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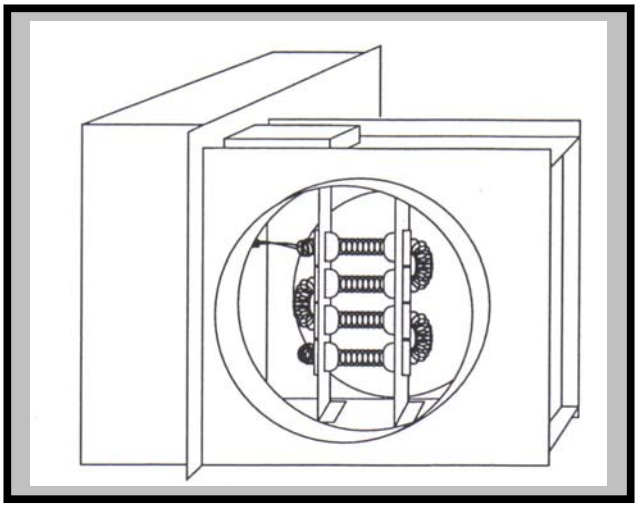
Acu-Zone™ I & II
Electric Zone Heaters

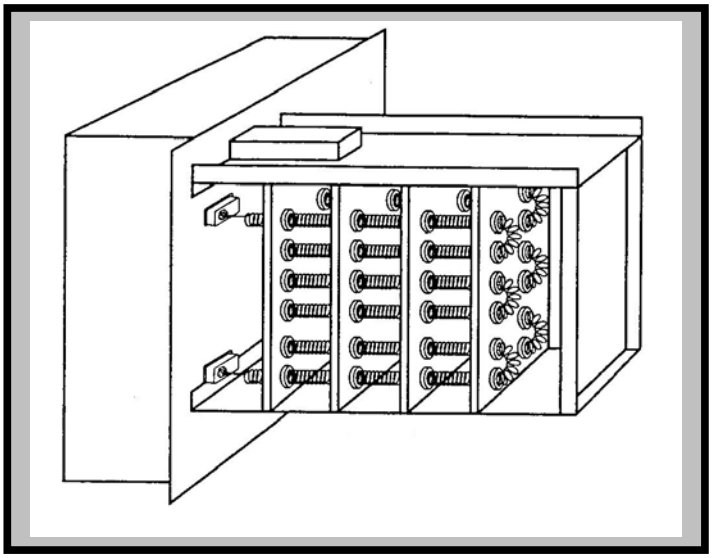
Application, Selection and Specification Manual



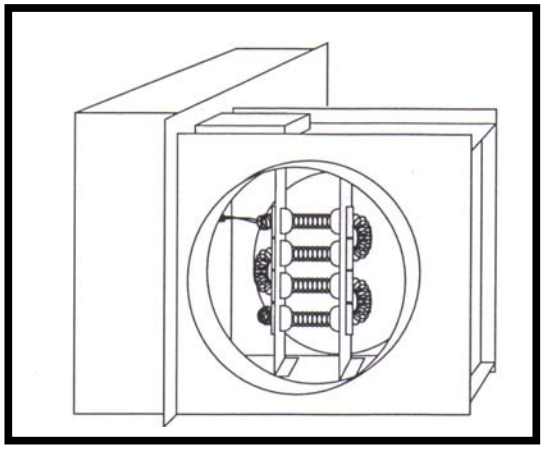
Acu-Zone™ I
Heating Unit
Round Sizes:
6"Ø, 8"Ø, 10"Ø, 12"Ø

Acu-Zone™ II
Heating Unit
Round Sizes:
14"Ø & 16"Ø

Acu-Zone™ II
Heating Unit
Square and Rectangular

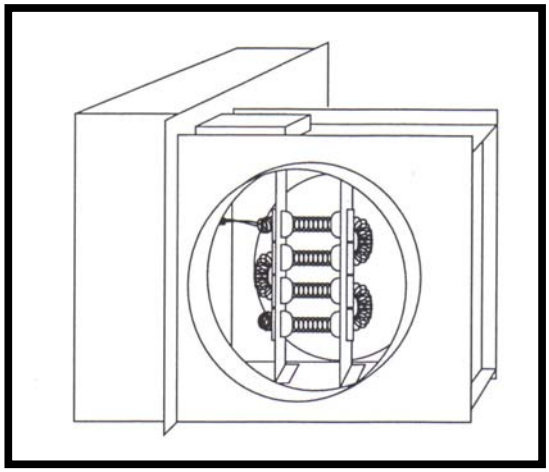


Acu-Zone™ Heater Models



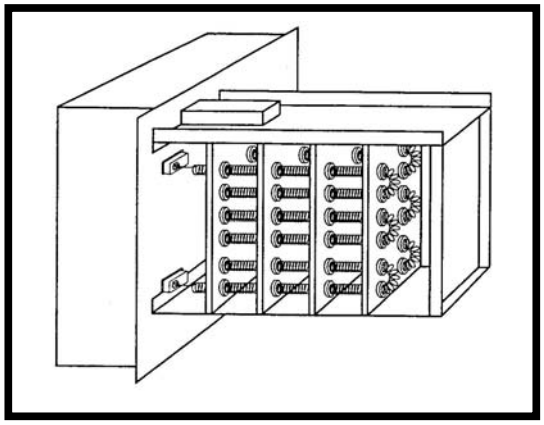
Acu-Zone ™ I Heating Unit (Round)

The ***Acu-Zone™ I*** is a specially designed unit that is available in smaller-sizes like 6"Ø, 8"Ø, 10"Ø, and 12"Ø that will match the Acutherm Therma-Fuser™ diffuser neck sizes. The units should be applied to Therma-Fuser ™ diffusers that are VAV cooling and heating and VAV cooling with constant volume heating (warm-up) - model numbers that have the HC or CW suffix respectively. The ***Acu-Zone™ I*** units should be used on individual diffusers and on multiple diffusers up to a total of four. Discharge temperature control is built-in to this unit.



Acu-Zone ™ II Heating Unit (Round)

The ***Acu-Zone™ II*** is designed for larger zones that require primary or supplementary heating. These units are to be used with the diffuser models indicated above. Discharge temperature control is accomplished by a remotely mounted discharge thermostat downstream from the heater.
The Round sizes that are available for this model are 14"Ø and 16"Ø.



Acu-Zone ™ II Heating Unit

The ***Acu-Zone™ II*** is designed for larger zones that require primary or supplementary heating. These units are to be used with the diffuser models indicated above. Discharge temperature control is accomplished by a remotely mounted discharge thermostat downstream from the heater. Units are configured for "slip-in" installation with flanges OPTIONAL (Consult Factory).
The ***Acu-Zone™ II*** heating units can be made in virtually any rectangular or square size and in any KW and voltage available.

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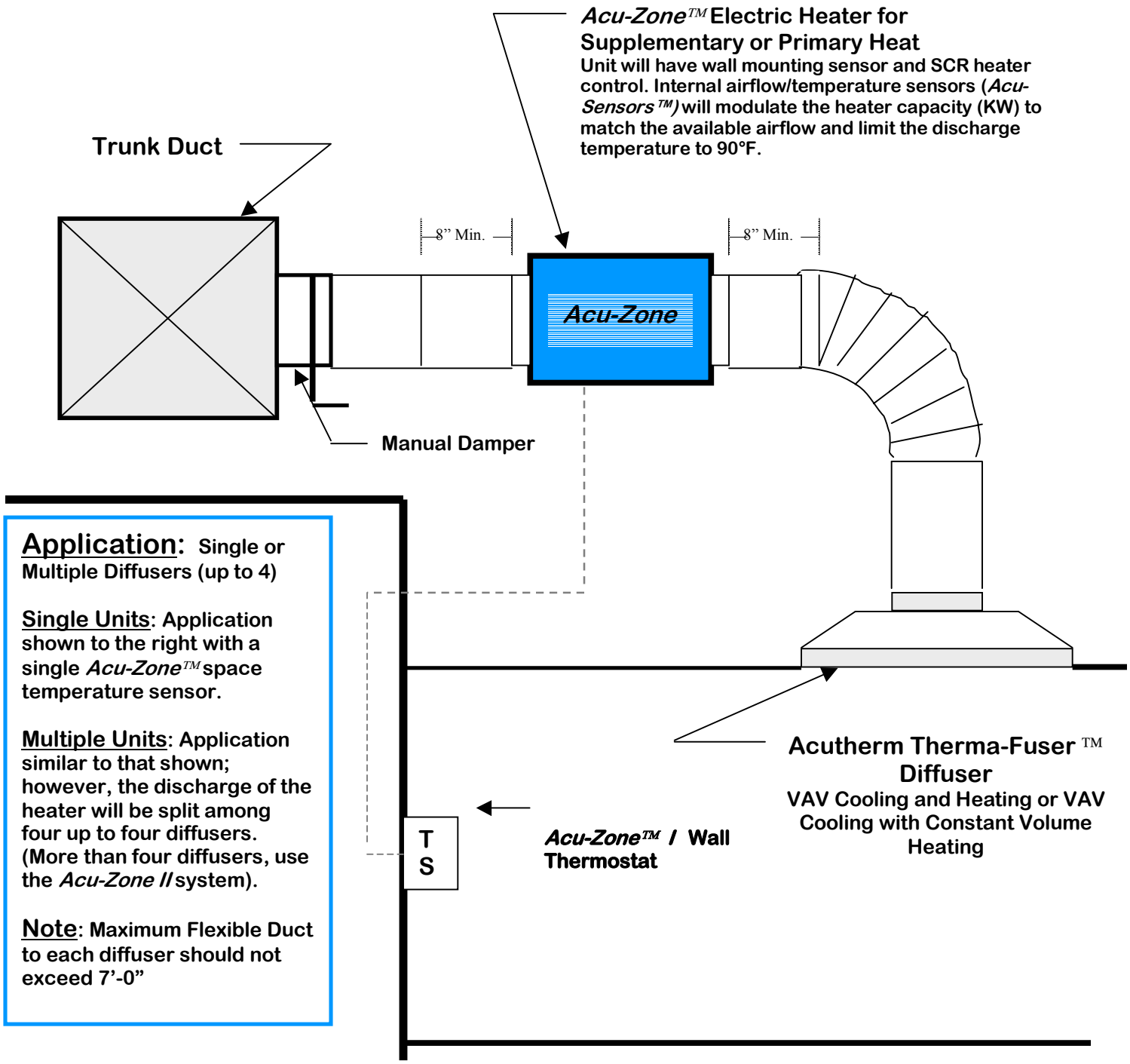
Application Drawing:
SCR Controlled Electric Heater
Acu-Zone™ I



Application: Single or Multiple Diffusers (up to 4)

Single Units: Application shown to the right with a single *Acu-Zone™* space temperature sensor.

Multiple Units: Application similar to that shown; however, the discharge of the heater will be split among four up to four diffusers. (More than four diffusers, use the *Acu-Zone II* system).

Note: Maximum Flexible Duct to each diffuser should not exceed 7'-0"

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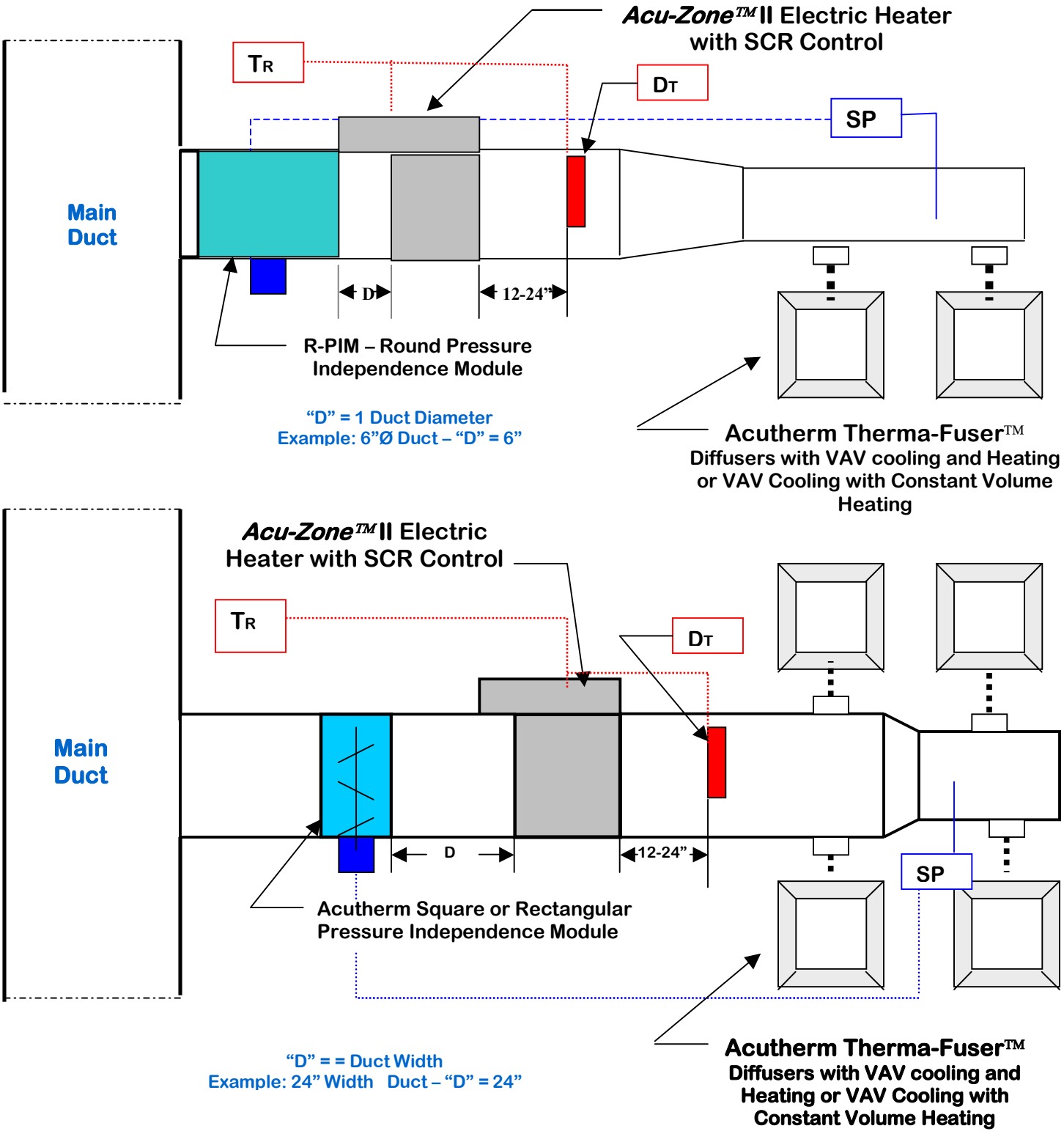
Application Drawing:
SCR Controlled Electric Heater
Acu-Zone™ II



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Acu-Zone™ I & II
Electric Zone Heater
Application, Selection, & Specification Manual

Selection of the Acu-Zone™ Heater using the following three steps:

1. Determine the heater capacity, voltage, and electrical components desired
2. Determine the duct dimensions, air requirements, and mechanical options
3. Determine the method of control and then select the control components

Step 1: Determine the heater capacity, voltage, and electrical components . . .

Heater Selection

Useful Formulas
BTU Formulas:

(#) BTU's x 0.29307 = Watts

1 KW = 3413 BTU's

Heating Calculation:

$$BTU = CFM \times 1.08(\Delta T°F)$$

$$KW = (CFM \times \Delta T) \div 3150$$

$$\Delta T = (KW \times 3150) \div CFM$$

Using the chart on the following page you can select the correct KW capacity if you know the CFM and the temperature rise desired. Follow the instructions on the page to easily select the properly sized heater.

Follow the instructions on the remaining pages to make sure that the KW you select is supported by the voltage and phase that you have available. Large KW units (over 20) are seldom available in single phase.

Continued

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Streamlined KW Selection Graph (Step 1)

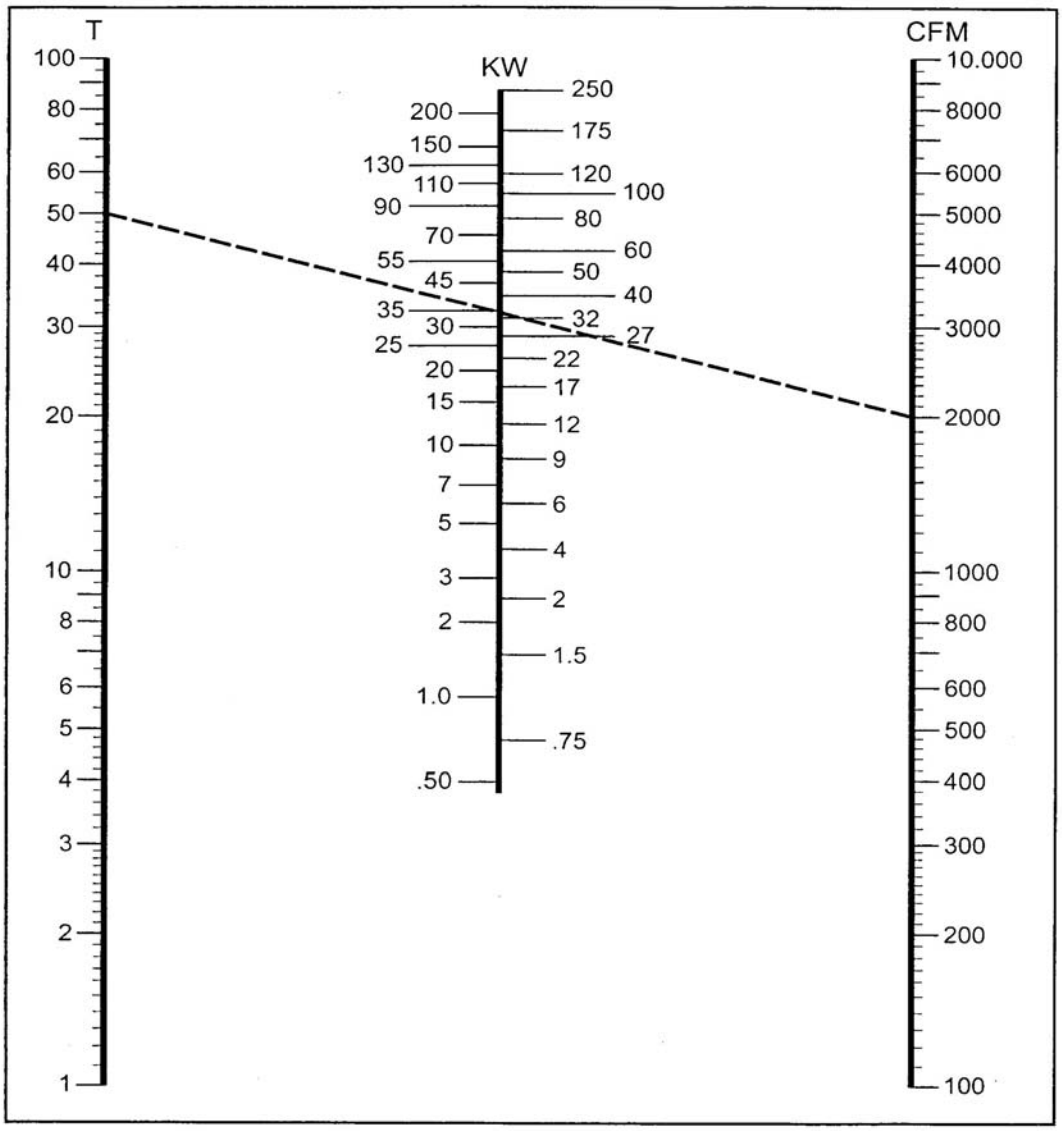

Chart to determine the required kilowatts

For a rough estimate, use the chart above.

Example:

Find the KW required to raise 2000 CFM from -10 to 40 °F.

$\Delta T = 40 + 10 = 50$ °F.

Lay a straightedge across the chart from 50 on the ΔT scale to 2000 on the CFM scale.

Find the required KW where the straightedge intersects the KW scale.

For this example, the KW required is approximately 35 KW.
You may decide to add any safety factor or loss allowance.

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Acu-Zone™ I - Heating Performance Data:

Selection by Diffuser Capacity (Model TF-HC)

Model AZON I Size	CFM	ΔT °F	BTUH	KW(Nominal)
6"Ø	100	35°F	3780	1.11
6"Ø	140	35°F	5292	1.58
6"Ø	**175**	**35°F**	**6615**	**1.94**
6"Ø	200	35°F	7560	2.22
6"Ø	225	35°F	8505	2.50
8"Ø	160	35°F	6048	1.77
8"Ø	225	35°F	8505	2.49
8"Ø	**275**	**35°F**	**10,395**	**3.04**
8"Ø	320	35°F	12,096	3.54
8"Ø	355	35°F	13,419	3.94
10"Ø	260	35°F	9828	2.88
10"Ø	370	35°F	13,986	4.10
10"Ø	**450**	**35°F**	**17,010**	**4.98**
10"Ø	520	35°F	19,656	5.76
10"Ø	580	35°F	21,924	6.43
12"Ø	350	35°F	13,230	3.87
12"Ø	470	35°F	17,766	5.20
12"Ø	**560**	**35°F**	**21,168**	**6.20**
12"Ø	640	35°F	24,192	7.08
12"Ø	720	35°F	27,216	7.97

Select the appropriate Acu-Zone™ I Heating Unit based on the CFM and KW noted that corresponds to the capacity that you need. Please note that the capacities shown are for reference only and are based on the Acu-Zone™ I use with the TF-HC. Performance data is the same for the model TF-CW (constant heating). For other models, use the desired diffuser's flow rate in the chart and apply the formula(s) shown on the previous pages.

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Acu-Zone™ I & II Electric Zone Heater Application, Selection, & Specification Manual

Acu-Zone ™ I Standard Models – Capacities & Voltages

Using the following capacity table, select the appropriate model number based on the KW capacity, voltage, and diameter. Please note that the models shown reflect multiple voltages in the model number. Pick only one voltage only (i.e. 120/1/60).

Model	Collar Size	KW	*Voltage	Nominal CFM Range	**Minimum CFM
AZONI-6-1120/208/240/277	6"Ø	1	120/208/240/277/1/60	100	60
AZONI-6-1.5120/208/240/277	6"Ø	1.5	120/208/240/1/60	101-140	60
AZONI-6-2120/208/240/277	6"Ø	2	120/208/240/277/1/60	155-199	120
AZONI-6-3208/240/277	6"Ø	3	208/240/277/1/60	200-225	180
AZONI-8-2120/208/240/277	8"Ø	2	120/208/240/277/1/60	160	120
AZONI-8-3208/240/277	8"Ø	3	208/240/277/1/60	225-275	180
AZONI-8-4208/240/277	8"Ø	4	208/240/277/1/60	276-355	240
AZONI-10-3208/240/277	10"Ø	3	208/240/277/1/60	260	180
AZONI-10-4208/240/277	10"Ø	4	208/240/277/1/60	261-370	240
AZONI-10-5208/240/277	10"Ø	5	208/240/277/1/60	371-450	300
AZONI-10-6208/240/277	10"Ø	6	208/240/277/1/60	451-520	360
AZONI-10-7208/240/277	10"Ø	7	208/240/277/1/60	521-580	420
AZONI-12-4208/240/277	12"Ø	4	208/240/277/1/60	350	240
AZONI-12-5208/240/277	12"Ø	5	208/240/277/1/60	351-470	300
AZONI-12-6208/240/277	12"Ø	6	208/240/277/1/60	471-560	360
AZONI-12-7208/240/277	12"Ø	7	208/240/277/1/60	561-640	420
AZONI-12-8208/240/244	12"Ø	8	208/240/277/1/60	641-720	480

*** See Page 34 for complete voltages available. Units will accept 50HZ or 60HZ power.**
**** Minimum CFM through the heater to have the full capacity shown. Unit automatically adjusts capacity as the airflow decreases.**

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Acu-Zone™ I & II Electric Zone Heater Application, Selection, & Specification Manual

Performance Data – Using with the R-PIM (Acu-Zone™ II)

	R-PIM Size	CFM	ΔT °F	BTUH	KW
Acu-Zone™ I **	6"Ø	510	45°F	24,786	7.27
		425	45°F	20,655	6.05
		350	**45°F**	**17,010**	**4.98**
		275	45°F	13,365	3.92
		150	45°F	7290	2.14
		83	45°F	4034	1.19
	8"Ø	905	45°F	43,983	12.89
		750	45°F	36,450	10.68
		625	**45°F**	**30,375**	**8.90**
		790	45°F	23,814	6.98
		300	45°F	14,580	4.28
		136	45°F	6610	1.94
	10"Ø	1415	45°F	68,769	20.10
		1200	45°F	58,320	17.08
		1000	**45°F**	**48,600**	**14.23**
		765	45°F	37,179	10.89
		500	45°F	24,300	7.12
		215	45°F	10,449	3.062
	12"Ø	2040	45°F	99,144	29.04
		1700	45°F	82,620	24.20
		1400	**45°F**	**68,040**	**19.92**
		1100	45°F	53,460	15.66
		700	45°F	34,020	9.96
		295	45°F	14,337	4.20
Acu-Zone II	14"Ø	2780	45°F	135,108	39.57
		2400	45°F	116,640	34.16
		2000	**45°F**	**97,200**	**28.47**
		1600	45°F	77,760	22.78
		1000	45°F	48,600	14.23
		413	45°F	20,072	5.88
	16"Ø	3615	45°F	175,689	51.47
		3050	45°F	148,230	43.42
		2500	**45°F**	**121,500**	**35.59**
		1950	45°F	94,770	27.76
		1200	45°F	58,320	17.09
		541	45°F	26,293	7.70

Indicates Nominal Performance Data – Unit will operate throughout the entire range shown. Consult the Sound Data before using selections above the Nominal Values.

** Indicates Special Order Units – ***Allow extra fabrication time (Standard capacities for Acu-Zone™ I units with 6"Ø, 8"Ø, 10"Ø, and 12"Ø - see table page 8). This unit uses the Acu-Zone™ II wall sensor with the internal Acu-Sensor™ for discharge temperature control.***

Power and Voltage Requirements: (Step 1)

Electric utilities refer to the voltage they supply with a nominal figure. The actual voltage that the electric heater sees may vary over a very wide range. For example, a nominal voltage of 575V / 3PH / 60 HZ may be called 550, 575, or 600V depending upon the normally accepted convention at your location.

Designing a heater for 550V when 600V is supplied will result in a current draw increase of over 10%, and there will be a 20% jump in the KW capacity. This is because the current is proportional to the voltage, and the KW is proportional to the square of the voltage. The application of a lower voltage will result in the underperformance of the heater because of “de-rating” caused by the lower voltage.

Therefore, it is imperative that the correct voltage is chosen and specified.

To insure the utmost safety, Acutherm has chosen the highest voltages for each range and the voltages are shown in the table below. Heaters designed for lower voltages in each range are available and will be supplied when the customer specifically requests the lower voltage.

Common Nominal Voltages	110 115 120	208		220	230 240		277	318 332 347	380		416		440 460 480		550 575 600	
Acutherm Standard Voltages	120	208 1 PH	208 3 PH	220 1 PH	240 1 PH	240 3 PH	277 1 PH	347 1 PH	380 1 PH	380 3 PH	416 1 PH	416 3 PH	480 1 PH	480 3 PH	600 1 PH	600 3 PH

This voltage standardization reduces the risk of overheating due to the heater being supplied with over-voltage. This overcapacity could result in the nuisance tripping of the high temperature cut-outs.

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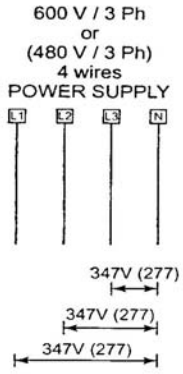
Acu-Zone™ I & II Electric Zone Heater Application, Selection, & Specification Manual

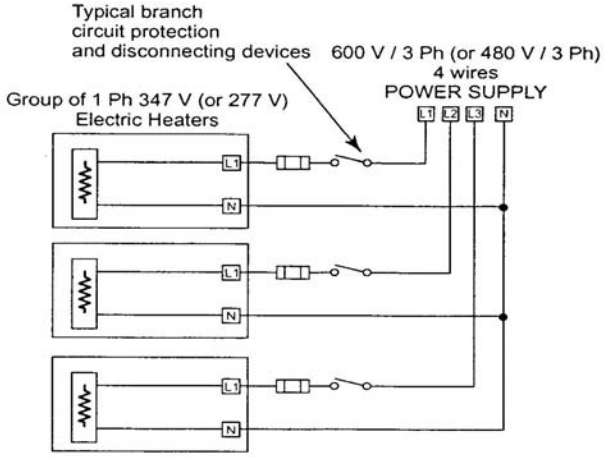
Single Phase Power Supply – 347 & 277V (Step 1)

When capacities are below 7 KW at 277 V and 8KW at 347 V, Acutherm recommends the use of the following arrangements to obtain the most economical cost for heaters and electrical distribution



347 / 600V
4 wire power supply
(also 277 / 480)

These voltages are generally derived from a 600 (480) volts - 3 phase - 4 wire power supply.
A group of 347 (277) volt - 1 phase heaters should be distributed as equally as practical over the three phases in order to keep current imbalance to a minimum.
Neutral conductor should not be broken by any switching or protective device, be it internal or external to the heater.



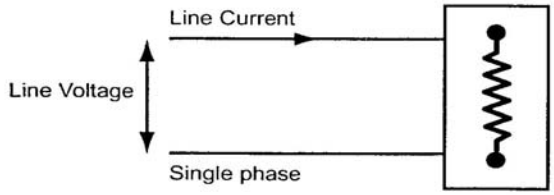
Equal distribution of heaters

Line Current

The table below shows line current per one KW capacity at various voltages. The following formulas apply:

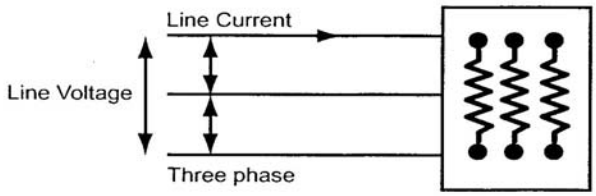
SINGLE PHASE

$$\text{Line Current in Amperes} = \frac{\text{Watts}}{\text{Line Voltage}}$$



THREE PHASE (Star or Delta loads)

$$\text{Line Current in Amperes} = \frac{\text{Watts}}{1.73 \times \text{Line Voltage}}$$



Standard Voltages	120 1 Ph	208 1 Ph	208 3 Ph	220 1 Ph	240 1 Ph	240 3 Ph	277 1 Ph	347 1 Ph	380 1 Ph	380 3 Ph	416 1 Ph	416 3 Ph	480 1 Ph	480 3 Ph	600 1 Ph	600 3 Ph
Multiplier Amp./KW	8.33	4.81	2.78	4.55	4.17	2.41	3.61	2.88	2.63	1.52	2.40	1.39	2.08	1.20	1.67	0.96

Multipliers to calculate Line Currents

(Line current in amperes = Multiplier x KW capacity)

Example: The Line current for a 40 KW / 600V / 3 phases heater is : 40 x 0.96 = 38.4 amperes.

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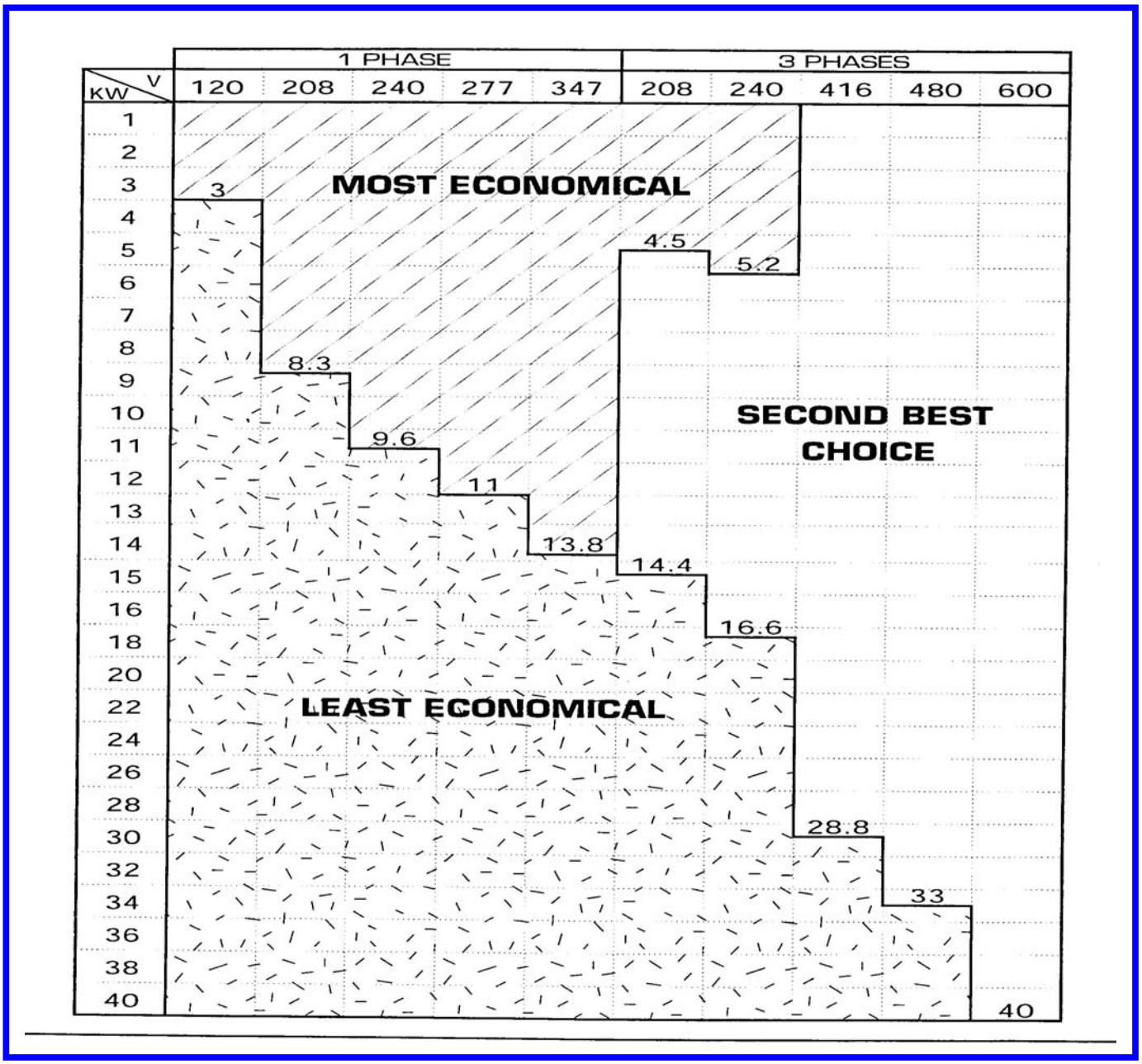
Acu-Zone™ I & II
Electric Zone Heater
Application, Selection, & Specification Manual

Selection Chart for the most economical design for Acu-Zone™ Heaters – KW / Voltage Combination (Step 1)



Fusing: (Step 1)

The National Electric Code requires that each power supply to a heater be individually protected by either fuses or circuit breakers external to the heater. See the NEC and local codes having jurisdiction.

Additional sub-circuit fusing within the heater (built-in load fuses) may be either mandatory or optional, and if they are chosen as optional, they may not be recommended. The following table supplies the information necessary for the decision to use built-in sub-circuit over-current protection.

As a general rule, built-in load fuses are rated 30 amps for circuits up to 24 amps and 60 amps to protect one or more circuits totaling 48 amps.

Table of Load Fusing

240 1 PH	208 1PH	277 1PH	347 1PH	480 3 PH	600 3PH	Heater Rated Amps	NEC Electrical Code	Internal Load Fusing Mandatory	Acutherm Recommends Built-in Load Fuses	Comments
Total Heater KW * up to . . .										
12	17	13	17	40	50	0-48	NO	NO	NO	Optional Load Fuses not recommended – only one power supply economically justified
38	57	44	55	133	166	49-160	YES	NO	YES	Fuses Limit extent of damage in the terminal box in case of a short circuit
39 & +	58& +	45&+	56&+	134&+	167&+	161&+	YES	YES	YES	Mandatory in case of short circuit

*** For Higher KW capacities consult the factory regarding the most economical number of power supplies.**

Load Fuses: The minimum required sets of 60 amp fuses for proper protection (option U-1). Example of load fusing: A single stage, three phase heater rated at 40 amps will use one set (3 fuses of 60 amps).

Stage Fuses: Mostly optional, one or more sets of fuses per stage. (Option U-2). Acutherm's standard fuses are 30 amps for circuits up to 24 amps, and 60 amps for circuits up to 48 amps.

Electrical Components: (Step 1)

Contactors

Contactors are used to power individual stages of heat or as back-up for safety switches.

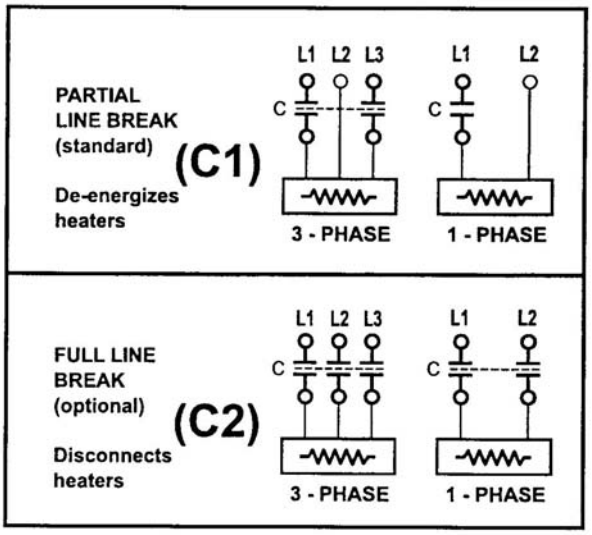
Contactors may be of two types:

Partial line-break (or de-energizing)

In the partial line-break arrangement the contactor opens the current path, thus de-energizing the heater.

Full line-break (or disconnecting)

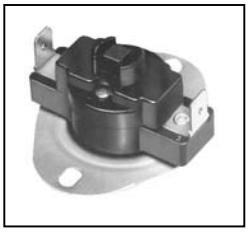
The full line-break type contactor opens all ungrounded power lines in the heater. This may be ordered as an option (Request option C2).



Partial and Full Break Figures

Standard Electrical Components (Step 1)

Automatic Reset Cut-out: The automatic reset thermal cut-out is a fixed temperature disc type safety device that opens the control circuit when the set point is reached. It automatically resets and returns the heater to operating condition when the overheating conditions have disappeared.



Manual Reset Cut-out: This device offers additional protection against overheating. It is standard on heaters of 30 KW and less and those not in excess of 300 volts. It is optional on all other heaters. This switch must be manually reset to return the heater to its operating condition.

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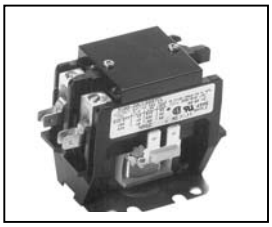
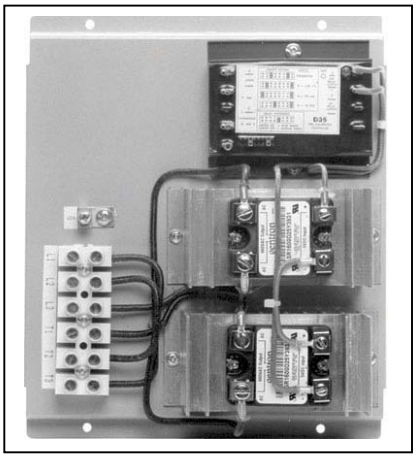
Standard Electrical Components: (Step 1)



Magnetic Contactors: Magnetic contactors are used for stage switching as back-up for safety devices. Approved for 250,000 cycles, magnetic contactors are cost effective and safe. Partial break contactors are standard on the Acu-Zone I & II units.

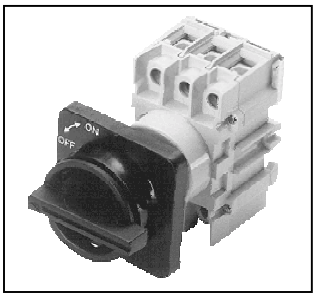
Transformer: A built-in control transformer is required on most heaters (standard on Acu-Zone™ I & II) to supply 24V to the control circuits. A Class II transformer has built-in safety protection and does not require primary fusing. Primary and secondary fuses can be supplied upon request.

Electronic Airflow Sensor: The electronic airflow sensor is a safety feature that monitors the quantity if air flowing through the heater, and adjusts the heaters capacity to match the airflow present. The sensor will shut the heater down upon the total loss of airflow. This feature is only available on the Acu-Zone™ I and II heaters with full SCR control. Full SCR Control is STANDARD on the Acu-Zone™ I & II products.



SCR Controller: The SCR (Silicone Controlled Rectifier) is a time proportioning type controller that modulates the heater and supplies the exact amount of power to match the heat demand. It is compatible with thermistor thermostat (ART or ADT), 0-10VDC, 4-20ma, and 0-135ohms signals. SCR control is STANDARD on the Acu-Zone™ Heating Units.
Standard capacities are up to 70 amps and 600V – 3 Phase. Consult Acutherm for higher SCR capacities.
Note: SCR Controllers are position sensitive (i.e. the fins of the heat-sink must be in a vertical position to ensure natural cooling). Make sure to specify the installation position of the heater.

Standard Electrical Components: (Step 1)



Disconnect Switch: A built-in disconnect switch (STANDARD on the Acu-Zone™ Heating Units) allows the heaters to disconnect individually so maintenance and repairs can be performed. The disconnect switch is a positive and inexpensive way to meet safety requirements, and since the disconnect switch is factory installed electrical installation costs are further reduced.

Step 2: Determine the duct dimensions, air requirements, and mechanical options . . .

Airflow requirements for minimum velocity:

Heating coil size is very important in the efficiency and the operation of an open coil duct heating unit. In fact, the smaller size, higher velocity electric coil will perform better, weigh less, and ultimately cost less per KW than an otherwise identical larger coil.

KW per Square Foot Range	Comments
Less than 5	Higher cost per KW
5 to 12	Medium cost per KW
12 to 20	Low cost per KW
Over 20	Medium cost per KW

Table 1- KW per Square Foot

Face Velocity in Feet Per Minute (FPM)	Comments
Less than 400	Requires de-rating of watt density on the elements. Specify proportional control
400-2000	Most economical range
Over 2000	Specify special coil supports

Table 2 – Design Velocity Table

Step 2: Determine the duct dimensions, air requirements, and mechanical options . . . *continued*

Airflow requirements for minimum velocity:

Electric heating coils will generate 100% of the heating capacity regardless of the airflow or the heating output is constant as long as the unit is energized. A drop in airflow through an electric coil below the minimum required velocity (FPM) will increase both the coil temperature and the temperature of the discharge air which may lead to the overheat devices tripping out. Further, if the airflow is uneven as it passes through the heater, then the uneven airflow across the heating element will cause "hot spots" and premature element failure. Therefore, it is most important to select the heaters with a KW capacity that is below 22.5 KW per square foot of duct area.

Airflow requirements for SCR Control:

The Acu-Zone™ SCR controlled heater may be considered as having an infinite number of control stages and the heater can operate with a velocity as low as 50 FPM.

The Acu-Zone™ contains a patented *proportional airflow sensor* (Acu-Sensor™) that responds to the radiant heat of the heating element which is directly affected by the airflow quantity passing through the heater by modulating the power to the heater down, thereby adjusting the heater capacity to accurately match the airflow available. This feature is unique to the Acu-Zone™ heating unit - a feature that allows precisely controlled heat upstream from the Therma-Fuser™ diffuser unit(s).

The benefits of the proportional air flow sensor are that it allows the heaters to operate with extremely low air flow, and the heaters operate safely regardless of the duct static pressure.

The electronic controller also allows a proportional control for the heater and is compatible with the following input signals:

1. Variable voltage signal 0-10VDC
2. Pulse signal – 24VAC or 24VDC

Standard Capacities	Standard Dimensions
Up to 2KW @120/1/60	6"Ø through 12"Ø – 6" x 6" through 24" x 18"
Up to 5KW @ 208/1/60	6"Ø through 12"Ø – 6" x 6" through 24" x 18"
Up to 6KW @ 240/1/60	6"Ø through 12"Ø – 6" x 6" through 24" x 18"
Up to 7KW @ 277/1/60	6"Ø through 12"Ø – 6" x 6" through 24" x 18"
Up to 8KW @ 347/1/60	6"Ø through 12"Ø – 6" x 6" through 24" x 18"

Other dimensions, capacities and voltages up to 40 KW and 600V/3PH are available upon request

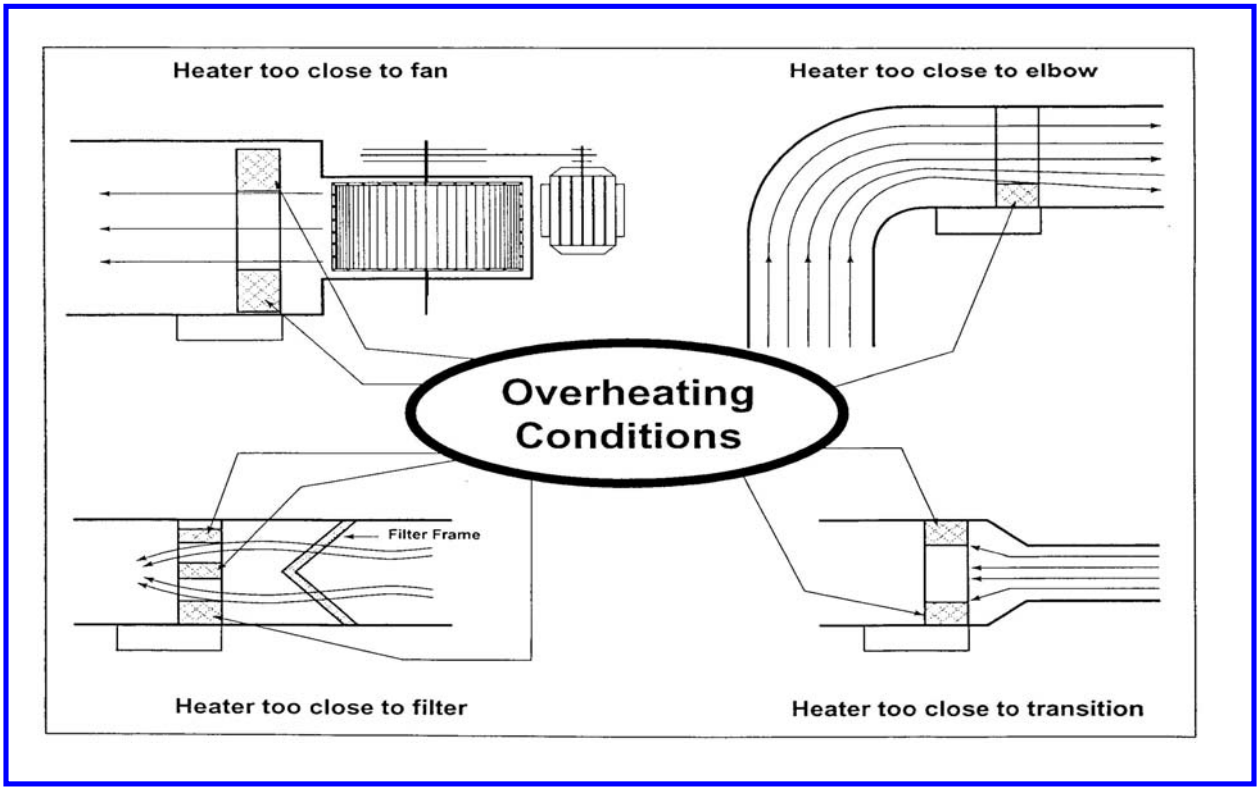
Step 2: Determine the duct dimensions, air requirements, and mechanical options . . . *continued*

Airflow Uniformity

In order to prevent hot spots, the airflow must be uniformly distributed across the heater area. The following figures illustrate typical heater misapplication where the airflow is not uniform. An NEC article (see below) specifies that a heater should not be installed closer than 4 feet downstream and 2 feet upstream from a fan outlet, an abrupt transition, an elbow or any other kind of obstruction in the duct.

1071 NEC Article 424-59

"Means shall be provided to assure uniform and adequate airflow over the face of the heater. Heaters installed near (within 4 feet) a fan outlet, elbows, baffle plates or other obstruction in duct work may require turning vanes, [ressure plates or other devices in the inlet side of the duct heater to assure an even distribution of air over the face of the heater."



Step 2: Determine the duct dimensions, air requirements, and mechanical options . . . *continued*

Size Limitations

Although there are virtually no limitations to the maximum size of Acutherm custom built heaters, all CSA Listed heaters must comply with the following dimensions:

	Slip-in Type Open Coil	Flanged Type Open Coil
Minimum Duct Width Dimension "W"	6"	5"
Minimum Duct Height Dimension "H"	5"	4"

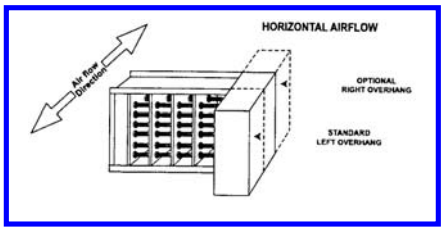
Table 3 – Heater Size Limitations

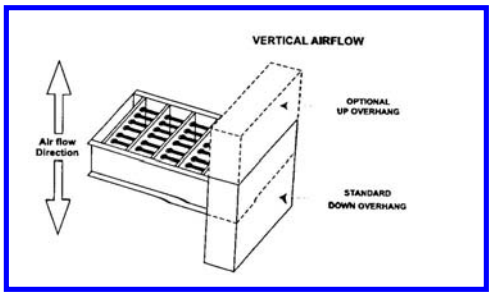
CSA listed custom heaters (Acu-Zone™ II) heaters are available in any KW rating; however, the listing is restricted to a maximum KW density of 22.5KW per square foot of heated area for open coil type heaters. For a quick approximation of the maximum KW available in a particular duct size, please use the following formula:

$$\text{Maximum KW} = \frac{22.5 \times \text{"W" (Inches)} \times \text{"H" (inches)}}{144}$$

Universal Mounting of Acu-Zone™ Heaters

The heaters are manufactured to be non-sensitive to airflow direction. The built-in high limit cut-outs are located such that the airflow can be in either direction without impairing the safety of the heater. The very same heater can be installed in horizontal or vertical duct.

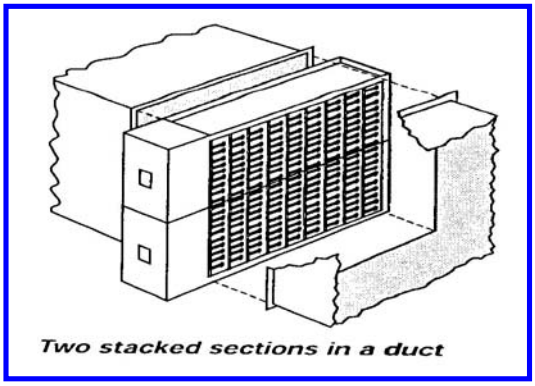




Step 2: Determine the duct dimensions, air requirements, and mechanical options . . . *continued*

Mulriple Heaters in a duct

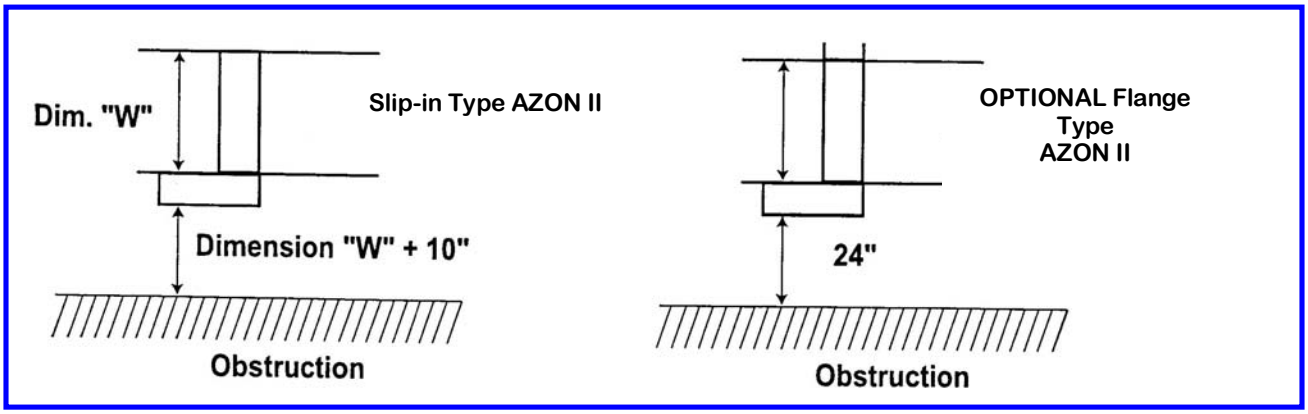
Electric heaters are not normally designed to be used is series in a heating installation. Very large Acu-Zone II heaters can be manufactured and shipped so they can be simplified by using two or more units specifically designed for parallel installation. Each section has cutouts and there are terminal blocks provided to interconnect the controls in the field.



Two stacked sections in a duct

Clearance

Acu-Zone™ heaters are CSA and NRTL/C approved for zero clearance to combustible material. This means that there are no distance restrictions between the section of the duct and combustible material. Care must be taken to install the heater such that clearance room is allowed for removal and servicing of the heater. The diagram below shows the recommended installation clearances/



Step 3: Determine the method of control and select the control components . . .

Temperature Control Mode

The temperature control mode that is STANDARD on both the Acu-Zone™ I & II Heating Units is SCR (Silicone Controlled Rectifier) proportional modulating control which essentially enables the heaters to have an infinite number of stages and very precise control.

Modulating control is also referred to as proportional – where the heater is electronically controlled to deliver abywhere from zero to 100% of its capacity, precisely and smoothly matching the heat demand of the system (discharge temperature of 90°F). This is achieved using the SCR controller connected to a proportioning discharge thermostat that holds the discharge temperature from the unit at 90°F or less. A wall sensor acts as a mode change energizing the heater through the SCR controller to hold the discharge temeperature. This control/thermostat set-up is unique to the Acu-Zone™ Heating unit and is well suited to its use upstream from the Therma-Fuser™ Diffusers. See the Acu-Zone™ I and II control sequence for more information.

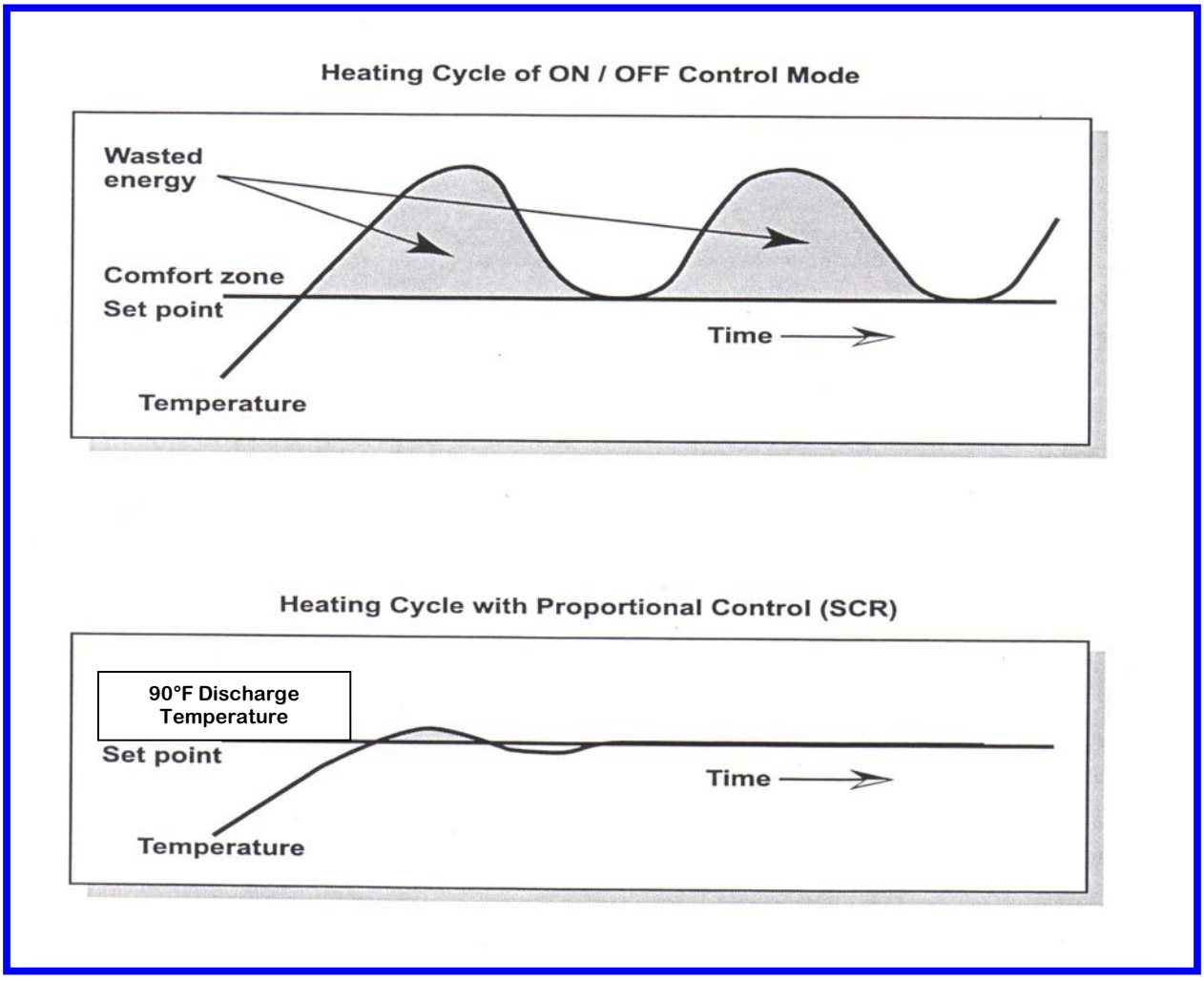
Proportional refers to the portion of a time period in which a heating element is turned ON and OFF (i.e. 10% ON and 90% OFF means a 10% heating capacity). Therefore, based on the discharge thermostat's demand (the difference between 90°F and the inlet air temperature) in the case of the Acu-Zone™ I & II controls, the heater is pilsed in different ON time and OFF time to match the discharge thermostat demand. The longer the time period that the element is turned ON, the more heat is being generated, and the heat produced during the ON period continues to dissipate during the OFF period – creating an average temperature output matching the discharge tthermostat output (90°F).

The Acu-Zone™ I & II Heating Units have an additional *Acu-Sensor*™ that monitors the airflow through the heater and automatically readjusts the KW to match the airflow, independent of the discharge thermostat above. In other words, when the mode change wall sensor triggers the SCR/discharge thermostat into operation, then the additional sensor is looking at the available airflow to determine is the discharge thermostat can allow 90°F supply air because of sufficient airflow. If the airflow to the heater is lost, then the *Acu-Sensor*™ shuts the heater down.

Step 3: Determine the method of control and select the control components . . .

Temperature Control Mode – Comparison between ON/OFF and Proportional Control

Traditional ON/OFF heater control wastes a gret deal of energy because of its high differential. The graphic below shows how the ON/OFF method creates high "overshoot" above the temperature set point while the electronic proportional method keeps the temperature close to the set point. The shaded areas correspond to wasted energy. A proportional control can maintain an accurate discharge temperature without the typical variations of the ON/OFF method. The energy savings of the proportional control is at least 15%.

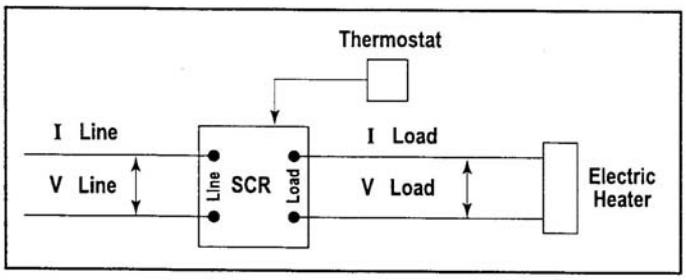


Step 3: Determine the method of control and select the control components . . .

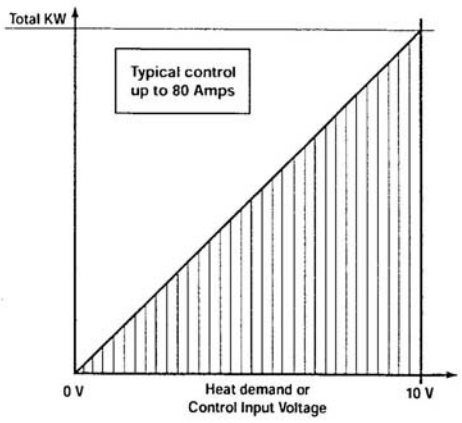
Temperature Control Mode – Full SCR Control

FULL SCR

SCR is the abbreviation of Silicon Controlled Rectifier, also called current valve because of its ability to modulate the current supplied to, and consequently the capacity of, the heater. The example below sketches how a typical SCR modulates the heat output of a 15 KW / 600 V / 1 PH, electric heater.
As long as the temperature controller demands less than full heat, the SCR will switch the heater on and off repetitively on a very short cycle or period, typically 2 seconds. The net heat output is the product of the KW capacity of the heater multiplied by the ratio of the "ON" to "ON+OFF" or "period" time.
This ratio is determined by an electronic logic in the SCR according to a signal from a proportioning thermostat. Enough heat is stored in the electric elements so that there is an almost constant operating temperature corresponding to the demand.
FULL SCR control is recommended where FINE temperature control is required.



Full SCR Control Electric Diagram



Full SCR Load Diagram

General Note: All controllers supplied are equipped with a zero-cross thyrister switching system that virtually eliminates electro-magnetic interference (EMI) and radio frequency interference (RFI).

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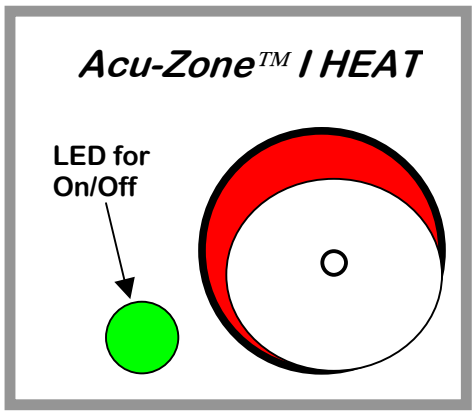
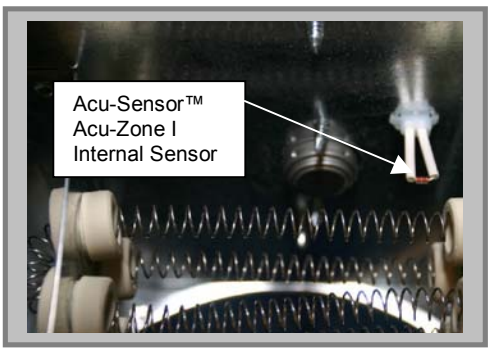
Step 3: Determine the method of control and select the control components . . .

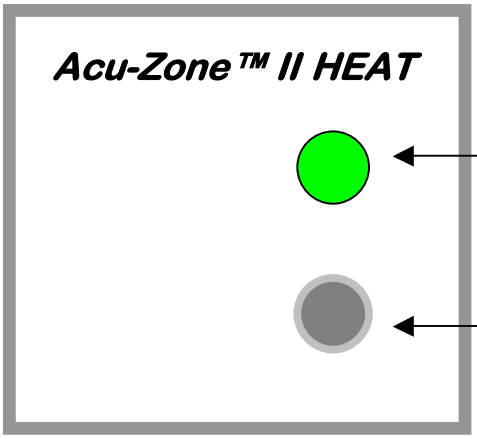
Temperature Control Mode – Wall Sensors and Duct Thermostats





Standard Control Acu-Zone I - # AZONT-25346

The ***Acu-Zone™*** Heaters are equipped with the most advanced modulating (SCR) heat controller and airflow sensor (*Acu-Sensor*) that allows the zone heater to operate at extremely low airflow conditions.
The discharge air temperature is fixed at 90°F.
The electronic, wall-mounting sensor can accurately control the temperature in each zone and can adjust the room heating set point between 70°F and 72°F – NO SETBACK. Unit has an "OFF" position. Unit will have a Green LED for "On & OFF" functions.
Each ***Acu-Zone™*** unit is ready to install with a single point electrical supply connection and the thermostat.
The airflow sensor detects the airflow and automatically and proportionally adjusts the heat to match the airflow; consequently, using the minimum amount of energy to meet the zone heating load.



Acu-Zone II Thermostat/Sensor: #AZONIITSDT-25347

This wall mounting Sensor works in conjunction with a Discharge Thermostat to control the SCR for the heat. One wall sensor is available with an On/Standby switch for operator interface and the other without the switch. In the "On" mode, the Discharge Thermostat is energized to maintain a constant discharge air temperature of 90°F. The Wall Mounting Sensor will have built-in pre-assigned and adjustable temperature ranges for both the "Room Set Point" and the "Set-Back" Temperature. Factory set "Room Set Point Range" will be 70°F to 72°F and the "Set Back" Temperature will be 65°F ± 1.5°F. The "Set Back" feature will always be energized even when the unit is "Stand By." The return from a power failure will energize the system in whatever mode that it was in upon the failure.

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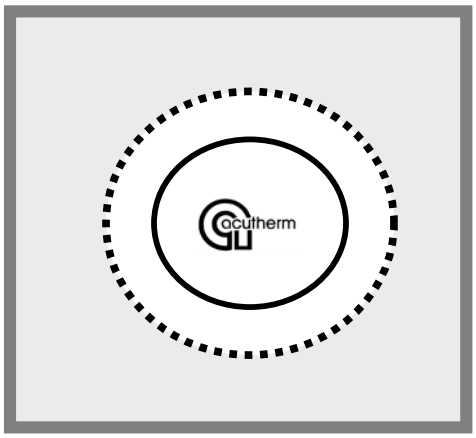
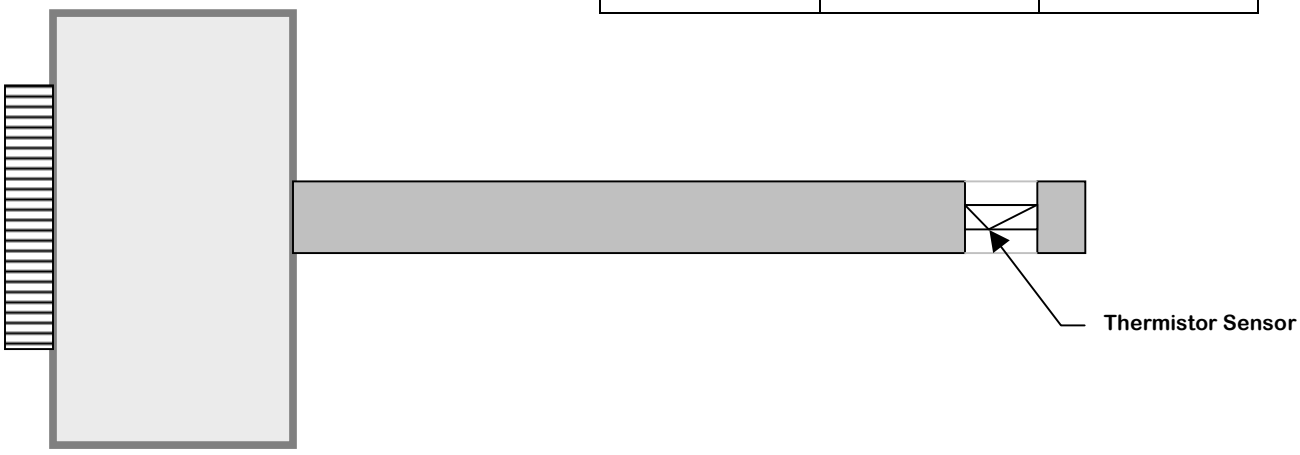


Acu-Zone II Thermostat/Sensor: #AZONIITSDT-25347

The Acu-Zone™ model ADT-1040electronic modulating thermostat is for use in conjunction with the wall sensor above, and is a thermistor proportional type that is compatible with the Acu-Zone™ II controls. The standard casing is a high strength ABS plastic.

The model ADT-1040 is a two wire connection with a built-in adjustable set point. Units will be set at 90°F. The adjustable range is as follows:

Model	Temperature °C	Temperature °F
ADT-1040	10-40°	50-104°F



Electronic SCR Controller – D21T

Inputs:

1. Thermistor thermostat – ADT-1040
2. Proportional Air Flow Sensor that allows:
    a) Full power with normal minimum air flow
    b) Reduced power with air flow below the minimum
    c) No heat with no airflow

Outputs: One SCR Load

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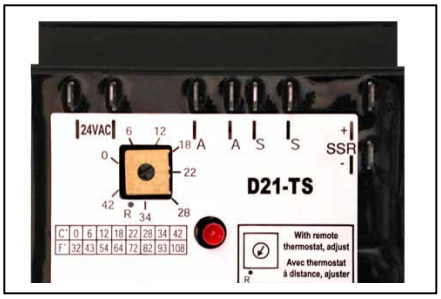
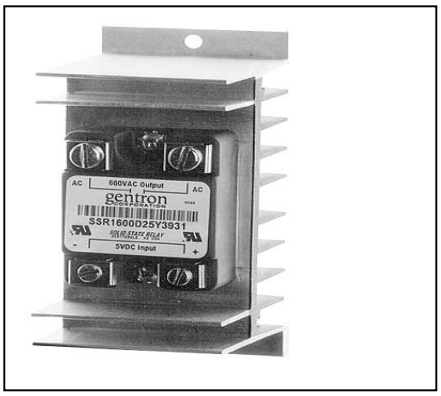


Electronic SCR Controller – D21TS

Inputs:
1. Thermistor thermostat – ADT-1040
2. Proportional Air Flow Sensor that allows:
   a) Full power with normal minimum air flow
   b) Reduced power with air flow below the minimum
   c) No heat with no airflow

Outputs: One output to solid state relays



Solid State Relays

Solid State Relays are designed for controlling a large amount of power in response to a pulsed signal – silently and proportionally. They incorporate a dual SCR (Silicon Controlled Rectifier) to provide full-wave capability and Zero Crossing Drive Circuitry. The opto-coupler provides the interface to the logic level input signal and electrical input-to-output isolation.

Please Note: SCR's are position sensitive (the fins of the heat-sink must be in a vertical position to ensure proper cooling). It is very important to properly specify which position the heater is to be installed.

Step 3: Determine the method of control and select the control components . . . *continued*

Specifications – *Acu-Zone™ I*

Acu-Zone™ I - Guide Specifications:

The model AZON I, Acutherm's ***Acu-Zone™ I*** electric zone heater shall be as supplied by Acutherm, LP, Hayward, California.

The ***Acu-Zone™ I*** electric zone heater shall be an open coil duct heater, packaged in a heavy duty galvanized steel box complete with controls, electronic thermostat, safety devices for over temperature control, round inlet and outlet, and shall be a complete package with a single point electric supply connection, and a thermostat connection in the terminal box.

Units shall have an ***Acu-Sensor™ I*** that modulates the heating capacity according to the quantity of air flowing through the heater, thus allowing the heater controls to be pressure independent and the heater to operate at a very low CFM. The sensor shall respond to radiant heat of the heating element, which is proportional to the airflow across the heating coils.

Step 3: Determine the method of control and select the control components . . . *continued*

Specifications – *Acu-Zone™ I*

Acu-Zone™ I - Guide Specifications: (Continued)

The ***Acu-Zone™ I*** shall have an *Automatic Reset Thermal Cutout,* a safety feature that prevents overheating and that will reset after cooling down. Unit shall also incorporate a *Manual Reset Thermal Cutout* for redundancy and to prevent the heater frame from overheating.

The Unit shall have open coil type elements constructed from the highest-grade nickel-chrome resistance wire ensuring that the wires will not age or oxidize, allowing longer life.

The ***Acu-Zone™ I*** electric zone heater enclosure shall be constructed from heavy gauge galvanized steel, and the controls enclosure cover shall be easily removable for access to the single point electrical supply connections and the thermostat connections as well.
Round connection collars (inlet and outlet) to simplify installation and reduce field labor.

The unit shall have a built-in *Electronic Temperature Controller* that will proportionally modulate the heating load to best match the exact capacity required and to minimize energy consumption.

The ***Acu-Zone™ I*** electric zone heater shall have a *Two Year Warranty* and shall be CSA [C & US] labeled for safety and reliability.

Acu-Zone™ II - Guide Specifications:

The model AZON, Acutherm's ***Acu-Zone™ II*** electric zone heater shall be as supplied by Acutherm, LP, Hayward, California.

The ***Acu-Zone™ II*** electric zone heater shall be an open coil duct heater, packaged in a heavy duty galvanized steel box complete with controls, electronic thermostat, safety devices for over temperature control, round inlet and outlet, square or rectangular shape, and shall be a complete package with a single point electric supply connection, and a thermostat connection in the terminal box.

Units shall have an airflow sensor that modulates the heating capacity according to the quantity of air flowing through the heater, thus allowing the heater controls to be pressure independent and the heater to operate at a very low CFM. The sensor shall respond to radiant heat of the heating element, which is proportional to the airflow across the heating coils.
The ***Acu-Zone™ II*** shall have an *Automatic Reset Thermal Cutout,* a safety feature that prevents overheating and that will reset after cooling down. Unit shall also incorporate a *Manual Reset Thermal Cutout* for redundancy and to prevent the heater frame from overheating.

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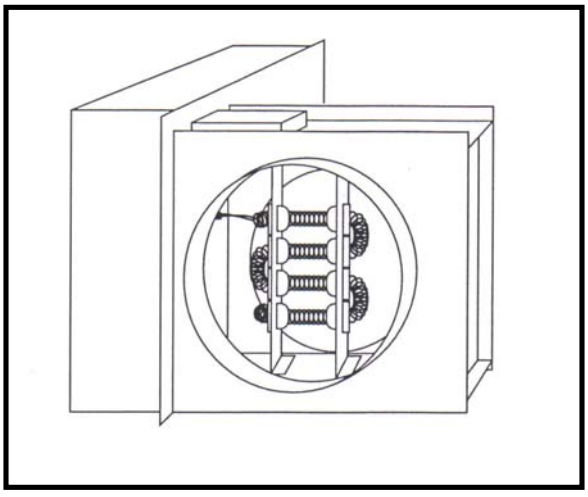
Acu-Zone™ II- Guide Specifications: (Continued)

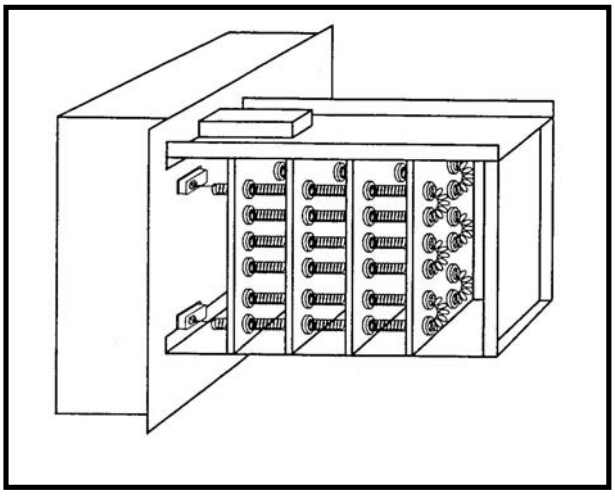
The Unit shall have open coil type elements constructed from the highest-grade nickel-chrome resistance wire ensuring that the wires will not age or oxidize, ensuring longer life.

The ***Acu-Zone™ II*** electric zone heater enclosure shall be constructed from heavy gauge galvanized steel, and the controls enclosure cover shall be easily removable for access to the single point electrical supply connections and the thermostat connections as well.
Round connection collars (inlet and outlet) to simplify installation and reduce field labor.

The unit shall have a built-in *Electronic Temperature Controller* that will proportionally modulate the heating load to best match the exact capacity required and to minimize energy consumption.

The ***Acu-Zone™ II*** electric zone heater shall have a *Two Year Warranty* and shall be CSA (C & US) labeled for safety and reliability.





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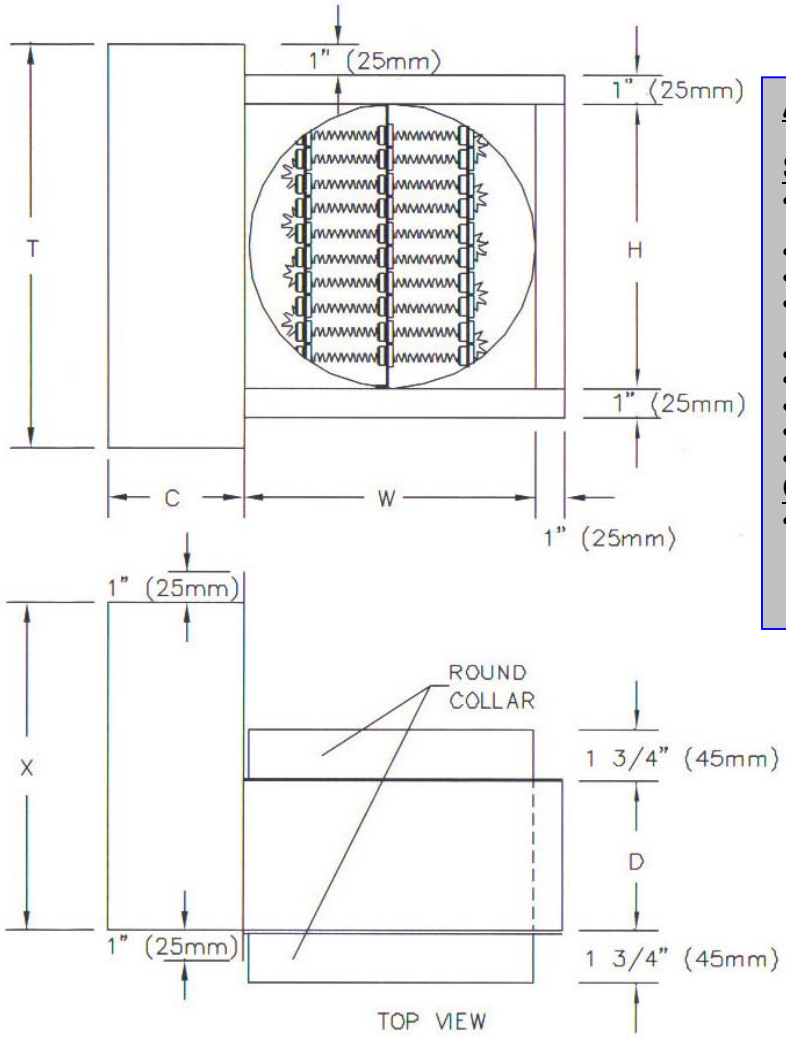

Acu-Zone™ I

Standard:

- Magnetic Contactor- Partial Break
- Automatic Cut-Out
- Transformer – Fused
- Built –In Air Flow Sensor
- SCR. Control
- UL Standard Protection
- Interlock Terminal Strip
- Disconnect Switch
- Manual Cut-Out

Options:

- Proportional Duct Thermostat – ADT 1040 (Standard on Acu-Zone II)

Unit Size	C	D	H	T	X
AZON I -06	6.5”	10”	6”	10”	14”
AZON I -08	6.5”	10”	8”	14”	11”
AZON I -10	6.5”	5”	10”	14”	14”
AZON I -12	6.5”	5”	12”	16”	14”

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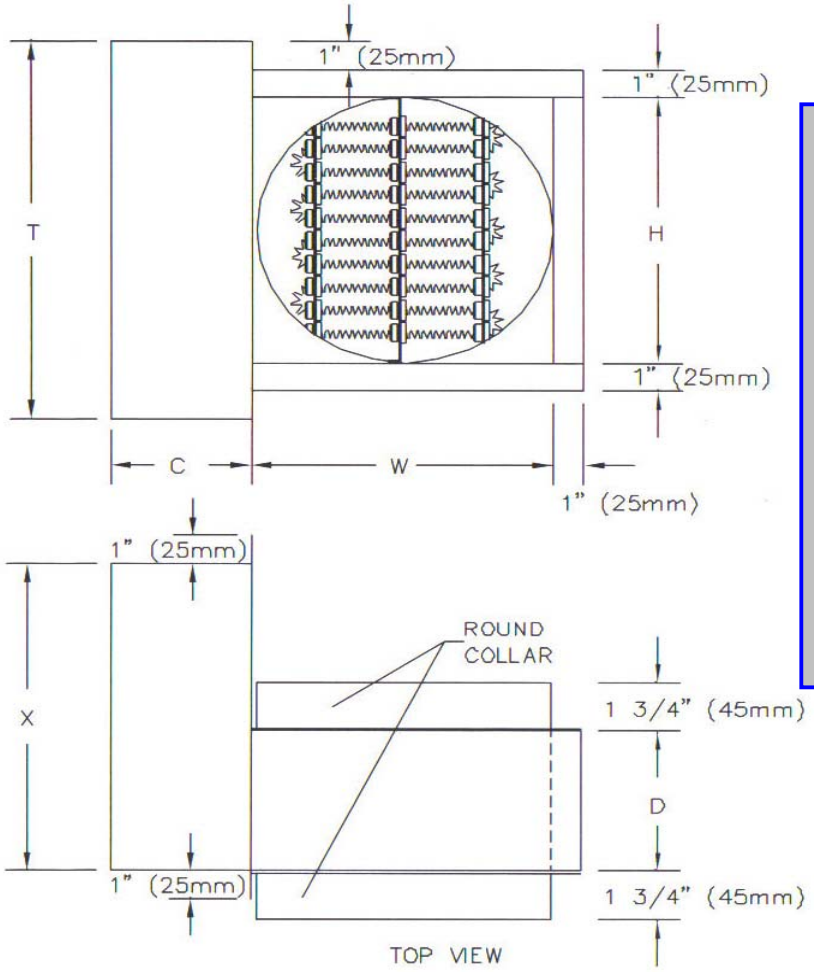

Acu-Zone™ II

Standard:

- Magnetic Contactor-Partial Break
- Automatic Cut-Out
- Transformer – Fused
- Built –In Air Flow Sensor
- SCR. Control
- Proportional Duct Thermostat – ADT 1040 (Standard)
- UL Standard Protection
- Interlock Terminal Strip
- Disconnect Switch
- Manual Cut-Out

Unit Size	C	D	H	T	X
AZON II -06*	6.5”	10”	6”	10”	14”
AZON II -08*	6.5”	10”	8”	14”	11”
AZON II -10*	6.5”	5”	10”	14”	14”
AZON II-12*	6.5”	5”	12”	16”	14”
AZON-14	6.5”	5”	14”	18”	14”

* Indicates Special Order Units for use with R-PIM Round Static Pressure Dampers

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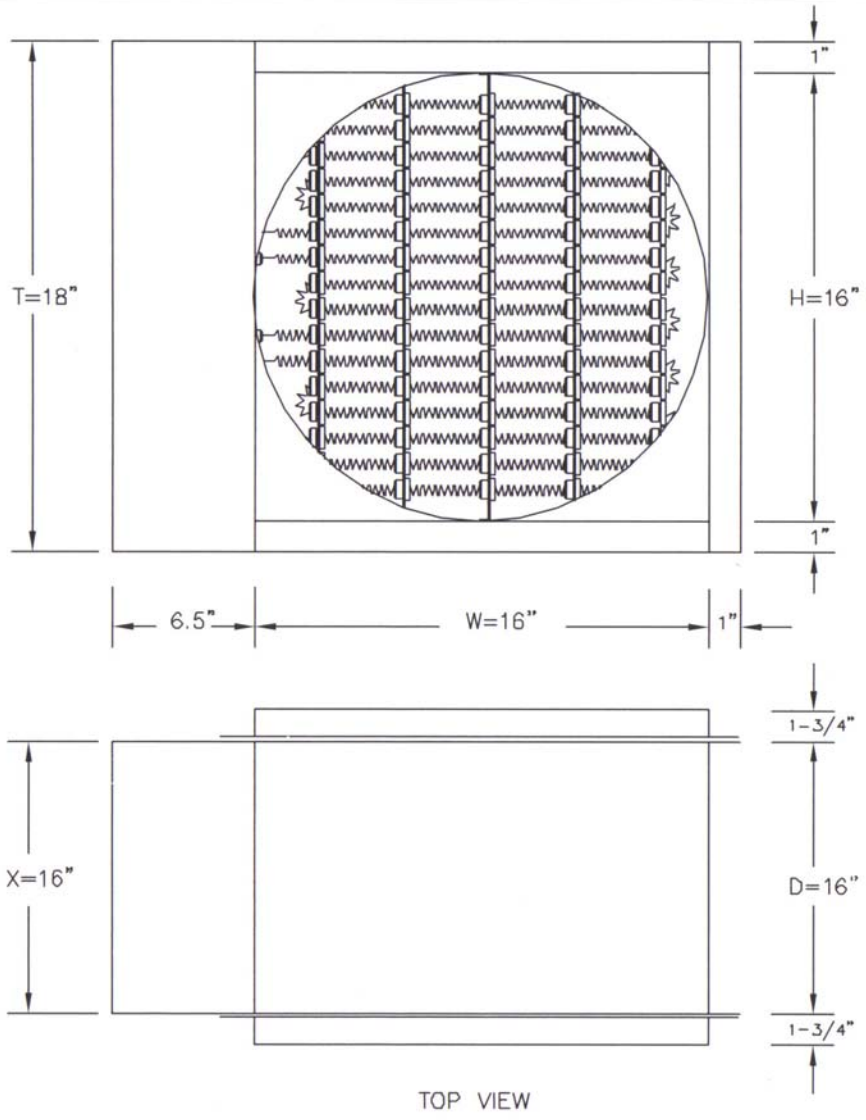

Acu-Zone™ II (16"Ø)

Standard:

- Magnetic Contactor- Partial Break
- Automatic Cut-Out
- Transformer – Fused
- Built –In Air Flow Sensor
- SCR. Control
- Proportional Duct Thermostat – ADT 1040 (Standard)
- UL Standard Protection
- Interlock Terminal Strip
- Disconnect Switch
- Manual Cut-Out

Unit Size	C	D	H	T	X
AZON-16	6.5"	16"	16"	18"	16"

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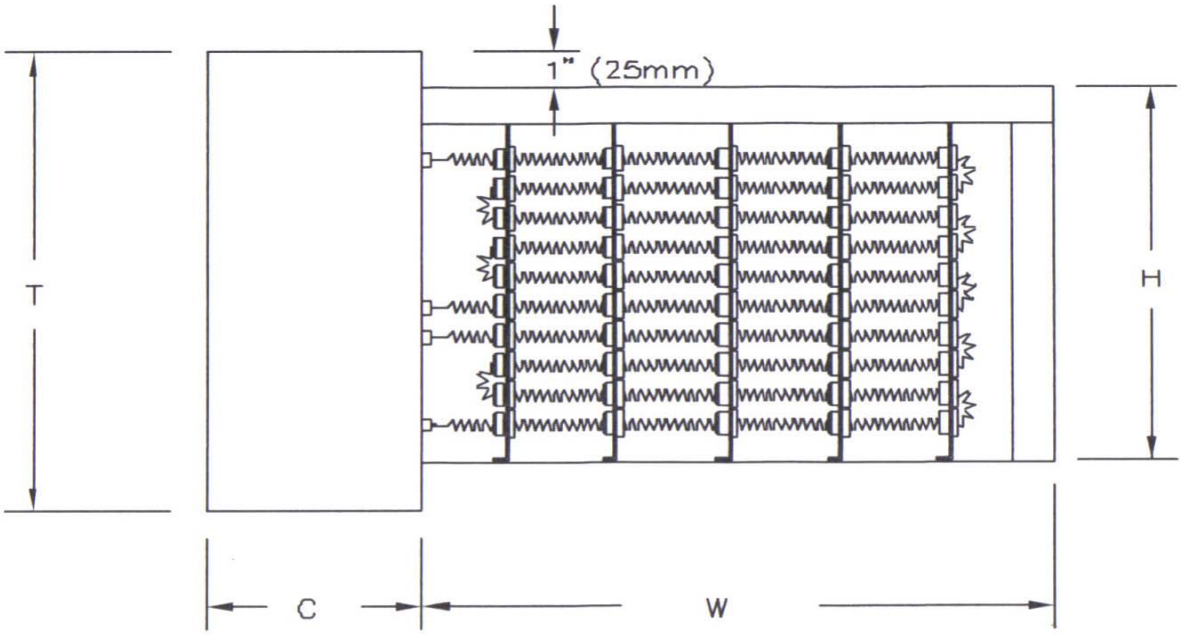
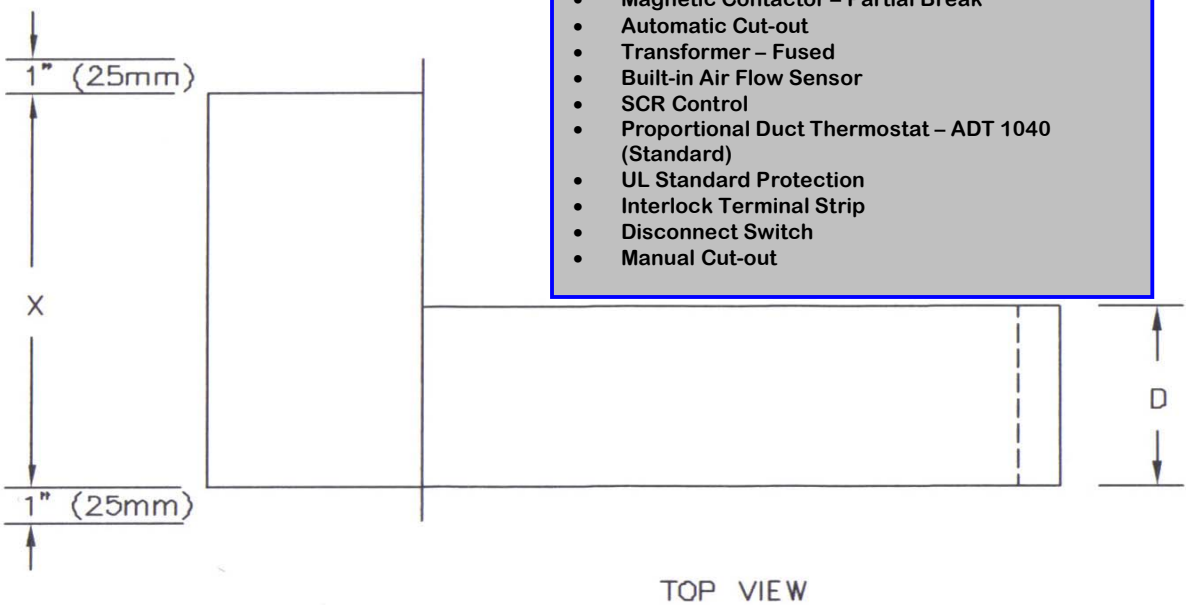


Options:

- Magnetic Contactor – Partial Break
- Automatic Cut-out
- Transformer – Fused
- Built-in Air Flow Sensor
- SCR Control
- Proportional Duct Thermostat – ADT 1040 (Standard)
- UL Standard Protection
- Interlock Terminal Strip
- Disconnect Switch
- Manual Cut-out



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Electric Zone Heater
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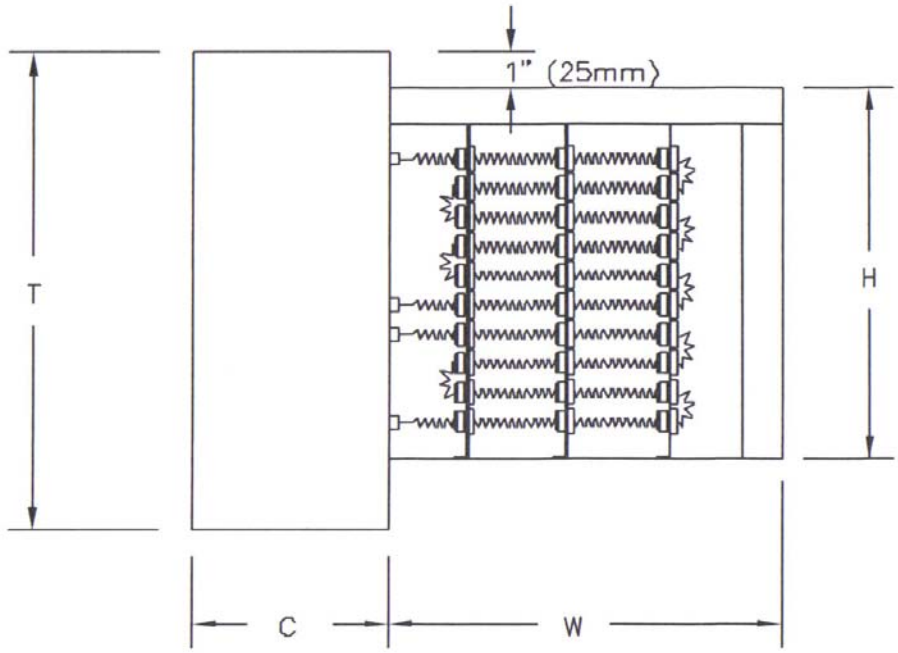
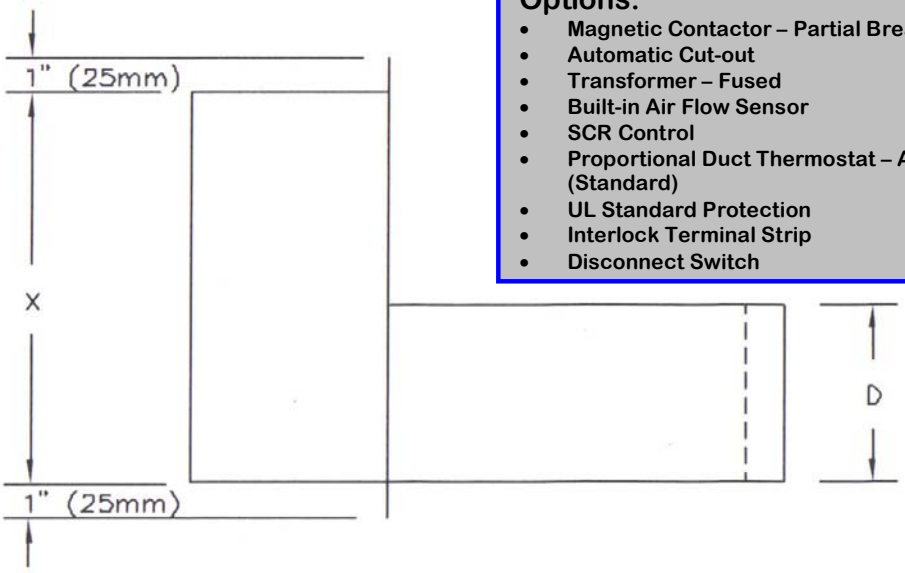


Options:

- Magnetic Contactor – Partial Break
- Automatic Cut-out
- Transformer – Fused
- Built-in Air Flow Sensor
- SCR Control
- Proportional Duct Thermostat – ADT 1040 (Standard)
- UL Standard Protection
- Interlock Terminal Strip
- Disconnect Switch



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Product Information Description

Use the following model number nomenclature to order the Acu-Zone™ I & II Heater and Accessories

Product	Type	Size	(3 & 4)	KW	Control	Voltage	Thermostat	Options	Access.
(1)	(2)	Width	Height	(5)	(6)	(7)	(8)	(9)	(10)
AZON					SCR				

Nomenclature:

(1) **Product:** AZON – ***Acu-Zone™***

(2) **Type:** – I or II

(3) **Width – {inches} – Round:** 6"Ø ,8"Ø, 10"Ø, 12"Ø, 14"Ø, 16"Ø

(4) **Height {inches} – Round**: R

(5) **KW** – Capacity of the Unit Selected

(6) **Control** : SCR

(7) **Voltage:** (1201) -120/1, (2081) - 208/1, (2401) – 240/1, (2771) – 277/1, (3471) – (2083) – 208/3/60, (2201) – 220/1, (2403) - 240/3, (3803) – 380/3, (4163) – 416/3, (4803) – 480/3, (6003) – 600/3
Note: All Heaters will accept 50HZ or 60HZ power.

(8) **Thermostat –** "S" – Standard Wall Sensor (AZONT-25346) ; "WSDT" – Wall Sensor and Discharge Thermostat (AZONIITSDT-25347) ,"WSDTDWA" - Wall Sensor, Discharge Thermostat, & Digital Wall Adjuster (AZONT-25346-WA or AZONIITSDT-25347-WA or WANS)

(9) **Options: DS (Disconnect is Standard Equipment)**

(10) **Accessories:**

Two-Year Warranty

Acutherm warrants that the model AZON Electric Zone Heater, exclusive of any options and accessories (whether factory or field installed) shall be free from defects in material or workmanship for a period of two (2) years from the date of shipment and agrees to repair or replace, at its option, any parts that fail during said two (2) year period due to any such defects which would not have occurred had reasonable care been taken, provided that such parts have been inspected by Acutherm and found defective and provided the units have been given normal and proper usage and all parts and controls remain unaltered. Acutherm makes no WARRANTY OF MERCHANTABILITY OF PRODUCTS OR OF THEIR FITNESS FOR ANY PURPOSE OR ANY OTHER EXPRESS OR IMPLIED WARRANTY WHICH EXTENDS BEYOND THE LIMITED WARRANTY ABOVE. ACUTHERM'S LIABILITY FOR ANY AND ALL LOSSES AND DAMAGES RESULTING FROM DEFECTS SHALL IN NO EVENT EXCEED THE COST OF REPAIR OR REPLACEMENT OF PARTS FOUND DEFECTIVE UPON EXAMINATION BY ACUTHERM. IN NO EVENT SHALL ACUTHERM BE LIABLE FOR INCIDENTAL, INDIRECT, OR CONSEQUENTIAL DAMAGES OR DAMAGES FOR INJURY TO PERSONS OR PROPERTY. Acutherm shall not be responsible for freight to or from its plant(s) in connection with the inspection, repair or replacements of parts under the terms of this limited warranty nor for cost of removal or installation.

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