

## **HYNES ELEMENTARY SCHOOL HVAC SYSTEM (BASED ON WATER COOLED VRF UNITS)**



**Pic 1: Water Cooled VRF Condensing Units**



**Pic 2: VRF Evaporator units in classrooms (Typ.)**

### **DESCRIPTION & INNOVATIVE DESIGN FEATURES**

- *The school utilized noisy packaged unit ventilators for heating and cooling; however replacing them with an all air system was very challenging. A conventional VAV system for the classroom wings was evaluated but the low ceiling heights in the corridors made it a prohibitively expensive solution, where supply and RA ductwork would have had to be run on the roof or a penthouse above the corridor. Providing a VRF system solved the noise issues and the low ceiling height issues at the same time.*
- *The project utilized the exterior existing pipe chase currently used for routing HW piping to the unit ventilators to route the outdoor air ductwork, which was very innovative. As a result, the space freed up by the unit ventilator was utilized for additional shelving. By providing the fresh air at between 36"-42" above finish floor (AFF), the effectiveness of the room neutral ventilation air is 20% higher than a conventional VAV system delivering air at 9'-0" AFF.*
- *The facility utilizes a water cooled VRF system design instead of an air cooled VRF system design which solved a couple of design issues. Firstly, we were able to utilize existing boilers which would otherwise have been under-utilized for the facility. Secondly, air cooled VRF condensing units have limitations in providing design heating capacities on extremely cold days, and spaces need to be supplemented with heat from another source, generally electric. The water cooled design effectively solved that problem.*
- *The water cooled VRF design solution was very effective for this school since 50% of the classrooms face north and 50% of them face south. There will be many instances during the heating season and shoulder months when heating and cooling loads will be balanced, which will ensure heating and cooling in all classrooms with neither the boiler nor the dry cooler being operational.*
- *The school utilizes direct outdoor air supply (DOAS) units supplying year round room neutral air to classrooms. These units use inverter compressors and hot gas reheat options, thereby ensuring that gas is not used in the summer months for reheat after de-humidification.*

### **ENERGY EFFICIENCY**

- *Energy efficiency is the hallmark of the project, as the VRF units operate at between 12.0 and 18.0 EER for peak and part load efficiencies respectively in summer and between 3.5 and 4.5 COP in winter. Since most of the load profile for the school falls in the part load category, very high efficiency is achievable.*
- *Based on energy usage comparisons, the average annual energy usage for the system designed is at least 30% better than the ASHRAE 90.1-2010 baseline HVAC system utilizing packaged RTU's and fan powered VAV units.*

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