Blue Water Sailing Club

Good Times! Good Sailing! Good Friends!

Founded 1959

DIY MARINE SOLAR & REFRIGERATION

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WHAT ARE WE GOING TO COVER

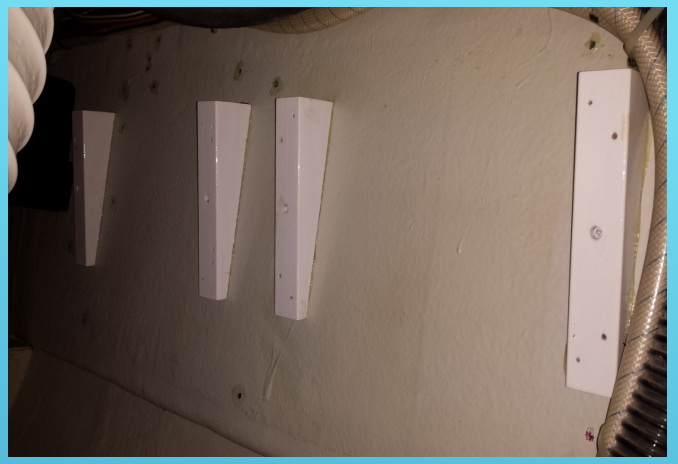
- Refrigeration replacement
- Solar power from scratch
- Solar power from a kit
- Solar accessories

Oh Honey.
We need refrigeration on the boat!

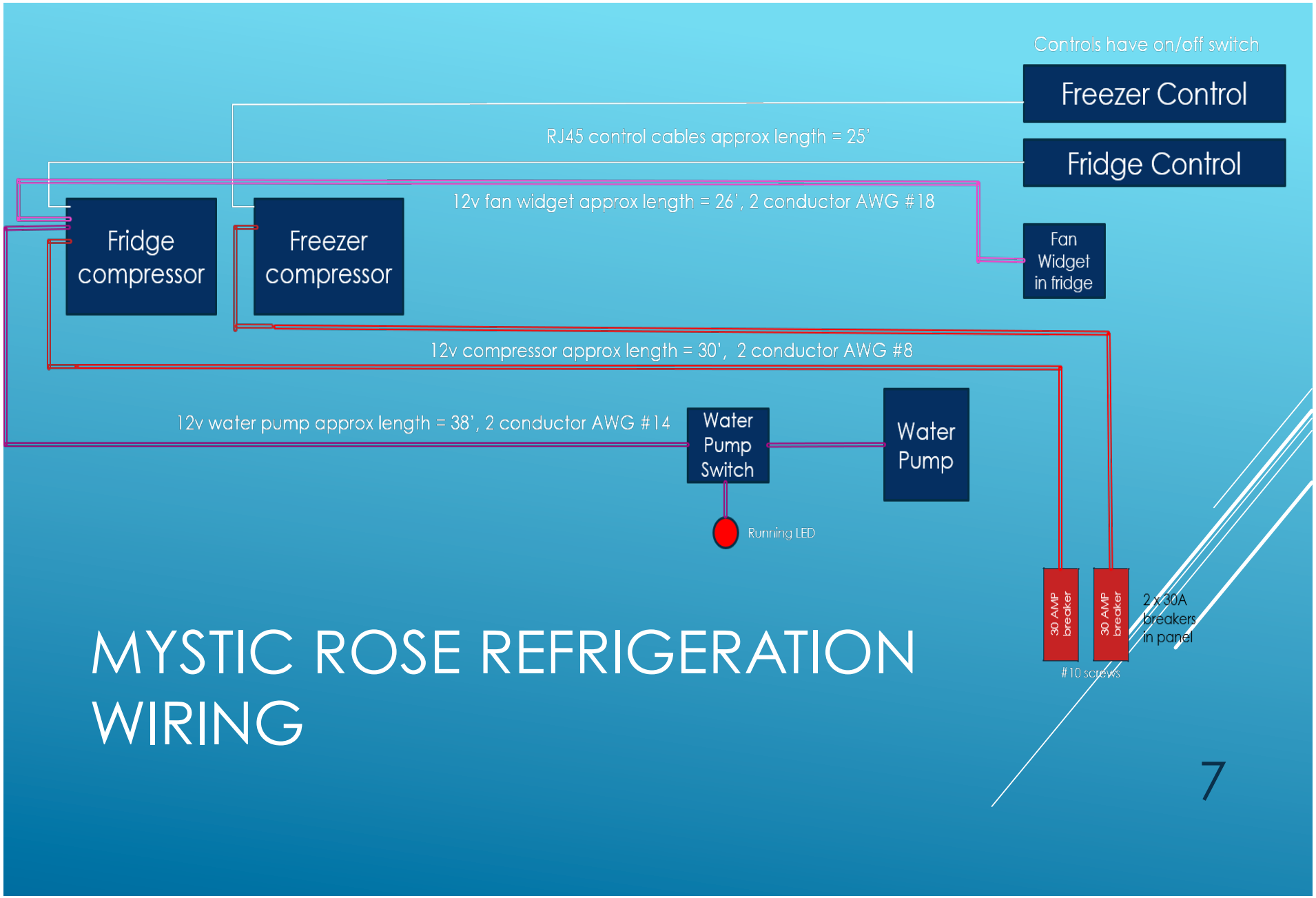
BD Systems

Sea Frost's BD is well-suited for boats with adequate battery banks and charging equipment. Thermostatic operation maintains the cold plate at even temperatures. The thin direct evaporator cold plate requires minimal box space. Dockside, the system operates through the boat's battery charger.

OUT WITH THE OLD SEAFRO



IN WITH THE NEW SEAFROST



MYSTIC ROSE REFRIGERATION WIRING

WHY SOLAR

- Ability to leave refrigeration on while boat unattended at anchor or mooring for several days
- Reduce engine/genset use
  - 110v refrigeration required 2x daily genset run for 1+ hr each time
  - Reduce noise
  - Save fuel
- Solar charging occurs during daylight hours even on overcast, foggy or rainy days
- More peace and quiet!

WIND GENERATORS VS SOLAR

- Wind generation Pros
  - Can put out a lot of power in winds > 10 knots (eg Caribbean)
  - Can produce 24x7 day and night
- Wind generation Cons
  - Requires 6 knots minimum to work
  - Some can be fairly noisy
  - High winds can be dangerous
  - Moving parts require routine maintenance

WIND GENERATOR OUTPUT — FOUR-DAY TEST RESULTS

UNIT	DAY 1	DAY 2	2-DAY AVERAGE	DAY 3	3-DAY AVERAGE	DAY 4	4-DAY AVERAGE	4-DAY TOTAL	24-HOUR MAXIMUM
RUTLAND 913	26.9 Ah	49.2 Ah	38.05 Ah	7.7 Ah	27.9 Ah	57.7 Ah	35.38 Ah	141.5 Ah	57.7 Ah
AMP AIR 100	18.7 Ah	39 Ah	28.85 Ah	2.6 Ah	20.1 Ah	44.9 Ah	26.3 Ah	105.2 Ah	44.9 Ah
KISS HIGH OUTPUT	55.5 Ah	88.1 Ah	71.8 Ah	2.7 Ah	48.7 Ah	84.4 Ah	57.68 Ah	230.7 Ah	88.1 Ah
AIR BREEZE	41.7 Ah	95.7 Ah	68.7 Ah	5.1 Ah	47.5 Ah	109 Ah	62.88 Ah	251.5 Ah	109 Ah
SUPERWIND 350	25.1 Ah	108.8 Ah	66.95 Ah	8.2 Ah	47.3 Ah	115.8 Ah	64.48 Ah	257.9 Ah	115 Ah

DETERMINE YOUR ELECTRIC LOAD

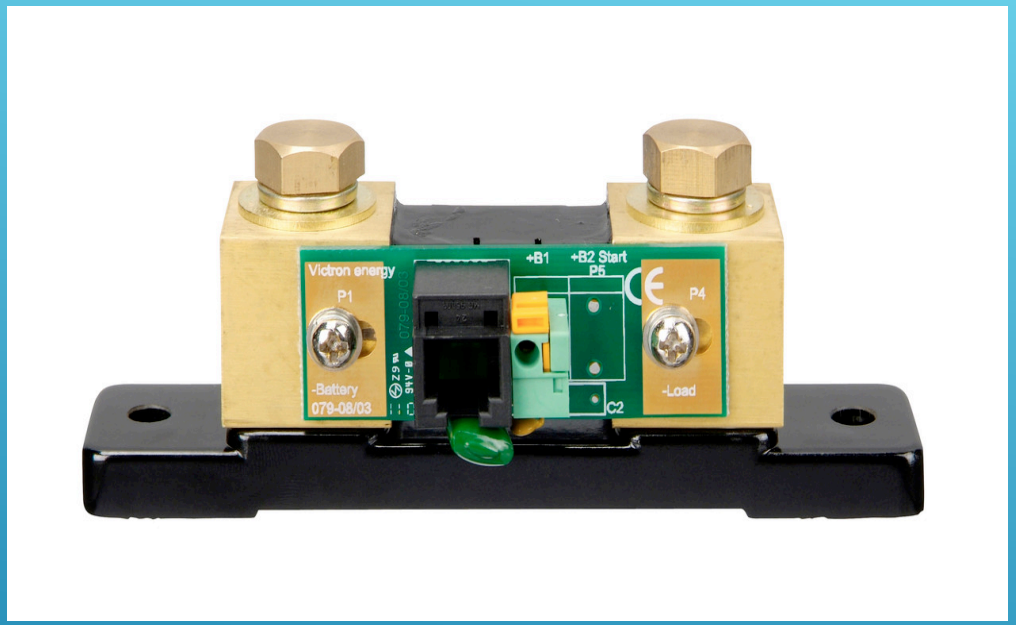
BATTERY MONITORS

- Great way to know what is really going on with your batteries and solar panels
- Real-time rate of charge or discharge
- AH's consumed
- Exact voltage and state of charge
- Digital displays provides more accurate readings

AGM BATTERY STATE OF CHARGE	
Level	Voltage
100%	13.00V
90%	12.75V
80%	12.50V
70%	12.30V
60%	12.15V
50%	12.05V
40%	11.95V
30%	11.81V
20%	11.66V
10%	11.51V
0%	10.50V

Xantrex
- 2 bank monitoring on Mystic Rose
- No longer in production

Victron Energy
- Single bank monitor on Breakaway & Salacia
- $169


Victron energy
P1
-Battery
079-08/03
+B1
+B2 Start
P5
P4
-Load
C2

quick installation guide

Connect the negative pole of the battery last!

Battery monitor

Fig. 1

Shunt

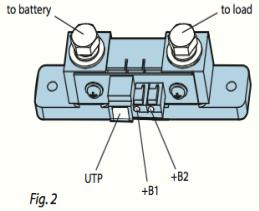


Fig. 2

Wiring diagrams

Connect the negative pole of the battery last!

BMV-700
BMV-702 configured for *STARTER/AUXILIARY*-battery monitoring.

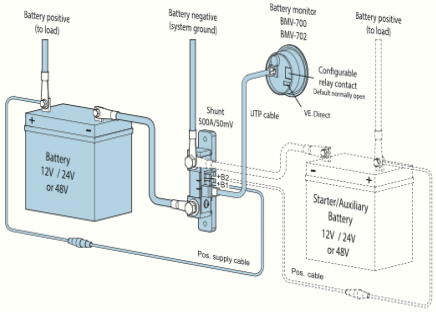


Fig. 3

BMV-702 configured for battery *TEMPERATURE* monitoring

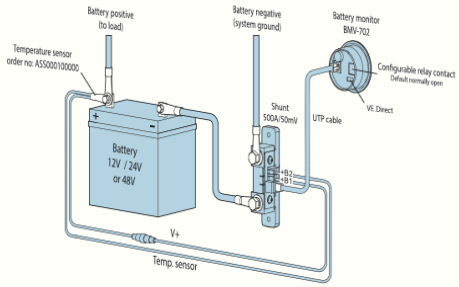


Fig. 4

HOW MUCH POWER DO YOU NEED

Power
Watts = Amps x Volts

MYSTIC ROSE – BERNIE COYNE

System load calculation worksheet for Mystic Rose

AC loads	Watts x	Hrs/Day x	Watts/day	Notes
laptop	135	12	1620	max rated AC power adapter is 135W
microwave	700	0.5	350	
Total			1970	
Add inverter loss			2266	
Total AC AH/day			**189**	
DC loads	**Watts x**	**Hrs/Day x**	**Watts/day**	**Notes**
tv/pc monitor	37	12	444	
cabin lights 20w	20	18	360	20w/halogen light;
refrigeration & freezer	66	12	792	92w max; 66w medium; assume running half the time
autopilot	60	4	240	ST 7000+ electric autopilot with type 2 long linear drive motor (48w-72w)
windlass	1600	0.2	320	Lewmar Concept v4
elec winch	2400	0.1	240	2 x primary
anchor light	2	12	24	
instruments	8.64	6	52	12 x Raymarine ST60; 60ma avg each
cell phone charger	12	9	108	
internet router	6	24	144	
TOTAL			2724	
Total DC AH/day			**227**	
Total AH/day			416	
Mystic Rose House Batteries				
	210A AGM x 2		420	
	100A AGM x 2		200	
	Total		**620**	
	Useable		310	

Requires ~ 416AH/day

BREAKAWAY POWER SYSTEMS ANALYSIS WHEN CRUISING						
	house voltage	12	avg hrs	daily	power	
Power use, maximum	amps	watts	per day	watts	amp-hrs	
navigation equipment	10	120	6	720	60	
radar	3	36	6	216	18	
running lights	1	12	1	12	1	
refrigerator	5	60	12	360	30	
cabin lites	1	12	3	36	3	
water pump	7	84	0.5	42	3.5	
stereo	2	24	5	120	10	
Total power required				1506	126	
Battery capacity, house in amp-hrs	315				157.5	

BREAKAWAY POWER SYSTEMS ANALYSIS WHEN ON MOORING						
	house voltage	12	avg hrs	daily	power	
Power use, maximum	amps	watts	per day	watts	amp-hrs	
navigation equipment	10	120	0	0	0	
radar	3	36	0	0	0	
running lites	4	48	0	0	0	
refrigerator	5	60	12	720	15	
cabin lites	3	36	4	144	12	
water pump	7	84	0.5	42	3.5	
stereo	2	24	5	120	10	
Total power required				1026	41	
Battery capacity, house in amp-hrs	315				157.5	

BREAKAWAY – LEN THIBODEAU

Requires ~ 126AH/day

SALACIA							
EQUIPMENT	AMPS	HRS.	RUNNING	HRS.	CRUISING	HRS.	ANCHOR
Autopilot	2.4	24	57.6	5	12		0
ChartPlotter	2.6	12	31.2		0		0
Radar-Stby	4.4	10	44	5	22		0
Radar- Trx	6.4	2	12.8	5	32		0
Binnacle light	0.11	10	1.1	0	0		0
Running lights	0.2	10	2	0	0		0
Steaming Light	0.75	0	0	0	0		0
TriColor	0.18	0	0	0	0		0
Anchor light	0.17	0	0	10	1.7		0
Cabin Lights	0.1	1	0.1	4	0.4	5	0.5
pressure water	11	0.1	1.1	0.3	3.3	0.25	2.8
VHF radio-standby	0.2	24	4.8	0.5	0.1	0.5	0.1
Refridgeration	2	24	48	24	48	24	48
STEREO	1	0	0	2	2	1	1
TOTAL AMP HOURS	31.51		202.7		121.5		52.4

SALCIA – STEVE LEE

Requires ~ 121AH/day

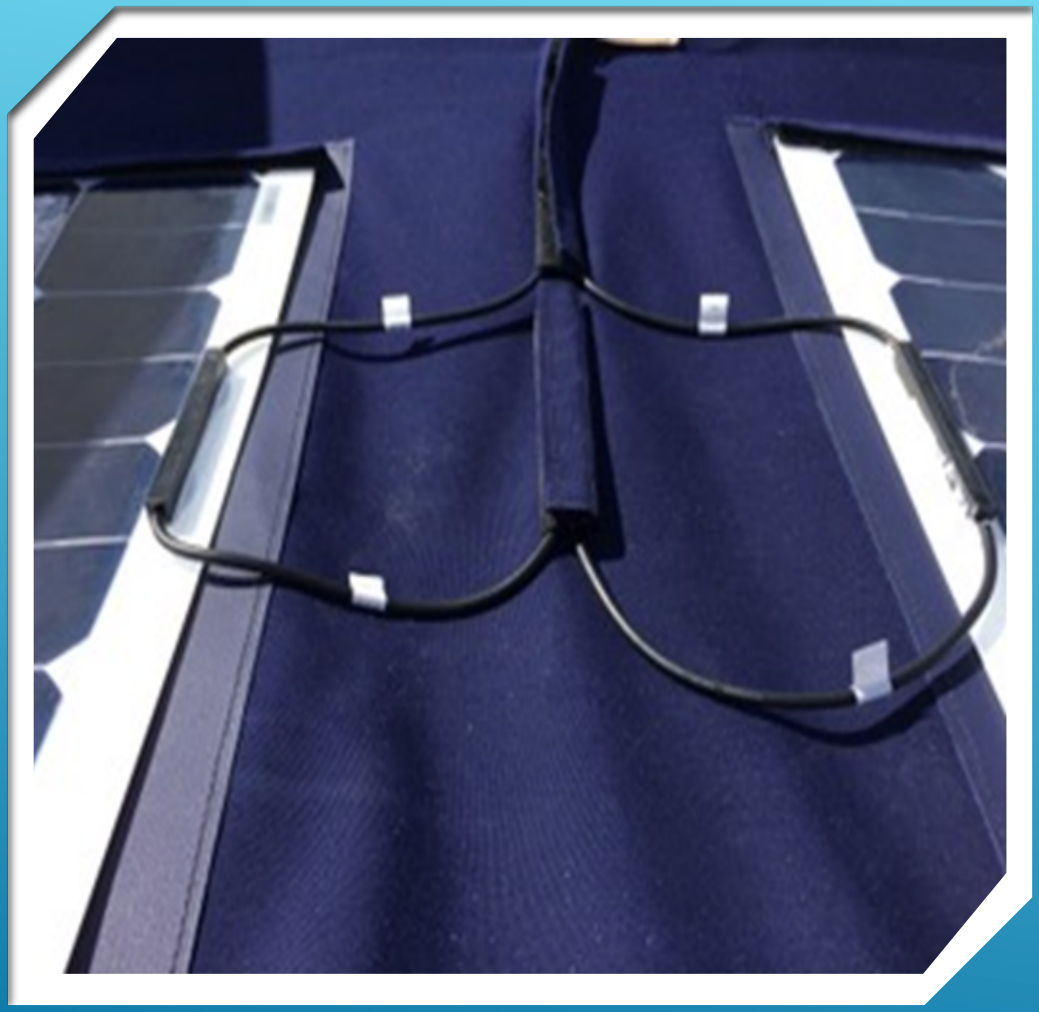
FIND SPACES ON YOUR BOAT
FIND PANELS WITH SUFFICIENT OUTPUT
FIND PANELS THAT FIT

MYSTIC ROSE

- ALLPOWERS 4x 100w flexible panels with Sunpower cells
- 400w total, 200AH/day
- No generator use required while cruising and using refrigeration and freezer (but did include some motor-sailing charging)
- On mooring batteries were always full (no refrigeration running)

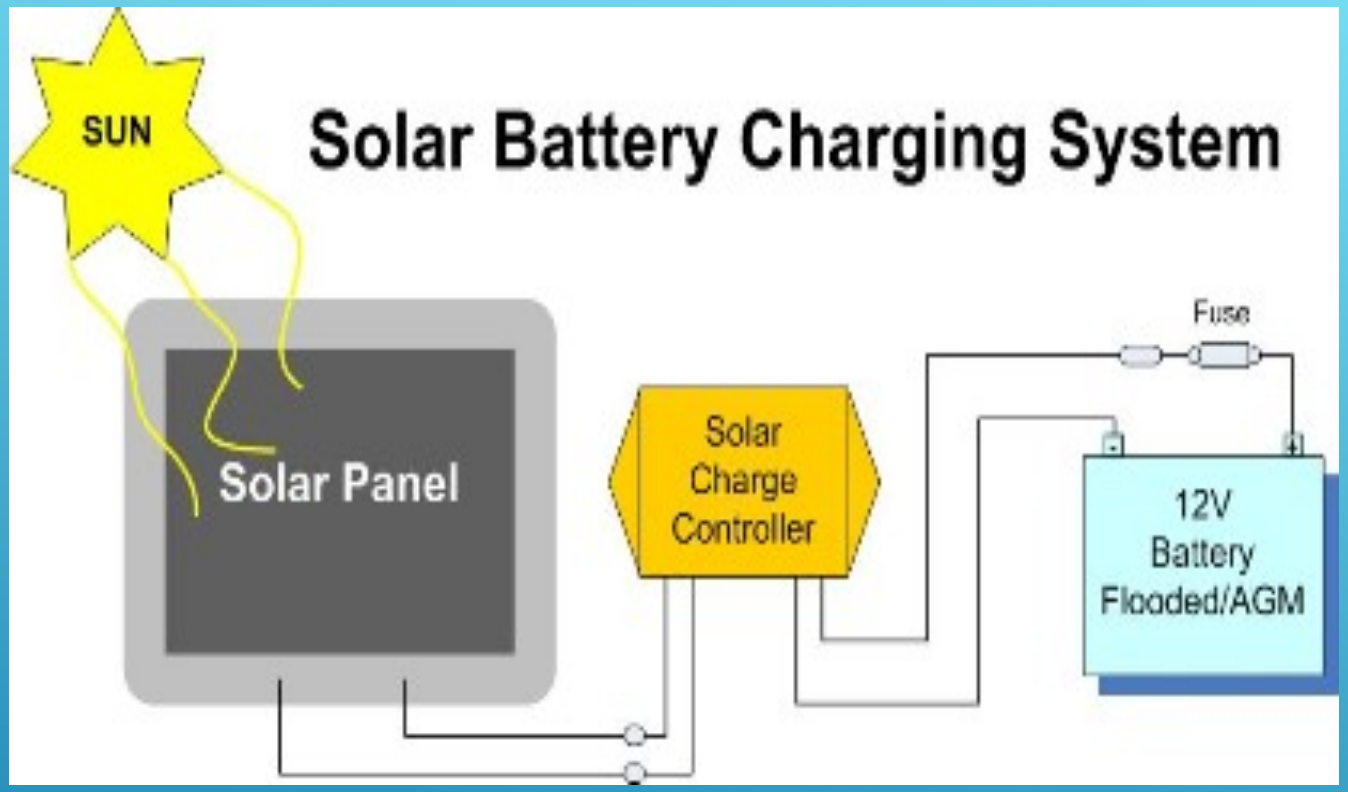
BREAKAWAY

- Kyocera 2 x 65w fixed panels above bimini
- Go Power Solar Flex100w flexible panel on dodger
- 230w total, 115AH/day
- Powered everything including refrigeration for entire season without running generator



SALACIA

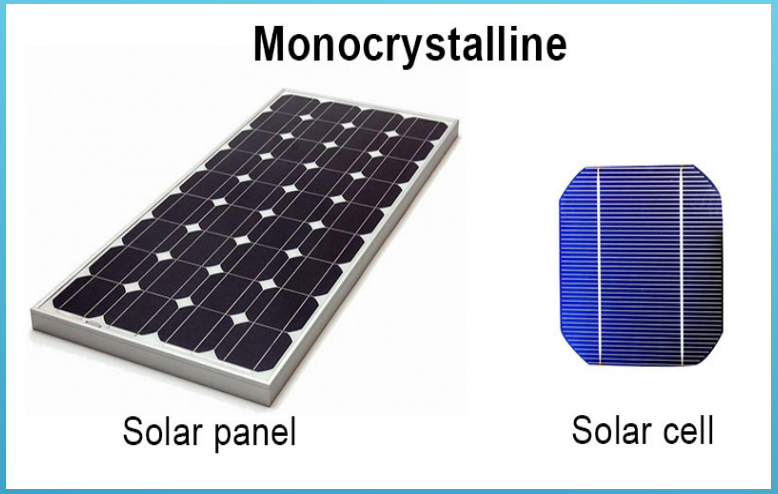
- HamiltonFerris SolarFlexx 2x 50w panels on dodger
- 46AH/day



HOW TO BUILD A SOLAR SYSTEM

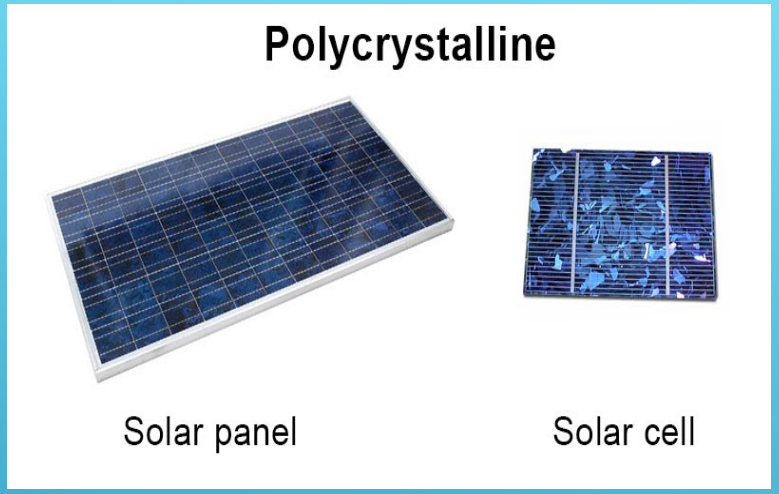
SOLAR PANEL CELL TYPES

Monocrystalline Cells ☑



- 15-21% efficient
- Slightly higher cost (eg Renogy 100w $140)
- Smallest area
- Perform better in low light
- Rounded edges
- Solid dark blue/black
- Sunpower cells most popular

Polycrystalline Cells



- Slightly less expensive (eg Renogy 100w $120)
- 13-16% efficient
- Larger area
- Exact rectangular shape
- Speckled blue