

# Thermocompressor Sizing

The following charts can be used to estimate the size of a thermocompressor. The size is based on the motive, suction, and discharge steam pressures and the required steam flow. The following parameters are used for these estimates:

- P = Atmospheric pressure (absolute) = 14.7 psi (typical)
- $P_m$  = Motive steam pressure (absolute) = gauge pressure + atmospheric pressure
- $P_s$  = Suction steam pressure (absolute) = gauge pressure + atmospheric pressure
- $P_d$  = Discharge steam pressure (absolute) = gauge pressure + atmospheric pressure
- $M_m$  = Motive steam flow rate
- $M_s$  = Suction steam flow rate
- $M_d$  = Discharge (total) steam flow rate =  $M_m + M_s$
- E = Expansion ratio =  $P_m/P_s$  (should be over 1.4)
- C = Compression ratio =  $P_d/P_s$  (normally less than 1.8)\*
- R = Entrainment ratio =  $M_s/M_m$

## Sizing Example

Operating Parameters:

- $P_m$  = Motive steam pressure = 85 psig + 14.7 = 99.7 psia
- $P_s$  = Suction steam pressure = 5 psig + 14.7 = 19.7 psia
- $P_d$  = Discharge steam pressure = 11 psig + 14.7 = 25.7 psia
- $M_s$  = Suction steam flow rate = 20,000 lb/hr

Calculate Ratios:

- E = Expansion ratio =  $P_m/P_s = 99.7 / 19.7 = 5.06$
- C = Compression ratio =  $P_d/P_s = 25.7 / 19.7 = 1.3$

Use these ratios and the sizing graph on the following page to determine entrainment ratio R:

- R = Entrainment ratio = 1.5

Calculate the motive and discharge (total) steam flow rates from the Entrainment ratio R

- Motive steam flow rate =  $M_m = M_s/R = (20,000/1.5) = 13,333$  lb/hr
- Discharge (total) steam flow rate =  $M_d = M_m + M_s = 13,333 + 20,000 = 33,333$  lb/hr

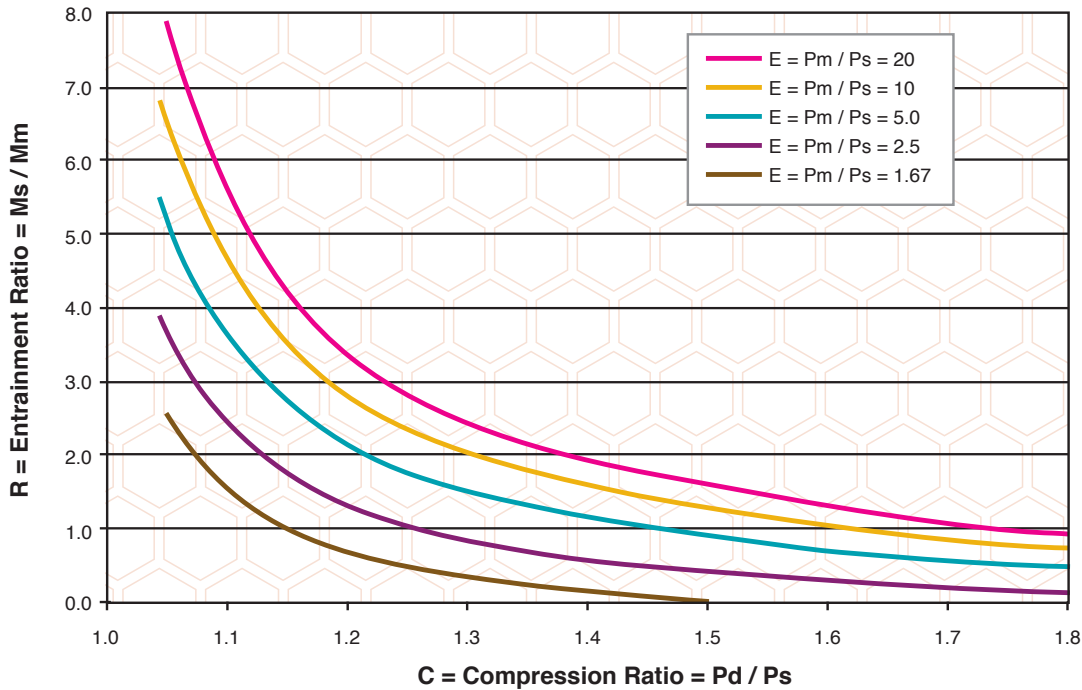
Determine the size of the thermocompressor using the Discharge (total) steam flow rate and the Discharge steam pressure and the Sizing Table on the following page:

- For this example, the thermocompressor size = 12"

**Note:** Consult Kadant Johnson for optimum sizing and thermocompressor performance curves.

\* For higher compression ratios, please contact Kadant Johnson.

## Thermocompressor Entrainment



### Thermocompressor Sizing Table

Nominal Size (Inches)	Pd = Thermocompressor Discharge Steam Pressure, psig								
	0	5	10	25	50	75	100	150	250
	Md = Discharge Steam Flow Rate, lb/hr								
1	60	80	100	170	270	360	460	650	1,000
1.5	180	240	300	480	760	1,000	1,300	1,800	2,900
2	360	480	590	930	1,400	2,000	2,500	3,500	5,600
2.5	590	780	960	1,500	2,400	3,200	4,100	4,800	9,100
3	1,000	1,300	1,600	2,600	4,100	5,600	7,100	10,100	15,900
4	2,100	2,800	3,500	5,500	8,700	11,900	15,000	21,200	33,500
5	3,700	4,900	6,000	9,500	15,000	20,400	25,700	36,500	57,500
6	5,300	7,000	8,700	13,700	21,700	29,500	37,200	52,700	83,000
8	9,300	12,200	15,100	23,800	37,600	51,100	64,400	91,200	140,000
10	14,700	19,300	23,900	37,500	59,200	80,600	101,000	143,000	226,000
12	21,100	27,700	34,200	53,800	85,000	115,000	145,000	206,000	325,000
14	25,700	33,800	41,800	65,600	103,000	140,000	177,000	251,000	396,000
16	34,000	44,800	55,300	86,900	137,000	186,000	235,000	333,000	524,000
18	43,600	57,300	70,800	111,000	175,000	238,000	301,000	426,000	671,000
20	54,100	71,100	87,900	138,000	218,000	296,000	373,000	529,000	833,000
22	66,100	87,000	107,500	168,000	266,000	362,000	457,000	647,000	1,010,000
24	79,200	104,100	128,700	202,000	319,000	434,000	547,000	774,000	1,220,000
26	93,400	122,800	151,800	238,000	376,000	512,000	645,000	913,000	1,430,000
28	108,000	143,000	176,000	277,000	438,000	596,000	751,000	1,060,000	1,670,000
30	125,000	164,000	203,000	319,000	505,000	687,000	865,000	1,220,000	1,930,000
32	143,000	188,000	232,000	365,000	576,000	784,000	988,000	1,390,000	2,200,000
34	161,000	213,000	263,000	413,000	652,000	887,000	1,110,000	1,580,000	2,490,000
36	182,000	239,000	295,000	464,000	733,000	997,000	1,250,000	1,780,000	2,800,000

*Dimensions are for reference only and subject to change.*