



## HIGH-EFFICIENCY CONDENSING GAS-FIRED SEPARATED COMBUSTION UNIT HEATERS



 **Effinity<sup>93</sup>**  
with Conservicore Technology®



At 93% thermal efficiency for all model sizes, Modine's Effinity<sup>93®</sup> condensing unit heater features the highest efficiency available in North America for gas-fired unit heaters. This industry leading efficiency is a result of the coupling of our Conservicore<sup>®</sup> secondary heat exchanger technology with our robust tubular primary heat exchanger design. The Conservicore<sup>®</sup> technology features a secondary recuperative heat exchanger fabricated from AL29-4C<sup>®</sup> stainless steel. This material is superior to other lower grades of stainless steel and aluminum, resulting in outstanding ability to withstand the corrosive environment of condensing gas fired equipment.

Available in ten model sizes with input ranges from 55,000 to 310,000 Btu/Hr, Modine offers application flexibility unmatched in the industry. The separated combustion units draw combustion air from outside to ensure that the unit will always have plenty of fresh, clean air for combustion while increasing the overall heating efficiency. Venting material to be used is PVC, an extremely cost effective vent system.

This catalog describes the design benefits, construction features, performance data, unit selection procedure, and the optional and accessory devices available for the Modine Effinity<sup>93®</sup> Condensing Unit Heater, Models PTC & BTC.

Table 2.1 - Estimated Annual Fuel Cost Savings Using the Effinity<sup>93®</sup> Condensing Unit Heater

		Estimated Annual Savings Against Other Equipment ① ②			
		Gravity Vented		Power Vented	
Design Heat Load (Btu/Hr):		120,000	280,000	120,000	280,000
Annual Heat Load Hours (Refer to Figure 2.1)	500	\$306	\$713	\$136	\$318
	1000	\$611	\$1,427	\$273	\$637
	1500	\$917	\$2,140	\$409	\$955
	2000	\$1,223	\$2,853	\$546	\$1,274
	2500	\$1,529	\$3,567	\$682	\$1,592
	3000	\$1,834	\$4,280	\$819	\$1,911
	3500	\$2,140	\$4,993	\$955	\$2,229

① Based on a natural gas rate of \$1.10/Therm. Actual realized savings can vary significantly based on a number of changing factors including, but not limited to, fuel prices, climate, building use or construction, etc.

② Compares 93% efficient against 65% seasonal efficient gravity vented and 78% seasonal efficient power vented.

Figure 2.1 - U.S. Average Heat Load Hours Map

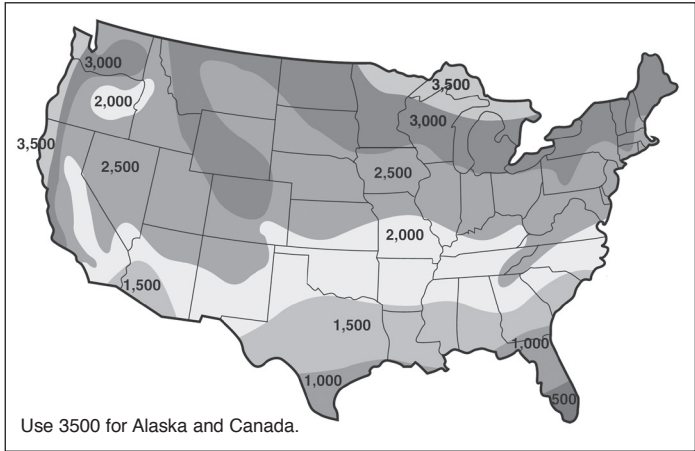


Table of Contents

Page

Design Features . . . . .	3-4
General Performance and Electrical Data - Model PTC . . . . .	5
General Performance and Electrical Data - Model BTC . . . . .	6-9
Electrical Selection Details - All Models . . . . .	10
Accessories . . . . .	11
Downturn Hood Performance Data . . . . .	12
Selection Example - Model PTC . . . . .	13
Selection Example - Model BTC . . . . .	14
Dimensional Data - Model PTC . . . . .	15
Dimensional Data - Model BTC . . . . .	16
Specifications - All Models . . . . .	17-18
Model Nomenclature . . . . .	19

# WARNING

1. Do not locate ANY gas-fired unit in areas where chlorinated, halogenated, or acidic vapors are present in the atmosphere.
2. Do not install in potentially explosive or flammable atmosphere laden with dust, sawdust, or similar airborne materials.

# CAUTION

Heaters are designed for use in heating applications with ambient temperatures between 40°F and 80°F. Heaters should not be used in applications where the heated space temperature is below 40°F. The combination of low space and combustion air temperatures may result in condensate freezing in the secondary heat exchanger and/or condensate drain.

As Modine Manufacturing Company has a continuous product improvement program, it reserves the right to change design and specifications without notice.

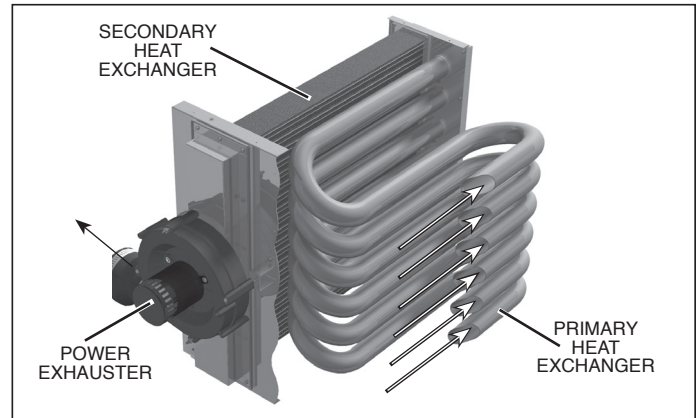
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® Effinity<sup>93®</sup>, Conservicore<sup>®</sup>, and any combination of these names either together or with other words is a registered trademark of Modine Manufacturing Co.

**Figure 3.1 - Effinity<sup>93</sup>® Model PTC/BTC (PTC Shown)**



**Figure 3.2 - Modine Conservicore® Heat Exchanger**



**Table 3.1 - Standard Features and Factory Options ①**

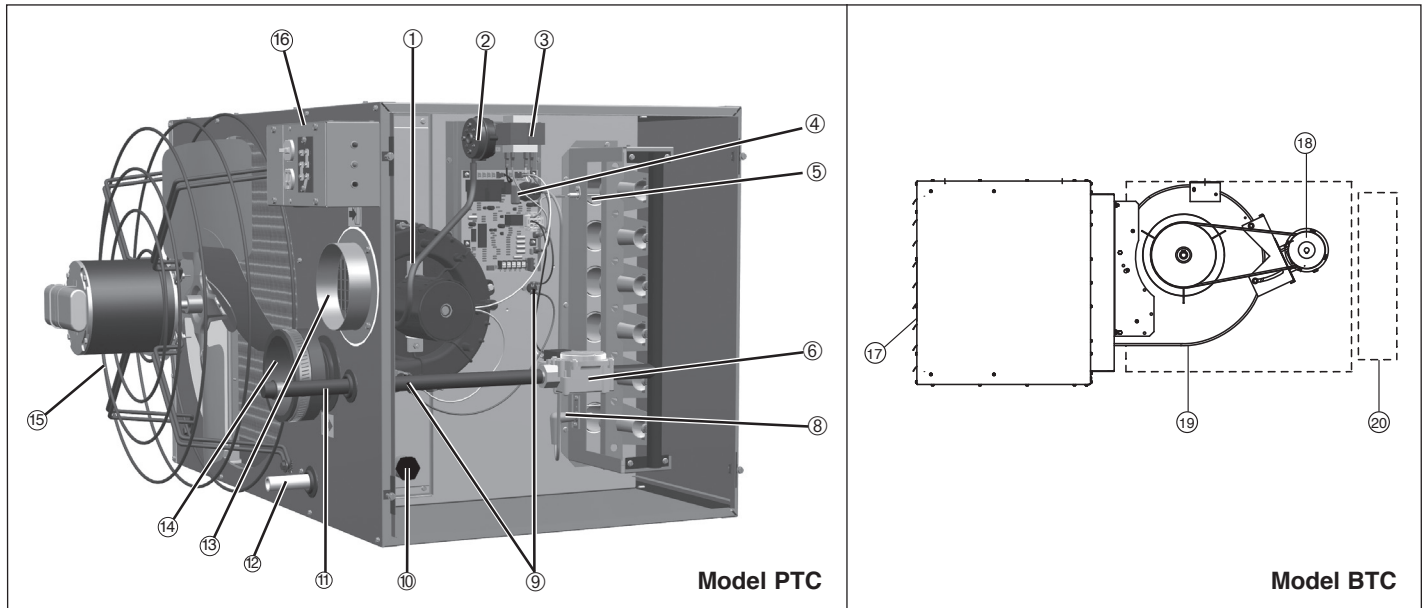
	Feature	PTC	BTC
Cabinet and Air Mover	Aluminized steel cabinet ( <i>gauge indicated</i> )	20 ga.	20 ga.
	Baked-on polyester powder paint for durability and corrosion resistance	•	•
	Adjustable air-deflector blades	•	•
	Fans engineered for quiet operation	•	•
	Totally enclosed fan motors for maximum durability	•	•
	Fingerproof fan guard ( <i>standard on sizes 110 and smaller</i> )	Opt	
	Adjustable motor sheaves, certified to 0.7" W.C. external static pressure		•
Heat Exchanger and Burner	93% thermally efficient	•	•
	Aluminized steel primary heat exchanger ( <i>409 stainless steel optional</i> )	•	•
	Tubular heat exchanger for superior durability	•	•
	In-shot burner on each heat exchanger tube for reliable performance, ease of serviceability and low sound level on flame ignition/extinction	•	•
	Modine Conservicore® technology on secondary recuperative heat exchanger with AL29-4C® stainless steel material as standard	•	•
Controls	ETL certification for residential ( <i>size 110 and smaller only</i> ), commercial, and industrial use in the US and Canada	•	
	Factory-installed power exhauster	•	•
	Controls for natural gas ( <i>propane optional</i> )	•	•
	Single stage gas controls	•	•
	Flame roll-out safety switch ( <i>model sizes 110 and smaller</i> )	•	
	High limit safety controls for both the heated air and flue gas temperature	•	•
	Condensate drain overflow switch to verify proper condensate drainage	•	•
	Differential pressure switch for proof of venting	•	•
	Direct spark ignition with continuous retry control system	•	•
	Contractor Convenience Package featuring a condensate pump convenience outlet, unit on/off switch, heater function status indicator lights, and external terminals for thermostat wiring	•	•
	Gas control step down transformer with 24V gas controls	•	•
	Fan delay timer	•	•

① • = See page 11 for Field Installed Accessories.



The Modine Breeze® AccuSpec is the fastest way to generate performance data based on actual job conditions. The Breeze® AccuSpec program is a web-based sizing and selection program. The program provides a series of step-by-step questions that allow for the easy configuration of Modine products. After a model has been configured, the program can generate Submittal Schedules, Submittal Data (including performance and dimensional drawings), and Specifications.

**Figure 4.1 - Factory Mounted Standard Features**



**① Power Exhauster**

All units are supplied with a round vent pipe and combustion air inlet pipe connections.

**② Pressure Switch**

An automatic reset vent pressure switch is supplied on all units and is designed to prevent operation of the main burner in the event there is restricted venting of flue products. This restriction may occur due to an improper vent diameter, long vent runs, un-approved vent terminal, high winds, high negative pressure within space, etc. After the cause of the restriction has been corrected, the pressure switch will reset automatically.

**③ Control Step Down Transformer**

The control step down transformer is located in the electrical junction box. The transformer is used to step down from 115V to 24V for the gas controls, fan delay relay, field supplied motor starter, etc. An additional field installed transformer is required if the supply voltage is 208V, 230V, 460V, or 575V. To determine the control transformer supplied as well as any required accessory transformers, refer to Table 10.1.

**④ Integrated Direct Spark Control Board**

The integrated direct spark ignition control combines all furnace control functions. The integrated board provides digital control of the air mover, inducer, ignition, gas valve and flame sense as well as monitoring the safety circuit at all times. The board includes LED diagnostics for trouble shooting and a fused power supply. Ignition control is 100% shut-off with continuous retry.

**⑤ Flame Sensor**

Remote flame sensor verifies ignition of all burners, monitors the flame signal and communicates with the integrated circuit board.

**⑥ Single Stage Gas Valve**

The main gas valve is factory installed on the unit heater gas train. The main gas valve provides regulator, main gas, and manual shutoff functions. The valve is redundant and provides 100% shut off.

**⑦ Flame Roll Out Switch (size 110 and smaller only) (hidden)**

Flame roll out switches are mounted near the burners and will shut off the gas supply in the event of an unsafe flame roll out condition.

**⑧ Direct Spark Igniter**

Provides spark for direct ignition of the burners.

**⑨ High Limit Switches**

One limit control is mounted in the air stream and will shut off the gas supply in the event of overheating. The other limit control is mounted on the power exhaustor housing and will shut off the gas supply in the event of overheating flue gas temperatures.

**⑩ Condensate Drain Overflow Switch**

Shuts down gas controls if condensate is not properly draining from the unit.

**⑪ Gas Pipe Connection**

Easy access to factory installed gas pipe connection stubbed to outside of unit casing.

**⑫ Condensate Drain Connection**

Easy access to factory installed condensate drain pipe connection stubbed to outside of unit casing.

**⑬ Combustion Air Inlet Pipe Connection**

Simple connection for combustion air inlet piping.

**⑭ Vent Pipe Connection**

Simple Fernco® rubber boot connection for PVC vent system.

**⑮ Fan Guard (Standard for PTC Models)**

Propeller units may be equipped with an optional finger proof fan guard (standard on size 110 and smaller) for added protection. If ordered, the finger proof fan guard is installed at the factory in place of the standard fan guard.

**⑯ Contractor Convenience Package**

External junction box features simple connection of supply power wiring internally, thermostat wiring to terminals externally, an On/Off switch, a single 115V outlet for connection of an external condensate pump, and status indicator lights to display the operational state of the unit.

**⑰ Horizontal Air Deflector Blades**

Factory mounted on the discharge of the unit, the blades can be adjusted to provide horizontal (up and down) delivery control of the heated air. Vertical deflector blades are available as a field installed accessory.

**⑱ Blower Motor (Standard for BTC Models)**

Blower motors smaller than 3 HP are factory installed on the blower housing. Motors 3 HP and above ship loose for field installation to prevent damage during shipment. The blower motor is supplied with an adjustable sheave that can be used to increase/decrease the blower RPM, and the blower motor can be provided in a variety of supply voltages and motor horsepowers.

**⑲ Blower Enclosure (OPT for BTC Models)**

**⑳ Filter Rack (OPT for BTC Models)**

Provides filtration of air to be heated. Must include Blower Enclosure accessory.

**Table 5.1 - Propeller Unit Heater Model PTC General Performance Data**

	Model PTC Sizes									
	55	65	85	110	135	156	180	215	260	310
<b>Btu/Hr Input ①</b>	55,000	65,000	85,000	110,000	135,000	155,000	180,000	215,000	260,000	310,000
<b>Btu/Hr Output ①</b>	51,150	60,450	79,050	102,300	125,500	144,150	167,400	199,950	241,800	288,300
<b>Condensate Production (Gal./Hr.)</b>	0.3	0.4	0.5	0.7	1.0	1.1	1.3	1.6	1.9	2.3
<b>Entering Airflow (CFM) @ 70°F ②</b>	1097	1141	1650	1750	2160	2600	3020	3865	4585	5400
<b>Outlet Velocity (FPM) ②</b>	618	650	619	668	719	862	676	699	831	765
<b>Air Temp. Rise (°F)</b>	43	49	44	54	54	51	51	48	49	49
<b>Max. Mounting Height (Ft.) ②</b>	12	12	13	13	14	18	15	17	20	19
<b>Heat Throw (Ft.) @ Max. Mtg Ht</b>	43	43	48	46	51	62	53	60	70	67
<b>Motor Type ③</b>	PSC	PSC	PSC	PSC	PSC	PSC	PSC	PSC	PSC	PSC
<b>Motor HP</b>	1/8	1/8	1/8	1/3	1/3	1/3	1/3	1/2	3/4	3/4
<b>Motor RPM</b>	1440	1440	1550	1075	1075	1075	1075	1075	1125	1125

① Ratings shown are for elevations up to 2,000 ft. For elevations above 2,000 feet, ratings should be reduced at the rate of 4% for each 1,000 feet above sea level (in Canada see rating plate). Reduction of ratings requires use of a high altitude kit.

② Data taken at 65°F ambient and unit fired at full-rated input. Mounting height as measured from bottom of unit, and without deflector hoods.

③ All motors used are produced, rated and tested by reputable manufacturers in accordance with NEMA standards and carry the standard warranty of both the motor manufacturer and Modine. All motors are totally enclosed and all single phase motors have built-in thermal overload protection.

**Table 5.2 - Model PTC Operating Electrical Data ⑤**

Supply Voltage	Power Code		Model PTC Sizes									
			55	65	85	110	135	156	180	215	260	310
115V 1 Phase	01 (115V)	<b>Motor Amps</b>	1.3	1.4	2.2	4.6	4.6	4.6	4.6	7.0	8.8	8.8
		<b>Total Amps</b>	2.7	2.7	4.5	6.9	6.9	6.9	6.9	9.3	11.1	9.9
		<b>Transformer kVA</b>	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
208V 1 or 3 Phase	01 (115V) with Transformer	<b>208V Total Amps</b>	1.49	1.49	2.49	3.81	3.81	3.81	3.81	5.14	6.14	5.47
		<b>Transformer kVA</b>	0.5	0.5	1.0	1.0	1.0	1.0	1.0	1.5	1.5	1.5
230V 1 or 3 Phase	01 (115V) with Transformer	<b>230V Total Amps</b>	1.35	1.35	2.25	3.45	3.45	3.45	3.45	4.65	5.55	4.95
		<b>Transformer kVA</b>	0.5	0.5	1.0	1.0	1.0	1.0	1.0	1.5	1.5	1.5
460V 3 Phase	01 (115V) with Transformer	<b>460V Total Amps</b>	0.68	0.68	1.13	1.73	1.73	1.73	1.73	2.33	2.78	2.48
		<b>Transformer kVA</b>	0.5	0.5	1.0	1.0	1.0	1.0	1.0	1.5	1.5	1.5
575V 3 Phase	01 (115V) with Transformer	<b>575V Total Amps</b>	0.54	0.54	0.9	1.38	1.38	1.38	1.38	1.86	2.22	1.98
		<b>Transformer kVA</b>	0.5	0.5	1.0	1.0	1.0	1.0	1.0	1.5	1.5	1.5

⑤ Amp draw data shown is operating amp draw at incoming power. For units that use a field installed accessory step-down transformer as noted, the amp draw shown is the primary side operating amp draw. For sizing of circuit protection for equipment with transformers, please refer to the National Electric Code.

Table 10.1 - Electrical Selection Details - All Models

Model	Supply Voltage	Phase	Motor Voltage	Required Accessory Transformer ①	Power & Gas Control Circuit Transformer Voltages	Factory Installed Transformer	Motor Starter Coil Voltage
PTC	115	1	115V/1ph	none	115V/1ph	115 to 24V	none
	208	1 or 3		208V to 115V			
	230			230V to 115V			
	460	3		460V to 115V			
	575			575V to 115V			
BTC	115	1	115V/1ph	none	115V/1ph	115 to 24V	none
	208	1	208V/1ph	208V to 115V			115V
	230		230V/1ph	230V to 115V			
	208	3	208V/3ph	208V to 115V			
	230		230V/3ph	230V to 115V			
	460	3	460V/3ph	460V to 115V			
	575		575V/3ph	575V to 115V			

① For accessory transformer sizing, refer to Table 5.2 for model PTC and Table 6.4 for model BTC.

Table 10.2 - Gas Controls – All Models ①

Model Size	Control System Description	Gas Type	Control Code	Control Voltage
55-310	<b>Single-Stage, Direct Spark Ignition</b> Utilizes a single-stage combination gas control and an ignition control. Gas is automatically lit with the direct spark igniter on call for heat.	Natural	11	24V
		Propane	21	

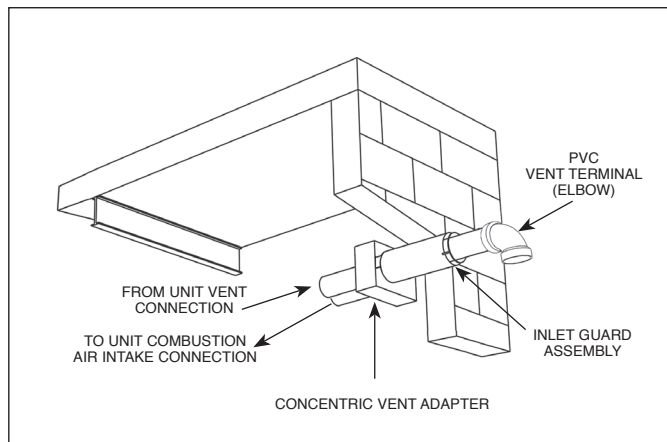
① All ignition controls are 100% Shut-Off with Continuous Retry.



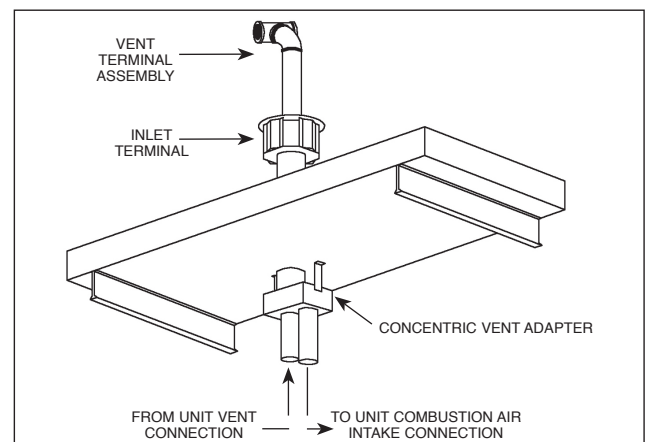
**Table 11.1 - Field Installed Accessories**

	Feature	Model	
		PTC	BTC
Cabinet and Air Mover	<b>Vertical Deflector Blades</b> - Allows directional discharge air control in the left and right directions.	•	•
	<b>Downward Air Deflector Hoods</b> - Available in 30°, 60°, and 90° configurations these deflector hoods provide more focused air flow control. Refer to page 12 for further details.	•	•
	<b>Two-Point Suspension Kits</b> - Converts from 4-point suspension to 2-point suspension.	•	
	<b>Fingerproof Fan Guard</b> - Ships installed on unit in place of standard guard (standard on size 110 and smaller).	•	
	<b>Pipe Hanger Adapter Kits</b> - Allows the unit to be suspended by 3/4" pipe from the standard 3/8" holes found in the top of the unit.	•	•
	<b>Discharge Transition for Polytube</b> - Allows for the connection of polytube (not included) to the discharge of the unit.		•
	<b>Blower Enclosure with or without Filter Rack</b> - Totally encases the motor and blower assembly. Optional filters provide filtering of the air prior to entering the heater.		•
	<b>Belt Guard</b> - Provides protection for building occupants as well as service people from the drive belt and sheaves.		•
Controls	<b>Natural Gas to Propane Gas Conversion Kit</b> - All required parts to convert a natural gas unit to propane gas.	•	•
	<b>Energy Saver Thermostats</b> - Mounted high and independent of the room stat, this control turns on the unit heater fan if high temperatures are sensed, forcing the heated air down, reducing stratification and potentially gas usage. SPDT switch, 30°-100° range. 16 amp @ 120V. Honeywell T631A1113.	•	•
	<b>Single-Stage Room Thermostats</b> - See Table 11.2 for details.	•	•
	<b>Stepdown Transformers</b> - Used to operate units on 208V, 230V, 460V, or 575V supply voltage. Refer to Table 10.1 for further selection details.	•	•
Condensate Handling	<b>Condensate Pump</b> - Used for high lift applications of up to 22' - DiversiTech CP-22	•	•
	<b>Condensate Pump Suspension Kit</b> - Used to suspend/support pump (DiversiTech CP-22) from heater.	•	•
	<b>Condensate Treatment</b> - Controls slime growth in pump (DiversiTech CP-22) and downstream drain.	•	•
	<b>Condensate pH Neutralizing Kit</b> - Reduces acidity of condensate.	•	•
	<b>Recharge Kit for pH Neutralizing Kit</b> - Aggregate material to recharge the pH Neutralizing kit (once per year or every 2000 hours).	•	•
Venting	<b>Horizontal Concentric Vent Kit</b> - Enables horizontal concentric venting. Kit consists of one concentric adaptor, one vent termination screen, and one inlet guard assembly (See Figure 11.1).	•	•
	<b>Vertical Concentric Vent Kit</b> - Enables vertical concentric venting. Kit consists of one concentric adaptor, one combustion air inlet cap, and two vent pipe terminal screens (See Figure 11.2).	•	•
	<b>Termination screens for horizontal or vertical, 2-pipe system terminals.</b> Terminals are by others.	•	•

**Figure 11.1 - Horizontal Concentric Vent Kit**



**Figure 11.2 - Vertical Concentric Vent Kit**



**Table 11.2 - Field Installed Thermostats**

	Description
Single-Stage Room Thermostats	WHITE-RODGERS 1C20-101 - 1.2 amps @30VAC, 50° -90°F temperature range, 0.15 to 1.2 amps adjustable heat anticipator
	WHITE-RODGERS 1C26-101 - Same as 1C20-101 above except adds Heat/Off/Cool and Fan On/Auto switches
	HONEYWELL TH5220D1029 digital non-programmable room stat with switching - range 40-90°F
Duct Thermostats (BTC Only)	JOHNSON CONTROLS A350 Electronic Temp Control with Sensor and S350 Stage Adder
	HONEYWELL T678A1015 20 foot capillary tube



Figure 12.1 - 30°, 60°, & 90° Deflector Hoods

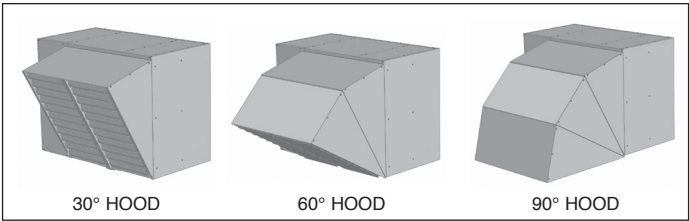


Figure 12.2 - 30° & 60° Hood Throw/Floor Coverage

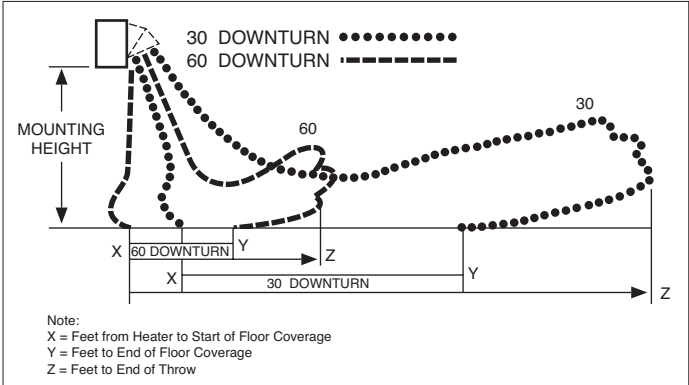


Table 12.1 - Deflector Hood General Performance Data - Model BTC

Model Size	Airflow (CFM)	Temp Rise (°F)	Mounting Height (ft)	Blade Angle (°)	30° Hood			60° Hood			90° Hood S (ft)
					X (ft)	Y (ft)	Z (ft)	X (ft)	Y (ft)	Z (ft)	
215	3366	55	8	59	14	31	42	27	32	44	22
			10	50	13	29	40	36	30	41	20
			12	40	11	27	37	40	27	37	18
			14	27	9	24	33	35	22	31	17
			15	17	7	21	30	28	18	25	16
260	4071	55	8	65	18	38	52	34	40	55	29
			10	58	17	37	50	48	39	53	26
			12	51	15	35	49	59	36	50	24
			14	42	14	33	46	64	33	46	22
			16	33	12	30	42	61	29	40	21
			18	18	9	26	37	42	23	32	19
310	4854	55	19	2	6	20	30	52	23	32	19
			8	64	17	37	51	33	39	54	28
			10	57	16	36	49	47	37	51	21
			12	50	15	34	47	56	35	48	16
			14	41	13	32	44	61	32	44	13
			16	30	11	29	41	56	27	38	11
			18	14	8	23	33	30	20	28	9

Note: Refer to Figures 12.1 through 12.3.

Figure 12.3 - 90° Hood Throw/Floor Coverage

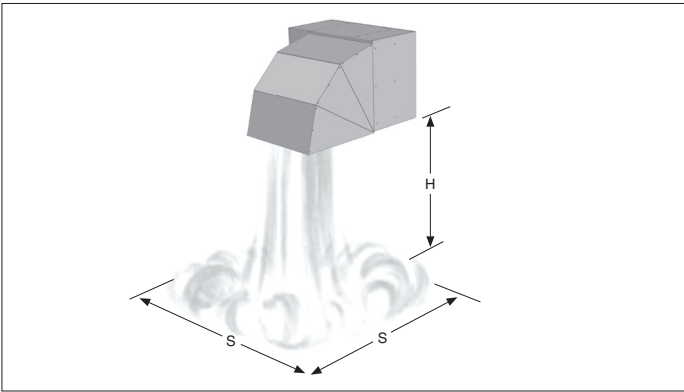


Table 12.2 - Deflector Hood General Performance Data - Model PTC

Model Size	Airflow (CFM)	Temp Rise (°F)	Mounting Height (ft)	Blade Angle (°)	30° Hood			60° Hood			90° Hood S (ft)
					X (ft)	Y (ft)	Z (ft)	X (ft)	Y (ft)	Z (ft)	
55	1097	43	8	55	12	27	37	0	28	39	19
			10	44	11	25	35	0	26	35	17
			12	31	9	23	32	0	22	30	15
65	1141	49	8	54	12	26	36	0	27	38	18
			10	43	10	24	34	0	25	34	16
			12	29	8	21	30	0	20	28	15
85	1650	44	8	59	14	30	41	0	32	43	17
			10	49	12	29	39	0	29	40	16
			12	39	11	26	37	0	26	36	14
			13	32	10	25	35	0	24	33	14
110	1750	54	8	57	13	29	39	0	30	41	16
			10	47	11	27	37	0	28	38	15
			12	35	10	25	34	0	24	33	13
			13	28	9	23	32	0	22	30	13
135	2160	53	8	60	15	32	44	0	34	47	24
			10	52	13	31	42	0	32	44	21
			12	42	12	29	40	0	29	40	19
			14	30	10	26	36	0	25	34	18
156	2600	51	8	60	19	41	56	0	43	60	26
			10	51	18	40	55	0	42	57	23
			12	41	17	38	53	0	40	55	21
			14	29	15	37	51	0	37	51	20
180	3020	51	16	8	14	34	48	0	34	47	18
			8	63	16	35	48	0	37	51	26
			10	55	15	34	46	0	35	48	23
			12	46	13	32	44	0	32	45	21
215	3865	48	14	36	12	29	41	0	29	40	20
			8	66	19	41	56	0	43	59	32
			10	60	18	40	54	0	42	57	29
			12	53	17	38	53	0	40	54	26
260	4585	49	14	46	15	36	50	0	37	51	24
			16	37	14	34	47	0	33	46	23
			8	69	22	45	62	0	48	66	37
			10	63	21	44	61	0	47	64	33
310	5400	49	12	57	19	43	59	0	45	62	30
			14	51	18	42	57	0	43	59	28
			16	44	17	40	55	0	40	55	26
			18	35	15	37	52	0	36	50	25
			20	25	13	33	47	0	31	43	24
			8	68	20	43	58	0	45	62	34
			10	61	19	42	57	0	44	60	31
			12	55	18	40	55	0	42	58	28
			14	48	17	39	53	0	40	54	26
			16	40	15	37	51	0	36	50	24
			18	31	13	34	47	0	32	44	23

Note: Refer to Figures 12.1 through 12.3.



## Selection Procedure

In order to properly select a unit heater it is necessary to have the following basic information.

### 1. Heating output capacity

Model size output is to be matched against the heat loss to be replaced.

### 2. External static pressure (blower units only)

The external static pressure (E.S.P.) is determined using the ASHRAE Guide for duct losses or provided by the design engineer.

### 3. Accessory internal static pressure (transitions, filters, etc.) (blower units only)

The critical accessories are those that add internal static pressure (I.S.P.) to the unit. Once these items are determined, the total pressure drop can be determined (if applicable).

### 4. Heat exchanger material

The heat exchanger type is determined by the application. The standard heat exchanger material is aluminized steel. A 409 stainless steel heat exchanger is recommended when the combined entering/return air to the unit is below 40°F or in high humidity applications.

### 5. Type of fuel

Either natural or propane gas determined by the design engineer.

### 6. Gas controls

Single stage, as determined by the design engineer.

### 7. Main power supply voltage to unit

## Selection Example (Propeller Unit)

### Selection Example Conditions (Propeller Unit)

Select a unit heater to meet the following conditions:

1. Heating output capacity = 166,000 Btu/Hr per design engineer
2. External static pressure = 0.0
3. Internal static pressure = 0.0. No static producing accessories are required.
4. Heat exchanger = 409 Stainless Steel
5. Gas Type = Natural
6. Gas Controls = Single Stage
7. Supply Voltage: 460V/60Hz/3Ph

With the information listed above, the basic model, using the information in this catalog and the Model Nomenclature shown on page 19, can be selected as shown:

### 1. Determine the Model and Input Rating (MBH):

Using the Heating output capacity, the Furnace Input Rating is determined from Table 5.1. The closest model to 166,000 Btu/Hr output has an Btu/Hr Input rating of 180,000 Btu/Hr so the Furnace Input Rating = 180. The corresponding model for a 180 size, propeller, separated combustion unit heater is PTC. The model and size are a PTC180.

### 2. Determination of Heat Exchanger Material:

From item #4 in the example, the Heat Exchanger required is 409 Stainless Steel. Thus, the Heat Exchanger Material = S from the Model Nomenclature on page 19.

### 3. Determine the Ignition Type:

The Ignition Type = S from the Model Nomenclature on page 19.

### 4. Determine Power Code Required:

Referring to Table 5.2, it can be seen that the supply voltage from the example conditions is not available (460V). A transformer kit selected later in this example must be used. In this instance, from Table 5.2 select the 115V/60Hz/1Ph power code (PC) = 01 unit.

### 5. Determine the control type:

From items #4 and #5 in the example conditions, the gas type is Natural Gas and controls are Single Stage. From Table 10.2, we are directed to use Control Code (CC) 11.

### 6. Determine the fan guard type:

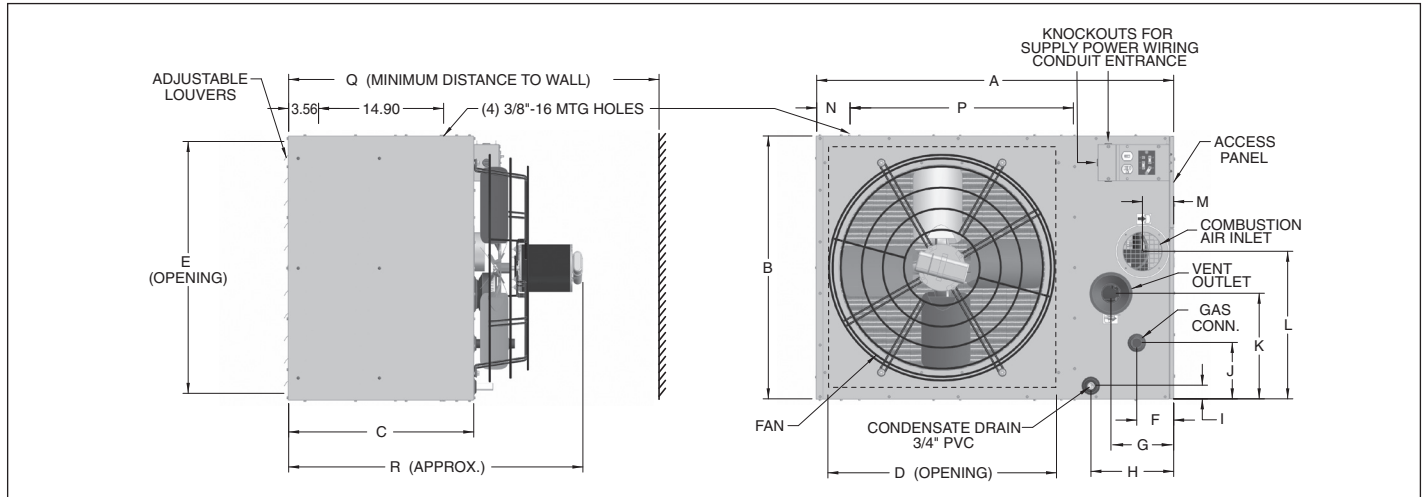
No specific type of fan guard was specified, so select Fan Guard = S from the Model Nomenclature on page 23.

**At this point we have a full model number of PTC180SS0111SBAN**

### 7. Determination of transformer:

To operate a 115V/60Hz/1Ph unit on 460V/60Hz/3Ph supply power a unit step down transformer must be selected. By referring to Table 10.1 we see that a 460V to 115V step down transformer is required. As noted in the footnote for Table 10.1, the size can be determined to be 1.0kVA from Table 5.2.

**Figure 15.1 - Dimensional Drawings - Model PTC**



**Table 15.1 - Dimensions (inches)**

Models	PTC 55	PTC 65	PTC 85	PTC110	PTC135	PTC156	PTC180	PTC 215	PTC260	PTC310
A	29.80	29.80	35.53	35.53	35.53	35.53	42.53	42.53	42.53	42.53
B	18.13	18.13	20.31	20.31	23.06	23.06	25.81	31.31	31.31	39.56
C	19.03	19.03	22.05	22.05	22.05	22.05	22.05	22.05	22.05	22.05
D	17.00	17.00	22.52	22.52	22.52	22.52	29.52	29.52	29.52	29.52
E	16.24	16.24	18.42	18.42	21.18	21.18	23.93	29.43	29.43	37.68
F	4.71	4.71	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50
G	7.19	7.19	7.98	7.98	7.98	7.98	7.98	7.47	7.47	8.12
H	10.22	10.22	10.27	10.27	10.18	10.18	10.36	9.86	9.86	9.79
I	3.10	3.10	1.32	1.32	2.15	2.15	1.73	1.63	1.63	1.88
J	12.81	12.81	6.73	6.73	8.09	8.09	9.47	6.72	6.72	10.84
K	6.00	6.00	8.74	8.74	8.45	8.45	9.82	12.58	12.58	16.19
L	9.07	9.07	12.13	12.13	12.95	13.45	14.92	17.58	17.58	22.19
M	3.30	3.30	3.86	3.86	3.48	3.98	3.98	3.72	3.72	4.62
N	1.90	1.90	1.54	1.54	1.54	1.54	3.97	3.97	3.97	3.97
P	16.00	16.00	22.03	22.03	22.03	22.03	26.60	26.60	26.60	26.60
Q	40.19	40.19	45.83	45.83	45.83	45.83	45.83	45.83	46.83	46.83
R	28.19	28.19	33.83	33.83	33.83	33.83	33.83	33.83	34.83	34.83
Combustion Air Inlet Pipe	3	3	3	3	3	4	4	4	4	6
Vent Outlet Pipe	3	3	3	3	3	4	4	4	4	4
Gas Connection	1/2	1/2	1/2	1/2	1/2	1/2	1/2	3/4	3/4	3/4
Fan Diameter	14	14	18	18	20	20	22	24	24	26
Approx. Shipping Weight (lbs.)	93	103	125	128	165	165	215	265	265	310

**Table 15.2 - Clearances - Sizes 110 and Below**

Unit Side	Clearance To Combustible Materials	Recommended Service Clearance
Top and Bottom	1"	1"
Access Side	1"	18"
Non-Access Side	1"	18"
Rear	18"	18"
Vent Connector	6"	6"

**Table 15.3 - Clearances - Sizes 135-310**

Unit Side	Clearance To Combustible Materials	Recommended Service Clearance
Top and Bottom	6"	6"
Access Side	6"	18"
Non-Access Side	6"	18"
Rear	18"	18"
Vent Connector	6"	6"

*Note: Specifications below are extracted from a master gas-fired unit heater specification and therefore certain numbered sections have been intentionally omitted.*

## General

### A. Standards

All unit(s) shall include:

- A.2. ETL design certification for use in both the US and Canada to the ANSI Z83.8 - latest revision, standard for "Gas Unit Heater and Gas-Fired Duct Furnaces" for safe operation, construction, and performance.

### B. Mechanical Configuration

- B.3. Condensing furnace section with 93% minimum efficiency provided by an indirect-fired tubular heat exchanger with individually fired tubes coupled to a secondary recuperative heat exchanger for maximum heat recovery.

### C. Venting/Combustion Air Arrangement

- C.4. The unit shall be separated combustion. The venting shall be a power exhausted arrangement with a separate combustion air intake pipe connection to allow for fresh combustion air from outside the conditioned space. The unit shall be tested to insure proper ignition when the unit is subjected to 40 mile per hour wind velocities. The unit shall also include a factory mounted differential pressure switch designed to prevent main burner ignition until positive venting has been proven.

Venting shall be Schedule 40 PVC. For Canadian installations, all vent pipe and components must be approved to ULC S636.

### D. Unit Casing

- D.1. The unit heater(s) casing shall be constructed of not less than 20 gauge aluminized steel with minimization of exposed fasteners.
- D.2. All exterior casing parts casing parts shall be cleaned of all oils and a phosphate coating applied prior to painting. The exterior casing parts shall then be painted with an electrostatically applied baked-on gray-green polyester powder paint (7-mil thickness) for corrosion resistance.
- D.3. The unit shall be furnished with horizontal air deflectors. The deflectors are adjustable to provide for horizontal directional airflow control (up or down).

### E. Furnace Section

- E.1.e. The primary heat exchanger(s) shall be made of 18 gauge aluminized steel (opt 409 stainless steel) tubes and headers. Each heat exchanger tube shall be individually and directly flame-fired. The heat exchanger tube shall be crimped to allow for thermal expansion and contraction. The flue collector box shall be made of 20 gauge AL29-4C stainless steel.  
The thermal efficiency of the unit(s) shall be a minimum of 93% efficient for all air flow ranges through the use of a secondary recuperative heat exchanger. The secondary heat exchanger shall be constructed of AL29-4C stainless steel to withstand the corrosive environment of condensing gas fired equipment.
- E.2. The heat exchanger(s) seams and duct connections shall be certified to withstand 0.9" W.C. external static pressure without burner flame disturbance.
- E.3.a. The burner(s) shall be in-shot type, directly firing each heat exchanger tube individually and are designed for good lighting characteristics without noise of extinction for both natural and propane gas.

- E.5. The ignition controller(s) shall be 100% shut-off with continuous retry.
- E.6. The gas pressure shall be between 6-7" W.C for natural gas (opt). The gas pressure shall be 11-14" W.C. for propane gas.
- E.7.a. The solid state ignition system shall directly light the gas by means of a direct spark igniter each time the thermostat calls for heat.
- E.8. The unit gas controls shall be provided with the following:
- E.8.d. Single-stage gas controls with a single-stage combination gas control, an ignition control, and a single-stage low voltage thermostat. The unit fires at 100% full fire based on a call for heat from a room thermostat.
- E.9. An automatic reset high limit switch mounted in the air stream to shut off the gas supply in the event of overheating.
- E.9.a. An automatic reset high limit switch mounted on the power exhauster housing to shut off the gas supply in the event of overheating flue gas temperatures.
- E.9.b. A condensate drain line overflow switch that senses if the condensate line is clogged and shuts the unit heater down.
- E.10. A time delay relay that delays the start of the air mover to allow the heat exchanger a warm-up period after a call for heat. The time delay relay shall also continue the air mover operation after the thermostat has been satisfied to remove any residual heat on the heat exchanger.
- E.11. The unit shall be orificed for up to 2000' elevation above sea level (opt the unit shall be orificed for \_\_\_\_\_ elevation above sea level).

### F. Electrical

- F.1. All electrical components shall carry UL, ETL, or CSA listing.
- F.2. Low voltage terminal board.
- F.3. A single 115V to 24V step down transformer shall be provided for all unit controls.

### G. Air Mover

- G.1. The motor horsepower shall be \_\_\_\_\_.
- G.2. The motor shall be factory wired (PTC Models).
- G.3. The motor shall be controlled by a time delay relay.
- G.4. Propeller models shall meet the following requirements.
- G.4.a. The motor type shall be Single-speed, totally enclosed (TE)
- G.4.b. The motor shall be rated for: (a) 115V/60Hz/1Ph
- G.5. Blower models shall meet the following requirements:
- G.5.a. The motor type shall be single-speed, totally enclosed (TE)
- G.5.b. The motor shall be rated for:
  - (a) 115V/60Hz/1Ph
  - (b) 208V/60Hz/1Ph (BTC model)
  - (c) 230V/60Hz/1Ph (BTC model)
  - (d) 208V/60Hz/3Ph (BTC model)
  - (e) 230V/60Hz/3Ph (BTC model)
  - (f) 460V/60Hz/3Ph (BTC model)
  - (g) 575V/60Hz/3Ph (BTC model)

- G.5.c. The motor shall be provided with an adjustable motor sheave to allow for minor adjustment of the blower rpm at the job site. (BTC models)
- G.5.d. The blower shall be a double width, double inlet (DWDI), forward curved, belt driven, assembly with spider ball bearings. (BTC models)

## H. Mounting

- H.1. The unit shall be equipped with tapped holes to accept 3/8"-16 threaded rod for suspension.
- H.1.a. The unit shall be equipped with mounting brackets to allow for threaded rod suspension or to be bolted directly to the ceiling support structure allowing 1" of top clearance. (PTC models - opt on sizes 55-110)
- H.3. Propeller unit to have 4 suspension points.
- H.4. Blower unit to have 6 suspension points.

## J. Accessories

The following field installed accessory control devices shall be provided with the unit:

- J.1. A 1/2-50 psi gas pressure regulator to reduce the inlet gas pressure for the operating controls.
- J.2. A clear plastic thermostat guard with two keys for room thermostats.
- J.4. Pipe Hanger Adapter Kit to facilitate threaded pipe suspension.
- J.7. Vertical Deflector Kit to enables side distribution of airflow.
- J.8. A blower enclosure fully encloses blower to enable the attachment of filter racks and/or duct.
- J.9. A combination filter rack/duct connector containing a 1" thick, cleanable filter.
- J.11. A belt guard enclosing the belts and sheaves (pulleys) on a blower type unit heater. (BTC models)
- J.12. Propane conversion kit for converting natural gas units to propane gas.
- J.17. Discharge transition from unit to polytube. (BTC models)
- J.18. 30° non-velocity generating downward air deflector hood constructed of 20 ga. cold rolled steel with baked-on gray-green polyester powder paint.
- J.19. 60° non-velocity generating downward air deflector hood constructed of 20 ga. cold rolled steel with baked-on gray-green polyester powder paint.
- J.20. 90° non-velocity generating downward air deflector hood constructed of 20 ga. cold rolled steel with baked-on gray-green polyester powder paint.
- J.21. A 208V to 115V step down shall be provided for operation of the 115V unit. (PTC models)
- J.22. A 230V to 115V step down shall be provided for operation of the 115V unit. (PTC models)
- J.23. A 460V to 115V step down shall be provided for operation of the 115V unit. (PTC models)
- J.24. A 575V to 115V step down shall be provided for operation of the 115V unit. (PTC models)
- J.25. A 208V to 115V step down shall be provided for operation of the 115V power exhaustor and control circuit. (BTC models)
- J.26. A 230V to 115V step down shall be provided for operation of the 115V power exhaustor and control circuit. (BTC models)
- J.27. A 460V to 115V step down shall be provided for operation of the 115V power exhaustor and control circuit. (BTC models)
- J.28. A 575V to 115V step down shall be provided for operation of the 115V power exhaustor and control circuit. (BTC models)
- J.29. A horizontal concentric vent kit shall be provided to allow the vent outlet and combustion air inlet pipes to penetrate the building wall through one opening.
- J.30. A vertical concentric vent kit shall be provided to allow the vent outlet and combustion air inlet pipes to penetrate the building roof through one opening.
- J.31. A 2-point suspension kit to convert the unit from 4-point mounting to 2-point mounting.
- J.32. An Energy Saver Thermostat to be mounted high and independent of the room stat to turn on the unit heater fan if high temperatures are sensed, forcing the heated air down to reduce stratification and gas usage.
- J.33. A condensate pump for high lift applications of up to 22'. Pump shall include indicator lights to show pump status, internal vibration isolation, a check valve, condensate treatment tablet dispenser, and alarm contacts to shut the unit heater down if the pump becomes inoperable.
- J.34. A condensate pump suspension kit to suspend/support the pump (DiversiTech CP-22) from the unit heater.
- J.35. Condensate treatment tablets to controls slime growth in pump (DiversiTech CP-22) and downstream drain.
- J.36. A condensate pH neutralizing kit to reduce the acidity of condensate. Includes barbed inlet and outlet fittings, mounting brackets and an initial charge of neutralizing aggregate.
- J.37. A recharge kit for pH neutralizing kit. Includes sufficient aggregate for a complete recharge of the neutralizing kit.

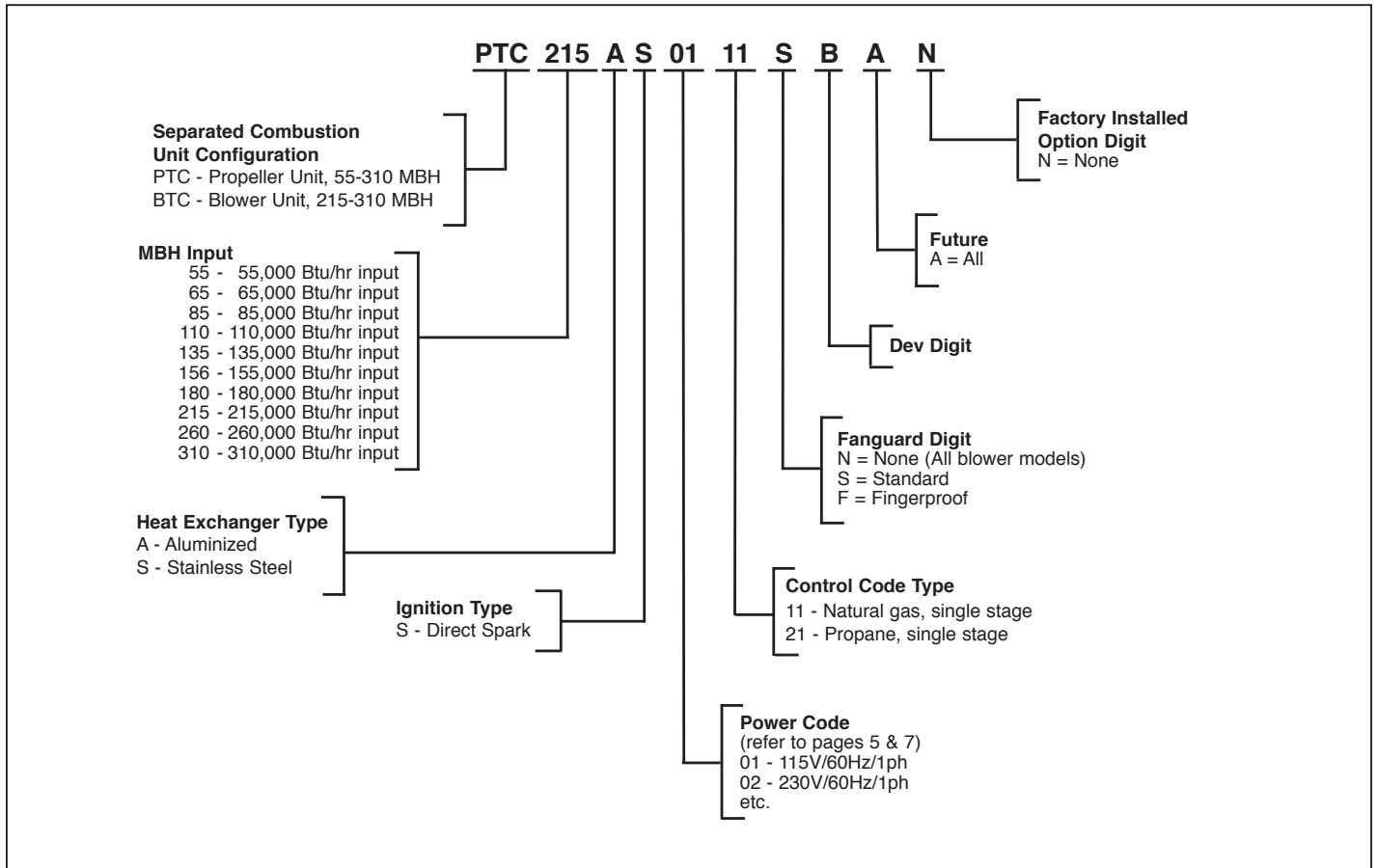
## K. Thermostats

The unit shall be provided with the following thermostat:

- K.2. A single stage room thermostat with a 50°-90°F range.
- K.3. A single stage room thermostat with a 50°-90°F range with Heat/Off/Cool and Fan On/Auto switching.
- K.4. Honeywell TH5220D1029 digital non-programmable room stat with switching - range 40-90°F.
- K.5. A field installed two-stage duct thermostat with a 0°-100°F range and 20-foot capillary.
- K.6. A two-stage electronic duct thermostat with field installed temperature sensor, temperature selector and one stage adder.

**Figure 19.1 -Model Number Designations**

(Remove access cover to locate)



Products from Modine are designed to provide indoor air-comfort and ventilation solutions for residential, commercial, institutional and industrial applications. Whatever your heating, ventilating and air conditioning requirements, Modine has the product to satisfy your needs, including:

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