1. Hub-dynamo testing laboratory conditions and procedures.

To measure the pedalling resistance on the dynamo hub, a solid steel bed was fabricated to which the fork was attached using nuts. The dynamo hub was installed on a 47-622 ETRTO (28”) wheel. The front brake disc was replaced by a sprocket attached to a chain to transmit the engine power, which was placed on a metal platform fixed on the bed.

The motor was powered from a high power direct current source. The voltage setting at the source output was checked by an APPA 505 multimeter and the current by a class 1 needle ammeter, allowing the hub revolutions to be adjusted. The speed was controlled according to the readings of the speedometer with the sensing magnet placed on the spokes of the wheel of perimeter 2268 mm.

At the output of the dynamo bushing, a GPM-8212 electrical power meter was connected which allowed to record the voltage at the bushing output, the current consumption and the power factor of the circuit.

The resistance of the dynamo bushing was measured indirectly. To do this, a Shimano Deore wheel with a conventional hub (without dynamo) was rolled at different speeds and the power consumption in the engine was checked. This power includes losses due to the conversion of electrical to mechanical energy, losses in sprockets and chain, and losses in the hub bearings. If this consumption reading is subtracted from the readings obtained for the same speeds with the dynamo hub assembly, the difference could only be due to the mechanical power due to the pedalling resistance of the dynamo (assuming that the engine responds linearly to the load on the shaft, and that the mechanical losses in the dynamo bearings are negligible compared to the magnetic losses).

2. Portable Battery Packs testing laboratory conditions and procedures

To check the characteristics of the batteries, the following procedure was followed: For charging, a conventional computer-controlled power supply, model PL 155-P from TTI, was used. To cut off the power at a given current, the computer monitors the load current and shuts down the source when it falls below the range. For the discharge, a BK Precision model 8500 computer con- trolled electronic load was used. This could be programmed for current from milliamperes to 30 A, as well as power, resistance and voltage. Capacity was measured by adding intensity over time.

Clamps were used for the battery connection, and 3 sets of cables were connected to them: load, power and measure. The connection to the battery was made with pieces of copper. The battery voltage drop at the measurement point, even at currents of 5 A, was less than 0.01 V.