SECTION 905 -- PROPOSAL (CONTINUED)

I (We) further propose to execute the attached contract agreement (Section 902) as soon as the work is awarded to me (us), and to begin and complete the work within the time limit(s) provided for in the Specifications and Advertisement. I (We) also propose to execute the attached contract bond (Section 903) in an amount not less than one hundred (100) percent of the total of my (our) part, but also to guarantee the excellence of both workmanship and materials until the work is finally accepted.

I (We) enclose a certified check, cashier's check or bid bond for **five percent (5%) of total bid** and hereby agree that in case of my (our) failure to execute the contract and furnish bond within Ten (10) days after notice of award, the amount of this check (bid bond) will be forfeited to the State of Mississippi as liquidated damages arising out of my (our) failure to execute the contract as proposed. It is understood that in case I am (we are) not awarded the work, the check will be returned as provided in the Specifications.

Bidder acknowledges receipt of and has added to and made a part of the proposal and contract documents the following addendum (addenda):

ADDENDUM NO.	**1**	DATED	**10/19/2004**	ADDENDUM NO.		DATED	
ADDENDUM NO		DATED		ADDENDUM NO		DATED	

Number	Description
1	Revised table of contents; Add Document 00910 Addendum No. 1

TOTAL ADDENDA: **1**
(Must agree with total addenda issued prior to opening of bids)

Respectfully Submitted,

DATE _____

_____
Contractor

BY _____
Signature

TITLE _____

ADDRESS _____

(To be filled in if a corporation)

Our corporation is chartered under the Laws of the State of _____ and the names, titles and business addresses of the executives are as follows:

President	Address
Secretary	Address
Treasurer	Address

The following is my (our) itemized proposal.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

TABLE OF CONTENTS
DOCUMENT 00010

PROJECT: **DISTRICT HEADQUARTERS BUILDING AT McCOMB, PIKE COUNTY, MISSISSIPPI**

PROJECT NUMBER: **BWO-7116-57(001) 501416**

DATE: **8-10-04 (Revised 10-14-04)**

DESCRIPTION A: The Department of Transportation shall clear and grub the site and have in place a building pad of compact select material within one foot of finish floor. This Work shall consist of minor site work and all construction work necessary in constructing the District Headquarters Building at McComb, Pike County, Mississippi in accordance with these Specifications and conforming with the Drawings.

It is the intention of these Specifications to provide the necessary items and instruction for a complete building including all code compliance. Omission of items or instruction necessary or considered standard good practice for the proper installation and construction of the building shall not relieve the Contractor of furnishing and installing such items and conforming to the building codes having jurisdiction.

GENERAL INDEX

DIVISION 1 GENERAL REQUIREMENTS

*** END OF DOCUMENT***

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

ADDENDUM No. 1
DOCUMENT 00910

DATE: **10-14-04**

PROJECT: **DISTRICT HEADQUARTERS BUILDING AT McCOMB, PIKE COUNTY, MISSISSIPPI**

PROJECT NUMBER: **BWO-7116-57(001) 501416**

PART 1 GENERAL

1.01 DESCRIPTION: Bidders are hereby advised that the following changes are to be made to this contract. Bidders shall acknowledge receipt of this addendum by inserting its number and date in the designated spaces on their Proposal.

1.02 SPECIFICATIONS

A. Section 05730 – Ornamental Metals. Omit this Section in its entirety and replace with Section 05730 – Ornamental Metals (Revised 10-14-04).

B. Section 08350 – Access Doors. Omit this section in its entirety and replace with Section 08305 – Access Doors (Revised 10-14-04).

C. Section 15605 – Electric Wall Heaters – Part 1 General, Paragraph 1.03 – change sentence to read as follows: “1.03 Acceptable Manufacturers: Electric wall heaters shall be as manufactured by Markel or Berko.”

D. Section 15660 – Condensing Units: Omit this Section in its entirety and replace with Sections 15670 Air Cooled Condensing Units (CU-1, CU-2 & CU-4) (Revised 10-14-04) and 15680 Air Cooled Condensing Unit (CU-5) (Revised 10-14-04).

E. Section 15701 – Variable Frequency Drives. Omit this Section in its entirety.

F. Section 15740 – Variable Air Volume Boxes, Part 1 General, add the following paragraph: “1.02 Acceptable Manufacturers: The following manufacturers are acceptable on this project: Trane or Carrier.”

G. Section 15765 – Rooftop Air Conditioning Unit. Omit this Section in its entirety and replace with Section 15733 Packaged Rooftop Air Conditioning Units (Revised 10-14-04).

H. Section 15840 – Ductwork & Accessories, Paragraph 2.02 Manual Dampers and Damper Hardware, modify Paragraph D to read as follows: “Dampers shall be Ruskin, Price or Greenheck.”

I. Section15850 – Fans, Part 2 Products, Paragraph 2.03 Description, delete the last sentence in Paragraph A-1, modify Paragraph 2.03 B-5 to read as follows: “Fans shall be manufactured by Greenheck or Cook.”

J. Section 15860 – Central Air Handling Units, Part 1 General, change sentence 1.03 to read as follows: “Acceptable Manufacturers: Air handling units shall be as manufactured by Trane or Carrier.”

K. Section 15860 - Central Air Handling Units, Part 2 Products, 2.02 Central Station Air Handling Unit, Paragraph D. Add the following sentence: “Provide two independent refrigerant circuits, each with its own distributor. The two circuits are to be intertwined so that full face of coil is always active.”

L. Section 15900 – Automatic Temperature Controls. Omit this Section in its entirety and replace with Sections 15910 – Building Automation System (Revised 10-14-04) and 15920 – Changeover/Bypass Variable Air Volume System Controller (Revised 10-14-04).

M. Section 16640-Security Systems. Omit this Section in its entirety and replace with Section 16640-Security Systems (Revised 10-14-04).

N. Section 16660 – Closed Circuit Television System – Add this section (10-14-04).

O. Section 16721-Fire Alarm and Detection System. Omit this Section in its entirety and replace with Section 16721-Fire Alarm and Detection System (Revised 10-14-04).

1.03 DRAWINGS

A. Replace Sheet Number 3, Working Number DM1 – Existing Conditions/Demolition Plan with Sheet (Revised 10-14-04). The following changes include:

1. Graphic was included south of canopy on east side of building, and related note inserted regarding clearing and grubbing, and removal of vegetation as necessary to install new handicap ramp.
2. Installation of handicap ramp shall precede all work in order to provide handicap access to the existing District Office.

B. Replace Sheet Number 4, Working Number L1 – Layout Plan with Sheet (Revised 10-14-04). The following changes include:

1. Sheet has been revised to include layout and notes for installation of the new handicap ramp on the east side of the existing building.

C. Replace Sheet Number 5, Working Number G1 – Grading Plan with Sheet (Revised 10-14-04). The following Changes include:

1. Sheet has been revised to include grading and notes for installation of the new handicap ramp on the east side of the existing building.

D. Replace Sheet Number 6, Working Number SWPPP – Storm Water Pollution Prevention Plan with Sheet (Revised 10-14-04). The following changes include:

1. Handicap ramp and grading was added to this sheet.

E. Replace Sheet Number 21, Working Number A4.7 – Monumental Stair Section and Plans with Sheet (Revised 10-14-04). The changes include:

1. Details 1 and 3; add additional pair of supports for each shelving unit and add two additional lights to each shelving unit.

F. Replace Sheet Number 32, Working Number A5.4 – Door and Window Details with Sheet (Revised 10-14-04). The changes include:

1. Details 1 and 6; indicate steel tube and angles as detailed in the structural design.

G. Replace Sheet Number 68, Working Number S3.5 –Steel Details with Sheet (Revised 10-14-04). The changes include:

1. Revise thickness of tube steel stair stringer as indicated.

H. Replace Sheet Number 78, Working Number M2.1 – First Floor Plan – Part A – HVAC with Sheet (Revised 10-14-04). The following changes include:

1. Variable Frequency Drives for AHU-1 and AHU-2 were deleted.
2. The ductwork served by VAV Box #62 was modified to serve Vestibule 102.
3. VAV Box #80 and associated ductwork, dampers, grille and thermostat was added to serve Vestibule 101.
4. Transfer ducts with grilles were added to Vestibule 101 and Vestibule 102.
5. VAV Boxes #81, #82, #83 and #84 were added to AHU-1 and AHU-2 between the supply duct and return duct.

I. Replace Sheet Number 80, Working Number M2.3 – Second Floor Plan – HVAC with Sheet (Revised 10-14-04). The following changes include:

1. Variable frequency drives for AHU-4 and AHU-5 were deleted.
2. VAV Boxes #85, #86, #87 and #88 were added to AHU-4 and AHU-5 between the supply duct and return duct.

J. Replace Sheet Number 81, Working Number M3.1 – Mechanical Room Section – HVAC with Sheet (Revised 10-14-04). The following changes include:

1. VAV Boxes #81, #82, #85 and #86 were added to AHU-1 and AHU-4 between the supply duct and return duct. Minimum mounting heights of boxes in Mechanical Room are shown.

K. Replace Sheet Number 82, Working Number M3.2 – Mechanical Room Section – HVAC with Sheet (Revised 10-14-04).

1. VAV Boxes #83, #84, #87 and #88 were added to AHU-2 and AHU-5 between the supply duct and return duct. Minimum mounting heights of boxes in Mechanical Room are shown.

L. Replace Sheet Number 84, Working Number M5.1 – HVAC Schedules with Sheet (Revised 10-14-04). The following changes include:

1. The CFM set-points for VAV Box #62 were reset to 550 CFM max., 105 CFM min., 330 CFM heating. VAV Box size and electric heat remain the same.
2. VAV Boxes #80, #81, #82, #83, #84, #85, #86, #87 and #88 were added to schedule.

M. Replace Sheet Number 85, Working Number M5.2 – HVAC Schedules and Details with Sheet (Revised 10-14-04). The following changes include:

1. Revise note on Package Air Handling Unit with Electric Heat Schedule to read as follows: "Provide space mounted humidistat to control space humidity (See Controls Sequence of Operation)."
2. Detail 4/M5.2 was deleted. Consult with equipment manufacturer for recommended refrigerant specialties, sizing, charging and start-up.

N. Replace Sheet Number 91, Working Number E2.4 – Second Floor – Part A - Lighting with new Sheet Number 91, Working Number E2.4 (Revised 10-12-04). The following changes include:

1. Delete receptacles with a C by them (two each at both entrances to the building).

O. Replace Sheet Number 92, Working Number E2.5 – First Floor – Part B - Electrical with new Sheet Number 92 (Revised 10-12-04). The following changes include:

a. Connect three CCTV camera junction boxes shown on this sheet to camera junction box shown on Sheet Number 94, Working Number E2.7 at Room 233.

P. Replace Sheet Number 93, Working Number E2.6 – First floor – Part A – Fire alarm, Security & Mechanical Equipment Electrical Connections with new Sheet Number 93, Working Number E2.6 (Revised 10-12-04). The following Changes include:

1. Added fixed CCTV camera at lobby looking at entrance.
2. Added circuit "PL1B-26" to serve two new VAV boxes (#81 & #82) – See also changes on panel schedule on Sheet Number 97, Working Number E3.3.
3. Added circuit "PL1A-40" to serve two new VAV boxes (#83 & #84) – See also changes to panel schedule on Sheet Number 98, Working Number E3.4.
4. Deleted connections to VFDs serving AHU-1 & AHU-2 and showed to connect straight to fans at each.
5. Added circuit "PH1B-27" to serve new VAV box #80 – See also changes to panel schedule on Sheet Number 97, Working Number E3.3.

Q. Replace Sheet Number 94, Working Number E2.7 – Second Floor – Part A – Fire Alarm, Security & Mechanical Equipment Electrical Connections Plan with new Sheet Number 94, Working Number E2.7 (Revised 10-12-04). The following changes include:

1. Add quadruplex receptacle for security control panel, area control unit and monitor in room 230.
2. Add phone/fax/data outlet in room 230.
3. Add quadruplex receptacle for CCTV rack and monitor in room 230.
4. Add connections for CCTV cameras. Connect to cameras shown on Sheet Number 92, Working Number E2.5. Utilize circuit PL2B-26.
5. Added circuit "PL2B-28" to serve two new VAV boxes (#85 & #86) – See also changes on panel schedule on Sheet Number 97, Working Number E3.3.
6. Added circuit "PL2A-21" to serve two new VAV boxes (#87 & #88) – See also changes to panel schedule on Sheet Number 98, Working Number E3.4.
7. Deleted connections to VFDs serving AHU-3 & AHU-4 and showed to connect straight to fans at each.

R. Replace Sheet Number 97, Working Number E3.3 – Electrical Panel Schedules with new Sheet Number 97, Working Number E3.3 (Revised 10-12-04).The following changes include:

1. Add circuit PL2B-22 (20A1P) to serve the security control panel in room 230.
2. Add circuit PL2B-24 (20A1P) to serve CCTV rack, equipment and color monitor.
3. Add circuit PL2B-26 (20A1P) to serve CCTV cameras shown on Sheet Number 92 and 94.
4. Add circuit PH1B-27 (20A1P) to serve new VAV box #80.

S. Replace Sheet Number 98, Working Number E3.4 – Electrical Panel Schedules with new Sheet Number 98, Working Number E3.4 (Revised 10-12-04). The following Changes include:

1. Add 20A1P circuit breaker to Panel PL1A (#38) for fixed CCTV camera at lobby. See Sheet Number 93, Working Number E2.6.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF DOCUMENT

SECTION 05730 ORNAMENTAL METALS
(Revised 10-14-04)

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Stainless Steel Plate and Angles.

B. Perforated Steel Plate.

C. Light Cove.

D. Stainless Steel Brake Metal.

1.02 SUBMITTALS

A. Product data for each product including finishing materials and methods.

B. Shop drawings showing fabrication and installation including plans, elevations and details of components and attachments to other units of work. Indicate materials, profiles of each metalwork member and fitting, joinery, finishes, fasteners, anchorages and accessory items. Include setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed as unit of work of other sections.

C. Installer certificates signed by contractor certifying that welders comply with requirements specified under "Quality Assurance" article.

D. Qualification data for firms and person specified "Quality Assurance" article to demonstrate their capabilities and experience. Include list of completed projects with project name, addresses, names of Architects and Owners, plus other information specified.

1.03 QUALITY ASSURANCE

A. Fabricator Qualifications: Firm experienced in successfully producing custom ornamental metalwork similar to that indicated for this project, with sufficient production capacity to produce required units without causing delay in the work.

B. Arrange for installation of metalwork specified in this section by same firm which fabricated them.

C. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code - Steel"

D. Certify that each welder employed in unit of work of this section has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification. Testing for recertification is contractor's responsibility.

1.04 PROJECT CONDITIONS

A. Take field measurements prior to preparation of shop drawings and fabrication, where possible, to ensure proper fitting of metalwork. Do not delay job progress; allow for adjustments and fitting where taking of field measurements before fabrication might delay Work.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store components and materials in clean, dry location, away from uncured concrete and masonry. Cover with waterproof paper, tarpaulin or polyethylene sheeting in a manner that permits air circulation within covering.

B. Handle metalwork on site to a minimum; exercise care to avoid damaging metal finishes.

1.06 COORDINATION

A. Coordinate the Work of this Section with the Work of Section 05722 – Stainless Steel Railing systems to ensure proper fit, alignment, substrate conditions, attachment methods, adhesion and other conditions required for uniform appearance.

PART 2 PRODUCTS

2.01 METALS

A. Provide ornamental metals of the forms and types which comply with requirements of referenced standards and which are free from surface blemishes where exposed to view in the finished unit. Exposed-to-view surfaces exhibiting pitting, seam marks, roller marks, stains, discolorations or other imperfections on finished units are **not** acceptable.

B. Steel: Provide stainless steel in the shapes indicated on drawings complying with the following requirements:

1. Tubing: ASTM A 554, Grade MT 304, Satin Finish No. 4.
2. Sheet, Strip, Plate, and Flat Bar: ASTM A 666, Type 304, Satin Finish No. 4.
3. Bars and Shapes: ASTM A 276, Type 304, Satin Finish No. 4.

C. Cast Aluminum: Provide alloy and temper recommended by aluminum producer and finisher with strength and durability properties not less than that of alloy and temper designated below.

1. Extruded Bars and Shapes: ASTM B 221, Alloy 6063-T5/T52.
2. Plate and Sheet: ASTM B 209, Alloy 3003-H4.
3. Castings: ASTM B 26/B, Alloy A356.0-T6.

D. Stainless Steel Sheets: Provide minimum 22 gauge type 304 flat stainless steel sheets with a number 4 finish to be formed into shapes indicated on the Drawings.

2.02 MISCELLANEOUS MATERIALS

A. Welding Electrodes and Filler Metal: Type and ally of filler metal and electrodes as recommended by producer of metal to be welded, complying with applicable AWS specifications, and as required for color match, strength and compatibility in the fabricated items.

B. Fasteners, Caps, Connectors and Turnbuckles: Of same metal and alloy as other metal components. Do not use metals which are corrosive or otherwise incompatible with metals joined.

1. Provide concealed fasteners for interconnection of ornamental metalwork components and for their attachment to other work, except where otherwise indicated.

2. Provide Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated or required.

C. Nonshrink Nonmetallic Grout: Pre-mixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with CE CRD C621. Provide grout specifically recommended by manufacturer for interior and exterior applications of type specified in this section.

D. Anchors and Inserts: Provide anchors of type, size, and material required for type of loading and installation condition shown, as recommended by manufacturer, unless otherwise indicated. Use toothed steel or expansion bolt devices for drilled-in-place anchors.

2.03 FABRICATION

A. Form ornamental metalwork to required shapes and sizes, with true curves, lines and angles. Provide components in sizes and profiles indicated, but not less than required to comply with requirements indicated for structural performance.

B. Allow for thermal movement resulting from the following maximum change (range) in ambient temperature, in the design, fabrication, and installation of installed metal assemblies to prevent buckling, opening up of joints and overstressing of welds and fasteners.

C. Provide necessary rebates, lugs and brackets for assembly of units. Use concealed fasteners wherever possible.

D. Comply with AWS for recommended practices in shop welding. Provide welds behind finished surfaces without distortion or discoloration of exposed side. Clean exposed welded joints of all welding flux, and dress on all exposed and contact surfaces. Exposed welds to be ground smooth.

E. Mill joints to a tight, hairline fit. Cope or miter corner joints.

F. Finish exposed surfaces to smooth, sharp, well-defined lines and arises.

G. Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

2.04 WELDED CONNECTIONS

A. Fabricate materials indicated below for interconnections of members by welding. Use welding method which is appropriate for metal and finish indicated and develops strength required to comply with structural performance criteria. Finish exposed welds and surfaces smooth, flush, and blended to match adjoining surfaces. Provide mitered joints at elbow bends.

B. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors for interconnection of fabrications to other work, unless otherwise indicated.

C. Furnish inserts and other anchorage devices for connecting fabrications to concrete or masonry work. Fabricate anchorage devices which are capable of withstanding loadings imposed. Coordinate anchorage devices with supporting structure.

2.05 FABRICATED ITEMS

A. Stainless Steel Plate and Angles at Reception Desk: Fabricate to sizes and shapes as indicated on drawings.

B. Perforated Steel Plate: Provide 12 gauge perforated steel plate with 1/8" diameter holes, staggered, with 7/32" centers, 24 holes per square inch, 30% open as manufactured by Harrington & King Perforating Company, 800-251-6026.

C. Light Cove: Provide custom light cove in dimensions as indicated on the drawings equal to products as fabricated by Pittcon Industries, 800-637-7638. Light cove shall incorporate a self-aligning backplate at joints, without exposed fasteners or supports. Light coves shall be formed from 0.080 inches aluminum with factory finish. All fasteners are to be concealed. Fabricate in individually divided sections attached with a taping joint and fabricated in single length units of 10 feet where required with factory mitered corners.

D. Stainless Steel Brake Metal: Fabricate brake metal to uniform in appearance without visible seams, oil canning or distortion. Use sheets as large as practicable to minimize joints.

PART 3 EXECUTION

3.01 PREPARATION: Coordinate and furnish anchorages and setting drawings, diagrams, templates, instructions and directions for installation of items having integral anchors which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to the project site.

3.02 INSTALLATION, GENERAL

A. Provide anchorage devices and fasteners where necessary for securing metal items to in-place construction; including, threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws and other connectors as required.

B. Perform cutting, drilling and fitting required for installation of metalwork. Set products accurately in location, alignment and elevation, plumb, level and true, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items which are to be built into concrete, masonry or similar construction.

C. Fit exposed connections accurately together to form tight, hairline joints or, where indicated, with uniform reveals and spaces for sealants and joint fillers. Where cutting, welding and grinding are required for proper shop fitting and jointing of ornamental metal items, restore finishes to eliminate any evidence of such corrective work.

D. Do not cut or abrade finishes which cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing or provide new units as required.

3.03 PROTECTION

A. Protect finishes from damage during construction period by use of temporary protective coverings approved by metalwork fabricator. Remove protective covering at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period so that no evidence remains of correction work. Return items which cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units as required.

END OF SECTION

SECTION 08305 ACCESS DOORS
(Revised 10-14-04)

PART 1 GENERAL

1.01 SECTION INCLUDES: Floor and wall access doors as indicated on the Drawings including indications of sizes and locations.

1.02 SUBMITTALS

A. Product Data: Submit manufacturer's technical data and installation instructions for required products, including setting drawings, templates, instructions and directions for installation of anchoring devices, and compliance with fire ratings specified where applicable.

B. Shop Drawings: Submit Shop Drawings for the fabrication and installation of customized access doors and frames, including details of each frame type, elevation of door design types, anchorage and accessory items.

1.03 QUALITY ASSURANCE

A. Provide access door as manufactured by a company that has been in business for a minimum of five years and can provide all the certificates and fire rating information required.

B. Size Variations: Obtain Architect's acceptance of manufacturer's standard size units which may vary slightly from size indicated.

C. Coordination: Furnish inserts and anchoring devices which must be built into other work for installation of access doors. Coordinate with other work to avoid delay.

1.04 DELIVERY, STORAGE, AND HANDLING: Deliver materials and products in labeled protective packages. Store and handle in strict compliance with manufacturers' instructions and recommendations. Protect from damage from construction operations

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Drawings and Specifications for floor access doors are based on products manufactured by The Bilco Company, P.O. Box 1203, New Haven, CT 06505. Tel. (203) 934-6363. The wall access door is based on products manufactured by Karp Associates, Inc., P.O. Box 78005, Maspeth, NY 11378. Tel. (800) 888-4212.

B. Equivalent products by the following manufacturers are acceptable:

1. Milcor, Inc., 1225 Corporate Drive, Suite B, Holland, OH 43528 Tel. (800) 528-1411.
2. Nystrom Building Products, 1701 Madison Street NE, Minneapolis, MN 55414. Tel. (800) 469-7876.

C. Substitutions shall fully comply with specified requirements and Section 01630-Product Options and Substitution Procedures

2.02 MATERIALS AND FABRICATION FOR FLOOR ACCESS DOORS: Furnish each floor access door assembly manufactured as an integral unit, complete with all parts and ready for installation.

A. Floor Access Door: Provide single leaf aluminum access floor door equal to Model T-1, 2'-0" by 2'-0", as manufactured by The Bilco Company.

C. Locking Devices: Furnish flush lock to hold door in flush, smooth plane when closed.

2.03 MATERIALS AND FABRICATION FOR WALL ACCESS DOOR: Furnish wall access door assembly manufactured as an integral unit, complete with all parts and ready for installation. This wall access door is required at the display shelves located under the Monumental Stairs. See Drawings for location.

A. Wall Access Door: Provide type 304 stainless steel wall access door with No. 4 satin finish equal to KDW –Flush Access Doors for Drywall Surfaces, door size 8 inches by 8 inches, as manufactured by Karp Associates, Inc.

B. Locking Devices: Furnish flush mounted, keyless Paddle Latch, with finger pull that facilitates opening.

PART 3 EXECUTION

3.01 EXAMINATION: Installer shall examine areas and conditions under which access doors are to be installed and must notify the Project Engineer and the Contractor in writing of conditions detrimental to proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 PREPARATION: Coordinate setting drawings, diagrams, templates, instructions and directions for installation of anchorage. Coordinate delivery of such items to Project Site.

3.03 INSTALLATION

A. Comply with manufacturer's instructions for installation of floor access doors.

B. Coordinate installation with work of other trades. Building in of anchors and grouting of frames in included in other Sections of these Specifications.

C. Set frames accurately in position and securely attach to supports with face panels plumb or level in relation to adjacent surfaces.

3.04 ADJUSTING AND CLEANING: Adjust hardware and panels after installation for proper operation. Remove and replace panels or frames which are warped, bowed or otherwise damaged. Clean just prior to installation of floor covering.

END OF SECTION

SECTION 15670 AIR COOLED CONDENSING UNITS (CU-1, CU-2 & CU-4)
(Revised 10-14-04)

PART 1 GENERAL

1.01 SECTION INCLUDES:

A. Condensing unit package.

B. Charge of refrigerant and oil.

C. Controls and control connections.

D. Refrigerant piping connections.

E. Motor starters.

F. Electrical power connections.

1.02 RELATED SECTIONS:

A. Section 03300 - Cast-in-Place Concrete: Equipment bases.

B. Section 15317 - Refrigeration Piping Systems.

C. Section 15860 – Central Air Handling Units.

D. Section 15910 – Building Automation System.

E. Section 15200 - Vibration Isolators

1.03 REFERENCES:

A. ANSI/ASHRAE 15 - Safety Code for Mechanical Refrigeration.

B. ANSI/ASHRAE/IES 90 A - Energy Conservation in New Building Design Standard.

C. ARI 210/240 - Unitary Air-Conditioning Equipment and Air-Source Heat Pump Equipment, (units less than 135,000 Btuh).

D. ARI 360 - Commercial and Industrial Unitary Air Conditioning Equipment testing and rating standard (condensing units greater than 135,000 Btuh).

E. ARI 340 - Commercial and Industrial Unitary Heat Pump Equipment, (heat pumps greater than 135,000 Btuh).

F. ANSI Z21.47/UL1995 - Unitary Air Conditioning Standard for safety requirements.

G. California Energy Commission Administrative Code - Title 20/24 - Establishes the minimum efficiency requirements for HVAC equipment installed in new buildings in the State of California.

H. ARI 270 - Sound Rating of Outdoor Unitary Equipment, (units less than 135,00 Btuh).

I. ARI 370 - Sound Rating of Large Outdoor Refrigerating and Air Conditioning Equipment (equipment above 135,000 Btuh).

1.04 SUBMITTALS:

A. Submit unit performance data including: capacity, nominal and operating performance.

B. Submit Mechanical Specifications for unit and accessories describing construction, components and options.

C. Submit shop drawings indicating overall dimensions as well as installation, operation and service clearances. Indicate lift points and recommendations and center of gravity. Indicate unit shipping, installation and operating weights including dimensions.

D. Submit data on electrical requirements and connection points. Include recommended wire and fuse sizes or MCA, sequence of operation, safety and start-up instructions.

1.05 DELIVERY, STORAGE, AND HANDLING:

A. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

B. Protect units on site from physical damage. Protect coils.

1.06 WARRANTY:

A. Provide parts warranty for one year from start-up or 18 months from shipment, whichever occurs first.

B. Provide one year parts warranty.

C. Provide five year extended warranty for compressors.

1.07 Maintenance Service

A. Furnish complete parts and labor service and maintenance of packaged roof top units for one year from Date of Substantial Completion by contractor.

B. Provide maintenance service with a two month interval as maximum time period between calls. Provide 24 hour emergency service on breakdowns and malfunctions.

C. Include maintenance items as outlined in manufacturer's operating and maintenance data.

D. Submit copy of service call work order or report and include description of work performed.

1.08 REGULATORY REQUIRMENTS:

A. Unit shall conform to ANSI Z21.47/UL 1995 for construction of packaged air conditioner.

1. In the event the unit is not UL approved, the manufacturer must, at his expense, provide for a field inspection by a UL representative to verify conformance to UL standards. If necessary, contractor shall perform modifications to the unit to comply with UL, as directed by the UL representative, at no additional expense to the Owner.

PART 2 PRODUCTS

2.01 SUMMARY:

A. The contractor shall furnish and install air-cooled condensing units as shown as scheduled on the contract documents. The unit(s) shall be installed in accordance with this specification and perform at the specified conditions as scheduled.

B. APPROVED MANUFACTURERS:

1. Trane
2. Carrier

2.02 GENERAL UNIT DESCRIPTION:

A. Provide self-contained, packaged, factory-assembled and pre-wired units suitable for outdoor use consisting of cabinet, compressors, condensing coil and fans, integral subcooling circuits, filter driers, and controls. Provide expansion valves and check valves for split system heat pump units.

B. Performance Ratings: Energy Efficiency Rating EER not less than prescribed by ANSI/ASHRAE 90A.

2.03 CASING:

A. House components in 18 gauge zinc-coated galvanized steel frame and panels with weather resistant, baked enamel finish. Units surface shall be tested 500 hours in salt spray test.

B. Mount controls in weatherproof panel provided with removable panels and/or access doors with quick opening fasteners.

2.04 CONDENSER COILS:

A. Coils: Aluminum fins mechanically bonded to seamless copper tubing. Provide subcooling circuit(s). Factory leak test under water to 450 psig, and vacuum dehydrate. Seal with holding charge of nitrogen.

2.05 FANS AND MOTORS:

A. Vertical discharge direct driven propeller type condenser fans with fan guard on discharge. Fans shall be statically and dynamically balanced.

B. Weatherproof motors suitable for outdoor use, with permanently lubricated totally enclosed or open construction motors shall be provided and shall have built in current and thermal overload protection. Motors shall be either sleeve or ball bearing type.

2.06 COMPRESSORS:

A. Compressors: Provide direct-drive hermetic, reciprocating type compressor(s) with centrifugal oil pump providing positive lubrication to moving parts and automotive type pistons, rings to prevent gas leakage, internal suction and discharge valves and crankcase heater. Motor shall be suction gas-cooled with internal temperature and current sensitive motor overloads. Internally isolated motors on springs. External high and low pressure cutout devices shall be provided.

B. Provide each unit with two refrigerant circuits with integral subcooling. Each circuit shall have factory-supplied filter driers, suction and liquid line service valves, all piped.

2.07 CONTROLS:

A. Provide factory-wired condensing units with 24 volt control circuit with internal fusing and control transformers, contactor pressure lugs and/or terminal block for power wiring. Contractor to provide field installed unit mounted disconnect switch. Units shall have single point power connections.

B. Provide 24-volt,time delay relay with four minute delay between compressor staging on dual compressor units.

C. Provide 24-volt, either 5 or 7 minute fixed-off timer that will prevent compressor short cycling upon shutdown.

2.08 MISCELLANEOUS FEATURES:

A. Low Ambient Control: Electronic head pressure control that allows operation to 0 degrees F outdoor ambient.

B. Condenser Coil guard: Metal grille with Polyvinyl chloride coating to cover condenser coil area.

PART 3 EXECUTION

3.01 INSTALLATION:

A. Install in accordance with manufacturer's instructions.

B. Provide for connection to electrical service.

C. Install units on vibration isolation.

D. Install units on concrete base as indicated.

E. Provide connection to refrigeration piping system and evaporators.

END OF SECTION

SECTION 15680 AIR COOLED CONDENSING UNIT (CU-5)
(Revised 10-14-04)

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Condensing unit package.

B. Charge of refrigerant and oil.

C. Controls and control connections.

D. Refrigerant piping connections.

E. Motor starters.

F. Electrical power connections.

1.02 RELATED SECTIONS

A. Section 03300 - Cast-in-Place Concrete: Equipment bases.

B. Section 15200 - Vibration Isolation.

C. Section 15180 - Piping Insulation.

D. Section 15280 – Mechanical System Insulation.

E. Section 15535 - Refrigeration Piping and Specialties.

F. Section 15910 – Building Automation System.

G. Section 16920 - Equipment Wiring Systems.

1.03 REFERENCES

A. ANSI/ASHRAE 15 - Safety Code for Mechanical Refrigeration.

B. ANSI/ASHRAE 90A - Energy Conservation in new Building Design.

C. ARI 370 - Sound Rating of Large Refrigeration and Air-conditioning Equipment.

D. ARI 360 - Unitary Air-Conditioning Equipment.

1.04 SUBMITTALS

A. Submit shop drawings indicating components, dimensions, weights and loadings, required clearances, and location and size of field connections. Include schematic layouts showing condensing units, cooling coils, refrigerant piping, and accessories required for complete system.

B. Submit product data indicating rated capacities, weights, specialties and accessories, electrical nameplate data, and wiring diagrams.

C. Submit design data indicating refrigeration and chilled water pipe sizing.

D. Submit manufacturer's installation instructions.

1.05 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data.

B. Include manufacturer's descriptive literature, start-up instructions, installation instructions, and maintenance procedures.

1.06 HANDLING

A. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

B. Protect units on site from physical damage.

1.07 WARRANTY

A. Provide a full parts warranty for one year from start-up or 18 months from shipment, whichever occurs first.

B. Provide five year extended warranty for compressors including materials only.

1.08 MAINTENANCE

A. Furnish complete service and maintenance of air cooled condensing units for one year from Date of Substantial Completion by contractor.

B. Provide maintenance service with a two month maximum time interval between calls. Provide 24-hour emergency service on breakdowns and malfunctions.

1.09 ACOUSTICS: Manufacturer of condensing unit shall provide outdoor sound power level data across all major octave band center frequencies for cataloged operating range of unit at gross cooling capacity range. Data shall be obtained in conformance with ANSI S1.32-1980, American National Standard Methods for the Determination of Sound Power Levels of Discrete Frequency and Narrow Band Noise Sources in Reverberation Rooms and per AMCA Standard 300-85 test code "Sound Rating Air Moving Devices".

1.10 REGULATORY:

A. Unit shall conform to UL 1995/CSA 22.2 #236 for construction of condensing units and shall have UL/CSA label affixed to unit.

1. In the event the unit is not UL/CSA approved, the manufacturer shall, at his expense, provide for a field inspection by a UL/CSA representative to verify conformance to UL/CSA standards. If necessary, contractor shall perform required modifications to the unit to comply with UL/CSA, as directed by the UL/CSA representative, at no additional expense to the Owner.

1.11 SUMMARY: The contractor shall furnish and install air-cooled condensing unit as shown as scheduled on the contract documents. The unit shall be installed in accordance with this specification and perform at the specified conditions as scheduled.

PART 2 PRODUCTS

2.01 GENERAL UNIT DESCRIPTION

A. Provide self-contained, packaged, factory-assembled and pre-wired units suitable for outdoor use consisting of cabinet, compressors, condensing coil and fans, subcooling circuits, and controls.

B. Approved manufacturers: Trane or Carrier.

2.02 CASING

A. Cabinet: Galvanized steel, phosphatized, and finished with an air-dry paint coating durable enough to withstand 1000 consecutive-hour salt spray application in accordance with standard ASTM B 117. Structural members shall be 14 gauge with access doors and removable panels of minimum 18 gauge steel.

B. Control Panel: The unit control panel section shall be compartmented to separate high and low voltage components. The control panels shall also be fully gasketed, hinged and provided with quick release latches for easy access.

2.03 CONDENSER SECTION: Coils: aluminum fins mechanically bonded to copper tubing. Provide subcooling circuit(s). Factory leak test under water to 450 psig and vacuum dehydrate.

2.04 REFRIGERANT CIRCUITS: Provide two circuits on 20 through 30 tons units.

2.05 FANS AND MOTORS

A. Vertical discharge direct driven propeller type condenser fans with fan guard on discharge. Fans shall be statically and dynamically balanced.

B. Provide motors suitable for outdoor use, three phase with permanently lubricated ball bearings and built in current and thermal overload protection.

2.06 COMPRESSORS

A. Compressors shall be industrial grade, energy-efficient direct-drive 3600 RPM maximum speed reciprocating, scroll type. The motor shall be of a suction gas cooled hermetic design. Compressor shall have centrifugal oil pump with dirt separator, oil sight glass, and oil charging valve. A solid state temperature sensor shall be embedded in the motor windings to protect against excessive winding temperatures.

1. If semi-hermetic reciprocating industrial grade compressors are utilized provide single piece crankshafts, connecting rods, aluminum pistons, rings to prevent gas leakage, high strength non-flexing ring type suction and discharge valves, spring loaded heads, replaceable cylinder liners, and sealing surface immersed in oil. Provide removable discharge heads and hand hole covers, and discharge service valves.

2. Provide compressor with automatic capacity reduction equipment consisting of suction valve unloaders. Use electric solenoid actuated lifting mechanism operated by oil pressure. Provide for unloaded compressor start.

B. Motor shall be designed for across-the-line starting and suitable for a voltage utilization range of +/- 10 percent from nameplate voltage.

2.07 SYSTEM CONTROLS

A. No System Control: Provide compressors wired to a terminal strip inside the control panel. Include guaranteed fixed-on and -off timers for compressor protection. Temperature controls not included in unit.

B. Unit Control: Provide 115 volt control circuit with fusing and control power transformer. Unit wired with contactors for compressor and condenser motors, compressor overload protection, high/low cutouts, differential oil pressure control, reset relay, and anti-cycle compressor timer.

2.08 LOW AMBIENT CONTROLS: Provide low ambient electronic damper assemblies to allow the unit to start and operate down to 0 degrees F (10 degrees F with hot gas bypass) outdoor ambient conditions. Low ambient damper operation shall be modulated based upon refrigerant head pressure.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide for connection to electrical service.

C. Install units on vibration isolation.

D. Install units on concrete base as indicated.

E. Provide connection to refrigeration piping system and evaporators.

3.02 MANUFACTURER'S FIELD SERVICES: Supply initial charge of refrigerant and oil for each refrigerant circuit.

END OF SECTION

SECTION 15733 PACKAGED ROOFTOP AIR CONDITIONING UNITS
(Revised 10-14-04)

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Package roof top unit.

B. Heat exchanger.

C. Refrigeration components.

D. Unit operating controls.

E. Roof curb.

F. Electrical power connections.

G. Operation and maintenance service.

1.02 RELATED SECTIONS

A. Section 15025 – Motor Controls and Wiring.

B. Section 15200 - Vibration Isolation.

C. Section 15180 – Mechanical System Insulation.

D. Section 15841 - Filters.

E. Section 15910 – Building Automation System..

F. Section 16920 - Equipment Wiring Systems.

1.03 REFERENCES:

A. NFPA 90 A & B - Installation of Air Conditioning and Ventilation Systems and Installation of Warm Air Heating and Air Conditioning Systems.

B. ANSI/ASHRAE 15 - Safety Code for Mechanical Refrigeration.

C. ARI 360 - Commercial and Industrial Unitary Air Conditioning Equipment testing and rating standard.

D. ARI 340 - Commercial and Industrial Unitary Heat pump Equipment.

E. ANSI/ASHRAE 37 - Testing Unitary Air Conditioning and Heat Pump Equipment.

F. ANSI/ASHRAE/IESNA 90.1-1999 - Energy Standard for New Buildings Except Low-Rise Residential Buildings.

G. ANSI Z21.47/UL1995 - Unitary Air Conditioning Standard for safety requirements.

H. ARI 210/240 - Unitary Air-Conditioning Equipment and Air- Source Heat Pump Equipment.

I. ARI 270 - Sound Rating of Outdoor Unitary Equipment.

J. ARI 370 - Sound Rating of Large Outdoor Refrigerating and Air Conditioning Equipment.

K. ANSI/NFPA 70-1995 - National Electric Code.

1.04 SUBMITTALS:

A. Submit unit performance data including: capacity, nominal and operating performance.

B. Submit Mechanical Specifications for unit and accessories describing construction, components and options.

C. Submit shop drawings indicating overall dimensions as well as installation, operation and services clearances. Indicate lift points and recommendations and center of gravity. Indicate unit shipping, installation and operating weights including dimensions.

D. Submit data on electrical requirements and connection points. Include recommended wire and fuse sizes or MCA, sequence of operation, safety and start-up instructions.

E. Shop drawings submitted for approval shall be accompanied by a copy of the purchase agreement between the Contractor and an authorized service representative of the manufacturer for check, test and start up and first year service.

1.05 DELIVERY, STORAGE and HANDLING:

A. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

B. Protect units from physical damage. Leave factory shipping covers in place until installation.

1.06 WARRANTY:

A. Provide parts warranty for one year from start-up or 18 months from shipment, whichever occurs first.

B. Provide five year extended warranty for compressors.

1.07 MAINTENANCE SERVICE:

A. Furnish complete parts and labor service and maintenance of packaged roof top units for one year from Date of Substantial Completion by contractor.

B. Provide maintenance service with a two month interval as maximum time period between calls. Provide 24 hour emergency service on breakdowns and malfunctions.

C. Include maintenance items as outlined in manufacturer's operating and maintenance data.

D. Submit copy of service call work order or report and include description of work performed.

1.08 REGULATORY REQUIREMENTS:

A. Unit shall conform to ANSI Z21.47/UL1995 for construction of packaged air conditioner.

1. In the event the unit is not UL approved, the manufacturer must, at his expense, provide for a field inspection by a UL representative to verify conformance to UL standards. If necessary, contractor shall perform modifications to the unit to comply with UL, as directed by the UL representative, at no additional expense to the Owner.

B. Conform to Canadian Standards Association (CAN/CSA-2.3/CAN/CSA C22.2 #236) for construction of packaged air conditioner.

1. In the event the unit is not CSA approved, the manufacturer must, at his expense, provide for a field inspection by a CSA representative to verify conformance to CSA standards. If necessary, contractor shall perform modifications to the unit to comply with CSA, as directed by the CSA representative, at no additional expense to the Owner.

1.09 EXTRA MATERIALS:

A. Provide one set of filters.

B. Furnish a complete set of fan motor drive belts.

PART 2 PRODUCTS

2.01 SUMMARY:

A. The contractor shall furnish and install package rooftop unit as shown and scheduled on the contract documents. The unit shall be installed in accordance with this specification and perform at the specified conditions as scheduled.

B. APPROVED MANUFACTURERS:

1. Trane

2. Carrier

C. All major HVAC equipment (i.e., Condensing Units, Air Handling Units, Variable Air Volume Terminal Units, Roof Top Package Units, etc.) and controls components shall be by the same manufacturer.

2.02 GENERAL UNIT DESCRIPTION:

A. Unit furnished and installed shall be cooling only packaged rooftop as scheduled on contract documents and these specifications. Cooling capacity ratings shall be based on ARI Standard 210. Unit shall consist of insulated weather-tight casing with compressor, air-cooled condenser coil, condenser fans, evaporator coil, return-air filters, supply motors and unit controls and drives.

B. Unit shall be 100% factory run tested and fully charged with R-22.

C. Unit shall have labels, decals, and/or tags to aid in the service of the unit and indicate caution areas.

D. Unit shall be dedicated downflow or dedicated horizontal airflow as manufactured.

E. Wiring internal to the unit shall be colored and numbered for identification.

2.03 UNIT CASING

A. Cabinet: Galvanized steel, phosphatized, and finished with an air-dry paint coating with removable access panels. Structural members shall be 16 gauge with access doors and removable panels of minimum 20 gauge.

B. Unit cabinet surface shall be tested 1000 hours in salt spray test in compliance with ASTM B117.

C. Cabinet construction shall allow for all service/ maintenance from one side of the unit.

D. Cabinet top cover shall be one piece construction or where seams exits, it shall be double-hemmed and gasket-sealed.

E. Access Panels: Water- and air-tight panels with handles shall provide access to filters, heating section, return air fan section, supply air fan section, evaporator coil section, and unit control section.

F. Downflow unit's base pans shall have a raised 1 1/8 inch high lip around the supply and return openings for water integrity.

G. Insulation: Provide 1/2 inch thick coated fiberglass insulation on all exterior panels in contact with the return and conditioned air stream.

H. Provide openings either on side of unit or thru the base for power, control and gas connections.

I. The base of the unit shall have provisions for forklift and crane lifting

2.04 AIR FILTERS: 2” Pleated Media

2.05 FANS AND MOTORS:

A. Provide evaporator fan section with forward curved, double width, double inlet, centrifugal type fan.

B. Provide self-aligning, grease lubricated, ball or sleeve bearings with permanent lubrication fittings.

C. Provide units 12 1/2 tons and above with belt driven, supply fans with adjustable motor sheaves.

D. Outdoor and Indoor Fan motors shall be permanently lubricated and have internal thermal overload protection.

E. Outdoor fans shall be direct drive, statically and dynamically balanced, draw through in the vertical discharge position.

F. Provide shafts constructed of solid hot rolled steel, ground and polished, with key-way, and protectively coated with lubricating oil.

2.06 ELECTRIC HEATING SECTION

A. Provide heavy duty nickel chromium heating elements internally wired. Heater shall have pilot duty or automatic reset line voltage limit controls and any circuit carrying more than 48 amps shall have fuse protection in compliance with N.E.C.

B. Heater shall be factory-supplied and field-installed internal to unit cabinet.

C. Heater shall be UL and CSA listed and approved and provide single point power connection.

2.07 EVAPORATOR COIL

A. Provide configured aluminum fin surface mechanically bonded to copper tubing coil.

B. Provide an independent expansion device for each refrigeration circuit. Factory pressure test at 450 psig and leak test at 200 psig.

C. Provide drain pan for base of evaporator coil constructed of PVC or galvanized steel with external connections.

2.08 CONDENSER SECTION:

A. Provide internally finned seamless copper tube mechanically bonded to configured aluminum fins. Factory pressure test to 450 psig.

B. Provide vertical discharge, direct drive fans with aluminum blades. Fans shall be statically balanced. Motors shall be permanently lubricated, with integral thermal overload protection in a weather tight casing.

2.09 REFRIGERATION SYSTEM:

A. Compressor: Provide scroll compressor with direct drive operating at 3600 rpm. Integral centrifugal oil pump. Provide suction gas cooled motor with winding temperature limits and compressor overloads.

B. Compressor: Provide direct drive, hermetic type, scroll compressor with centrifugal type oil pump. Motor shall be suction gas cooled and have internal spring isolation. Compressors shall include crankcase heaters, internal pressure relief, temperature and current sensitive overloads.

C. Units shall have cooling capabilities down to 0 degree F as standard. For field-installed low ambient accessory, the manufacturer shall provide a factory-authorized service technician that will assure proper installation and operation.

D. Provide each unit with two refrigerant circuit(s) factory-supplied completely piped with liquid line filter-drier, suction and liquid line pressure ports.

2.10 OUTDOOR AIR SECTION:

A. Provide motorized outside air damper with 0-50 percent outside air operating range, manually set.

B. Provide spring return motor for outside air damper closure during unit shutdown or power interruption.

2.11 OPERATING CONTROLS:

A. Provide factory-wired roof top units with 24 volt control circuit with control transformers, contactor pressure lugs or terminal block for power wiring. Contractor to provide field-installed unit-mounted disconnect switch. Units shall have single point power connections. Field wiring of zone controls to be NEC Class II.

B. Provide microprocessor unit-mounted control which when used with an electronic zone sensor provides proportional integral room control. This UCM shall perform all unit functions by making all heating, cooling and ventilating decisions through resident software logic.

C. Provide factory-installed indoor evaporator defrost control to prevent compressor slugging by interrupting compressor operation.

D. Provide an anti-cycle timing and minimum on/off between stages timing in the microprocessor.

2.12 STAGING CONTROLS:

A. Provide NEC Class II, electronic, adjustable zone control to maintain zone temperature setting.

B. Provide programmable electronic microcomputer based zone control.

1. Zone control shall incorporate:

a. Automatic changeover from heating to cooling.
b. Set-up for at least 2 - sets of separate heating and cooling temperatures per day.
c. Instant override of setpoint for continuous or timed period from one hour to 31 days.
d. Switch selection features including Fahrenheit display, 12 or 24 hour clock, keyboard disable, remote sensor, fan on-auto.

2. Zone sensor display shall be capable of:

a. Time of day.
b. Actual room temperature.
c. Programmed temperature.
d. Programmed time.
e. Duration of timed override.
f. Day of week.
g. System mode indication: heating, cooling, low battery fan on.

2.13 BUILDING MANAGEMENT SYSTEM

A. Interface control module to Energy Management System to be furnished and mounted by rooftop unit manufacturer. Through this interface module, all Energy Management functions (specified in Energy Management Section 15910) shall be performed. See Building Automation and Automatic Temperature Control System Specifications. The interface module with necessary controls and sensors shall all be factory mounted (not field mounted). If not furnished by rooftop unit manufacturer, this shall be furnished by Energy Management System Contractor for factory mounting by rooftop unit manufacturer in rooftop unit and rated for service up to 140 F. The only field connection to Energy Management System shall be a single communication link.

B. Control Functions: Include unit scheduling, occupied/unoccupied mode, start-up and coast-down modes, nighttime free-cool purge mode, demand limiting, night setback, discharge air set point adjustment, timed override and alarm shutdown.

C. Diagnostic Functions: Include supply fan status, and a field supplied and installed sensor, to provide a dirty filter alarm.

D. Provide capabilities for Boolean Processing and trend logs as well as "templated" reports and logs.

2.14 UNIT PERFORMANCE REQUIREMENTS

A. See Equipment Schedules for performance capacities.

B. Supply air fan performance data as submitted shall include the effect of a wet coil, downflow or horizontal configuration and the return air filter static loss.

C. Scheduled performance shall be based on ARI 210/240/340/360 and ANSI Z21.47 test conditions.

2.15 Unit Sound Rating Number shall be based on ARI 270 and ARI 370.

PART 3 EXECUTION

3.01 EXAMINATION

A. Contractor shall verify that roof is ready to receive work and opening dimensions are as indicated on shop drawings.

B. Contractor shall verify that proper power supply is available.

3.02 INSTALLATION

A. Contractor shall install in accordance with manufacturer's instructions.

B. Mount units on factory built roof mounting frame providing watertight enclosure to protect ductwork and utility services. Install roof mounting curb level.

3.03 MANUFACTURER'S FIELD SERVICES

A. The manufacturer shall furnish an alternative price for:

1. Extended compressor warranty for five years.
2. Extended heat exchanger warranty for five years.
3. Extended parts and labor by manufacturer to be provided to the owner for a period of one years.

B. The contractor shall furnish manufacturer complete submittal wiring diagrams of the package unit as applicable for field maintenance and service.

END OF SECTION

SECTION 15910 BUILDING AUTOMATION SYSTEM
(Revised 10-14-04)

PART 1 GENERAL

1.01 DESCRIPTION:

A. General: The control system shall be as indicated on the drawings and described in the specifications.

B. Direct Digital Control (DDC) technology shall be used to provide the functions necessary for control of mechanical systems on this project.

C. The control system shall accommodate simultaneous multiple user operation. Access to the control system data should be limited only by operator password. Multiple users shall have access to all valid system data. An operator shall be able to log onto any workstation on the control system and have access to all appropriate data.

D. The control system shall be designed such that each mechanical system will be able to operate under stand-alone control. As such, in the event of a network communication failure, or the loss of any other controller, the control system shall continue to independently operate under control.

E. Communication between the control panels and all workstations shall be over a high-speed network. All nodes on this network shall be peers. The operator shall not have to know the panel identifier or location to view or control an object. Application Specific Controllers shall be constantly scanned by the network controllers to update point information and alarm information.

1.02 SYSTEM PERFORMANCE:

A. Performance Standards. The system shall conform to the following:

1. Graphic Display. The system shall display a graphic with a minimum of [20] dynamic points. All current data shall be displayed within [20] seconds of the request.
2. Graphic Refresh. The system shall update all dynamic points with current data within [30] seconds.
3. Object Command. The maximum time between the command of a binary object by the operator and the reaction by the device shall be [10] seconds. Analog objects shall start to adjust within [10] seconds.
4. Object Scan. All changes of state and change of analog values shall be transmitted over the high-speed network such that any data used or displayed at a controller or workstation will be current, within the prior [60] seconds.
5. Alarm Response Time. The maximum time from when an object goes into alarm to when it is annunciated at the workstation shall not exceed [45] seconds.
6. Program Execution Frequency. Custom and standard applications shall be capable of running as often as once every [5] seconds. The Contractor shall be responsible for selecting execution times consistent with the mechanical process under control.
7. Performance. Programmable Controllers shall be able to execute DDC PID control loops at a selectable frequency from at least once every [5] seconds. The controller shall scan and update the process value and output generated by this calculation at this same frequency.

8. Multiple Alarm Annunciation. All workstations on the network shall receive alarms within [5] seconds of each other.

1.03 WARRANTY:

A. Warrant all work as follows:

1. Labor & materials for control system specified shall be warranted free from defects for a period of twelve (12) months after final completion acceptance by the Owner. Control System failures during the warranty period shall be adjusted, repaired, or replaced at no charge or reduction in service to the Owner. The Contractor shall respond to the Owner's request for warranty service within 24 hours during customary business hours.

PART 2 PRODUCT

2.01 MANUFACTURERS:

A. Trane

B. Carrier

C. Controls components and major equipment (i.e., Condensing Units, Air Handling Units, Variable Air Volume Terminal Units, Roof Top Package Units, etc.) to be furnished by the same manufacturer.

2.02 UNINTERRUPTED POWER SUPPLY:

A. ATC contractor shall furnish a Uninterrupted Power Supply (UPS) with each major control panel. Necessary UPS shall protect the major control panels from loss of programming, time-of-day, etc. in the event of a power failure.

2.03 OPERATOR INTERFACE:

A. Operator Interface. A touch screen display is factory mounted on the front of the controller. The operator display has graphical images that show the type of equipment controlled by the head end controller. The screen will be used for viewing equipment and system status information, making changes to time of day schedules, changing system setpoints, viewing the alarm and event log, performing timed overrides.

B. System Software

1. Operating System. Furnish a commercially available, concurrent multi-tasking operating system. The operating system shall also support the use of other common software applications that operate under DOS or Microsoft Windows. Acceptable operating systems are Windows NT, and Windows 95/98.

2. System Graphics. The Operator Workstation software shall be graphically oriented. The system shall allow display of up to 10 graphic screens at once for comparison and monitoring of system status. Provide a method for the operator to easily move between graphic displays and change the size and location of graphic displays on the screen. The system graphics shall be able to be modified while on line. An operator with the proper password level shall be able to add, delete, or change dynamic points on a graphic. Dynamic points shall include analog and binary values, dynamic text, static text, and animation files. Graphics shall have the ability to show animation of equipment. Graphics shall be capable of launching other PC applications.

    a) Custom Graphics. Custom graphic files shall be created with the use of commonly available graphics packages such as PC Paint. The graphics generation package shall create and modify graphics that are saved in industry standard formats such as PCX, BMP, GIF and JPEG. The graphics generation package shall also provide the capability of capturing or converting graphics from other programs such as Designer, or AutoCAD.
    b) Graphics Library. Furnish a complete library of standard HVAC equipment such as chillers, boilers, air handlers, terminals, fan coils, and unit ventilators. This library shall also include standard symbols for other equipment including fans, pumps, coils, valves, piping, dampers, and ductwork. The library shall be furnished in a file format compatible with the graphics generation package program.
    c) Engineering Units. Allow for selection of the desired engineering units (i.e. Inch pound or SI) in the system. Unit selection shall be able to be customized by locality to select the desired units for each measurement. Engineering units on this project shall be: [Standard Inch Pound] [SI] [Custom as follows:].

C. System Applications. Each workstation shall provide operator interface and off-line storage of system information. Provide the following applications at each workstation.

1. Automatic System Database Save and Restore. Each workstation shall store on the hard disk a copy of the current database of each building controller. This database shall be updated whenever a change is made in any panel in the system. The storage of this data shall be automatic and not require operator intervention. In the event of a database loss in a building management panel, the first workstation to detect the loss shall automatically restore the database for that panel.
2. Manual Database Save and Restore. A system operator with the proper password clearance shall be able to archive the database from any system panel and store on magnetic media. The operator shall also be able to clear a panel database and manually initiate a download of a specified database to any panel in the system.
3. System Configuration. The workstation software shall provide a graphical method of configuring the system. The user with proper security shall be able to add new devices, and assign modems to devices. This shall allow for future system changes or additions.
4. On-Line Help and Training. Provide a context sensitive, on line help system to assist the operator in operation and editing of the system. On-line help shall be available for all applications and shall provide the relevant data for that particular screen. Additional help information shall be available through the use of hypertext. Provide an interactive tutorial CD, which will act as on-line training/help for the systems operator.

5. Security. Each operator shall be required to log on to the system with a user name and password in order to view, edit, add, or delete data. System security shall be selectable for each operator. The system supervisor shall have the ability to set passwords and security levels for all other operators. Each operator password shall be able to restrict the operator's access for viewing and/or changing each system application, full screen editor, and object. Each operator shall automatically be logged off of the system if no keyboard or mouse activity is detected. This auto logoff time shall be set per operator password. All system security data shall be stored in an encrypted format.
6. System Diagnostics. The system shall automatically monitor the operation of all workstations, printers, modems, network connections, building management panels, and controllers. The failure of any device shall be annunciated to the operator.
7. Alarm Processing. Any object in the system shall be configurable to alarm in and out of normal state. The operator shall be able to configure the alarm limits, warning limits, states, and reactions for each object in the system.

    a) Alarm Reactions. The operator shall be able to determine what actions, if any, are to be taken, by object (or point), during an alarm. Actions shall include logging, printing, starting programs, displaying messages, dialing out to remote stations, paging, forwarding to an e-mail address, providing audible annunciation or displaying specific system graphics. Each of these actions shall be configurable by workstation and time of day. An object in alarm that has not been acknowledged within an operator specified time period shall be re-routed to an alternate operator specified alarm receipt device.
    b) Binary Alarms. Each binary object shall be set to alarm based on the operator-specified state. Provide the capability to disable alarming when the associated equipment is turned off or is being serviced.
    c) Analog Alarms. Each analog object shall have both high and low alarm limits and warning limits. Alarming must be able to be automatically and manually disabled.

8. Trend Logs. The operator shall be able to define a custom trend log for any data in the system. This definition shall include interval, start-time, and stop-time. Trend intervals of 1, 5, 15, 30, and 60 minutes as well as once a shift (8 hours), once a day, once a week, and once a month shall be selectable. All trends shall start based on the hour. Each trend shall accommodate up to 64 system objects. The system operator with proper password shall be able to determine how many samples are stored in each trend. Trend data shall be sampled and stored on the Building Controller panel and be archived on the hard disk. Trend data shall be able to be viewed and printed from the operator interface software. Trends must be viewable in a text-based format or graphically. They shall also be storable in a tab delimited ASCII format for use by other industry standard word processing and spreadsheet packages.
9. Dynamic Graphical Charting. The operator shall be able to select system values to be charted in real time. Up to three values at one time can be selected for each chart. The type of chart (bar, line, 3-D, etc.) shall be selectable.
10. Alarm and Event Log. The operator shall be able to view all logged system alarms and events from any location in the system. The operator shall be able to sort and filter alarms. Events shall be listed chronologically. An operator with the proper security level may acknowledge and clear alarms. All that have not been cleared by the operator shall be archived to the hard disk on the workstation.

11. Object and Property Status and Control. Provide a method for the operator with proper password protection to view, and edit if applicable, the status of any object and property in the system. These statuses shall be available by menu, on graphics, or through custom programs.
12. Clock Synchronization. The real time clocks in all building control panels and workstations shall be synchronized on command of an operator. The system shall also be able to automatically synchronize all system clocks; daily from any operator designated device in the system. The system shall automatically adjust for daylight savings and standard time if applicable.
13. Reports and Logs. Provide a reporting package that allows the operator to select, modify, or create reports. Each report shall be definable as to data content, format, interval, and date. Report data shall be archived on the hard disk for historical reporting. Provide the ability for the operator to obtain real time logs of designated lists of objects. Reports and logs shall be stored on the PC hard disk in a format that is readily accessible by other standard software applications including spreadsheets and word processing. Reports and logs shall be readily printed to the system printer. The operator shall be able to designate reports that shall be printed or stored to disk at selectable intervals.

    a) Custom Reports: Provide the capability for the operator to easily define any system data into a daily, weekly, monthly, or annual report. These reports shall be time and date stamped and shall contain a report title and the name of the facility.

2.03 SYSTEM SOFTWARE:

A. Furnish the following applications software for building and energy management. All software applications shall reside and run in the system controllers. Editing of applications shall occur at the operator workstation.

B. System Security

1. User access shall be secured using individual security passwords and user names.
2. Passwords shall restrict the user to only the objects, applications, and system functions as assigned by the system manager.
3. User logon/logoff attempts shall be recorded.
4. The system shall protect itself from unauthorized use by automatically logging off following the last keystroke. The delay time shall be user definable.

C. Scheduling. Provide the capability to schedule each object or group of objects in the system. Each of these schedules shall include the capability for start, stop, optimal start, optimal stop, and night economizer actions. Each schedule may consist of up to [10] events. When a group of objects are scheduled together, provide the capability to define advances and delays for each member. Each schedule shall consist of the following:

1. Weekly Schedule. Provide separate schedules for each day of the week.
2. Exception Schedules. Provide the ability for the operator to designate any day of the year as an exception schedule. This exception schedule shall override the standard schedule for that day. Exception schedules may be defined up to a year in advance. Once an exception schedule is executed it will be discarded and replaced by the standard schedule for that day of the week.
3. Holiday Schedules. Provide the capability for the operator to define up to [99] special or holiday schedules. These schedules may be placed on the scheduling calendar and will be repeated each year. The operator shall be able to define the length of each holiday period.

4. Optimal Start/Stop. The scheduling application outlined above shall support an optimal start/stop algorithm. This shall calculate the thermal characteristics of a zone and start the equipment prior to occupancy to achieve the desired space temperature at the specified occupancy time. The algorithm shall calculate separate sets of heating and cooling rates for zones that have been unoccupied for less then and greater than 24 hours. Provide the ability to modify the start/stop algorithm based on outdoor air temperature. Provide an early start limit in minutes to prevent the system from starting before an operator determined time limit.
5. Timed Override. Building will be divided into seven zones for timed override activation using the touch-screen. Timed override period will be user defined.

D. Alarm Reporting. The operator shall be able to determine the action to be taken in the event of an alarm. Alarms shall be routed to the appropriate workstations based on time and other conditions. An alarm shall be able to start programs, be logged in the event log, printed, generate custom messages graphics.

E. Remote Communications. The system shall have the ability to dial out in the event of an alarm. Receivers shall include PC Workstations, and alphanumeric pagers. The alarm message shall include the name of the calling location, the device that generated the alarm, and the alarm message itself. The operator shall be ably to remotely access and operate the system using dial up communications.

F. Maintenance Management. The system shall monitor equipment status and generate maintenance messages based upon user designated run time, starts, and/or calendar date limits.

G. PID Control. A PID (proportional-integral-derivative) algorithm with direct or reverse action and anti-wind-up shall be supplied. The algorithm shall calculate a time-varying analog value used to position an output or stage a series of outputs. The controlled variable, set-point, and PID gains shall be user-selectable. The set-point shall optionally be chosen to be a reset schedule.

H. Staggered Start. This application shall prevent all controlled equipment from simultaneously restarting after a power outage. The order in which equipment (or groups of equipment) is started, along with the time delay between starts shall be user-selectable.

I. System Calculations. Provide software to allow instantaneous power (e.g. KW), flow rates (e.g. L/s [GPM]) to be accumulated and converted to energy usage data. Provide an algorithm that calculates a sliding-window KW demand value. Provide an algorithm that calculates energy usage and weather data (heating and cooling degree days). These items shall all be available for daily, previous day, monthly and the previous month.

J. Anti-Short Cycling. All binary output points shall be protected from short cycling. This feature shall allow minimum on-time and off-time to be selected.

K. Building Controller Operator Display. The building controller shall include an operator display allowing the user to perform basic daily operations tasks on the building automation system. At a minimum this operator display shall:

1. Be installed on the building controller and require no additional power source.
2. Consist of a one-quarter VGA touch screen with 320 X 240-pixel resolution. The brightness and the contrast of the backlit touch screen shall be adjustable to allow for easy reading of information on the screen.

3. Be capable of having unique user identification and passwords that can be programmed to limit access to the system and operator functions.
4. Display the current state of an input/output point and equipment controller connected to the system.
5. Give the operator the ability to override the current state of an output point or HVAC equipment controller connected to the building controller.
6. Allow the operator to modify the start and stop times of any time-of-day schedule within the system.
7. Provide a visual indication that a system alarm exists and allow for an optional audible alarm annunciation.
8. Provide the ability to view and acknowledge alarms that are annunciated at that building controller.
9. Allow the operator to view custom graphical displays with dynamic status information.
10. Automatically update displayed system information every 10 seconds.

2.04 INPUT/OUTPUT INTERFACE:

A. Hard-wired inputs and outputs may tie into the system through Building, Custom, or Application Specific Controllers. The points list will be included and demonstrated to the owner and professional.

B. All input points and output points shall be protected such that shorting of the point to itself, another point, or ground will cause no damage to the controller. All input and output points shall be protected from voltage up to 24V of any duration, such that contact with this voltage will cause no damage to the controller.

2.05 LOCAL CONTROL PANELS:

A. All indoor control cabinets shall be fully enclosed NEMA 1 Type construction with [hinged door], key-lock latch, and removable sub-panels. A single key shall be common to all field panels and sub-panels.

1. Interconnections between internal and face-mounted devices pre-wired with color-coded stranded conductors neatly installed in plastic troughs and/or tie-wrapped. Terminals for field connections shall be UL listed for 600-volt service, individually identified per control/interlock drawings, with adequate clearance for field wiring. Control terminations for field connection shall be individually identified per control drawings.
2. Provide on/off power switch with over-current protection and main air gauge for control power sources to each local panel.

PART 3 EXECUTION

3.01 WIRING:

A. All control and interlock wiring shall comply with the national and local electrical codes and Division 16 of these specifications. Where the requirements of this section differ with those in Division 16, the requirements of this section shall take precedence. EMT Conduit where exposed and plenum cable elsewhere.

3.02 CONTROLLERS:

A. Provide a separate Controller for each major piece of HVAC equipment. Points used for control loop reset such as outside air or space temperature are exempt from this requirement.

B. Building Controllers and Custom Application Controllers shall be selected to provide a minimum of [15%] spare I/O point capacity for each point type found at each location. If input points are not universal, [15%] of each type is required. If outputs are not universal, [15%] of each type is required. A minimum of one spare is required for each type of point used.

C. Future use of spare capacity shall require providing the field device, field wiring, points database definition, and custom software. No additional Controller boards or point modules shall be required to implement use of these spare points.

3.03 PROGRAMMING:

A. Provide sufficient internal memory for the specified control sequences and trend logging. There shall be a minimum of 25% of available memory free for future use.

B. Point Naming: System point names shall be modular in design, allowing easy operator interface without the use of a written point index.

C. Software Programming

1. Provide programming for the system as per specifications and adhere to the strategy algorithms provided. All other system programming necessary for the operation of the system but not specified in this document shall also be provided by the Control System Contractor. Imbed into the control program sufficient comment statements to clearly describe each section of the program. The comment statements shall reflect the language used in the sequence of operations.

D. Operators' Interface

1. Standard Graphics. Provide graphics for each major piece of equipment and floor plan in the building. This includes each Chiller, Air Handler, VAV Terminal, Fan Coil, Boiler, and Cooling Tower. These standard graphics shall show all points dynamically as specified in the points list.
2. The controls contractor shall provide all the labor necessary to install, initialize, start-up, and trouble-shoot all operator interface software and their functions as described in this section. This includes any operating system software, the operator interface data base, and any third party software installation and integration required for successful operation of the operator interface.
3. As part of this execution phase, the controls contractor will perform a complete test of the operator interface. Test duration shall be a minimum of [16] hours on-site. Tests shall be made in the presence of the Owner or Owner's representative.

E. Demonstration: A complete demonstration and readout of the capabilities of the monitoring and control system shall be performed. The contractor shall dedicate a minimum of 16 hours on-site with the Owner and his representatives for a complete functional demonstration of all the system requirements. This demonstration constitutes a joint acceptance inspection, and permits acceptance of the delivered system for on-line operation.

F. TRAINING: Provide a minimum of 1 classroom training sessions, 8 hours each.

3.04 DUCT SMOKE DETECTION:

A. Provide complete submittal data to controls system contractor for coordination of duct smoke detector interface to HVAC systems. Smoke Detectors furnished by Div 16, mounted by Div 15, powered by Div 16, control wiring by ATC(Div 15).

3.02 Div 16 contractor shall provide a dry-contact alarm output in the same room as the HVAC equipment to be controlled.

PART 4: SEQUENCE OF OPERATIONS

4.01 PACKAGED ROOFTOP UNITS (PRTU)

A. Each PRTU shall be controlled by a stand-alone microprocessor based controller with resident control logic. The BAS shall perform the following rooftop control strategies, provide the points listed on the points list and provide the specified monitoring and diagnostics.

1. Occupied Mode - All unit functions will be enabled for normal heating and cooling operation. Unit defaults to thermostat mode when communication with BAS is lost.

2. Normal Operation - When in occupied mode as described above, the dedicated unit control shall operate stages of heating and cooling to maintain space temperature setpoint. Setpoints shall be reset through BAS by the operator.

B. Starting Mode - When the unit is turned on by the BAS for optimal start, heating or cooling is provided as required. The outside air dampers, if provided, remains closed, in heating mode, until occupied time.

C. Coastdown Mode - When the unit is turned "OFF" by the BAS for optimal stop, the supply fan remains "ON", the outside air damper remains open for ventilation, and a setpoint offset is initiated to limit heating and cooling. Space comfort is protected by the user defined setpoint offset.

D. Duty Cycle Mode - When the unit is duty cycled "OFF" it is put in a user-defined Duty Cycle Mode. User defines max/min temperature limits to ensure occupant comfort and override duty cycle if limits are exceeded.

E. Demand Limit Mode - Through the BAS a user defined Demand Limit Mode shall be available. User defines maximum off time and temperature to ensure occupant comfort.

F. Night Setback Temperature Control - When the BAS selects unoccupied mode, the unit shall be controlled to maintain user defined unoccupied heating and cooling setpoints. The outdoor air damper remains closed during heating night setback operation, if provided.

G. Nighttime Free-Cool Purge Mode - An "economizer only" cooling cycle shall be provided during unoccupied hours when outdoor air conditions are suitable and the zone requires cooling.

H. Low Ambient Compressor Lockout - Compressor operation shall be disabled below a user defined outdoor air temperature.

I. Timed Override - When a timed override is initiated by the user, the unit will return to its user defined normal occupied mode for the user determined period of time.

J. Fire Shutdown - The unit will shut down in response to a customer supplied contact closure to the BAS indicating the presence of a fire or other emergency condition.

K. Manual Setting of Heat or Cool Mode - BAS Operator shall be able to select the following unit operating modes:

1. Heating
2. Cooling
3. Emergency heat (heat pump). Default mode is automatic changeover.

L. Heat Pump Auxiliary Heat Lockout - Heat pump auxiliary heat operation shall be prevented above a user defined outdoor air temperature.

M. Emergency Heat Mode - Shall be selectable at BAS. In emergency heat mode, compressors shall be locked out and auxiliary heat shall control for space comfort.

N. Unit status report - For each PRTU unit, the BAS shall provide an operating status summary of all sensed values (zone temperature, discharge temperature, etc.) setpoints and modes.

O. Diagnostic/Protection - The BAS system shall be able to alarm from all sensed points from the rooftop units and diagnostic alarms sensed by the unit controller. Alarm limits shall be designated for all sensed points.

P. Humidity Control – RTU-3 shall be furnished with a space humidistat. If the space humidity exceeds 55%rh (adj.), the humidistat shall override the cooling thermostat to place the package roof top unit shall be in the cooling/dehumidification mode. The space thermostat shall maintain space temperature via the auxiliary electric heat.

PART 5: POINTS LIST

A. See attached points list for 3 to 25 ton light commercial rooftop.

END OF SECTION

SYSTEM POINT LIST

SYSTEM POINT DESCRIPTION

PRTUPTS1

3 to 25 - ton Light Commercial Rooftop Page 1 of 2

SYSTEM POINT DESCRIPTION			ANALOG														
			INPUT										OUTPUT				
	INTEROPERABLE	GRAPHIC	TEMPERATURE	PRESSURE	RH	KW	KWH	BLUHR	GPM	PERCENT	CFM	NUMBER OF STAGES	DDC (4-20ma, 0-10vdc)		SETPOINT ADJ.	MIN. POSITION	
UNIT CONTROLLER COMMUNICATIONS	X																
SUPPLY FAN STATUS	X																
SUPPLY FAN MODULATION	X									X							
COMPRESSOR CONTROL																	
HEAT STATUS																	
MODE: HEAT/COOL	X																
HEATING SETPOINT															X		
EMERGENCY HEAT MODE																	
EXHAUST FAN STATUS																	
EXHAUST MODE																	
CONDENSER FAN STATUS																	
SPACE TEMPERATURE	X		X														
OCCUPIED COOLING SETPOINT	X														X		
SUPPLY AIR TEMPERATURE	X		X														
COND COIL DEFROST MODE																	
EVAP COIL DEFROST MODE																	
COOLING STAGES ACTIVE	X																
ECONOMIZER DAMPER POSITION	X									X							
ECONOMIZER MIN POSITION																X	

SYSTEM POINT DESCRIPTION	BINARY											
	INPUT						OUTPUT					
	STATUS ON/OFF	FILTER STATUS	STATUS OPEN/CLSD.	STATUS	NO. OF STARTS	IMED. OVERRIDE	OFF/ON	OPEN/CLOSED	LOCKOUT	ENABLE/DISABLE	LOCAL/REMOTE	
UNIT CONTROLLER COMMUNICATIONS	X											
SUPPLY FAN STATUS							X					
SUPPLY FAN MODULATION												
COMPRESSOR CONTROL										X		
HEAT STATUS	X											
MODE: HEAT/COOL				X								
HEATING SETPOINT												
EMERGENCY HEAT MODE										X		
EXHAUST FAN STATUS	X											
EXHAUST MODE										X		
CONDENSER FAN STATUS	X							X				
SPACE TEMPERATURE												
OCCUPIED COOLING SETPOINT												
SUPPLY AIR TEMPERATURE												
COND COIL DEFROST MODE	X											
EVAP COIL DEFROST MODE	X											
COOLING STAGES ACTIVE	X											
ECONOMIZER DAMPER POSITION			X						X			
ECONOMIZER MIN POSITION												

SYSTEM POINT DESCRIPTION	SYSTEM FEATURES																											
	ALARMS										PROGRAMS																	
	HIGH ANALOG	LOW ANALOG	HIGH BINARY	LOW BINARY	PROOF	SENSOR FAIL	FLOW FAIL	COMM. FAIL	LOCKOUT	DIAGNOSTICS	TIME SCHEDULING	DEMAND LIMITING	OPT. START/STOP	RESET	EVENT PROGRAM	DDC	ALARM INSTRUCT	MAINT. WK. ORDER	RUNTIME	EXP. MESSAGE	SETBACK/SETUP	NIGHT PURGE	TENANT BILLING	TREND LOG				NOTES:
UNIT CONTROLLER COMMUNICATIONS								X			X		X		X	X					X	X		X				
SUPPLY FAN STATUS					X																	X						
SUPPLY FAN MODULATION																												
COMPRESSOR CONTROL									X																			
HEAT STATUS										X																		EACH STAGE
MODE: HEAT/COOL										X																		
HEATING SETPOINT										X																		
EMERGENCY HEAT MODE																												HEAT PUMP UNITS ONLY
EXHAUST FAN STATUS																												
EXHAUST MODE																												
CONDENSER FAN STATUS										X																		CONDENSER FANS A & B
SPACE TEMPERATURE					X																			X				
OCCUPIED COOLING SETPOINT																												
SUPPLY AIR TEMPERATURE																												NOTE 2
COND COIL DEFROST MODE																												HEAT PUMP UNITS ONLY
EVAP COIL DEFROST MODE														X														3 TO 25-TON UNITS ONLY
COOLING STAGES ACTIVE																												
ECONOMIZER DAMPER POSITION											X		X		X						X	X						NOTE 3
ECONOMIZER MIN POSITION																												NOTE 3

GENERAL NOTES:

1. Software programs require a building management program.
2. Supply air temperature sensor is available only on units with economizer controllers installed.
3. Valid only on units with economizer.

SYSTEM POINT LIST

PRTUPTS1

3 to 25 - ton Light Commercial Rooftop Page 2 of 2

SYSTEM POINT DESCRIPTION	INTEROPERABLE	GRAPHIC	ANALOG INPUT: TEMPERATURE	PRESSURE	RH	KW	KWH	BLUHR	GPM	PERCENT	CFM	NUMBER OF STAGES	ANALOG OUTPUT: DDC (4-20ma, 0-10vdc)		SETPOINT ADJ.	MIN. POSITION	
OUTDOOR AIR TEMP			X														
OUTDOOR AIR HUMIDITY					X												
RETURN AIR HUMIDITY					X												
RETURN AIR TEMPERATURE			X														
TIMED OVERRIDE REQUEST																	
TIMED OVERRIDE REQUEST CANCEL																	
OCCUPY/UNOCCUPY	X																
PRIORITY SHUTDOWN	X																
DIRTY FILTER	X																
MANUAL RESET REQUIRED	X																

SYSTEM POINT DESCRIPTION	BINARY INPUT: STATUS ON/OFF	FILTER STATUS	STATUS OPEN/CLSD.	STATUS	NO. OF STARTS	IMED. OVERRIDE	BINARY OUTPUT: OFF/ON	OPEN/CLOSED	LOCKOUT	ENABLE/DISABLE	LOCAL/REMOTE		ALARMS: HIGH ANALOG	LOW ANALOG	HIGH BINARY	LOW BINARY	PROOF	SENSOR FAIL	FLOW FAIL	COMM. FAIL	LOCKOUT	DIAGNOSTICS
OUTDOOR AIR TEMP																		X				
OUTDOOR AIR HUMIDITY																		X				
RETURN AIR HUMIDITY										X												
RETURN AIR TEMPERATURE																						
TIMED OVERRIDE REQUEST				X																		
TIMED OVERRIDE REQUEST CANCEL				X																		
OCCUPY/UNOCCUPY							X															
PRIORITY SHUTDOWN							X															
DIRTY FILTER		X																				
MANUAL RESET REQUIRED				X																		

SYSTEM POINT DESCRIPTION	PROGRAMS: TIME SCHEDULING	DEMAND LIMITING	OPT. START/STOP	RESET	EVENT PROGRAM	DDC	ALARM INSTRUCT	MAINT. WORK ORDER	RUNTIME	EXP. MESSAGE	SETBACK/SETUP	NIGHT PURGE	TENANT BILLING	TREND LOG				NOTES:
OUTDOOR AIR TEMP														X				OA SENSOR IS OPTIONAL
OUTDOOR AIR HUMIDITY														X				NOTE 3
RETURN AIR HUMIDITY														X				NOTE 3
RETURN AIR TEMPERATURE																		NOTE 3
TIMED OVERRIDE REQUEST																		
TIMED OVERRIDE REQUEST CANCEL																		
OCCUPY/UNOCCUPY																		
PRIORITY SHUTDOWN																		
DIRTY FILTER																		
MANUAL RESET REQUIRED																		

GENERAL NOTES:

1. Software programs require a building management program.
2. Supply air temperature sensor is available only on units with economizer controllers installed.
3. Valid only on units with economizer.

SECTION 15920 CHANGEOVER/BYPASS VARIABLE AIR VOLUME SYSTEM CONTROLLER
(Revised 10-14-04)

PART 1 GENERAL

1.01 SECTION INCLUDES:

A. Variable air volume (VAV) terminal units.

B. Bypass variable air volume terminal units.

C. Integral damper motor operators.

D. Terminal unit controller.

E. Central network controller.

F. Zone thermostat.

1.02 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION:

A. Section 15910 and 15920 - Controls and Instrumentation: Thermostats, duct pressure sensors, temperature sensors, and central network controller.

B. Section 16920 – Motor Controls and Wiring: Thermostats, duct pressure sensors, temperature sensors, unit controller and central network controller.

1.03 RELATED SECTIONS:

A. Section 15910 and 15920 - Building Automation and Central Systems.

B. Section 16920 – Motor Controls and Wiring: Electrical supply to units.

1.04 SYSTEM DESCRIPTION:

A. The changeover/bypass VAV system shall provide temperature control of multiple comfort zones through the use of a constant volume single-zone HVAC unit. Variable air volume control shall be provided for each zone to maintain zone temperature within the heating/cooling setpoints. The system shall monitor the temperature and setpoints of the zones and automatically change the heat/cool mode of the HVAC unit to satisfy zone requirements. The system shall maintain airflow through HVAC unit by bypassing air from the supply to the return duct. Bypass air is modulated based upon system monitoring of supply duct pressure.

1.05 SUBMITTAL:

A. Submit shop drawings and product data sheets indicating configuration, general assembly, and materials used in fabrication.

B. Submit manufacturer's installation instructions.

1.06 OPERATION AND MAINTENANCE:

A. Include manufacturer's descriptive literature, operating instructions, and maintenance data.

1.07 QUALITY ASSURANCE:

A. Manufacturer; Company specializing in manufacturing VAV products of the type specified in this section with minimum 15 years documented experience.

1.08 SYSTEM RESPONSIBILITY:

A. The entire changeover/bypass system, including VAV terminal units, direct digital controls and Building Automation System shall be furnished by a single manufacturer who shall be responsible for the entire system. Acceptable manufacturers may either be the variable air volume terminal unit or temperature control manufacturer, but must bear sole responsibility for the system.

1.09 WARRANTY:

A. Provide one year manufacturer's parts warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS:

A. Specified Manufacturers

1. Trane
2. Carrier

B. Control components and major equipment (i.e., Condensing Units, Air Handling Units, Variable Air Volume Terminal Units, Roof Top Package Units, etc.) shall be furnished by the same manufacturer.

2.02 MANUFACTURED UNITS:

A. Zone controls are ceiling mounted variable air volume supply air control terminals for connection to low pressure duct. VAV terminal units shall be networked to a central controller, which, based on the multiple zones comfort requirements, provides a staged "heat" or "cool" decision to be used by the building air conditioning unit. A variable air volume bypass air control terminal shall modulate to maintain a minimum air flow across the air conditioning unit.

B. The systems controls shall be a dedicated direct digital microprocessor based control system with multi-level distributed microprocessing. System controls shall be designed for use exclusive to zone temperature and changeover/bypass control. General purpose or generic controls are not acceptable.

2.03 FABRICATION:

A. Casings: Units shall be completely factory assembled, manufactured of rolled and seam welded 18 gauge galvanized steel. Discharge end shall be crimped to fit standard round ductwork. Casings shall be available in the following inlet and outlet diameter sizes: 6", 8", 10", 12", 14", 16".

2.04 VOLUME DAMPER:

A. Damper blade shall be constructed of 22 gauge galvanized steel.
B. Damper blade shall have aerodynamically designed edges to provide seal tight operation at full closure without gasketing and vibration free operation at open positions.

C. Damper blade shall be round and shall modulate a full 90 degrees from open to close.

2.05 WIRING:

A. Factory mount and wire VAV terminal unit controls. Mount electrical components in terminal unit control box with removable cover.

B. Provide industry standard 1/4" male spade connectors on terminal unit controller for field wiring of thermostat, communications, and power source.

C. All wiring shall comply with local and national electric codes and the manufacturer's published installation manual.

D. Provide terminal strips in central controller for field wiring of air conditioning unit input connections, duct temperature sensor, duct pressure sensor, communications, time clock, bypass damper motor and power wiring.

2.06. CONTROLS:

A. Electric damper actuator: 24 VAC with end switches to eliminate actuator motor stall conditions.

B. Zone thermostat

1. Zone thermostat shall be a sensor with thumbwheel setpoint adjustment, night setback override and cancel buttons, and a communications jack.

   a. The zone sensor shall have the capability of manually overriding the unit controller to the continuous unoccupied mode.
   b. The zone sensor shall have the capability of manually overriding the unit controller to the maximum flow position.

2. Zone thermostat shall be simple, and easy to use. If programming or editing of parameters at zone thermostat is required, customer training must be provided.

C. Variable air volume (VAV) terminal unit controller

1. The VAV terminal unit controller shall be a microprocessor-based, direct digital controller and shall contain the control logic required to modulate the flow of primary air through the terminal unit in response to the difference between zone temperature and the appropriate setpoint. The control algorithm shall be proportional integral.

2. All VAV terminal unit controller setpoints and operating parameters shall be stored in non-volatile electronic memory. Battery back-up is not acceptable.

3. All VAV terminal unit controllers will come with factory programmed setpoints and operating parameters, or have default settings capable of providing typical operating control on power-up.

4. The VAV terminal unit controller shall be field or factory configurable to function as an auto-changeover device, or as an auto-changeover device with remote heat control capability.

   a. The auto-changeover terminal unit controller shall control damper position, and therefore primary air flow, in response to the difference between zone temperature and the appropriate set point. The terminal unit controller shall be capable of operating as a cool supply air controller or to "changeover" and operate as a warm supply air controller.

   b. The terminal auto-changeover unit controller configured for remote heat control shall control damper position, and therefore primary air flow, in response to the difference between zone temperature and the appropriate set point. The terminal unit controller shall be capable of operating as a cool supply air controller or to "changeover" and operate as a warm supply air controller.

      Additionally, the terminal unit controller shall be capable of controlling local heat, remote from the air conditioning unit heat, in response to a difference between zone temperature and the appropriate setpoint.

   c. The terminal unit controller configured to control remote heat shall be capable of allowing 1) simultaneous remote heat and HVAC unit heat, or 2) disabling remote heat when HVAC unit heat is being provided.

   d. The terminal unit controller shall be equipped with 24 VAC triac output(s) to energize remote heat. The triacs shall be configurable to function as normally open or normally closed outputs. If only a contact closure is available to enable remote heat, additional relay power wiring must be provided.

   e. The terminal unit controller shall be configurable to control various types of remote heat. These types of remote heat are to include:

      1) 1-3 stages electric

D. Central Controller

1. The central controller shall exchange information with each terminal unit controller. The information shall be electronically encoded and serially transmitted on single twisted pair communication link.

2. The central controller shall send setpoints and override instructions to the terminal unit controller. The terminal unit controller shall send operating status and configuration information to the central controller.

3. The central controller shall be capable of communicating and operating with any configuration of manufacturer's DDC VAV terminal unit product, including fan powered reheat and pressure independently controlled units.

4. The central controller shall communicate with up to 16 terminal unit controllers.

5. The central controller shall scan the terminal unit controllers to determine deviations from temperature setpoint, time of deviation, time from last changeover and number of terminal unit controllers requiring heating or cooling. Based upon this information, the system heat/cool mode and stage of capacity shall be determined.

6. The central controller shall be capable of excluding a zones request for cooling or heating if that zone remains more than 3 degrees from setpoint for a period of 60 minutes.
7. The central controller shall monitor the system supply air temperature to ensure that high and low temperature limits are maintained. The temperature limits shall be editable values.
8. The central controller shall modulate the position of the bypass damper based on a supply air duct [velocity] [pressure] input, to maintain a minimum air flow rate through the air conditioning unit. Bypass damper position and setpoints shall be available for monitoring and editing at the central controller. If bypass damper information is not available at central controller, additional equipment must be provided which will allow monitoring and editing bypass damper parameters at central controller.

    a. The duct pressure sensor shall be field convertible to sense supply duct velocity or static pressure. The central controller shall be capable of modulating the position of the bypass damper based on a supply duct velocity of static pressure input.

9. The central controller shall be capable of re-calibrating the supply air duct velocity or pressure sensor (pressure transducer). The central controller shall be capable of commanding all terminal unit controllers to re-calibrate their damper blade position. This calibration process shall occur upon system power up, and each time the system switches from the occupied to unoccupied mode.
10. All central controller setpoints and operating parameters shall be stored in non-volatile electronic memory within the central controller or transmitted to each terminal unit controller for storage in non-volatile electronic memory. Battery back-up is not acceptable.
11. The central controller shall be capable of accepting time clock input to determine occupied or unoccupied setpoint mode of operation.
12. Central controller shall be configurable as either an air conditioning unit controller or a heat pump controller.
13. The central controller shall be capable of local or remote interface via RS-232 port for an electronic display and keyboard terminal. Electronic display and keyboard terminal shall allow monitoring and editing of all central controller setpoint and operating parameters and terminal unit controller setpoint and operating parameters.
14. The central controller shall not require electronic display and keyboard terminal for system start-up and normal operation.
15. The central controller shall be capable of issuing override commands to the terminal unit controller. Override commands shall be used by the terminal unit controller to change the criteria by which the actuator and the terminal unit heat outputs are controlled. The central controller shall be capable of issuing the following override commands:

    -Drive terminal unit damper to maximum position.
    -Drive terminal unit damper to minimum position.
    -Drive terminal unit damper to fully closed.
    -Drive terminal unit damper to fully open.
    -Disable terminal unit remote heat.

a. The central controller shall be capable of resetting the terminal unit minimum position setpoint for purposes of increasing ventilation to the space whenever the HVAC unit has no heating or cooling stages energized.

16. The central controller shall be capable of assigning terminal unit controllers into groups. Grouping shall allow for acquiring group status information and executing override commands to all unit controllers within a group at one time.

17. The central controller shall be capable of monitoring and editing the following setpoints, which reside in the terminal unit controller:

-Occupied cooling setpoint (45-95 F).
-Occupied heating setpoint (45-95 F).
-Unoccupied cooling setpoint (45-95 F).
-Unoccupied heating setpoint (45-95 F).
-Minimum position setpoint (0-100%).
-Maximum position setpoint (0-100%).
-Minimum heating position setpoint (0-100%)

18. The central controller shall be capable of reporting the following terminal unit controller status information:

-Active cooling temperature setpoint.
-Active heating temperature setpoint.
-Current terminal unit damper position.
-Current zone temperature.
-Terminal unit remote heat status
-Occupied/Unoccupied mode

19. The central controller shall be capable of monitoring and editing the following terminal unit controller configuration information:

-Unit identification.
-Enable/disable zone thermostat setpoint thumbwheel.
-Set high/low limits on zone thermostat setpoint thumbwheel.
-Set zone thermostat setpoint thumbwheel deadband from 2-10 degrees.
-Enable/disable zone request for heating or cooling.
-Calibration (-10 to +10 degrees) of zone thermostat temperature sensor, zone thermostat setpoint thumbwheel, and auxiliary temperature inputs.

20. The central controller shall be capable of reporting the following system status information:

-System type (air conditioning unit or heat pump).
-Mode of operation (occupied or unoccupied).
-Operating status (heat or cool).
-Supply air temperature.
-Supply air duct static pressure in inches W.C.
-Position of bypass damper.
-System fan status (on or off).
-Stages of cooling (on or off).
-Stages of heating (on or off).

21. The central controller shall be capable of monitoring and editing the following system configuration information:

-System identification.
-Supply air high temperature limit.
-Supply air low temperature limit.
-Supply air minimum flow or static pressure setpoint.
-Required heat/cool calls required for changeover.
-Energy saver mode of operation.
-Ventilation mode of operation.
-Unoccupied terminal unit damper position.

22. Central controller shall be capable of interface via serial communications link with higher end building automation system.

23. The central controller shall have a digital operator's panel to provide monitoring and control of terminal unit controllers from one location. Multiple central controllers can be linked to one operator's panel.

a. The operator's panel shall have an LCD display screen to display system information, and an integral keypad for system control.

b. The panel shall allow the operator to enter the occupied and unoccupied heating and cooling setpoints for each terminal unit controller connected to the system. Setpoints shall be stored in non-volatile memory and maintained during a power outage without the use of batteries.

c. The operator's panel shall have time-of-day scheduling capability. Scheduling shall be two on/off periods per day for each of the seven weekdays, plus exception and holiday schedules. Schedules shall be stored in non-volatile memory and maintained during a power outage without the use of batteries. The terminal unit controllers shall be scheduled by group.

d. The operator's panel shall have:
-automatic implementation of daylight saving time and leap year
-24 holiday dates
-timed override capability for groups of terminal unit controllers
-optimal start
-the ability to display temperature and system failure alarms
-an alarm log of the last 32 alarm events
-password protection
-auto log-off

24. The central controller shall have the capability of directly controlling the operation a packaged rooftop unit with a factory installed microprocessor control board. The central controller and the rooftop control board shall be capable of sharing data and control modes over a single pair of wires via a communications board mounted in the unit. The central controller shall automatically recognize and communicate with the rooftop unit on the communications link.

E. Failure modes of operation

1. The central controller shall accommodate the following failure conditions:

a. Supply air velocity sensor failure: the central controller shall drive the bypass damper to 25 percent open position(editable), and allow the terminal units to function normally. The failure shall be reported at the central controller status display.

b. Supply air temperature sensor failure: the central controller shall disable the supply fan and all stages of heating and cooling. The bypass damper shall be driven to 50 percent open, and terminal unit dampers shall be driven to maximum position. The failure shall be reported at the central controller status display.

c. Communication failure: the central controller shall disable all stages of heating and cooling and the supply fan, and drive the bypass damper to 50 percent open if the central controller receives no response from the terminal unit controllers.

2.07 TESTS:

A. Velocity sensor component, pressure transducer, must pass a voltage stability test, executed over a period of time of four days to assure accuracy and repeatability of voltage output to 1% of operational range.

B. Manufacturer shall download all setpoints at factory for unit control.

C. Manufacturer shall 100% functionally test unit controller at factory when fabrication of equipment is complete. The test shall assure successful operation of damper stroke, sensor inputs and communications.

PART 3 EXECUTION

3.01 INSTALLATION:

A. Install in accordance with manufacturer's instructions.

B. Support units individually from structure. Do not support from adjacent ductwork.

PART 4 – SEQUENCE OF OPERATION

4.01 CHANGEOVER BYPASS VAV ZONING SYSTEM:

A. DAMPER UNIT CONTROLLER

1. Damper Control - The microprocessor based damper unit controller shall continuously monitor the zone temperature, damper position, and zone setpoints. The damper unit controller shall use a PI control loop to maintain the heating and cooling setpoints by positioning the damper for the proper airflow to meet the load requirements. Airflow shall be limited by the minimum and maximum position setpoints.

2. Heat/Cool Mode Decision for Damper Unit Controller - The heat/cool control action for the individual damper unit controller shall be determined by the changeover/bypass system controller, and then sent to the damper unit controller to be executed. The changeover/bypass system controller compares the supply air temperature of the system to the individual zone temperature and zone setpoint. If the supply air temperature is less than or equal to the zone temperature the control action shall be Cool. If the supply air temperature is greater than or equal to the zone temperature +10°F, the control action shall be Heat. If the duct temperature is between the zone temperature and the zone temperature plus 10°F, the unit controller shall select the mode to drive the damper to the minimum position.

3. Local Heat Control - The damper unit controller shall have three local heat outputs available to control duct or perimeter heat. The local heat type selection shall determine the heating control algorithm used by the damper unit controller. The choices shall include:

   a. None - No local heat is being controlled.

   b. 1-3 stages electric - Three stages of local electric heat are staged on by space demand.

   c. Fast pulse width modulation - Pulse width modulation energizes an electric heat output for some portion of a time window. The time window for fast pulse width modulation shall be 2 seconds.

   d. Slow pulse width modulation - Pulse width modulation shall energize an electric heat output for some portion of a time window. The time window for slow pulse width modulation shall be 3 minutes.

   e. Proportional hot water and aux. output - The local heat shall be controlled by a proportional hot water valve.

   f. 1-3 stages hot water/perimeter - Three stages shall be available to control local hot water heat. The outputs are staged on by space demand.

4. If the local heat is configured to "1-3 stages electric" and the changeover/bypass system controller goes into the heating mode, the Local Heat shall be disabled. If the Local Heat is configured to "1-3 stages hot water/perimeter" and the changeover/bypass system controller goes into the heating mode, the Local Heat shall remain enabled. When the Local Heat is enabled to run, the damper shall go to the heating minimum position as edited in the damper unit controller setpoint menu.

5. Priority Local Heat - Priority Local Heat shall be controlled via an entry on the changeover/bypass system controller setup menu. If Priority Local Heat is edited to YES, damper unit controllers shall control their local heat to the heating setpoint for that zone. In this mode, the damper unit controller shall attempt to heat to setpoint with local heat first. If the damper unit controller cannot achieve this, and the space temperature falls below the zone heating setpoint, it shall become a heat caller for heat from the main air handler. If "Priority Local Heat" is edited to NO, the damper unit controller will first become a heat caller for heat from the main air handler when the space temperature falls 1 F below the zone heating setpint, the damper unit controller shall then attempt to heat to setpoint with local heat.

6. Standalone Control - The damper unit controller can be used on a standalone basis. It is not required for the damper unit controller to communicate with the changeover/bypass system controller. Under this condition, the damper unit controller shall uses the duct temperature analog input (auxiliary temperature sensor) to determine the heating or cooling control action.

7. Occupied/Unoccupied Mode - During occupied operation the damper unit controller shall control to the zone sensor module setpoint knob or a setpoint provided by the changeover/bypass system controller. The setpoint at the zone sensor module shall be the cooling setpoint; the heating setpoint shall be 2°F below the cooling setpoint. This heating setpoint offset shall be editable from 2-10°F. If the zone sensor setpoint knob is disabled or has failed, the damper unit controller shall control to the programmed Occupied Cooling setpoints. The factory defaults shall be 74°F cooling and 71°F heating. These setpoints shall be editable. During unoccupied operation, the damper unit controller shall control to the programmed unoccupied setpoints. These setpoints shall have factory defaults of 85°F cooling and 60°F heating. The setpoints shall be editable.

8. Drive to MAX - A damper unit controller shall be able to be manually overriden from the zone sensor to drive to the Maximum position.

9. Override to Unoccupied - A damper unit controller shall be able to be manually overridden from the zone sensor to go into the Continuous Unoccupied mode.

B. CHANGEOVER/BYPASS SYSTEM CONTROLLER

1. Heat/Cool Decision for the Changeover/bypass System Controller - All damper unit controllers shall be scanned continually by the changeover/bypass system controller. The quantity and strength of all zone heating and cooling calls shall be determined. At power-up and on transition from Unoccupied to Occupied, the greater number of calls for either heat or cool shall determine the mode of the changeover/bypass system controller and the HVAC system.

2. Heat/Cool Changeover for the Changeover/bypass System Controller - Once a heating/cooling decision has been determined, the changeover/bypass system controller shall require a minimum number of opposite calls to changeover. This shall be an editable setup parameter. All current mode callers shall be responded to before the system shall be allowed to changeover. A minimum time between changeovers shall also be enforced. This shall be an editable setup parameter. The Minimum Time to Changeover counter shall begin running immediately after a changeover occurs. This timer shall be expired before another changeover shall be allowed.

3. Heat/Cool Changeover from Opposite Strong Callers - A heat/cool changeover can also occur if enough opposite strong callers exist. Zones which are more than 2°F away from their setpoint shall be considered strong callers. The "minimum opposite strong calls to changeover" shall be an editable setup parameter. All current mode callers do not have to be satisfied, but the "minimum time to changeover" shall be expired before changeover is allowed.

4. Changeover/bypass System Controller Heat/Cool Staging - The changeover/bypass system controller shall have the capability of controlling multiple stages of heating and cooling. The number of stages to be energized shall be determined by the quantity of zones calling, the strength of the calls (degrees from setpoint), and the time duration of the calls. All stages of heating and cooling shall be protected with minimum on/off timers. A stage shall not turn off until its minimum ON time has been satisfied. Once a stage is off, it shall not be able to be turned on again until its minimum OFF time has been satisfied.

5. Supply Air Temperature Limiting - The changeover/bypass system controller shall enforce supply air temperature limits to avoid mechanical problems with the air handling unit, and to help insure occupant comfort by maintaining reasonable discharge air temperatures. When the supply air temperature falls outside the normal operating range, cooling and heating stages shall be limited by the changeover/bypass system. Normal staging control shall resume when the supply air temperature returns within normal operating range. The supply air temperature high/low limits shall be an editable setup parameter.

6. Velocity/Static Bypass Control - The changeover/bypass system controller shall modulate one or more bypass dampers to protect air handling components from excessively low air flow or high duct velocity pressure. A sensor located in the supply air duct shall measure system air flow velocity or static and pass the information to the changeover/bypass system controller. The controller shall compare the measured air flow against the supply air setpoint. This setpoint shall be editable. If the measured flow or pressure is lower than the setpoint the bypass dampers shall be driven towards the closed position. If the measured airflow or pressure is greater than the setpoint plus a differential, the dampers shall be driven towards the open position. If the airflow is in the deadband between the setpoint and the differential, the dampers shall remain stationary. The bypass shall be able to be repositioned up to four times per minute.

    a. The changeover/bypass system controller shall be capable of controlling the bypass dampers using measured duct static or velocity pressure. The selection shall be made with a dip switch located on the controller. The duct mounted pressure sensor shall be field-convertible for velocity or static pressure.

    b. If the duct velocity or static sensor should fail, the bypass damper shall be driven to the Fail Safe position. This should be an editable setpoint.

    c. The changeover/bypass system controller shall calibrate the sensor against actual flow or pressure on power-up, when the system goes from the occupied to the unoccupied mode, or randomly once every seven days if no other calibration has occurred.

    d. In the unoccupied mode the bypass damper shall be driven to 50%.

7. Priority Shutdown - The changeover/bypass system controller shall have priority shutdown capability. A priority shutdown shall be initiated by a building automation system command or an external contact closure. It shall also be initiated by a supply air temperature sensor failure or a communication failure (no damper unit controllers communicating). When the system goes into the priority shutdown mode the following control actions shall be taken:

    a. Disable all stages of heating and cooling (minimum ON time not enforced)

    b. Turn the main supply air fan to OFF (minimum ON time not enforced)

    c. Disable all damper unit controller local heat, if present

    d. Drive all damper unit controller dampers to MAX

    e. Drive the bypass damper(s) 50% open. The changeover/bypass system controller shall return to normal operation when the priority shutdown condition is corrected.

8. 2 Heat-2 Cool and Heat Pump Operation - Dip switches on the changeover/bypass system controller shall be able to be set to tell the system if it is operating a 2 HEAT/2 COOL unit or a HEAT PUMP unit. Setting the dip switch shall establish the operating parameters for the changeover/bypass system controller, such as staging and supply air limiting. It shall also configure the binary outputs to control in the appropriate sequence.

9. Binary Output Rooftop Operation - The changeover/bypass system controller shall use an optional relay board with six binary output relays to control the stages of heating, cooling, and the supply fan on the air conditioning unit. These same relays shall be used both for heat pump and 2 heat-2 cool operation.

10. COMMUNICATING MICROPROCESSOR ROOFTOP OPERATION - The changeover/bypass system controller shall have the capability of directly operating a rooftop unit with a factory installed microprocessor control board via a communications board mounted in the rooftop unit. The changeover/bypass system controller and the rooftop control board shall be capable of sharing data and control modes over a single pair of wires. The changeover/bypass system controller shall automatically recognize and communicate with the rooftop unit on the communications link. The relay board in the changeover/bypass system controller shall not be required when communicating directly with this rooftop unit.

11. Building Automation System (BAS) Control - The changeover/bypass system controller shall be controlled and monitored from a building automation system. The BAS system shall determine the operating modes of the changeover/bypass system controller.

C. CHANGEOVER/BYPASS SYSTEM CONTROLLER GROUP FUNCTIONS

1. Group Functions - The changeover/bypass system controller shall allow groups of damper unit controllers to be controlled and monitored independently. The following group functions shall be supported:

2. Group Occupied/Unoccupied - The time of day scheduling for the changeover/bypass system shall be done by group.

3. Group Timed Override - If the timed override button on a sensor is pressed to invoke the timed override period, all damper unit controllers that are members of that group shall go to the occupied mode.

4. Group Overrides - The changeover/bypass system controller shall have the ability to override several damper unit controller zone functions as a group. The following Group commands shall be issued:

   a. Occupied/Unoccupied. The group can be set to Auto which shall follow the time of day schedule, or it can be overridden to Continuous Occupied or Continuous Unoccupied mode.

   b. Flow Control. The group can be set to Auto which shall follow temperature vs. setpoint demand, or it can be overridden to Continuous Open, Closed, Minimum, or Maximum.

   c. Local Heat. Local zone heat can be overridden to enabled or disabled.

   d. Enforce Minimum While Unoccupied. Selecting Yes enforce the minimum positions of the damper unit controllers during unoccupied. Selecting No shall allow the dampers to go fully closed during unoccupied.

   e. Energy Saver Mode. When enabled the energy saver mode shall allow damper unit controllers to close below their minimums. This shall only occur if a zone is in the cooling mode and if it has a zone temperature lower than the active heating setpoint, or if a zone is in the heating mode and it has a zone temperature greater than the active cooling setpoint.

   f. Ventilation Mode. When enabled this mode shall allow dampers to open for greater ventilation. This shall occur when the group is occupied and the air conditioning system is in a zero energy state (no stages of heating or cooling are energized) for more than four minutes. When the ventilation mode is active, the minimum damper position setpoint shall be multiplied by four (4).

PART 5: POINTS LIST

A. See attached points list for central control panels with changeover/bypass dampers.

END OF SECTION

SYSTEM POINT LIST

SYSTEM POINT DESCRIPTION

CBZLIST1

Central Control Panels with Changeover/ Bypass Dampers

SYSTEM POINT DESCRIPTION	GRAPHIC	ANALOG INPUT: TEMPERATURE	PRESSURE	RH	KW	GPM	CFM	PPM	PERCENT	PERCENT RLA	CALCULATED VALUE	ANALOG OUTPUT: DDC		SETPOINT ADJ.		
ZONE TEMPERATURE		X														
ACTIVE COOLING		X														
ACTIVE HEATING SETPOINT		X														
UNIT STATUS																
HEAT/COOL STATUS																
DAMPER POSITION									X							
MINIMUM DAMPER POSITION									X							
VENTILATION RATIO											X					
ACTIVE COOLING SETPOINT														X		
ACTIVE HEATING SETPOINT														X		
GROUP STATUS																
TOTAL FLOW							X									
AVERAGE TEMP		X														
MINIMUM TEMP		X														
MAXIMUM TEMP		X														
MAXIMUM TEMP DEVIATION		X														
MAXIMUM DAMPER POSITION									X							
CRITICAL VENTILATION RATIO											X					

SYSTEM POINT DESCRIPTION	BINARY INPUT: PNEU. TRANSDUCER	STATUS ON/OFF	FILTER STATUS	STATUS OPEN/CLSD.	STATUS		BINARY OUTPUT: OFF/ON	OPEN/CLOSED	LOCKOUT	ENABLE/DISABLE		
ZONE TEMPERATURE												
ACTIVE COOLING												
ACTIVE HEATING SETPOINT												
UNIT STATUS					X							
HEAT/COOL STATUS					X							
DAMPER POSITION												
MINIMUM DAMPER POSITION												
VENTILATION RATIO												
ACTIVE COOLING SETPOINT												
ACTIVE HEATING SETPOINT												
GROUP STATUS					X							
TOTAL FLOW												
AVERAGE TEMP												
MINIMUM TEMP												
MAXIMUM TEMP												
MAXIMUM TEMP DEVIATION												
MAXIMUM DAMPER POSITION												
CRITICAL VENTILATION RATIO												

SYSTEM POINT DESCRIPTION	SYSTEM FEATURES – ALARMS: HIGH ANALOG	LOW ANALOG	BINARY	PROOF	SENSOR FAIL	FLOW FAIL	COMM. FAIL	DIAGNOSTICS		
ZONE TEMPERATURE					X					
ACTIVE COOLING		X								
ACTIVE HEATING SETPOINT	X									
UNIT STATUS							X			
HEAT/COOL STATUS										
DAMPER POSITION										
MINIMUM DAMPER POSITION										
VENTILATION RATIO										
ACTIVE COOLING SETPOINT										
ACTIVE HEATING SETPOINT										
GROUP STATUS										
TOTAL FLOW										
AVERAGE TEMP										
MINIMUM TEMP										
MAXIMUM TEMP										
MAXIMUM TEMP DEVIATION										
MAXIMUM DAMPER POSITION										
CRITICAL VENTILATION RATIO										

SYSTEM POINT DESCRIPTION	SYSTEM FEATURES – PROGRAMS: TIME SCHEDULING	OPT. START/STOP	DEMAND LIMITING	RESET	EVENT PROGRAM	DDC	ALARM	MAINT. WK. ORDER	RUN TIME	EXP. MESSAGE	SETBACK/SETUP	NIGHT PURGE	TENANT BILLING	TREND LOG	TOTALIZING	TIME DE OVERRIDE			NOTES:
ZONE TEMPERATURE	X		X		X									X		X			VAV ZONE
ACTIVE COOLING																			VAV ZONE
ACTIVE HEATING SETPOINT																			VAV ZONE
UNIT STATUS																			VAV ZONE
HEAT/COOL STATUS																			VAV ZONE
DAMPER POSITION																			VAV ZONE
MINIMUM DAMPER POSITION																			VAV ZONE
VENTILATION RATIO																			VAV ZONE
ACTIVE COOLING SETPOINT																			VAV ZONE
ACTIVE HEATING SETPOINT																			VAV ZONE
GROUP STATUS																			PER GROUP
TOTAL FLOW																			PER GROUP
AVERAGE TEMP																			PER GROUP
MINIMUM TEMP																			PER GROUP
MAXIMUM TEMP																			PER GROUP
MAXIMUM TEMP DEVIATION																			PER GROUP
MAXIMUM DAMPER POSITION																			PER GROUP
CRITICAL VENTILATION RATIO																			PER GROUP

GENERAL NOTES: SYSTEM REQUIRES A SMALL BUILDING MANAGEMENT PANEL.

Sep-98

SECTION 16640 SECURITY SYSTEMS
(Revised 10-14-04)

PART 1 GENERAL

1.01 GENERAL:

A. Install as hereafter specified and as shown on the plans a complete and operating Access Control System. All components required for a complete operating system shall be furnished and installed.

B. The system shall be installed in conduit, and shall be connected and checked out by professional technicians, thoroughly familiar with the equipment being installed. Cables exposed to weather shall be encased in Sealtite or equal.

C. The Access Control System shall be a proprietary, state of the art system capable of integrating with the CCTV security control system and future Integrated Security Management and Monitoring System.

D. Contractor shall closely coordinate and schedule any existing equipment down time with the Owner. This may require late night or weekend work hours at no extra cost to the project..

E. New equipment shall be provided and installed at to accommodate direct integration with a future Integrated Security Management and Monitoring System.

1.02 Instructions:

A. Door controllers shall monitor a minimum of four (4) doors each and shall be located in Communications Rooms.

B. Card readers shall be provided as shown on the plans and shall be suitable for indoor/outdoor operation.

C. Request to exit devices shall be a momentary contact push button mounted on a single gang stainless steel plate or a plate as accepted by Architect.

D. Devices, raceways, junction boxes and wiring installation shall be coordinated and approved by Architect prior to beginning work. All wiring shall be concealed. All raceways shall be concealed or located to minimize objectionable visual impact in exposed areas.

E. Provide hardware wiring and connections to fire alarm system to release electric/magnetic door locks per code requirements.

F. Equipment rack(s) shall be sized as required to accommodate all headend equipment. Provide multi-outlet power strips as required.

G. All access controls and associated equipment shall be powered by emergency generator circuits.

H. Cable shall be suitable for the application. Cable shall be as manufactured by Belden. Cables manufactured by West Penn or Atlas shall be considered equal. Provide appropriate connectors as required. All cables are to be permanently marked at both ends. Identify cable markings on shop drawings and record drawings.

I. The contractor shall provide a one-year guarantee of the installed system against defects in material and workmanship. All labor and materials shall be provided at no expense to the Owner. Guarantee period shall begin on the date of acceptance by Owner.

J. The Contractor shall furnish a minimum of four hours of in-service training with the system. Operating manuals and user guides shall be provided at the time of the training.

K. The Contractor shall furnish manufacturer's manuals of the completed system including individual specifications sheets, inter-panel and intra-panel wiring diagrams. In addition, all information necessary for operation and proper maintenance of the system must be included.

L. Check-out and final connections shall be made by a factory trained technician in the employ of a manufacturer of the products installed. In addition, factory trained technicians shall demonstrate operation of the complete system and each major component to the Owner.

M. System Components shall be the following:

Quantity	Manufacturer	Cat. No.	Description
2	Advantor	AAM4-A	4 Door Controller
1	Advantor	RMOD-A	8 Point Relay Module
8	HID	Thinline II	Proximity Card Readers
6	Securitron	PB2E	Egress Button
1	Securitron	PB3ER	Push Button @ Reception Desk
6	Securitron	SAM	Shear Aligning Magnetic Locks
As Required	Securitron	B-24-4	24VDC Battery Pack
As Required	Securitron	BPS-24-4	24VDC 4 Amp Power Supply
2	Yuasa	12-18	18 A.H. Batteries
2	Securitron	MUNL-24	Mortise Unlatch for 24VDC Locks
6	Securitron	XMS	Exit Motion Sensor
As Required	West Penn	Cable	As Recommended by Manufacturer
As Required	Data Code	Pre Numbered	Proximity Cards with Photo Badging Capability

Other acceptable manufacturers shall be considered. System shall be compatible with software and data management equipment installed in Administration Building in Jackson, MS. Installed system shall be compatible with existing cards that are distributed to MDOT personnel.

N. Doors at rooms 137 and 217 will get the following:

1-MUNL-24; 1-B-24-4; 1-BPS-24-2-4; 1-PB2E as well as cable (Verify with Architect).

Doors at rooms/exits 102,103,140B,148,149 & 151will get the following:

1-SAM; 1-B-24-4; 1-BPS-24-4; 1-XMS; as well as cable (Verify with Architect). Verify door hardware to see if maglock will fit.

END OF SECTION

SECTION 16660 CLOSED CIRCUIT TELEVISION SYSTEM
(Revised 10-14-04)

PART 1 GENERAL

1.01 GENERAL:

A. Install as hereafter specified and as shown on the plans a complete and operating Access Control System. All components required for a complete operating system shall be furnished and installed.

B. The system shall be installed in conduit, and shall be connected and checked out by professional technicians, thoroughly familiar with the equipment being installed. Cables exposed to weather shall be encased in Sealtite or equal.

C. The Closed Circuit Television System (CCTV) security control system shall be a proprietary, state of the art system capable of integrating all video switching and pan/tilt zoom control, alarm point processing, external system relay control, and recording as specified, into a single, user friendly CCTV security control system.

D. Contractor shall closely coordinate and schedule any existing equipment down time with the Owner. This may require late night or weekend work hours at no extra cost to the project.

E. New equipment shall be provided and installed at to accommodate direct integration with a future Integrated Security Management and Monitoring System.

1.02 Instructions:

A. Cameras shall be solid state CCD type with auto-iris lens. Cameras shall be furnished in quantity and locations shown on the plans.

B. Fixed lenses shall be of the focal length required to provide optimum viewing of the desired area.

C. Camera housings shall be furnished in quantity and locations as shown on the plans.

D. Video Multiplexer shall be full duplex and support color cameras and monitors. The video multiplexer shall be 16 channel and support all fixed cameras and leave one channel to monitor all pan/tilt/zoom cameras.

E. Video Multiplexer shall be a 20” Color one. Monitors shall provide a minimum of 450 TVL of resolution. Suitable rack mounting hardware for wall/ceiling mounts shall be furnished as required.

F. Time lapse video recorder shall be of the digital type with 4 inputs (minimum) and provide twenty-four hours of operation of near real-time recording. Suitable rack mounting hardware shall be furnished as required.

G. Equipment rack(s) shall be sized as required to accommodate all head-end equipment. Provide multi-outlet power strips as required.

H. All CCTV and associated equipment shall be powered by emergency generator circuits.

I. Cable shall be suitable for application. Cable shall be as manufactured by Belden. Cables manufactured by West Penn or Atlas shall be considered equal. Provide appropriate connectors as required. All cables are to be permanently marked at both ends. Identify cable markings on shop and record drawings.

J. The Contractor shall provide a one-year guarantee of the installed system against defects in material and workmanship. All labor and materials shall be provided at no extra expense to the Owner. Guarantee period shall begin on the date of acceptance by Owner.

K. The contractor shall furnish a minimum of fours of in-service training with the system. Operating manuals and user guides shall be provided at the time of the training.

L. The Contractor shall furnish manufacture's manuals of the completed system including individual specification sheets, inter-panel and intra-panel wiring diagrams. In addition, all information necessary for the operation and proper maintenance of the system must be included.

M. Check-out and final connections shall be made by a factory trained technician in the employ of a manufacture of the products installed. In addition, factory trained technicians shall demonstrate operation of the complete system and each major component to the Owner.

N. System Components shall be the following:

Quantity	Manufacturer	Cat. No.	Description
2	American Dynamics	ADC 860	½" Color Cameras
If required	American Dynamics	AD PT16-E	Pan Tilt Zoom Controller
2	American Dynamics	AD Delta Dome II	176X Digital Zoom Color Cameras
2	American Dynamics	AD Delta Dome	Outdoor Housing for Delta Dome II
1	JVC	JVC TM2000SU	20" Color Monitor
1	Alpha Systems Lab	ASL FPSDC4064	Input Digital Video Recorder
All	Wire, Wiremold, labor, and hardware required to install and test the above CCTV system for proper operation.		

Other acceptable manufacturers shall be considered.

END OF SECTION

SECTION 16721 FIRE ALARM SYSTEM
(Revised 10-14-04)

PART 1 GENERAL

1.01 GOVERNING STATEMENT:

A. The Contractor shall furnish and install in conduit, complete and ready for operation, an Automatic Fire and Smoke Detection System, including a central control panel, remote alarm annunciator, detection and alarm devices, conduit and wiring, and building plan diagram of alarmed detector in accordance with the drawings and specifications. The entire Fire Alarm System shall conform to the standards of the National Electrical Codes, NFPA, Federal, State and Local laws and ordinances.

B. The system shall be addressable, and shall be Class B electrically supervised against both short and open wiring faults in the detection and alarm circuits. A short, open wiring fault, or ground occurring in these circuits shall cause an audible alarm and visual trouble indication at the control panel.

PART 2 OPERATION

2.01 SYSTEM DESCRIPTION:

A. Furnish and install where indicated on the plans a complete intelligent, addressable fire alarm detection and signaling panel. The control panel shall be of dead front construction, housed in all metal cabinet with all function switches mounted behind a key locked door. Furnish a complete owner's manual with installation guide, programming instructions, operating instructions, basic hook-up diagram, trouble shooting guide and complete service information with the control panel. The control panel shall include all of the following:

1. Furnish internally current limited initiating circuits capable of operation with normally open contact devices. In addition, the circuits shall be capable of supplying power for standby and alarm operation of system smoke detectors. Each circuit shall include a red alarm LED indicator, a set of normally open alarm contacts rated at 1 amp at 28VDC resistive and a supervised current limited alarm annunciator output.
2. One signal circuit designed for connection to polarized 21 and 28VDC parallel connected audible or visual alarm indicating devices. Provide one 2-wire Class "B" circuit.
3. A positive or negative DC ground fault detection circuit which monitors all field wiring for ground faults or near ground fault wiring conditions.
4. A set of single pole double throw (SPDT) auxiliary alarm contacts rated at 5 amps at 28VDC resistive.
5. A two-line dialer with all necessary interface and peripheral devices.
6. Auxiliary contacts as required for use by the Division 15 of the specifications Contractor for air handling unit shut down. All wiring for air handling unit shutdown shall be furnished and installed by the Division 15 Contractor.

2.02 POWER SUPPLY: Provide, as part of the control panel, a full wave rectified 24 VDC power supply with a continuous output rating of 2.5 amperes. The power supply shall derive its operating power from a 120V-60Hz source. Include as part of the power supply section a fully automatic battery charger capable of recharging a fully discharged battery set in less than 48 hours.

2.03 STANDBY BATTERY

A. Furnish and install in the fire alarm panel cabinet, a 24VDC sealed lead acid or gel-type battery set. The batteries provided shall have sufficient capacity to maintain the system for 60 hours of standby operation and 5 minutes of alarm at the full power supply output capability of 2.5 amperes. The battery set shall have been tested by UL with the control panel and recharging circuit to insure that the standby and alarm cycle drain as well as the recharge requirements specified are met completely.

B. The system shall automatically changeover to the standby battery whenever the AC input voltage drops below 120VAC. The battery shall continue to power the system until the AC input voltage returns to at least 108VAC. If this changeover sequence occurs while the system is in alarm, a system reset shall not occur.

2.04 FUNCTION SWITCHES AND INDICATORS:

A. Provide panel mounted switches for the following functions:

1. System Reset: Shall restore the entire system including all panel circuitry and system smoke detectors to a normal standby operating condition. Two stage system reset shall not be permissible.
2. Signal Silence: Shall silence all audible signaling devices. Provisions shall be included for subsequent signal operation should additional zones initiate alarm conditions. At no time shall it be possible to silence signals if the designated waterflow switch zone initiates an alarm.
3. Trouble Silence Switch: Shall silence only the audible system trouble device.

B. Provide the following LED type status indicators on the control panel.

1. Power On: Green LED to indicate the presence of the 120V-60Hz source.
2. System Trouble: Amber LED to operate whenever any supervisory fault is present on the system.
3. Ground On System: Amber LED to activate whenever a D.C. ground fault condition occurs anywhere on the system.
4. Zone Alarm and Trouble: Provide individual red zone alarm and amber zone trouble LED indicators for each of the 4 initiating circuits.

2.05 SYSTEM SUPERVISION

A. The control panel shall provide for supervision of the following conditions. Detection of any of these fault conditions shall activate the system trouble circuitry.

1. An open circuit or ground fault on the initiating circuits or initiating circuit annunciator output.
2. An open circuit, short circuit or ground fault on the signal circuit. In addition, detection of a short circuit shall prevent the operation of the signal circuit.
3. Detection of a positive or negative D.C. ground fault condition on any system field wiring.
4. A drop in the 120V-60Hz input voltage to a point less than 102 volts.
5. The off normal position of any system function switch and the trouble buzzer silence switch.
6. The operation of the range hood extinguishing system alarm switch.

2.06 SYSTEM TROUBLE CIRCUIT

A. The control panel shall contain a complete system trouble circuit. The circuitry shall include an audible trouble sounding device, a visual system trouble indicator, a set of form "C" trouble contacts and a trouble buzzer silence switch. The detection of any supervisory fault shall cause the audible trouble sounding device to pulse, the system trouble LED to flash and the system trouble contact to transfer its state. The trouble buzzer may be silenced by operation of the trouble silence switch. The common system trouble indicator shall continue to flash. Restoration of the fault condition to normal operating condition shall cause the trouble buzzer to resound at a steady rate until the trouble silence switch is returned to its normal position.

B. Actuation of any initiating device shall cause the following to occur:

1. Activate the general alarm audible and visual devices.
2. Activate zone indicators at the central control panel.
3. Interrupt power to AHU's as indicated.

2.07 EQUIPMENT REQUIREMENTS

A. Manual Pull Stations: Furnish and install as indicated on the drawing non-coded double action manual pull stations with raised lettering operating instructions on the face of the device. Each manual pull station shall have a false alarm deterrent device such as the Safety Technology International "Stopper II" installed. The station shall be of the handle bar type operation. A wrench shall be required to gain access for restoring the station to normal condition. Screw terminals in lieu of wire pigtails shall be provided.

B. Audible/Visual Devices: The signaling devices shall consist of an electro-mechanical device and a flashing strobe light. The unit shall be suitable for surface of semi-flush mounting on a standard 4-inch square box. The horn, when activated, shall produce an output of 87 dB at 10 feet and the strobe unit shall flash at a rate of 60 times per minute. The light output from the strobe shall not be less than 2 candela. Both devices shall be electrically separated from each other and include a blocking network to insure proper supervision of the signal circuit wiring.

C. Visual-only devices: Shall be as outlined in section “B” above, except without the presence of an audible signaling component.

D. Automatic Detectors-Photoelectric:

1. Furnish and install where indicated on the plans photoelectric smoke detectors. The combination detector head and twist-lock base shall be UL listed and be compatible with the fire alarm control unit. The photoelectric detector shall be interchangeable with a companion ionization unit without changing the detector base or wiring. Detector removal for any reason shall cause a trouble condition at the fire alarm panel. Detector shall have NO-NC contacts for air handling unit shut down.
2. The photoelectric detector shall include a flashing status indicating LED for visual supervision. Upon detection of a smoke condition, the flashing LED will latch on steady at full brilliance and the detector shall activate the fire alarm control panel. The detector may be reset by operation of the fire alarm panel reset switch.
3. It shall be possible to perform a functional test of the detector without the need for generating smoke. The test method shall simulate the effects of smoke in the sensing chamber to insure the testing of all detector circuitry.
4. To facilitate installation the detector shall be non-polarized. By using the furnished jumper, it shall be possible to check initiating circuit loop prior to installation of the detector head. Voltage and shielded cable shall not be required. The detector heads shall not be installed until construction has been completed.

5. The detector base shall have provisions for connection of a remote indicator. The remote indicator shall visually verify normal operation and an alarm condition on the detector. The remote indicator shall be an LED type mounted on a single gang stainless steel plate located where indicated on the drawings. The operation of the integral LED on the detector shall not be compromised.

E. Automatic Detectors-Thermal:

1. Install in those areas indicated, combination rate of rise/fixed and/or fixed temperature units with thermal ratings as indicated on the drawings. Detectors shall be of low profile construction and be colored white to blend in with the ceiling. The rate of rise section of the detector shall be self restoring, fixed temperature section when actuated, shall give a mechanical indication of operation and shall not self restore.

F. Automatic Detectors-Duct Type:

1. The air duct detector for the fire and smoke detection system shall be equipped with a photoelectric detector head. The detector shall provide detection of combustion gases and smoke in air conditioning ducts in compliance with the National Fire of Air Conditioning and Ventilating Systems, NFPA 90A. The detector shall be UL listed specifically for the use in air handling systems. The detector shall operate at air velocities ranging from 500 feet per minute to 3100 feet per minute without requiring compensation for operation at specific air velocities. Sampling tubes of sufficient length shall be provided so that the sampling tube can be cut to exact length at the installation site to match duct width at the installed location. One duct detector shall be installed in the supply duct downstream of filter and one in the return duct near unit and upstream of outside air duct connection.
2. The duct detector shall interface directly with various remote indicators and control accessories such as the Remote Indicator.

G. The equipment designations are to establish a minimum standard of quality. Equipment of other manufacturers will be considered if in the opinion of the Architect it conforms to the quality and functions of that specified.

PART 3 EXECUTION

A. All wiring shall be checked and tested by the installing contractor in accordance with instructions provided by the manufacturer of the fire alarm equipment to insure that the system is free of grounds and shorts. Wiring size shall be as recommended by manufacturer and consistent color coding shall be maintained.

B. System components shall be as manufactured by Notifier, Pyrotronics, Edwards, or equals approved by Architect.

END OF SECTION