Steam/Hot Water Unit Heaters

Type Vertical (UD) and Horizontal (UH)

Model UH

Model UD

Units are listed by the
Canadian Standards Association

McQuay® Air Conditioning

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Horizontal Air Delivery Model – UH

Model UH

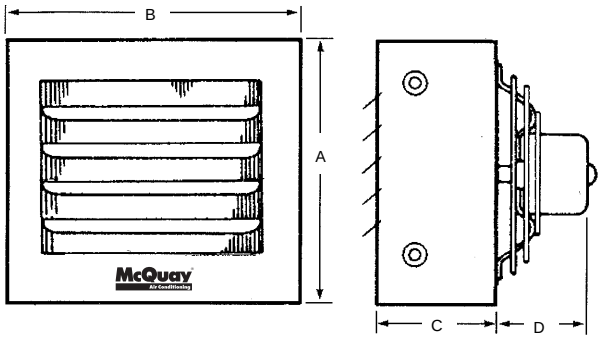


Table 1. Dimensions

Dimensions	A	B	C	D 115V Stnd. Mtr.	D 115V Expl. Prf.Mtr.	Female Connections NPT	Fan Diam.	Approx. Shipping Wgt. in lbs.
UH-18, UH-24	11½"	12¾"	6"	5"	12½"	½"	9"	16 / 20
UH-33, UH-47	15"	17½"	8¾"	6"	12"	¾"	12"	34 / 36
UH-63, UH-86	18½"	21½"	8¾"	7⅝"	12"	¾"	14"	48 / 52
UH-108, UH-121	22½"	25½"	9½"	6¾"	13¼"	¾"	18"	74 / 76
UH-165, UH-193	26½"/30½"	29½"/32½"	9¼"	8½"	14"	¾" / 1¼"	22"	92 / 98
UH-258, UH-290	38½"	38½"	12½"	10"	15"	1¼"	22" / 24"	162 / 168
UH-340	38½"	44½"	12½"	10"	15"	1¼"	24"	176

- UH models have squared off corners for clean, smooth appearance.
- UH type units have a copper tube and copper coil connections.
- UH style models have side inlet and outlet for low clearance applications.
- All models have a two piece casing for quick access to coil.
- All units include an electric junction box for easy electrical connections.
- Baked on Antique Ivory, environmentally friendly paint.
- Motors are totally enclosed with thermal overload protection.
- All units are listed by the Canadian Standards Association.
- UHH has standard motor.
- UHX has explosion proof motor.

Standard Model UH

Table 2. Standard Models Performance Data - Model UH

Model Number	Standard Models: Steam (2# Steam 60°F Ent. Air) ▲ Motor HP	Steam Btu/Hr	Steam Final Air Temp. (°F)	Hot Water (200°F In, 180°F Out, 60°F Ent. Air) Btu/Hr	Water Flow (GPM)	Final Air Temp. (°F)	CFM	*Max. Mtg. Height (Ft)	*Heat Spread @ Max. Mtg. Height (Ft)
18	1/60	18,000	107	12,800	1.3	93	340	8	17
24	1/25	24,000	119	15,700	1.6	101	370	9	18
33	1/25	33,000	108	24,500	2.5	91	630	10	21
47	1/12	47,000	119	29,000	2.9	98	730	12	28
63	1/12	63,000	111	47,000	4.7	96	1120	14	29
86	1/8	86,000	118	63,000	6.3	102	1340	15	31
108	1/8	108,000	109	81,000	8.1	96	2010	17	31
121	1/6	121,000	122	90,000	9.0	107	1775	16	25
165	1/3	165,000	106	133,000	13.5	97	3240	19	40
193	1/3	193,000	121	139,000	14.0	105	2900	18	38
258	1/2	258,000	111	198,000	20.0	100	4560	19	44
290	1/2	290,000	117	224,000	22.0	105	4590	20	46
340	1/2	340,000	120	273,000	27.0	108	5130	20	46

▲ Applies to most popular motor.

Vertical Air Delivery Model – UD

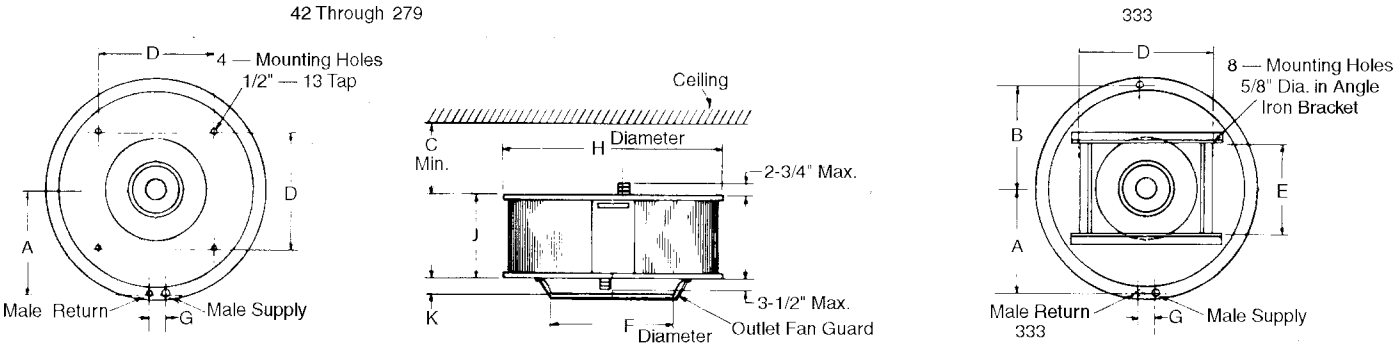


Table 3. Dimensions

UD Models Standard	A	B	C	D	E	F	G	H	J	K	Nom. Fan Dia.	Male Conn. NPT		Approx. Shipping Wt.Lbs.
												Top	Bottom	
42	11	–	8	11⅜"	–	14½"	2⅛"	24¾"	3⅝"	4⅜"	14	1¼"	¼"	36
59	11	–	8	11⅜"	–	14½"	2⅛"	24¾"	5⅛"	4¾"	14	1¼"	¼"	42
78	11	–	8	11⅜"	–	16½"	2⅛"	24¾"	6⅝"	2⅝"	16	1¼"	¼"	46
95	11	–	8	11⅜"	–	16½"	2⅛"	24¾"	8⅛"	2⅝"	16	1¼"	¼"	48
139	16	–	8	18⅜"	–	19½"	2⅛"	34¾"	6⅞"	3"	19	1½"	1"	70
161	16	–	8	18⅜"	–	19½"	2⅛"	34¾"	8⅜"	3"	19	1½"	1"	80
193	16	–	8	18⅜"	–	19½"	2⅛"	34¾"	9⅞"	3"	19	1½"	1"	86
212	16	–	8	18⅜"	–	19½"	2½"	34¾"	12⅞"	3"	19	2"	1¼"	94
247	16	–	8	18⅜"	–	21½"	2½"	34¾"	12⅞"	3"	21	2"	1¼"	108
279	16	–	8	18⅜"	–	21½"	2½"	34¾"	14¾"	3"	21	2"	1¼"	112
333	20	–	12	24"	16⅝"	22½"	2⅞"	43¼"	14½"	3⅛"	22	2"	1¼"	166

- UD models have copper tubes.
- All units provided with outlet fan guard.
- Motor cooling cone shields motor from heat for longer life.
- Optional air deflectors, Cone jet, Truncone and Louvers for a variety of heat throw patterns.
- All units include an electric junction box for easy electrical connections.
- Baked on Antique Ivory, environmentally friendly paint.
- All units are listed by the Canadian Standards Association.
- UDH has standard motor.
- UDX has explosion proof motor.

Standard Model UD

Table 4. Standard Models Performance Data - Model UD

Model Number	Standard Models								
	Steam (2# Steam 60°F Ent. Air)			Hot Water (200°F In, 180°F Out, 60°F Ent. Air)					
	▲ Motor HP	Btu/Hr	Final Air Temp. (°F)	Btu/Hr	Water Flow (GPM)	Final Air Temp. (°F)	CFM	*Max. Mtg. Height (Ft)	*Heat Spread @ Max. Mtg. Height (Ft)
42	1/30	42,000	103	30,000	3.0	91	950	15	11
59	1/30	59,000	111	43,000	4.3	96	1155	19	14
78	1/15	78,000	109	57,000	5.7	95	1590	20	15
95	1/15	95,000	118	68,000	6.8	101	1665	20	15
139	1/6	139,000	112	105,000	10.5	99	2660	24	18
161	1/3	161,000	115	123,000	12.5	98	2945	27	20
193	1/3	193,000	116	140,000	14.0	102	3500	30	22
212	1/3	212,000	120	156,000	15.5	104	3610	30	22
247	1/2	247,000	111	184,000	18.5	98	4820	34	26
279	1/2	279,000	111	210,000	21.0	98	5460	37	30
333	3/4	333,000	116	261,600	27.1	103	5980	37	30

▲ Applies to most popular motor. *Vertical types equipped with cone jet deflector.

Selecting Unit Heaters

Selection by Type and Size

Once the building heat loss (Btuh), cfm requirement, final air temperature, and general air distribution pattern are determined, selection of the specific unit heater types and number of each can be made. Consideration of the use and character of the space to be heated should influence selection of the unit heater type, or types, best suited to fill the heating need.

Many industrial and commercial unit heating applications will suggest the use of a combination of all unit heater types offered by McQuay. The broadness of the McQuay line permits greater discrimination in the selection of a unit heater which most specifically meets an application requirement.

Each of the unit heaters cataloged differ principally in velocity of the delivered air and/or the direction (horizontal or vertical) of the air delivered.

Horizontal Delivery Unit Heaters

Characterized by its horizontal air delivery, this unit heater is widely used for general industrial and commercial heating. Horizontally positioned louvers (standard) attached to the air-discharge side of the unit can be adjusted to lengthen or shorten heat throw and/or decrease or increase the mounting height. Adjustable vertical louvers (optional) when used in combination with horizontal louvers permit complete directional control of heated air.

Vertical Delivery Unit Heaters

Due to their directly downward air discharge, vertical units are particularly desirable for heating areas with high ceilings and where craneways and other obstructions dictate higher mounting of heating equipment. Four air-distribution devices providing distinctively different heat-throw patterns are offered to meet specific heat-throw and heat-spread requirements. (See pages 8 & 9).

Other Factors Which Can Influence Selection

Where it is necessary to mount units low, select models with lower cfm ratings as the greater volumes of air handled by larger units can create excessive air movement when mounted low.

Better air distribution and economy of heating-system operation is realized when a greater number of smaller unit heaters are used instead of a fewer number of larger units.

Sound ratings of certain models may limit their use for certain applications. In such instances, select units by size such that the total number of units meet the heat loss and sound criteria.

Canadian Standards Association (CSA) requirements state that explosion-proof units may not be used with a fluid temperature in excess of 329°F or 100 psi and still maintain their explosion-proof rating.

Selection for Applications Where Quietness is a Factor

Wherever fans and motors are used to move air, sound is generated. Such, of course, is the case with unit heaters. Sound emissions of a certain large unit heater model may limit its use in applications where sound level requirements may be critical. In such instances, smaller models should be selected which in total meet the heat-load criteria of a larger single unit heater. Cfm and velocity (fpm) ratings are generally indicative of sound levels, i.e., the higher the cfm and velocity rating of a unit heater, the greater the sound emissions from the unit.

Sound-silencing was given special emphasis in the design of McQuay unit heaters. The fan shroud (air intake opening) was formed to eliminate eddy air currents which create noise. Fans were designed to move air quietly. Motors were selected for dependability, economy, and quietness.

All McQuay unit heater models are sound-classified as to the type of building in which they may be considered for use. As a result, McQuay units can be selected on the basis of acoustical ratings. (See tables 5 and 6, page 6).

Sound ratings included in this catalog are the results of tests made in modern testing laboratories in accordance with industry approved testing procedure.

Table 5. Building or Room Quietness Zones

Type of Building or Room	Quietness Zone
Apartments, Class Rooms, Court Rooms, Executive Offices, Hospitals, Libraries, Museums, Residences	I
General Offices, Hotel Dining Rooms, Private Offices, Recreation Rooms, Show Rooms, Small Stores, Tea Rooms, Upper Floors at Department Stores	II
Bank Lobbies, Cafeterias, Drug Stores, General Offices, Grocery Stores, Gymnasiums, Main Floors at Department Stores, Public Buildings, Post Offices, Restaurants, Service Stations	III
Factories, Foundries, Garages, Machine Shops, Office Machinery Rooms, Packing Plants, Shipping Platforms, Steel Mills	II - VII
Boiler Works, Forge Shops, Round Houses, Steel Fabricating Shops	VII

How To Calculate Heat Loss

It is suggested that when calculating heat loss, reference be made to procedures outlined in the ASHRAE Handbook. As an easy reference, however, the following abbreviated method may be used with a good degree of reliability.

1. Determine inside temperature to be maintained and the design outside temperature for your locality. The difference between these two figures is the design temperature difference.
2. Calculate net areas in sq. ft. of glass, wall, floor, and roof exposed to outside temperature or unheated spaces.
3. Select heat-transfer coefficients from table 7, page 7 (or the ASHRAE Guide) and compute the heat-transmission loss for each type of area in Btuh by multiplying each area by the heat-transfer coefficient and by the temperature difference.
4. Calculate the volume of the room in cubic feet and multiply by the estimated number of air changes per hour due to infiltration (usually from one to two). Determine the number of cubic feet per hour of air exhausted by ventilating fans or industrial processes. Substitute the larger of these two figures in the formula to determine the heat required to raise the air from outside to room temperature —

$$\text{Btuh} = \frac{\text{Cu. ft. per hour x temp. difference}}{55}$$

5. The totals of Btu losses from 3 and 4 (above) will give the total heat to be supplied by unit heaters. (Note: if processes performed in the room liberate considerable amounts of heat, this may be determined as accurately as possible and subtracted from the total.)
6. Add 10% to the heat-loss figures for areas exposed to prevailing winds.

Table 6. Sound Ratings of McQuay Unit Heaters

Type	Model No.	Speed	RPM	Quietness* Zone
Horizontal Delivery	UH-18	High	1550	II
		Low	1000	II
	UH-24	High	1550	II
		Low	1000	II
	UH-33	High	1550	II
		Low	1000	II
	UH-47	High	1550	III
		Low	1000	II
	UH-63	High	1550	II
		Low	1000	II
	UH-86	High	1625	III
		Low	1000	II
	UH-108	High	1625	III
		Low	1000	II
	UH-121	High	1075	III
	UH-165	High	1075	IV
	UH-193	High	1075	IV
	UH-258	High	1075	V
	UH-290	High	1075	V
	UH-340	High	1075	V

Type	Model No.	Speed	RPM	Quietness Zone
Vertical Delivery	UD-42	High	1050	II
	UD-59	High	1050	II
	UD-78	High	1050	II
	UD-95	High	1050	II
	UD-139	High	1075	III
	UD-161	High	1075	IV
	UD-193	High	1075	IV
	UD-212	High	1075	IV
	UD-247	High	1075	V
	UD-279	High	1075	V
	UD-333	High	1140	V

*See Table 5, above

Table 7. Common Heat-Transfer Coefficients

Building Material	"U" Factor
Walls	
Poured concrete, 80#/cu. H.	
8-inch	0.25
12-inch	0.18
Concrete Block, hollow cinder aggregate	
8-inch	0.39
12-inch	0.36
Gravel aggregate	
8-inch	0.52
12-inch	0.47
Concrete Block w/4-inch facebrick	
Gravel, 8-inch	0.41
Cinder, 8-inch	0.33
Metal	
(un-insulated)	1.17
w/1-inch blanket insulation	0.22
w/3-inch blanket insulation	0.08
Frame	
2 x 4 w/$^1/_2$" asphalt sheathing and wood siding, $^1/_2$" gypsum wall board	
(un-insulated)	0.23
w/3-inch insulation	0.07
Roofing	
Corrugated Metal (un-insulated)	1.50
w/1-inch bolt or blanket	0.23
w/1$^1/_2$-inch bolt or blanket	0.16
w/3-inch bolt or blanket	0.08
Flat Metal	
w/$^3/_8$-inch built-up roofing	0.90
w/1-inch blanket insulation under deck	0.21
w/2-inch blanket insulation under deck	0.12
Wood/ 1"/	
(un-insulated) w/$^3/_8$-inch built-up roofing	0.48
w/1-inch blanket insulation	0.17
Wood/2"/	
(un-insulated) w/$^3/_8$-inch built-up roofing	0.32
w/1-inch blanket insulation	0.15
Concrete slab/2"/	
(un-insulated) w/$^3/_8$-inch built-up roofing	0.30
w/1-inch insulation board	0.16
Concrete slab/3"/	
(un-insulated) w/$^3/_8$-inch built-up roofing	0.23
w/1-inch insulation board	0.14
Gypsum slab/2"/	
(un-insulated) w/$^1/_2$-inch gypsum board	0.36
w/1-inch insulation board	0.20
Gypsum slab/3"/	
(un-insulated) w/$^1/_2$-inch gypsum board	0.30
w/1-inch insulation board	0.18
Windows	
Vertical, single-glass	1.13
Vertical, double-glass, $^3/_{16}$-inch air space	0.69
Horizontal, single-glass (sky light)	1.40
Doors	
Metal–single sheet	1.20
Wood, 1-inch	0.64
2-inch	0.43

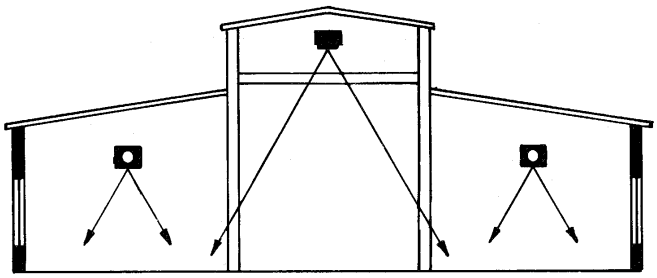
Refer to ASHRAE Handbook of Fundamentals, for expansion of this table.

Locating Unit Heaters

1. Use as few unit heaters as possible to give proper heat distribution and coverage of the area to be heated. The number used depends on the heat throw or heat spread of the individual heaters. Arrange unit heaters to minimize piping costs.
2. More than any other single factor, improper mounting height is responsible for most unsatisfactory unit heater installations. When heaters are mounted higher than recommended, improper heat distribution is the result and comfort is reduced.
3. Horizontal delivery unit heaters should be located so that the air streams of the individual units wipe the exposed walls of the building with either parallel flow or angular flow without blowing directly against the walls. Heaters should be spaced so that each supports the air stream from another heater. This sets up a circulatory air movement which produces a blanket of warm air along the cold wall.
4. It is advisable to locate unit heaters so that their air streams are subjected to a minimum of interference from columns, machinery, partitions, and other obstacles.
5. Unit heaters installed in a building exposed to a prevailing wind should be located so as to direct a large portion of the heated air along the windward side of the building.
6. Large expanses of glass, or large doors that are frequently opened, should be covered by long-throw unit heaters such as large horizontal delivery unit heaters.
7. In buildings having high ceilings, vertical delivery unit heaters equipped with the correct air-distribution devices are recommended to produce comfort in central areas of the space to be heated. Horizontal delivery units are generally used for heating the peripheral areas of the same building.
8. Horizontal units should be arranged so they do not blow directly at workers. Their air streams should be directed down aisles, into open spaces on the floor, or along exterior walls of the building.

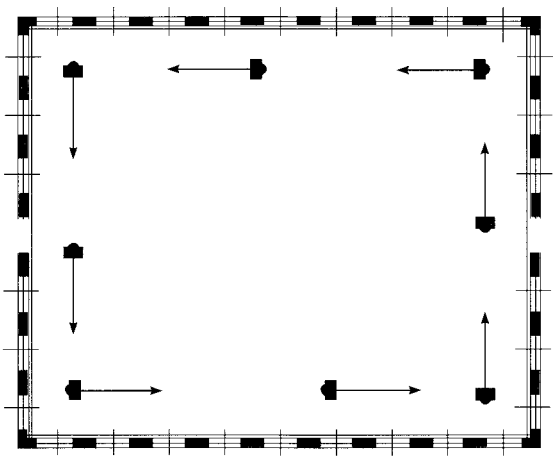
Monitor-Type Building

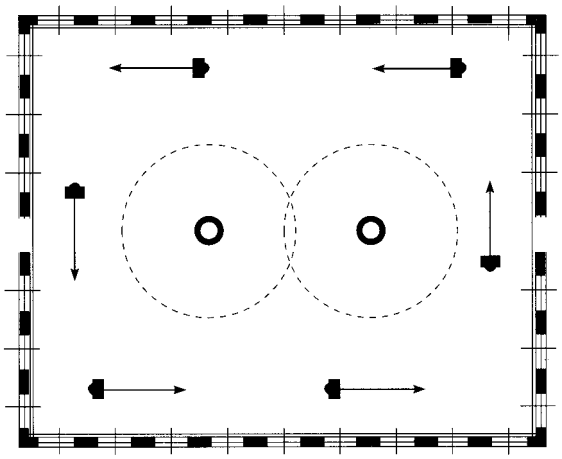
This application utilizes both horizontal and vertical delivery unit heaters. Vertical units located in the central high-ceiling area clear the craneway below them. Horizontal units are used in the low-ceiling areas.



Mill-Type Building

Here each horizontal delivery unit heater supports the air stream from another to set up a circulatory air movement within the space to be heated. This arrangement illustrates the basic principle of unit heater location.

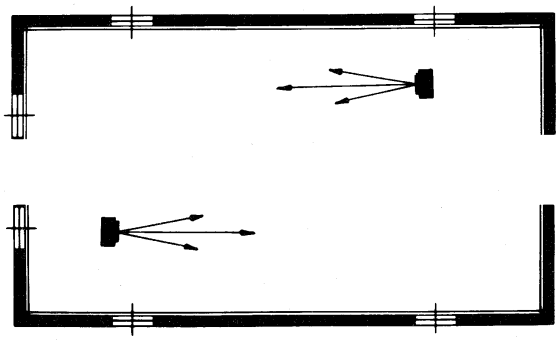




Locating Unit Heaters *(Continued)*

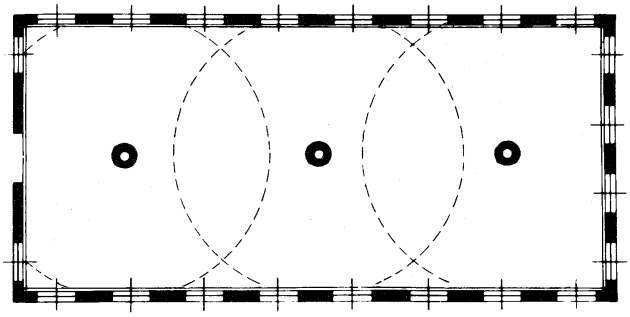
9. When only vertical delivery heaters are used, they should be located so that exposed walls are blanketed with the warm air they deliver.
10. Several unit heaters may be operated by a single thermostat. In large open spaces where various activities are carried on, zonal heating will improve comfort and generally reduce fuel costs. Unit heaters may also be controlled individually, either manually or by a thermostat.
11. Unit heater fans may be operated during warm weather to maintain air circulation. If this is desired, units should be equipped with fan switches when they are installed.
12. Illustrations appearing on this page and the facing page, suggest various spacing and arrangements of unit heaters for providing adequate heating coverage. Proper placement of unit heaters in a space to be heated will also simplify piping and reduce installation costs.

Warehouse Building



This typical application of horizontal unit heaters illustrates the maximum heat coverage with a minimum number of units.

Narrow Building



Heat spread from vertical units supplies good coverage of the entire floor space and blankets walls with warmed air.

Automatic Control

Intermittent Fan Operation – Hot coil

A room thermostat starts and stops the motor. An aquastat is sometimes strapped to the supply or return piping to prevent fan operation when heat is not being supplied to the unit heater.

Continuous Fan Operation – Intermittent Hot/Cold Coil

A room thermostat controls a valve which opens to allow steam or hot water to supply the unit and closes to shut off the supply when the thermostat is satisfied.

Intermittent Fan Operation – Intermittent Hot/Cold Coil

To prevent a unit heater from delivering cold air when the thermostat is "calling for" heat, an aquastat prevents fan operation when the heat supply to the coil is interrupted. Conversely, the aquastat energizes the fan when the automatic supply valve opens to allow the heating medium to enter the unit heater coil.

Energy Saver

An "Energy Saver" control used with vertical air delivery unit heaters can automatically deliver warm stratified air to the zone of occupancy, minimize ceiling heat loss and overall energy consumption. Two thermostats and an auxiliary switch are required for one or more unit heaters, plus a two-position supply valve for each unit heater. The room thermostat controls the two-position supply valve to each unit heater. An auxiliary fan switch stops the unit heater fan when the supply valve is closed. The other thermostat ("Energy Saver" Control) is located near the vertical unit heater at the ceiling or roof where warm air tends to stratify. The room thermostat will automatically signal the supply valve to close when its setting has been "satisfied". However, the thermostat mounted near the unit heater can override the auxiliary switch to allow the unit heater fan to run, with the supply valve closed, until the temperature at the higher level falls below the set-point of the higher mounted thermostat. Additionally, air delivered by a vertical unit heater located in high ambient temperatures prevalent at the upper levels within a building, is excessively buoyant and frequently prevents the unit heater fan from delivering the heated air to the occupancy level of the building. By recycling the heat which builds up at these higher levels, the two-thermostat control arrangement contributes to increased comfort and lower heating costs.

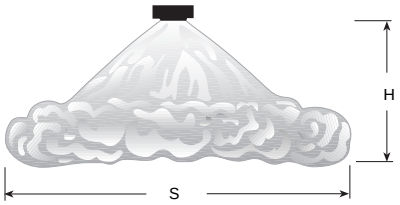
Mounting Height and Heat Throw

Height at which unit heaters are installed is critical. Maximum mounting heights for all units are listed in Tables 8, 9, 10, 11 and 12. Maximum mounting heights for vertical models are given for units with or without optional air deflectors. The data in Tables 8, 9, 10, 11, and 12 is based on operating conditions of 2 lbs. steam or 220°F. entering water with 60°F. entering air. When operating conditions are other than those above, refer to Table 13 for maximum mounting height correction factor. To obtain the maximum mounting height at actual operating conditions, multiply the appropriate factor from Table 13 by the mounting height in Tables 8, 9, 10, 11 or 12. The mounting heights must be followed closely to assure maximum comfort.

Table 8. Vertical Delivery Unit Heater (UD without deflector)

Maximum mounting height and corresponding heat throw data based on unit heaters operating under standard conditions—2 lbs. steam, 60° entering air. Maximum mounting heights will be reduced as entering air temperatures exceed 60°F.

Motor Number	Motor RPM	Standard	
		H (Max.)	S
UD-42	1050	11	17
UD-59	1050	14	21
UD-78	1050	15	23
UD-95	1050	15	23
UD-139	1075	18	27
UD-161	1075	20	30
UD-193	1075	22	33
UD-212	1075	22	33
UD-247	1075	26	39
UD-279	1075	30	45
UD-333	1140	30	45

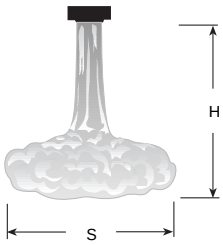


Model UD (without deflector)

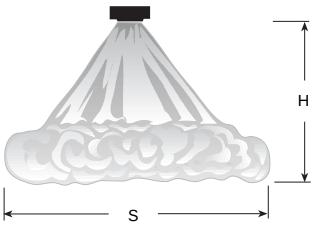
Table 9. Vertical Delivery Unit Heater (UD with cone-jet)

Motor Number	Motor RPM	Standard			
		Vertical*		at 45° *	
		H (Max.)	S	H (Max.)	S
UD-42	1050	15	11	8	19
UD-59	1050	19	14	10	25
UD-78	1050	20	15	11	26
UD-95	1050	20	15	11	26
UD-139	1075	24	18	13	32
UD-161	1075	27	20	14	35
UD-193	1075	30	22	15	39
UD-212	1075	30	22	15	39
UD-247	1075	34	26	18	46
UD-279	1075	37	30	21	53
UD-333	1140	37	30	21	53

* Indicates pitch of adjustable louvers

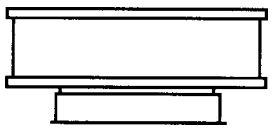


Vertical



45°

Model UD (with cone-jet)



Note:

Maximum mounting heights and corresponding heat throws shown in table 9 are based on operation at standard conditions (2 lbs. steam or 220°F water with 60°F entering air) with horizontal louvers opened approximately 30° from the vertical plane. When horizontal units are mounted below the maximum mounting height, and the horizontal deflector blades are repositioned, the resultant heat throw can be increased as shown above. The extent to which the heat throw can be increased at lower mounting heights depends on the actual operating conditions, mounting height and the positioning of the horizontal deflector blades. Maximum mounting height and heat throw will be reduced as entering air temperatures exceed 60°F. The maximum mounting height (H max.) for all units is that height above which the unit heater will not deliver heated air to the floor at standard rating conditions.

Table 10. Vertical Delivery Unit Heater (UD with trucone)

Motor Number	Motor RPM	Standard	
		H (Max.)	S
UD-42	1050	8	19
UD-59	1050	9	25
UD-78	1050	11	26
UD-95	1050	11	26
UD-139	1075	13	32
UD-161	1075	14	35
UD-193	1075	16	39
UD-212	1075	16	39
UD-247	1075	17	46
UD-279	1075	18	53
UD-333	1140	17	53

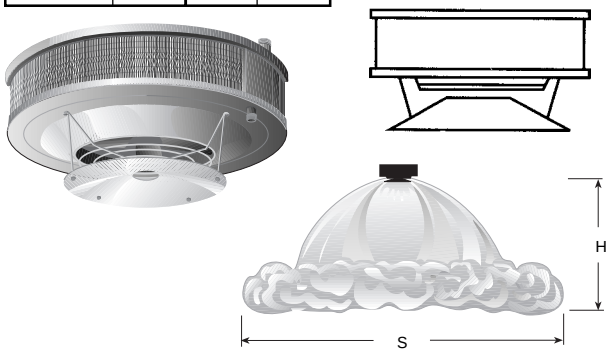


Table 11. Vertical Delivery Unit Heater (UD with louvers)

Motor Number	Motor RPM	Standard			
		Vertical*		at 45°	
		H (Max.)	T	H (Max.)	T
UD-42	1050	13	11	8	22
UD-59	1050	16	14	10	28
UD-78	1050	17	15	11	30
UD-95	1050	17	15	11	30
UD-139	1075	21	18	13	36
UD-161	1075	23	20	14	40
UD-193	1075	25	22	15	44
UD-212	1075	25	22	15	44
UD-247	1075	30	26	18	52
UD-279	1075	35	30	21	60
UD-333	1140	35	30	21	60

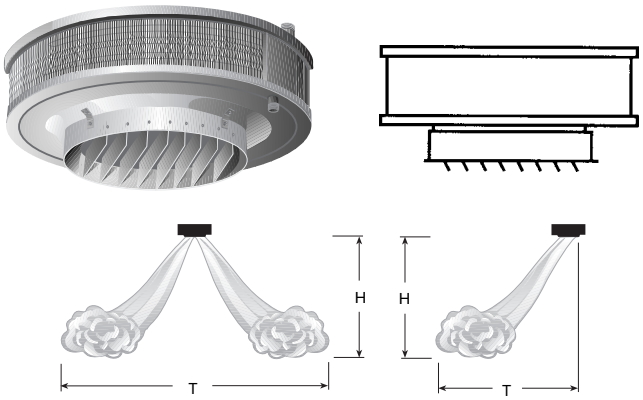


Table 12. Horizontal Delivery Unit Heater (UH)

Model Number	Standard Models			
	H_M (Max.) Mounting Height	T Heat Throw @ H_M	H_L Lower Mounting Height	T_L Heat Throw @ H_L
UH-18	8	17	–	–
UH-24	9	18	–	–
UH-33	10	21	–	–
UH-47	12	28	–	–
UH-63	14	29	8	39
UH-86	15	31	10	43
UH-108	17	31	10	43
UH-121	16	25	10	38
UH-165	19	40	10	56
UH-193	18	38	10	53
UH-258	19	44	12	60
UH-290	20	46	12	60
UH-340	20	46	12	56

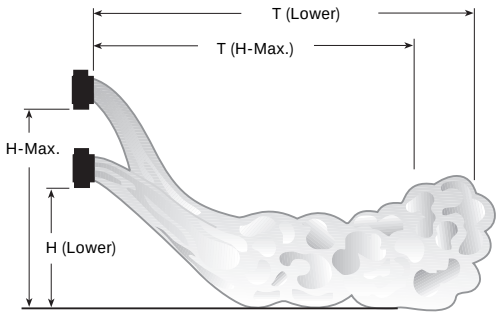
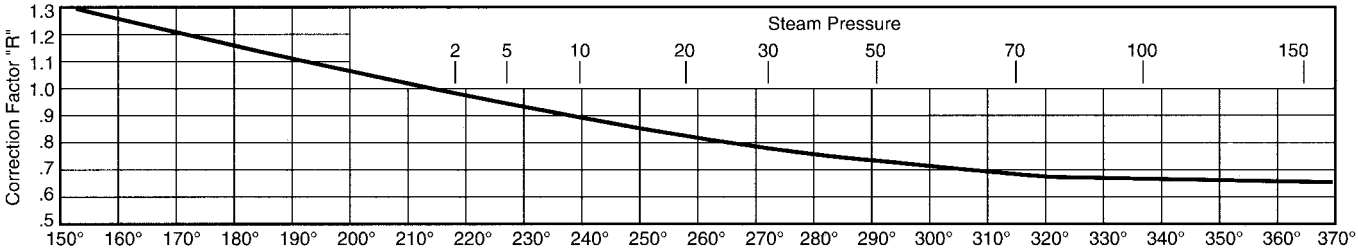


Table 13. Maximum Mounting Height Correction Factors

These correction factors are to be used as multipliers to correct the maximum recommended mounting heights "H," heat throw "T" or spread "S" of unit heaters when operated with steam pressure other than 2 pounds or with water at other than average temperature of 220°F.



Steam Unit Heater Selection Data

In using these conversion factors, it will be necessary to refer to the direct reading tables of standard operating conditions on page 18.

Table 14. Steam Heating Capacity Conversion Factors

To determine the heating capacity (Btu/Hr.) of a unit heater at any steam pressure and entering air temperature, multiply the rated capacity (2 lbs. steam, 60°F entering air) on page 14, by the factor from this table.

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

Example 1. How To Use Conversion Factors

Determine the capacity (Btu/hr.) final air temperature, and condensate (lbs./hr.) of an UH-165 at 15 lbs. steam and 50°F entering air.
Capacity conversion factor from table 14 = 1.28. Standard rated capacity of UH-165 from page 14 = 165,000 Btu/hr.
Corrected capacity of UH-165 (165,000 x 1.28 = 211,200 Btu/hr.)
Air temperature rise conversion factor from table 9 = 1.24
Air temperature rise of UH-165 from page 13 = 106°F—60°F = 46°F
Corrected air temperature rise of UH-165 (46°F x 1.24 = 57 F)
Final air temperature of UH-165 at 15 lbs steam and 50°F entering air, 50°F + 57°F = 107°F final air temperature

$$\text{Condensate (lbs./hr.)} = \frac{\text{Btu/hr. (corrected)}}{\text{h (Btu/lb.)}}$$

$$= \frac{211{,}200 \text{ Btu/hr.}}{945.5}$$

$$\text{Condensate} = 223.4 \text{ lbs./hr.}$$

h = latent heat (Btu/lb.) from table 16. Refer to table 13 for mounting height correction.

Table 15. Air Temperature Rise Conversion Factors

To determine the air temperature rise of a unit heater at any steam pressure and entering air temperature, subtract 60°F from the final air temperature on page 14. Multiply the resultant air temperature rise by the factor from this table. Add the result to the actual entering air temperature to determine the new final air temperature.

Unit Heater Type	Steam Press.	Temperature of Entering Air °F											
	Psig	-10°	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°
Horizontal Delivery	0	1.33	1.28	1.24	1.17	1.12	1.07	1.01	.96	.896	.841	.782	.721
	2	1.38	1.33	1.27	1.22	1.17	1.11	1.06	1.00	.937	.882	.825	.764
	5	1.43	1.38	1.33	1.27	1.21	1.16	1.11	1.05	.998	.934	.877	.818
	10	1.50	1.45	1.40	1.35	1.29	1.24	1.19	1.13	1.07	1.02	.951	.903
	15	1.56	1.51	1.46	1.42	1.36	1.31	1.24	1.19	1.14	1.08	1.02	.969
	20	1.56	1.51	1.52	1.46	1.41	1.36	1.30	1.25	1.19	1.14	1.08	1.02
	30	1.70	1.65	1.61	1.55	1.51	1.46	1.40	1.35	1.29	1.24	1.18	1.12
	40	1.78	1.73	1.68	1.62	1.58	1.54	1.48	1.43	1.38	1.32	1.26	1.21
	50	1.84	1.79	1.74	1.69	1.65	1.60	1.55	1.50	1.45	1.39	1.33	1.28
	60	1.91	1.86	1.81	1.75	1.71	1.66	1.61	1.56	1.50	1.45	1.40	1.33
	70	1.95	1.91	1.86	1.81	1.76	1.71	1.66	1.61	1.56	1.51	1.45	1.39
	75	1.97	1.93	1.89	1.84	1.79	1.74	1.69	1.64	1.58	1.53	1.47	1.42
	80	2.00	1.95	1.91	1.86	1.82	1.76	1.72	1.66	1.61	1.56	1.49	1.44
	90	2.04	2.00	1.95	1.90	1.86	1.81	1.75	1.70	1.65	1.60	1.54	1.49
	100	2 08	2.04	1.99	1.95	1.89	1.85	1.79	1.75	1.69	1.64	1.59	1.53
	125	2 17	2.13	2.09	2.04	1.99	1.94	1.89	1.84	1.79	1.74	1.68	1.63
	150	2.25	2.21	2.17	2.12	2.07	2.03	1.98	1.93	1.87	1.83	1.77	1.71
Vertical Delivery	0	1.36	1.31	1.25	1.19	1.13	1.08	1.02	.96	.90	.84	.78	.72
	2	1.41	1.35	1.29	1.24	1.18	1.12	1.06	1.00	94	.88	.82	.76
	5	1.46	1.40	1.35	1.29	1.23	1.17	1.12	1.06	1.00	.94	.88	.82
	10	1.54	1.48	1.43	1.37	1.31	1.25	1.20	1.14	1.08	1.02	.96	.89
	15	1.61	1.55	1.49	1.44	1.38	1.32	1.26	1.20	1.14	1.09	1.02	.97
	20	1.67	1.61	1.55	1.50	1.44	1.38	1.32	1.26	1.20	1.15	1.08	1.02
	30	1.77	1.71	1.65	1.60	1.54	1.48	1.42	1.36	1.30	1.25	1.18	1.12
	40	1.85	1.79	1.74	1.68	1.62	1.56	1.51	1.45	1.39	1.33	1.27	1.21
	50	1.92	1.86	1.81	1.75	1.69	1.64	1.58	1.52	1.46	1.40	1.34	1.28
	60	1.99	1.93	1.88	1.82	1.76	1.70	1.65	1.58	1.53	1.47	1.41	1.35
	70	2.05	1.99	1.94	1.88	1.82	1.76	1.70	1.65	1.59	1.53	1.47	1.41
	75	2 08	2.02	1.96	1.91	1.85	1.79	1.73	1.67	1.62	1.56	1.50	1.43
	80	2 10	2.04	1.99	1.93	1.87	1.81	1.75	1.70	1.64	1.58	1.52	1.46
	90	2.15	2.09	2.04	1.00	1.92	1.86	1.80	1.74	1.69	1.63	1.57	1.51
	100	2.19	2.14	2.08	2.02	1.97	1.91	1.85	1.79	1.73	1.67	1.61	1.55
	125	2.29	2.24	2.18	2.12	2.07	2.01	1.95	1.89	1.83	1.77	1.71	1.65
	150	2.39	2.33	2.27	2.22	2.16	2.10	2.04	1.99	1.93	1.87	1.81	1.75

Table 16. Properties Of Steam

Gauge Pressure Lbs. per Sq. in.	Temp. Degrees F.	Latent Heat Btu per Lb. (h)	Gauge Pressure Lbs. per Sq. in.	Temp. Degrees F.	Latent Heat Btu per Lb. (h)	Gauge Pressure Lbs. per Sq. in.	Temp. Degrees F.	Latent Heat Btu per Lb. (h)	Gauge Pressure Lbs. per Sq. in.	Temp. Degrees F.	Latent Heat Btu per Lb. (h)
0	212.0	970.3	32	276.8	926.6	66	312.6	899.9	**100**	337.9	880.0
2	218.5	966.2	34	279.4	924.7	68	314.4	898.6	103	339.8	878.8
4	224.4	962.4	36	281.9	922.9	**70**	316.0	897.3	106	341.7	876.9
5	227.2	960.6	38	284.3	921.1	72	317.7	896.0	109	343.6	875.4
6	229.8	958.8	**40**	286.7	919.3	74	319.3	894.8	112	345.4	873.9
8	234.8	955.6	42	289.0	917.6	76	320.9	893.5	115	347.2	872.5
10	239.4	952.5	44	291.3	915.9	78	322.4	892.3	118	348.9	871.0
12	243.7	949.6	46	293.5	914.3	**80**	323.9	891.1	121	350.7	869.6
14	247.8	946.8	48	295.6	912.7	82	325.4	889.9	124	352.4	868.2
16	251.6	944.2	**50**	297.7	911.2	84	326.9	888.8	**125**	352.9	867.8
18	255.3	941.7	52	299.7	909.7	86	328.4	887.6	127	354.0	866.9
20	258.8	939.3	54	301.7	908.2	88	329.8	886.5	130	355.7	865.5
22	262.1	936.9	56	303.6	906.7	**90**	331.2	885.4	133	357.3	864.1
24	265.3	934.7	58	305.5	905.3	92	332.5	884.3	136	358.9	862.9
26	268.3	932.5	**60**	307.3	903.9	94	333.9	883.2	139	360.4	861.5
28	271.3	930.5	62	309.1	902.5	96	335.2	882.1	142	362.0	860.3
30	274.1	928.5	64	310.9	901.2	98	336.6	881.1	145	363.5	859.0
–	–	–	–	–	–	–	–	–	**150**	365.9	856.9

Steam Performance Data

Standard Models at Standard Conditions
2 Lbs. Steam / 60° Entering Air

Table 17. High Motor Speeds

Type	Model No.	Btu./hr.	Sq. Ft. Edr.	Sound Class	Max. Mounting Height (ft.)	Air Data							Motor Data	
						*Heat Throw or Spread @ Max. Height	Lower Mounting Height (ft.)	Heat Throw @ Lower Mntg. Height	†Cfm.	Outlet Velocity (Fpm.)	Final Air Temp. (°F)	Conden-sate Lbs./hr.	** Hp	Approx. Rpm.
Horizontal Delivery	UH-18	18,000	75	II	8	17	–	–	340	625	107	18	16MHP	1550
	UH-24	24,000	100	II	9	18	–	–	370	695	119	25	1/25	1550
	UH-33	33,000	138	II	10	21	–	–	630	690	108	35	1/25	1550
	UH-47	47,000	196	III	12	28	8	33	730	810	119	49	1/12	1550
	UH-63	63,000	263	II	14	29	8	39	1,120	690	111	66	1/12	1550
	UH-86	86,000	358	III	15	31	10	43	1,340	835	118	89	1/8	1625
	UH-108	108,000	450	III	17	31	10	43	2,010	790	109	111	1/8	1625
	UH-121	121,000	504	III	16	25	10	38	1,775	715	122	126	1/6	1075
	UH-165	165,000	688	IV	19	40	10	56	3,240	880	106	170	1/3	1075
	UH-193	193,000	804	IV	18	38	10	53	2,900	810	121	200	1/3	1075
	UH-258	258,000	1075	V	19	44	12	60	4,560	750	111	267	1/2	1075
	UH-290	290,000	1208	V	20	46	12	60	4,590	765	117	300	1/2	1075
	UH-340	340,000	1417	V	20	46	12	56	5,130	735	120	352	1/2	1075
Vertical Delivery	UD-42	42,000	175	II	15	11	–	–	950	825	103	43	1/30	1050
	UD-59	59,000	246	II	19	14	–	–	1,155	1005	111	61	1/30	1050
	UD-78	78,000	325	II	20	15	–	–	1,590	1065	109	81	1/15	1050
	UD-95	95,000	396	II	20	15	–	–	1,665	1120	118	99	1/15	1050
	UD-139	139,000	579	III	24	18	–	–	2,660	1285	112	144	1/6	1075
	UD-161	161,000	671	IV	27	20	–	–	3,200	1420	115	167	1/3	1075
	UD-193	193,000	804	IV	30	22	–	–	3,500	1690	116	200	1/3	1075
	UD-212	212,000	883	IV	30	22	–	–	3,610	1740	120	219	1/3	1075
	UD-247	247,000	1029	V	34	26	–	–	4,820	1910	111	256	1/2	1075
	UD-279	279,000	1163	V	37	30	–	–	5,460	2165	111	288	1/2	1075
	UD-333	333,000	1388	V	37	30	–	–	5,980	2165	116	345	3/4	1140

Table 18. Reduced Motor Speeds (Requires Solid State Motor Speed Controller)

Type	Model No.	Btu./hr.	Sq. Ft. Edr.	Sound Class	*Max. Mounting Height (ft.) ▲	Air Data					Motor Data	
						*Heat Throw or Spread @ Max. Height	†Cfm.	Outlet Velocity (Fpm.)	Final Air Temp. (°F)	Conden-sate Lbs./hr.	** Hp	Approx. Rpm.
Horizontal Delivery	UH-18	14,000	58	II	8	10	220	415	118	14	16MHP	1000
	UH-24	18,000	75	II	9	11	230	440	131	18	1/25	1000
	UH-33	25,000	104	II	10	13	395	440	118	26	1/25	1000
	UH-47	38,000	158	III	12	17	450	515	137	36	1/12	1000
	UH-63	47,000	195	II	14	17	685	430	122	49	1/12	1000
	UH-86	64,000	265	III	15	19	825	525	131	66	1/8	1000
	UH-108	81,000	340	III	17	19	1,255	500	119	84	1/8	1000

* Horizontal units with horizontal louvers opened 30° from the vertical plane.
Vertical types equipped with cone jet deflector, blades in full open position.

** For most popular motor used on these models.

† Cfm for horizontal types is entering Cfm.
Cfm for vertical types is leaving Cfm.

▲ High motor speed.

In using these formula and conversion factors, it will be necessary to refer to the direct reading tables of standard operating conditions on page 18 or the standard hot water performance curves.

Example 1:

Determine the capacity (Btu /hr.), Gpm, water temperature drop and final air temperature of an UH-86 at 240° F entering water temperature and 70° F entering air temperature. Refer to page 18, standard operating conditions.
Capacity of an UH-86 at standard conditions (200°F water, 60°F air) is 63,000 Btu/hr at 6.3 Gpm.
Conversion factor for actual operating conditions from table 20 = 1.201.
Calculate actual Btu/hr. of UH-86 at actual operating conditions of 240°F water at 6.3 Gpm, 70°F air.

Btu_0 = 63,000 x 1.201

Btu_0 = 75,663 Btu/hr. @ 6.3 Gpm

Calculate required Gpm.

G_0 = must remain at 6.3 since the standard conditions were based on this flow rate.

Calculate water temperature drop at operating conditions. (Formula 3)

$$D_0 = \frac{Btu_0}{500 \times G_0}$$

$$D_0 = \frac{75{,}663}{480 \times 6.3}$$

D_0 = 25° F water temperature drop.

Calculate final air temperature at operating conditions. (formula 1)

$$F_0 = E_0 + \left[\frac{(460 + E_0)}{576} \times \frac{Btu_0}{Cfm_0}\right]$$

$$F_0 = 70 + \left[\frac{460 + 70}{576} \times \frac{75{,}663}{1{,}340}\right]$$

F_0 = 70 + 52

F_0 = 122° F final air temperature

Refer to table 19 (below) for maximum mounting height correction. At 240°F the correction factor is (.9). Multiply maximum mounting height of UH-86 from page 18 by (.9).

Example 2:

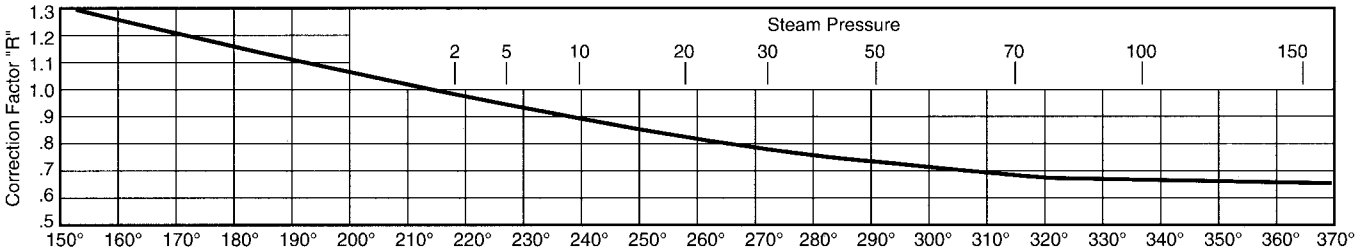
Select a vertical type unit heater that will deliver 150,000 Btu/hr. with 160° F entering water and 60°F entering air.
Determine required Gpm, resultant water temperature drop and final air temperature.
Conversion factor for actual operating conditions from table 20 = 0.714.
Divide 150,000 Btu/hr. by 0.714 to obtain performance at standard conditions. (200°F water, 60°F air)

$$\frac{150{,}000 \text{ Btu/hr.}}{0.714} = 210{,}000 \text{ Btu/hr. (standard conditions)}$$

Example 2: *(continued on page 16)*

Table 19. Maximum Mounting Height Correction Factors

These correction factors are to be used as multipliers to correct the maximum recommended mounting heights "H," heat throw "T" or spread "S" of unit heaters when operated with steam pressure other than 2 pounds or with water at other than average temperature of 220°F.



Example 2: *(continued)*

Refer to standard operating conditions – table 23, page 18.
A UD-279 delivers 210,000 Btu/hr. (standard conditions)
At 21.0 Gpm.
Actual capacity (Btu_0) of UD-279 at 160°F EWT and 60°F EAT is 210,000 Btu/hr. x 0.714 = 150,000 Btu/hr. @ 21 Gpm (G_0). Final air temperature and water temperature drop can be calculated using formulas 2 and 3. Refer to table 19 on previous page for maximum mounting height correction.
Note: Refer to hot water performance curve for UD-333, page 23. Note that a UD-333 could have been selected to deliver the 210,000 Btu/hr. at standard conditions at about 11 Gpm. A new water temperature drop and final air temperature could be calculated for the UD-333.

Example 3:

Select a horizontal type unit heater that will deliver 80,000 Btu/hr. with 140° F water at 10 Gpm and 70° F entering air. Determine water temperature drop and final air temperature. Conversion factor for actual operating conditions from table 20 = 0.494. Divide 80,000 Btu/hr. by 0.494 to obtain performance at standard conditions. (200°F water, 60°F air)

$$\frac{80{,}000 \text{ Btu/hr.}}{0.494} = 161{,}943 \text{ Btu/hr. (standard conditions)}$$

Enter standard hot water performance curves for UH units and locate the first horizontal unit that will deliver 161,943 Btu/hr. (standard conditions) at 10 Gpm.
A UH-258 will deliver 170,000 Btu/hr. at 10 Gpm (standard conditions).
Calculate Btu/hr. of UH-258 at actual operating conditions of 140°F water, at 10 Gpm, 70°F air.
Btu_0 = 170,000 x 0.494
Btu_0 = 83,980 Btu/hr. Calculate water temperature drop at operating conditions (Formula 3).

$$D_0 = \frac{Btu_0}{480 \times G_0}$$

$$D_0 = \frac{83{,}980}{480 \times 10}$$

D_0 = 18°F Water Temperature Drop.

Calculate final air temperature at operating conditions (Formula 1).

$$F_0 = E_0 + \left[\frac{(460 + E_0)}{576} \times \frac{Btu_0}{Cfm_0}\right]$$

$$F_0 = 70 + \left[\frac{460 + 70}{576} \times \frac{83{,}980}{4{,}560}\right]$$

$F_0 = 70 + 17$

F_0 = 87°F Final Air Temperature.

Refer to table 19, page 15 for maximum mounting height correction.

Identification of Symbols

E = Entering Air Temperature (°F)
F = Final Air Temperature (°F)
D = Water Temperature Drop (°F)
G = Gallons Per Minute (Gpm)

Subscript

$_0$ = Actual Operating Conditions.

Formulas

1. $F_0 = E_0 + \left[\frac{(460 + E_0)}{576} \times \frac{Btu_0}{Cfm_0}\right]$ UH Units

2. $F_0 = E_0 + \left[\frac{(460 + E_0)}{\left(\frac{576 \times Cfm_0}{(Btu_0)}\right) - 1}\right]$ UD Units

3. $D_0 = \frac{Btu_0}{480 \times G_0}$

Table 20. Hot Water Heating Capacity Conversion Factors

To determine the heating capacity (Btu/hr.) of a unit heater at any entering water temperature and entering air temperature multiply the capacity at 200°F EWT and 60°F EAT by the factor from this table. Note GPM must be identical to that at 200°F EWT and 60°F EAT. Conversion factors in table 20 may be used with standard hot water data obtained from the standard hot water performance curves.

Entering Water Temp. (°F)	Entering Air Temperatures°F										
	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°
60	0.462	0.380	0.300	0.222	0.146	0.072	0	0	0	0	0
70	0.539	0.456	0.375	0.296	0.219	0.145	0.071	0	0	0	0
80	0.615	0.531	0.450	0.370	0.293	0.217	0.143	0.071	0	0	0
90	0.692	0.607	0.524	0.444	0.366	0.289	0.214	0.141	0.070	0	0
100	0.769	0.683	0.599	0.518	0.439	0.361	0.286	0.212	0.140	0.069	0
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	1.462	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	1.692	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	1.214	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 21. Ethylene Glycol Correction Factors

Table 21 lists the correction factors for various percentages of ethylene glycol in water. Use the factors to correct the heating capacity of unit heaters when using an ethylene glycol solution. Follow the normal procedures in determining the heating capacity of a unit heater at any water temperature and entering air temperature, then apply the correction factor from table 21 to determine the corrected heating capacity based on an ethylene glycol solution.

Percent Ethylene Glycol	Average Solution Temperature (°F)			
	100	150	200	250
40	0.855	0.875	0.910	0.925
50	0.820	0.850	0.870	0.900
60	0.770	0.800	0.830	0.850
70	0.725	0.750	0.780	0.825
80	0.680	0.715	0.740	0.770
90	0.630	0.660	0.695	0.725
100	0.586	0.620	0.645	0.680

Table 22. Minimum Water Flow and Water Volume (Gallons)

Type	Model No.	Min. GPM	Coil Volume (Gals.)	Type	Model No.	Min. GPM	Coil Volume (Gals.)
Horizontal Delivery	UH-18	.15	.13	Vertical Delivery	UD-42	.30	.15
	UH-24	.15	.13		UD-59	.45	.23
	UH-33	.20	.41		UD-78	.60	.31
	UH-47	.20	.41		UD-95	.75	.38
	UH-63	.20	.66		UD-139	.60	.43
	UH-86	.20	.66		UD-161	.75	.54
	UH-108	.20	.98		UD-193	.90	.65
	UH-121	.20	.98		UD-212	1.20	.86
	UH-165	.20	1.35		UD-247	1.20	.86
	UH-193	.40	1.45		UD-279	1.35	.97
	UH-258	.40	2.2		UD-333	1.35	1.24
	UH-290	.40	2.2				
	UH-340	.40	2.5				

Hot Water Performance Data

Standard Models at Standard Conditions

200 °F Entering Water 60°F Entering Air
20°F Water Temperature Drop

Table 23. High Motor Speeds

Type	Model No.	Btu./hr.	GPM	Pressure Drop (Ft. of Water)	Sound Class	Air Data							Motor Data	
						*Max. Mounting Height (Ft.)	Heat Throw or Spread @ Max. Height	Lower Mntg. Height (Ft.)	Heat Throw @ Lower Mounting Height	†Cfm	Outlet Velocity (Fpm.)	Final Air Temp (°F)	** Hp	Approx. Rpm.
Horizontal Delivery	UH-18	12,800	1.3	0.5	II	9	18	–	–	340	615	93	16MHP	1550
	UH-24	15,700	1.6	0.8	II	10	19	–	–	370	675	101	1/25	1550
	UH-33	24,500	2.5	0.2	II	11	23	–	–	630	675	91	1/25	1550
	UH-47	29,000	2.9	0.3	III	13	30	8	36	730	785	98	1/12	1550
	UH-63	47,000	4.7	0.8	II	15	31	8	42	1,120	680	96	1/12	1550
	UH-86	63,000	6.3	1.4	III	16	33	10	46	1,340	820	102	1/8	1625
	UH-108	81,000	8.1	3.2	III	18	33	10	46	2,010	775	96	1/8	1625
	UH-121	90,000	9.0	4.0	III	17	27	10	41	1,775	700	107	1/6	1075
	UH-165	133,000	13.5	7.9	IV	20	43	10	60	3,240	870	97	1/3	1075
	UH-193	139,000	14.0	2.0	IV	19	41	10	57	2,900	790	105	1/3	1075
	UH-258	198,000	20.0	5.0	V	20	47	12	65	4,560	740	100	1/2	1075
	UH-290	224,000	22.0	5.8	V	22	50	12	65	4,590	750	108	1/2	1075
	UH-340	273,000	27.0	11.0	V	22	50	12	60	5,130	720	108	1/2	1075
Vertical Delivery	UD-42	30,000	3.0	0.6	II	16	12	–	–	950	825	90	1/30	1050
	UD-59	43,000	4.3	0.6	II	20	15	–	–	1,155	1005	96	1/30	1050
	UD-78	57,000	5.7	0.6	II	22	16	–	–	1,590	1065	95	1/15	1050
	UD-95	68,000	6.8	0.5	II	22	16	–	–	1,665	1120	100	1/15	1050
	UD-139	105,000	10.5	2.4	III	26	19	–	–	2,660	1285	98	1/6	1075
	UD-161	123,000	12.5	2.2	IV	29	22	–	–	3,200	1420	101	1/3	1075
	UD-193	140,000	14.0	1.8	IV	32	24	–	–	3,500	1690	99	1/3	1075
	UD-212	156,000	15.5	1.4	IV	32	24	–	–	3,610	1740	102	1/3	1075
	UD-247	184,000	18.5	1.9	V	37	28	–	–	4,820	1910	97	1/2	1075
	UD-279	210,000	21.0	2.0	V	40	32	–	–	5,460	2165	97	1/2	1075
	UD-333	257,000	26.0	3.8	V	40	32	–	–	5,980	2165	102	3/4	1140

Table 24. Reduced Motor Speeds *(Requires Solid State Motor Speed Controller)*

Type	Model No.	Btu./hr.	GPM	Pressure Drop (Ft. of Water)	Sound Class	Air Data					Motor Data	
						*Max. Mounting Height (ft.) ▲	Heat Throw or Spread (ft.)	†Cfm.	Outlet Velocity (Fpm.)	Final Air Temp (°F)	** Hp	Approx. Rpm.
Horizontal Delivery	UH-18	9,800	1.3	0.5	II	9	11	220	400	100	16MHP	1000
	UH-24	12,000	1.6	0.8	II	10	12	230	425	105	1/25	1000
	UH-33	19,000	2.5	0.2	II	11	14	395	430	105	1/25	1000
	UH-47	22,000	2.9	0.3	III	13	18	450	490	105	1/12	1000
	UH-63	36,000	4.7	0.8	II	15	18	685	420	105	1/12	1000
	UH-86	48,000	6.3	1.4	III	16	20	825	515	115	1/8	1000
	UH-108	62,000	8.1	3.2	III	18	20	1,255	490	105	1/8	1000

* Horizontal units with horizontal louvers opened 30° from the vertical plane.
Vertical types equipped with cone jet deflector, blades in full open position.

** For most popular motor used on these models.

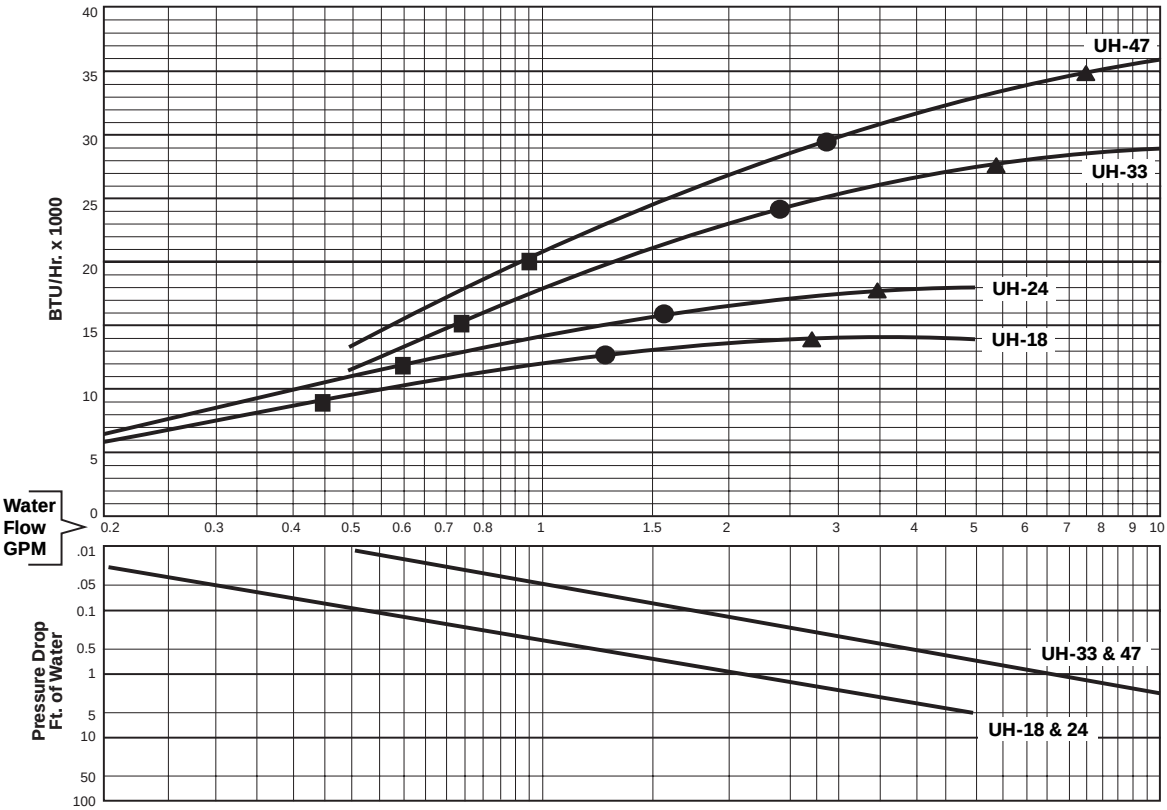
† Cfm for horizontal types is entering Cfm.
Cfm for vertical types is leaving Cfm.

▲ High motor speed.

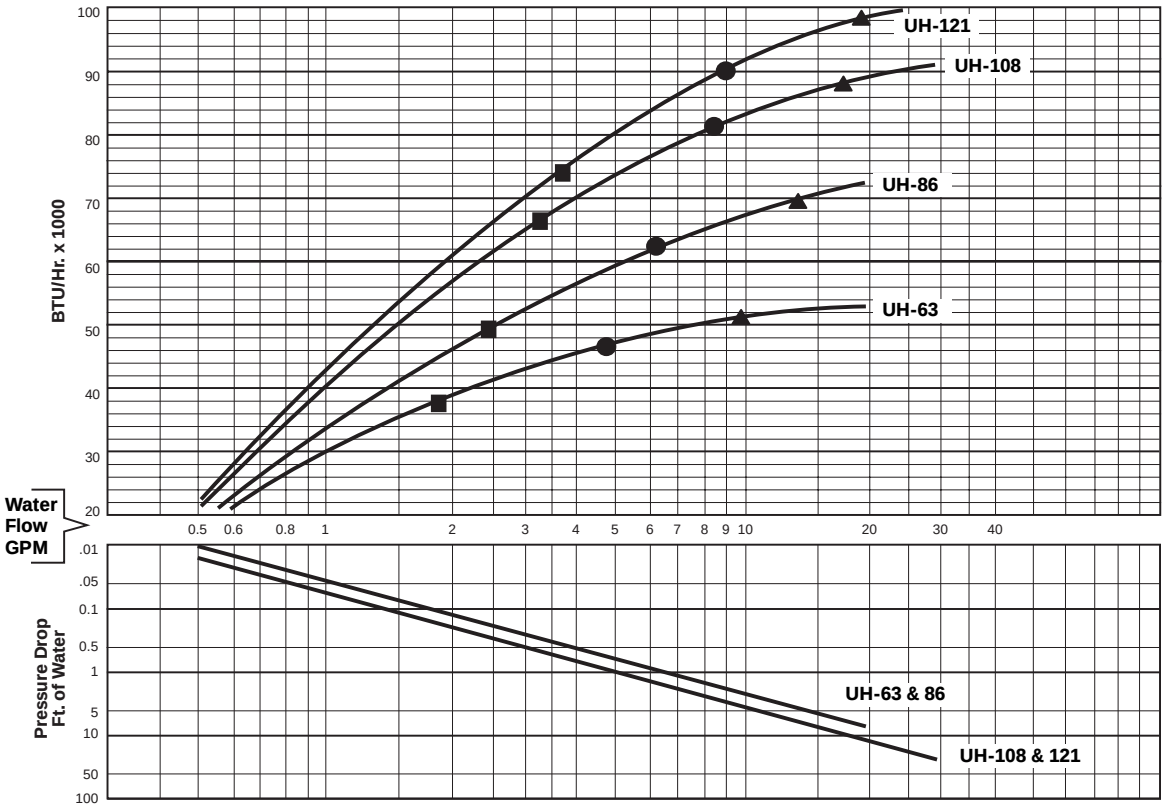
Hot Water Performance Curves

200°F Entering Water Temperature/60°F Entering Air Temperature

Standard Models
UH-18, UH-24, UH-33, UH-47



Standard Models
UH-63, UH-86, UH-108, UH-121

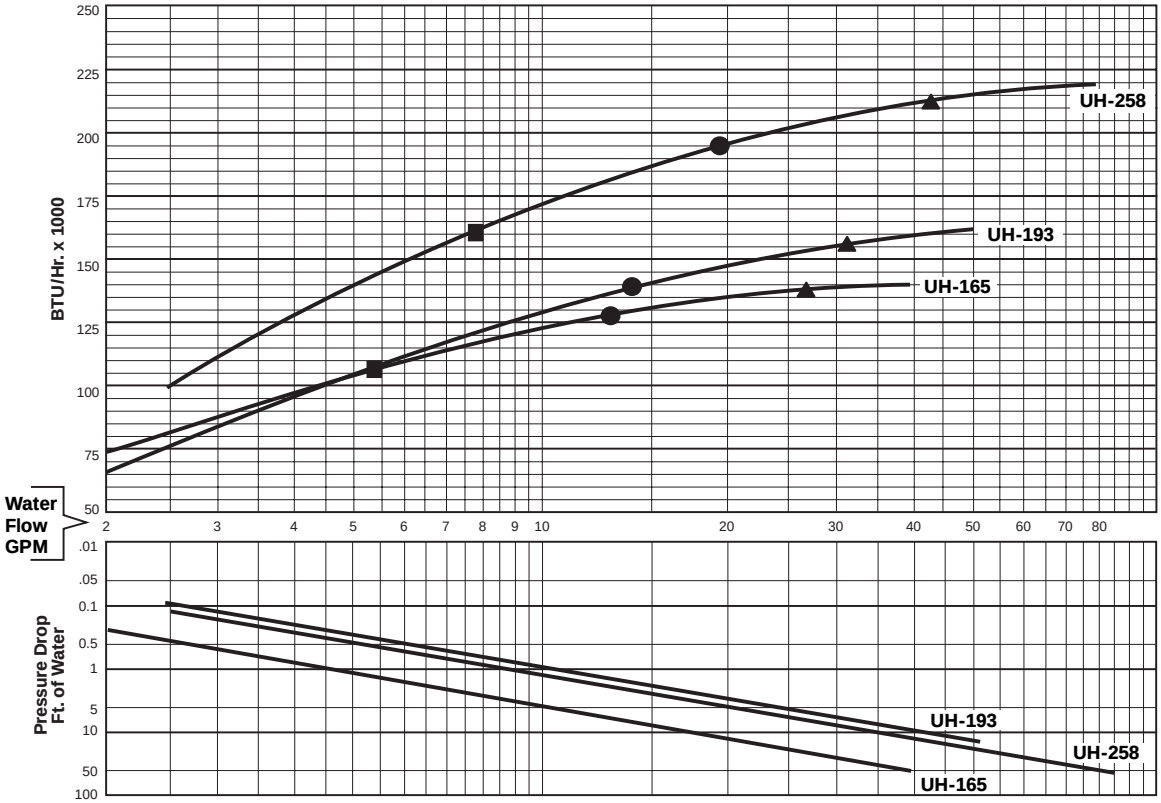


● Indicates point of 20°F water temperature drop ▲ Indicates point of 10°F water temperature drop ■ Indicates point of 40°F water temperature drop

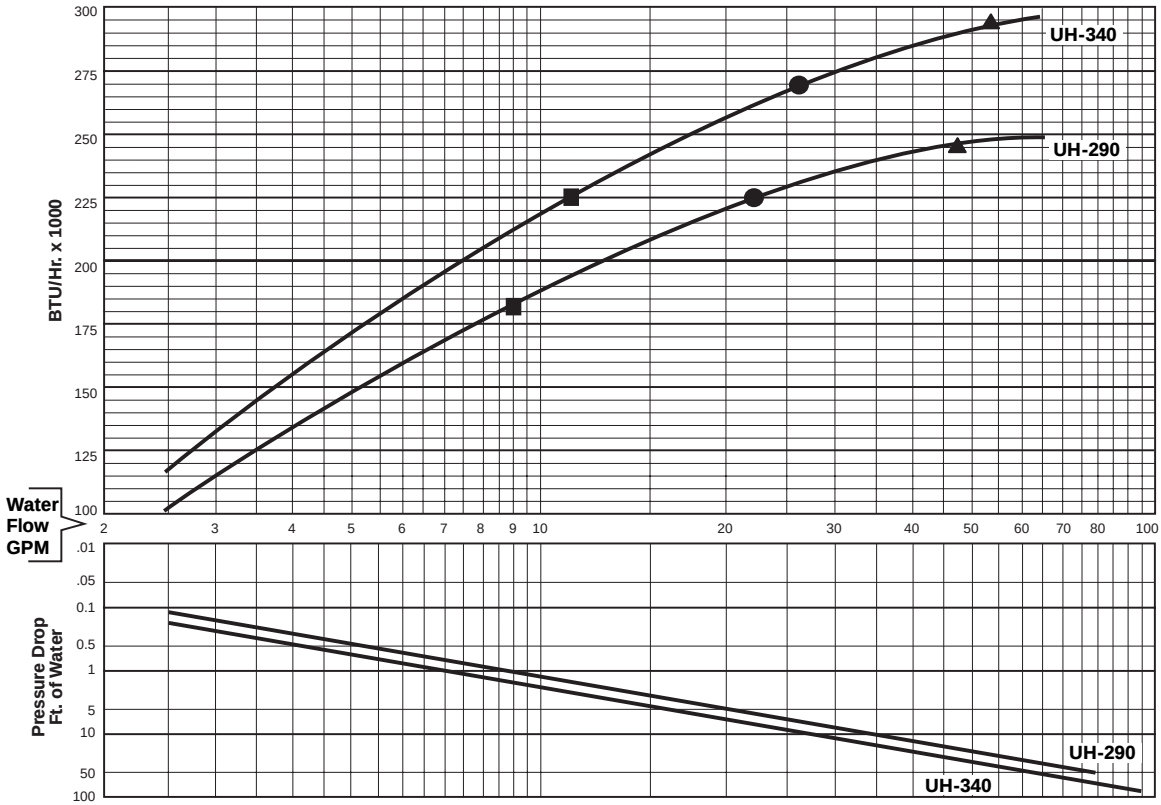
Hot Water Performance Curves

200°F Entering Water Temperature/60°F Entering Air Temperature

Standard Models UH-165, UH-193, UH-258



Standard Models UH-290, UH-340

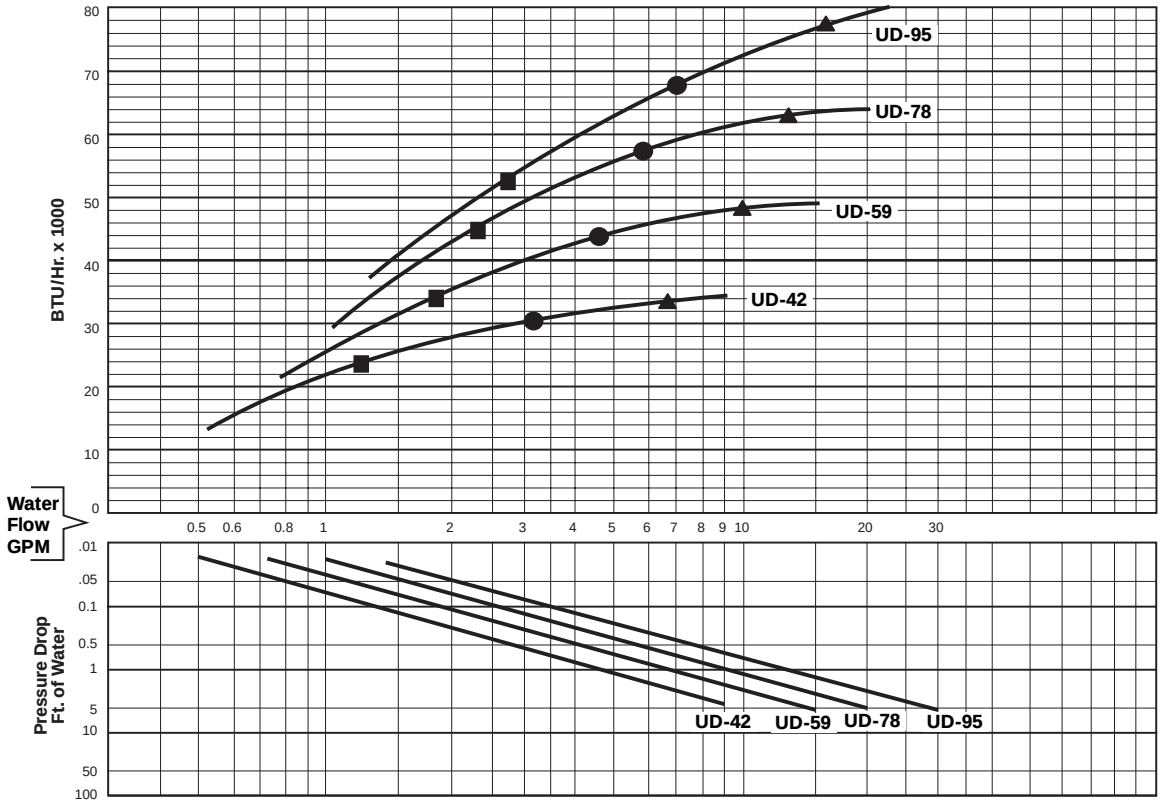


● Indicates point of 20°F water temperature drop ▲ Indicates point of 10°F water temperature drop ■ Indicates point of 40°F water temperature drop

Hot Water Performance Curves

200°F Entering Water Temperature/60°F Entering Air Temperature

Standard Models
UD-42, UD-59, UD-78, UD-95

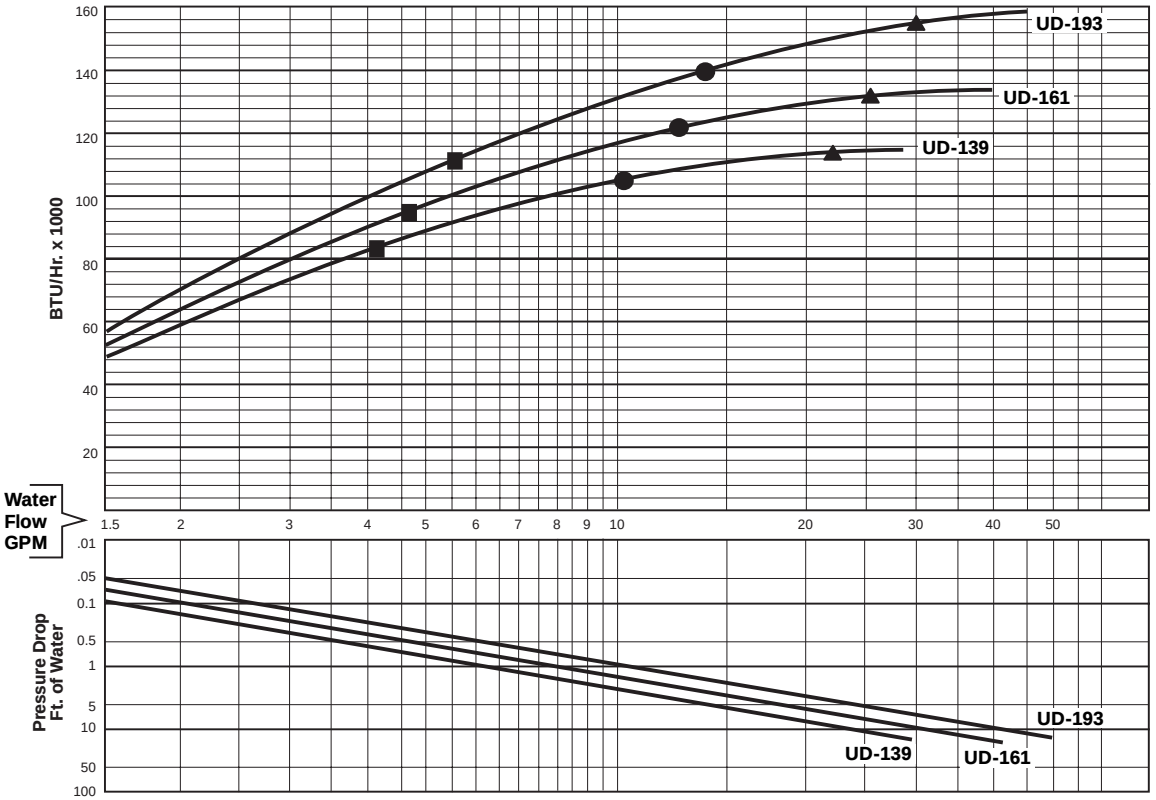


● Indicates point of 20°F water temperature drop ▲ Indicates point of 10°F water temperature drop ■ Indicates point of 40°F water temperature drop

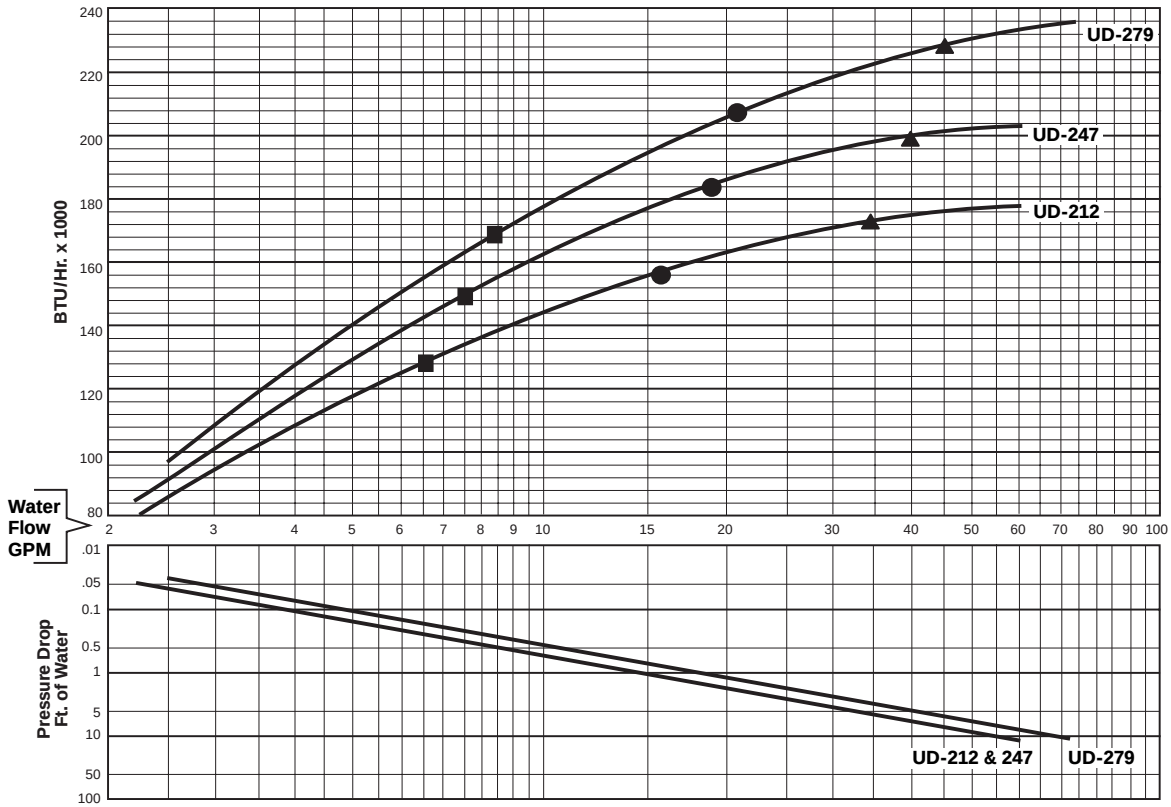
Hot Water Performance Curves

200°F Entering Water Temperature/60°F Entering Air Temperature

Standard Models
UD-139, UD-161, UD-193



Standard Models
UD-212, UD-247, UD-279

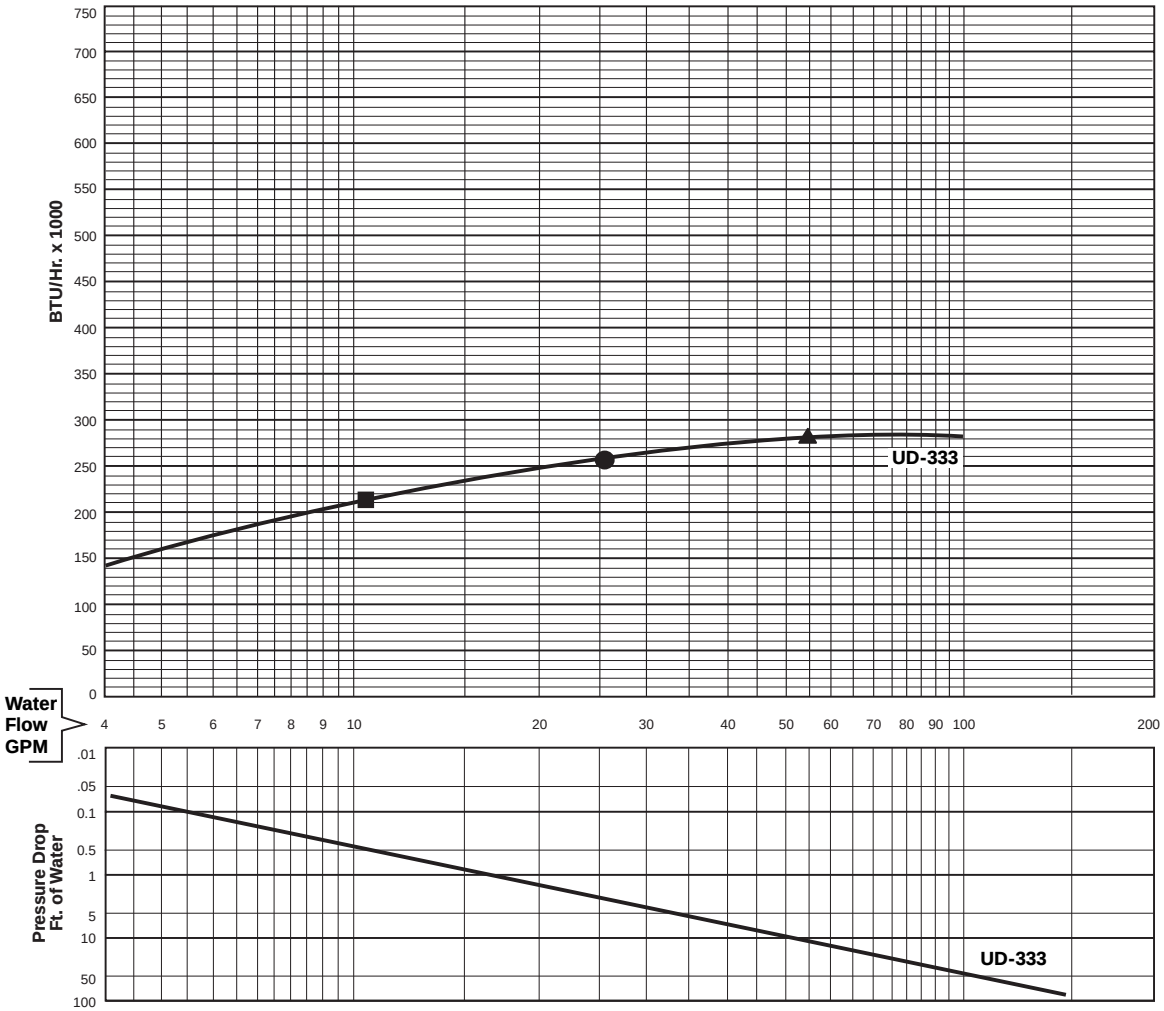


● Indicates point of 20°F water temperature drop ▲ Indicates point of 10°F water temperature drop ■ Indicates point of 40°F water temperature drop

Hot Water Performance Curves

200°F Entering Water Temperature/60°F Entering Air Temperature

Standard Models
UD-333



● Indicates point of 20°F water temperature drop ▲ Indicates point of 10°F water temperature drop ■ Indicates point of 40°F water temperature drop

Motor Data

Motors are produced, rated, and tested by reputable motor manufacturers in accordance with NEMA standards and carry the motor manufacturer's standard warranty. All motors will operate in a 104°F ambient temperature.

Table 25. Motor Characteristics - *Shaded areas indicate standard motors*

Motor Type		Totally enclosed with Thermal overload			Totally enclosed with Thermal overload			Totally enclosed			Totally enclosed			Explosion Proof with Thermal overload			Explosion Proof with Thermal overload		
Power Code		A *			G			B			I			A			I		
Voltage/Hertz/Phase		115/60/1			230/60/1			200/60/3			230/460/60/3			115/60/1			230/460/60/3		
Unit Heater Type	Model	Amps	Hp	Rpm	Amps	Hp	Rpm	Amps	Hp	Rpm	Amps	Hp	Rpm	Amps	H	Rpm	Amps	Hp	Rpm
Horizontal Delivery	UH-18	0.90	16MHP	1550	0.5	25MHP	1550	—	—	—	—	—	—	4.3	1/6	1725	—	—	—
	UH-24	1.6	1/25	1550	1.0	1/8	1725	—	—	—	—	—	—	4.3	1/6	1725	—	—	—
	UH-33	1.6	1/25	1550	1.0	1/8	1725	—	—	—	—	—	—	4.3	1/6	1725	—	—	—
	UH-47	3.0	1/12	1550	1.0	1/8	1725	1.5	1/4	1725	1.4/.7	1/4	1725	4.3	1/6	1725	—	—	—
	UH-63	3.0	1/12	1550	1.0	1/8	1725	1.5	1/4	1725	1.4/ 7	1/4	1725	4.3	1/6	1725	—	—	—
	UH-86	2.3	1/8	1625	1.0	1/8	1725	1.5	1/4	1725	1.4/.7	1/4	1725	4.3	1/6	1725	—	—	—
	UH-108	2.3	1/8	1625	1.0	1/8	1725	1.5	1/4	1725	1.4/.7	1/4	1725	4.3	1/6	1725	—	—	—
	UH-121	2.8	1/6	1075	1.5	1/6	1075	1.9	1/3	1140	2.1/1.05	1/3	1140	4.0	1/6	1140	1.4/0.7	1/3	1140
	UH-165	5.4	1/3	1075	2.5	1/3	1075	1.9	1/3	1140	2.1/1.05	1/3	1140	6.5	1/3	1140	1.4/0.7	1/3	1140
	UH-193	5.4	1/3	1075	2.5	1/3	1075	1.9	1/3	1140	2.1/1.05	1/3	1140	6.5	1/3	1140	1.4/0.7	1/3	1140
	UH-258	6.7	1/2	1075	3.5	1/2	1075	2.6	1/2	1140	3.0/1.5	1/2	1140	9.0	1/2	1140	2.0/1.0	1/2	1140
	UH-290	6.7	1/2	1075	3.5	1/2	1075	2.6	1/2	1140	3.0/1.5	1/2	1140	9.0	1/2	1140	2.0/1.0	1/2	1140
	UH-340	6.7	1/2	1075	3.5	1/2	1075	2.6	1/2	1140	3.0/1.5	1/2	1140	9.0	1/2	1140	2.0/1.0	1/2	1140
Vertical Delivery	UD-42	2.1	1/30	1050	0.6	1/30	1050	1.9	1/3	1140	2.1/1.05	1/3	1140	4.0	1/6	1140	—	—	—
	UD-59	2.1	1/30	1050	0.6	1/30	1050	1.9	1/6	1140	2.1/1.05	1/3	1140	4.0	1/6	1140	—	—	—
	UD-78	2.5	1/15	1050	1.3	1/15	1050	1.9	1/3	1140	2.1/1.05	1/3	1140	4.0	1/6	1140	—	—	—
	UD-95	2.5	1/15	1050	1.3	1/15	1050	1.9	1/3	1140	2.1/1.05	1/3	1140	4.0	1/6	1140	—	—	—
	UD-139	2.8	1/6	1075	1.5	1/6	1075	1.9	1/3	1140	2.1/1.05	1/3	1140	4.0	1/6	1140	1.4/0.7	1/3	1140
	UD-161	5.4	1/3	1075	2.5	1/3	1075	1.9	1/3	1140	2.1/1.05	1/3	1140	6.5	1/3	1140	1.4/0.7	1/3	1140
	UD-193	5.4	1/3	1075	2.5	1/3	1075	1.9	1/3	1140	2.1/1.05	1/3	1140	6.5	1/3	1140	1.4/0.7	1/3	1140
	UD-212	5.4	1/3	1075	2.5	1/3	1075	1.9	1/3	1140	2.1/1.05	1/3	1140	6.5	1/3	1140	1.4/0.7	1/3	1140
	UD-247	6.7	1/2	1075	3.5	1/2	1075	2.6	1/2	1140	3.0/1.5	1/2	1140	9.0	1/2	1140	2.0/1.0	1/2	1140
	UD-279	6.7	1/2	1075	3.5	1/2	1075	2.6	1/2	1140	3.0/1.5	1/2	1140	9.0	1/2	1140	2.0/1.0	1/2	1140
	UD-333	8.8	3/4	1140	4.4	3/4	1140	3.7	3/4	1140	3.4/1.7	3/4	1140	—	—	—	—	—	—

* A solid state multi-speed controller is available for models UH-18 thru UH-108 with power code "A".

Motor Codes Defined

Power Code A: Motors are 115 volt, 60 Hertz, single phase, totally enclosed, with built-in thermal overload protection. Horizontal models UH-18 through UH-63 and vertical models UD-42 through UD-95 have shaded-pole motors. Horizontal models UH-86 through UH-340 and vertical models UD-139 through UD-333 have motors with a permanent split capacitor to minimize current draw.

Power Code G: Motors are 230 volt, 60 Hertz, single phase, totally enclosed with built-in thermal overload protection. Horizontal models UH-18 through UH-63 and vertical models UD-42 through UD-95 have shaded-pole motors.. Horizontal models UH-86 through UH-340 and vertical models UD-139 through UD-333 have motors with a permanent split capacitor to minimize current draw.

Power Code B: Motors are 200 volt, 60 Hertz, three phase, totally enclosed, polyphase induction type.
Power Code I: Motors are 230/460 volt, 60 Hertz, three phase, totally enclosed, polyphase induction type.

Power Code A: Motors are 115 volt, 60 Hertz, single phase, explosion-proof, totally enclosed, with built-in thermal overload protection, split-phase type. Canadian Standards Association (CSA) requirements state that explosion-proof units may not be used with a fluid temperature in excess of 329°F or 100 psi and still maintain their explosion-proof rating.

Power Code I: Motors are 230/460 volt, 60 Hertz, three phase, explosion-proof, totally enclosed, with built-in thermal overload protection, polyphase induction type.

Explosion-Proof Motors: Explosion-proof motors offered with Power Codes A and I are suitable for Class I, Group D, Class II, Groups F and G, Class III atmospheres. Canadian Standards Association (CSA) requirements state that explosion-proof units may not be used with a fluid temperature in excess of 329°F or 100 psi and still maintain their explosion-proof rating.

Class I, Group D motors are for operations in areas containing gasoline, petroleum, naphtha, benzine, butane, propane, alcohol, acetone, benzol, lacquer-solvent vapors, or natural gas.

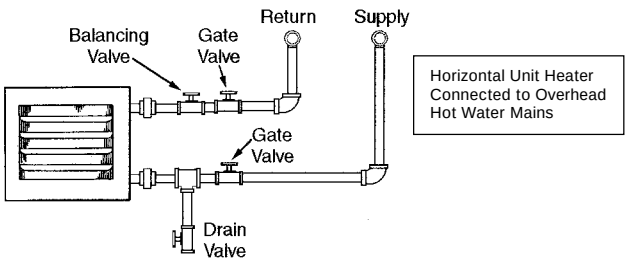
Class II, Group F motors are for operations in areas containing carbon black coal, or coke dust.

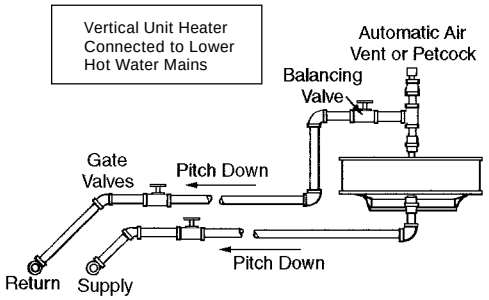
Class II, Group G motors are for operations in areas containing flour, starch, or grain dust.

Piping For Unit Heaters

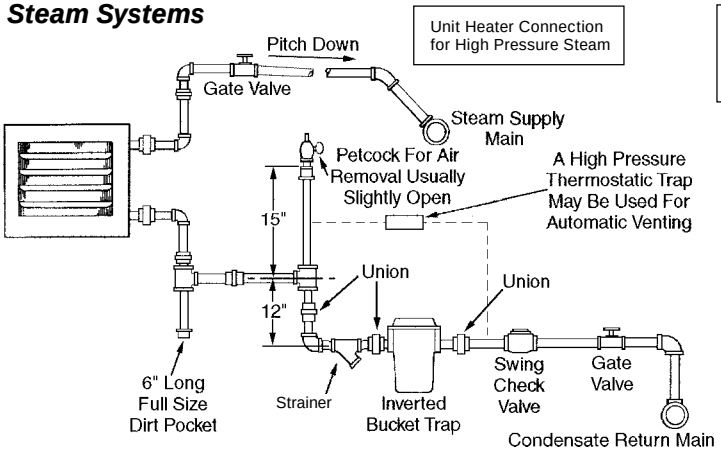
Suggested Piping Arrangements

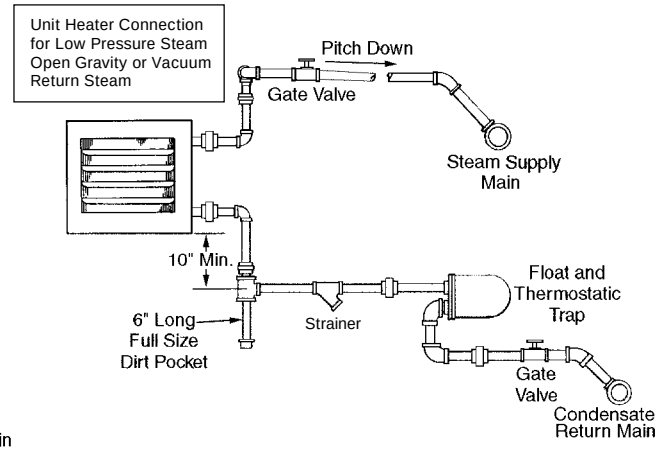
Hot Water Sytems





Steam Systems





Piping

1. Branch piping to and from unit heater should be the same size as unit connections and include swing joints to allow for expansion and contraction of the piping without placing a strain on the unit heater element. On steam systems, the branch piping should be taken off and returned above the centerline of the supply and return line.
2. Install pipe unions and shut-off valves in lines to and from each unit heater to allow maintenance or replacement of unit without shutting down and draining entire system. For hot water systems, include a balancing valve in return line when possible for water flow regulation. A drain valve should also be provided below each unit heater to allow removal of water from the heating coil it located in an area subject to freezing.
3. In steam or hot water systems, rapid air removal is required because entrained air is a cause of corrosion. Hot water systems should be equipped with suitable air vent valves for rapid and complete removal of air at the high points and ends of both supply and return mains. Proper air venting for steam systems can be achieved by use of a steam trap with an internal air vent.
4. Traps must be located below the outlet of the unit. Consult trap manufacturer for specific recommendations. Each steam unit heater should be provided with a trap of sufficient size and capacity to pass a minimum of two times the normal condensate released by the unit at the minimum differential pressure in the system. Trap capacity is based on the pressure differential between supply and return mains. Steam systems should be equipped with a float and thermostatic trap or an inverted bucket trap with an air bypass.
5. It is advisable to use a pipe line strainer before each steam trap draining a unit heater. This protection will reduce the maintenance of the steam trap. When strainers are used they could be installed between the unit heater and the trap and be the same size as the trap tapping. In order to catch dirt and scale, the strainer should have a screen perforation size smaller than the trap orifices.
6. On systems where the steam supply to the unit heater is modulated or controlled by a motorized valve, a vacuum breaker should be installed between unit outlet and the trap. If a vacuum breaker is used, it should be in conjunction with a float and thermostatic trap.
7. Install a scale pocket at bottom of unit heater to collect dirt and scale as shown in illustrations. Pipe diameter must be the same size as unit connections and about six inches long.
8. Provide adequate pipe hangers, supports, or anchors to secure the piping system independently of the unit heater.

Horizontal and Vertical Unit Heaters

Motors - The electrical motors to be built by reputable nationally know manufacturer in accordance with National Electric Manufacturers Association (NEMA) standards for continuous fan-duty motor operation.

Starters - Single Phase, 115 or 230 volts - Manual starter with thermal overload elements sized to carry the full-load amp rating of the motor to be furnished with each unit heater. Three Phase, 200 or 230 volt - Magnetic starter with thermal overload elements sized to carry the full-load amp rating of the motor to be furnished with each unit heater. Three Phase, 460 volt - Magnetic starter with thermal overload element sized to carry to carry the full-load amp rating of the motor and a 460/115 volt control circuit transformer to be furnished with each unit heater.

Typical Specifications

Casings
Horizontal Models - Casings are formed from 18-gauge die-formed steel and consists of front and back halves. Both halves are joined together at top and bottom, utilizing the coil mounting screws for attachment. Casing top is provided with threaded hanger connections for unit suspension. Fan venturi is formed in casing back half.
Vertical Models - The casing on these models consists of two circular steel covers. With the coil in between, the two covers are securely bolted together to form a single unit. The bottom cover has a die-formed venturi. The top cover has a depression for the motor and has an opening provided for circulation of motor cooling air.
Finish
All metal surfaces of the casing are treated to prevent the formation and spread of rust. Standard models are painted with an electrostatically applied Antique Ivory powder paint for optimum corrosion protection.
Fans - Fans are aluminum, balanced and designed specifically for unit heater application on ALL units.
Hangers - Horizontal and vertical discharge unit heaters to be supported by rod-type hangers attached to the building structure with "C" clamps or by other approved means.
Piping- Piping for each unit heater will be in accordance with local and national codes and manufacturer's recommendations.
Motors - Refer to page 24 for full particulars.
Wiring - Wiring must be sized to handle the full-load amp draw of the motor and any other controls specified in accordance with local and national codes.
Thermostats - Line voltage, heavy-duty type with contacts, sized to carry the full-load amp rating of the motor or the motor starter coil, shall be furnished with each unit heater.

Coils
General - Coils are of the extended-surface type with aluminum fins and DLP-type copper tubes with steel supply and return connections. The coils are warranted for steam or hot water pressures up to 150 psig and up to 375°F. All coils are leak tested at 200 psi", air under water.
Horizontal Models - Coils are of serpentine design with horizontal tubes, vertical fins and all tubes have individual expansion bends with brazed joints.
Vertical Models - Coils are circular, providing for natural expansion. Each tube is continuous between supply and return and all tube joints are silver brazed.

Fan Safety Guard - **Horizontal units** are equipped with a combination fan guard/motor mounting bracket. **Vertical units** are supplied with an outlet fan guard covering the bottom of the unit.
Air Deflectors - **Horizontal units** are furnished with adjustable, horizontal air deflectors as standard equipment. Vertical deflectors are available as optional equipment.