When sizing a portable prime power generator, it's crucial to follow a systematic approach that considers all the necessary aspects of your power needs. Here's a quick guide:

Calculate Total Electrical Requirements: You need to list all the electrical components that will be powered by the generator. For each component, find out their power requirements in watts or kilowatts (kW). This information can be usually found on the device's label or in the product's user manual. At times you may sized based on sub-panel ratings -sub-panels are rated based on the maximum amount of electricity they can safely carry, typically indicated in amps (A). However, for generator sizing, you're more interested in the power, which is measured in watts (W) or kilowatts (kW).

Motor Starting Power: Electric motors require high startup power. This initial load is calculated in terms of Locked Rotor Amps (LRA). Motor code letters, which can be found on the motor nameplate or estimated using CHART B - MOTOR STARTING RATING and CHART C - NEMA CODE AND EFFICIENCY ESTIMATES, will help to calculate LRA.

For a single-phase motor, the LRA can be calculated with the following formula: Motor HP x KVA per HP x (1000 / Motor Voltage). For instance, a 3/4 HP, Code L motor at 240 Volts would require a 7.5 KW generator to handle a 31 LRA.

For a three-phase motor, the formula changes slightly: Motor HP x KVA per HP x (1000 / (Volts x 1.73)). An example would be a 20 HP Code G motor at 460 Volts, which needs a generator capable of producing 151 Amps to start safely.

It is worth noting that VFD equipped motors do not have in-rush currents typically.

Add a Buffer: Once you've added up the power requirements of all your components, you should add a buffer of around 20-25% to account for unexpected power surges or additions of new devices. It is also never advisable to run generators at 100% power output for long periods of time.

Select a Generator: Based on your total power requirements including the buffer, you can now select a generator. The generator chosen should have a power output rating that matches your calculated total power requirements. It is advisable to plan to run your generator in the 50-70% load threshold as a goal.

Power Distribution System: Decide how you will distribute power from the generator to your components. This may involve using extension cords (see CHART D), transformers (see CHART E), or a combination of both.

Remember, these calculations are designed to limit voltage dips to 25% at startup according to the National Electrical Code Handbook Article 430.7. If you can tolerate a higher dip (up to 35%), you can reduce the LRA and kW size by 25%.

However, voltage dips over 35% are not recommended. Also, always consult local authorities and adhere to relevant codes and regulations. The CSA standards applicable to portable generators should be strictly followed. Most generators have motor starting capacity well above their prime amperage rating @ 25% voltage dip.

This is a basic guide, but generator sizing can be complex depending on your specific needs, so it's often a good idea to consult with a professional.

COMMON ELECTRICAL LOADS

Model	Phase	Volts	Amps	kW	kVa
Heaters					
IAQH-1000	3	208	23	3.8	4.8
IAQH-2000	3	208	41	6.8	8.5
Job Shacks:					
30 Amp Panel:	1	208	30	5	-
50 Amp Panel:	1	208	50	8.3	-
30 Amp Panel:	1	240	30	7.2	-
50 Amp Panel:	1	240	50	12.0	-
Distribution Panels:					
SBP-250-ALR	3	208	225	37.4	46.8
120/240v, 1 Phase - 50 Amp "Spider Box"	1	240	50	12.0	-
208v, 3Ø - 100 Amp	1	240	100	24	-
208v, 3Ø - 100 Amp	3	208	100	28.8	36
208v, 3Ø - 250 Amp	3	208	250	72	90
208v, 3Ø - 400 Amp	3	208	400	115.2	144
480v, 3Ø, 250 AMP	3	480	250	166.1	207.6
480v, 3Ø, 400 AMP	3	480	400	265.7	332.1
600v, 3Ø, 100 Amps	3	600	100	83	103.8
600v 3Ø, 250 AMP	3	600	250	207.6	259.5

When you're setting up a gas piping system, the size of the pipe is a critical factor. An incorrectly sized pipe can lead to inefficient operation or even safety issues. Here's a basic guide to help you determine the correct size for your pipe:

Step 1: Determine the total length of pipe
Start by measuring the actual length of your piping system. This includes the distance from the gas source to each appliance that will be using the gas. If your system branches out, ensure you measure each separate section.

Step 2: Account for Resistance
Piping systems don't just involve straight pipe. There are bends, fittings, and valves, each of which adds resistance to the gas flow, and this resistance can be quantified in an equivalent length of straight pipe. For instance, a 90-degree elbow might be equivalent to an additional 5 feet of straight pipe. Refer to Table "F" which gives the equivalent lengths of different components. Add these lengths to your actual pipe length from Step 1.

Example: If your actual pipe length is 100 feet, and you have a 90-degree elbow equivalent to 5 feet and a valve equivalent to 3 feet, your total length for calculations would be 108 feet (100 + 5 + 3).

Step 3: Determine Gas Pressure
Different appliances and setups require different pressures. Ensure you know the required pressure for your setup. This could be in terms of water column inches (like 7" WC) or pounds per square inch (like 0.5 PSI).

Step 4: Refer to Pressure Charts
Once you have the total length from steps 1 and 2 and your pressure requirement from step 3, refer to the appropriate pressure chart. These charts will tell you the appropriate pipe size for your length and pressure. Make sure to use the chart that matches your pressure requirement.

Step 5: Select Your Pipe Size
From the chart, find your total length in the left column. Follow that row across until you find the column that represents your gas consumption requirement (BTUH - British Thermal Units per Hour). The point where this row and column meet is the correct pipe size for your system.

By following these steps, you can determine the correct pipe size for your gas piping system. Always remember, if in doubt, consult with a professional. Remember that the aim of this guide is to provide you with a general understanding of how pipe sizing works for gas systems. Always consult with a licensed professional before undertaking any gas piping work yourself. Missized pipes can cause inefficiencies and potential safety hazards. It's always best to leave this kind of work to the experts if you are unsure.

CHART F - PIPE FITTING EQUIVALENT LENGTH

Resistance of bends, fittings, and valves for natural gas and propane expressed in equivalent length of straight pipe in feet* (See Clauses 6.3.7, A.2.4, and A.4 of CSA 149.1 Code Book)

Nominal Pipe Size	Inside Diameter	45°	90°	TEE
3/8	0.493	0.58	1.23	2.46
1/2	0.622	0.73	1.55	3.1
3/4	0.824	0.96	2.06	4.12
1	1.049	1.22	2.62	5.24
1-1/4	1.38	1.61	3.45	6.9
1-1/2	1.61	1.88	4.02	8.04
2	2.067	2.41	5.17	10.3
2-1/2	2.469	2.88	6.16	12.3
3	3.068	3.58	7.67	15.3

CHART J - 11" WC PROPANE GAS SYSTEM

Maximum capacity of propane in thousands of Btu/h for Schedule 40 pipe and plastic pipe, including fittings, for pressures of 11 in w.c. based on a pressure drop of 1 in w.c. (See Clauses 6.3.2, 6.3.5, B.2.3, B.2.4, and B.3.5 of CSA 149.1 Code Book)

Length of pipe,ft	1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	3
10	386	807	1520	3121	4676	9005	14353	25374
20	265	555	1045	2145	3214	6189	9865	17439
30	213	445	839	1722	2581	4970	7922	14004
40	182	381	718	1474	2209	4254	6780	11986
50	162	338	636	1307	1958	3770	6009	10623
60	146	306	577	1184	1774	3416	5445	9625
70	135	282	530	1089	1632	3143	5009	8855
80	125	262	493	1013	1518	2924	4660	8238
90	118	246	463	951	1424	2743	4372	7729
100	111	232	437	898	1345	2591	4130	7301
125	98	206	388	796	1192	2297	3660	6471
150	89	186	351	721	1080	2081	3317	5863
175	82	172	323	663	994	1914	3051	5394
200	76	160	301	617	925	1781	2839	5018

CHART A - USEFUL POWER FORMULAS

TO FIND:	SINGLE PHASE	THREE PHASE
KILOWATTS KW	VOLTS X AMPS X P.F. / 1000	VOLTS X AMPS X 1.73 X P.F.
KILO-VOLT-AMPS KVA	VOLTS X AMP / 1000	VOLTS X AMPS X 1.73 / 1000 = KW / .8
KW REQUIRED FOR MOTOR	MOTOR HP X EFF.	HP X .746 / EFFICIENCY
KVA REQUIRED FOR MOTOR	MOTOR HP X EFF. X .8	HP X .746 / EFFICIENCY X .8
POWER FACTOR P.F.	KW / KVA	KW / KVA
AMPS - WHEN KW IS KNOWN	(KW X 1000) / (VOLTS X P.F.)	(KW X 1000) / (1.73 X VOLTS x P.F.)
AMPS - WHEN KVA IS KNOWN	KVA X 1000 / VOLTS	(KVA X 1000) / (1.73 X VOLTS)
REQUIRED PRIME MOVER (ENGINE) HORSE POWER	KW / (GENERATOR EFF. X .746)	
FREQUENCY (HERTZ)	NUMBER OF POLES X R.P.M / 120	

CHART F - ECO POWER EQUIPMENT GENERATOR SPECS

Model	Phase	Voltages	Prime kW LP	Prime Amps LP	Prime kW NG	Prime Amps NG	Main Breaker Size
CIPR-15Z	1	120/240	14	49	12	42	70 Amp
CIPR-25K	3	120/208	24	83	20	69	100 Amp
CIPR-50W	1/3	240/208/480/600	45	175@ 240, 1Ø 156@ 208, 3Ø 68@ 480, 3Ø 54@ 600, 3Ø	42	175@ 240, 1Ø 147@ 208, 3Ø 110@ 480, 3Ø 51@ 600, 3Ø	175 Amp
CIPR-76W	1/3	240/208/480/600	72	250@ 240, 1Ø 250@ 208, 3Ø 108@ 480, 3Ø 87@ 600, 3Ø	64	250@ 240, 1Ø 222@ 208, 3Ø 167@ 480, 3Ø 77@ 600, 3Ø	250 Amp
CIPR-100W	1/3	240/208/480/600	80	250@ 240, 1Ø 278@ 208, 3Ø 120@ 480, 3Ø 96@ 600, 3Ø	101	250@ 240, 1Ø 350@ 208, 3Ø 263@ 480, 3Ø 121@ 600, 3Ø	350 Amp
CIPR-250W	3	480/600	103	154@ 480, 3Ø 123@ 600, 3Ø	220	331@ 480, 3Ø 265@ 600, 3Ø	400 Amp

CHART G - 7" WC NATURAL GAS SYSTEM

Maximum capacity of natural gas in thousands of Btu/h for Schedule 40 pipe and plastic pipe, including fittings, for pressures of less than 7 in w.c. based on a pressure drop of 0.5in w.c. (See Clauses 6.3.2, A.2.3, A.2.4, A.2.6, and A.3.5 of CSA 149.1 Code Book)

Length of pipe,ft	1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	3
10	156	326	614	1261	1890	3639	5800	10253
20	107	224	422	867	1299	2501	3986	7047
30	86	180	339	696	1043	2008	3201	5659
40	74	154	290	596	893	1719	2740	4843
50	65	137	257	528	791	1524	2428	4293
60	59	124	233	478	717	1380	2200	3889
70	54	114	214	440	659	1270	2024	3578
80	51	106	199	409	613	1181	1883	3329
90	48	99	187	384	576	1109	1767	3123
100	45	94	177	363	544	1047	1669	2950
125	40	83	157	322	482	928	1479	2615
150	36	75	142	291	437	841	1340	2369
175	33	69	131	268	402	774	1233	2180
200	31	64	121	249	374	720	1147	2028

CHART K - 10PSI PROPANE GAS SYSTEM

Maximum capacity of propane in thousands of Btu/h for Schedule 40 pipe and plastic pipe for pressures of 10 psig based on a pressure drop of 5 psig (See Clauses 6.3.5, 8.2.3, 8.2.4, and 8.3.5 of CSA 149.1 Code Book)

Length of pipe,ft	1/2	3/4	1	1-1/4	1-1/2	2
10	7658	16014	30166	61933	92795	178714
20	5264	11006	20733	42566	63777	122829
30	4227	8838	16649	34182	51216	98636
40	3618	7565	14249	29256	48834	84420
50	3206	6704	12629	25929	38949	74820
60	2905	6075	11443	23493	35200	67792
70	2673	5589	10527	21613	32384	62368
80	2486	5199	9794	20107	30127	58021
90	2333	4878	9189	18866	28267	54439
100	2204	4608	8680	17821	26701	51423
125	1953	4084	7693	15794	23664	45575
150	1770	3700	6970	14311	21442	41295
175	1628	3404	6413	13166	19726	37990
200	1515	3167	5966	12248	18351	35343

CHART B - MOTOR STARTING RATING

NEMA CODE	LOCKED ROTOR KVA/HP	NEMA CODE LETER	LOCKED ROTOR KVA/HP
A	0-3.14	L	9.0-9.9
B	3.15-3.54	M	10.0-11.19
C	3.55-3.99	N	11.2-12.49
D	4.0-4.49	P	12.5-13.99
E	4.5-4.99	R	14.0-15.99
F	5.0-5.59	S	16.0-17.99
G	5.6-6.29	T	18.0-19.99
H	6.3-7.09	U	20.0-22.39
J	7.1-7.99	V	22.4-UP
K	8.0-8.99		
NEMA STD. MG 1-10.36 JAN '84			

CHART C - NEMA CODE AND EFFICIENCY ESTIMATES

CODE	TYPICAL HP RANGE
F	15 HP & UP
G	10-12 HP
H	5-9 HP
J	3-4 HP
K	1.5-2.5 HP
L	1 HP
M	LESS THAN 1 HP

CHART D - EXTENSION CORD SIZE REFERENCE (FREE AIR COPPER)

LOAD AMPS	0 - 50 FEET	51 - 100 FEET	101 - 150 FEET
1-11	18	16	14
12-18	16	12	10
19-25	12	10	8
26-35	10	8	6
36-40	8	6	4
41-50	6	4	2
100*	4	4	2
150*	1	4	2
200**	1/0		
250**	1/0		
300**	3/0		
400**	4/0		

*: Refer to CSA C22.1:21 Table 1 for the allowable ampacities of bare, covered, or insulated single copper conductors rated under 5000 V in free air, assuming a 30 °C ambient temperature.
**: Refer to CSA C22.1:21 Table 12E for the allowable ampacities of Type DLO cables permanently installed in a cable tray.
Please note, manufacturers' specifications and local codes override our recommendations. Consult with the OEM for verification.

CHART E - TRANSFORMER PRIMARY AND SECONDARY AMPS

Model	Ø	Primary Volt	Secondary Voltage	kVa	Primary Amps	Secondary Amps
SBP-15-XFMR	3	480/600	120/208V	15	18/14.4	41.6
SBP-45-XFMR	3	480/600	120/208V	45	54.1/43.3	124.5
SBP-75-XFMR	3	480/600	120/208V	75	90.2/72.2	208.2
SBP-150-XFMR	3	480/600	120/208V	150	180.4/144.3	400
SBP-300-XFMR	3	480/600	120/208V	300	360.8/288.7	832.7

CHART H - 2PSI NATURAL GAS SYSTEM

Maximum capacity of natural gas in thousands of Btu/h for Schedule 40 pipe and plastic pipe for pressures of 5 psig based on a pressure drop of 2.5 psig. (See Clauses A.2.3, A.2.4, A.2.6, and A.3.5. of CSA 149.1 Code Book)

Length of pipe,ft	1/2	3/4	1	1-1/4	1-1/2	2
10	1440	3012	5673	11648	17425	33610
20	990	2070	3899	8005	11994	23100
30	795	1662	3131	6429	9632	18550
40	680	1423	2680	5502	8244	15877
50	603	1261	2375	4876	7306	14071
60	546	1142	2152	4418	6620	12749
70	503	1051	1980	4065	6090	11729
80	468	978	1842	3782	5666	10912
90	439	917	1728	3548	5316	10238
100	414	867	1632	3351	5022	9671
125	367	768	1447	2970	4451	8571
150	333	696	1311	2691	4032	7766
175	306	640	1206	2476	3710	7145
200	285	596	1122	2303	3451	6647

CHART I- 5PSI NATURAL GAS SYSTEM

Maximum capacity of natural gas in thousands of Btu/h for Schedule 40 pipe and plastic pipe for pressures of 5 psig based on a pressure drop of 2.5 psig. (See Clauses A.2.3, A.2.4, A.2.6, and A.3.5. of CSA 149.1 Code Book)

Length of pipe,ft	1/2	3/4	1	1-1/4	1-1/2	2
10	2800	5855	11028	22643	33925	65337
20	1924	4024	7580	15562	23317	44906
30	1545	3231	6087	12497	18724	36061
40	1323	2766	5210	10696	16026	30864
50	1172	2451	4617	9479	14203	27354
60	1062	2221	4183	8589	12869	24785
70	977	2043	3849	7902	11839	22801
80	909	1901	3581	7351	11014	21212
90	853	1783	3359	6897	10334	19903
100	806	1685	3173	6515	9762	18800
125	714	1493	2812	5774	8652	16662
150	647	1353	2548	5232	7839	15097
175	595	1245	2344	4813	7212	13889
200	554	1158	2181	4478	6709	12921

ECO POWER EQUIPMENT