

## Hydro Turbine-Generator Package Built and Installed As Part of Conduit Energy System for Hartford, Conn.

Sorensen Systems was selected to supply the turbine control systems for the Barkhamsted Transmission Hydro project near Hartford, Connecticut including the induction generator, inlet expansion box, and the hydraulic power pack system to operate the turbine wicket gates, the turbine inlet valve and the main transmission by-pass valve.

According to John Ford, Project Manager for Sorensen Systems, construction of a qualifying Conduit Hydropower Facility was approved as part of an overall \$2.1 billion clean water improvement project for the 30 billion gallon Barkhamsted Reservoir. John said, "The conduit portion of the project would consist of a 250kW turbine replacing the existing booster pump, which is currently unused, in the Puddletown booster pump station." The estimated annual generating capacity of 1,475 megawatt-hours would be generated while the water is flowing to MDC (Metropolitan District Commission) customers from the reservoir.

### Turbine-Generator

Working with its strategic partner, James Leffel & Co, the Sorensen Systems engineering project team took responsibility for the design/build of a Francis turbine-generator. Significant sub-assemblies of the system included the Inlet Expansion Box, the



### Hydraulic Power Unit

To operate the turbine wicket gates, the engineering team designed a self-contained Hydraulic Power Pack System.

Stay Ring/Spiral Case, the Stainless Steel Runner, the Front and Rear Stainless Steel Covers, the Wicket Gate Mechanism, the Discharge Draft Tube, and the Marelli-Motori induction generator.

### Hydraulic Power Pack

To operate the turbine wicket gates, the Sorensen Systems engineering team designed and built a Hydraulic Power Pack System, which was a complete self-contained hydraulic system to

*(Continued on other side)*

## Hydro Turbine-Generator Package

(Continued from other side)

operate the turbine wicket gates, the turbine inlet valve (36 inch) and the main transmission by-pass valve (48 inch). Other important components included a full containment drip pan base with level switch alarm; dual premium efficiency 480VAC, 3PH, 60HZ electric motor driven hydraulic pumps, with one operating and one on standby.

The design provided a control manifold to provide for normal operation and failsafe emergency close operation of the turbine wicket gates, the turbine inlet valve and the turbine outlet valve. Other components included four-inch stainless steel pressure gauges with gauge isolators, flow control valves to limit the maximum closure rate of the wicket gate and valves to prevent pressure spikes in the water system.

To provide for manual operation of the HPP (high pressure pump) motors, a stainless steel motor starter enclosure was mounted to the HPU (hydraulic power unit) base. Other components included a lockable flanged disconnect switch and enclosure intrusion alarm switch. The entire power pack system weighed approximately 1,200 lbs.

### Turbine Generator Control Panel

The stainless steel free-standing turbine generator control panel contains an Allen-Bradley SLC500 PLC system, an Allen-Bradley Panel View HMI color



#### Turbine Control Panel

The stainless steel free-standing turbine generator control panel contains an Allen-Bradley PLC system.

touch-screen, PLC programming, a 24 VDC redundant power supply with loss of power detection and control power circuit breakers/fusing. In addition to the stainless steel enclosure, significant sub-assemblies and components include redundant power supplies, PLC programming, Ethernet communications, hardwired I/O interface to existing SCADA system, and enclosure intrusion alarm switch.

### Circuit Breaker/Switchgear Panel

This panel weighs nearly 1,000 lbs and contains a custom 480VAC, 3PH, 4W, 60 HZ switchboard. Other components include metering, control



#### Control Manifold

The design included a control manifold for normal operation and failsafe emergency close operation.

switches, multifunction protection relay, modbus communications, and an intrusion alarm switch.

### Uninterruptible Power Supply (UPS)

The UPS panel comes in a stainless steel enclosure and is sized to supply four hours of back-up power to the control system in associated panels, and the miscellaneous solenoids and valves. Other components for the panel include a maintenance bypass switch, status and alarms to be sent to the existing SCADA system.

#### Our Three Subsidiaries



ISO 9001:2008 Certified  
UL 508A Panel Shop

Sorensen Systems is a subsidiary of

**THG Corporation**

70 Bearfoot Road  
Northborough, MA 01532

Tel: 508-393-7660  
Fax: 508-393-6042

[www.SorensenSystems.com](http://www.SorensenSystems.com)