RAINBOW POWER COMPANY LTD

Search Here

Go

Top » products » hydropower » Hydro Power Systems FAQ

My Account | Cart Contents | Checkout

RPC Menu

- Company
- Products
- Training
- Information
- PDF Downloads.

Course Info

Living with Solar Course
These courses are held regularly.

Next course is on the weekend 24th-25th March. 2007

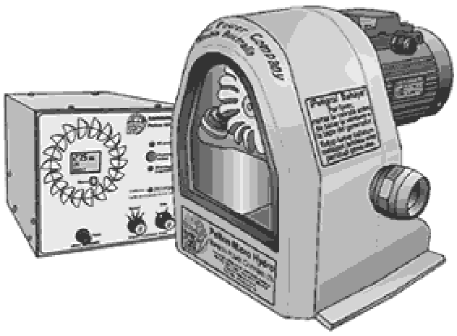
Registration by Friday 16th March. 2007

Sundaya See the Sundaya Product Range.

Hydro Power Systems FAQ

Please visit our online shop

1) Micro hydro site assessment and installation.



HYD-200

To fully assess your hydro site, we'd need the following information:

- head/pressure from penstock(pipe) inlet to the turbine/generator(metres or kPa)
- length of pipe to achieve the above head (m)
- internal diameter of this pipe (if installed) (mm)
- minimum flow (litres per second) of the water source
- distance between the turbine and the house/building (m)

We could then give you an assessment for your site.

2) Micro hydro - Measuring your head

The head is the vertical distance from the source of the water down to the turbine. This is usually measured in metres. There are various ways to measure it including:

- obtaining the information from a topographic map - If there is a water pipe already installed, you could measure the static pressure with a pressure gauge. The static pressure is when there is no water flowing through the pipe, eg. all taps and gate valves are turned off - Altimeters, dumpy levels and other surveying type of equipment.

The penstock (pipe) length is the length of pipe you need to obtain a certain head.

If the site were a vertical waterfall, then the head and penstock length would be equal.

In general terms, high head turbines will cost less and / or produce more power than low head units. You might need to use a few hundred metres of pipe to obtain a suitable head.

If you need to measure the flow, the easiest method is to see how long it takes to fill a container of a known volume - eg: a 10-litre bucket, 200-litre drum.

3) Micro hydro around the world

Our hydro has been sold in many countries including:
- Philippines
- Papua New Guinea
- Japan
- Peru
- Ecuador
- England
- New Zealand
- Brazil
- Vanuatu
- U.S.A.
- Fiji
- New Caledonia

- Indonesia

4) Measuring your Flow Rate for a Micro Hydro

To determine the power potential of water flowing in a river or stream it is necessary to determine both the flow rate of the water and the head through which the water can be made to fall.

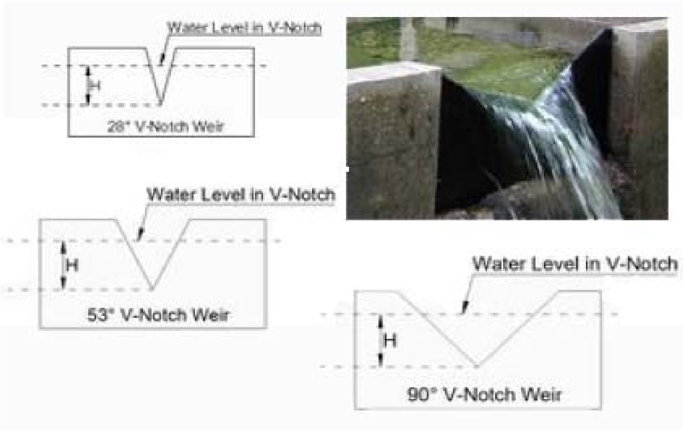
The flow rate is the quantity of water flowing past a point in a given time. This is usually measured in litres per second.

- **Bucket Method**
  An easy method for measuring flow rate is with a common 10-litre bucket and a stopwatch. The litres per second flow rate would then be exactly one tenth of the time it took to fill the 10-litre bucket.
  This method can be employed if you have a narrow opening through a weir or a pipe operating at its maximum flow rate.
- **Pump Method**
  If you have a pump, you could determine at what rate you can pump the water out without lowering the water level in the pond.

- **V-Notch Method**
  If you have a weir or dam on the water source you may be able to use the V-Notch method of creek flow measurement.

  See the PDF file for the detailed tables of flow rates and instructions.

  The formula is a rounded form of the very complex formulae required to calculate the water flow. This rounded formula will be correct within ± 1 to 3% up to 300mm of head, ± 2 to 5% 300mm to 500mm of head.



  The numbers used are constants for clean-ish water up to 1.05SG @ 15-250C @ 0-300m altitude. So as you can see it is by strict engineering standards, "a thumb suck", but for most intents and purposes it is accurate enough.

  H2.5 is made up from the fact that an increase of height of water, increases the area available to flow by the square of the height change and also increases the pressure (head) at the discharge, therefore making more water flow for a given area.

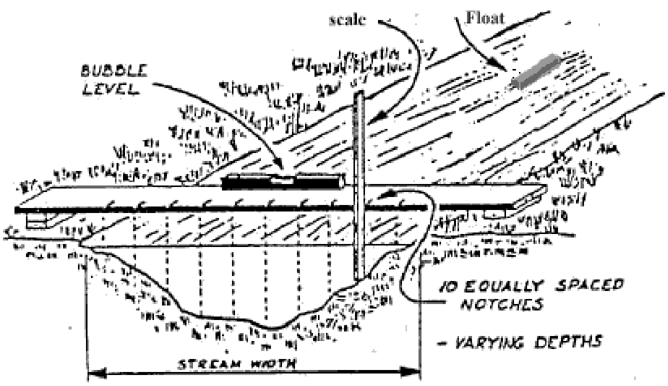
  I should have noted that it is difficult to measure the height at the discharge, so measure it say 300mm to 600mm back from the weir.

  Instructions on how to use the table and a drawing of the V-Notch angle are included in a 3 page PDF of weirs for different flow rates, 0-64, 0-125, 0-250 litres per second.

- **Cross Section Flow Method**
  For larger creeks, this method involves the cross sectional area of the flow and the speed of the flow.

  If you wish to ascertain the flow rate of a stream, when the 10 litre bucket method cannot be employed, you can get a rough idea by measuring the size (cross section) and average flow rate of the stream.

  For this method the speed of the mid-stream surface water is measured by timing a float. Choose a part of the stream where the cross section is regular. Measure the cross section by finding the average depth as shown, and the width. Time the float over a short distance to obtain the speed.



  The average speed of the whole stream can then be calculated by multiplying the measured speed by:
  0.8 for a concrete channel
  0.7 for an earth channel
  0.5 for a rough hill stream

  For streams less than 150 mm average depth, the factor becomes unpredictable and can be as low as 0.25. The flow rate is then equal to the distance that the float travelled multiplied by the correction

factor and multiplied by the
average depth and width of the stream and then divided by the number of seconds for the float to cover that distance.

If the measurements are taken in metres and the float is timed in seconds, then the result multiplied by 1000 will
give you the litres per second flow rate. Overall accuracy of this method is about 80%.

5) SIPHONS ON MICRO HYDRO PENSTOCKS

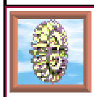
If you have a dam, the ideal penstock intake will go through the dam wall and always be below the water level. If you have a 'drain pipe' at the bottom of your dam (to clear out silt, etc), the most clever design is to have a smaller pipe coming off that which gives you a second intake about one-third down from the top of the water level. This will give you the best quality water for drinking and to run your hydro. A flexible pipe on a float is ideal for this intake so your intake can move with your water level.

A less than ideal method is to run your pipe over the dam wall. This means a siphon will be needed. The theoretical maximum lift of a siphon is about 6m, but in practice it will be difficult to achieve this maximum. A large pipe and/or high suction head will make the siphon all the more difficult to start and maintain.

Systems like this are not necessarily self-starting. If air gets into the pipe for any reason, such as exceeding the flow of the creek, turbulence washing bubbles into the intake, or dissolved air coming out of the water where the pipe lies in the sun, then the water can cease flowing and require complex measures to restart. Some of the methods used are:

1. sucking on the end of the pipe,
2. blowing into the end of the pipe,
3. driving water into the bottom of the pipe with a pump or another pipe,
4. wriggling the pipe,
5. filling the pipe with water using a bucket or another portion of pipe above the dam,
6. constructing a small dam so the inlet and first portion of the pipe are below the water level,
7. or simple leaving it alone in the hope that temperature variations will cause air in the pipe to expand and contract and start the siphon.

To conclude, if at all possible, have your hydro penstock pipe going through the wall below the level of the water to avoid suction problems.

Related Information	
	• Micro Hydro Installation Manual Download the Manual (1.5Mb PDF)

Top of Page

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