Power System Sizing

# BR1100

## Solar Powered Chemical Injection Pump

The BR1100 Chemical Injection Pump is designed to operate utilizing the power supplied from 12 volt DC batteries which are charged using photovoltaic solar panels. The amount of power required by the pump is a result of the discharge pressure and the volume required.

In order to determine the size of the power system required, which is the size and number of batteries and the size and number of solar panels, you first need to determine the amount of power that will be required by the pump, or the pumps Amperage Draw. The pump system works best when it is utilized for low pressure and low volume applications. This is because:

- As the discharge pressure increases, the amperage draw on the system increases, requiring more power from the solar power system.
- As the volume requirement increases, the amount of time that the pump is on increases, requiring more power from the solar power system.

To determine the daily power requirement of the pump, follow these steps:

**Step 1:** Determine the pressure that the pump will be injecting into in psi.

**Injection Pressure = _____ psi**

**Step 2:** Determine the daily volume that is required to be injected in liters per day.

**Daily Injection Volume = _____L/day**

**Step 3:** Use the Amperage Draw Graph to determine the amperage draw based on the discharge pressure.

**amps = _____**

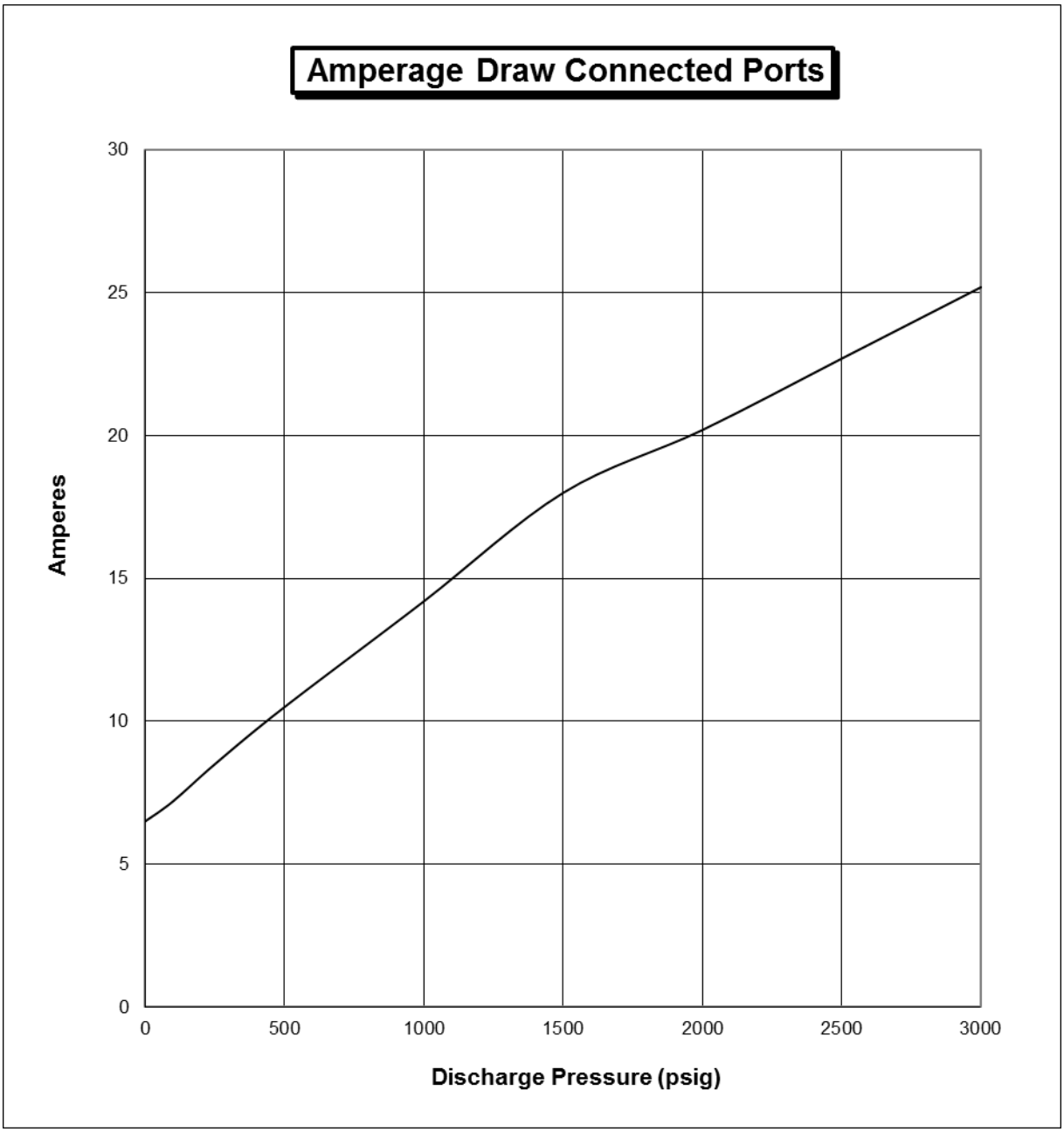
**Step 4:** Use TABLE 1 to approximate the ON TIME (s/min) required from the pump to inject the required volume at the required discharge pressure. Locate the approximate injection pressure listed on the top of the table and then follow the column down to the approximate daily injection volume located on the left column of the table, the intersecting box is the approximate on time per minute required. The duty cycle required (percentage of time that the pump is required to run) is also determined (ie. for an injection pressure of 250 psi and a daily injection volume of 20L/day, the approximate on time would be 1.03 seconds per minute, and the duty cycle would be 1.72).

**On time (t) = _____**

**Step 5:** The Average Daily amp hours required by the system can then be calculated by:

**Amp hrs/day = amps * t * 0.4**

=_____

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## Table 1 - Determine Required Duty Cycle from Required Pressure and Volume

| Volume L/day | Pressure PSI | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | | 100 | | 250 | | 500 | | 1000 | | 1500 | | 2000 | | 2500 | | 3000 | |
| | On time (s/min) | Duty cycle | On time (s/min) | Duty cycle | On time (s/min) | Duty cycle | On time (s/min) | Duty cycle | On time (s/min) | Duty cycle | On time (s/min) | Duty cycle | On time (s/min) | Duty cycle | On time (s/min) | Duty cycle | On time (s/min) | Duty cycle |
| **1** | 0.035 | 0.06 | 0.042 | 0.07 | 0.045 | 0.08 | 0.058 | 0.10 | 0.085 | 0.14 | 0.1 | 0.17 | 0.145 | 0.24 | 0.175 | 0.29 | 0.22 | 0.37 |
| **2** | 0.052 | 0.09 | 0.066 | 0.11 | 0.075 | 0.13 | 0.097 | 0.16 | 0.15 | 0.25 | 0.2 | 0.33 | 0.27 | 0.45 | 0.33 | 0.55 | 0.42 | 0.70 |
| **3** | 0.073 | 0.12 | 0.09 | 0.15 | 0.102 | 0.17 | 0.14 | 0.23 | 0.23 | 0.38 | 0.31 | 0.52 | 0.4 | 0.67 | 0.5 | 0.83 | 0.62 | 1.03 |
| **4** | 0.094 | 0.16 | 0.115 | 0.19 | 0.138 | 0.23 | 0.19 | 0.32 | 0.32 | 0.53 | 0.425 | 0.71 | 0.54 | 0.90 | 0.67 | 1.12 | 0.8 | 1.33 |
| **5** | 0.12 | 0.20 | 0.14 | 0.23 | 0.177 | 0.30 | 0.25 | 0.42 | 0.4 | 0.67 | 0.53 | 0.88 | 0.68 | 1.13 | 0.84 | 1.40 | 1.02 | 1.70 |
| **6** | 0.15 | 0.25 | 0.175 | 0.29 | 0.23 | 0.38 | 0.315 | 0.53 | 0.49 | 0.82 | 0.64 | 1.07 | 0.8 | 1.33 | 0.98 | 1.63 | 1.3 | 2.17 |
| **7** | 0.18 | 0.30 | 0.21 | 0.35 | 0.28 | 0.47 | 0.38 | 0.63 | 0.58 | 0.97 | 0.75 | 1.25 | 0.95 | 1.58 | 1.17 | 1.95 | 1.4 | 2.33 |
| **8** | 0.217 | 0.36 | 0.25 | 0.42 | 0.33 | 0.55 | 0.44 | 0.73 | 0.66 | 1.10 | 0.85 | 1.42 | 1.08 | 1.80 | 1.33 | 2.22 | 1.6 | 2.67 |
| **9** | 0.265 | 0.44 | 0.31 | 0.52 | 0.38 | 0.63 | 0.52 | 0.87 | 0.75 | 1.25 | 0.96 | 1.60 | 1.19 | 1.98 | 1.48 | 2.47 | 1.77 | 2.95 |
| **10** | 0.306 | 0.51 | 0.36 | 0.60 | 0.44 | 0.73 | 0.57 | 0.95 | 0.83 | 1.38 | 1.06 | 1.77 | 1.32 | 2.20 | 1.7 | 2.83 | 1.95 | 3.25 |
| **15** | 0.543 | 0.91 | 0.63 | 1.05 | 0.75 | 1.25 | 0.9 | 1.50 | 1.28 | 2.13 | 1.65 | 2.75 | 2 | 3.33 | 2.5 | 4.17 | 2.95 | 4.92 |
| **20** | 0.82 | 1.37 | 0.9 | 1.50 | 1.03 | 1.72 | 1.26 | 2.10 | 1.7 | 2.83 | 2.12 | 3.53 | 2.69 | 4.48 | 3.37 | 5.62 | 3.96 | 6.60 |
| **25** | 1.07 | 1.78 | 1.19 | 1.98 | 1.3 | 2.17 | 1.6 | 2.67 | 2.15 | 3.58 | 2.67 | 4.45 | 3.38 | 5.63 | 4.22 | 7.03 | 4.92 | 8.20 |
| **30** | 1.37 | 2.28 | 1.45 | 2.42 | 1.63 | 2.72 | 1.9 | 3.17 | 2.58 | 4.30 | 3.21 | 5.35 | 4.07 | 6.78 | 5.06 | 8.43 | 5.95 | 9.92 |
| **35** | 1.615 | 2.69 | 1.7 | 2.83 | 1.9 | 3.17 | 2.3 | 3.83 | 3.02 | 5.03 | 3.77 | 6.28 | 4.76 | 7.93 | 5.9 | 9.83 | 6.94 | 11.57 |
| **40** | 1.875 | 3.13 | 1.97 | 3.28 | 2.2 | 3.67 | 2.6 | 4.33 | 3.45 | 5.75 | 4.32 | 7.20 | 5.45 | 9.08 | 6.81 | 11.35 | 8.05 | 13.42 |
| **45** | 2.13 | 3.55 | 2.25 | 3.75 | 2.5 | 4.17 | 2.95 | 4.92 | 3.88 | 6.47 | 4.86 | 8.10 | 6.14 | 10.23 | 7.58 | 12.63 | 9 | 15.00 |
| **50** | 2.4 | 4.00 | 2.53 | 4.22 | 2.8 | 4.67 | 3.28 | 5.47 | 4.32 | 7.20 | 5.29 | 8.82 | 6.83 | 11.38 | 8.47 | 14.12 | 10.17 | 16.95 |
| **60** | 2.94 | 4.90 | 3.1 | 5.17 | 3.4 | 5.67 | 3.95 | 6.58 | 5.2 | 8.67 | 6.42 | 10.70 | 8.16 | 13.60 | 10.17 | 16.95 | 12.05 | 20.08 |
| **70** | 3.5 | 5.83 | 3.65 | 6.08 | 3.97 | 6.62 | 4.65 | 7.75 | 6.1 | 10.17 | 7.47 | 12.45 | 9.53 | 15.88 | 11.93 | 19.88 | 14.14 | 23.57 |
| **80** | 4 | 6.67 | 4.2 | 7.00 | 4.57 | 7.62 | 5.3 | 8.83 | 6.94 | 11.57 | 8.54 | 14.23 | 11 | 18.33 | 13.62 | 22.70 | 16.14 | 26.90 |
| **90** | 4.55 | 7.58 | 4.75 | 7.92 | 5.17 | 8.62 | 5.96 | 9.93 | 7.82 | 13.03 | 9.59 | 15.98 | 12.26 | 20.43 | 15.21 | 25.35 | 18.24 | 30.40 |
| **100** | 5.1 | 8.50 | 5.3 | 8.83 | 5.76 | 9.60 | 6.65 | 11.08 | 8.69 | 14.48 | 10.69 | 17.82 | 13.69 | 22.82 | 17.16 | 28.60 | 20.36 | 33.93 |
| **120** | 6.2 | 10.33 | 6.4 | 10.67 | 6.96 | 11.60 | 7.98 | 13.30 | 10.5 | 17.50 | 12.63 | 21.05 | 16.29 | 27.15 | 20.36 | 33.93 | 24.43 | 40.72 |
| **140** | 7.2 | 12.00 | 7.5 | 12.50 | 8.16 | 13.60 | 9.35 | 15.58 | 12.2 | 20.33 | 14.83 | 24.72 | 19.17 | 31.95 | 23.86 | 39.77 | 28.73 | 47.88 |
| **160** | 8.3 | 13.83 | 8.6 | 14.33 | 9.35 | 15.58 | 10.95 | 18.25 | 13.95 | 23.25 | 17.16 | 28.60 | 21.93 | 36.55 | 27.42 | 45.70 | 32.47 | 54.12 |
| **180** | 9.35 | 15.58 | 9.7 | 16.17 | 10.9 | 18.17 | 12.55 | 20.92 | 15.75 | 26.25 | 19.27 | 32.12 | 24.69 | 41.15 | 30.43 | 50.72 | 36.55 | 60.92 |
| **200** | 10.4 | 17.33 | 11.25 | 18.75 | 11.75 | 19.58 | 13.9 | 23.17 | 17.5 | 29.17 | 21.55 | 35.92 | 27.55 | 45.92 | 34.09 | 56.82 | 41.06 | 68.43 |
| **300** | 15.7 | 26.17 | 16.27 | 27.12 | 17.7 | 29.50 | 20.25 | 33.75 | 26.3 | 43.83 | 32.12 | 53.53 | 41.23 | 68.72 | 51.37 | 85.62 | | |
| **400** | 21 | 35.00 | 21.8 | 36.33 | 23.3 | 38.83 | 26.6 | 44.33 | 35.05 | 58.42 | 43.17 | 71.95 | 55.35 | 92.25 | | | | |
| **500** | 26.3 | 43.83 | 27.3 | 45.50 | 29.5 | 49.17 | 33.9 | 56.50 | 43.9 | 73.17 | 53.91 | 89.85 | | | | | | |
| **600** | 31.6 | 52.67 | 32.7 | 54.50 | 35.6 | 59.33 | 40.7 | 67.83 | 51.4 | 85.67 | | | | | | | | |
| **800** | 42.2 | 70.33 | 43.65 | 72.75 | 47.55 | 79.25 | 54.36 | 90.60 | | | | | | | | | | |
| **1000** | 52.8 | 88.00 | 54.6 | 91.00 | 58.75 | 97.92 | | | | | | | | | | | | |