ADDENDUM #2
PORTLAND PUBLIC SCHOOLS
RIVERTON EXPANSION AND RENOVATION PROJECT
Portland, Maine

DATE: May 25, 2006

FROM: Semple & Drane Architects
496 Congress Street
Portland, ME 04101

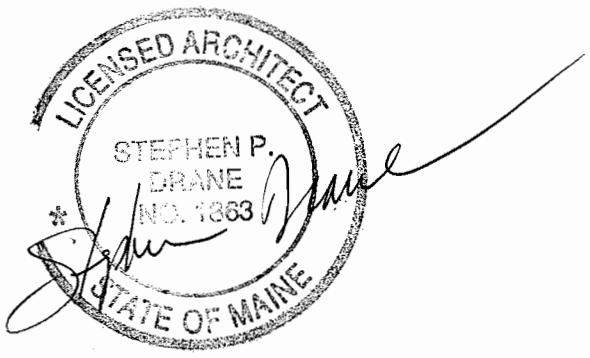
TO: All Prospective Bidders

RE: Addendum No. 2 to the Bidding Documents for:

PORTLAND PUBLIC SCHOOLS
RIVERTON EXPANSION AND RENOVATION PROJECT
Project Bid # 7706
Portland, Maine

This Addendum forms a part of the Contract Documents and modifies the original Bidding Documents dated May 9, 2006. Acknowledge receipt of this Addendum in the space provided in the Bid Form that has been included in the Project Manual.

Stephen Drane, AIA
Semple & Drane Architects



ADDENDUM #2
PORTLAND PUBLIC SCHOOLS
RIVERTON EXPANSION AND RENOVATION PROJECT
Portland, Maine

GENERAL

1) Attendees of the pre-bid conference (mandatory attendance for General Contractors) are listed on City of Portland's, Purchasing Department website located at the following web-address:
www.portlandpurchasing.com/bidconf.asp

PERTAINING TO THE PROJECT MANUAL

Table of Contents:

ADD the following:
Division 0, Forms and Contract Requirements; Section 00310 – Form for Bid
Division 7; Section 07531 – EPDM Membrane Roofing

Section 00310 - Form for Bid:

ADD in it's entirety, attached at the end of this Addendum.

Section 00810 – Exhibit A, Supplementary General Conditions:

Page 4, **ADD** the following Item;

"E'. DELETE paragraph 3.7.1. and substitute the following:

3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for State Plumbing Permit, governmental fees, licenses and inspections necessary for proper execution and completion of the Work which are legally required when bids are received or negotiations concluded. The City of Portland waives the Building Permit Fee."

Page 13, **ADD** the following:

"ARTICLE 11 INSURANCE AND BONDS

A. At subparagraph 11.1(d) Builder's Risk; **CHANGE** "CONTRACTOR" to read "OWNER" and **CHANGE** "OWNER" to read "CONTRACTOR".

Section 00840 – Special Conditions:

Page 1, Part 1, Items 1.01.1. through 3.; **DELETE** entirely.
Page 2, Items 5.4 and 5._ ; **DELETE** entirely.

Section 01100 – Summary:

Page 4, Part 1, Item 1.9.A.3.; **ADD** the following subparagraph:

"a. A phasing timeline and associated drawing with Key Plans is attached to this Section entitled Appendix A, comprised of two pages.

Section 01500 – Temporary Facilities and Controls:

Page 2, Part 2, Item 2.2.A.and B.; **CHANGE** to read,

"A. Field Office, General: The Owner will provide a furnished room within the existing building of sufficient size for the purposes of supporting field operations of the General Contractor. The room will be lit, heated and wired with telephone (non-toll calls only), data, and power.

B. Field Office will be provided for General Contractor's personnel alone. Office may be within the building and somewhat remote from assigned on-site parking areas. Furnishings and equipment required to be supplied by the Contractor are as follows:

1. File cabinet, plan table, plan rack and storage shelving deemed necessary by on-site personnel.
2. Office equipment as necessary but no less than a fax machine, computer for e-mail correspondence, and printer/copier.
3. Task lighting for office desk provided by Owner."

ADDENDUM #2
PORTLAND PUBLIC SCHOOLS
RIVERTON EXPANSION AND RENOVATION PROJECT
Portland, Maine

Page 3, Part 3, Item 3.2.C. and D.; **CHANGE** to read,

"C. Water Service: The Contractor will be permitted to utilize existing water supplies from various hose connections on the building exterior and within custodial spaces inside the building. Contractor shall supply hoses, nozzles, containers and where necessary, back-flow prevention for safe and proper delivery of the water to the Project. Reasonable conservation and waste prevention will be expected.

D. Sanitary Facilities: An existing interior, permanent, unisex restroom will be designated for construction personnel usage only. The Contractor will be responsible for maintenance, sanitation, paper product supply, and will be expected to return it to as-found condition at the completion of the project.

1. Should a single facility be insufficient for the workforce present on the site, a portable, temporary toilet shall be provided and properly serviced at regular intervals for the duration needed."

Page 4, Item 3.2.G.; **ADD** the following: "3. Interior renovations activities (only) may utilize existing interior permanent power from the facility electrical system at no cost to the Contractor."

Section 07531 – EPDM Membrane Roofing:

ADD this Specification Section 07531 in its entirety, attached at the end of this Addendum.

Section 08710 – Door Hardware:

Page 14, Hardware Group 1; **CHANGE** "1 each Latchset Passage Function" to read "1 each Exit Device 8810 (No exterior trim)"; Function shall read, "Egress by inside touchpad. No exterior trim, no entry, non-dogging."

Pages 14, 15, 17, 19 and 20; Hardware Groups 2, 4, 8, 10, 19, 20, 22 and 24; **DELETE** the Item "1 Set Weatherstripping". Weatherstripping shall be provided as integral part of aluminum entrance frame and door system.

Page 18, Hardware Group 16; **DELETE** the feature "with Hold-open Arms" noted for the closers.

Section 08950 – Translucent Panel Glazed Roof Assemblies:

Page 2, Part 2, Item 2.1.; ADD the following:

"B. Basis of Design Product: The design intent for the translucent panel glazed roof system to be installed under Alternate 6 is for a complete component replacement in lieu of the plywood, sleeper, insulation and metal roofing system at the entry canopies as follows:

1. Kalwall "Kalcurve" Low Profile Vault panels and framing system for joining panels and flashing only, including but not limited to mullions, muntins, ridge, battens, and perimeter edge trim with drip and edge caps.
2. Kalwall System shall require no supporting understructure as it is intended to overlay the structural steel framing designed and detailed in the Drawings for the Base Bid metal roofing system, replacing the roofing system in entirety."

Section 09260 – Gypsum Board and Related Metal Framing:

Page 4, Part 2, Item 2.2.; ADD the following item:

"C. Exterior Gypsum Board for Soffits and Ceilings: ASTM C 931 or ASTM C 1396, with manufacturer's standard edges.

1. Core: 5/8 inch, Type X.

D. Joint Compound for Exterior Applications of Exterior Gypsum Soffit Board: Use setting-type taping compound and setting-type, sandable topping compound."

ADDENDUM #2
PORTLAND PUBLIC SCHOOLS
RIVERTON EXPANSION AND RENOVATION PROJECT
Portland, Maine

Section 09653 – Resilient Wall Base and Accessories:
Page 2, Part 2, Item 2.3.A.2.; **CHANGE** to read "2. Flexco."

Section 10801 – Toilet and Bath Accessories:
Page 3, Part 2, Item 2.2.F.2.; **CHANGE** paragraph to read "2. Toilet Rooms B110, C106 and C120 shall receive in addition to items indicated above, one (1) Sanitary Napkin Disposal Unit in each room – a total of 3 required.
Page 4, Item 2.3.D.2.; **CHANGE** to read "2. Material: Vinyl, 0.008 inches thick with integral antibacterial and flame-retardant agents. Sides and bottom edges are to be hemmed.

Section 15410 – Plumbing Fixtures:
Page 5, Part 2, Item 2.4.B.; CHANGE to read as follows:

"B. Locker Room Stall Shower **(P-4):** Basis of Design; Symmons Temptrol pressure-balancing shower unit with hand-held shower accessory head for ADA compliance. Equal to No. 96-500-B30. Provide mixing valve with adjustable stop screw to limit handle turn. Provide wall mounted Fre-Flo #295 institutional, vandal resistant shower head in addition to wall mounted hand-held. Provide accessory quick-disconnect fitting for hand-held shower hose for easy removal from wall elbow connection when not in use. All piping shall be concealed in ceramic tiled masonry wall and all mounting fasteners for valves, heads and fittings shall be vandal resistant recessed hex socket type, of stainless steel."

ADD the following:

"2.5 DRINKING FOUNTAIN

A. Manufacturers:
   1. Halsey Taylor
   2. Elkay Manufacturing Company.
   3. Oasis Corporation
   4. Haws Corporation

B. Drinking Fountain, **(DF)**: Basis of Design; Halsey Taylor, Model HRFSEBP (bi-level) barrier-free, pressure adjust with bubbler, wall-hung stainless steel fixture.
   1. Twin, face-mounted one-piece fountain fabricated of non-corroding 300 series stainless steel with brushed satin finish. Design shall be contour-formed basins with rounded corners and eased edges to reduce splatter, insure proper drainage andprevent standing waste water. Fixture design shall be easily accessible to both physically challenged and non-disabled individuals, fully compliant with the ADA.
   2. Provide one-piece, flexible, two-stream mound-building bubblers with removable anti-squirt feature and integral hood.
   3. Pushbutton Actuation Mechanism: Actuators shall be self-closing, vandal resistant pushbuttons which shall not require grasping or twisting to operate.
   4. Automatic Stream Height Regulator: Self-closing corrosion resistant stop/regulator shall be located inside cabinet/bubbler to prevent tampering. A constant stream height shall be automatically maintained during supply line pressure fluctuations from 20 to 100 psi.
   5. Inlet Strainer: Provide in-line strainer screen that can be easily cleaned and that is capable of trapping particles of 140 microns or larger before they enter the waterway.
   6. Water Inlet/Supply: Supply pipe size shall be ½-inch O.D. tubing.
   7. Drain Outlet: 1-1/4 inch waste pipe outlet size.
   8. Support carriers: ASME A112.6.1M drinking fountain carrier. Include vertical steel uprights with feet, tie-rods, and bearing plates with mounting studs matching fixtures to be supported."

ADDENDUM #2
PORTLAND PUBLIC SCHOOLS
RIVERTON EXPANSION AND RENOVATION PROJECT
Portland, Maine

Section 15940 – Sequence of Operations:
DELETE Section 15940 in entirety. **ADD** the replacement Section 15940, attached.

Section 17100 – Cable Plant
DELETE Section 17100 in entirety. **ADD** the replacement Section 17100, attached.

Section 17700 – Intra-Building Communications
ADD this Specification Section 17700 in entirety, attached at the end of this Addendum.

PERTAINING TO THE DRAWINGS
COVER: List of Drawings; ADD the following Drawings; SB-500 FOUNDATION DETAILS, SF-500 STRUCTURAL FRAMING DETAILS, and SF-501 STRUCTURAL FRAMING DETAILS.

REMOVE reference to EL-101 and EP-103. These Drawings do not exist.

Drawing S-000: A1: ADD the following item to the Column Schedule "C-7, HSS 6x3x5/16"". Refer to attached sketches SKS-01 and SKS-04.

Drawing SB-100 - Foundation Notes: CHANGE both notes 1 and 2 to read ".....SEE DRAWING S-000 FOR SCHEDULE". **ADD** the following note; "8. [B-#X] INDICATES BASE PLATE TYPE AND THICKNESS, SEE SB-100. WHERE # = TYPE AND X = THICKNESS."

The North Arrow indicating Plan North should be rotated counterclockwise 90 degrees. True North remains the same as shown.

A1: ADD the following notes in entirety; "1) Elevation 0'-0" indicated on plan for this addition, equals the elevation noted on Drawing C-1.2 as 97.7'. 2) The entry slab at door A105B is to be provided in the Base Bid as shown and detailed. Under the Sprinkler Alternate (No. 5 - See Architectural), the entry slab, frost walls, and block down in top of wall for door and top of wall section shown in detail E1/SB-500 shall be deleted and bid price adjusted accordingly within the Alternate 5 Proposal."

D5: ADD this note in its entirety; "Elevation 0'-0" indicated on plan for this addition, equals the elevation noted on Drawing C-1.2 as 93.8'."

Drawing SB-500: ADD Drawing SB-500 in its entirety. Drawing sheet attached.

Drawing SF-100: The North Arrow indicating Plan North should be rotated counterclockwise 90 degrees. True North remains the same as shown.

A1: ADD the following note; "TJ = TIE JOIST".
The beam (W12x19) in Line-4, spanning between Lines A and C, should be indicated to be "SLOPING".

A1 and D5: CHANGE Detail Markers labeled "A7/SF-501" to read "A8/SF-501".
CHANGE Detail Markers labeled "A4/SF-501" to read "A6/SF-501".

ADDENDUM #2
PORTLAND PUBLIC SCHOOLS
RIVERTON EXPANSION AND RENOVATION PROJECT
Portland, Maine

Drawing A100 – Demolition Plan and Overall Floor Plan:

B1: CHANGE General Note 1 to read; "1) SEE A101, A201 AND A604 FOR ENLARGED PART-PLANS SHOWING DETAILED EXTENT OF WORK. DEMOLITION SCOPE IS KEYED AND NOTED ON THIS DRAWING BELOW."

Drawing A101 – Floor Plans:

ADD a General Note that reads; "1) SEE DRAWING A100 FOR LOCATION/KEY PLAN AND A604 FOR ENLARGED PLANS OF TOILET ROOMS AND LOCKER ROOM SPACE WITHIN INTERIOR OF BUILDING BEING RENOVATED AS PART OF THIS PROJECT."

A4: CHANGE Tackboard Type 4 to Type 6 on west wall of Discovery Room, over bleachers.

B1: CHANGE main entry canopy width dimension between column 8-9 centerlines to read **19'-4".**
DELETE hatching and notes reading "NEW WALK-OFF MAT" at each side of interior vestibule doors C102A,B,and C.
ADD Tackboard Type 8 on Corridor wall face at proposed door opening infill at Nurse C105.

B1, D1, and D4: ADD a total of four (4) fire extinguishers with semi-recessed cabinets as specified, in the following locations;

1) Lobby B102 in CMU wall along column line L near the exterior wall.
2) Corridor B117 in CMU wall, positioned north of column R/10.8.
3) Corridor C118 in Admin. in 6" stud-framed wall opposite door C118B.
4) Lobby A109 in CMU wall between borrowed-lite HM windows of Reading A101 and A102.

D1: ADD one (1) bi-level ADA compliant drinking fountain, fixture type P-5, in Lobby B102, centered on CMU wall to Office B104 between door B104A and exterior window.
CHANGE Tackboard Type 3 to Type 6 on south wall of Multi-Purpose B (B105).

D4: At Plan northern end, **CHANGE** the first dimension for outside corner to corner wall length that runs north-south, from 5'-2 1/8" to read **5'-4"** at both upper and lower locations on plan. CHANGE the next dimension in continuation on west wall from 45'-6" to read **45'-7 7/8"**.

D1 and D4: ADD the following note; "PROVIDE A HIGH-STRENGTH, SELF-LEVELING CEMENTITIOUS TOPPING OVER THE ENTIRE SURFACE OF THE EXISTING EXTERIOR STRUCTURAL SLABS OUTSIDE DOORS A109A AND B117A TO MAKE FLUSH WITH NEW FINISH FLOOR ELEVATION."

Drawing A102 – Roof Plans and Details:

B2: REPLACE Detail with attached ASK-4.

B3: **CHANGE** the note "Masonry Fasteners (Typ.) Refer to Struct. Drwgs." to read "DOUBLE ANGLE – CONT. AT NEW ROOF EDGES – SEE STRUCTURAL DETAILS".

B4: **REPLACE** Detail with attached ASK-5.

D1: MODIFY southerly portion of Roof layout in Plan as indicated in attached ASK-6.

Drawing A203 – Exterior Canopies, Plans and Details:

ADD the following Sketch Drawings to this sheet;

ASK-10	Canopy Section
ASK-11	Canopy Connection Detail

ASK-12 Canopy Envelope Detail

Drawing A300 – Plan Details and Wall Types:

B5: ADD Plan Detail ASK-1 in blank space.

C1: ADD Plan Detail ASK-2 in blank space.

D1, D2 and D5: ADD Plan Details ASK-8, ASK-9 and ASK-7 respectively in blank spaces.

Drawing A500 – Doors, Frames, Schedule & Miscellaneous Details

Door Schedule: CHANGE Door A105B material to read "HM".
CHANGE Door B104B Hardware Group from "1" to "11".
ADD a Fire Rating of "90 Minutes" at Door and Frame B103A.
DELETE Remark key note "3" from pair of doors B117A.
ADD Alternate #5 key note "A" in the Remarks column at door pairs B109A and B117A.

Drawing A501 – Windows and Miscellaneous Details:

A1: MODIFY Window Types as indicated in ASK-13.

A1, B1, and B2: **ADD** the following General Notes; "1) ALL FRAMES AND WINDOWS IN EXTERIOR OPENINGS SHALL BE THERMALLY BROKEN, FACTORY FINISHED ALUMINUM. 2) ALL INTERIOR BORROWED LIGHT FRAMES SHALL BE HOLLOW METAL – FIELD PAINTED. 3) DOOR FRAMES SHALL BE AS INDICATED IN SCHEDULE ON A500."

Drawing A600 – Interior Elevations:

A1: REPLACE Lobby A109 Elevation with revised elevation on ASK-3.

Drawing A602 – Interior Elevations:

A1: CHANGE Lobby Tackboard Type note from "7" to "8".

D3: **CHANGE** Discovery Room Tackboard Type note from "5" to "6".

Drawing MD-400: A1: Refer to attached Sketch SKM-01 for revisions.

Drawing MH-400: A1: Refer to attached Sketch SKM-02 for revisions.

A5: Refer to attached Sketch SKM-04 for revisions.

G4 and G7: Refer to attached Sketch SKM-03 for revisions.

Drawing MH-500: F4: Refer to attached Sketch SKM-06 for revisions.

G7: Refer to attached Sketch SKM-06 for revisions.

Drawing MH-600: A1: Refer to attached Sketch SKM-05 for revisions to "Air Handling Unit Schedule (Bid Alternate No. 3).

Drawing PL-100: B1, C5, and E5: Refer to attached Sketch SKP-03 for revisions.

Drawing PL-102: A1 & E6: Refer to attached Sketch SKP-01 for revisions.
B6 & E6: Refer to attached Sketch SKP-02 for revisions.

Drawing ED-100: Refer to attached Sketch SKE-01 for revisions.

Drawing EL-100: Refer to attached Sketch SKE-02 for revisions.

Drawing EP-100: Refer to attached Sketch SKE-01 for revisions.

Drawing EP-500: **A1 & E6:** Refer to attached Sketch SKE-02 for revisions.

SPECIFICATION SECTIONS ATTACHED TO THIS ADDENDUM
Section 07531 – EPDM Membrane Roofing
Section 15940 – Sequence of Operations:
Section 17100 – Cable Plant
Section 17700 – Intra-Building Communications

SKETCH DETAILS AND DRAWINGS ADDED BY THIS ADDENDUM
ASK-1, ASK-2, ASK-3, ASK-4, ASK-5, ASK-6, ASK-7, ASK-8, ASK-9, ASK-10, ASK-11, ASK-12, and ASK-13.
SKS-01, SKS-02, SKS-03,SKS-04, SKS-05, SKS-06, SKS-07, SKS-08, SKS-09, and SKS-10
SKP-01, SKP-02, and SKP-03
SKM-01, SKM-02, SKM-03,SKM-04, SKM-05, and SKM-06
SKE-01 and SKE-02

SB-500 FOUNDATION DETAILS
SF-500 STRUCTURAL FRAMING DETAILS
SF-501 STRUCTURAL FRAMING DETAILS

END OF ADDENDUM TEXT

SECTION 00310
FORM FOR BID

PROPOSAL FORM FOR GENERAL CONTRACTORS
(PUBLIC SCHOOL PROJECTS)

BIDDER: _____

_____

_____

TO: Matthew F. Fitzgerald, Purchasing Agent

City Hall, Room 103

389 Congress Street

Portland, ME 04101

A. Having carefully examined the Form of Contract, General Conditions, Special Provisions and Plans and Specifications dated May 9, 2006.

Prepared by: Semple & Drane Architects, the Architects/Engineer for Riverton Expansion and Renovation Project, Portland, Maine.

As well as the premises and conditions affecting the Work, we the undersigned propose to furnish all Labor, Equipment and Materials necessary for and reasonably incidental to the construction and completion of this Proposal for the amount of:

$_____

NOTE: The bidder acknowledges that the lump-sum amount listed in the Schedule of Allowances indicated in Section 01210 is included in the Base Bid price noted above.

B. Alternate prices as follows:

Alternate #1:	New VAV terminals and Ductwork	ADD $_____
Alternate #2:	Landscaping	ADD $_____
Alternate #3:	Air Handler Unit 7 & 8 and Chiller System	ADD $_____
Alternate #4:	Library Carpet	ADD $_____
Alternate #5:	Fire Protection System	ADD $_____
Alternate #6:	Canopy Skylights	ADD $_____

C.	**UNIT PRICE SCHEDULE**	**ADD**	**DEDUCT**
1.	Open Excavation including backfill, Per cubic yard	_____	_____
2.	Rock excavation, per cubic yard-open (indicate same amount for Add & Deduct)	_____	_____
3.	Rock excavation, per cubic yard-trench (indicate same amount for Add & Deduct)	_____	_____
4.	Structural Fill, per cubic yard	_____	_____
5.	Crushed Stone, per cubic yard	_____	_____

D. This proposal includes the following Addenda to the Plans and Specifications:

Addendum No._____, Dated_____Addendum No._____, Dated_____

Addendum No._____, Dated_____Addendum No._____, Dated_____

Addendum No._____, Dated_____Addendum No._____, Dated_____

E. The undersigned agrees, if this Proposal is accepted, to sign a Contract and deliver it, along with the Bonds and Affidavits of all Insurance specified within twelve (12) calendar days after the date of notification of such acceptance, except if the 12th day falls on a holiday, a Saturday or Sunday, then the conditions will be fulfilled if the required documents are received before 12 o'clock noon on the day following the holiday, or the Monday following the Saturday or Sunday, and as a guarantee thereof, herewith submits a Certified or Cashier's Check or Bid Bond as required.

The undersigned agrees that each of the above Subcontractors represents a bonafide Subproposal based on the Plans and Specifications and will be used for the Work indicated at the Amount stated, unless a substitution is made by mutual agreement as provided for by the Instructions to Bidders. In the event Alternate Prices are requested and various trades are involved, General Contract Bidders may use properly filed Subproposals even though a change in Subcontractors from those carried in the Base Bid may occur. If different Subcontractors are used because of Alternates, attach supplemental sheets to this Bid Form to indicate such changes.

The undersigned agrees, if awarded the Contract, to complete the work to allow occupancy of building as described in Section 01010 "Summary of Work".

1. Substantial Completion of entire building on or before August 7, 2007:

Signed _____

By _____

Address _____

_____

NOTE: If bidder is a Corporation, write State of incorporation, and if a partnership, give full names of all partners.

SECTION 03300 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mix design, placement procedures, and finishes, mud slabs, Flowable fill and under slab vapor barrier system.

B. Related Sections include the following:

1. Division 1 Section "Alternates" for work of this section affected by alternates.
2. Division 2 Section "Earthwork" for drainage fill under slabs-on-grade.
3. Division 4 Section "Unit Masonry" for concrete in-fill of masonry unit assemblies.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume.

1.4 REFERENCES

A. American Concrete Institute (ACI):

1.	117	-Specifications for Tolerances for Concrete Construction and Materials
2.	301	-Specifications for Structural Concrete for Buildings
3.	305R	-Hot Weather Concreting
4.	306R	-Cold Weather Concreting
5.	309R	-Guide for Consolidation of Concrete
6.	315	-Manual of Standard Practice for Detailing Reinforced Concrete
7.	347	-Recommended Practice for Concrete Formwork
8.	318	-Building Code Requirements for Reinforced Concrete
9.	544.1R	-State-of-the-Art Report of Fiber Reinforced Concrete
10.	554.2R	-Measurement of Properties of Fiber Reinforced Concrete

B. American Society for Testing and Materials (ASTM):

1.	A 185	-Welded Steel Wire Fabric for Concrete Reinforcement
2.	A 615	-Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

3.	C 33	-Concrete Aggregate
4.	C 39	-Compressive Strength of Cylindrical Concrete Specimens
5.	C 94	-Ready-Mixed Cement
6.	C 150	-Portland Cement
7.	C 260	-Air-Entraining Admixtures for Concrete
8.	C 309	-Liquid Membrane-Forming Compounds for Curing Concrete
9.	C 494	-Chemical Admixtures for Concrete
10.	C 1018	-Standard Test Method for Flexural Toughness and First-Crack Strength of Fiber-Reinforced Concrete (Using Beam with Third-Point Loading)
11.	C 1116	-Type III, Sections 4.1.3 and 4.2, and Performance Level I, Toughness Index I5 outlined in Section 21, Note 17, Standard Specification for Fiber-Reinforced Concrete and Shotcrete

C. Federal Specifications (FS):

1.	TT-C-800	-Curing Compound, Concrete, for New and Existing Surfaces

D. Concrete Reinforcing Steel Institute (CRSI):

1.	CRSI	-Manual of Standard Practice and Recommended Practice for Placing Reinforcing Bars (MSP-latest edition)

E. American Welding Society (AWS)

F. Scaffolding and Shoring Institute (SSI):

1. Scaffolding and Shoring Safety Rules

1.5 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated.

B. Design Mixes: For each concrete mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.

1. Provide cement manufacturer's letter of certification and chemical content test results stating that the Portland cement is in compliance with ASTM designation C 150 and ASTM C 845.
2. Indicate amounts of mix water to be withheld for later addition at Project site.

C. Steel Reinforcement Shop Drawings: Details of fabrication, bending, and placement, prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement." Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement. Include special reinforcement required for openings through concrete structures.

D. Welding Certificates: Copies of certificates for welding procedures and personnel.

E. Flatwork Certificates: Copies of supervisors "ACI Concrete Flatwork Technician" certificate.

F. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:

G. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:

1. Cementitious materials and aggregates.
2. Form materials and form-release agents.
3. Steel reinforcement and reinforcement accessories.
4. Fly ash materials history and origin.
5. Fiber reinforcement.
6. Admixtures.
7. Waterstops.
8. Curing materials.
9. Floor and slab treatments.
10. Bonding agents.
11. Adhesives.
12. Vapor retarders.
13. Epoxy joint filler.
14. Joint-filler strips.
15. Repair materials.

H. Minutes of preinstallation conference.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed concrete Work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

1. Flatwork (interior and exterior slabs) shall be placed, finished and cured under the direct supervision of a "Certified ACI Concrete Flatwork Technician".

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for formwork and shoring and reshoring installations that are similar to those indicated for this Project in material, design, and extent.

C. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.

1. Manufacturer must be certified according to the Department of Transportation's "Certificate of Ready Mixed Concrete Production Facilities".

D. Testing Agency Qualifications: An independent testing agency, approved by the Engineer and acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

E. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.

F. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."

G. ACI Publications: Comply with the following, unless more stringent provisions are indicated:

1. ACI 301, "Specification for Structural Concrete."
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

1. Flatwork (interior and exterior slabs) Preinstallation Conference: Conduct conference at Project site to review all details and requirements for the batching, mixing, transporting, placing, finishing, and curing all interior and exterior flatwork operations. Require representatives of each entity directly concerned with flatwork operation to attend, including the following:

a. Contractor and Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixes.
c. Ready-mix concrete producer.
d. Flatwork subcontractors.
e. Quality assurance firm.
f. Cement Manufacturer's factory representative
g. Testing agency
h. Engineer.
i. Owner's representative.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle steel reinforcement to prevent bending and damage.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Provide reusable forms.

B. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
1. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:

a. High-density overlay, Class 1, or better.

b. Medium-density overlay, Class 1, or better, mill-release agent treated and edge sealed.
c. Structural 1, B-B, or better, mill oiled and edge sealed.
d. B-B (Concrete Form), Class 1, or better, mill oiled and edge sealed.

2. Manufactured forming system: metal or other panel system with prior review and approval.

C. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

D. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

E. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.

F. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.

G. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

H. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
1. Furnish ties that, when removed, will leave holes not larger than 1 inch (25 mm) in diameter in concrete surface.
2. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

1. Bars shall be clean and free from rust, scale or coatings that will reduce bond. Reinforcing steel shall be capable of bending 180 degrees and rebending to original shape without fracture.

B. Low Alloy Steel Reinforcing Bars for Welding: ASTM A706, deformed.

C. Plain-Steel Wire: ASTM A 82, as drawn.

D. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

2.3 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete, and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected or CRSI Class 2 stainless-steel bar supports.

B. Joint Dowel Bars: Plain-steel bars, ASTM A 615/A 615M, Grade 60 (Grade 420). Cut bars true to length with ends square and free of burrs.

2.4 CONCRETE MATERIALS

A. Portland Cement: ASTM C150, Type II – Low Alkali, ASTM C114, expressed as sodium oxide (Na_2O), of less than 0.60%.

B. Portland Cement: ASTM C 150, Type V.
1. Fly Ash: ASTM C 618, Class C or F.
   a. Manufacturer to provide evidence that fly ash is free of radon.
2. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
   a. At the supplier's option, slag cement may be blended with type II cement to achieve the performance of 0.60% alkali. The cement supplier shall provide a letter certifying the percentage of slag cement required to achieve the performance of low alkali cement specified.

C. Normal-Weight Aggregate: ASTM C 33, uniformly graded, and as follows:

1. Class: Severe weathering region, but not less than 3S.
2. Nominal Maximum Aggregate Size: 3/4 inch (19 mm).
3. Combined Aggregate Gradation: Well graded from coarsest to finest with not more than 18 percent and not less than 8 percent retained on an individual sieve, except that less than 8 percent may be retained on coarsest sieve and on No. 50 (0.3-mm) sieve, and less than 8 percent may be retained on sieves finer than No. 50 (0.3 mm).

D. Water: Potable and complying with ASTM C 94.

2.5 ADMIXTURES

A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.

B. Air-Entraining Admixture: ASTM C 260. Sika AER by The Sika Chemical Corp. or approved equal

C. Air-Entraining Admixture (Flowable Fill): DuraFill by W.R. Grace or approved equal.

D. Water-Reducing Admixture: ASTM C 494, Type A. Eucon WR-75 by the Euclid Chemical Co., "Pozzolith 200N" by Master Builders, "Plastocrete 161" by the Sika Chemical Corp., or approved equal.

E. Non-Corrosive Accelerator: ASTM C 494, Type C or E, Accelguard 80 by the Euclid Chemical Co. or "Polar Set" by W. R. Grace and Co. or approved equal.

a. Non –corrosive accelerator shall have long-term test data proving its non-corrosive effect on reinforcing steel.

2.6 FIBER REINFORCEMENT

A. Synthetic Fiber: Fibrillated or monofilament polypropylene fibers engineered and designed for use in concrete, complying with ASTM C 1116, Type III, 1/2 to 1-1/2 inches (13 to 38 mm) long.

B. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. Monofilament Fibers:

a. Fibrasol IIP; Axim Concrete Technologies.
b. Fiberstrand 100; Euclid Chemical Co.
c. Fibermix Stealth; Fibermesh, Div. of Synthetic Industries.
d. Forta Mono; Forta Corporation.
e. Grace MicroFiber; W. R. Grace & Co., Construction Products Div.
f. Hi-Tech PPM Fiber; Hi-Tech Fibers, Div. of Martin Color-Fi, Inc.
g. Polystrand 1000; Metalcrete Industries.

2.7 WATERSTOPS

A. Self-Expanding Strip Waterstops: Manufactured rectangular or trapezoidal strip, sodium bentonite or other hydrophylic material for adhesive bonding to concrete. Parastop II by Paramount Technical Products, Inc. or approved equal.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Volclay Waterstop-RX; Colloid Environmental Technologies Co.
b. Conseal CS-231; Concrete Sealants Inc.
c. Swellseal Joint; De Neef Construction Chemicals (U.S.) Inc.
d. Hydrotite; Greenstreak.
e. Mirastop; Mirafi Moisture Protection, Div. of Royal Ten Cate (USA), Inc.
f. Adeka Ultra Seal; Mitsubishi International Corporation.
g. Superstop; Progress Unlimited Inc.
h. Parastop II; Paramount Technical Products, Inc.

2.8 VAPOR RETARDERS

A. Vapor Retarder: Provide water-resistant barrier consisting of high density, polyethylene meeting the following specifications:
   1. Water Vapor Transmission: 0.006 gr./sq.ft./hr per ASTM E96.
   2. Permeance Rating: 0.01 gr./sq.ft./hr per ASTM E96.
   3. Puncture Resistance: 204 lbs/sq.ft. per GRI-GS-1-86.
   4. Tensile Strength: 54.2 lbs. @ 1139% strain/MD and 55.5 lbs. @ 1009% strain/CMD per ASTM D638.
   5. Tear Resistance: 7.40 lbs/ft. MD and 8.22 lbs/ft. CMD per ASTM D1004.
   6. Low Temperature Brittleness: Pass both machine direction and cross machine direction per ASTM D1790 (15 min. @ 15 deg F.)
   7. Meets to ASTM E 1745, Class A and B standards for underslab vapor retarders.
   8. Product: Subject to compliance with requirements, provide Stego Wrap by Stego Industries, LLC, 15 mil thick vapor retarder. (877) 464-7834.

2.9 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete. Evaporation retarder shall be "Con-film" by Master Builders or approved equal.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz. /sq. yd. (305 g/sq. m) dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Clean and Potable.

E. Curing Compound (Exterior Concrete Application): Conform to method of ASTM C 156 for compliance with ASTM C 309, non-coloring, non-staining, curing compound. Curing compound shall be Sonocrete SONOSIL as manufactured by Sonneborn – Chemtrex, Inc. or approved equal.

F. Curing and Sealing Compound (Exposed Interior Concrete Slab Application): Conform to Federal Spec. TT-C-800A, 30 percent solids content minimum. Curing and sealing compound shall be "Super Floor Coat" by the Euclid Chemical Co., "Master-Seal" by Master Builders, or approved alternate.

G. Waterproof Paper for Curing and Protection (Interior Non-Exposed Concrete): Conform to ASTM C 171, Type I. Paper shall be lapped and seams taped with reinforced tape, orange label Sisalcraft, Floor Cure Wet Strength by Glas-Kraft, Inc., or approved equal.

2.10 RELATED MATERIALS

A. Isolation Joint Former (Columns): 24" x 24" diamond/square as manufactured by Greenstreak, P.O. Box 7139, St. Louis, MO 63177, or approved equal.

B. Perimeter Isolation Joint: 2 lb. density, cross linked polyethylene with removable strip-off equal to ISO-STRIP as manufactured for Century Floors, Topsham, Maine.

C. Joint-Filler Strips: ASTM D1571, asphalt-saturated cellulosic fiber or high recycled-content product complying with ASTM D1571.
1. Product: "Homex 300" by Homasote CO. (West Trenton, NJ, 800.257.9491).

D. Epoxy Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Shore A hardness of 80 per ASTM D 2240.

E. Deicer Protection (Exterior Concrete): Saltgard as manufactured by Pro So Co, Inc., or approved equal.

F. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

G. Epoxy-Bonding Adhesive: A two-component, solvent-free, moisture-insensitive structural epoxy adhesive in compliance with ASTM C 881, Type I and Type II, Grade 2, Class B and C, and shall be Sikadur 32, Hi-Mod by Sika Corp. or approved equal.

H. Doweling Adhesive: A two-component, vinylester blend resin equal to HI HY150 adhesive as manufactured by Hilti Fastening Systems, Tulsa, Oklahoma or approved equal

I. Floor Control/Construction Joints: Control joints shall be saw cut or 1/4" wide soff-cut. Construction joints shall be keyed and doweled. Key joint is of 24 gauge galvanized steel with 1-1/8" dowel knockouts 6" on center. Keyway shall be equal to "Key-Lock Joint" with removable plastic cap strip by Form-A-Key Products Div., Louisville, KY 40214, or approved equal.

J. Reglets: Fabricate reglets of not less than 0.0217-inch- (0.55-mm-) thick galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

K. Weep Holes: 2" diameter PVC pipe.

L. Non-Shrink Grout: Premixed compound with non-metallic aggregate, cement, water-reducing and plasticizing agents capable of minimum compression strength of 2,400 lbs. Non-shrink grout shall be "Eucon N-S" (non-metallic) by the Euclid Chemical Co., "Masterflow 713" (non-metallic) by Master Builders, Five Star Grout by U.S. Grout Corp., or approved equal.

2.11 REPAIR MATERIALS

A. Slurry: Slurry shall consist of the same proportions of cement to fine aggregates used in the regular concrete mix (coarse aggregate only omitted) and shall be well mixed with such amount of water as will produce a thick consistency.

B. Dry Pack: Dry pack for cosmetic concrete repairs only shall consist of one part cement to 2-1/2 parts fine aggregate (screen out all materials retained on No. 4 sieve), mixed with a minimum amount of water, in small amounts. The consistency shall be such that when a ball of the mixture is compressed in the hand it will maintain its shape, showing finger marks, but without showing any surface water.

C. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3 to 6 mm) or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi (29 MPa) at 28 days when tested according to ASTM C 109/C 109M.

D. Repair Topping: Traffic-bearing, cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch (6 mm).

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3 to 6 mm) or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5700 psi (39 MPa) at 28 days when tested according to ASTM C 109/C 109M.

2.12 CONCRETE MIXES

A. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data bases, as follows:

1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.

B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the laboratory trial mix basis.
1. DO not use Owner's field quality control testing agency as the independent testing agency.

C. Minimum Recycled Content: At least 25% of Cementitious material by weight in each cast-in-place concrete mix shall be from documented post industrial or post-consumer sources as specified in Division 1 Section "LEED Requirements" and shall consist of one or more of the following, within allowable limits:
1. Fly ash.
2. Ground granulated blast furnace slag.
3. Other industrial waste aggregate complying with requirements and approved by Engineer.

D. Cementitious Materials: Limit percentage, by weight, of Cementitious materials other than Portland cement in concrete as follows:
1. Fly ash: 25 percent.
2. Combined Fly ash and pozzolans: 25 percent.

3. Ground Granulated Blast Furnace Slag: 50 percent.
4. Combined Fly Ash or Pozzolans and Ground Granulated Blast Furnace Slag: 50 percent Portland cement minimum, with fly ash or pozzolans not exceeding 25 percent.

E. Footings and foundation walls: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.45.
3. Slump Limit: 4 inches, plus or minus 1 inch.
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.

F. Interior Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 3500 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.45.
3. Slump Limit: 5 inches.
4. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.
5. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd.

G. Suspended Slabs: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Minimum Cementitious Material Content: 520 lb/cu. Yd.
3. Slump Limit: 5 inches.
4. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.
5. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd.

H. Miscellaneous Site Concrete not specified in other sections: Unless otherwise indicated, proportion normal-weight concrete mix as follows:

1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.40.
3. Slump Limit: 5 inches.
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.

I. All concrete shall contain the specified water-reducing admixture. All slabs placed below 50 degrees F shall contain the specified non-corrosive accelerator. All exterior concrete shall contain an approved air-entraining admixture.

J. All exterior concrete shall have an air content of five percent to seven percent.

K. All exterior concrete subjected to freezing and thawing shall have a maximum water-cement ratio of 0.53. All concrete subjected to deicers shall have a maximum water-cement ratio of 0.45.

L. No air entrainment in interior floor slab.

M. Limit water soluble, chloride=ion content in hardened concrete to 0.15 percent by weight of cement.

N. All mix design, batching, placing, finishing, curing, joint sealing and patching of color conditioned concrete shall be in strict accordance with the manufacturers recommendations

O. Flowable Fill:

1. Flowable fill shall be excavatable, composed of a homogenous mixture of Type II Portland cement, fine aggregate, water, and air-entraining admixture proportioned according to these specifications. All material shall be approved prior to use.
2. Flowable Fill Limits:

a.	Laboratory Design Compressive Strength	100 psi at 28 days
b.	Cement Factor	70-100 lbs/cy
c.	Water-Cement Ratio	3.00*
d.	Air Content	20% to 25%**
e.	Modified slump	7" to 8"

Notes
* The water-cement ratio for Flowable fill shall not be high enough to cause segregation of the mix.
** Air content of 20% to 25% is the target. Higher air contents may be acceptable but will increase set time. All Flowable fill shall be air-entrained by the addition of an air-entraining admixture in strict accordance with the manufacturer=s recommendations and written instructions.

P. Air Content: Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content of 5 to 7 percent, unless otherwise indicated.

Q. Do not air entrain concrete to trowel-finished interior floors and suspended slabs. Do not allow entrapped air content to exceed 3 percent.

R. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

S. Synthetic Fiber: Uniformly disperse in concrete mix at manufacturer's recommended rate, but not less than 1 lb/cu. yd. (0.60 kg/cu. m).

T. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
4. Use corrosion-inhibiting admixture in concrete mixes where indicated.

2.13 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.14 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and ASTM C 1116, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For mixer capacity of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least one and one-half minutes, but not more than five minutes after ingredients are in mixer, before any part of batch is released.
2. For mixer capacity larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads.

1. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117. Excessive deflection of forms after concrete is poured shall be sufficient cause for rejection of that portion of concrete and formwork. Excessive deflection will be considered to be that which will produce visible and noticeable waves in the finished concrete.
2. Construct forms so that walls will key into each other at ends unless poured monolithically.

B. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:

1. Class A, 1/8 inch (3 mm).

C. Construct forms tight enough to prevent loss of concrete mortar.

D. All possible care shall be taken in the formwork to produce surfaces free from honeycomb or other defects.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.

1. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Schedule the work and notify other trades in time so that provisions for their work in the formwork can be made without delaying progress of the project. Verify that all sleeves, pipes, etc., for electrical, plumbing, heating and ventilation, or other work are installed.

I. Chamfer exterior corners and edges of permanently exposed concrete.

J. Do not chamfer corners or edges of concrete.

K. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

L. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

M. Bolts, rods or other approved devices shall be used for internal ties. They shall be so arranged that when the forms are removed, no metal shall be within 1" of any surface.

N. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

O. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Secure information about and provide for all openings, offsets, recessed nailing blocks, channel chases, anchors, ties, inserts, etc., in the formwork before concrete is poured.
2. Install anchor bolts, accurately located, to elevations required.

a. The setting of all anchor bolts and the grouting for all structural steel base plates shall be included as part of this contract. Bolts and base plates will be furnished under Section 05500 - Metal Fabrications.
b. All column base plates, equipment bases, and other locations noted in the structural drawings shall be grouted with the specified non-shrink grout. All exposed grout shall be the specified non-metallic type.

3. Install reglets to receive top edge of foundation sheet waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
4. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork, for sides of beams, walls, columns, and similar parts of the Work, that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete provided concrete is hard enough to not be damaged by form-removal operations and provided curing and protection operations are maintained.

B. Leave formwork, for beam soffits, joists, slabs, and other structural elements, that supports weight of concrete in place until concrete has achieved the following:

1. 28-day design compressive strength.
2. At least 70 percent of 28-day design compressive strength.
3. Determine compressive strength of in-place concrete by testing representative field- or laboratory-cured test specimens according to ACI 301.
4. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

C. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

D. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Engineer.

3.4 SHORES AND RESHORES

A. Comply with ACI 318, ACI 301, and recommendations in ACI 347R for design, installation, and removal of shoring and reshoring.

B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.

C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.5 MOISTURE VAPOR RETARDER SYSTEM (UNDER FLOOR SLABS)

A. Moisture vapor retarder system shall be installed at all interior floor slabs and as otherwise indicated in the drawings in strict accordance with the manufacturer's printed instructions and as follows.

1. Snap chalk line along inside perimeter of foundation walls at top of slab elevation.
2. Without wetting, clean a 3" wide band on the surface of the concrete below the chalk line at approximately mid-slab height. Remove dirt, residual form release, or other bond inhibiting surface contaminates. Grind smooth any surface projections within the band.
3. While removing the contact paper on the backside, firmly press 2" wide manufacturer's approved perimeter and penetration strip onto wall, parallel to the chalk line on the cleaned band at mid-slab elevation.
4. Remove contact paper on the face side.
5. Apply 12" wide manufacturer's approved edge roll covering only the bottom 1" of contact surface on the perimeter strip. Cut, fit, and seal corner details with manufacturer's approved seaming tape.
6. Align top edge of isolation joint material to chalk line, and press material onto remaining 1" of exposed perimeter strip adhesive.
7. Roll out Vapor Barrier material, overlapping edge rolls and all seams by 3". Tape all seams with manufacturer's approved seaming tape.
8. All tears, punctures, etc. to be repaired and taped as required to maintain the watertight integrity of the vapor barrier system.

3.6 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. All steel bars, wire and fabric shall be of size, gauge and length indicated, accurately bent or formed to shapes detailed or scheduled by experienced shops using methods that will not injure the materials.
2. Steel reinforcing shall not be bent in a manner that will injure the material or the embedding concrete. Bars with kinks or bends not shown on the plans shall not be used. Heating of reinforcement for bending will not be permitted. Bars shall be bent once only (no rebending or straightening allowed) unless shown as such on the drawings.
3. All details of reinforcement not shown or indicated on the drawings or specifically called for in the specifications shall conform to ACI 315.
4. Lap all bars at splices, corners and intersections a minimum of 36 bar diameters unless otherwise indicated. Laps of welded-wire fabric shall be at least two times the spacing of the members in the direction lapped but not less than twelve inches.
5. All intersecting concrete walls shall be tied with #4L bars 3'-0" long, bent 18" x 18" spaced 12" on center, outside face only unless otherwise indicated.
6. Splices of reinforcement shall not be made at points of maximum stress. Splice lengths shall be a minimum of 36 bar diameters unless otherwise indicated and shall provide sufficient lap to transfer the stress between bars by bond and shear. Stagger splices of adjacent bars where possible. All splices and laps at corners and intersections shall be tied with wire at each end.
7. Where obstructions (pipes, conduit, ducts, etc.) prevent the intended placement of reinforcing, provide additional reinforcing as directed by the Engineer or his Representative around the obstruction to match that reinforcing interrupted.

8. Provide additional stirrups, ties, trim bars, etc., as directed around all openings, sleeves, pipes, and conduits, which pass through structural elements.
9. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials.Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

1. Coverage of bars (including stirrups and column ties) shall, unless otherwise shown, be as follows:

Footings:	3" soil face, 2" top
Slabs (on grade):	2" soil face, 1-1/2" top face
Slabs (elevated):	1" top and bottom
Beam and Column:	1-1/2"
Walls:	2" clear to form at exterior

2. Misplaced Reinforcing: If any reinforcing bars are found to be misplaced after concrete has been placed, the Engineer shall be notified immediately and no correction or cutting shall be made without his direction. Misplaced bars shall not be bent or kinked. Any redesign and/or reinforcing required because of misplaced bars shall be at the Contractor's expense.
3. All reinforcing shall be kept separate from soil, pipe, conduit ducts, etc., by approved non-metallic separators.
4. Reinforcement shall not have welded joints unless indicated on the drawings or unless prior approval has been given by the Engineer. Welding shall conform to the requirements of the American Welding Society Structural Welding Code for reinforcing steel D1.4. Field welding shall be performed by AWS certified welders.
5. Shop- or field-weld reinforcement according to AWS D1.4, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire fabric in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

1. At edges of slabs, construction joints, and expansion joints, extend fabric to within one inch of pour. As concrete for slabs is placed, support fabric reinforcement at intervals to ensure proper embedment. Support fabric in mid-depth of slab. All weld wire mesh shall be located one-half the thickness of the slab unless otherwise noted on the drawings.
2. Extend fabric over supporting beams and walls.

3.7 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Engineer.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form from preformed galvanized steel, plastic keyway-section forms, or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.

    a. Wall control "V" joints shall have a depth of 1/8 times the thickness of the wall and be 1/2" wide at surface. "V" joints shall be placed as shown or as directed by the Engineer.

6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness, or 3/4" minimum for soff-cut as follows:
1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/4" (maximum) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

    a. Floor slab control joints (including elevated slabs) shall be placed as shown on the foundation plan (slab on grade). Unless otherwise noted, control joints shall be spaced at intervals not to exceed 12'-0" on center in both directions.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
2. Terminate full-width joint-filler strips not less than 1/2 inch (12 mm) or more than 1 inch (25 mm) below finished concrete surface where joint sealants, specified in Division 7 Section "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Dowel Joints: Install dowel sleeves and dowels or dowel bar and support assemblies at joints where indicated.

1. All new concrete walls shall be tied to existing concrete walls with #6 dowels, 20" long at 8" on center, drilled 8" into existing concrete unless otherwise indicated. Dowels shall be set in doweling adhesive in strict accordance with the manufacturer's recommendations

2. All intersecting slab construction joints acting as control joints shall be doweled according to the following schedule unless otherwise indicated. Dowels shall be smooth, steel grade 60 with saw cut ends. Grease, wrap or cap one end.

Dowel Schedule

	Dowel Dia.	Length	Spacing
4" Slab	1/2"	12"	12"
5" Slab	5/8"	14"	12"
6" Slab	3/4"	14"	12"
7" Slab	7/8"	14"	12"
8" Slab	1"	14"	12"

3. New slabs shall be tied to existing slabs with #6 bars 12" long at 8" on center.

3.8 WATERSTOPS

A. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, bonding or mechanically fastening and firmly pressing into place. Install in longest lengths practicable.

1. Remove all protrusions and indentations 2" or over in all areas.
2. Lay waterstop flat against concrete surface and nail every 1" to 6" with case hardened washered nails.
3. Overlap all joints a minimum of 2".

3.9 WEEP HOLES

A. Provide weep holes at a minimum of 10'-0" on center at the base of all perimeter foundation walls with underdrains unless indicated otherwise.

3.10 MIXING CONCRETE

A. General: The concrete shall be mixed in the quantities required for immediate use, and any which has developed initial set or exceed the time limit of ASTM C 94 shall not be used. No retempering of mortar or concrete shall be allowed under any circumstances. Concrete shall be proportioned, mixed and placed only in the presence of the Engineer or his Authorized Representative. The Contractor shall give ample notice to the Engineer before mixing is

commenced. Aggregate size will be adjusted to suit conditions of work. Pumping of concrete shall be permitted only after approval by the Engineer of the Pumping Contractor and the pumping equipment and method to be employed. The Engineer shall be notified of dates when pumping of concrete shall be performed to permit his on-the-job inspection of the operations.

B. Final proportions shall be in accordance with approved mix designs. Adjustments to approved proportions, for whatever reason, shall be approved by the Engineer.

C. Add fibrous concrete reinforcing to all concrete used at slabs on grade, slabs on metal deck, and structural slabs and sidewalks. The amount of fiber reinforcement shall be in accordance with the manufacturer's recommendations and approved submittals. Add the fibrous reinforcement at the time the concrete is batched; mix in strict accordance with the manufacturer's instructions and recommendations for a uniform and complete distribution.

3.11 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Remove loose dirt, mud, standing water, and foreign matter from excavations or from cavities.

C. Thoroughly clean reinforcement and other embedded items free from loose rust and other matter. Assure reinforcing is held securely in place.

D. Thoroughly wet wood forms (except coated plywood), bottom and sides of trenches, base underslab, and adjacent concrete or masonry at least one hour in advance of placing concrete; securely close cleanout and inspection ports; repeat wetting as necessary to keep forms damp.

E. Equipment shall be maintained clean and of sufficient quantity and capacity to efficiently execute the work required.

F. Do not add water to concrete during delivery, at Project site, or during placement, unless approved by Engineer.

G. Before placing concrete, water may be added at Project site, subject to limitations of ACI 301.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mix.

H. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation.

I. Deposit concrete in forms in horizontal layers no deeper than 24 inches (600 mm) and in a manner to avoid inclined construction joints. Place each layer while preceding layer is still plastic, to avoid cold joints.

1. Consolidate placed concrete with mechanical vibrating equipment. Use equipment and procedures for consolidating concrete recommended by ACI 309R.

a. concrete shall be vibrated into final position in forms with an internal type vibrating machine. The vibration shall have a frequency of not less than 8,000 vibrations per minute. The mechanical vibrating equipment shall be satisfactory to the Engineer.
b. The vibration shall be of sufficient intensity and duration to cause flow or settlement of the concrete and complete consolidation. Over vibration, especially of mixtures that are too wet, may cause segregation and will be avoided. A sufficient number of vibrators shall be provided to permit consolidation of each batch before the next batch is delivered and without delaying the delivery.
c. The vibrations shall be applied directly to the concrete, and vibration through the forms shall not be permitted. Vibration shall be applied at the point of deposit and in the area of freshly deposited concrete. The concrete shall be placed in layers of uniform thickness

2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the vibrator. Place vibrators to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix constituents to segregate.
3. When conditions make puddling difficult, or where the reinforcement is congested, batches of mortar containing the same proportions of cement to sand used in the concrete shall be deposited in the forms. The operation of filling with the regularly specified mix shall be carried on at such a rate that the mix is at all times plastic and flows readily into the spaces between the bars.
4. In thin walls or inaccessible portions of the forms where rodding is impractical, the concrete shall be worked into place by tapping or hammering forms adjacent to the freshly deposited concrete.
5. The Contractor's attention is called to the importance of making the concrete dense, and he shall provide sufficient labor to the entire satisfaction of the Engineer to thoroughly consolidate the concrete, avoid air pockets and voids in exposed sections, and leave smooth, uniform surfaces after forms are removed.
6. Should any honeycombed concrete be disclosed upon removal of forms, the Contractor shall immediately cut out the said honeycombed portions back to solid concrete and shall fill the opening thus formed with a concrete of the same proportions as that specified for the section of work in which the fault occurs.
7. When placing fresh concrete upon hardened concrete, the latter shall be thoroughly roughened and cleaned of all loose material, scum or latency. The bonding compound shall be applied and the new concrete placed while the bonding compound is still tacky.
8. Joints in the concrete work shall be made only in places and the manner specified by the Engineer.
9. The Contractor's attention is called to the importance of properly and carefully placing concrete around reinforcement, as the reinforcing metal must not be exposed; and in cases where reinforcing metal becomes exposed on the surface, that portion of work must be removed and re-laid as the covering of same by plastering with cement mortar will not be allowed. All reinforcing rods or other reinforcing material shall be lightly tapped so that they will retain their original position.
10. No concrete shall be retempered except as allowed in ASTM C 94 nor shall set concrete be used as aggregate.

J. Flowable fill placement methods and sequences shall be approved by the Engineer before the start of any placement operation.

1. Fill shall be placed before it has taken initial set. Fill shall be placed in such a manner as to avoid separation and segregation of the mix.
2. Consolidation, tamping, or vibration is not required and shall not be allowed.
3. The drop height of shall be as low as practically possible.
4. Fill shall not be placed until fill area has been checked and approved by the Owners Representative.

K. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.

    a. Reinforcement, unless otherwise indicated, shall be placed one-half the thickness of the slab.

3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, free of humps or hollows, before excess moisture or bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
6. In addition to steel bar and/or welded-wire fabric reinforcement, slabs shall be reinforced with fibrous concrete reinforcement which is to be added when the concrete is being batched in strict accordance with the manufacturer's recommendations.
7. Slabs shall be monolithically placed with control joints. Sawed control joints will be located as indicated on the drawings and/or as directed by the Engineer. Floors shall be cleaned of objects before saw cutting begins. A true, continuous saw cut is what is expected as a finish result.
8. Slabs designated as colored in the room finish schedule shall be placed in strict accordance with manufacturers recommendations. The concrete shall never be covered with plastic sheathing.

L. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When air temperature has fallen to or is expected to fall below 40 deg F (4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.
4. Contractor shall have on the job, ready to install, adequate equipment for heating the materials and the freshly placed concrete and for enclosing the work in accordance with the requirements specified herein.

M. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows, when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

N. Protection:

1. Concrete just placed shall be protected from rain in an approved manner until the concrete has set, or if a slab, the curing compound has dried.
2. Concrete, when placed in the forms, shall have a temperature of not less than 50 degrees F nor more than 90 degrees F. Freshly placed concrete and the surrounding air shall be maintained at a temperature of 50 degrees F or greater for a period of seven days after placing. If high early strength concrete is used, the aforementioned time period may be reduced to three days. The methods of protection and curing shall be such as to prevent evaporation of moisture from the concrete and injury to the surface.
3. Should it later develop that any concrete work has become injured in any way by freezing or otherwise, the defective concrete shall be repaired or replaced as directed by the Engineer at no added expense to the Owner. Repair materials shall include all reinforcement grouts, dry pack, admixtures, epoxy and aggregates as may be necessary

O. Deicer Protection:

1. Apply deicer protection to all exterior slabs on grade, stairs, sidewalks, and related work 30 days after concrete placement in strict accordance with manufacturer=s written recommendations.

3.12 PROTECTIVE COATING FOR STRUCTURAL STEEL

A. All structural steel and columns and their bases which extend into or through concrete floors or walls shall be thoroughly brush painted with two coats of foundation coating as specified in Section 07150 - Dampproofing, and applied in accordance with the manufacturer's directions, neatly cut off one inch below finish floor.

3.13 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched. Remove fins and other projections exceeding ACI 347R limits for class of surface specified.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch (3 mm) in height.

1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or painting.
2. Do not apply rubbed finish to smooth-formed finish.

C. Rubbed Finish: Apply the following to smooth-formed finished concrete:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.14 FINISHING FLOORS AND SLABS

A. General: Comply with recommendations in ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

1. All interior concrete floor slabs shall be finished true and smooth by steel troweling or finishing machine. All exterior slabs, pads, ramps, stairs, and sidewalks shall be broom finished.
2. When a section of the concrete floor is completed, it shall be left entirely undisturbed until the concrete is thoroughly hardened.
3. Adequate provisions will be made to eliminate the possibility of accidental encroachment upon the newly concreted area.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes.

1. Apply scratch finish to surfaces indicated and to surfaces to receive concrete floor topping or mortar setting beds for ceramic or quarry tile, portland cement terrazzo, and other bonded cementitious floor finishes.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots.

Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces indicated, to surfaces to receive trowel finish, and to floor and slab surfaces to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

D. Trowel Finish: After applying float finish, apply first trowel finish and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces indicated and to floor and slab surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin film-finish coating system

3.15 Flatness/Levelness:

A. Flatness/Levelness: Finished Concrete surfaces of both slabs on grade and topping slabs shall meet the following minimum tolerances for flatness F(F) and Levelness F(L) in areas wkith finish flooring materials indicated, as measured within 24 hours according to ASTM E 1155/E 1155M for a randomly trafficked floor surface, except meet or exceed finish flooring manufacturer's required substrate tolerances where they are more stringent than the following:
1. Thin Set Stone Flooring: Specified overall values of flatness, F (F) 35; and levelness, F (L) 25; with minimum local values of flatness, F (F) 24; and levelness, F (L) 17.
2. Resilient Flooring: Specified overall values of flatness, F (F) 35; and levelness, F (L) 25; with minimum local values of flatness, F (F) 24; and levelness, F (L) 17.
3. Rubber Treads: Specified overall values of flatness, F (F) 35; and levelness, F (L) 25; with minimum local values of flatness, F (F) 24; and levelness, F (L) 17.
4. Carpet: Specified overall values of flatness, F (F) 25; and levelness, F (L) 20; with minimum local values of flatness, F (F) 17; and levelness, F (L) 15.
5. Exposed (Sealed) Concrete: Specified overall values of flatness, F (F) 20; and levelness, F (L) 15; with minimum local values of flatness, F (F) 15; and levelness, F (L) 10.

B. Trowel and Fine-Broom Finish: Apply a partial trowel finish, stopping after second troweling, to surfaces indicated and to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. Immediately after second trowelling, and when concrete is still plastic, slightly scarify surface with a fine broom.

C. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Engineer before application.

D. Slip-Resistive Aggregate Finish: Before final floating, apply slip-resistive aggregate finish where indicated and to concrete stair treads, platforms, and ramps. Apply according to manufacturer's written instructions and as follows:

1. Uniformly spread 25 lb/100 sq. ft. (12 kg/10 sq. m) of dampened slip-resistive aggregate over surface in one or two applications. Tamp aggregate flush with surface, but do not force below surface.
2. After broadcasting and tamping, apply float finish.
3. After curing, lightly work surface with a steel wire brush or an abrasive stone, and water to expose slip-resistive aggregate.

E. Mineral Dry-Shake Floor Hardener Finish: After initial floating, apply mineral dry-shake materials to surfaces according to manufacturer's written instructions and as follows:

1. Uniformly apply mineral dry-shake materials at a rate of 100-lb/100 sq. ft. (49 kg/10 sq. m), unless greater amount is recommended by manufacturer.
2. Uniformly distribute approximately two-thirds of mineral dry-shake materials over surface by hand or with mechanical spreader, and embed by power floating. Follow power floating with a second mineral dry-shake application, uniformly distributing remainder of material, and embed by power floating.
3. After final floating, apply a trowel finish. Cure concrete with curing compound recommended by dry-shake material manufacturer and apply immediately after final finishing.

3.16 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

D. Mechanical Equipment Pads: Provide 4" concrete pads reinforced with 6x6 - W1.4xW1.4 welded-wire fabric under all mechanical equipment supported on concrete floor slab unless otherwise indicated.

E. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces.

F. Foundation Insulation: Install foundation insulation using a dab of emulsified asphalt mastic in each corner and the center to adhere the insulation to the concrete wall. Insulation will be installed on the inside face of all perimeter foundation walls extending from the underside of floor slab to top of footing. Insulation furnished under Section 07200 - Insulation.

3.17 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing by one or a combination of the following methods:

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces as indicated below

1. Interior:

    a. Exposed concrete slabs (excluding shrinkage compensating concrete slabs and slabs scheduled to receive curing/sealer/hardener floor finish) shall receive the specified curing and sealing compound applied immediately following final finishing operations and in strict accordance with the manufacturer=s recommendations.
    b. All concrete slabs designated as colored in the room finish schedule shall be cured and sealed in strict accordance with manufacturer recommendations.
    c. Slabs as indicated on the Room Finish Schedule shall receive the specified curing/sealer/hardener as follows:

        1) Apply immediately following the final concrete finishing operation of the concrete floor slab and as soon as the concrete is firm enough to work on in strict accordance with the manufacturer's recommendations and written instructions.

2. Exterior:

    a. Concrete slabs, pads, stairs, ramps, sidewalks, and related work shall receive the specified curing compound applied in strict accordance with the manufacturer's written recommendations.
    b. Concrete slabs, pads, stairs, ramps, sidewalks, and related work shall receive the specified deicer protection 30 days after concrete placement in strict accordance with the manufacturer's written recommendations.

3. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

    a. Water.
    b. Continuous water-fog spray.
    c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.

4. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

    a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
    b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
    c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer recommends for use with floor coverings.

5. Waterproof Paper (gymnasium floor): Apply waterproof paper in accordance with manufacturer's recommendations in widths as wide as possible. Paper shall be lapped and seams taped with reinforced tape.
6. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.18 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

    1. Defer joint filling *(until concrete has aged at least six months)* **(OR)** *(till the completion of the project)*. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semirigid epoxy joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

D. Install isolation joints around columns in accordance with the drawings and manufacturer's recommendations.

E. Install perimeter isolation joints in accordance with the drawings and manufacturer's recommendations.

3.19 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 (1.2-mm) sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension in solid concrete but not less than 1 inch (25 mm) in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least 3/4 inch (19 mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mix as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.20 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement. Sampling and testing for quality control may include those specified in this Article.

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. A set of four (4) test cylinders shall be made for each 100 cubic yards, or fraction thereof, of each class of concrete placed each day. Cylinders shall be made and cured by the Testing Agency in accordance with ASTM C 31. The properly marked cylinders shall be picked up by the approved testing agency and tested in accordance with ASTM C 39. The test results will be sent directly to the Engineer with location and date marked. In addition to the date cast, the date and time the cylinders are picked up for transportation to the lab shall be shown.
2. Description of the manner in which cylinders were stored for the first 24 hours and the succeeding 27 days shall also be indicated.
3. Air temperature, as well as the concrete temperature, shall be shown so that there is adequate data to evaluate varying and possibly low test results.
4. On-site slump tests will be made as directed:

    a. Type II Cement: At placement maximum slump 4", minimum slump 2"
    b. Flowable Fill: Slump tests shall be performed using the modified slump test as follows:

        1) Apparatus: Scoop, Measuring tape, flat edge, 3" x 6" cylinder mold open at both ends and a flat, nonabsorbent surface.
        2) Procedure:

            a) Set cylinder upright on flat, nonabsorbent surface.
            b) Scoop representative sample of flowable fill.
            c) Fill the cylinder with the sample in one lift without tamping. Strike off the top with the flat edge to form a level surface.
            d) Clear any residue from around the bottom of the cylinder.
            e) During a count of three seconds, lift the cylinder straight up allowing the sample to spread on the flat surface.
            f) Measure the spread diameter to the nearest 2". A spread of 7" to 8" is considered flowable.

5. Air content shall be checked at least twice each day on air-entrained concrete in accordance with ASTM C 173 or ASTM C 231.
6. Air content for flowable fill shall be measured following the requirements of ASSHTO T152 utilizing Type B equipment.

7. At least one set of measurements for air content, temperature, and slump of the flowable fill mix shall be performed per placement or per day, whichever is less frequent. Test cylinders shall not be required.

C. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.

D. Strength of each concrete mix will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).

E. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-and 28-day tests.

F. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

G. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Engineer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Engineer.

END OF SECTION 03300

SECTION 05120 - STRUCTURAL STEEL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes:

1. Structural steel Shapes, plates and angles
2. Beams
3. Columns

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Quality Control" for independent testing agency procedures and administrative requirements.
2. Division 5 Section "Steel Deck" for field installation of shear connectors.
3. Division 5 Section "Metal Fabrications" for loose steel bearing plates and miscellaneous steel framing.
4. Division 9 Section "Painting" for surface preparation and priming requirements.

1.3 PERFORMANCE REQUIREMENTS

A. Engineering Responsibility: Engage a fabricator who utilizes a qualified professional engineer to prepare calculations, Shop Drawings, and other structural data for structural steel connections.

B. Construction: Type 2, Simple Framing (Typical).

1.4 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for each type of product specified.

C. Shop Drawings: A complete set shall include the following items. Partial submittals will not be reviewed and will be returned bearing the label "Not Approved".

1. Shop Drawings detailing fabrication of structural steel components.

a. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
b. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.

2. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify high-strength bolted slip-critical, direct-tension, or tensioned shear/bearing connections.
3. Include design calculations sealed by a professional engineer licensed to practice in the State of Maine for all connections.
4. Certification:

    a. Submit a letter of certification from the material fabricator sealed by a professional engineer licensed to practice in the State of Maine attesting that all shop drawings were prepared under his direct supervision.
    b. Submit certification that field welders are AWS certified.

5. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
6. Mill test reports signed by manufacturers certifying that their products, including the following, comply with requirements.

    a. Edit list below to suit requirements. Add twist-off tension control bolts or other alternative design bolts, if required.
    b. Structural steel, including chemical and physical properties.
    c. Bolts, nuts, and washers, including mechanical properties and chemical analysis.
    d. Direct-tension indicators.
    e. Shop primers.
    f. Non-shrink grout.

D. Source quality Control test reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed structural steel work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Fabricator Qualifications: Engage a firm experienced in fabricating structural steel similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to fabricate structural steel without delaying the Work.

1. Fabricator must hold current membership and be a member in good standing in either AISC or Structural Steel Fabricators of New England (SSFNE).

C. Comply with applicable provisions of the following specifications and documents:

1. AISC's "Code of Standard Practice.
2. AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."
3. AISC's "Specification for Allowable Stress Design of Single-Angle Members."
4. AISC's "Seismic Provisions for Structural Steel Buildings."
5. ASTM A 992/A 992M "Specifications for High-Strength Low-Allow Columbium-Vanadium Structural Steel"

6. ASTM A 307 "Specifications for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength"
7. ASTM A 325 "Specifications for Structural Bolts, Steel Heat Treated, 120/105 ksi Minimum"
8. ASTM A 500 "Specifications for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes"
9. ASTM A 6 "Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use."
10. Research Council on Structural Connections' (RCSC) "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
11. Research Council on Structural Connections' (RCSC) "Load and Resistance Factor Design Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Professional Engineer Qualifications: A professional engineer who is legally authorized to practice in the jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for projects with structural steel framing that are similar to that indicated for this Project in material, design, and extent.

E. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code--Steel."

1. Present evidence that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

F. Structural Steel Painting Manual: Comply with applicable provisions of the "Structural Steel Painting Manual.

G. Structural Steel Painting Council: Comply with provisions as follows:

1. SSPC-SP3 - Power Tool Cleaning
2. SSPC-SP6 – Commercial Blast Cleaning

H. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver structural steel to Project site in such quantities and at such times to ensure continuity of installation.

B. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.

1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
2. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.7 SEQUENCING

A. Supply anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, templates, instructions, and directions, as required, for installation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Structural steel W-shapes shall conform to ASTM Specification, Serial Designation A 992, as amended to date. Structural steel shapes (other than W-shapes), plates and bars shall conform to ASTM Specification for Bridges and Buildings, Serial Designation A 36, as amended to date. No secondhand materials shall be used.

B. Cold-Formed Structural Steel Tubing: ASTM A 500, Grade B (Fy = 46 ksi). Hot-Formed Steel

C. Pipe: ASTM A 53, Type E or S, Grade B.

D. Anchor Rods, Bolts, Nuts, and Washers: As follows:

1. Unheaded Rods: ASTM A 36.
2. Headed Bolts: ASTM A 307, Grade A; carbon-steel, hex-head bolts; and carbon-steel nuts.
3. Headed Bolts: ASTM A 325, Type 1, heavy hex steel structural bolts and heavy hex carbon-steel nuts.
4. Headed Bolts: ASTM A 490, Type 1, heavy hex steel structural bolts and heavy hex carbon-steel nuts.
5. Washers: ASTM A 36.

E. Nonhigh-Strength Bolts, Nuts, and Washers: ASTM A 307, Grade A; carbon-steel, hex-head bolts; carbon-steel nuts; and flat, unhardened steel washers.

1. Finish: Plain, uncoated.

F. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, and hardened carbon-steel washers.

1. Finish: Plain, uncoated.
2. Direct-Tension Indicators: ASTM F 959, Type 325.

a. Optional: Snap off tension indicating high-strength bolts certified to provide the minimum fastener tension per AISC "Specifications for Structural Joints Using ASTM A 325 or ASTM A 490"

1) Finish: Plain, uncoated.

G. High-Strength Bolts, Nuts, and Washers: ASTM A 490, Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, and hardened carbon-steel washers, uncoated.

1. Direct-Tension Indicators: ASTM F 959, Type 490, uncoated.

a. Optional: Snap off tension indicating high-strength bolts certified to provide the minimum fastener tension per AISC "Specifications for Structural Joints Using ASTM A 325 or ASTM A 490"

H. Welding Electrodes: Comply with AWS requirements.

2.2 PRIMER

A. Structural Steel Primer Paint: Refer to and comply with requirements of Division 9 Section "Painting".

2.3 GROUT

A. Non-Shrink Grout: Premixed compound with non-metallic aggregate, cement, water-reducing and plasticizing agents capable of minimum compression strength of 2,400 lbs. Non-shrink grout shall be "Eucon "N-S" (non-metallic) by the Euclid Chemical Co., "Masterflow 713" (non-metallic) by Master Builders, Five Star Grout by U.S. Grout Corp.

2.4 FABRICATION

A. Fabricate and assemble structural steel in shop to greatest extent possible. Fabricate structural steel according to AISC specifications referenced in this Section and in Shop Drawings.

1. Camber structural steel members where indicated.
2. Identify high-strength structural steel according to ASTM A 6 and maintain markings until steel has been erected.
3. Mark and match-mark materials for field assembly.
4. Fabricate for delivery a sequence that will expedite erection and minimize field handling of structural steel.
5. Complete structural steel assemblies, including welding of units, before starting shop-priming operations.
6. Comply with fabrication tolerance limits of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded.

2.5 SHOP CONNECTIONS

A. Shop install and tighten nonhigh-strength bolts, except where high-strength bolts are indicated.

B. Shop install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1. Bolts: ASTM A 325 high-strength bolts, unless otherwise indicated.
2. Connection Type: Slip-critical, direct-tension, or tensioned shear/bearing connections as indicated.

C. Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.

2.6 SHOP PRIMING

A. Shop prime steel surfaces as specified in Division 9 Section "Painting", except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
2. Surfaces to be field welded.
3. Surfaces to be high-strength bolted with slip-critical connections.
4. Surfaces to receive sprayed-on fireproofing.
5. Galvanized surfaces.

B. Coordinate sequencing of primer application to maintain Indoor Air Quality according to the IAQ Plan and minimize release of Volatile Organic Compounds into enclosed spaces of the Project.

C. Surface Preparation: Clean surfaces to be painted. Remove loose rust, loose mill scale, and spatter, slag, or flux deposits. Prepare surfaces according to SSPC specifications as follows:

1. SSPC-SP 3 "Power Tool Cleaning."
2. SSPC-SP 6 "Commercial Blast Cleaning."

D. Priming: Immediately after surface preparation, apply primer according to manufacturer's instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.7 SOURCE QUALITY CONTROL

A. Owner will engage an independent testing and inspecting agency to perform shop inspections and tests and to prepare test reports.

1. Testing agency will conduct and interpret tests and state in each report whether test specimens comply with or deviate from requirements.
2. Provide testing agency with access to places where structural steel Work is being fabricated or produced so required inspection and testing can be accomplished.

B. Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.

C. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

D. Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

E. In addition to visual inspection, shop-welded connections will be inspected and tested according to AWS D1.1 and the inspection procedures listed below, at testing agency's option.

1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.

3. Radiographic Inspection: ASTM E 94 and ASTM E 142; minimum quality level "2-2T."
4. Ultrasonic Inspection: ASTM E 164.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Before erection proceeds, and with the steel erector present, verify elevations of concrete and masonry bearing surfaces and locations of anchorages for compliance with requirements.

B. Do not proceed with erection until unsatisfactory conditions have been corrected.

3.2 WORKMANSHIP - GENERAL

A. Workmanship shall be equal to the best practice in modern structural shops. Material shall be clean and straight. All holes shall be accurately drilled or punched. Burning and drifting to enlarge holes will not be permitted. Holes that must be enlarged shall be reamed. Particular care shall be taken to protect all materials from injury of any kind, either in transportation, storage or erection. Material that is damaged must be replaced by perfect material or repaired in a manner approved and accepted by the Engineer. The use of drift pins will be allowed only to bring together the several parts, and they must not be driven with such force as to distort or injure the material. Material that has been distorted by drift pins will not be accepted.

B. All shop and field welding shall be performed by certified welders in conformance with American Welding Society's "Code for Arc and Gas Welding in Building Construction."

C. No holes shall be burned in steel members under any circumstances without express approval and instructions from the Engineer.

D. Bolted members shall have all parts well pinned-up and firmly drawn together. Abutting joints shall be dressed or cut true and straight and fitted closely together. In compression joints, depending upon contact bearing, the surfaces shall be truly faced so as to have even bearing after they are bolted up complete; and, when properly aligned, the several pieces forming one built-up member shall be straight and shall fit closely together. Finished members shall be free from twists, bends or open joints. Abutting joints in compression members faced for bearing shall be spliced sufficiently to hold the connecting members accurately in place. All other joints in bolted work, whether in tension or compression, shall be fully spliced.

3.3 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.

3.4 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC specifications referenced in this Section.

B. Base and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.

1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
2. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.
3. Pack grout solidly between bearing surfaces and plates so no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.

    a. Comply with manufacturer's instructions for proprietary grout materials.

C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.

E. Splice members only where indicated.

F. Do not use thermal cutting during erection.

G. Do not enlarge unfair holes in members by burning or by using drift pins. Ream holes that must be enlarged to admit bolts.

H. Protect steel embedded in concrete or gravel with a liberal brushed coat of asphalt mastic.

3.5 FIELD CONNECTIONS

A. Install and tighten nonhigh-strength bolts, except where high-strength bolts are indicated.

B. Install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.

1. Comply with AISC specifications referenced in this Section for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.

3.6 FIELD QUALITY CONTROL

A. Owner will engage an independent testing and inspecting agency to perform field inspections and tests and to prepare test reports.

1. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from requirements.

B. Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.

C. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

D. Field-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

E. In addition to visual inspection, field-welded connections will be inspected and tested according to AWS D1.1 and the inspection procedures listed below, at testing agency's option.

1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
3. Radiographic Inspection: ASTM E 94 and ASTM E 142; minimum quality level "2-2T."
4. Ultrasonic Inspection: ASTM E 164.

3.7 CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.

1. Apply by brush or spray to provide a minimum dry film thickness of 1.5 mils (0.038 mm).

B. Finish Painting: Finish painting of steel surfaces are included in Division 9 "Painting"

END OF SECTION 05120

SECTION 05310 - STEEL DECK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Roof deck.

B. Related Sections include the following:
   1. Division 5 Section "Structural Steel" for shop-welded shear connectors.
   2. Division 5 Section "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.

1.3 SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, and deck openings, special jointing, accessories, and attachments to other construction.

C. Product Certificates: Signed by steel deck manufacturers certifying that products furnished comply with requirements.

D. Welding Certificates: Copies of certificates for welding procedures and personnel.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed steel deck similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

C. AISI Specifications: Calculate structural characteristics of steel deck according to AISI's "Specification for the Design of Cold-Formed Steel Structural Members."

D. FM Listing: Provide steel roof deck evaluated by FM and listed in FM's "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

1.6 PROJECT CONDITIONS

A. Design:

1. Steel deck shall be designed in accordance with the AISI "Specifications for the Design of Cold-Formed Steel Structural Members." Simple short spans shall be avoided, and all deck units shall extend over three or more supports unless absolutely impractical.
2. Design Loads: As specified on the drawings.

PART 2 - PRODUCTS

2.1 ROOF DECK

A. Steel Roof Deck (1-1/2"): Typical U.N.O. Provide galvanized steel roof deck and all necessary accessories conforming to ASTM A611, Grade C. Steel deck shall be 20-gauge with all required accessories for a complete and finished installation. Accessories to be of the same material as the deck unless otherwise specified. Metal deck shall be Type B by United Steel Deck, Inc., or approved equal. At areas where metal deck is scheduled to receive a finish top coating, verify compatibility of primer.

2.2 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Adjusting Plates: Provide adjusting plates or segments of roof units in locations too narrow to accommodate full-size roof units. As far as practical, provide plates of the same gauge and configuration as the roof units. Plates of predetermined sizes shall be factory cut.

C. Reinforcing Plates: Provide .057" thick reinforcing plates for all openings less than 12 inches in diameter. Length and width of plates as required satisfying The Steel Deck Institute requirements.

D. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

E. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

F. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

G. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

H. Steel Sheet Accessories: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.

I. End Closures: Provide end closures of minimum 22 gauge to close the ends at end walls, eaves, and openings through the roof.

J. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, thickness as required by manufacturer.

2.3 Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck, with 3-inch-wide flanges and level recessed pans of 1-1/2- inch minimum depth. For drains, cut holes in the field.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 29, manufacturer's written instructions, and requirements in this Section.

B. Install temporary shoring before placing deck panels, if required to meet deflection limitations.

C. Locate decking bundles to prevent overloading of supporting members.

1. Exercise special care not to damage the material or overload the decking during the entire construction period. The maximum uniform distribution storage load shall not exceed the design live load.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

1. Simple short spans shall be avoided, and all deck units shall extend over three or more supports unless absolutely impractical. Do not use unanchored deck units as a work or storage platform.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to decking. Reinforce and frame openings through roof in accordance with the drawings for rigidity and load-carrying capacity. Holes or other openings required for the work of other trades shall be drilled or cut and reinforced by the respective trades; the deck manufacturer and the Engineer shall approve such holes or other openings larger than 6 inches in diameter.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of decking, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 DECK INSTALLATION

A. Immediately after placement and alignment, and after inaccuracies have been corrected, permanently fasten steel roof deck and floor deck units in place. Clamp or weight deck units to provide firm contact between deck units and structural supports while fastening is being performed. Decking shall be fastened as recommended by the manufacturer unless indicated otherwise on the drawings.

B. End Bearing: Install deck ends over supporting frame as per drawings or unless otherwise noted, with a minimum end bearing of 1-1/2 inches, with end joints as follows:

1. End Joints: Lapped **2 inches**minimum

C. Roof Sump Pans: Install over openings provided in roof decking and weld flanges to top of deck. Space welds not more than 12 inches apart with at least 1 weld at each corner.

D. Miscellaneous Roof Deck Accessories: finish strips, cover plates, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.

3.4 FIELD QUALITY CONTROL

A. Inspect the decking top surface for flatness after installation. Place a four-foot straightedge across the decking ribs over the structural supporting members at all locations. If the straightedge fails to touch the entire top surface of the decking or if top surfaces of abutting units are not in alignment, corrective measures or replacement shall be provided. After corrective measures or replacement has been performed, the decking shall be reinspected.

B. Field welds will be subject to inspection.

C. Testing agency will report test results promptly and in writing to Contractor and Engineer.

D. Remove and replace work that does not comply with specified requirements.

3.5 REPAIRS AND PROTECTION

A. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.

B. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05310

SECTION 07531 - EPDM MEMBRANE ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Adhered membrane roofing system.
   2. Roof insulation, including tapered system.
   3. Fascias and copings.
   4. Roof drains.

B. Related Sections include the following:
   1. Division 6 Section "Rough Carpentry" for wood nailers, cants, curbs, blocking, sleepers, and for wood roof deck sheathing panels.
   2. Division 7 Section "Manufactured Roof Specialties" for fascia and coping system.
   3. Division 7 Section "Sheet Metal Flashing and Trim" for metal roof penetration flashings, flashings, and counterflashings.
   4. Division 7 Section "Joint Sealants."
   5. Division 15 for piping and connection thereto of roof drains provided and installed as part of the work of this Section.

1.3 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.

B. Design Uplift Pressure: The uplift pressure, calculated according to procedures in SPRI's "Wind Load Design Guide for Fully Adhered and Mechanically Fastened Roofing Systems" and ASCE 7, before multiplication by a safety factor.

C. Factored Design Uplift Pressure: The uplift pressure, calculated according to procedures in SPRI's "Wind Load Design Guide for Fully Adhered and Mechanically Fastened Roofing Systems," after multiplication by a safety factor.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing membrane manufacturer based on testing and field experience.
   1. All materials used shall be asbestos free.

C. Roofing System Design: Provide a membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist the factored design uplift pressures calculated according to SPRI's "Wind Load Design Guide for Fully Adhered and Mechanically Fastened Roofing Systems" and ASCE 7.
   1. Corner Uplift Pressure: 52-lbf/sq.ft.
   2. Perimeter Uplift Pressure: 40-lbf/sq.ft.
   3. Field-of-roof Uplift Pressure: 28-lbf/sq.ft.

D. FMG Listing: Provide roofing membrane, base flashings, and component materials that comply with requirements in FMG 4450 and FMG 4470 as part of a membrane roofing system and that

are listed in FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable.

1. Identify materials for compliance with FMG markings.
2. Fire/Windstorm Classification: Class 1A-90.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated and specified.

B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other Work.
   1. Copings and fascia shall be detailed with submittal indicating materials, thickness, weights, attachment, method of installation, color options available, etc.
   2. Base flashings and membrane terminations.
   3. Insulation fastening patterns.
   4. Fastener layouts.

C. Samples for Verification: For the following products:
   1. 12-by-12-inch square of sheet roofing, of color specified, including T-shaped side and end lap seam.
   2. 12-by-12-inch square of roof insulation.
   3. Two insulation fasteners of each type, length, and finish.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of roofing system.

E. Research/Evaluation Reports: For components of membrane roofing system.

F. Maintenance Data: For roofing system to include in maintenance manuals.

G. Warrantee: The submitted literature shall include a copy of the roof system manufacturer's standard "Total System Warrantee" reflecting the term of the guarantee specified.

H. Installer Approval/Certification: Submit copy of Roof system manufacturer's signed certification indicating that the Installer is approved, authorized, or licensed by manufacturer to install roofing system specified including all associated components.

I. Post-Installation Submittals: The Contractor shall provide certification that the installed Work complies with the current warrantee requirements for the existing adjacent roof surfaces and that parameters set forth in the existing warrantee are maintained for the remainder of that warrantee period, in addition to all new Work requirements as well.
   1. Provide a copy of the Roof System Manufacturer's inspection report of completed roofing installation with sign-off for the warrantee indicated.
   2. As-built drawings and details indicating the following:
      a. Outline of the roof areas with dimensions and configuration of drainage.
      b. Location and type of penetrations, curbs, accessories, etc.
      c. Perimeter and penetration details, including special conditions.
      d. Manufacturer's assigned project number and insulation system design number.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Only a qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's warrantee shall bid on this project.
   1. The Roofing Contractor shall use only competent and skilled workmen who are completely familiar with the products and the manufacturer's current, recommended installation methods and details.
   2. The Roofing Contractor shall be able to substantiate that they have installed a minimum of 500,000 square feet of this type of roofing and have achieved a manufacturer's installation rating of 9.0 or better.

B. Fire-Test-Response Characteristics: Provide membrane roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, FMG, or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.
   1. Exterior Fire-Test Exposure: Class A; ASTM E 108, for application and roof slopes indicated.

C. Preinstallation Conference: Conduct conference at Project site. Comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to roofing system including, but not limited to, the following:
   1. Meet with Owner; Designer; Owner's insurer if applicable; testing and inspecting agency representative; roofing Installer; roofing system manufacturer's representative; deck Installer; and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
   2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
   3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
   5. Review structural loading limitations of roof deck during and after roofing.
   6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
   7. Review governing regulations and requirements for insurance and certificates if applicable.
   8. Review temporary protection requirements for roofing system during and after installation.
   9. Review roof observation and repair procedures after roofing installation.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
   1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck. No materials weighing over 1,000 lbs in bulk shall be placed upon any roof deck without the prior supervision and written approval of the Designer or his Representative.

1.8 PROJECT CONDITIONS

A. Existing Roof Systems: The existing roofing on the building is a Carlisle EPDM Sure Seal system installed in 1999 by D.H. Pinette & Sons, Inc. Carlisle issued their trademark "Golden Seal" total roofing system warranty (CMD990765N) for a period of fifteen (15) years, effective December 29, 1999. In addition, the Portland Public Schools received a twenty (20) year Sure Seal Membrane material warranty. ALL ROOFING WORK IMPACTING THESE ROOFS

SHALL BE PERFORMED TO COMPLY WITH THE CARLISLE SYNTEC REQUIREMENTS FOR MAINTENANCE OF THIS EXISTING WARRANTEE.

B. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

C. Regulatory Requirements: Special attention shall be given OSHA requirements, especially 29 CFR 1926.500(g) – Guardrails, Handrails, and Covers for Roofing Projects.

D. The Roofing and Flashing Subcontractor shall furnish and maintain their own scaffolding, mechanical hoisting equipment and operating personnel, including all required rigging and safety hardware.

1.9 INSPECTION

A. Upon completion of the installation, an inspection shall be made by a representative of the roof system manufacturer to ascertain that the roofing system has been installed according to published specifications and details. Warranty shall be issued to the Owner upon manufacturer's approval of the installation.

B. Corrective work, if necessary, based on the inspection shall be performed as required by the manufacturer's inspector, at no additional cost to the Owner, until the warrantee requirements have been met and the warrantee issued to the Owner.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period. Failure includes roof leaks.

1. Special warranty includes roofing membrane, base flashings, roof insulation, fasteners, walkway products and other components of membrane roofing system.
2. Warranty Period: 15 years no dollar limit from date of Substantial Completion.

B. Special Project Warranty: Submit Roofing Installer's warranty, on standard warranty form signed by Installer, covering Work of this Section, including all components of membrane roofing system such as roofing membrane, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, roof pavers, and walkway products, for the following warranty period:

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements of this Section, provide roofing products by the following:

1. EPDM Roof Membrane: Match existing roof membrane product currently on existing building roof surfaces, as necessary to maintain warrantee.
   a. Carlisle SynTec Systems; CarlisleCorporation.
2. Rigid Single-thickness and Tapered Polyisocyanurate Insulation: Manufacturer as required by the Roofing System Manufacturer ot maintain the total system warrantee (new and existing).

2.2 EPDM ROOFING MEMBRANE

A. Roofing Membrane: ASTMD4637, Type I, non-reinforced uniform, flexible sheet made from EPDM, and as follows:

1. Thickness: 60 mils, nominal.
2. Exposed Face Color: White.
3. Backing: None.

2.3 AUXILIARY MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.
   1. Liquid-type auxiliary materials shall meet VOC limits of authorities having jurisdiction.
B. Sheet Flashing: 60-mil- thick EPDM, partially cured or cured, according to application.
C. Bonding Adhesive: Manufacturer's standard bonding adhesive.
D. Cold Fluid-Applied Membrane Adhesive: Manufacturer's standard cold fluid-applied bonding adhesive formulated to adhere roofing membrane to substrate.
E. Seaming Material: Manufacturer's standard synthetic-rubber polymer primer and 3-inch- wide minimum, butyl splice tape with release film.
F. Lap Sealant: Manufacturer's standard single-component sealant, color to match roofing membrane.
G. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.
H. Metal Termination Bars: Manufacturer's standard predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.
I. Fasteners: Factory-coated steel fasteners and metal plates meeting corrosion-resistance provisions in FMG4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.
J. Miscellaneous Accessories: Provide pourable sealers, preformed cone-shaped flashings for vents, preformed inside and outside corner sheet flashings, T-joint covers, in-seam sealants, flexible control joints, termination reglets, and other accessories recommended by the roofing system manufacturer for the various conditions and applications necessary to complete the indicated installations.
K. Vapor Retarder: Equivalent to Carlisle CCW-725, as acceptable to roofing membrane manufacturer for use in warranted system.

2.4 ROOF INSULATION

A. General: Provide preformed rigid roof insulation boards that comply with the requirements and referenced standards, selected from manufacturer's standard sizes and in thicknesses indicated.
B. Roof Insulation – Non-tapered: Polyisocyanurate Board Insulation complying with ASTM C 1289, Type I, Class 1, glass fiber reinforced asphaltic mat, moisture resistant facers on both major surfaces.
   1. Available Manufacturers: Subject to compliance with requirements and confirmation of compatibility with membrane proposed, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Carlisle SynTec Incorporated.
      b. Hunter Panels, Inc.
   2. R-Value: Thermal resistance values for the installed insulation system shall be "Aged" values determined in accordance with RIC/TIMA Technical Bulletin 281-1 and shall be not less than R-5.56 per inch of thickness.
      a. The combined, installed insulation system (including tapered system specified below) shall have a minimum thickness of 2-inches and a minimum average R-value of 30 unless indicated otherwise on the Drawings.
C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches, unless otherwise indicated. Materials shall match single thickness material specified above including facers.
D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.5 INSULATION ACCESSORIES

A. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.
B. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.
   1. Select and install fasteners to achieve minimal length penetrating interior at roof areas indicated to cover spaces with exposed structure and roof deck.

2.6 ROOF DRAINS
A. General: All roof drains shall comply with ASME A112.21.2M and be acceptable to the roof membrane manufacturer. Coordinate with plumbing contractor regarding connection requirements.
B. Manufacturers:
   1. Josam Company
   2. Smith, Jay R. Mfg. Company
   3. Watts Industries, Inc.
   4. Zurn Industries, Inc.
C. Standard Drain: Basis-of-design Roof Drain for typical insulated TPO single-ply membrane roofing system shall be equal to Zurn Z-100-EA-C-R-GD. 15 inch diameter drain with cast iron body, combination membrane flashing clamp/debris guard, low-profile galvanized cast iron dome, underdeck clamp, adjustable extension assembly and roof sump receiver.
   1. Provide IP or NH outlet style for threaded or no-hub connection respectively, as required by plumbing contractor who shall make connection thereto.
   2. Size outlet to match pipe size indicated on Plumbing Drawings.

2.7 WALKWAYS
A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, solid-rubber, slip-resisting, surface-textured walkway pads or rolls, approximately 3/16 inch thick, and acceptable to membrane roofing system manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION
A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
   1. Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.
   2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
   3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Division 5 Section "Steel Deck."
   4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION
A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.3 INSULATION INSTALLATION

A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with membrane roofing system manufacturer's written instructions for installing roof insulation.

C. Install tapered insulation under area of roofing to conform to slopes indicated.

D. Install one or more layers of insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2 inches or greater, install 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 12 inches in each direction.

E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

1. Provide square sumps at all roof drains as indicated on the Drawings. If not indicated, provide a four foot square sump (roof drain to be in center of tapered sump) witha1/4" per foot pitch from the four sidees of the sump toward the roof drain.

F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.

1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

G. Mechanically Fastened Insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.

1. Fasten insulation according to requirements in FMG's "Approval Guide" for specified Windstorm Resistance Classification.
2. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.
3. Mechanical fasteners at metal deck exposed-to-view in finished areas shall only be fastened to the uppermost flutes of the corrugations on standard metal deck, with screw penetration not in excess of ¾ of an inch. Fastening to the lower flutes of the metal deck in these areas will not be acceptable.
   a. Install fasteners carefully in aligned, regular patterns where penetration of deck in areas exposed-to-view cannot be avoided. Secure to structure or sleepers as shown, where applicable.

3.4 ADHERED ROOFING MEMBRANE INSTALLATION

A. Install roofing membrane over area to receive roofing according to membrane roofing system manufacturer's written instructions. Unroll roofing membrane and allow to relax before installing.

B. Start installation of roofing membrane in presence of membrane roofing system manufacturer's technical personnel.

C. Accurately align roofing membrane and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Bonding Adhesive: Apply bonding adhesive to substrate and underside of roofing membrane at rate required by manufacturer and allow to partially dry before installing roofing membrane. Do not apply bonding adhesive to splice area of roofing membrane.

E. Mechanically fasten roofing membrane securely at terminations, penetrations, and perimeter of roofing.

F. Apply roofing membrane with side laps shingled with slope of roof deck where possible.

G. Adhesive Seam Installation: Clean both faces of splice areas, apply splicing cement, and firmly roll side and end laps of overlapping roofing membranes according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of roofing membrane terminations.
   1. Apply a continuous bead of in-seam sealant before closing splice if required by membrane roofing system manufacturer.

I. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape, and firmly roll side and end laps of overlapping roofing membranes according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of roofing membrane terminations.

J. Repair tears, voids, and lapped seams in roofing that does not meet requirements.

K. Spread sealant or mastic bed over deck drain flange at deck drains and securely seal roofing membrane in place with clamping ring.

3.5 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.6 MISCELLANEOUS INSTALLATIONS

A. Flexible Walkways: Install walkway products in locations indicated. Adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

B. Roof Drains: Installation of roof drains shall be as indicated on the Drawings and in strict accordance with manufacturer's instructions.

C. Expansion and Control Joints: Install joints were and as recommended by roof system manufacturer and as shown on details in Drawings.

D. Roof Penetrations: Pipes, conduits, clusters of pipes and unusual shaped penetrations shall be sealed with pourable sealer of a boot-type clashing system is not feasible. Poured sealant shall be no less than 2 inches deep, in a pitch-pocket type seal detail.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Owner may engage a qualified independent testing and inspecting agency to perform roof tests and inspections and to prepare test reports.

B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Designer.
   1. Notify Designer or Owner 48 hours in advance of date and time of inspection.

C. Repair or remove and replace components of membrane roofing system where test results or inspections indicate that they do not comply with specified requirements.

D. In the event that Work must be replaced or additional work required as a result of initial inspections, additional testing and inspecting may be performed at Contractor's expense to determine compliance of remedial work with specified requirements.

3.8 PROTECTING AND CLEANING

A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Designer and Owner.

B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07531

SECTION 15940 - SEQUENCE OF OPERATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Sections include the following:
1. Division 1 Section "Alternates".
2. Division 15 Section "Basic Mechanical Materials and Methods"
3. Division 15 Section " HVAC Instrumentation and Controls"

1.2 SUMMARY

A. This Section includes control sequences for HVAC systems, subsystems, and equipment. Provide control devices, control software and control wiring as required for automatic operation of each sequence specified.

B. Provide automatic control for system operation as described herein, although word "automatic" or "automatically", is not used.

C. Manual operation is limited only where specifically described; however, provide manual override for each automatic operation.

D. Where manual start-up is called for, also provide scheduled automatic start-stop capabilities.

E. Functions called for in sequence of operations are minimum requirements and not to limit additional DDC system capabilities.

F. For each item of equipment, provide following functions which are not specifically mentioned in each Sequence of Operation:
1. Start-Stop, manual, and scheduled
2. On-Off status of each piece of equipment
3. Run-time

G. Coordination of Air-Handling Unit Sequences: Ensure that preheat, mixed-air, heating-coil, and cooling-coil controls have common inputs and do not overlap in function. Provide a deadband between heating and cooling stages.

H. Room temperature setpoints for each temperature sensor shall be monitored and adjustable for Central Operator Workstation.

I. All setpoints shall be adjustable. Setpoints listed herein are approximate. It is the responsibility of the DDC contractor to calibrate the system and all setpoints to actual working conditions once the system is on line.

J. Normal positions for controlled devices:
1. Unless noted, the following valves and dampers shall fail closed:
a. Outside air dampers

b. Relief air dampers
c. Exhaust air closure dampers
d. Cooling coil valves for coils located indoors shall close to the coil.

2. Unless noted, the following valves and dampers shall fail open:
   a. Hot water heating coils.
   b. Cooling coil valves for coils located outdoors shall open to the coil.

1.3 DEFINITIONS

A. DDC: Direct-digital controls.

B. BAS: Building Automation System

C. RTU: Roof Top Unit

D. ADJ.: Adjustable

E. OA: Outside Air

F. RA: Return Air

G. RLA: Relief Air

H. DA: Discharge Air

I. EA: Exhaust Air

J. MA: Mixed Air

K. MOD: Motor operated damper

1.4 SEQUENCE OF OPERATIONS **(Base Bid)**

A. Packaged Rooftop Unit (PRTU-1) VAV bypass air system with radiation.
   1. Occupied Mode:
      a. User defined occupancy schedule.
      b. BAS shall enable PRTU-1 to operate via its own factory installed controls to maintain DA temperatures, CO2 levels, and OA Energy recovery unit module.
      c. BAS shall enable associated Exhaust Fans.
      d. VAV terminal operation: BAS shall modulate VAV terminal air flow and heating coil control valve to maintain space (zone) setpoint 70°F (adj). Associated baseboard radiation or radiant panel (where applicable) shall be enabled as 2nd stage space heating when VAV heating coil can not maintain space heating setpoint. See VAV terminal schedule for set maximum and minimum air flow amounts.
      e. VAV bypass terminal operation: BAS shall modulate bypass VAV in response to system static pressure. Supply duct static pressure sensor (locate 2/3 down main) basis setpoint shall be determined during final air balancing procedure.
   2. Unoccupied Mode:
      a. User defined schedule.
      b. PRTU-1 system shall have override ability thru the BAS head end.

c. PRTU-1 is disabled.
d. Reduced space setpoint (60 F) is maintained via respective baseboard radiation, radiant panel, and CUH.
e. PRTU-1 shall be enabled to cycle as required whenever baseboard radiation cannot maintain reduced space setpoint. PRTU-1 shall be 100% RA and 0% RA, interlock as required with unit manufacturer's controls

3. Safety:
   a. Duct smoke detector (by DIV 16).
   b. Freezestat (by unit Manufacturer and by Maine Controls).
   c. Low and High DA temperature (by unit Manufacturer).
4. BAS: Display the following data:
   a. Monitoring DA temperature.
   b. Freezestat (print out alarm)
   c. Monitor supply fan and economizer (OA energy recovery unit) fan(s) status.
   d. Monitor PRTU-1 operating mode: heating, cooling, or economizing.
   e. Associated exhaust fan status (print out alarm).

B. Rooftop Energy Recovery Unit (RTU-1) with heating duct coils.
1. Occupied Mode:
   a. User defined occupancy schedule.
   b. BAS shall enable RTU-1 to operate via its own factory installed controls to maintain DA temperature. Dedicated preheat coil pump, C-1, operates continuously when outside temperature falls below 40 F (adj).
   c. Duct heating coil operation: 3-way heating coil control valve shall modulate to maintain space (zone) setpoint 72 F (adj).
2. Unoccupied Mode:
   a. User defined schedule.
   b. RTU-1 shall be cycled (100% recirculation per manufacturer's controls) to maintain reduced space setpoint 60 F (adj). Duct heating control valves shall be at 100% flow thru the coils. RTU-1 dedicated pump, C-1, shall operate continuously below 40 F (adj).
3. Safety:
   a. Duct smoke detector (by DIV 16).
   b. Freezestat (by unit Manufacturer and by Maine Controls).
   c. Low and High DA temperature (by unit Manufacturer).
   d. Pump, C-1, status: print out alarm.
4. BAS: Display the following data:
   a. Monitoring DA temperature.
   b. Pump C-1 status.
   c. Freezestat (print out alarm).
   d. Monitor RTU-1 supply fan and exhaust fan status.
   e. Monitor RTU-1 operating mode: heating, cooling, or economizing.

C. Miscellaneous Control Points.
1. UHs & CUHs: On call for heat from space thermostat, two position 3-way control valves open, and fan cycles after return water aquastat reaches 140 F (adj). Setpoint 60 F (adj) occupied and unoccupied.
2. Exhaust Fans: BAS shall enable and disable fan based on occupied and unoccupied schedule of associated air handling unit. BAS shall monitor fan status via current sensor.

1.5 SEQUENCE OF OPERATIONS (**Alternate No 1**) New VAV terminal units (no reheat):

A. Occupied Mode:

1. BAS, thru existing VAV controller and new CO2 controllers, shall modulate VAV from scheduled minimum to maximum air flows to maintain space CO2 levels less than 900 ppm (adj).
   a. First step shall for lowering CO2 levels shall be accomplished by modulating VAV terminal toward 100% open at set timed increments until the space CO2 setpoint is satisfied.
   b. Second step shall be accomplished by opening the AHU OA damper from set minimum position at timed increments until the space CO2 setpoint is satisfied.
   c. As the space CO2 levels decrease, the AHU OA shall close to set minimum position at same timed increments as when opening.
2. Note: Space heating shall continue to be accomplished by existing fintube radiation via existing controls.
3. Existing AHUs' control modifications:
   a. AHU DA shall be maintained between 65 and 75 F.
   b. AHU supply duct static pressure sensor shall vary supply and relief fan speeds in response throttling and opening of the VAV terminals.
   c. BAS shall average space temperatures and reset DA as required to reduce overheating or overcooling (economizer/free cooling).

B. Unoccupied Mode:
   1. VAV terminal shall go to set minimum positions and the AHUs shall be disabled.
   2. Heating is accomplished via existing fintube radiation and controls at reduced setpoint temperatures 60 F (adj).

C. Safety:
   1. Existing safeties. Re-commission and check for proper operation.

D. BAS: Display the following data:
   1. DA temperature reset.
   2. Space CO2 measurements.

1.6 SEQUENCE OF OPERATIONS (**Alternate No 3**) New AHU-7 & 8, Chiller, Chilled Water Pump, and Condenser

A. Occupied Mode (AHUs):
   1. AHUs shall operate continuously at a constant volume. Associated relief/exhaust fan shall be enabled.
   2. Morning warm up shall be based on "optimal start" control based on building temperature and lag time to reach each zone's setpoint. During warm up the OA and EA dampers are 100% closed and RA damper is 100% open. After each zone has reached setpoint, air system OA, RA and EA dampers go to set minimum positions.
   3. Heating: 3-way hot water control valve modulates as required to maintain DA and average space temperature setpoints as accomplished by existing control logic.
   4. Mechanical Cooling: 3-way chilled water control valve modulates as required to maintain average space temperatures setpoints as accomplished by existing control logic.
   5. Economizer Cooling: when OA enthalpy is less than RA enthalpy during cooling mode, the AHU shall modulate OA open and RA closed as required to maintain cooling setpoints, while the chilled water control valve is 100% closed to the coil. Relief Fan MOD shall open whenever OA damper modulates open above set minimum position. Relief Fan shall be energized when OA damper is 70% (adj) open or greater. When OA

enthalpy is greater than RA enthalpy the OA damper goes to set minimum position, the Relief Fan is de energized, and mechanical cooling is enabled.

6. Return duct CO2 sensor (located in boiler room) shall measure average RA CO2 levels. When CO2 reaches 900 ppm (adj) BAS shall modulate OA damper open at timed increments until CO2 levels are maintained at maximum set point. Sequence associate relief fan and MOD as outlined in "economizer cooling" above. When CO2 levels drop below maximum setpoint by 100 ppm (adj), BAS shall modulate OA damper closed via same timed increment logic for opening damper.
7. MA temperature: MA low temperature setpoint shall be 40 F (adj). MA shall have priority over CO2 control.

B. Unoccupied Mode (AHUs):
   1. AHU supply fan is disabled, OA damper is 100% closed, relief damper is 100% closed, and relief fan is disabled.

C. Safety (AHUs):
   1. Shall stop the supply fan, cause the system valves and dampers to return to their normal positions.
   2. A freezestat shall initiate a low temperature alarm if the temperature drops below the freezestat's setpoint. Return to the normal mode of operation shall require manual reset at the freezestat.
   3. Duct smoke detectors, located as shown on the plans: Installation in ductwork and connection to control system shall be under Division 15. Detector furnished and wired to the fire alarm system by Division 16. Activated when products of combustion are detected in air stream.
   4. DA high temperature limit is 105 F (adj) and low temperature limit is 50 F (adj).

D. BAS (AHUs): Display the following data:
   1. DA temperature.
   2. MA temperature.
   3. Supply fan status (print out alarm).
   4. Relief fan status (print out alarm).
   5. Freezestat trip (print out alarm).
   6. OA and RA damper position.

E. Occupied Mode (Chiller/Condenser):
   1. Chilled water pump, chiller, and condenser shall be enabled whenever OA is above 60 F (adj).
   2. Pump runs at constant speed.
   3. Chiller and condenser operate thru factory provided controls and safeties.
   4. BAS shall interface with chiller to be able read supply and return chilled water temperatures, and to reset supply temperature as required based on the delta Ts.
   5. Whenever condenser is enabled, OA and EA dampers are 100% opened.

F. Unoccupied Mode (Chiller/Condenser):
   1. Chilled water pump, chiller, and condenser shall be disabled.
   2. Condenser OA and EA dampers are 100% closed.

G. Safety (Chiller/Condenser):
   1. Duct smoke detectors, located in the supply duct: Installation in ductwork and connection to control system shall be under Division 15. Detector furnished and wired to the fire

alarm system by Division 16. Activated when products of combustion are detected in air stream.

2. Chiller and Condenser factory safety controls.

H. BAS (Chiller/Condenser): Display the following data:
1. Chilled water supply and return temperature.
2. Chiller status (print alarm).
3. Condenser status (print alarm).
4. Chilled water pump status (print alarm).
5. Chiller and Condenser safeties interfaced between BAS and Equipment Factory Controllers.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 15940

SECTION 17100 – CABLE PLANT- Reissued in its entirety ADDENDUM 2

PART 1 - GENERAL REQUIREMENTS

1.1 Experience

A. The selected Contractor shall be fully capable, certified, and experienced in the installation of telecommunications distribution systems.

B. Codes, Standards, and Ordinances: It is the contractors responsibility to be sure the installation complies with all below and must be aware of all codes and standards that may impact this project.
   1. All work shall conform to the latest edition of the National Electrical Code, the Building Code, and all local codes and ordinances, as applicable.
   2. In addition to the following applicable standards listed below this installation shall comply with any new standards recently approved and all other approved telecommunications standards.
      a. ANSI/TIA/EIA-568-B.1
      b. ANSI/TIA/EIA-568-B.2
      c. TIA/EIA-568-B.2-1
      d. ANSI/TIA/EIA-568-B.3
      e. TIA/EIA 568-B.3-1
      f. ANSI/TIA/EIA-569-A
      g. ANSI/TIA/EIA-569-A.1
      h. ANSI/TIA/EIA-569-A.2
      i. ANSI/TIA/EIA-569-A.3
      j. ANSI/TIA/EIA-569-A.4
      k. ANSI/TIA/EIA-606
      l. ANSI/TIA/EIA-607
      m. ANSI/ICEA S-90-661
      n. ANSI/TIA/EIA-492-AAAA
      o. ANSI/TIA/EIA-472-CAAA
      p. ANSI/TIA/EIA-472-DAAA
      q. ANSI/TIA/EIA-598
      r. ANSI/TIA/EIA-455
      s. ANSI/TIA/EIA-604
      t. ANSI/ICEA S-80-576
      u. ANSI/ICEA S-83-596
      v. ANSI/ICEA S-83-640
      w. TIA/EIA TSB67
      x. TIA/EIA TSB72
      y. TIA/EIA TSB75
      z. TIA/EIA TSB95
      aa. ISO/IEC 11801
      bb. ISO/IEC JTC 1/SC 25/WG 3 N655
      cc. CENELEC EN50173
      dd. IEC 603-7

C. Provide installer-training certificates from the manufacturer of the products to be installed for the technicians who will be performing the installation, terminating and testing.

D. Structured Cabling System Warranty: Provide certificates and manufacturer documentation that the materials and labor will qualify and will be warranted for a minimum of fifteen years. This minimum fifteen-year warranty applies to both the optical fiber and copper cabling systems.
   1. The owner will be provided with all information on the terms and conditions of the warranty. The installing contractor shall explain the warranty in detail to the owner.
   2. System acceptance will not begin until this documentation is received.
   3. All warranty information shall be provided with the bid submittal.
   4. Provide details on any additional warranty coverage that will be provided or that is available.
   5. Clearly present what warranty coverage is provided with your bid and if any additional warranties are available but not included. Clearly detailed the additional warranty, that it is not included and the terms and conditions.
   6. Provide a list with the bid of any materials that will not be included in the warranty.
   7. The installation shall meet all requirements of the manufacturers warranty.

1.2 Firestopping

A. General
   1. All requirements for fire-stopping in division 1 shall be met in addition to the following.
   2. Telecommunications cables and cable paths penetrating non-rated and fire-rated floors, walls, and other partitions of building construction shall be sleeved and fire-stopped where they penetrate building construction. The structure will be returned to its intended and original fire rating.
   3. Fire-stopping shall be accomplished by using a combination of materials and devices, including penetrating raceway, putty's and caulk required to make up a complete fire-stop system.
   4. Verify that cabling and other penetrating elements and supporting devices have been completely installed and temporary lines and cables have been removed.
   5. All fire-stopping shall be performed using UL® approved methods. Provide the system number for each fire-stop system to be used.
   6. All telecommunications through-wall and through-floor penetrations shall be identified on the as-built documentation. The fire-stop system number for all penetrations shall be part of the identification.
   7. All penetrations made in the main cable path (corridors, hallways, Telecommunications Room) shall be four-inch sleeve minimum. Multiple sleeves shall be installed as needed to support the number of cables being installed and for the fire-stop system being used. Provide 50% future capacity on all sleeves for data cable paths and 20% on all others. A sleeve shall be installed for each system as detailed in the main cable paths.
   8. A minimum of a two-inch sleeve shall be installed to each classroom and a minimum of a one-inch sleeve to each office. Size the sleeve for the number of cables and the fire-stop system being used. All telecommunications cabling shall use these sleeves to access the classrooms and offices.

1.3 General

A. Section Includes: Equipment, materials, labor, and services to provide telephone and data distribution system including, but not limited to:
   1. Cable pathways (including through-wall and through floor penetrations, excluding conduit, conduit by division 16)
   2. Copper cabling and terminations.
   3. Optical fiber and terminations.

4. Telecommunications outlets.
5. Termination blocks.
6. Equipment racks and cabinets.
7. System testing.
8. Documentation and submissions.

B. Provide all equipment, materials, labor, and services, not specifically mentioned or shown, which may be necessary to complete all parts of the installation. Ensure that they are in compliance with requirements stated or reasonably implied by the contract documents.

C. Work not included:
1. Off-site services.
2. Providing network electronics, servers, computers, and other active devices.

D. Where materials, equipment, apparatus, or other products are specified by manufacturer, brand name, type or catalog number, such designation is only to establish standards of performance, quality, type and style, unless such designation is identified as proprietary.

E. Federal, state, and local codes, rules, regulations, and ordinances governing the work, are as fully part of the specifications as if herein repeated or hereto attached. If the contractor should note items in the drawings or the specifications, construction of which would be code violations, promptly call them to the attention of the owner's representative in writing. Where the requirements of other sections of the specifications are more stringent than applicable codes, rules, regulations, and ordinances, the specifications shall apply.

1.5 Submittals

A. Submit to the engineer shop drawings, product data (including cut sheets and catalog information), and samples required by the contract documents. Submit shop drawings, product data, and samples with your bid submittal. The engineer will indicate approval of shop drawings, product data, and samples submitted to the engineer by stamping such submittals "APPROVED" with a stamp. Submitted shop drawings shall be initialed or signed by the contractor, showing the date and the contractor's legitimate firm name.
1. By submitting shop drawings, product data, and samples, the contractor represents that he or she has carefully reviewed and verified materials, quantities, field measurements, and field construction criteria related thereto. It also represents that the contractor has checked, coordinated, and verified that information contained within shop drawings, and product data conform to the requirements of the work and of the contract documents.
2. The engineer's approval of shop drawings, product data, and samples submitted by the contractor shall not relieve the contractor of responsibility for deviations from requirements of the contract documents, unless the contractor has specifically informed the engineer in writing of such deviation at time of submittal, and the engineer has given written approval of the specific deviation. The contractor shall continue to be responsible for deviations from requirements of the contract documents not specifically noted by the contractor in writing, and specifically approved by the engineer in writing.

B. Perform no portion of the work requiring submittal and review of shop drawings, or product data until the engineer has approved the respective submittal. Such work shall be in accordance with approved submittals.

C. Provide additional requirements per Section 01300 - Submittals.

D. Shop drawings: Submit the following:
   1. System block diagram, indicating interconnection between system components and subsystems.
   2. Interface requirements, including connector types and pin-outs, to external systems and systems or components not supplied by the contractor.
   3. Submit cable schedules for each cable by system. Use the cable form included in Section 3.

E. Product Data: Provide catalog cut sheets and information for the following. Include only information on the products to be used. Include quantities, part numbers and descriptions with bid submittal.
   1. Copper cables and optical fiber cables.
   2. Outlet modules, faceplates and bulkheads. Assemble one of each type of faceplate to be installed and provide with a sample of the labeling to be used.
   3. Terminal blocks and/or patch panels.
   4. Enclosures, racks, and equipment housings.
   5. Fire-stop systems.
   6. Testing equipment to be used

F. Quality Assurance
   1. The contractor shall have worked satisfactorily for a minimum of five (5) years on systems of this type and size.
   2. Furnish a list of references with specific information regarding type of project and involvement in providing materials, installation and project management. Provide references of projects of similar size and scope.
   3. Equipment and materials of the type for which there are independent standard testing requirements, listings, and labels, shall be listed and labeled by the independent testing laboratory.
   4. Where equipment and materials have industry certification, labels, or standards (i.e., NEMA - National Electrical Manufacturers Association), this equipment shall be labeled as certified or complying with standards.
   5. Material and equipment shall be new, and conform to grade, quality, and standards specified. Equipment and materials of the same type shall be a product of the same manufacturer throughout unless pre-approved.
   6. Subcontractors shall assume all rights and obligations toward the contractor that the contractor assumes toward the owner and engineer. Any and all sub-contractors shall be identified in the bid submittal.

1.6 Warranty

A. Unless otherwise specified, unconditionally guarantee in writing all the materials, equipment, and workmanship for a period of not less than one (1) year from date of acceptance by the owner in addition to the minimum 15 year system warranty. Acceptance shall be deemed as beneficial use by the owner.

B. Transfer manufacturer's warranties to the owner in addition to the General System Guarantee. Provide all warranty information with bid submittal. It is the installing contractors responsibility to be sure that all the criteria is met to be eligible for the manufactures warranty. Submit additional available warranties for each item in list form with shop drawings. Detail specific parts within equipment that are subject to separate conditional warranty.

C. All proprietary equipment and systems involved in this contract shall be warranted during the guarantee period. Final payment shall not relieve you of these obligations.

PART 2 - PRODUCTS

2.1 Approved Manufacturers and Products

A. Manufacturers
1. All faceplates, consolidation points, connector modules, patch panels, termination blocks, bulkheads, horizontal cable management and cable shall all be from the same manufacturer. Cable from a different manufacturer than that of the connectivity manufacturer or a combination of manufacturers must be pre-approved and must have a warranty program to cover the proposed combination solution.

B. Wall plates: Provide flush mount electrical ivory wall plates at all locations.
1. All wall plates shall have a top and bottom clear plastic label holders for the identification of all outlet locations. All locations shall be machine labeled.
2. Provide six position wall plates for all single gang box locations use blank fitting for all unused positions. Provide twelve position wall plates for all double gang box locations use blank fitting for all unused positions.
3. Weatherproof covers for exterior data outlets shall consist of outlets as specified, mounted in box with a gasketed, weatherproof, cast metal cover plate and cap over each receptacle opening. The cap shall be permanently attached to the cover plate. The weatherproof integrity shall not be affected when heavy duty specification or hospital grade attachment plug caps are inserted. Covers shall be in use style Hubell WP26M series. Cover plates on outlet boxes mounted flush in the wall shall be gasketed to the wall in a watertight manner.

2.2 UNSHIELDED TWISTED PAIR (UTP) CABLING SYSTEMS

G. Manufacturer: Provide products meeting the requirements of the Drawings and Specifications from one of the following manufacturer's:

Wire and Cable:	AT&T, Belden, Berk-Tek, CommScope, General Cable, Mohawk, Prestolite, Superior or approved equal.
Modular Jacks:	Shall be provided by the Work Area Outlet Manufacturer.
Patch Panels:	AT&T, Amp, Hubbell, Krone, Ortronics, Panduit, Siemon, or approved equal.
Patch Cables:	Shall be provided by patch panel, Work Area Outlet or wire and cable manufacturer.
Cable Management:	Shall be provided by patch panel manufacturer.

NOTE: Each of the products listed above shall be provided by a single manufacturer.

Voice/Phone Punch Block::	AT&T, Hubbell, Siemon, or approved equal.

H. UTP Pin/pair Termination Assignment:The UTP cabling systems shall have EIA/TIA 568B Series standard pin/pair termination assignment. All conductors provided shall be properly and consistently terminated at both ends throughout the entire systems.

I. Horizontal Cable -Voice & Data
1. Voice & Data Cable shall be TIA/EIA Category 6 Unshielded Twisted Pair (UTP) cable, General Cable GENSPEED 6000
2.
3. Non-plenum rated cable - CM rated jacket for Non-plenum applications.
4. Riser rated cable - CMR rated jacket for Riser applications.

J. Cable Management
1. Each equipment rack and equipment cabinet shall have cable management panels with horizontal and vertical brackets.
2. Cable management shall be EIA nineteen inch (518mm) rack mounted 3.5 inch (88mm) high panel with horizontal and vertical patch cable, distribution rings, or approved equivalent and shall be provided above and below each patch panel in the equipment rack.
3. Equipment rack cable management shall be furnished by patch panel manufacturer.
4. Cable management for high density, IDC Type cross-connect block panels shall be distribution rings integral to the panel or approved equivalent. Cable management shall be provided above and below each cross connect block in the equipment rack.

K. Modular Jacks (Work Area Outlets)
1. Jacks shall be RJ-45 TIA/EIA Category 6 (UL Category 6) with printed circuit board technology and integral board mounted, color-coded, high density, IDC type terminations. Provide 8 position modular jacks. Keyed jacks are not allowed. Jacks shall be able to withstand at least a minimum of 2000 mating cycles without any transmission degradation.
2. Modular jacks color shall match Work Area Outlet faceplate.
3. Each Work Area Outlet and modular jack shall have jack opening dust cover. Modular jacks that do not have integral dust covers shall have dust covers installed on each unused modular jack.
4. Each 8-position modular jack shall have color-coded icons.
5. Modular jacks that allow preconnectorized cables to be connected to the jacks are specifically prohibited. Cables shall have single point IDC Type connection to the jacks only.
6. Modular jacks for Work Area Outlets shall be integral to a jack module either having one or two jacks per module. Single jacks shall be located in the center of the module while double jacks shall be side-by-side horizontally. Jack modules with a single jack and a blank in the opening where a second jack would normally be located are specifically prohibited.
7. Jack modules shall be flame retardant thermoplastic with integral cable strain relief.

L. Voice and Data Patch Panels – Provide patch panels as required for all new outlets plus 20% spare calculated as a percentage of the new outlets.

1. Patch panels shall be EIA nineteen inch (518mm), rack mounted, TIA/EIA Category 6, UL Category 6 type patch panels with integral printed circuit board, color-coded, high density, IDC type terminations and 8 position modular jacks. Keyed jacks are not allowed. Jacks shall be able to withstand at least a minimum of 2000 mating cycles without any transmission degradation.
2. Provide high density rack mounted patch panels.
3. Modular Jacks that allow pre-connectorized cables to be connected to the jacks are specifically prohibited. Cables shall have single point IDC type connection to the jacks only.
4. Each port shall have color-coded identification label. Continuous label strips for multiple in-line ports are acceptable. Silk screened identifiers "1" through "96" are acceptable.
5. Patch panel shall have horizontal strain relief bar on mounted rear.

M. Patch Cables and Line Cords
1. Patch cables and line cords shall be factory pre-connectorized, TIA/EIA Category 6 (UL Category 6), 4 UTP, 8-position modular jack, stranded conductors. Patch cables and line cords shall be able to withstand at least a minimum of 2000 jack mating cycles without any transmission degradation.

1.2 BROADBAND RF CABLING SYSTEMS

A. Manufacturer: Provide products meeting the requirements of the Drawings and Specifications from one of the following:

Wire and Cable:	Avaya, CommScope, Belden, Ber-Tek, General Cable or approved equal.
Connector Modules:	Shall be provided by manufacturer of UTP Work Area Outlets.
Broadband Connector:	Amp, Amphenol, Cambridge, Regal, Gilbert.
Line Cords:	CommScope, Lucent Technologies, AT&T, Berk-Tek, General Cable, Champlain, or approved equal.
Splitting Devices:	Blonder-tongue, General Instruments/Jerrold, Regal, or approved equal.

B. All required components shall be provided for the reception and distribution of signal for all rooms equipped with outlets.

C. The system including all of its components shall be broadcast quality and shall provide for reception of monochrome (black and white) and color TV transmission and FM (at every outlet) equal to or superior to that obtainable on a single standard receiver connected directly to the system antennas (CATV).

D. The system design minimum shall be a 43 dB carrier-to-noise ratio and minus 46 dB (0.5%) cross-modulation level at output of the last amplifier in the distribution system.

E. The system shall be designed so subsequent expansion to additional VHF of UHF channels shall require modifications of head-end equipment only.

F. All active equipment shall be designed and rated for 110V to 125V, 60 Hz, AC operation and shall be NRTL listed.

G. The system shall provide for distribution of up to 100 + television channels from a feed provided by a CATV Company or satellite dish.

H. The system shall meet or exceed the technical standards set forth in the FCC Rules, Part 76.

I. The system shall also be capable of providing two-way communication (Bi-directional video distribution) over a single cable.

J. Bandwidth of all passive devices shall be from 5 MHZ to 1.2 GHz. Bandwidth of amplifiers shall be from 54 MHZ to 1 GHz in the forward direction and from 5 MHZ to 30 MHZ in the reverse path.

K. The system shall be designed for minus 57 dB cross-modulation or greater and carrier-to-noise ratio of at least 46 dB.

L. The broadband RF cable shall be coaxial copper-clad center conductor, foam polyethylene dielectric, quad-shield aluminum-mylar-aluminum foil type, aluminum braid shield and non-contaminating polyvinyl chloride jacket. Cable shall have 75 ohm impedance with 80 dB shielding. No discontinuity shall exist within 54-216 MHZ and 470-890 MHZ bands. Cable shall be used as follows:

M. Hardline Backbone cable shall be equivalent to CommScope #T3JCAP Hardline Coax Cable for Plenum-Rated areas and #T3JCAR Coax Cable for Non-Plenum Rated areas.

N. The Hardline trunk/backbone cable shall be home run directly to video head end location. If field amplification is required to increase db levels, the amplification hardware must be installed in all applicable IDFs and MDFs.

O. Backbone cable shall meet or exceed the following nominal attenuation specifications and shall not exceed 1000 feet from head end:

5mhz	.13db/100'
30mh	.34 db/100'
50mhz	.43 db/100'
108mhz	.63 db/100'
220mhz	.93 db/100'
400mhz	1.26 db/100'
750mhz	1.8 db/100'
865mhz	1.90 db/100'
1000mhz	2.10 db/100'

P. Drop Cable, shall be equivalent to CommScope RG-6/U, utilize quad-shielding.
1. Non-Plenum Rated Cable: #5740 CM rated jacket for Non-plenum applications.
2. Drop Cable shall meet or exceed the following nominal attenuation specifications and shall not exceed 100 feet to tap on A/V Distribution Trunk/Backbone cable:

1mhz	.21db/100'
10mhz	.65 db/100'
50mhz	1.46 db/100'
100mhz	2.04 db/100'
200mhz	2.98 db/100'
400mhz	4.46 db/100'
700mhz	5.89 db/100'
900mhz	7.47 db/100'
1000mhz	8.02 db/100'

Q. Broadband CATV Cable - Provide Hardline cable equivalent to CommScope #QR 540 Hardline Coax Cable.

R. Signal Level, calculated and tested signal level shall fall between +2dBmv and +11dBmv. Submit signal level test results to specifying authority for approval. Channel to Channel differential shall not exceed 2dB nor shall it exceed 10dB from 50 MHZ to 550 MHZ.

S. Broadband Connector Modules
1. Broad band connectors for work area outlets shall be integral to a connector module either having one or two connectors per module. Single connectors shall be located in the center of the module while double jacks shall be located side by side horizontally.
2. Connector modules shall be high impact, flame-retardant thermoplastic with RF type connectors. Modules shall be interchangeable with UTP cabling jack modules.
3. Refer to Work Area Outlets, section for connector modules.

T. Broad Band Connectors
1. Refer to Work Area Outlets, section for termination/connector type.
2. Connector type shall be compatible with cable type.
3. Connector types: 75 ohm with hexagonal 3/4 inch compression termination.

U. Line Cords
1. Each work area outlet shall be provided with a line cord, field measured for proper length, which meets the following:
2. Line cords shall be Type 6U, quad shielded, stranded, (extra flexible), copper-clad core cable with an "F" type connector with solid center conductor terminated on both ends.

V. Broadband Cabling Splitting Devices
1. Broadband tap/splitting devices shall be used in the system as required to meet specified signal strength at each jack location. These units shall utilize a die cast housing and RF

shielding exceeding local cable company requirements (minimum -80dB) and be equipped with flanges to permit mounting on any flat surface and shall meet FCC specifications on radiation.

2. Passive Splitters shall have a rated frequency range of 5-1000 Hz and shall be equivalent to Blonder Tongue XRS series. .
3. Two-way splitters shall have a maximum splitting loss of 3.8 dB. Four-way splitters shall have a maximum splitting loss of 8.4 dB. Directional couplers shall be available in nominal tap loss values of 8, 12, and 16 dB and the return loss of any terminal shall be 18 dB or higher.
4. Terminating Resistor: Terminating resistors with 75 ohm impedance shall be installed at unused ports and feeder line ends. Terminating resistors shall be designed to cover the frequency range from 5 MHZ to 890 MHZ with minimum return loss of 25 dB at UHF and 30 dB across the VHF band.
5. Directional Coupler Tap, Flush Mounted: Directional coupler type taps shall be provided as required for signal distribution. The taps shall be fully shielded and in compliance with FCC rules pertaining to radiation. The taps shall be available in isolation values of 3, 8, 12, 16, 20, and 24 dB. Frequency response through any port shall be from 5 MHZ to 890 MHZ.
6. The directional coupler taps shall provide a single RF outlet with a type "F" connector. A through match shall be 18 dB minimum and back match shall be in excess of 14 dB. Any combination of taps shall provide a minimum isolation between tap ports of 30 dB. Through connection to the tap shall be made by standard type "F" fittings. The tap shall be housed in a rugged cast aluminum case and shall be above first floor lay-in ceilings.
7. Directional Coupler Multi-Tap, Surface Mounted: Eight-way directional couple-type taps shall be provided as required for signal distribution. The taps shall be fully shielded and in compliance with FCC rules pertaining to radiation. All connections to the unit shall be by standard type "F" connectors. The taps shall be available in isolation value of 20 dB.
8. The frequency response shall be from 12 MHZ to 890 MHZ and the return loss at any port shall be no less than 14 dB. Isolation between any two tap outlets shall be no less than 30 dB from 5 MHZ to 400 MHZ and no less than 15 dB from 470 MHZ to 806 MHZ.
9. The tap shall be housed in a rugged cast aluminum housing provided with flanges to permit mounting on any flat surface.

1.3 AUDIO/VIDEO OUTLETS AND PATCH CABLING SYSTEM

A. Provide products meeting the requirements of the Drawings and Specifications from one of the following:

Cable:	Cables-to-Go, L-COM, Technical Necessities, or approved equal
Jack Modules:	Shall be provided by the work area outlet manufacturer
Couplers:	Cables-to-Go, L-COM, Technical Necessities, or approved equal
Line Cords:	Cables-to-Go, L-COM, Technical Necessities or approved equal

B. RCA audio/video cabling:
1. Patch cables shall be 6' stranded, 18 awg, shielded cable designed specifically for audio/visual distribution with manufacturer pre-connectorized ends (Male) Jacks shall be color coded(white, red, yellow) and interface to female/female, gold plated RCA type coupler modules. Jacks shall be able to withstand at least a minimum of 2000 mating cycles without any transmission degradation.
2. Between jack (within conduit) cabling shall be stranded, 18 awg, shielded cable designed specifically for audio/visual distribution, interfaced to applicable RCA jack modules.

C. Modular RCA Jacks (Work Area Outlets)
1. Jacks shall be color coded (white, red, yellow), female/female, gold plated RCA type coupler modules. Jacks shall be able to withstand at least a minimum of 2000 mating cycles without any transmission degradation.
2. Jack modules color shall match work area outlet faceplates.
3. Jack modules shall be flame retardant thermoplastic with integral cable strain relief. Color shall match faceplate.

1.4 VGA OUTLETS AND CABLE

A. Provide products meeting the requirements of the Drawings and Specifications as follows:

Cable:	L-COM part # CTBL3VGAMM xxT, or approved equal
Jack Modules:	Shall be provided by the cable manufacturer
Couplers:	L-COM part # DGBH15MF, or approved equal
Line Cords:	L-COM, or approved equal

B. VGA video cabling: Provide at all applicable locations. VGA cable shall be equivalent to L-COM # CTB3VGAMM-xxT. The VGA cable shall have three (3) 75 ohm coaxial lines.
1. Conductor: 32 AWG Tinned Wire Stranded
2. Insulator: Foam PE
3. Shield 1: Spiral tinned Copper Wire
4. Conductor Resistance: 588 ohms/km Max at 20 Deg C
5. Dielectric Test: 500 VAC 1 min
6. Impedance: 75 ±10 ohms
7. The VGA cable shall have nine (9) 30 AWG copper conductors.
8. Conductor: 30 AWG 7-strand Tinned Copper Wire
9. Insulator: Polypropylene
10. Conductor Resistance: 376 ohms/km Max at 20 Deg C
11. Dielectric Test: 500 VAC 1 min
12. The VGA cable shall have an outer aluminized Mylar shield, and tinned copper braid and drain wire.
13. The VGA cable shall have two (2) 15-pin molded housing connectors (P1 and P2), and two (2) 16-pin low profile, .079" (2mm) pitch disconnect connectors (P3-male, J1-Female).

C. VGA cables lengths shall be field measured.

D. Coupler shall be equivalent to L-COM part # DGBH15MF.

E. Patch cables and line cords.
1. Patch cables and line cords shall be HD15 male to HD 15 female, equivalent to L-COM # CTL3VGAMF-xxB.
2. Patch cable lengths shall be field measured.

2.5 Outdoor cable surge and lighting protection

A. All UTP cables run from the head end to IDF closets through underground conduits shall be gel filled OSP rated cables with each conductor protected on both ends by lightning/surge protectors. Lightning/surge protectors shall be equivalent Citel 280T series.

B. Manufacturer.
1. CITEL
1515 N W 167th Street - Suite 5-223
Miami, FL 33169
TEL: 800-248-3548 / 305-621-0022

C. Category 5 Surge Protection.
1. Citel part # 280T series, B25QC66 Base, or approved equal.
a. Cable Capacity: 25 pairs.
b. Connector type: QC66.
c. Module Capacity: 13.
d. Resistance: 47Ω.
e. Capacitance: 70 pF.
f. Maximum Line Current: 200 mA
g. Clamping Voltage: 190V
h. Power Handling:
8/20 μs 10 x's: 10 kA
8/20 μs 1 x's: 20 kA

1) include; a back-lit digital readout which displays the time; a monitor speaker which permits these audio programs to be monitored before they are transmitted to classrooms or other locations; and a 4 - position monitor switch offering the follow selections: send program; send/monitor program; monitor program only, and "OFF" position.

2) A dedicated roof mounted twin dipole omni directional FM Antenna shall be provided. Two 1/2 wave dipole elements mounted 90 degrees to one another on the antenna mast give this antenna an omni-directional reception pattern. The antenna shall be supplied with the following accessories: connector cable, an 18" boom, vertical mounting bracket and horizontal mounting

2.4 Cable Paths

A. All cabling shall be supported using cable tray and J hooks. Cables shall not be supported by any other devices or the building structure. Secure the cable tray and J hooks to the structure using fasteners approved for the purpose and for the materials being fastened to. Provide cable tray from Chatsworth or approved equal and J hooks and assembly materials from Erico or an approved equal.

B. All main cable paths shall be installed in corridors and hallways and be completely accessible after completion of the project. No cable paths shall be installed through any rooms.

C. Provide a separate cable path for each systems cabling for all main cable paths sized as specified.

D. Provide all clearances as required by the codes and standards for the cabling being installed.

E. Provide cable tray or J hooks in all rooms, corridors and areas to be cabled.

2.5 Miscellaneous

A. Provide all equipment and accessories, as required, to furnish completed and functioning systems.

B. All cables and outlets shall be labeled with a unique identification scheme or as directed by the owner. All labeling shall comply ANSI/TIA/EIA-606.

PART 3: EXECUTION

3.1 Pre-installation site survey

A. Prior to start of systems installation, meet at the project site with representatives of trades performing related work to coordinate efforts. Review areas of potential interference and resolve conflicts before proceeding with the work. Facilitation with the General Contractor will be necessary to plan the crucial scheduled completions.

B. Examine areas and conditions under which the system is to be installed. Do not proceed with the work until satisfactory conditions have been achieved.

3.2 Handling and Protections of Equipment and Materials

A. Be responsible for safekeeping of your own and your subcontractors' property, such as equipment and materials, on the job site. The owner assumes no responsibility for protection of above named property against fire, theft, and environmental conditions.

3.3 Protection of Facilities

A. Effectively protect the owner's facilities, equipment, and materials from dust, dirt, and damage during construction.

B. Remove protection at completion of the work.

3.4 Installation

A. Receive, check, unload, handle, store, and adequately protect equipment and materials to be installed as part of the contract. Store in areas as directed by the owner's representative. Include delivery, unloading, setting in place, fastening to walls, floors, ceilings, or other structures where required, interconnecting wiring of system components, equipment alignment and adjustment, and other related work whether or not expressly defined herein.

B. Install materials and equipment in accordance with applicable standards, codes, requirements, and recommendations of national, state, and local authorities having jurisdiction, and National Electrical Code (NEC) and with manufacturer's printed instructions.

C. Adhere to manufacturer's published specifications for pulling tension, minimum bend radii, and sidewall pressure when installing cables.
   1. Where manufacturer does not provide bending radii information, minimum bending radius shall be 10 times cable diameter. Arrange and mount equipment and materials in a manner acceptable to the engineer and the owner.

D. Through Wall and Through Floor Penetrations
   1. All through floor and through wall penetrations shall be sleeved using metallic conduit with bushings installed on both sides. The sleeve must be supported or secured on both sides of the wall. Sleeves shall be centered on the wall penetration and have equal amounts extending out off of each wall on both sides. All penetrations shall be installed so both sides are accessible and will easily allow for future cabling. All through floor and through wall penetrations shall be fire-stopped. Fire-stop systems will be performed using UL® approved methods. Provide the UL® system number for the fire-stop systems to be used. Use, It's Unique Firestop Products – Smooth and Threaded Penatrators or approved equivalent.
   2. Provide four-inch sleeves for all through wall and through floor penetrations along all main cable paths in corridors and between floors. A separate sleeve will be installed for data, voice (Category 5e cable), video, ITCS (shielded cabling for speakers, clocks and other devices) and other services. If any sleeve for any or each service will be filled at more than allowed for the fire-stop system to be used install an additional four-inch sleeve. Use It's Unique Firestop Products – Smooth Penatrator P/N #SP-4 for gypsum walls and It's Unique Firestop Products – Threaded Penatrator P/N # TP-4 for block and concrete floors and walls or an approved equivalent.
   3. Provide sleeves as described in 1 and 2 above for entering the Server Room. Provide a minimum of a four inch sleeve for each system (data, voice, video, security, paging, spare). Supply additional sleeves as needed for the number of cables and for the fire-stop system being used.
   4. In addition to all sleeves needed and required provide all necessary sleeves for accessing future surveillance camera locations identified as "SDC".
   5. Provide 50% spare capacity for all sleeves for data cabling and 20% spare capacity for all other sleeves.
   6. Provide one-two inch sleeve into each classroom and one-one inch sleeve in to each room to be serviced with telecommunications cabling. If the cabling will exceed the number of cables for the fire-stop system being used use a larger sleeve. These sleeves will be used for all telecommunications cabling entering the room to be serviced.
   7. Supply and install sleeves in 1 inch, 2 inch and 4 inch sizes only.
   8. All sleeves and conduits shall be installed to an accessible ceiling space or access point. Both ends of all sleeves and conduits must be accessible after the project completion.

E. Installation shall conform to the following basic guidelines:
   1. Use of approved wire, cable, and wiring devices.
   2. Neat and uncluttered wire termination.

F. Cable Paths
   1. For the main cable paths attach cable supports to permanent structure with fasteners approved for the material being fastened to at intervals of not more than 48 inches.

2. Support cables installed above removable ceilings using Erico – Caddy Cable Cat, Angled Hanger Bracket P/N # CATHBA with the need number of P/N # CAT32 or P/N # CAT64 cable supports.
   a. Attach the P/N # CAT32 and /or P/N # CAT 64 to the P/N # CATHBA using ¼-20 hardware. Do not use rivets or riveted assemblies.
   b. Attach a P/N # CAT32 or P/N # CAT64 for each of the following systems to be installed along the cable path include one or more for each; data, voice (Category 5e cabling), video, ITCS (shielded cable for speakers, clocks and other devices) and other services (HVAC).
   c. If the P/N # CAT32 will be filled more that 50% of its capacity install P/N # CAT64.
3. Install Erico – Caddy Cable Cat P/N # CAT32 cable support or approved equal and any needed attachments or fasteners with in the classrooms, offices and rooms to support the cabling to be installed.
   a. Cable from all systems will be installed in the same cable path with in the rooms.
   b. If the P/N # CAT32 will be filled more that 50% of its capacity install P/N # CAT64.
4. Install an adequate cable support for service loops at each outlet location. Install a separate cable support for the service loop if the service loop is to be supported along the cable path.
5. Use Erico – Caddy Cable Cat products or approved equivalent. Provide these assemblies in the configurations as detailed.
6. In addition to the supports needed and required provide cable supports for cable paths to the future surveillance camera locations identified as "SDC".

G. Install cables in one continuous piece. No splicing of cables will be acceptable unless otherwise noted.

F. No cabling shall be installed unsupported or laying on ceilings. All cabling shall be concealed.

G. Terminate all cables, at each end, regardless of their "in-service" status, unless noted otherwise.

H. Patch all holes related to the scope of work provided in this specification. The patching is to restore the area in question to pre-existing conditions, and to proper compliance with code(s) and the structural and aesthetic levels required.

I. Connect all equipment cabinets and racks within the Server Room and IDF's with green insulated #6 copper wire. Ground to a ground bar installed in the each Room. Telecommunications Grounding Busbar by division 16. Comply with EIA/TIA 607.

J. Furnish one horizontally mounted six-outlet power strip, with surge suppression and a circuit breaker in the Server Room. Install in floor mounted equipment rack in the Server Room as shown. Each power strip is to be provided with the power cord that is long enough to be neatly routed overhead from the power strip, through the equipment rack(s) and overhead tray to the outlets designated to feed the network electronics.

K. Provide required plates, rings, adapters, blanks and/or accessories to provide a complete installation in all raceways, and other locations. All wall plates shall be flush mounted.

L. Jacks, plates, terminations are to match building standard, in color, finish and quality.

M. Labels and labeling shall conform to EIA/TIA-606.

N. Provide wall mounted cabinets as required for new patch panels.

O. Terminate data and voice station cables in ascending numerical order.

P. Optical fiber in the outlet boxes shall be secured and dressed in so that the optical fiber is secured, has the required slack storage and will not exceed the bend radius requirements of the manufacturer.

Q. Service slack: All horizontal optical fiber cables shall have a minimum of a twenty foot service loop installed at each outlet location and a minimum of a ten foot service loop in the Server Room all other cabling shall have a minimum of a ten-foot service loop supported in the ceiling above each location and neatly coiled in the Server Room. Cables for different systems shall be stored separately.

R. All cabling shall be homerun from the outlet location to the Server Room.

3.5 Grounding

A. Grounding shall conform to ANSI/TIA/EIA 607 - Commercial Building Grounding and Bonding Requirements for Telecommunications, National Electrical Code and manufacturer's grounding requirements as minimum.

B. Ground equipment racks, housings, messenger cables, raceways, etc as required.

C. An insulated ¼" copper grounding bus bar will be installed in the Server Room as indicated. The ground bar will be provided and installed by division 16.

D. Connect cabinets, racks, and frames to single-point ground which is connected to building ground system via #6 AWG green insulated copper grounding conductor.

3.6 Labeling

A. Labeling shall conform to ANSI/TIA/EIA-606 standards. In addition, provide the following.

B. All labels shall be machine generated. No hand written labels will be permitted for any application.

C. Label each outlet with label sized as recommended by the manufacture for the wall plate being used with minimum 3/16 in. high characters.

D. Label each cable with permanent self-adhesive label with minimum, 1/8 in. high characters, in the following locations:
   1. Inside box at the work area.
   2. At termination point in the Server Room

E. Use labels on face of data patch panels. Provide facility assignment records in a protective cover at the Server Room location that is specific to the facilities terminated therein.

F. Use color-coded labels for each termination field that conforms to ANSI/TIA/EIA-606 standard color codes for termination blocks.

G. Label cables, outlets, patch panels, and punch blocks with a letter or number for the Server Room where the cabling will terminate, the section letter or number for the particular area of the building where the outlet is located, the room number in which the outlet is located, followed by a numerical suffix to indicate the outlet location number within the room.

H. Mark up floor plans showing outlet locations, type, and routing of cables. Turn these drawings over to the owner two (2) weeks after completion.

I. One (1) set of as-built drawing shall be delivered to the owner within four (4) weeks of acceptance of project by the owner. A set of as-built drawings shall be provided to the owner in magnetic media form (3.5" floppy disks) utilizing CAD software that is acceptable to the owner. The magnetic media shall be delivered to the owner within two (2) weeks of the acceptance of the project by owner.

3.7 Copper Testing

A. All cables shall be tested and all parameters of each test shall be within acceptable limits for the test being performed. An average of tests or testing a percentage of cables will not be acceptable in any form.

B. The owner or owner's representative shall be invited to and have the opportunity to witness the testing of any and all cables.

C. Testing shall conform to TIA/EIA Transmission Performance Specifications for Field Testing of Unshielded Twisted Cabling Systems, Propagation Delay and Delay Skew Specification for 100 ohm 4-pair cable. Testing shall be accomplished using level III field tester. Provide a current calibration certificate for the test equipment to be used.

D. Test each pair of each cable for all parameters as specified for the Category of cabling being installed. Correct any failed tests
   1. Testing of cables shall be in compliance with ANSI/TIA/EIA-568-B and all other applicable standards.
   2. Replace any damaged cable.

3.9 Demonstration / Orientation

A. Provide one half day, (four (4) hours) on site for familiarization and orientation by senior technician of the contractor, or other qualified approved personnel, for each of the voice, data, and video cabling systems. Up to eight (8) Owner personnel will be accommodated during this session. This session is to cover as a minimum:
   1. The physical configuration and interrelationship of the components of the system.
   2. Labeling and interconnection techniques used in this installation.
   3. Applications or unique connections or interfaces currently in use on this site.
   4. A review of warranty documents for the system.

B. Coordinate with the owner, and complete training during week prior to occupancy, or as scheduled with the owner.

3.10 Cleaning

A. Prior to presentation for acceptance by client equipment and work areas of this scope shall be cleaned. This work shall include, as necessary, wiping of work areas, removal of streaks, stains, etc., and assurance that systems and components as represented are new and undamaged.

3.11 System Acceptance

A. Contractor must obtain written acceptance from the owner or the owner's representative at the completion of system installation, testing, documentation and training. Failure of the contractor to obtain sign off will result in the contractor remaining responsible for extending, at no charge to the owner, conditions of the warranty and guarantees until such time that sign off had occurred. Time included in the above condition will be presented to the owner in addition to the standard warranties.

END OF SECTION 17100

SECTION 17700 – INTRA-BUILDING COMMUNICATIONS – Reissued in its entirety ADDENDUM 2

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

B. A telephone system head end and phones will be provided by Owner separate from this contract.

C. All equipment and devices provided under this project must be fully integrated with the Owner provided telephone system equipment.

1.2 SUMMARY OF WORK INCLUDED IN THIS SECTION:

A. This Section includes all materials and work associated with the complete installation of an Integrated Intercom/Telecommunications System. It includes requirements for Integrated Electronic Communications Network system components including, but not limited to, the following:
1. Ceiling/Wall Mounted Speaker Assemblies.
2. Normal and Normal/Emergency Intercom Call Buttons.
3. Bell/Class Change Signaling System.
4. Public Address/Intercom System.
5. Controls, Amplifiers, and Terminal Equipment.
6. Power supplies.
7. Wiring.
8. Paging Horns.
9. Volume Attenuators.
10. Master Clock.
11. Secondary Clocks.

B. Related Sections: The following Division 16 and Division 17 Sections contain requirements that relate to this Section:
1. Division 16 "Raceways," for raceways used for Integrated Electronic Communications Network systems cables.
2. Division 16 "Electrical Boxes and Fittings," for boxes, cabinets and fittings used with communications systems.
3. Division 17 Cable Plant.

1.3 GENERAL

A. All bids shall be based on the equipment specified herein.

B. It is the responsibility of this section to provide the following as needed and required:
1. Over-voltage protection.
2. Cross-wiring.
3. UL® listed materials and equipment.

C. Sound balancing and volume adjustment.
   1. Bidders wishing to submit alternate equipment shall submit to the specifying authority, at least 10 days prior to the filed sub bid opening, the equipment proposed to provide a precise functional equivalent system to meet specifications. Bidder shall provide adequate information prior to bid date such as specification sheets, working drawings, shop drawings, and a demonstration of the system. Alternate supplier-contractor must also provide a list to include six installations of the identical system proposed which have been in operation for a period of two years or more.
   2. Final approval of the alternate system shall be determined at the time of job completion. Failure to provide the "precise functional equivalent" shall result in the removal of the alternate system at the contractor's expense.

D. Provide and install all materials, labor, equipment, permits, etc., to provide a full functioning INTERCOM/communications system with the features and capabilities described and intended by this specification. Provide all items described herein, that are illustrated on the Drawings, are required by the manufacturer or are needed to provide the completed operating system as intended.

E. All materials and equipment shall be new, free from any defects, and be of the best quality of their respective kinds unless otherwise noted. All like materials used shall be of the same manufacture, model, series and quality to make up a complete system. Different systems shall be connected as required to provide the features and functions intended. Each system and the components of each system shall be listed and approved by all National, State and local codes and standards and by the manufacturer for use as intended in this specification.

F. All manufactured articles, material, and equipment shall be installed connected, assembled, cleaned, adjusted, and conditioned as recommended by the manufacturers and as needed to provide the function and features as intended, unless specifically specified to the contrary.

G. Substitutions will be acceptable; if, in the opinion of the Owner, the substitute material is of a quality as good or better than the material specified, and will serve with equal efficiency and dependability, the purpose for which the items specified were intended. Any substitutions must be submitted at the time of the bid.

1.4 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of integrated communication systems and ancillary equipment, of types and capacities required, whose products have been in satisfactory use in similar service for not less than five years.

B. The Contractor shall be an established communications and electronics contractor that has had and currently maintains a facility to service this facility now and in the future and that has operated this business for at least five years. The contractor shall utilize a duly authorized distributor of the equipment supplied for this project location with full manufacturer's warranty privileges.

C. Provide current certification certificates for the installation staff that will perform this installation from the manufacturer of the products to be installed.

D. Provide all information on all warranties available from the manufacturer of the products to be installed. It will be the responsibility of the installation contractor to be sure that all the

manufacturers requirements are met for the proper installation of the system and to be eligible for any and all available warranties.

E. All items of equipment including wire and cable shall be designed by the manufacturer to function as a complete system and shall be accompanied by the manufacturer's complete service notes and drawings detailing all interconnections.

F. Electrical Component Standard: Provide work complying with applicable requirements of NFPA 70 "National Electrical Code" including, but not limited to:
1. Article 250, Grounding.
2. Article 300, Part A. Wiring Method.
3. Article 310, Conductors for General Wiring.
4. Article 725, Remote Control, Signaling Circuits.
5. Article 800, Communication Systems.

G. EIA Compliance: Comply with the following Electronics Industries Association Standards:
1. Sound Systems, EIA-160.
2. Loudspeakers, Dynamic Magnetic Structures, and Impedance, EIA-299-A.
3. Racks, Panels, and Associated Equipment, EIA-310-A.
4. Amplifiers for Sound Equipment, SE-101-A.
5. Speakers for Sound Equipment, SE-103.

H. Installation and start up of all systems shall be under the direct supervision of a local agency regularly engaged in installation, repair, and maintenance of such systems. The supplier shall be accredited by the proposed equipment manufacturers and be prepared to offer a service contract for system maintenance on completion of the guarantee period and provide the names, locations, and size of five (5) recent successful installations in the area.

I. The agency providing equipment shall be responsible for providing all specified equipment and mentioned services for all equipment as specified herein. The agency must be a local authorized distributor of all specified equipment for single source of responsibility and shall provide documents proving such. The agency must provide written proof that the agency is adequately staffed with factory-trained technicians for all of the specified equipment. The agency must have established business for and currently be providing all services for the equipment to be provided for a minimum of 3 years.

J. The contractor shall guarantee availability of local service by factory-trained personnel of all specified equipment from an authorized distributor of all equipment specified under this section.

K. The contractor shall, at the owner's request, make available a service contract offering continuing factory authorized service of the system after the initial warranty period.

L. The supplier shall visit the sites and familiarize himself with the existing conditions and field requirements prior to submitting a proposal.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in factory containers. Store in clean, dry space in original containers. Protect products from fumes and construction traffic. Handle carefully to avoid damage.

1.6 SERVICE AND MAINTENANCE

A. The Contractor shall provide a five-year warranty of the installed system against defects in material and workmanship. All labor and materials shall be provided at no expense to the Owner. The warranty period shall begin on the date of acceptance by the owner. Provide all details of the warranty to be provided with the bid. List what is included and the terms of the warranty. The installation shall meet all requirements for the manufacturers recommendations and warranty and provide any details of anything additional that will be needed to meet the requirements of the warranty in the bid. Acceptance of the system will not begin until documentation of this warranty has been provided. Detail the beginning and ending dates of the warranty and all requirements, conditions and rules pertaining to the agreement. Final payment does not exclude the responsibility to perform this service.

B. Sole Source Responsibility: Except where specifically noted otherwise, all equipment supplied shall be a pre-approved manufacturer of known reputation and experience. A combination of manufacturers will only be considered who have a current affiliation and warranty program that make up a complete system.

C. The Contractor must have attended, been trained and have current certification from the manufacturer of the products to be installed. Provide a copy of the companies certification and certifications for the installers from the manufacturer of the material to be installed with the bid. Provide certifications from each manufacturer if different manufactures products will be used.

D. In-service Training: The Contractor shall provide a minimum of eight hours on site, of in-service training with this system. Training will include the training of individuals selected by the owner in the operation of this system. The training shall be performed during three different sessions as requested by the owner. Typically training is performed upon completion of the installation, after six (6) weeks use of the system and one year from the acceptance date of the final installation.

E. Operators Manuals and Users Guides shall be provided at the first training session.

1.7 SUBMITTALS

A. Shop Drawings, Product Data and Samples, furnish the following as detailed and as specified in division 1 specification sections:
   1. Submit equipment prints, inter-panel and intra-panel, full electronic wiring diagrams and specification sheets for each item specified herein. Provide a tabulation of the specification clearly comparing the submitted item with the specified item, being able to refer to all written expressed functions and capabilities. Specification Sheets shall be submitted on all items including cable types.
   2. Shop drawings, detailing Integrated Electronic Communications Network system including, but not limited to, the following:
      a. Built-in station arrangement.
      b. Equipment cabinet arrangement.
   3. Wiring diagrams, detailing wiring for power, signal, and control, differentiating clearly between manufacturer -installed wiring and field-installed wiring. Identify terminals to facilitate installation, operation and maintenance.
      a. Submit wiring diagrams showing typical connections for all equipment.

4. Provide a riser diagram for the system showing in technically accurate detail all connections, interconnections, and all provisions available and made for adaptability of all specified future functions. In addition, riser diagram must include all calculations, charts, and test data necessary to demonstrate that all systems and system components deliver the specified signals, grades, and levels at all required points and locations.
5. Submit a certificate of completion of installation and service training.
6. Manuals: Submit copies of complete set of operating instructions including circuit diagrams and other information necessary for proper installation, operation, and maintenance of system components.
7. As-built drawings of the system shall be supplied. Supply three sets in hard copy and one electronic copy in a format approved by the owner.

1.8 SYSTEM DESCRIPTION

A. General: Furnish and install all equipment, accessories, and materials in accordance with these specifications and drawings to provide a complete and operating Integrated Intercom/Communications system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Subject to compliance with requirements, provide one of the following systems or an approved equal:
   1. Bogen Communications Inc.
   2. Dukane Corp.
   3. Rauland-Borg Corp.
   4. Telecor, inc.

B. The intent of this specification is to establish a standard of quality, function and features. It is the responsibility of the bidder to insure that the proposed product meets or exceeds every standard set forth in these specifications.

C. The functions and features specified are vital to the operation of this facility, therefore, the acceptance of alternate manufacturers does not release contractor from strict compliance with the requirements of this specification.

D. The Contractor for this work shall be held to have read all of the Bidding Requirements, the General Requirements of division 1, and Contract Proposal Forms; and in the execution of this work, he will be bound by all of the conditions and requirements therein.

E. The contractor shall be responsible for providing a complete functional system including all necessary components whether included in this specification or not.

F. In preparing the bid, the bidder should consider the following:
   1. No claim will be made against the owner for any costs incurred by the bidder for any equipment demonstrations which the owner requests.
   2. Any prior approval of an alternate system does not automatically exempt the supplier from meeting the intent of these specifications. Failure to comply with the operational

and functional intent of these specifications may result in the total removal of the alternate system at the expense of the contractor.

3. Alternate equipment shall be considered if submitted to the specifying authority at least ten (10) days prior to the sub filed bid date. Submission of an alternate shall contain engineering drawings of the system with specification sheets covering all components of the system as well as all items of Section 1 "SUBMITTALS." The system and equipment drawings and specifications sheet shall meet all items of the specification.

2.2 SYSTEM REQUIREMENTS

A. General:

1. The system shall provide the state of the art in technology for all internal intercom communications, emergency call-in notification, paging and evacuation tones, secondary clock corrections, and bell schedule. The system shall be easy to learn and operate. All standard system programming shall be user friendly to allow the system administrator the ability to easily program system features.
2. Provide complete and satisfactorily operating Integrated Intercom/Communications System as described herein, using materials and equipment of types, sizes, ratings, and performances as indicated. Use materials and equipment that comply with referenced standards and manufacturers standard design and construction, in accordance with published product information. Coordinate the features of all materials and equipment so they form an integrated system, with components and interconnections matched for optimum performance of specified functions.
3. Features offered by this system shall be implemented and controlled by software programs that can be changed and expanded as customer needs evolve.
4. The system shall allow system monitoring and administration from a local Windows PC or remote Windows PC via a modem.
5. The system shall be an electronic system consisting of one amplified intercom channels, (classroom) speakers, call switches, and/or telephones, digital readout for display of call origination, and solid-state logic and sensing.
6. Ability to provide multiple zone program distribution, which is not interrupted by intercom communications.
7. Ability to initiate paging announcements, evacuation tones, take cover tones to any location within the facility.
8. Ability to selectively communicate with or monitor individual classrooms in emergency situations; all communications within the classroom shall be hands free and will not require any interaction by the end-user to answer.
9. The system shall lend itself to expansion by simple addition of modules.
10. The central switching system shall provide for switching of the intercom talk path to a telephone mode, during the course of a call.
11. Two-way telephonic communication capability from any classroom phone to any administrative phone on the associated PBX or EKSU phone system.
12. Two-way communication between any telephone and any room speaker.
13. Room speakers and call switches shall be programmable and may be assigned any three, four or five digit number. Any room number may be reassigned at any time, and it shall not be dependent on wiring or circuit numbers.
14. Eight (8) separate paging zones shall be provided; each location shall be programmed in software to belong to any combination of software zones. Initially, zones shall be provided for the following:
    a. One zone for inside classroom speakers.
    b. One zone for inside classroom speakers.

c. One zone for inside classroom speakers.
d. One zone for inside classroom speakers.
e. One zone for gymnasium speakers.
f. One zone for cafeteria speakers.
g. One zone for corridor speakers.
h. One zone for common areas.

B. Provide the ability to perform diagnostics of the system which shall be as follows:
1. Check active list of activity within the system.
2. DTMF test to check the DTMF registers.
3. IO diagnostics enables the checking of each line and each device connected in the circuit, e.g. can determine if a telephone is off-hook or if a speaker has been disconnected.
4. Capability of checking each link and ability to remotely block a link from the system if found defective.
5. Obtain results of statistics maintained internally by the system which shall include:
a. Service requests
b. ADT's that received dial tone
c. DISA lines that received dial tone
d. Incoming trunk calls
e. Outgoing trunk calls
f. Links in use at any time
g. Active lines
h. DTMF faults
i. Processor faults
j. Data faults
k. Interface resets
l. FIFO overflows
m. Active list traversals

C. Normal Call Switch:
1. Normal Call Switches shall be installed where indicated on the drawings with an "IC" symbol. Call switches shall be flush mount remote speaker station with call in switch. The unit shall provide functions as scheduled below:
a. Provide one (1) "Normal" call switch that shall activate a distinctive "NORM" level call from a single button activation. Button shall be clearly marked "NORM" and shall route call to any one or more Administrative Displays for quick and easy response from an Administrative Telephone.
b. Where indicated as "WP" provides a water resistant station suitable for outdoor installation. Include all hardware and Install as recommended by the manufacturer.
c. Flush mount with tamper proof hardware.
d. Stainless steel construction.
e. Speaker, microphone and call in button.
f. Two way voice communication.

D. Time Control System/Secondary Clock Correction:
1. Clocks: Shall be low voltage, RS485 controlled, analog clocks Sapling SAR series or approved equivalent.
a. Provide 5 spare clocks to the owner at project closeout.
b. Provide clocks as specified and as indicated on the drawings.

c. Provide a Sapling flush mount metal back box or approved equivalent for each clock installed.
d. Each clock shall have the following features:
   1) Shall be 12" diameter with a 1.3" depth.
   2) Where a large clock is specified it shall be 16" diameter with a 2.0" depth.
   3) Upon receipt of the RS485 signal, the clock shall self correct.
   4) Shall have a microprocessor-based movement and shall be capable of being used as a stand-alone clock.
   5) The clock shall have a low-profile /semi-flush smooth surface metal case with ivory housing.
   6) The crystal shall be shatterproof Lexan® or acrylic with no visible molding marks.
   7) Glass is unacceptable.
   8) The clock shall have black hour and minute hands and a red second hand.
   9) The clocks shall have U.L.® and F.C.C. compliances.

2. Master Clock: Provide a Time Control System as an integral part of the Communications System Sapling Master Clock SMC 2000 series or approved equivalent in the Server Room. The time control system shall have the following features:
   a. It shall be a microprocessor based and programmable via a 16 pad waterproof keypad and a 20 Character X/2 row LCD display.
   b. Shall provide field enabled/disabled daylight savings time.
   c. Shall be capable of storing, in a non-volatile memory, and controlling up to 800 events, each set with precise second resolution.
   d. Special programs shall be readily programmed for up to 255 different schedules and holidays, and 50 scheduling changes can be set in advance.
   e. Shall be capable of controlling two different clock systems simultaneously, in addition to RS485 input and output and SAD output for controlling Sapling RS485 and Sapling digital communication analog clocks.
   f. Shall have a ten year battery backup for timekeeping.
   g. Shall have an RS232 computer interface port, input port to interface with other systems and WWVB/GPS interface capability.
   h. Provide connection for controlling class change signals to all or all desired speakers.
   i. Unit shall be rack mountable.

E. Accessories:
   1. Speakers
      a. Mechanical and Air-Handler Rooms: Provide the following speaker in the Mechanical Room and Air Handler Spaces.
         1) Reentrant type.
         2) Frequency Response: 375 to 14,000 Hz.
         3) Power Handling: 30 Watts, 60 Watts Peak.
         4) Variable screw taps, 25 V transformer.
         5) Sound Pressure Level: 110 dB at 1 meter with 1-watt input.
         6) Mounting: Adjustable, horizontal, and vertical.
         7) Color: Beige.
         8) Rauland Model 3602.
      b. Wall and Ceiling-Mounted Speakers shall be flush mounted and:
         1) 8" Cone.
         2) Frequency Response: 65 to 17,000 Cycles.
         3) Power Rated: 8 Watts.

4) Magnet: 5 Ounce.
5) Axial Sensitivity: 93 dB at 4 feet with 1-watt input.
6) 25-watt variable tap transformer.
7) White epoxy finish
8) Rauland Model USO188.

2. Outdoor Loudspeaker - Provide outdoor weatherproof horn speaker:
   1) Frequency Response: 375 to 14,000 Hz.
   2) Power Handling: 30 Watts, 60 Watts Peak.
   3) Variable screw taps, 25 V transformer.
   4) Sound Pressure Level: 110 dB at 1 meter with 1-watt input.
3. Loudspeakers
   1) Gym: The Public Address loudspeakers shall have the following features:
      a) Shall be self contained, wide range device with a wide coverage pattern.
      b) The frequency response shall be 70Hz – 16kHz, ± 6dB.
      c) The vertical polar coverage shall be 180 degrees within ± 5dB.
      d) The loudspeaker shall have a minimum sensitivity of 92dB SPL 1 Watt / 1 meter.
      e) A continuous power handling capability of 35 Watts RMS.
      f) A rated impedance of 4 ohms.
      g) The loudspeaker driver shall be one 6.5-inch full range unit.
      h) The driver shall be mounted in a spherical enclosure made of structural foam polystyrene.
      i) All hardware shall be stainless steel or plated steel.
      j) Optional mounting kits shall be used for mounting flat against a ceiling surface or wall surface, or a three-element cable hanging kit for single point suspension.
      k) The enclosure and reflector color will be white unless other wise noted.
      l) The loudspeaker shall be comprised of a 14.78-inch (378mm) diameter reflector mounted to a 10-inch (254mm) diameter sphere.
      m) The complete loudspeaker shall be 11.78 inches (302mm) in overall height and weigh 8 lbs (3.6kg).
4. Provide speaker cabling per manufacturer's requirements. Hallways may be looped. Individual rooms, offices and other areas must be home run to the Telecommunications Room. Multiple speakers with in a room maybe looped. Rooms that have multiple sections or dividers to section the room will have a homerun for each section. Speakers with in each individual section maybe looped.
5. 45-ohm speakers are unacceptable for any application.

F. Equipment Racks: Equipment racks shall be located as coordinated with owner and meet the following requirements:
   1. Self-contained, specifically engineered racks with provisions for all present and future components as described and recommended by the manufacturer within this specification.
   2. Racks shall be accessible from front and rear.
   3. All program, zone, and time circuitry, data, linkage, power, telecommunications components, and circuitry to be located in racks configured as approved by the Engineer.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine conditions, with the Installer present, for compliance with requirements and other conditions affecting the performance of the Integrated Electronic Communications Network system.
   1. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:
   1. Install system in accordance with NFPA 70 and other applicable codes. Install equipment in accordance with manufacturer's written instructions.

B. Wiring Methods:
   1. Install wiring in raceway except within consoles, desks, and counters, and except in accessible ceiling spaces, and in gypsum board partitions, where cable wiring method may be used. Use UL listed plenum cable in environmental air spaces including plenum ceilings. Conceal wiring except in unfinished spaces.

C. Impedance and Level Matching:
   1. Carefully match input and output impedance's and signal levels at signal interfaces. Provide matching networks where required.

D. Control Circuit Wiring:
   1. Install control circuits in accordance with NFPA 70 and as indicated. Provide number of conductors as recommended by system manufacturer to provide control functions indicated or specified.

E. The contractor shall mount a main distribution frame behind the Integrated Electronic Communications Network console. All wires shall be laid down on terminal punch blocks and identified by the actual room location it serves. All the communications points shall be wired into this main distribution frame, laid down in sequence, and identified by which line it is on and the point position it serves.

F. All housings are to be located as specified and shown on drawings.

G. Make installation in strict accordance with approved manufacturer's drawings and instructions.

H. The contractor shall provide necessary transient protection on the AC power feed, all station lines leaving or entering the building, and all central office trunks. All protection shall be as recommended by the equipment supplier and referenced to earth ground.

I. Wiring Within Enclosures:
   1. Provide adequate length of conductors. Bundle, lace, and train the conductors to terminal points with no excess. Provide and use lacing bars.
   2. Provide physical isolation from each other for speaker-microphone, line-level, speaker-level, and power wiring. Run in separate raceways, or where exposed or in same enclosure, provide 12 inch minimum separation between conductors to speaker-microphones and adjacent parallel power and telephone wiring. Provide physical separation as recommended by equipment manufacturer for other Integrated Electronic Communications Network system conductors.

J. Splices, Taps, and Terminations:

1. Make splices, taps and terminations on numbered terminal punch blocks in junction, pull, and outlet boxes, terminal cabinets and equipment enclosures.

K. Identification of Conductors and Cables:
1. Use color coding of conductors and apply wire and cable marking tape to designate wires and cables so all media are identified in coordination with system wiring diagrams.

L. Weatherproofing:
1. Provide weatherproof enclosures for items to be mounted outdoors, indoors in wet or damp locations, or exposed to weather.

M. Repairs:
1. Wherever walls, ceilings, floors, or other building finishes are cut for installation, repair, restore, and refinish to original appearance.

3.3 GROUNDING

A. Provide equipment grounding connections for Integrated Electronic Communications Network systems as indicated. Tighten connections to comply with tightening torque specified in UL Standard 486A to assure permanent and effective grounds.

B. Ground equipment, conductor, and cable shields to eliminate shock hazard and to minimize to the greatest extent possible, ground loops, common mode returns, noise pickup, cross talk, and other impairments. Provide 5-ohm ground at main equipment location. Measure, record, and report ground resistance.

C. The contractor shall provide all necessary transient protection on the AC power feed and on all station lines leaving or entering the building.

D. The contractor shall note in his system drawings, the type and location of these protection devices as well as all wiring information.

E. The contractor shall furnish and install a minimum of a #6 AWG ground conductor from the central equipment rack and to grounding bus bar installed by division 16000.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Services:
1. Provide services of a duly factory authorized service representative for this project location to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the system.

B. Inspection:
1. Make observations to verify that units and controls are properly labeled, and interconnecting wires and terminals are identified. Provide a list of final tap settings of paging speaker line matching transformers.

C. Testing:
1. Rectify deficiencies indicated by tests and completely re-test work affected by such deficiencies at Contractor's expense. Verify by the system test that the total system meets the Specifications and complies with applicable standards.

3.5 TRAINING

A. Train Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventative maintenance of the system. Provide a minimum of three (3) days (minimum of 4 hours each day) of training. Operators Manuals and Users Guides shall be provided at the time of this training.
   1. Schedule training with Owner through the Architect, with at least seven (7) days advance notice.
   2. Training shall take place on three (3) different days.
      a. Upon completion.
      b. After three months.
      c. After one year.

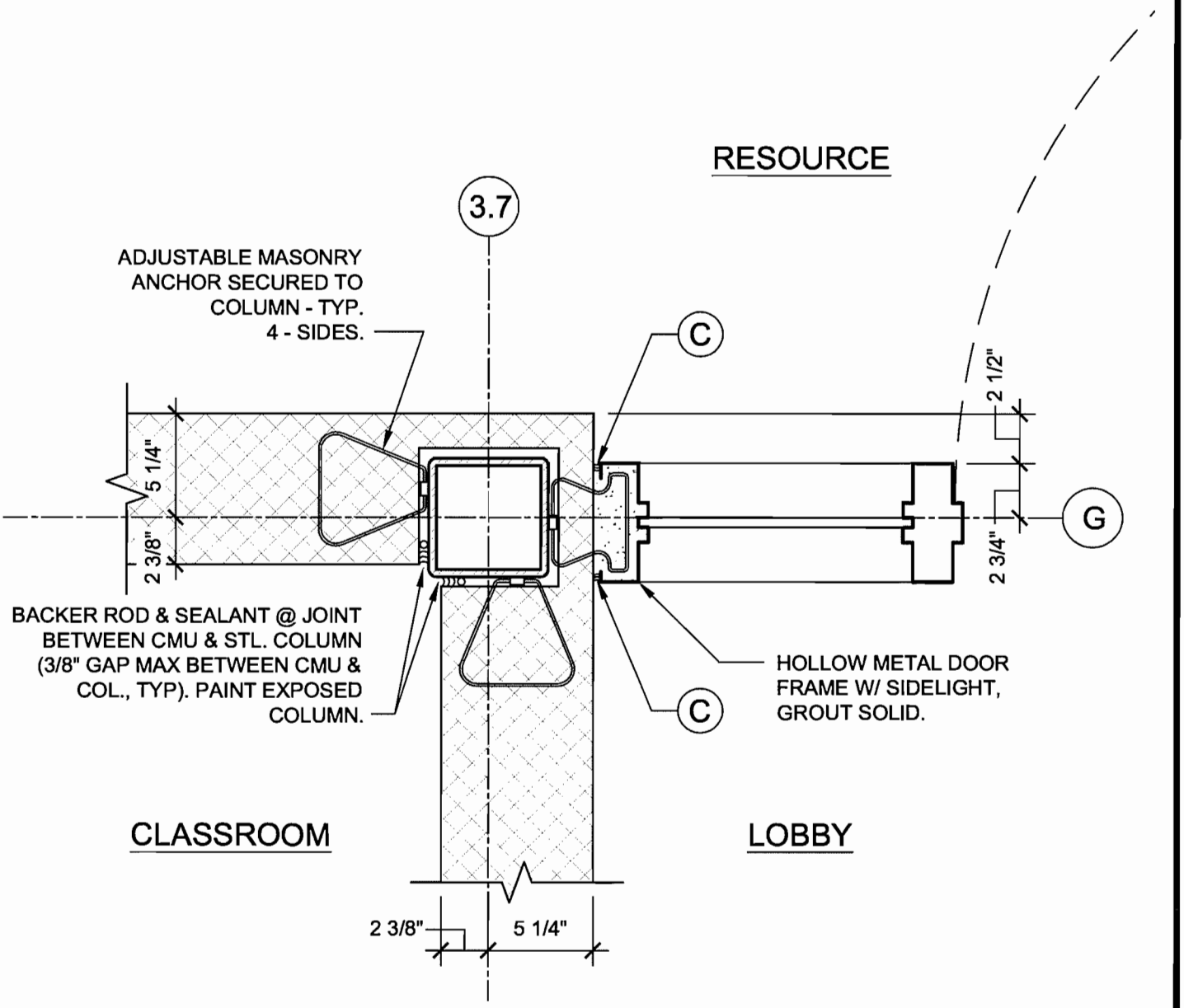
3.6 OCCUPANCY ADJUSTMENTS:

A. When requested by the Owner or Owner's Representative within one year of date of Substantial Completion, provide on-site assistance in adjusting sound levels, resetting matching transformer taps, and adjusting controls to suit actual occupied conditions. Provide up to three visits to the site for this purpose.

3.7 CLEANING AND PROTECTION

A. Prior to final acceptance, clean system components and protect from damage and deterioration.

END OF SECTION 17700



PLAN DETAIL B5/A300 - SCALE: 1:8 (A)

SEMPLE & DRANE ARCHITECTS
496 CONGRESS STREET
PORTLAND, MAINE 04101
TEL: (207) 761-4231 FAX: 774-0152
www.sempledrane.com

PROJECT:
RIVERTON EXP & RENO PROJECT
PORTLAND, MAINE 04103

DRAWING NAME:
B5 / A300

DATE:
Issued by:AF
Scale: 1:8
File:0515

SKETCH #
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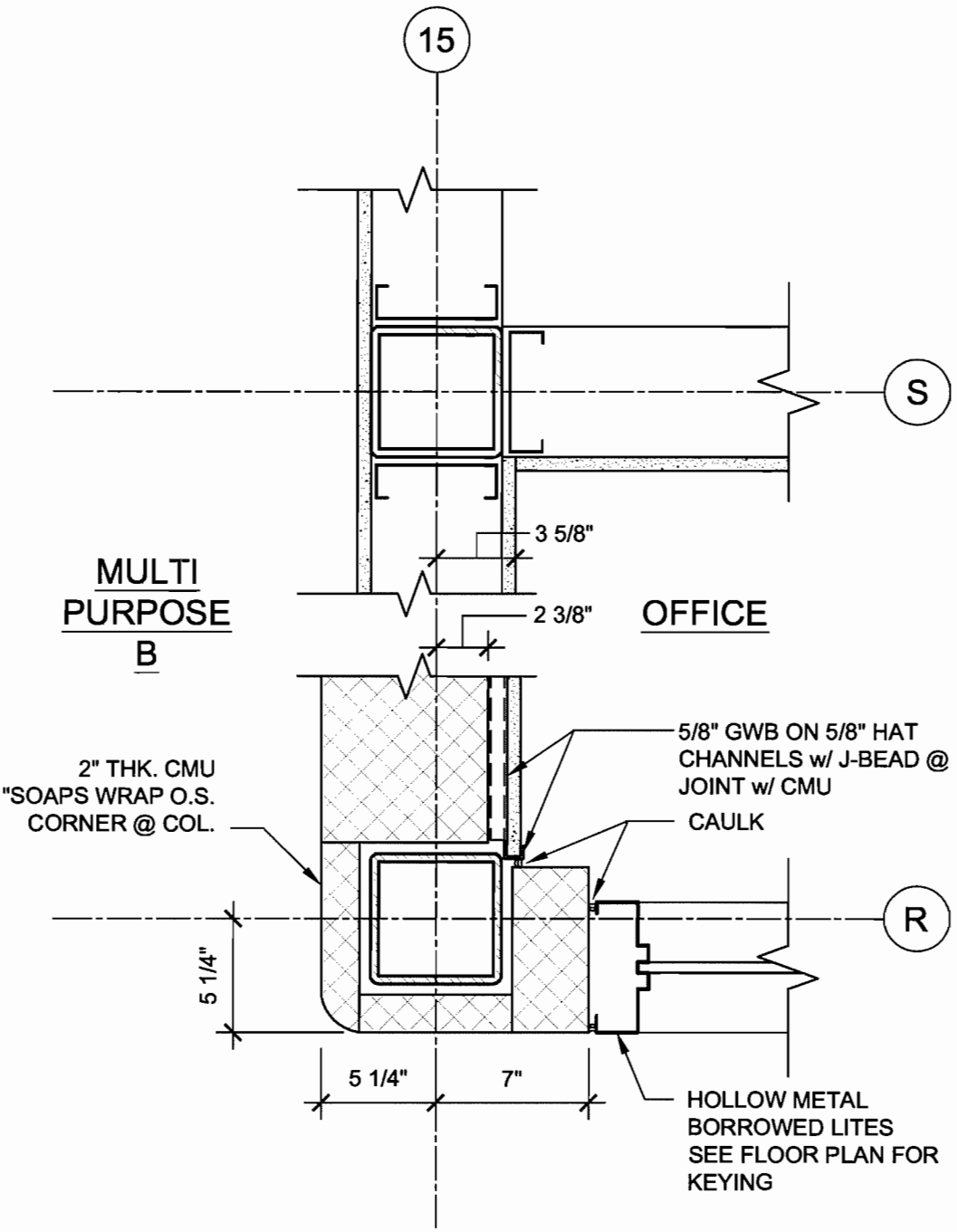

PLAN DETAIL C1/A300 - SCALE: 1:8 (A)

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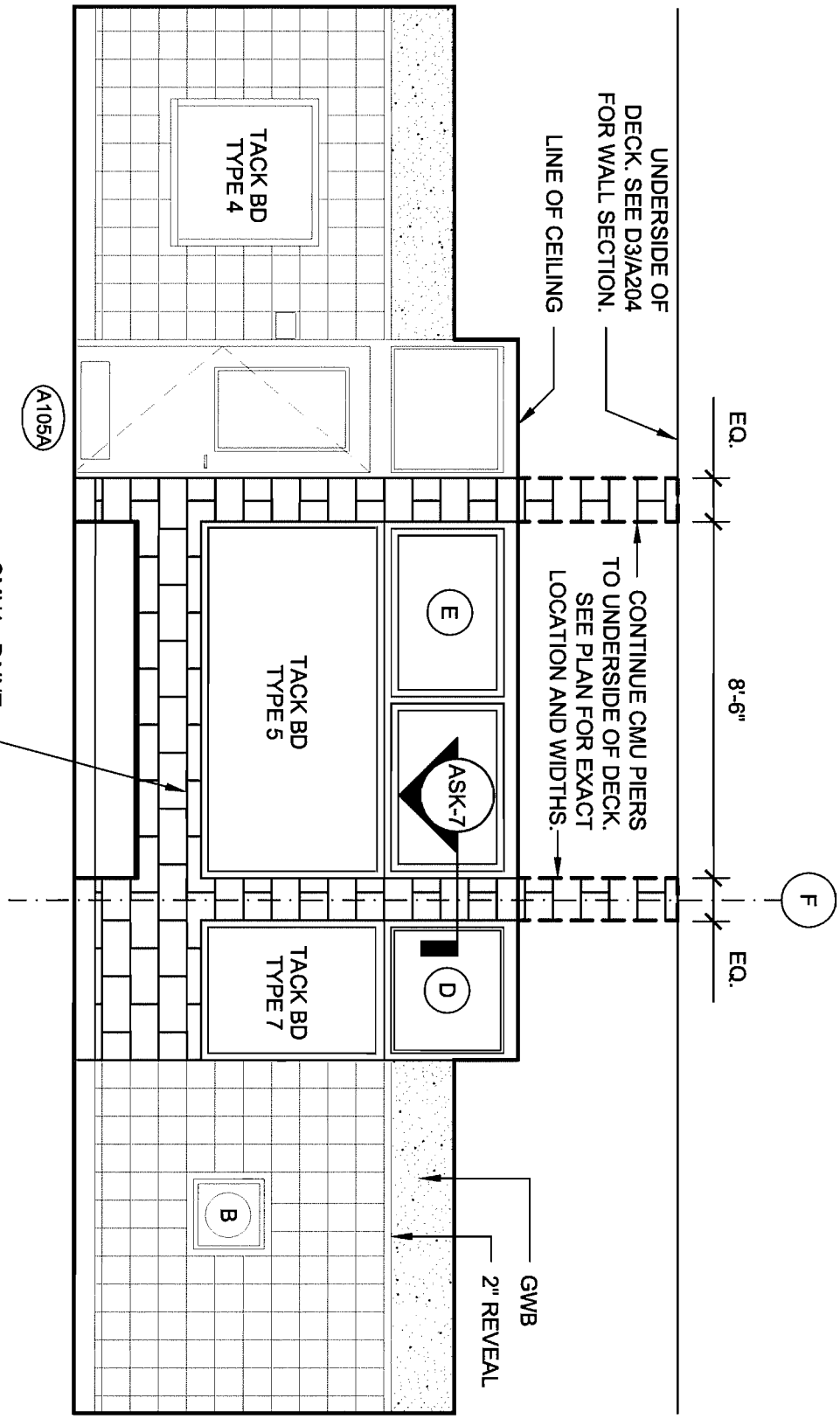
DRAWING NAME:
C1 / A300

DATE:
Issued by:AF
Scale: 1:8
File:0515

SKETCH #
ASK-2



INTERIOR ELEVATION DETAIL - A1/A600 - SCALE: 1/4" = 1'-0" (A)

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DRAWING NAME:
A1/A600

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Scale: 1/4" = 1'-0"
File:0515

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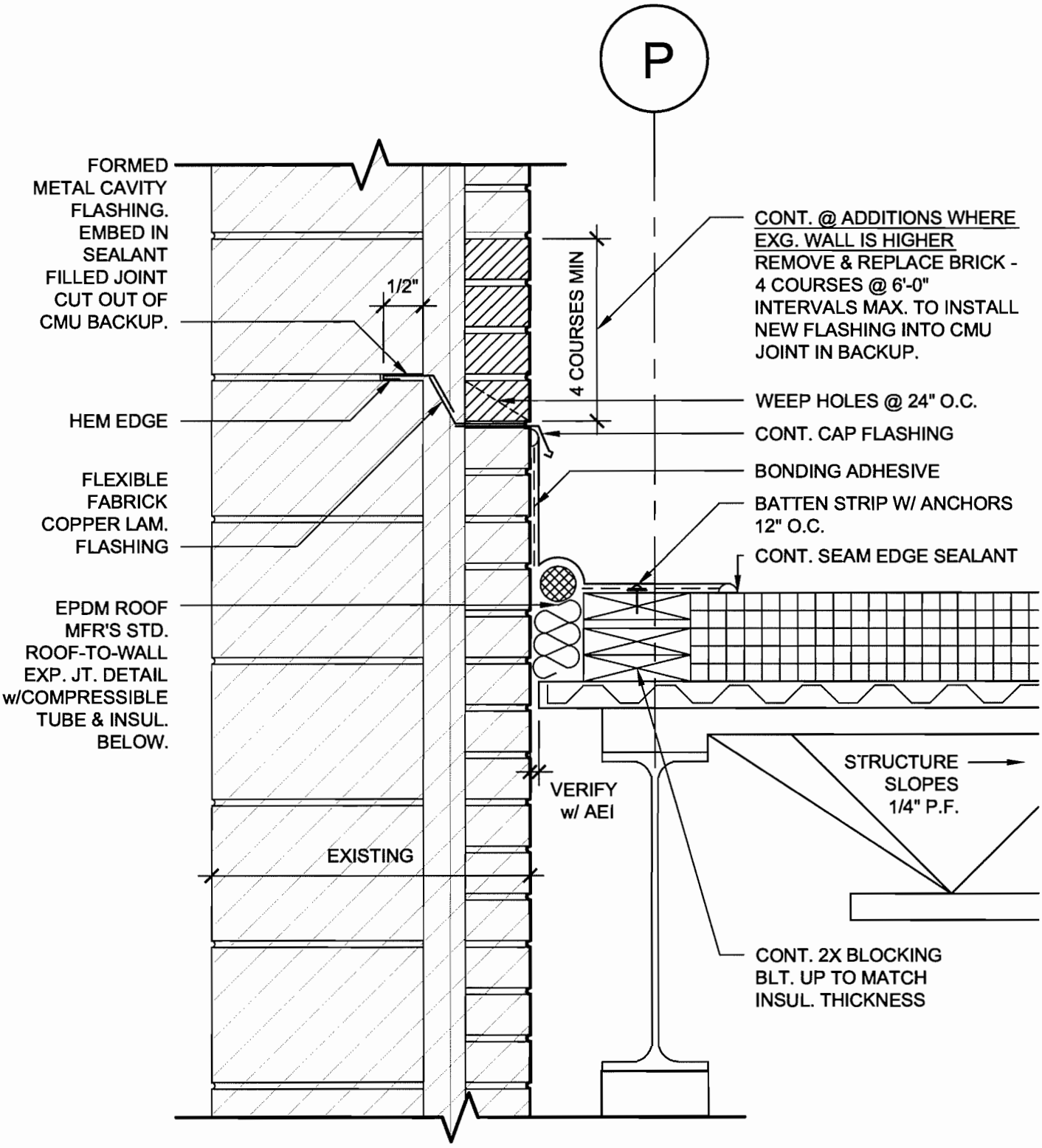

PLAN DETAIL B2/A102 - SCALE: 1:8 (A)

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DRAWING NAME:
B2 / A102

DATE:
Issued by:AF
Scale: 1:8
File:0515

SKETCH #
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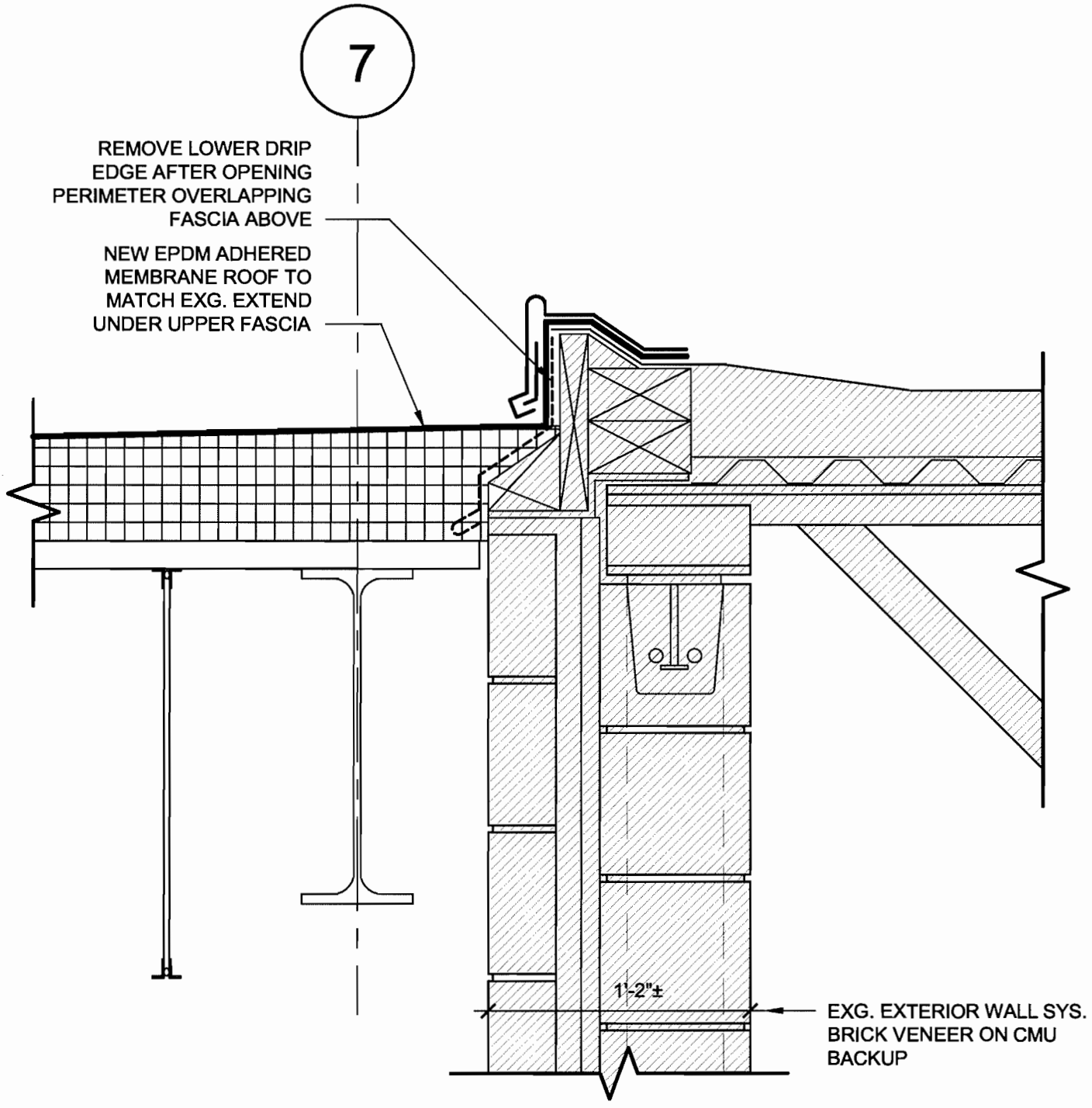

PLAN DETAIL B4/A102 - SCALE: 1:8 (A)

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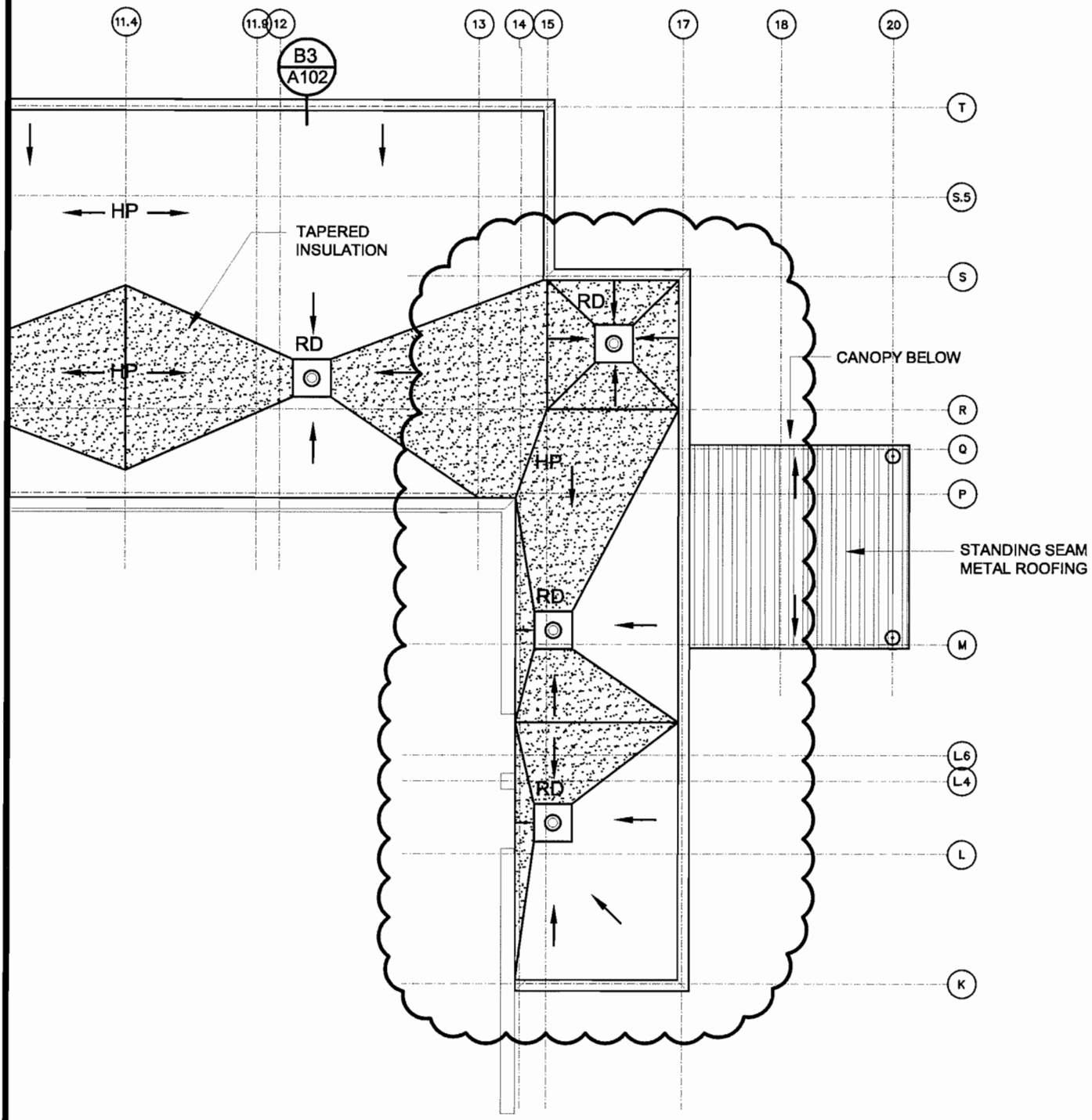
DRAWING NAME:
B4 / A102

DATE:
Issued by:AF
Scale: 1:8
File:0515

SKETCH #
ASK-5



ROOF PLAN D1/A102 - SCALE: 1/16" = 1'-0" (A)

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DRAWING NAME:
D1 / A102

DATE:
Issued by:AF
Scale: 1/16" = 1'-0"
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SKETCH #
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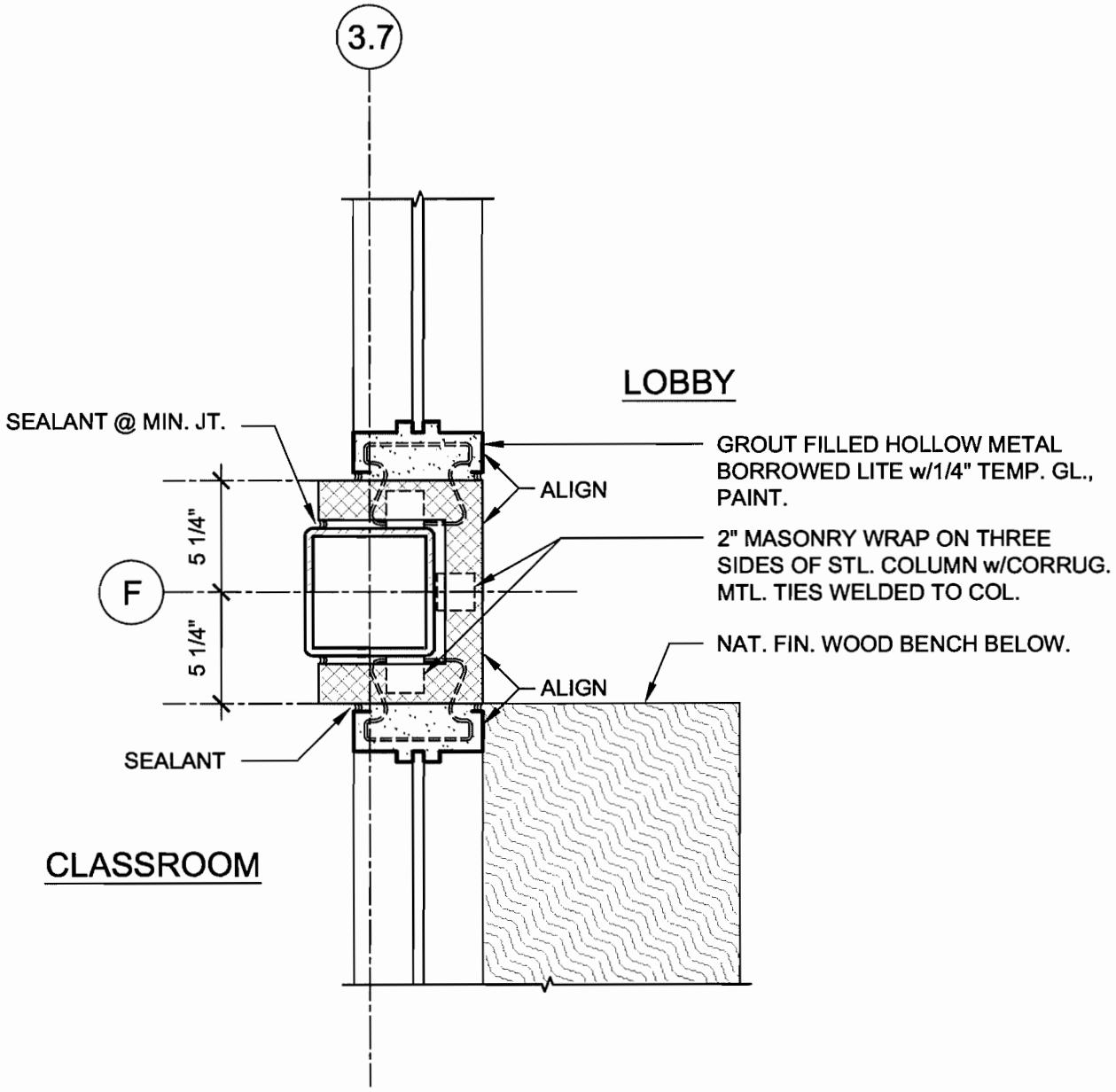

PLAN DETAIL D5/A300 - SCALE: 1:8 (A)

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D5 / A300

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File:0515

SKETCH #
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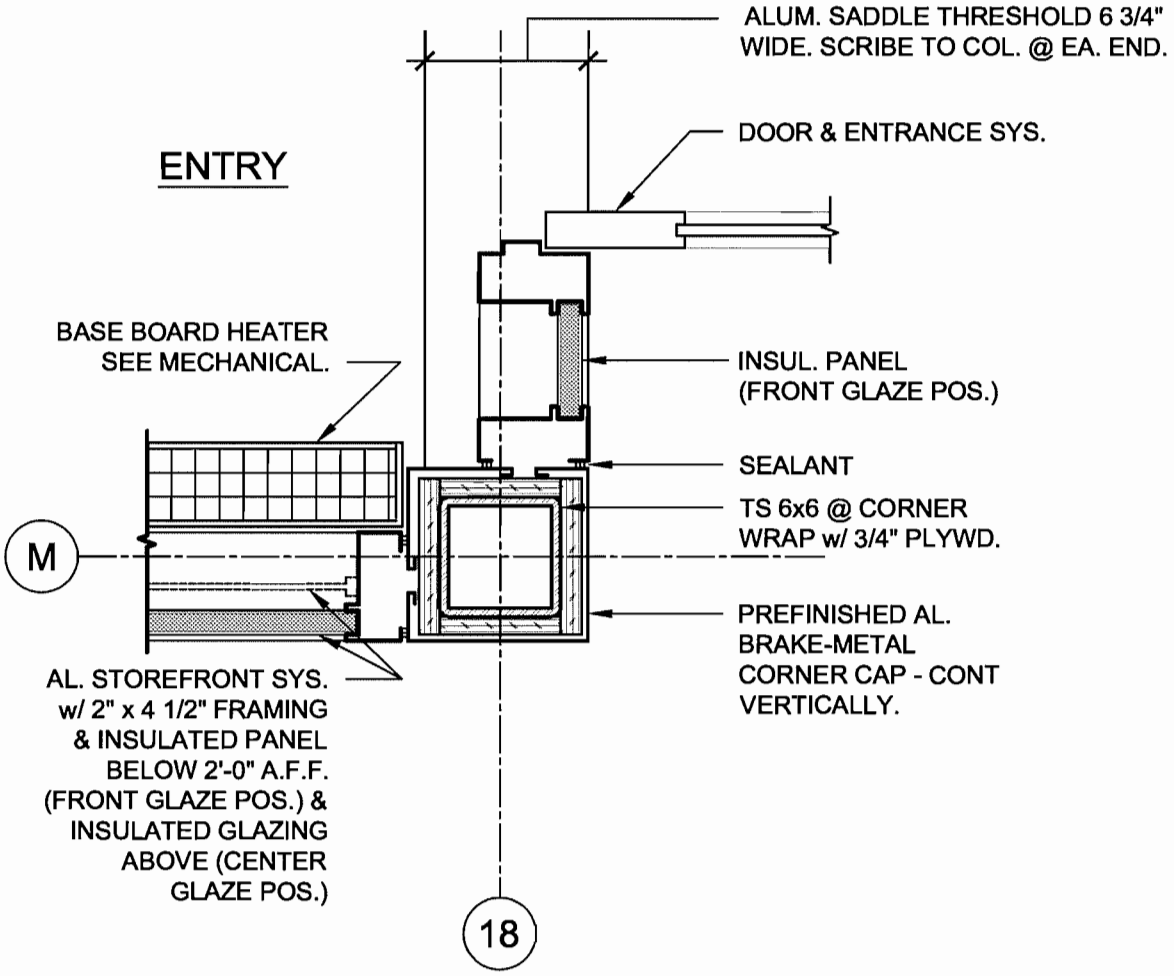

PLAN DETAIL D1/A300 - SCALE: 1:8 (A)

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D1 / A300

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File:0515

SKETCH #
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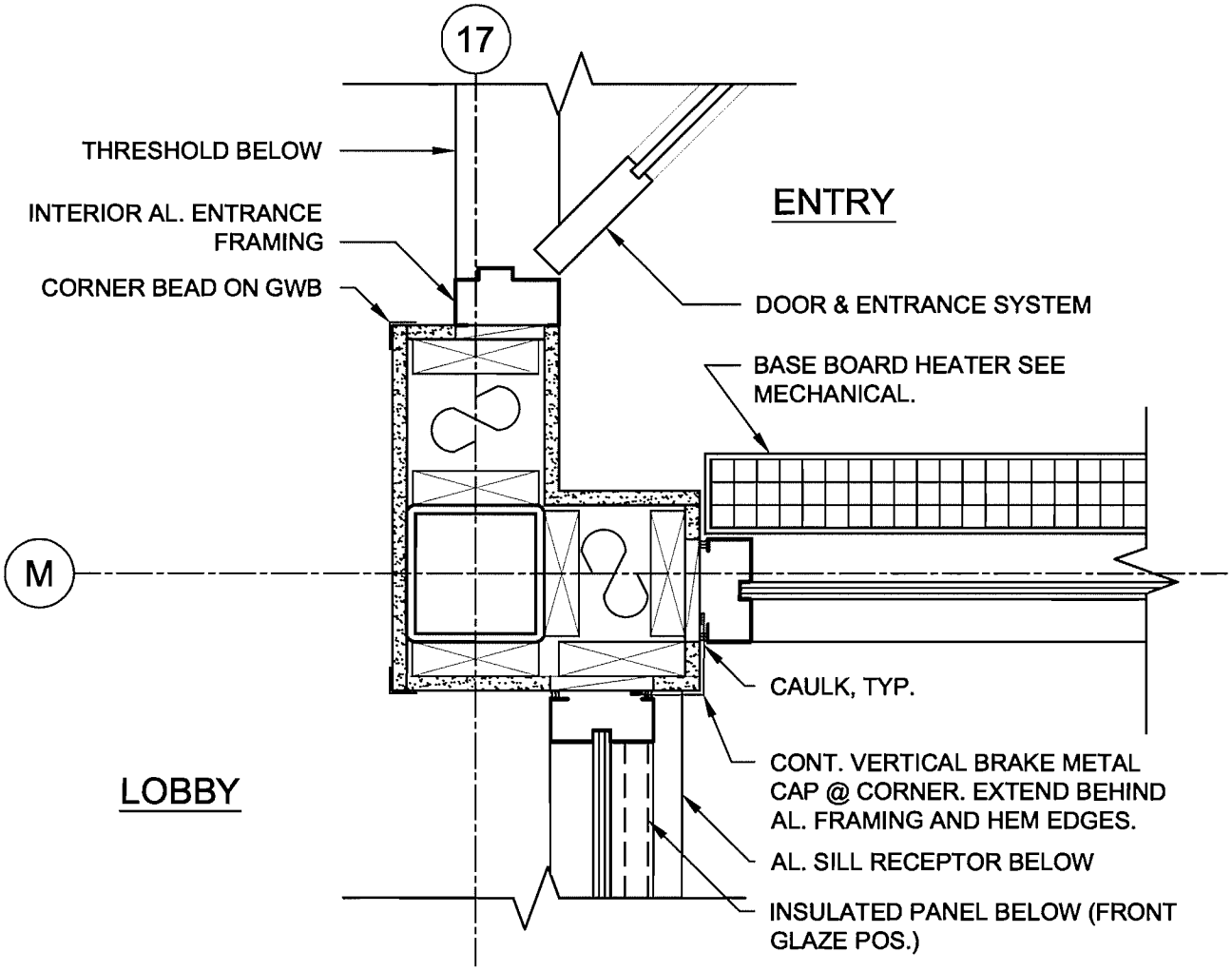

PLAN DETAIL D2/A300 - SCALE: 1:8 (A)

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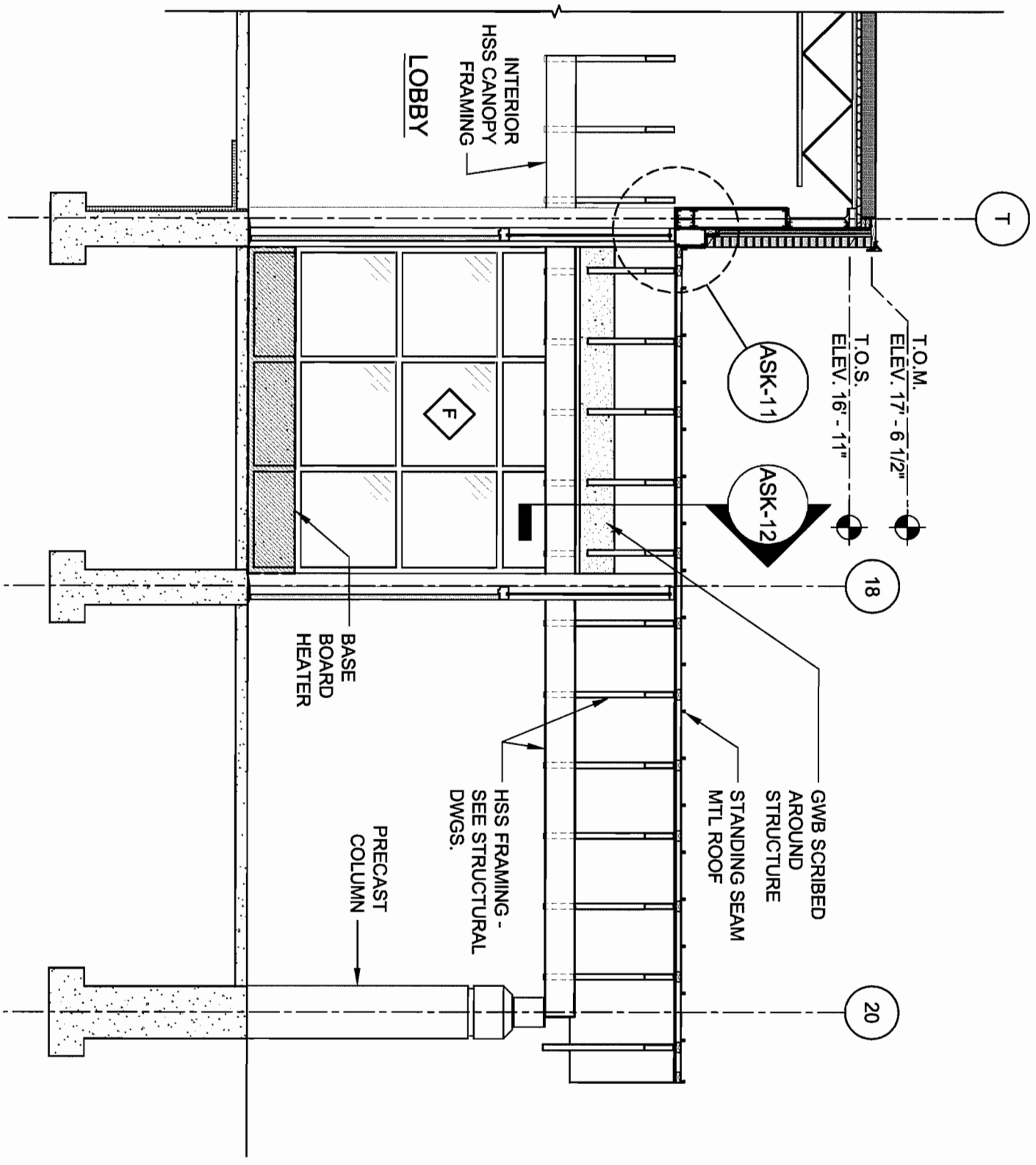
DRAWING NAME:
D2 / A300

DATE:
Issued by:AF
Scale: 1:8
File:0515

SKETCH #
ASK-9



CANOPY SECTION - SCALE: 1/4" = 1'-0" (A)

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CANOPY SECTION

DATE:
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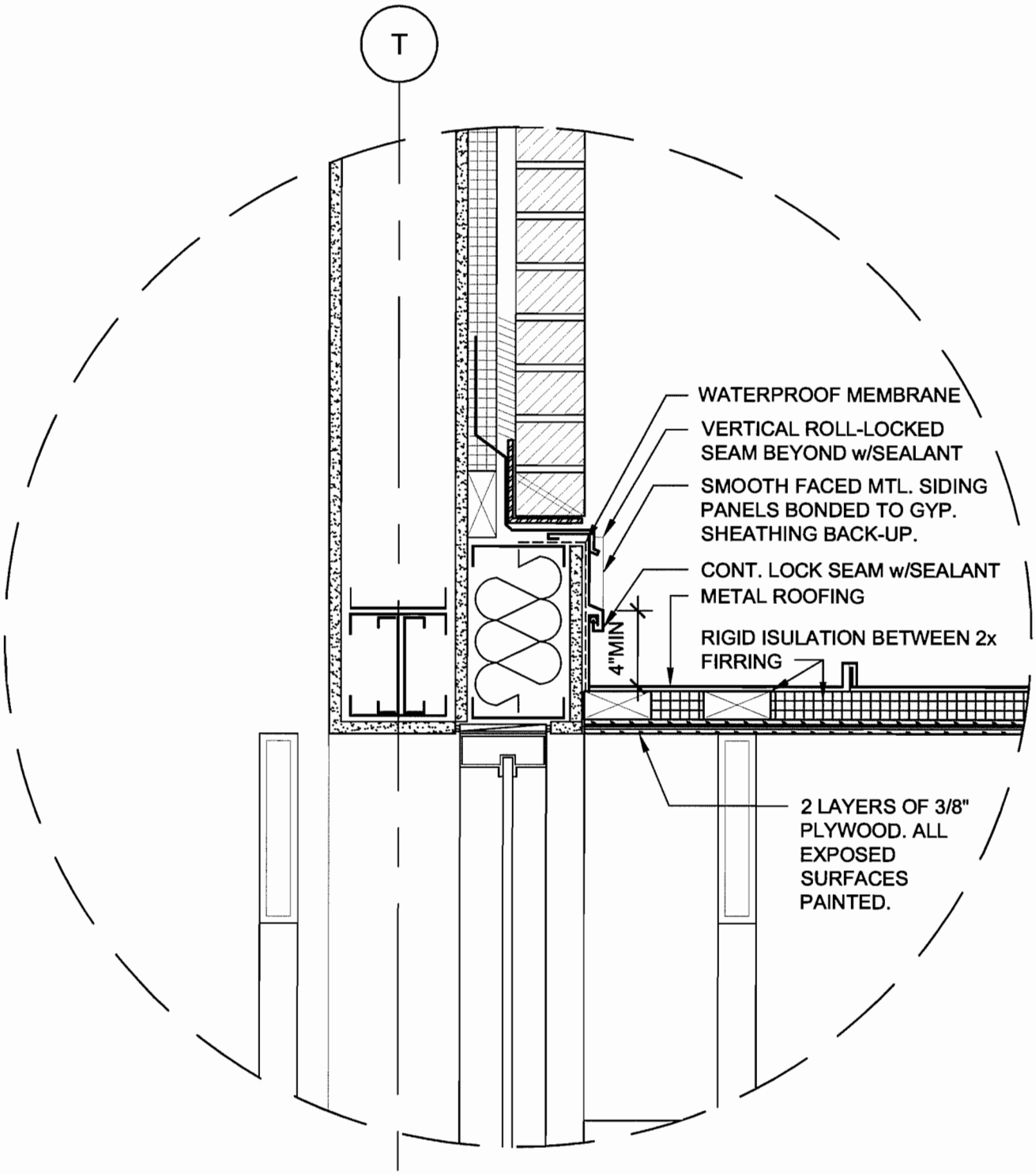
File:0515

SKETCH #
ASK-10



CANOPY CONNECTION DETAIL - SCALE: 1:8 (A)

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DRAWING NAME:
CANOPY CONNECTION DTL.

DATE: 05/25/06
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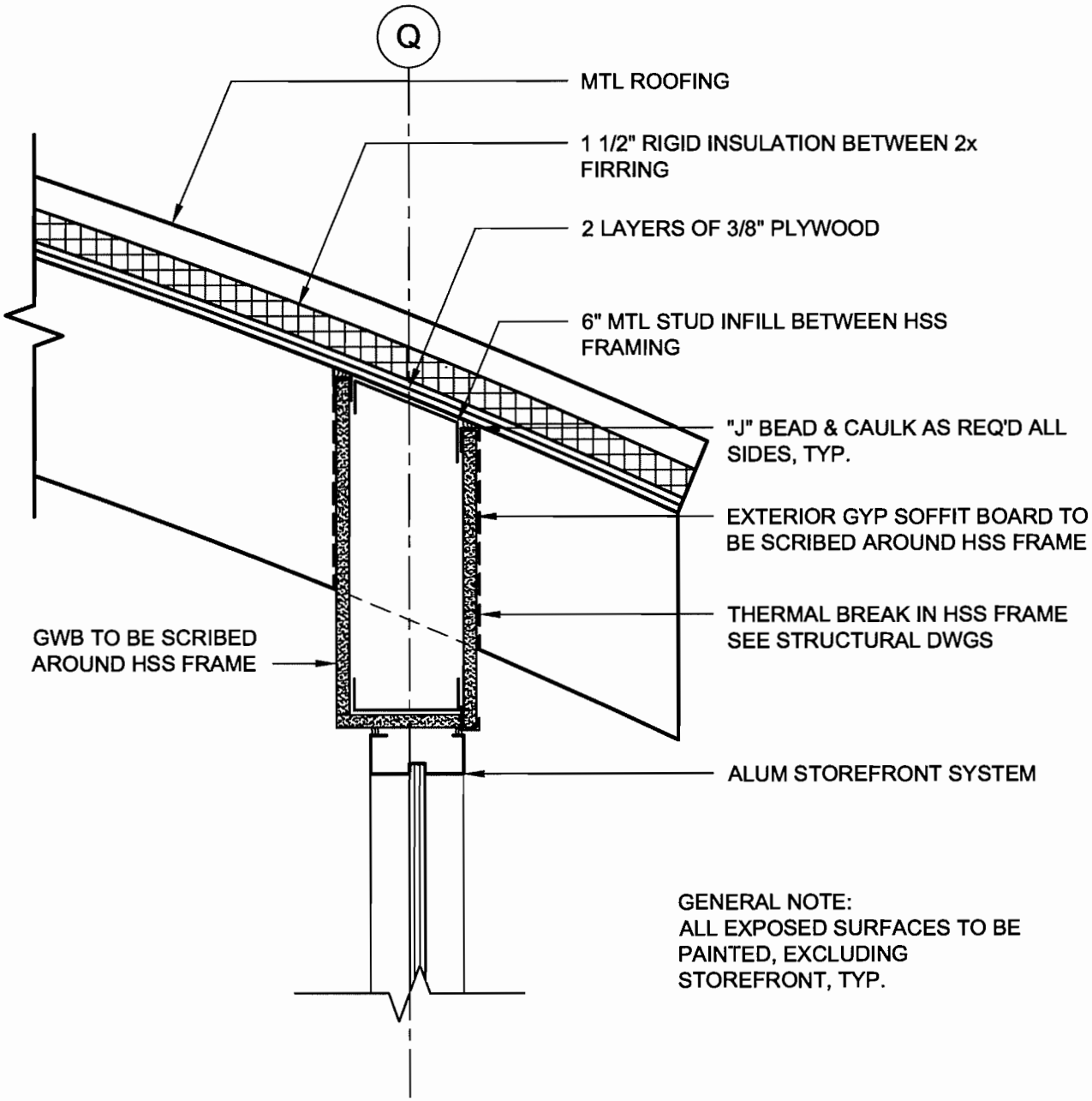
Scale: 1:8
File:0515

SKETCH #
ASK-11



GENERAL NOTE:
ALL EXPOSED SURFACES TO BE PAINTED, EXCLUDING STOREFRONT, TYP.

CANOPY ENVELOPE DETAIL - SCALE: 1:8 (A)

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DRAWING NAME:
CANOPY ENVELOPE DTL.

DATE: 05/25/06
Issued by:AF
Scale: 1:8
File:0515

SKETCH #
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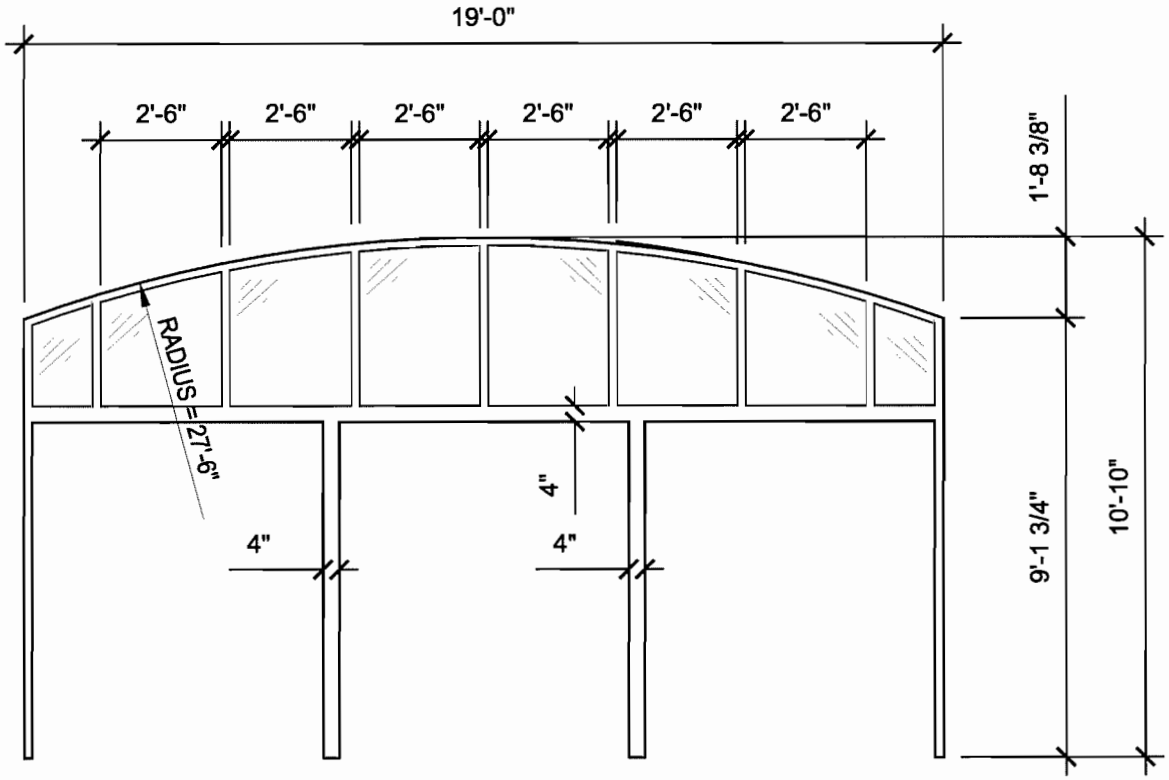
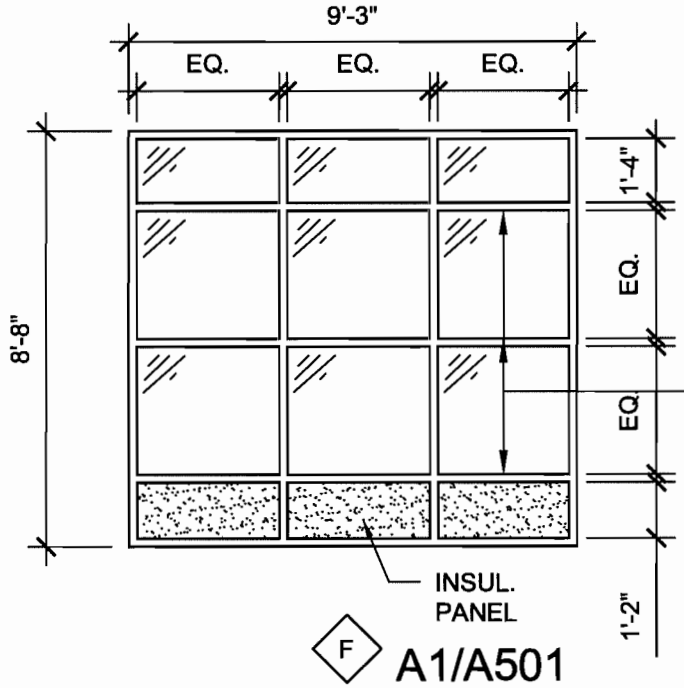


TYPE 10

A1/A500



F A1/A501

FRAME SPACING TO ALIGN WITH STOREFRONT BEYOND, TYP.

GENERAL NOTE:
2" FRAMES UNLESS OTHERWISE NOTED, TYP.

A1/A500 - A1/A501 - SCALE: 1/4" = 1'-0" (A)

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DRAWING NAME:
A1/A500 - A1/A501

DATE: 05/25/06
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Scale: 1/'4"=1'-0"
File:0515

SKETCH #
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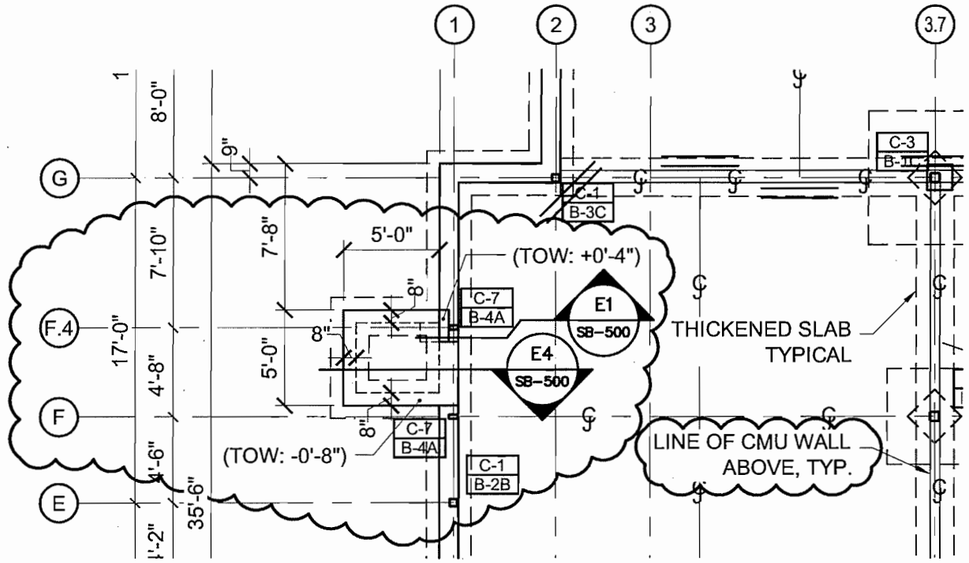
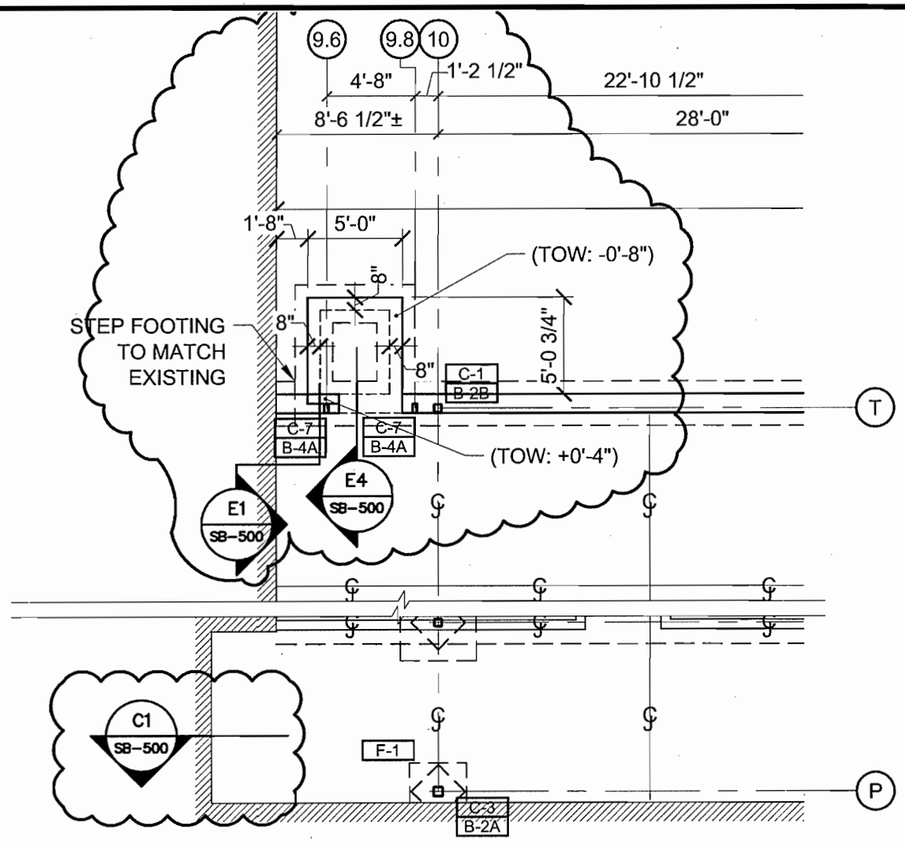
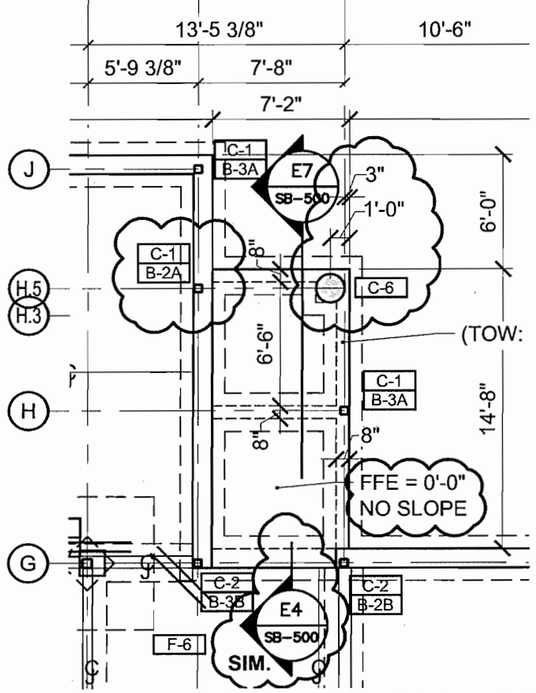
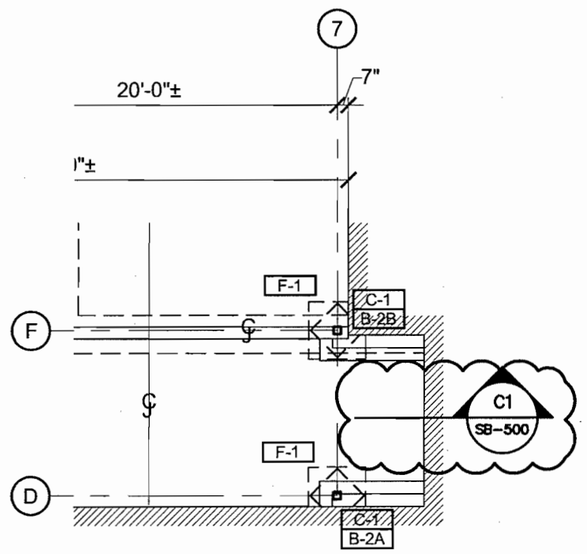


PART PLAN - SECTION A1/SB-100

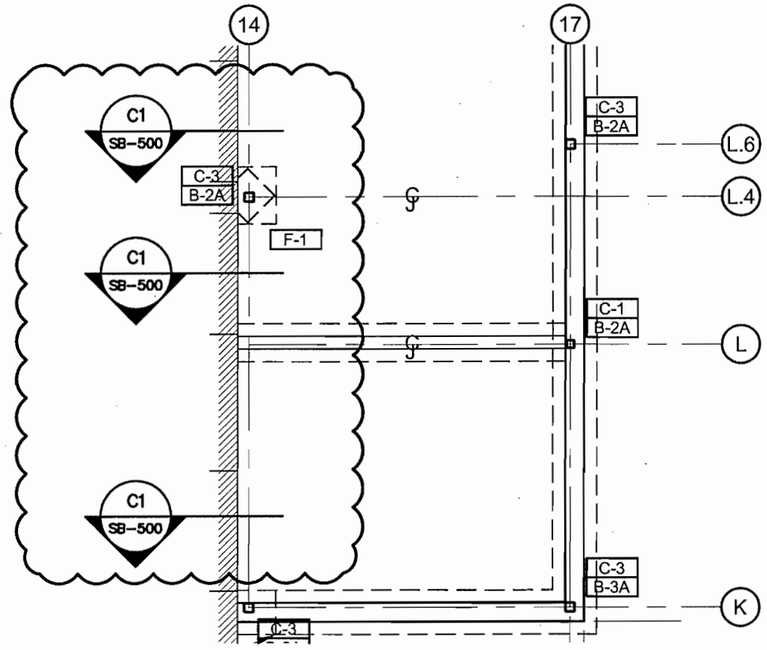


PART PLAN - SECTION D5/SB-100





PART PLANS - SECTION A1/SB-100



PART PLAN - SECTION D5/SB-100

160 Veranda Street
Portland, Maine 04103
T: 207.221.2260
F: 207.221.2266
Web: www.allied-eng.com

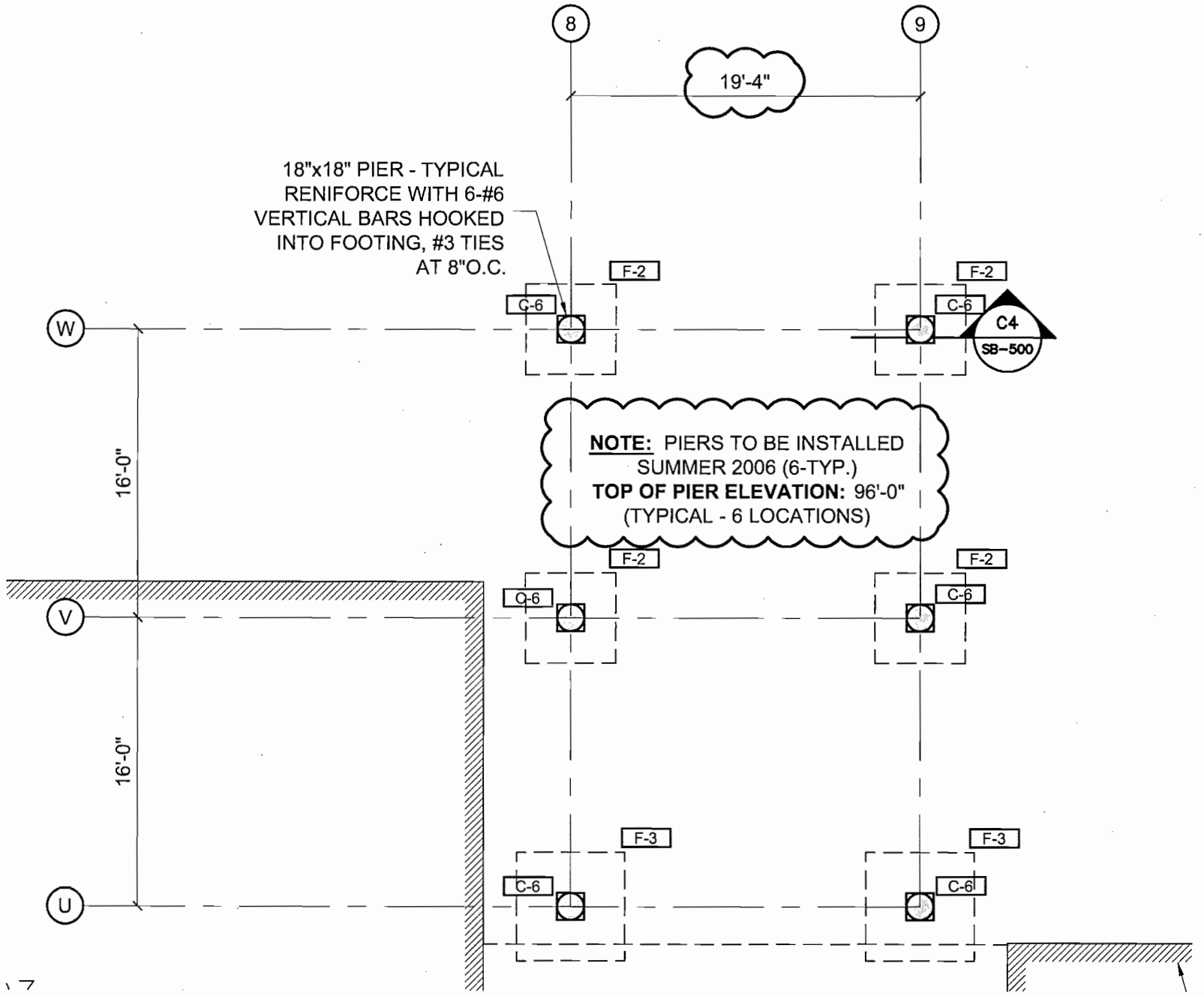
Allied Engineering
Structural Mechanical Electrical Commissioning

FOUNDATION PART PLANS

RIVERTON EXPANSION AND
RENOVATION PROJECT
1600 FOREST AVE., PORTLAND, MAINE 04103

Scale: 1/8"=1'-0" | Date: 05-23-2006 | Project No: 06014 | Cad File: 06014SB.dwg

SKS-01



PART PLAN - SECTION F1/SB-100

Allied Engineering
Structural Mechanical Electrical Commissioning
160 Veranda Street
Portland, Maine 04103
T: 207.221.2260
F: 207.221.2266
Web: www.allied-eng.com

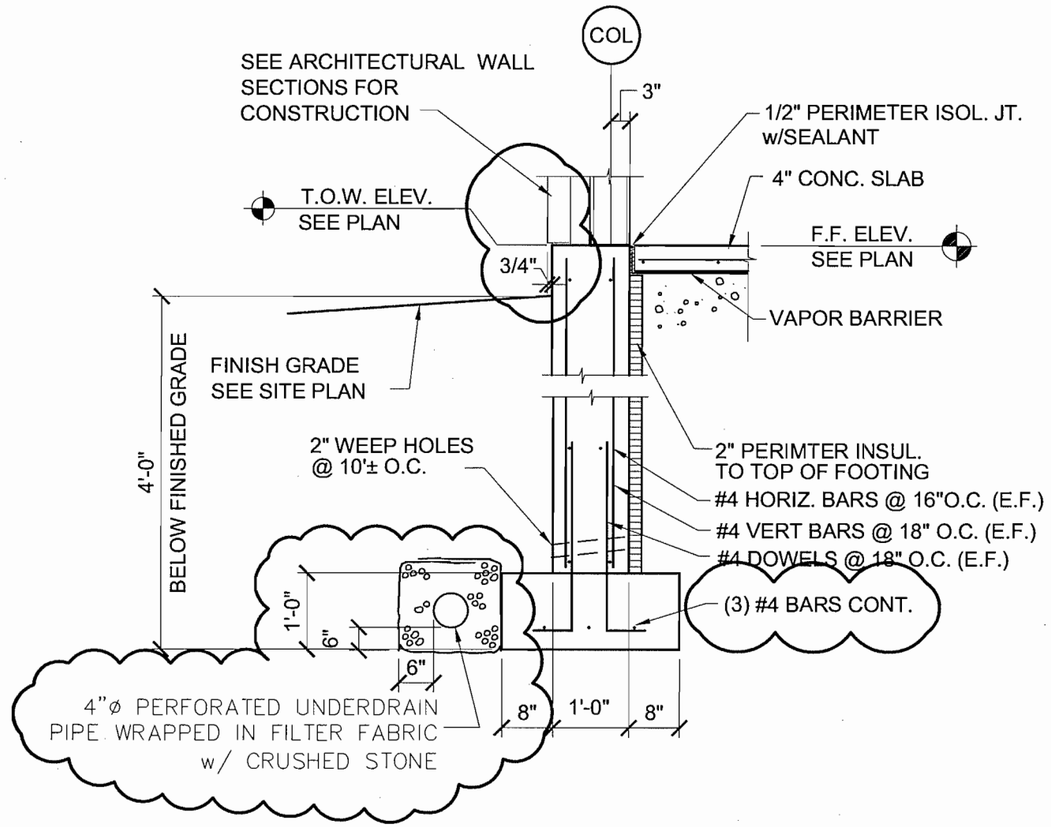
FOUNDATION PART PLAN

RIVERTON EXPANSION AND RENOVATION PROJECT
1600 FOREST AVE., PORTLAND, MAINE 04103

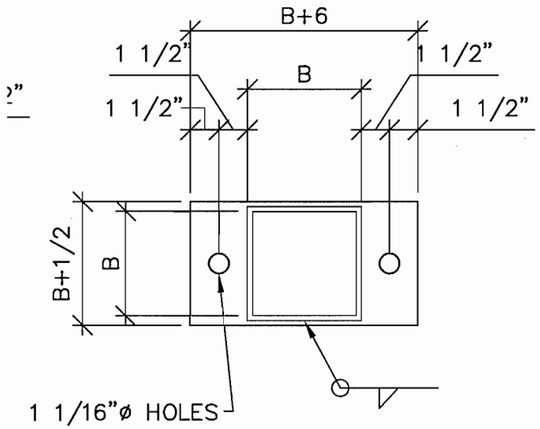
Scale: 1/8" = 1'-0" | Project No: 06014

Date: 05-23-2006 | CAD File: 06014SB.dwg

SKS-02



REVISED SECTION A5/SB-100



TYPE "4" BASE PLATE

ADDED BASE PLATE TYPE

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REVISED/ADDED DETAILS

RIVERTON EXPANSION AND RENOVATION PROJECT
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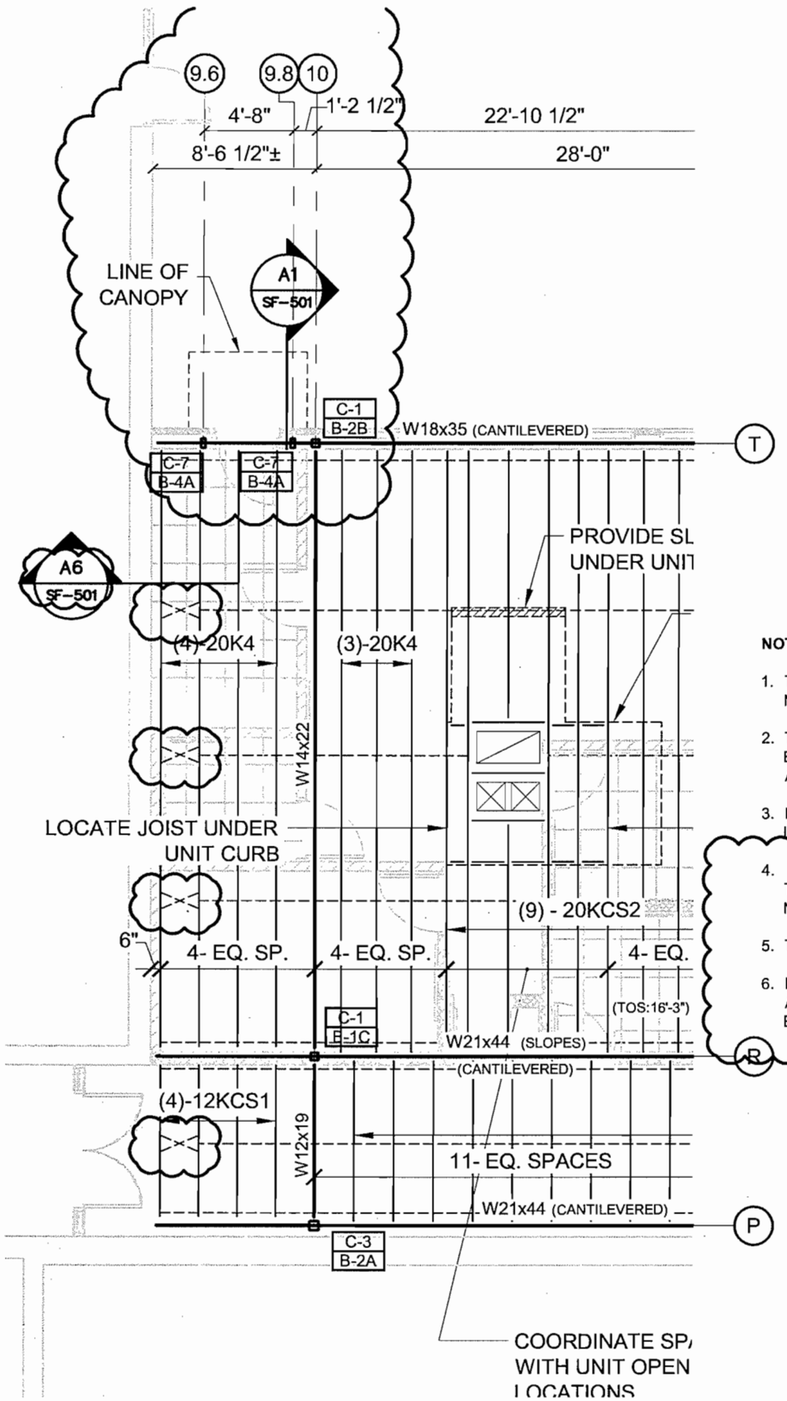
Scale: NONE | Date: 05-23-2006 | Project No: 06014 | Cad File: 06014SB.dwg

SKS-03

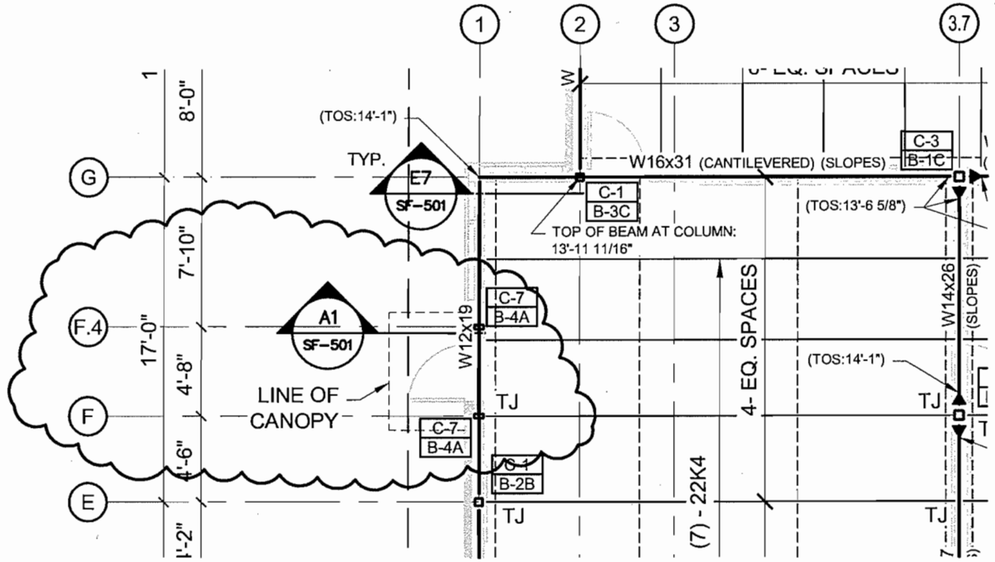


PART PLAN - SECTION D5/SF-100

NOTES:

1. TOP OF STEEL (TOS) = 16'-11" UNLESS OTHERWISE NOTED.
2. TOP OF STEEL REFERS TO BEAMS SUPPORTING JOISTS. BEAMS PARALLEL TO JOIST TO BE (+2 1/2") FROM ADJACENT TOP OF STEEL ELEVATION - UNLESS NOTED.
3. REFER TO ARCHITECTURAL FOR ROOF DRAIN LOCATIONS.
4. >< INDICATES CROSS BRIDGING BETWEEN LAST TWO JOISTS ADJACENT TO (E) WALL. BRIDGING DOES NOT CONNECT TO (E) WALL.
5. TJ = TIE-JOIST.
6. REFER TO TYPICAL OPENING IN ROOF DECK DETAIL FOR ALL APPLICABLE ROOF PENETRATIONS LOCATED IN EXISTING RENOVATED AREAS AND NEW ROOF.

REVISED NOTES FOR SECTION D5/SF-100



PART PLAN - SECTION A1/SF-100

PART PLAN - SECTION A1/SF-100

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ROOF FRAMING PART PLANS

RIVERTON EXPANSION AND RENOVATION PROJECT
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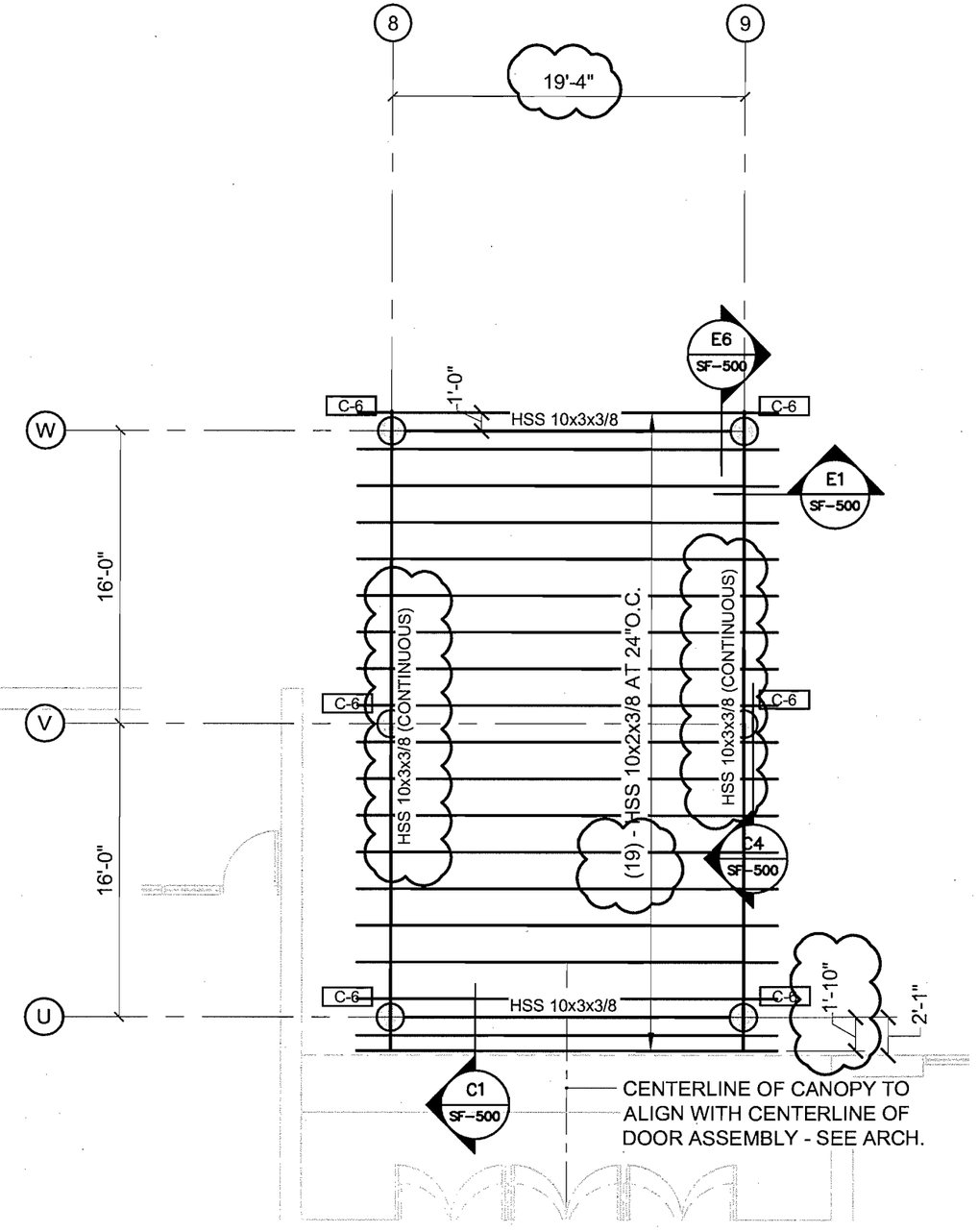
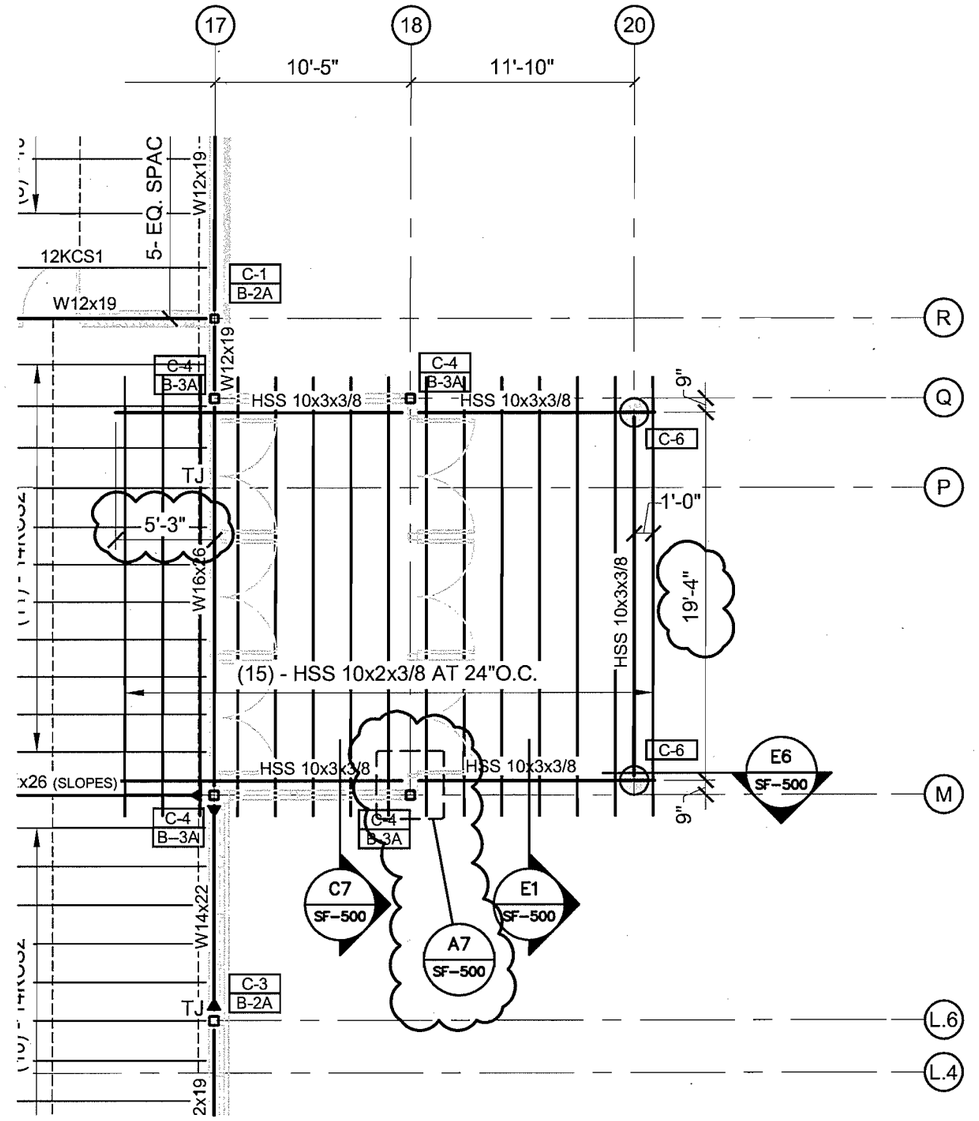
Scale: 1/8"=1'-0" | Date: 05-23-2006 | Project No: 06014 | Cad File: 06014SF-ROOF.dwg

SKS-04



PART PLAN - SECTION F1/SF-100



PART PLAN - SECTION D5/SF-100

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ROOF FRAMING PART PLANS

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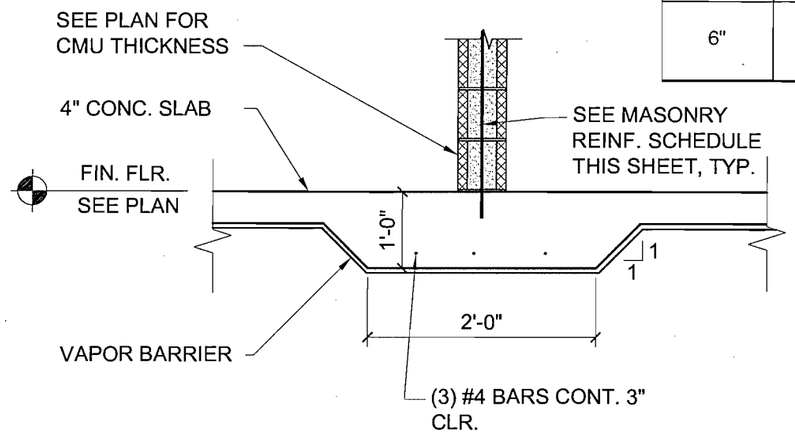
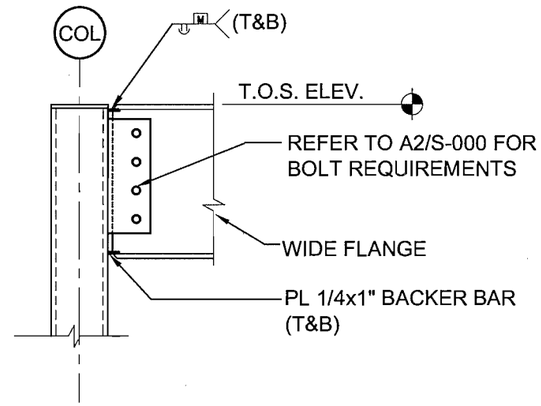
SKS-05

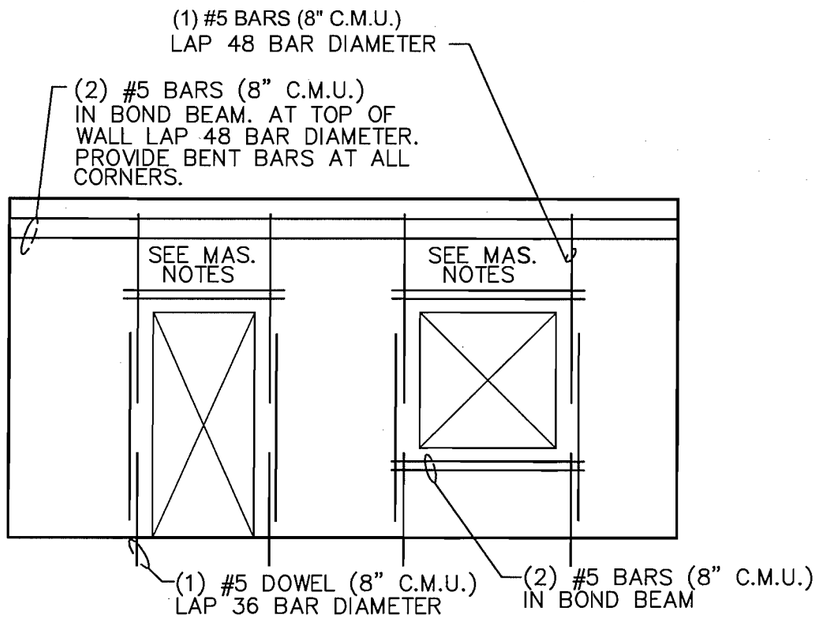
MASONRY REINFORCING SCHEDULE				
CMU SIZE	VERT. REINF.	HORIZ. REINF.	DOWELS	TOP OF WALL BRACING
8"	#4@32"	#4 JOINT REINFORCING @ 16"O.C. PROVIDE MASONRY COLUMN TIE AT EACH COLUMN AT HORIZ. REINF. LEVEL	#4 @ 32"O.C. DRILL AND DROP ROD IN 4" DEEP HOLE - NO EPOXY	AT STEEL (DETAIL C1/SF-501) MAINTAIN MIN. 2" GAP TO UNDERSIDE OF STEEL BEAM FLANGE
6"	#3@16"	#4 JOINT REINFORCING @ 16"O.C. PROVIDE MASONRY COLUMN TIE AT EACH COLUMN AT HORIZ. REINF. LEVEL	#3 @ 16"O.C. DRILL AND DROP ROD IN 3" DEEP HOLE - NO EPOXY	NONE



REVISED SECTION C5/S-000



TYPICAL MOMENT FRAMED DETAIL



CMU - BOND BEAM, WALL OPENING & END OF WALL REINF.

NOTES:

1. PROVIDE VERTICAL REINFORCING AT EACH SIDE OF EACH OPENING, w/IN 16" OF ENDS OF WALLS.
2. PROVIDE HORIZONTAL REINFORCING AT TOP AND BOTTOM OF WALL OPENINGS AND CONTINUOUSLY AT STRUCTURALLY CONNECTED ROOF AND FLOOR LEVELS AND AT THE TOP OF WALLS.
3. FILL ALL CORES TO RECEIVE REINFORCING WITH 3000 psi CONCRETE.
4. PROVIDE 48 BAR DIAMETER SPLICES IN ALL MASONRY WALLS. PROVIDE 36 BAR DIAMETER BAR EMBEDMENT IN ALL CONCRETE WALLS.

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MISC. DETAILS

RIVERTON EXPANSION AND RENOVATION PROJECT
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Cad File: 06014S0.dwg
Project No: 06014
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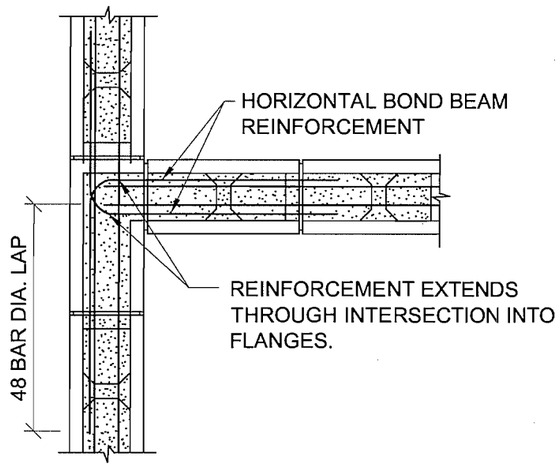
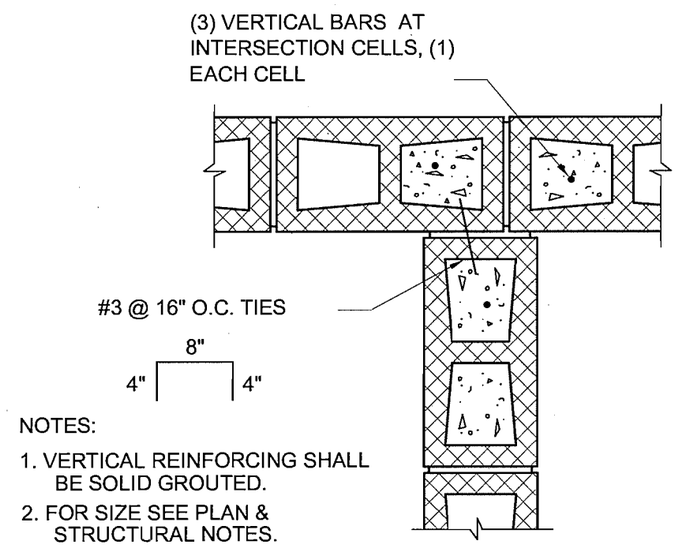
SKS-06



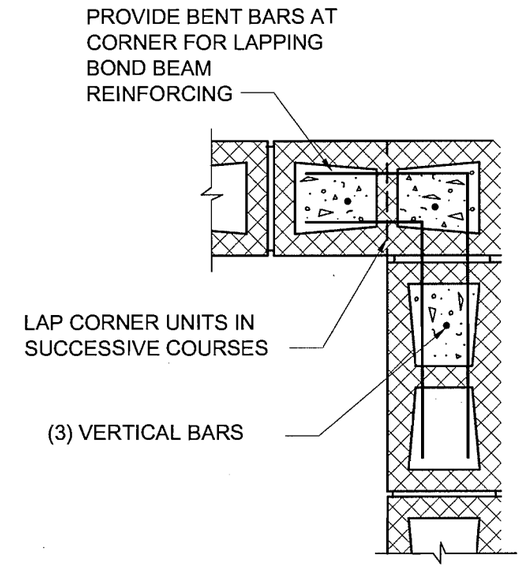
TYPICAL BOND BEAM @ WALL INTERSECTION



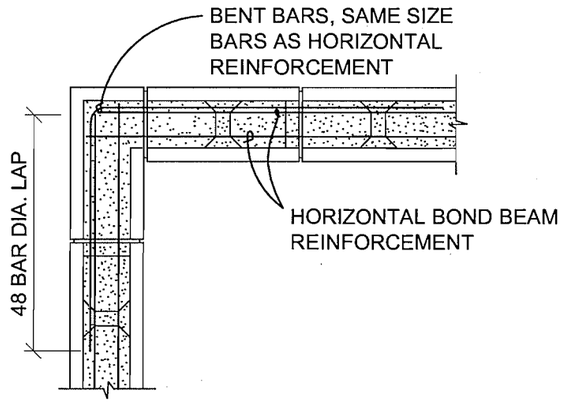
NOTES:

1. VERTICAL REINFORCING SHALL BE SOLID GROUTED.
2. FOR SIZE SEE PLAN & STRUCTURAL NOTES.

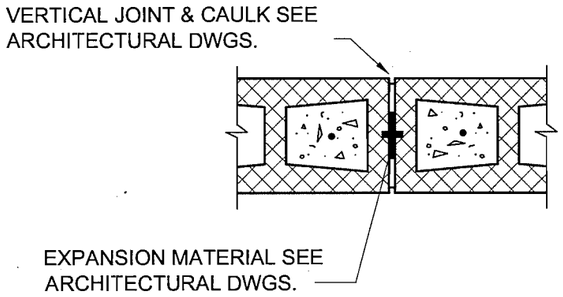
INTERSECTION



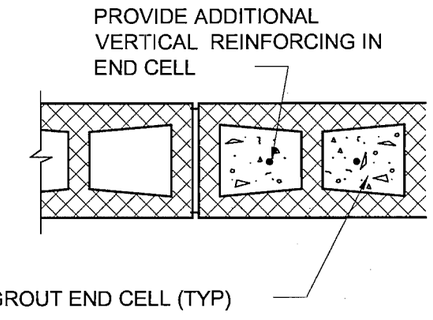
CORNERS



TYPICAL BOND BEAM @ CORNER



CONTROL JOINT



JAMB & WALL ENDS

TYPICAL CMU REINFORCING DETAILS

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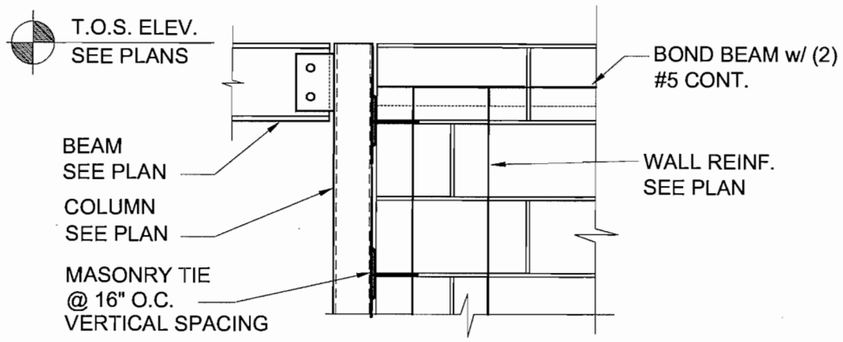
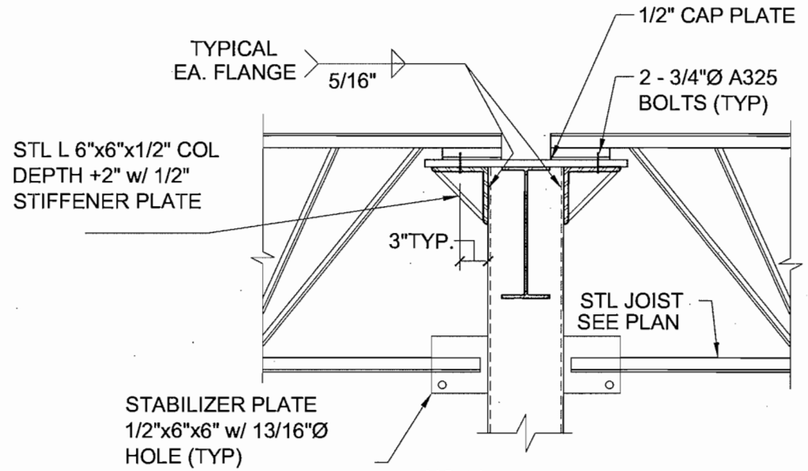
SKS-07



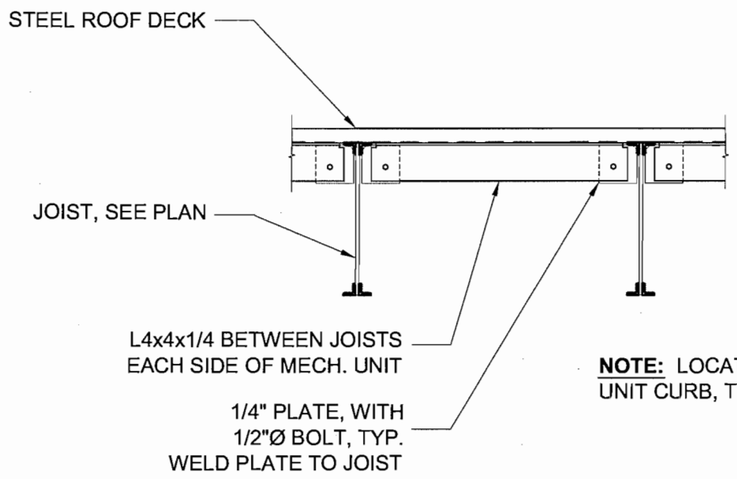
MASONRY TIES PURCHASED BY DIV. 4, INSTALLED BY DIV. 5.

TYPICAL CMU WALL TO COLUMN DETAIL



NOTE:
DO NOT WELD BOTTOM CHORD
TO STABILIZER PLATE

TYPICAL TIE-JOIST CONNECTION DETAIL



NOTE: LOCATE ANGLES UNDER UNIT CURB, TYP.

TYPICAL MECHANICAL CURB SUPPORT DETAIL

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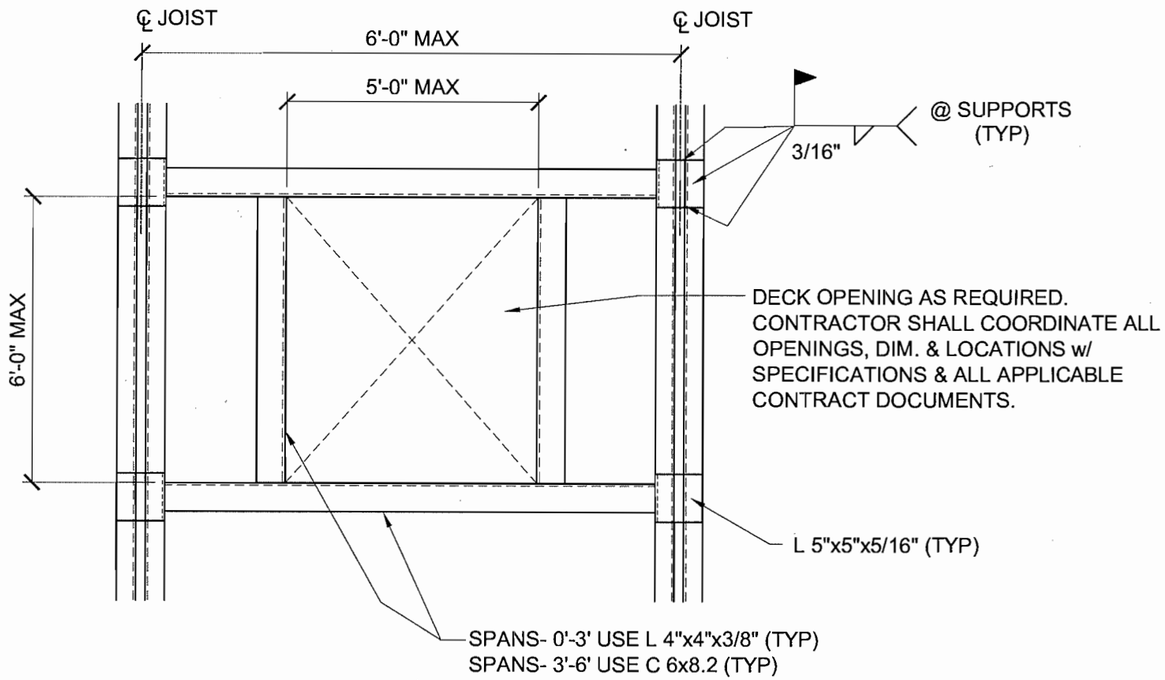
Date: 05-23-2006 | Project No: 06014 | Cad File: 06014SD.dwg

Scale: NONE

SKS-08



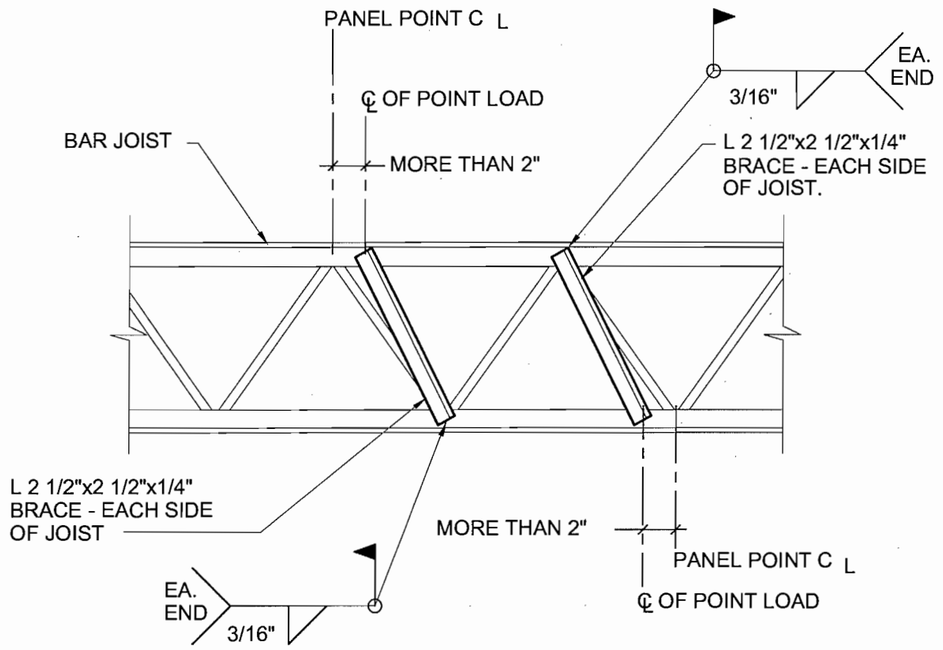
NOTES:

1. 1,2,3, OR 4 SIDED FRAMES MAY BE USED AS REQUIRED. ALSO, LOOSE INTERIOR MEMBERS MAY BE USED FOR ADDED ADJUSTMENT.
2. FRAME NOT REQUIRED FOR ROUND OPENINGS LESS THAN 12"ø

TYPICAL OPENING IN ROOF DECK DETAIL (UNO)

NOTE:
1. JOIST REINFORCEMENT REQUIRED WHEN POINT LOAD EXCEEDS 200 LBS.

2. BENEATH MECH. CURBS, PROVIDE JOIST REINF. AT JOIST PANEL JOINTS. WHEN CURBS ARE OFFSET FROM PANEL BY MORE THAN 2", REINF. JOIST AS DETAILED ABOVE.



TYPICAL FIELD MODIFICATION FOR POINT LOAD > 200

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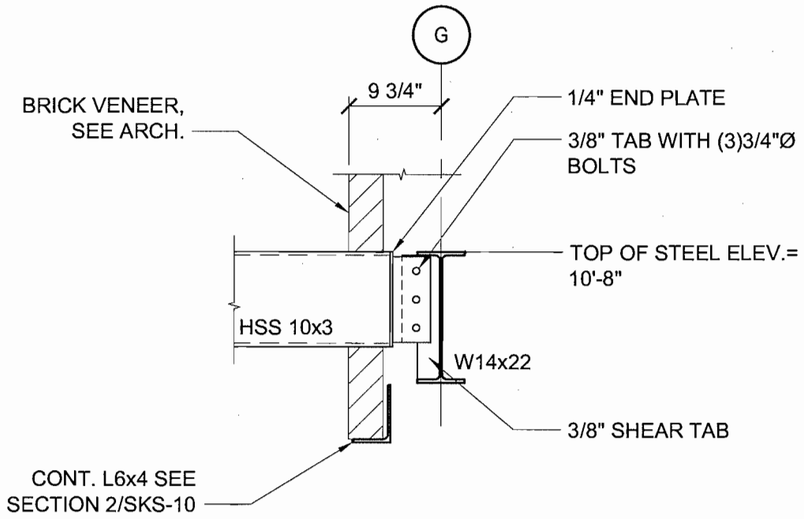
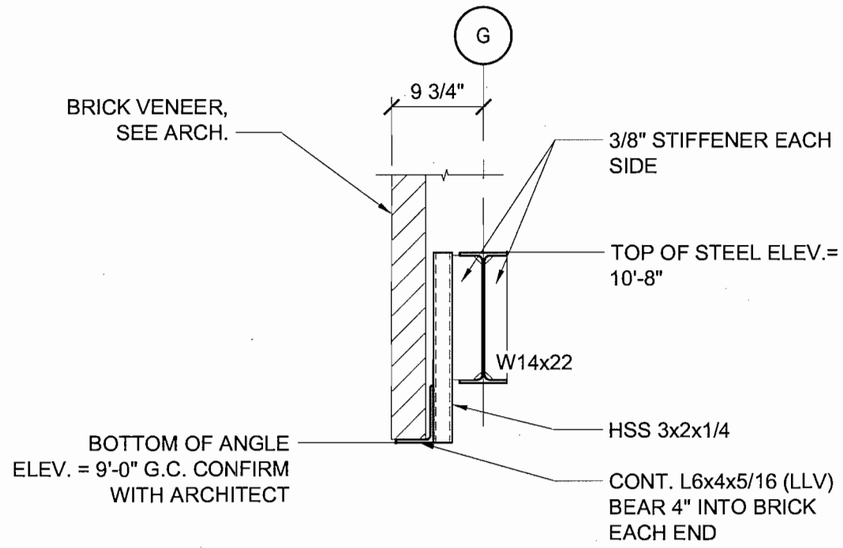
SKS-09



DETAIL - 1



TYPICAL BRICK SUPPORT OVER DOORWAY
PROVIDE HSS 3x2 CONNECTION AT EACH END
AND MID-BEAM

DETAIL - 2

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DETAIL 1 AND 2 (REFER TO SKS-04)

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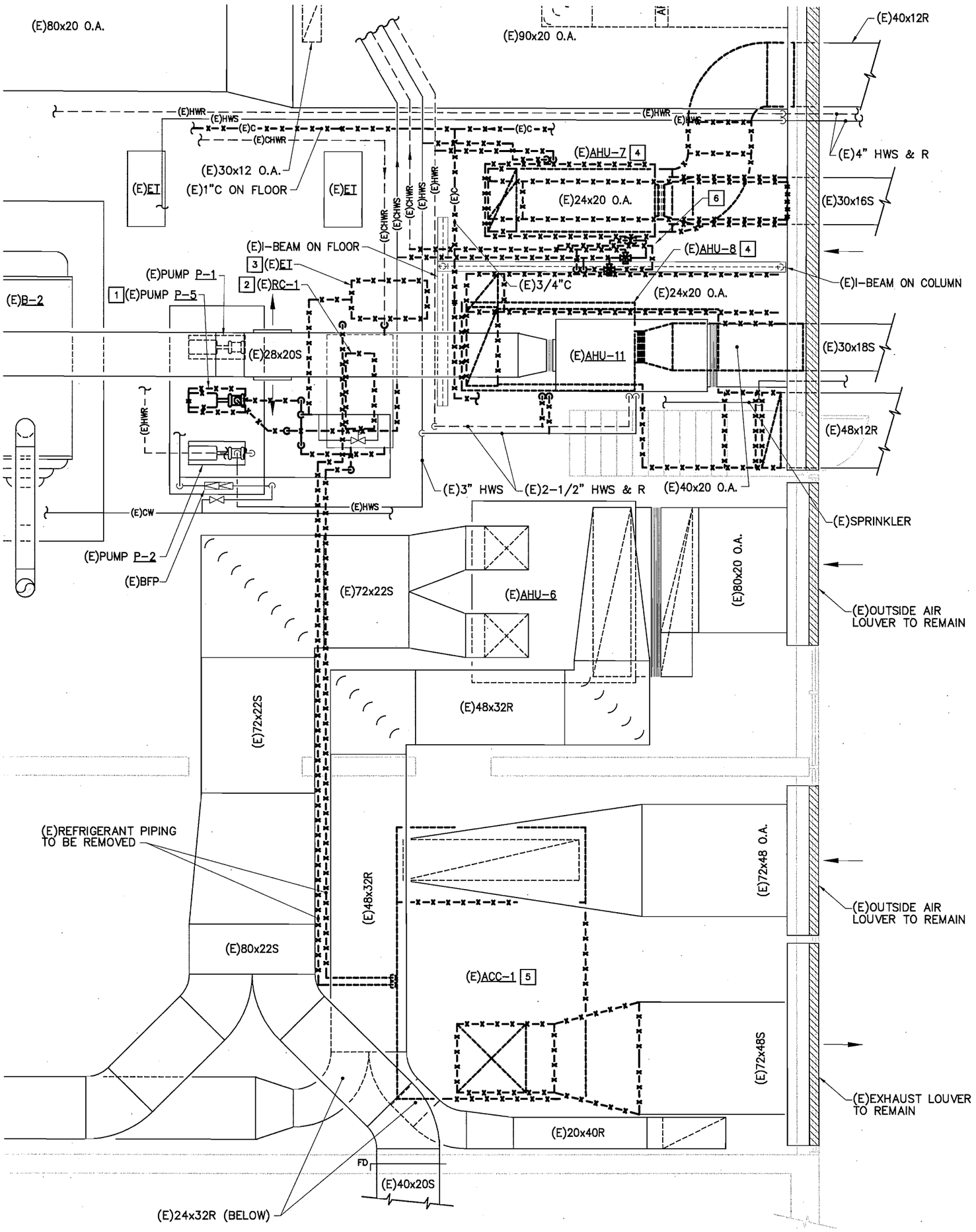
Scale: 1/8"=1'-0" | Date: 05-23-2006 | Project No: 06014 | Cad File: 06014SF-ROOF.dwg

SKS-10



BID ALTERNATE No. 3 DEMOLITION KEYED NOTES:

1. REMOVE (E)PUMP AND ALL ASSOCIATED PIPING COMPLETE.
2. REMOVE (E)CHILLER AND ALL ASSOCIATED PIPING AND CONTROLS COMPLETE. (E)CONCRETE HOUSEKEEPING PAD TO REMAIN.
3. REMOVE (E)EXPANSION TANK AND ALL ASSOCIATED PIPING BACK TO (E)CHWR MAIN. CAPTURE AND REMOVE REFRIGERANT IN ACCORDANCE WITH ALL LOCAL, STATE AND FEDERAL LAWS.
4. REMOVE (E)AHU-7 & 8 COMPLETE W/OUTSIDE AIR TO O.A. PLENUM, AND SUPPLY/RETURN DUCTS TO POINTS AS INIDICATED. REMOVE (E)AHU SUPPORTS AND HANGERS.
5. REMOVE (E)ACC-1 COMPLETE WITH CONTROLS AND REFR-IGERATION PIPING. PREMOVE (E)O.A. DUCT AT (E)DUCT FLEX CONNECTION ON DROP TO UNIT.
6. REMOVE (E)CHWS & R PIPING COMPLETE WITH HANGERS, VALVES, AND CONTROLS.

REVISED DEMOLITION PART PLAN ~ A1 - SHEET MD-400

SKM-01

RIVERTON EXPANSION AND RENOVATION PROJECT
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Scale: 3/16" = 1'-0" | Date: 05-23-2006 | Project No: 06014 | Cad File: 06014M.DWG

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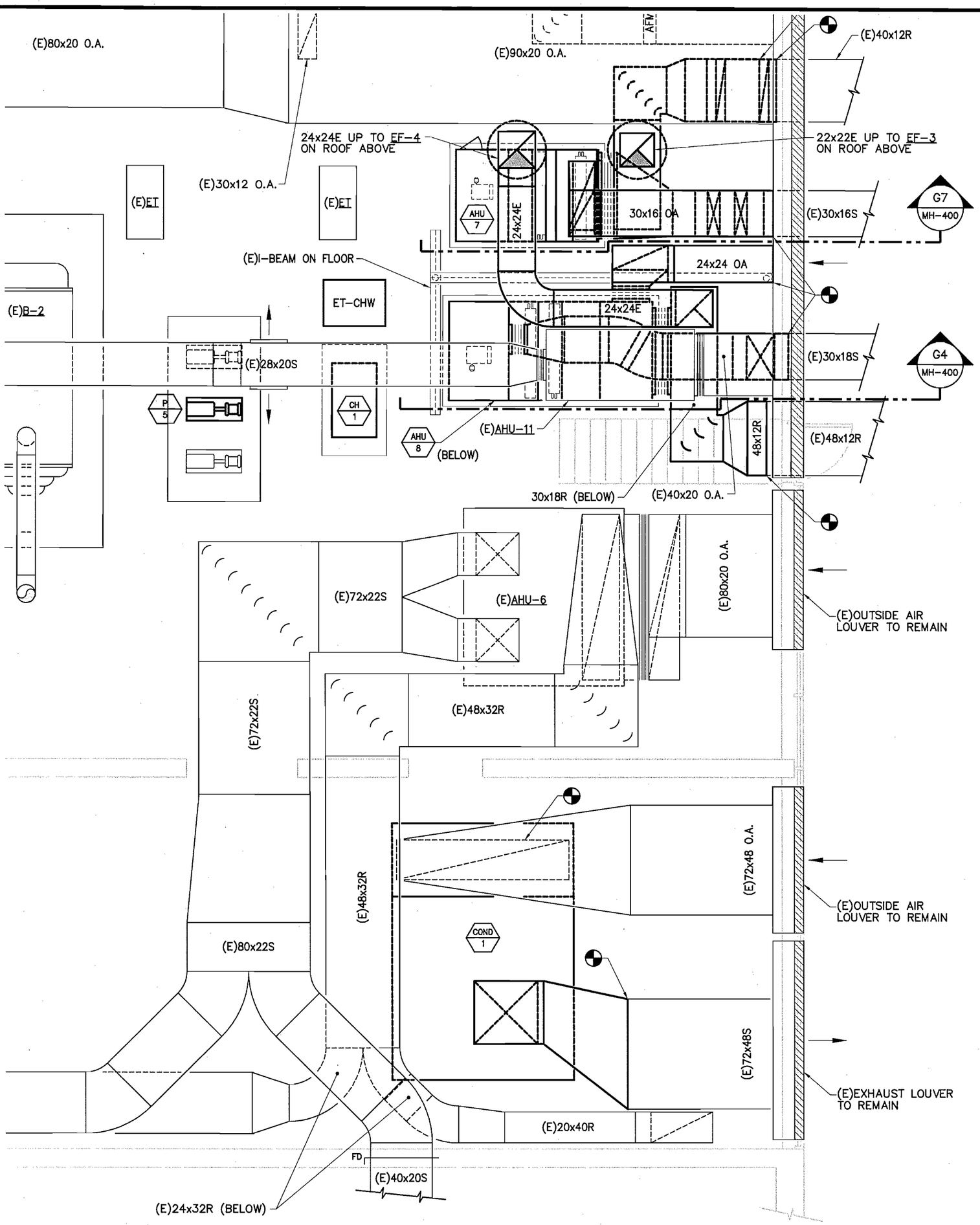

REVISED MECHANICAL ROOM PART PLAN ~
A1 - SHEET MH-400

SKM-02

RIVERTON EXPANSION AND
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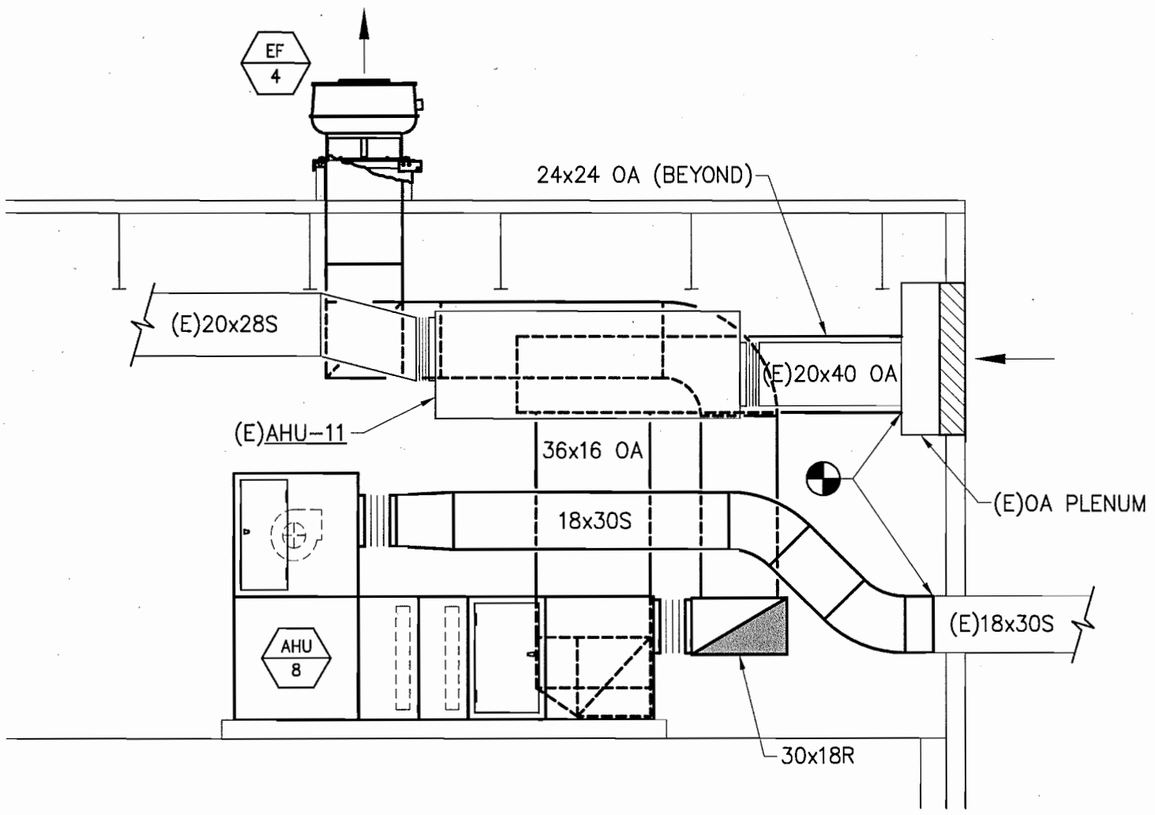
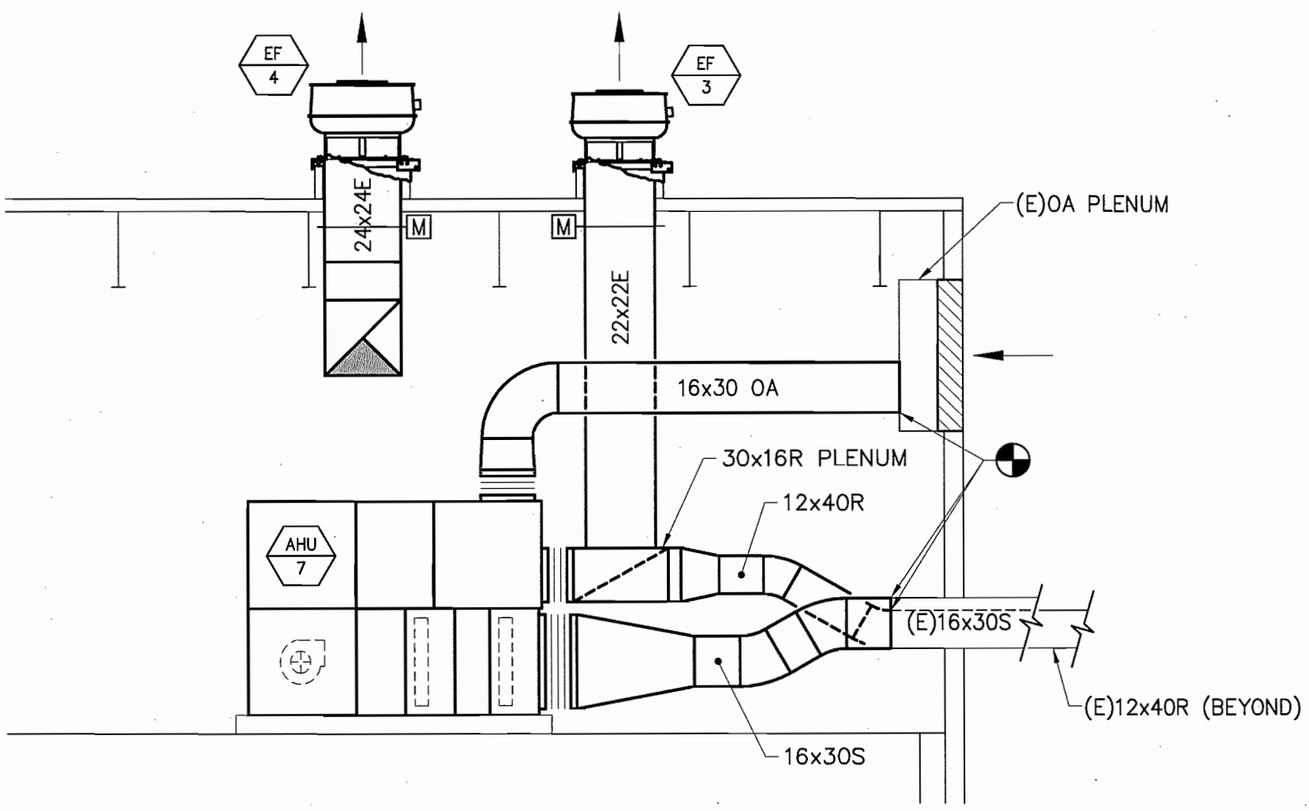


G4	DETAIL ~ SECTION - AHU-8
1/4" = 1'-0"	



G7	DETAIL ~ SECTION - AHU-7
1/4" = 1'-0"	

ADDITIONAL MECHANICAL ROOM SECTIONS ~
G4/G7 - SHEET MH-400

SKM-03

RIVERTON EXPANSION AND
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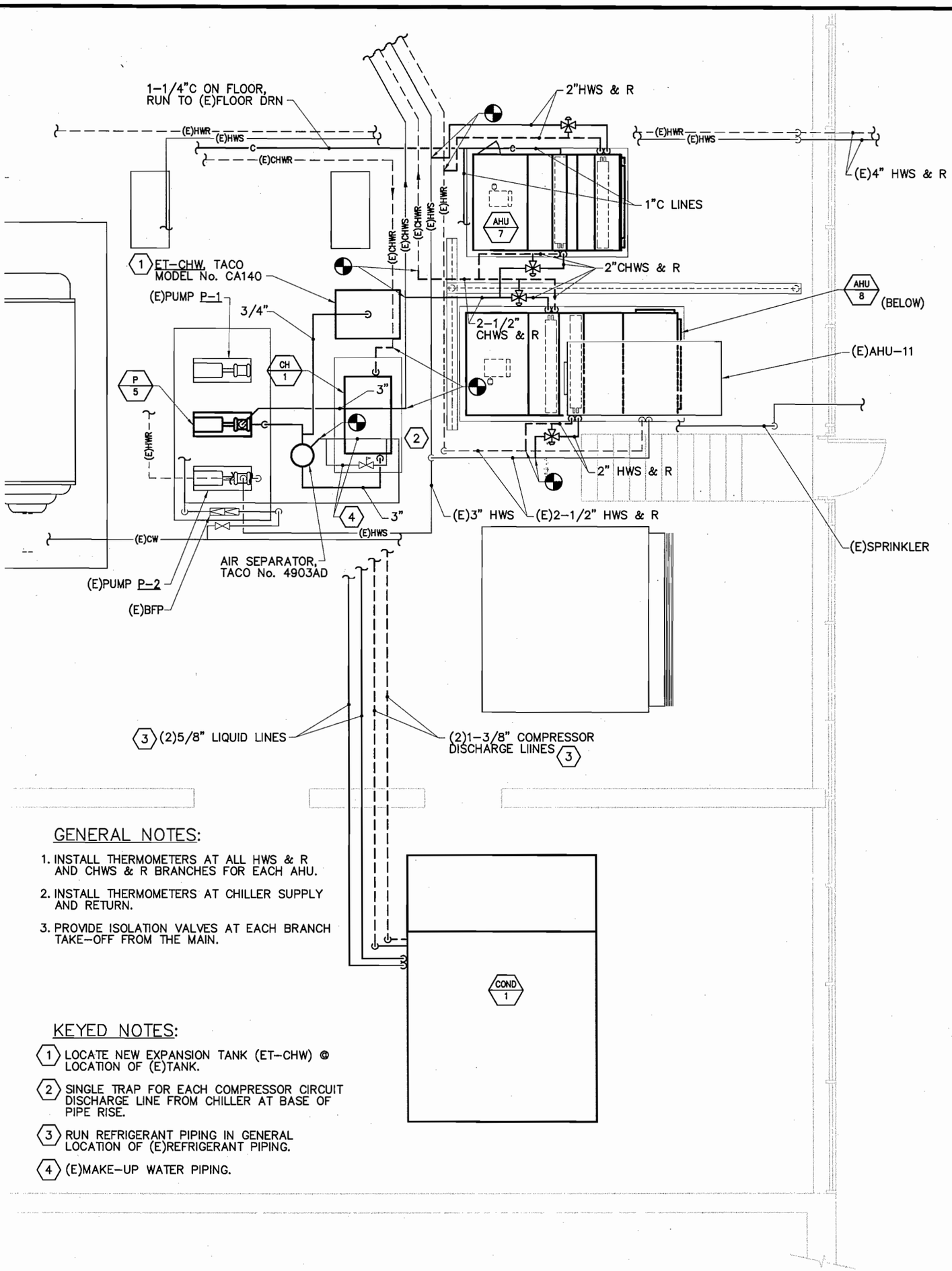

GENERAL NOTES:

1. INSTALL THERMOMETERS AT ALL HWS & R AND CHWS & R BRANCHES FOR EACH AHU.
2. INSTALL THERMOMETERS AT CHILLER SUPPLY AND RETURN.
3. PROVIDE ISOLATION VALVES AT EACH BRANCH TAKE-OFF FROM THE MAIN.

KEYED NOTES:

1. LOCATE NEW EXPANSION TANK (ET-CHW) @ LOCATION OF (E)TANK.
2. SINGLE TRAP FOR EACH COMPRESSOR CIRCUIT DISCHARGE LINE FROM CHILLER AT BASE OF PIPE RISE.
3. RUN REFRIGERANT PIPING IN GENERAL LOCATION OF (E)REFRIGERANT PIPING.
4. (E)MAKE-UP WATER PIPING.

REVISED MECHANICAL ROOM PIPING PART PLAN ~ A5 - SHEET MH-400

SKM-04	RIVERTON EXPANSION AND RENOVATION PROJECT 1600 FOREST AVE., PORTLAND, MAINE 04103		
Scale: 3/16" = 1'-0"	Date: 05-23-2006	Project No: 06014	Cad File: 06014M.DWG

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AIR HANDLING UNIT SCHEDULE (BID ALTERNATE NO 3)

ITEM	DESCRIPTION	AHU-7	AHU-8
GENERAL	SERVES	ADMINISTRATION	LIBRARY
	SYSTEM TYPE	CONSTANT VOLUME	CONSTANT VOLUME
	AIR CONDITIONING	YES	YES
	MFR-MODEL	TRANE M-SERIES	TRANE M-SERIES
	SIZE	10	12
	CONFIGURATION	BLOW - THRU	BLOW - THRU
	RIGGING WEIGHT, lbs.	3,000	3,400
SUPPLY FAN	DESIGN AIRFLOW, cfm	4,400	5,500
	O.A. AIRFLOW (base Ventilation)	25%	25%
	ESP, in.wc.	2.4	2.4
	TSP, in. wc.	5.2	5.8
	MAX-BHP/HP	8.3/ 10	8.8 / 10
	MAX RPM	3,350	2,545
	VFD	NO	NO
	SIZE AND TYPE	F10-12"AF	F12-15"AF
	VOLTS-PH-HZ	460/3/60	460/3/60
HW PREHEAT COIL	EAT, deg-F.	40	40
	LAT, deg-F.	90	90
	TMBTUH	244	299
	MIN COIL AREA, sf.	9.4	12.4
	COIL FACE VELOCITY	480	444
	MAX AIR PD. in. wc.	0..20	0.20
	FLUID	WATER	WATER
	EWT	180	180
	LWT, deg-F	160	160
	GPM	24.4	29.8
	MAX WATER PD, ft-H2O	12	12
CHILLED WATER COOLING COIL	EAT, db/wb deg-F.	80/67	80/67
	TMBTUH	171	213
	SMBTUH	124	152
	TONS	11.3	17.8
	GPM	34.5	42.4
	MAX WATER PD, ft-H2O	15	15
	MIN COIL AREA, sf	9.64	12.3
	MAX AIR PD. In wc.	0.7	0.7
	COIL FACE VELOCITY	467	447
FILTER SECTION	PRE-FILTERS	30%- ANGLED	30%-FLAT
	FINAL FILTERS (SHORT BAG)	85%	85%
	MIN. AREA, sf	9.3	10.0
	MAX VELOCITY	473	550

SKM-05

REVISED AHU SCHEDULE ~
A1 – SHEET MH–600

RIVERTON EXPANSION AND
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Scale: NONE | Project No: 06014

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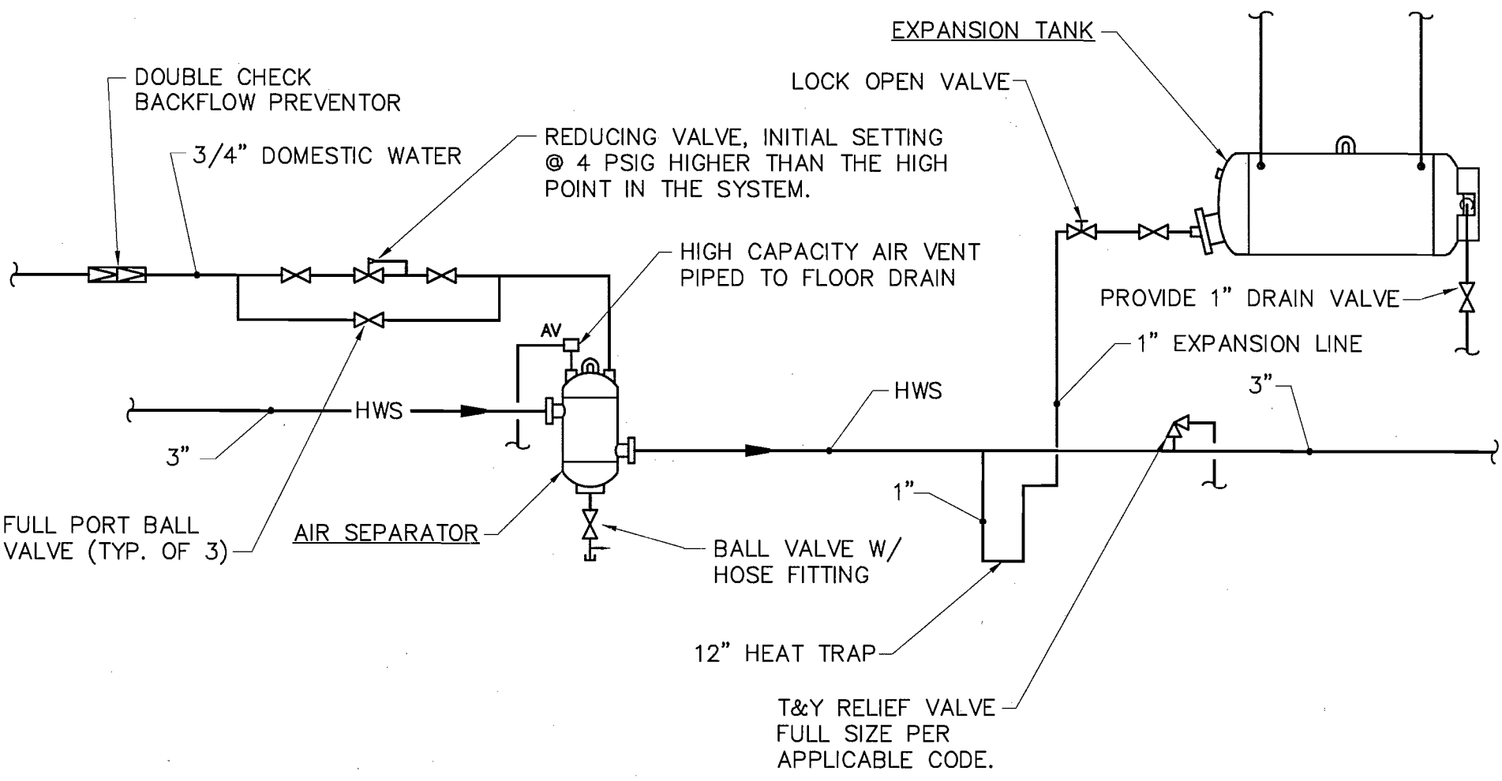
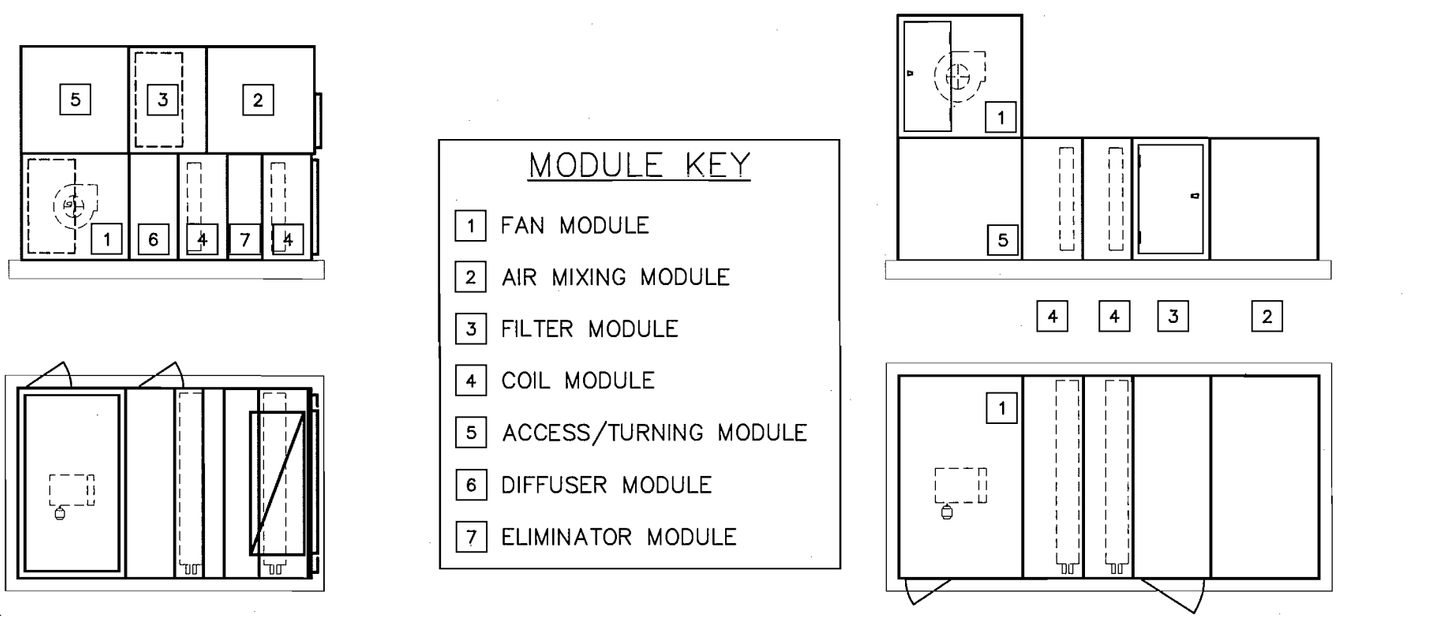


F4	DETAIL ~ AIR SEPARATOR & EXPANSION TANK PIPING
NOT TO SCALE	



AHU–7

AHU–8

G7	DETAIL ~ AIR HANDLING UNIT CONFIGURATIONS
NOT TO SCALE	

REVISED MECHANICAL DETAILS ~ SHEET MH-500

SKM-06	RIVERTON EXPANSION AND RENOVATION PROJECT 1600 FOREST AVE., PORTLAND, MAINE 04103		
Scale: AS NOTED	Date: 05–23–2006	Project No: 06014	Cad File: 06014M.DWG

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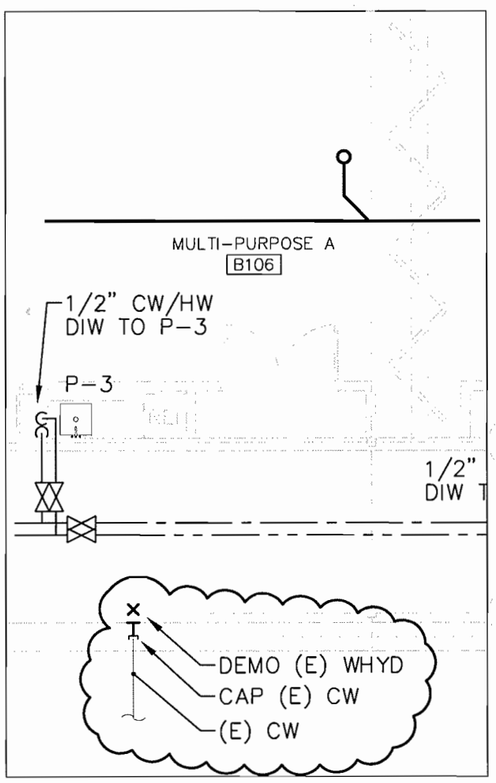
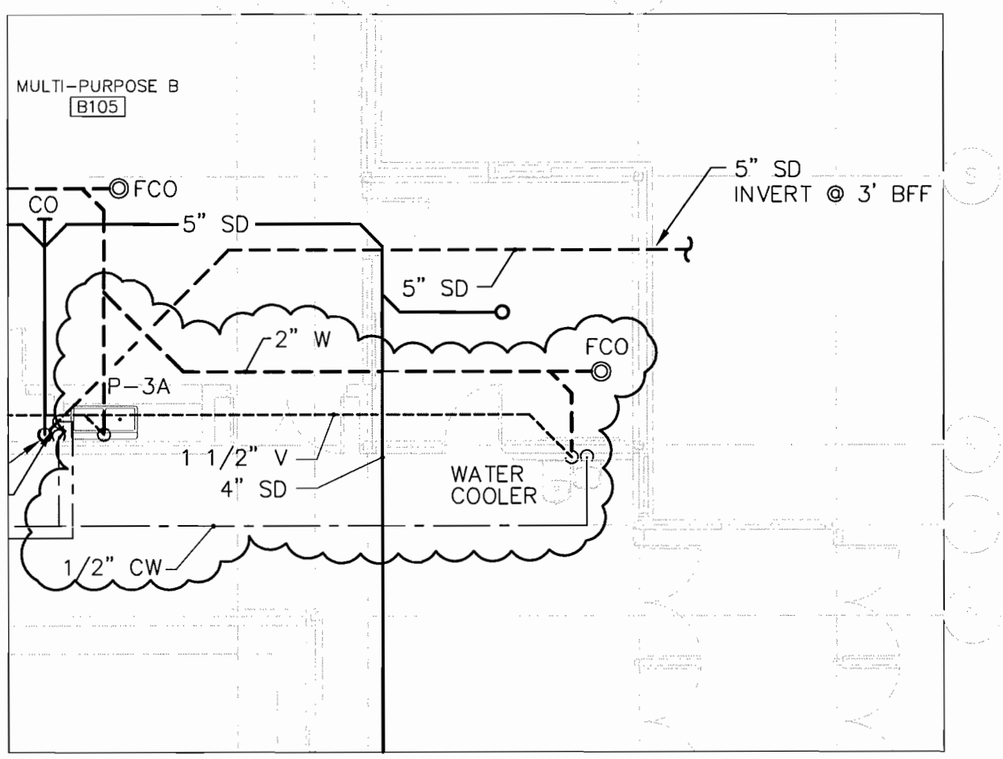
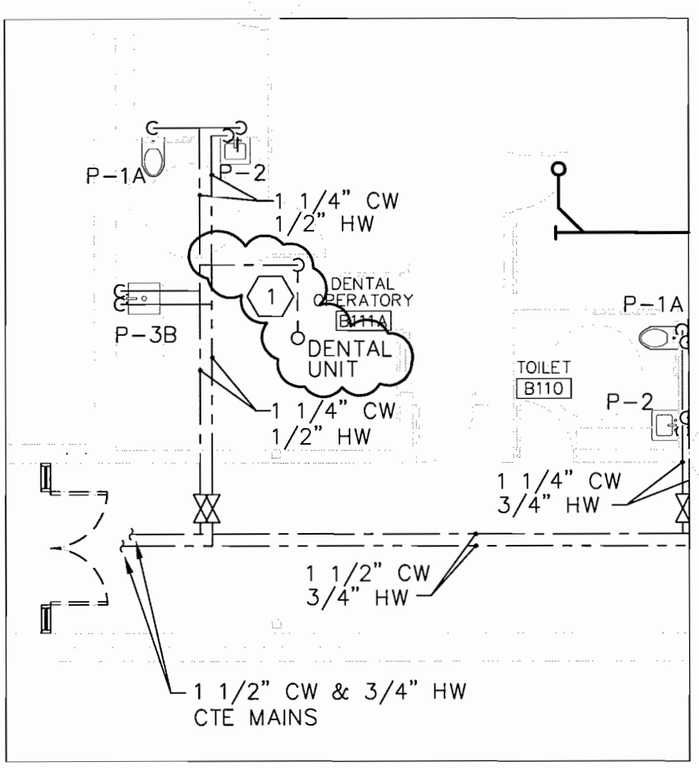


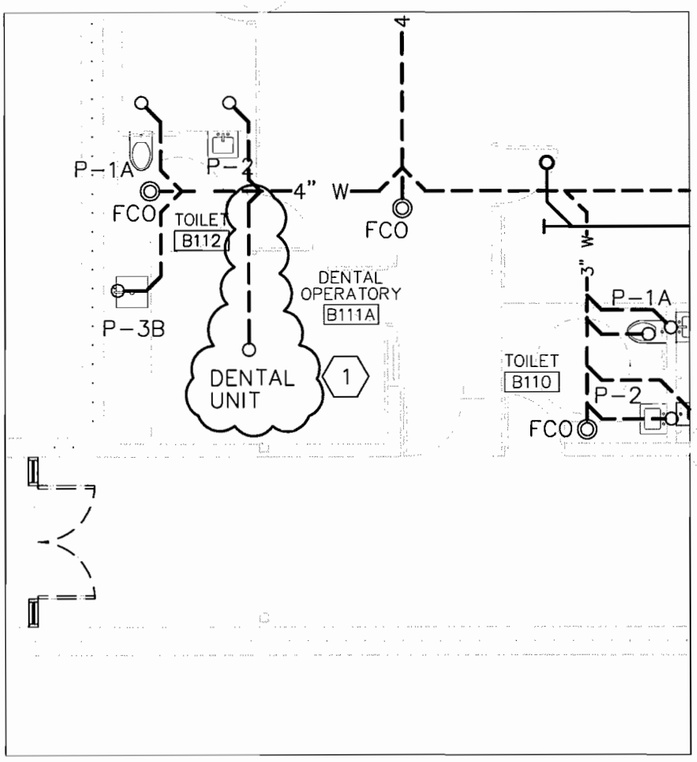
PLUMBING PART PLAN – COMM. ADDITION



PLUMBING PART PLAN – ADD WATER COOLER – COMM. ADDITION



DOMESTIC WATER PIPING PART PLAN – COMM. ADDITION



SANITARY PIPING PART PLAN – COMM. ADDITION

KEYED NOTES:

1. COORDINATE DOMESTIC WATER AND SANITARY PIPE SIZES WITH DENTAL UNIT CONNECTION REQUIREMENTS.

PLAN NORTH

REVISED PLUMBING PART PLANS ~ DENTAL OPERATORY
E6 & B6 - SHEET PL-102

SKP-02
Addendum No.2

RIVERTON EXPANSION AND RENOVATION PROJECT
1600 FOREST AVE., PORTLAND, MAINE 04103

Scale: 1/8" = 1'-0" | Date: 05-25-2006 | Project No: 06014 | Cad File: 06014M.DWG

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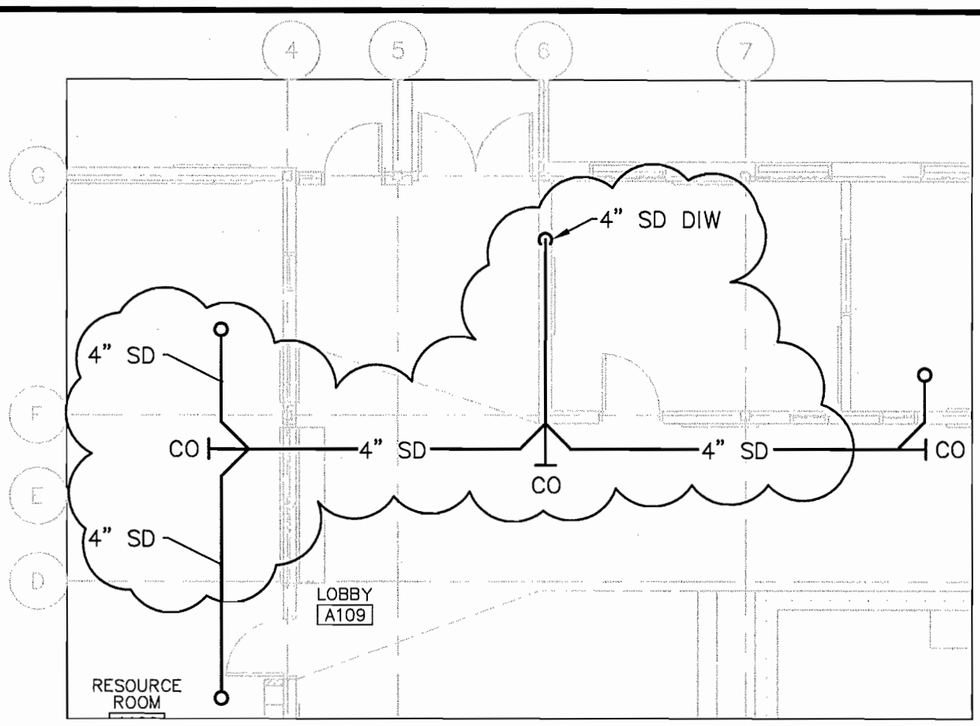
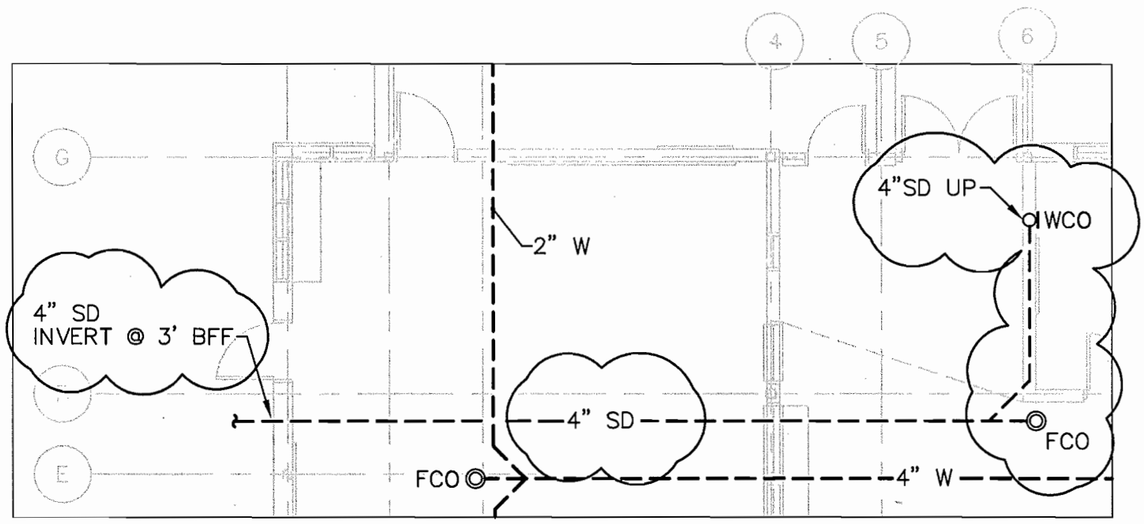
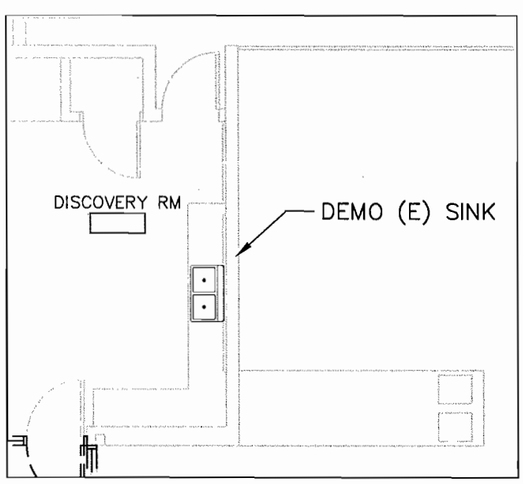


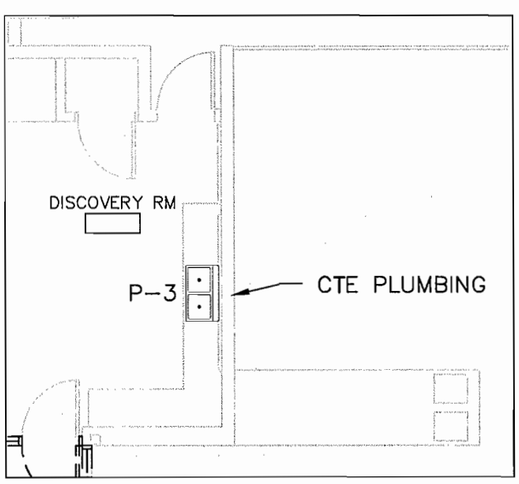
STORM PIPING CLASSROOM ADDITION – 1ST FLOOR



STORM PIPING CLASSROOM ADDITION – 1ST FLOOR



DEMOLITION PART PLAN – DISC. AREA



PLUMBING PART PLAN – DISC. AREA

PLAN NORTH

REVISED PLUMBING PART PLANS ~ CLASS. & DISC. AREAS
B1, E5, & C5 - SHEET PL-100

SKP-03

RIVERTON EXPANSION AND
RENOVATION PROJECT
1600 FOREST AVE., PORTLAND, MAINE 04103

Scale: 1/8" = 1'–0" | Date: 05–23–2006 | Project No: 06014 | Cad File: 06014M.DWG

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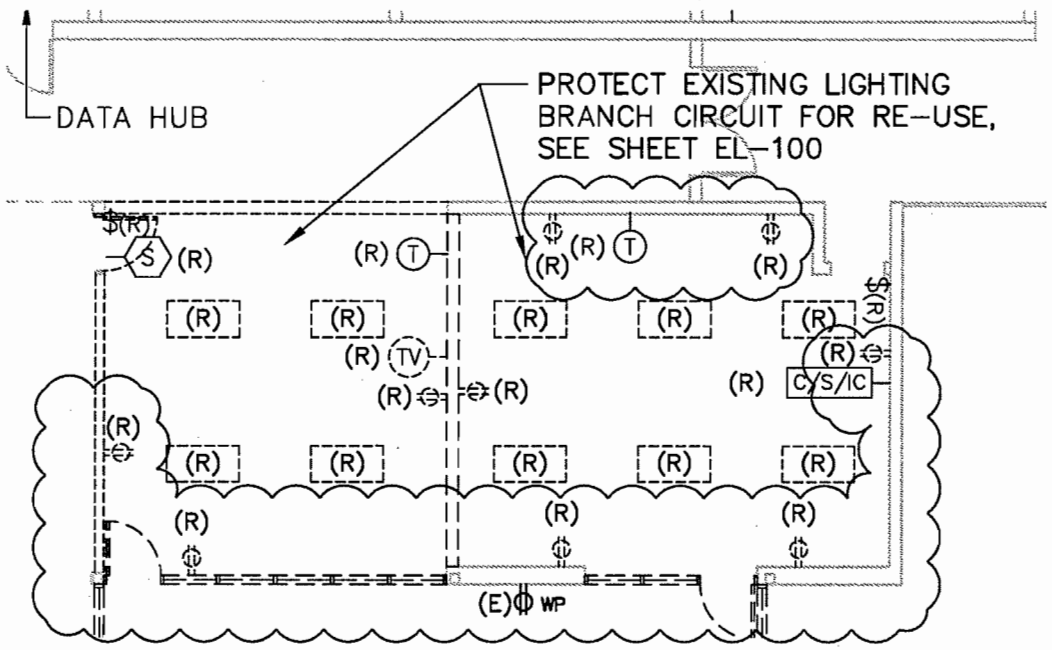
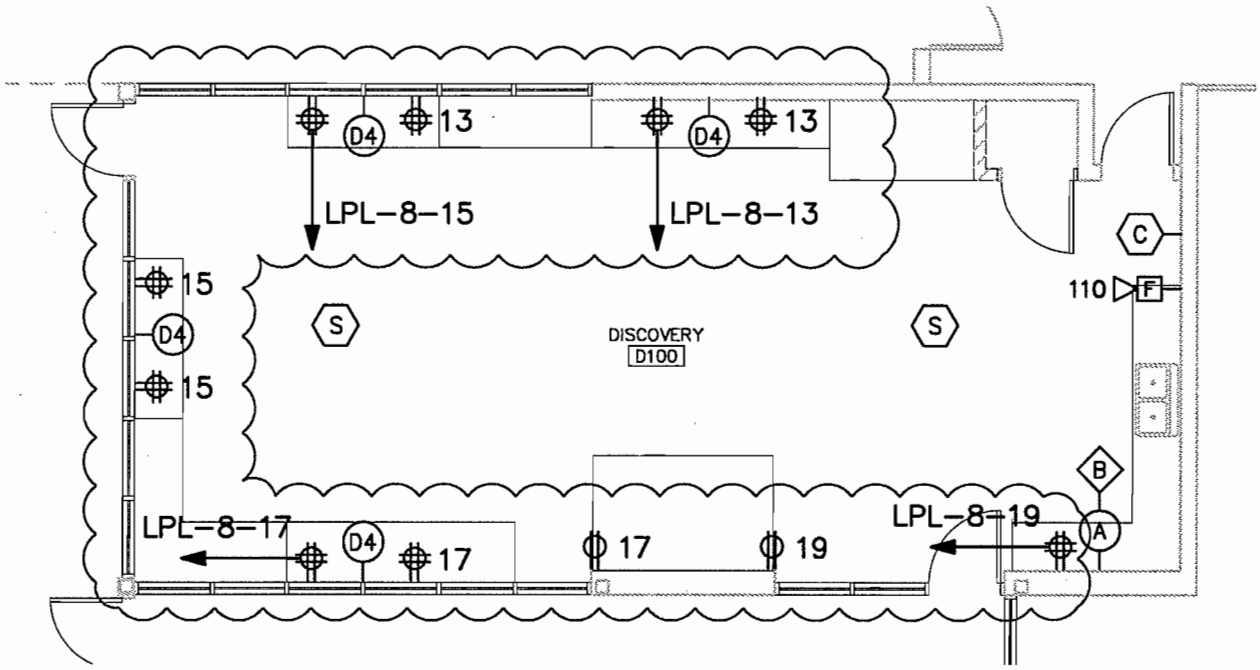


A1 - SHEET ED-100

3/32" = 1'-0"



A1 - SHEET EP-100

1/8" = 1'-0"

SKE-01

REVISED PART PLAN
A1 – SHEET ED-100 & EP-100

RIVERTON EXPANSION AND RENOVATION PROJECT
1600 FOREST AVE., PORTLAND, MAINE 04103

Scale: AS NOTED	Project No: 06014
Date: 05-23-2006	CAD File: 06014EP.DWG

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LIGHTING CONTROL PANEL SCHEDULE

NOTE: PROVIDE NETWORK CLOCK/PROGRAMMER.

DESIGNATION:	LCH8	MOUNTING:	SURFACE
CONTROL VOLTAGE:	277	LOCATION:	MECH RM-EX
CONTROL CIRCUIT:	LPH8-41	PROJECT:	RIVERTON

RELAY NO	CIRCUIT NO	SEE NOTE	DESCRIPTION
1	LPL-42	2	EXTERIOR SIGN LIGHTS 'H2'
2	LPH8-39	2	EXTERIOR LIGHTS
3	LPH8-39	1	LOBBY/CORRIDOR B102/117 'c'
4	LPH8-35	1	WORKSPACE B114 'a'
5	LPH8-35	1	WORKSPACE B114 'b'
6	LPH8-35	1	COPY C108 'd'

LIGHTING CONTROL PANEL SCHEDULE

NOTE: PROVIDE NETWORK CLOCK/PROGRAMMER.

DESIGNATION:	LCH3	MOUNTING:	SURFACE
CONTROL VOLTAGE:	277	LOCATION:	
CONTROL CIRCUIT:	PPH3-5	PROJECT:	RIVERTON

RELAY NO	CIRCUIT NO	SEE NOTE	DESCRIPTION
1	PPH3-3	1	LOBBY - A109 & ENTRY A103
2	PPH3-3	2	EXTERIOR LTGS
3			SPARE
4			SPARE
5			SPARE
6			SPARE

PANEL SCHEDULE ~ LPL8

PROVIDE 200% RATED NEUTRAL AND TVSS

VOLTAGE: 208/120V	MLO: 225	MOUNTING: FLUSH
3 PHASE, 4 WIRE	MCB:	LOCATION: A109
AIC: 10KA	CIRCUITS: 42	PROJECT: RIVERTON ELEMENTARY

CKT NO	BRKR SIZE	NO OF POLES	PH	CIRCUIT LOAD (KVA) A	B	C	BRANCH CIRCUIT DESCRIPTION
1	20	1	A	1.44			A101 RECEPTACLES
3	20	1	B		1.44		A102 RECEPTACLES
5	20	1	C			1.26	A102, A109, ROOF RECEPTACLES
7	20	1	A	1.08			A104 RECEPTACLES
9	20	1	B		1.26		A104 RECEPTACLES
11	20	1	C			1.26	A105 RECEPTACLES
13	20	1	A	1.08			**A-100 RECEPTACLES**
15	20	1	B		1.08		**A-100 RECEPTACLES**
17	20	1	C			0.90	**A-100 RECEPTACLES**
19	20	1	A	0.54			**A-100 RECEPTACLES**
21	20	1	B				
23	20	1	C				
25	20	1	A				

SKE-02

REVISED SCHEDULES
A1 – SHEET EL–100 & E–500

RIVERTON EXPANSION AND RENOVATION PROJECT
1600 FOREST AVE., PORTLAND, MAINE 04103

Scale: AS NOTED | Project No: 06014
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