**MECHANICAL DESIGN CRITERIA**

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| **Revision History** |
| **Revision Date** | **Section / Nature of Revision** |
| 03/01/2017 | Document Issued |
| 10/20/2021 | Updated to reflect the current CSI formatII. C8F Added Gas Regulators vent outside Per CSD-1 CF 190 (d) III. B13h Added Gas Regulators vent outside Per CSD-1 CF 190 (d) |

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# GENERAL

A. The Design Professional shall use this document in conjunction with the Educational Specifications and District Master Specifications (DMS) to develop the design and contract documents.

* + 1. The engineer of record shall be responsible for incorporating owner requirements and preferences in drawings and specifications. The engineer shall utilize standard industry specifications and practices.
		2. Exercise caution to maintain competitive bidding and avoid single-source supply of such equipment and systems.
	1. In this document, the term “Engineer” represents the professionally qualified Design Engineer of Record and/or Engineering Consultant, duly licensed in the State of Florida, that signs and seals project design documents.
	2. The Engineer is the person “responsible in charge” for the design and development of all project documents.
	3. Engineer shall be responsible for using the latest code references, testing agencies, etc. including but not limited to:
		1. Florida Building Code - Mechanical, FBC
		2. Florida Energy Code
		3. National Fire Protection Association, NFPA
		4. American Association of Heating Refrigerating and Air Conditioning Engineers, ASHRAE standards
		5. ASHRAE Advanced Energy Design Guidelines for K12 School Buildings
		6. ASME
		7. ARI
		8. NEMA
		9. UL
		10. ANSI
		11. SMACNA
		12. AMCA

# CRITERIA

## HVAC DESIGN - GENERAL

### Drawings Numbering

At a minimum include the following drawings with corresponding information on each drawing. (Drawing numbering is preferred, but not mandatory)

* + - 1. M0.0 Legend
			2. M0.1 Flow diagram
				1. Any controllable equipment
				2. Sensor locations
				3. Table of loads. (see attached)
			3. M0.2 Site plan – pipe routing, associated site obstructions (trees, sidewalks, etc.)
			4. M1.0 Demolition plans – clearly label equipment to be removed.
			5. M2.0 New work plans – 1/8” per foot floor plans; ¼” per foot mechanical room layout
			6. M3.0 Details
			7. M4.0 Schedules
			8. M5.0 Controls diagrams – control logic and sequence of operations for each piece of equipment to be controlled; location of LAN controllers; location of computer.

### Requirements for Phases 1 through 3

* + - 1. Phase 1 Schematic Design:
				1. Floor plan with location of major mechanical equipment.
				2. Room sizes
				3. Flow diagram with system type
				4. Table of contents specs.
			2. Phase 2 Design Development (Mechanical design team shall schedule review meeting with District Mechanical engineer to discuss design plan)
				1. Floor plan with AHU’s sized and positioned in room. (if no load models, assume 1.2 cfm/SF)
				2. Show ¼” scale mechanical rooms. Show locations of VFD, control panel, duct detector, spin in fitting in supply air, pipe penetrations into room (assume footer width); service clearances in shaded box;
				3. Flow diagram with load summary table setup (or complete)
				4. Site plan with pipe routing.
				5. Chiller plant layout of equipment and single line piping.

Pumps shall have motors facing serviceable aisles

Condenser pumps close to wall of tower yard.

Manufacturers operating and service clearances in shaded box.

Show locations for chemical treatment; VFD’s; disconnects; control panel; FCU; air separator; expansion tank;

* + - * 1. All sheets including detail sheet with anticipated details, schedule sheet (not filled in); anticipated general controls diagrams.
				2. Full book specs with owner requirements in bold.
			1. Phase 3 Construction Documents.
				1. Completed design.
				2. Energy calcs
				3. Life Cycle calcs
				4. Completed load summary
				5. Elevation view of AHU mechanical room including height of outdoor air inlet and location of serviceable equipment such as control valves, control dampers, duct heaters, duct access doors.
				6. Chiller equipment room: piping larger than 2” shall be double lined. Show elevation view for clarification of specific pipe routing.

### Design guidelines

* + - 1. Indoor summer: 74 degF; 50% RH
			2. Outdoor summer: 92 degF; 80 degF wet bulb
			3. Indoor winter: 70 degF
			4. Outdoor winter: 32 degF
			5. Indoor kitchen: 78 degF
			6. Building pressurization: .10 to .15 cfm/SF

## HVAC DESIGN – ROOM SPECIFIC

* + 1. Media: ability to control humidity after hours without entire plant running.
		2. Dining/Multipurpose: single zone VAV. CO2 demand control ventilation.
		3. Gym: Single zone VAV. CO2 demand control ventilation.
		4. Auditorium: CO2 demand control ventilation.
		5. Classroom: DO NOT USE demand control ventilation.
			1. Provide room temperature sensors in the return air for each room.
			2. Use ANSI standard S12.60-2002 American National Standard Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools.
		6. Mechanical AHU Equipment Rooms:
1. Coordinate size and location with architect.
2. Room shall be located on exterior wall with double doors to exterior.
3. Provide 18” min. clearance on back wall of AHU.
4. Show all service clearances.
5. All serviceable equipment shall be located such that a maximum 6’ ladder can be used. All dampers, control valves, air monitors preferred to be serviced from ground level.
6. Provide access doors for dampers.
7. Provide concrete pad on exterior grade of entrance to mechanical room with exterior lighting.
8. Provide positive pressurization with 4” spin in fitting with damper in supply air duct.
9. Provide each room with hub drain to storm for condensate AND floor drain to sanitary for other.
10. Provide with hose bib
11. If room is not of proper size, please notify PCS mechanical engineer.
	* 1. Chiller/Pump/Boiler Building:

a. Roll up door in front of each chiller sized large enough for installation and removal of entire machine.

b. Chilled water fan coil unit for tempering of air.

1. Condenser water return pipe shall not be higher than cooling tower sump.
	* 1. Interior Corridors:

Shall be conditioned. Provide one half cfm that is recommended by load model peak value. Do not use VAV’s.

* + 1. Food Service Cooking Equipment:

All cooking equipment used in processes producing smoke or grease laden vapors shall be equipped with an exhaust hood ventilation system that complies with all the equipment and performance requirements of NFPA 96: Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations. The system design shall be submitted for review to the Pinellas County Schools (PCS) Fire Marshall.

## HVAC DESIGN – EQUIPMENT

* + 1. Chillers:
		2. Air cooled chillers shall be provided with low sound fans and compressor sound attenuation.
		3. A/C chillers shall be mounted and secured on 6” high hot dip galvanized I beams with vibration isolation.
		4. Provide chiller piping with an additional supply and return flange connection for emergency chiller installation.
		5. A/C chillers shall be provided with wire coil guards. (hail guards are not necessary)
		6. Chillers shall be sized to connected load plus 10%. Show in table on flow diagram.
		7. Utilize primary/secondary pumping arrangement. Consult with district mechanical engineer if another pumping scheme is desired.
		8. Provide chiller yard with concrete housekeeping pad, gravel or shell yard, exterior lighting.
		9. Chiller yard walls shall be designed to attenuate noise to meet current noise guidelines and allow proper airflow to chillers. Wall shall be no higher than 2 feet above height of chillers.
		10. Cooling Towers:
			1. Select only direct drive motor/fan assemblies. No belt drive fans.
			2. All stainless steel construction including accessories and mounting hardware.
			3. Provide with aluminum ladder.
		11. Piping:

Do not route piping below buildings (unless entering in building) or under walkways unless approval from PCS mechanical engineer.

HDPE hydronic piping for underground installation may be specified as a bid base item with the insulated steel piping as an alternate deduct option.

* + 1. AHU’s:
			1. No stacked dual path AHU’s shall be accepted unless approval from PCS mechanical engineer.
			2. Mount on pad vibration isolators.
			3. Provide base rails in addition to 6” high housekeeping pad.
			4. Provide flexible duct connection for supply duct.
			5. Provide mixing box with angled 2” MERV 7 pre-filters if space permits. (2” flat filters section is acceptable.
			6. Provide separate filter section with 4” MERV 11 after filters.
			7. Size AHU cooling coils using entering water temperature 1 degF higher than leaving chilled water temperatures.
			8. Outdoor air and return air dampers preferred to be located in mixing box.
		2. Ductwork:
			1. Fiberglass duct is not acceptable.
			2. Flex duct is preferred for transfer air duct. Minimum 2 90 degree turns not including drop down to devices.
			3. Exposed duct shall be spiral or flat oval double walled internally insulated duct. Paint to match structure.
		3. Air Devices:
1. Insulate the tops of all air devices.
2. Provide flex duct between 4’ and 10’ to supply air devices.
3. Import VAV locations into architect’s reflected ceiling plan in addition to air devices. Coordinate location of VAV’s to insure proper service clearance. Avoid lights, cable trays, plumbing pipe etc.
4. Use plastic air devices for kitchens. Insulate tops of devices.
	* 1. EFs:
5. Rooftop exhaust fans are preferred.
6. Provide with min. 18” roof curb.
7. Specify direct drive fans unless belt is only option.
8. All EF’s shall be controlled by EMS unless otherwise noted. ALL EF’s shall be at least monitored by EMS.
	* 1. Boilers:
9. Gas fired flex tube boilers are preferred, provide condensing boilers in design.
10. Provide boiler rooms with manual emergency shutdown switches in accordance with ASME boiler code CSD-1.
11. Provide minimum 18” clearance around entire boiler.
12. Provide room with floor drain.
13. Provide with rigid relief pipe.
14. For Gas regulators- Per CSD-1 CF 190 (d) Gas vent, bleed, or relief lines shall have provisions to be piped by the installer to the outdoors at a safe point of discharge a means shall be provided at the terminal point to prevent stoppage of the lines by foreign material, moisture or insects.
	* 1. DX Split Systems:
15. The following rooms shall be equipped with standalone DX cooling (preferably minisplit)
16. Principal’s office;
17. dedicated computer lab;
18. Main CER;
19. Elevator machine room;
20. Dry storage
	* 1. Pumps:
			+ 1. Orient pumps such that motors are facing out for easy access
				2. Do not use suction diffusers unless space constraints dictate. Put Y-strainer in rise of suction pipe. Use long radius elbow to inlet.
				3. Y-strainer shall be equipped with hose bibb connection at drain
				4. All pumps shall be equipped with the following:

Shutoff valves on supply and return

Check valve

Balancing valve

Y-strainer

Flexible connectors

# SPECIFICATIONS

## SPECIFICATIONS GENERAL:

**All owner requirements shall be in bold in specifications during all submittals with the exception of 100% bid and permit set**. All owner furnished specifications shall be included in its entirety with footer showing the revision date.

## SPECIFICATIONS CRITERIA:

### Division 1 Boilerplate

* 1. For all hard bid projects, provide most recent district supplied Division 1 boilerplate. Consult with project coordinator for all fillable items.
	2. For special conditions provide the following verbiage for contingency:

 In addition to your bid, there shall be a **{fill in amount for 3% construction cost**} contingency. The contingency shall be a separate line item with no markup added to it. The purpose of the contingency is for defraying expenses due to unforeseen circumstances related to construction. The contractor shall be required to furnish documentation evidencing expenditures charged to the contingency with a 15% markup prior to written approval and release of funds by the Owner. This contingency shall be part of the contract, and if not used, or partially used, there shall be a deductive change order to reconcile the contract balance upon completion of the project.

### 23 05 10 General Requirements

 Refer to 23 05 10

### 23 05 29 Supports and anchors

* 1. Provide pipe saddles for insulated pipe 12” long and 18 gauge sheet metal.
	2. Provide pipe hanger within 12” of all elbows.
	3. Support vertical piping midway at each floor or minimum 12’ spacing.

### 23 05 53Mechanical Identification

1. Label all visible piping in mechanical rooms and exposed areas with supply and return and arrows denoting flow. Mark with either hot, chilled, or condenser water.
2. Label all equipment with 2” x 4” plastic tags. Black with white lettering.
3. Label AHU numbers by building number first following by number of AHU’s in building.
4. Label VAV’s with AHU # first then VAV #
	1. Ex. AHU 2-3 (Building 2 AHU-3)
	2. VAV 2-3-11 (VAV from AHU 2-3 #11)
5. Label pumps as follows:
	1. Chilled water: CHP
	2. Primary chilled water: PCHP
	3. Secondary chilled water: SCHP
	4. Condenser Water: CP
	5. Hot water: HWP
	6. Boiler pump: BP

### 23 05 48 Vibration Isolation

1. Provide flex connectors at outlet of each pump and ahu.
2. Pad mounted AHU’s. Neoprene.
3. Air cooled and water cooled chillers. Pad type neoprene pads or per manufacturers recommendations.
4. Pumps on 2nd floor or over 50 HP shall be installed on inertia pads.

### 23 07 19 Piping Insulation

1. Provide clear insulation schedule for piping on each project.
2. Exposed insulation in mechanical rooms (up to 8 ft.); interior exposed rooms; all exterior insulated pipe shall have .016” aluminum smooth finish jacket. Jacket shall be continuous and include pre-formed aluminum covers for all elbows and fittings. Exterior jacketing must be installed with seams facing down. Insulation shall be vapor sealed prior to installation of jacketing. Jacketing shall be continuous and include pre-formed aluminum covers for all elbows and fittings.
3. Interior above grade: white fire retardant finish all service jacket (ASJ)
4. Underground insulation shall be sealed in a water proof manner.
5. Insulate interior condensate pipe. Exterior condensate pipe does not need insulation.
6. All exposed Armaflex insulation on DX piping shall get aluminum jacket.
	1. Type A: Closed cellular glass (Foamless) .29 k value conductivity.
		1. Chilled water;
		2. heating hot water;
		3. Refrigerant suction pipe in plenums or through firewall penetrations.
7. Type B: Closed cell foam plastic (Armaflex) 27 k value.
	* 1. Condensate pipe
		2. Refrigerant suction lines except in plenums or firewall.
8. Type C: Glass Fiber .23 k value

Domestic hot water

1. Provide pipe saddles minimum 12”.

### 7. 27 07 16 Equipment Insulation

1. Chillers shall be insulated per manufacturer’s specifications. Armaflex.
2. Pumps shall be insulated with Foamglass box.
3. Type A: Closed cell glass (Foamglass) .29 k value.
	1. Air separators, strainers and valve bodies
	2. Pumps?
4. Type B: Closed cell foam plastic (Armaflex)

 Chiller cold surfaces.

### 23 07 13 Ductwork Insulation

1. All supply and return air duct shall be externally wrapped Type A fiberglass R-6 insulation with seams that are sealed with tape and mastic.
2. Ducts greater than 18” width shall be pinned with fasteners to minimize sagging every 18”. Pins shall be sealed with mastic.
3. Exhaust and relief air duct shall be internally lined with Type B smooth surface cleanable duct liner.
4. Double walled internally insulated duct for first 20 ft. of supply and return unless otherwise noted.
5. Outdoor air duct is not required to be insulated.

### 23 21 13 Hydronic Piping

1. Above Grade Chilled/Hot water pipe:
	1. 2.5” and larger schedule 40 Carbon Steel;
	2. 2” and smaller Type L, Copper Tubing or schedule 40 black steel with screwed fittings;
2. Below Grade Chilled/Hot water pipe:
	1. Factory fabricated pre-insulated piping system.
	2. Consider factory pre-insulated HDPE pipe. No insulation on joints, elbows.
	3. PVC casing pipe.
	4. Polyurethane foam insulation.
	5. If no insulation or casing on joints, insulation at ends of each pipe section must be sealed weather tight.
	6. Schedule 40 black steel Sleeves required for penetrations through masonry or concrete walls floors and roofs. Shall extend min. 1” AFF.
3. Condenser Water pipe:
	1. PVC or HDPE below grade.
	2. Steel above grade.
4. Condensate drain piping:
	1. Inside mechanical room and inside building – copper (insulated with Armaflex)
	2. Rooftop condensate may be uninsulated PVC painted with UV coating.
	3. All condensate drain lines shall be supported properly.

### 23 21 16 Hydronic Specialties

1. Provide thermometers and pressure gauges for all AHU’s in wells deep enough to provide accurate readings.
2. Provide strainers before coils and pump inlets. Strainers shall have valve and hose connection.

### 23 21 23 HVAC pumps

1. Approved manufacturers: B&G; Armstrong; Weinman; Taco
2. TEFC motor 1750 or less RPM. VFD compatible.
3. Floor mounted end suction unless otherwise directed.
4. Flexible coupling with coupling guard.
5. Cast iron casing with gage ports and flanged suction and discharge.
6. Bronze impeller keyed to motor shaft.
7. Bearings: L10 rated life of 30,000 hours
8. Carbon steel shaft with bronze key.
9. Seal: stainless steel.
10. Vertical inline are accepted for some applications
11. Contractor shall include impeller shaving on all pumps 7.5 HP and larger.
12. Laser alignment for all pumps 20 HP or larger.
13. Alignment by factory trained and authorized representative.
14. 1 year warranty.
15. Orient pumps with motors facing service area.
16. Provide built in hoist for pumps larger than 40 HP.
17. Long radius elbow in lieu of suction diffuser. Strainer in rise of pump inlet.

### 23 57 00 Plate and Frame Heat Exchanger

1. HX shall be tested and flushed at the factory and shipped completely assembled.
2. All nozzle connections shall be sealed.
3. Shall designed, fabricated and tested in accordance with ASME code; and shall bear the appropriate stamp and National Board Registration number.
4. Shall be designed to include minimum of 10% additional surface for fouling.
5. Shall be designed with a redundant heat exchanger.
6. Plates shall be stainless steel.
7. Gasket shall be one piece Nitrile rubber.
8. Frame shall be carbon steel.
9. Bolts shall be treated with rust-protective coating and covered with plastic sleeves.
10. Frame and bolt shall be provided with capacity to add 25% more plates for future expansion.
11. Provide backup heat exchanger unless otherwise noted.
12. Design with proper service clearance.
13. Provide with 2 year unconditional parts and labor warranty.
14. Provide with 1” valve and hose bib connection to supply and return of shell side for flushing without removing plates.

### 23 52 00 Boilers

1. Manufacturer’s:
	1. RBI
	2. Bryan
	3. Raypak
2. Vertical water tube copper fin boiler. ASME Heating Boiler Code with ASME H stamp.
3. 160 Psig; 210 degF ratings.
4. Minimum 7/8” ID tubes; min. 7 fins per inch;
5. Combustion chamber shall be min. 16 gauge aluminum, completely enclose heat exchanger, and be readily removable installable.
6. Air tight observation port.
7. Provide Boiler Inspectors Certifications; factory test reports; O&M manuals.
8. For Gas regulators- Per CSD-1 CF 190 (d) Gas vent, bleed, or relief lines shall have provisions to be piped by the installer to the outdoors at a safe point of discharge a means shall be provided at the terminal point to prevent stoppage of the lines by foreign material, moisture or insects.

### 23 63 00 Condensing Units

1. Casing: welded steel frame with zinc coated galvanized steel panel coated with epoxy primer and enamel finish.
2. Condenser coils: Aluminum fin bonded to copper tubing.
3. Coil guard: PVC coated steel wire?
4. Fans and motors: weatherproof motor
5. Compressors: scroll
6. Crankcase heater: thermostatically energized.
7. Warranty: 1 year machine; 5 year compressor.
8. Provide with defrost controls; low ambient operation to 35 degF; anti-short cycle timer 5 minutes.

### 23 64 23.13 Air Cooled Scroll Chiller

Refer to attached spec.

### 23 64 26.13 Air cooled Screw Chiller

Refer to attached spec.

### 23 64 16.16 Water Cooled Centrifugal chiller

1. Owner pre-purchased chillers: a life cycle cost analysis bid method shall be used for owner purchased equipment unless otherwise indicated. See attachment for methodology. Engineer shall meet with district engineer and project coordinator to discuss process.
2. Warranty: in accordance with OEM service agreement and bid results.
3. Provide a factory certified ARI test witnessed by engineer of record and 2 owner representatives at manufacturer’s factory as part of the base bid. Provide hard and electronic copies of certification.
4. Acceptable manufacturers: Carrier, McQuay, Trane, York.
5. Unit shall be mounted on neoprene vibration isolators when on ground level slab. Use spring isolators if not.
6. Compressors: Hermetically sealed motor transmission and compressor. Hermetic motor driven oil pump, oil cooler, pressure regulator, oil filter, oil pump starter, automatic water control valve, thermostatically controlled oil heater, and reservoir oil temperature gage.
7. Cooler: carbon steel with carbon steel tube sheet. Tubes shall be 0.028” wall thickness. Rated to 150 psig, and tested to 225 psig. Cooler shall be flooded shell and tube type.
8. Provide factory 1.5” thick Armaflex vapor seal insulation on all cold surfaces including but not limited to evaporator shell, heads, and compressors.

### 23 64 26.16 Water cooled Screw chiller

### 23 65 00 Cooling tower

1. Refer to attached spec.
2. Gear driven fan.
3. All stainless steel construction of cold and hot water basin, structural elements, hardware for fabrication, hardware for miscellaneous connections ie. Conduit, pipe, etc.

### 26 82 16.14 Electric duct heater

1. Acceptable manufacturers: Warren, Indeeco**.**
2. Heaters shall meet all NEC and UL requirements and listings.
3. Elements shall be open coil, 80% nickel, 20% chromium Type A resistance wire.
4. Heater frames shall be aluminized steel.
5. Provide thermal cutout and over temperature protection, airflow switch, fuses, control circuit transformer, and door interlocking disconnect switch.
6. Provide with SCR controls when possible.
7. Provide with insulated dust tight terminal box.
8. Install per ARI and SMACNA ducted electric heat guide.

### 23 82 19 Fan Coil Unit

1. Chassis shall be 18 gauge galvanized steel insulated with foil faced closed cell insulation.
2. Provide with noncorrosive drain pan. Provide with auxiliary drain pan or auxiliary drain connection installed with float switch.
3. Access doors shall be hinged and fully accessible.
4. Copper tubes and aluminum fins.
5. 2” filter rack.
6. Centrifugal forward curbed fan.
7. Electric heat shall be UL approved.

### 23 81 26 Split System Air Handling Unit

### 23 74 16 Packaged DX Rooftop unit

1. Warranty: provide 1 year manufacturer’s warranty and compressor warranty 5 years.
2. Casing: zinc coated heavy gauge, galvanized steel with external surfaces finished with baked enamel.
3. Service panels?
4. ½” foil faced fiberglass insulation for 10 tons and below. ½” foil faced closed cell insulation for over 10 tons.
5. Compressor: direct drive scroll type. Internal motor overloads, crankcase heater and vibration isolation.
6. Fixed orifice refrigeration circuit.
7. Internally finned copper tubes with aluminum plate fin. Leak tested to 200 psig and pressure tested to 450 psig.
8. Direct drive outdoor fans.
9. Direct drive indoor fan for under 6 tons. Over 6 tons shall have belt drive?
10. Unit shall be secured to minimum 18” high roof curb in accordance with proper wind loading methods. Contractor shall provide manufacturers detail for screw number and placement during inspection.
11. Outdoor air damper shall have the capability to fully close and be manually set to up to 50% open.

### 23 73 13 Chilled Water Air Handling Unit

1. No large AHU’s on 2nd floor of buildings.
2. Provide detail of all AHU sections with access doors.
3. Provide room large enough for proper normal clearance AND 18” on backside of unit.
4. Leave one panel on fan section free from conduit or other items that would need to be removed to remove section panel.
5. Outdoor air louvers shall be no less than 60” above grade to lowest point of louver.
6. All chilled water coils shall be equipped with the following:
	1. Shut valves supply and return.
	2. Strainer on inlet with valve and hose

### 23 35 00 Exhaust Fans

1. Specify direct drive fans unless belt drive is only option.
2. Provide rooftop exhaust fans as much as possible.
3. Single restrooms may be single ceiling mounted EF. Fans shall be controlled by light switch with 10 min. time delay for shutoff.
4. EF’s shall be connected to campus wide DDC controls.
5. All rooftop fans shall be installed on a minimum 18” high roof curb.
6. Acceptable Manufacturers:
	1. Greenheck
	2. Cook

### 23 30 00 Ductwork (Including Accessories)

1. Sheet metal ductwork for all supply, return, exhaust and relief air duct. No duct board shall be permitted.
2. Installed in accordance with SMACNA.
3. Dampers shall be galvanized steel with locking quadrant and a 2” standoff.
4. All interior surfaces shall be smooth. Seams and joints shall be external.
5. Provide turning vanes in all 45 and 90 degree bends.
6. Mastic seal on all joints.
7. Pressure tested by contractor in accordance with FBC and SMACNA and witnessed by PCS Test and Balance contractor.
8. Double walled internally insulated duct for first 20 ft. of supply and return unless otherwise noted.
9. Provide access doors in accordance with SMACNA for cleaning and inspection of all controllable components in system.
10. All ductwork scheduled to be existing to remain shall be cleaned. Replace air devices unless otherwise noted.

### 23 36 16 Variable Air Volume Units

1. Manufactured with 22 gauge zinc coated steel, 1” glass fiber insulation with foil liner to prevent fiberglass from entering airstream.
2. UL listed.
3. Support units directly to structure. Do not support with ductwork.
4. Coordinate location with RCP and other trades to avoid clearance conflicts.
5. Actuators shall be pre-installed on VAV boxes by controls contractor prior to being hung.

### 23 37 13 Air Devices

1. Supply air devices shall be Titus TMS – AA or equivalent. 4 cone.
2. Return air devices shall be Titus PAR – AA or equivalent. Perforated hinged for cleaning.
3. Contact PCS mechanical engineer for specialty air devices for gyms, auditoriums, media centers, etc.
4. Supply and return air devices shall be insulate on tops of device.
5. Supply air devices in kitchens shall be plastic with insulated tops.
6. Acceptable manufacturers:
	1. Metalaire
	2. Titus

### 23 09 23 DDC Controls

See attached spec. Provide in its entirety.

1. 40 97 00 Variable Frequency Drives

See attached spec. Provide in its entirety.

### 23 05 10 Supplementary Requirements

### 32. 23 05 93 TAB Work

### 33. 23 25 00 Water Treatment

### 34. 23 41 00 HVAC filters

END OF SECTION