

Village Hydro Management Manual
for Community Electricity Unit

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【Attached Document】

Annex - 1 TROUBLE SHOOTING

FORM - 1 Daily Inspection Tour

FORM - 2 Monthly Data of Theu Hydro Plant Operation

FORM - 3 Daily Check Sheet

Chapter II Organization and Financial Management

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【Attached Document】

FORM - 1 Collection data book of connection charge

FORM - 2 Electricity users book

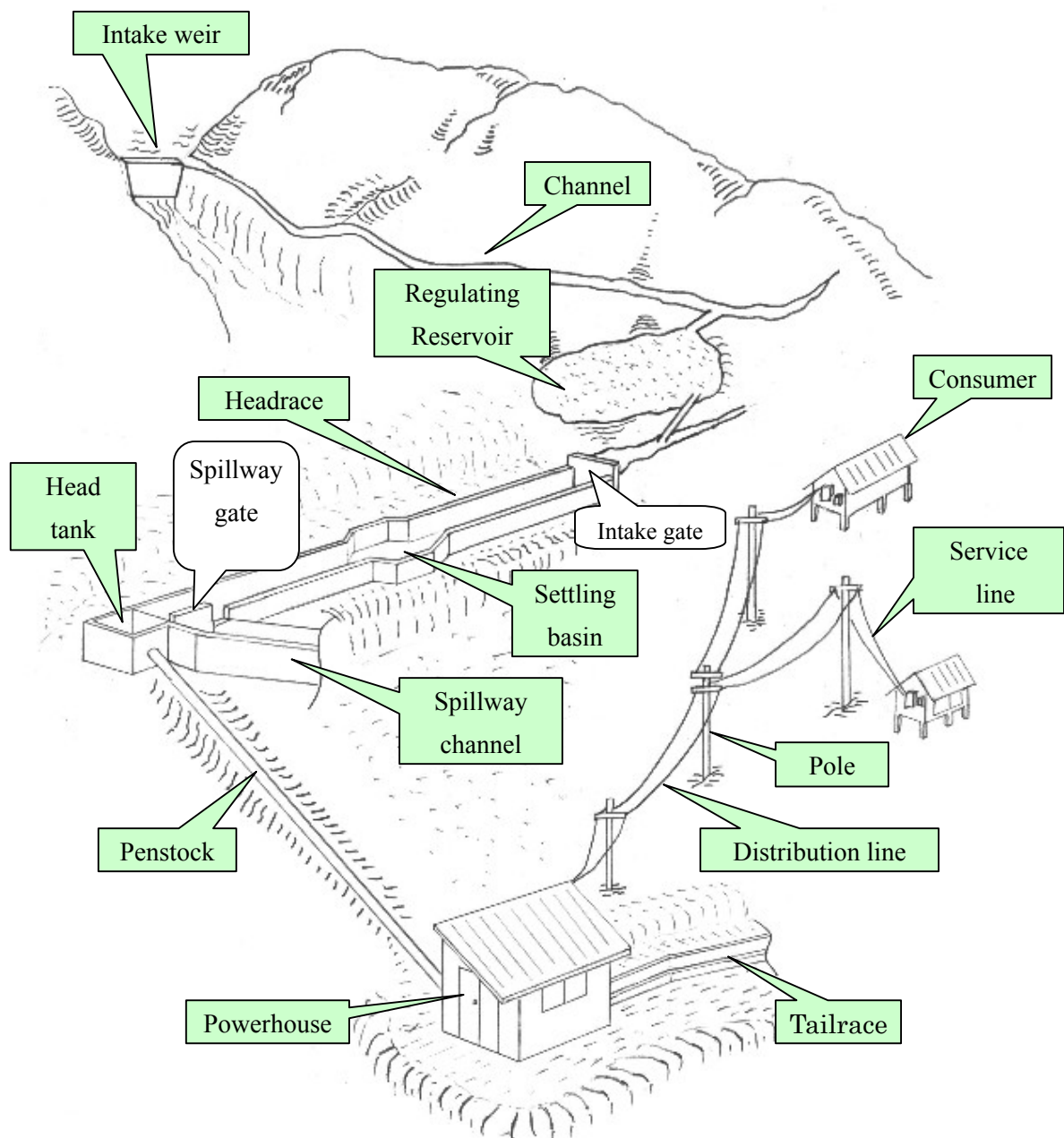
FORM - 3 CEU account book

FORM - 4 Sample contract

Chapter I Operation and Maintenance

1. Facilities Name

(1) Outline of Pilot Plant



(2) Civil structures

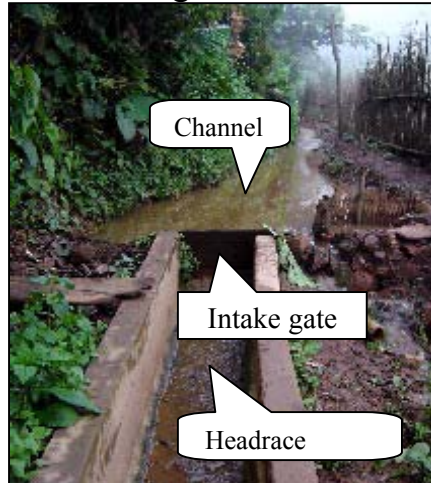
○ Intake Weir



○ Channel



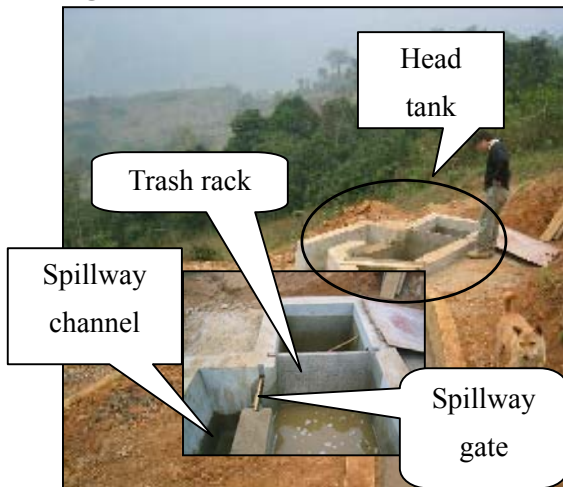
○ Intake gate



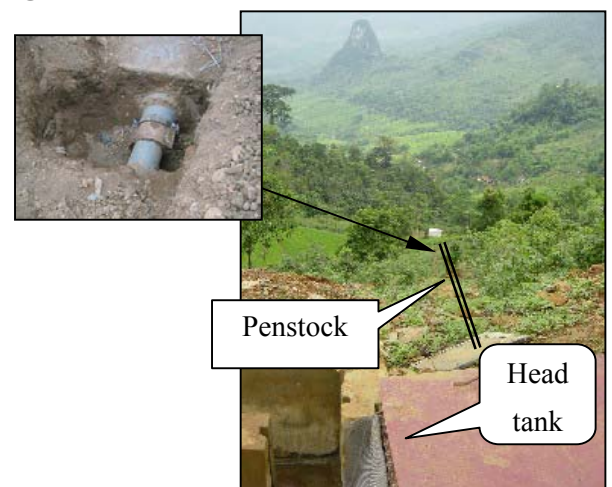
○ Settling basin



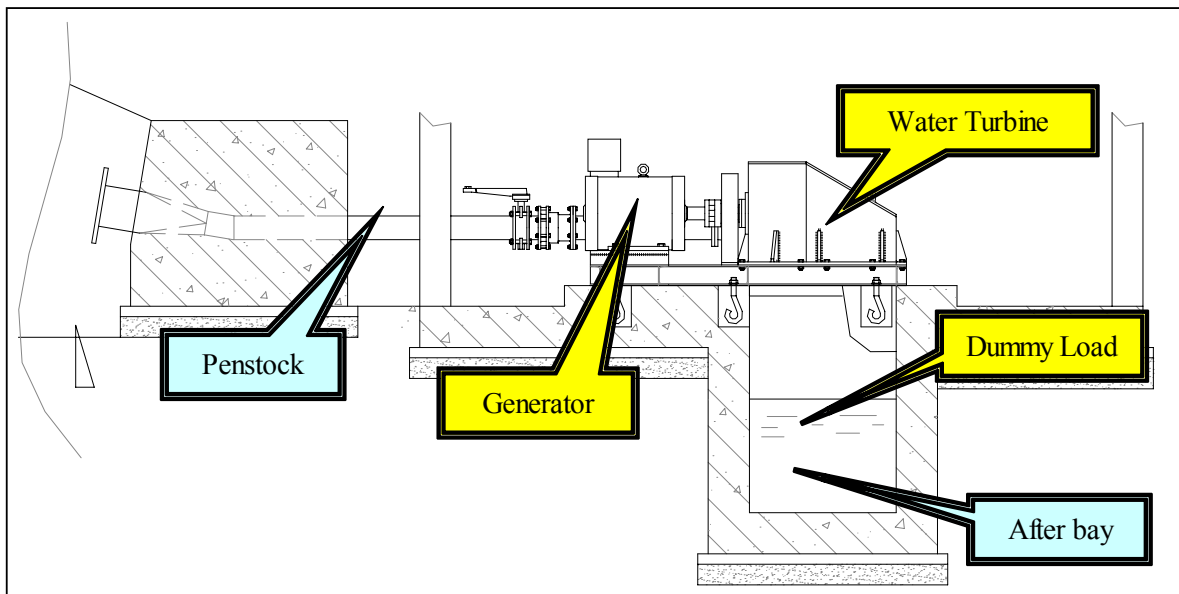
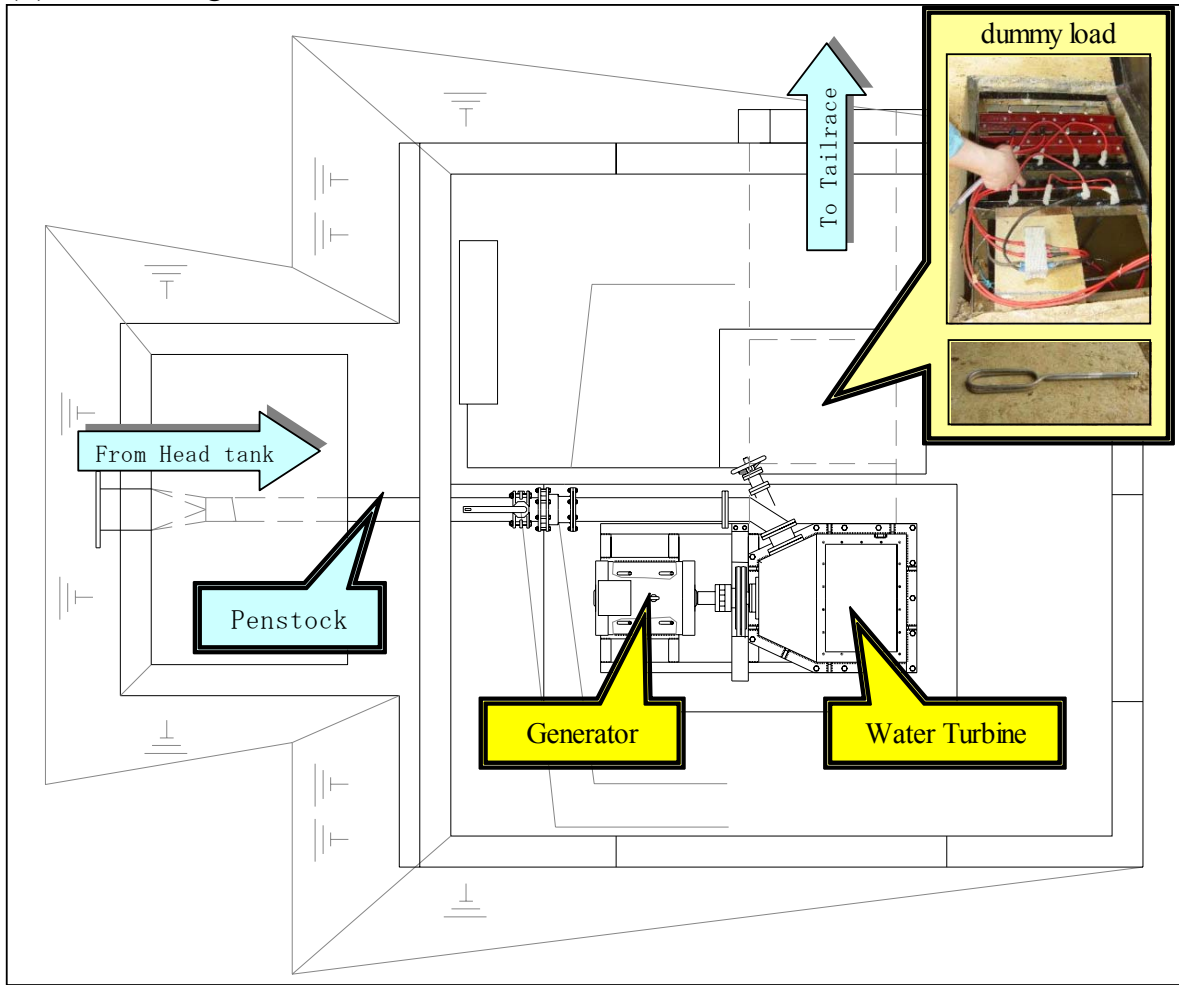
○ Head tank



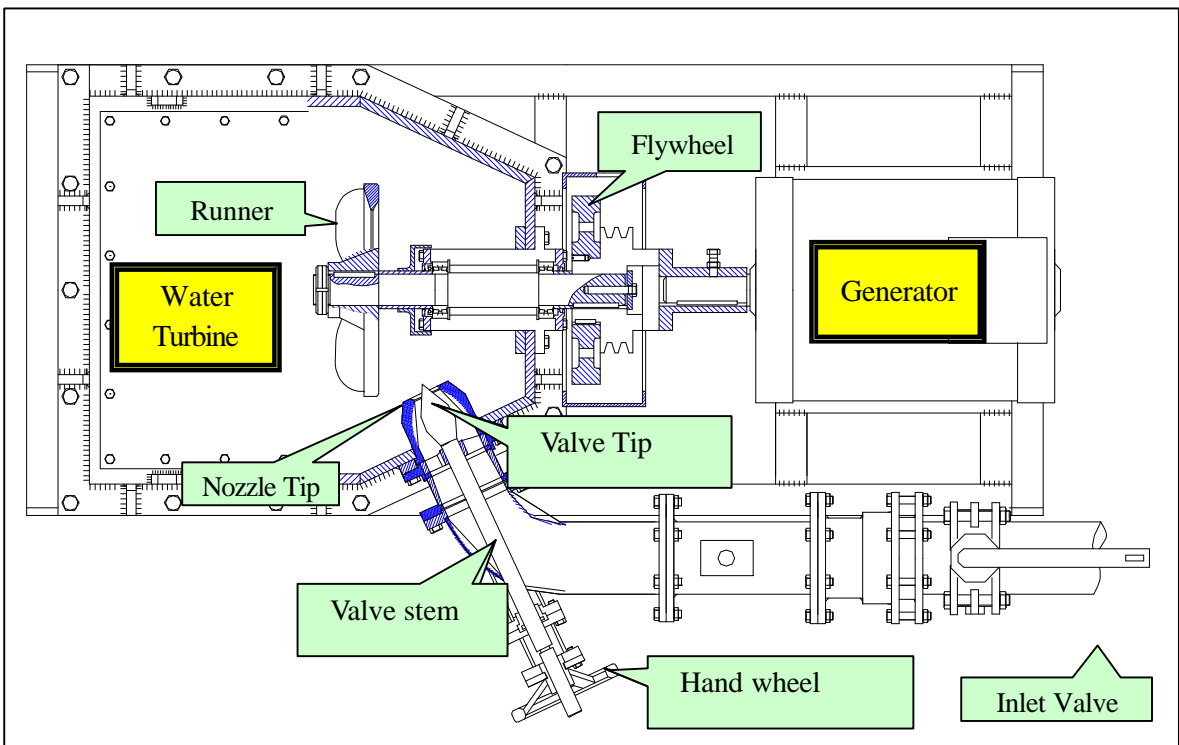
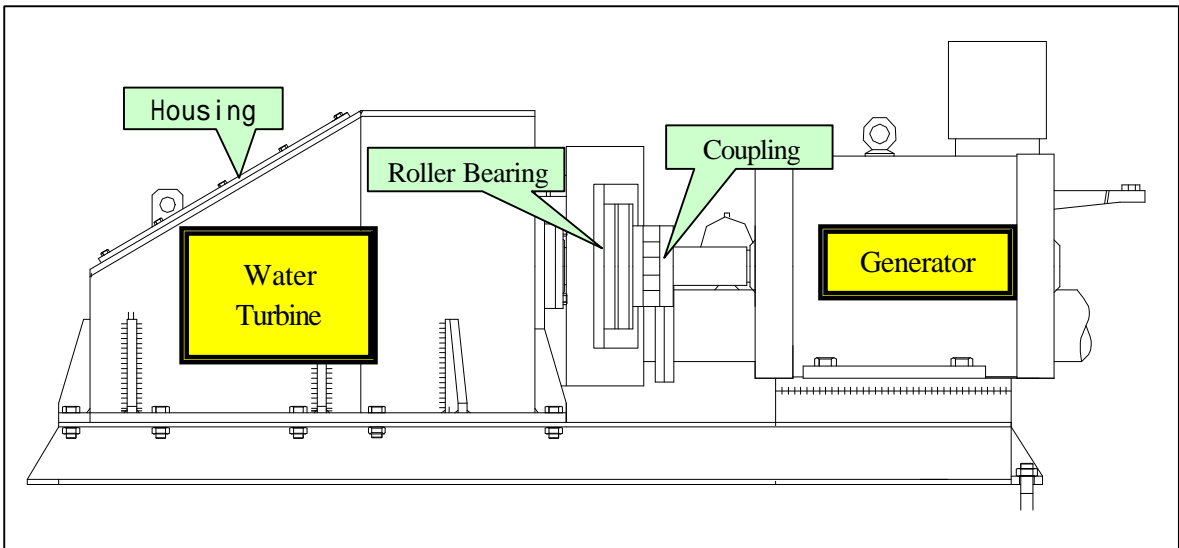
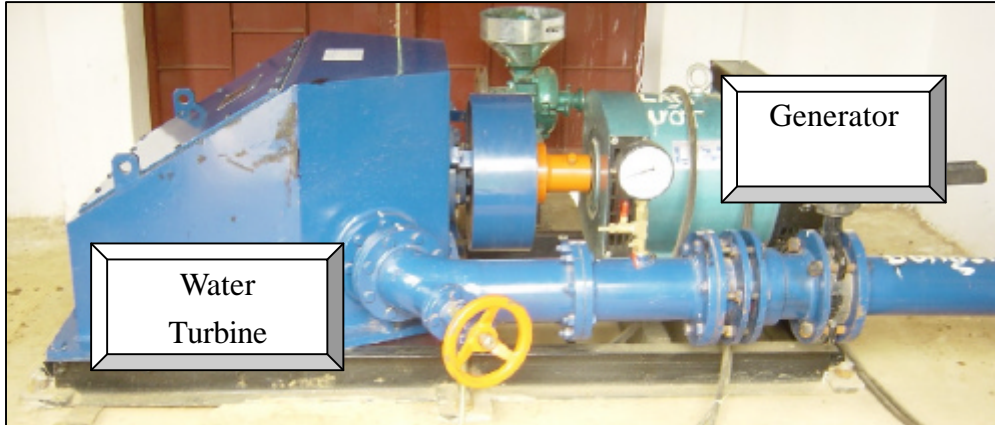
○ Penstock



(3) Generating Facilities

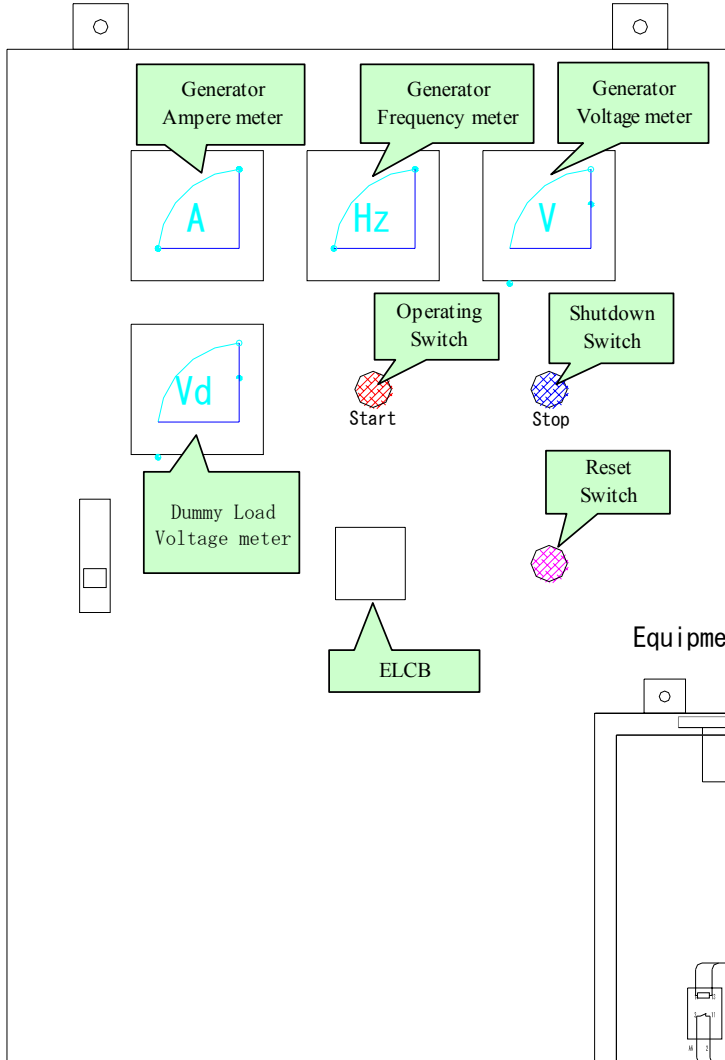


Water Turbine Generator

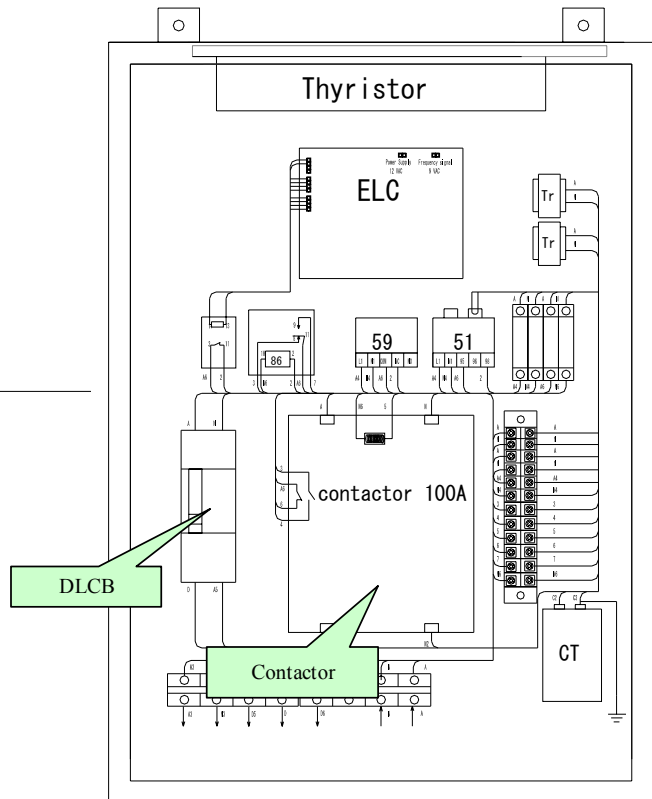


Control Panel

The front of panel

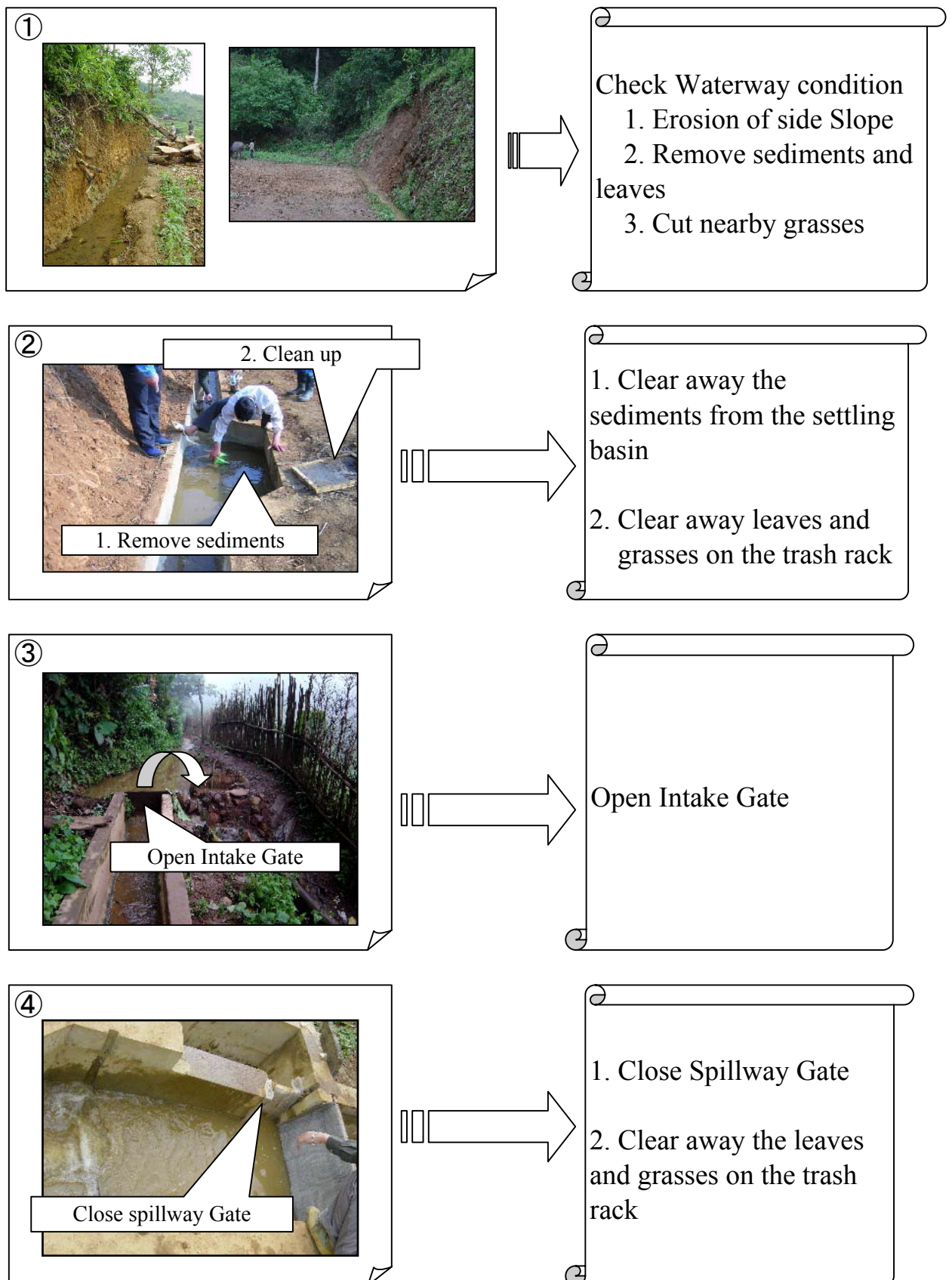


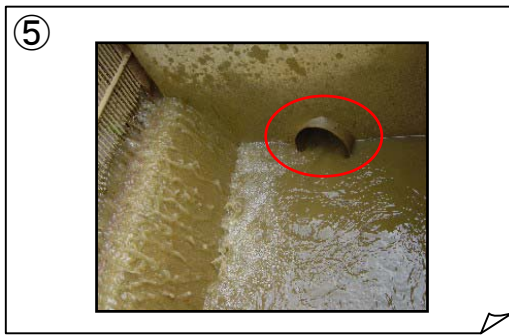
Equipment arrangement inside the panel



2. Operating Procedures

(1) Start-Up

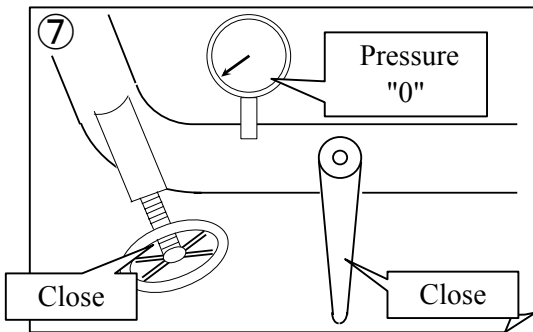




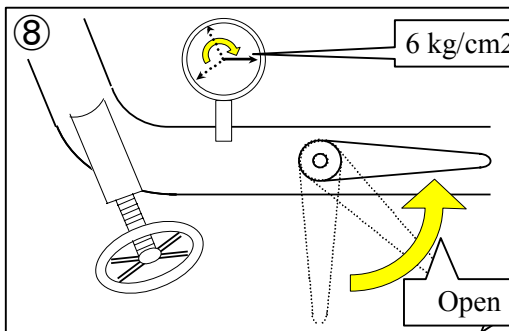
Fill water in Penstock
 -- Gradually pour water in case of large inflow.



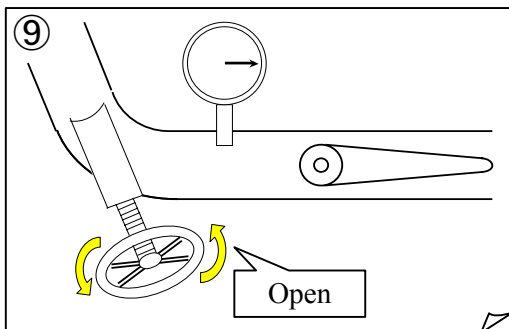
When the tank is filled with enough water, signal to powerhouse operator.



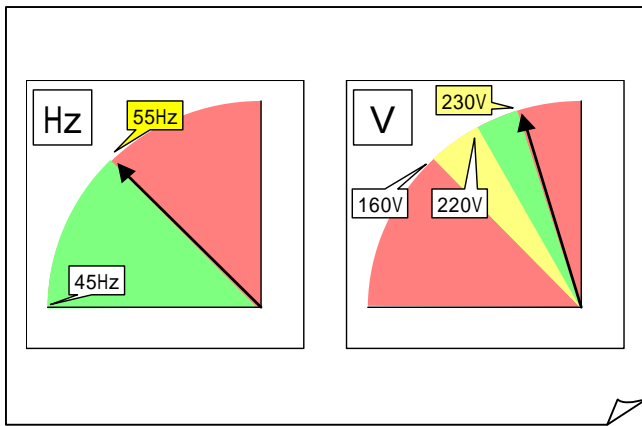
Check all conditions
 1. Spear Valve "Close"
 2. Pressure Meter "0"
 3. Inlet Valve "Close"



1. Inlet valve "Open"
 2. Check the pressure meter
 6 kg/cm² or over

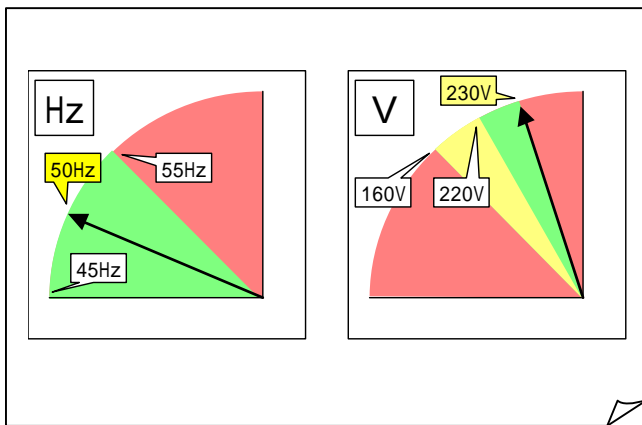


1. Open spear valve gradually,
 2. Check that the water turbine and shaft are rotating.



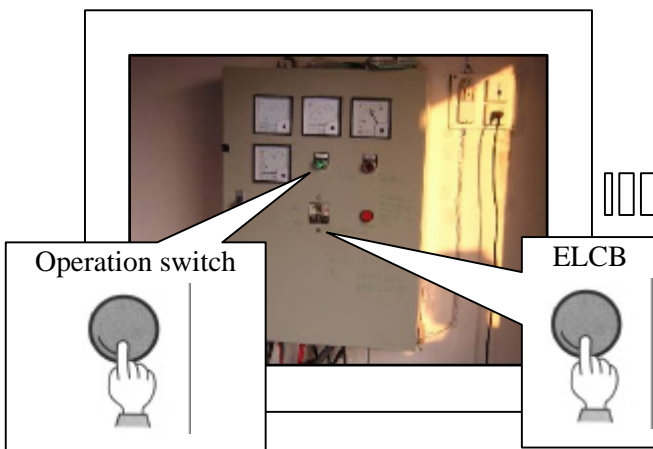
Open spear valve gradually,

1. Valve head gap=3.0mm
2. Generating Voltage= about 250V
3. Frequency=about 55HZ
Dummy load starts operating



Check the following, after the dummy load works properly.

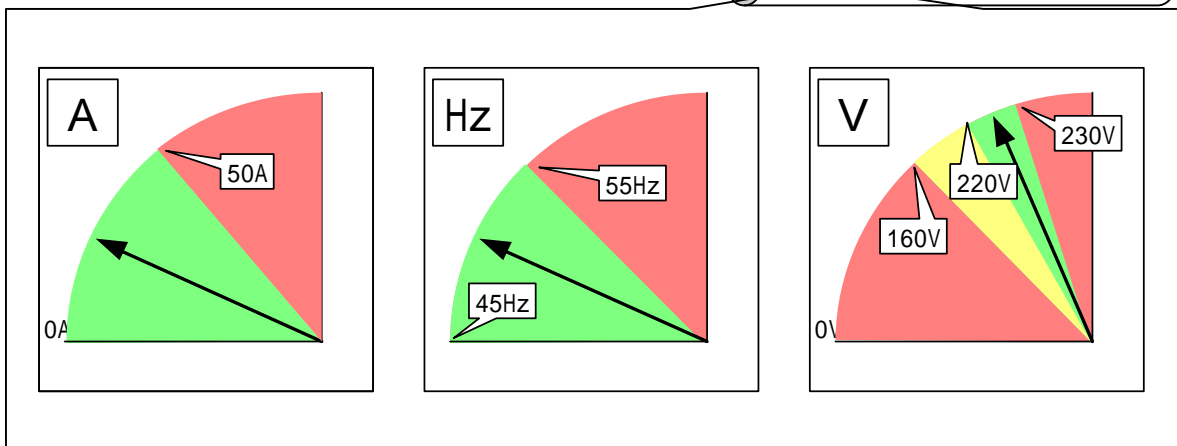
1. Generating Voltage = 230V
2. Frequency = 50HZ



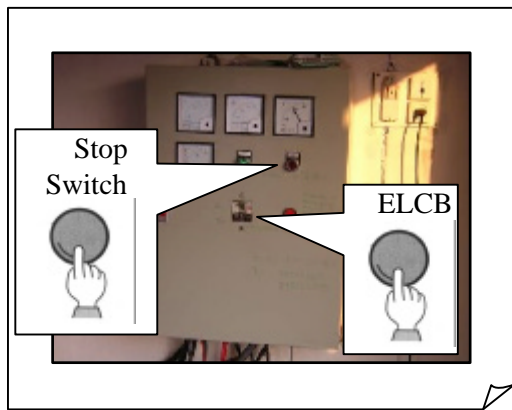
1. Switch on the operation switch
-- Supply power to only powerhouse

2. ELCB ON
-- Supply power to load (distribution line)

3. Check all the V, I, F meter readings in normal range

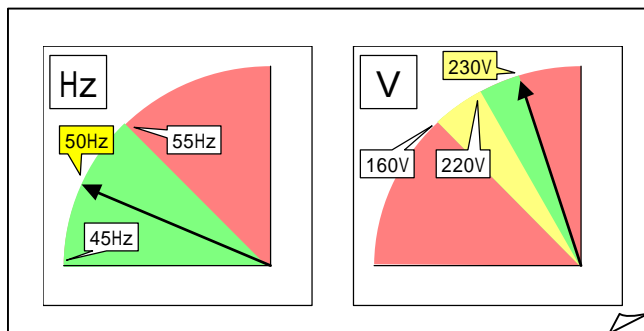


(2) Stop operation (Normal shutdown) (Operators are in the powerhouse)



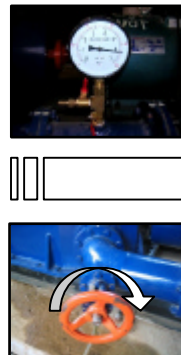
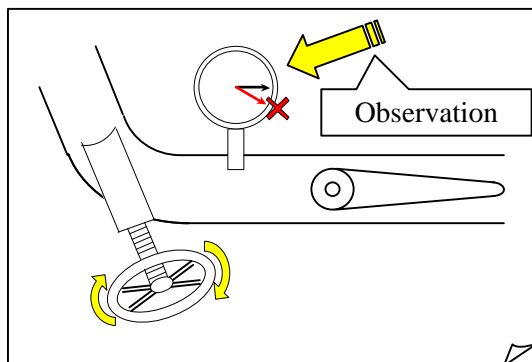
ELCB Off
-- Stop supplying to load

Stop switch
-- Stop supplying to powerhouse

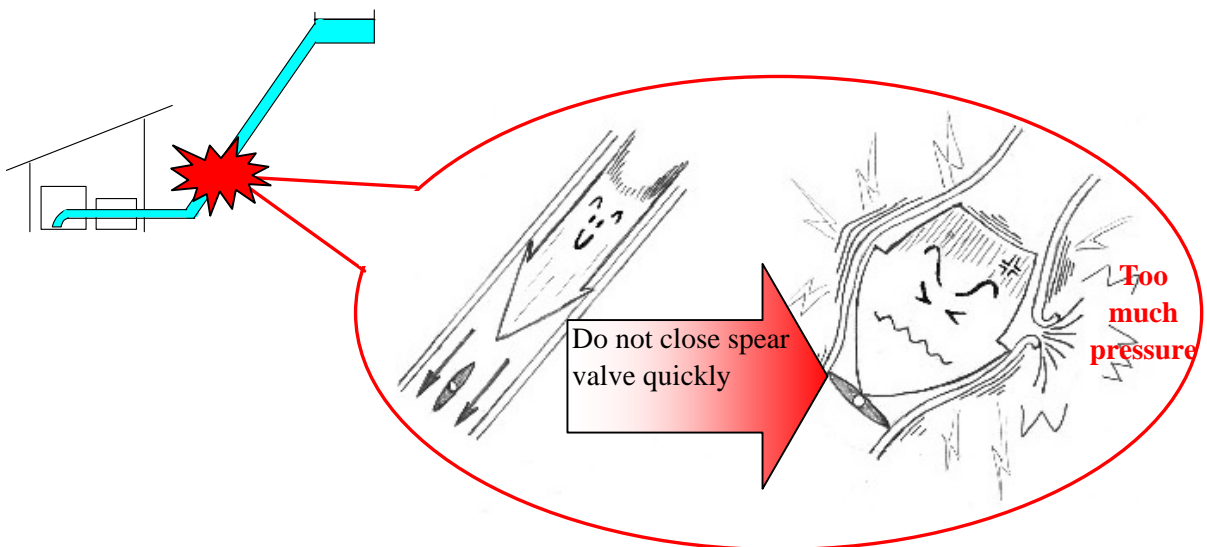


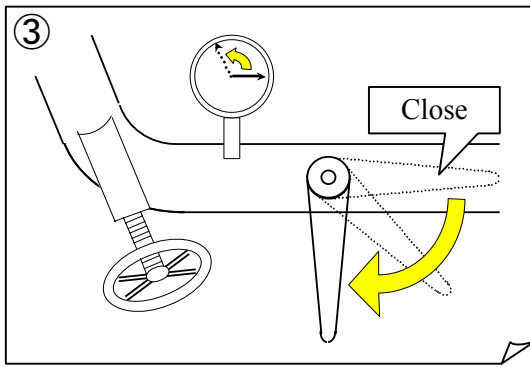
With Dummy Load Controller Operating

- Generator V=230V
- Frequency=50HZ

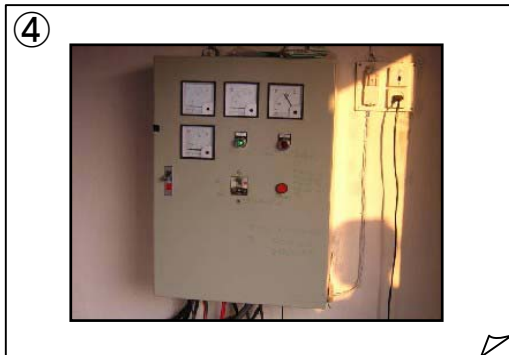


Close spear valve slowly, preventing a sharp rise in pressure (with observation of pressure meter)





Close Inlet Valve after
shutting down Spear
Valve

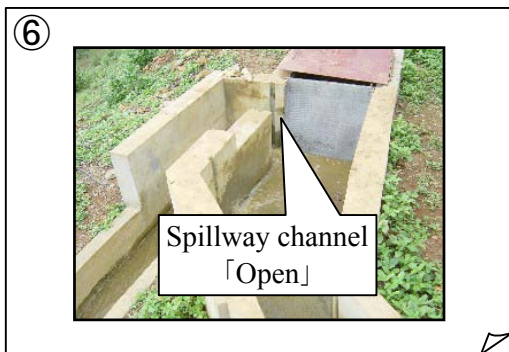


Check that all meters
show "0"

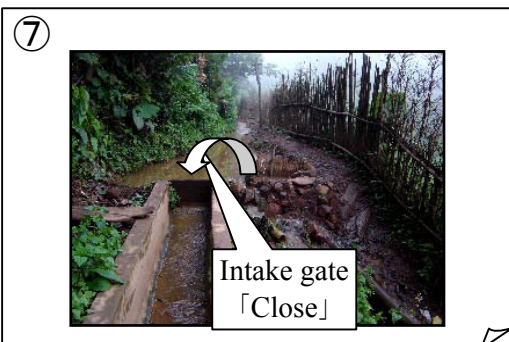
- Voltage
- Current
- Frequency



Check water turbine is
stopped



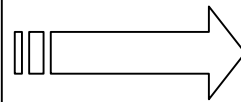
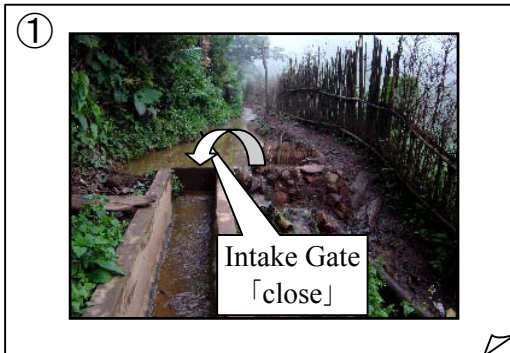
Open Spillway Channel



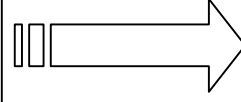
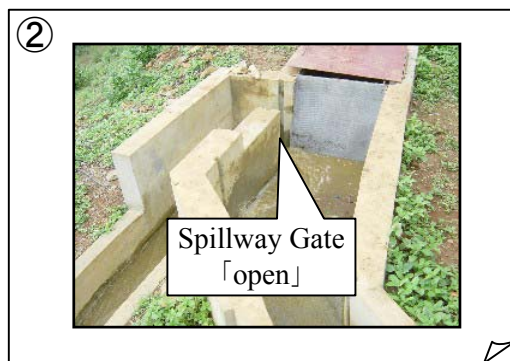
Close Intake Gate

(3) Stop Operation (Emergency stop / Quick shutdown)

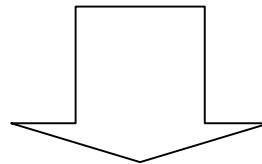
Stop water inflow during night time, heavy rain or emergency



Close Intake Gate



Open Spillway Gate
gradually and decrease
water level of Head Tank



Without water flow to the water turbine,
the generator will stop in about 20 minutes.
You can stop all the equipment in the powerhouse the next day.

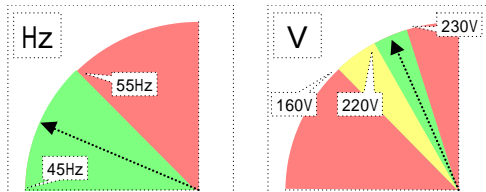
(4) Basic operation procedures

In case of voltage drop



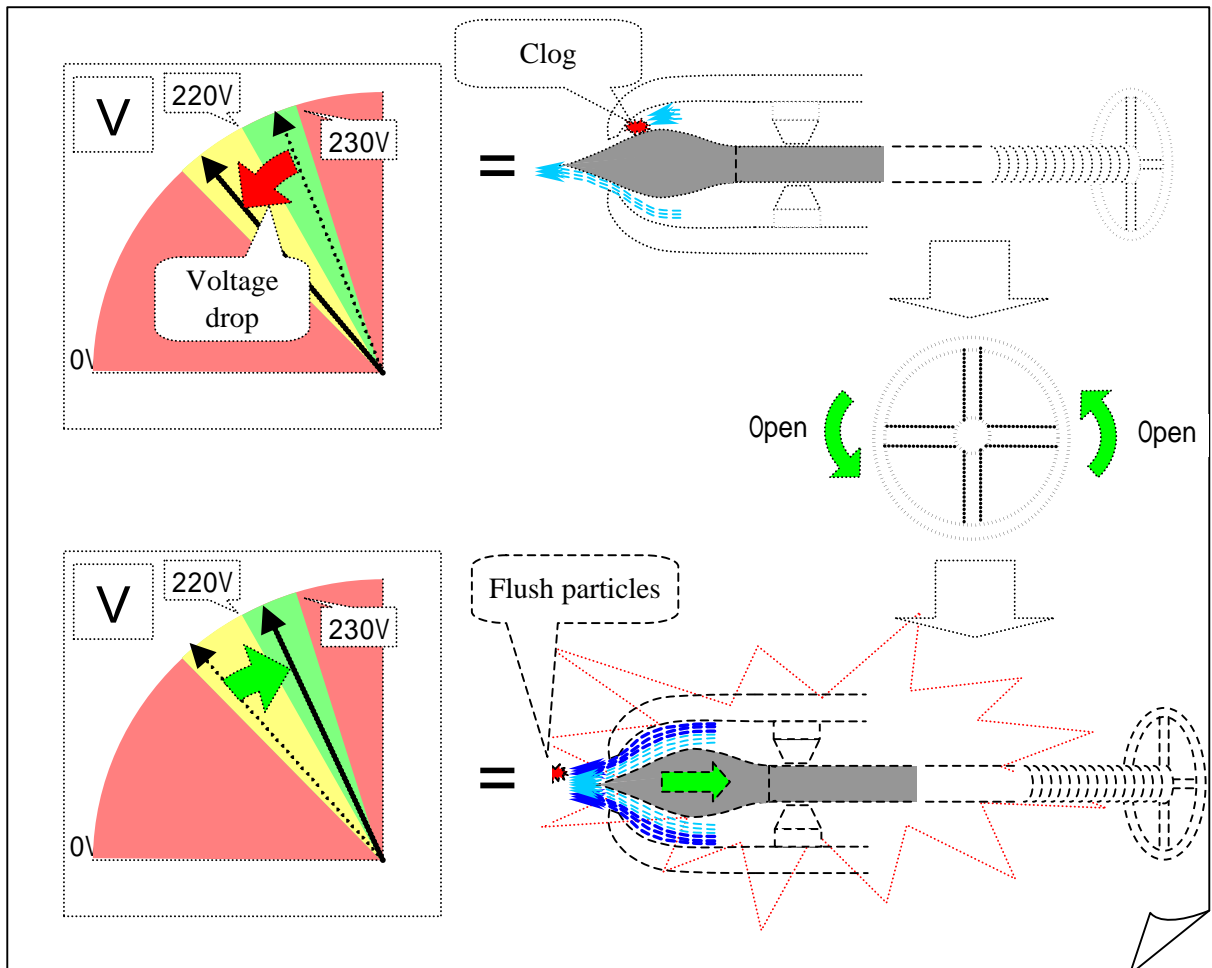
Check all the meters

- Generator Voltage
- Generator Frequency

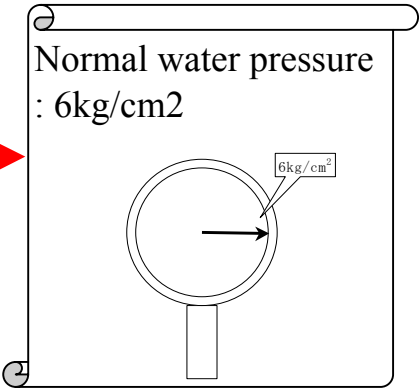
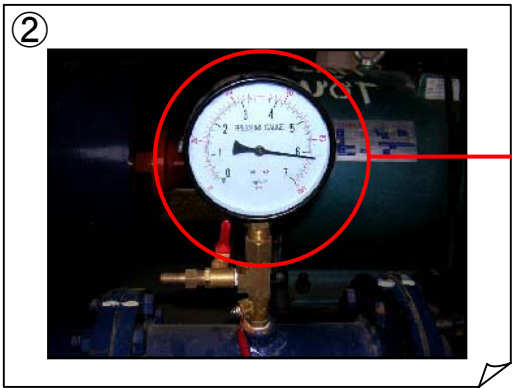


In case of clog in dry season

How to handle against voltage drop

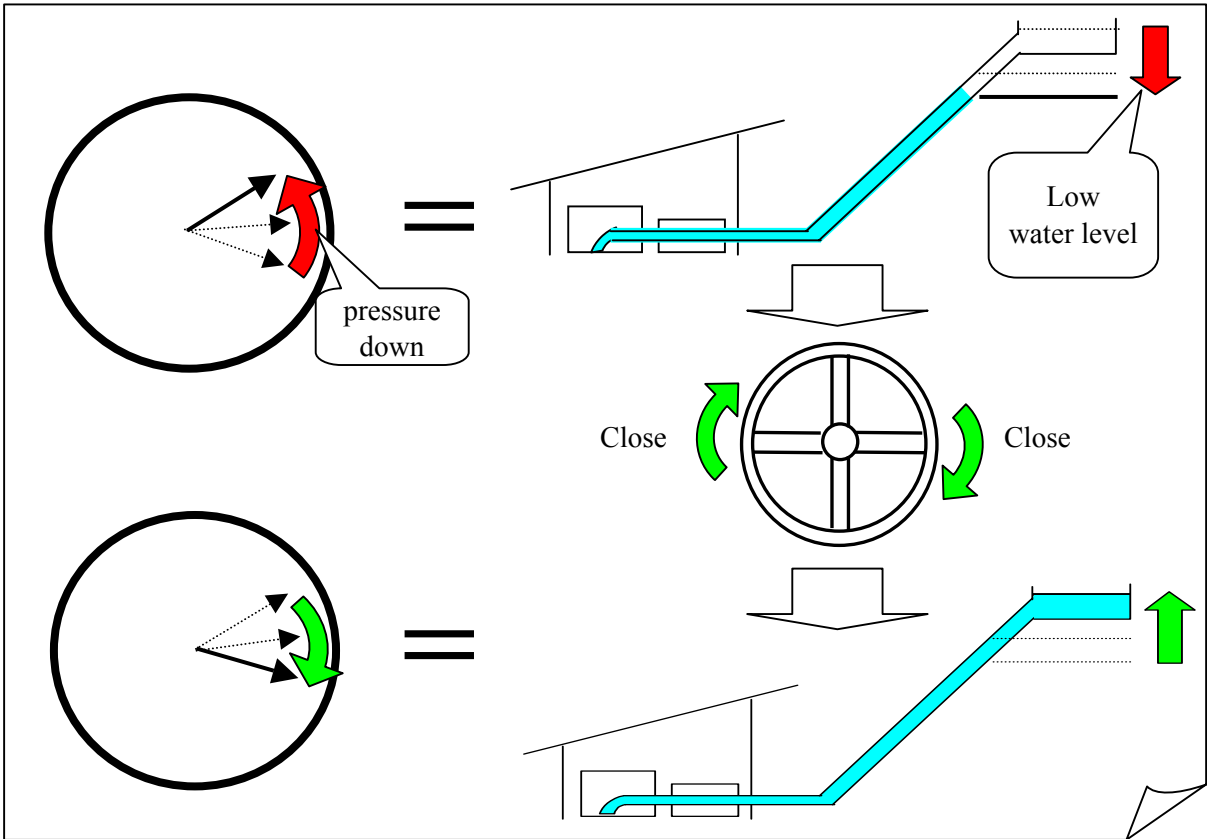


In case of water pressure drop

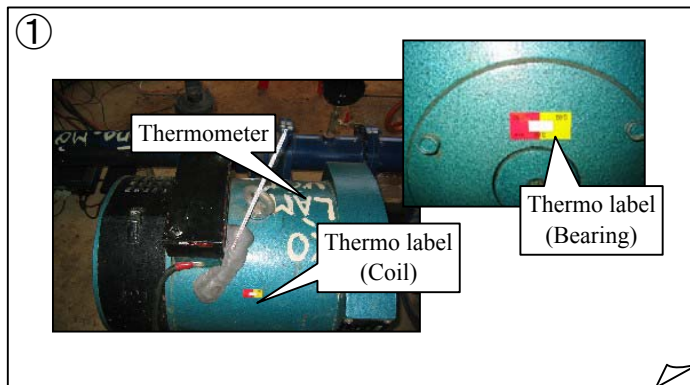


Shortage of water in Penstock

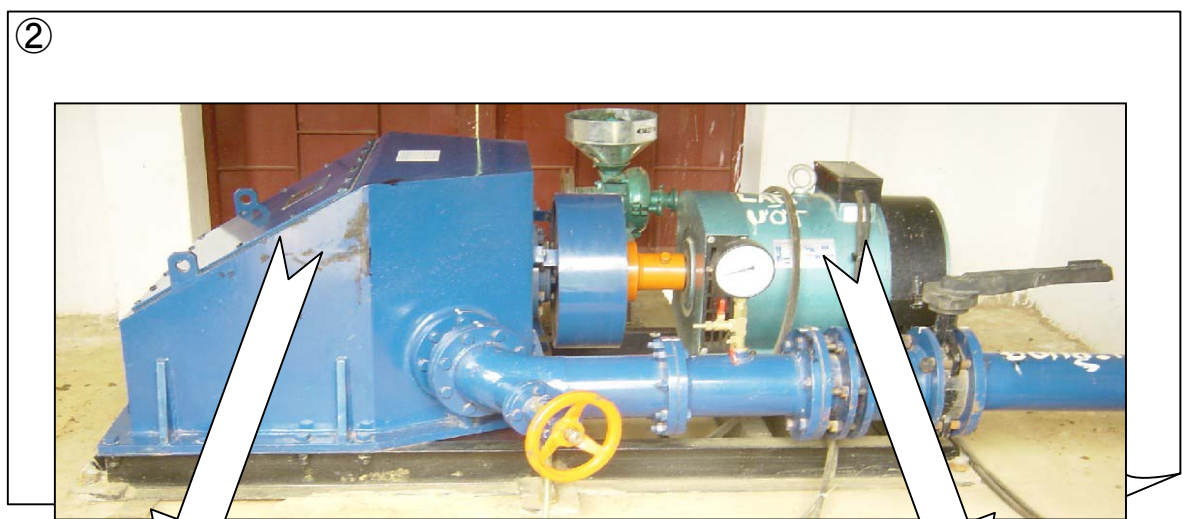
How to handle against lowered pressure



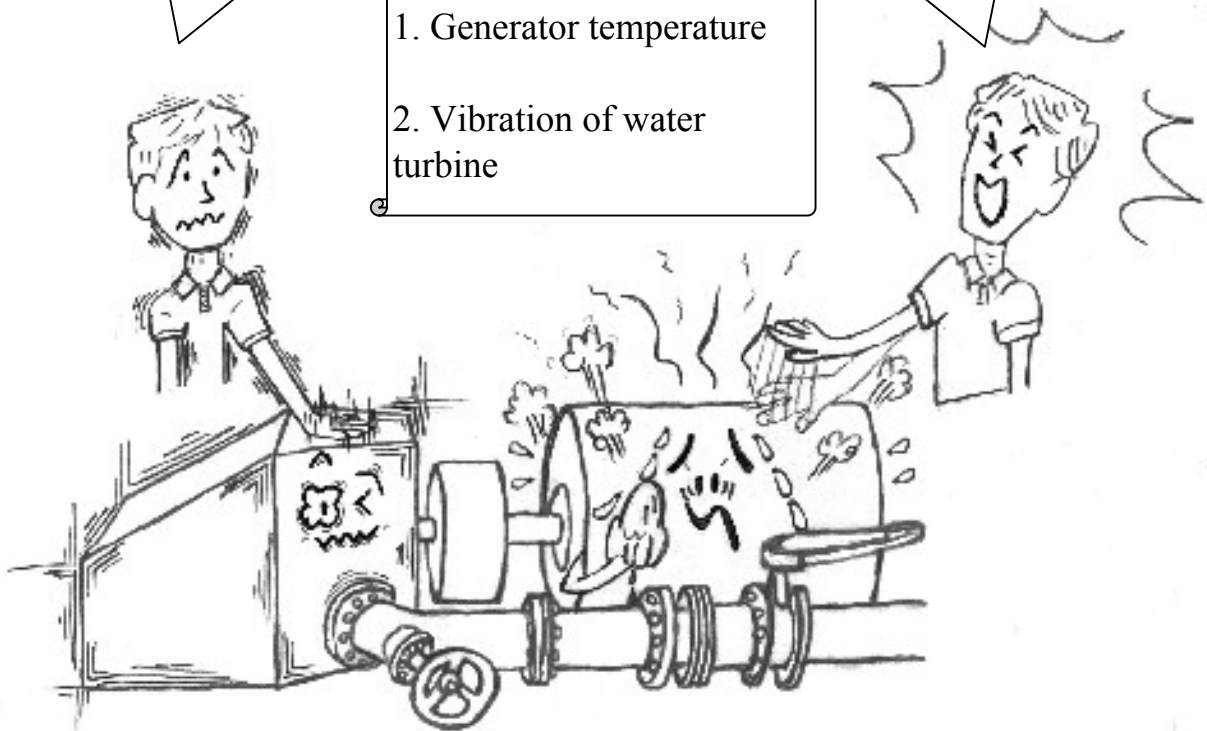
(5) Observations during operation



1. Observe the generator's temperature
2. Observe the roller bearing / coil temperature



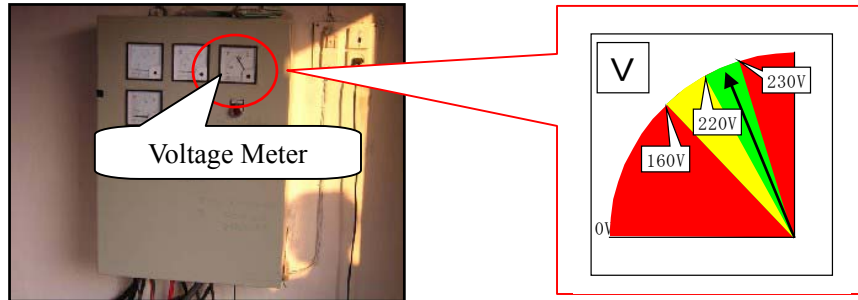
1. Generator temperature
2. Vibration of water turbine



3. Basic Procedures for Correct Operation

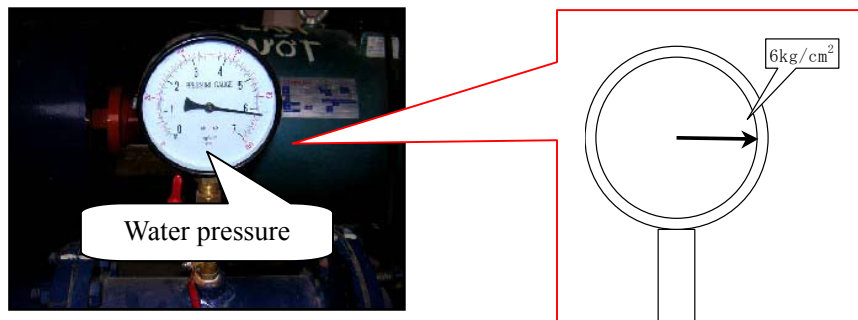
(1) Maintain Constant Voltage

Keep generator voltage between 220 and 230V in principle. But the lower limit can be lowered to 160 V during the dry season.



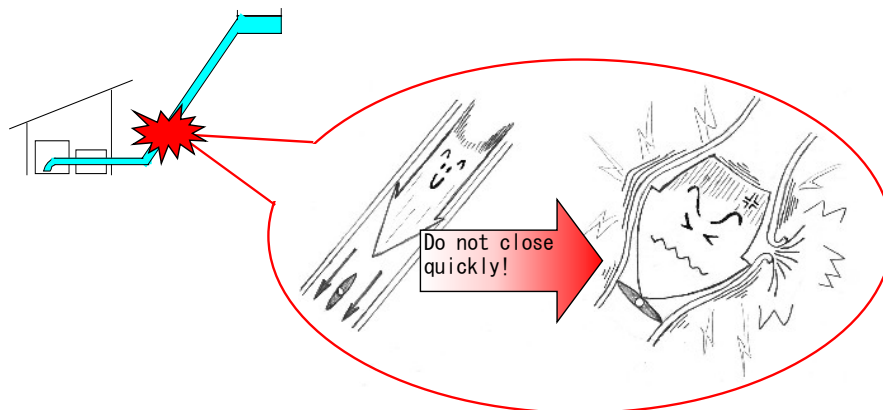
(2) Maintain Water Pressure

Water pressure should be kept at $6\text{kg} / \text{cm}^2$ at all times.



(3) Slow Shutdown of Spear Valve and Inlet Valve

The Spear Valve or Inlet Valve should be shutdown slowly to prevent pressure surge in the penstock. A surge will lead to serious damage to the Penstock.



4. Measures Against Emergency

(1) Dry season operation

During the dry season that experiences a small amount of rainfall, voltage will tend to drop.

Please operate the system as follows;

- Utilization of regulating reservoir
- Limitation of electricity consumption
Obtain cooperation from villagers not to use large capacity appliances during the dry season to reduce electricity demand.
- If there is still a voltage drop, proceed to conduct a planned outage in rotation.

(Reference) Characteristics of florescent lamps

- Long life and four times energy efficient compared with incandescent lamps.
- Life is shortened by voltage fluctuation.

(2) Handling against failures or blackout

When electricity blackout has occurred, operators should first close the Intake Gate and cut water flow to the water turbine as soon as possible. After that, visit the powerhouse and stop all equipment according to the situation.

(3) Handling against lightning

When you experience a large thunderstorm, operators should stop the electricity supply.

(4) Troubleshooting

When you find something wrong with the facilities, conduct proper maintenance and try to find the cause of the problem. Following that, conduct the appropriate measures according to Annex-1: Troubleshooting.

5. Organization

(1) Operation organization

In general, two operators should operate the system. The manager should supervise the duty shift.

The manager should create the weekly duty schedules one week in advance. Operators on duty should operate the system and check the facilities. In case of an emergency, such as blackout, operators should be able to react to any accident as soon as possible.

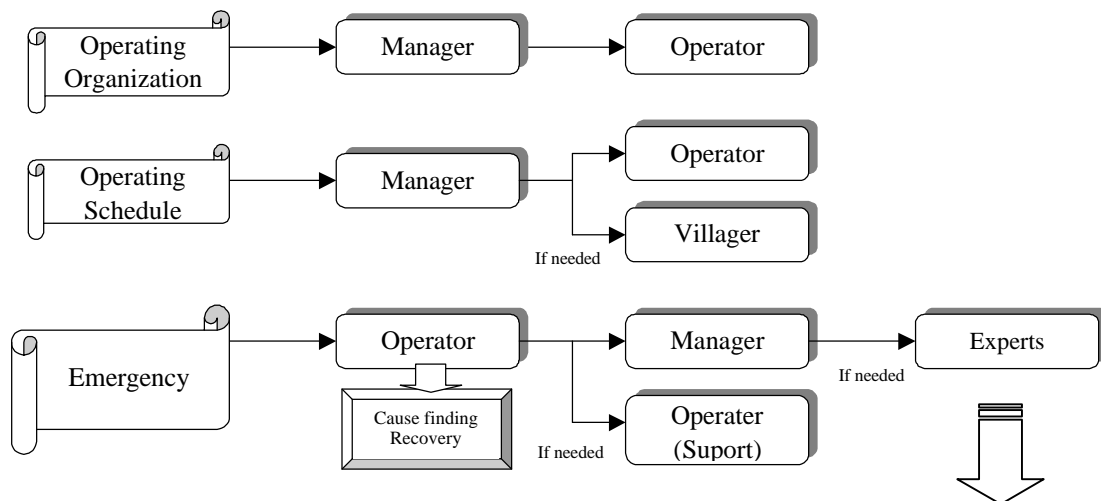
(2) Operation schedule

It is the responsibility of the manager to decide the operation schedule. In the manager's absence, he/she can delegate the duty to appropriate staff member.

- Operation includes irrigation and planned outages.
- Operating hours should be decided in consideration of the amount of precipitation and the allocation of irrigation water.

(3) Chain of instructions

Operation organization, operating schedule and emergency action is as follows;



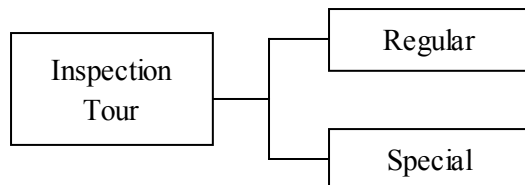
Items	Support organization	name	Address	Tel
Runner, Nozzle, control panel	HPC	Mr. Nguyen Tung	Hanoi	04-852-1298
Generator, Bearing, Rectifier	Agriculture & Irrigation office	Mr. Nguyen Hoa	Lac Son	018-86-1183
Distribution Line	PC Lac Son	Mr. Bui Bien	Lac Son	018-86-1121

6. Inspection Tour and Maintenance

(1) Inspection Tour

a. Type of inspection tour

Operators should take appropriate measures in case of failure or abnormality of facility. The type and frequency of inspection tours are as follows;



Type	Contents	Frequency
Regular Tour	During Operation, check the condition of all facilities to find abnormality.	Every Operation
Special Tour	After heavy rainfall, earthquake or failure, operator should check the facilities condition.	Emergency

b. Items of daily inspection

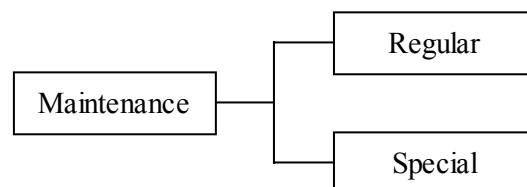
Operating record

Operators check the facility's condition according to the daily operating memo (Form-1). Additionally, the monthly operating record (Form-2) should be written down by operators and stored until the next maintenance inspection. The Form-2 enables operators to share information and to identify failure of the facilities.

(2) Maintenance

a. Types of maintenance

Operators or manufacturers should conduct maintenance. The type and frequency of maintenance are as follows;



Type	Contents	Frequency
Regular Maintenance	Check facilities' condition regularly	Waterturbine, Generator every three months
Special Maintenance	If there are failure or abnormal condition, it is needed to inspect its parts.	After finding

b. Items of maintenance

Regular maintenance should be conducted by Form-3. Regular maintenance of each facility is as follows;

【Frequency of regular maintenance : every three months】

1. Internal inspection of water turbine (runner / nozzle)

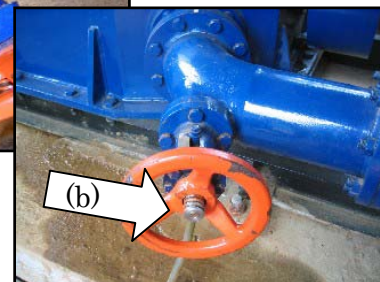
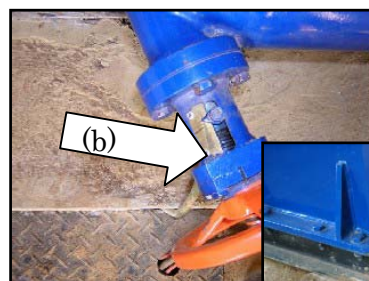
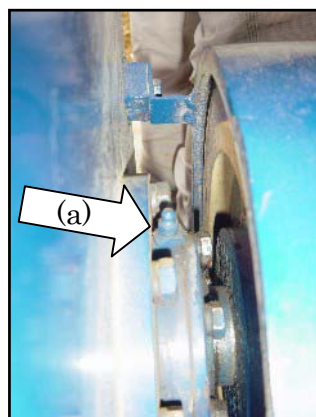
Runner is damaged and deteriorated by sandy water. Operators should take internal inspection periodically.

1. Remove cover of the water turbine housing
2. Check the runner for damage, cracks and a change in shape.
3. Check inside of housing, such as nozzle, visually.
4. When there are cracks or damage on the runner, operators should contact the manufacturers and follow their instructions.



2. Grease rotating bearing and needle

1. There is a hole (a) on the water turbine. Operators should lubricate this hole appropriately with grease with special tools.
2. Grease handwheel of spear valve (b) with dry cotton cloth. Twist the needle a few times to spread the grease.

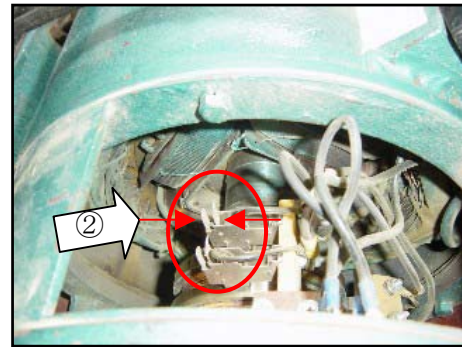
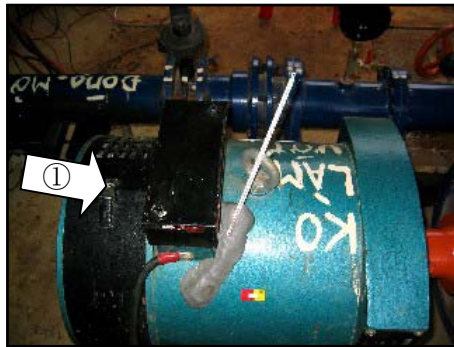


3. Change carbon brushes

Carbon brushes wear out based on operating time. Operators should change carbon brushes regularly.

1. Remove the generator cover
2. Unclamp the brush holder and pull out the brush
3. Remove the brush from contact button
4. If the brush is less than 5mm long, replace it with a new one.

(Attention) Prevent the breaking of the holder or wire. Do not use too much power during the above procedure.

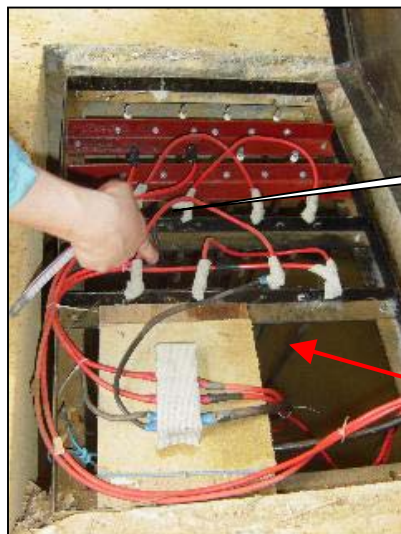


4. Maintenance of dummy load

1. Check disconnection of the dummy load circuit.

Check that the resistance is less than 20Ω by measuring with a tester

2. Check water condition of after bay.



Measure with a tester

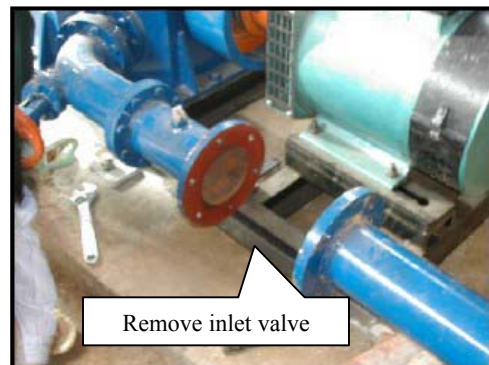
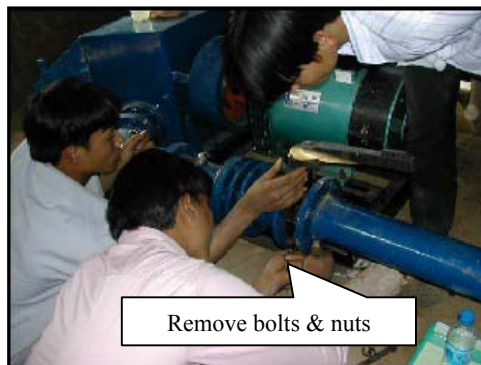


【When operators find abnormal condition】

1. Internal inspection of Inlet Valve

An internal inspection will need to be performed in the event of a water leakage of the Inlet Valve.

1. After draining the water from the penstock, remove the inlet valve.
2. Clean and visually inspect the inside of the inlet valve
3. If there is damage to the valve or shutter, operators should contact the manufactures and follow their instructions.



2. Cleaning the Intake Gate

To keep the capacity of the water flow, be sure to remove the sediment buildup, especially after a heavy rainfall.

1. Surface of concrete

If there is peeling or cracking on the concrete, apply the proper coating.

2. Digging waterway

If there is sediment buildup or a lack of water depth, dig the bottom of waterway to prevent water from overflowing.

(3) House connection

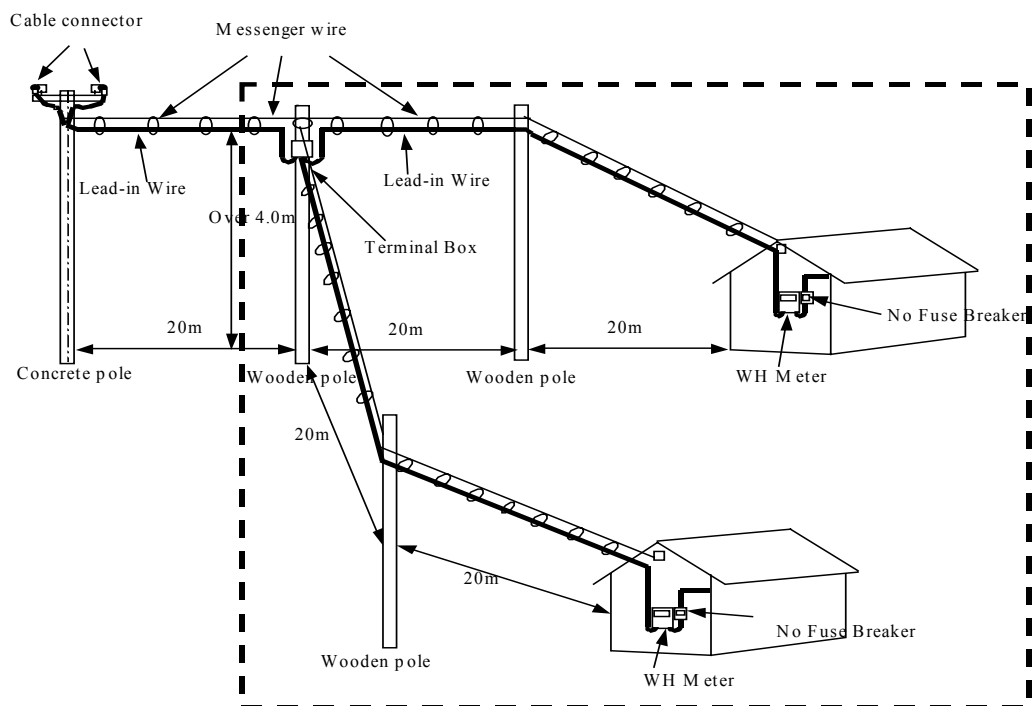
a. Drawing lead-in wires

If there is a wire break or problem with the watt-hour meters, operators and villagers should conduct repair work.

Material for house connection

Item	Specification	Size
Pole		
Lead-in Pole	Wood	L=more than 4.0m D=more than 0.1m
Lead-in wire		
Wire	Cable	PVC-M2.0 × 1.5mm ²
Messenger Wire	Steel wire	1.5mm ² , 2.0mm ²
Wire connector	Clamp connector	Low voltage: 35-95mm ² Lead in wire: 6-25mm ²
Terminal BOX	Copperplate BOX	
Terminal	AC600V25A × 6	
Other		
WHM	Single phase 2 wire	Single Phase 220V, 5A
Breaker	No fuse breaker	Single Phase 220V, 10A
Connecting cable	PVC cable	1.5mm ² x 2 core

Layout of lead-in wire



(4) Long term maintenance and management

a. List of consumable materials

To achieve long-term operation, it is important to change consumable materials and keep them in good condition. The next table shows how to change consumables.

List of Consumable Materials

Equipment	Parts	Changing measure	Task	Reference
Water Turbine	Bearing	noise / vibration / overheating Compare with normal condition Manufacturer recommendation every 3 years	1.Grease 2.Bearing change	By Operators Manufacturer (If needed)
Generator	Brush	Change at less than 5mm Wear out speed is deferent.	Change Brush	By Operators
	Rectifier	Manufacturer recommendation every 5 years Voltage is fluctuating	Change rectifier	By Operators
Dummy Load	Terminal	Rust Rust brings short circuited or loose connection	Change terminal	By Operators Manufacturer (If needed)
	Resistance	Breaking wire Water shortage of after bay caused breaking wire	Change Resistance	By Operators Manufacturer (If needed)
Panel Board	AUX RY	Rust Malfunction	Change AUX RY	By Operators Manufacturer (If needed)
	Meter	Malfunction	Change meter	By Operators Manufacturer (If needed)

* Devices in panel board are high-tech. Therefore operators should contact manufacturers and follow their instructions.

b. Spare parts list

It is vital to always have spare parts available so that damaged items can be replaced as soon as possible.

Spare Parts List

No	Name of parts	Place	Quantity
1	Generator Carbon Brush	Operator	4
2	Rectifier	Operator	1
3	Bearing for water turbine	Manufacturer	1
4	Dummy load	Operator	1 Set
5			

7. Safety

Operators should understand and be aware of the dangers during operation, inspection tour and maintenance of the system. Therefore, they should be careful and alert at all times. Additionally, operators should advise villagers to use electricity safely.

(1) General matter

- Make sure to keep a distance from circuits and networks in the powerhouse, distribution line and indoor wiring, or electric shock will occur!
- Two or more operators should perform maintenance and it should occur only during the daytime. Refrain from conducting maintenance work during the nighttime and bad weather.

(2) Safety measure of generating unit

- Keep out unauthorized person from the powerhouse
- Before electric maintenance, make sure to stop generator and electric switches.
- Before water related work is performed, such as water turbine, make sure to stop the generator and to close all gates. In addition, clear away water from the penstock.
- During operation, keep away from any moving devices such as the turbine and generator.

(3) Safety measure of distribution line

- Only authorized operators are should be allowed to climb the electric poles.
- Never hold a long bar under or near the distribution line. Failure to comply may lead to electric shock.
- Do not hang, or attach any objects to the electric pole or distribution wire.
- In the event that an animal or object, such as a tree limb is entangled in the distribution line, immediately notify the operators.


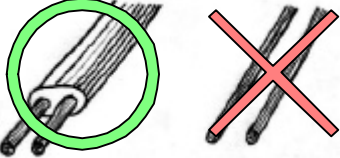
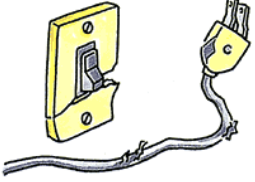
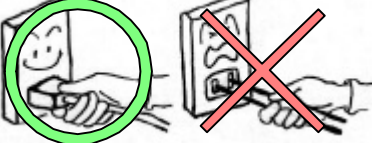
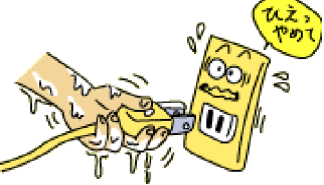
(4) Lecture to villagers

Manager and operators should lecture to all villagers about proper use of electricity and the potential danger of electricity.


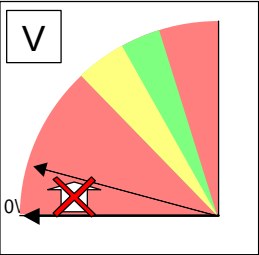

Put danger labels on the electric poles and system components to warn against electric shock.




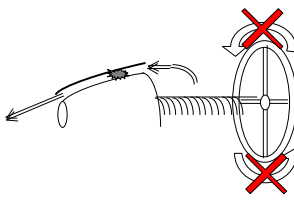
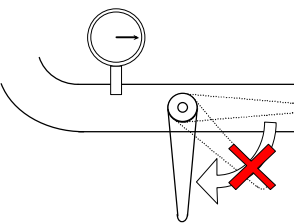
Safety measure

 An illustration of a girl in a blue shirt and pink skirt being shocked by an angel. The girl has a red 'X' on her forehead and is falling back. The angel has wings and a halo.	<p>Keep away from electric network and never touch it, or you might die from electric shock.</p>
 An illustration showing two bundles of wires. One bundle is circled in green, and the other is crossed out with a red 'X'.	<p>Never use exposed wires as electric circuits</p>
 An illustration of a yellow plug outlet and a cord with a damaged, frayed end.	<p>Do not use damaged plug outlets and broken cords, or it might lead to electric shock or fire.</p>
 An illustration showing two hands. One hand is inserting a coin into an outlet, which is circled in green. The other hand is inserting a finger into an outlet, which is crossed out with a red 'X'.	<p>Never insert strange objects or fingers into the electric outlet.</p>
 An illustration of a hand with water droplets touching a yellow plug. A speech bubble says 'ひえっ やめて' (Hi-e, yamete), meaning 'It's cold, stop!'.	<p>Never touch socket and plug by wet hands.</p>

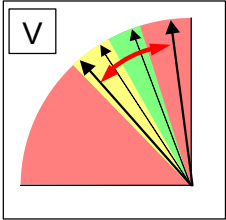
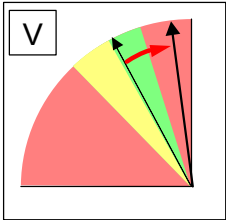
TROUBLE SHOOTING

Problem / Trouble		Risk Degree	Order	Check	Possible Cause	Action
Generator	Generator Vibration 	B		There are strange noise from bearing.	= Bearing trouble	Replace bearing Contact experts (ask advice / support)
				Main part has loose bolts or nuts.	= Improper installment	Tighten bolts and nuts
				Coupling vibrates and gets loose	= Centering mismatch of generator & water turbine	Adjust position of the generator and turbine
	Generator without voltage 	A		Worn out brush Defective contact surface	= Brush trouble	Change brush if less than 5mm Adjust contact surface with brush
				Rectifier becomes burned Disconnecting rectifier wire	= Rectifier trouble	Change to spare rectifier Contact experts (ask advice / support)
	Generator heating up 	A		Coil becomes burned	Coil trouble	Change generator Contact experts (ask advice / support)
		B		Current goes over 50A	= Too much consumption	Cut load until less than 50A

TROUBLE SHOOTING

Problem / Trouble		Risk Degree	Order	Check	Possible Cause	Action
Water Turbine	Turbine rotation speed going up (Runaway)	A		Controller is out of order Generator is out of order	Trouble of - Control panel - Dummy load - Generator	Cut out water and stop turbine immediately Contact experts (ask advice / support) Indicates a very dangerous situation.
	Turbine Vibration 	B		Remove the cover and then check for trouble at the runner or nozzle	= Trouble of runner or nozzle	Contact manufacturer and ask for technical support
				There is strange noise from the bearing	= Bearing trouble	Contact experts (ask advice / support) Change bearing
				Main part has loose bolts or nuts	= Improper installment	Tighten bolts and nuts
				Coupling vibrates and makes noise (The appearance of the connecting part is not good.)	= Centering mismatch	Adjust position of the generator and turbine
	Malfuction of nozzle 	C		Blockage of small dust jams the gear	= Dust jam blockage	Clean the inside of the gear and handle
				Blockage of small dust jams the nozzle	= Dust jam blockage	-- Twist valve several times (Fully open and close it) -- If problem is not solved, clear out water in the penstock, remove needle, and clean the needle. Make sure not to close needle with too much power, or damage will occur.
	Malfuction of valve 	C		Blockage of small dust jams the lever shaft	= Dust jam blockage	Clean the inside of the lever shaft and handle
				Blockage of small dust jams the inlet valve	= Dust jam blockage	-- Twist valve several times (Lightly open and close it) -- If problem is not solved, clear out water in the penstock, remove needle, and clean the needle. Make sure not to close needle with too much power, or damage will occur

TROUBLE SHOOTING

Problem / Trouble		Risk Degree	Order	Check	Possible Cause	Action
Panel Board	Generator voltage is	A		Reset button can not solve it.	= Controller trouble	Dummy load controller might have problem Contact manufacturer and ask for technical support
						
	Generator voltage goes beyond 230V. (Frequency goes over 50Hz.)	A		Reset button can not solve it.	= Controller trouble or	Dummy load controller might have problem. Contact manufacturer and ask for technical support
						
			-- Break of dummy load wire -- Damaged dummy load resistance	= Dummy load trouble	Repair dummy load circuit or change dummy load	
	Difficult to switch on	B		Voltage frequency and dummy load voltage are normal however the switch can not be toggled.	= Controller trouble	Contact manufacturer and ask for technical support
	Others	C		Wire disconnection, terminal rust or unusual smell.	= Controller trouble	Contact manufacturer and ask for technical support

Safety Measure

Trouble	order	Check	Prospective Cause	Action
Blackout in household (Blackout area : Only one house)	①	There is lightning ※Spread to ②、③	= Lightning strike	⇒ After thunderstorm, check ②、③
	②	Breaker "ON"	= Fluorescent light trouble	⇒ Change fluorescent light
	③	Breaker "Off"	= In-house wiring trouble	⇒ -- Turn on breaker, If breaker trips again, there are some problems with the in-house wiring -- Repair or change wire ※Check black burned parts on wire.
Blackout in household (Blackout area : Several houses)	①	Neighborss also have blackout	= Distribution or generator trouble	⇒ Inform situation to CEU manager (When & where blackout occured?)
Typhoon or Heavy rain	①	Sediments in settling basin or screen of tank	= Water flood	⇒ Clean up screen
	②	Sediment or dust in waterway or tank	= Water flood	⇒ -- Stop generator and close intake gate -- Clean up tank and basin -- If needed, conduct recovery work
	③	Breakdown of waterway and spillover	= Water flood	⇒ -- Stop generator and close intake gate -- Clean up tank and basin -- If needed, conduct recovery work
	④	Rain leaks into the Powerhouse or blows into it.	= Heavy rain	⇒ -- Stop operation and try to stop leaking of rain ※Make sure not to splash water on generator or panel box

Safety Measure

Trouble	order	Check	Prospective Cause	Action
Thunderstorm	①	The possibility of lightning from thunderstorms exist	= Proactive measure	⇒ -- Stop operation -- Switch off in-house breaker in all houses
	②	Trip of generating system after thunderstorm ends	= NO	⇒ Operators gets ready against facilities failure
			= YES	⇒ After lightning, conduct special inspection tour of distribution line and Powerhouse
	③	【Powerhouse】 Check condition of water turbine generator, Switches ON/OFF, record meter indication (1) There are problems at voltage or frequency	= Check	⇒ —
			= (2) There are not problems above mentioned. Only contactor shut down	⇒ -- Stop generation operation immediately ※Close needle slowly -- Find causes
④	【Distribution Line】 -- There are shorting wires -- Trees are touching the wire(s)	= Trouble at distribution line	⇒ 1. Turn on contactor and supply electricity again. 2. If no problem, continue to supply ※In case of lightning, there are no specific causes at breaker trip and it may recover by itself 3. If the breaker trips again, stop generating system and conduct special inspection tour of distribution line	
			= Trouble at distribution line	⇒ 1. Ask other operators to provide support 2. Stop generating system completely ※Make sure to stop generator to prevent electric shock. 3. Conduct special inspection tour of distribution line and fix the trouble

Daily Inspection Tour

FORM-1

Name of Inspector _____ Date _____ Manager Signature _____

Items	Check points	Check	Reference	
Civil Facilities	Intake Dam	Repair if collapsed, breaking or leaking		
	Water Channel (Soil)	Clean up sediment & dust		
		Repair slide, check for potential of a collapse & leaks		
	Water Channel Tank (Concrete)	Clean up sediment & dust		
		Repair cracks, check for potential of a collapse & leaks		
	Penstock	Repair leaks		
Tailrace	Repair cracks, check for potential of a collapse & leaks			
Electric Facilities	Pipe	Repair leaks		
	Inlet Valve	Check noise, vibration & leaks		
		Tighten bolts & nuts		
	Turbine	Body	Check noise, vibration & leaks	
			Tighten bolts & nuts	
		Bearing	Check noise, vibration & overheating	
	Needle Handling	Check condition of lubrication		
		Needle function		
	Generator	Body	Check noise, vibration & burnt smell	
		Coil	Check dust and for breaking	
		Brush	Wipe down if it is dirty	Wipe slip-ring
	Coupling	Check nose, vibration & stagger		
	Dummy Load	Check damage, rust & stagger		
		Check water level (i.e. rod is underwater)		Where water stops
		Check that rods have heat		
	Panel Box	Body	Check noise, burnt smell, heat & wet	
Check breaking & touching wire (i.e. electric shorting)				
Terminal		Check dust, rust & stagger		Clean & tighten
		Check striped tape, damage of end terminal		
AUX Ry		Check for dew or wetness		
Meter	Check if indicating properly			

Monthly Data of Theu Hydro Plant Operation

/2004

No.	Date	Water Information			Operated Time			Generation Information			Recorded by
		Time required to fill Penstock (sec)	Overflow Depth (cm)	Water Volume (m ³ /s)	From	To	Total (hrs)	Voltage (V)	Current (A)	Frequency (Hz)	
1					:	:					
2					:	:					
3					:	:					
4					:	:					
5					:	:					
6					:	:					
7					:	:					
8					:	:					
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31					:	:					

Daily Check Sheet

FORM - 3

Date _____
 Prepared _____
 Weather _____



Items		Check Point	Result	Reference
Water Turbine	Overview	Check noise, vibration & leaks		
		Tighten bolts & nuts		
	Bearing	Check noise, vibration & heating		
		Check condition of lubrication		
	Needle Handle	Check that needle function is smooth		
		Check condition of lubrication		
	Runner	Check damage, wear, cracks		overhaul if needed
	Nozzle Tip	Check damage, wear, cracks		
Needle Tip	Check dust block out			
Needle Tip	Check damage, wear, cracks			
Housing	Tighten bolts & nuts			
Inlet Valve	Overview	Tighten bolts & nuts		
		Check leaking water		
	Valve	Check damage, wear, cracks		overhaul if needed
Handling	Check that valve moves smoothly			
Generator	Overview	Check noise, vibration & burnt smell		
	Coil	Check dust and breaking		
	Brush	Wipe down if it is dirty		Clean slip ring
		Exchange carbon brush (in case of less than 5mm)		
	Other	Temperature of stem thermometer		
Check color of thermo label				
Coupling		Tighten bolts & nuts		
		Check wear of rubber and shape		
Dummy Load		Check connecting point (damage, rust or stagger)		
		Check resistive elements (damage or rust)		
Control Panel	Overview	Check noise, burnt smell, heat & wet		
		Check breaking & touching wires		
	Terminal	Check dust, rust & stagger		Clean & tighten
	End Terminal	Check striped tape, damage of end terminal		
	Aux Relay	Check for dew or wetness		
	Meter		Indicating properly	
		Temperature of Powerhouse	°C	
		Humidity of Powerhouse	%	

Chapter II Organization and Financial Management

1 Management Work of Community Electricity Unit (CEU)

(1) Electricity supply contract

◆ There are electricity users and suppliers in Village Hydro rural electrification.

<p style="text-align: center;">Supplier (CEU)</p> 	<p style="text-align: center;">User (Villager)</p> 
Main roles	
Install lead-in wire and meter Generate and supply electricity to users Collect electricity charge (sell electricity) Maintain and manage all facilities	Pay connection charge Use electricity properly Pay electricity charge (buy electricity)

◆ The responsibilities of users and suppliers are written in the contract. (See Form -4)



When a user applies for electricity, he signs two copies of the contract and keeps one copy.



Contract completed



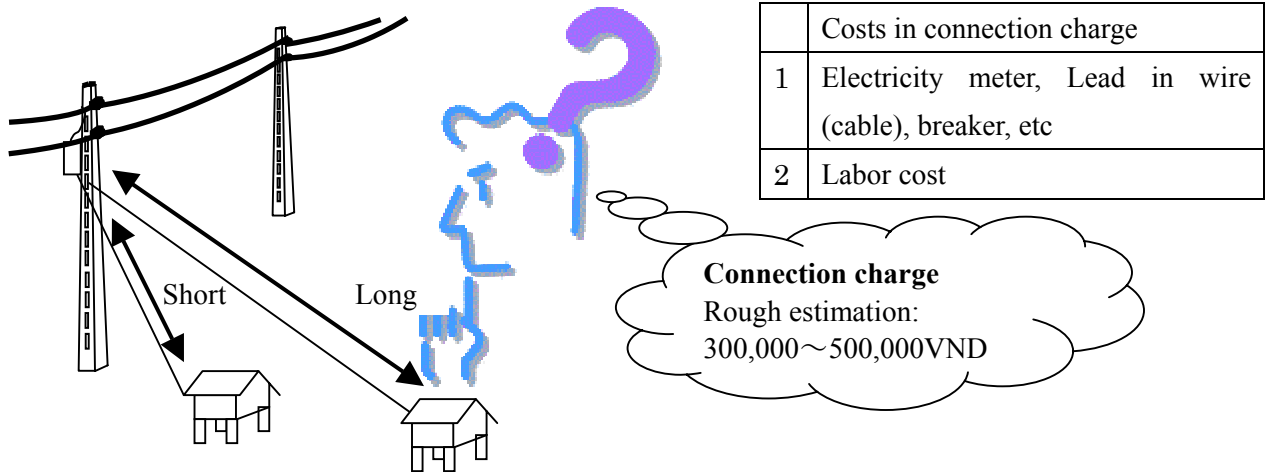
After signing the contract, the CEU will install lead-in wire and meter.

(2) Collection of connection charge (Operator's work)

◆ Electricity users have to pay a connection charge to the CEU.

(Although payment in a lump sum is common, payment by installment is sometimes allowed to make more people pay for connection charge.)

◆ Amount of the connection charge depends on the necessary cable length.



◆ Collection date and collected amount are recorded in the record book of connection charge. (See Form-1)

< Example :Record book of connection charge >

◆ It is natural that interest is charged in the case of payment by installment.

Record connection charge according to connection cable length

Top : Installment payment
Middle : Interest
Bottom : Date and signature
(Collector and payer)

Collection data book of connection charge

No	Name	Amount	1	2	3	4	5	6
1	Bui Van Thong	200,000	200,000					
2	Nguyen Thi Anh	300,000	50,000	50,000	50,000	50,000	50,000	50,000
			15/2 Oct 09	2500	2000	1500	1000	500
			15/2 Oct 09	15/1 Oct 09	15/2 Oct 09	15/3 Oct 09	15/4 Oct 09	15/5 Oct 09

◆ Interest amount is calculated by "Payment balance × interest rate"

$$300,000 - 50,000 = 250,000 < \text{payment balance} >$$

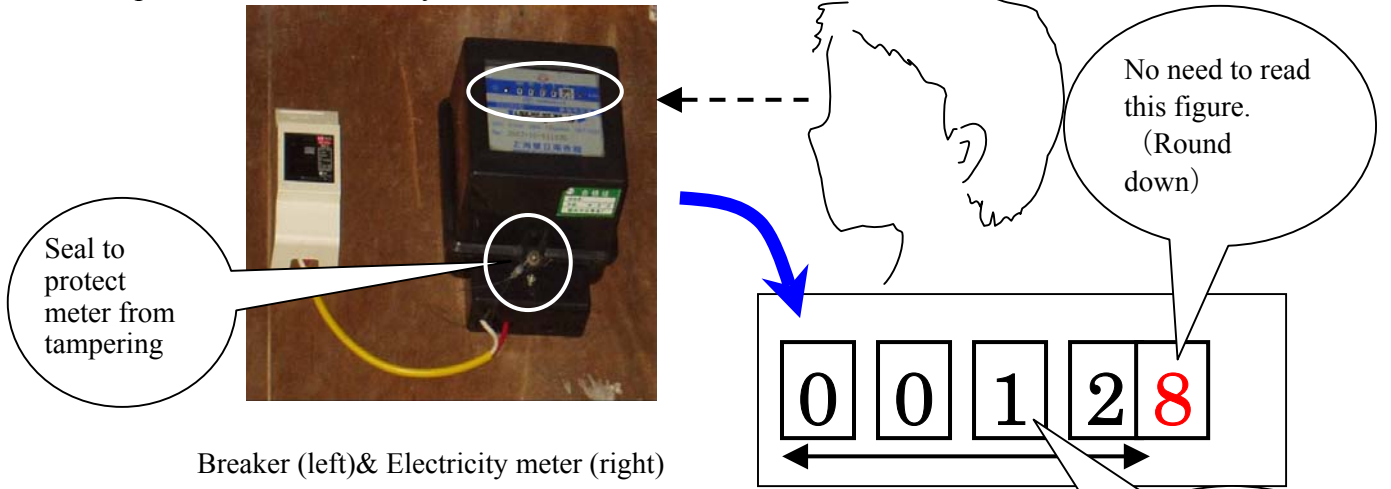
$$250,000 \times 1\% = 2,500 < \text{Interest} >$$

$$50,000 + 2,500 = 52,500$$

(Installment + interest) = Total amount to pay

(3) Collection and record of electricity charge(Operator's work)

◆Operator reads electricity meter at each user's house.



Breaker (left)& Electricity meter (right)

◆Operator records meter reading in the record book of electricity charge. (See Form-2)



Check four figures as meter reading. This is 0012. *0012.8 or 0013 is wrong.

< Example :Electricity users book >

Electricity users book

No.	Name	Start	1	2	3	4	5	6	7	8	9	10	11	12
1	Bui Van Thong	0002 15/12	0008 6E 4200 30/1	0012										
2														

0012 - 0008 = 4 kWh
Payment amount for this month is 2,800VND

Top : Meter reading
Middle: Electricity consumption(kWh) and electricity charge amount (VND)
Bottom : Date and signature (Collector and payer)

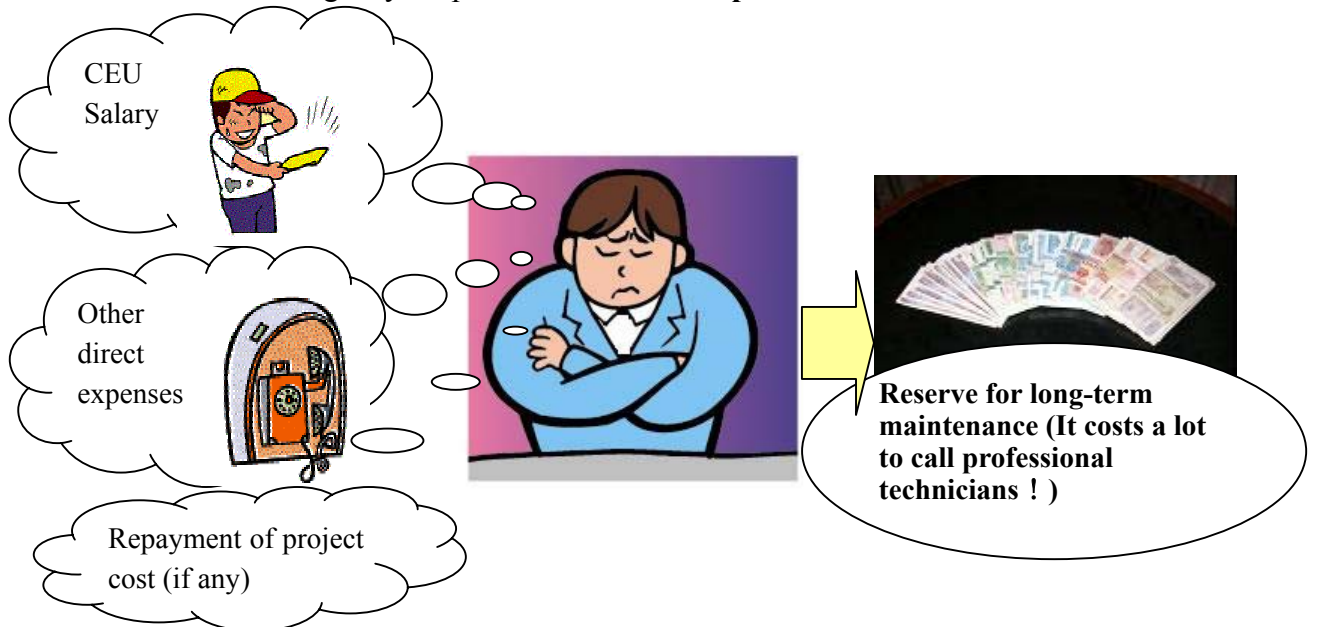
Electricity tariff table
(700VND/kWh)

Electricity consumption (kWh/month)	Payment amount (VND)
5	3,500
4	2,800
3	2,100
2	1,400
1	700

- ◆The electricity charge is determined by electricity consumption.
- ◆It is important to collect electricity charges. If there are some people who don't pay, it is not fair.

(4) Money management of CEU (Manager's work)

- ◆ Manager keeps and manages all the books and money.
- ◆ Manager records income and expenses in account book. (See Form-3)
- ◆ Surplus after necessary expenses, if any, must be kept as a reserve for the long-term maintenance of Village Hydro plant. (Never use up)



< Example :CEU account book >

Date	Application	Income	Expense	Balance	Remarks
	Bringing forward			65,000	
May 15	Telephone		1,200	63,800	
May 18	Buy notebook & pen		4,000	59,800	
May 30	Electricity tariff income	177,200		237,000	'See' Electricity users book"
May 31	CEU salary		120,000	117,000	

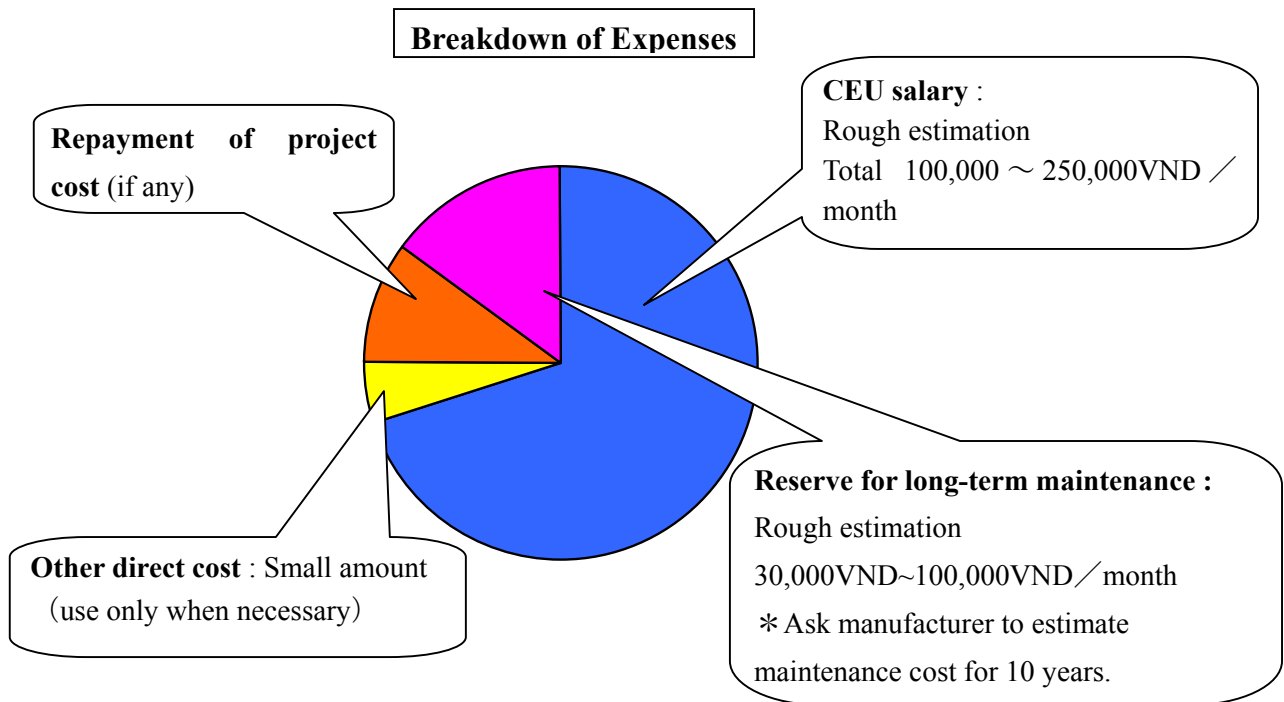
- ◆ Manager checks all the data and the account book, and counts the balance of the money.
- ◆ Manager strongly requests prompt payment of overdue electricity charges. If a customer doesn't pay for a long time, he should take action such as disconnecting the power to the customer.

2 Financial planning

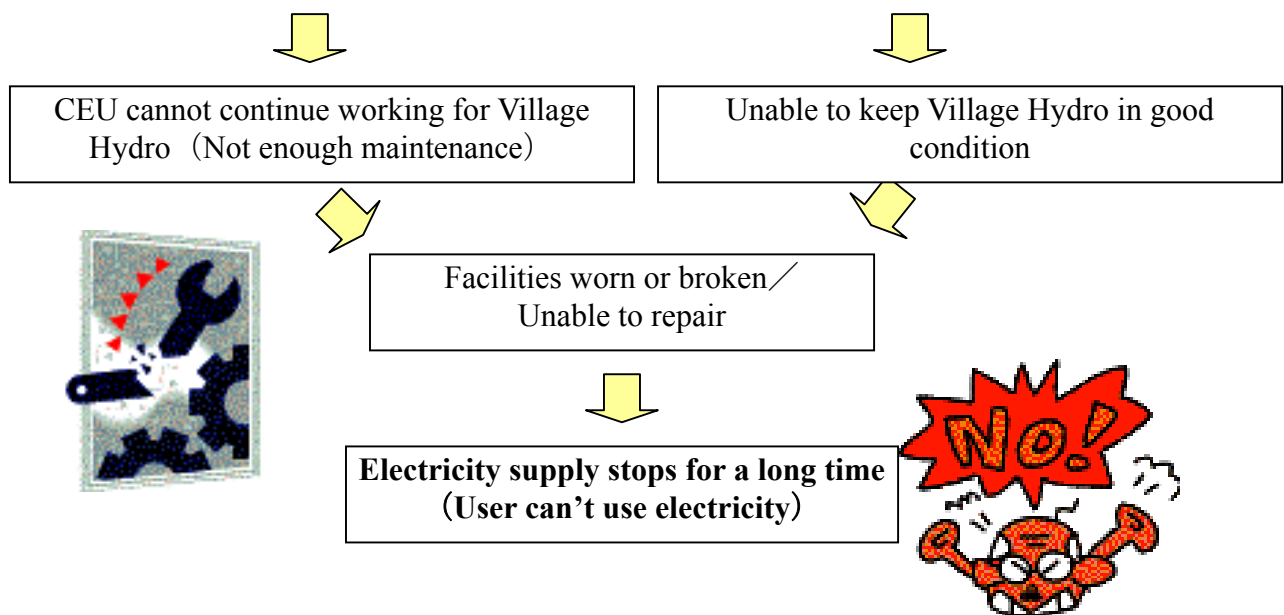
◆It is significant to secure enough money for plant maintenance, to continuously use Village Hydro for a long time.

(1) Expense —How much is necessary and for what ?

◆CEU salary is the largest expense.



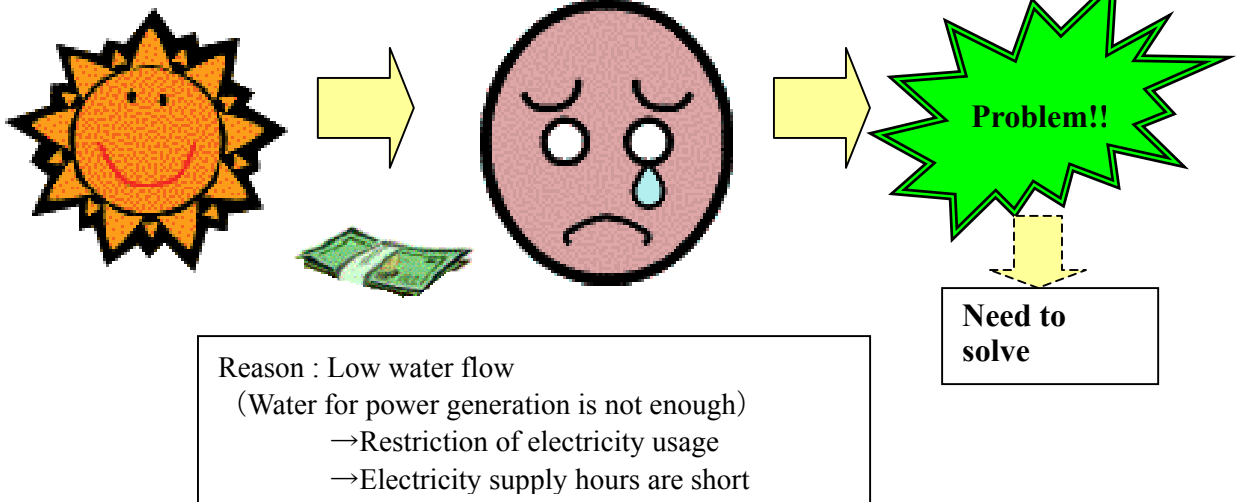
◆If CEU salary is not enough ◆If reserve for a long term maintenance is not enough . . .



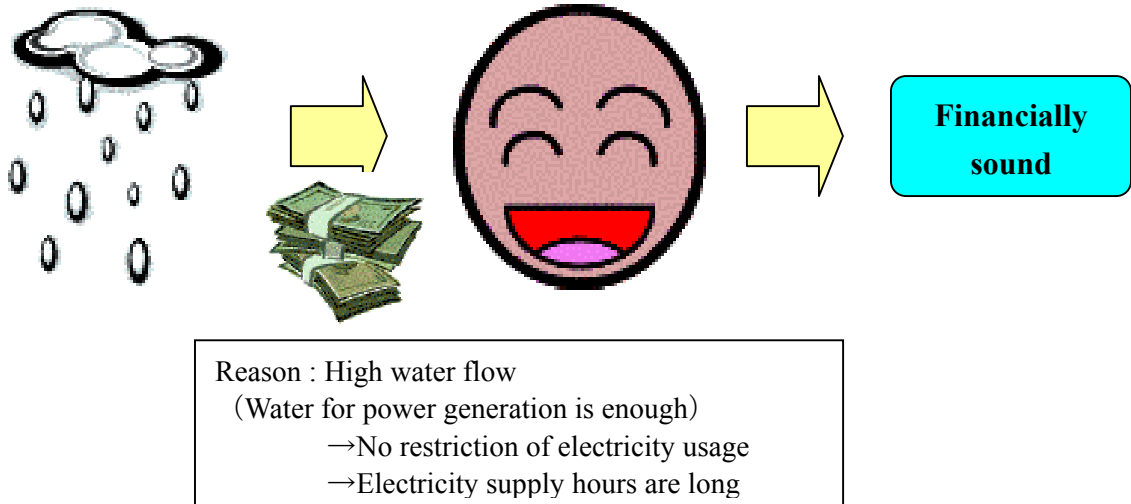
(2) Income—Income amount fluctuates.

◆ Electricity charge is the largest source of income.

In dry season Electricity charge income is small



In rainy season Electricity charge income is large



◆ When electricity charge income is apparently insufficient compared with necessary expenses, it is necessary to revise the electricity tariff.

(3) Revision of electricity tariff

◆ When the electricity charge income is insufficient, it is possible to change the electricity tariff.

◆ There are mainly two methods of electricity tariff revision as follows.

- | | |
|---|---|
| <p>① 700VND/kWh + additional fixed charge
(same amount allocated to each household)</p> | <p>② Raise of unit price per kWh</p> |
|---|---|

* Let's learn from the following example of "X village".

X village – Three households use electricity in the village.

– Total expense was 14,400VND, Electricity charge income was 8,400VND in a certain month (**shortage is 6,000VND**) .




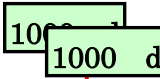
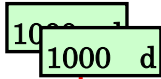
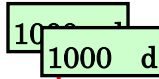
– At that time, electricity consumption of the three households was 2kWh,4kWh, and 6kWh respectively.

①700VND/kWh + additional charge (same amount allocated to each household)

= Every user equally bears the same amount.

→ Shortage 6,000VND ÷ 3 households = 2,000 VND / household

Table Case of additional 2000VND per each household

Electricity users in X village	Mr.Vinh 	Mrs.Hoa 	Mr.Thong 
Electricity consumption	2kWh	4kWh	6kWh
Old electricity tariff (700VND/kWh)	1,400VND	2,800VND	4,200VND
Additional charge	2,000VND 	2,000VND 	2,000VND 
New electricity tariff (700VND/kWh + Additional charge)	3,400VND	4,800 VND	6,200 VND
Total 14,400VND → Shortage of 6,000VND is covered.			

◆ ① Electricity tariff table based on 700VND/kWh + additional charge (reference)

Electricity consumption (kWh/month)	Old electricity tariff (VND)	Additional charge (VND)	New electricity tariff (VND)
5	3,500	2,000	5,500
4	2,800	2,000	4,800
3	2,100	2,000	4,100
2	1,400	2,000	3,400
1	700	2,000	2,700




Low consumption users may complain.

② Raise of unit price per kWh

= This is another method to cover shortage by raising unit price of electricity.

→ Shortage 6,000VND ÷ Total consumption 12 kWh = 500 VND/kWh

Table Case of raising unit price to 1,200VND/kWh

Electricity users in X village			
Electricity consumption	2kWh	4kWh	6kWh
Old electricity tariff (700VND/kWh) 500 d 200 d	1,400VND	2,800VND	4,200VND
New electricity tariff (1,200VND/ kWh) 1000 d 200 d	2,400VND Compared with old tariff, 1000 d UP	4,800 VND Compared with old tariff, 1000 d UP	7,200VND Compared with old tariff, 1000 d UP
Total 14,400VND → Shortage of 6,000VND is covered.			

◆ ② Electricity tariff table based on raising unit price per kWh (reference)

Electricity consumption (kWh/month)	Old electricity tariff (VND)	Raise of price (VND)	New electricity tariff (VND)
5	3,500	2,500	6,000
4	2,800	2,000	4,800
3	2,100	1,500	3,600
2	1,400	1,000	2,400
1	700	500	1,200

Income may be less than expected when many users do not consume a lot of electricity

* When either method does not provide a good solution, you may consider the following method which combines ① and ②.

Combination method of ① and ②
700VND/kWh + variable additional charge (kWh)

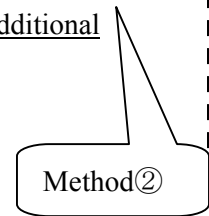
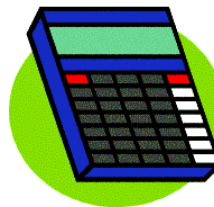
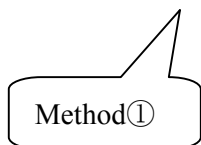
* In the dry season when electricity consumption is not high, many users fall in a certain range (e.g. : 1-3kWh). The electricity charge income may be insufficient with method ② alone.

* In this case, it is better to raise the tariff of low consumption category higher than other parts to secure more income. See an actual example of this method below.

Example of Theu village in JICA pilot project

Electricity consumption kWh	Old electricity tariff 700VND/kWh	Additional charge	New electricity tariff (Old tariff + additional charge)
5	3,500	2300	5,800
4	2,800	2300	5,100
3	2,100	2300 > No change	4,400
2	1,400	1800 > 500 VND up	3,200
1	700	1300 > 500 VND up	2,000

* Here, the amount of additional charge is set higher by 500VND per kWh in the range of 1~3kWh that many users fall in during dry season, and the additional charge is constant in the range of more than 4kWh.



(4) Implementation of new electricity tariff

◆ Consensus making among users is important before implementation of new electricity tariff. (It is better to discuss in the villagers' meeting)

◆ New electricity tariff also can be revised based on financial condition of CEU in the future.



3 Work of CEU and member selection (reference)

◆ For Village Hydro, it is necessary to secure people who operate the power plant and manage money. This group of people is called Community Electricity Unit (CEU).

◆ It is better to discuss at the villagers' meeting who are suitable for CEU.

Discussion at villagers meeting



An honest person whom villagers trust is better.

We select people who can work for long term.

If we select only young people, there may be some people who don't obey CEU and don't pay. It is better to consider someone who has leadership.

We need a person who can properly manage money.

Table Work of CEU and suitable person

	Main work	Suitable person
Manager (1 person)	He/she takes full responsibility for CEU work on the whole. — Manage collected money — Manage all the books	① Has leadership to lead and manage CEU ② Has skills for financial management work. (like leaders who have similar experience in dealing with public money in the village)
Operator (2 persons)	— Install lead-in wire and meter — Operate power station — Record operation data — Maintain relevant facilities — Meter reading — Money collection	① Has eagerness to study new technology and basic knowledge for it. ② Live near power station so that he/she can deal with troubles quickly.

* It is better to secure two operators considering job rotation.

Form-1 Collection data book of connection charge

Collection data book of connection charge _____ village

No	Name	Charge amount	1	2	3	4	5	6
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
	Total	Principal collected						
		Interest collected						

Form -4 Sample contract

Socialist Republic of Vietnam
Independence – Freedom – Happiness

Theu Village, Quy Hoa Commune
LacSon District, HoaBinh Province

Contract for Electricity sales, purchase and usage

I, _____ (hereinafter referred as the “Buyer”) and the Community Electricity Unit, which operates the Village Hydropower Station(hereinafter referred as the “Village Hydro”) in Theu Village (hereinafter referred as the “Seller”), agree to the terms of this contract.

Article 1.

The Buyer agrees to buy electricity from the Seller for daily usage under the terms and conditions given below.

Article 2. Connection Fee

The Buyer agrees to pay a connection fee for installation and ownership of the lead-in wire up to his house, circuit breaker and electricity meter to supply electricity. The lead-in wire is defined as the wire connecting the nearest concrete post installed by the Seller and his house. The rates are decided based on the length of the lead-in wire as follows:

- 200,000VND (Short Distance: less than 70 m)
- 250,000VND (Medium Distance: 70 m ~ 250 m)
- 300,000VND (Long Distance: more than 250 m)

The due date for the connection fee is / /2004. However, the Buyer may choose to pay by installments. In case of installments, the payment period is 6 months at the longest, and the Buyer must pay no less than 50,000 VND and 1 % of the balance in each month.

Article 3. Warranty

The lead-in wire, circuit breaker and electricity meter supplied by the Seller for the connection are covered with a 6-month warranty.

Article 4. Meter reading

The Seller checks the meter reading on the 25th of every month and notifies the buyer of the amount due. The date can be moved by a few days by the Seller.

Article 5. Electricity tariff

The Buyer agrees to pay an electricity tariff based on the meter reading to the Seller on the 30th of every month. The electricity rate is 700VND/kWh. The first due date of the electricity tariff is / /2004.

Article 6. Failure of payment

In case the Buyer fails to pay the electricity tariff for one month after the due date, electricity supply will be stopped. When he pays the electricity tariff in full and a penalty fee of 25,000VND, electricity supply will be resumed.

Article 7. Change of electricity tariff

The electricity rate is subject to change based on the decision of the village authority. After the change of the electricity rate, the new rate will be applied.

Article 8. Restriction of usage

(1) The Buyer agrees that electricity supply, with prior notice, may be stopped for scheduled maintenance, irrigation, etc.

(2) The Buyer agrees to limit his electricity usage, following the Seller’s guidance, when the Village Hydro cannot supply enough electricity; i.e. water shortage, overload.

Article 9. Buyer’s other responsibilities

(1) The Buyer must not move, change or tamper with the lead-in wire, circuit breaker and electricity meter without the Seller’s permission.

(2) The Buyer must immediately notify the Seller in case of a fault in the lead-in wire, circuit breaker and electricity meter. The Seller will carry out repairs and replacements. After the warranty has expired, the Buyer must reimburse the full cost of the repair or replacement to the Seller.

(3) The Buyer is responsible for cost and installation of indoor-wiring and other equipment necessary to use electricity in the house. He is responsible for the safety and correct use of electricity.

(4) The Buyer must use only electricity which is metered coming into his house, and not use any electricity which is not metered.

Article 10. Seller’s other responsibilities

(1) The Seller is responsible for safe and stable electricity supply to the Buyer, the operation and maintenance of the Village Hydro, tariff collection, and giving advice to the Buyer for safe use of electricity.

(2) The Seller is responsible for safety and correct wiring in all parts of the distribution system. The distribution system is defined as concrete posts and cables before lead-in wires. If troubles or accidents occur in the distribution system, the Seller must fix and record them.

Article 11. No Claim of Indemnity

When the Buyer incurs any damage because of sudden disruption of electricity supply, he cannot claim compensation from the Seller.

Article 12. Cancellation of the contract

(1) If the Buyer wants to cancel the contract because of moving or other reasons, he needs to notify the Seller at least 15 days in advance.

(2) If the Buyer persistently fails to comply with the terms and conditions in this contract, the Seller can cancel the contract.

All charges paid under this contract are non-refundable.

This Contract is effective from the date of signing. This Contract is made in 2 copies. Each Party retains 1 copy.

Date: _____

Electricity Seller
Community Electricity Unit

Electricity Buyer
Household No. or address _____

Manager: _____

Head of household: _____

Signature: _____

Signature: _____

|