GRUNDFOS **SQFLEX BATTERY BACKUP SYSTEM**

Renewable-energy water supply – with a backup plan

SYSTEM SET-UP AND SIZING

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SQFlex Battery Backup Systems

Battery backup systems can be used with an SQFlex pumping system. These systems are typically used in applications where the pump will not be running during most of the peak sun hours of the day, or where it is impossible or impractical to store large volumes of water. Examples include remote homes or cabins, automatic livestock waterers, and very low-yielding wells.

System Set-up

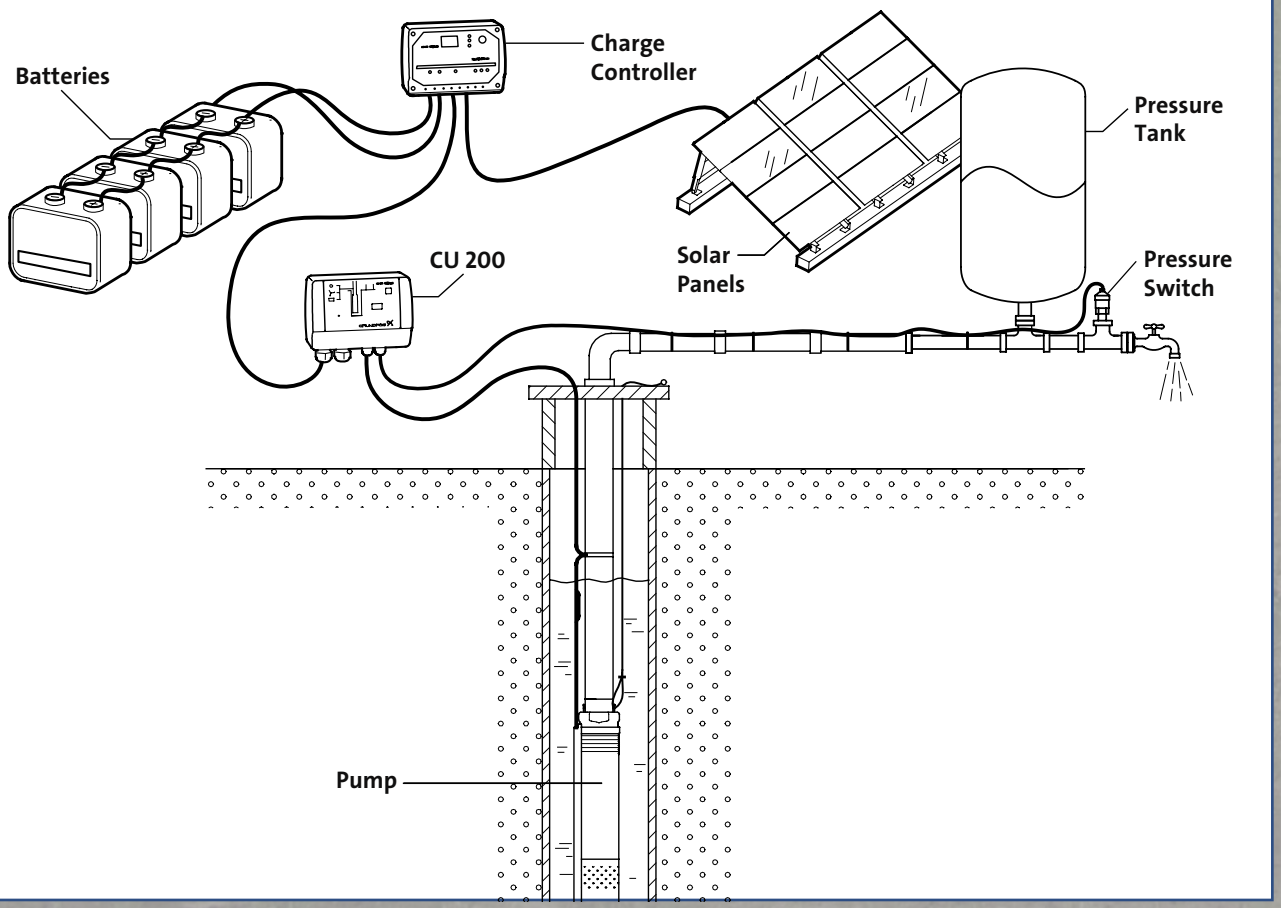
The system will be wired as shown in the accompanying diagram.

- Power will be provided by the calculated number of solar panels wired to produce 48 VDC (nominal)
- Power from the solar panels will feed into a 48 VDC charge controller, which will regulate the current fed to the batteries
- From the charge controller, power passes into the battery bank, which consists of the number of appropriately sized batteries, wired in series to achieve 48 VDC (nominal) output
- Power is drawn from the battery bank and routed through an SQFlex control box (IO 100/101, or CU 200)
- Power is run from the control box to the SQFlex pump

For domestic water supply applications

The CU200 pump control box should be selected, since it includes terminals for a pressure switch, which will control the pump's on/off operation via the pressure in the storage tank. The pressure switch should be of a normally-open configuration, where the contacts within the switch are in the open position when the pressure is below the maximum set-point. When the pressure in the system rises to the maximum desired pressure, the contacts will close, signaling the pump to shut off.

Battery Backup System Diagram



Charge Controller

Morning Star PS15M-48V Charge Controller includes connections for solar input, battery output, and load output to the CU 200 and SQFlex

Battery Bank

Batteries used should be marine or other type of deep-cycle battery

Sizing guidelines are provided for the pump, solar panels, and battery bank.
Follow the given instructions to size your system.

Selecting the Pump Model

1. Calculate the total dynamic head (TDH) of the system as you would for a normal water supply application
2. Determine the required flow rate
3. **(Refer to Chart A)**. Locate your calculated total dynamic head in the "Head" column on the left. Follow the chart to the right and select the pump model which provides the desired flow rate at that head.

Sizing the Solar Array

1.	Enter the number of run-time hours per day (for normal household use, enter 2)	
2.	Multiply by 8.4 for maximum pump current draw and battery losses	x 8.4 =
3.	Enter average sun hours per day in your area **(from chart B)**	
4.	Divide line 2 by line 3 to get total solar amps required	=
5.	Enter peak amp rating of solar panel (2.07 for GF65C)	
6.	Divide line 4 by line 5	=
7.	Round up to next higher whole number	=
8.	Enter number of panels in series needed to achieve 48 VDC (2 for GF65C)	
9.	Multiply line 7 by line 8. This is the **total number of solar panels required**	=

Sizing the Battery Bank

1.	Enter the result from line 2 above	
2.	Enter number of consecutive days without solar power you need	
3.	Multiply line 1 by line 2	=
4.	Multiply by 2 for allowable depth of battery discharge	x 2 =
5.	Determine lowest temperature batteries will be exposed to during use Enter temperature correction factor **(from chart C)**	
6.	Multiply line 4 by line 5. This is the total battery capacity in **Amp-hours for each battery** required	=
7.	The total number of batteries required is equal to 48V divided by the voltage output of each battery (4 for 12 VDC battery)	

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Being responsible is our foundation
Thinking ahead makes it possible
Innovation is the essence

Chart A

	Flow (gpm)		
Head (ft)	3 SQF-2	6 SQF-2	11 SQF-2
20	2.4	5	11
40	2.4	5	11
60	2.4	5	10.5
80	2.4	5	10
100	2.4	4.8	8.5
120	2.4	4.8	7
140	2.4	4.8	6
160	2.4	4.6	5
180	2.4	4.4	4.5
200	2.4	4	3.5
220	2.3	3.8	2.5
240	2.3	3.4	2
260	2.3	3.2	1.5
280	2.3	3	0.5
300	2.3	2.8	0
320	2.3	2.6	0
340	2.3	2.4	0
360	2.2	2.2	0
380	2.2	2	0
400	2.2	1.8	0

Chart C

Temperature	Correction Factor
80 F	1.00
70 F	1.04
60 F	1.11
50 F	1.19
40 F	1.30
30 F	1.40
20 F	1.59

Chart B

Average sun hours/day

State	City	Average	State	City	Average
AK	Fairbanks	3.99	MT	Glasgow	5.15
AK	Anchorage	3.55	MT	Great Falls	4.93
AL	Montgomery	4.23	NM	Albuquerque	6.77
AR	Little Rock	4.69	NE	Lincoln	4.79
AZ	Tucson	6.57	NE	Omaha	4.9
AZ	Phoenix	6.58	NC	Cape Hatteras	5.31
CA	Santa Maria	5.94	NC	Greensboro	4.71
CA	Sacramento	5.1	ND	Bismark	5.01
CA	Fresno	5.38	NJ	Sea Brook	4.21
CA	Los Angeles	5.62	NV	Las Vegas	6.41
CA	San Diego	4.77	NV	Ely	5.98
CO	Grand Lake	5.08	NY	Binghampton	3.16
CO	Grand Junction	5.85	NY	Schenectady	3.55
DC	Washington	4.23	NY	Rochester	3.31
FL	Miami	5.62	OH	Columbus	4.15
FL	Gainesville	5.27	OH	Cleveland	3.94
FL	Tampa	5.67	OK	Stillwater	4.99
GA	Atlanta	4.74	OK	Oklahoma City	5.59
HI	Honolulu	6.02	OR	Corvallis	4.03
IA	Ames	4.4	OR	Medford	4.51
ID	Boise	4.92	PA	Pittsburg	3.28
ID	Twin Falls	4.7	RI	Newport	4.23
IL	Chicago	3.14	SC	Charleston	5.06
IN	Indianapolis	4.21	SD	Rapid City	5.23
KS	Manhattan	4.57	TN	Nashville	4.45
KS	Dodge City	5.79	TN	Oak Ridge	4.37
KY	Lexington	4.94	TX	San Antonio	5.3
LA	Lake Charles	4.93	TX	Brownsville	4.92
LA	New Orleans	4.92	TX	El Paso	6.72
LA	Shreveport	4.63	TX	Midland	5.83
MA	Boston	3.84	TX	Fort Worth	5.43
ME	Caribou	4.19	UT	Salt Lake City	5.26
ME	Portland	4.51	VA	Richmond	4.13
MI	Sault Ste Marie	4.2	WA	Seattle	3.57
MI	Lansing	4	WA	Richland	4.44
MN	St. Cloud	4.53	WA	Spokane	4.48
MO	Columbia	4.73	WI	Madison	4.29
MO	St. Louis	4.38	WV	Charleston	3.65
MS	Meridian	4.43	WY	Lander	6.06

Chart B (Canada Locations)

Province	City	Average	Province	City	Average
AB	Edmonton	3.75	NT	Fort Smith	3.29
AB	Suffield	4.10	NT	Norman Wells	2.89
BC	Kamloops	3.29	NS	Halifax	3.38
BC	Prince George	3.14	ON	Ottawa	3.70
BC	Vancouver	3.14	ON	Toronto	3.44
MB	The Pas	3.56	PE	Charlottetown	3.56
MB	Winnipeg	4.02	QC	Montreal	3.50
NB	Fredericton	3.56	QC	Sept-Isles	3.50
NL	Goose Bay	3.33	SK	Swift Current	4.23
NL	St. Johns	3.15	YT	Whitehorse	3.10

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