



Lesoni 8 - iVolanivuli

Yavu ni Qaravi Sola

VOSA VAKAVITI RARABA

Vakailavotaka na:

KOICA
Korea International
Cooperation Agency

Ena veitauriliga kei:




Pacific Islands
Development Forum





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- Na lesoni "Yavu ni Qaravi Sola" e ganiti ira na bau kila na matai, mera vulica na vakaduri sola kei na kena qaravi.
- Ni oti na vuli qo, e dodonu me kilai qo:
- Veimataqali sola
 - Gacagaca kece ni sola
 - Kedra qaravi na gacagaca ni sola
 - Na iyaya ni cakacaka vakayagataki ena vakaduri sola kei na kena qaravi
 - Veitaravi ni cakacaka ni vakaduri sola kei na kena qaravi
 - Veika meda qaqarauni kina nida qarava na sola
 - Leqa e dau tubu vakalevu ena sola kei na kedra iwali
 - Vakaraitaka kena vakayagataki na ivola ni itavi ni qaravi sola

iTuvatuva ni Lesoni

TEVELI 2: iTuvavua ni Lesoni

Wase	Mataqali Lesoni
1. Taumada – Tou veikilai mada	Vuli kei na IVakadre 1
2. Gacagaca ni sola	Vuli
	IVakadre 2
	IVakadre 3
	IVakadre 4
3. Qaravi ni gacagaca ni sola	Vuli
	IVakadre 5
	IVakadre 6
	IVakadre 7
	IVakadre 8
4. Mataqali sola	Vuli
	IVakadre 9
	IVakadre 10
5. iYaya ni cakacaka ena sola	Vuli
	IVakadre 11
6. Vakaduri sola	Vuli
7. Qaqarauni ena sola	Vuli
	IVakadre 12
8. Kune leqa ni sola kei na kena wali	Vuli
	IVakadre 13
9. iVola ni itavi ni qaravi sola	Vuli
	IVakadre 14

Na ivolanivuli qo e yavutaki ena kena Salavata nei Qasenivuli (Trainers Guide). Sa vakarawarawataki na lewenivola ka vakalekalekataki, qai vakabibitaki kina na droini, yaloyalo kei na kena ivakadre me ratou veimaliwai vinaka tikoga kina na lewe ni vuli kei qasenivuli ni toso tiko na vuli. Ke o gadreva na ikuri ni ivakamacala ni wase cava ga, mo raica na Salavata nei Qasenivuli.

Taba e waqanivola: Sola ni vuli vakayagataki ena vuli tovolei mai Vanuatu. iVurevure: GGGI Vanuatu.

Moni Kila: Na Global Green Growth Institute e sega ni yalataka, se yalataka lo madaga, ni donu se taucoko na itukutuku ena ivola qo, se rawa ni veilewaitaki ke cala, ni dua e vakayagataka na vua ni itukutuku se iyaya se cakacaka e volai kina, wili kina ni beci na dodonu ni kena itaukei.

IVOLAVOSA

iDoladola – Na gacagaca e lewa na jajitaki ni baieri ka tarova me kua ni jajitaki vakasivia.

Jaji sivia – Ni jajitaki tale na bateri ni sa sinai tu, rawa ni vakacacani kina na bateri se mate koso.

Kui – Kena kui tiko na livaliva ena kena sala.

Livaliva dodonu – Mataqali livaliva dei, vu vakalevu mai na ulunisola se bateri.

Livaliva dri (AC) – Mataqali livaliva dau veiveisau, vu vakalevu mai na ivuki (inverter), jenereita, kei na

iqaqi lelevu ni livaliva.

Mita Liga – iYaya e vakatovolei se vakarautaki kina na sala ni livaliva, mv vakarautaki volt, vakamuri sala (continuity test).

Mita iQamu – Gacagaca e vakarautaki kina na kui ni sala ni livaliva, e levu e rawa ni vakarautaki kina e so tale na ka

Pawa – totolo ni kena vakayagataki se vakavurei na livaliva ena kena sala, vakarautaki ena Watt.

Sucu-na, teminala – Duru ena bateri me sema kina na waya ni iyaya livaliva. Na bateri e tiko na kena + (positive) kei na – (negative). Dau vakalevu me vakabolu na sucu ni bateri me qaqaco kina na isema.

Shot – Ni rau veitarai na wa, dua e + (positive), dua e – (negative). Na shot e rawa ni leqa kina na iyaya livaliva, kama na vale se veivakamavoataki.

iTūtū – Ka e toka dei kina, mv veika e vakadeitaki kina na ulunisola ni vakaduri e delnivale se ena qele.

Ulunisola – Na iyaya e soli igu livaliva ni ciiavi siga.

iUsana – Ka ga e vakayagataki livaliva, mv cina, irinicagi

Veilunisola – Levu na ulunisola veisemasemai

Volt – Kedrau veisivi e rua na vanua ena sala ni livaliva, vu ni drodro ni livaliva ena sala sogo.

iVuki – Ka e vukica na livaliva dodonu me livaliva dri

Waikama ni bateri – Na mataqali waikama e loma ni bateri 'lead acid'. Qo na waikama dau kakana ka rerevaki sara.

A large, white, stylized number '1' is positioned on the left side of the page. The background is a gradient of blue and teal, with a vertical line separating the blue area on the left from the teal area on the right. The number '1' is white and stands out against the blue background.

Taumada – Tou
veikilai mada

IVAKADRE 1

Vakamacalataki iko vakalekaleka vei iratou na lewe ni kalasi ni sa veisureti o dauveituberi. Tukuna na yacamu kei na ka o sa bau kila oti tu baleta na sola ena koro. Tukuna talega na ka o na dau cakava, kei na nomu marautaka na vanua ni vuli se sega.



2

Gacagaca ni sola —————

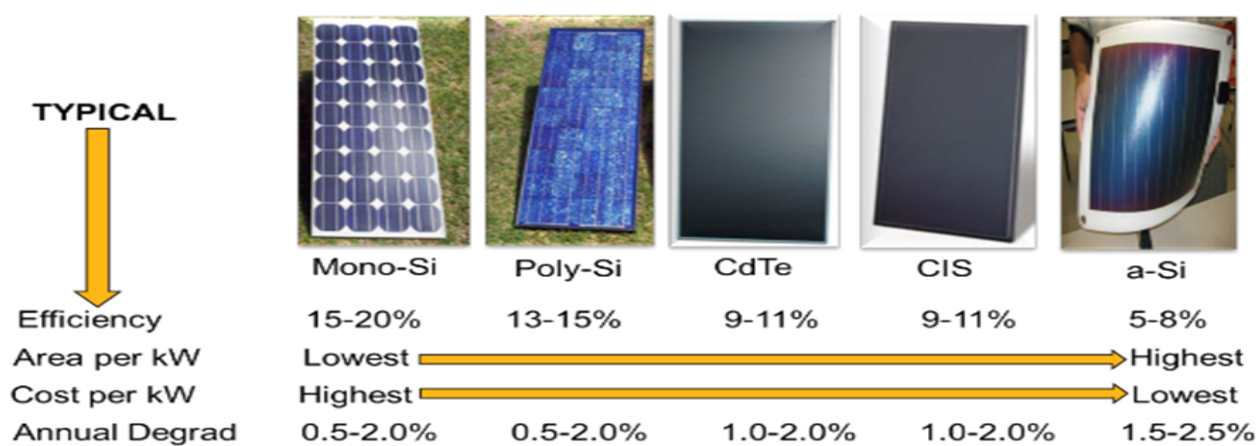
E vica tiko na gacagaca ni sola.

2.1 Ulunisola

Yaloyalo 1: Ulunisola¹



YALOYALO 2: Mataqali Ulunisola²



Yaca ni ulunisola kei na kena ivakabalavu:

- Mono-Si: Monocrystalline silicon
- Poly-Si: Polycrystalline silicon
- CdTe: Cadmium telluride (CdTe). Qo e caka mai na ka mamare (thin film)
- CIS: Copper indium gallium selenide solar cell. Caka mai na ka mamare (thin film)
- A-Si: Amorphous silicon. Caka mai na ka mamare (thin film)

2.2 iDoladola (charge controller)

Na idoladola e yalana na kiu ni livaliva e curuma na bateri. E tarova kena jajitaki sivia se kena sivia beka na volt.

¹ Ivurevure: Audio Digital, <http://www.audio-digital.com/tag-produk/sound/>

² Yavutaki ena the System Components- PV Modules, Arizona State University (VOCTEC), <http://voctec.asu.edu>

YALOYALO 3: So na mataqali idoladola³



Morningstar ProStar controller



Morningstar TriStar controller



Xantrex C-series controller



Morningstar lighting controller



Outback MPPT controller

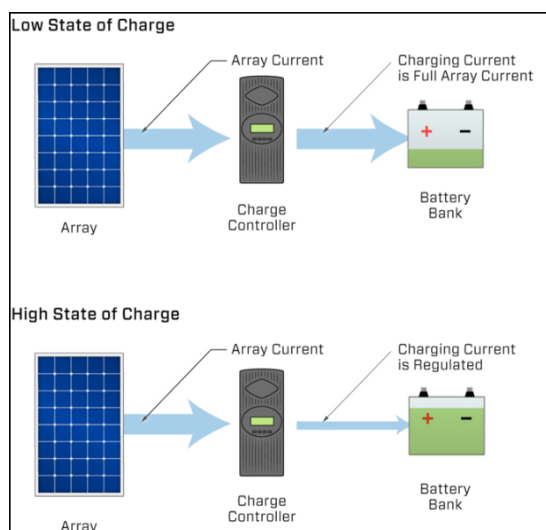
• Tarovi ni jajitaki sivia

- Ni drekea na volt ni bateri, e dolava na idoladola na sala mai na ulunisola me jajitaki kina
- Ni tawa vinaka na bateri, e sogota na idoladola na kedrau isema na ulunisola kei na bateri me cegu kena jajitaki

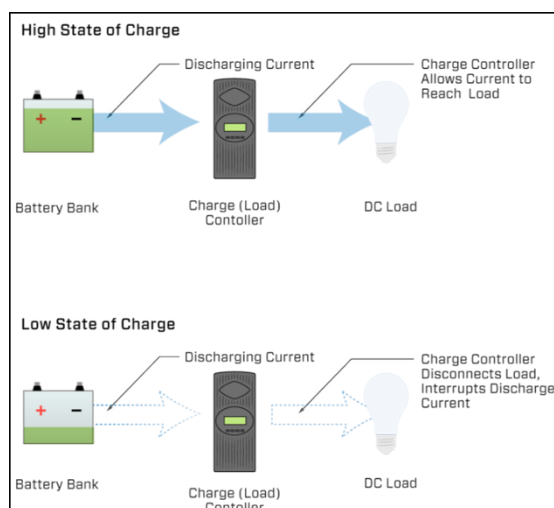
• Tarovi na talaci sivia

- Ni tawa vinaka na volt ni bateri, e sema na idoladola na bateri kei na iusana (iyaya livaliva)
- Ni drekea na volt ni bateri, e sogota na idoladola na sala mai na iusana (iyaya livaliva) ina bateri

YALOYALO 4: Tarovi na jaji sivia⁴



YALOYALO 5: Tarovi na talaci sivia⁵



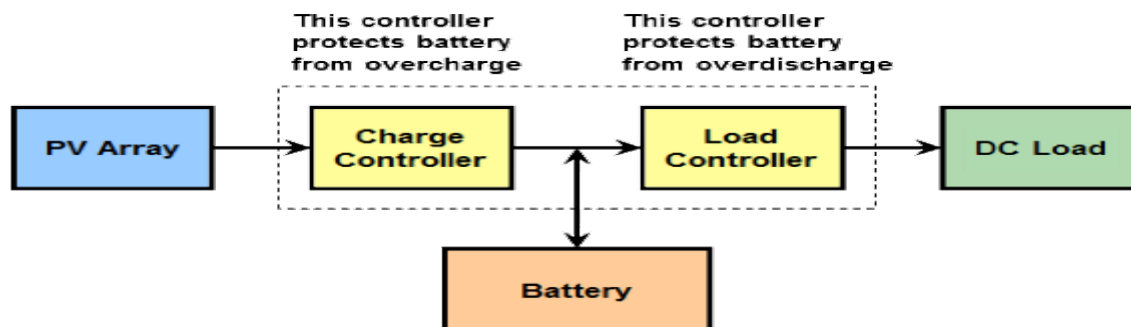
³ Yavutaki ena System Components: Charge Controllers & Inverters, Arizona State University (VOCTEC), <http://voctec.asu.edu>

⁴ Photovoltaic Systems, Dunlop, 2nd Ed.

⁵ Photovoltaic Systems, Dunlop, 2nd Ed.

- E daumaka na sala ni livaliva qo

YALOYALO 6: Sala ni livaliva vakaturi⁶



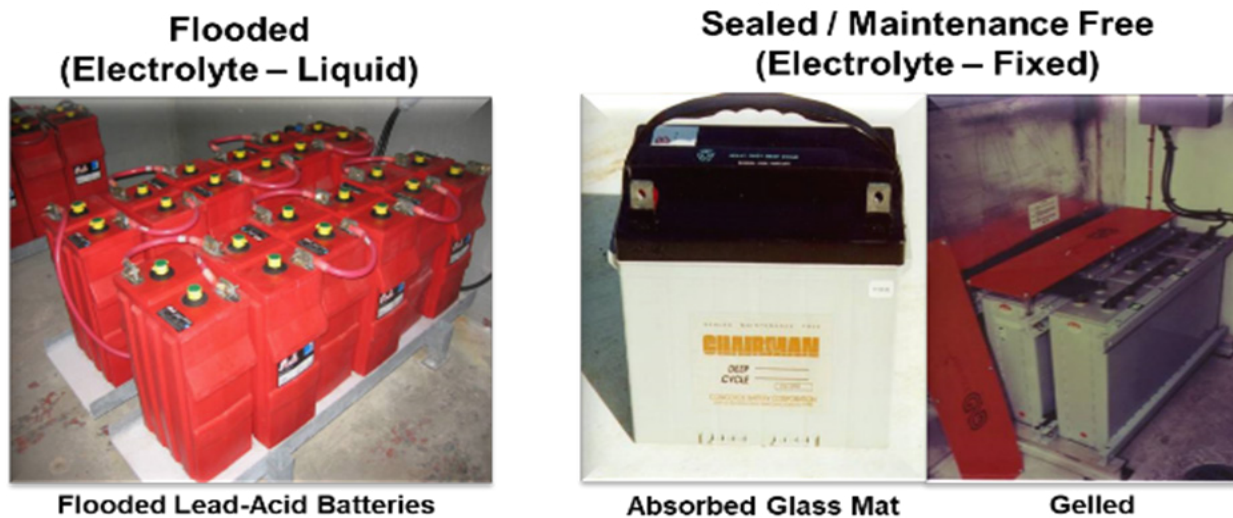
2.3 Bateri

Na bateri na iyaya e maroroya na igu livaliva ena igu kemiki qai vukica me livaliva.

YALOYALO 7: Bateri⁷



YALOYALO 8: Dui mataqali bateri⁸



⁶ IVurevure: Jim Dunlop Solar

⁷ IVurevure: JICA

⁸ Yavutaki ena "System Components- Batteries", Arizona State University, VOCTEC, <http://voctec.asu.edu>

2.3.1 Bateri vakawai

Qo na bateri kilai levu ni idini, terekitā &s (deep cycle-style).

2.3.2 Bateri sogo

Na lomana e mataqali vata kei na bateri vakawai, ia e qarauni me rauta na levu ni waikama me vinaka tuga na bateri me yacova ni cava na kena gauna yalataki (warranty).

2.3.3 Bateri AGM

Ena kena qo, e vakayagataki na 'Absorbed Glass Mat' me rau veivolekati kina na waikama kei na peleti.

2.3.4 Bateri gel

Na waikama ni bateri qo e tu kina na gel me sosoko kina. Na kena volt e sega so ni levu me vaka na bateri vakawai tale eso. E ganita na 'deep cycle', qai dede beka ni katakata na draki.

2.4 Wa

YALOYALO 9: Wa⁹



Na wa ni livaliva e dau sema kina na iyaya, me dewa kina na itukutuku se na igu livaliva.

2.5 Na ivakariba (circuit breaker/isolator)

Na itavi levu ni ivakariba me tarova na drodro ni livaliva ni kune na leqa.

YALOYALO 10: iVakariba kei na Isolator¹⁰



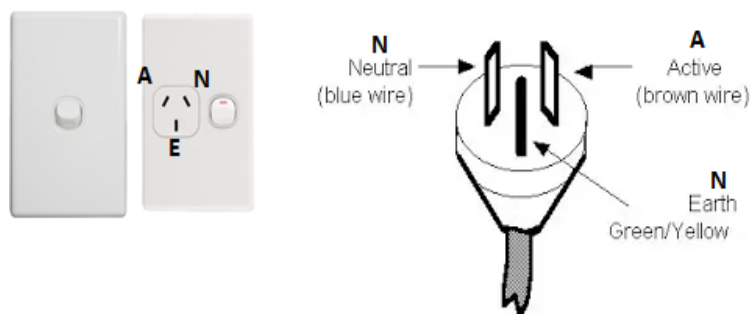
⁹ IVurevure: Global Market, http://newimg.globalmarket.com/PicLib/group0/5e/73/c477defc613ecc9a0e47b82452f4_l.jpg

¹⁰ IVurevure: Wave inverter.co, <https://waveinverter.co.nz/shop/solar/solar-connectors/pv-dc-isolator-switch-mc4/> and POSO.com, <http://poso.com.vn/wp-content/uploads/2020/04/1-2.png>

2.6 Suiti kei na vunilivaliva

Na suiti e bokoca na livaliva, na vunilivaliva e rawa livaliva mai kina na iyaya

YALOYALO 11: Suiti kei na vunilivaliva¹¹



2.7 iVuki (inverter)

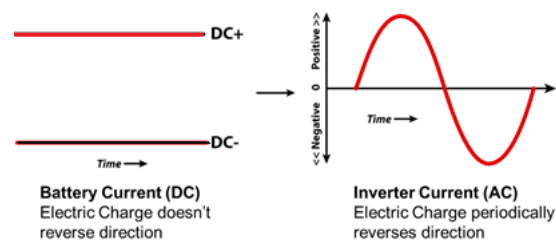
Na ivuki na iyaya se sala ni livaliva e vukica na livaliva dodonu (direct current, DC) me livaliva dri (alternating current, AC). E vica na mataqali ivuki, duidui na kedra yaga. [Qo na veika me nanumi nida digitaka na ivuki ni sola tugalala:](#)

- Volt mai na bateri (12, 24 se 48 V)
- Volt livaliva dri e solia (120 se 220V)
- Gadrevi me levu na livaliva dri me colata na iusana lelevu (ena watt)
- Kui (surge current), mv ena moto, ke dua (ena amp)
- Veika tale eso (jaja ni bateri &s)

YALOYALO 12: iVuki¹²



YALOYALO 13: iTavi ni iVuki¹³



YALOYALO 14: Dui mataqali ivuki¹⁴

	Stand-Alone Inverter	Operate from batteries and supply power independent of the utility grid
	Interactive Inverter	Operate from PV arrays and supply power in parallel with the utility grid
	Bi-Model Inverter	Transfer PV system operation to a stand-alone mode and provide backup electric power to critical loads when the utility grid is not energized

¹¹ Iurevure: Wave inverter.co, <https://waveinverter.co.nz/shop/solar/solar-connectors/pv-dc-isolator-switch-mc4/> and POSO.com, <http://poso.com.vn/wp-content/uploads/2020/04/1-2.png>

¹² MorningStar, May 2021, <https://www.morningstarcorp.com/products/suresine/>

¹³ Yavutaki ena System Components: Charge Controllers & Inverters, Arizona State University (VOCTEC), <http://vottec.asu.edu>

¹⁴ Yavutaki ena System Components: Charge Controllers & Inverters, Arizona State University (VOCTEC), <http://vottec.asu.edu>

2.8 iTutu ni ulunisola

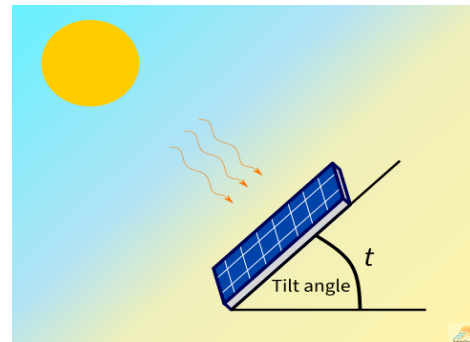
YALOYALO 15: iTutu ni ulunisola¹⁵



Na itutu ni ulunisola e vakadeitaki kina e delanivale se ena qele. Na itutu qo e dau rawa kina ni vakuri se veisautaki na ituvatua ni ulunisola e dela se lalaga ni vale.

2.9 Kala ni ulunisola

YALOYALO 16: Kala ni uunisola¹⁶

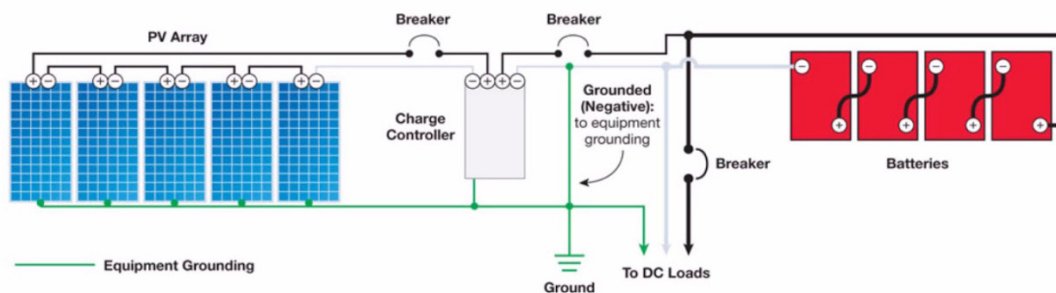


2.10 Gacagaca ni sobuiqe (earth, grounding)

E lavaki me sobuiqe (ground) na sola kece, ni kena sobuiqe ena taqomaki keda mai na shok se mate, vb ni kui sivia na livaliva se lidi na yaseyase. E bau tarova talega na kena kama. Na kena isoqoni, ni sobuiqe na sola, o taqomaki o iko.

YALOYALO 17: iCakacaka ni sobuiqe¹⁷

Equipment Grounding in DC-Only Systems

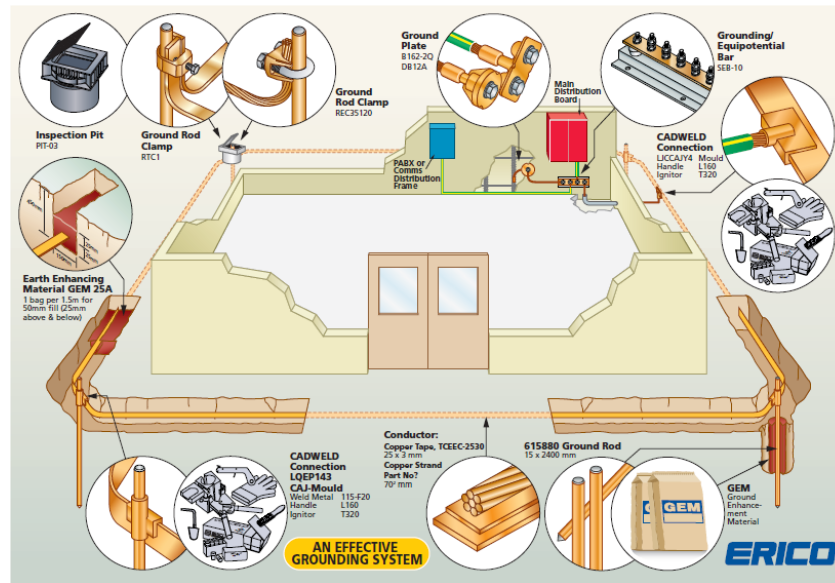


¹⁵ Ivurevure: Shopping.co, <https://shopee.co.th/Utilizing%E2%9C%BF%E2%9C%B2-Solar-Panel-Mounting-Bracket-End-Mid-Clamp-Kit-Adjustable-For-19Mm-55Mm-Framed-i.188349769.7409094766>

¹⁶ Solar Sena, "Optimal Solar Panel Tilt Angle Calculator", May 2021, <https://solarsena.com/solar-panel-tilt-angle-calculator>.

¹⁷ Ivurevure: Jim Dunlop Solar

YALOYALO 18: Gacagaca ni sobuiqe¹⁸

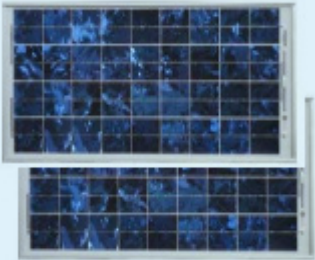
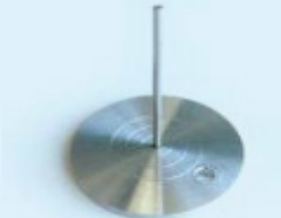
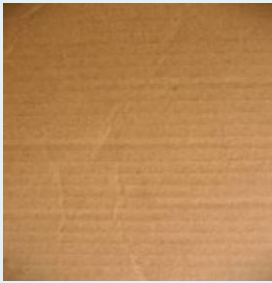
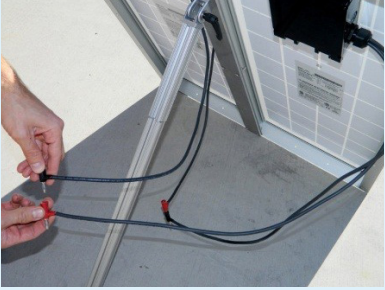


Volavola:

18 Ivurevure: Erico, Components to an effective grounding systems, <http://wapp.com.au/2018/03/components-effective-grounding-system/>

IVAKADRE 2

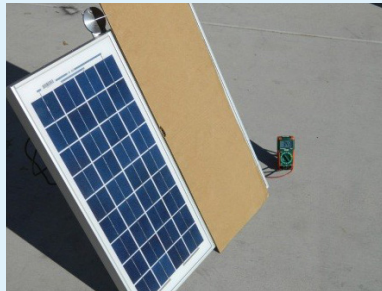
Vakaraitaka na ka e yacova na ulunisola ni vakaruguti.
Vakarautaka na volt (V_{oc}) kei na kui (I_{sc}) ena dui levu ni vakaruru ena ulunisola e sema salavata (in series) se duisala (in parallel).

Test Set-up		
1. Ulunisola (2x) 	2. iTutu ni ulunisola 	3. Kaloko ni siga 
4. Mita liga 	5. Kateni (ivakaruru) 	6. Semasemā na veiulunisola me vaka e dusimaki ena MTT Quick Start Guide 
Vakatovotovo: Vakarautaki na volt		
1. Semā na ulunisola me salavata 	2. Vakarau na volt ni sala dola (V_{OC1}) sega ni vakaruguti 	3. Vakaruguta e dua na tiki ni ulunisola 

4. Vakarau na volt ni sala dola (VOC2)



5. Vakaruquta e dua na ulunisola



6. Vakarau na volt ni sala dola (VOC3)


Vakatovotovo: Vakaraotaki na kui

 7. Vakaruataka na ivakarau 2 - 6 baleta na kui shot (short circuit current, I_{sc1})

 8. Vakaruataka na ivakarau 2 - 6 baleta na kui shot (short circuit current, I_{sc2})

 9. Vakaruataka na ivakarau 2 - 6 baleta na kui shot (short circuit current, I_{sc3})

Dikevi kei na vakaivolataki ni volt kei na kui: (Sabolo ni fika e loaloa)

Veikulunisola sega ni vakaruquti:

Vakaruquti dua na tikina:

Vakaruquti dua na ulunisola

Volt ni sala dola (VOC)

VOC1 = 41.1V

VOC2 = 41.0V

VOC3 = 34.4V

Macala: Na VOC3 e tiko e cake mai na kena namaki 20.5V (Voc ni dua na ulunisola) ni kateni e vakaruquta vakatikina ga na siga

Sot Seket Karent (ISC)

ISC1 = 1.88

ISC2 = 1.84

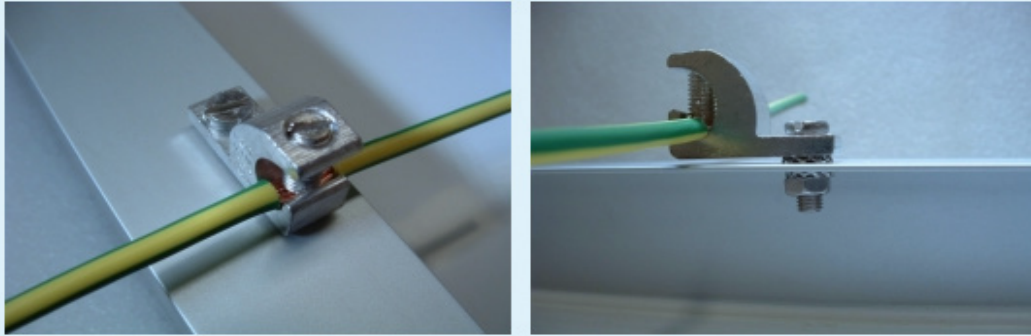
ISC3 = 0

Macala: Na ISC3 e 0 baleta na ulunisola qo e sega na kena by-pass diode (na ulunisola vakaruquti e vaka na 'resistor' vakaitamera, mani via vaka saraga ni voleka ni sala dola)

Vakatovotovo: Dusimaki iratou na lewenikalasi meratou taleva na ivakadre qo ena iwasewase leleyatolu.

IVAKADRE 3

Cava meda sobuiqeletaka kina na sola? Sobuiqeletaka na ulunisola me vaka e vakaraitaki e ra.



IVAKADRE 4

Veivosakitaka se cava me vakayagataki kina na itutu dina ni ulunisola, vakacava me taqa ga e delanivale?

3

Qaravi ni gacagaca
ni sola

3.1 Ulunisola

E ka bibi sara meda kila na ka e gadrevi ena ulunisola. E so na taro bibi me tarogi qo:

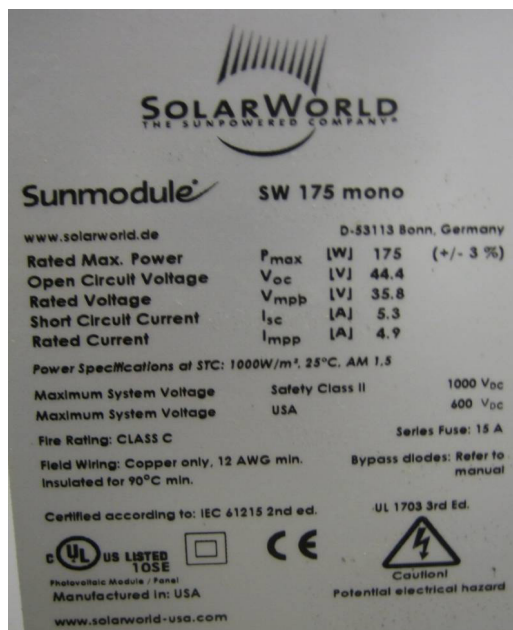
- Vica na kena volt?
- Vica na kena pawa levu duadua?
- Vica na kena kui?

Na ulunisolas kece me volai kina na itukutuku qo (ke sega, de bulia na kabani sega ni nuitaki):

- Open-circuit voltage (Voc)
- Short-circuit current (Isc)
- Operating voltage (Vmp)
- Operating current (Imp)
- Maximum power (Pmax)
- Polarity of terminals
- Maximum permissible system voltage

Meda nanuma tiko ni vakatau ena serau ni matanisiga na pawa kei na kui, ia na volt e via dua tuga, loma ni 200-1000 W/m²

YALOYALO 19: iTukutuku ena ivolakabi ni ulunisola¹⁹



3.2 Kena katakata

Na cakacaka ni ulunisola e vakatau vakalevu ena kena katakata.

- Lutu na volt ena 1% ni tubu na katakata ena 2°C
- Tubu na kui ena 1% ni tubu na katakata ena 12°C
- Lutu na pawa ena 1% ni tubu na katakata ena 2.2°C

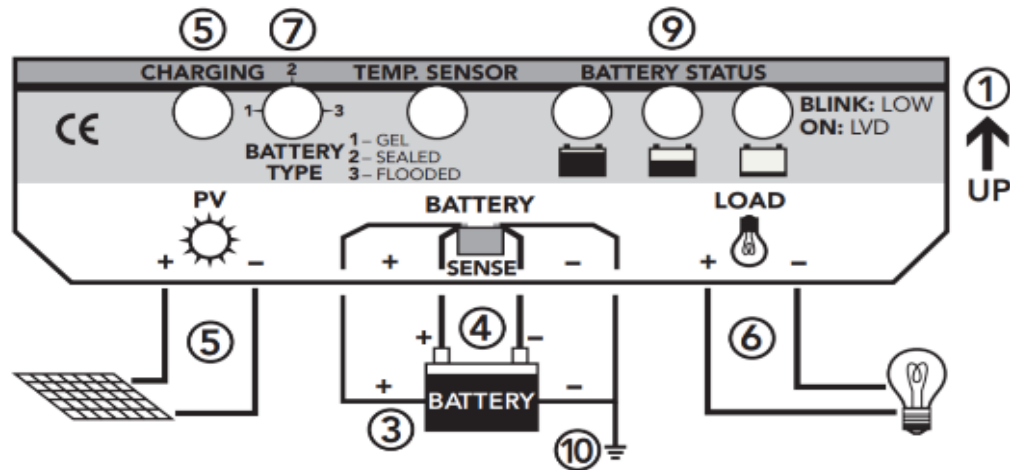
3.3 iDoladola (charge controller)

Na idoladola e dodonu me:

- veirauti na kui e rawa ni colata kei na jaji (amp mai na ulunisola) kei na usausa (kui ni iusana)
- rawata na volt mai na ulunisola kei na volt ni bateri
- rawata na pawa ni livaliva dodonu me colata e levu na iusana
- rawa ni vakayagataki kina na veimataqali bateri (vakawai se sogo)
- nuitaki – e nuitaki vakalevu na idoladola rawarawa, sega so na ka vereverea (kua ni rawai ena kena fensi (“extra “features”) mv LCD screen, micro-processor programmed control &s)

So na kena gacagaca yaga:

- 3 na digidigi ni bateri: gel, sogo (sealed) se vakawai (flooded)
- Jaji vakatautaki ena katakata
- Cina led ni ituvaki ni bateri kei na leqa
- Sucu ni bateri tu yawa me tukuna na volt

YALOYALO 20: Gacagaca ni idoladola²⁰


3.4 Bateri

Na bateri e maroroya ga na livaliva e SEGA ni bulia.

- Mata ni bateri (unit cell) e 2V
 - 2V e kena volt vakacaca. Kena volt dina ena 1.85V - 2.40V
- Bateri 12V e salavata kina e 6 na matana
- Bateri 6V e salavata kina e 3 na matana

YALOYALO 21: Sabolo ni idusidusi ni bateri²¹

SPECIFICATIONS

Nominal Voltage		12 Volts	
Amp Hour Capacity		115 (C20)	90(C5)
Reserve Capacity Minutes		170 @ 25 Amperes	
Physical Characteristics	Length	13.13"	334 mm
	Width	6.75"	171 mm
	Height	9.38"	238 mm
	Wet Weight	58 Lbs	26.4 Kgs
Terminal Options		BCI Type M	

ELECTRICAL SPECIFICATIONS

Amp Hour Capacity	20 Hour Rate	5.75 A	115 Ah
	10 Hour Rate	10.30 A	103 Ah
	5 Hour Rate	18.00 A	90 Ah
	2 Hour Rate	33.50 A	67 Ah
Internal Resistance	80 F	27 C	7.6 mOhm
Capacity affected by Temperature (20 Ah Rate)	104 F	40 C	102%
	80 F	27 C	100%
	32 F	0 C	65%

²⁰ Morning Star, June 2021, <https://www.keoghsmarine.com.au/morningstar-prostar-solar-charge-controller-30a-12-or-24v-pwm-4-stage-charging-led-charge-indicators-sr-ps-30>

²¹ IVuevure: Waveinverter, co.nz, <https://waveinverter.co.nz/wp-content/uploads/2017/12/products-CR325-1.png>

YALOYALO 22: iTovo ni veisemasemai ni bateri²²

Me nanumi dei:

- Duisala (in parallel) soqoni na gumatua (Ah).
- Salavata soqoni na volt (V).
- Soqoni ni igu maroroi e tautauvata (Wh).
- Vinaka cake me KUA ni duisala e sivia na 2 na bateri (de qai vakavuna me duidui na jajitaki bateri se kena talatalaci, qai leqa koso kina na bateri; e levu na kabani ni bateri ena sega ni rokova na yalayala (warranty) ke duisala e sivia na rua na bateri).
- KUA ni duisala e sivia na 4 na bateri, de qai vakavuna me duidui na jajitaki bateri se kena talatalaci, qai leqa koso kina na bateri.
- KUA ni vakayagataki vata na bateri dui kabani, mataqali se yabaki, de qai leqa koso kina.
- Na bateri me vakadeitaki ena vanua cagicagi, vakarurugi mai na siga kei na uca. Tabu sara ni tokari e loma ni vale.
- Na iyaya ni jajitaki bateri me dei na kena wa (hard-wired), kua ni caka ga me rawa.
- Na sucu ni bateri me ubi ena isulu me kua kina ni shot.
- Qarauna me rau veiyawaki na sucunibateri kei na lalaga kava.

Cakacaka kece ni bateri me vakayagataki na iyaya vakarava (insulated tools).

3.5 iVuki (inverter)**YALOYALO 23: Na ivuki tugalala Suresine 300W¹²****TEVELI 3: Sabolo ni idusidusi kei na gacagaca ni ivuki**

iDusidusi & Gacagaca	
Continuous Power Rating (300 Watts ena 25°C)	Total Harmonic Distortion (< 4%)
Peak Power Rating (600 Watts at 25°C)	Low Voltage Disconnect (LVD) (11.5V se 10.5V)
DC Input Voltage (10.0V – 15.5V)	Low Voltage Reconnect (12.6V se 11.6 V)
Waveform (Pure sine wave)	LVD Warning Threshold (11.8V se 10.8V)
AC Output Voltage (220V se 115V +/- 10%)	LVD Delay Period (4 miniti)
AC Output Frequency (50 se 60 Hz +/- 10%)	High Voltage Disconnect (15.5V)
Peak Efficiency (92%)	High Voltage Reconnect (14.5 V)

²² Yavutaki ena "System Components, Batteries", Arizona State University (VOCTEC), <http://votec.asu.edu>

Volavola:

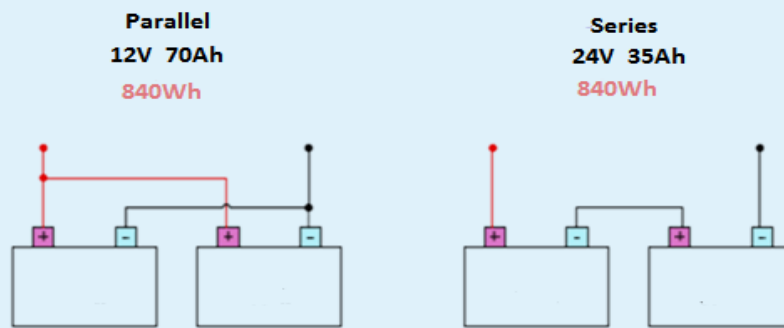
IVAKADRE 5

Cava so me qarauni nio digitaki ulunisola? Dou veivosakitaka.
De na yaga mo taleva na ivola e cake mo kila kina se cava me
vaqarai ena ivolakabi ni ulunisola.

IVAKADRE 6

Me rua na bateri, me rau sema salavata kei na duisala.
Vakarautaka na levu ni volt ena sala ruarua.

Bateri (x2)	WA	Mita Liga
		



IVAKADRE 7

Taro me veivosakitaki: E dau vakacava na pawa kei na kui ni ulunisola ni tubu na kena katakata?

IVAKADRE 8

O dauveituberi me solia na iyaya kece cavuti e cake (ulunisola, idoladola, bateri, ivuki, matanicina 12v DC kei na kena itutu). O dauveituberi ena kaya mo kila na itukutuku e volai tu ena kena dui ivolakabi (iDusidusi & Gacagaca). Dodonu.mo kila

kece na itukutuku qori me vaka sa vakamacalataki e cake. Veivosakitaka vakaiwasewase, kua ga ni madua na tarogi dauveituberi.

4

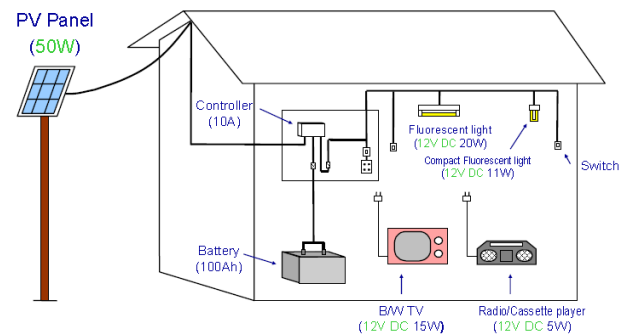
Mataqali sola —————

4.1 Sola tugalala (standalone)

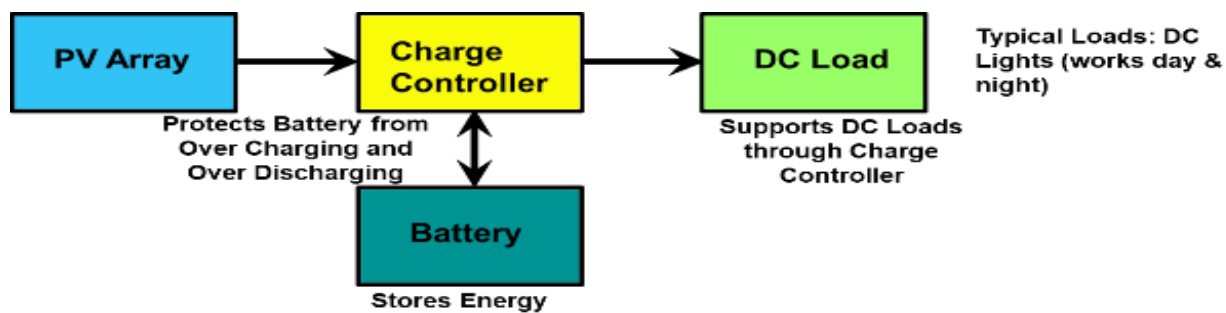
Na sola tugalala e sega ni sema kei na lawalevu (grid), e vakadurī vakalevu ena vanua yawa sega ni sema kei na lawalevu, se na vanua e sega ni gadrevi vakalevu kina na livaliva.

4.1.1. Sola tugalala vakabateri

YALOYALO 24: Sola livaliva dodonu tugalala²³



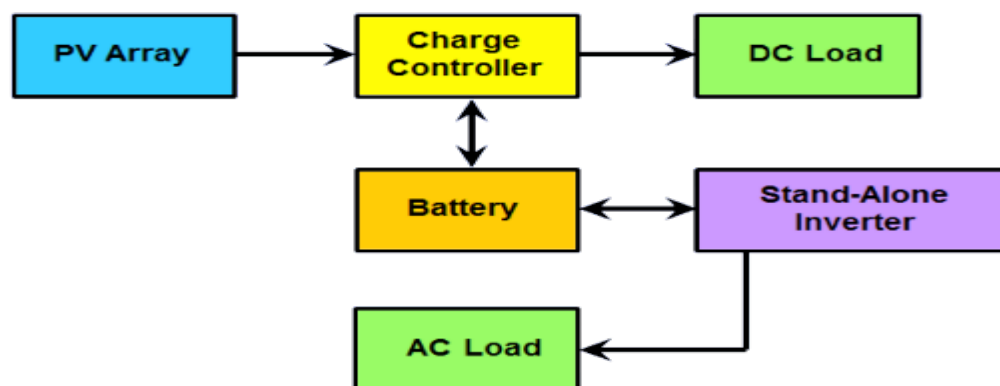
YALOYALO 25: Sabolo ni sola tugalala livaliva dodonu vakabateri²⁴



- KUA ni kuria na cina se iyaya cava ena sola tugalala, ena leqa kina na sola, se katakata sivia, se mavoia se mate sara ni guce
- Vakayagataki vakalevu ena vale sega so ni levu ni gadrevi ga na cina kei na jajitaki talevoni.

4.1.2 Sola tugalala livaliva ruarua (DC+AC) vakabateri

YALOYALO 26: Sola tugalala livaliva ruarua (DC+AC) vakabateri²⁵



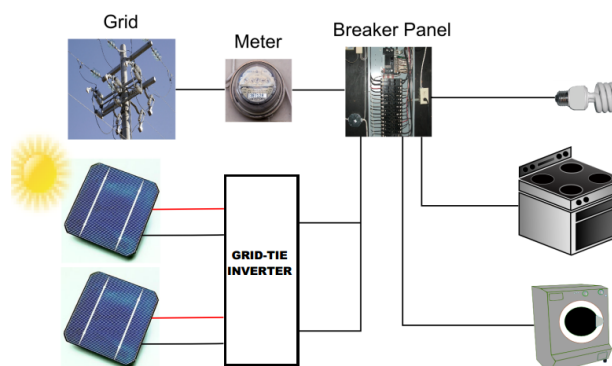
²³ Ivurevure: JICA

²⁴ Ivurevure: Jim Dunlop Solar

²⁵ Ivurevure: Jim Dunlop Solar

- Yavala siga kei na bogi, ni vakabateri
- Tautauvata kei na sola livaliva dodonu (DC), qai vakaivuki (inverter) me yavala talega kina na iyaya livaliva dri (AC)
- KUA SARA ni veisautaka na iyaya livaliva dri kei na livaliva dodonu. Na iyaya livaliva dodonu me cici ga ena livaliva dodonu. KUA SARA NI SEMA NA IYAYA LIVALIVA DODONU INA LIVALIVA DRI. **E RAWA SARAGA ni ca na iyaya, se o mavo se mate sara.**
- Vakayagataki vakalevu ena vale levu toka ni gadrevi kina na cina, jajitaki talevoni kei na iyaya livaliva lai.

YALOYALO 27: Sola lawalevu²⁶



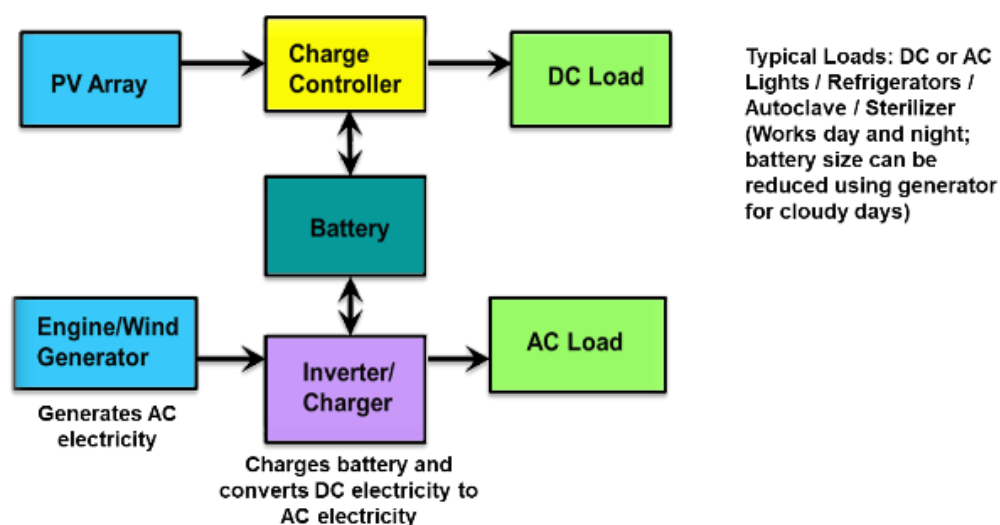
4.2 Sola lawalevu

Na mataqali qo e kune ga ena vanua e tu kina na lawalevu (grid) e ganita.

4.3 Solar veimama (hybrid)

Na mataqali sola qo e ganita na vanua e bau tarabi kina na isau ni livaliva ni lawalevu.

YALOYALO 28: iTuvatuva ni sola veimama²⁷



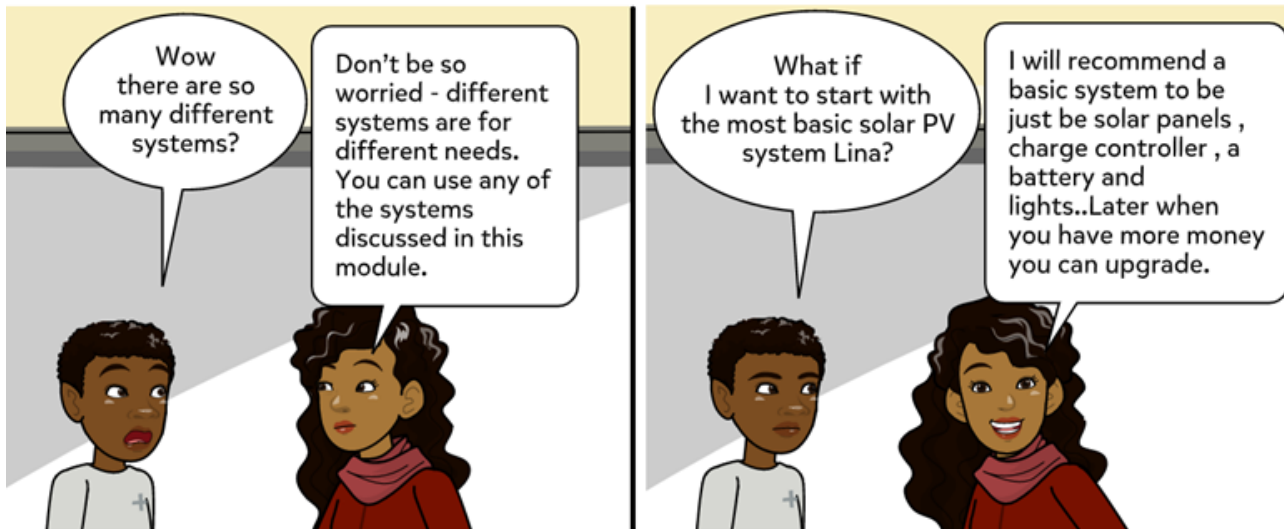
- Yavala siga kei na bogi, ni vakabateri
- Tautauvata kei na sola tugalala ruarua, kena ivuki ga e rawa ni jajitaki bateri ni vakayagataki na idini benisini/disili, ivocevoce ni cagi &s. Qo sa tu rawa kina na igu me kua na usabi se guce.

Vakayagataki vakalevu ena vale lelevu ni gadrevi kina na cina, jajitaki talevoni kei na iyaya livaliva lelevu (TV, misini ni savasava, katoniwaililiawa &s)

²⁶ Ivurevure: Hindawi, "Journal of Renewable Energy", June 2021, <https://www.hindawi.com/journals/jre/2013/785636/fig1/>

²⁷ Ivurevure: Jim Dunlop Solar

Sara kisitoni mada



Volavola:

IVAKADRE 9

Droinitaka e 3 na mataqali sola, qai vola na yaca ni gacagaca kece. Vinaka modou veivosakitaka rawa vakaiwasewase.

IVAKADRE 10

Veivosakitaka vakalasi se mataqali sola cava o vinakata. Baleta?

5

iYaya ni cakacaka
ena sola

Qo na iyaya e dau vakayagataki vakalevu ena vakaduri sola.

YALOYALO 29: iYaya vakayagataki vakalevu²⁸

Common tools used in home solar electric installations include:

tape measure	ratchet set
extension ladder	caulk gun
chalk line	level
ink marker	lineman pliers
hammer	crimping tool
roofing bar	wire stripper
(shingle ripper)	screwdrivers
utility knife	hacksaw
cordless drill	conduit bender
impact driver	multimeter



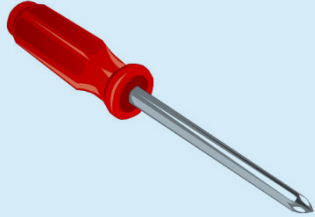
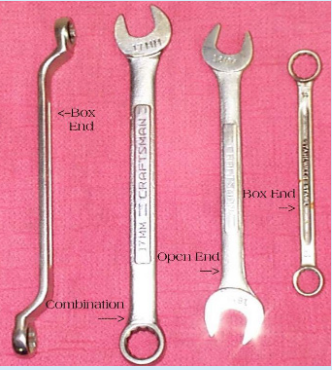
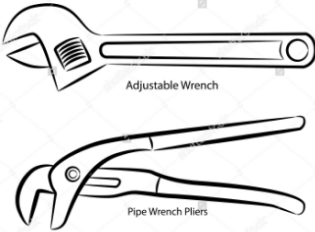
5.1 iYaya yadua kei na kedra yaga

Kena yaloyalo	Yacana	Kena yaga
YALOYALO 30: Mita iqamu²⁸ 	Mita iqamu (clamp meter)	Na mita iqamu e vakarautaka na kui ni livaliva dri, volt ni livaliva ruarua, kei na idre (resistance), koya e ganita vinaka kina na cakacaka ni livaliva. Rawarawa qai ganita na vakarautaki kui lelevu Na iKuri B e vakaraitaki kina na vakayagataki mita iqamu
YALOYALO 31: Mita liga²⁹ 	Mita liga (multimeter)	Na mita liga e dau vakarautaka vakalevu na volt, kui, kei na idre (resistance) E ivakarau matailalai. Rawa ga ni vakarautaki na kui ni salavata kei na iyaya e vakarautaki (vakavo ni tiko na kena 'adapter') Na iKuri C e vakaraitaki kina na vakayagataki mita liga
Yaloyalo 32: Skrudraiva³⁰ 	Skrudraiva (screwdriver)	Wirica na skru

²⁸ Quora, "What type of tools and fasteners are required to install a solar panel", <https://www.quora.com/What-type-of-tools-and-fasteners-are-required-to-install-a-solar-panel/#n=12>

²⁹ Jim Dunlop Solar

³⁰ Ivurevure: Galco, www.galco.com

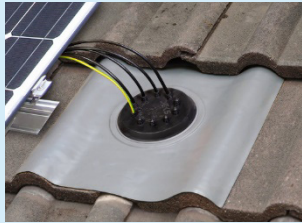
YALOYALO 33: Skrudraiva sta (Philips screwdriver)³¹ 	Skrudraiva sta (Philips screwdriver)	Wirica na skru
YALOYALO 34: Mita ni Serau³² 	Mita ni Serau (Solar Irradiance Meter)	Vakarautaka na serau ni matanisiga
YALOYALO 35: So na mataqali spana³³ 	So na mataqali spana, mv spana mama takelo (offset ring spanner), spana duimua (combination spanner), spana tadola (open-ended spanner), spana mama (ring spanner)	Qo na iyaya e vesuka matua e dua na ka meda wirica, vb nati se bolu, se me kua ni cowiri
YALOYALO 36: Spana³⁴ 	Shifta (adjustable spanner) Spana ni paipo (multigrip pliers)	Qo na iyaya e vesuka matua e dua na ka meda wirica, vb nati se bolu, se me kua ni cowiri

³¹ Ivurevure: Conceptdraw.com, "Manufacturing and Maintenance", <https://www.conceptdraw.com/examples/diagram-of-screwdriver-and-its-specific-use-in-maintenance>

³² Solar Panel Store Blog, June 2021, <https://www.solarpanelstore.com/products/daystar-ds-05-solar-irradiance-meter>

³³ Mechanical Engineering, <https://mechanical-engg.com/gallery/image/2209-wrench-typesjpg/>

³⁴ Ivurevure: Pinterest.com, "Different types of wrenches", <https://www.pinterest.com/pin/147352219031480866/>

YALOYALO 37: Plais³⁵ 	Plais (lineman pliers)	Qo na mataqali plais ra vakayagataka vakalevu na daunilivaliva me qamuta, wirica, loveca se kotiva na wanilivaliva.
YALOYALO 38: Plais ucumomoto (needle-nose pliers)³⁶ 	Plais ucumomoto (needle-nose pliers)	Mataqali plais vb ni daunilivaliva me loveca, tokia se kotiva na wanilivaliva
YALOYALO 39: iVakamalu (flashing)³⁷ 	Na ivakamalu e dau tarova na curu ni wai ena vanua e tadola se laqa	
YALOYALO 40: iSema ni ulunisola³⁸ 	Na isema ni ulunisola (module connector) e semā na ulunisola salavata	

35 Ivurevure: AmPro, <https://ampro.fr/en/shop/pliers/wire-cutting-pliers/71-2-high-leverage-diagonal-pliers/>

36 Ivurevure: DORNO, Rubber Grip Long-Nose Pliers, <https://www.olo-7.top/products.aspx?cname=rubber+needle+nose+pliers&cid=40>

37 Ivurevure: Alternergy Solar Pv and Storage solutions, <https://www.alternergy.co.uk/dektite-lead-multicable-solar-flashing-tiled-or-slate>

38 Ivurevure: CED Greentech, <https://www.cedgreentech.com/article/pv-connectors-what-you-need-know>

E levu na mataqali ulu ni skru e vakayagataki ena sola, qai dui tu na kena skrudraiva.

YALOYALO 41: Dui ulu ni skru³⁹



E ka bibi meda kauta voli vakamaqosa na iyaya vakamatai nida caka sola tiko. Qo e vica na kena icakacaka:

YALOYALO 42: iWalewale ni kau iyaya ena kena beleti⁴⁰



E tolu na mataqali ikabakaba:

- iKabakaba yavairua (Step ladder, A-frame):

YALOYALO 43: iKabakaba yavairua⁴¹



³⁹ Ivurevure: UU-99, <https://www.hindawi.com/journals/jre/2013/785636/fig1/>

⁴⁰ Ivurevure: Pinterest.com, <https://www.pinterest.com/bambulancemania/work-apparel/>

⁴¹ Ivurevure: Total Tools, <https://www.totaltools.com.au/2-4-4-0m-extension-ladder>

- iKabakaba vakavata (platform ladder):

YALOYALO 44: iKabakaba vakavata⁴²



- iKabakaba veisodoi (extension ladder):

YALOYALO 45: iKabakaba veisodoi⁴³



E ka bibi sara mo digitaka na ikabakaba e donu vinaka na kena balavu. Na kena balavu me vakatau ena vanua ena tarā kina na lalaga se delanivale.



SAFETY TIP: When selecting a straight or extension ladder, choose a length that extends a minimum of 3 ft above the rung you need to stand on to work from. When using extension and straight ladder the fourth rung from the top is the highest rung to climb to or work from.



SAFETY TIP: Never use a metal ladder near electrical lines or equipment. Always look up prior to raising a ladder to ensure no overhead powerline are present.

Volavola:

⁴² Ivurevure: Total Tools, <https://www.totaltools.com.au/2-4-4-0m-extension-ladder>

⁴³ Ivurevure: Swallow Tail Inn, <http://www.swallowtailinn.com/when-should-replace-your-siding/>

IVAKADRE 11

1. Cava na kedrau duidui levu na mita iqamu kei na mita liga?

6

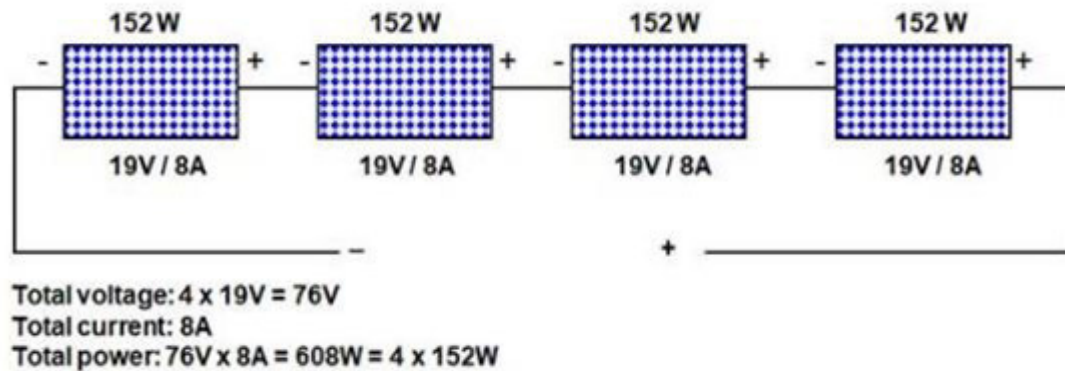
Vakaduri sola —————

Na vakaduri sola na itavi ni daunilivaliva vakaivola. E vica tiko na kena ivakarau me muri me vakadeitaki kina ni sa vakaduri vakavinaka qai sega ni rerevaki, me vaka na kena itovo era dau muria na kena dau.

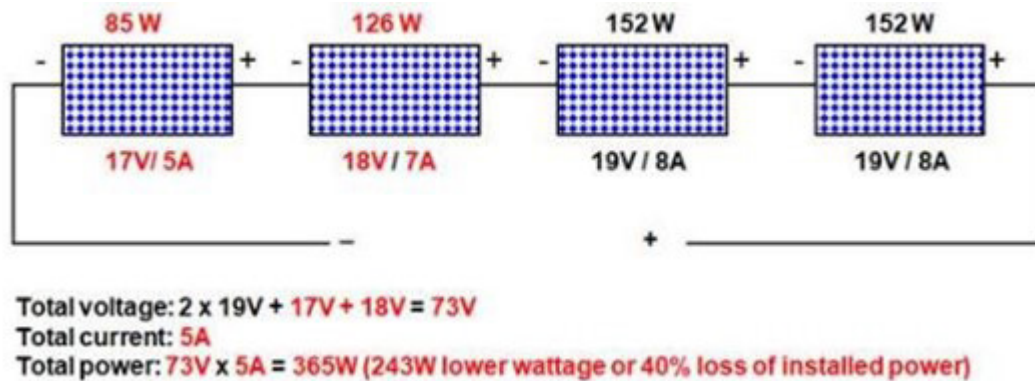
6.1 Saladua (series connection)

Na ulunisola e dau semasemai vakasalavata me tubu kina na volt e rawata (na kui ena dua tuga). Na veisemasemai qo, erau sema kina na + ni dua kei na - ni dua tale. Na iusana (iyaya) e sema kei na muana + kei na muana -. Ena uasivi sara ni ratou tautauvata kece na bateri salavata.

YALOYALO 46: Semai vakasalavata⁴⁴



YALOYALO 47: Semai vakasalavata duidui levu⁴⁴

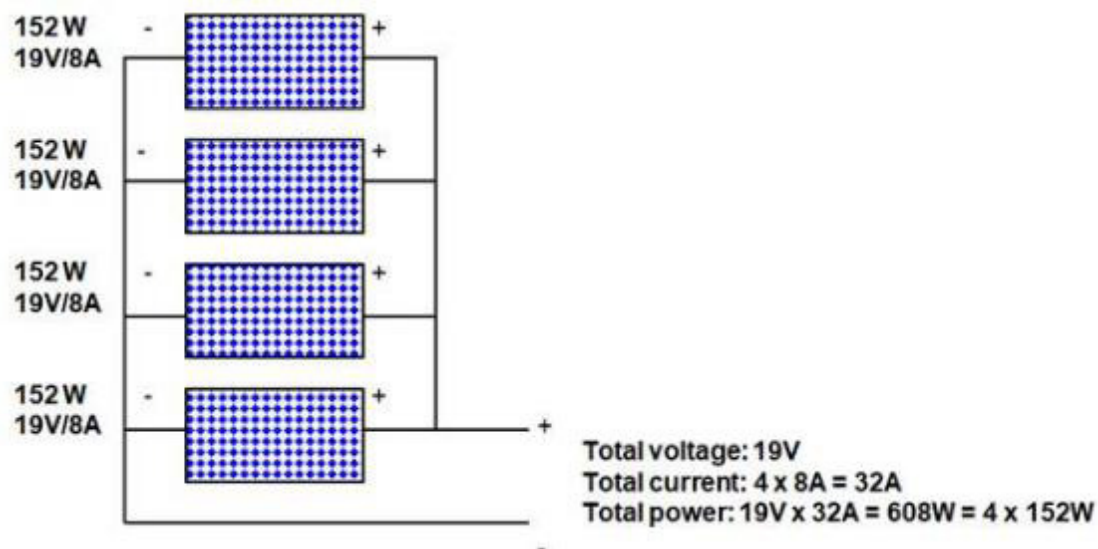


44 Photo credit: <https://solarpanelsvenue.com/>

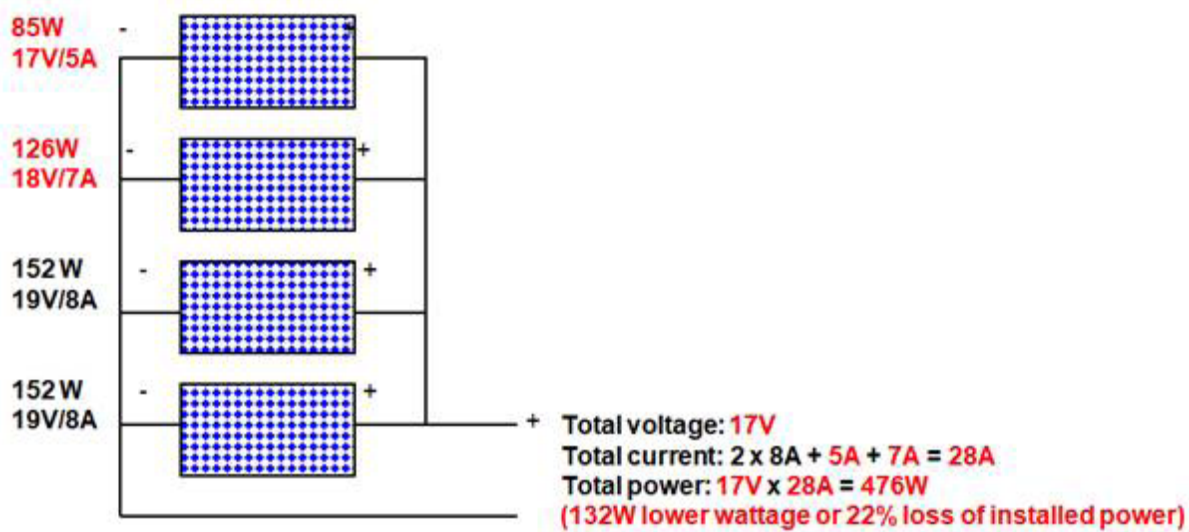
6.2 Semasemai Duisala

E semasemai duisala (in parallel) na ulunisola me tubu kina na kui (na volt e dua tuga). Ni semai duisala, na + (positive) ni dua e sema kei na + ni dua tale, na – (negative) erau sema talega.

YALOYALO 48: Semasemai duisala⁴⁴



YALOYALO 49: Semasemai duisala, dui levu⁴⁴



6.3 Vakarau me vakadurī

Ni se bera ni tekivu vakadurī, me tuvanaki rawa e lomamu qai vakarautaki rawa na iyaya kece ena gadrevi kina. Lewā se me sema vakasaladua se duisala, vakasamataka se leqa cava so e rawa ni yaco. Me tu rawa na kena iyaya ni tataqomaki (PPE, personal protective equipment). Vakadeitaka me donu na lelevu kei na iwiliwili ni gacagaca o kauta tiko me lai vakadurī.

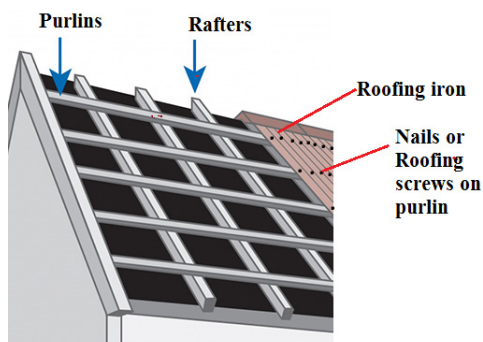
6.4 iTutu ni ulunisola

Veitalia se mataqali itutu cava sa digitaki, me vakadeitaki ni kaukaua qai sega ni rerevaki se vakasevā na cakacaka ni sola.

6.5 Ulunisola e delanivale

Tou dikeva mada kena vakadurī na ulunisola ena delanivale kava ni vale vakavalagi, se e vei na kau e colata tiko na kava.

YALOYALO 50: iTuvatuva ni kau ni delanivale⁴⁵



Matai ni ka me caka, me dua na yavu ni itutu (mounting base) me skrutaki ena poleni ena skru ni kava.

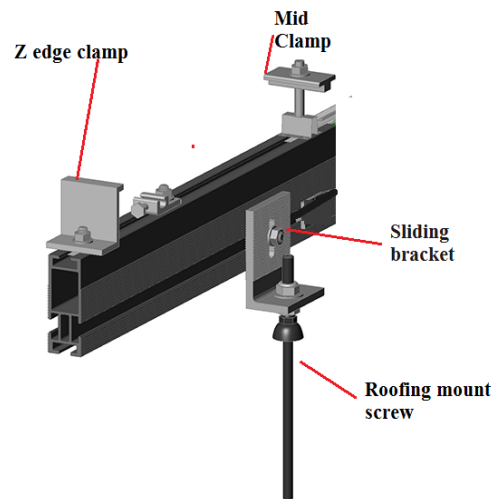
YALOYALO 51: iLago ni sola ena kava⁴⁶



Oti, me vesuvesu na ilago (solar rail) ena yavu ni itutu. E vinaka me vakayagataki tuga na kena ilago nida vakaduria e vica na ulunisola e delanivale.

E Viti, e vinaka me kala ena 20 dikiri, kua ni sivia, ke rawa me volekata na latitude (rauta na 15 - 20 dikiri e Viti).

YALOYALO 52: iQamu ni bati ni ulunisola kei na kena e lomadonu⁴⁷



Ni sa dei na ilago, sa davo yani na ulunisola qai vakadeitaki e dela ni ilago ena so na iqamu.

YALOYALO 53: Davo na ulunisola ena ilago⁴⁸



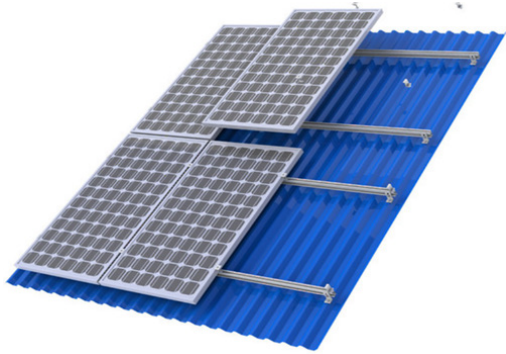
⁴⁵ IVurevure: Pinterest.com, March 2021, <https://www.pinterest.co.uk/pin/539446861598727570/>

⁴⁶ IVurevure: Sun for Son, <http://www.solar-mount.com/solar-mounts/high-quality-tile-roof-aluminum-alloy-pv.html>

⁴⁷ IVurevure: Solar Gain, June 2021, <https://www.solargain.ca/product/fast-rack-10-panel-mounting-kit/>

⁴⁸ IVurevure: ClayEnergy, Fiji.

YALOYALO 54: Vakaduri sola ena delanivale ni Pasifika, vakadeitaki ena iqamu 'z' kei na kauvaro⁴⁹



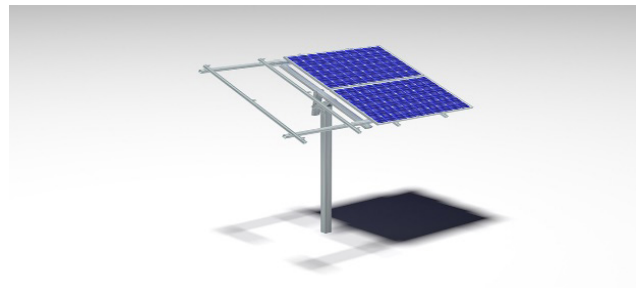
YALOYALO 55: Vinaka me taqa na sola ena duru ni sega ni veirauti na delanivale⁵⁰



6.6 Ulunisola ena duru se ena gele

Ke sega ni rawa se sega ni veiganiti me duri na ulunisola e delanivale, e daumaka me vakaduru, vakabibi ena koro yawa.

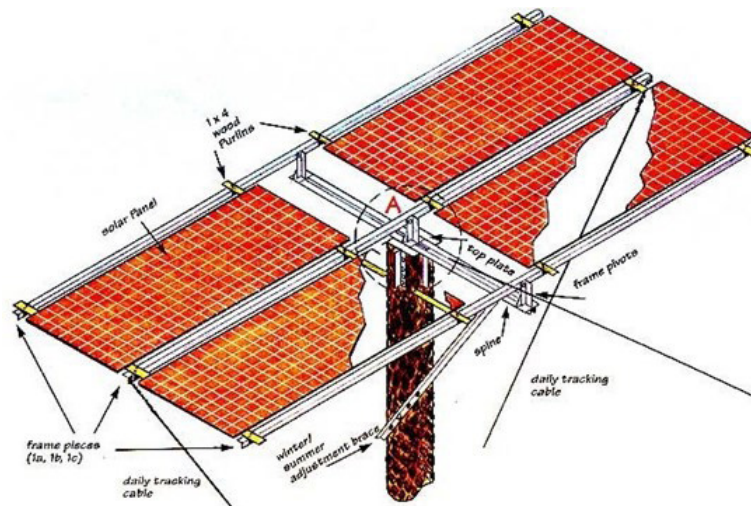
YALOYALO 56: Sabolo ni ulunisola vakaduru⁵¹



Qo e vica na vuna e vinaka kina me vakaduru ni dua ga se rua na ulunisola:

- rawa ni tu e vanua cilavi siga,
- rawarawa kena qara donu kei na kala,
- cagicagi vinaka na ruku ni ulunisola,
- sega ni leqataki na draunikau se soqosoqo ena maliwa ni ulunisola kei na delanivale,
- rawarawa noda lako kina meda qarava,
- sega ni leqataki na turu ni wai ena laqa ni itutu ni ulunisola e delanivale.

YALOYALO 57: Kena duru e tu ga mai na koro⁵²



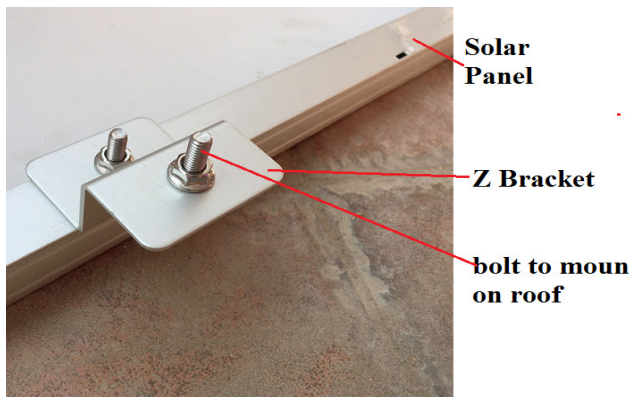
⁴⁹ Ivurevure: Able Solar, "Tin Roof Mounting System", <https://www.ablesolar.co.nz/shop/Solar+Panel+Array+Frame/Roof+Mounting+Frames/Tin+Roof+Mounting+System.html>

⁵⁰ Ivurevure: Fiji Department of Energy

⁵¹ Ivurevure: Mibet Energy, May 2021, <https://www.mibetsolar.com/>

⁵² Ivurevure: Mother Earths News, "How to Build a Manual Solar Tracker", <https://www.motherearthnews.com/diy/manual-solar-tracker-zmaz97amzgoe>

YALOYALO 58: iQamu 'Z' matailalai⁵³



6.7 Sema Bateri

YALOYALO 59: Mataqali bateri⁵⁴



Qo e so na idusidusi baleta na kena tokari na bateri:⁵⁵

- Na bateri me tiko ena kena rumu se lomanibai.
- Na vanua e toka kina e dodonu me taqomaki kina, qai rawa nira torova ga o ira na vakadonui mera torova.
- Me lomalevu kena rumu se lomanibai me rawarawa kena tokari kina kei na kena qaravi, me kua talega na kaukamea me volekata de lutuka na sucuna qai shot.
- Ke dua sara na kena rumu ena vale tawani, na kena katuba me qara i tuba; ke bateri e rawa ni kacabote kena kuvu (mv open-cell lead-acid) e tabu ni lamuti kena lalaga e loma, me lamuti ga na lalaga e tuba me icegucegu ni kuvu
- E tabu ni dua na iyaya livaliva e dela ni bateri e kuvuraki kasi dau kacabote se kakana
- Na itokatoka ni bateri me mamaca.
- Na bateri me taqa. Ke toka e ra, na vu ni bateri ena via batabatā vata kei na qele se fuloa, sa na duidui gona kei na katakata ni bateri e cake. E so na bateri kemiki, e rawa ni veitaqataqai kina na waikama qai mate koso.
- Kena rumu se lomanibai me kua ni cilavi siga, me tiko ena vanua ena bau batabata kina na bateri.
- Me vanua cagicagi me kua ni katakata sivia, me kauta laivi talega na haidrojini se kasi cava tale e rawa ni kuvuraki mai ni jajitaki.
- Na bateri e dau vakalevu me ka bibi, me qarauni me tabei vinaka, me kua ni kalove ena kena bibi.

⁵³ Ivurevure: Engineer Solar, June 2021, <http://engineer-solar.com/Products/solar-panel-z-bracket.html>

⁵⁴ Ivurevure: Yavutaki ena "System Components- Batteries", Arizona State University, VOCTEC, <http://voctec.asu.edu>

⁵⁵ Off Grid PV Power Systems – System Installation Guidelines, SEI/API, 2019

6.7.1 Sema na idoladola kei na gacagaca tale eso

Na vo ni gacagaca ni sola ni vale, me vaka na idoladola, iusana, ivuki (ni livaliva dri) na wa kei na iyaya tataqomai e dau taqa ena dua na kena baba qai vakoti e lalaga, me vaka ena yaloyalo e ra.

YALOYALO 60: Vakaraitaka o idinia na sola ni vale e lalaga⁵⁶



Qo na idusidusi eso ni vakadurī ni gacagaca qo:

- Na gacagaca kece ni vakadurī meda muria na kena ivoladusidusi.
- Me murī na idusidusi ni veiyawaki ni gacagaca, me galala vinaka qai cagicagi.
- Ni sema na idoladola kei na ivuki (ke tiko) me veivolekati kei na bateri me kua ni balavu na kena wa, de lutu kina na volt
- Gacagaca kece me kua ni vakadurī ena vanua cilavisiga se levu kina na kuvu
- Me vaka niratou gacagaca bibi, vb na ivuki, me qarauni me kaukaua na baba me colati iratou.
- Na wa kece ni livaliva dodonu (DC) (kei na livaliva dri (AC) ke tiko na ivuki) me dodo ka vakadeitaki vakamaqosa. Me wase na wa ni livaliva dri kei na wa ni livaliva dodonu qai ubi (mechanical protection) me kua ni tarā na wa tale eso se tamata.
- Na wa kece me tiko e cake na kena yalayala ni volt kei na kui mai na kena e namaki ena salanilivaliva ya.
- Na gacagaca kece ni tataqomaki kei na suiti me yalataki (rated) me yavala vakavinaka ni gadrevi.

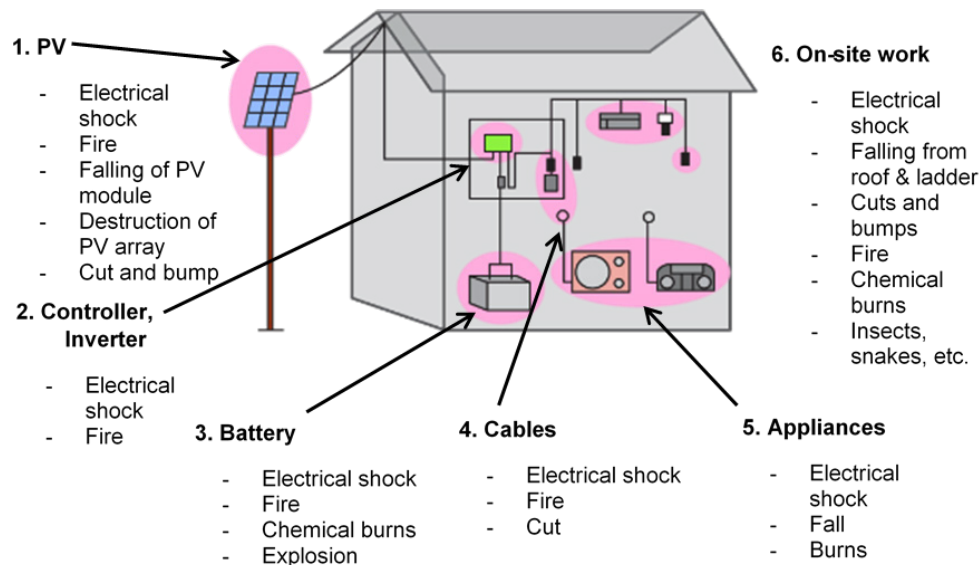
Volavola:

A large, bold, white number '7' is positioned on the left side of the image. The background is a gradient of teal and blue, with a vertical line separating the lighter blue on the left from the darker teal on the right. The number '7' is white and stands out against the blue background.

Qaqarauni ena sola —————

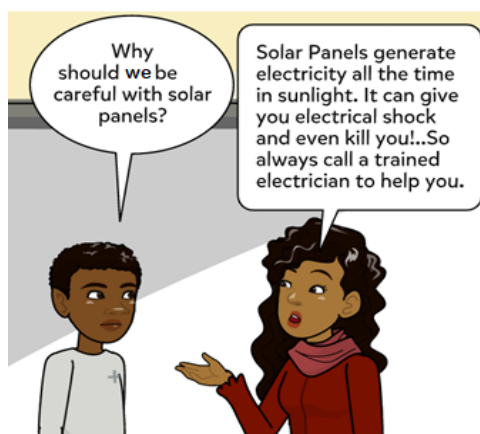
E levu na leqa e rawa ni tarā noda bula ena sola. E so era dusimaki ena yaloyalo e ra.

YALOYALO 61: Veika me qarauni ena sola⁵⁷



7.1 Lawa ni qaqarauni

YALOYALO 62: Dau kere veivuke vei daunisola⁵⁸



1. Nio vakarau semā se moica na sola, mo dau tukuna vei iratou na itaukei ni vale qai bokoca na livaliva.

YALOYALO 63: Notisi ni qaqarauni⁵⁹



2. Mo vakaduri se ripeataki gacagaca ga ena salanilivaliva o sa vulica oti. Kua ni tovolea mo veisautaka na sola, vakavo nio kila sara vakavinaka.

⁵⁷ Ivurevure: JICA

⁵⁸ GGGI, Fiji

⁵⁹ Ivurevure: AviationPros, <https://www.aviationpros.com/tools-equipment/safety-equipment/article/11148860/ground-handling-safety-signs>

YALOYALO 64: Vaqaniliga rava⁶⁰



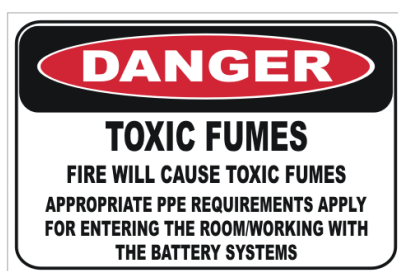
3. Mo dau vakaiyaya ni tataqomaki (PPE, personal protective equipment) mv qaniliga rava, matailoilo ni tataqomaki kei na ivava kaukaua. Tabu na tarā na waya ni livaliva, veitalia nio vaqaniliga.
4. Kua ni tovolea mo ripeataka duadua na bateri. Na bateri e tu kina na kemiki rerevaki e rawa nida mavoa bibi kina.

YALOYALO 65: Notisi ni waikama⁶¹



5. Kua ni tokara na bateri volekata na matadravu se e loma ni rumu ni gade – e so na bateri e dau kuvuraki kasi kama se kasi gaga, dina ni sega ni laurai.

YALOYALO 66: Notisi ni kasi gaga⁶²



6. E tabu ni maroroi na bateri e vanua qiqo se veitikivi kei na benisini se karasini, de qai lidika qai caudre. Na bateri me dau maroroi e vanua cagicagi.

YALOYALO 67: Notisi ni bateri⁶³



7. Mo dau vakabeleti ni qaqaarauni (harness) me vesu ena delanivale nio kaba e delanivale mo vakaduri sola. Ke rawa, mo drau le rua na cakacaka vata.

YALOYALO 68: Dau vesu na beleti e delanivale⁶⁴



8. Qarauna mo kua sara ni tarā na waya, se mo tovolea mo semā na wa bula. Me dua e veivuke ena lave ulunisola, na ulunisola mamada madaga ni liwa tiko na cagi.

YALOYALO 69: Qarauna na lave ulunisola ni katakata⁶⁵



⁶⁰ Ivurevure: Safety workblog.com, <https://safetyworkblog.com/assets/understanding-the-2015-edition-of-nfpa-70e-the-arc-flash-hazard.jpg>

⁶¹ MSDS online, <https://www.msds-online.com/2014/07/22/sulfuric-acid-safety-tips-sulfuric-acid-msds-information/>

⁶² Ivurevure: National Safety Signs, <https://nationalsafety-signs.com.au/wp-content/uploads/2020/02/D10332-Toxic-Fumes-sign.png>

⁶³ We Need Signs.com, "Anzsi Battery Charging Safety Signs", <http://www.weneedsigns.com/home.php?cat=403>

⁶⁴ Ivurevure: Solar Power World, <https://www.solarpowerworldonline.com/2016/01/how-to-stay-safe-on-top-of-metal-roofs-when-installing-solar/>

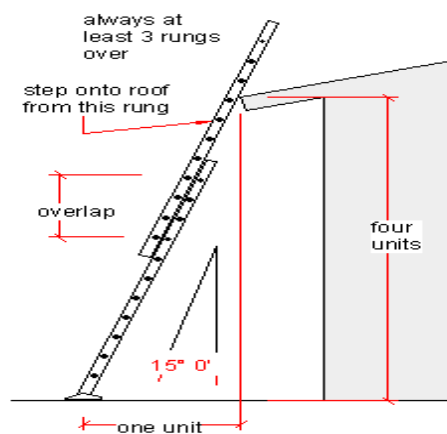
⁶⁵ Yavutaki ena Barefoot college Annual Report (2016-2017), https://www.barefootcollege.org/wp-content/uploads/2018/10/Barefoot_annualreport_2016-17_v7_online.pdf

9. Mo dau qaqarauni nio vakayagataka na iyaya livaliva me vaka na iqiva &s, qai vakamatailoilo ni tataqomaki nio vakayagataka na iqiva se ituki.
10. Qaqarauni tikoga nio kaba ena ikabakaba mo qaravi sola e delanivale.

YALOYALO 70: Vakaiyaya ni tataqomaki, vakabeleti e delanivale⁶⁶



YALOYALO 71: Kala ni ikabakaba ena qele me 75 dikiri se sivia⁶⁷



Volavola:

⁶⁶ Ivurevure: Pacific Prime Singapore, <https://www.pacificprime.sg/blog/covid-19-lockdown-singapores-quarantine-measures-for-foreign-workers/>

⁶⁷ Ivurevure: Builder Bill, <https://builder-bill.com/diy-help>

IVAKADRE 12 - LAVAKI

Wase A: Veitalanoa ni qaqarauni

Lewenikalasi me vakaiwasewase qai vakasamataka ni nodratou itavi na vakaduria e 2 na ulunisola 50 watt, 3 na bateri 30Ah, dua na idoladola 20A, 2 na matanicina livaliva dodonu (DC) kei na 1 na ivuki 100W kena iusana e dua ga na matanicina livaliva dri (AC).

Me ratou veivosakitaka mada na itovo kece ni qaqarauni me ratou muria ena vakaduri sola qo. Me ratou veitalanoataka ga se me volai.

- iDoladola
- iVuki
- Matanicina livaliva dodonu (rauta 10W) kei na suiti me iusana ni livaliva dri
- Matanicina livaliva dri (rauta 10W) kei na suiti
- iTutu kece ni ulunisola
- Wa livaliva
- Plais, skrudraiva, mita liga
- iYaya ni tataqomaki – qaniliga rava, matailoilo ni tataqomaki, iyaya vakarava, isala kaukaua, beleti ni kaba.
- iSema ni wa kei na ivakariba livaliva dodonu

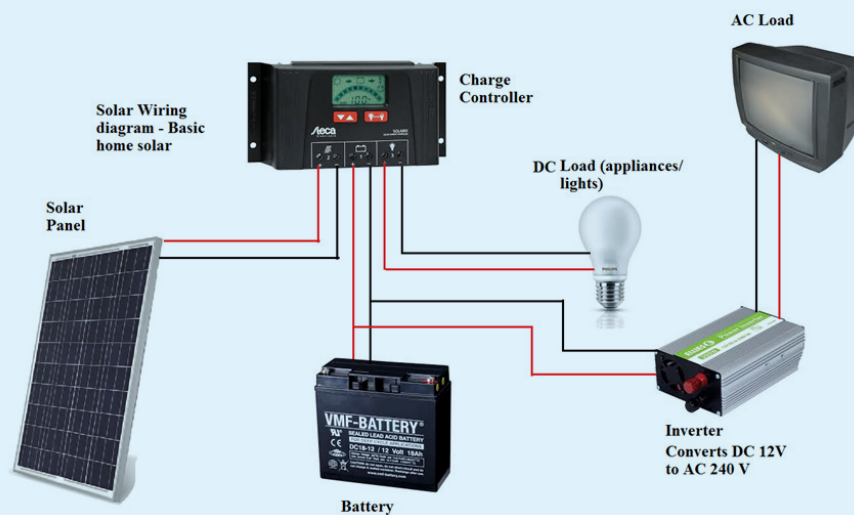
Wase B: Vakaduri sola tugalala livaliva ruarua

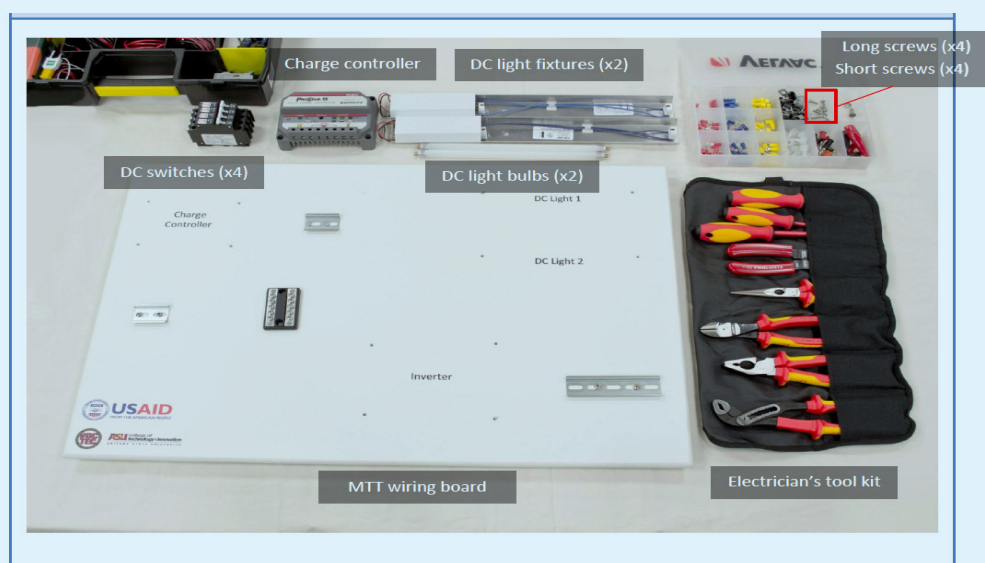
Ena iVakadre qo me ratou sagā na lewe ni kalasi me ratou vakaduri sola me vaka ena droini ni salanilivaliva qo:

Me soli vei iratou na kalasi na sola e lewena tiko qo:

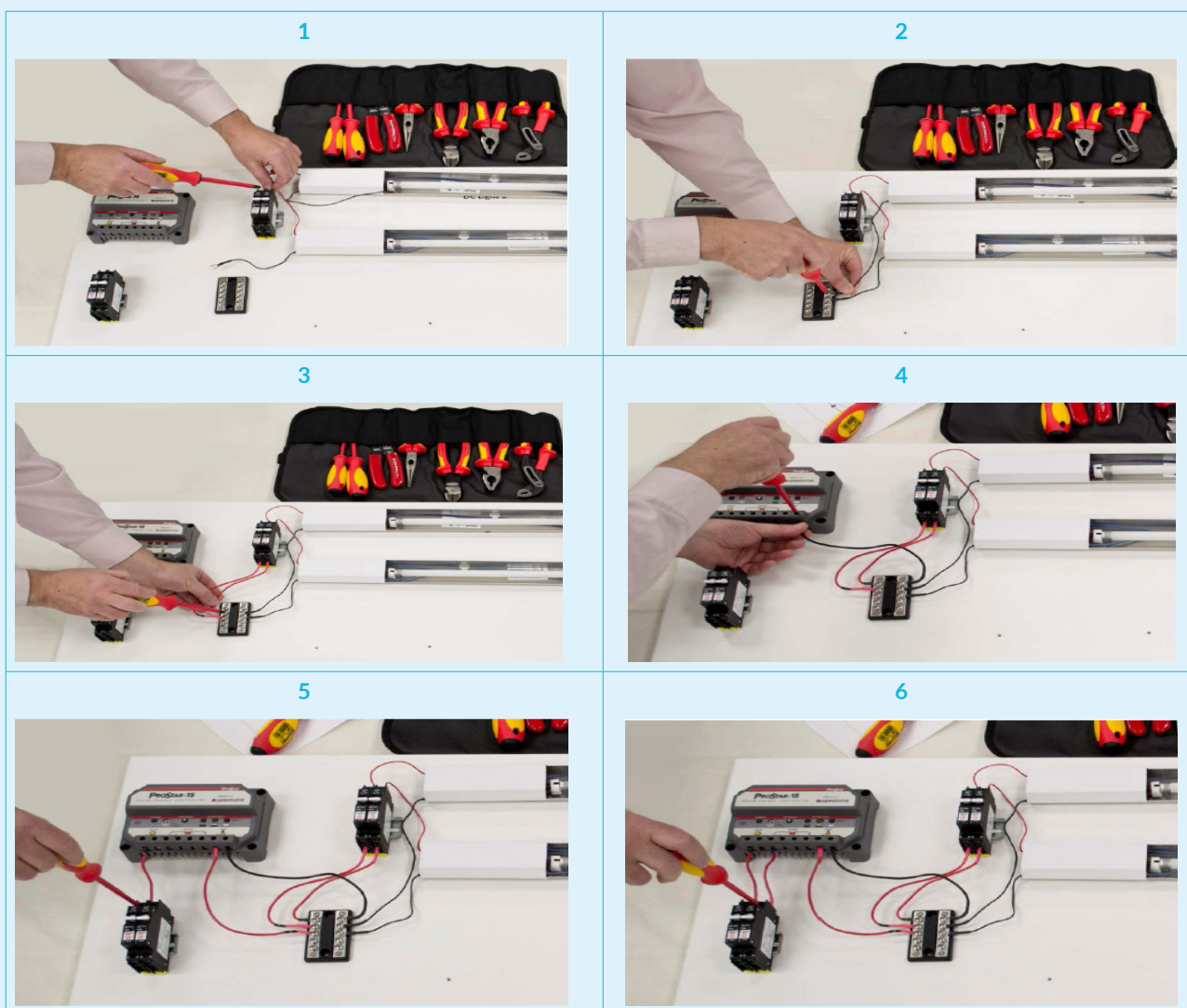
- Ulunisola
- Bateri

YALOYALO 72: Droini ni semasemai ni sola livaliva ruarua⁶⁸

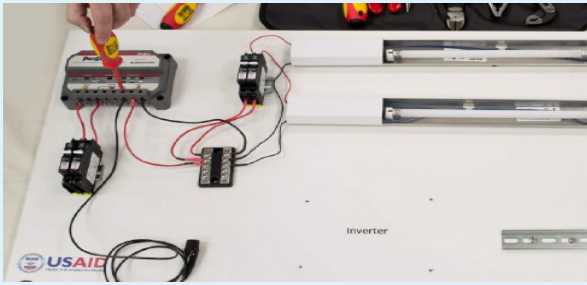




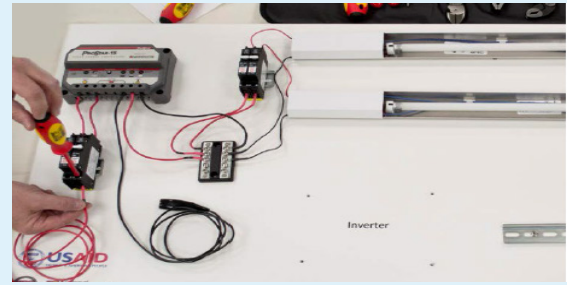
iYaya gadrevi ni vakaduri sola livaliva dodonu



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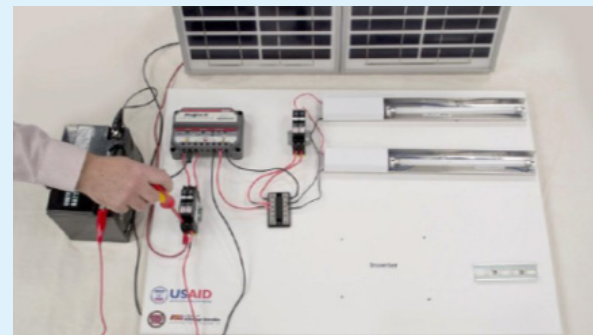


OTIOTI NI SEMASEMA NI SOLA

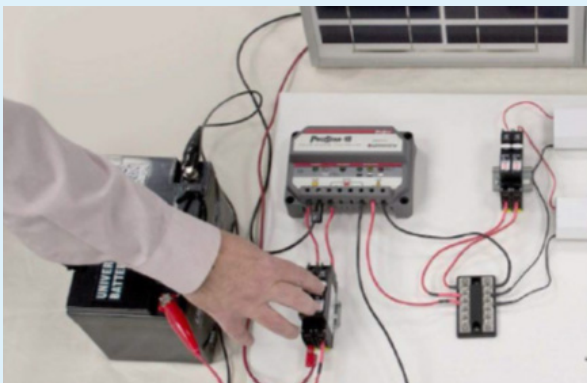
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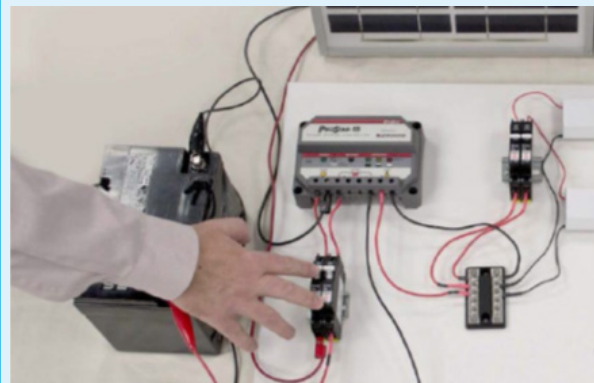
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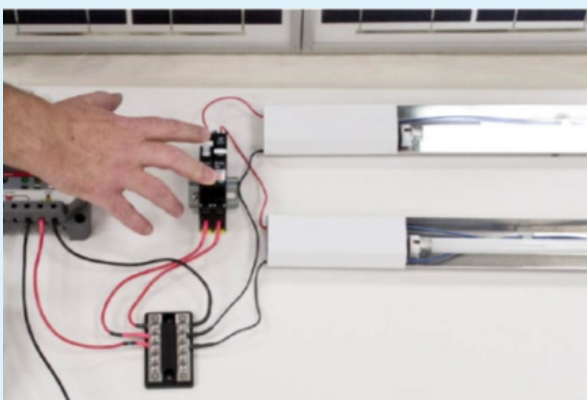
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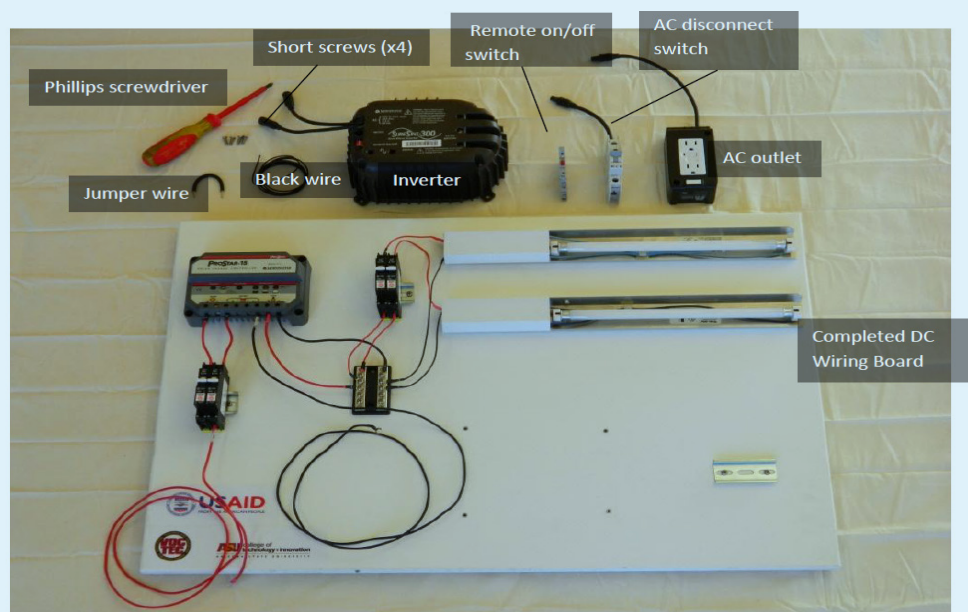
5



6



Sa rawa qori na sola livaliva dodonu (DC) tou dewa mada ina kena livaliva dri (AC). E so tale na gacagaca ena gadrevi qori.



Me sa sema mada na ivuki.

7



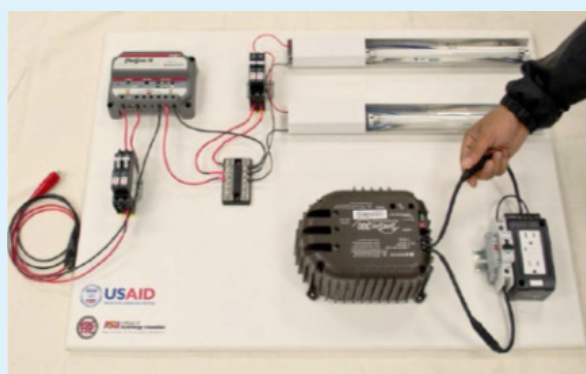
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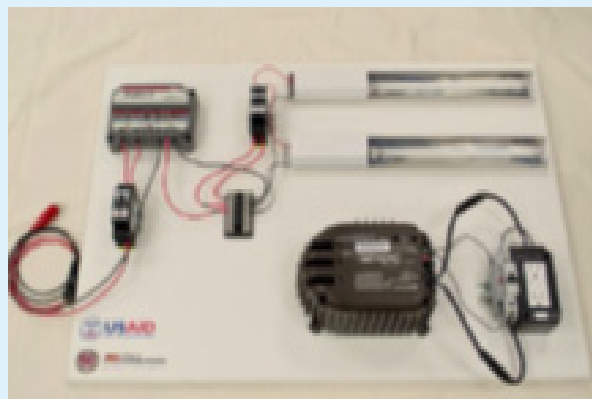
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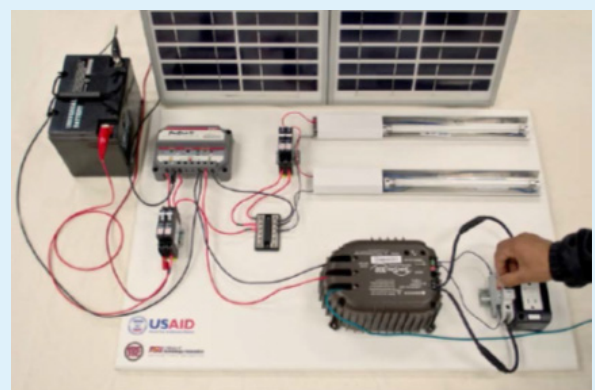
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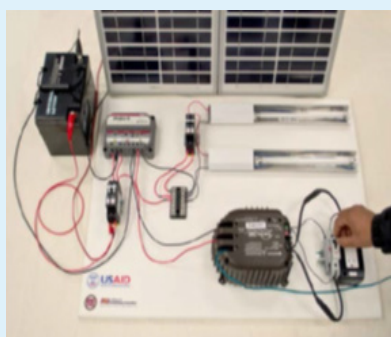
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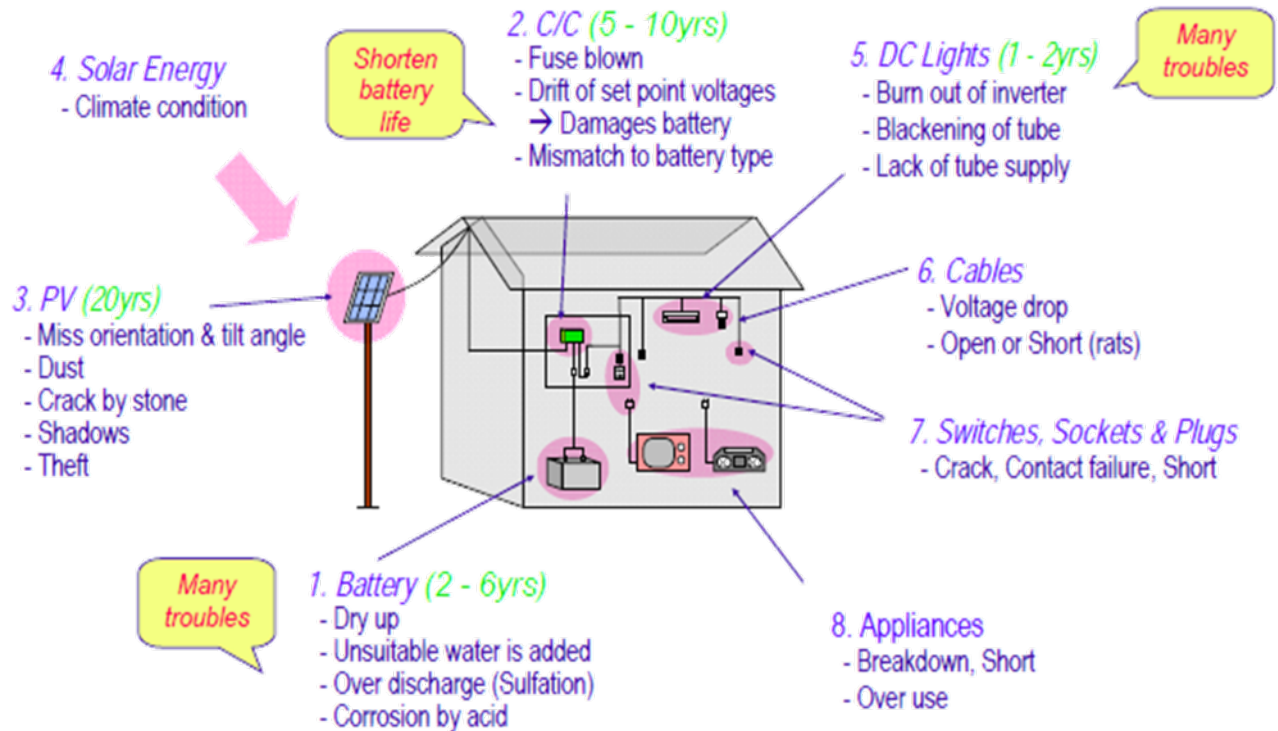
Volavola:

8

Kune leqa ni sola kei na
kena walī _____

Na yaloyalo qori e vakaraitaki kina na mataqali leqa e dau kune vakalevu ena sola ni vale.

YALOYALO 73: Leqa ni gacagaca yaco wasoma⁶⁹



8.1 Leqa ni idoladola

Na idoladola e vaka me 'mona' ni sola taucoko, qai bau leqaleqa vakalevu. Qo e so na leqa kune wasoma ena idoladola.

Leqa 1: Na idoladola e sega ni vakaraitaka ni jajitaki taucoko ni dromu na siga

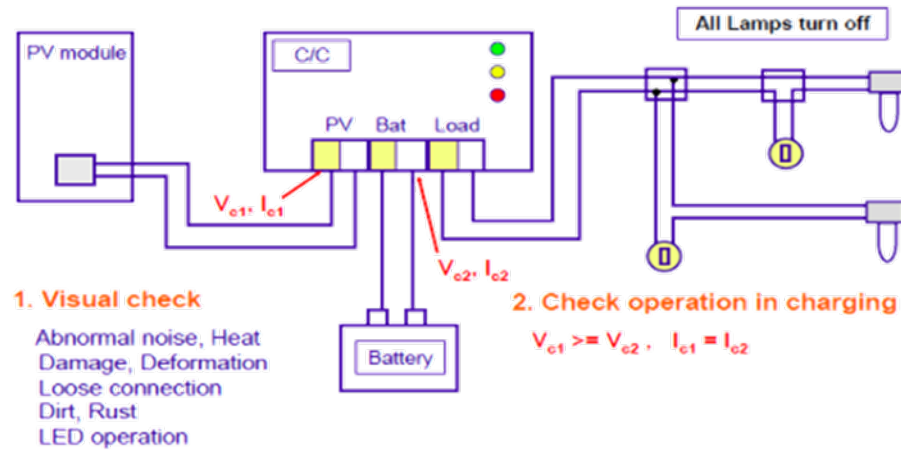
Vuna: Vakayagataki vakasivia vakacalaka (rugurugua, uca, sivia na sara TV)

iWali: Musurua kena vakayagataki ena dua na siga me jaji tale vakavinaka na bateri

Leqa 2: Na idoladola e bokoca na cina kei na iusana

Vuna: Vakayagataki vakasivia e veisiga (maca na bateri):

iWali: Musurua kena vakayagataki me jaji vinaka na bateri me yacova ni vakaraitaki ni sinai (macawa dua se sivia). Yalana na gauna ni vakayagataki iyaya e veisiga.

YALOYALO 74: Kune leqa ena idoladola⁷⁰


Leqa 3: Sega ni tawa tiko na bateri, se tukuni ni sinai na bateri ni se qai tekivu jaji, se jaji tikoga ni sa sinai.

Vuna: Kama na fius, sema vakaca na wa se ca na salanilivaliva ni idoladola.

iWali: Vakadre na isema, dua na fius vou, raica na setting ni LVD kei na HVD.

Leqa 4: Sega se lailai na livaliva mai na ulunisola

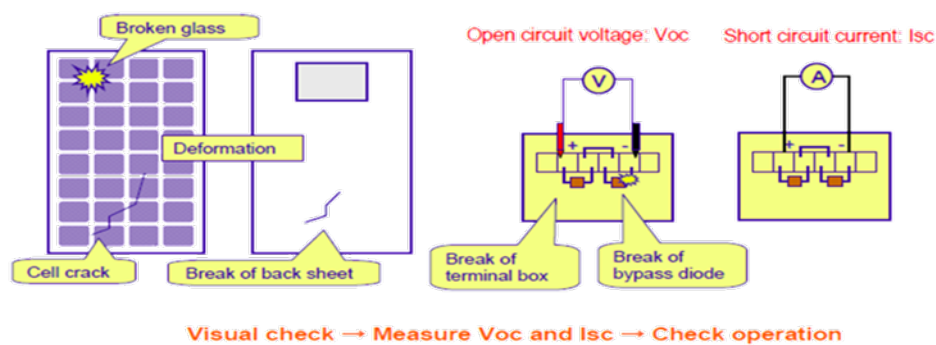
Vuna: Qara cala (cala kena kala se vanua e namata kina), tauvi kuvu, kaca na iubi ni iloilo, vakaruguti na ulunisola, rugurugua na vanua, shot na bypass diode, cavuka se sema vakaca na wa, butakoci na ulunisola.

iWali:

- Vakadodonutaka na namata kei na kala (kala me 10° se sivia, me namata ina noca)
- Raica se tu na kuvu se kaca
- Savata ena wai walega, kua na pouta
- Vakadreta na isema ni wa e luluqa
- Kauta laivi na ka e vakaruguta na ulunisola ena 9am – 3pm
- Me dua na bypass diode vou

8.2 Leqa ni ulunisola

Na leqa ni ulunisola e kune vakalevu ni boko na livaliva se nio vakarautaka na livaliva. E laurai na volt ni ulunisola ena so na idoladola.



⁷⁰ Ivurevure: JICA

⁷¹ Ivurevure: JICA

E so tale na vuna e dau lailai se sega kina na livaliva:

Tacega: ni tacega na iubi palasitika ni ulunisola. Qo e rawa nida kati livaliva kina, qai lutu sara na livaliva e rawa.

YALOYALO 76: Vakacacani na mata ni ulunisola



Damu: Qo ni dau damu se gaigaia mai na mata ni ulunisola, baleta na cila ni siga kei na vuki vakemiki ni mata ni ulunisola. Ena sega beka nida kati livaliva kina, ia ena lutu sara na livaliva e rawa mai.

8.3 Leqa kune wasoma ni bateri

Leqa 5: Jajitaki vakatotolo na bateri, se sega ni rawa ni jajitaki vakavinaka ni duidui na volt ni bateri yadua.

Vuna: Vakasulifure (vuki kemiki ni uma (electrode)), drekea na waikama, veitaqataqai (ni lutu e ra na waikama sosoko), luluqa na isema ni sucuna, katakata na bateri se cila na livaliva baleta na waikama e dela ni bateri e maliwa ni sucuna.

iWali:

- Luvata na wa e sucuna
- Qua na sucuna ena barasi sitila, tokara tale qai vaqirisi (mv

Vasilini se 'lithium grease') me tarova na kena veveka

- Drekea na waikama ni bateri, tuvuca
- Vakayagataka ga na kena iqamu (lug/clamp) dina
- Qua na sucuna ena barasi waya me kau tani na veveka
- Kurea vakamalua na bateri (kua ni sivia e 10 na dikiri kena kala) me kua na veitaqataqai
- E toka vakaca (katakata sivia, sega na cagi &s), tokia ke gadrevi

8.4 Dikevi na volt ni bateri

Ke dua na bateri e leqa vakalevu, me sosomitaki, de qai vakacacani tale na bateri ratou sema tiko.

YALOYALO 77: Jajitaki bateri – dau yadrava na volt ⁷²

Full charge

After 10 minutes



How much is the battery voltage?

8.5 iSoqoni ni leqa ni iyaya

Leqa

- wa, suiti, matanicina &s
- Sinai na bateri, boko ga na cina
- Lutu na volt ena mua ni wa (iusana)
- Sega na livaliva ena mua ni wa (iusana)

Vuna:

- Dola se shot na salanilivaliva, se sobuiqe
- Veicalati se lalai na wa (lutu sara na volt)
- Kama na matanicina livaliva dodonu se ivuki
- Sema vakaca e sucuna
- Levu na idre (resistance) ena wa ni suiti

iWali:

- Raica se vica na volt ena mua ni wa (iusana) kei na kena lutu ni waqa na cina.
- Vaqacotaka na isema ena sucuna
- Raica me donu na tolo ni wa, ke sega veisau
- Raica na wa, ni sala dola, vakamuri wa qai vakadodonutaka na sala dola
- Raica de shot se sobuiqele vakaca qai vakadodonutaka
- Raica se vinaka na suiti kei na lutu ni volt mai na wa ni mata ni suiti kei na wa e dakuna ni waqa tiko.

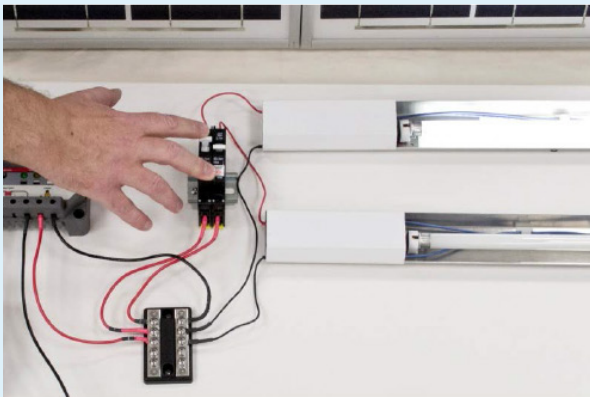
Volavola:

IVAKADRE 13- VAKAMURI SALA

Ena iVakadre qo, o dauveituberi e dodoka e dua na wa ca ena maliwa ni bateri kei na idoladola, qai nodratou itavi na lewenivuli na vakamuri sala (continuity test) me kune na wa ca qai vakavinakataki.

Vakaduria na sola livaliva dodonu, vakaraitaka ni vinaka tu.

5- Switch on DC light disconnect switches (DC lights will come on)



6- Completed DC System



Ni ratou sa raica na lewenivuli ni vinaka tu – kauta laivi dua na wa vinaka, sosomitaka ena wa ca, me vaka e laurai e ra.

Na idusidusi qo e rawa nio vakaraitaka kina ni sa kune na leqa kei na kena vakavinakataki.

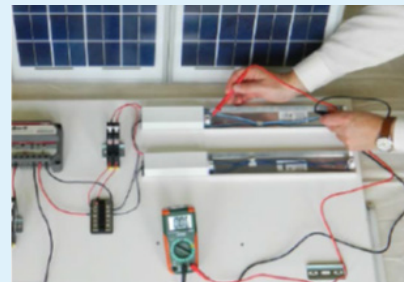
1- Conduct visual inspection of system



2- Remove DC light bulb(s)



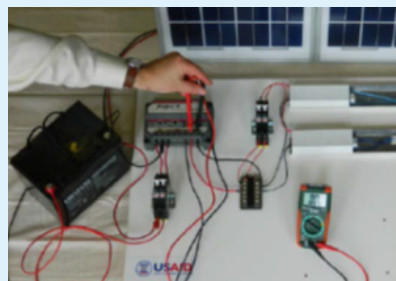
3- Measure voltage at light fixture terminals (voltage should be 0V)



4- Check indication lights at charge controller (all light should be off)



5- Measure voltage at charge controller's load output (voltage should be 0V)



6- Measure voltage at charge controller's battery input (voltage should be 0V)



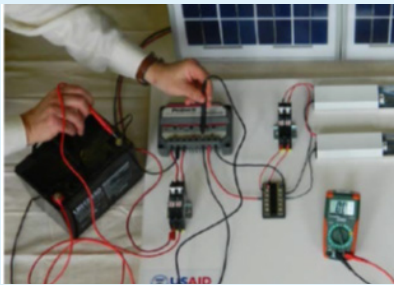
7- Switch on DC light disconnect switches (DC lights will come on)



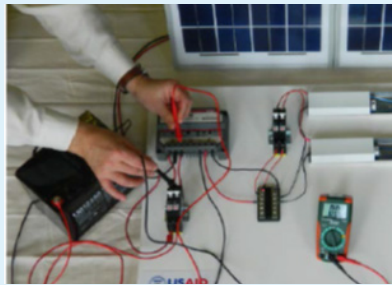
8- Problem is identified as "broken continuity" between battery and charge controller



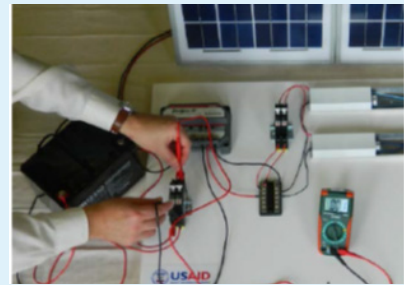
1- Switch multimeter to continuity setting and check connection between negative battery terminal and negative charge controller battery input



2- If multimeter beeps, the circuit is continuous. Measure continuity between positive charge controller battery input and disconnect switch (DMM should beep)



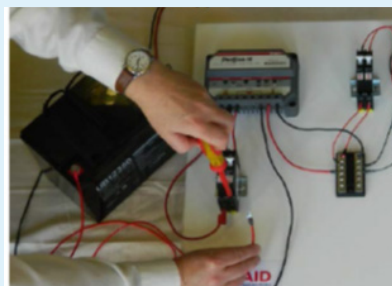
3- Measure continuity between input and output terminals of disconnect switch (DMM should beep when switch is on)



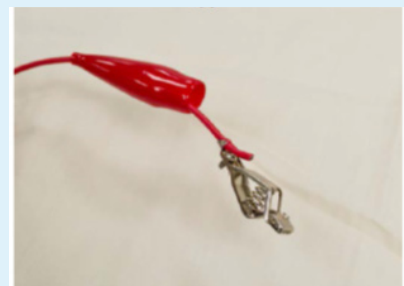
4- Measure continuity between disconnect switch and positive (red) battery terminal (DMM will NOT beep)



5- Problem is detected as discontinuity between battery positive terminal (red) and disconnect switch



6- Check connecting cable for faultiness. Cause is identified as wire insulation not stripped at battery connector



9

iVolanitavi ni
qaravi sola

9.1 Tuvani na qaravi sola

Kena qaravi wasoma ga ena bula balavu kina nomu sola kei na kena gacagaca. Na qaravi sola e dau vakamurī vakalevu kina e dua na ivola ni itavi me qaravi, meda tikitaka ni sa rawa. Na inaki ni ivolanitavi qo me dikevi, samaki, vakalewai qai qaravi ena kena gauna donu na gacagaca kece mera bula balavu.

9.2 Qaravi ulunisola

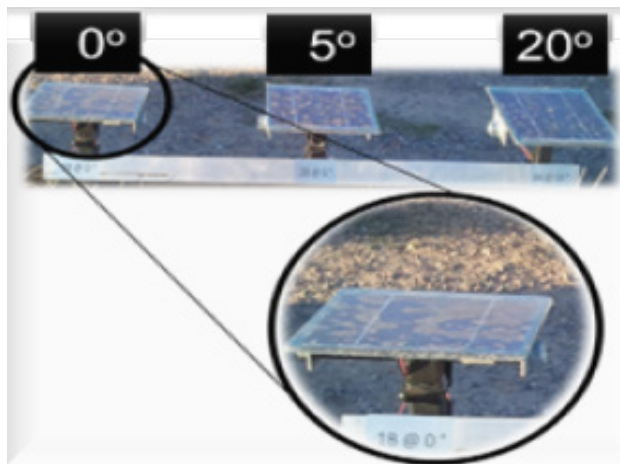
- Dikeva na ulunisola de mavoa, kaca &s
- Matana me savasavā, taucoko; qusia me kau laivi na duka se soqosoqo e matana se dakuna, ke duri e delanivale.

YALOYALO 78: Ulunisola mavoa⁷³



- Levu ni kala, lailai ni duka. Qarauna me kua ni davo sara na ulunisola, me kala.

YALOYALO 79: Duka ni ulunisola⁷⁴



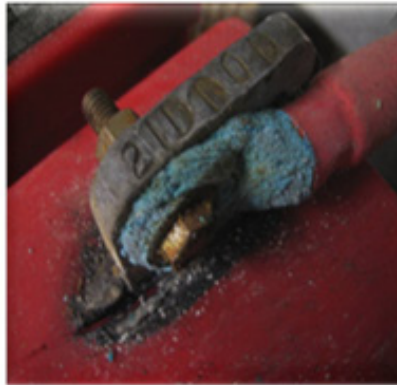
9.3 Qaravi bateri

Na qaravi bateri e levu na kena itavi, vakatau se mataqali bateri cava, kei na ivoladusidusi ni kabani a bulia, me vaka:

- Dikeva ka samaka kena vata se cava e toka kina
- Dikeva na kena 'disconnect', tarovi ni kui sivia kei na veidodoyaki ni wa
- Vakarauteki volt
- Tovolei iusana ni bateri (load testing) e talaci vakalevu me vica na sekodi, ni vakarauteki na lutu ni volt ni bateri.
- Tovolei gumatua ni bateri (capacity testing) e talaci vakalailai na bateri me yacova na levu ni talaci e gadrevi (prescribed depth-of-discharge).
- Ni saladua e vica na bateri qai dua e ca, me sosomitaki. Ena sega ni solia nona igu taucoko ni ca e dua.
- Kua so ni talaci vakasivia (over-discharge) – ni sivia na kena vakayagataki kei na kena talaci ena lekaleka na kena bula.
- Vakarauteki sosoko (specific gravity) ni waikama, ni drekea me tuvuci ena wainiua (distilled water) (bateri vakawai ga!)
- Ni dau qaravi na bateri me laurai na sucuna kece se veveka se luluqa
- Na barasi sitila me qusi tani kina na veveka ena isema. Vaqaniliga rava tuga.

⁷³ Jim Dunlop Solar

⁷⁴ IVurevure: ASU PV/ Reliability Laboratory

YALOYALO 80: Qaravi bateri⁷⁵

QAQARAUNI: E daumaka mo vakamatailoilo ni tataqomaki kei na qaniliga rava ni o qaravi bateri. Nio qarava na bateri luvu (vakawai), mo vakaisuai, de sikavi iko na waikama. Me dua na kava ivakatubu dola rawa kei na taku wai, ke mani tasova na waikama me sova na ivakatubu i loma ni wai, ulia, qai sui sara kina na waikama me kua ni vakamai keda.

Qarauna me kua ni lutu na iyaya vakacakacaka e dela ni bateri, de qai shot qai vakavuna na mavoa vakayago se leqa ni iyaya. Qarauna!

YALOYALO 81: iTuvaki ni bateri⁷⁶

State-of-Charge	Specific Gravity	Open-Circuit Voltage (V)
100%	1.265	12.6
75%	1.225	12.4
50%	1.190	12.2
25%	1.155	12.0
0	1.120	11.8

For typical lead-acid battery at 25°C

9.4 Vakaraautaki ituvaki ni bateri (state of charge)

Na ituvaki (state of charge, SoC) ni bateri e tukuna na kena bulabula kei na kena gumatua. E rua na kena icakacaka – na volt ni sala dola (open circuit voltage) kei na vakaraautaki sosoko ni waikama (specific gravity, SG) (bateri vakawai ga).

9.5 Vakarautaki volt

E dau vakarautaki na sosoko (specific gravity) ni waikama (ena bateri vakawai ga) kei na volt ni sala dola (open circuit) ni qaravi na bateri me kilai kina kena bulabula kei na kena ituvaki.

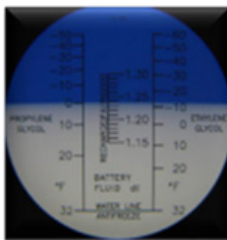
9.6 iVakarau ni sosoko (hydrometer) (bateri vakawai ga)

Na iyaya qo (hydrometer) e vakarautaki kina na sosoko (specific gravity, SG) ni waikama, ni domici na waikama mai na bateri me dikevi.

⁷⁵ Ivurevure: Jim Dunlop Solar

⁷⁶ Ivurevure, Pinterest.com, <https://www.pinterest.com/bambulancemania/work-apparal/>

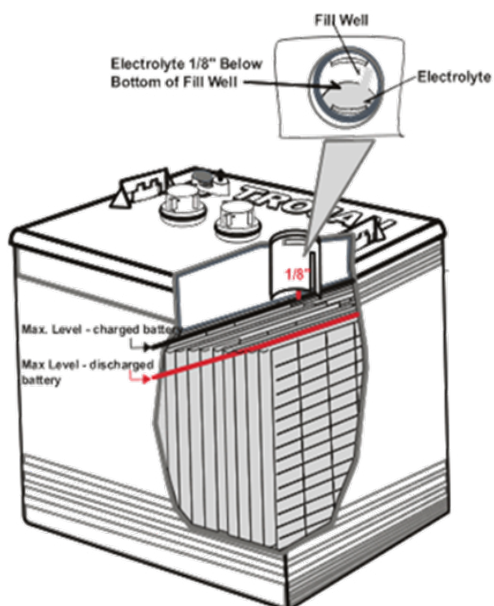
YALOYALO 82: iVakarau ni sosoko⁷⁷

Archimedes Hydrometer

Refractive Index Hydrometer

Source: Jim Dunlop Solar

Tuvuci na wainiua (distilled water) ena bateri (bateri vakawai ga).

- Na bateri vakawai tadola (open vent) e dau maca mai na wai baleta na kena vakalivalivataki (electrolysis) kei na kena vuki me kasi ni jajitaki tiko
- E maca mai baleta na kena katakata, ituvaki kei na kena makawa
- Vakayagataka na wainiua (distilled water) me kua ni tauvi duka na bateri, me kua ni vua

YALOYALO 83: iTuvatuva ni bateri⁷⁸


Dua na sabolo ni ivolanitavi ni qaravi bateri e ra de na yaga.

Bateri (tu vakawawa beka)	
Raica na isema livaliva	Veimacawa
Raica de duka se veveka na sucuna	Veimacawa
Raica na levu ni wai, tuvucu (bateri vakawai)	Veimacawa
Qarauna me dau tawa vinaka tuga na bateri	Veimacawa
Veisautaka na veibateri (battery bank)	Vakalevu me veiyabaki ya 3-5 (bateri vakawai), ya 5-10 (bateri sogo, gel) ni qaravi vakavinaka
Maroroi ka biu tani na ka rerevaki (hazardous material), vakavoutaka na bateri makawa, qarava na tasova ni waikama (bateri vakawai)	Me ganita

9.7 Qaravi iVuki (inverter)

- Vakadeitaka se curuma na ivuki na livaliva dodonu (DC) mai na bateri ena mita e dusimaki kina na 'DC voltage'
- Vakadeitaka se solia na ivuki na livaliva dri (AC) ena mita e dusimaki kina na 'AC voltage'

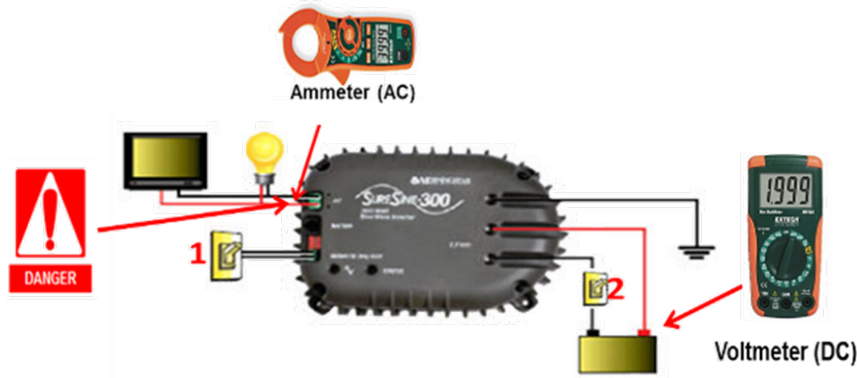


QAQARAUNI: Na ivuki e solia na livaliva dri rerevaki na kena volt (220-240V). Vaqaniliga rava, muria kece na itovo ni qaqarauni.

⁷⁷ Ivurevure: Jim Dunlop Solar

⁷⁸ Ivurevure: Jim Dunlop Solar

YALOYALO 84: Semasemai ni wa ni ivuki⁷⁹



KUA ni luvata e dua na wa, muria na veitarataravi qo:

- Bokoca na suiti 1 kei na 2 (raica na yaloyalo)
- Vakayagataki na mita iqamu ni vakarau kui (ammeter) ena yasana e solia na livaliva dri
- Semā na mita ni volt (KUA ni mita ni kui, ammeter) kei na sucu ni bateri (nanuma: ke vakayagataki na mita ni kui ena shot na bateri qai kama na fius ni mita!)
- Waqaca na suiti 1 kei na 2
- Raica se tiko na volt, qai drodro na kui ina iusana. Ke dina, e vinaka tu na ivuki.

YALOYALO 85: iDoladola³



9.8 Qaravi idoladola

Na idoladola e dau vakalevu me iyaya momoqaqa, ena rawa ga ni leqa ke usabi.

- Raica me dei na isema
- Raica na volt e vakaraitaki kei na itukutuku ni cala (error message).
- Raica ni sega ni kama na fius
- Raica na itutu ni idoladola

9.9 Na buli ivolanitavi kei na vakayagataka

E dua na sabolo ni ivolanitavi levu vakavula sa vakaraitaki e ra, e rawa nio vakuria se musuka me vaka e ganita.

⁷⁹ Yavutaki ena "Operations & Maintenance of Stand-Alone PV Systems, Arizona State University, VOTEC, <http://votec.asu.edu>

TEVELI 4: iVolanitavi

Cava	Donu	Cava tale
Vakadidike Raraba		
Dikeva na ulunisola de kune kina na we ni kama, roka ca, tacega na iubi se kavoro na iloilo.		
Dikeva ni ulunisola de duka vakalevu se tauvi denimanumanu.		
Qarauna me dei vinaka na wa ni ulunisola qai sega ni taqa e delanivale, se lili wale e vanua rerevaki, se takelo vakaca, se dodo e vanua gagata se quraqurā.		
Dikeva na itutu ni ulunisola de veveka, kakana, damele, se yali se kamusu na kena iqamu se bolu.		
Dikeva na iubi ni wa (conduit, bushing) me tokoni vinaka, kei na kena gacagaca, ni ganita.		
Ni toka na sola e delanivale, raica na kena malu (sega ni turu).		
Ni toka e qele, raica de veveka se vuca na kena duru.		
Vakadeitaka ni sogo vinaka na kena kovate (ke dua) qai sega ni curuma na wai.		
Dikeva na ivuki e loma e tuba. Raica de curuma na wai, kalavo se kuvu.		
Vakadidike ni ivuki		
Samaka na vulo (filter).		
Samaka na loma ni kovate.		
Tovolea na irinicagi se vinaka tu.		
Raica na fuis.		
Vakadeitaka ni kabi na notisi ni qaqarauni.		
Raica de roka tani ena katakata sivia.		
Vakadeitaka ni vinaka na sobuiqeke kece.		
Raica se vesu vinaka ena lalaga se fuloa.		
Volā kece na ivakarau ni volt kei na kui ena matana (ke dua).		
Raica me rairai vinaka/savasavā na kovate, sala ni cagi kei na tikina e vakarava (insulated).		
Raica de veveka/katakata sivia na sucuna se wa.		
Vaqaqacotaka na isema kei/se bolu ni ganita.		
Vola na itukutuku ni draki, wili kina na katakata ni siga kei na rugurugua ni vanua se sega.		
Vakadeitaka ni vinaka na iyaya kece ni qaqarauni (ivakariba, 'surge arrestor' &s).		
Vakadidike ni bateri		
Ni bateri vakawai, raica se to na waikama ena kena terē (ke tiko) se ena fuloa, de turu na bateri se vua.		
Raica se vinaka na itawatawa ni bateri		
Raica na volt ni bateri - volā.		

Volavola:

[illegible]

IVAKADRE 14

Vakaiyaya ni tataqomaki (PPE) qai vakayacora na vakadidike ni qaravi sola ena kena o se qai vakaduria ena iotioti ni ivakadre. Vakayagataka na ivolanitavi e cake. Cakacaka vakailala ena veivuke nei dauveituberi.

Drama tale

E rua na bui mai na koro rau se qai lesu mai na vuli tauyavu ni sola, rau veitalanoa tiko.

Tima: Au marau saraga niu a lako ina vuli ya – au a kaya niu sa gase sa sega tale na ka meu vulica – qai cala o yau.

Anna: O yau talega – levu na ka me vulici, au qai kurabui niu muria vakavinaka, vakabibi noqu taura rawa na vuli vakamatai.

Tima: E ka tani dina na lomada – nida dolava ga na lomada meda vulica e dua na ka vou – sa rawa sara. Au tukuna tikoga e lomaqu niu na rawata, eratou qai veivakauqeti talega na luvequ kei na makubuqu.

Anna: Au kila ke a sega nodratou veitokani na wekaqu, ke u a lutu koso – ia qo daru sa daunisola... hahaha

Tima: De daru guilecava na ka kece daru sa vulica vakacava me daru sota vakadua e veimacawa me daru lesuva na ka daru sa vulica. Cava o nanuma?

Anna: Donu vei au. E dina ni se cici tiko na livaliva ni EFL, sa levu na vale ena koro era vakasola, qori na vanua daru rawa ni veivuke kina.

Tima: Qai bokoboko vakalevu tiko na livaliva, au kila ni le levu tale era na via vakasola. E na taleitaki vakalevu na sola ni vale.

Anna: Dina saraga o iko. Na sola vakabateri ena rawa kina meda maroro livaliva mai na matanisiga ena siga, me qai vakayagataki ena yakavi me livaliva ni vale kei na iyaya livaliva.

Tima: Au marau vakalevu ni daru cavaka vata qo, mera vukeyi kina na luvedaru, makubudaru kei na lewenikoro kece, qai yaga talega vei ira kece na veikabula.



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