

The quantities of condensate to be handled from direct radiation, direct-indirect radiation and indirect or fan blast radiation may be estimated as follows:

$$\begin{aligned} \text{For direct radiation} \quad W &= 0.3 R^1 \\ \text{For direct-indirect radiation} \quad W &= 0.6 R^1 \\ \text{For indirect radiation} \quad W &= \frac{Q \times 60 \times T}{55.6 \times r} \end{aligned}$$

where

W = pounds of condensate per hour.

R = square feet of radiation.

Q = cubic feet of air per minute.

T = temperature rise of air in deg. fahr.

r = the latent heat of steam in the system in B.t.u. per pound.

CONDENSATION PUMPS

Condensation return pumps are generally of two types: (1) automatic pumps and receivers, and (2) continuously operating non-automatic return pumps. These may be of the steam or power driven reciprocating type or motor-driven centrifugal type. Steam and power-driven reciprocating condensation pumps should always be of the automatic type.

TABLE 1. HORIZONTAL STEAM DRIVEN SIMPLEX RECIPROCATING BOILER FEED PUMPS—150 LB. WORKING PRESSURE

CYLINDER SIZES INCHES			PIPE SIZES INCHES				CAPACITY IN GALLONS PER STROKE	BOILER HORSEPOWER PUMP WILL FEED AT MODERATE SPEED
Steam	Water	Stroke	Steam	Exhaust	Suction	Delivery		
2½	1⅜	2	¼	⅜	¾	½	0.013	20
3	1¾	2½	⅜	½	1	¾	0.020	35
4	2⅜	3	⅜	¾	1¼	¾	0.058	60
4	2½	6	⅜	¾	2	1¼	0.128	100
5	3	6	½	1	2	1¼	0.184	150
5½	3½	6	¾	1	2	1½	0.250	200
6	3⅝	8	¾	1	2½	2	0.360	250
6	4	8	¾	1	2½	2	0.435	300
7	4	8	1	1¼	2½	2	0.435	350
8	5	8	1	1½	3	2½	0.675	450
7	4½	10	1	1¼	3½	2½	0.688	400
7½	4½	10	1	1¼	3½	2½	0.688	450
8	5	10	1	1½	3½	2½	0.850	500
8	5	12	1	1½	4	3	1.02	600
10	6	12	1¼	1½	4	3	1.469	1,000
12	7¼	12	1½	2	5	4	2.144	1,500
12	8	12	1½	2	5	4	2.611	1,650
14	8½	12	2	2½	6	5	2.948	2,000
16	9¼	16	3	3½	8	7	4.656	2,200
16	10	16	3	3½	8	7	5.441	2,500
16	9¼	20	3	3½	8	7	5.820	2,400
16	10	20	3	3½	8	7	6.801	2,700
20	12	20	3½	4	8	7	9.794	3,500

¹This is greater than the standard 0.25 lb. of condensate per square foot, to take care of heating-up periods.

Automatic Pumps and Receivers

The volumetric capacity of receivers for electrically-driven pumps should be not less than twice the maximum minute volumetric flow of condensation to be handled, measured between the high and low water lines in

TABLE 2. HORIZONTAL STEAM DRIVEN DUPLEX RECIPROCATING BOILER FEED PUMPS—150 LB. WORKING PRESSURE

CYLINDER SIZES INCHES			PIPE SIZES INCHES				GALLONS PER STROKE EACH PISTON	BOILER HORSEPOWER BASED ON 34.5 LB. EVAPORATION— NO FACTOR OF SAFETY	No. OF STROKES PER MINUTE	DIS- CHARGE IN GALLONS
Steam	Water	Stroke	Steam	Exhaust	Suction	Discharge				
3	2	3	¾	½	1¼	1	0.04	83	70	5.6
4	2½	4	½	¾	2	1½	0.08	150	60	9.6
4½	2¾	4	½	¾	2	1½	0.103	180	60	12.0
5¼	3½	5	1	1¼	2½	1½	0.208	330	50	20.0
6	4	6	1	1½	3	2	0.33	470	50	33.0
7	4½	8	1¼	1½	4	3	0.55	760	50	55.0
7½	4½	10	1½	2	4	3	0.69	840	40	55.2
8	5	10	1½	2	4	3	0.85	1,100	40	68.0
10	6	10	2	2½	5	4	1.22	1,600	40	97.6
12	7	12	2½	3	6	5	1.99	2,300	35	139.3

TABLE 3. HORIZONTAL DUPLEX POWER DRIVEN BOILER FEED PUMPS—150 LB. WORKING PRESSURE

CYLINDER SIZES, INCHES		MAXIMUM R. P. M. CRANK SHAFT	DIS- PLACEMENT GALLONS PER REVOLUTION	GALLONS PER MINUTE	BRAKE HORSEPOWER REQUIRED AT 150 LB. PRESSURE	BOILER HORSEPOWER SERVED WITHOUT SAFETY FACTOR	PIPE SIZES INCHES		PULLEY SIZES INCHES AND R. P. M.		
Diam.	Stroke						Suction	Disch.	Diam.	Face	R. P. M.
2¾	4	60	0.41	24	2.1	330	2½	2	14½	2½	300
3	4	60	0.48	28	2.46	390	2½	2	14½	2½	300
3½	6	50	0.99	59	5.2	820	3	2	25	5	250
4	6	55	1.32	79	6.96	1,010	4	3	25	5	275
4½	8	45	2.19	110	9.65	1,520	4	3	30	5	225
5	10	40	3.40	136	11.97	1,890	4	3	37	8	200
5½	10	40	4.11	164	14.45	2,280	5	4	37	8	200
6	10	40	4.88	195	17.17	2,700	5	4	37	8	200

*Figure pump efficiency at 50 per cent to arrive at motor horsepower to be used.

the receiver. For steam-driven pumps and receivers, the capacity may be less than for electrically-driven pumps.

The piston speed in feet per minute should not be more than 10 times the square root of the number of inches in the length of stroke.

The volumetric displacement rate of water pistons should not be less than three times the maximum volumetric rate of the flow of condensate to be handled.

The normal capacity of centrifugal pumps should not be less than twice the maximum rate of flow of the condensate to be handled.