INSTALLATION, OPERATING AND SERVICE INSTRUCTIONS FOR

BH™ AND BV™ UNIT HEATERS

FOR STEAM OR HOT WATER

For service or repairs to heater, call your heating contractor. When seeking information on heater, provide Model Number and Serial Number as shown on Rating Label located on top of the heater.

Model Number	Serial Number	Installation Date
Heating Contractor		Phone Number
Address		

Burnham® Hydronics
U.S. Boiler Co., Inc.

8144A001R4-2/07

TABLE OF CONTENTS

I. IMPORTANT INFORMATION - READ CAREFULLY BEFORE INSTALLATION

The following terms are used throughout this manual to bring attention to the presence of hazards of various risk levels, or to important information concerning product life.

NOTICE

Indicates special instructions on installation, operation, or maintenance which are important but not related to personal injury hazards.

WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death, serious injury or substantial property damage.

WARNING

Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or loss of life. Failure to follow all instructions in the proper order can cause personal injury or property damage. Read and understand all instructions, before installing, starting-up, operating, maintaining or servicing this heater. Keep this manual and literature in legible condition and posted near heater for reference by owner and service technician.

Installation, maintenance, and service must be performed only by an experienced, skilled and knowledgeable installer or service agency.

This heater, when in operation, is HOT. To avoid burns, do not let bare skin touch hot surfaces.

Use extreme caution in use near children.

Use extreme caution whenever the heater is operating.

Do not operate any heater after the heater malfuncions. Return heater to an authorized service facility for examination or repair.

Do not use outdoors.

Use this heater only as described in this manual. Any other use is not recommended by the manufacturer.

NOTICE

This radiator has a limited warranty, a copy of which is printed on the back of this manual. The warranty for this radiator is valid only if the radiator has been installed, maintained and operated in accordance with these instructions.

II. GENERAL INFORMATION

A. INSTALLATION LIMITATIONS

Installation and service instructions in this manual are applicable to the steam/hot water unit heaters which should be installed in their proper applications for their most effective function as overhead heating units. The copper coils are warranted for operation at steam or hot water pressures up to 150 psig, and/or temperatures up to 375°F. Canadian Standards Association (CSA) requirements state that explosion-proof units may not be used with a fluid temperature in excess of 329°F and still maintain their explosion-proof rating, for national electric code ignition temperature rating T3B for grain dust.

B. INSPECTION ON ARRIVAL

1. Inspect unit upon arrival. In case of damage, report immediately to transportation company and your local Burnham Hydronics Representative.

WARNING

DO NOT REMOVE OUTLET FAN GUARD FROM MODEL BV UNITS.

2. Check rating plate on unit and motor to verify that power input and motor specification meet available electric power at point of installation.
3. Inspect unit received for conformance with description of product ordered (including specifications where applicable).

III. INSTALLATION

A. SPECIAL PRECAUTIONS

1. Disconnect power supply before making wiring connections to prevent electrical shock and equipment damage. All units must be wired strictly in accordance with wiring diagram furnished with unit.
2. Units should not be installed in atmospheres where corrosive fumes or sprays are present.
3. Units must not be installed in potentially explosive or flammable atmospheres.
4. Be sure no obstructions block air intake or air discharge of unit heater.
5. Do not install unit above recommended maximum mounting heights (see Table 1) or below the minimum height of eight feet.

B. UNIT SUSPENSION

Horizontal Delivery Units, Model BH Series

All horizontal delivery units have two tapped holes (3/8”-16) in the top for unit suspension. Piping support hangers or clamps are recommended and should be placed as close to the unit heater as possible. For other models, independent suspension can be made with threaded rods, pipes, or ceiling hanger brackets.

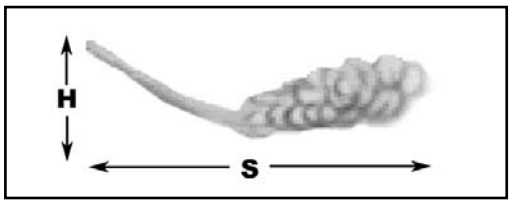


Figure 1: Horizontal Air Delivery

Vertical Delivery Units, Model BV Series

Models BV-42 through BV-161 have 4 tapped holes (1/2”-13) on the top surface for unit suspension. Suspension can be made with threaded rods, pipes, or ceiling hanger brackets. Models BV-193 through BV-610 have angle-iron frame mounting brackets for heavy-duty installation with applicable hardware.

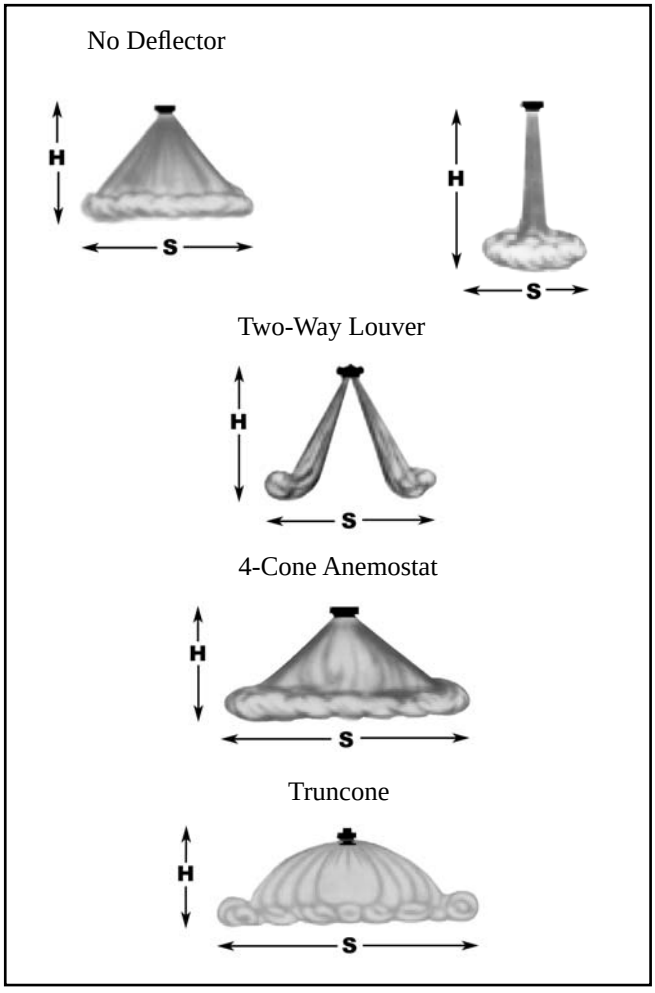


Figure 2: Vertical Air Delivery

C. UNIT HEATER MOUNTING HEIGHT

Do not install unit above recommended maximum mounting heights or below the minimum height of eight feet. The height at which unit heaters are installed is critical. Maximum mounting heights for all units are listed in Table 1. Maximum mounting heights for Model BV is given for units with or without air diffusion accessories. Locate horizontal delivery unit heaters so air streams of individual units wipe the exposed walls of the building with either parallel or angular flow without blowing directly against the walls. Heaters should be spaced so the air stream from one supports the air stream from another heater. Locate vertical delivery unit heaters in the center area of the space to be heated, using horizontal delivery unit heaters along the walls where heat loss is usually greatest.

D. PIPING INSTALLATION

Horizontal and Vertical Unit Heaters

Note: Only make piping connections using two (2) pipe wrenches. One wrench is used as a “back-up” while the other wrench is used for applying force necessary to tighten the fitting.

The illustrations, on page 6, suggest four (4) different piping configurations. Refer to the ASHRAE Guide & Specialty Manufacturer for selection of filter, piping traps and other specialty sizing. Piping is typical for unit heaters.

E. WIRING INSTRUCTIONS

1. Disconnect power supply before making wiring connections to prevent electrical shock and equipment damage. All units must be wired strictly in accordance with wiring diagram (Figure 3).
2. All wiring must be done in accordance with the National Electric Code and applicable local codes. In Canada, wiring must conform to the Canadian Electric Code. It is recommended that all wiring be adequately grounded.
3. Electric wiring must be sized to carry the full load amp draw of the motor, starter, and any controls that are used with the unit heater. Overcurrent protectors should be sized based on motor current rating shown on the unit serial plate, and applicable national electric code procedures.
4. All units should be installed with an electrical junction box. Junction boxes are either integral to the motor or to be attached to the unit casing. Units with explosion-proof motors have an explosion-proof junction box attached to the motor. Any damage to or failure of Burnham Hydronics heater units caused by incorrect wiring of the units is not covered by Burnham Hydronics standard warranty.

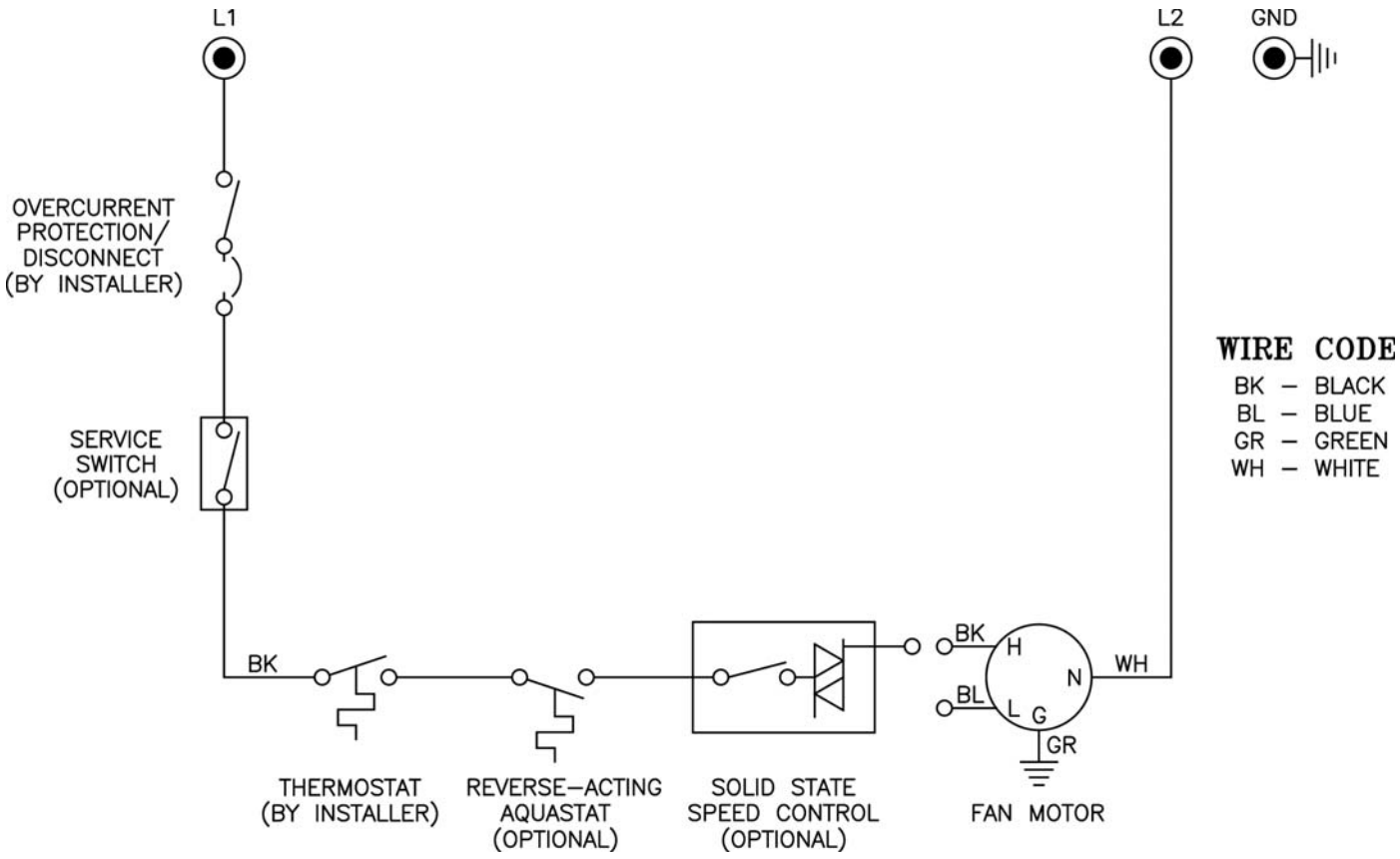
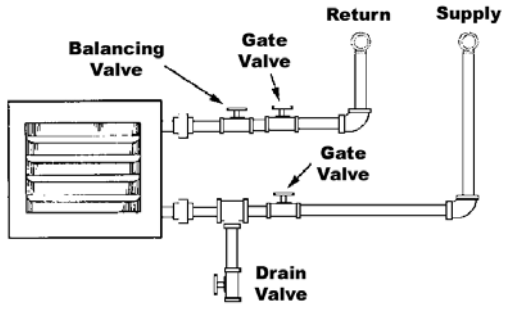


Figure 3: 115V / 60Hz / 1PH Wiring Schematic

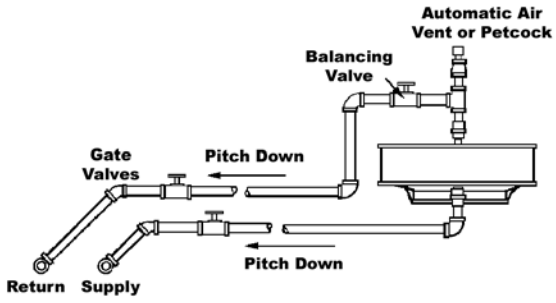
Table 1: Recommended Maximum Mounting Height

Horizontal Type			Vertical Type													
Model Number	Height-Ft.		Model Number	No Deflector		Cone-Jet		Truncone		One-Way Louvers		Two-Way Louvers		3-Cone Anemostat		4-Cone Anemostat	
				Height-Ft.		Height-Ft.		Height-Ft.		Height-Ft.		Height-Ft.		Height-Ft.		Height-Ft.	
	H	S		H	S	H	S	H	S	H	S	H	S	H	S	H	S
BH-18	9	17	BV-42	11	17	15	11	8	19	13	11	8	22	8	22	8	28
BH-24	9	18	BV-59	13	20	18	13	9	25	16	14	10	28	9	28	8	35
BH-33	10	20	BV-78	14	22	19	14	11	26	17	15	11	30	11	30	8	30
BH-47	12	25	BV-95	16	24	21	16	11	26	17	15	11	30	11	30	8	30
BH-63	14	29	BV-139	18	27	24	18	13	32	21	18	13	36	13	36	9	45
BH-86	15	31	BV-161	21	31	28	21	14	35	23	20	14	40	14	40	10	50
BH-108	15	32	BV-193	23	34	31	23	16	39	25	22	15	44	16	44	12	55
BH-121	16	33	BV-212	25	37	33	25	16	39	25	22	15	44	16	44	12	55
BH-165	17	34	BV-247	26	39	34	26	17	46	30	26	18	52	17	52	13	65
BH-193	18	37	BV-279	30	45	37	30	18	53	35	30	21	60	18	60	13	75
BH-258	19	40	BV-333	30	45	37	30	17	53	35	30	21	60	17	60	13	75
BH-290	20	44	BV-385	30	45	36	30	17	53	35	30	21	60	17	60	13	75
BH-340	20	46	BV-500	37	56	44	37	19	65	42	37	26	74	19	74	13	93
			BV-610	36	54	43	36	19	63	41	41	25	72	---	---	---	---

NOTES: With horizontal louvers open 30° from the vertical plane. Values are for heaters operating at standard condition (2psi. Steam and 60°F entering air).
Listed heights for two-way louvers and cone jet are with deflectors in their fully-opened position.

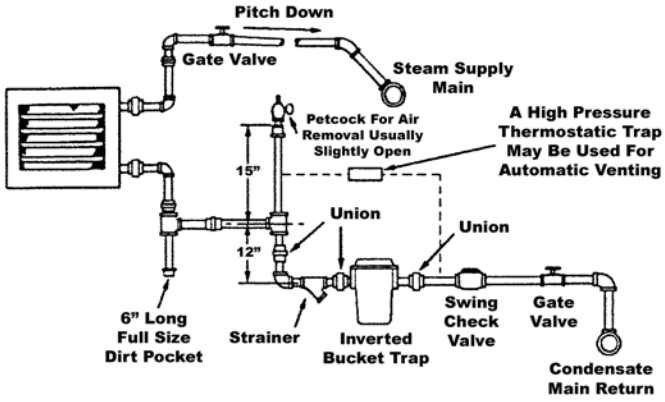


Horizontal Unit Heater Connected to Overhead Hot Water Mains

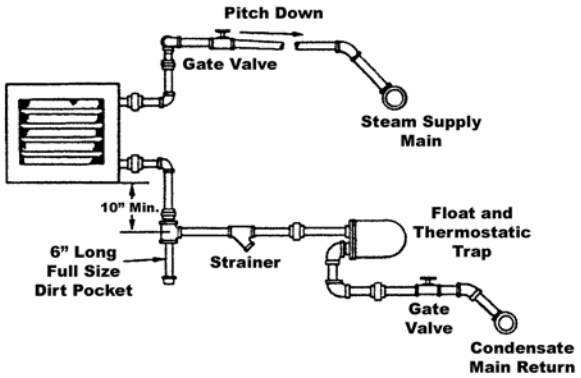


Vertical Unit Heater Connected to Overhead Hot Water Mains

Figure 4: Hot Water System Piping



Unit Heater Connection for High Pressure Steam



Unit Heater Connection for Low Pressure Steam - Open Gravity or Vacuum Return System

Figure 5: Steam System Piping

IV. OPERATION

A. PRIOR TO OPERATION

1. Check all electrical connections to assure they are secure.
2. Check rigidity of unit mounting. Tighten all fasteners, if necessary.
3. Inspect piping, strainers, traps, fittings, etc.

B. INITIAL START-UP

1. Set thermostat to lowest position.
2. Turn on power supply to unit.
3. Open return gate valve, and then open supply gate valve to unit.
4. Raise thermostat setting to desired position.
5. Adjust louvers (if provided) for desired heat distribution.
6. To insure proper sequence of operation, cycle unit on and off a few times by raising and lowering thermostat setting.
7. Check for proper rotation of fan. All fans must rotate in a counterclockwise direction when viewed from the back (BH) of the unit heater.

V. MAINTENANCE

A. INSPECT REGULARLY

Under average conditions, it is recommended that unit heaters be inspected before every heating season — more often in locations where air is contaminated with corrosive fumes, dust, soot or oil spray. Check for dirty, clogged coils, excessive vibration and loose connections. Inspect piping, strainers, traps, fittings, etc.

B. MOTORS

1. Cleaning

   Remove grease and dirt on motor during each inspection or lubrication. Open frame motors should be blown clean every heating season, or whenever coils are cleaned, whichever is sooner.

2. Lubrication

   Lubricate motor according to manufacturer's instructions located on the motor. When no motor oiling instructions are on the motor, oil the motor every two thousand hours of operation with SAE20 motor oil for units in normal applications. Adjust oiling according to usage and atmosphere. Some motors do not have oil fittings. These motors are lubricated for long life and do not require further lubrication.

3. Overload Protection

   A change in line voltage higher or lower than motor nameplate rating may cause overheating and serious motor damage. Check plant voltage conditions. A separate manual starter with thermal overload protection device is recommended for those units that do not have motors with built in overload protection.

C. CASINGS

1. Cleaning

   Periodic cleaning of casings is recommended to remove dirt, grease and corrosive substances that may injure finish. Rusted or corroded spots should be cleaned and repainted.

2. General Inspection

   Tighten fan guard and motor bracket. Check fan for proper clearance, free rotation and firm connection to shaft. When servicing is complete, tag unit to indicate date of inspection, lubrication and cleaning.

WARNING

The equipment covered in this manual should be installed, maintained and serviced by a qualified technician.

NOTICE

For service contact your local qualified installation and service contractor or appropriate utility company.

D. COILS

1. Cleaning

   Clean coil at least once a year, more often under unfavorable conditions. Unless coil is kept reasonably free of dirt, lint and grease, its original heating capacity will be reduced — possibly to a serious degree, and motor damage may result.

Two commonly used cleaning methods are:

a. Loosen dirt by brushing fins on side where air enters coil and then turn on fan to blow dirt from unit.

b. Use high-pressure air hose to loosen dirt by blowing from side where air leaves coil (side adjacent to louvers on blow-through units (BH); side adjacent to fan on draw-through units (BV)). For thorough cleaning of coil, remove motor and fan and spray a mild alkaline cleaning solution over the coil. After a few minutes, follow by a hot water rinse. (A steam gun can be used for spraying cleaning solution and hot water.) Coils subjected to corrosive fumes should be checked and cleaned frequently.

2. Internal Corrosion Safeguards

   Provide controlled water treatment -- don't use excess of boiler compounds. Contact your boiler compound supplier for proper usage or the services of a water treatment laboratory. Periodic internal flushing of the coils is recommended in areas where water supply is suspected of causing scale. Use an alkaline-chelant solution and introduce it at the main pump of the hydronic system. Flush thoroughly.

WARNING

Using inorganic or mineral acids such as muriatic (hydrochloric) acid, even though inhibited, may lead to severe damage, including corrosion and leakage.

De-aerate boiler feed-water (particularly if large amount of new water is used). Insure rapid continuous and adequate condensate drainage by properly sized and installed traps and piping. Check traps for sticking. Clean strainers ahead of traps. (When traps don't work, condensate accumulates in unit heater coil; water hammer results.) Adequately vent each unit. Use low-pressure steam when possible.

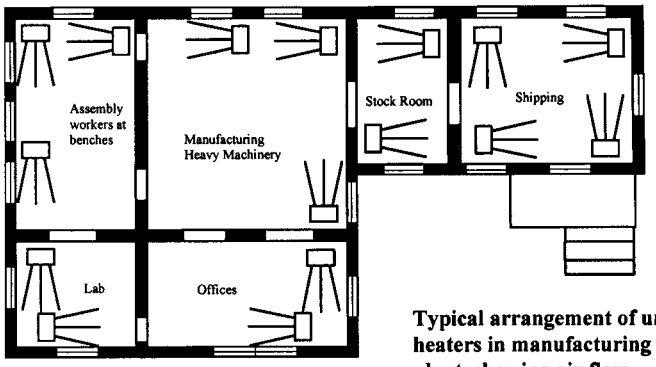
VI. APPLICATION GUIDELINES

A. GENERAL GUIDELINES

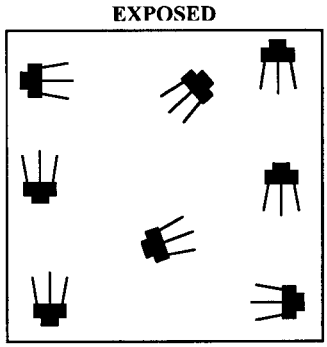
1. The first step in the design of a job is typically to determine the heat loss. Refer to ASHRAE and others for publications on the basic methodology used in calculating the building or area's heat loss. Special attention should be paid to the building type (architecturally) and application placement (area use) in this procedure.
2. The second step is to decide the necessary engineering data for design conditions such as CFM, final air temperature, quantity and location of units, based on the specific Burnham Hydronics Unit Heater model selected.
3. Burnham Hydronics steam/hot water unit heaters' versatility offers a wide selection of outputs and airflow allowing almost unlimited flexibility in job design.
4. Keep the following guidelines in mind when designing any job using steam/hot water unit heaters:

- Always direct airflow to regions of greatest heat loss.
- Use louvers for adjustment of throw length and complete directional control of airflow.
- Mount units at the lowest practical and allowable level.
- Select lower CFM models for lower installation heights and heavily occupied areas. Select higher CFM models for areas where higher installation is required.
- More, smaller units will provide better heat distribution than fewer larger units.
- Watch final air temperatures on units mounted at lower levels or in heavily occupied areas to ensure that air is warm enough to avoid drafts being felt.
- Sound classifications: Burnham Hydronics Unit Heaters provide exceptional heat output while considering the nuisance of a loud unit. All units were designed to minimize sound created by airflow and motor operation by careful component selection and inlet geometry. Sound Classification Table 2 shows typical rooms and their corresponding sound class rating.

Typical BH Unit Arrangement



Typical arrangement of unit heaters in manufacturing plant, showing air flow patterns. Please note not to scale.



A large square area with exposed walls and roof; units are blanketing all exposed surfaces.

A narrow area with four exposed walls

A small area with exposed walls requiring two units.

Table 2: Sound Class Ratings*

TYPE OF ROOM OR BUILDING	SOUND CLASS RATING
Schools, Offices, Libraries, Hospitals, Foyers, Restrooms	I
Showrooms, Department Stores, Clubhouses, Commercial Dining Facilities	II
Large Lobbies, Warehouse Stores, Gymnasiums, Bars	III
Small Factories, Shipping Areas, Machine Shops, Stadium Common Areas	II-VII
Large Factories, Fabrication Shops	VII

*When placed in the paired room, the unit's noise should be relatively comparable to the ambient sound level.

B. STEAM PERFORMANCE DATA

Table 3: Steam Performance Data -- High Motor Speed

Performance Data at Standard Conditions of 2 lb. Steam and 60°F Entering Air

Model Type	Model Number	BTU/Hr.	Sq. Ft. EDR	AIR DATA							
				Sound Class**	Max. Mounting Height (ft)*		Heat Spread at Max. Height*		Cfm	Outlet Velocity (Fpm)	Final Air Temp. (°F)	Condensate lb/hr
HORIZONTAL AIR DELIVERY	BH-18	18,000	75	II	9		17		400	510	102	18
	BH-24	24,000	100	II	9		18		450	580	109	25
	BH-33	33,000	138	II	10		20		630	510	109	35
	BH-47	47,000	196	III	12		25		730	600	120	49
	BH-63	63,000	263	III	14		29		1120	605	112	66
	BH-86	86,000	358	III	15		31		1340	730	119	89
	BH-108	108,000	450	III	15		32		1550	625	125	111
	BH-121	121,000	504	III	16		33		1775	715	123	126
	BH-165	165,000	688	IV	17		34		2500	750	121	170
	BH-193	193,000	804	IV	18		37		2900	870	122	200
	BH-258	258,000	1075	V	19		40		3900	920	121	267
	BH-290	290,000	1208	V	20		44		4300	1010	122	300
	BH-340	340,000	1417	V	20		46		5130	965	121	352
VERTICAL AIR DELIVERY	BV-42	42,000	175	II	11	**15**	17	**11**	950	779	103	43
	BV-59	59,000	246	II	13	**18**	20	**13**	1150	943	111	61
	BV-78	78,000	325	II	14	**19**	22	**14**	1550	992	110	81
	BV-95	95,000	396	II	16	**21**	24	**16**	1775	1136	113	99
	BV-139	139,000	579	III	18	**24**	27	**18**	2500	1284	116	144
	BV-161	161,000	671	III	21	**28**	31	**21**	2900	1490	115	167
	BV-193	193,000	804	IV	23	**31**	34	**23**	3900	1643	109	200
	BV-212	212,000	883	IV	25	**33**	37	**25**	4300	1812	109	219
	BV-247	247,000	1029	IV	26	**34**	39	**26**	5130	1805	107	256
	BV-279	279,000	1163	V	30	**37**	45	**30**	5800	2040	107	288
	BV-333	333,000	1388	V	30	**37**	45	**30**	6600	1968	110	345
	BV-385	385,000	1604	VI	30	**36**	45	**30**	7860	1930	106	398
	BV-500	500,000	2083	VI	37	**44**	56	**37**	10790	2490	103	518
	BV-610	610,000	2542	VI	36	**43**	54	**36**	12350	2345	106	631

Table 4: Steam Performance Data -- Reduced Motor Speed

Performance Data at Standard Conditions of 2 lb. Steam and 60°F Entering Air

Model Type	Model Number	BTU/Hr.	Sq. Ft. EDR	AIR DATA						
				Sound Class**	Max. Mounting Height (ft)*	Heat Spread at Max. Height*	Cfm	Outlet Velocity (Fpm)	Final Air Temp. (°F)	Condensate lb/hr
HORIZONTAL AIR DELIVERY	BH-18	14,800	62	I	9	12	310	395	104	15
	BH-24	19,700	82	I	9	13	350	455	112	21
	BH-33	27,100	113	I	10	14	490	395	111	29
	BH-47	38,500	161	II	12	18	565	465	123	40
	BH-63	51,700	216	II	14	21	870	470	115	54
	BH-86	70,500	294	II	15	22	1040	570	123	73
	BH-108	88,600	369	II	15	23	1240	500	126	91
	BH-121	99,200	413	II	16	23	1415	570	125	103
	BH-165	135,300	564	III	17	24	1990	600	123	139
	BH-193	158,300	659	III	18	26	2310	695	123	164

* Units with horizontal louvers open 30° from vertical plane, vertical types equipped with cone jet deflector, blades fully opened are shown in bold.
Non-bolded mounting height/spread data is for units without deflectors. Please see page 21 for additional outlet accessory performance data.

** See page 7 for Sound Class Definitions.

C. SELECTION PROCEDURE - STEAM APPLICATION

Example 1:

GIVEN DESIGN CONDITIONS:

Unit Heater Model: BH-63
Steam Pressure: 10 lb
Entering Air Temperature: 70°F

APPLICATION PROCEDURE:

1. Capacity:	$Btu_A = Btu_S$ x Heating Capacity Factor = 63,000 x 1.06 = **66,780 Btu/hr**	• The standard capacity of an BH-63 is **63,000** Btu/hr from Table 3. • Steam heating capacity conversion factor for given circumstance is **1.06** from Table 5.
2. Condensate:	Condensate Rate = Btu_A / Latent Heat of Steam = 66,780 / 952.5 **= 70.11 lb./hr**	• The latent heat of steam at 10 lb. is **952.5** Btu/lb., from Table 8.
3. Final Air Temperature:	$ATR_A = (FAT_S - EAT_S)$ x Air Temp. Rise Factor = (12°F - 60°F) x 107 = **55.64°F** $FAT_A = EAT_A + ATR_A$ = 70°F + 55.64°F **= 125.64°F**	• The final air temperature of an BH-63 at **std.** conditions is **112°F** from Table 3. • Air temperature rise conversion factor for given circumstance is **1.07** from Table 6.
4. Max. Mounting Height:	$MMH_A = MMH_S$ x Correction Factor = 14 feet x 0.94 = **13.16 fee**t	• The max. mounting height at std. condition is **14** feet, from Table 3. • The mounting height correction factor is **0.94** from Table 7.

Example 2:

GIVEN DESIGN CONDITIONS:

Vertical Air Delivery requested
Heating Load: 100,000 Btu/hr
Entering Air Temperature: 50°F
Steam Pressure: 2 lb

APPLICATION PROCEDURE:

1. Unit Selection:	$Btu_S = Btu_A$ / Heating Capacity Factor =100,000 / 1.07 = **93,458 Btu/hr** (at standard conditions). Select **BV-95.**	• From Table 3, an BV-95 model will meet the heating requirements with its rated capacity of **95,000** Btu/hr at standard conditions.
2. Actual Heating Capacity:	The capacity of an BV-95 at actual conditions will be $Btu_A = Btu_S$ x Heating Capacity Factor = 95,000 x 1.07 = **101,650 Btu/hr**.	• Steam heating capacity conversion factor for given circumstance is **1.07** from Table 5.

D. STEAM CALCULATION FORMULAS

1. Refer to Table 5:
   a. To determine the heating capacity (Btu/hr) of a unit heater at a steam pressure and/or entering air temperature other than standard conditions of 2 lb. Steam and 60°F entering air temperature.
   b. To find actual unit heater capacity when operating at non-standard (actual) conditions:

      Btu_A = Btu_S x Heating Capacity Factor
   c. To select a heater capacity based on standard conditions to meet a heating capacity at non-standard (actual) conditions:

      Btu_S = Btu_A / Heating Capacity Factor
2. Refer to Table 6:
   a. To determine the air temperature rise of a unit heater at a steam pressure and/or entering air temperature other than standard conditions of 2 lb. Steam, 60°F entering air temperature.
   b. To find actual air temperature rise of unit heater when operating at non-standard (actual) conditions:

      ATR_A = (FAT_S - EAT_S) x Air Temperature Rise Factor
   c. To find actual final air temperature of unit heater when operating at non-standard (actual) conditions:

      FAT_A = EAT_A + ATR_A
3. Refer to Table 7:

   To determine how non-standard steam pressures (other than 2 lb.) affect mounting height.

   Max. Mounting $Height_A$ = Max. Mounting $Height_S$ x Correction Factor
4. Refer to Table 8:

   To determine the rate of condensate production at steam pressures other than 2 lb.

   Condensate Rate = Btu_A / Latent Heat of Steam
5. Terminology:
   a. ATR_A = Air temperature rise at non-standard (actual) conditions
   b. Btu_A = Capacity at actual operating conditions
   c. Btu_S = Capacity at standard conditions (2 lb. Steam, 60°F entering air temperature) from Tables 3 and 4.
   d. EAT_A = Entering air temperature at non-standard actual) conditions
   e. EAT_S = Entering air temperature at standard conditions (60°F)
   f. FAT_A = Final air temperature at non-standard (actual) conditions
   g. FAT_S = Final air temperature at standard conditions from Tables 3 and 4.
   h. Max. Mounting $Height_A$ = Maximum mounting height at actual conditions
   i. Max. Mounting $Height^S$ = Maximum mounting height at standard conditions

E. STEAM CORRECTION FACTORS

Table 5: Steam Heating Capacity Conversion Factors

Unit Heater Types	Entering Air Temp. (°F)	STEAM PRESSURE (PSIG)																
		0	2	5	10	15	20	30	40	50	60	70	75	80	90	100	125	150
HORIZONTAL DELIVERY	-10	1.54	1.59	1.64	1.73	1.80	1.86	1.97	2.06	2.13	2.20	2.26	2.28	2.31	2.36	2.41	2.51	2.60
	0	1.45	1.50	1.55	1.64	1.71	1.77	1.87	1.96	2.04	2.09	2.16	2.18	2.21	2.26	2.31	2.41	2.50
	10	1.37	1.41	1.46	1.55	1.61	1.68	1.78	1.86	1.94	2.00	2.06	2.09	2.11	2.16	2.20	2.31	2.40
	20	1.27	1.32	1.37	1.46	1.53	1.58	1.68	1.77	1.85	1.90	1.96	1.99	2.02	2.06	2.11	2.21	2.30
	30	1.19	1.24	1.29	1.38	1.44	1.50	1.60	1.68	1.76	1.81	1.87	1.90	1.93	1.97	2.02	2.11	2.20
	40	1.11	1.16	1.21	1.29	1.34	1.42	1.51	1.60	1.67	1.73	1.78	1.81	1.84	1.88	1.93	2.02	2.11
	50	1.03	1.08	1.13	1.21	1.28	1.33	1.43	1.51	1.58	1.64	1.70	1.72	1.75	1.79	1.84	1.93	2.02
	60	0.96	1.00	1.05	1.13	1.19	1.25	1.35	1.43	1.50	1.56	1.61	1.64	1.66	1.71	1.75	1.84	1.93
	70	0.88	0.93	0.97	1.06	1.12	1.17	1.27	1.35	1.42	1.47	1.53	1.55	1.58	1.62	1.66	1.76	1.84
	80	0.81	0.85	0.90	0.98	1.04	1.10	1.19	1.27	1.34	1.39	1.45	1.47	1.50	1.54	1.58	1.68	1.76
	90	0.74	0.78	0.83	0.91	0.97	1.02	1.12	1.19	1.26	1.31	1.37	1.40	1.42	1.46	1.50	1.59	1.67
	100	0.67	0.71	0.76	0.84	0.90	0.95	1.04	1.12	1.19	1.24	1.29	1.32	1.34	1.38	1.42	1.51	1.59
VERTICAL DELIVERY	-10	1.49	1.52	1.58	1.64	1.70	1.75	1.83	1.90	1.96	2.02	2.07	2.10	2.11	2.15	2.19	2.27	2.34
	0	1.41	1.45	1.50	1.57	1.62	1.67	1.75	1.82	1.87	1.94	1.99	2.02	2.04	2.08	2.11	2.19	2.26
	10	1.33	1.37	1.42	1.49	1.55	1.60	1.68	1.75	1.81	1.87	1.92	1.94	1.96	2.00	2.03	2.11	2.18
	20	1.25	1.29	1.34	1.41	1.47	1.52	1.61	1.68	1.74	1.79	1.84	1.86	1.88	1.92	1.95	1.99	2.10
	30	1.18	1.22	1.27	1.34	1.40	1.45	1.53	1.61	1.67	1.72	1.76	1.79	1.80	1.84	1.88	1.91	2.03
	40	1.11	1.15	1.20	1.27	1.32	1.37	1.46	1.53	1.59	1.64	1.69	1.71	1.73	1.77	1.80	1.88	1.95
	50	1.03	1.07	1.12	1.19	1.25	1.30	1.39	1.46	1.52	1.57	1.62	1.64	1.66	1.69	1.73	1.81	1.88
	60	0.96	1.00	1.05	1.12	1.18	1.23	1.32	1.39	1.45	1.50	1.55	1.57	1.59	1.62	1.66	1.74	1.81
	70	0.90	0.93	0.98	1.05	1.11	1.16	1.25	1.32	1.38	1.43	1.47	1.49	1.51	1.55	1.59	1.67	1.74
	80	0.83	0.86	0.91	0.98	1.04	1.09	1.18	1.25	1.31	1.36	1.40	1.42	1.44	1.48	1.52	1.60	1.67
	90	0.76	0.80	0.85	0.91	0.97	1.02	1.11	1.18	1.24	1.29	1.33	1.36	1.38	1.41	1.45	1.53	1.60
	100	0.69	0.73	0.78	0.85	0.90	0.96	1.04	1.11	1.17	1.22	1.27	1.29	1.31	1.34	1.38	1.46	1.53

Table 6: Air Temperature Rise Conversion Factors

Unit Heater Types	Entering Air Temp. (°F)	STEAM PRESSURE (PSIG)																
		0	2	5	10	15	20	30	40	50	60	70	75	80	90	100	125	150
HORIZONTAL DELIVERY	-10	1.33	1.38	1.43	1.50	1.56	1.61	1.70	1.78	1.84	1.91	1.95	1.97	2.00	2.04	2.08	2.17	2.25
	0	1.28	1.33	1.38	1.45	1.51	1.56	1.65	1.73	1.79	1.86	1.91	1.93	1.95	2.00	2.04	2.13	2.21
	10	1.24	1.27	1.33	1.40	1.46	1.52	1.60	1.68	1.74	1.81	1.86	1.89	1.91	1.95	1.99	2.09	2.17
	20	1.17	1.22	1.27	1.35	1.42	1.46	1.55	1.62	1.69	1.75	1.81	1.84	1.86	1.90	1.95	2.04	2.12
	30	1.12	1.17	1.21	1.29	1.36	1.41	1.51	1.58	1.65	1.71	1.76	1.79	1.82	1.86	1.89	1.99	2.07
	40	1.07	1.11	1.16	1.24	1.10	1.36	1.46	1.54	1.60	1.66	1.71	1.74	1.76	1.81	1.85	1.94	2.03
	50	1.01	1.06	1.11	1.19	1.24	1.30	1.40	1.48	1.55	1.61	1.66	1.69	1.72	1.75	1.79	1.89	1.98
	60	0.96	1.00	1.05	1.13	1.19	1.25	1.35	1.43	1.50	1.56	1.61	1.64	1.66	1.70	1.75	1.84	1.93
	70	0.90	0.94	1.00	1.07	1.14	1.19	1.29	1.38	1.45	1.50	1.56	1.58	1.61	1.65	1.69	1.79	1.87
	80	0.84	0.88	0.93	1.02	1.08	1.14	1.24	1.32	1.39	1.45	1.51	1.53	1.56	1.60	1.64	1.74	1.83
	90	0.78	0.83	0.88	0.95	1.02	1.08	1.18	1.26	1.33	1.40	1.45	1.47	1.49	1.54	1.59	1.68	1.77
	100	0.72	0.76	0.82	0.90	0.97	1.02	1.12	1.21	1.28	1.33	1.39	1.42	1.44	1.49	1.53	1.63	1.71
VERTICAL DELIVERY	-10	1.36	1.41	1.46	1.54	1.61	1.67	1.77	1.85	1.92	1.99	2.05	2.08	2.10	2.15	2.19	2.29	2.39
	0	1.31	1.35	1.40	1.48	1.55	1.61	1.71	1.79	1.86	1.93	1.99	2.02	2.04	2.09	2.14	2.24	2.33
	10	1.25	1.29	1.35	1.43	1.49	1.55	1.65	1.74	1.81	1.88	1.94	1.96	1.99	2.04	2.08	2.18	2.27
	20	1.19	1.24	1.29	1.37	1.44	1.50	1.60	1.68	1.75	1.82	1.88	1.91	1.93	2.00	2.02	2.12	2.22
	30	1.13	1.18	1.23	1.31	1.38	1.44	1.54	1.62	1.69	1.76	1.82	1.85	1.87	1.92	1.97	2.07	2.16
	40	1.08	1.12	1.17	1.25	1.32	1.38	1.48	1.56	1.64	1.70	1.76	1.79	1.81	1.86	1.91	2.01	2.10
	50	1.02	1.06	1.12	1.20	1.26	1.32	1.42	1.51	1.58	1.65	1.70	1.73	1.75	1.80	1.85	1.95	2.04
	60	0.96	1.00	1.06	1.14	1.20	1.26	1.36	1.45	1.52	1.58	1.65	1.67	1.70	1.74	1.79	1.89	1.99
	70	0.90	0.94	1.00	1.08	1.14	1.20	1.30	1.39	1.46	1.53	1.59	1.62	1.64	1.69	1.73	1.83	1.93
	80	0.84	0.88	0.94	1.02	1.09	1.15	1.25	1.33	1.40	1.47	1.53	1.56	1.58	1.63	1.67	1.77	1.87
	90	0.78	0.82	0.88	0.96	1.02	1.08	1.18	1.27	1.34	1.41	1.47	1.50	1.52	1.57	1.61	1.71	1.81
	100	0.72	0.76	0.82	0.89	0.97	1.02	1.12	1.21	1.28	1.35	1.41	1.43	1.46	1.51	1.55	1.65	1.75

Table 7: Steam Unit Heater Mounting Height Correction Factors

Steam Pressure (PSIG)	2	5	10	15	20	30	40	50	60	70	80	90	100	125	150	175
Correction Factor	1.00	0.97	0.94	0.92	0.89	0.86	0.84	0.82	0.80	0.79	0.77	0.76	0.75	0.74	0.72	0.71

Table 8: Properties of Steam

Gauge Pressure (PSIG)	Temp (°F)	Latent Heat (Btu/lb.)	Gauge Pressure (PSIG)	Temp (°F)	Latent Heat (Btu/lb.)	Gauge Pressure (PSIG)	Temp (°F)	Latent Heat (Btu/lb.)	Gauge Pressure (PSIG)	Temp (°F)	Latent Heat (Btu/lb.)
0	212.0	970.3	34	279.4	924.7	70	316.0	897.3	109	343.6	875.4
2	218.5	966.2	36	281.9	922.9	72	317.7	896.0	112	345.4	873.9
4	224.4	962.4	38	284.3	921.1	74	319.3	894.8	115	347.2	872.5
5	227.2	960.6	40	286.7	919.3	76	320.9	893.5	118	348.9	871.0
6	229.8	958.8	42	289.0	917.6	78	322.4	892.3	121	350.7	869.6
8	234.8	955.6	44	291.3	915.9	80	323.9	891.1	124	352.4	868.2
10	239.4	952.5	46	293.5	914.3	82	325.4	889.9	125	352.9	867.8
12	243.7	949.6	48	295.6	912.7	84	326.9	888.8	127	354.0	866.9
14	247.8	946.8	50	297.7	911.2	86	328.4	887.6	130	355.7	865.5
16	251.6	944.2	52	299.7	909.7	88	329.8	886.5	133	357.3	864.1
18	255.3	941.7	54	301.7	908.2	90	331.2	885.4	136	358.9	862.9
20	258.8	939.3	56	303.6	906.7	92	332.5	884.3	139	360.4	861.5
22	262.1	936.9	58	305.5	905.3	94	333.9	883.2	142	362.0	860.3
24	265.3	934.7	60	307.3	903.9	96	335.2	882.1	145	363.5	859.0
26	268.3	932.5	62	309.1	902.5	98	336.6	881.1	150	365.9	856.9
28	271.3	930.5	64	310.9	901.2	100	337.9	880.0	175	377.4	846.8
30	274.1	928.5	66	312.6	899.9	103	339.8	878.5	200	387.9	837.2
32	276.8	926.6	68	314.4	898.6	106	341.7	876.9	225	397.3	828.5

F. HOT WATER PERFORMANCE DATA (at Standard Conditiions of 200°F Entering Water, 60°F Entering Air and 20°F Water Temperature Drop)

Table 9: Hot Water Performance Data -- High Motor Speed

Model Type	Model Number	BTU/Hr.	WATER DATA			AIR DATA						
			GPM	Pressure Drop (ft. of water)	Min/Max GPM	Sound Class**	Max. Mounting Height (ft.)*		Heat Spread at Max. Height*		Cfm	Outlet Velocity (Fpm)	Final Air Temp. (°F)
HORIZONTAL AIR DELIVERY	BH-18	13,000	1.3	0.49	0.3/5.0	II	9		18		400	500	90
	BH-24	17,300	1.7	0.83	0.3/5.0	II	10		20		450	570	96
	BH-33	24,500	2.5	0.12	0.4/10.0	II	11		22		630	495	96
	BH-47	33,800	3.4	0.21	0.4/10.0	III	13		26		730	580	103
	BH-63	46,500	4.7	0.47	0.5/15.0	III	15		30		1120	590	98
	BH-86	61,900	6.2	0.79	0.5/15.0	III	16		31		1340	710	103
	BH-108	81,000	8.1	0.85	0.5/20.0	III	16		33		1550	605	108
	BH-121	90,000	9.0	1.04	0.7/20.0	III	17		36		1775	690	107
	BH-165	133,000	13.3	2.48	2.0/30.0	IV	18		38		2500	735	109
	BH-193	156,000	15.6	3.35	2.0/30.0	IV	19		40		2900	850	110
	BH-258	198,000	19.8	3.54	2.5/40.0	V	20		42		3900	895	107
	BH-290	224,000	22.4	4.45	2.5/40.0	V	21		46		4300	990	108
	BH-340	273,000	27.3	3.24	2.5/50.0	V	22		50		5130	945	109
VERTICAL AIR DELIVERY	BV-42	30,500	3.1	0.09	0.5/10.0	II	11	**15**	17	**11**	950	776	91
	BV-59	44,300	4.5	0.18	0.8/15.0	II	14	**19**	21	**15**	1150	940	97
	BV-78	58,500	6.0	0.43	1.0/20.0	II	15	**21**	23	**16**	1550	990	96
	BV-95	71,000	7.2	0.61	1.3/25.0	II	17	**23**	25	**17**	1775	1132	99
	BV-139	111,000	11.3	0.84	1.0/30.0	III	18	**25**	28	**19**	2500	1281	103
	BV-161	128,800	13.1	1.11	1.3/40.0	III	22	**30**	33	**21**	2900	1488	103
	BV-193	142,700	14.5	0.81	1.5/50.0	IV	24	**33**	36	**24**	3900	1640	95
	BV-212	159,000	16.1	0.98	2.0/60.0	IV	25	**35**	37	**25**	4300	1809	96
	BV-247	197,000	19.9	1.65	2.0/60.0	IV	27	**36**	40	**27**	5130	1803	97
	BV-279	220,000	22.2	2.01	2.3/75.0	V	31	**39**	47	**31**	5800	2037	97
	BV-333	265,000	26.7	1.27	2.8/75.0	V	30	**38**	46	**30**	6600	1966	99
	BV-385	308,000	31.1	1.68	3.3/75.0	VI	33	**40**	49	**33**	7860	1928	97
	BV-500	403,000	40.9	2.32	3.0/100.0	VI	40	**48**	60	**40**	10790	2487	94
	BV-610	459,000	46.3	2.42	6.0/100.0	VI	39	**47**	58	**40**	12350	2343	97

Table 10: Hot Water Performance Data -- Reduced Motor Speed

Model Type	Model Number	BTU/Hr.	WATER DATA		AIR DATA					
			GPM	Pressure Drop (ft. of water)	Sound Class**	Max. Mounting Height (ft.)*	Heat Spread at Max. Height*	Cfm	Outlet Velocity (Fpm)	Final Air Temp. (°F)
HORIZONTAL AIR DELIVERY	BH-18	10,660	1.3	0.49	I	9	13	310	390	92
	BH-24	14,186	1.7	1.83	I	10	14	350	450	98
	BH-33	20,090	2.5	0.12	I	11	16	490	390	98
	BH-47	27,716	3.4	0.21	II	13	18	565	455	105
	BH-63	38,130	4.7	0.47	II	15	21	870	460	101
	BH-86	50,758	6.2	0.79	II	16	22	1040	550	105
	BH-108	66,420	8.1	0.85	II	16	23	1240	485	110
	BH-121	73,800	9.0	1.04	II	17	26	1415	555	108
	BH-165	109,060	13.3	2.48	III	18	27	1990	590	111
	BH-193	127,920	15.6	3.35	III	19	28	2310	680	111

* Units with horizontal louvers open 30° from vertical plane, vertical types equipped with cone jet deflector, blades fully opened are shown in bold.
Non-bolded mounting height/spread data is for units without deflectors. Please see page 21 for additional outlet accessory performance data.

** See page 7 for Sound Class Definitions.

G. SELECTION PROCEDURE - HOT WATER APPLICATION

Example 1:

GIVEN DESIGN CONDITIONS:

Unit Heater Model: BV-59, Entering Water Temperature: 250°F, Entering Air Temperature: 70°F

APPLICATION PROCEDURE:

1. Capacity:	$Btu_A = Btu_S$ x Heating Capacity Factor =44,300 x 1.272 = **56,350 Btu/hr**	• The standard capacity of an BV-59 is **44,300** Btu/hr from Table 9. • Steam heating capacity conversion factor for given circumstance is**1.272** from Table 11.
2. Water Flow Rate:	Same as standard	• The standard capacity on BV-59 is based upon a water flow rateof **4.5** GPM, from Table 9.
3. Final Air Temperature:	$FAT_A = EAT_A + [(460 + EAT_A) / (576 \times Cfm_S) / Btu_A - 1)]$ $FAT_A = 70°F + [(460 + 70) / (576 \times 1150) / 56{,}350-1)]$ = **119°F**	• The standard airflow of an BV-59 is **1150** CFM, from Table 9.
4. Max. Mounting Height:	$WTD_A = Btu_A / (480 \times GA) = 56{,}350 / (480 \times 4.5)$ = **26.09°F**	• The standard capacity on BV-59 is based upon a water flow rate of **4.5** GPM, from Table 9.
5. Max. Mounting Height:	$MMH_A = MMH_S$ x Correction Factor = 14 feet x 0.86 = **12.0 feet**	• The max. mounting height at standard condition is **14** feet, from Table 9. • The mounting height correction factor is **0.86** from Table 14.

Example 2:

GIVEN DESIGN CONDITIONS:

Horizontal Air Delivery requested, Heating Load: 120,000 Btu/hr, Entering Air Temp.: 50°F, Entering Water Temp.: 180°F

APPLICATION PROCEDURE:

1. Unit Selection:	$Btu_S = Btu_A$ x Heating Capacity Factor =120,000 / 0.940 = **127,660 Btu/hr** (at standard conditions). Select **BH-165.**	• Hot Water heating capacity conversion factor for given circumstance is **0.940** from Table 11.
2. Actual Heating Capacity:	The capacity of an BH-165 at actual conditions will be $Btu_A = Btu_X$ x Heating Capacity Factor = 133,000 x 0.940 = **125,020 Btu/hr**	• Hot Water heating capacity conversion factor for given circumstance is **0.940** from Table 11.
3. Final Air Temperature:	$FAT_A = EAT_A + [(460 + EAT_A) \times (Btu_A)/ (576 \times Cfm_S)] = 50 \times [(460 + 50 \times (125{,}020) / (576 \times 2500)]$ = **94°F**	• Cfm for given circumstance is **2500** from Table 9.
4. Water Temperature Drop:	$WTD_A = Btu_A / (480 \times GPM_A)$ = 125,020 / (480 x 13.3) = **19.5°F**	• GPM_A for given circumstance is **13.3** from Table 9.
5. Max. Mounting Height:	$MMH_A = MMH_S$ x Correction Factor = 18 x 1.08 = **19.4 feet**	• The mounting height correction factor is **1.08** from Table 14.

H. HOT WATER CALCULATION FORMULAS

1. Refer to Table 11:
   a. To determine the heating capacity (Btu/hr) of a unit heater at a water temperature and/or entering air temperature other than standard conditions of 200°F entering water temperature, 60°F entering air temperature.
   b. To find actual unit heater capacity when operating at non-standard (actual) conditions:

      $Btu_A = Btu_S$ x Heating Capacity Factor

   c. To select a heater capacity based on standard conditions to meet a heating capacity at non-standard (actual) conditions:

      $Btu_S = Btu_A$ / Heating Capacity Factor

2. Refer to Table 12:
   a. To determine how water temperature drop affects heat capacity in Btu, water flow rate is in GPM and pressure drop in feet of water. These factors should be applied to the values at actual entering water and air temperature conditions.
   b. To find actual unit heater capacity or flow rate or pressure drop when operating at non-standard (actual) conditions:

      $Btu_A = Btu_S$ x Btu Correction Factor
      $GPM_A = GPM_S$ x GPM Correction Factor
      $WPD_A = WPD_S$ x WPD Correction Factor

   c. To select a heater capacity based on standard conditions to meet a heating capacity at non-standard (actual) conditions:

      $Btu_S = Btu_A$ / Btu Correction Factor

   d. Other useful formulas:

      $FAT_A = EAT_A + [(460 + EAT_A) \times (Btu_A) / (576 \times Cfm_S)]$ For BH units only
      $FAT_A = EAT_A + [(460 + EAT_A) / (576 \times Cfm_S / Btu_A) - 1)]$ For BV Units only

3. Refer to Table 13:
   a. To determine how glycol solutions affect heater capacity. These factors should be applied to the heater capacity at actual entering water and air temperature conditions.
   b. To find actual unit heater capacity when operated with glycol solution:

      $Btu_{AG} = Btu_S$ (or Btu_A) x Glycol Correction Factor

   c. To select a heater capacity based on standard conditions to meet a heating capacity with glycol solution:

      Btu_S (or Btu_A) = Btu_{AG} / Glycol Correction Factor

4. Refer to Table 14:

   To determine how water temperatures other than 200°F affect mounting height of unit.

   Max. Mounting $Height_A$ = Max. Mounting $Height_S$ x Correction Factor

5. Terminology:
   a. Btu_A = Capacity at non-standard (actual) conditions
   b. Btu_{AG} = Capacity with Glycol solution
   c. Btu_S = Capacity at standard conditions (200°F entering air temperature, 60°F entering air temperature) from Tables 9 and 10
   d. Cfm_S = Unit airflow as found in Tables 9 and 10
   e. EAT_A = Entering air temperature at actual conditions
   f. FAT_A = Final air temperature at actual conditions
   g. GPM_A = Water flow rate at actual conditions in GPM
   h. GPM_S = Flow rate at standard conditions (200°F entering water temperature, 60°F entering air temperature) from Tables 9 and 10
   i. Max. Mounting $Height_A$ = Maximum mounting height at actual conditions
   j. Max. Mounting $Height_S$ = Maximum mounting height at standard conditions
   k. WPD_A = Water pressure drop at non-standard (actual) conditions
   l. WPD_S = Water pressure drop at standard conditions (200°F entering water temperature, 60°F entering air temperature) from Tables 9 and 10

I. HOT WATER CORRECTION FACTORS

Table 11: Hot Water Heating Capacity Conversion Factors

Entering Air Temp. (°F)	ENTERING AIR TEMPERATURE (°F)										
	0	10	20	30	40	50	60	70	80	90	100
100	0.769	0.683	0.599	0.518	0.439	0.361	0.286	0.212	0.140	0.069	0.000
110	0.846	0.759	0.674	0.592	0.512	0.434	0.357	0.283	0.210	0.138	0.068
120	0.923	0.835	0.749	0.666	0.585	0.506	0.429	0.353	0.279	0.207	0.137
130	1.000	0.911	0.824	0.740	0.658	0.578	0.500	0.424	0.349	0.276	0.205
140	1.077	0.987	0.899	0.814	0.731	0.651	0.571	0.494	0.419	0.345	0.273
150	1.154	1.063	0.974	0.888	0.805	0.723	0.643	0.565	0.489	0.414	0.342
160	1.231	1.139	1.049	0.962	0.878	0.795	0.714	0.636	0.559	0.483	0.410
170	1.308	1.215	1.124	1.036	0.950	0.867	0.786	0.706	0.629	0.552	0.478
180	1.385	1.291	1.199	1.110	1.024	0.940	0.857	0.777	0.699	0.621	0.547
190	1.492	1.367	1.274	1.184	1.097	1.012	0.929	0.848	0.768	0.690	0.615
200	1.539	1.443	1.349	1.258	1.170	1.084	1.000	0.918	0.838	0.759	0.684
210	1.615	1.519	1.424	1.332	1.243	1.157	1.071	0.989	0.908	0.828	0.752
220	1.962	1.594	1.499	1.406	1.312	1.229	1.143	1.060	0.978	0.897	0.820
230	1.769	1.670	1.573	1.480	1.390	1.301	1.241	1.130	1.048	0.966	0.889
240	1.846	1.746	1.649	1.554	1.463	1.373	1.286	1.201	1.118	1.035	0.957
250	1.923	1.822	1.723	1.628	1.536	1.446	1.357	1.272	1.188	1.104	1.025
260	2.000	1.898	1.798	1.702	1.609	1.518	1.429	1.342	1.257	1.173	1.094
270	2.077	1.974	1.873	1.776	1.682	1.590	1.500	1.413	1.327	1.242	1.162
280	2.154	2.050	1.948	1.850	1.755	1.663	1.571	1.483	1.397	1.311	1.230
290	2.231	2.126	2.023	1.924	1.829	1.734	1.643	1.554	1.467	1.380	1.300
300	2.308	2.202	2.098	1.998	1.902	1.807	1.714	1.625	1.537	1.449	1.367

Table 12: Correction Factors for Varying Water Temperature Drop*

Water Temperature Drop, (°F)	5	10	15	20	25	30	35	40	45	50	55	60
Btu Correction Factor	1.23	1.13	1.06	1.00	0.95	0.90	0.86	0.82	0.78	0.72	0.69	0.67
GPM Correction Factor	4.64	2.21	1.40	1.00	0.76	0.61	0.50	0.42	0.36	0.30	0.26	0.23
WPD Correction Factor	17.24	4.32	1.85	1.00	0.61	0.41	0.30	0.22	0.18	0.14	0.12	0.11

* Water temperature drop correction factors valid only for standard 200°F entering water and 60°F air temperature conditions.

Table 13: Ethylene Glycol Correction Factors**

Solution Temperature (°F)	ETHYLENE GLYCOL SOLUTION %						
	20%	30%	40%	50%	60%	70%	80%
100	0.99	0.96	0.93	0.89	0.85	0.81	0.76
150	0.99	0.96	0.94	0.90	0.87	0.83	0.78
200	0.99	0.97	0.94	0.92	0.88	0.85	0.81
250	0.98	0.96	0.94	0.92	0.89	0.86	0.82

** For Propylene Glycol solution correction factor, multiply Ethylene Glycol correction factor by 0.95.

Table 14: Hot Water Unit Heater Mounting Height Correction Factors***

	ENTERING WATER TEMPERATURE, °F																
	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300
Correction Factor	1.33	1.25	1.19	1.13	1.08	1.04	1.00	0.97	0.94	0.91	0.89	0.86	0.84	0.82	0.80	0.78	0.77

*** Factors are for use with entering air temperature ranging from 50°F to 70°F.

VII. OPTIONS, ACCESSORIES AND CONTROL SEQUENCES

A. FIELD INSTALLED OPTIONS FOR HORIZONTAL AND VERTICAL MODELS

Part No.	Description	
B709-OP	Thermostat	Line Voltage Heating Thermostat Range 50°F to 90°F 22A @ 125V/277V.
B710-OP	Explosion-Proof Thermostat	46°F to 84°F range 10.2A @ 115V, 6.5A @ 230V.
B711-OP	Aquastat	Surface Mounted Aquastat Range 100°F to 240°F. It will delay the motor until a predetermined water temperature is reached.
B712-OP	Speed Controller (Variable speed)	Wall Mounted speed controller allows remote infinite adjustment of fan speed, controlling airflow volume, available only for BH-18 thru BH-258.
B713-OP	Thermostat Guard	Clear plastic locking guard with lock and keys to deter unwanted adjustment of set temperature.
B714-OP	Pipe Hanger Kit	Allow unit to be suspended from ceiling by threaded pipe instead of threaded rod.
Refer to Following Table	Manual Starter	Wall Mounted toggle switch starter with thermal overload protection for remote on/off control of fan. Starter comes with a fused overload that protects unit up to 125% load.
B716-OP	Disconnect	Wall Mounted disconnect allow on/off control of fan operation.

Wall Mounted Manual Starters

Part No.	Description
BMS-01	with 0.81A Fuse: BH018, BH024
BMS-02	with 0.89A Fuse: BH033, BH047
BMS-03	with 1.6A Fuse: BH063, BH086, BV042, BV059
BMS-04	with 1.9A Fuse: BH108, BH121
BMS-05	with 3.1A Fuse: BH165, BV078, BV095
BMS-06	with 3.4A Fuse: BH193
BMS-07	with 4.5A Fuse: BH258
BMS-08	with 5.5A Fuse: BH290, BH340, BV139, BV161, BV193, BV212
BMS-09	with 7.3A Fuse: BV247, BV279
BMS-10	with 10.6A Fuse: BV333

B. CONTROL SEQUENCES

The following control sequence descriptions are commonplace for steam/hot water horizontal and vertical air delivery unit heaters.

1. Intermittent Fan Operation - Intermittent Hot/Cold Coil
   a. When a thermostat calls for heat, the motor is energized. At the same time, a valve is opened allowing the heating fluid to enter the unit heater.
   b. Placing an aquastat to the supply or return piping will prevent motor operation until coil is properly heated to avoid the delivery of cold air.
   c. After thermostat is satisfied, motor is de-energized.
2. Intermittent Fan Operation - Hot Coil
   a. When a thermostat calls for heat, the motor is energized.
   b. The heating fluid is continuously supplied to the unit heater, even with the motor off.
   c. After thermostat is satisfied, motor is de-energized.
3. Continuous Fan Operation - Intermittent Hot/Cold Coil
   a. When a thermostat calls for heat, a valve opens, allowing the heating fluid to enter the unit heater.
   b. After the thermostat is satisfied, the valve closes.
   c. The fan runs continuously.

C. FIELD INSTALLED OPTIONS FOR HORIZONTAL MODELS ONLY

Part No.	Description
B7A-01	BH-18/BH-24 Diffuser Blades
B7A-02	BH-33/BH-47 Diffuser Blades
B7A-03	BH-63/BH-86 Diffuser Blades
B7A-04	BH-108/BH-121 Diffuser Blades
B7A-05	BH-165/BH-193 Diffuser Blades
B7A-06	BH-258 Diffuser Blades
B7A-07	BH-290 Diffuser Blades
B7A-08	BH-340 Diffuser Blades

D. FIELD INSTALLED OPTIONS FOR VERTICAL MODELS ONLY

Cone-Jet	The cone-jet allows the unit's discharged air to be adjusted from a direct high velocity stream to a broadened stream that can cover a larger area.
Part No	**Description**
BVCJ-01	Cone Jet RV-42, 59
BVCJ-02	Cone Jet RV-78, 95
BVCJ-03	Cone Jet RV-139, 161
BVCJ-04	Cone Jet RV-193, 212
BVCJ-05	Cone Jet RV-247, 279
BVCJ-06	Cone Jet RV-333, 385
BVCJ-07	Cone Jet RV-500
BVCJ-08	Cone Jet RV-610
Truncone	The truncone allows for a broad air stream covering a larger area than possible with a cone-jet.
Part No	**Description**
BVTC-01	Truncone RV-42, 59, 78, 95
BVTC-02	Truncone RV-139, 161, 193, 212
BVTC-03	Truncone RV-247, 279, 333, 385
BVTC-04	Truncone RV-500, 610
One-Way Louver	The one-way louver allows for a one directional discharge of air.
Part No	**Description**
BV1L-01	One-Way Louver RV-42, 59
BV1L-02	One-Way Louver RV-78, 95
BV1L-03	One-Way Louver RV-139, 161
BV1L-04	One-Way Louver RV-193, 212
BV1L-05	One-Way Louver RV-247, 279
BV1L-06	One-Way Louver RV-333, 385
BV1L-07	One-Way Louver RV-500
BV1L-08	One-Way Louver RV-610
Two-Way Louver	The two-way louver allows for a one directional discharge of air.
Part No	**Description**
BV2L-01	Two-Way Louver RV-42, 59
BV2L-02	Two-Way Louver RV-78, 95
BV2L-03	Two-Way Louver RV-139, 161
BV2L-04	Two-Way Louver RV-193, 212
BV2L-05	Two-Way Louver RV-247, 279
BV2L-06	Two-Way Louver RV-333, 385
BV2L-07	Two-Way Louver RV-500
BV2L-08	Two-Way Louver RV-610
3-Cone Anemostat	The 3-cone anemostat allows for an even air stream covering a larger area than possible with the truncone.
Part No	**Description**
BV3A-01	3-Cone Anemostat RV-42, 59
BV3A-02	3-Cone Anemostat RV-78, 95
BV3A-03	3-Cone Anemostat RV-139, 161
BV3A-04	3-Cone Anemostat RV-193, 212
BV3A-05	3-Cone Anemostat RV-247, 279
BV3A-06	3-Cone Anemostat RV-333, 385
BV3A-07	3-Cone Anemostat RV-500
BV3A-08	3-Cone Anemostat RV-610
4-Cone Anemostat	The 4-cone anemostat allows for an even air stream covering a larger area than possible with the 3-cone anemosat.
Part No	**Description**
BV4A-01	4-Cone Anemostat RV-42, 59
BV4A-02	4-Cone Anemostat RV-78, 95
BV4A-03	4-Cone Anemostat RV-139, 161
BV4A-04	4-Cone Anemostat RV-193, 212
BV4A-05	4-Cone Anemostat RV-247, 279
BV4A-06	4-Cone Anemostat RV-333, 385
BV4A-07	4-Cone Anemostat RV-500
BV4A-08	4-Cone Anemostat RV-610

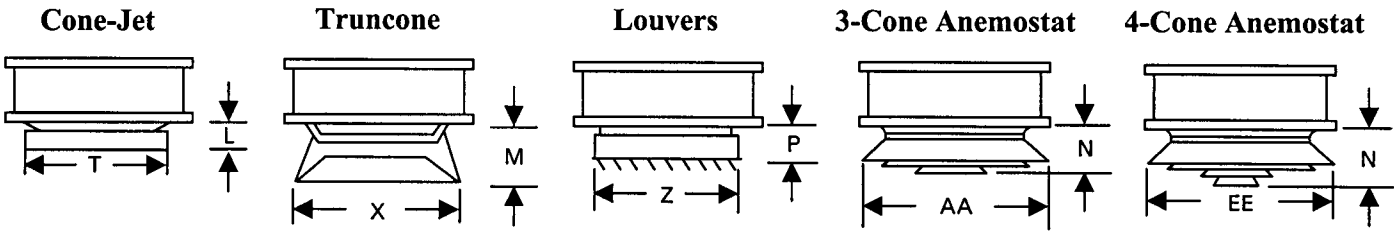


Table 15: Vertical Air Outlet Accessory Dimensions*

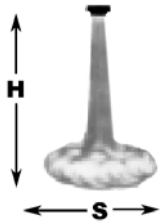
	Cone Jet		Truncone		Louvers		3-Cone Anemostat		4-Cone Anemostat	
Model	L	T	M	X	P	Z	N	AA	N	EE
BV-42/BV-59	6-1/2	16-1/2	10	25	6-1/2	16-1/2	12-1/2	22-1/2	14	25
BV-78/BV-95	6-1/2	18-1/2	10	25	6-1/2	18-1/2	12-1/2	24-1/2	14	27
BV-139/BV-161	8	20-1/2	12	29	8	20-1/2	14	26-1/2	15-1/2	29
BV-193/BV-212	8	22-1/2	12	29	8	22-1/2	14	28-1/2	15-1/2	31
BV-247/BV-279	9	24-1/2	14	33	9	24-1/2	15	30-1/2	16-1/2	33
BV-333/BV-385	9	26-1/2	14	33	9	26-1/2	15	32-1/2	16-1/2	35
BV-500/BV-610	10	30-1/2	18	37	10	30-1/2	16	36-1/2	17-1/2	39

* All dimensions in inches.

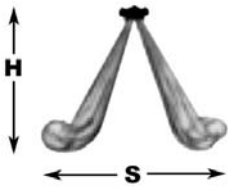
Table 16: Vertical Air Outlet Accessory Maximum Height and Spread[123]

Model	Cone Jet		Truncone		One-Way Louvers		Two-Way Louvers		3-Cone Anemostat		4-Cone Anemostat	
	Standard		Standard		Standard		Standard		Standard		Standard	
	H	S	H	S	H	S	H	S	H	S	H	S
BV-42	15	11	8	19	13	11	8	22	8	22	8	28
BV-59	18	13	9	25	16	14	10	28	9	28	8	35
BV-78	19	14	11	26	17	15	11	30	11	30	8	30
BV-95	21	16	11	26	17	15	11	30	11	30	8	30
BV-139	24	18	13	32	21	18	13	36	13	36	9	45
BV-161	28	21	14	35	23	20	14	40	14	40	10	50
BV-193	31	23	16	39	25	22	15	44	16	44	12	55
BV-212	33	25	16	39	25	22	15	44	16	44	12	55
BV-247	34	26	17	46	30	26	18	52	17	52	13	65
BV-279	37	30	18	53	35	30	21	60	18	60	13	75
BV-333	37	30	17	53	35	30	21	60	17	60	13	75
BV-385	36	30	17	53	35	30	21	60	17	60	13	75
BV-500	44	37	19	65	42	37	26	74	19	74	13	93
BV-610	43	36	19	63	41	41	25	72	---	---	---	---

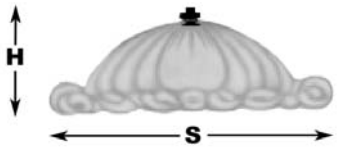
1. Data shown for standard 2 lb. Steam, 60°F entering air temperature conditions. For louvers or cone-jet, data shown for deflectors in fully-opened position.
   For mounting height/spread at steam pressure other than 2 lb., multiply the value by the correction factor in Table 7.
2. For mounting height and spread for hot water, multiply the value above by 1.06 to approximate the mounting height and spread at 200°F entering water temperature. For entering water temperature other than 200°F, multiply the value above by 1.06 and then multiply the correction factor in Table 14.
3. All dimensions in feet.



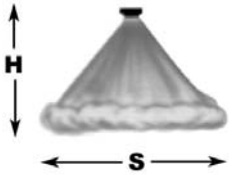
Cone-Jet



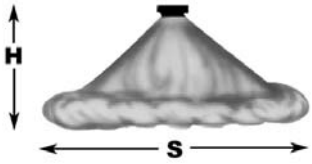
Lou-



Truncone



No Deflector



Anemo-

VIII. DIMENSIONAL DATA

A. BH DIMENSIONAL DATA

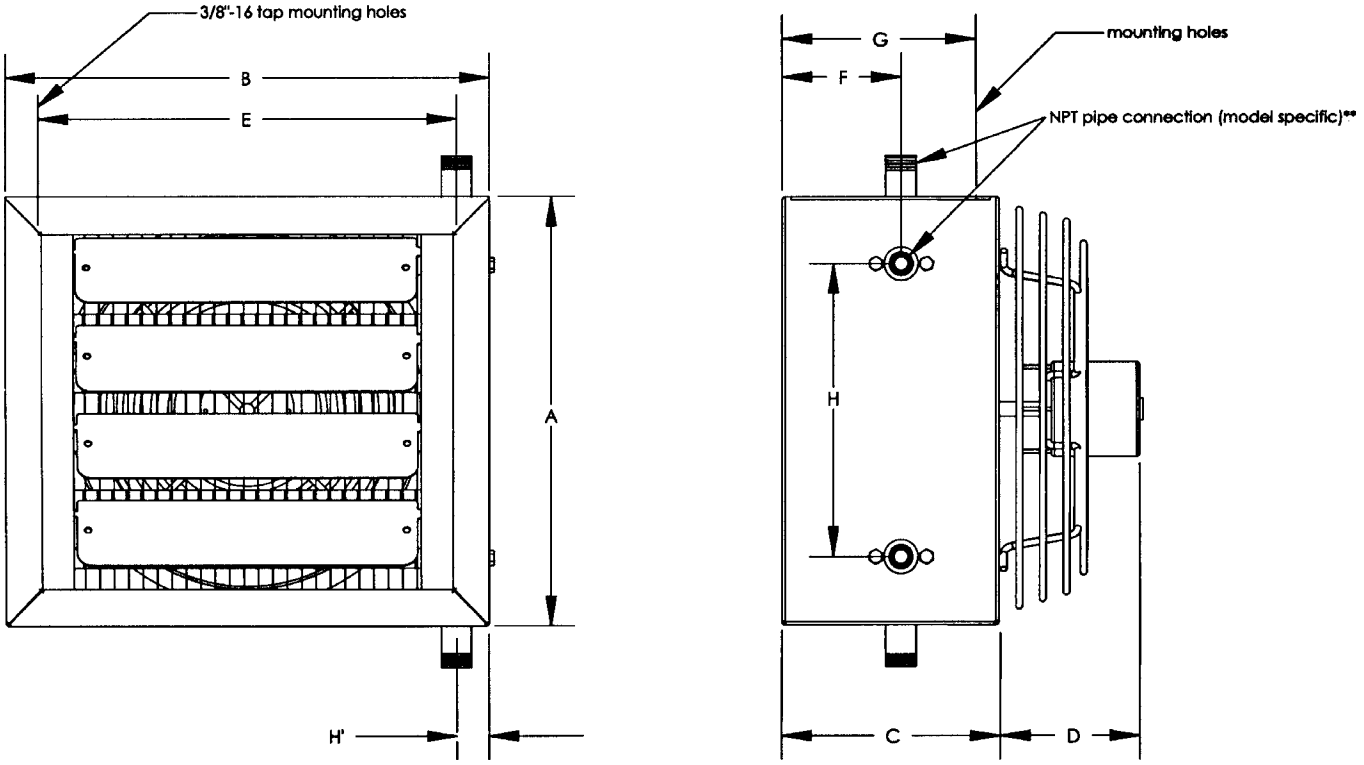


Table 17: Model BH Dimensions

Model	A	B	C	D	E	F	G	H	H*	Male NPT Connections	Fan Diameter	Approx. Ship Weight
BH-18	14-3/4	16-3/4	7-7/16	4-1/2	12-3/4	4-1/8	5-9/16	10	N/A	3/4	9	18
BH-24	14-3/4	16-3/4	7-7/16	4-1/2	12-3/4	4-1/8	5-9/16	10	N/A	3/4	9	19
BH-33	18-7/8	16-3/4	7-7/16	4-3/4	12-3/4	4-1/8	5-13/16	16	N/A	3/4	12	35
BH-47	18-7/8	16-3/4	7-7/16	4-3/4	12-3/4	4-1/8	5-13/16	16	N/A	3/4	12	36
BH-63	18-7/8	22-3/4	8-7/16	4-3/4	17-3/4	4-1/8	7	16	N/A	3/4	14	51
BH-86	18-7/8	22-3/4	8-7/16	4-3/4	17-3/4	4-1/8	7	16	N/A	3/4	14	52
BH-108	26-15/16	25-7/8	9-1/2	6-1/4	24-3/4	3-1/2	6-1/4	N/A	2	1-1/2	18	76
BH-121	26-15/16	25-7/8	9-1/2	6-1/4	24-3/4	3-1/2	6-1/4	N/A	2	1-1/2	18	77
BH-165	26-15/16	31-7/8	10	6-1/4	30-3/4	3-1/2	6-1/4	N/A	2	1-1/2	20	95
BH-193	26-15/16	31-7/8	10	6-1/4	30-3/4	3-1/2	6-1/4	N/A	2	1-1/2	20	96
BH-258	32-15/16	40-13/16	11	6-1/4	39-11/16	3-1/2	6-1/4	N/A	2	2	22	165
BH-290	32-15/16	40-13/16	11	6-1/4	39-11/16	3-1/2	6-1/4	N/A	2	2	22	167
BH-340	38-15/16	40-13/16	12	6-1/4	39-11/16	3-1/2	8-1/4	N/A	2	2	24	182

* All dimensions in inches.
** BH-18 thru BH-86 have side female NPT pipe connections.
BH-108 thru BH-340 have top and bottom male NPT pipe connections.

B. BV DIMENSIONAL DATA

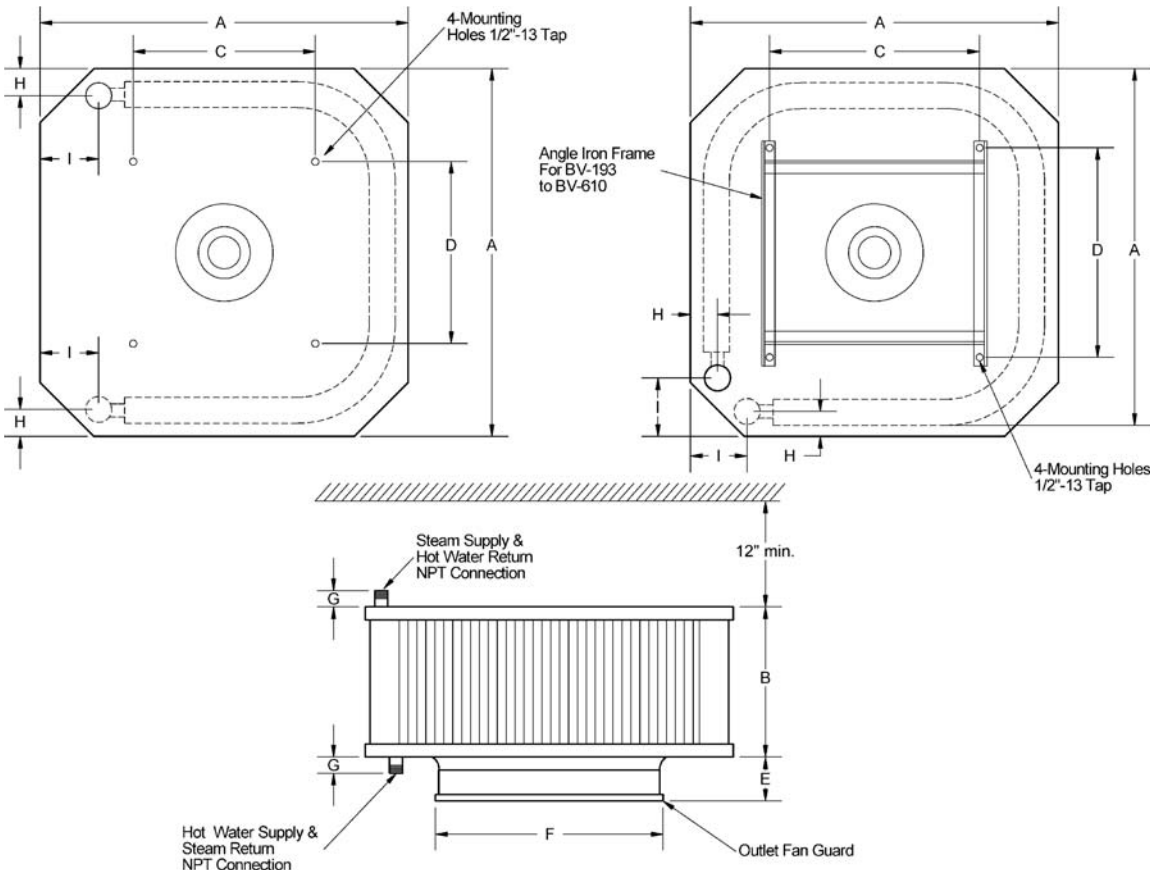


Table 18: Model BV Dimensions*

Model	A	B	C	D	E	F	G	H	I	Male NPT Connections	Fan Diameter	Approx. Ship Weight
BV-42/BV-59	23	6-3/8	12	12	3-1/8	15	2-3/4	1-7/8	3-1/4	1-1/2	13-3/4	52
BV-78/BV-95	25	6-3/8	13	13	3-1/8	17	2-3/4	1-7/8	3-1/4	1-1/2	15-3/4	64
BV-139/BV-161	35	6-3/8	19	19	3-1/8	18-7/8	2-3/4	1-7/8	3-1/4	1-1/2	17-3/4	99
BV-193/BV-212	30	12-3/8	19	17	4	20-7/8	2-3/4	2	3-5/8	2	19-3/4	126
BV-247/BV-279	35	12-3/8	20	18	4	22-7/8	2-3/4	2	3-5/8	2	21-3/4	154
BV-333/BV-385	35	18-3/8	21	21	4	24-3/4	3	2-1/2	4-1/2	2-1/2	23-3/4	189
BV-500	43	18-3/8	25	25	4	28-3/4	3	2-1/2	4-1/2	2-1/2	27-3/4	270
BV-610	43	18-3/8	27	27	4	30-3/4	3	2-1/2	4-1/2	2-1/2	29-3/4	290

* All dimensions in inches.

IX. MOTOR DATA

HORIZONTAL AIR DELIVERY UNIT HEATER MOTOR DATA

Motor Data		Voltage and Motor Type			
		115/60/1	230/60/1	230/460/60/3	115/208 - 230/60/1
		Totally Enclosed w/ Thermal Overload		Totally Enclosed	Explosion Proof w/Thermal Overload
Model No.	Motor HP	Full Load Amps			
BH-18	1/30	0.70	0.35	N/A	4.8/2.3-2.4
BH-24	1/30	0.70	0.35	N/A	4.8/2.3-2.4
BH-33	1/15	0.72	0.40	N/A	4.8/2.3-2.4
BH-47	1/15	0.72	0.40	N/A	4.8/2.3-2.4
BH-63	1/10	1.30	0.80	1.4/0.7	4.8/2.3-2.4
BH-86	1/10	1.30	0.80	1.4/0.7	4.8/2.3-2.4
BH-108	1/8	1.58	0.90	2.2/1.1	6.8/3.1-3.4
BH-121	1/8	1.58	0.90	2.2/1.1	6.8/3.1-3.4
BH-165	1/4	2.70	1.40	2.2/1.1	6.8/3.1-3.4
BH-193	1/4	2.80	1.40	2.2/1.1	6.8/3.1-3.4
BH-258	1/3	3.60	1.90	2.2/1.1	7.8/3.6-3.9
BH-290	1/2	4.70	2.40	2.2/1.1	9.6/4.7-4.8
BH-340	1/2	4.70	2.40	2.2/1.1	9.6/4.7-4.8

VERTICAL AIR DELIVERY UNIT HEATER MOTOR DATA

Motor Data		Voltage and Motor Type			
		115/60/1	230/60/1	230/460/60/3	115/208 - 230/60/1
		Totally Enclosed w/ Thermal Overload		Totally Enclosed	Explosion Proof w/Thermal Overload
Model No.	Motor HP	Amps			
BV-42	1/20	1.30	0.70	1.4/0.7	4.8/2.3-2.4
BV-59	1/20	1.30	0.70	1.4/0.7	4.8/2.3-2.4
BV-78	1/8	2.70	1.40	1.4/0.7	4.8/2.3-2.4
BV-95	1/8	2.70	1.40	1.4/0.7	4.8/2.3-2.4
BV-139	1/4	2.80	1.40	2.2/1.1	6.6/3.1-3.3
BV-161	1/4	2.80	1.40	2.2/1.1	6.6/3.1-3.3
BV-193	1/2	4.70	2.40	2.2/1.1	9.6/4.7-4.8
BV-212	1/2	4.70	2.40	2.2/1.1	9.6/4.7-4.8
BV-247	5/8	5.90	3.00	4.2/2.1	9.6/4.7-4.8
BV-279	5/8	5.90	3.00	4.2/2.1	9.6/4.7-4.8
BV-333	1	9.00	4.50	4.2/2.1	N/A
BV-385	1	N/A	N/A	4.2/2.1	N/A
BV-500	1-1/2	N/A	N/A	5.0/2.5	N/A
BV-610	1-1/2	N/A	N/A	5.0/2.5	N/A

Motor/Power Codes

Motor/Power Code	Description
01	115V, 60 HZ, 1PH
02	230V, 60HZ, 1PH
05	230V/460V, 60HZ, 3PH
06	115V/208-230V, 60HZ, 1PH, Explosion Proof

Limited Warranty

PANELRAY™, Convector and BH and BV Series Unit Heaters

Limited Warranty – Except as provided below with respect to products or parts not manufactured by U.S. Boiler™ Company, Inc. U.S. Boiler Company, Inc. warrants to the original owner at the original installation site that products manufactured by U.S. Boiler Company, Inc. comply, at the time of manufacture, with recognized Hydronics industry regulatory agency standards and requirements then in effect and will be free from defects in materials and workmanship for a period of one year after the date of installation.

The remedy for breach of this warranty is expressly limited to the repair or replacement of any part found to be defective under conditions of normal use and does not extend to liability for incidental, special or consequential damages or losses such as loss of the use of the products, inconvenience, loss of time or labor expense involved in repairing or replacing alleged defective product. U.S. Boiler Company, Inc. shall have no responsibility for the performance of any product sold by it under conditions varying materially from those under which such product is usually tested under existing industry standards, nor for any damage to the product from abrasion, erosion, corrosion, deterioration or the like due to abnormal temperatures or the influence of foreign matter or energy, nor for the design or operation of any system of which any such product may be made a part or for the suitability of any such product for any particular application.

For products or parts not manufactured by U.S. Boiler Company, Inc., the warranty obligation of U.S. Boiler Company, Inc. shall, in all respects, conform and be limited to the warranty actually extended to U.S. Boiler Company, Inc. by its vendors.

Warranty service can be obtained by contacting the original installer of the product and providing him with a detailed description of any apparent defect. If this procedure fails to result in satisfactory warranty service, the owner should notify U.S. Boiler Company, Inc., P.O. Box 3079, Lancaster, PA 17604. Transportation to a factory or other designated facility for repairs of any products or items alleged defective shall, in all events, be the responsibility and at the cost of the owner.

Notwithstanding any of the above provision, (1) failures resulting from misuse, improper installation or lack of maintenance are not covered by this warranty, and (2) U.S. Boiler Company, Inc.'s liability under this warranty shall not exceed the selling price of the product found to be defective.

Equipment furnished by the Buyer, either mounted or unmounted, and when contracted for by the Buyer to be installed or handled is not covered by this warranty. U.S. Boiler Company, Inc. does not assume any responsibility in connection with such equipment, operation, warranty, performance, or any other liability connected thereto.

Then foregoing provisions of this WARRANTY shall be effective to the maximum extent permitted by applicable law, and, to the extent that any such provision would otherwise have an unconscionable result or would otherwise be inconsistent with applicable law, such provision shall be limited in effect to the minimum extent necessary to avoid such unconscionable result or inconsistency with applicable law.

Any implied warranties, including implied warranties of merchantability and fitness for a particular purpose shall, to the extent permitted by applicable law, be limited in duration to a period of one year after the date of installation. To the extent permitted by applicable law, the remedies for breach of any such implied warranty shall be limited to the remedies set forth above with respect to a breach of the express limited warranty provided. With respect to the limitations on implied warranties set forth above, U.S. Boiler Company, Inc. hereby notifies each person to whom such warranty is made as follows: Some states do not allow limitations on how long an implied warranty lasts or the exclusion or limitation of incidental or consequential damages, so the above limitations, or exclusions may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Burnham® Hydronics