Pelton Turbine

for

Laurel Creek Hydroelectric Power Plant

Designed by:

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Design Flow: variable from .5 to 2.5 cubic feet / second, with two nozzles of wqual bore, one stationary, one variable needle type

Design Head: 140 feet to 175 feet, depending on head loss, which varies with flow rate through penstock

Runner: 19 3/4 inches outside diameter

15 inch pitch diameter (center line of jets)

Bucket dimensions (shown in figure 1)

The runner is a standard Doble Pelton Wheel cast by Dependable Turbines in Vancouver, British Columbia, and ground, polished, and balanced by Canyon Industries in Deming Wahhington. The runner meets all design dimensions except the angle of the bucket splitters is between 15 and 30 degrees too great, which may mean some loss of efficiency. The runner has a 1 1/2 inch bore with a standard key seat, 3/8 inch by 3/16 inch.

Nozzles

The maximum allowable jet diameter for t the above bucket dimensions is 1.6 inches. At full design flow the net head at the nozzles should be very close to 140 feet. Two jets 1.6 inches in diameter under 149 feet of head should deliver 1.25 cfs per jet, assuming 96 to 98% efficiency for the nozzles. In order to achieve a full range of flows available from the stream, one nozzle is fixed and the other is of the adjustable needle type (figures 2 and 3). When full flow is available from the stream, both butterfly valves will be open and the needle will be drawn back 2.8 inches, giving a cross sectional area equal to that of the lower fixed nozzle. As the stream flow drops below 2.5 cfs the needle will be run inward, reducing the flow in this nozzle. The needle may be used to adjust the upper nozzle's flow so that the lower nozzle is the only supplier. It should be noted that the needle nozzle is not to be used for a shut-off as seating the needle against the nozzle cone will cause a wear ring which may interfere with the jet stream. As the stream flow drops below 1.25 cfs, the lower nozzle is hut off by means of its butterfly valve and the upper needle nozzle is used to regulate the flow down to around .5 cfs, or the minimum flow that will still produce power.

Housing

The housing is constructed from 1/4 inch steel plates welded together to support the nozzles, runner, pillow block bearings, and jet deflectors (figure 3). The housing also diverts the spent water and splash down to the tail pit below the concrete floor. The top plate is removable so that a glass or plastic viewing window may be installed in order to facilitate inspection of turbine performance. The side plate on the right (viewing the housing in direction of water flow) is also removable in orderto allow dismantling of the mechanism. Around the bottom of the housing the 2 inch side of a 2 inch by 4inch by 1/4 inch angle flange is bolted with the 4 inch side welded to a matching 4inch by 4 inch by 1/4 inch angle frame embedded into the concrete floor (figure 3).

This Pelton Turbine was fabricated at Miller Machine Shop in Boone, N.C. by Jack Norris. The turbine is to be installed on Laurel Creek near Sugar Grove where it will be used to produce approximately 17 kw of electricity which will be sold to the Blue Ridge Electric Membership Corporation. Funds for this experimental program were provided by a Department of Energy Appropriate Technology Grant awarded to the Blue Ridge Group Sierra Club and the Earth Studies Program at Appalachian State University.