

# Axial Flow Hydro Turbine User's Manual



## Brief Introduction

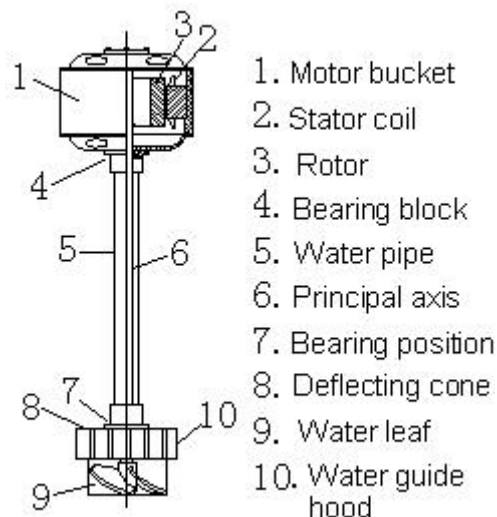
Axial small hydro generators are mainly used in places where the water drop is relatively low, for example, by small rivers, small dams, and so on. The axial small hydro generator is mainly composed of a generator and impeller coaxial.

Working Principle and Installation Method: First plan the installation site, generally next to, or under the rocky place to install the construction is more solid. Mixed soil, stone masonry water intake channel, with wooden boards to do a good switch sluice. With wire mesh to do garbage stalls, constitute the water intake system. Use soil and stone to build a spiral plane of water channel according to the model, so that the water will form a vortex and drive the impeller to rotate.

In the spiral plane below the construction of a small above, below the large, flared tailpipe, the main purpose is to let the water in the formation of a suction, the impeller downward attraction, thus generating strong power to drive the generator work. Therefore, the power of the generator mainly from the tailpipe, the length of the tailpipe, that is, the waterfall, called the head. Small axial flow hydro generators generally work in the head of water between 1 meter and 6 meters.

## I . Axial Flow Hydro Turbine Parameters

Structure and Principle (with diagram)



Axial turbine generator working principle: The main use of the tailpipe to form a vacuum suction pipe, pull the suction upstream of the incoming water to make the formation of jets, the impulse water blade rotation, so that the kinetic energy of the water flow is converted into mechanical energy, the rotation of the water blade to drive the generator to rotate to send out electricity.

## Installation and Commissioning

### (1) Preparation before installation

① After selecting the ideal installation location, measure the height of the head, measure the flow of water, and according to the requirements of the installation and the need to install the location, according to local conditions, the budget of the cement structure of the sand, stone, bricks and other required materials transported to the location of the installation.

② According to the model of the turbine and the openness multiplier of the tailwater pipe with a small upper side and large lower side, use the round wood cake, small square wood bar, or use other materials to make the inverted cement concrete mold of the tail water suction pipe and the drainage outlet. (As shown in the example)

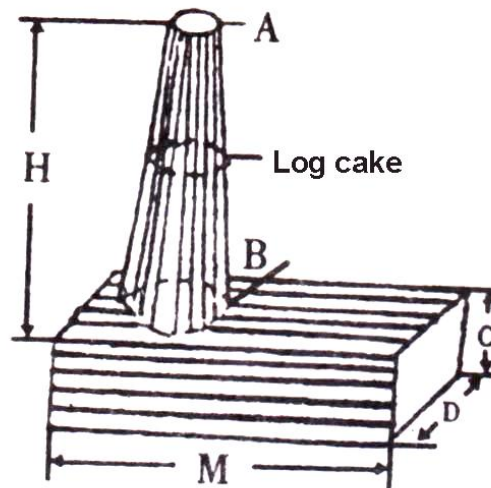


Figure II Type 20

(unit: mm)

10 Type	12 Type	15 Type	18 Type	20 Type	25 Type
A=10	A=12	A=15	A=18	A=20	A=25
B=20	B=24	B=30	B=36	B=40	B=40
C=15	C=20	C=25	C=30	B=30	C=40
D=25	D=25	D=40	D=40	D=40	D=70

A, B indicates the number of diameters of round log cakes and small square logs together; H is determined by the height of the head, M is determined by the slope of the hill.

### (2) Pre-construction preparation

According to the data in Fig. 2, type 20 will be according to type 20 firstly dig a square pit of 60-100 centimeters under the loading position counting from the lower water level line, and then pour a layer of cement concrete more than 10-20 centimeters thick at the bottom of the dug pit. Then pour a layer of cement concrete more than 10-20 centimeters thick at the bottom of the dug pit for the foundation platform, which must be firm.

The manufactured tailpipe and drain pipe mold, wrapped in newspaper or cement paper (to prevent non-removal of the mold) placed in the center of the dug pit.

### (3) Construction

First, brick around the installed tailwater pipe to ensure that the thickness of the tailwater pipe is 5-10 centimeters thick. Then carefully pour into the space around the mold with well-mixed cement, sand, and concrete. Be careful to pour it continuously at one time to prevent disconnection and air leakage.

Pouring system to the top, pay attention to the water turbine water guide cover removed, installed in the upper end of the tailpipe and tailpipe connection solidification. At the same time, the water guide cover and the tailwater pipe must be installed vertically, otherwise it will affect the generating capacity of the generator set. (As shown in Figure 3)

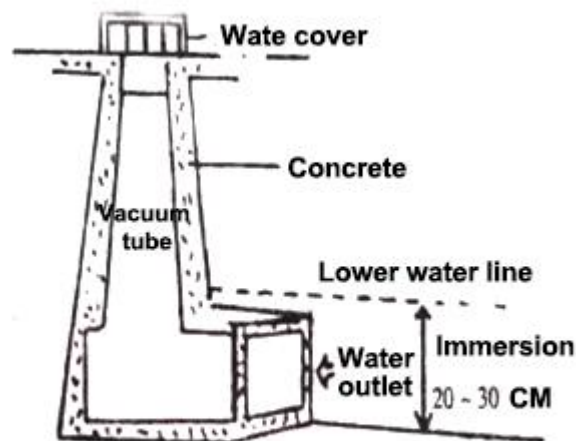
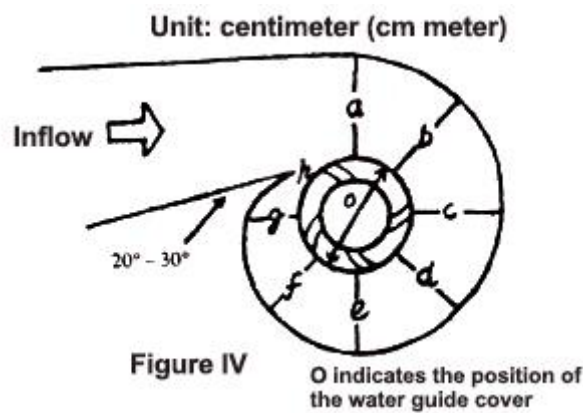


Figure III

#### (4) Method and data for building a vortex chamber

The vortex chamber plays the role of water conduction, and its size is determined according to the size of the turbine model. Therefore, before laying, first, make a paper mold to determine the size of the water inlet, write a large "m" shape, and then according to the turbine's water conduction, measure the size of the calculated data linkage points to scratch the shape, cut the paper mold put to do the tailpipe at the top end of the batch of the ground, and finally use the bricks by the side of the paper to build up 30-60 cm high, with cement batch round smooth that is into a vortex chamber. 60 centimeters high, with cement batch round smooth that is into the vortex chamber. (As shown in Figure 4)



10 型	12 型	15 型	18 型	20 型	25 型
a=15.5	a=17.5	a=22	a=24	a=27	a=41
b=13.6	b=15.4	b=19.6	b=21	b=23.8	b=36
c=11.6	c=13.2	c=16.8	c=18	c=20.4	c=31
d=9.7	d=11	d=14	d=15	d=17	d=26
e=7.8	e=8.8	e=11.2	e=12	e=13.6	e=21
f=5.8	f=6.6	f=8.4	f=9	f=10.2	f=16
g=3.9	g=4.4	g=5.6	g=6	g=6.8	g=11
h=1.94	h=2.2	h=2.8	h=3	h=3.4	h=6

#### (5) Installation

General cement structure needs 6 to 7 days to solidify, to be solidified after the cement is ready to remove the mold, the mold can be used  $\Phi 16$  round iron or hard small wooden bar from the top of the bump down, the round wood cake from the tailpipe below to take out, and the small square wood from the tailpipe on the upper end of the water shield to take out. After the work of removing the mold is completed, verify the tailpipe if there are no bee holes and other air leakage phenomena, you can install the generator set on the water guide cover firmly. (As shown in figure V)

## (6) Test machine

After the installation is completed, the water can be released to test the machine, to be a few minutes to see the tailpipe there is no air bubbles discharged, if there are bubbles, should be stopped to check and make up that is qualified.

## **Maintenance of Hydro Generator Sets**

### 1. Maintenance of hydraulic turbine

The hydraulic turbine should keep the fasteners in a tight state and the rotating parts rotating flexibly. Whenever the hydraulic turbine runs for 50-100 hours, the rolling bearings should be filled with No.2 or No.3 sodium-based (or calcium-based) lubricating grease (note: different types of lubrication should not be mixed in order to avoid deterioration of the grease), and when it runs for 300-500 hours, the grease should be added to the cups, and the amount of wax should be filled up to 2/3 of the volume of the bearing cavity.

If the gap between the bearings is found to be too large or the roll appears to be pockmarked, etc., new parts should be replaced. When the unit runs for 2500-3000 hours, it should check the coupling, replace the rubber ring, belt, and other worn parts, and repaint the corroded parts.

Regularly check the working reliability of water seals and water stoppers. The unit should be overhauled once in 2-3 years of operation. When overhauling, it should check the welding condition of the rotor and replace bearings, coupling pins, and rubber rings.

### 2. Transmission line maintenance

Line maintenance work should be based on the operation and different seasons, inspection, and maintenance. Thunderstorm season, thunderstorms have a big impact on the insulation of electrical appliances, should be done in advance to preventive testing of electrical equipment, lightning protection measures to eliminate line insulation defects, and replacement of broken parts. The porcelain vase with traces of flashover. Should be fastened.

Flood and typhoon season. This season is prone to falling down, broken lines, washed-out pole bases, and other accidents. There should be a reinforced pole base, replacement of rotten wood poles tighten all parts of the bolt, and tighten or replace the binding line and pull line.

During frost and snow season, conductor force, easy to pull off, should be based on the degree of damage to the conductor, with the same wire reinforcement, adjust the strength of the wire. During the dry season, porcelain vases are easy to accumulate dirt, and wooden poles and parts are easy to lose, and should be tightened and cleaned in time.

In addition to the corresponding maintenance work in all seasons, you should also often check the poles are not crooked, porcelain vase clamps have not fallen off, the lowest point of the wire sag is less than 5 meters, the wire on the gate there is no cross, entanglement, whether the wire is hung with foreign objects (such as drying clothes), whether the junction is solid, the gate knife and the gate seat contact surface with or without deformation or burns, and so on.

### 3. Maintenance of hydraulic facilities

Management personnel should be familiar with the channel cross-section size, longitudinal slope, and each section of the water capacity and construction, and pay attention to the protection of plants around the canal, to ensure that the canal line is smooth.

Often checking the channel for leakage, subsidence, slippage, and other phenomena, the remedial measures for these phenomena are generally taken "soil replacement method". The soil replacement method is to dig a large cross-section of the water, fill it with clay, and tamp it. The thickness of the replacement is generally 20-30 centimeters. The surface protection method is the over-water section with stone eggs, block stone, slate, and lime triad lining.

Timely removal of silt, stones, and weeds in the channel to reduce water resistance. In addition, the channel longitudinal slope is too slow will also lead to channel siltation. Therefore, the channel should maintain the original design of the slope.

Regularly remove sediment and floating debris at the end of the diversion to prevent them from entering the front pool.

Heavy rain, heavy rain, and flash floods before and after the outbreak, should be done promptly to drain the silt work.

### 4. Maintenance of the pressure front pool

Often check the water level in the front pool to ensure that the minimum water level above the top of the pressure water pipe inlet pipe inlet 0.6 meters above. The highest water level to the top of the pool, to maintain a safe distance of 0.3 meters.

The bottom of the front pool should be regularly removed from the silt, sand flushing should also be opened at regular intervals, and should be cleaned up in time after rainstorms or floods.

Remove the dirt and weeds on the barrage every day, check whether the barrage is in good condition, repair the damaged parts, or replace the new barrage.

Check the front pool wall, foundation, and other parts of the leakage.

### Axial Hydro Generator Set Installation Diagram

