

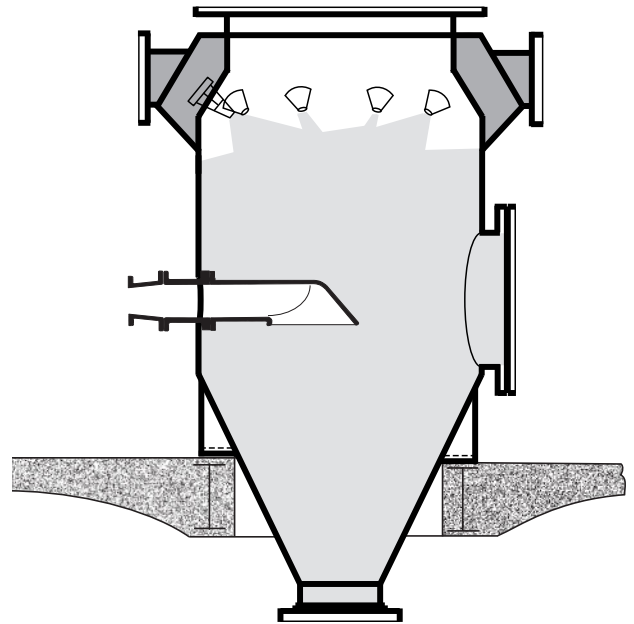
Direct Contact, High Capacity Steam Heaters for Liquids

The condensation of steam in liquids by means of S&K Direct Contact, Steam Heaters is a very efficient method of heating liquids. Since the steam and its condensate is mixed directly with the fluid, all of the heat in the incoming steam is utilized to heat the liquid. Where the addition of condensate to the mixture is not objectionable, this type of heater is ideal.

S&K manufactures various types of these heaters. The application will determine what particular type is most suitable. These Direct Contact, High Capacity Steam Heaters provide large quantities of hot water for delivery to a tank or reservoir. A temperature rise of 130°F is possible under certain operating conditions. The hot water capacity is limited only by the maximum size of the heaters offered as standard items. Details on temperature and capacity are given for each type heater.

These heaters are simple in design, having no moving parts. Heating is continuous and fast. Inspection and routine maintenance are greatly facilitated by conveniently placed access ports. Because of high heating efficiency, a relatively small, lightweight size can be used to deliver a large supply of heated liquid. Injected water is broken up into fine particles by passing through spray nozzles or over trays and intimate mixing is obtained by the turbulence of the liquid steams. The thorough mixing provides for full condensation of the steam transferring maximum heat to the water.

Three piping connections - water inlet, steam inlet, and heated liquid outlet - are all that are necessary. These heaters are adaptable to the use of special materials to meet corrosive and other conditions. They can be furnished in cast iron, fabricated steel, alloy steel, Hastelloy, in any combination of these, or other materials.



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TYPE 323 CONTINUOUS HEATER

APPLICATION

The Type 323 Continuous Heater is suitable for operation within a wide range of conditions. It does not require a barometric leg. At atmospheric pressure and above, a temperature rise of 100°F is obtainable. Hot water capacity ranges from 10 gpm to 240 gpm. The Type 323 Heater should not be used if air and other non-condensables are present.

CONSTRUCTION

Type 323 Heaters are the most compact in design and construction of the various types manufactured by S&K. Standard units are made with cast iron bodies and diffusers, and with bronze water nozzles, combining tubes and tail bushings.

OPERATION

The heater must be installed vertically and water flow must be started before steam flow. The water enters the unit through the top inlet at a pressure great enough to overcome back pressure and pressure drop within the unit. These two factors set the lower pressure limit of the inlet water. (Nozzles can be designed for any pressure above the lower limit.) Steam enters through the side inlet and is entrained by the water jet passing at high velocity through the combining tube. Temperature is controlled by throttling the steam.

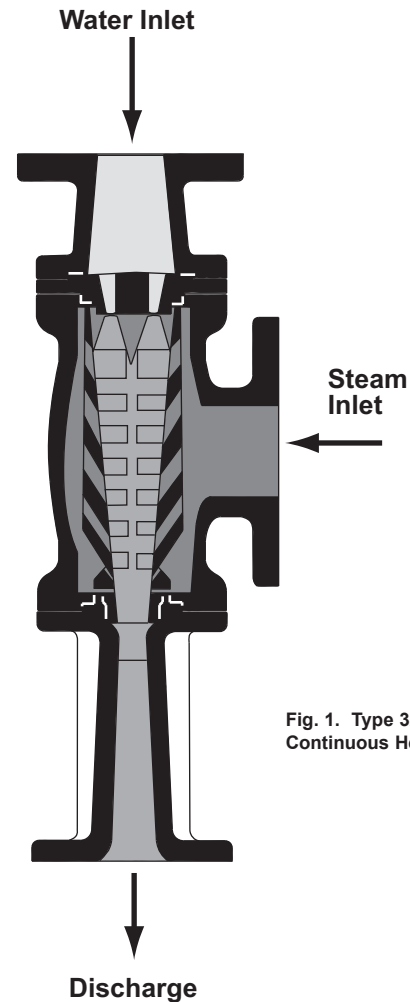


Fig. 1. Type 323
Continuous Heater

**TABLE 1. SIZES, DIMENSIONS, AND APPROXIMATE CAPACITIES
OF TYPE 323 HEATERS**

Size (Inches)	Size Connections (Inches)			Over-All Height* (Inches)	Approx. Weight (Lbs.)	Water Capacity (gpm)
	Steam Inlet	Water Inlet	Discharge			
1 1/2	1 1/2	1	1	12	30	15
2	2	1 1/4	1 1/4	15	45	26
2 1/2	2 1/2	1 1/2	1 1/2	18	60	37
3	3	2	2	21	75	52
4	4	3	3	29	130	112
6	6	4	4	41	250	240

*Does not include required tail pipe into hot well which is usually 2 feet long

TYPE 337 AND 338 COUNTER-CURRENT STEAM HEATERS
APPLICATION

Type 337 and 338 Heaters are "counter-current" types with the water and steam flowing in opposite (counter) directions. All operate effectively with internal pressures above and below atmospheric pressure. With typical units of medium size, hot water capacities range from 6 to 6,000 gpm. No limits on unit size have been set and, since capacities are determined by unit size and steam available, there are no limitations on hot water capacity. In conventional units, a water temperature rise of 130°F is obtainable provided air is absent and other operating criteria are met.

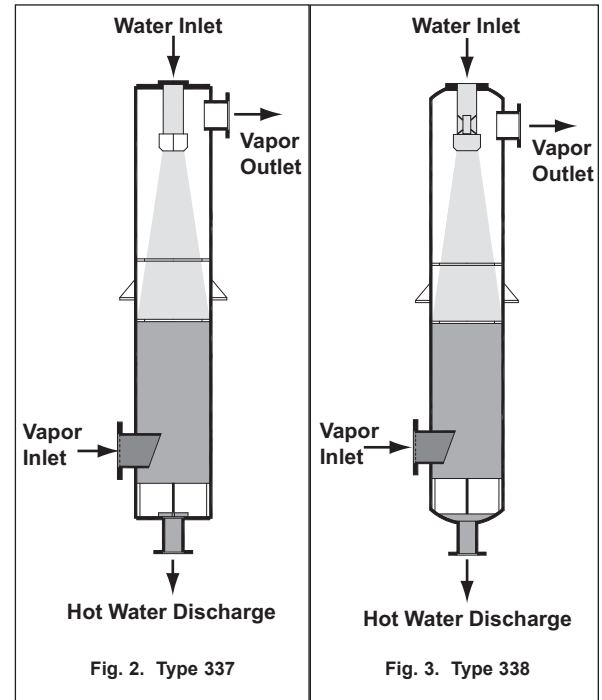
CONSTRUCTION

As illustrated, Type 337 units consist of a cylindrical body with side vapor inlet, top water inlet, and spray nozzle to provide direct, intimate contact between water and steam. Type 338 units are similar but larger and have slightly different nozzles. In sizes up to 42 inches, the 338 type has flat heads at water inlet and discharge. In larger sizes, heads are dished as shown in Fig. 3.

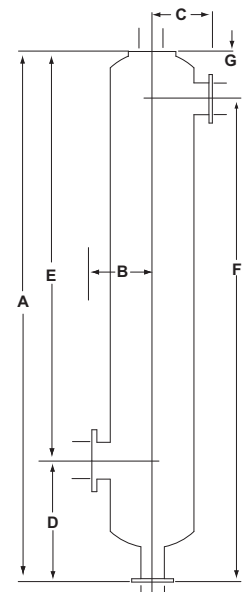
OPERATION

Water is sprayed or discharged from the top of the heater. Steam enters from the vapor inlet and flows up through the water spray or "cascade". Heating of the water is accomplished by the direct contact of steam and water and the resulting condensation of the steam.

The heaters shown also can be used as gas coolers. In such applications, dry gases are cooled by sensible heat transfer in which water is evaporated into the gas - as in the case of flue gas. Normally, the 337/338 operates at atmospheric pressure or above, but can be designed to produce hot water under vacuum conditions. In the vacuum mode, it is necessary to discharge heated water through a barometric discharge pipe.


TABLE 2. SIZES - TYPE 337 AND 338 HEATERS

Size (Inches)	Dimensions (Inches)							Connections (Inches)				Net Wgt. (Lbs.)	Max. Water Capacity (gpm)
	A	B	C	D	E	F	G	Water Inlet	Vapor Inlet	Vapor Outlet	Disch.		
Type 337													
0	35 1/2	7 7/16	6	8	27 1/2	32 1/4	3 1/4	1	3	2	2	150	24
1	53	7	6	11	42	48 1/2	4 1/2	2	4	2	3	225	43
2	69 1/8	10	9	14	55 1/8	64 1/4	4 7/8	2 1/2	6	2 1/2	4	475	96
3	81 3/4	12	12	16	65 3/4	76 1/2	5 1/4	3	8	3	4	750	160
4	91 1/4	13	13	18 1/4	73	85 1/4	6	4	10	4	5	1,040	204
5	101 1/4	14	14	20 3/4	80 1/2	94 1/4	7	4	12	6	6	1,270	254
Type 338													
18	91 1/4	13	13	18 1/4	73	85 1/4	6	4	10	4	5	1,075	204
20	101 1/4	14	14	20 3/4	80 1/2	94 1/4	7	4	12	6	6	1,175	254
22	121	15	15	28	93	114	7	6	12	6	6	1,300	308
26	145	18	18	35	110	138	7	6	14	6	8	1,500	429
30	158	19	19	36	122	151	7	8	16	6	8	2,000	575
36	182	22	22	39	143	174	8	8	20	8	10	2,700	833
42	203	27	27	41	162	195	9	10	24	8	12	4,100	1,132
48	239	29	29	43	196	217	22	12	28	10	14	4,700	1,490
54	260	31	31	44	216	237	23	14	30	10	16	5,900	1,890
60	285	35	35	46	239	260	25	16	32	12	18	8,200	2,335
66	307	39	39	48	259	281	26	16	36	12	18	9,300	2,830
72	329	42	42	51	278	303	26	18	42	14	20	12,400	3,360
78	351	45	45	51	300	324	27	20	42	16	20	15,000	3,960
84	374	49	49	54	320	345	29	20	48	16	24	18,500	4,580
90	398	54	54	54	344	366	32	24	48	18	24	22,000	5,260
96	423	58	58	56	367	387	36	24	54	20	30	26,000	6,000



TYPE 326 DIRECT CONTACT MULTI-SPRAY HEATER

APPLICATION

The Type 326 Direct Contact Multi-Spray Heater is suitable for very large quantities of hot water, a top vapor inlet is required, and steam pressure is atmospheric or above. Type 326 Heaters will operate with a differential of 3 psi between inlet water pressure and the internal pressure. Flow variation is dependent upon the maximum pressure available. Under some operating conditions a temperature rise of 130°F is obtainable.

Hot water capacities range from 350 gpm to 9000 gpm.

CONSTRUCTION

The body of the heater is made of cast iron or fabricated steel. Spray nozzles are bronze and are non-clogging provided inlet water is screened by ¼" or ⅜" mesh. Ready access is provided by inspection ports opposite each nozzle. Heaters can be made of special materials as required.

OPERATION

Water is distributed peripherally to a series of converging spray nozzles which disperse the inlet water into very fine particles. Further dispersion is accomplished by a centrally placed deflection baffle. Steam enters at the top and passes through the water spray, condensing immediately and completely.

The hot water is delivered to a tank through an outlet at the bottom of the heater. If internal pressure is below atmospheric pressure, a barometric leg, long enough to balance the pressure within the heater must be used to permit discharge of the hot water. The air vent prevents accumulation of non-condensables and balances the pressure of the heater. The Type 326 Heater is designed to prevent flooding, and to heat water close to the steam saturation temperature.

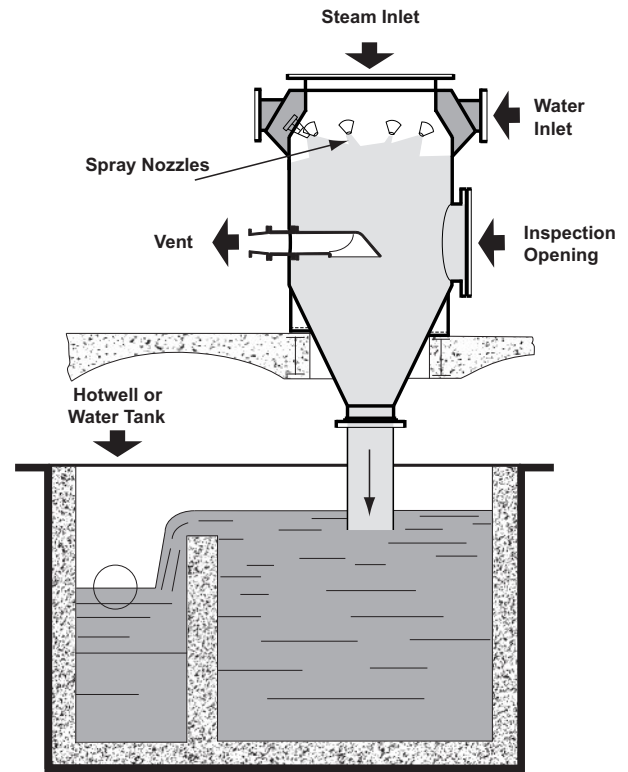


Fig. 4. A typical arrangement of Type 326 Heater

TABLE 3. SIZES, DIMENSIONS, AND APPROXIMATE CAPACITIES OF TYPE 326 HEATERS

Size (Inches)	Size Connections (Inches)				Over-All Dimensions (Inches)		Approx. Weight, (Lbs.)		Max. Water Capacity (gpm)
	Steam Inlet	Water Inlet	Water Outlet	Vent	Shell Dia.	Height*	Cast Iron	Fab. Steel	
30	20	6	6	4	26	67	1,800	1,200	625
31	24	6	6	4	32	74	2,300	1,500	750
32	24	8	8	4	32	74	2,600	1,700	950
33	30	8	8	4	35	75 3/4	4,400	2,400	1,100
34	30	8	8	4	35	75 3/4	4,500	2,500	1,300
35	30	8	10	6	40	82 3/8	6,000	3,200	1,700
36	36	10	10	6	46	94	8,000	4,000	2,200
37	42	12	12	6	52	115	10,000	5,000	3,200
38	48	12	12	6	58	126	11,000	5,500	3,800
39	54	14	14	6	68	134	12,500	7,500	5,000
40	60	16	16	8	74	142	14,000	8,750	6,000
41	60	16	18	8	74	150	16,000	9,500	8,000
42	66	20	20	8	74	160	20,000	11,000	9,000

*Does not include required tail pipe into hot well.

TERMINAL DIFFERENCE (steam saturation temp. - water exit temp.) This will vary with the type of heater used, the amount of non-condensables present, and temperature rise desired. The range is from 0° to 40°F. Schutte & Koerting should be contacted for further details.

TABLE 4. MAXIMUM TEMPERATURE RISE IN RELATION TO PERCENTAGE OF AIR IN ENTERING MIXTURE*

Percent Air in Entering Mixture (by wt.)	0-10%	15%	20%	35%	50%
Temperature Rise in °F	100°	90°	75°	45°	30°

*This table applies to Type 326, 337 and 338 heaters; not to Type 323 heaters which are not for use where air and other non-condensables are present. The data in Table 4 is limited to heaters operating at atmospheric pressures and above.