TYPICAL SOUND POWER LEVELS OF PUMPSETS

The following sound power levels for various rating of pumpsets are given in Tables 7a and 7b for reference purpose only. Where practicable, the sound power level of the concerned pumpset should be referred to the respective manufacturers.

Table 7a: Typical Sound Power Levels of Pumpsets a 3600rpm

Horsepower of Pumpset (hp)	Sound Power Level (dB(A))
5 to 10	100
11 to 20	103
21 to 30	105
31 to 50	107
51 to 100	109

Table 7b: Typical Sound Power Levels of Pumpsets a 1800rpm

Horsepower of Pumpset (hp)	Sound Power Level (dB(A))
5 to 10	92
11 to 20	92
21 to 30	94
31 to 50	97
51 to 100	100

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MCA/MOP (Minimum Circuit Ampacity / Maximum Overcurrent Protection) for 2 to 6 Motors

(1 to 200HP, 208/230/460/575V)

1. FLA per NEC Table 430.150
2. MCA (Minimum Circuit Ampacity) = (125% * the FLA of the Largest Motor) + (100% * the FLA of the Remaining Motors)
3. MOP (Maximum Overcurrent Protection) = (225% * the FLA of the Largest Motor) + (100% * the FLA of the Remaining Motors)
   i) 1 amp added to MCA for control panel
   ii) MOP is rounded down to next smaller standard size (NEC 240.6A) unless this value is less than MCA in which case it is rounded up to next larger standard size

208 V

		2 Motors		3 Motors		4 Motors		5 Motors		6 Motors	
HP	FLA (per motor)[1]	MCA[2]	MOP[3]	MCA[2]	MOP[3]	MCA[2]	MOP[3]	MCA[2]	MOP[3]	MCA[2]	MOP[3]
1	4.6	11	15	16	20	21	25	25	30	30	30
1.5	6.6	16	20	22	25	29	35	36	40	42	45
2	7.5	18	20	25	30	33	35	40	45	48	50
3	10.6	25	30	35	45	46	50	57	60	67	70
5	16.7	39	50	55	70	72	80	89	100	105	125
7.5	24.2	55	70	80	100	104	125	128	150	152	175
10	30.8	70	100	101	125	132	150	163	175	194	200
15	46.2	105	150	151	175	197	225	244	250	290	300
20	59.4	135	175	194	250	253	300	313	350	372	400
25	74.8	169	225	244	300	319	350	394	450	469	500
30	88	199	250	287	350	375	450	463	500	551	600
40	114	258	350	372	450	486	500	600	700	714	800
50	143	323	450	466	600	609	700	752	800	895	1000
60	169	381	500	550	700	719	800	888	1000	1057	1200
75	211	476	600	687	800	898	1000	1109	1200	1320	1600
100	273	615	800	888	1000	1161	1200	1434	1600	1707	2000
125	343	773	1000	1116	1200	1459	1600	1802	2000	2145	2500
150	396	892	1200	1288	1600	1684	2000	2080	2500	2476	2500
200	528	1189	1600	1717	2000	2245	2500	2773	3000	3301	4000

230 V

		2 Motors		3 Motors		4 Motors		5 Motors		6 Motors	
HP	FLA (per motor)[1]	MCA[2]	MOP[3]	MCA[2]	MOP[3]	MCA[2]	MOP[3]	MCA[2]	MOP[3]	MCA[2]	MOP[3]
1	4.2	10	15	15	15	19	20	23	25	27	30
1.5	6	15	20	21	25	27	30	33	35	39	40
2	6.8	16	20	23	25	30	35	37	40	44	45
3	9.6	23	30	32	40	42	50	51	60	61	70
5	15.2	35	45	50	65	66	80	81	90	96	110
7.5	22	51	70	73	90	95	110	117	125	139	150
10	28	64	90	92	110	120	125	148	175	176	200
15	42	96	125	138	175	180	200	222	250	264	300
20	54	123	175	177	225	231	250	285	300	339	350
25	68	154	200	222	250	290	350	358	400	426	450
30	80	181	250	261	300	341	400	421	500	501	600
40	104	235	300	339	400	443	500	547	600	651	700
50	130	294	400	424	500	554	600	684	800	814	1000
60	154	348	500	502	600	656	800	810	1000	964	1000
75	192	433	600	625	800	817	1000	1009	1200	1201	1600
100	248	559	800	807	1000	1055	1200	1303	1600	1551	1600
125	312	703	1000	1015	1200	1327	1600	1639	2000	1951	2000
150	360	811	1000	1171	1200	1531	1600	1891	2000	2251	2500
200	480	1081	1200	1561	2000	2041	2500	2521	3000	3001	4000

460 V

		2 Motors		3 Motors		4 Motors		5 Motors		6 Motors	
HP	FLA (per motor)[1]	MCA[2]	MOP[3]	MCA[2]	MOP[3]	MCA[2]	MOP[3]	MCA[2]	MOP[3]	MCA[2]	MOP[3]
1	2.1	6	15	8	15	10	15	12	15	14	15
1.5	3	8	15	11	15	14	15	17	20	20	20
2	3.4	9	15	12	15	15	15	19	20	22	25
3	4.8	12	15	17	20	21	25	26	30	31	35
5	7.6	18	25	26	30	33	40	41	45	49	50
7.5	11	26	35	37	45	48	50	59	60	70	80
10	14	33	45	47	60	61	70	75	80	89	100
15	21	48	60	69	80	90	110	111	125	132	150
20	27	62	80	89	110	116	125	143	150	170	175
25	34	78	110	112	125	146	150	180	200	214	225
30	40	91	125	131	150	171	200	211	250	251	300
40	52	118	150	170	200	222	250	274	300	326	350
50	65	147	200	212	250	277	300	342	400	407	450
60	77	174	250	251	300	328	400	405	450	482	500
75	96	217	300	313	400	409	500	505	600	601	700
100	124	280	400	404	500	528	600	652	700	776	800
125	156	352	500	508	600	664	800	820	1000	976	1000
150	180	406	500	586	700	766	800	946	1000	1126	1200
200	240	541	700	781	1000	1021	1200	1261	1600	1501	1600

575 V

		2 Motors		3 Motors		4 Motors		5 Motors		6 Motors	
HP	FLA (per motor)[1]	MCA[2]	MOP[3]	MCA[2]	MOP[3]	MCA[2]	MOP[3]	MCA[2]	MOP[3]	MCA[2]	MOP[3]
1	1.7	5	15	7	15	8	15	10	15	12	15
1.5	2.4	6	15	9	15	11	15	14	15	16	20
2	2.7	7	15	10	15	12	15	15	15	18	20
3	3.9	10	15	14	15	18	20	21	25	25	25
5	6.1	15	20	21	25	27	30	33	35	39	40
7.5	9	21	25	30	35	39	45	48	50	57	60
10	11	26	35	37	45	48	50	59	60	70	80
15	17	39	50	56	70	73	80	90	100	107	110
20	22	51	70	73	90	95	110	117	125	139	150
25	27	62	80	89	110	116	125	143	150	170	175
30	32	73	100	105	125	137	150	169	200	201	225
40	41	93	125	134	150	175	200	216	250	257	300
50	52	118	150	170	200	222	250	274	300	326	350
60	62	141	200	203	250	265	300	327	350	389	450
75	77	174	250	251	300	328	400	405	450	482	500
100	99	224	300	323	400	422	500	521	600	620	700
125	125	282	400	407	500	532	600	657	700	782	800
150	144	325	450	469	600	613	700	757	800	901	1000
200	192	433	600	625	800	817	1000	1009	1200	1201	1600

Some Effects of Operating Pumps Away from Best Efficiency Point

February 20, 2013
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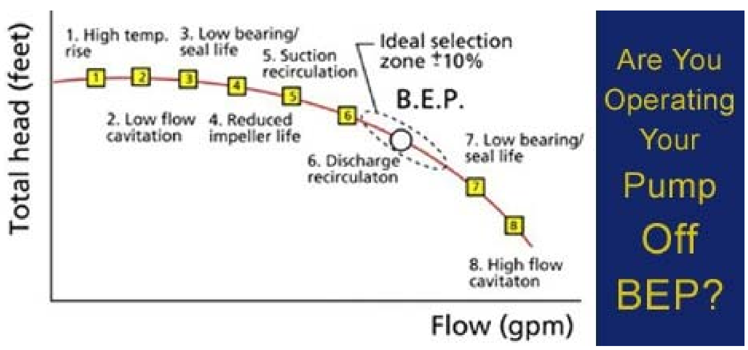

The Best Efficiency Point, or BEP, is a term that is used quite often in pump vernacular. Like the terms Shut-off (SO) or Run-out (RO), the Best Efficiency Point identifies an operating region or point along the pump performance curve. The Best Efficiency Point is defined as the flow at which the pump operates at the highest or optimum efficiency for a given impeller diameter. When we operate a pump at flows greater than or less than the flow designated by the BEP, we call this "operating pumps away from the Best Efficiency Point". Therefore, operating a pump at flows higher or greater than the flow at the BEP is called "operating to the right of the BEP", and conversely, operating a pump at flows lower or less than the flow at the BEP is called "operating to the left of the BEP."

Under ideal circumstances, a pump will not operate at flows greater than BEP plus 10% or flows less than BEP minus 10%. While we try not to stray too far from the BEP, in general, most pumps operate away from the BEP to one degree or another, and this is acceptable for intermittent duty. There are many consequences, however, to operating your pump too far to the left or right of its Best Efficiency Point for a sustained period of time.

Some of these effects can include:

Cavitation is caused by the formation of vapor bubbles which violently collapse, eroding impeller surfaces and resulting in reduced mean-time-between-repair. Cavitation can occur when operating the pump to the far right of the BEP. For most centrifugal pumps, as the flow increases beyond the BEP, the Net Positive Suction Head required (NPSHr) also increases; and when the NPSHr exceeds the Net Positive Suction Head available (NPSHa), cavitation occurs. Remedies are limited to increasing the NPSHa, which is not always possible, reducing the flow to values resulting in lower NPSHr, or installing special impellers which are designed to operate under low NPSHr conditions.

Comment [DoVA1]: If you look at the curve the NPSH does increase and relatively steeply so this may be the issue because I think the calc for the operating point NPSH has errors in it and if operated at design you wouldn't see cavitation.

My concern is replacing the tower will not fix this but actually make it worse as the discharge head is reduced.

Vibration can be caused by many factors and can create bending moments in the shaft, resulting in poor pump performance and risk of shaft failure. Excessive vibration can occur when pumps operate too far to the right of BEP, due in part to cavitation which causes hydraulic imbalances within the impeller as voids are formed by the vaporization of the liquid. Excessive vibration can also occur due to higher bearing loads associated with pump operation closer to run-out or shut-off conditions.

Impeller Damage can be caused by cavitation, and excessive vibration could potentially cause the rotor to make contact with the casing. As the vapor bubbles, formed during the onset of cavitation, migrate to the higher pressure regions of the impeller, they implode with enough force to send shock waves to the surrounding area which in turn breaks molecules from the parent metal, leaving behind the telltale signs of cavitation – pitting and erosion.

Suction & Discharge Recirculation, which can occur depending on the hydraulic design of the pump, happens when the fluid does not flow through the pump properly. This phenomenon can cause significant instability and can reduce flow. The damage caused by suction or discharge recirculation resembles cavitation and can lead to catastrophic failure of the pump when portions of the impeller inlet or discharge vanes fatigue and fail by breaking off.

Reduced Bearing and Seal Life can occur as a result of recirculation and cavitation and will increase the maintenance costs as these components will need to be frequently replaced. The rotor instability that occurs at off-BEP operation can lead to shaft failures, premature packing wear, mechanical seal failures, or simply higher bearing temperatures leading to premature lubrication breakdown.

Comment [DoVA2]: You had mentioned that this was happening so again a concern that we are actually flowing what the pump is designed for and not running out to the right.

In our quest for higher efficiencies and increased reliability resulting in longer mean-time-between-failure, we often make modifications to the existing pumps so we can get their BEP to coincide with the duty point of the pumping systems. If you are not aware of your pump's Best Efficiency Point for your specific application, consider testing your pump. Hydro can provide a certified performance test, from shut-off to run-out, and identify the BEP for your pumps.