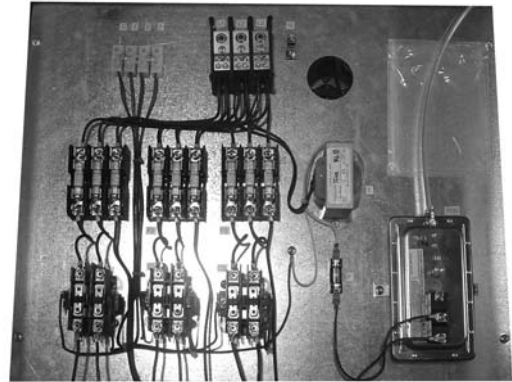


fig.3.1

### Operation:

A thermostat dry contact activates each stage of the electric heater.

Besides wiring of the power supply, you must connect the appropriate wires to the thermostat (see wiring diagram figure 3.18).

### Proportional Control (Modulating)

The control panel of a proportional electric heater includes the following components:

- Transformer and control fuse
- Automatic reset thermal cutout
- Manual reset thermal cutout when required by code, otherwise optional
- Neptronic HEC controller
- Contactor(s)
- Solid state relay(s) (SSR)
- Fuses when required by code, otherwise optional
- Disconnect switch when required by code, otherwise optional

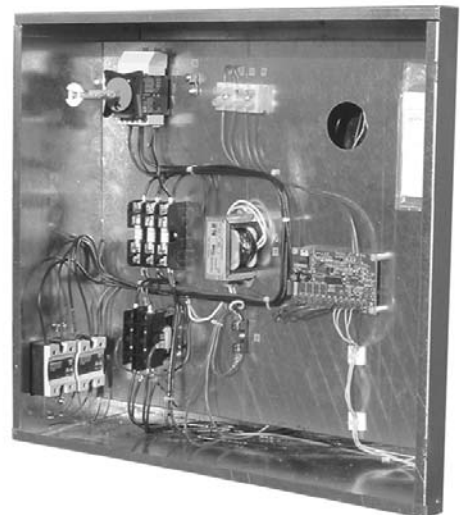


fig.3.2

### Operation:

An electric signal from a proportional thermostat is transmitted to the HEC controller. The HEC activates the proportional stage of the electric heater. The other stages are generally ON/OFF and are controlled by the HEC controller.

Besides wiring of the power supply, you must connect the appropriate wires to the thermostat (see wiring diagram figure 3.19).



**Pneumatic Control**

**ON/OFF Control**

The control panel of an ON/OFF electric heater with pneumatic input includes the following components:

- Transformer and control fuse
- Automatic reset thermal cutout
- Manual reset thermal cutout when required by code, otherwise optional
- Airflow switch
- Pneumatic electric switch/proportional
- Contactor(s)
- Fuses when required by code, otherwise optional
- Disconnect switch when required by code, otherwise optional

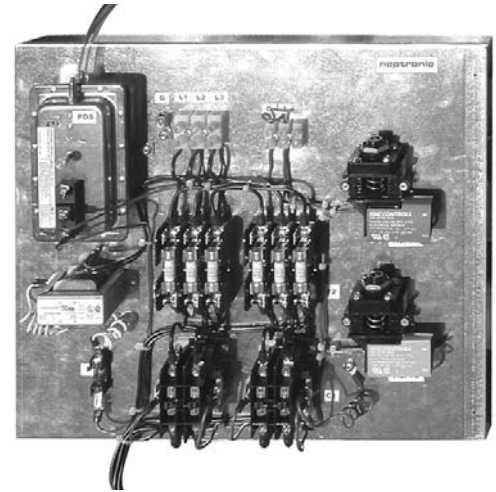


fig.3.3

**Operation:**

A pneumatic signal from a pneumatic thermostat activates the different stages of the electric heater.

Besides wiring of the power supply, you must connect a 1/4" (6mm) diameter, pneumatic signal tube onto the pneumatic electric switch (see wiring diagram figure 3.20).

**Proportional Control (Modulating)**

The control panel of a pneumatic proportional electric heater includes the following components:

- Transformer and load fuse
- Automatic reset thermal cutout
- Manual reset thermal cutout when required by code, otherwise optional
- Neptronic HEC controller
- Pneumatic electric controller
- Contactor(s)
- Solid state relay(s)
- Fuses when required by code, otherwise optional
- Disconnect switch when required by code, otherwise optional

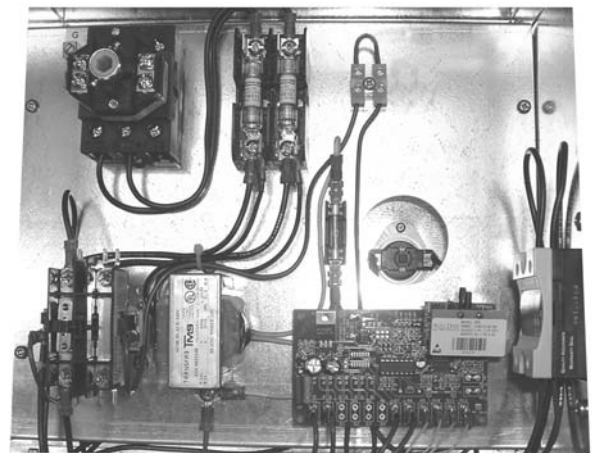


fig.3.4

**Operation:**

A proportional signal from a pneumatic thermostat is transmitted to the HEC controller. The HEC activates the proportional stage of the electric heater. The other stages are generally ON/OFF and are controlled by the HEC controller.

Besides wiring of the power supply, you must connect a 1/4" (6mm) diameter, pneumatic signal tube onto the pneumatic electric module (see wiring diagram figure 3.21).

**Magnetic Contactor - code: CA**

Magnetic Contactors are the Neptronic standard. They are reliable and field proven. They have been tested for a minimum of 250,000 operations.

**Features:**

Coil Voltage: 24 or 120VAC  
Resistive Load from 25 to 50A at 600 VAC 50/60Hz  
Number of Poles: 1, 2, or 3



fig.3.5

**Transformer (supplied with a control fuse) - code: TR**

A transformer is standard on Neptronic electric heaters. The transformer supplies power to the control circuit. If you prefer that the control power be supplied by others, you must specify this with your order.

**Features:**

Primary Voltage: same as that of electric heater  
Secondary Voltage: 24 or 120 VAC from 25 to 250VA  
Insulation: Class B



fig.3.6

**Automatic Reset Thermal Cutout - code: AC**

Standard for all Neptronic electric heaters. If overheating occurs, the automatic reset will remove power from the elements.

**Features:**

Maximum Voltage and Current: 240VAC, 25A  
Cut-off Temperature:

- Open coil elements: 110°F (43°C)
- Tubular elements: 167°F (75°C)



fig.3.7

**Airflow Switch - codes: PDN or PDA**

A non-adjustable airflow switch (PDN) is standard for all ON/OFF Neptronic heaters. Prevents heater from operating if there is no airflow.

**Features:**

Triggering Pressure: 0.03+/-0.02" w.c.  
(0.762+/-0.508mm w.g.) - adjustable optional (PDA)  
Maximum Pressure: 0.5psi (3.5kPa)  
Maximum Voltage and Current: 227V, 15A  
Tube Connections: 2 nozzles 1/4" (6.35mm)  
Accessories: supplied with 3' (914mm) pitot tube to be installed in the duct.

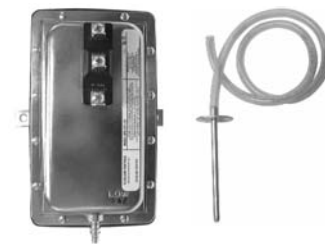


fig.3.8

**Solid State Relay - code: SSR**

Standard for proportional Neptronic heaters. Proportionally controls the amount of power transmitted to the heating element.

**Features:**

Maximum Voltage: 600V  
Current: 25A, 50A or 100A  
Zero voltage crossing detection and switching



fig.3.9

**Manual Reset Thermal Cutout -code: MC**

Standard when required by code, otherwise optional.  
Optional for all other electric heaters. If overheating occurs, the device must be manually reset.

**Features:**

Maximum Voltage and Current: 240V, 25A  
Cut-off temperature:

- Open coil elements: 175°F (79°C)
- Tubular elements: 200°F (93°C)



fig.3.10

**Pneumatic Electric Switch (ON/OFF) - code: PSO or PSC**

Standard for heaters with pneumatic ON/OFF signal. Transmits the pneumatic signal to the electric circuit.

**Features:**

Pneumatic Signal: from 2 to 20psi (14 to 138kPa)  
Maximum Pressure: 30psi (207kPa)  
Maximum Voltage and Current: 277V, 25A  
Pneumatic Connection: 1, 3/16" (5mm) nozzle for 1/4" (6mm) O.D. polyethylene tube  
Normally Open (PSO) or Normally Closed (PSC)



fig.3.11

**Pneumatic Electric Controller - code: PCD or PCR**

Standard for modulating electric heaters with proportional pneumatic control signal.  
Transmits proportional pneumatic control signal to the control circuit.

**Features:**

Pneumatic Signal: 0 to 15psi (0 to 103 kPa)  
Direct (PCD) or Reverse (PCR) Acting  
Output Signal: 1 to 5VDC  
Supply Voltage: 12 or 24VAC  
Pneumatic connection: 2 3/16" (5mm) nozzles for 1/4" (6mm) O.D. polyethylene tube

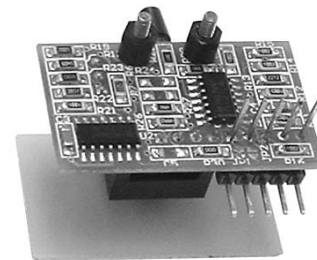


fig.3.12

**Pilot Lights - codes: LP, LH, LN, LS or LO**

Pilot lights are optional for all heaters. Pilot lights can indicate any of the following:

- Line Power ON (LP)
- Electric heater ON/OFF (LH)
- No airflow (LN)
- Stage ON (LS)
- Overheat (LO)

Pilot lights are installed on the front door of the control panel.

**Features:**

Voltage and Amperage: 24V, 0.073A or 120V, 0.025A  
Color: Red or Green depending on application.



fig.3.13

**Disconnect Switch - codes: DS or TS**

A disconnect (DS) with door interlock or a toggle switch (TS) is optional (except when required by code). Cuts the power supply to the heater in order to safely perform installation and maintenance tasks.

The disconnect switch with door interlock (DS) prevents the control panel from being opened if the heater is powered. It is installed on the door of the control panel.

**Features:**

Number of Poles: 3  
Maximum Voltage and Current: 600V, 800A



Disconnect Switch (DS)

fig.3.14

**Fuses - code: SF or LF**

Fuses are optional, except when required by code. They can be installed either on the supply line (LF) and/or on the individual heater stages (SF).

They protect the total load if overheating or a short circuit occurs. Characteristics depend on current flow.

**Features:**

Maximum Voltage: 600VAC  
Current: from 1 to 600A  
Type: HRC form 1 (fast acting)



fig.3.15

**Mercury Contactor - code: CM**

For special applications where quiet operation is required, magnetic Contactor can be replaced with optional mercury Contactor. Mercury Contactor have been tested for a minimum of 5,000,000 operations.

**Features:**

Coil Voltage: 24 or 120VAC  
Resistive Load: 35A at 600VAC, 50/60Hz  
Number of Poles: 1



fig.3.16

**Silent Relay- code: CS**

As an alternative to mercury contactor, silent relay can be supplied in option. These relays are for special quiet operations.

**Features:**

Coil Voltage: 24VAC  
Resistive Load: - 26.0A at 120, 208, 240, 277VAC ; 60 Hz  
- 13.6A at 480VAC ; 60 Hz  
- 10.4A at 600VAC ; 60 Hz

Number of Poles: 2



fig.3.17

**Auxiliary Switches - code: AUX**

Auxiliary switch can be installed in option when the 3 pole standard magnetic contactor has been selected. When you need a remote dry contact with quick connect terminals. (maximum 2 per contactor)

**Features:**

Number of Poles: 2 (1 N.O. & 1 N.C.)  
Contact Rating: 10A at 600VAC

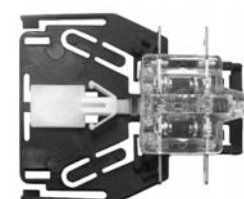


fig.3.18

# *Neptronic Electronic Heater Controller - HEC*

The Neptronic HEC is a universal controller. It accepts any input signal used in the industry and converts it to a modulating or ON/OFF control signal to the solid state relay(s) and/or the contactor(s).

This controller assures an extra level of safety by precisely measuring the air velocity and continuously updating the proportional control signal to the heater. This avoids tripping the thermal cutouts for VAV applications, if the air filters are dirty or if there is an obstruction in the duct.

The Neptronic HEC universal controller considers only convection heat and differential temperature. It continuously updates the signal to the solid state relay. The result is an extremely precise control of heater output.

## Features:

### Inputs:

- 0-10 VDC
- 2-10 VDC
- 4-20 mA
- 0-135 Ohms
- Pulsed AC or DC and pulsed to GND.
- Pneumatic on/off or modulating

### Option:

HEC can be supplied with Internal Setpoint upon request (HEC/ISP) - A potentiometer is installed on the HEC board and allows you to adjust the temperature setpoint directly on the heater. This option is used in association with the DS100 duct sensor

### Outputs:

- 1 output 4-32 VDC for solid state relay (TPM)
- Up to 4 step control for ON/OFF stages (standard), additional steps optional
- Hybrid control - Sequential or Binary

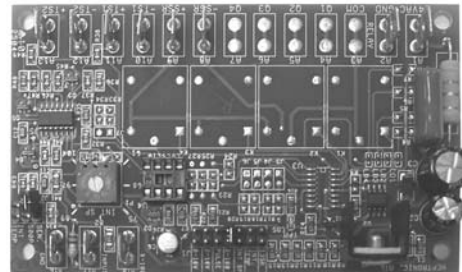


fig.3.17  
(HEC with internal setpoint)

## *Patent Pending*

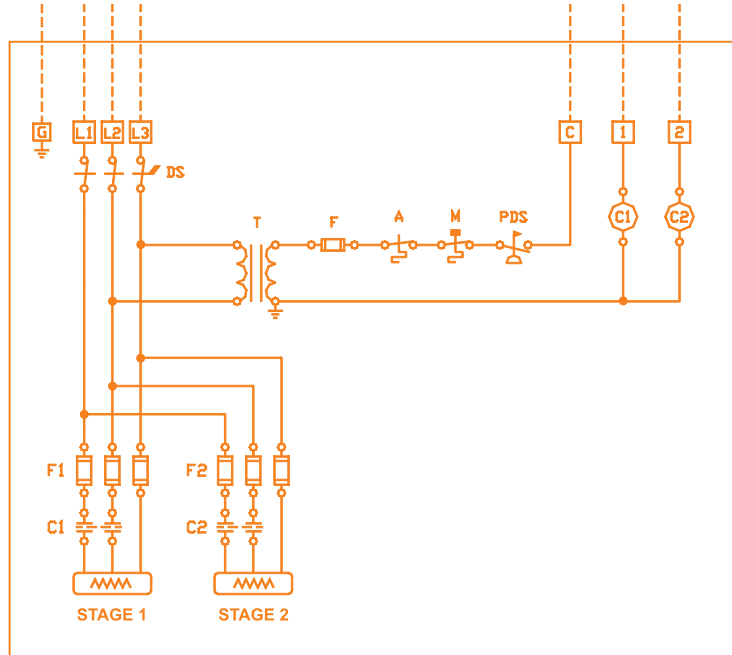
With the Neptronic HEC universal controller, you no longer require an airflow switch. The control system is installed directly onto the electric heater and assembled in our plant. This assures quality and reliability.

Typical Wiring Diagrams

Three phase supply

ON/OFF electric signal - 2 stages

(Equipped with disconnect switch, stage fuses and airflow switch options)



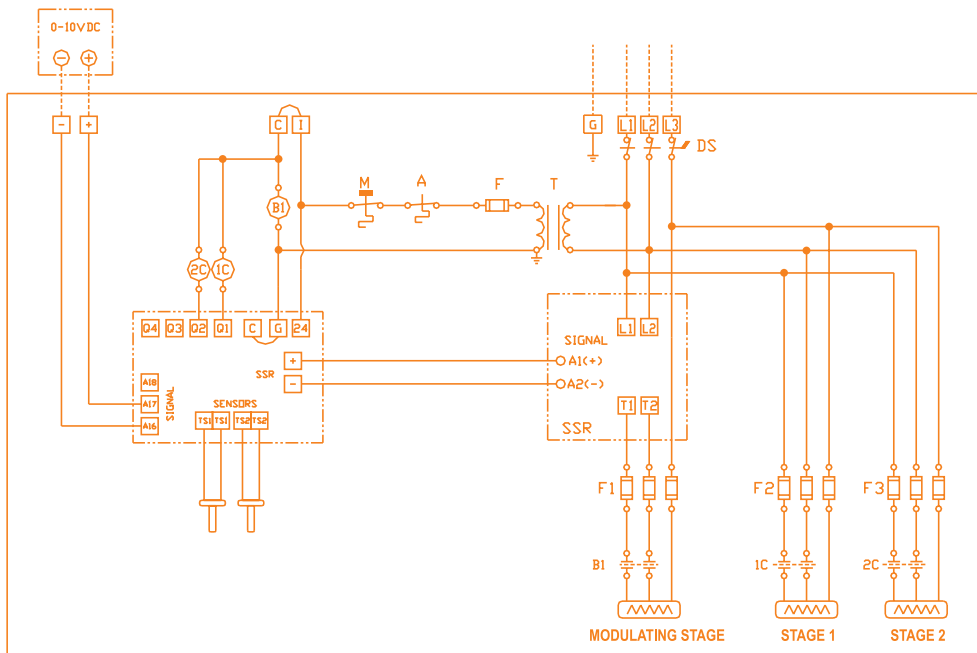
(for legend see next page)

fig.3.18

Three phase supply

Modulating (0-10VDC) electric signal - 3 stages

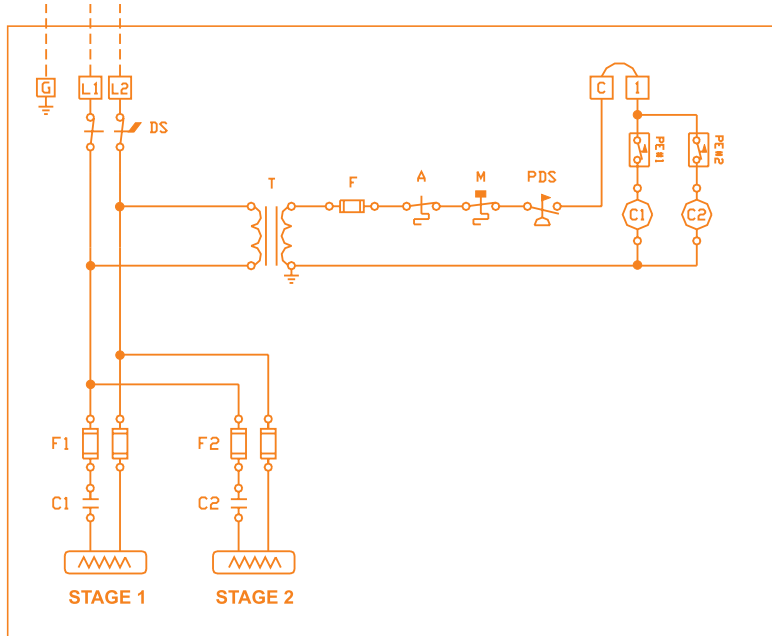
(Equipped with disconnect switch and stage fuses options).



(for legend see next page)

fig.3.19

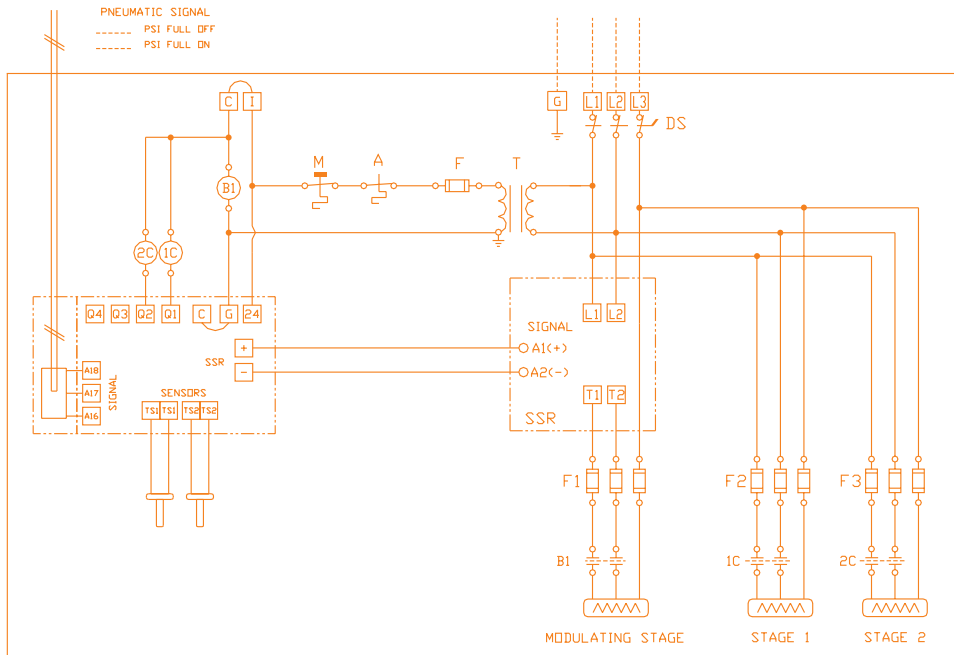
**Single phase supply**  
**ON/OFF Pneumatic signal - 2 stages**  
 (equipped with disconnect switch, stage fuses and airflow switch options)



(for legend see next page)

fig.3.20
















**Three phase supply**  
**Modulating pneumatic signal - 3 stages**  
 (Equipped with disconnect switch and stage fuses options)












(for legend see next page)

fig.3.21

Legend

Components	
Automatic Reset Thermal Cutout	A 
Manual Reset Thermal Cutout	M 
Airflow Switch	PDS 
Disconnect Switch	DS 
Contact (N.O.) (normally open)	
Contact (N.C.) (normally closed)	
Start Button (normally open)	
Stop Button (normally closed)	
Transformer	
Contactors Coil	
Back-up Contactors Coil	
Fuse	
Heating Element	
Pneumatic Electric Switch	PE#1 
Pneumatic Electric Controller	

Terminals	
	Terminal Block Single phase
	Terminal Block 3 Phase
	Power Block
	Ground Terminal
	Common
	Terminal Block (control)
	Solid State Relay Terminals (Input) by others
	Solid State Relay Terminals (Output) by others
	Control Circuit Supply



**section IV**

*Thermostats*



## ON/OFF Thermostats

## Room Thermostats - White Rodgers

Heating: 1 stage - Model 1F30.  
 ON/OFF thermostat, allows control of 1 heating stage.  
 Adjustable anticipation.  
 Input Voltage: 24 VAC

Heating: 2 stages - Model 1F37.  
 ON/OFF thermostat, allows control of 2 heating stages.  
 Adjustable anticipation for the 1st heating stage.  
 Electrical supply: 24 VAC

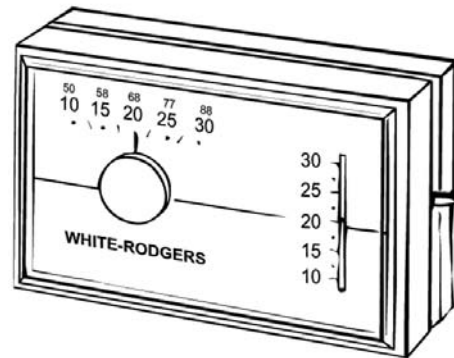


fig.4.1

## Room Thermostat - Honeywell

Heating: 1 stage - Model T822.  
 ON/OFF thermostat, allows control of 1 heating stage.  
 Input Voltage: 24 VAC



fig.4.2

### Duct Thermostats - Honeywell

Heating: 1 stage - Model T675A.  
ON/OFF thermostat, allows control of 1 heating stage.  
Mounted on duct downstream of heating coil.  
Input Voltage: 24 VAC

Heating: 2 stages - Model T678A.  
ON/OFF thermostat, allows control of 2 heating stages.  
Mounted on duct downstream of heating coil.  
Input Voltage: 24 VAC

Note: For duct thermostats with more than 2 heating stages, please contact NEP.

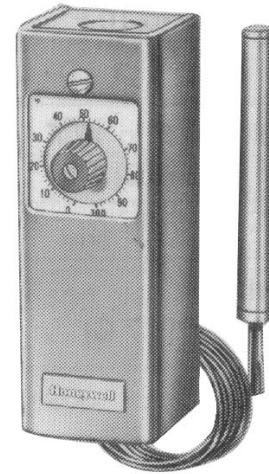


fig.4.3

**Proportional Thermostats**

**Room Thermostat - X100**

The Neptronic X100 wall mounted thermostat allows setpoint adjustment directly in the room where it is installed. The control logic is integrated into the Neptronic HEC controller installed in the electric heater control panel. This design makes the X-100 elegant, simple and affordable.

**Operation:**

The X-100 is installed directly on the wall. The two temperature sensor wires are connected to the Neptronic HEC controller located in the electric heater using two 28AWG wires.



fig.4.4

**Duct Sensor - DS100**

The Neptronic DS-100 duct sensor transmits temperature of the air to be heated.

The required setpoint can be adjusted directly on the Neptronic HEC controller with the internal setpoint option or by using the Neptronic X200 setpoint controller or with Neptronic PTA thermostat. The control logic is integrated into the Neptronic HEC controller installed in the electric heater control panel.

When using DS100 + X200, the X200 can be installed on a wall or on the duct close to the DS-100.

**Operation:**

The DS-100 is installed directly onto the ventilation duct by inserting the tube with the temperature sensor into the duct, downstream of the electric heater. The two wires of the DS100 sensor are connected directly onto the X200 setpoint controller (or PTA thermostat) which is then connected to the Neptronic HEC controller located in the electric heater control panel or directly to the Neptronic HEC controller if internal setpoint option has been chosen. Two 28AWG wires are required for any of these connections.



fig.4.5

### Proportional Room Thermostat - PTA

The Neptronic PTA thermostat is for room temperature control applications. Two heating and two cooling output ramps are available.

It includes 0-10 VDC proportional output signals for heating and cooling ramps and a TPM (time proportional modulation) output for heating. A NSB (night set back) input is available to expand the deadband around the setpoint for energy savings during unoccupied periods.

An internal temperature sensor is standard with the PTA, however an external sensor (DS-100) may be used.

#### Features:

Setpoint range: 57° to 88°F (14° to 31°C)

Deadband: 0.5°F (0.3°C) or +/- 0.25° F (+/-0.15°C)

Power consumption: 2VA

Output Signals:

- Proportional heating and cooling: 0-10VDC (2 heating and 2 cooling ramps)
- One TPM heating ramp: 1.2 or 24 VDC

NSB input (day/night adjustment): 0-10VDC or 24VAC



fig.4.6

#### Operation:

##### **Proportional Mode:**

The PTA adjusts the 0-10VDC output signal proportionally to the difference between measured temperature and setpoint temperature.

The proportional band can be 3.5°F (2°C) or 7°F (4°C).

With a 7°F (4°C) proportional band, a difference between the measured temperature and the setpoint temperature of 3.5°F (2°C) results in a 50% demand corresponding to 5VDC. The second proportional heating or cooling ramp may be used as a high demand signal.

##### **TPM Mode (time proportional modulating) for Heating:**

This mode allows the adjustment of a TPM period of 2 seconds proportional to the difference between measured temperature and setpoint temperature. The output voltage is a 24VDC pulse.

The proportional band can be 3.5°F (2°C) or 7°F (4°C).

With a 7°F (4°C) proportional band, a difference between the measured temperature and the setpoint temperature of 3.5°F (2°C) results in a 50% demand corresponding to 24VDC, half the time, i.e. every other second.

##### **NSB Mode (day /night setting)**

A 0-10VDC or 24VAC input from an external source is used to expand the deadband to 12°F (7°C) or to 14°F (8°C).





D F C F 0 1 H

**C** Open coil elements  
**T** Tubular elements  
**F** Finned tubular elements

**I** Slip-In  
**F** Flanged  
**R** Round collar

**0** No protective screen to the left of the control panel  
**1** Protective screen to the left of control panel

**0** No protective screen to the right of control panel  
**1** Protective screen to the right of control panel

**H** Horizontal airflow  
**V** Vertical airflow

**Example:****DF CI11H**

Open coil elements, slip-in type, screen to the left and right of control panel, horizontal installation.

**DF FF00V:**

Finned tubular elements, flanged type, no screens, vertical installation.

**Available Options**

<b>FC</b>	Full Break Contactor	<b>PDA</b>	Pressure Differential Switch - Adjustable	<b>SMM</b>	Starter Motor for Fan Manual
<b>RT</b>	Thermal Relay	<b>HEC</b>	Neptronic Electronic Controller	<b>PSO</b>	Pneumatic/Electric Switch Normally Open
<b>CA</b>	Magnetic Contactor	<b>HEC/ISP</b>	Neptronic HEC Controller with Internal setpoint	<b>PSC</b>	Pneumatic/Electric Switch Normally Closed
<b>CS</b>	Silent Relay	<b>EAS</b>	Electronic Airflow Sensor (HEC required)	<b>PCD</b>	Pneumatic/Electric Controller Direct Acting
<b>CM</b>	Mercury Contactor	<b>SSR</b>	Solid State Relay	<b>PCR</b>	Pneumatic/Electric Controller Reverse Acting
<b>LF</b>	Load Fuses	<b>LP</b>	Pilot Light - Power	<b>CGA</b>	Open Coil Grade A
<b>SF</b>	Stage Fuses	<b>LH</b>	Pilot Light - Heating	<b>EF</b>	Extended Flange - 1.5" (38mm)
<b>DS</b>	Disconnect Switch with Door Interlock	<b>LN</b>	Pilot Light - No Airflow	<b>PH</b>	Process Heater
<b>TS</b>	Toggle Switch	<b>LS</b>	Pilot Light - Stage On	<b>N12</b>	Control Panel - NEMA 12 (IP52)
<b>AC</b>	Automatic Thermal cutout	<b>LO</b>	Pilot Light - Overheat	<b>N4</b>	Control Panel - NEMA 4 (IP56)
<b>MC</b>	Manual Thermal cutout	<b>FR</b>	Fan Relay	<b>N4X</b>	Control Panel - NEMA 4X (IP56)
<b>TR</b>	Transformer	<b>SMA</b>	Starter Motor for Fan Automatic	<b>RP</b>	Remote Panel
<b>PDN</b>	Pressure Differential Switch - Non Adjustable				
<b>AUX</b>	Auxiliary switch (specify quantity max. 2)				

Please contact factory for special options



## Specification: Open Coil Element Heater

Supply as described below and/or on the drawings, CSA approved electric heaters according to CSA standard C22.2 No. 155 and UL 1996, as manufactured by NEP (Neptronic).

### Mechanical Construction

Neptronic electric heaters shall be manufactured using galvanized steel of appropriate gauge and will provide proper rigidity and resistance to corrosion.

Electric heaters will be manufactured and approved for zero clearance for all combustible materials.

### Heating Elements (Open Coil)

Heating elements will be manufactured from a grade C nickel chrome alloy (NiCr60).

### Modulating Heaters

Neptronic modulating electric heaters will be supplied with an electronic sensor on each side of the heater to measure the temperature and the airflow, and a Neptronic HEC controller to adjust the output temperature in accordance with the measured parameters. The Neptronic HEC controller will stop the electric heater when there is no airflow.

### Electrical Construction

Electric heaters will be supplied with a control panel with electric components adapted to the required voltage and current of the system.

The control panel will be manufactured for indoor conditions and will provide safety features against accidental contact with internal components (Nema type 1) (IP10).

The control panel will include a removable, hinged door to provide easy access.

The connection terminals will be clearly identified, and a corresponding wiring diagram will be affixed to the control panel.

The following standard components will be installed:

- Transformer with secondary fuse
- Magnetic contactor
- Automatic thermal cutout
- Manual thermal cutout (when required by code)
- Airflow switch
- Solid state relay (modulating control)

Additional components are optional, see list of options.

### Safety

Electric heaters shall be supplied with the appropriate thermal cutout to protect the installations and the users against the risk of overheating.

Inspections and tests will be performed before delivery according to safety and quality standards.

Protective screens will be installed upon request, see list of options.

### System Conditions

Electric heater operation shall not be affected by airflow direction and heaters may be installed in either vertical or horizontal ventilation ducts. To ensure that the electric components are correctly placed, please specify the direction of airflow.

Modulating electric heater operation shall not be affected by the airflow direction. The Neptronic HEC controller will automatically recognize the direction of airflow and will operate accordingly.

The mechanical dimensions and electrical requirements as well as the airflow will be as indicated on the heater schedule.

### Approvals

Mechanical drawings and wiring diagrams shall be submitted to the Consulting Engineer for approval prior to production.

## List of Options

### Mechanical Construction

*Compulsory option, choose one of the three options:*

- Slip-in electric heater
- Flanged electric heater
- Round collar electric heater

*If one of the following options is selected, remove the corresponding standard description:*

- Heating section (frame) in 304 stainless steel

### Open Coil Elements

*If one of the following options is selected, remove the corresponding standard description:*

- Open coil elements in grade A (NiCr80) Nickel Chrome alloy, no traces of iron

### Electrical Construction

*If one of the following options is selected, remove the corresponding standard description:*

- 304 stainless steel control panel
- Remote control panel
- Nema12 (IP52) Control panel (protection against dust)
- Nema4 (IP56) Control panel (protection against foul weather)
- Nema4X (IP56) Control panel (protection against foul weather and corrosion)
- No transformer-control voltage provided by others
- No contactor-control components provided by others
- Mercury Contactor
- Disconnect switch -no door interlock
- Disconnect switch with door interlock
- Load fuses HRC form 1
- Stage fuses HRC form 1
- Manual reset thermal cutout
- Neptronic HEC controller, assures precise modulation for heating demand and provides protection against overheating if there is a decrease in airflow.
- Power supply pilot light
- Stage pilot light
- Airflow pilot light
- Overheat pilot light

### Heater Protective Screens

*Optional:*

- 1 protective screen to the left of control panel.
- 1 protective screen to the right of control panel.
- 1 protective screen to the left and one to the right of control panel.

### Special Construction

Neptronic electric heaters may be constructed to adapt to particular conditions. Special construction will be available upon request according to the many options described in the catalogue and on the options summary sheet.

## Specification: Tubular Element Heater

Supply as described below and/or on the drawings, CSA approved electric heaters according to CSA standard C22.2 No. 155 and UL 1996, as manufactured by NEP (Neptronic).

### Mechanical Construction

Neptronic electric heaters shall be manufactured using galvanized steel of appropriate gauge and will provide proper rigidity and resistance to corrosion.

Electric heaters will be manufactured and approved for zero clearance for all combustible materials.

### Heating Elements (Standard Tubular)

Heating elements will be standard tubular type, made of an Incoloy 800 (Nickel alloy) tube with a diameter of 3/8" (9.5mm) containing a heating coil in magnesium oxide powder.

### Modulating Heaters

Neptronic modulating electric heaters will be supplied with an electronic sensor on each side of the heater to measure the temperature and the airflow, and a Neptronic HEC controller to adjust the output temperature in accordance with the measured parameters. The Neptronic HEC controller will stop the electric heater when there is no airflow.

### Electrical Construction

Electric heaters will be supplied with a control panel with electric components adapted to the required voltage and current of the system.

The control panel will be manufactured for indoor conditions and will provide safety features against accidental contact with internal components (Nema type 1) (IP10).

The control panel will include a removable, hinged door to provide easy access.

The connection terminals will be clearly identified, and a corresponding wiring diagram will be affixed to the control panel.

The following standard components will be installed:

- Transformer with secondary fuse
- Magnetic contactor
- Automatic thermal cutout
- Manual thermal cutout (when required by code)
- Airflow switch
- Solid state relay (modulating control)

Additional components are optional, see list of options.

### Safety

Electric heaters shall be supplied with the appropriate thermal cutout to protect the installations and the users against the risk of overheating.

Inspections and tests will be performed before delivery according to safety and quality standards.

Protective screens will be installed upon request, see list of options.

### System Conditions

Electric heater operation shall not be affected by airflow direction and heaters may be installed in either vertical or horizontal ventilation ducts. To ensure that the electric components are correctly placed, please specify the direction of airflow.

Modulating electric heater operation shall not be affected by the airflow direction. The Neptronic HEC controller will automatically recognize the direction of airflow and will operate accordingly.

The mechanical dimensions and electrical requirements as well as the airflow will be as indicated on the heater schedule.

### Approvals

Mechanical drawings and wiring diagrams shall be submitted to the Consulting Engineer for approval prior to production.

## List of Options

### Mechanical Construction

*Compulsory option, choose one of the three options:*

- Slip-in electric heater
- Flanged electric heater
- Round collar electric heater

*If one of the following options is selected, remove the corresponding standard description:*

- Heating section (frame) in 304 stainless steel

### Heating Elements (Finned Tubular)

*If one of the following options is selected, remove the corresponding standard description:*

- Heating element shall be finned tubular type, made of an Incoloy 800 (Nickel alloy) tube with a diameter of .375" (9.5mm) containing a heating coil in magnesium oxide powder.

### Electrical Construction

*If one of the following options is selected, remove the corresponding standard description:*

- 304 stainless steel control panel
- Remote control panel
- Nema12 (IP52) Control panel (protection against dust)
- Nema4 (IP56) Control panel (protection against foul weather)
- Nema4X (IP56) Control panel (protection against foul weather and corrosion)
- No transformer-control voltage provided by others
- No contactor-control components provided by others
- Mercury Contactor
- Disconnect switch -no door interlock
- Disconnect switch with door interlock
- Load fuses HRC form 1
- Stage fuses HRC form 1
- Manual reset thermal cutout
- Neptronic HEC controller, assures precise modulation for heating demand and provides protection against overheating if there is a decrease in airflow.
- Power supply pilot light
- Stage pilot light
- Airflow pilot light
- Overheat pilot light

### Heater Protective Screens

*Optional:*

- 1 protective screen to the left of control panel.
- 1 protective screen to the right of control panel.
- 1 protective screen to the left and one to the right of control panel.

### Special Construction

Neptronic electric heaters may be constructed to adapt to particular conditions. Special construction will be available upon request according to the many options described in the catalogue and on the options summary sheet.

**1. General**

Unless otherwise arranged, in writing, the acceptance of the Order Confirmation by the purchaser includes acceptance of the "General Conditions of Sale and Warranty" of National Environmental Products, Ltd hereafter referred to as NEP.

**2. Incoterms**

The international rules for interpretation of trade terms "Incoterms" as defined by the ICC Incoterms publication no. 460 from 1990, shall apply to the commercial terms used herein.

**3. Confirmation of Order**

- NEP shall not be deemed to have accepted an order until written "**Order Confirmation**" from NEP is issued to the purchaser.
- The order is not cancelable as soon as NEP has sent the "**Order confirmation**".
- It is the responsibility of the purchaser to verify that all information concerning his/her order is correct and to notify NEP In writing, of any discrepancy prior to the order being shipped. In the event of a change or correction to an existing order, a second "**Order Confirmation**" will be issued by NEP.

**4. Price**

- Our prices are net, Ex-works Montreal in U.S. Currency, unless stated otherwise.
- Minimum orders shall be \$50.00 minimum.
- Shipping and Handling charges are \$5.00 minimum per order unless the shipment is billed to the purchaser's account or shipped freight collect.
- NEP reserves the right to adjust accepted prices in the event of alterations in rates of exchange, variations in costs of materials, changes in wages, interference on the part of the Government or similar conditions over which NEP has no control.

**5. Payments terms**

- Major credit cards, C.O.D., Prepayment.
- For open account, invoices are payable within 30 days from the date of invoice without no deduction, unless specify otherwise.
- An interest charge of 2% per month will be included on all overdue payments.
- No new order will be process if invoices are not paid within 45 days.

**6. Transfer of ownership**

The goods shall remain the property of NEP until the full payment for the goods has been received by NEP.

**7. Delivery terms**

- Shipments are Ex-works 400 Lebeau, St Laurent, Quebec, H4N 1R6, CANADA unless notified otherwise.
- Unless special instructions, the order will be delivery in the way which NEP deems best without guaranteeing this to be the cheapest way of transport.
- For International Order, a written designation naming the freight for warding agent is required and will remain in effect until notified otherwise.
- Any discrepancy, damage or breakage should be reported in writing both to NEP and to the Carrier within 5 working days from the receipt date.

**8. Risk**

From the moment of delivery, the purchaser shall bear all risks for the goods and NEP shall not be responsible for loss and damage incurred during transportation.

**9. Delivery time**

- Delivery time is stated approximately and depends on the product ordered, please allow a minimum of:
  - a) 1 week for processing North American order.
  - b) 2 weeks for processing International order.
- We will make every effort to adhere to our delivery promises, but will not accept order or contract cancellation or any liability for any direct or indirect losses that may arise for any reason whatsoever as a result of our failure to adhere to such promises.

**10. Return of good**

- Goods received by the purchaser cannot be returned unless a completed "**R.M.A. Form**" (Return Material Authorization Form) has been issued by NEP's **Customer Service**.
- Any returned goods must be sent to NEP 400 Lebeau, St Laurent, Quebec, H4N 1R6, CANADA, unless stated otherwise by the R.M.A. Form, accompanied with the completed "**R.M.A. Form**", the R.M.A. number shall be prominently displayed on the shipping box. Unauthorized returns will be refused.
- Any returned goods must be sent freight prepaid. Any goods that come to us freight collect will be refused and returned to sender unless previously agreed to by us in writing on the "R.M.A. Form".
- Electric heaters are not returnable and not refundable.

**11. Warranty**

- Provided that the terms of payment are observed, the purchaser is offered a warranty of **18 months** from the original shipping date of delivery or **12 months** from the date the product is first placed in service, whichever period lapses first. Provided the equipment has been properly installed and operated in accordance with NEP instructions.
- The warranty covers faulty manufacture, design and/or defective materials and is limited to the equipment and components. The warranty shall cease to be valid in the event of misapplication, incorrect installation, improper maintenance or any other incorrect uses or misuse of the product.
- NEP assumes no responsibility for repairs made on equipment, unless performed by NEP's authorized personnel.
- The defective product or component shall be returned in accordance with the paragraph 10 (Returns of goods) as described in this document.
- NEP agrees under the warranty to repair or replace (at the discretion of NEP) such standard product or component, which upon examination by NEP are found to be defective.
- Product or component replaced or repaired under warranty will be sent back to the purchaser, standard freight paid by NEP
- Expenses in connection with travelling time, dismantling and mounting shall not be paid by NEP
- Guarantee for products or components sold but not manufactured by NEP, is only given to the same extent as given to NEP, however, not exceeding the normal NEP warranty.
- Parts used for repairs are warranted for the balance of the term of the warranty on the original product or 90 days, whichever is longer.
- Any repair made, after the original warranty period; at the NEP facilities are warranted for 1 month from the date of repair.

**12. Proper law and jurisdiction**

This contract is and shall be deemed to have been made in the province of Quebec, CANADA, and shall in all respects, be governed by the province of Quebec laws.

National Environmental Product, Ltd.

Tel: 1 800 361-2308	
Fax: (514) 333-3163	
Customer Service Fax: (514) 333-1091	
Business hours:	from Monday to Friday, 8:00a.m. to 5:00p.m. (North American Eastern time zone)

**Formulas**

**Power or electric heater capacity**

*Imperial*

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

*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*

$$P = \frac{Q \times (T^{\circ}2 - T^{\circ}1) \times 1,3}{3600}$$

*P : Power in kW  
Q : Air volume in m³/hour  
T°2 : Temperature of air leaving heater in °C  
T°1 : Temperature of air entering heater in °C*

**Temperature differential**       $\Delta T = T^{\circ}2 - T^{\circ}1$

*Imperial*

$$\Delta T = \frac{kW \times 3413}{CFM \times 1.08}$$

*Metric*

$$\Delta T = \frac{P \times 3600}{Q \times 1,3}$$

**KW per square foot**

*Imperial*

$$kW / ft^2 = \frac{kW}{S}$$

*kW : Power in kW  
S : Surface area in square feet*

*Metric*

$$kW / m^2 = \frac{P}{S}$$

*P : Power in kW  
S : Surface area in m²*

**Duct area**

*Imperial*

$$S = \frac{W \times H}{144}$$

*S : Surface area in square feet  
W : Duct width in inches  
H : Duct Height in inches*

*Metric*

$$S = W \times H$$

*S : Surface area in m²  
W : Duct width in meter  
H : Duct height in meter*

**Electric power**

*Single phase*

$$P = V \times I \quad \text{ou} \quad P = \frac{V^2}{R}$$

*3 phase*

$$P = V \times I \times 1.732 \quad P = \frac{V^2}{R} \times 1.732$$

*P : Power in Watts  
V : Voltage in Volts  
R : Resistance in Ω (Ohm)  
I : Current in Amps*

**Line current**

*Single phase*

$$I = \frac{P}{V}$$

*3 phase*

$$I = \frac{P}{V \times 1.732}$$

**Conversions**

**°F to °C**

$$^{\circ}C = \frac{(^{\circ}F - 32)}{1.8}$$

**°C to °F**

$$^{\circ}F = (1.8 \times ^{\circ}C) + 32$$

**BTU to kW**

$$1 \text{ kW} = 3413 \text{ BTU/hre}$$

**kW to BTU**

$$1 \text{ BTU/hre} = 0.29307 \times 10^{-3} \text{ kW}$$

**mm to inches**

$$1 \text{ in} = 25.4 \text{ mm}$$

**Inches to mm**

$$1 \text{ mm} = 0.03937 \text{ in}$$

**CFM to FPM**

$$1 \text{ FPM} = \frac{1 \text{ CFM}}{S}$$

**FPM to CFM**

$$1 \text{ CFM} = 1 \text{ FPM} \times S$$

*S : Surface area in square feet*

