SECTION 2A-6
MECHANICAL DESIGN CRITERIA

A. DESIGN CRITERIA

1. HVAC system design, equipment selection and energy conservation shall meet the requirements of the currently approved Florida Building Code - Mechanical. In addition, follow the currently approved editions of the design and application guidelines of the Industrial Ventilation Manual, ASHRAE Handbooks, SMACNA and other accepted authorities including the manufacturer's recommendations for installation and service clearances.

2. The volume of outside air/ventilation for all areas shall be determined by using the Ventilation Rate Procedure in accordance with the currently approved ASHRAE Standard 62.1. The ASHRAE Standard 62.1 ventilation calculation spreadsheet shall be used for the ventilation calculations of all areas such as classrooms, auditoriums, gymnasiums, multipurpose/dining rooms, etc.

3. Selection of the HVAC equipment and systems shall include a Life Cycle Cost Analysis (LCCA) of the key components with minimal energy consumption of depletable energy sources for equipment of 30 Tons and greater. Some typical methods which should be explored include increased chiller efficiency, variable frequency drives, high efficiency and premium efficiency motors, additional insulation, shutting off the classroom terminal box of a variable air volume system design when the classroom occupancy sensor shuts off the lights, and equipment sizing to maintain efficiency at actual operating points.

4. For new schools, a completed copy of the engineering heat gain calculations, the ASHRAE Standard 62.1-2004 ventilation calculation spreadsheet, the LCCA and the currently approved Florida Building Code, Chapter 13, Florida Energy Efficiency Code for Building Construction (FEEC) shall be provided to the SBBC Design Services Department for review during the Design Development - Phase III 50 Percent Submittal. For existing schools requiring chiller and/or AHU replacement only, engineering heat gain calculations shall also be performed. An LCCA is not required for projects whose heat gain load is less than 30 Tons. **Data shall be submitted in a 1 inch, hard cover, 3 ring type 8-1/2"x11" binder titled "HVAC Calculations" and shall include the school name, project name, project number and date.** The HVAC engineering heat gain calculations shall be determined using the outdoor design parameters for the month of **AUGUST** and the following design parameters:
    - A. Summer Design Parameters
        - (1) Indoor Design = 75 Degree Fdb and 50% RH
        - (2) Outdoor Design = 91 Degree Fdb and 78 Degree Fwb
    - B. Winter Design Parameters
        - (1) Indoor Design = 68 Degree Fdb
        - (2) Outdoor Design = 46 Degree Fdb
            - a. Daily Range = 15 Degree Fdb
            - b. Atmosphere Clearness factor = 0.90
            - c. Lighting Heat Gain = 1.5 Watts/SF
            - d. Number of Classroom Occupants:
              Elementary Schools = 18 Students Plus 1 Teacher (19 Occupants)
              Middle Schools = 22 Students Plus 1 Teacher (23 Occupants)
              High Schools = 25 Students Plus 1 Teacher (26 Occupants)

e. Occupant Heat Gain:
Elementary Schools:
200 BTUH Sensible & 150 BTUH Latent (Children)
250 BTUH Sensible & 200 BTUH Latent (Adults)
Middle & High Schools: 250 BTUH Sensible & 200 BTUH Latent

f. Occupant Hours
Elementary Schools = 7:00 AM to 3:00 PM
Middle Schools = 8:00 AM to 4:00 PM
High Schools = 7:00 AM to 3:00 PM
Note: School primary cooling system is traditionally shutdown at anywhere between 9:00 PM and 11:00 PM.

5. The Contractor shall be responsible to retain a Test & Balance (T&B) firm to balance the HVAC system to plus 10 or minus 5 percent of design values prior to Substantial Completion as part of his contract. Substantial completion shall not occur until 30 days after approval of certification by an independent T & B Consultant, under contract with the SBBC, who shall verify the results of the Contractor's T & B firm. Typical operational test and balancing shall include airside balance, waterside balance, smoke detectors, operational testing of controls, and fire and smoke damper testing.

6. Installation of rooftop equipment on newly constructed buildings such as cooling towers, rooftop air conditioning DX package units, ducts, CHW piping, exhaust fans, conduit, etc. is **PROHIBITED**. Exceptions will occur such as the replacement rooftop air conditioning units of existing schools, air intake hoods and split system condenser units (when installation on grade is not possible) provided for such areas as the media center, equipment room (ER), telecommunication room (TR), kitchen, graphic arts room, kiln room, chemical storage room, chemistry classroom purge fans, flammable storage room, fume hood, welding hood and other special ventilation systems. When the installation of rooftop equipment or piping is unavoidable such as for existing schools, permission and a waiver shall be requested from the SBBC Design Services Department. Upon approval, a minimum clearance of 18 inches above the finished roof shall be provided for all exhaust fans, air intake ventilators, HVAC equipment, etc. having a width of no greater than 36 inches.

7. For rooftop units having widths greater than 36 inches, clearance heights as outlined in the currently approved FBC - Building, Chapter 15, Table 1509.7 shall be used.

8. Minimum windload calculations for rooftop exhaust fans, air intake ventilators, HVAC equipment, etc. shall be required in accordance with the current ASCE Standard 7. Anchoring methods of these type rooftop equipment to the roof in order to sustain hurricane force winds as outlined in ASCE Standard 7 along with anchoring details shall be provided on the mechanical drawings and detailed on the structural drawings.

9. All rooftop exhaust fans, air intake ventilators HVAC equipment, etc. shall be designed and approved to sustain minimum 140 MPH hurricane force winds and shall require a Miami-Dade Product Approval Notice of Acceptance (NOA). For the EHPA, it is required that the exhaust fans…required for ventilation during hurricane periods…be designed to be of the inline type installed inside the building interior envelope and discharge through the side of the exterior wall in lieu of providing rooftop exhaust fans which would be exposed to hurricane damage.

10. For existing rooftop units such as A/C units, exhaust fans, air intake ventilators, HVAC equipment, etc. and their respective roof curbs or other rooftop mechanical equipment that do not contain a Miami-Dade NOA, calculations for anchoring methods to the roof shall be submitted by a registered engineer showing that the roof curb is designed and

constructed in accordance with the current ASCE Standard 7 to withstand the High-Velocity Hurricane Zone (HVHZ) wind loads, overturning moment and uplift in accordance with Sections 1620 and 1621 of the FBC – Building and Section 301.12 of the FBC – Mechanical. A signed and sealed drawing detail shall be provided to the SBBC indicating the means and method of attachment to withstand the calculated loads. If the calculated loads indicate that the existing roof curb does not meet the requirements, reinforcing of the roof curb shall be allowed as determined by the registered engineer.

11. **DO NOT** install any HVAC piping inside the block cores of building exterior concrete masonry unit (CMU) walls. Install all piping in furred walls or in pipe chases.

12. Ensure positive pressure in all areas except in kitchens, toilets, custodian rooms, science lab chemistry classrooms containing fume hoods, organic/inorganic storage rooms, locker rooms, etc. Building positive pressure shall not exceed 0.10 Inches of Water Column.

13. Show CFM values on all supply and return air openings so that the system can be properly balanced to the design value. Also provide a note or indicate if the supply air opening is 1-way, 2-way, 3-way or 4-way.

14. Noise levels due to air conditioning unit fan, ventilating equipment, ducts, grilles, diffusers and air system pressure reducing devices shall conform to the RC Noise Rating Procedure outlined in the latest edition of the ASHRAE HVAC Applications Handbook and ANSI S12.60 - Acoustical Performance Criteria, Design Requirements & Guidelines for Schools shall be:

    a. Classrooms RC-25(N) to RC-30(N)
    b Corridor, Lobbies RC-40(N)
    c. Chiller Rooms RC-60(N)
    d. Storage, Toilets, Custodial RC-45(N)
    e. Mechanical Rooms RC-45(N)
    f. Gymnasium RC-45(N)
    g. Kitchens RC-40(N)
    h. Prototyping Room RC-40(N)

    NOTE: Internally lined double wall insulated galvanized steel ducts shall be provided on all mechanical room supply and return air ducts for a distance of 20 feet to and from the air handling unit (AHU) discharge and return air openings. This applies to both low pressure constant air volume (CAV) and variable air volume (VAV) designed systems.

15. Should the air conditioning equipment noise levels exceed those listed above, other methods of reducing the noise levels shall be entertained and require approval by the SBBC Design Services Department.

16. Exterior installed air-cooled chillers, emergency generators, pumps, cooling towers and accessories shall be designed so that the noise levels do not exceed the Broward County Noise Ordinances, Chapter 27-7 noise recommendation of 55 dBA at the property line or be transmitted to an adjacent classroom. Should it be determined that a noise problem exists with an air-cooled chiller, the air-cooled chiller shall be provided with the chiller manufacturer's sound attenuation package similar to the powder coated metal sandwich panels provided with acoustical material installed between the metal sheets located on the inside face of the chiller enclosure.

17. Enclosures for air-cooled chillers shall be an aesthetically pleasing and sound attenuating CMU wall enclosure of a height not to exceed the height of the chiller by more than two

feet or as recommended by the manufacturer. The use of chainlink fencing is not approved.

18. Enclosures for cooling towers shall be an aesthetically pleasing CMU wall enclosure perforated on all four sides for ventilation and at a height not to exceed the cooling tower or as recommended by the manufacturer. The use of chain link fencing is not approved.

19. Grade mounted A/C equipment such as DX condenser units shall be installed on a concrete pad and enclosed within a 6 foot high chain link fence.

20. In existing school facilities requiring remodeling, renovation and/or new building additions...the following requirements shall be adhered to by the Project Consultant in order to ensure that final construction documents are correct and brought up-to-date.

    a. Field verification shall be performed by the Project Consultant. This is **MANDATORY!** The Project Consultant shall verify all existing conditions to ensure the feasibility of construction in order that the proposed work can be performed in a timely manner and to prevent conflicts and/or delays in the field during construction.

    b. A complete set of demolition plans for areas within the Scope-Of-Work shall be provided as part of the contract documents. Demolition plans shall include room FISH numbers, room names, **ALL** mechanical equipment such as AHUs, ductwork, ductwork sizes including CFM values, exhaust fans, natural or propane gas system, sanitary system, storm drain system, domestic water system plumbing fixtures, etc. whether the equipment or systems are to remain, to be removed or to be reused. Notations such as “EXISTING TO REMAIN” is insufficient and will not be approved.

    c. A complete updated set of remodeled or renovated plans for areas within the Scope-Of-Work shall be provided and shall include room FISH numbers, room names and all new mechanical equipment such as AHUs, ductwork sizes, supply and return air CFM values, exhaust fans, natural or propane gas system, sanitary system, grease waste system, acid waste system, storm drain system, domestic water system, plumbing fixtures, etc. Plans shall also include the new plumbing fixture count (fixture units) being added to the existing sanitary and the domestic water systems. Should new duct branches be added to the existing HVAC system or the existing duct be extended to serve new areas...the AHU and all terminal devices serving areas other than those in the Scope-Of-Work, but on the same HVAC zone including the outside air duct, shall also be properly rebalanced. The entire system along with the new CFM values shall be shown on the plans.

    d. When the Scope-Of-Work calls for the replacement of AHUs in existing facilities, new heat gain calculations shall be performed for the zones served by the AHUs being replaced in order to determine the capacity of the new AHUs that will be required. In addition, the existing chiller system shall be analyzed to verify that it is operating at optimum design parameters. The ventilation rate shall be based on the original design value. In the older schools, this value can vary between 5 to 7-1/2 CFM/Person. The heat gain calculations shall be provided in order to verify that the new AHUs are of the proper capacity. Otherwise, the new AHUs selected in-kind to replace the existing ones may be undersized or oversized due to the many changes that have occurred over the years such as the installation of new insulated roofs, increased student population, the addition of new computers, new lighting, etc.

    e. The Project Consultant shall design the new replacement AHUs to meet all the clearance distance requirements from existing electrical panels and other electrical equipment in accordance with the National Electrical Code (NEC).

    f. The Contractor shall verify that the new replacement AHUs are installed to meet all the clearance requirements from existing electrical panels and other electrical equipment in accordance with the National Electrical Code (NEC).

21. All existing HVAC equipment to be reused in existing school facilities requiring remodeling or renovation work shall be shown on schedules on the plans by the Project Consultant. The existing HVAC automatic temperature controls shall be upgraded to satisfy the life safety code and energy conservation requirements. All existing equipment, electrical data and capacities shall be listed so that proper testing and balancing can be performed. In addition, the Contractor shall provide a maintenance schedule describing all cleaning and repair work to be performed if required. The above work shall be documented on the Contractor's letterhead stationary in a service report format and demonstrated to the Owner for final approval.

22. Unless otherwise specified, when selecting either HVAC, plumbing or other mechanical equipment, a minimum of three manufacturers complete with selected series types shall be provided.

23. In new school facilities, all new AHUs shall be tagged and identified in a sequential numerical format. Included in the tagging identification shall be the building number followed by the AHU number and area served such as AHU-1-1/Media Center, AHU-1-2/Multipurpose/Dining Room, etc. Should the design include VAV boxes, all new VAV boxes shall be tagged and identified with the building number first followed by the AHU number and the VAV box number such as VAV 1-1-1, VAV 1-1-2, etc.

24. In existing school facilities requiring remodeling, renovations and/or new building additions, all new AHUs shall be tagged and identified in a sequential numerical format in sequence and in coordination with the existing AHUs so as not to repeat AHU numbers. Included in the tagging identification shall be the building number followed by the AHU number and area served such as AHU-1-1/ Media Center, AHU-1-2/Multipurpose/Dining Room, etc. Should the design include VAV boxes, all new VAV boxes shall be tagged and identified with the building number first followed by the VAV box number such as VAV 1-1-1, VAV 1-1-2, etc.

B. HVAC SYSTEM

1. For new building additions at existing elementary, middle and high schools…the Contractor shall perform a physical survey of the entire existing facility HVAC plant/equipment to determine if there is available tonnage capacity to connect the new building addition heat load to the existing HVAC plant/equipment. If there isn't sufficient tonnage capacity, a new dedicated air-cooled chiller shall be provided for the new building addition.

2. The basis of design for new elementary schools with heat gain loads of up to 300 Tons shall be an air-cooled chiller selected to provide 120 percent of the facility's calculated heat gain load. The air-cooled chilled water system shall be designed with multiple independent refrigerant circuits and a variable air volume (VAV) system. Take note that for additions to existing school facilities, the equipment for the new addition shall be selected to provide 100 percent of the facility's heat gain load in lieu of 120 percent.

3. The basis of design for new middle and high schools shall be dual water-cooled chillers selected to provide 120 percent of the facility's calculated heat gain load. The water-cooled chilled water system shall be designed with the primary chiller being a centrifugal chiller designed for 60 percent of the chilled water capacity and the secondary chiller being a screw chiller designed for 40 percent of the chilled water capacity. The system shall contain a primary and a secondary chilled water pumping system, dual variable speed cooling towers and a VAV system.

4. Both the air-cooled and water-cooled chilled water systems shall be designed so that each zone AHU not exceed a total of 20 HP connected fan motor load. Pre-conditioning of the outside air shall only be required for areas requiring greater than 25 percent outside air. One such area shall be the gymnasium/locker room where 100 percent outside air is required. Areas to be zoned separately are the administration area, media center, music area, kitchen, multipurpose/dining room, auditorium and the gymnasium/locker room. Additional cooling shall be provided on the stage when in usage for performances requiring stage lighting.

5. Extreme care shall be provided to maintain the proper humidity levels within conditioned spaces. The following is a minimum requirement that shall be followed:
   a. The use of VAV systems such as required for classrooms, administration areas, etc. with discharge temperature controls shall utilize pressure independent characterized control valves (PICCV) as manufactured by Belimo or 2-way, modulating chilled water valves with a 3-way, 2-position chilled water valve at the end of the loop to prevent pump dead-heading.
   b. In CAV systems such as required for the kitchen and the gymnasium/locker room, utilize pressure independent characterized control valves (PICCV) as manufactured by Belimo or 3-way, 2-position chilled water valves.
   c. Outside air intake ducts shall be directly connected to the AHU and positioned so that the outside air does not bypass the chilled water coil with untreated air.
   d. Use extreme care in areas with high ventilation rates such as auditoriums, gymnasiums/locker rooms, multipurpose/dining rooms, etc. to avoid excessive space humidity.
   e. Utilize an outside air pretreatment unit (PTU) to maintain proper space humidity and temperature conditions for areas where the outside air requirement is greater than 25 percent such as the gymnasium/locker rooms. Other than the gymnasium/locker rooms, there should be no need for an outside air PTU in any other area of new facilities when the proper engineering is performed.
   f. Maintain all conditioned spaces with positive pressure of a minimum of 0.10 Inches of Water Column positive pressure relative to the outdoor by supplying more outdoor air than total exhaust. Exceptions will occur such as in kitchens, toilets, locker rooms, etc. where negative pressure is a code requirement.
   g. Provide a fan powered building pressure relief exhaust system to exhaust the interior ventilation air requirements in accordance with ASHRAE Standard 62.1. The use of a gravity relief system is not approved.
   h. For VAV systems, all outside makeup air shall be provided by means of an inline supply fan sized to provide and maintain an outside air ventilation rate as required by the ASHRAE Standard 62.1.
   i. Electrically interlock the general exhaust fans with the AHUs serving that area and the outside air intake louver damper actuators to prevent the introduction of untreated outdoor air makeup air into the building when the chilled water system is shutdown. Should the chiller shut down during the occupied period due to voltage phase imbalance or other reasons, all AHUs shall be designed to shutdown and the outside air intake dampers shall close. The only exception to this will be the exhaust fans designed for continuous operation in specialty areas such as in the flammable storage room, organic/inorganic storage rooms, etc. Size all AHUs to avoid oversizing of the unit.

6. The water-cooled chillers shall be installed in parallel and be provided with primary/secondary loops. The primary loop pumps shall be designed with constant volume flow for the chillers while the secondary loop pumps shall be designed for variable volume flow for the building distribution to the AHU coils. Other methods providing energy savings such as providing variable volume flow on the primary loop shall be considered to determine its feasibility. In addition, automatic isolation valves

shall be provided on each of the chiller discharge chilled water piping in order to prevent CHW blending when one of the two chillers is cycled off.

7. A CAV system shall be selected for such areas as the kitchen, auditorium, gymnasium/locker rooms and the multipurpose/dining room. The multipurpose/dining room shall be provided with a single zone CAV AHU equipped with a variable frequency drive motor because of the variable loads and the large area involved. Pre-conditioning of the outside air shall only be required for areas requiring greater than 25 percent outside air such as the gymnasium/locker rooms where 100 percent outside air is required. In this case, each of the gymnasium/locker rooms shall be provided with a single zone CAV AHU equipped with an outside air PTU or a stacked dehumidification unit (SDU) consisting of an outside air cooling coil and filters. All other areas shall be provided with VAV air handling systems using variable frequency drive motors for fan control. Variable inlet vanes are **PROHIBITED**. Approved variable speed drive motor manufacturers shall be ABB ACH Series or Toshiba. **No other substitutes shall be approved**.

8. VAV boxes with electric strip heaters sized for 277 Volt/1 Phase shall be evaluated to select the system most appropriate for the project. Key evaluation criteria shall include, but not be limited to the following:
    a. Energy efficiency
    b. Life Cycle Cost
    c. Performance
    d. Comfort
    e. Sound Criteria
    f. Maximum zone size of 2000 CFM.
    g. Minimum air change rate as required to meet the proper room ventilation rates provided by an air makeup supply fan to ensure ventilation rates are satisfied.
    h. Classroom diffusers sized for a maximum of 275 CFM each and a maximum of 500 FPM neck velocity. All other non-classroom diffusers to also be sized for a maximum of 500 FPM neck velocity.

9. The central station air handling unit shall be double walled with 1 inch thick/3 PCF density or 2 inch thick/1-1/2 PCF density uncompressed insulation having a minimum R-value of 4.2 sandwiched between the two panels constructed of galvanize steel and contain a 4 inch flat filter section with access modules for coil maintenance. For systems designed as CAV systems, the AHU shall be furnished with a face and bypass damper section or a dedicated outside air cooling coil section such as the Trane SDU (Stacked Dehumidification Unit) in coordination with a pressure independent characteristic control valve or a 3-way, 2-position chilled water valve. Should the dedicated outdoor cooling coil section design concept be used, there will not be a need for a face and bypass damper section. For systems designed as VAV systems and containing a primary/secondary CHW pumping system, the AHU coil shall be furnished with a pressure independent characteristic control valve or a 2-way, modulating chilled water valve on the secondary loop and a 3-way, 2 position chilled water valve on the primary loop system. The cooling coil shall be designed to contain a minimum of six rows and a maximum of 8 to 12 Fins per Inch (FPI).

10. The AHU unit shall contain a sloped stainless steel drain pan with a bottom drain in lieu of a flat galvanized steel drain pan.

11. When the AHUs are provided with the manufacturer's minimum 6 inch factory installed rails, the use of the 6 inch concrete pads in the mechanical rooms shall not be required.

12. For VAV designed systems, the AHU shall be provided with air foil plug fans to reduce air turbulence and noise at the AHU discharge. Forward curved fans shall be provided for CAV designed systems. In either case, the outlet velocity shall be limited to 3000 FPM.

13. In existing school facilities or buildings designed with new or replacement air-cooled chillers or packaged rooftop A/C units, the coils shall be provided with a factory applied spray-processed coating for corrosion protection. The coating material and process as applied to fin tube coils shall provide an effective corrosion protection in a pH range of 1.0 to 14.0. The coils shall be prepared through the manufacturer's procedural cleaning steps allowing for drying prior to the coating process. A 0.5 to 1.0 dry mil thickness of acrylic polymer resin primer shall be applied by spray-coating and be fully cured prior to applying the protective finish coat. The coil corrosion protection coating shall be applied by spray application and builtup to a dry mil thickness of 2.0 to 3.0. The corrosion protection coating shall be builtup on the fin edges with a final four-step spray coating process applied to both sides of the coil. Protection shall be provided for the coil tubes from fluid infiltration during the coating process by maintaining a 50 PSI blanket of nitrogen on the fluid side. Coating materials shall have passed a **MINIMUM OF 1000 HOURS OF SALT SPRAY EXPOSURE** in testing performed by an independent laboratory in accordance with ASTM B117.85 standards. The coating shall be field-repairable and touchup product shall be available for this purpose. The company providing the coating process shall also provide a five year coil warranty. The entire coating process shall be similar to the Husky Coil Coat patented process as manufactured by Bronz-Glow Technologies, Inc. (Jacksonville, FL). Other approved coatings are as manufactured by Thermoguard (Coconut Creek, FL), Blygold (Ft. Lauderdale, FL) or Heresite (Manotowac, WI).

14. Typically, elementary school kindergarten through Grade 3 classrooms contain 1040 SF of classroom area plus 45 SF for the toilet for a total of 1125 SF. In middle and high schools, the classrooms are nominally 840 SF in size with the exception of the science classrooms which are approximately 1330 SF.

15. In elementary school classrooms, heat gain calculations are to be determined on the basis of eighteen students plus one teacher (nineteen occupants total) requiring approximately 830 to 1040 CFM per classroom (0.8 to 1.0 CFM/SF) with an outdoor air requirement based on ASHRAE Standard 62.1. Therefore in classrooms with ducted systems, use four supply air diffusers sized for aproximately 210 to 260 CFM per diffuser. Where this is not possible, confer with the SBBC Design Services Department prior to design for permission and a waiver.

16. In middle school classrooms, heat gain calculations are to be determined on the basis of twenty-two students plus one teacher (twenty-three occupants total). For high schools, it will be determined on the basis of twenty-five students plus one teacher (twenty-six occupants total). The quantity of supply air will be approximately 675 to 840 CFM per classroom (0.8 to 1.0 CFM/SF) with an outdoor air requirement based on ASHRAE Standard 62.1. Therefore in middle and high school classrooms with ducted systems, use four supply air diffusers sized for approximately 170 to 210 CFM per diffuser. Where this is not possible, confer with the SBBC Design Services Department prior to design for permission and a waiver.

17. When the EHPA is designed as a Special Needs Shelter, the designated Special Needs Shelter shall be provided with a dedicated packaged rooftop DX unit designed to maintain a temperature of 75 Degree F and a relative humidity of 50 percent for 72 hours (cooling only). The dedicated DX unit shall be electrically connected to the facility emergency generator so that it is operable during hurricane periods or when there is an electrical outage. The design of the dedicated DX unit shall be in addition to the chilled water air

conditioning provided by the primary HVAC chilled water system which is operable during the occupied non-hurricane periods.

18. In addition to the chilled water air conditioning provided by the primary HVAC chilled water system during the occupied periods, the media center, the single equipment room (ER), all telecommunication rooms (TRs), electrical rooms with transformers of 15 KVA or greater, elevator machine room and the kitchen dry storage room shall each be provided with 7 day/24 hour air conditioning through a dedicated DX split system unit or a ductless unit designed to maintain a temperature of 75 Degree F and a relative humidity range of 30 to 50 percent during unoccupied periods such as evenings, weekends and holidays when the chiller is shutdown.

19. There is only one ER containing the telephone and the computer server IT racks in a school facility which is traditionally installed in the media center, and one TR per building at a school facility. Should a building be a multiple story building, one TR per floor is provided.

20. The dedicated DX unit required for the media center reading room, ER, TRs, electrical rooms with transformers of 15 KVA or greater, elevator machine room and the kitchen dry storage room shall be properly sized for the heat gain loads occurring during the unoccupied periods when no lighting load, people load, solar load and ventilation air requirements are present. The condenser units shall be installed on grade whenever possible and enclosed within an 6 foot high chain link fence enclosure with a swing gate. Wall mounted condenser units shall be installed at a minimum height of 6 ft. 8 Inches AFF or AFG in accordance with Section 423.14.3 of the FBC - Building. Installation of the condenser unit on the roof shall be the last design option taken.

21. Each dedicated DX unit required for the media center reading room, ER, TRs and the kitchen dry storage room shall be provided with a digital thermostat set at 75 Degree F to start and stop the unit. The same will be provided for the elevator machine room and the electrical rooms containing transformers of 15 KVA capacity or greater except that the digital thermostat will be set at 80 Degree F. The digital thermostat shall **NOT** be of the programmable type.

22. In new school facilities, only the dedicated DX unit required for the ER, TRs, kitchen dry storage room and the EHPA Special Needs Shelter shall be electrically connected to the facility emergency generator so that it is operable during electrical outages. In existing school facilities, connection of the DX units to the facility emergency generator is not required.

23. The dedicated DX unit in the media center reading room shall be provided with a humidistat to energize the unit when the room relative humidity exceeds 60 percent RH and de-energize it when it falls below 60 percent RH.

24. Electrical rooms containing transformers of 15 KVA capacity or greater be provided with a dedicated DX unit…N**OT** exhaust fans. They shall be maintained at a temperature of 80 Degree F and a relative humidity range of 30 to 50 percent at all times including unoccupied periods such as evenings, weekends and holidays throughout the year. During the occupied periods, air conditioning shall be provided through the use of an A/C drop off the chilled water air system. During the unoccupied periods, the dedicated DX split unit shall energize on a rise in temperature of 80 Degree F.

25. Electrical rooms **NOT** containing electrical transformers **SHALL** be provided with exhaust fans controlled by a thermostat set at 80 Degree F. Makeup air requirements shall be provided with conditioned air transferred from adjacent classrooms or other

similar rooms required to be exhausted in accordance with ASHRAE Standard 62.1. This will eliminate the need to provide moist, laden outside air for makeup to the electrical room.

26. Condensate drywells of 18 inch Diameter x 18 Inches long shall be provided for DX units of 2-1/2 Tons or larger. For units of 2 Tons or smaller, condensate discharge onto the ground is approved.

27. In electrical rooms containing 150 Degree C rise, dry type electrical transformers and requiring the use of a dedicated DX ductless unit …the following estimated transformer heat loads can be used as part of the heat gain calculation for the room.

15 KVA/3,000 BTUH	75 KVA/ 9,500 BTUH	225 KVA/21,500 BTUH
30 KVA/5,000 BTUH	112 KVA/13,000 BTUH	300 KVA/25,000 BTUH
45 KVA/7,500 BTUH	150 KVA/16,000 BTUH	500 KVA/38,000BTUH

28. Multipurpose/dining rooms and classrooms with accordion partitions shall be treated as two separate areas and provided with ceiling supply diffusers and return air grilles in each separated area.

29. Mechanical rooms located on the building perimeter only shall be provided with a supply air diffuser supplying a minimum of 100 to 150 CFM (according to the room size) of conditioned air in order to prevent condensation from forming on the AHU casing. Interior mechanical rooms shall not require this provision.

30. The use of return air plenums, whether ceilings or mechanical rooms, in newly constructed facilities is **PROHIBITED**. The only exception being in existing school facilities already containing and using these spaces as plenums. In such cases, an effort shall be made to convert to a return air ducted system. In all other instances, the return air and outside air ducts shall be designed to connect directly to the AHU unit.

31. In order to minimize the introduction of moist laden outside air into the building interior during unoccupied periods such as evenings and weekends, provide a motor-operated, 2-position, low leakage outside air damper at each of the mechanical room outside makeup air openings arranged to open one-half hour before classes start and to close one-half hour after classes end. The low leakage motorized outside air dampers shall be programmed to remain closed during unoccupied evenings, weekends and holidays. The dampers shall also close if the chiller shuts down for any reason during the occupied periods such as during an electrical outage. Provision shall also be made for a manual volume damper on the duct downstream of the motorized outside air damper to properly balance the required quantity of outside air. Demand control ventilation (DCV) through the use of CO2 sensors or other approved method is to be explored in areas requiring large amounts of outside air such as the auditorium or gymnasium in order to minimize the introduction of untreated outside air makeup by modulation of the outside air damper.

32. If mechanical rooms are approved for use as return air plenums by the SBBC Design Services Department in existing school facilities requiring remodeling, renovations and/or additions…design the outside air supply duct so that it is connected to the return air duct. If this is not possible because of insufficient mechanical room size, locate the outside air supply duct as close as possible to the AHU inlet and direct it to the bottom portion of the cooling coil. In addition, the walls and doors of the mechanical room shall be sealed with moisture retardants and insulation so as to prevent air infiltration and heat intrusion.

33. The use of louvered doors for mechanical rooms is **PROHIBITED**. The exterior doors shall be solid and weather stripped to minimize air infiltration in order to prevent condensation from forming on the AHU casing and ductwork. For mechanical rooms, an

outside air makeup opening (transom) over the door shall be provided with a door-width, vertical rain-resistant louver equipped with a 2-position, motor-operated damper and a manual volume damper ducted to the air handling units. For VAV systems only, the outside makeup air shall be provided by means of an inline supply fan sized to provide and maintain a constant outside air ventilation rate in accordance with ASHRAE Standard 62.1.

34. Mechanical rooms in new school facilities shall be of sufficient size to provide the HVAC equipment manufacturer's recommended clearances for maintenance and servicing. **A MINIMUM OF THREE FEET CLEARANCE SHALL BE PROVIDED ON BOTH SIDES AND FRONT AND TWO FEET CLEARANCE ON THE REAR OF THE AHU**. In addition, provision shall be made to locate the exterior double doors to allow coil pull space for coil servicing, fan shaft and drive servicing, etc. as the need arises.

35. When the AHUs are provided with a minimum 6 inch factory installed rails, the use of the 6 inch concrete pads in the mechanical rooms shall not be required. Otherwise, a 6 inch concrete pad shall be required and shall extend a minimum of 4 inches beyond the AHU footprint on all sides unless otherwise noted and have 1/2 inch chamfered edges. All AHUs shall be installed on a 3/8" cross-ribbed, oil-resistant, resilient neoprene mounting pad between the unit and the concrete pad or rail. Ascertain that each AHU sits sufficiently high on the concrete pad or rail to enable adequate space for removal/replacement of the condensate trap.

36. In mechanical rooms, provide a floor drain at the rear or to the side of each AHU and as close as possible to the 6 inch concrete housekeeping pad or AHU base rail, whichever is applicable. Route each AHU condensate pipe to discharge into the floor drain or a safewaste that is connected to the floor drain and routed into the sanitary system. Verify that a 2 inch minimum air gap is provided on the discharge of each of the condensate pipes. Should connection to the sanitary system not be possible, provide a floor drain with a backwater valve and connect the condensate into the site storm drain system catch basins only after permission and a waiver is granted by the SBBC Design Services Department prior to design. Floor drains installed in front of the AHU where they can become a tripping hazard are **PROHIBITED**.

37. In the chiller plant, the Contractor shall make provision to drain the pot feeder into a sanitary floor drain located in or under the pot feeder via an air gap. Verify that a 2 inch minimum air gap is provided on the pipe discharge into the floor drain. Discharge onto the floor slab or into the ground is **PROHIBITED**.

38. In each mechanical room, provide a hose bibb installed adjacent to the exterior double door at a height of 30 inches. In addition to coil cleaning…the hose bibb shall also be used for outdoor cleaning purposes if the mechanical room is located on the building perimeter. This will eliminate the use of an additional exterior mounted wall hydrant if one is located in that immediate area. Take note that hose bibbs shall only be approved for mechanical rooms. All other interior and exterior areas requiring a need for domestic water shall be provided with wall hydrants which shall also be installed 30 inches above finished floor or finished grade.

39. When designing the Automatic Temperature Control (ATC) System, make it simple and easy to operate. Maintain the "**KISS**" principal. The ATC system for new schools, existing schools scheduled to be demolished and replaced as new schools through a construction phasing program, new building additions or existing schools requiring replacement of their existing ATC system shall be provided with a Direct Digital Control (DDC) automatic temperature control system as manufactured by TAC-Andover Controls "Continuum" or Johnson Controls "Metasys".

40. The installation of wall mounted thermostats (other than sensors) in classrooms and other areas where they are accessible to unauthorized personnel such a teachers, students, etc. is **PROHIBITED**. For CAV systems, the thermostat shall be installed in the return air duct to average out the return of the various zones served by the associated AHU. For VAV systems, the thermostat shall be installed in the neck of the return air duct above the return air grille with a sensor installed inside the room.

41. All AHU motors…with the exception of fractional HP motors…shall be NEMA standard design, sound rated and be of the grease lubricated ball bearing type. Motors shall be high efficiency types wound for specified voltage, have a minimum power factor of 85 to 100 percent load and a minimum efficiency of 91.7 percent at 100 percent load per IEEE Test Procedure 112, Method B.

42. All AHU three phase motors shall be protected against contact failure, loss of any phase (single phasing), low voltage, high voltage, voltage imbalance and phase reversal. The protection device shall be capable of providing automatic power system range sensing; adjustable trip delay, restart delay and voltage adjustment; imbalance trip indicator; LED status readout and shall be as specified in the SBBC Electrical Design Criteria.

43. All rooftop exhaust fans, air intake ventilators, rooftop HVAC equipment, etc. shall be designed and approved to sustain minimum 140 MPH hurricane force winds and missile impact criteria in accordance with ASCE Standard 7. In addition, they shall possess a Miami-Dade Product Approval Notice of Acceptance (NOA).

44. During hurricane periods, provision shall be made in the EHPA only to shutdown the AHUs serving that area and fully closing the motorized outside air dampers when the emergency generator energizes the EHPA ventilation system. During non-hurricane periods, the EHPA ventilation system shall be de-energized, but shall be provided with an electrical relay in order to exercise these fans under normal operating power.

45. In the EHPA and with the exception of the EHPA Special Needs Shelter, inline exhaust fans shall be provided in the building interior in lieu of rooftop exhaust fans in order to minimize hurricane damage to the fans. The Special Needs Shelter shall be provided with a dedicated packaged rooftop DX unit for cooling only.

46. Provide Y-type strainers with blowdown valves on the CHW supply line upstream of each AHU cooling coil. Also provide a drain valve and air vent directly on each of the cooling coils.

47. During construction, all AHUs shall be fitted with 4 inch depth, UL Class 2, medium efficiency, disposable extended area, MERV 13 filters with an atmospheric dust spot (ADS) efficiency of 80-85 percent in accordance with ASHRAE Standard 52.1. In addition, all supply and return air ductwork openings shall be fitted with blanket type, disposable polyethylene sheet in order to prevent construction debris from entering and accumulating inside the duct surfaces. At the discretion of the Owner's representative, the AHU air filters may be removed and replaced as needed in order to maintain the cooling coil and system clean. Prior to test and balance, the 4 inch construction air filters shall be removed and replaced with a new set of 4 inch final air 80-85 percent ADS efficiency MERV 13 filters and the ductwork opening polyethylene sheets shall be removed and discarded. The filters installed in the AHUs shall be taped to each other to facilitate filter removal and prevent air bypass. The Contractor shall provide a metal strap with the end turned up at the bottom and ends of each AHU filter frame to facilitate sliding the filters out for easy removal and replacement.

48. An analog type differential pressure gauge shall be provided across the AHU filters to monitor dirty filter conditions. The gauges shall be marked to show clean filter and dirty filter conditions.

49. In a design containing a VAV system, the specification shall include a statement that a total of four hours shall be provided for training SBBC/PPO Maintenance Department personnel by the VAV box manufacturer's technical representatives. The training shall be comprised of classroom instruction and hands-on-training.

50. A simplified Sequence of Operation geared to a non-technical individual of high school education explaining the HVAC system operation and corresponding to the actual devices used shall be installed behind a plexiglas or lexan cover adjacent to the Central H.O.A. Control Panel and in each mechanical room. The transparent cover shall be permanently anchored to the wall at a height of 5 feet to the bottom of the cover. An electrical schematic drawing of the equipment shall also be provided in a similar manner for use by the SBBC/PPO Maintenance personnel during servicing of the equipment.

C. DUCTWORK

1. Single line duct drawings shall only be approved up to and including the Phase II submittal. All ductwork shall be drawn in doubleline for the Phase III 50 and 100 percent submittals.

2. The use of fiberglass duct board for duct construction or exposed fiberglass duct liner is **PROHIBITED** in all existing or new school facilities.

3. The supply and return air ductwork for medium pressure VAV designed systems shall be fabricated of galvanized steel. For low pressure CAV designed systems, galvanized steel or phenolic foam pre-insulated board as manufactured by Kingspan, Tradename "Koolduct" shall be used. The use of Kingspan "Koolduct" for medium pressure duct is **PROHIBITED**. Installation shall be in compliance with SMACNA "HVAC Duct Construction Standards Metal and Flexible".

4. All exhaust and outside air ductwork shall be fabricated of galvanized steel with the exception of specialty exhaust systems such as the shower/locker room exhaust, swimming pool equipment room exhaust (aluminum), kitchen hood exhaust (stainless steel), fume hood exhaust (stainless steel), organic/inorganic storage room (chemically coated stainless steel), battery storage room (chemically coated stainless steel), dishwasher exhaust (stainless steel), etc. Installation shall be in compliance with SMACNA "HVAC Duct Construction Standards Metal and Flexible".

5. In either CAV or VAV designed systems, only internally lined double wall insulated galvanized steel ducts shall be provided on all mechanical room supply and return air ducts for a distance of 20 feet to and from the AHU discharge and return air openings. The use of phenolic foam pre-insulated board as manufactured by Kingspan, Tradename "Koolduct" in mechanical rooms is **PROHIBITED**.

6. For medium pressure systems, ductwork shall be round or flat oval duct fabricated of galvanize steel. Rectangular duct is **NOT** approved for medium pressure ductwork.

7. For low pressure ductwork systems, rectangular, round or oval duct fabricated of galvanized steel or phenolic foam pre-insulated board as manufactured by Kingspan, Tradename "Koolduct" can be used.

8. For low pressure rectangular galvanized steel ductwork, ensure that the duct is fabricated with Pittsburgh spiral lock seam construction.

9. For medium pressure single wall and double wall round or flat oval galvanized steel ductwork, ensure that the galvanized steel ductwork is fabricated with spiral lock seam construction. Snaplock seam construction of any variety for medium pressure galvanized steel ductwork is **PROHIBITED**. Fittings are to be fabricated by the same manufacturer as the ductwork

10. For low pressure single wall and double wall round or flat oval galvanized steel ductwork, ducts with dimensions greater than 12 inches are to be fabricated with spiral lock seam construction. Snaplock seam construction on round or oval galvanized steel ductwork of 12 inches or less is permissible. Snaplock seam constructed steel duct greater than 12 inches in size is **PROHIBITED.**

11. Whenever possible, design the return air ductwork so that it is routed along the exterior building perimeter

12. In order to attenuate noise and for flexibility, use UL 181 Class 1 commercial grade insulated flexible duct to connect the supply air diffusers and return air grilles to the supply and return air distribution duct. Flexible duct shall have a minimum R-value of 6.0 and be constructed of an aluminum foil laminate inner core liner encapsulating a steel wire helix, factory installed high density fiberglass blanket insulation and a metalized reinforced vapor barrier jacket similar to Omniair Series 1200, Thermaflex MKE or Flexmaster Type 5M. **Hard duct drops should only be used as a last option when there is no ceiling space or no ceilings at all**.

13. Flexible duct shall be one-piece, **8 F00T MAXIMUM** in length and shall not be installed so that it lies on the ceiling or is kinked. Spliced duct is **PROHIBITED**.

14. Clearance from the top of the acoustical ceiling tile to the bottom of the insulated ductwork shall be a minimum of 7 inches to account for lighting fixtures clearance.

15. In order to attenuate noise from individual toilets or offices, provide u-shaped ceiling transfer ducts with 90 degree miter fittings as air makeup ducts in lieu of door louvers or door undercuts. The transfer duct and grilles shall be designed in accordance with Section 601.4 of the FBC – Mechanical.

16. Duct sealers such as mastic shall be water-base, fire resistive, non-toxic and compatible with mating materials. Under no circumstances will the use of a petroleum-based products be permitted for duct or insulation sealant or adhesive purposes. Mastic sealant shall be applied to all duct transverse joints and longitudinal seams. All adhesives and sealants installed in the building interior shall meet the testing and product requirements of the South Coast Air Quality Management District (SCAQMD) Rule #1168.

17. Galvanized steel supply and return air ducts installed in unconditioned concealed areas such as above ceilings shall be insulated with fiberglass blanket insulation having a minimum R-6 insulation value.

18. In mechanical rooms containing exposed ductwork, only double wall insulated galvanized steel duct shall be provided on the supply and return air ducts for a distance of 20 feet to and from the AHU discharge and return air openings.

19. All exposed and uninsulated galvanized steel ductwork such as in the gymnasium shall be cleaned, primed and painted with two coats of low VOC paint. The color shall be

selected by the architect. All paints and coatings installed in the building interior must meet the testing and product requirements of the 1997 Green Seal Standard GS-03 Second Edition for anticorrosive and anti-rust paints applied to interior metal ferrous surfaces and GREENGUARD™ Product Emission Standard for Children & Schools for all interior and coating applications.

20. On existing buildings containing rooftop ductwork requiring replacement, verify that the top surface of the duct is pitched so that it sheds rainwater in accordance with Section V of the SMACNA Flexible Metal Duct Construction Standards. In projects where the exterior ductwork is to be replaced, provide aluminum round duct in lieu of rectangular galvanize steel ducts. The installation of rectangular galvanized steel ductwork on rooftops of existing or newly constructed buildings is **PROHIBITED**. The only exception is for the kitchen hood supply fan when the supply air duct is extended to achieve the 10 foot separation between the hood supply and exhaust air openings.

21. The supply and return air ducts shall be provided with 45 degree shoetap takeoffs and volume dampers. Should the 45 degree shoetap takeoffs not be appropriate such as for rectangular ducts, two-piece round bellmouth spinin takeoffs such as manufactured by Buckley or two-piece conical takeoffs provided with volume dampers will be acceptable. **THE USE OF ANY 90 DEGREE BRANCH SPININ TAKEOFF SHALL NOT BE APPROVED**.

22. Supply and return air duct branches or sub-branches are to be provided with volume dampers for balancing purposes. The terminal devices **SHALL NOT** contain dampers (registers). Registers are subject to tweaking by unauthorized individuals which will result in unbalancing of the air side system. **THE USE OF ANY AIR TURNING DAMPER OR EXTRACTOR SHALL NOT BE APPROVED**.

23. The smoke detector shall be installed in the supply air ductwork downstream of the AHU unit discharge but before the electric resistance duct heater. Smoke detectors shall not be required on the ducts of AHUs having a capacity of less than 2000 CFM or in areas having a dedicated unit with a population of less than fifty people.

24. HVAC or exhaust ducts shall not be supported from joist cross and lateral bracing or from galvanized steel decking. Should the deck be constructed of concrete, support from the concrete deck will be permitted with concrete anchor fasteners after concrete is poured and completely cured. Powder-actuated stud fasteners are **NOT** approved for concrete decks.

25. During duct installation, provide temporary closure such as with taped polyethylene sheet on all open ductwork to prevent construction dust from entering and accumulating inside ductwork.

26. After installation and prior to test and balance, the duct system shall be cleaned by forcing high velocity air through it to remove the accumulated construction dust. To obtain sufficient air, half the system should be cleaned at a time dependent on the system size. Equipment that may be subject to damage from excessive dust or dirt shall be protected with construction filters or bypassed during cleaning.

27. A duct leakage test shall be performed on all medium pressure duct systems operating at pressures of 3 Inch WC or greater prior to being insulated in order to determine the integrity of the duct. Maximum duct leakage rate shall not exceed 2 percent of the total design CFM at 1-1/2 times the design external static pressure. Low pressure duct systems are not required to have a duct leakage test performed.

28. The Contractor shall be responsible for the hiring of a certified test and balancing firm to perform a complete test and balance of then HVAC system. Upon completion, the SBBC…at its option… shall certify the readings with the use of its own independent test and balancing firm.

29. For grid type ceilings, the ceiling supply air diffusers shall be a layin aluminum louvered diffusers with 2'x2' extended panels and round necks similar to the Titus TDC-AA. Ceiling return air grilles shall be aluminum hinged, louvered or eggcrate types provided **WITHOUT** filters similar to the Titus #350FFL or Titus #50FF, respectfully. The top panel of both the supply air diffusers and the return air grilles above the ceiling shall be fully insulated to prevent condensation with the outer edges of the insulation adhered to the ceiling grid with silver foil tape. The use of perforated type diffusers for supply air is **PROHIBITED**!

30. For the kitchen only, the ceiling supply air diffusers shall be surface mount aluminum louvered types similar to the Titus TDC-AA. For ceiling supply air diffusers located within ten feet of the kitchen hood perimeter, the diffusers shall be perforated type without pattern controllers similar to the Titus #PAR-AA. Ceiling return air grilles shall be aluminum hinged, louvered types provided without filters similar to the Titus #350FFL or Titus #50FF, respectfully. The top panel of the both the supply air diffusers and the return air grilles above the ceiling shall be fully insulated to prevent condensation. The use of perforated type diffusers for supply air is **PROHIBITED**.

31. In buildings not containing a supervised automatic fire sprinkler system, duct openings in the one hour fire rated corridor shall be protected with either fire dampers or smoke dampers whichever is applicable.

32. Duct openings in a smoke barrier or corridor walls shall be provided with smoke dampers in accordance with Sections 607.3.2 and 607.3.3 of the FBC - Mechanical. Duct penetration into the corridors shall be minimized in order to reduce the number of smoke dampers and smoke detectors. Electrical connection shall be performed by the fire alarm specialist.

33. Where a smoke damper is required in the corridor wall, a smoke detector shall be installed in the duct within five feet of the smoke damper. See Section 607.3.2.1 of the FBC – Mechanical for the other four methods of use for the smoke detectors. Electrical connection shall be performed by the fire alarm specialist.

34. When applicable, the wall opening for a duct penetration through a fire rated wall where a fire damper is not required shall be provided with a 12 inch long by 0.06 inch thick steel sleeve secured to both sides of the wall with steel retaining angles and the annular space between the steel sleeve and the wall opening shall be filled with mineral wool. See Section 607.5.3 of the FBC - Mechanical for the other five exceptions to the use of fire dampers. Electrical connection shall be performed by the fire alarm specialist.

35. All fire dampers, smoke dampers, electric duct heaters and automatic temperature control devices shall be provided with access doors of the maximum size permitted by the duct dimensions in accordance with Section 607.4 of the FBC - Mechanical, but no less than 18"x18". Access doors shall be hinged with cam latches and fully gasketed to the perimeter. Keep in mind that access doors for access to the heaters in VAV designed systems are not required.

36. After completion of the fire or smoke damper installation, screws provided on the duct breakaway joint used during installation are to be removed.

37. **Mechanical room plan and elevated sections shall be provided at a minimum scale of 3/8 inch per foot**. Design drawings shall include the project name and names of the Project Architectural and Engineering Consultants, Contractors, Subcontractors and/or supplier. Contractor shop drawings for duct systems shall be provided at a minimum scale of 1/4 inch per foot on reproducible transparencies and shall indicate the architectural and structural backgrounds with room names and FISH numbers, etc., including but not limited to plans, sections, elevations, details, etc.; fabrication and erection dimensions; necessary details including complete information for making connections to air distribution devices and air handling units; material and finish types, descriptive names of equipment, etc.

D. CHILLERS

1. For non-LEED designed elementary schools, provide an air-cooled chiller with multiple refrigeration circuits. For middle and high schools, provide dual water-cooled chillers installed in parallel and containing primary and secondary loops. Size chiller for 120 percent of the facility calculated heat gain load to allow for future building expansion.

2. For LEED designed elementary schools, the basis of design shall be a dual water-cooled chillers selected to provide 120 percent of the facility's calculated heat gain load. The water-cooled chilled water system shall be designed with the primary chiller being a centrifugal chiller designed for 60 percent of the chilled water capacity and the secondary chiller being a screw chiller designed for 40 percent of the chilled water capacity. The system shall contain a primary and a secondary chilled water pumping system, variable speed cooling towers and a VAV system.

3. The basis of design for middle and high schools shall be dual water-cooled chillers selected to provide 120 percent of the facility's calculated heat gain load. The water-cooled chilled water system shall be designed with the primary chiller being a centrifugal chiller designed for 60 percent of the chilled water capacity and the secondary chiller being a screw chiller designed for 40 percent of the chilled water capacity. The system shall contain a primary and a secondary chilled water pumping system, variable speed cooling towers and a VAV system.

4. Water cooled chillers shall be either screw of centrifugal, contain refrigerants not scheduled to be phased out immediately such as HCFC-123, HFC-134A or HFC-410A. The use of reciprocating type chillers is approved only when either screw or centrifugal chillers are not available. Air-cooled chillers shall contain HFC-410A or other approved refrigerant. The use of HCFC-22 refrigerant is **PROHIBITED**. In either case, chiller selection shall based on a minimum of 44 Degree F leaving water temperature (LWT) and a 12 degree delta temperature.

5. For dual water cooled chillers installed in parallel, provide automatic isolation valves on the discharge CHW piping of each chiller to prevent CHW blending when one chiller is cycled off.

6. In addition to the standard manufacturer's one year parts and labor warranty on the chiller, an extended four year parts and labor warranty on the chiller compressor and motor shall be required.

7. During the occupied periods, a voltage imbalance on 3-phase systems (aka. under-voltage) may cause the chillers to shutdown. The calculated phase-to phase voltage imbalance should be opened up to the FPL recommended values of 3 percent voltage and 30 percent current. In order to protect the chiller and avoid the shutdown, select the chiller motors with operating limits of 480V plus or minus 7.5 percent (444V to 516V) so

that they can operate at minimum imbalance settings of plus or minus 2.5 percent voltage and plus or minus 25 percent current. In addition, should protection devices be required, they shall be capable of providing automatic power system range sensing; adjustable trip delay, restart delay and voltage adjustment; imbalance trip indicator; LED status readout and shall be as specified in the SBBC Electrical Design Criteria.

8. For existing school facilities scheduled to have new classroom building additions, but having the existing chilled water capacity maxed out, a dedicated air-cooled chiller for the new building addition may be selected and sized for 100 percent of the new building addition's calculated heat gain load. The dedicated air-cooled chiller shall not be oversized. Also, take note that packaged modular air cooled chillers are not approved.

9. Chillers shall be provided with the manufacturer's microprocessor module in addition to an internet interface to the school based TAC-Andover Energy Management/Security (EM/S) System. The EM/S System shall be able to monitor, display and control the data available from the chiller microprocessor module. The chiller shall be "Enabled" by a single contact closure at the Central H.O.A. Control Panel.

10. The chiller manufacturer shall provide all the recommended high and low alarm limits to be set on the EM/S System.

11. When the existing water-cooled or air-cooled chiller is to be replaced at an existing school facility, the replacement chiller must be specified within the FPL Retrofit Program criteria. This also applies to new chillers installed at new facilities. Under this program, the minimum EER for air-cooled chillers shall be 9.6. For water cooled chillers, the maximum KW/Ton shall be 0.65 for chillers less than 150 Tons; 0.58 for chillers of 150 to 300 Tons; and 0.53 for chillers greater than 300 Tons. FPL will pay a percentage rebate to the SBBC of the cost including labor and materials to install a new chiller or replace the existing chiller and its associated appurtenances. For further information, please contact the FPL Program Specialist at (954) 321-2162.

12. Refrigerants from all existing water-cooled chillers at existing school facilities scheduled for replacement and containing CFC-11, CFC-12 or HCFC-22 shall be recovered by SBBC/PPO Maintenance Department personnel. All other HVAC equipment refrigerant recovery shall be the responsibility of the Contractor in compliance with the Clean Air Act.

13. The chiller water makeup line shall be provided with a pressure reducing backflow preventer similar to the Wilkens #975RPZ or Watts #909RP backflow preventer to prevent contamination of the domestic water line. Unless the design criteria requires a higher pressure, adjust the PRV to maintain 12 PSI pressure on the chilled water pump suction.

14. Refrigerant discharge to the atmosphere is permitted solely for the water-cooled chiller pressure relief device or rupture seal. In compliance with Section 608 of the Clean Air Act, venting chiller refrigerant into the atmosphere via the same device during servicing or disposing of HVAC equipment is **PROHIBITED**.

15. All water-cooled chillers containing either Group A1 refrigerants such as HFC-134A or Group B1 refrigerants such as HCFC-123 shall be provided with a dedicated exhaust fan and oxygen deprivation sensors to monitor any refrigerant leak and to warn of oxygen levels below 19.5% in accordance with ASHRAE Standard 15. Upon activation, the sensor shall activate an alarm located at all entrance doors to the chiller room and start the exhaust fan to create room negative pressure. Air makeup shall be provided by means of wall louvers or other method approved by the SBBC Design Services Department.

16. The Contractor shall furnish the initial treatment of the chilled water system. Subsequent treatment of the chilled water system and all treatment of the condenser water system shall be furnished, installed and maintained by the SBBC PPO/Water Treatment Department. The Contractor shall be responsible for furnishing and installing the chemical pot feeder, wells, taps, electrical service, the required piping connections and a sanitary floor drain to drain the pot feeder. The electrical services shall include a 120 Volt dedicated service to the water treatment system and a 120 Volt hookup to the solenoid for bleed purposes. The Contractor shall confer with the SBBC PPO/Water Treatment Department, Telephone # (954) 790-2384, for directions required in the installation of this equipment.

17. In the chiller plant, the Contractor shall make provision to drain the pot feeder into a sanitary floor drain located in or under the pot feeder via an air gap. Verify that a 2 inch minimum air gap is provided on the pipe discharge into the floor drain. Discharge onto the floor slab or into the ground is **PROHIBITED**.

18. When replacing or installing a new water-cooled chiller, the specification shall include a statement that a total of fifteen hours shall be provided for training SBBC PPO maintenance personnel by the HVAC manufacturer's technical representatives. The total should be comprised of seven and one-half hours of classroom instruction and seven and one-half hours of hands-on training. A total of seven and one-half hours training shall be provided for air-cooled chillers. Training should start at the time of equipment startup and be completed prior to Substantial Completion.

E. COOLING TOWERS

1. Provide a stainless steel mechanical-draft, counterflow, vertical discharge, variable speed cooling tower with a stationary water distribution manifold, stainless steel hardware, a maximum of 0.005 percent drift loss of design GPM flow rate and capable of cooling water from 95 Degree Fdb to 85 Degree Fdb at an entering wet bulb temperature of 80 Degree Fwb. New cooling towers shall be factory CTI certified and provided with the manufacturer's performance guaranty. Factory certification is preferred, but field certification by CTI certified personnel shall be acceptable. Take note that installation of cooling towers atop roofs is **PROHIBITED**.

2. The cooling towers shall be designed for variable speed through the use of a variable frequency drive motors. When towers with capacities greater than 200 Tons are gear driven, the speed reducer gear shall be rated in accordance with the practices of the American Gear Manufacturer's Association using a service factor of 2.0 for cooling tower service in accordance with CTI Standard 111. The gear reducer shall be of the spiral bevel, single reduction oil fill type of industrial grade as manufactured by Flenders-Motox, Amarillo, Hub City or approved equal. Gear driven towers shall be provided with variable frequency drive (VFD's) motors, when specified, similar to those manufactured by ABB ACH Series or Toshiba in addition to a one year parts and labor warranty. No other VFD manufacturer shall be approved.

3. SBBC approved towers are the Evapco Series ICT-SST, American Cooling Tower ACF Series, Thermal-Care-Mayer Series FC and the BAC Ultralite. Approved gear driven towers are the Evapco Series USST, American Cooling Tower ACF Series, Marley NC Diamond Series and the BAC JE Premier Series.

4. Select two cooling towers or multiple cell towers in lieu of one tower in order to prevent system downtime. On multiple towers having a common condenser water system, an equalizer line shall be provided between both tower sumps and contain a manual butterfly valve for servicing. In addition, provision shall be made for an internal service

working platform and a heavy duty ladder to be used to replace the tower fan motors and drive assemblies. Take note that the ladder shall not be required, nor desired, to be provided with a 3 foot ladder extension to grade.

5. Provision shall be made to drain the cooling tower overflow and basin into a 4 inch sanitary area drain located under the tower in the tower foundation pad via an air gap. Discharge into the ground is **PROHIBITED**.

6. The tower enclosure shall be provided with a hose bibb within the enclosure for maintenance purposes. Hose bibb shall be installed 30 inches above finished grade.

7. When the tower enclosure is installed adjacent to a building, verify that the tower fan discharge is above the building height and that the manufacturer's recommended distance between the tower and the building is achieved.

8. When the tower enclosure is installed away from buildings, verify that the CMU enclosure shall be the same height of the tower fan discharge. Height of the CMU enclosure shall not exceed the tower height.

9. PVC pipe shall be used only for the above ground condenser water connection to the cooling tower within the tower enclosure in lieu of black steel piping. This is due to the deterioration of steel piping caused by the tower overdrift spray which the steel pipe would be constantly exposed to if used.

10. For optimum chiller performance, provision shall be made to have the chiller based microprocessor module cycle the cooling tower fans in lieu of an aquastat since the microprocessor module provides more stringent control of the condenser water temperature.

F. VENTILATION AND EXHAUST

1. All rooftop exhaust fans, air intake ventilators, etc. shall be designed and approved to sustain minimum 140 MPH hurricane force winds and shall require a Miami-Dade Product Approval Notice of Acceptance (NOA).

2. Individual toilet exhaust fans located in the same zone or in adjacent toilets shall be combined in order to minimize the number of exhaust fans in that zone in addition to reducing the EM/S points for fan ON/OFF operation.

3. The use of toilet ceiling and inline exhaust fans with sidewall exhaust discharge is highly encouraged and preferred in lieu of rooftop exhaust fan installation in order to minimize rooftop equipment. If rooftop exhaust fan installation is the only option, install a roof curb having a minimum clearance of 18 inches above the finished roof. The roof curb shall be Model GPI as manufactured by Greenheck or approved equal. Minimize all roof penetrations at all times in order to prevent potential roof leaks.

4. In building perimeter toilets and custodian rooms, use ceiling exhaust fans containing gravity dampers and terminating with a brick vent or extruded aluminum louver such as manufactured by Greenheck Model SP or approved equal. Air makeup shall be provided from adjacent classrooms or other similar rooms required to be exhausted to the exterior in accordance with ASHRAE Standard 62.1.

5. The use of door undercuts on exterior doors to provide air makeup is **PROHIBITED**.

6. All classroom toilet exhaust fans as well as interior area toilet exhaust fans shall be started and stopped by a single zone switch on the TAC-Andover Central H.O.A. Control Panel already dedicated to close the outside air damper of the AHU serving that zone. These areas shall be continuously exhausted during occupied periods. The low leakage outside air damper shall close one-half hour after classes end and remain closed during evenings, weekends and holidays when the building is unoccupied.

7. In addition to being controlled by a zone switch on the Central H.O.A. Control Panel, the group toilet exhaust fans located in the EHPA shall be electrically interlocked to the emergency generator powered ventilation system so that they are energized during hurricane periods in order to provide exhaust of toilet room odors.

8. In new school facilities, the flammable storage room exhaust fan shall be electrically interlocked to the emergency generator so that they are energized at all times during non-hurricane and hurricane periods in order to provide continuous exhaust in these rooms so as to prevent any flammable vapor buildup. Flammable storage rooms in existing schools shall not require this provision.

9. All general purpose exhaust fans in non-classroom areas such as gymnasiums, auditoriums, etc. shall be electrically interlocked to the H.O.A switch on the Central H.O.A. Control Panel which is interfaced to the school based TAC-Andover Energy Management/Security (EM/S) System. The general purpose exhaust fans shall shutdown one-half hour after classes end and remain closed during evenings, weekends and holidays when the building is unoccupied.

10. All custodian room exhaust fans shall be electrically interlocked to the AHU serving that zone so that the exhaust fan operates when the AHU is energized. The custodial closet shall be continuously exhausted during occupied periods and shutdown after custodial cleaning has been completed in the evening. The AHU low leakage outside air damper shall close one-half hour after classes end and remain closed during evenings, weekends and holidays when the building is unoccupied.

11. All electrical rooms **NOT** containing electrical transformers shall be provided with exhaust fans started and stopped by a wall mounted thermostat set at 85 Degree F. These rooms shall be continuously exhausted during occupied periods. Conditioned air in lieu of moist, laden outside air for air makeup requirements shall be provided from adjacent classrooms or other similar rooms required to be exhausted to the exterior in accordance with ASHRAE Standard 62.1.

12. In the flammable storage room, provide a mechanical ventilation system consisting of an explosion-proof upblast exhaust fan sized for ten Air Changes/Hour or 6 Air Change Minutes. The galvanized steel exhaust duct main shall split into two vertical branches extending from floor to ceiling in order to exhaust fumes from both the floor and ceiling levels.

13. In the equipment storage room containing lawn mowers and gasoline cans, provide a mechanical ventilation system consisting of an explosion-proof upblast exhaust fan sized for ten Air Changes/Hour or 6 Air Change Minutes. The galvanized steel exhaust duct main shall consist of one vertical branch extending from floor to ceiling in order to exhaust fumes from both the floor and ceiling levels.

14. In the kitchen and multipurpose/dining room, provide full door width, corrosion-resistant galvanized steel insect fly fans with adjustable full length discharge nozzles over every exterior door. Ensure that each insect fly fan unit is energized with a door microswitch for automatic operation.

15. The high school science lab material storage/preparation area organic and inorganic storage rooms shall each be provided with continuous operating, explosion-proof upblast exhaust fans sized for twenty Air Changes/Hour or 3 Air Change Minutes. The exhaust fans shall run continuously. The stainless steel exhaust ducts shall extend from floor to ceiling in order to exhaust fumes from both the floor and ceiling levels. In addition, a factory applied chemical resistant coating such as Eisenheiss or approved equal shall be applied to all the exhaust fans. Makeup air shall be provided shall be provided from adjacent classrooms or other similar rooms required to be exhausted to the exterior in accordance with ASHRAE Standard 62.1. Should that not be possible, makeup air shall be provided by means of an outside makeup air duct containing a fire damper and a grille which shall be chemical resistant coated.

16. In the high school science lab material storage/preparation area and the science lab classrooms containing fume hoods only, provide a dedicated mechanical exhaust system consisting of an explosion-proof upblast purge fan sized for twenty Air Changes/Hour or 3 Air Change Minutes and coated with a chemical resistant coating. The exhaust air duct shall be fabricated of stainless steel or chemical resistant coated galvanized steel. The exhaust fan shall be manually started and stopped by an ON/OFF wall mounted switch located behind the teacher's demo table and provided with an engraved sign stating **"OPERATE PURGE FAN WITH CLASSROOM DOORS OPEN"**. Makeup air can be provided by the AHU system's supply air diffusers to the classroom while simultaneously closing the return air register/grille via a motor operated damper electrically interlocked to the purge fan in order to prevent fumes from returning back to the AHU and being re-distributed throughout the zone.

17. In the high school science lab material storage/preparation area and the science chemistry classrooms containing permanently fixed fume hoods, provide a mechanical exhaust system for the fume hood consisting of an explosion-proof upblast fan coated with a chemical resistant coating and sized for twenty Air Changes/Hour or 3 Air Change Minutes. The fume hood exhaust air duct shall be fabricated of stainless steel or chemical resistant coated galvanized steel. The makeup air duct to the fume hood may be fabricated of galvanized steel and does not require a chemical resistant coating. The above commentary shall not apply when portable fume hoods are provided.

18. The art lab kiln room containing either one or two kilns shall be capable of exhausting a capacity calculated on the basis of ten Air Changes/Hour or 6 Air Change Minutes. Typically, a single kiln installation is provided for elementary schools designed to exhaust at a minimum rate of 200 CFM. In middle and high schools, dual kiln installations are provided having a minimum exhaust rate of 300 CFM.

19. The art lab kiln room shall be provided with a direct drive exhaust fan electrically interlocked to the kiln so the kiln does not energize unless the fan is energized. Upon fan failure, the kiln shall shutdown.

20. All clothes dryer exhaust ducts shall be constructed of a minimum 26 gauge galvanized steel having a smooth interior surface. Joints shall run in the direction of airflow and not contain sheet metal screws or other fasteners in the air stream. The maximum length of straight duct shall not exceed 25 feet and shall terminate with a wall cap containing a backdraft damper. When sidewall exhaust is not available, a roof jack with a backdraft damper shall be provided.

21. All exhaust fans, with the exception of the kitchen hood supply/exhaust fans and specialty fans such as the flammable storage room exhaust fans, shall be designed to immediately shutdown upon activation of the building fire alarm system.

22. An audible/visual alarm activated by a current transducer or pressure differential switch in the exhaust ductwork or other approved methods shall be provided for exhaust fans in potentially hazardous areas as the flammable storage area, equipment storage room, science material storage/preparation area, organic and inorganic storage rooms and science lab classrooms to indicate fan failure. The alarm shall be wired on a separate circuit.

23. In new school facilities, all new exhaust fans, supply air fan, etc. shall be tagged and identified in a sequential numerical format with the building number first followed by the exhaust fan number, area served and the fan CFM such as EF-1-1/Toilet/50 CFM, EF-1-2/Custodian Closet/50 CFM, SF-1-1/Toilet/50 CFM, SF-1-2/Custodian Closet/50 CFM, etc. in accordance with the currently approved FBC - Mechanical, Section 503.3.

24. In existing school facilities requiring remodeling, renovations and/or additions…all new exhaust fans, supply air fans, etc. shall be tagged and identified in a sequential numerical format in coordination with the existing equipment so as not to repeat the existing exhaust fan or supply fan numbers. The tagging shall include the building number first followed by the exhaust fan number, area served and the fan CFM.85

G. CHILLED AND CONDENSER WATER PIPING

1. The Contractor shall furnish the initial treatment of the chilled water system. Subsequent treatment of the chilled water system and all treatment of the condenser water system shall be furnished, installed and maintained by the SBBC PPO/Water Treatment Department. New chilled water and condenser water chemical treatment systems for chillers shall be furnished, installed and maintained by the SBBC PPO/ Water Treatment Department, Telephone # (954) 790-2384.

2. Provision shall be made by the Contractor for furnishing and installing the chemical pot feeder, wells, taps, electrical service, the required piping connections and a floor drain to drain the pot feeder. The electrical services shall include a 120 Volt dedicated service to the water treatment system and a 120 Volt hookup to the solenoid for bleed purposes.

3. Only Schedule 40 black steel pipe with welded joints and dielectric fittings at points of connections to dissimilar metals shall be approved for the chilled water (CHW) and condenser water (CW) main piping. Above ground chilled water piping runouts to the individual AHU of sizes 2 inches and smaller may be Type “L” copper not to exceed 20 feet in length. Victaulic joint type piping shall only be approved for piping in mechanical rooms. Usage of PVC pipe for the chilled and condenser water piping is **PROHIBITED** with the sole exception of the above ground condenser water connection to the cooling tower which shall be PVC. Black steel pipe installed underground shall be coated with a bitumastic material or provided with a factory applied PVC coating.

4. For suspended piping from concrete decks, install drilled concrete anchor fasteners after concrete slab is placed and completely cured. Powder-actuated stud fasteners are **PROHIBITED**.

5. All constant air volume AHU chilled water coils shall be provided with 3-way, 2-position chilled water valves or pressure independent characterized control valves in order to maintain a wet coil so that dehumidification is performed at all times. Variable air volume AHU chilled water coils shall be provided with 2-way, modulating chilled water valves in addition to a 3-way, two position chilled water valve installed at the end of the loop to prevent pump dead heading.

6. Upon installation and after pressure testing, the chilled water and condenser water piping shall be flushed with water in order to remove sand and other foreign contaminants. It is **MANDATORY** that the pipe ends be temporarily sealed with plastic polyethylene sheeting and duct tape or capped and remain empty of any water after pressure testing until the final pipe connections are completed.

7. Underground chilled water and condenser water piping shall not be installed less than 36 inches below grade and shall be provided with expansion loops as necessary. A detail of the expansion loop with dimensions shall be shown on the plan.

8. The Contractor shall verify that all basket strainers installed on the chilled water piping can easily be accessed and that the basket strainers can be removed, cleaned and re-installed during the cleaning procedure.

9. Upon completion of the chilled water and condenser water piping installation and prior to insulating the basket strainers, the Contractor shall flush the piping systems with water in order to remove sand and other foreign contaminants. The strainers shall be removed, cleaned and re-installed during this cleaning procedure. The chilled water and condenser water piping shall be chemically cleaned by the Contractor in order to remove mill slag, dirt, oil and/or other foreign contaminants. The strainers shall then be removed again, cleaned and reinstalled. Upon completion, the chilled water and condenser water piping shall be drained, flushed and a nitrite solution shall be applied to prevent pipe oxidation. The Contractor shall then contact the SBBC/PPO Water Treatment Department, Telephone #954-790-2384, for verification of the water quality and strainer cleaning. Upon acceptance, the SBBC/PPO Water Treatment Department shall furnish, install and maintain the water chemical treatment system.

10. Include on the plans and in the specifications that 125 PSI W.O.G. Mueller Model 91 AP or Nibco Model F-910 flanged silent check valves are preferred for the chilled water system.

11. When field-insulating the black steel chilled water piping and fittings in both the building interior and exterior spaces, two-piece pre-formed foam glass insulation such as Foamglas as manufactured by Pittsburgh Corning with VentureClad jacketing for above grade piping or Pittwrap CW jacketing for underground piping will be used. For exterior underground piping only, the use of factory pre-insulated polyurethane foam black steel pipe with extruded PVC or high density polyethylene jacket such as manufactured by Thermacor, Perma-Pipe, Rovanco, Thermal Pipe or Insul-Tec is approved. Fiberglass insulation will not be approved for chilled water piping.

12. Details of the underground chilled water and condenser water pipe anchors, sleeves and expansion loops or joints shall be shown on the plans.

13. The use of underground chilled or condenser water shutoff valves in valve boxes is **PROHIBITED** unless it is intended for a branch tap to a future building addition. Install the valves inside the building mechanical rooms in an accessible location and properly identified. A shutoff valve shall be installed on the vertical riser inside the room at approximately 5 feet AFF.

14. Valves for the chilled water system shall be required at each piece of HVAC equipment, branch tap, main riser and at other locations to allow system isolation and balancing and as follows:
    a. Bronze body ball valves with stainless steel balls and stems for isolating and throttling duty in sizes up to 2-1/2 inches.

b. Bubble tight, ductile iron, lug body butterfly valves with EPDM seats and silicon bronze discs for isolating and throttling duty in sizes 3 inches and larger.
c. Ductile iron body plug valves for precision balancing applications.

H. ENERGY MANAGEMENT/SECURITY (EM/S) SYSTEM

1. The General Contractor shall be responsible for the installation of the Automatic Temperature Control (ATC) System. He shall retain an ATC Contractor specializing in application of automatic temperature control work with minimum five years documented experience.

2. The SBBC has an integrated Energy Management/ Security (EM/S) System at every existing school site. The EM/S System consists of TAC-Andover Controls based equipment which interfaces to the electronic security devices and reports intrusion alarms to a central monitoring station, optimizes the outside lighting and provides START/STOP of the HVAC equipment

3. Contact the SBBC/PPO Energy Conservation & Utility Management Office designated representative, Telephone (754) 321-4757, for additional information concerning the EM/S equipment interface and ATC requirements.

4. For all new schools, existing schools and new building additions to existing school facilities, the ATC system shall be a Direct Digital Control (DDC) as manufactured by TAC-Andover Controls “Continuum” or Johnson Controls “Metasys”. **NO OTHER CONTROLS MANUFACTURER SHALL BE APPROVED**.

5. Should Johnson Controls “Metasys” be selected for use as the ATC system, no extra software shall be required on the existing SBBC workstations to provide functionality. It is the intent to use the existing Andover Cyberstation software to manage the entire SBBC energy management system. The ATC Contractor shall provide for all needed programming, configuration, etc. on the existing TAC-Andover system to accomplish this functionality.

6. Should the Johnson Controls “Metasys” ATC system be provided, it shall require an upgrade to the TAC-Andover system in order for it to function and shall include the cost of the TAC-Andover upgrade in their proposal. Furthermore, Johnson Controls shall provide laptops, service tools and all other required devices along with all required software to configure, program, troubleshoot, etc. that particular product/system to each SBBC Energy Management Technician that may work on the system including any non-SBBC personnel as designated by SBBC.

7. The Central H.O.A. Control Panel shall be installed in the media center equipment room (ER). The TAC-Andover Controls EM/S panel, which measures 36”x24”, will be mounted adjacent to the Central H.O.A. Control Panel so that an open wall space will be required. In existing schools requiring renovation, the new HVAC systems shall be wired back to the existing Central H.O.A. Control Panel. A simplified sequence of operation geared to a non-technical individual explaining the HVAC system operation shall be installed behind a Plexiglas or lexan cover adjacent to the Central H.O.A. Control Panel. An electrical schematic drawing of the equipment shall also be provided in a similar manner for use by repairmen during servicing of the equipment.

8. All AHUs, condenser water pumps, general purpose exhaust fans, toilet exhaust fans and outside air dampers shall be started and stopped by zone from a Central H.O.A. Control Panel. Should the installed ATC be manufactured by Johnson Controls (approved for building additions only), the panel shall be provided with separate, Hand-Off-Auto

(H.O.A.) switches, zone status pilot lights and permanent engraved labels for each zone. In most cases, the ATC shall be as manufactured by TAC-Andover and the front panel shall be blank since the above functions shall be controlled by a desktop computer at the facility and at the SBBC PPO/Energy Conservation & Utility Management Office located offsite. Each zone should not exceed a total of 20 HP connected fan motor load. The mechanical room outdoor air dampers and toilet exhaust fans shall be on one zone and separate from the AHUs. The HVAC equipment is to be enabled and disabled by a single zone switch. All electrical wiring interface between the TAC-Andover EM/S system and the HVAC system will be done at the auto side of the H.O.A. switch for Start/Stop control.

9. The TAC-Andover EM/S system shall be capable of providing temperature control, maintenance logs, etc. through the use of space temperature and humidity sensors. Take note that temperature and humidity sensors shall also be provided on the building exterior to record the exterior ambient temperature and relative humidity.

10. Monitoring alarm and control points shall be provided for the proposed new chiller. They shall include the following as a minimum:
    a. Chiller ON/OFF Status.
    b. Chilled Water Temperature Setpoint.
    c. Evaporator and Condenser Water Flow Pressure Differential.
    d. Compressor Status including Current Limiting Setpoint.
    e. Evaporator Entering and Leaving Water Temperature.
    f. Condenser Entering and Leaving Water Temperature.
    g. Evaporator and Condenser Refrigerant Temperatures.
    h. Condenser Refrigerant Pressure.
    i. All Motor Bearing Temperatures.
    j. All Motor Winding Temperatures.
    k. Phase Current for Each Phase.
    l. Diagnostic Status.

11. For a new building addition to existing school facilities, the new addition's ATC system shall be extended via a 2 inch PVC conduit to the location where the existing Central H.O.A. Control panel is installed.

I. FIRE PROTECTION SYSTEM

1. A site plan shall be provided for all fire lanes, fire hydrants and fire department connections (Siamese) and any other fire department accessibility issues on school District sites. Site plan shall be reviewed and signed off by the local Fire Marshall.

2. For new facilities, the fire main shall be designed as a closed loop system without any dead ends.

3. The minimum size of the pipe connection to the fire hydrants shall be 8 inches.

4. Fire hydrants shall be installed along the fire lanes and designed so that they are inline with the traffic flow, not in areas subject to building collapse, at a minimum distance of 40 feet from a building, at a maximum distance of 300 feet from each other, oriented so that the steamer cap faces the traffic flow and the center of the steamer cap is a minimum of 18 inches above grade.

5. Fire hydrants shall not be installed on sidewalks or behind bus barriers. A minimum of 7.5 feet of unobstructed clearance shall be provided around each fire hydrant for accessibility.

6. Provide bollards around the fire hydrants when they are installed in areas adjacent to traffic lanes and not protected by concrete curbs.

7. Provide a blue dot pavement marker in the traffic lane or other asphalt area in front of each fire hydrant to identify its location.

8. Fire department connections shall be installed along the fire lanes and designed so that they are inline with the traffic flow, not in areas subject to building collapse and at a minimum distance of 40 feet from a building.

9. The fire department connection shall not be installed on sidewalks or behind bus barriers. A minimum of 7.5 feet of unobstructed clearance shall be provided around it for accessibility so that the hose lines can be readily and conveniently attached to inlets without interference from nearby objects such as buildings, fences, posts or other fire department connections.

10. For each fire department connection, a sign stating "**NO PARKING, FIRE LANE BY ORDER OF POLICE AND FIRE DEPARMENT"** shall be installed on a pole behind the fire department connection with the bottom of sign a minimum of 7 feet above finished grade. A separate sign shall also be provided on the pole showing the building section that the fire department connection serves.

11. The fire hydrants shall be painted yellow in accordance with the Occupational Safety and Health Standards (OSHA). Glass beads shall be provided to the paint while it is still wet.

12. The fire department connection shall be painted red in accordance with the Occupational Safety and Health Standards (OSHA). Glass beads shall be provided to the paint while it is still wet.

13. A fire hydrant shall be installed no more than a maximum of 15 feet from a fire department connection.

14. In new facilities containing central courtyards where fire apparatus is not accessible, a dry standpipe system shall be installed and provided with a fire department connection or multiple connections dependent of the courtyard size. In addition, an additional fire department connection shall be located within 15 feet of a fire hydrant installed outside the courtyard area. For the dry standpipe, a sign identifying the dry standpipe system shall be installed on the dry standpipe with the bottom of the sign a minimum of 7 feet above the finished grade.

15. The school facility shall be fully sprinklered in accordance with Chapter 9 of the current State of Florida approved FBC, NFPA 10, NFPA 13, NFPA 14, NFPA 20 and NFPA 24 using standard coverage area sprinkler heads. The extended coverage area sprinkler head method of design is **PROHIBITED.**

16. All areas are to be designed based on light hazard occupancy with the exception of the kitchen (Ordinary Hazard Group 1), food court (Ordinary Hazard Group 1), science lab classrooms (Ordinary Hazard Group 1), science material storage/preparation area (Ordinary Hazard Group 1), flammable storage room (Ordinary Hazard Group 1), equipment storage room (Ordinary Hazard Group 1), mechanical rooms (Ordinary Hazard Group 1), storage rooms (Ordinary Hazard Group 1) and the working stage containing over 1000 SF (Ordinary Hazard Group 2).

17. Provide 1/8" scale shop drawing plans designed and sealed by a State of Florida licensed engineer of a complete hydraulically designed sprinkler system in accordance

with NFPA 13 and other applicable code requirements. Submission of performance plans shall be provided with the Phase III 50 Percent Construction Documents submittals. **Hydraulic calculations shall be based on drought conditions which shall be a maximum static pressure of 50 PSI**. The residual water pressure shall be proportionally adjusted. Also include pipe sizes, pipe lengths and calculations.

18. All piping shall be installed by State certified personnel having a State of Florida license for the servicing, repairing, installing or inspecting of all types of pre-engineered fire extinguishing systems in accordance with FAC Statute 633.

19. Provide an inspector's test station for each individual automatic sprinkler system. Test station shall be located at the furthest point or most remote area of the system opposite the point-of-entry into the building.

20. Since both ferrous and CPVC piping are approved for hard piped connected systems, the Contractor shall provide the unit pricing for the material and installation cost of each of the two systems on the Bid Forms in order for the SBBC to determine which system shall be selected for the project. Keep in mind that the use of CPVC piping is approved for branch piping only.

21. When used, CPVC piping shall not be exposed to direct sunlight. Such exposure deteriorates CPVC piping.

22. In addition to the traditional hard-piped armovers connection to the heads from the branches, the use of stainless steel flexible hose for the connections is also approved. The Contractor shall provide the unit pricing for the material and installation cost of the traditional hard-piped armover connection versus the stainless steel flexible hose on the Bid Forms in order for the SBBC to determine which of the two connection type systems shall be selected for the project.

23. Should the SBBC selected connection type system be with the stainless steel flexible hoses over the traditional hard-piped armovers, the system shall consist of a threaded pipe nipple connected to the main or branch line, stainless steel flexible connecting hose with braided sheath of standard length, a reducing fitting that the sprinkler head is connected to, and a mounting bracket that attaches to the ceiling grid. As a last design option, the use of armovers shall be approved for exceptional designs where the use of flexible fire sprinkler connections is not possible.

24. Sprinkler heads installed in areas with suspended ceiling panels or finished plastered ceilings shall be provided with concealed type sprinkler heads.

25. Sprinkler heads shall be of the standard coverage area, quick response type having a maximum area of 15'x15' or 225 SF per head shall be used for light hazard occupancy areas. 130 SF per head shall be provided for ordinary hazard (Group 1) occupancy areas. Extended coverage area sprinkler heads are not approved.

26. Sprinkler heads installed in the exterior or exposed to a corrosive environment shall be semi-recessed and coated with an anti-corrosive material such as Nickel Teflon in accordance with Paragraph 6.2.6.1.1 of the 2002 NFPA 13 and listed for outdoor use.

27. Ensure that all areas with the exception of electrical rooms are designed with a wet pipe sprinkler system. The electrical rooms shall be designed to be two hour fire rated and shall not be provided with sprinkler heads. For existing schools having electrical rooms without two hour fire rated walls, the electrical equipment shall be protected from sprinkler head discharge by shields as stipulated in NFPA 13, Section 5-13.11.

28. The exterior underground piping shall be a minimum of 8 inches and designed as a loop. Pipe shall be fabricated of Class 52 ductile iron pipe for pipe sizes 4 inches and larger, DR-14 PVC pipe or DR-18 PVC pipe for pipe sizes 3 inches and smaller. Dead ends are **PROHIBITED**.

29. The above grade fire sprinkler system piping mains shall be fabricated of steel, Schedule 10, ASTM A135 or ASTM A795 black steel pipe with welded or grooved ends for above grade piping sizes 2-1/2 inches and larger. Branch piping up to 2 inches in size shall be XL, ASTM A135 threadable light wall galvanized steel piping with screwed ends or CPVC as manufactured by Noveon, Tradename "BlazeMaster" or approved equal.

30. When CPVC branch piping is provided in lieu of steel piping, verify that oil provided to thread the steel piping at the joints does not come in contact with the CPVC piping as it will cause a chemical deterioration of the CPVC piping.

31. When CPVC branch piping is provided in lieu of steel piping, verify that the proper hanger spacing in accordance with the manufacturer's recommendations is provided in order to prevent pipe snaking.

32. Provide fusible link or glass bulb type sprinkler heads with the ordinary temperature range of 155 Degree F except where subject to high temperatures caused by heaters, hot pipes, radiant ceilings or other heat source in which case they shall be of the high temperature type.

33. All exposed fire protection piping shall be painted red.

34. In existing school group toilets not containing a sprinkler system, but requiring remodeling, renovation and/or additions, ensure that sprinkler heads are provided by using the limited area sprinkler system as outlined in the currently approved FBC-Building, Chapter 9, Section 903.3.5.1.1. Limited area sprinkler systems are limited to the use of six sprinkler heads and shall contain a flow indicating shutoff valve and a check valve installed at the point of connection between the fire protection piping and the domestic water piping to protect the domestic water system from contamination. A waterflow alarm device shall not be required in accordance with the FBC-Building, Chapter 9, Section 901.6.1.

J. GAS SYSTEM

1. The gas system piping installed above grade shall be fabricated of ASTM A53 or A120, Schedule 40 black steel pipe or ASTM B88 hard drawn Type L copper pipe. Gas piping installed underground and outside the building shall be fabricated of ASTM D2513, SDR 11.5 polyethylene (PE) pipe installed 36 inches below grade. Transitional risers connecting the plastic piping to black steel shall be installed by the plastic pipe manufacturer's certified installer and in accordance with the requirements of the utility company.

2. An electrically continuous corrosion resistant yellow tracer wire (minimum AWG 14) shall be installed 12 inches above all buried gas piping to facilitate locating of the gas pipe. One end shall terminate above grade at the building wall or riser. In addition, a color-coded detection tape shall be installed 24 inches above all buried gas piping for early detection during excavation.

3. Avoid running gas piping under concrete slabs at all times. If approved by the SBBC Design Services Department, install the carrier pipe in a Schedule 40 PVC pipe sleeve sealed on the building interior end and vented to the outside at the building exterior end.

The pipe sleeve should be at least two and one-half to three pipe sizes larger than carrier pipe, but not less than 2 inches for a 3/4 inch gas pipe. Never embed piping in concrete.

4. Gas supply pipe shall be routed to above-ceiling spaces immediately upon entering a building. The routing of gas piping above or across interior corridors, in stairwells or underneath the building is **PROHIBITED**. As an example, gas supply piping running through or passing across an interior corridor is **PROHIBITED**.

5. Typically, elementary school emergency generators are always less than 125 KW and are LP gas driven. Whereas, middle and high school emergency generators are always greater than 125 KW and are diesel oil driven.

6. Heritage Propane is the SBBCs vendor for LP gas and LP tanks of 250, 500, 750 or 1000 Gallon capacities. In any design concept where LP gas is to be used for other than the emergency generator, Heritage Propane shall furnish the LP tank and be responsible for installing it. In addition, Heritage Propane shall be responsible for filling out the SBBC form titled Propane Service Request Form which can be found in the contract documents.

7. When an underground LP tank is to be installed or removed, the Contractor shall be responsible for completing either or both the SBBC forms titled Contractor's Request For LP Gas Tank Installation (Document 15105a) and/or Contractor's Request for LP Gas Tank Removal (Document 15105b).

8. LP tanks of 500 Gallons or greater shall be installed underground and properly anchored to prevent hydraulic uplift. Installation of tanks of 250 Gallons or less for above grade installation shall require review and approval by the SBBC Design Services Department prior to design. If approved, the above grade tank shall be anchored to a concrete pad or wall to sustain hurricane force winds as outlined in ASCE-7 and provided with a 6 foot high chainlink fence enclosure.

9. For underground LP tanks, the Contractor shall be responsible for filling the tanks with liquid propane immediately after installation completion by Heritage Propane in order to prevent hydraulic uplift.

10. Should LP be used solely for the emergency generator, the Contractor shall be responsible for all cost associated with the furnishing, installation and filling of the tank by Heritage Propane.

11. A gas supply branch connected upstream of the building gas supply main solenoid valve shall be installed to provide uninterrupted gas supply to the emergency generator.

12. The exterior above grade building LP or natural gas supply main entering the science classroom building and containing the gas meter (natural gas), pressure regulator, manual shutoff valve, etc. shall be provided with a weatherproof NEMA 4, normally closed, lever-operated manual reset, 120 Volt electric solenoid valve. The entire assembly shall be enclosed within a 6 foot high chainlink fence. Should the building fire alarm system be activated, the science classroom building gas supply main solenoid valve shall close and cutoff any further supply of gas into the building.

13. The exterior above grade building LP or natural gas supply main entering the kitchen and containing the gas meter (natural gas), pressure regulator, manual shutoff valve, etc. shall be enclosed within a minimum 6 foot high chainlink fence. Should the building fire alarm system be activated, the kitchen hood gas supply main solenoid valve shall not be effected by the alarm. Closure of the kitchen hood solenoid valve shall only occur when

the hood fire suppression system is activated cutting off any further supply of gas into the cooking equipment.

14. Whenever possible, the high school science and chemistry lab classrooms along with the science material storage/preparation area shall be designed so that they are located on the second floor order to avoid the installation of any gas piping underneath the building concrete slabs.

15. For the middle school science classrooms, gas shall be required only at the teacher's demo table. Gas **SHALL NOT** be provided at the student tables.

16. For the high school science classrooms, chemistry lab classrooms and the science material storage/preparation area, gas shall be provided at both the teacher's demo table and the student tables.

17. In the middle and high school science and chemistry lab classrooms, provide a Master Control Utility Panel with a lockable hinged cover installed recessed in the partition wall behind the teacher's demo table. The Master Control Utility Panel shall contain a printed circuit board along with three front panel mounted push buttons to activate/deactivate the gas, water and electrical services; a 60 minute time switch; and a front panel mounted red panic ON/OFF mushroom button. The system shall also include a ceiling mounted, solenoid box enclosure containing a normally closed, lever-operated manual reset, 24 Volt electric solenoid valve along with a manual quarterturn butterfly valve for each of the gas, water and electrical services; and an electrical contactor box enclosure. The Master Control Utility Panel shall be similar to the Utility Controller manufactured by Isimet (Naples, TX). Take note that automatic reset type solenoid valves are **PROHIBITED**

18. In the middle and high school science material storage/preparation area, provide a Master Control Utility Panel with a lockable hinged cover installed recessed in the partition wall behind the teacher's prep table or other designated area. The Master Control Utility Panel shall contain a printed circuit board along with three front panel mounted push buttons to activate/deactivate the gas, water and electrical services; a 60 minute time switch; and a front panel mounted red panic ON/OFF mushroom button. The system shall also include a ceiling mounted, solenoid box enclosure containing a normally closed, lever-operated manual reset, 24 Volt electric solenoid valve along with a manual quarterturn butterfly valve for each of the gas, water and electrical services; and an electrical contactor box enclosure. The Master Control Utility Panel shall be similar to the Utility Controller manufactured by Isimet (Naples, TX). Take note that automatic reset type solenoid valves are **PROHIBITED**.

19. The sequence of operation for the gas in the middle school and high school teacher's demo table, the high school science and chemistry lab classrooms, and the science material storage/preparation areas is as follows. Each gas solenoid valve will be de-energized by activating the red ON/OFF mushroom button located on the front panel of the recessed wall mounted Master Control Utility Panel which will simultaneously shutoff the gas supply, water and electricity (except the classroom lights) to the high school classroom student work tables, the fume hood and the teacher's demo table at the discretion of teacher. It shall not be directly wired to the building fire alarm system, but shall be de-energized when the fire alarm system is activated. For example, activation of the red ON/OFF mushroom button shall not activate the building fire alarm system...but activation of the building fire alarm system shall de-energize the gas solenoid valves via a set of contacts. All other electrical circuits shall be wired separately. In addition to the ceiling mounted solenoid box enclosure, the hot and cold water supplies located under the chemistry lab classroom teacher's demo table shall be equipped with manual quarterturn butterfly valves for manual shutoff purposes.

20. The routing of the gas piping for the middle school teacher's demo table, shall be from the above-ceiling mounted solenoid box enclosure, down through the wall located behind the teacher's demo table, to underneath the floor and then up inside the teacher's demo table . Take note that middle school classroom student tables shall not be provided with gas.

21. The routing of the gas piping for the high school science lab and chemistry lab classrooms and the science material storage/preparation areas located on the first floor only, shall be from the above-ceiling mounted solenoid box enclosure, down through the wall located behind the teacher's demo table, to underneath the floor and then up inside the demo table, then back down underneath the floor, and up to the classroom student tables located along the perimeter walls. For the chemistry lab classrooms with the island type student tables, the gas piping shall run up through the wall to the ceiling and then down through a vertical vandal-resistant pipe sleeve or chase located on the far end of each island student table.

22. In the high school science and chemistry lab classrooms and the science material storage/preparation areas located on the second floor, the gas piping shall be routed above the first floor ceiling space through the solenoid box enclosure, and up into the teacher's demo table. The gas piping shall then be re-routed back down into the first floor ceiling space and then up into the high school chemistry lab classroom student tables located along the perimeter walls. For the chemistry lab classrooms with the island student table, the gas piping shall run up into the island student table.

23. Coordinate with the project electrical engineer to verify that no occupancy sensors…used to control the lighting fixtures…are installed in the middle and high school science classrooms and the science material storage/preparation area. Occupancy sensors installed in such areas can lead to a potential explosion should there be an accumulation of gas in the enclosed area caused by a leak during the evening or weekend periods when the school is closed and later reopened.

K. FUME HOOD

1. Both the middle and high school chemistry lab classrooms and the science material storage/preparation area containing permanently fixed fume hoods shall be provided with gas and CW at both ends of the hood along with an integral exhaust/supply air makeup system. The fume hood shall be de-energized by activating a red ON/OFF mushroom button on the wall mounted Master Control Switch Panel located behind the teacher's demo table which will simultaneously shut off the gas supply, domestic water supply and electricity (except the classroom lights) to the demo table, student work tables in high schools and the fume hood.

L. COMPRESSED AIR SYSTEM

1. In the prototyping room of the middle and high school technology laboratory classroom, the air compressor shall be a portable, wheeled, air-cooled, single stage compressor with a 20 Gallon capacity horizontal receiving tank. The use of compressed air piping drops shall not be provided.

2. In the prototyping room of the middle and high school technology laboratory classroom, the walls separating the prototyping room from the technology lab shall be acoustically treated to reduce sound transmission emanating from the prototyping room to a noise criteria range of RC-30(N) to RC-40(N).

M. KITCHEN

1. Design the kitchen and food court area waterwash exhaust hoods to be a UL listed island type four-sided, filterless stainless steel hoods capable of extracting 95 percent of generated grease through a series of horizontal overlapping exhaust air baffles. Each hood shall be provided with a UL listed wet chemical fire suppression system such as Ansul R-102, exhaust and supply air fans, stainless steel exhaust ductwork, recessed florescent lighting, low velocity perforated vertical air discharge at the ceiling along the full front length of the hood and one common 140 Degree F minimum detergent water wash control panel for multiple waterwash exhaust hoods (if applicable). In addition, the kitchen hood shall be provided with a utility distribution system (UDS). The water wash control panel for both the kitchen and food court hoods shall be mounted on the UDS riser.

2. The kitchen hood UL listed wet chemical fire suppression system shall be designed to protect the hood plenum, exhaust duct, Expando burner, conveyor pizza oven, titling skillet, steam kettle and other open surface cooking equipment in accordance with all codes and UL requirements.

3. Electrical connections made inside the kitchen hood UL listed wet chemical fire suppression system control box are **PROHIBITED**.

4. The kitchen shall be provided with a condensing commercial grade, high efficiency, quick recovery, LP or natural gas-fired water heater with a separate storage tank such as manufactured by Lochinvar “Armor” Series, Teledyne-LAARS, A.O. Smith or Webon-Jarco. The condensing gas-fired water heater shall be located in a dedicated one hour fire-rated room located on the building perimeter and equipped with an exterior door. Should LP or natural gas not be available, a commercial type electric water heater shall be acceptable. For such designs, the dedicated one hour fire-rated room shall not be required.

5. Install the floor mounted gas-fired condensing commercial grade water heater and storage tank (if applicable) atop a reinforced concrete housekeeping pad. Concrete pads shall be a minimum of 6 inches in depth and extend a minimum of 4 inches beyond the footprint of the supported equipment in all directions. All exposed edges shall be 1/2 inch chamfered.

N. PLUMBING

1. All plumbing design shall be in compliance with the current State of Florida approved Florida Building Code - Plumbing, the 1990 American Disability Act (ADA) and the 1997 Florida Accessibility Code for Building Construction (Chapter 553, F.S.) implemented under the 1993 Florida Americans with Disability Accessibility Implementation Act and the U.S Architectural and Transportation Barriers Compliance Board.

2. Installation of any plumbing piping inside the block cores of exterior concrete masonry unit (CMU) walls is **PROHIBITED**. Coordinate with the architect and install piping in furred walls, pipe chases, etc.

3. No piping carrying domestic water, CHW, fire sprinkler water, etc. shall be run through or over any of the electrical rooms, equipment room or telecommunication rooms. In addition, do not penetrate domestic water lines used for electrical grounding through and into the electrical rooms. Terminate the water line outside the electrical rooms and provide grounding straps.

4. All black steel piping installed underground shall be PVC coated extruded black steel pipe or black steel pipe wrapped and coated with a bitumastic material or other SBBC approved material. Pipe shall be thoroughly cleaned of dirt and surface rust, etc. prior to being coated with the corrosion resistant material. The use of PVC coated piping for above grade installation in the building interior is **PROHIBITED** with the exception of high school swimming pool equipment rooms where it is approved.

5. Each building sanitary drain shall be provided with a two-way grade cleanout within five feet of the junction of the building drain and building sewer immediately after exiting the building. If the two-way cleanout is installed in a grass area, it shall be embedded in an 18”x18”x4” thick concrete pad.

6. Each horizontal sanitary and storm drainage pipe shall be provided with a cleanout at the upstream end of the pipe and in changes in direction greater than 45 degrees. Offset cleanouts so that they are not located in classrooms or building entrances whenever possible.

7. Cleanouts shall be provided at 50 foot intervals for horizontal sanitary and grease drain pipes of 3 inch or less and 100 foot intervals for pipes 4 inch and larger.

8. In no instance will the use of PVC piping such as for the domestic water, sanitary, grease, storm drain, fire protection systems, two pipe venting system for gas fired heaters, etc. be permitted for above finished floor installations in any portion of the building interior with the exception of swimming pool equipment room. As an alternative for above grade building interior piping in other than the swimming pool equipment room, CPVC piping can be substituted for the fire protection branch piping and the two pipe venting system for gas fired heaters. Usage of CPVC in other areas is **PROHIBITED**.

9. Joint connections for joining domestic water pipe shall be **FREE OF LEAD** and that the 95/5 solder and flux not have a lead content exceeding 0.2 percent. Pressed joint is another approved method of joining domestic water piping. Threaded connections shall be made with non-lead bearing compounds. Joint connections for gas copper pipe shall be welded or brazed with lead-free solder.

10. All shutoff valves installed on domestic water piping in building interiors for pipe sizes less than 3 inches shall be full flow stainless steel ball valves for pipe. The use of gate valves is **PROHIBITED**.

11. The primary roof drain system shall be sized for a rainfall intensity of 4.5 inches per hour for a 100 year rainfall in accordance with the currently approved FBC - Plumbing, Chapter 11, Figure 1106.1. Roof drains, interior storm drain piping (conductors) or exterior storm drain piping **SHALL NOT** be less than 4" in size.

12. All primary roof drain system storm drain runoff shall be connected to discharge directly into the storm drain system. The use of splash blocks or discharging onto grade is **PROHIBITED**. All secondary emergency roof drain system storm drain runoff shall be terminated above grade and may be discharged onto splash block or grade.

13. A secondary emergency roof drain system shall be sized totally independent of the primary roof drain system and in accordance with the currently approved FBC - Plumbing, Chapter 11, Section 1107.3. It may consist of parapet scuppers or scupper heads and exterior surface mounted leaders.

14. Roof drain systems designed with interior building conductors are to be limited and require approval by the SBBC Design Services Department. If approved, the vertical

storm drain piping shall be insulated and provided with base cleanouts and access doors. For such designs, the use of No-Hub cast iron pipe for above grade interior use is approved.

15. Sanitary, grease and storm drain system piping installed below grade within the building interior can be either cast iron or PVC. For the kitchen steam kettle and the tilting skillet only, the first ten feet of underground drain piping from the trough shall be fabricated of cast iron before transitioning over to PVC piping due to the high temperature of the steam kettle discharge water which can exceed 140 Degree F.

16. Group toilets designed to be back-to-back shall be provided with a minimum 24 inch pipe chase to allow maintenance personnel access for repair work. Whenever possible, entry to the pipe chase shall be through the custodial closet.

17. Group toilets in all new school construction projects shall be provided with high efficiency 1/8 GPF urinals in group toilets. In existing school group toilets requiring remodeling, 1/4 to 1/2 GPF urinals shall be provided. Verify that the urinal fixture is properly engineered to match the flush valve in order to attain the high efficiency flow and flushing velocity through the urinal fixture. Refer to SBBC Specification Section 15410 - Plumbing Fixtures for the approved manufacturers and models.

18. Water closets in all new and remodeling projects shall be high efficiency 1.28 GPF fixtures. In addition, water closets installed back-to-back such as in group toilets shall be provided with double tee-wye or double combination sanitary fittings. The use of double sanitary tees is **PROHIBITED**.

19. Since domestic water is considered to be 70 Degree F, commercial and domestic water heaters for all areas shall be sized for a 70 Degree F temperature rise and provided with quarterturn full flow ball valves in lieu of gate valves on the cold and hot water supply lines. In addition, heat traps shall be provided on the CW and the HW lines if they are not already integral with the water heater.

20. 110 Degree F hot water shall be required in the kitchen for the kitchen two compartment vegetable sink, kitchen handwash sinks, kitchen lounge toilet lavatories, kitchen exterior dumpster pad, Somat extractor/waste handling equipment room service faucet, Somat pulper room service faucet, kitchen laundry room, etc. Other non-kitchen areas such as showers, clinic sinks, classroom sinks when applicable, lavatories, etc. shall also be provided with 110 Degree F hot water.

21. 140 Degree F hot water shall be required for the kitchen waterwash exhaust hood, Somat extractor equipment located in the extractor/waste handling equipment room, the commercial dishwasher when applicable and the four compartment pot sink.

22. Condensing commercial grade, high efficiency, quick recovery, gas-fired water heaters with separate storage tanks shall be provided for the kitchens and middle and high school gymnasium locker room showers. Water heaters and storage tanks shall be installed on 6 inch high concrete housekeeping pads and provided with inline recirculation pumps. Inline recirculation pumps for all other water heaters shall be considered if the length of pipe run is 100 feet or greater or if the piping is very excessive.

23. When sizing hot water requirements for showers, use 5 minutes/shower for the water consumption rate.

24. Both floor mounted electrical and gas-fired water heaters along with HW storage tank shall be mounted on a 6 inch high concrete housekeeping pads.

25. Gas-fired water heaters with an input capacity exceeding 60,000 BTUH shall be installed in a dedicated one hour fire-rated room located on the building perimeter containing an exhaust fan, floor drain and an outswinging door opening directly to the exterior.

26. Shelf mounted electric water heaters shall be provided with a galvanized steel safety pan containing a pan drain. Both the 1 inch pan drain and the 3/4 inch P&T relief drain shall be made of copper and run separately into a mop sink or floor drain. The shelf mounted water heaters in the custodian rooms shall be mounted at a height of 6'-8" minimum from the bottom of the shelf. The heater shall be installed close to, but not directly over, the mop sink in order to allow installation and access to the mop rack over the mop sink. Should a mop sink, floor drain or other method of P&T discharge not be available, discharge to the exterior grass area at a height of 6 inches above grade shall be approved.

27. Electric water heaters shall be wired and controlled by the SBBC EM/S System for ON/OFF operation in order to de-energize the unit during unoccupied periods. In existing facilities when connection to the EM/S system is not possible, a time switch shall be provided to perform the ON/OFF operation.

28. The kitchen and kitchen laundry room shall be provided with 3 inch floor drains for the finished floor areas. Trough drains shall be provided at the dry storage room and paper storage room entry doors. The cooking equipment under the hood, the Somat pulper, the Somat extractor and the can wash in the Somat extractor/waste handling room shall be provided with 3 inch floor sinks or trough drains.

29. Whenever possible, all floor drains in the kitchen are to be installed under the serving line equipment or other kitchen equipment. The installation of floor drains in the open kitchen floor space is to be minimized. When this is not possible, the floor drains shall be installed so that the floor does not slope more than one percent.

30. Because of the required daily floor washdowns, the kitchen floor drains, floor sinks and trough drains **SHALL NOT** be required to be provided with trap primers.

31. The Somat pulper shall discharge into a 3 inch floor sink containing a 3/4 grate which shall be connected to the grease waste system. The floor sink shall be installed directly underneath the Somat pulper discharge outlet.

32. The Somat extractor shall be installed in either a rectangular 2-1/2 inch deep recessed pit or provided with a concrete curb around the equipment in order to avoid flooding the Somat extractor/waste handling room. In either case, the Somat extractor shall discharge into a 3 inch floor sink containing a 3/4 grate which shall be connected to the sanitary system. The floor sink shall be installed directly underneath the Somat extractor discharge outlet.

33. The can wash located in the kitchen Somat extractor/waste handling room shall be installed in a rectangular 2-1/2 inch deep recessed pit containing a 3 inch floor sink equipped with a chrome plated, bronze spray nozzle and water supply assembly. In addition, a wall mounted service faucet containing a threaded spout with hot and cold water and shall be installed above the can wash in the Somat extractor/waste handling equipment room and in the Somat pulper room.

34. The kitchen steam kettle shall be installed in a rectangular 2-1/2 inch deep recessed pit containing a 3 inch floor sink with a 1/2 grate. The floor sink shall be located directly underneath the steam kettle discharge faucet. In addition, the floor sink shall also be used to receive the discharge of the waterwash hood water used to clean the hood.

35. The kitchen grease tank shall be provided with a minimum 4 inch influent and effluent pipes. All tank sizes shall be a minimum of 750 gallon and a maximum of 1250 gallon and contain a PVC or concrete baffle plate on a single tank installation or on the last tank of a multiple tank installation in order to separate the grease containment area from the liquid containment area. Multiple tanks shall be installed in series.

36. Sizing calculations for the kitchen grease tanks shall be provided on the plans along with a tank detail. The formula is Tank Gallonage = (School Population x Diversity Factor) (5 GPM/Meal)(0.75 for Somat Equipment or 1.0 for Dishwasher). The Diversity Factor is 80 percent for low economic geographical areas, 70 percent for median economic geographical areas and 60 percent for high economic geographical areas. Calculations shall be inserted on drawings.

37. The concrete pads provided for the dumpster and compactor (if applicable) located outside the kitchen shall contain area drains connected to the grease waste system and wall hydrants containing 110 Degree F hot water and cold water.

38. A minimum of two wall mounted washdown hose stations consisting of a wall mounted faucet containing a threaded spout with hot and cold water and a separate stainless steel hose rack installed directly under the faucet shall be provided at opposite ends of all elementary school kitchens. A minimum of three washdown hose stations shall be provided for middle and high schools. Should the design include a food court serving area, two additional station shall be provided in this area for middle schools and high schools. Each washdown hose station with a stainless steel hose rack is to be installed at a height of 42 inches from the finished floor to the bottom of the faucet and be provided with an SBBC furnished 3/4 inch, fifty foot high pressure/high temperature hose suitable for 110 Degree F hot water and a front trigger control nozzle.

39. Self contained, air-cooled ice making machines are to be provided for the administration building production room, the high school physical education training room and the kitchen. The ice making machines shall be provided with a water filter system as manufactured by Cuno Model ICE-140-S. Only the kitchen ice making machine shall be electrically connected to the facility emergency generator so that it is operable during hurricane periods when there is an electrical outage.

40. 3/4 inch flush mounted anti-siphon wall hydrants shall be provided for all building interior and exterior installations with the sole exception being the mechanical rooms… where only 3/4 inch hose bibbs shall be used. All wall hydrants, whether interior or exterior, shall be installed at a height of 30 inches AFF or finished grade. In addition, all exterior wall hydrants shall be installed at a maximum horizontal spacing of 100 feet apart.

41. Plumbing fixtures flows are to be in accordance with the currently approved FBC - Plumbing, Table 604.4 which restrict flows to 0.25 GPM at 60 PSI for lavatories containing metering valves; 2.2 GPM at 60 PSI for Classroom sinks, kitchen sinks, service sinks and mop sinks; 2.5 GPM at 60 PSI for showers. The only exception to Table 604.4 shall be the flow restrictions to the urinals and water closets which will be 1/8 GPF and 1.28 GPF, respectively.

42. All lavatory and sink faucets shall be provided with laminar flow aerators.

43. Provide all stainless steel sinks in faculty areas such as the clinic, teacher's lounge, faculty toilets, etc. with hot and cold water. Unless otherwise stipulated, provide all student lavatories in clinic toilet rooms, student toilets, etc. with cold water only.

44. Designated ADA toilets in Elementary School Kindergarten through Grade 5 classrooms shall contain standard height (non-ADA) water closets roughed in at 12 inches from the rear wall and 16 inches from the side wall.

45. Elementary school ADA toilet rooms located in Kindergarten through Grade 5 classrooms and the designated ADA toilet stall in the student group toilet shall be provided with standard height water closets and 16 inch high flush valves with pipe supports in order to avoid conflict with the split horizontal grab bars behind the water closet. Designated ADA toilet stalls for Grades 6 through 12, individual faculty toilets and public group toilets shall be provided with 17 inch high handicap height water closets and 11-1/2 inch high flush valves without pipe supports. All group toilets are to be provided with a minimum of one floor drain and a wall hydrant installed 30 inches AFF on an easy-to-access wall located away from the battery of plumbing fixtures. In designs where the group toilet is elongated and the floor pitch to the floor drain is found to be greater than 1 inch, allowance shall be made to provide two floor drains in order to minimize the floor pitch to a maximum of 1 inch. Floor drains are not required in individual toilets unless otherwise noted such as toilets containing a shower and ESE toilets.

46. All floor drains with the exception of those provided in the kitchen and mechanical rooms shall be equipped with trap primers in order to prevent evaporation of the trap seals.

47. Floor drains and floor sinks shall be 3 inches in size in all areas with only one exception…that being the cooling tower area drain which shall be 4 inches in size.

48. All ADA water closet flush valves, urinal flush valves and lavatory self-closing faucets shall be suitable for a maximum of 5 PSI activating pressure in accordance with ADA requirements.

49. All ADA lavatories shall be provided with insulated P-traps installed parallel to the wall.

50. During hurricane periods, the sanitary waste from the enhanced hurricane protection area (EHPA) shall be diverted into an underground, double wall fiberglass sanitary waste storage tank anchored to a concrete slab. Flow into the sanitary waste storage tank shall be controlled by the use of two bi-directional knife blade gate valves as manufactured by DeZurik or approved equal. One knife gate valve shall be installed on the sanitary piping leading into the city sanitary system and the other on the pipe leading into the sanitary waste storage tank. Both valves shall be located within the confines of a 36 inch diameter, free floating manhole anchored to a concrete slab at grade. The tank shall be properly anchored to prevent hydraulic uplift. Flushing of the plumbing fixtures and the lavatory water usage used to determine the required sanitary waste storage tank size shall be based on a minimum of three flushes per person per day for the water closet and urinals and three cycles per person per day for the lavatories during an **occupancy period of seventy-two hours**. An additional load of 30 percent for allowance of solids shall be added to the original load. Sizing calculations shall be provided on the plans along with the tank details and the system sequence of operation.

51. The domestic water storage tank for the EHPA shall be designed to be a pressurized tank type fabricated of steel, pressure rated and capable of sustaining a domestic water operating pressure between 30 and 80 PSIG and lined with a polyamide epoxy certified by NSF. The domestic water storage tank shall be installed underground so that domestic water service to the building is routed through the tank at all times. Valves shall be provided so as to shutoff water to the building and storing potable water necessary for the EHPA toilet lavatories and flushing of the EHPA water closets in the tank prior to a hurricane. The tank shall be properly anchored to prevent hydraulic uplift. Flushing of the plumbing fixtures and the lavatory water usage used to determine the required

domestic water storage tank size shall be based on a minimum of three flushes per person per day for the water closet and urinals and three cycles per person per day for the lavatories during an **occupancy period of seventy-two hours**. Sizing calculations shall be provided on the plans along with the tank details and the system sequence of operation. The pump equipment for the EHPA domestic water tank shall be installed inside the mechanical room and electrically connected to the facility emergency generator so that it is operable during hurricane periods when there is an electrical outage.

52. In high school science lab and chemistry lab classrooms, science material storage/preparation area and the photography dark room, chemical waste shall run through a chemical acid waste system into an exterior underground high density, double wall polyethylene neutralizing tank before being discharged into the sanitary sewage system. The tank shall be as manufactured by Orion or Enfield. Chemical acid waste piping shall not be required for the middle school science lab classrooms or the science material storage/preparation area.

53. When applicable, the chemical acid waste neutralizing tank shall be installed in the building exterior inside an underground concrete vault filled with pea gravel to a level just below the tank inlet and outlet pipes. The bolted tank cover shall be provided with nuts adhered to the bottom of the tank flanged lip so that they are not lost during removal of the bolts. In addition, the tank cover shall be provided with an easy, open access cover for visual inspection of the limestone level and tank interior without the need to remove the tank cover. The tank shall be filled with 1 to 3 inch diameter limestone chips having a calcium carbonate content of 90 percent or greater. Calcium carbonate content of less than 90 percent is not approved.

54. In the middle school science lab classrooms and the science material storage/preparation area, provide an ADA compliant eyewash fixture at the end of the teacher's demo table equipped with two spray heads containing six aerated brass outlets having converging streams. Waste from the eyewash fixture shall be indirectly (safewaste) connected to the chemical waste system with all the waste piping installed inside the teacher's demo table. The ADA eyewash fixture shall be Model #SE-400-ADA as manufactured by Speakman.

55. In high school science lab and chemistry lab classrooms and the science material storage/preparation area, provide an ADA compliant combination emergency shower/eyewash unit equipped with a stay-open shower ball valve, two spray heads with six aerated brass outlets having converging streams with a stay-open ball valve and a 3 inch acid resistant floor sink for evacuating large volumes of shower water. Waste from the eyewash fixture shall be indirectly (safewaste) connected to the chemical waste system with all the waste piping installed inside interior walls. The ADA combination emergency shower/eyewash is to be installed at the rear of the classroom adjacent to the utility sink and away from any door or cabinets. The fixture shall be anchored to the floor with a base plate and to the wall with a bracket at the top of the fixture riser which shall be screwed into a 2"x4" length of metal stud or equivalent installed behind the plastered wall. The ADA combination emergency shower/eyewash shall be Model #SE-600-ADA as manufactured by Speakman.

56. In the high school science lab and chemistry lab classrooms, provide hot and cold water to each teacher's demo table and to each utility sink at the rear of the classrooms. The student table sinks shall be provided with cold water only.

57. In the high school science material storage/preparation area, a distillation water still shall be provided over the utility sink to produce the highest purity water. The still shall be Mega-Pure Still/Fisher EMD Scientific #S50920ND as manufactured by Corning.

58. In the prototyping room of the middle and high school technology laboratory classroom, provide a wall mounted ADA compliant eyewash unit equipped with two spray heads containing six aerated brass outlets having converging streams with a stay-open ball valve. The ADA eyewash unit shall be Model #SE-400-ADA as manufactured by Speakman.

59. In the clinics of new school facilities, provide a countertop or wall mounted ADA compliant eyewash unit equipped with two spray heads containing six aerated brass outlets having converging streams with a stay-open ball valve. The ADA eyewash unit shall be Model #SE-400-ADA as manufactured by Speakman.

60. In the clinics of existing school facilities, provide an eyewash assembly unit mounted to the existing clinic stainless steel sink faucet. Unit shall be equipped with two spray heads with a water diverter and a stay-open ball valve. The ADA eyewash unit shall be Model #S19-200B as manufactured by Bradley.

61. All domestic hot water piping shall be insulated with 3/4 inch fiberglass insulation. All interior mounted roof drain bodies and horizontal roof drain piping and horizontal waste drain piping carrying AHU condensate shall also be insulated.

62. Air admittance valves (AAW) used to eliminate venting to the outdoors are **PROHIBITED**.

63. A vent terminal shall be a minimum of 10 feet from any door, window or fresh air intake.

64. Mounting heights of the plumbing fixtures shall be found in the SBBC Architectural Design Criteria.

O. EMERGENCY GENERATOR

1. All diesel fired emergency generators shall be provided with a primary and an emergency vent. Only the primary vent is required to be vented to the outside.

2. The emergency generator exhaust piping shall be fabricated of Schedule 40 black steel piping and shall be insulated.

3. When applicable, the sizing of a storage tank for a diesel fired generator at an EHPA facility shall be based on 72 hours of operation. For all Non-EHPA facilities, the storage tank sizing shall be based on 24 hours of operation.

4. For diesel fuel tanks installed aboveground (AG) or underground (UG), the Contractor shall be responsible for generating, filling out and obtaining the Hazmat License for the tanks prior to installation. Refer to Broward County Code, Chapter 27.356 and all other applicable regulations for storage, handling and dispensing of diesel fuel.

5. Should diesel fuel or LP gas be used solely for the emergency generator, the Contractor shall be responsible for all cost associated with the furnishing, installation and filling of the tank. In addition, the tank shall be filled prior to turnover to the SBBC.

END OF SECTION