

Special Applications

Air Conditioning & Air Handling Units – For more than 50 years, INDEECO has been supplying special heaters for use in air handling and air conditioning equipment (Figure 50). A wide range of special construction techniques has been developed to insure proper operation as well as easy installation, either in the OEM's plant or in the field. These heaters typically fall into one of the categories described on the following pages.



Figure 50.

Modular Construction – The heater is designed to match adjacent air handling unit components such as fans, cooling sections, filter boxes, etc. (Figure 51). Special construction is used so that the heater mounts adjacent to other components; the heater becomes simply one module of the air handling unit assembly. Unheated sections are provided where there is little or no airflow, such as the area blocked by an adjacent cooling coil header. Pressure plates can be provided to insure uniform airflow when the heater must be installed adjacent to the fan. Buffer sections can be furnished to space the heating coils away from temperature sensitive components or to help assure uniform airflow.

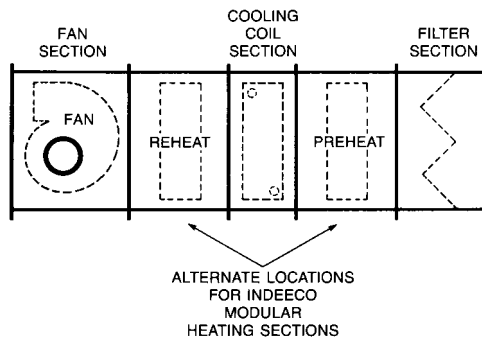


Figure 51.

Multi-Zone or Dual Duct Heaters – These heaters are designed for installation inside multi-zone or dual duct air conditioning equipment, where the airflow is highly variable and unevenly distributed (Figure 52). These heaters use coils derated to approximately 25 watts per square inch (3.8 watts per square cm) of wire surface area (approximately one half normal watt density). Low density coils run cooler and thus provide longer life under these stringent operating conditions.

These heaters are supplied with fully proportional SCR control or with many heating stages to insure that no more heat is being supplied than is absolutely necessary. Each heater stage is spread over the entire face area to take advantage of all available airflow.

A perforated pressure plate is factory-installed on the air inlet side of the heater to make the airflow as uniform as possible. Linear limit thermal cutouts protect against serious overheating anywhere along the length of the heater.

When the heater must be installed entirely within the unit, only thermal cutouts are built into the heater, a remote panel is required for controls. When the terminal box can be external, heaters are available with a wide range of built-in controls.

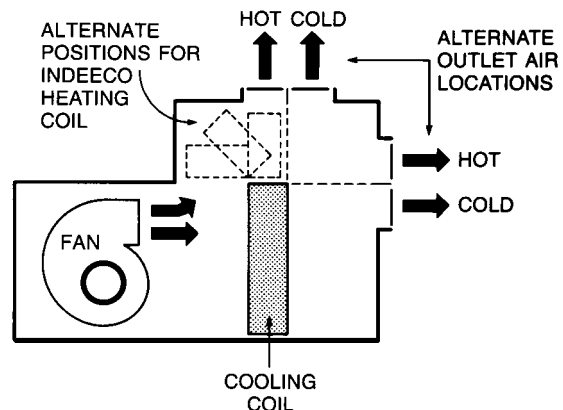


Figure 52.



Custom Duct Heaters

Package Units – INDEECO manufactures heaters specifically designed for installation in packaged air conditioning equipment. This is a particularly tough application as package units are compactly designed. INDEECO developed heater designs to meet these conditions: narrow heating sections to fit into the thinnest of spaces; unusually configured terminal boxes and covers; special mounting flanges; prepunched mounting holes and detailed instructions to aid the field installer (see Figures 53 and 54).

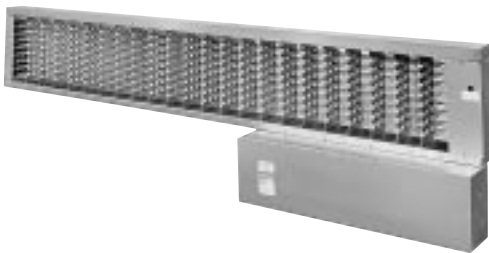


Figure 53. Heater with offset terminal box for package unit

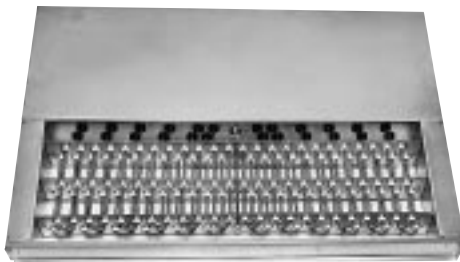


Figure 54. Heater with narrow coil section and terminal box for package unit

Marine Duty – Only INDEECO offers a UL Listed duct heater which is also ABS Approved and meets U.S. Coast Guard Requirements for shipboard use (Figure 55).



Figure 55.

Variable Air Volume (VAV) Units – To serve the fast moving and very competitive VAV market, INDEECO has developed a fully computerized design and construction system which enables us to ship substantial volumes of heaters in a wide variety of sizes, ratings and control options quickly. This system was patterned after our methods of designing and producing standard duct heaters, modified to solve the problems unique to the VAV industry. Slip-and-drive sheet metal connections, control packages tailored to VAV systems, and special techniques for fan interlocks are some of the features designed for this market (Figure 56).



Figure 56.

Railway and Subway Applications – Tough rail car industry standards have been developed to overcome the severe vibration, shock, high operating voltages and voltage swings routinely encountered. For more than 30 years, INDEECO has built heaters to meet these standards, using heavy gauge corrosion resistant steel frames and oversized coil and terminal support bushings (Figure 57).

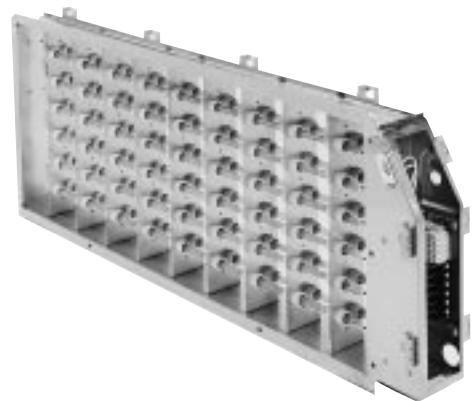


Figure 57.

Duct Heaters for Wet, Dusty and Corrosive Areas

INDEECO offers a wide selection of custom built electric duct heater designs for outdoor, wet, dusty and corrosive areas. Typical applications include use with roof top air handling equipment, in washdown areas such as food processing plants, wet and humid spaces near indoor swimming pools, and marine or casino boat applications including shipboard use.

Features:

- Disconnect switch with door interlock
- Manual reset thermal cutout
- Automatic reset thermal cutout
- Stainless steel frame
- Large diameter stainless steel finned tubular heating elements
- Heavy duty control transformer
- Fusing per NEC
- Airflow switch
- Stainless steel terminal hardware

Outdoor UL Listed 3R

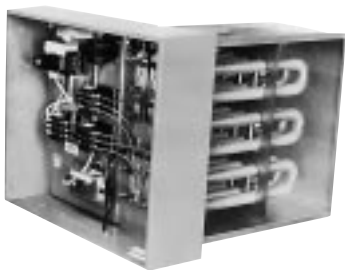


Figure 58.

Outdoor type 3R heaters (Figure 58) are intended for outdoor use to provide a degree of protection against falling rain, sleet and external ice formation. UL Listed 3R heaters can be used in most HVAC outdoor applications and indoors for protection against dripping water. Water-tight hubs for incoming power and control connections are furnished.

Dust-tight Construction



Figure 59.

A dust-tight terminal box (Figure 59) is available to meet local codes that require dust-tight construction for a heater installed above a false ceiling when the entire area is used as a return air plenum. It is also suitable for commercial or light industrial applications and to avoid dust accumulation inside the terminal box while a building is under construction.

These boxes are spot welded corrosion resistant steel, with all openings sealed. The hinged cover is gasketed and hold-down clamps are provided. (Note that this construction does not meet the more rigid requirements of NEMA 12 described below).

NEMA 12 Type Terminal Box

For heavy duty industrial applications involving both dust and oil, NEMA 12 construction is available on custom heaters (Figure 60). The all welded, stainless steel terminal box has a hinged, gasketed cover with hold-down clamps. Scru-tite hubs for line and power connections are included.



Figure 60.

NEMA 4 Type Terminal Box

For weatherproof locations and washdown areas such as food processing plants, a NEMA 4 Type construction is available. This all welded stainless steel enclosure is furnished with a hinged, gasketed cover and is provided with water-tight hubs for incoming power and control connections.



Custom Duct Heaters

Bottom Mounted Terminal Box

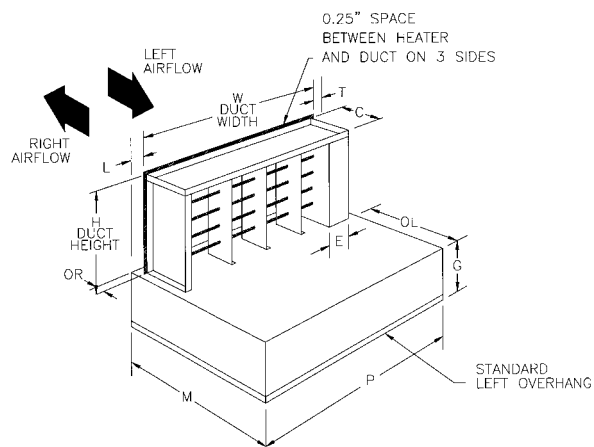


Figure 61.

The NEC requires a work space at least 2½' (76.2 cm) wide by 3½' (10.67 cm) deep in front of a heater terminal box for service access. More space is required for large heaters. When this space is not available at the side of a duct, the heater can be installed through the bottom using a special bottom mounted terminal box construction which maintains the required horizontal orientation of open coil resistance elements.

Custom heaters of either flanged or slip-in design are available with this feature. However, slip-in is normally preferred for ease of installation (Figure 61). UL Listed heaters are limited to the sizes indicated in **Table XIII**.

Table XIII

Duct Size Limitations of Bottom Terminal Box Heaters

Heater Type	Minimum W in (mm)	Minimum H in (mm)	Maximum H in (mm)
Open Coil Flanged	5 (127)	3 (76.2)	40 (1016)
Open Coil Slip-in	8 (203)	4.25 (108)	40 (1016)
Finned Tubular Flanged	4.5 (114)	4 (102)	72 (1829)
Finned Tubular Slip-in	11 (279)	5.25 (133)	72 (1829)

Insulated Terminal Box

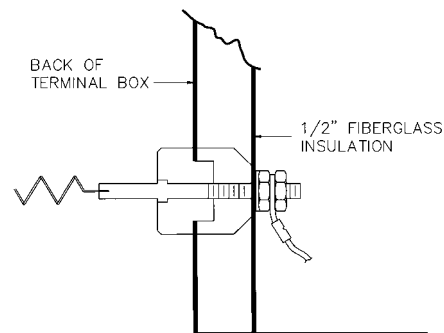


Figure 62.

When the heater is installed in an air conditioning duct which runs through an un-airconditioned space, condensation may form inside the terminal box. To eliminate this condensation or for energy conservation, the back of the terminal box can be factory insulated (Figure 62). This construction is available with all heaters.

Pressure Plates

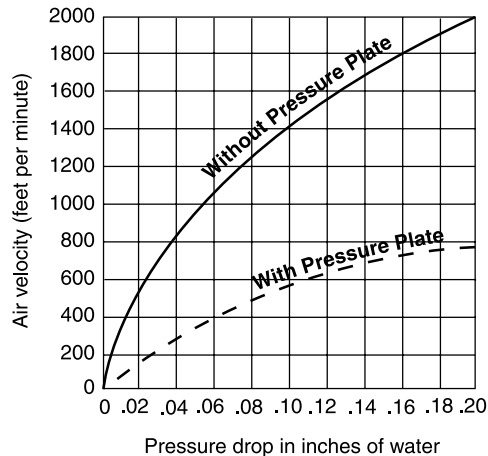


Figure 63.

A 40% open pressure plate on the inlet side of custom open coil type heaters evens out the airflow pattern in installations where it is not uniform. A pressure plate significantly increases the pressure drop across the heater (Figure 63). This increase must be considered in sizing the fan motor. To assure correct plate location, specify the exact airflow direction as defined in Figures 40 and 41, page 23.

Protective Screens



Figure 64.

Protective screens protect personnel from accidental contact with electrically hot open coil elements and prevent large airborne contamination from reaching the elements (Figure 64). They are available on custom heaters only. The 3/8" (9.5mm) wire mesh screen may be mounted on both sides of the heater. Finned tubular duct heater construction may be more appropriate for these applications.

Unheated Sections

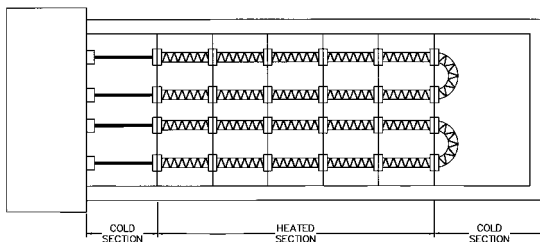


Figure 65.

INDEECO custom heaters can be supplied with unheated sections, either open or blocked off (Figure 65). Such constructions are particularly helpful when the heater frame must extend through an area with little or no airflow to maintain accessibility to the terminal box. For example, a heater next to a cooling coil should have extended terminal shanks so no heat is generated adjacent to the cooling coil header. Most constructions are available with a UL label.

Construction For Lined Ducts

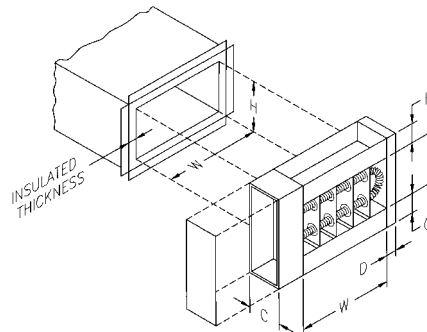


Figure 66. Installation of flange type heater in lined duct

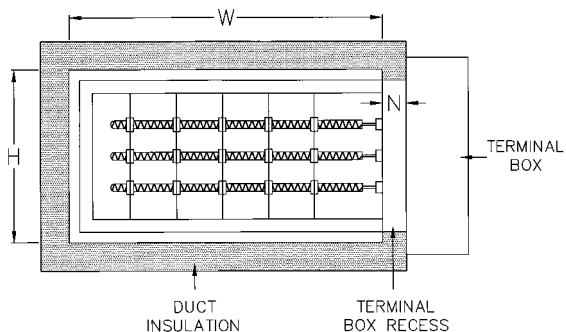


Figure 67. Installation of slip-in heater where insulation is more than 1" (25.4 mm) thick

All INDEECO slip-in heaters are suitable for use in ducts lined with up to 1" (25.4 mm) of interior insulation. Extended terminals and the design of the terminal cutout system make standard slip-in heaters suitable for such installations without any deterioration in performance or life. Be sure that the duct dimensions specified are those inside the duct lining.

For slip-in heater applications where the insulation is more than 1" (25.4 mm) thick or where flanged heaters are required, the special constructions illustrated in Figures 66 and 67 are available on custom heaters. Dimensions inside the insulation must be specified as well as the insulation thickness.



Custom Duct Heaters

Slip-and-Drive Construction

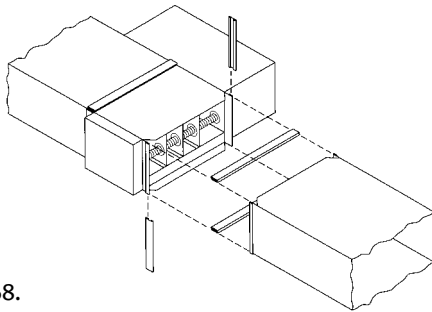


Figure 68.

This option for custom flanged heaters, allowing installation with conventional HVAC slip-and-drive connections, offers the rugged and secure mounting of a flanged heater, yet requires less installation labor than a slip-in heater. It is particularly useful when other equipment in the duct system uses slip-and-drive connections, as the contractor can standardize throughout (Figure 68).

By using INDEECO's slip-and-drive construction in variable air volume (VAV) units, the manufacturer can offer the same standard VAV box for electric heat, hot water heat or no heat.

Remote Panelboard

When specifying remote panelboards (Figure 69), we recommend the following changes in control and safety components to insure the safety of the installation and to minimize the field labor costs.

- **Contactors** – Use disconnecting controlling contactors which break all ungrounded lines. Thus, when heat is not being called for, all terminals in the heater will be dead.

- **Pilot Switch** – Add a dead front pilot switch to the heater terminal box to make it safe for servicing by simply tripping the pilot switch. This shuts off power to the heater circuits through the disconnecting contactors in the panel.
- **Fuses** – Built-in fusing for each panelboard will be in accordance with UL and NEC requirements.

Except for SCR's, which are mounted through the panelboard side wall, control components are mounted on a sub-panel. Labeled terminal blocks are provided for all field wiring, both in the panel and in the heater. Knockouts and wiring gutter spaces are supplied in all panelboards.

NEMA 1 panels are made from heavy gauge steel, welded and painted (as required), and are provided with a lock and key. Wall mounting, flush mounting or floor mounting on legs are available.

NEMA 3R type panelboards for outdoor use are UL Listed. These are intended for outdoor use to provide protection against falling rain, sleet and external ice formation.

NEMA 4 and NEMA 12 panelboards for outdoor, dusty, and oil atmospheres are also available, as well as explosion-resistant panels furnished with cast aluminum enclosures.

All standard type QUA/QUZ and TFQU heaters are available with remote panels. Panels for these standard heaters are available in NEMA 1 wall mounting only. Fusing, disconnecting contactors and a heater-mounted pilot switch, all as described above, are supplied.



Figure 69.

Custom Duct Heaters

Minimum & Maximum Duct Dimensions

Although there is no limitation on the maximum size of custom heater assemblies, individual UL Listed heaters must meet the following minimum and maximum requirements (see tables below).

UL Listed custom heaters are also available in virtually any KW rating. However, heaters are restricted to maximum KW ratings based on the square feet of heated area.

INDEECO has built individual duct heaters for space heating applications ranging from 0.1 KW to over 900 KW, multi-section units with up to 2000 KW in one assembly, and face areas as large as 40' wide x 14' high. Exact dimensional and KW limits can be determined by contacting your local INDEECO representative.

Table XIV

Open Coil Custom Heaters

	Slip-in Type in (mm)	Flanged Type in (mm)
Minimum Duct Width (W)	5.25 (133)	5 (127)
Minimum Duct Height (H)	4.25 (108)	3 (76)
Maximum Duct Width (W)	240 (6100)	240 (6100)
Maximum Duct Height (H)	120 (3050)	120 (3050)

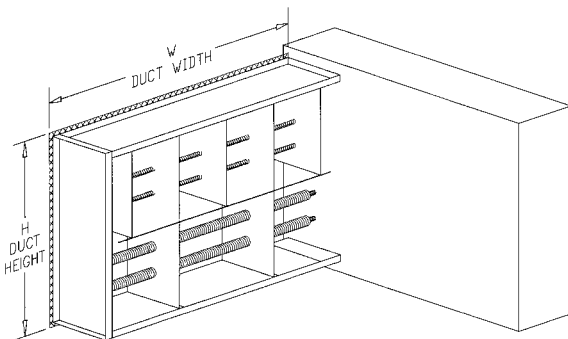


Figure 70. Slip-in Duct Heater

Table XV

Finned Tubular Custom Heaters

	Slip-in Type in (mm)	Flanged Type in (mm)
Minimum Duct Width (W)	4.75 (121)	4.5 (114)
Minimum Duct Height (H)	5.25 (133)	4 (102)
Maximum Duct Width (W)	175 (4450)	175 (4450)
Maximum Duct Height (H)	120 (3050)	120 (3050)

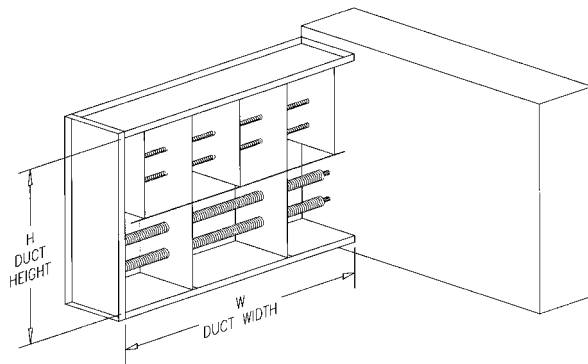


Figure 71. Flanged Duct Heater



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Custom Duct Heaters

Open Coil Custom Heater – Sample Specification

A job specification can be prepared by using the following information. Simply darken the applicable circles. Material which is part of the basic specification has already been darkened. Additional copies of this specification guide are available from your local INDEECO representative.

- 1. Duct heaters shall be INDEECO:
 - Type XUB Custom Slip-in Heater
 - Type ZUB Custom Flanged Heater
- 2. Approvals – Heaters and panelboards (if required) shall meet the requirements of the National Electrical Code and shall be listed by Underwriters Laboratories for zero clearance to combustible surfaces and for use with heat pumps and air conditioning equipment.
- 3. Heating elements shall be open coil, 80% nickel, 20% chromium, Grade A resistance wire. Type C alloys containing iron or other alloys are not acceptable. Coils shall be machine crimped into stainless steel terminals extending at least 1" into the airstream and all terminal hardware shall be stainless steel. Coils shall be supported by ceramic bushings staked into supporting brackets.
- 4. Heater frames and terminal boxes shall be corrosion resistant steel. Unless otherwise indicated, the terminal box shall be NEMA 1 construction and shall be provided with a hinged, latching cover and multiple concentric knockouts for field wiring.
- 5. All heaters shall be furnished with a disc type, automatic reset thermal cutout for primary overtemperature protection. All heaters shall also be furnished with disc type, load-carrying manual reset thermal cutouts, factory wired in series with heater stages for secondary protection. Heat limiters or other fusible overtemperature devices are not acceptable.
- 6. Heaters shall be rated for the voltage, phase and number of heating stages indicated in the schedule. All three-phase heaters shall have equal, balanced, three-phase stages. All internal wiring shall be stranded copper with 105°C insulation and shall be terminated in crimped connectors or box lugs.
- 7. Terminal blocks shall be provided for all field wiring and shall be sized for installation of 75°C copper wire rated in accordance with NEC requirements.
- 8. Heaters shall be furnished either with the Control Option specified in the schedule and described below or with the specific components listed in the schedule.

○ Option G – Thermal cutouts, airflow switch, contactors, fuses (if over 48 amps), control circuit transformer (where required) and built-in, snap-acting, door interlocked disconnect switch.

○ Option J – Thermal cutouts, airflow switch, PE switches, contactors (where required), fuses (if over 48 amps), control circuit transformer (where required) and built-in, snap-acting, door interlocked disconnect switch.

○ Option K – Thermal cutouts, airflow switch, SCR (with step controller and contactors if heater draws over 96 amps three-phase or 192 amps single-phase), fuses (if over 48 amps), control circuit transformer (where required) and built-in, snap-acting, door interlocked disconnect switch.

○ 9. When specified in the schedule, or below, heaters will be supplied with the following Special Features:

- Airflow switch for negative pressure operation
- Insulated terminal box
- Dust-tight terminal box
- Controls mounted in remote panelboard
- Deletion of transformer
- Transformer primary fusing
- Deletion of transformer and contactor
- Deletion of disconnect switch
- Fuses for heaters rated 48 amps or less
- "Low Airflow" pilot light
- "Heater On" pilot light
- Each "Stage On" pilot light(s)
- Disconnecting contactors
- Mercury controlling contactors
- Fan relay (instead of airflow switch)
- Fan relay (in addition to airflow switch)
- Step controller
- 25 watts per square inch resistance coils
- 35 watts per square inch resistance coils
- Built-in PE transducer
- Custom terminal box type:
 - UL3R ○ NEMA 4 ○ NEMA 12
- Bottom mounted terminal box
- 40% open pressure plate

○ 10. When specified in the schedule, or below, heaters shall be supplied with the following thermostats:

- Pilot duty single stage room thermostat
- Pilot duty two stage room thermostat
- Proportional electronic room thermostat
- Pilot duty single stage duct thermostat
- Pilot duty two stage duct thermostat
- Proportional electronic duct thermostat with set point adjuster
- Special inputs (135 ohms, 2200 ohms, 4-20 mA, 0-10 VDC)

○ 11. Duct Heater Schedule – Use of the following typical format will insure that all necessary information is available to bidders:

Item or Tag #	Heater Type	KW	Duct Dimensions (Inches)		Supply Line		No. of Heating Stages	Control Circuit Voltage	Control Option	Special Features	Thermostats
			W (Width)	H (Height)	Volts	Phase					
EDH -1	XUB	10	27	14	208	3	2	24	G	UL 3R Type Terminal Box	Room
EDH -2	XUB	15	16.5	10	240	1	3	240	J	Insulated Terminal Box	None
EDH -3	XUB	7.5	24	24	280	1	1	24	K	Bottom Mounted Terminal Box	Duct

Finned Tubular Custom Heater – Sample Specification

A job specification can be prepared by using the following information. Simply darken the applicable circles. Material which is part of the basic specification has already been darkened. Additional copies of this specification guide are available from your local INDEECO representative.

- 1. Duct heaters shall be INDEECO:
 - Type TFXU Custom Slip-in Heater
 - Type TFZU Custom Flanged Heater
- 2. Approvals – Heaters and panelboards (if required) shall meet the requirements of the National Electrical Code and shall be listed by Underwriters Laboratories for zero clearance to combustible surfaces and for use with heat pumps and air conditioning equipment.
- 3. Heating elements shall consist of coil, 80% nickel, 20% chromium, Grade A resistance wire, precisely centered in a stainless steel tube filled with granular magnesium oxide. A stainless steel fin is to be helically wound onto the tube. Elements are to be furnished with mounting flanges, making them individually removable through the terminal box.
- 4. Heater frames and terminal boxes shall be corrosion resistant steel. Unless otherwise indicated, the terminal box shall be NEMA 1 construction and shall be provided with a hinged, latching cover and multiple concentric knockouts for field wiring.
- 5. All heaters shall be furnished with triple overtemperature protection. A disc type and linear, automatic reset thermal cutout are included for primary overtemperature protection. All heaters must also be furnished with a linear type manual reset thermal cutout with backup contactors (as required). For secondary overtemperature protection, heat limiters or other fusible overtemperature devices are not acceptable.
- 6. Heaters shall be rated for the voltage, phase and number of heating stages indicated in the schedule. All three-phase heaters shall have equal, balanced, three-phase stages. All internal wiring shall be stranded copper with 105°C insulation and shall be terminated in crimped connectors or box lugs.
- 7. Terminal blocks shall be provided for all field wiring and shall be sized for installation of 75°C copper wire rated in accordance with NEC requirements.
- 8. Heaters shall be furnished either with the Control Option specified in the schedule and described below or with the specific components listed in the schedule.
 - Option G – Thermal cutouts, airflow switch, contactors, fuses (if over 48 amps), control circuit transformer (where required) and built-in, snap-acting, door interlocked disconnect switch.

- Option J – Thermal cutouts, airflow switch, PE switches, contactors (where required), fuses (if over 48 amps), control circuit transformer (as required), and built-in, snap-acting, door interlocked disconnect switch.
- Option K – Thermal cutouts, airflow switch, contactors (where required), SCR (with step controller if heater draws over 96 amps three-phase or 192 amps single-phase), fuses (if over 48 amps), control circuit transformer (where required) and built-in, snap-acting, door interlocked disconnect switch.
- 9. When specified in the schedule, or below, heaters will be supplied with the following Special Features:
 - Airflow switch for negative pressure operation
 - Insulated terminal box
 - Dust-tight terminal box
 - Controls mounted in remote panelboard
 - Deletion of transformer
 - Transformer primary fusing
 - Deletion of transformer and contactor
 - Deletion of disconnect switch
 - Fuses for heaters rated 48 amps or less
 - “Low Airflow” pilot light
 - “Heater On” pilot light
 - Each “Stage On” pilot light(s)
 - Disconnecting contactors
 - Mercury controlling contactors
 - Fan relay (instead of airflow switch)
 - Fan relay (in addition to airflow switch)
 - Step controller
 - Built-in PE transducer
 - Custom terminal box type:
 - UL3R ○ NEMA 4 ○ NEMA 12
 - Bottom mounted terminal box
 - Protective screens
- 10. When specified in the schedule, or below, heaters shall be supplied with the following thermostats:
 - Pilot duty single stage room thermostat
 - Pilot duty two stage room thermostat
 - Proportional electronic room thermostat
 - Pilot duty single stage duct thermostat
 - Pilot duty two stage duct thermostat
 - Proportional electronic duct thermostat with set point adjuster
 - Special inputs (135 ohms, 2200 ohms, 4-20 mA, 0-10 VDC)
- 11. Duct Heater Schedule – Use of the following typical format will insure that all necessary information is available to bidders:

Item or Tag #	Heater Type	KW	Duct Dimensions (Inches)		Supply Line		No. of Heating Stages	Control Circuit Voltage	Control Option	Special Features	Thermostats
			W (Width)	H (Height)	Volts	Phase					
EDH -1	TFXU	7.5	23	17	480	3	2	24	G	Insulated Terminal Box	Room
EDH -2	TFXU	25	36	20	208	3	3	240	J	—	None
EDH -3	TFXU	150	75	60	480	3	1	120	K	Vernier Controlled	Duct