

Steam Jet Syphons

Steam Jet Syphons operate on the steam jet principle utilizing the energy of steam under pressure to pump, mix liquids and handle solids. They can be used for the handling of corrosive or abrasive liquids and solids because of their design simplicity and the absence of moving parts.

S&K syphons offer numerous advantages. Within the syphon, there are no moving parts to wear or break, and thus nothing to require extensive maintenance. Since the syphon is small in relation to the work it does, the cost is correspondingly low. Easy to install, they may be located in remote and inaccessible places without requiring constant attention.

In operation, steam under pressure discharges at high velocity through a nozzle and entrains the suction liquid or slurry. The steam and suction fluid are mixed intimately in the specially designed diffuser of the syphon and are discharged against counter pressure. The pressure steam, which passes through the nozzle at high velocity, is condensed by the suction liquid, raising its temperature. Density, viscosity, specific heat, discharge head and suction pressure of the pumped liquid all influence the temperature rise. Steam jet syphons will not operate if the temperature rise brings the liquid to the boiling point. For proper operation, complete condensation of the motive steam in the syphon is required.

Syphons are especially well suited for processes where heating is required in addition to pumping since the pumping is accomplished for the cost of the heating. Some of their uses include intermittent pumping of liquids from tanks and pits, pumping filtrate from vacuum vessels and condensate from surface condensers, supplying heated water to the jackets of stills and graining bowls, removing liquid from pickling baths, extracting chemicals in reaction chambers, moving powdered material or material in granular form, filling and emptying gas holder tanks, handling soap solutions in textile plants, pumping sugar juice and various liquids in canning plants.

Although the types shown in this bulletin will meet many normal requirements, specific applications and operating conditions often require design modifications. S&K engineers will work with you to design a syphon for your purpose. Jet ejectors which use water as the operating medium instead of steam to pump and mix liquids and handle solids are described in S&K Bulletin 2M.



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SECTION 1 - DESIGN, CONSTRUCTION AND OPERATION

Fig. 217 and Fig. 219 Syphons

Application

Fig. 217 and Fig. 219 Steam Jet Syphons are designed for liquid pumping and mixing operations and for the handling of some solids where requirements do not necessitate capacities greater than those obtained with sizes up to and including 6". It is considered the standard syphon within this size range.

Construction

The Fig. 217 syphon has a streamlined body with threaded pipe connections. The steam nozzle is threaded to the body and can be removed for cleaning or replacement. Made in sizes from 1/2" to 3", the Fig. 217 Syphon is stocked in cast iron, bronze, and in Type 316 stainless steel.

Fig. 219 Syphons are made in 4" and 6" sizes with flanged connections, removable steam nozzle and throat bushing. They are stocked in cast iron, bronze mounted and can be supplied in other materials on special order.

Both Fig. 217 and Fig 219 Syphons are available with either Type 60 or Type 115 nozzles. When ordering, the nozzle type should be specified. The two nozzle types provide different capacities, as shown in Tables 2 and 4 on the next two pages.

Operation

Steam under pressure enters the syphon and produces a high velocity jet. This jet action creates a vacuum in the line causing the suction material to be drawn into the body of the syphon where it is entrained by the steam.

Steam and suction material are mixed in the throat or diffuser of the syphon and are discharged against back pressure. The body, which has no pockets, prevents solids in the suction material from collecting and clogging the syphon. In addition, pressure drop in the suction chamber is held to a minimum. Fig. 217 Syphons operate best at a definite steam pressure as shown in Tables 2 and 4. For example, Table 2 (Fig. 217 Syphon with Type 60 nozzle) indicates that with a 10' lift, 20' discharge head and 70° F. water, the highest capacity (37 gpm) is obtained with 60 psig steam pressure and 434 lb./hr. steam consumption (Table 3). Table 4 shows that under the same conditions, but with a Type 115 nozzle, the highest capacity (47 gpm) is obtained with 125 psig steam pressure and 496 lb./hr. steam consumption (Table 3). These tables also indicate performance at other than optimum pressure, but most economical operation is attained by throttling steam to that pressure.

The Jet equipment described here can also be used as a Steam Jet Vacuum Pump to handle gases. Designated a Type 517 Vacuum Pump, it is described in Bulletin 4E.

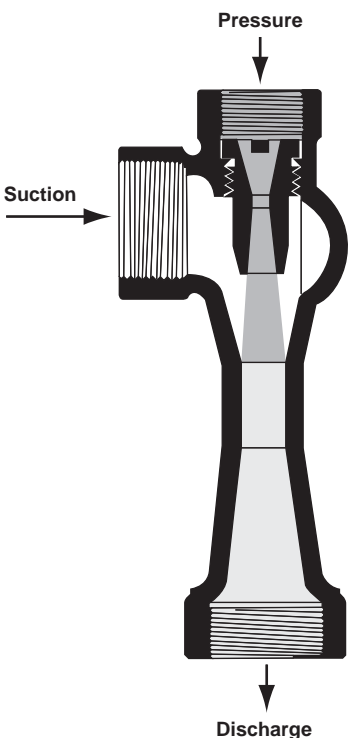


Fig. 217-A. Sectional view of Steam Jet Syphon with threaded connections.



Fig. 217. Steam Jet Syphon with threaded connections.

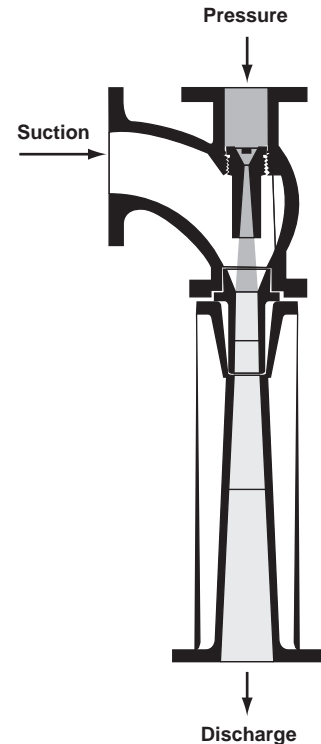


Fig. 219. Steam Jet Syphon with flanged connections.

Fig. 217 and Fig. 219 Syphons

Table 1. Sizes and Dimensions of Fig. 217 and Fig. 219 Syphons

Size In Inches	Connections in Inches		Wgt. In Lbs.	Working Pressures (psig)						Dimensions in Inches		
	Suction Disch.	Pressure		Cast Iron (450°F)		Bronze (400°F)		Stainless Steel (600°F)		A	B	C
				Steam	Liquid	Steam	Liquid	Steam	Liquid			
Fig. 217												
1/2	1/2	3/8	3/4	175	125	125	100	500	300	1 1/16	2 9/16	1 1/8
3/4	3/4	1/2	1 1/4	175	125	125	100	500	300	1 3/8	3 3/8	1 1/4
1	1	3/4	2	175	125	125	100	500	300	1 1/2	4 3/16	1 5/8
1 1/2	1 1/2	1	5	150	100	125	100	500	300	2	6 1/2	2
2	2	1 1/4	6	150	100	125	100	500	300	2 1/4	7 5/8	2 1/4
2 1/2	2 1/2	1 1/2	11	200	100	200	100	500	300	2 11/16	9 1/4	3 1/8
3	3	2	20	200	100	200	100	500	300	3 1/8	11 1/4	3 1/2
Fig. 219 (Cast Iron, Bronze Mounted)												
4	4	2 1/2	80	200	150	-	-	-	-	4 3/8	19 1/4	7 13/16
6	6	4	180	200	150	-	-	-	-	6 1/16	28 3/8	9 1/8

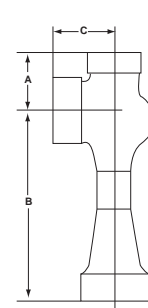


Fig. 217

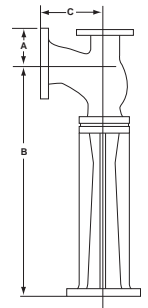


Fig. 219

Table 2. Suction Capacities of Fig. 217 and Fig. 219 Syphons with Type 60 Nozzle

Suction Lift (Ft.)	Suction Temp. (°F)	Suction Capacity (gpm) of 1 1/2" Size Fig. 217 Syphon*															
		Operating Steam Pressure (psig)															
		40	50	60	80	100	120	160	240	40	50	60	80	100	120	160	240
		0 Ft. Discharge Head								20 Ft. Discharge Head							
1	70	52	51	51	49	46	43	37	30	36	47	48	48	45	41	35	29
	90	45	44	43	42	40	37	33	26	37	44	43	43	41	38	33	26
	110	40	38	36	36	35	33	28	22	38	39	37	37	36	34	30	23
	130	35	32	30	30	29	29	25	-	35	33	31	31	30	29	25	-
	150	26	25	24	24	24	24	21	-	26	25	24	24	23	22	20	-
	165	17	17	17	18	18	17	17	-	17	17	17	17	17	17	16	-
10	70	38	38	37	35	30	28	25	20	27	36	37	35	31	29	25	19
	90	34	34	33	30	27	25	21	17	26	32	32	29	26	23	20	17
	110	28	27	26	25	23	21	18	-	26	27	27	25	23	21	18	-
	130	21	21	21	20	18	16	14	-	21	22	22	21	18	16	14	-
	145	16	16	16	16	14	12	-	-	16	16	16	16	14	12	-	-
15	70	34	32	30	26	23	21	18	14	24	33	32	27	24	23	19	15
	90	29	28	26	23	20	18	16	12	23	28	27	23	20	19	16	12
	110	24	23	22	19	17	15	13	-	23	23	22	19	17	15	13	-
	130	17	17	17	15	13	11	-	-	17	17	17	14	13	-	-	-
	145	10	12	11	9	-	-	-	-	11	11	10	10	-	-	-	-
20	70	26	23	21	18	16	15	13	-	24	24	22	19	17	15	12	-
	90	22	19	17	15	14	12	11	-	19	20	18	15	14	12	11	-
	110	18	16	14	12	11	10	-	-	17	16	14	12	11	-	-	-
	125	13	12	11	-	-	-	-	-	12	11	10	-	-	-	-	-
		40 Ft. Discharge Head								50 Ft. Discharge Head							
1	70	-	20	33	47	44	41	36	29	-	-	18	44	44	41	36	28
	90	-	18	36	43	42	39	34	27	-	-	21	42	42	39	34	27
	110	-	20	36	37	37	35	30	24	-	-	24	37	36	34	30	24
	130	-	23	31	31	30	29	25	-	-	-	26	30	30	29	25	-
	150	-	24	24	24	24	24	20	-	-	-	24	24	24	24	20	-
	165	-	17	18	18	18	18	16	-	-	-	18	18	18	18	16	-
10	70	-	-	24	34	30	27	24	18	-	-	-	35	30	27	23	18
	90	-	-	26	29	26	24	20	17	-	-	-	29	27	24	21	17
	110	-	-	27	26	23	20	18	-	-	-	-	25	23	20	18	-
	130	-	-	22	21	19	16	14	-	-	-	-	21	19	17	14	-
	145	-	-	16	16	14	12	-	-	-	-	-	16	14	13	-	-
15	70	-	-	23	28	24	22	19	15	-	-	-	27	24	21	18	14
	90	-	-	20	24	20	18	16	-	-	-	-	24	21	18	16	-
	110	-	-	21	19	17	15	-	-	-	-	-	19	17	15	-	-
	130	-	-	17	14	12	-	-	-	-	-	-	14	-	-	-	-
	145	-	-	11	-	-	-	-	-	-	-	-	-	-	-	-	-
20	70	-	-	21	19	16	15	12	-	-	-	-	-	16	15	-	-
	90	-	-	18	16	14	13	11	-	-	-	-	-	15**	13**	-	-
	110	-	-	-	11	10	-	-	-	-	-	-	-	-	-	-	-

*Use Capacity Ratio from Table 3 to calculate capacity of any other size.

**Suction Temperature 85°F

Fig. 217 and Fig. 219 Syphons

Table 3. Steam Consumption of Fig. 217 and Fig. 219 Syphons

Syphon Size (Inches)	Capacity Ratio	Steam Consumption (Lbs./Hr.)																
		Operating Steam Pressure (psig)																
		40	50	60	80	100	120	160	240	40	60	80	100	115	125	150	200	240
		Type 60 Nozzle								Type 115 Nozzle								
1/2	0.125	40	47	54	69	83	97	126	184	24.8	33.5	42.2	50.8	57.3	61.6	72.4	94.0	112
3/4	0.222	70	83	96	122	147	173	222	322	45.2	61.1	77.0	92.8	105	112	132	172	204
1	0.346	110	130	150	190	230	270	350	510	68.5	92.7	117	141	159	170	200	260	308
1 1/2	1.000	318	376	434	550	665	780	1012	1475	199	270	340	409	461	496	583	756	895
2	1.38	440	520	600	761	920	1080	1400	2040	277	375	473	569	641	689	810	1050	1244
2 1/2	2.0	635	750	865	1100	1329	1558	2020	2940	396	537	677	815	917	988	1160	1505	1780
3	3.11	990	1170	1350	1710	2065	2425	3145	4590	619	840	1059	1271	1432	1542	1810	2350	2780
4	5.54	1760	2085	2400	3045	3685	4320	5500	8170	1105	1495	1885	2270	2560	2750	3230	4200	4960
6	12.45	3960	4680	5400	6850	8280	9710	12600	18360	2480	3350	4220	5080	5730	6160	7240	9400	11200

Table 4. Suction Capacities of Fig. 217 and Fig. 219 Syphons With Type 115 Nozzle

Suction Lift (Ft.)	Suction Temp. (°F)	Suction Capacity (gpm) of 1 1/2" Size Fig. 217 Syphon*																	
		Operating Steam Pressure (psig)																	
		40	60	80	100	115	125	150	200	240	40	60	80	100	115	125	150	200	240
		20 Ft. Discharge Head									40 Ft. Discharge Head								
1	70	12	31	48	51	52	52	53	53	-	-	23	38	48	50	52	54	54	
	90	-	36	48	49	49	49	49	49	-	-	23	39	49	48	48	49	49	
	110	-	41	45	43	42	42	42	43	-	-	24	42	43	42	41	43	44	
	130	-	37	41	39	36	35	34	35	-	-	22	39	36	35	34	35	36	
	150	-	29	27	26	26	26	26	29	-	-	21	25	26	27	28	29	30	
5	70	-	18	18	18	18	19	19	21	-	-	15	18	19	19	19	20	23	
	90	-	28	41	49	51	51	51	43	-	-	18	35	42	48	52	51	43	
	110	-	24	40	44	44	44	44	39	-	-	16	34	38	41	41	40	39	
	130	-	23	39	42	40	39	37	40	-	-	12	28	38	39	37	40	39	
	150	-	31	34	32	32	32	32	30	-	-	12	33	32	30	32	34	30	
10	70	-	15	16	16	16	17	17	18	-	-	-	18	17	18	16	17	18	
	90	-	25	39	45	46	47	43	43	-	-	17	30	41	41	43	43	35	
	110	-	22	32	40	41	41	41	40	-	-	-	24	34	40	42	40	37	
	130	-	17	33	34	34	34	35	36	-	-	-	18	33	33	34	36	32	
	150	-	23	27	27	27	27	27	23	-	-	-	25	26	27	28	27	23	
20	70	-	16	19	17	17	18	18	19	-	-	-	17	18	18	19	19	-	
	90	-	14	27	31	30	29	29	22	-	-	-	-	29	29	27	22	19	
	110	-	-	30	28	27	26	24	21	-	-	-	-	26	26	25	23	-	
	130	-	-	22	22	21	20	19	-	-	-	-	-	20	20	19	-	-	
	150	-	-	14	14	13	15	20	-	-	-	-	-	-	-	-	-	-	
		60 Ft. Discharge Head									80 Ft. Discharge Head								
1	70	-	-	-	-	25	33	48	54	-	-	-	-	-	-	29	51	54	
	90	-	-	-	-	27	33	46	50	-	-	-	-	-	-	25	48	49	
	110	-	-	-	-	24	35	42	43	-	-	-	-	-	-	26	43	44	
	130	-	-	-	-	22	26	34	35	-	-	-	-	-	-	-	35	37	
	150	-	-	-	-	18	26	26	28	-	-	-	-	-	-	-	28	30	
5	70	-	-	-	-	18	18	19	21	-	-	-	-	-	-	-	21	23	
	90	-	-	-	-	16	27	42	42	-	-	-	-	-	-	16	29	39	
	110	-	-	-	-	16	28	37	40	-	-	-	-	-	-	15	40	40	
	130	-	-	-	-	18	30	33	34	-	-	-	-	-	-	15	34	30	
	150	-	-	-	-	19	21	24	25	-	-	-	-	-	-	-	25	26	
10	70	-	-	-	-	16	16	17	18	-	-	-	-	-	-	-	17	18	
	90	-	-	-	-	17	25	40	43	-	-	-	-	-	-	18	43	35	
	110	-	-	-	-	12	20	37	40	-	-	-	-	-	-	-	40	36	
	130	-	-	-	-	7.5	31	32	36	-	-	-	-	-	-	-	36	32	
	150	-	-	-	-	20	24	28	27	-	-	-	-	-	-	-	27	22	
20	70	-	-	-	-	-	-	30	23	-	-	-	-	-	-	-	23	-	
	90	-	-	-	-	-	-	28	21	-	-	-	-	-	-	-	-	-	
	110	-	-	-	-	-	-	19	-	-	-	-	-	-	-	-	-	-	

*Use Capacity Ratio from Table 3 to calculate capacity of any other size.

Fig. 2175 Automatic Syphon

Application

Fig. 2175 Automatic Steam Jet Syphons are used to pump out sumps (pits, tanks, etc.) where liquid accumulates slowly but must be evacuated when it reaches a predetermined level.

Construction

Fig. 2175 Syphons are assembled from a standard Fig. 217 Syphon, and a Fig 280 Pilot-Operated Snap Valve with Ball Float. They are stocked in sizes from 3/4" to 3".

Fig. 2175 Syphons are available in several standard material combinations and in special materials for problem liquids.

Special automatic syphons can also be made from any size or style syphon described in this Bulletin. Designation for such units is the same as that for the syphon alone, plus the addition of the numeral 5. For example, a Fig. 220 Syphon with automatic feature is designated Fig. 2205.

The Fig. 280 Pilot-Operated Snap Valve has a bronze body, stainless steel piston and pilot valve, Teflon (glass filled) pilot valve seat, and Teflon pilot valve stem seal.

The 8" diameter copper ball float is suspended on a bronze actuating rod with trip collars adjustable for (an approximate) float travel between 2" and 5 3/8". An easy-to-use replacement kit, consisting of a pilot valve stem seal and seat is available, should unusual service conditions make service necessary. A brass strainer is screwed into the base of the steel suction pipe. Longer suction pipes can be furnished for use in deep pits.

When the temperature of the suction liquid is too high to permit a suction lift, the arrangement is modified so that the suction connection of the syphon is submerged and the liquid flows into it under a slight head.

Operation

As the liquid in the sump (basin, tank, cellar, bilge, etc.) accumulates, it raises the ball float until the upward action of the float opens the snap-acting valve, admitting motive steam into the pressure connection of the syphon.

The jet action of the motive steam creates a vacuum in the syphon, and entrains the suction fluid, discharging both fluids under pressure. As the suction fluid is thus pumped out, the sump level drops to a point where the snap-acting valve shuts off. No further pumping action takes place until the sump again fills to the operating

level.

The float-operated snap-acting valve has no intermediate position: it is wide open at the operating level and closed tight at all other float positions. This design prevents inefficient operation of the syphon at intermediate sump levels.

Operation of the Fig. 2175 Syphon is completely automatic and requires no electrical connections or any external power other than the motive steam. The snap-acting valve and ball float are the only moving parts. The full assembly is so compact it can be installed in tanks as small as 13 1/2" diameter.



Fig. 2175 Automatic Steam Jet Syphon

Fig. 2175 Automatic Syphon

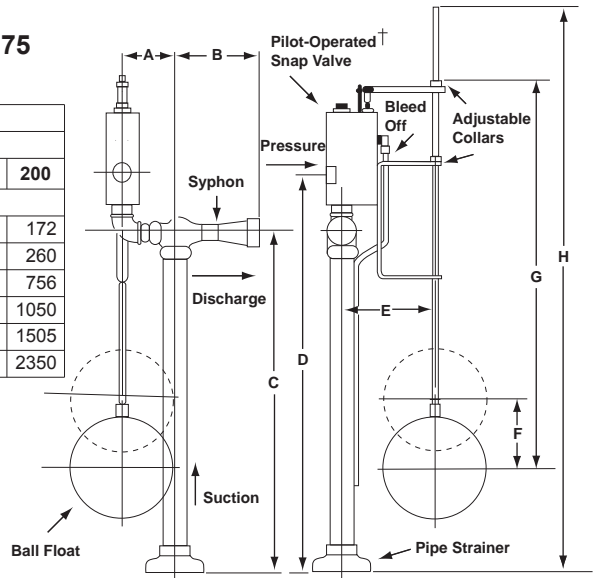
Table 5. Sizes and Dimensions of Fig. 2175 Syphons

Size In Inches	Connections in Inches		Wgt. In Lbs.	Working Pressure (Bronze)		Dimensions in Inches							
	Suction Disch.	Pressure (Snap-Valve)		Steam* (psig)	Liquid (psig)	A	B	C	D	E	F	G	H
3/4	3/4	1	24	100	100	3 11/16	3 3/8	41	44 7/8	7 5/16	5 3/8	47 1/8	60
1	1	1	26	150	125	4 5/16	4 3/16	41	44 7/8	7 5/16	5 3/8	47 1/8	60
1 1/2	1 1/2	1	32	125	90	4 1/8	6 1/2	41	44 7/8	7 5/16	5 3/8	47 1/8	60
2	2	2	43	125	85	6 1/4	7 5/8	38 3/8	43 15/16	7 7/16	5 3/8	47 1/8	60
2 1/2	2 1/2	2	65	200	125	6 11/16	9 1/4	38 3/8	43 15/16	7 7/16	5 3/8	47 1/8	60
3	3	2	81	200	125	6 3/8	11 1/4	38 3/8	43 15/16	7 7/16	5 3/8	47 1/8	60

*Minimum steam pressure for all Fig. 2175 Syphons: 40 psig

Table 6. Steam Consumption and Relative Capacities of Fig. 2175 Syphons

Size in Inches	Cap. Ratio	Steam Consumption - lbs./hr.												
		Motive Steam Pressure (psig)												
		40	50	60	80	100	120	160	80	100	115	125	150	200
		Type 60 Nozzle						Type 115 Nozzle						
3/4	0.2215	70	83	96	122	147	173	222	77	93	105	112	132	172
1	0.346	110	130	150	190	230	270	350	117	141	159	170	200	260
1 1/2	1.000	318	376	434	550	665	780	1012	340	409	461	496	583	756
2	1.38	440	520	600	761	920	1080	1400	473	569	641	689	810	1050
2 1/2	2.0	635	750	865	1100	1329	1558	2020	677	815	917	988	1160	1505
3	3.11	990	1170	1350	1710	2065	2425	3145	1059	1271	1432	1542	1810	2350



† Maximum working pressure of Fig. 280 Pilot-Operated Snap Valve is 200 psi.

Table 7. Suction Capacities of Fig. 2175 Syphons with Type 60 Nozzle* (See also Table 2)

Suction Lift (Ft. H ₂ O)	Suction Temp. (°F)	Suction Capacity of 1 1/2" Syphon (gpm)**											
		Motive Steam Pressure (psig)											
		40	50	60	80	100	120	160	60	80	100	120	160
		20 Ft. Discharge Head						40 Ft. Discharge Head					
10	70	27	36	37	35	31	29	25	24	34	30	27	24
	90	26	32	32	29	26	23	20	26	29	26	24	20
	110	26	27	27	25	23	21	18	27	26	23	20	18
	130	21	22	22	21	18	16	14	22	21	19	16	14
	145	16	16	16	16	14	12	-	16	16	14	12	-

* Also available with Type 115 Nozzle (see Table 4) for higher capacities.

** Use capacity ratio from Table 6 to calculate capacity of any other size.

Table 8. Suction Capacities of Fig. 2175 Syphons with Type 115 Nozzle* (See also Table 4)

Suction Lift (Ft. H ₂ O)	Suction Temp. (°F)	Suction Capacity of 1 1/2" Syphon (gpm)**																	
		Motive Steam Pressure (psig)																	
		80	100	115	125	150	200	80	100	115	125	150	200	115	125	150	200	150	200
		20 Ft. Discharge Head						40 Ft. Discharge Head						60 Ft. Discharge Head				80 Ft. Discharge Head	
10	70	39	45	46	47	43	43	17	30	41	41	43	43	17	25	40	43	18	43
	90	32	40	41	41	41	40	-	24	34	40	42	40	12	20	37	40	-	40
	110	33	34	34	34	35	36	-	18	33	33	34	36	8	31	32	36	-	36
	130	27	27	27	27	27	27	-	25	26	27	28	27	20	24	28	27	-	27
	145	19	17	17	18	18	19	-	17	18	18	19	19	15	17	18	-	-	-

* Also available with Type 60 Nozzle (Table 2) for lower capacities.

**Use capacity ratio from Table 6 to calculate capacity of any other size.

Fig. 220 Syphons

Application

Fig. 220 Syphons are designed for use where solids or semi-solids must be passed through the pump. Typical uses include handling sewage and muddy water, cleaning cesspools and cleaning sludge out of tanks. Ejectors of this type can be used as pipeline slurry heaters for continuous processing. For information on such applications, refer to S&K Bulletin 3A.

Construction

These syphons are made in cast iron or bronze from 1 1/4" to 8" inclusive. Other materials can be supplied on special order. All connections (except 6" & 8" sizes) are threaded and the design provides a straight unobstructed passage for the material being handled. A strainer is required for the suction connection. These syphons have no moving parts to get out of order and supervision is reduced to a minimum since operation can be controlled by means of a single valve.

Operation

The steam enters the syphon at the side, passes through an annular orifice and discharges at high velocity into the

throat. The suction liquid is drawn in through the open suction nozzle, is entrained by the steam and is discharged through the discharge connection. With this syphon, low lying districts of a sewage system can be drained, the sewage being lifted and discharged into the main system at a higher elevation. This eliminates the need for separate mechanically driven pumps.

These ejectors can also be used as pipeline slurry heaters, in which case, they are designated as Type 327 Slurry Heaters. For information, request Bulletin 3A.

Table 9. Calculated Capacities of 3" Fig. 220 Syphons

Water Temperature 100°F - 0 Suction Lift				
Steam Pressure (psig)	50	75	100	125
Steam Consumption (Lb./Hr.)	1180	1620	2060	2490
Max. Back Pressure (psig at Zero Flow)	12	18	22	35
Suction Capacity (gpm)	140	130	120	110
Discharge Pressure (psig)	5	8	12	30

Relative Capacities of Standard Sizes								
Size Syphon (Inches)	1 1/4	1 1/2	2	2 1/2	3	4	6	8
Capacity Ratio	0.13	0.21	0.30	0.60	1.00	1.85	4.0	7.1

Table 10. Sizes and Dimensions of Fig. 220 Syphon

Size In Inches	Connections in Inches		Wgt. In Lbs.	Working Pressures (psig)		Dimensions in Inches		
	Suction Disch.	Pressure		Cast Iron (450°F)	Bronze (400°F)	A	B	C
1 1/4	1 1/4	3/4	4 1/2	250	200	1 3/4	1 9/16	6 7/16
1 1/2	1 1/2	3/4	8	250	200	2	2	8 3/4
2	2	1	9 1/2	200	150	2 1/4	2 1/4	9 1/8
2 1/2	2 1/2	1 1/4	15	200	150	2 3/8	2 3/4	11 1/4
3	3	1 1/2	28	200	150	2 3/4	3 1/16	13 1/4
4	4	2	37	200	-	3 3/16	3 5/8	17 1/16
6*	6	3	-	-	-	5 3/4	4 1/4	22 3/4
8*	8	4	-	-	-	7	5	30

*These syphons have flanged connections for suction and discharge.

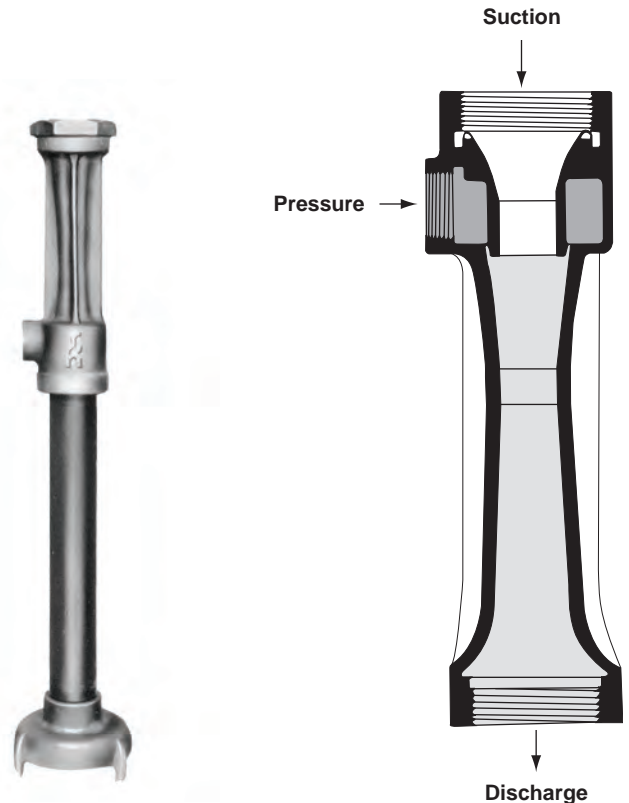
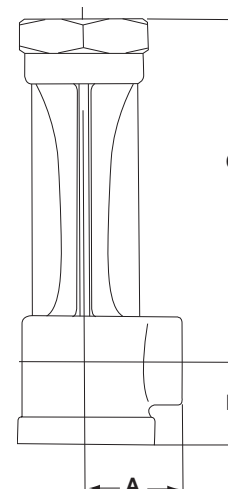


Fig. 220-A. Syphon arrangement showing extension pipe and strainer.

Fig. 220 Syphon strainer.



SECTION 2 - SPECIAL PURPOSE SYPHONS
Fig. 228, Fig. 210 and Fig. 225 Syphons

Fig. 228 Cast or Welded Special Metal Syphon
Application

Custom-made to meet individual requirements, this syphon is especially recommended for higher lift or discharge head specifications than are possible with standard syphons. The syphon can also be designed for minimum steam consumption with minimum temperature rise and dilution of suction fluid. Under some conditions, the unit may be designed so that the available discharge head varies with steam pressure; under other conditions, it may be designed so that suction flow varies with steam pressure.

Construction

The welded type consists of a one-piece body and tail forging with the other parts welded on. The cast type is also a one-piece unit except for the pressure nozzle and throat. Both types may be made from special metals such as high-alloy stainless steels, Durimet, Hastelloy and others. Connections may be flanged, threaded or butt-welded.


Fig. 210 Corrosion-Resistant Syphon
Application

Designed for use with corrosive fluids.

Construction

Made of corrosion resistant materials in sizes from 1/2" to 6", this syphon has a one-piece body with a removable nozzle and with threaded or split-flange pressure connection and split-flange suction and discharge connections. Supporting rods are provided to offset any pipe strain. Use Tables 2 and 4 for performance data. Maximum steam pressure is 125 psig.


Fig. 225 Sand and Mud Syphon
Application

This syphon is designed for pumping out pits and receptacles where there is an accumulation of sand, mud, sludge or similar materials. The syphon is submerged in the material being handled which it entrains and discharges vertically.

Construction

Standard syphons are made in cast iron and have bronze steam nozzles; however, they can be made in other materials on special order. Sizes from 1 1/2" to 4" have threaded connections while the 5" and 6" sizes have flanged connections.

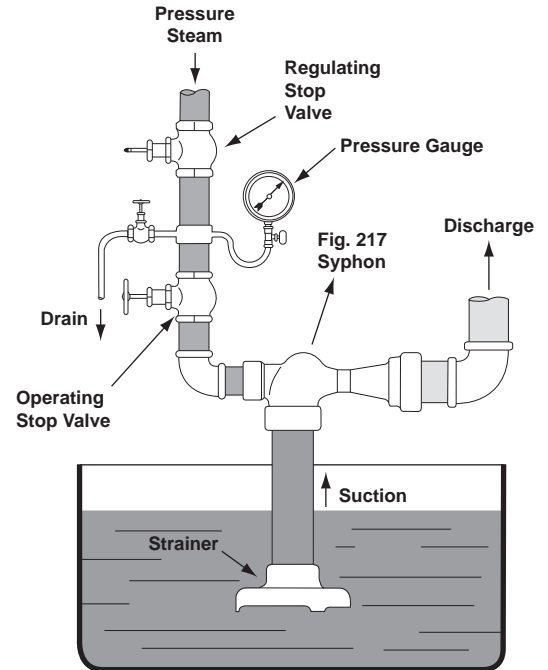
SECTION 3 - TYPICAL APPLICATIONS

Typical Pipe for Threaded Syphons

Illustrated is the usual and most satisfactory method of installing a standard threaded syphon. To obtain maximum results the syphon should be suspended a foot or two above the surface of the liquid to be lifted. Under these conditions, the syphon automatically empties itself when not in operation. The live steam pipe should be blown out before connection is made to the syphon. In cases where there are lumps or other material in the liquid, a Strainer should be used on the suction pipe. Stoppage in the suction pipe, in the strainer or in the syphon is cleared by closing a valve in the discharge line. This causes the steam to blow back and remove the obstruction.

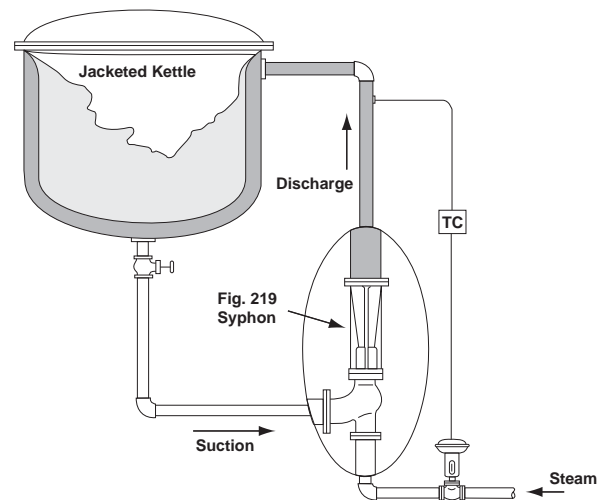
The syphon works best for any individual condition at a definite steam pressure, which must be determined by throttling the steam. Therefore, when the syphon is first installed, the regulating stop valve in the steam line is adjusted to the most favorable pressure and locked in that position. A second stop valve is then used for operating the syphon.

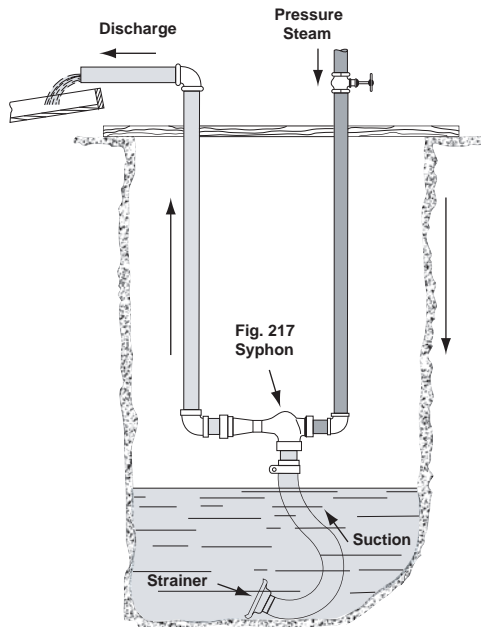
Before starting, the drain valve should be opened to draw off any condensation. The delivery pipe should be arranged without any traps or loops, and the suction line should be air tight. The syphon is started by opening the operating valve to turn on the live steam, and it can be shut off by closing this valve.



Holds Uniform Temperature

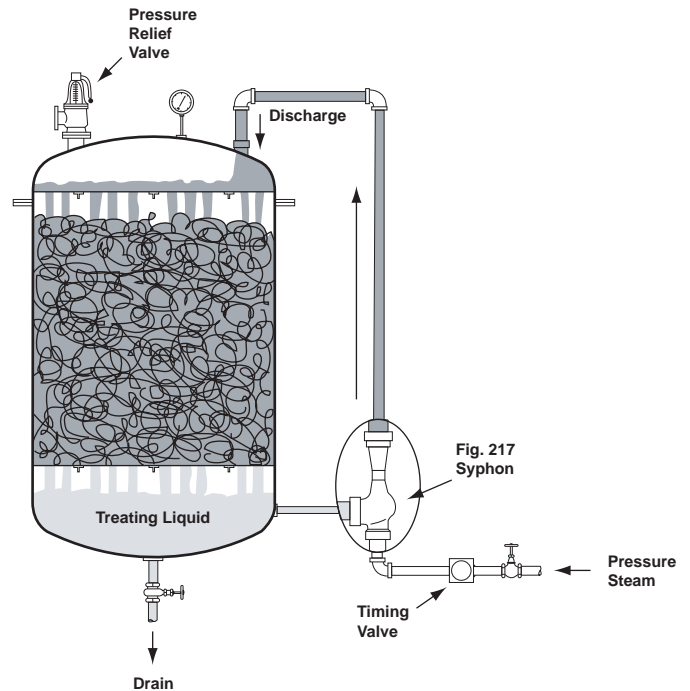
When steam is injected directly into a jacketed kettle, there is usually a large temperature gradient between the top and bottom of the kettle due to condensation of steam in the jacket. Use of a Fig. 219 steam jet syphon eliminates this gradient because the syphon constantly entrains and reheats the steam in the jacket before it has a chance to condense. Temperature is thus held uniform throughout the jacket.





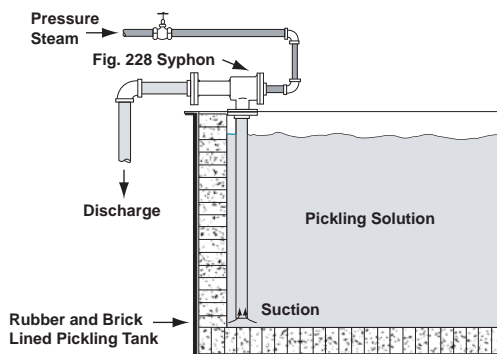
Installation in Pits

Because the syphon is low in cost, requires minimum maintenance, has no moving parts, and is not seriously affected by semi-solids, dirt, grit or grime, it is used extensively for draining pits, cellars and other receptacles as illustrated. After installing the syphon, draining can be accomplished periodically by merely opening the stop valve in the steam line.



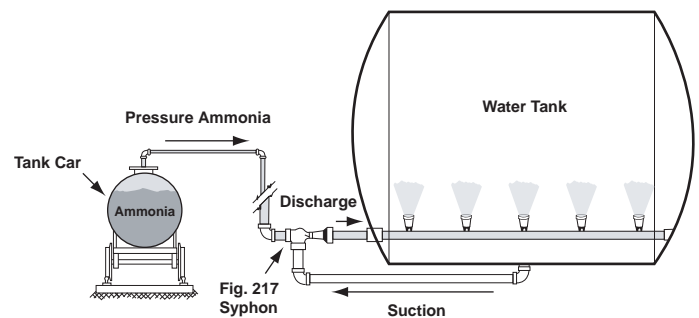
Intermittent Operation

The tank in which cloth is being treated has a perforated false bottom through which treatment liquid filters. A timing device provides intermittent operation so the cloth does not settle. The jet action of the pressure steam draws the liquid from the bottom of the tank, heats it and pumps it through the inlet in the top of the tank. The heated liquid then trickles down over the cloth. Since the liquid is maintained at boiling point, a relief valve is provided at the top of the tank. The syphon pumps and heats the liquid and eliminates agitators within the tank.



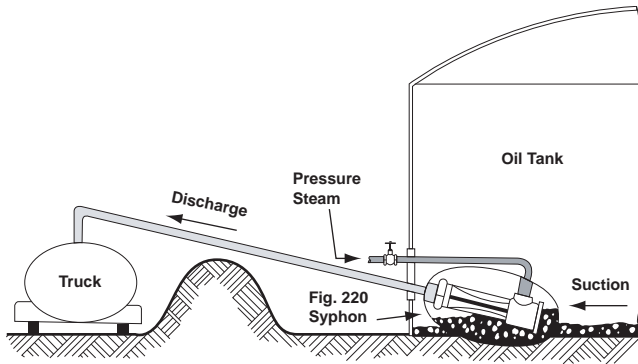
Draining From Top of Tank

A Fig. 228 Steam Jet Syphon is being used to empty spent pickling liquor from a pickling tank. Since the liquid is very corrosive, the tank is lined with rubber and brick which necessitates draining from the top. The syphon provides a good suction lift with warm liquids, heats as it pumps, is ideal for periodic operation and resists corrosion. Again, it is necessary only to open the valve in the steam line to begin the draining operation.



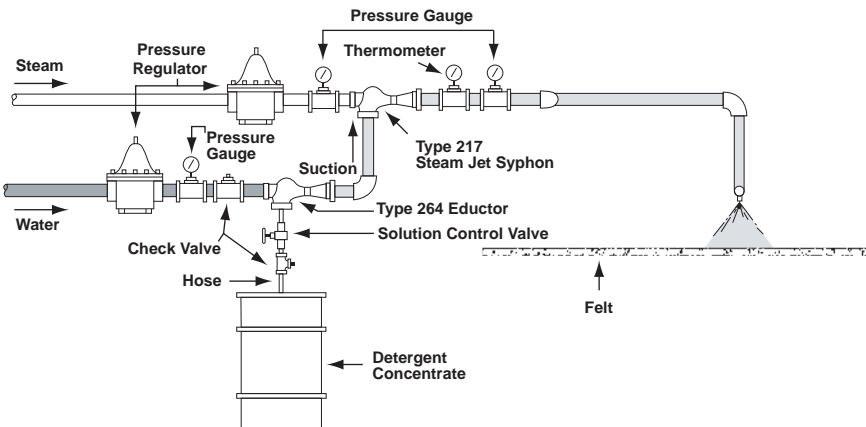
Condensing and Mixing Ammonia

An unusual, but efficient, method of condensing and mixing ammonia in water without the use of a pump is illustrated. Ammonia at atmospheric temperature issues from a tank car under sufficient pressure to entrain water from the bottom of the water tank and discharge the mixture back into the tank through sparger nozzles. The sparger nozzles perform another mixing and agitating action within the tank.



Pumping Sludge Without Clogging

In this operation, a Fig. 220 Syphon is partially submerged in the sludge at the bottom of an oil tank which may or may not contain oil. The pressure steam not only provides the motivating force necessary to entrain and discharge the sludge but also heats the sludge and makes it easier to move the sludge from the tank to the discharge point. Also, if additional pumping is required, the heated sludge is sufficiently fluid to permit the use of a centrifugal pump. The streamlined body of the syphon provides maximum efficiency without clogging.



Pipeline Heater

Fig. 217 Syphon being used as a pipeline heater in a system for the continuous application of detergent solution to paper-mill felts. A water-motivated jet eductor is used to entrain detergent concentrate from a drum. This detergent is intimately mixed with the motive water in the diffuser and this solution is immediately entrained by the steam jet syphon. It is brought to the desired temperature by contact with the steam in the body of the syphon. It is discharged at an elevated temperature and pressure into piping, then through spray jets which apply the solution to the felt. Other types of pipeline heaters are described in S&K Bulletin 3A.

