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LH1000 HYDRO TURBINE

The reaction Water Turbines like the LH1000 are designed to produce electricity from sites that have very low head (pressure) but lots of water volume. It is designed for sites that have from 2 to 10 ft (0.6 m to 3 m) of head. The realistic minimum for the LH1000 is 2 ft of head and about 500 GPM of flow volume. That minimum produces 100 watts of power.

The discharge water is not released from the turbine system until it exits the bottom of the draft tube. Therefore, head for the LH1000 is a combination of **pressure head** created by the water above the turbine propeller that *pushes* the water through the turbine propeller and **suction head** created by the water flowing through the draft tube that *pulls* the water through the turbine propeller. The ability to utilize both pressure and suction head is crucial for the LH1000. The turbine can only accommodate up to 18” of water above it so pressure head alone would severely limit the output of the turbine.

Basically the LH1000 turbine functions as follows:

Water is channeled to a open-top reservoir tank. The LH1000 is mounted in a 7” diameter hole cut in the bottom of this reservoir tank. The combination of the pressure head created by the water in the reservoir tank above the turbine and the suction head created by the turbine draft tube force water out the hole and through the turbine. The water flowing through the turbine turns the turbine propeller, which spins an alternator – creating electricity.

There are several important issues to consider when evaluating the potential for the LH1000 water turbine at a site:

- The LH1000 turbine is designed for sites with minimal head. The water is normally diverted to the turbine inlet via an open ditch (canal or trough). If you find that the head at the site is so great that diverting the water via the ditch is impractical, consider using a turgo turbine like the Water Baby or Stream Engine with a closed diversion system.

- Water at the turbine end of the ditch will seek to maintain the water level at the inlet to the ditch. The ditch at the turbine end must have sufficient depth to contain the water. Also, with the LH1000 turbine the alternator is above the turbine, connected to the propeller via a shaft. The length of the alternator shaft will dictate the maximum allowable water depth. The standard LH1000 will only allow a maximum of 18” water depth above the turbine.
- Water flow volumes through the diversion will undoubtedly vary through the year. Install an overflow at the turbine end of the ditch to discharge excess water and maintain stable depth above the turbine.
- Since the inlet area for the turbine is fixed, the volume of water that will pass through the turbine is directly related to the head pressure – the more head, the more volume. Therefore, for any given head there is a optimal amount of water that should flow through the turbine. See the Output Chart to determine the turbine power output for specific head distances and the volume of water that is necessary at that head.

LH1000 POWER OUTPUT CHART

Head ¹	Flow Volume ²	Watts	Min Pipe Size ³	Ditch Area ⁴
1	316	30	8”	0.24 sq. ft.
2	447	90	8”	0.34 sq. ft.
3	548	160	10”	0.41 sq. ft.
4	632	250	10”	0.47 sq. ft.
5	707	350	10”	0.53 sq. ft.
6	775	465	12”	0.58 sq. ft.
7	837	585	12”	0.62 sq. ft.
8	894	715	12”	0.67 sq. ft.
9	949	850	12”	0.71 sq. ft.
10	1000	1000	12”	0.75 sq. ft.

(to convert Head to meters, multiply feet x .3048)

¹ Net Head in Feet

² Flow Volume In GPM

³ Schedule 40 PVC pipe @ 3 ft/sec flow rate

⁴ Minimum water depth X ditch (water) width @ 3 ft/sec flow rate

- If the available water volume is less than that necessary for the available head, reduce the head to match the available volume of water. Accomplish this by adjusting the vertical drop in elevation for the diversion inlet and/or the length of the draft tube. If the site cannot produce the water volume necessary for the head, the turbine will consume more water than can be replenished in the reservoir tank and the water level will be lowered, creating turbulence and air in the water and drastically reducing the performance of the water turbine.
- If the water flow volume exceeds that required for the head, consider adding additional turbines.

- The velocity (speed) of the water flowing through the diversion ditch should be fast enough to replenish the water but slow enough to keep turbulence from developing and keep the walls of the ditch from eroding (if a lined trough is used, erosion is not an issue). With the LH1000, the velocity at the reservoir tank should not exceed 3 feet per second. For earthen ditches, see the Velocity Table below:

Maximum Permissible Velocity For Earthen Ditches

Type of Soil	Water Velocity		
	Ft/Sec	Ft/Min	MPH
Sand Only	1.1	66	0.75
Sandy Soil, 15% Clay	1.2	72	0.82
Sandy Loam, 40% Clay	1.8	108	1.23
Loamy Soil, 65% Clay	3.0	180	2.05
Clay Loam, 85% Clay	4.8	288	3.27
Agricultural Soil, 95% Clay	6.2	372	4.23
Clay	7.3	438	4.98

MINIMUM DITCH AREA REQUIRED FOR VARIOUS HEADS & SOIL TYPES *

Type of Soil	Ft/Sec	Feet of Head									
		1	2	3	4	5	6	7	8	9	10
Sand Only	1.1	0.64	0.91	1.11	1.28	1.43	1.57	1.70	1.81	1.92	2.03
Sandy Soil, 15% Clay	1.2	0.59	0.83	1.02	1.17	1.31	1.44	1.55	1.66	1.76	1.86
Sandy Loam, 40% Clay	1.8	0.39	0.55	0.68	0.78	0.88	0.96	1.04	1.11	1.17	1.24
Loamy Soil, 65% Clay	3.0	0.23	0.33	0.41	0.47	0.53	0.58	0.62	0.66	0.70	0.74
Clay Loam, 85% Clay **	4.8	0.15	0.21	0.25	0.29	0.33	0.36	0.39	0.41	0.44	0.46
Ag Soil, 95% Clay **	6.2	0.11	0.16	0.20	0.23	0.25	0.28	0.30	0.32	0.34	0.36
100% Clay **	7.3	0.10	0.14	0.17	0.19	0.22	0.24	0.26	0.27	0.29	0.31

* Area in square feet. Actual depth & width of the water. Not adjusted for friction losses.

** Recommended water speed at the Reservoir Tank is not more than 3 feet/second.

• Reservoir Tank

The reservoir tank can be constructed of various materials (wood, metal, plastic) but should conform to the following specifications:

Length	minimum of 40 inches (1000 mm)
Width	minimum of 24 inches (600 mm)
Depth	minimum of 12 inches (300 mm)
Overflow	maximum of 18 inches (450 mm)
Turbine Backset	18 inches (450 mm) from back wall to hole center

If the diversion ditch is open-air, the entrance to the reservoir tank should have a self-cleaning screen installed to keep trash from clogging the turbine.

- **Draft Tube**

The Draft Tube provides the suction portion of the head and is critical to gaining optimum performance from the LH1000. There are two very important issues with respect to the Draft Tube:

- 1) The Draft Tube must be air tight – no leaks, especially at the connection to the turbine.
- 2) The lower end of the Draft Tube must be submerged in the tail water. Plan the location for the turbine and the design for the spent water dispersion accordingly.

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