



Introduction

Liberty Science Center is a state-of-the-art science and technology museum located in Jersey City, NJ and offers beautiful views of the Hudson River, lower Manhattan and the Statue of Liberty. The Center recently upgraded their boiler room by installing three Patterson-Kelley MACH® C2500 Cast Aluminum commercial boilers featuring P-K's best-in-class patented NURO® control system.

The main goal for this project was to replace the capacity of one of the two existing Scotch Marine boilers with several, smaller high-efficiency condensing boilers while leaving the 2nd existing boiler in place. This provides the Center with greater operating flexibility and additional equipment redundancy which is critical considering the tens of thousands of annual guests who expect a comfortable indoor climate during their visit to the museum.

Condensing boilers exceed 94%+ efficiency by recovering the latent heat of nearly all the water vapor contained in the exhaust gases, which would be otherwise be sent up and out the chimney. By capturing more of the thermal energy contained within the Natural Gas supply, this allows condensing boilers to consume significantly less fuel than a traditional non-condensing gas-fired boiler. The hot water supply from the P-K MACH® C2500 boilers is sent to several large capacity hydronic coils installed in several Air Handling Units (AHU's) throughout the facility to heat the common areas of the museum.



To avoid the cost and complexity of replacing the existing chimney system piped to the old Scotch Marine boiler, sidewall venting was applied to the three P-K boilers. This significantly reduced the installation of the new boiler equipment.



FUEL CONSUMPTION

Ron Taglieri, Chief Engineer at Liberty Science Center, recently shared the impressive results after 6 months of continuous operation following the equipment startup in October 2018:

- ✓ The project's initial fuel savings projections were estimated at 20%... but the first six months of operation have reduced fuel consumption by 30%!
- ✓ The NURO® control system maintains a consistent hot water supply temperature to the AHU's within $\pm 1^{\circ}\text{F}$.

The boiler system at Liberty Science Center has several unique functional requirements, all of which are handled entirely by the boiler's built-in NURO® control system:

- ✓ **External backup for heat call via “Auxiliary Boiler in Cascade” relay output:** The system has retained one of the two existing Scotch Marine boilers. In the extremely rare situation where the Patterson-Kelley boiler equipment is unable to maintain the entire heating load, the P-K boiler equipment calls for backup from the Scotch Marine with the programmable “Auxiliary Boiler in Cascade” relay output.

- ✓ **Motorized control valve operation via programmable relay outputs:** The system features three motorized isolation valves installed at each boiler which must be opened prior to operation. Each boiler offers four programmable relay outputs (A, B, C & D) which can be configured to operate external devices such as air dampers, draft inducers, fixed-speed circulation pumps, variable-speed circulation pumps, motorized control valves, domestic water heat exchangers, etc. The control valve logic always ensures at least one valve is open at all times to prevent dead-heading the primary circulation pumps.

Variable speed control of primary circulation pumps via an adjustable 4-20mA analog output signal:

- ✓ The system features three variable speed primary circulation pumps which track the firing rate of the boilers to maintain a consistent ΔT throughout the entire firing range.

Automatic outdoor air temperature reset via outdoor temperature sensor:

- ✓ The system automatically adjusts its operating setpoint throughout the year by monitoring the outdoor temperature conditions. In addition to changing the operating temperature, the NURO® cascade control the fewest number of boilers required to satisfy the heating load.

Building Management System integration via BACnet:

- ✓ The system features a Siemens Building Management System which is able to monitor all the operating data from the P-K MACH® C2500 boilers and send remote commands via a BACnet ProtoNode gateway device. The operating data is then visually mapped to an interactive schematic of the boiler system which is displayed on a large screen TV inside the Engineering offices.