Temple University
Project Delivery Group

TEMPLE UNIVERSITY
OFFICE OF FACILITIES MANAGEMENT
PROJECT DELIVERY GROUP

TECHNICAL SPECIFICATIONS (TS), ARCHITECTURAL DESIGN STANDARDS (ADS) AND GRAPHIC STANDARDS

CONTENTS:

		PAGE	REVISED
DIVISION 1 (TS)	GENERAL REQUIREMENTS	2-163	01/2015
DIVISION 2 (ADS)	SITE WORK	164-188	04/2010
DIVISION 3 (ADS)	CONCRETE	189	10/2022
DIVISION 4 (ADS)	MASONRY		
DIVISION 5 (ADS)	METALS	190-215	04/2010
DIVISION 6 (ADS)	WOOD AND PLASTICS	216-221	04/2010
DIVISION 7 (ADS)	THERMAL AND MOISTURE PROTECTION	222-230	04/2010
DIVISION 8 (ADS)	OPENINGS	231-242	09/2022
DIVISION 9 (ADS)	FINISHES	243-245	09/2022
DIVISION 10 (ADS)	SPECIALTIES	246-251	09/2022
DIVISION 12 (ADS)	FURNISHES	252-257	09/2022
DIVISION 14 (ADS)	ELEVATORS (Updates in Progress)	258	09/2022
DIVISION 22 (TS+ADS)	PLUMBING	259-317	02/2018
DIVISION 23 (TS)	HVAC	318-411	06/2022
DIVISION 25 (TS)	INTEGRATED AUTOMATION	412-474	06/2022
DIVISION 26 (TS+ADS)	ELECTRICAL CONTROLS & LIGHTING FIXTURES	475-484	06/2022
DIVISION 27 (TS)	TELECOM	485-505	10/2022
DIVISION 32 (ADS)	EXTERIOR IMPROVEMENTS	506	09/2022
DIVISION TU (GS)	GRAPHIC STANDARDS (CAD Files Provided on Demand)	507-559	10/2022

Note: These technical specifications are generic in nature and have not been edited for this specific project. Some sections may not apply. Where there is a conflict between any other specifications and the Temple University Technical Specifications, this document shall apply and supersede. In the event of a conflict between the terms of the Agreement that governs this project and the terms of these specifications, the terms of the Agreement shall control.

***Revisions to specifications and standards for Divisions 2, 5-7 are in progress. Confirm all current design standards with Project Delivery Group.**

Temple University
Project Delivery Group

TEMPLE UNIVERSITY
OFFICE OF FACILITIES MANAGEMENT
PROJECT DELIVERY GROUP

TECHNICAL SPECIFICATIONS (TS)
AND ARCHITECTURAL DESIGN STANDARDS (ADS)

BACK

PROJECT TITLE:
T.U. PROJECT NUMBER:
WORK REQUEST NUMBER:

DIVISION 1 (TS) GENERAL REQUIREMENTS

In the event of a conflict between the terms of the Agreement that governs this Project and the terms of this Section, the terms of the Agreement shall control. The provisions of other Contract Documents may apply to the subject matter of this Section.

SECTION 01100 - SUMMARY

<BACK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Phased construction.
4. Work by Owner.
5. Work under separate contracts.
6. Future work.
7. Purchase contracts.
8. Owner-furnished products.
9. Contractor-furnished, Owner-installed products.
10. Access to site.
11. Coordination with occupants.
12. Work restrictions.
13. Specification and drawing conventions.
14. Miscellaneous provisions.

B. Related Requirements:

1. Section 01500 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 PROJECT INFORMATION

A. Project Identification: Refer to Scope of Work.

B. Owner: Temple University of The Commonwealth System Of Higher Education (TU).

1. Owner's Representative: Temple University Project Delivery Group Construction Manager (TU CM) or as otherwise noted in contract documents.

C. Architect: Temple University Campus Planning & Design (TU CPD) or as otherwise noted in contract documents.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:

1. Refer to Scope of Work.

B. Type of Contract:

1. Project will be constructed under a single prime contract unless otherwise noted in the Scope of Work

1.5 PHASED CONSTRUCTION

A. The Work shall be conducted in one or more phases as defined in the Scope of Work.

1.6 WORK BY OWNER

A. General: Cooperate fully with Owner so work may be carried out smoothly, without interfering with or delaying work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.

B. Work by Owner: Refer to the Scope of Work.

1.7 WORK UNDER SEPARATE CONTRACTS

A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts. Refer to the Scope of Work for Work Under Separate Contracts.

B. Work Under Separate Contracts: Refer to the Scope of Work.

1.8 PURCHASE CONTRACTS

A. General: Owner may have negotiated purchase contracts with suppliers of material and equipment to be incorporated into the Work. Owner will assign these purchase contracts to Contractor. Include costs for purchasing, receiving, handling, storage if required, and installation of material and equipment in the Contract Sum, unless otherwise indicated.

B. Purchase Contracts: Refer to the Scope of Work.

1.9 OWNER-FURNISHED PRODUCTS

A. Owner will furnish products indicated. The Work includes receiving, unloading, handling, storing, protecting, and installing Owner-furnished products and making building services connections as identified by the drawings Owner-Furnished Products.

B. Owner-Furnished Products: Refer to the Scope of Work

1.10 ACCESS TO SITE

A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

B. Use of Site: Limit use of Project site to areas identified within the contract documents. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Limits: Confine construction operations to limits as shown in the contract documents.
2. Limits: Limit site disturbance, including earthwork and clearing of vegetation, to 40 feet beyond building perimeter; 10 feet beyond surface walkways, patios, surface parking, and utilities less than 12 inches in diameter; 15 feet beyond primary roadway curbs and main utility branch trenches; and 25 feet beyond constructed areas with permeable surfaces (such as pervious paving areas, stormwater detention facilities, and playing fields) that require additional staging areas in order to limit compaction in the constructed area. These areas are intended to be maximum areas of disturbance permitted but in no case shall the limits exceed those shown on any AHJ (e.g. PADEP/PWD).
3. Driveways, Walkways and Entrances: Keep driveways, parking garage, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

    a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
    b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

1.11 COORDINATION WITH OCCUPANTS

A. Full Owner Occupancy: Owner may occupy site and existing and/or adjacent building(s) during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used

facilities without written permission from Owner and approval of authorities having jurisdiction.

2. Notify Owner not less than 14 calendar days in advance of activities that will affect Owner's operations.

1.12 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction. Contractor shall procure all required street closure and connection permits as required.

B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 7:00 a.m. to 3:30 p.m., Monday through Friday, unless otherwise indicated.

1. Notify Owner not less than 10 business days in advance of any off-hours work.
2. Obtain Owner's written permission before proceeding with off-hours work. Submit "Weekend & Off Hours Authorization Form" for approval prior to performing any off-hours work.

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:

1. Notify Owner not less than 10 business days in advance of proposed utility interruptions.
2. Obtain Owner's written permission before proceeding with utility interruptions. Submit "Utility Shutdown Authorization Form" for approval prior to initiating any utility interruptions.

D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.

1. Notify Owner not less than three business days in advance of proposed disruptive operations.
2. Obtain Owner's written permission before proceeding with disruptive operations.

E. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet of entrances, operable windows, or outdoor-air intakes.

F. Controlled Substances: Use of alcohol, tobacco products and other controlled substances within existing buildings or on the Project site is not permitted.

G. Employee Identification: Owner will provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times and to produce to any TU personnel upon request.

1.13 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.
3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual or as detailed in the contract documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01100

TEMPLE UNIVERSITY®
Facilities Management

Date: _____

WEEKEND & OFF HOURS WORK AUTHORIZATION FORM

Project Title: _____

Work Order Number: _____

Temple Project Manager: _____ **Phone Number:** _____

Contractor: _____

On-Site Contact: _____ **Phone Number:** _____

General Information:

Date Work is Requested: _____ to _____

Timeframe Work is Requested: ☐ to ☐

Associated Costs: No Additional Costs Other: _____

Premium Time Only Shutdowns required?

Scope of Contractors Work:

Office of Facilities Management Support:	Yes	No	N/A
Shut Down Posted:	Yes	No	N/A
Coordinated With Event Schedule:	Yes	No	N/A

Authorization: _____ _____

Construction Operations & Maintenance

Please note: this is a REQUEST and requires proper authorization. If Shutdowns are required, the Shutdown notice form needs to be processed

TEMPLE UNIVERSITY®
Facilities Management

Date:

UTILITY SHUTDOWN AUTHORIZATION FORM

PROJECT TITLE: _____

(As Identified by the Office of Facilities Management)

1. REQUESTING SOURCE:

Contractor: _____ Name: _____

SubContractor: _____ Phone: _____

2. UTILITY TO BE SHUTDOWN:

		ADVANCE NOTICE	
MECHANICAL SYSTEMS			
CHILLED WATER	_____	10	Days
REFRIGERATION SYSTEMS/GLYCOL	_____	10	Days
STEAM/CONDENSATE	_____	10	Days
HEATING WATER LOOPS (including Reheat)	_____	10	Days
MEDICAL GAS	_____	10	Days
PLUMBING SYSTEMS			
DOMESTIC HOT WATER	_____	10	Days
DOMESTIC COLD WATER	_____	10	Days
SANITARY WASTE	_____	10	Days
SPRINKLER (includes fire pump)	_____	2	Days
ELECTRICAL SYSTEMS			
ELECTRICAL (high and low voltage)	_____	10	Days
FIRE ALARM	_____	2	Days
HOT WORK PERMITS	_____	2	Days

3. SHUTDOWN EXPLANATION:

DATE OF SHUTDOWN REQUEST: _____

REQUESTED START TIME: _____ APPROXIMATE COMPLETION: _____

REASON FOR SHUTDOWN:

EXTENT OF SHUTDOWN:

ON SITE CONTACT: _____ CONTACT INFO: _____

FACILITIES MANAGEMENT USE ONLY

INTERNAL DISTRIBUTION: _____ RECEIVED BY & DATE

Submit Form to: Office of Facilities Management, Main Campus: 1009 Montgomery Avenue, Philadelphia PA 19122

or HSC Campus: 3525 Germantown Avenue, Philadelphia PA 19140

In the event of a conflict between the terms of the Agreement that governs this Project and the terms of this Section, the terms of the Agreement shall control. The provisions of other Contract Documents may apply to the subject matter of this Section.

SECTION 01210 - ALLOWANCES

<BACK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements governing allowances.

1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.

B. Types of allowances include the following:

1. Lump-sum allowances.
2. Unit-cost allowances.
3. Quantity allowances.
4. Contingency allowances.
5. Testing and inspecting allowances.

C. Related Requirements:

1. Section 01270 "Unit Prices" for procedures for using unit prices.

2. Section 01330 “Submittal Procedures” for action and informational submittals.

1.3 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.

B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected by Architect from the designated supplier.

1.4 ACTION SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

1.5 INFORMATIONAL SUBMITTALS

A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.

C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.6 COORDINATION

A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.7 LUMP-SUM, UNIT-COST AND QUANTITY ALLOWANCES

A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include taxes, freight and delivery to Project site.

B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials under allowance shall be included as part of the Contract Sum and not part of the allowance.

C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.

1. If requested by Architect, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

1.8 CONTINGENCY ALLOWANCES

A. Use the contingency allowance only as directed by Owner for Owner's purposes and only by Change Orders that indicate amounts to be charged to the allowance.

B. Contractor's overhead, profit, and related costs for products and equipment ordered by Owner under the contingency allowance are included in the allowance and are not part of the Contract Sum. These costs include delivery, installation**,** taxes, insurance, equipment rental, and similar costs.

C. The Owner may request Change Orders authorizing the use of contingency funds. Change Orders will include Contractor's related costs and overhead and profit margins as defined in Owner's General Conditions.

D. At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order.

1.9 TESTING AND INSPECTING ALLOWANCES

A. Testing and inspecting allowances include the cost of engaging testing agencies, actual tests and inspections, and reporting results.

B. The allowance does not include incidental labor required to assist the testing agency or costs for retesting if previous tests and inspections result in failure. The cost for incidental labor to assist the testing agency shall be included in the Contract Sum.

C. Costs of services not required by the Contract Documents are not included in the allowance.

D. At Project closeout, credit unused amounts remaining in the testing and inspecting allowance to Owner by Change Order.

1.10 ADJUSTMENT OF ALLOWANCES

A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.

1. Include installation costs in purchase amount only where indicated as part of the allowance.
2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
3. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to unit-cost allowances.
4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.

B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.

1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.
2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

Refer to Scope of Work or contract documents for allowances, if required.

END OF SECTION 01210

In the event of a conflict between the terms of the Agreement that governs this Project and the terms of this Section, the terms of the Agreement shall control. The provisions of other Contract Documents may apply to the subject matter of this Section.

SECTION 01230 - ALTERNATES

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Response Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.

C. Execute accepted alternates under the same conditions as other work of the Contract.

D. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

Refer to Scope of Work or contract documents.

END OF SECTION 01230

In the event of a conflict between the terms of the Agreement that governs this Project and the terms of this Section, the terms of the Agreement shall control. The provisions of other Contract Documents may apply to the subject matter of this Section.

SECTION 01250 - CONTRACT MODIFICATION PROCEDURES

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

B. Related Requirements:

1. Section 01635 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.

1.3 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710.

1.4 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Owner will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Work Change Proposal Requests issued by Owner are not instructions either to stop work in progress or to execute the proposed change.
2. Within time specified in Proposal Request or within 14 calendar days when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

    a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.

c. Include costs of labor and supervision directly attributable to the change.
d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
e. Quotation Form: Use AIA G701 with material and labor backup.

B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Owner.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Section 01635 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
7. Proposal Request Form: Use AIA G701 with material and labor backup.

1.5 ADMINISTRATIVE CHANGE ORDERS

A. Allowance Adjustment: See Section 01210 "Allowances" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.

B. Unit-Price Adjustment: See Section 01270 "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit-price work.

1.6 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Changes Proposal Request, Contractor will issue a Change Order for signatures of Owner’s representative on AIA Document G701.

1.7 WORK CHANGE DIRECTIVE

A. Work Change Directive: Owner may issue a Work Change Directive on AIA Document G714. Work Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Work Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Work Change Directive.

1. Daily logs shall be submitted at the end of each shift to Owner for signature.

2. After completion of change, submit to the Owner an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01250

In the event of a conflict between the terms of the Agreement that governs this Project and the terms of this Section, the terms of the Agreement shall control. The provisions of other Contract Documents may apply to the subject matter of this Section.

SECTION 01270 - UNIT PRICES

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for unit prices.

B. Related Requirements:

1. Section 01250 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
2. Section 01400 "Quality Requirements" for general testing and inspecting requirements.

1.3 DEFINITIONS

A. Unit price is an amount incorporated in the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.

B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.

D. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

Refer to Scope of Work or Contract Documents, if required.

END OF SECTION 01270

In the event of a conflict between the terms of the Agreement that governs this Project and the terms of this Section, the terms of the Agreement shall control. The provisions of other Contract Documents may apply to the subject matter of this Section.

SECTION 01290 - PAYMENT PROCEDURES

<BACK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Requirements:

1. Section 01210 "Allowances" for procedural requirements governing the handling and processing of allowances.
2. Section 01250 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
3. Section 01270 "Unit Prices" for administrative requirements governing the use of unit prices.
4. Section 01320 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of Contractor's construction schedule.

1.3 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.

1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:

a. Application for Payment forms with continuation sheets.
b. Submittal schedule.

c. Items required to be indicated as separate activities in Contractor's construction schedule.

2. Submit the schedule of values to Owner at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.

B. Format and Content: Use Major Work Divisions as a guide to establish line items for the schedule of values, as applicable.

1. Identification: Include the following Project identification on the schedule of values:

a. Project name and location.
b. Name of Architect.
c. Architect's project number.
d. Contractor's name and address.
e. Date of submittal.
f. Owner’s Purchase Order Number

2. Arrange schedule of values consistent with format of AIA Document G703.
3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide multiple line items for principal subcontract amounts in excess of ten percent of the Contract Sum.
4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

a. Differentiate between items stored on-site and items stored off-site. Include evidence of insurance and Bill of Lading.

6. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
7. Purchase Contracts: Provide a separate line item in the schedule of values for each purchase contract. Show line-item value of purchase contract. Indicate Owner payments or deposits, if any, and balance to be paid by Contractor.
8. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense.

1.5 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified and paid for by Owner.

1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: Submit Application for Payment to Owner by the 25th of the month. The period covered by each Application for Payment is one month, ending on the last day of the month.

1. Submit draft copy of Application for Payment seven days prior to due date for review by Owner.

C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Owner will return incomplete applications without action.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives approved before last day of construction period covered by application.

E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.

F. Transmittal: Submit one signed and notarized original copy of each Application for Payment to Owner by a method ensuring receipt. Application for Payment shall include waivers of liens and similar attachments.

G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application. Waivers shall also be submitted from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
2. When an application shows completion of an item, submit conditional final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.

4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
5. Waiver Forms: Submit executed waivers of lien on forms, acceptable to Owner.

H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of values.
3. Contractor's construction schedule (preliminary if not final).
4. Submittal schedule (preliminary if not final).
5. Copies of permits, if applicable.
6. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work if applicable.
7. Initial progress report.
8. Owner's "Contractor Payment Affidavit, Release and Waiver of Liens."

I. Application for Payment at Substantial Completion: After Owner issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

J. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited to, the following:

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. Owner's "Contractor Final Payment Affidavit, Release and Waiver of Liens."
5. Evidence that claims have been settled.
6. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
7. Final liquidated damages settlement statement, if applicable.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01290

In the event of a conflict between the terms of the Agreement that governs this Project and the terms of this Section, the terms of the Agreement shall control. The provisions of other Contract Documents may apply to the subject matter of this Section.

SECTION 01310 - PROJECT MANAGEMENT AND COORDINATION

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General coordination procedures.
2. Coordination drawings.
3. Requests for Information (RFIs).
4. Project meetings.

B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.

C. Related Requirements:
1. Section 01320 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
2. Section 01700 "Execution Requirements" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
3. Section 01770 "Closeout Procedures" for coordinating closeout of the Contract.
4. Section 01810 "General Commissioning Requirements" for coordinating the Work with Owner's Commissioning Authority.

1.3 DEFINITIONS

A. RFI: Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.

B. Key Personnel Names: Before starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1.5 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. Coordination: Each contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its operations with operations included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components with other contractors to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

C. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings and meeting minutes.
6. Photographic documentation
7. Preinstallation conferences.
8. Project closeout activities.
9. Startup and adjustment of systems.
10. Track and provide documentation of all cost events including but not limited to: Change orders, allowances, unit prices, and contingencies.

E. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

1.6 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
b. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
f. Indicate required installation sequences.
g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed

resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Mechanical and Plumbing Work: Show the following:

    a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
    b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
    c. Fire-rated enclosures around ductwork.

7. Electrical Work: Show the following:

    a. Runs of vertical and horizontal conduit.
    b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
    c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
    d. Location of pull boxes and junction boxes, dimensioned from column center lines.

8. Fire-Protection System: Show the following:

    a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.

9. Review: Architect or Owner will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect or Owner determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect or Owner will so inform Contractor, who shall make changes as directed and resubmit.
10. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 01330 "Submittal Procedures."

C. Coordination Digital Data Files: Prepare coordination digital data files according to specification.

1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings or as directed by the Owner or Architect.
2. File Submittal Format: Submit or post coordination drawing in a format directed by Owner or Architect.

1.7 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Project name.
2. Project number.
3. Date.
4. Name of Contractor.
5. Name of Architect
6. RFI number, numbered sequentially.
7. RFI subject.
8. Specification Section number and title and related paragraphs, as appropriate.
9. Drawing number and detail references, as appropriate.
10. Field dimensions and conditions, as appropriate.
11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
12. Contractor's signature.
13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Forms: Form with substantially the same content as indicated above, acceptable to Architect.

1. Attachments shall be electronic files in Adobe Acrobat PDF format.

D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow 5 business days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following business day.

1. The following Contractor-generated RFIs will be returned without action:

    a. Requests for approval of submittals.
    b. Requests for approval of substitutions.
    c. Requests for approval of Contractor's means and methods.
    d. Requests for coordination information already indicated in the Contract Documents.
    e. Requests for adjustments in the Contract Time or the Contract Sum.
    f. Requests for interpretation of Architect's actions on submittals.
    g. Incomplete RFIs or inaccurately prepared RFIs.

2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 01250 "Contract Modification Procedures."

    a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 5 business days of receipt of the RFI response.

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log bi-weekly. Spreadsheet with the following information is acceptable:

1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect.
4. RFI number including RFIs that were returned without action or withdrawn.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.

F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven calendar days if Contractor disagrees with response.

1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
2. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.8 PROJECT MEETINGS

A. General: Contractor will schedule, conduct, and document meetings and conferences at Project site unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.

3. Minutes: Contractor will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned within five business days of the meeting.

B. Preconstruction Conference: Contractor shall schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 10 business days after execution of the Agreement.

1. Conduct the conference to review responsibilities and personnel assignments.
2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect progress, including the following:

    a. Tentative construction schedule.
    b. Phasing.
    c. Critical work sequencing and long-lead items.
    d. Designation of key personnel and their duties.
    e. Lines of communications.
    f. Procedures for processing field decisions and Change Orders.
    g. Procedures for RFIs.
    h. Procedures for testing and inspecting.
    i. Procedures for processing Applications for Payment.
    j. Distribution of the Contract Documents.
    k. Submittal procedures.
    l. Preparation of record documents.
    m. Use of the premises.
    n. Work restrictions.
    o. Working hours.
    p. Owner's occupancy requirements.
    q. Responsibility for temporary facilities and controls.
    r. Procedures for moisture and mold control.
    s. Procedures for disruptions and shutdowns.
    t. Construction waste management and recycling.
    u. Parking availability.
    v. Office, work, and storage areas.
    w. Equipment deliveries and priorities.
    x. First aid.
    y. Security.
    z. Progress cleaning.

4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Pre-installation Conferences: Conduct a pre-installation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and

installations that have preceded or will follow, shall attend the meeting. Advise Architect and Owner of scheduled meeting dates.

2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

    a. Contract Documents.
    b. Options.
    c. Related RFIs.
    d. Related Change Orders.
    e. Purchases.
    f. Deliveries.
    g. Submittals.
    h. Review of mockups.
    i. Possible conflicts.
    j. Compatibility requirements.
    k. Time schedules.
    l. Weather limitations.
    m. Manufacturer's written instructions.
    n. Warranty requirements.
    o. Compatibility of materials.
    p. Acceptability of substrates.
    q. Temporary facilities and controls.
    r. Space and access limitations.
    s. Regulations of authorities having jurisdiction.
    t. Testing and inspecting requirements.
    u. Installation procedures.
    v. Coordination with other work.
    w. Required performance results.
    x. Protection of adjacent work.
    y. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 30 calendar days prior to the scheduled date of Substantial Completion.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:

a. Preparation of record documents.
b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
c. Submittal of written warranties.
d. Requirements for preparing operations and maintenance data.
e. Requirements for delivery of material samples, attic stock, and spare parts.
f. Requirements for demonstration and training.
g. Preparation of Contractor's punch list.
h. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
i. Submittal procedures.
j. Coordination of separate contracts.
k. Owner's partial occupancy requirements.
l. Installation of Owner's furniture, fixtures, and equipment.
m. Responsibility for removing temporary facilities and controls.

4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

E. Progress Meetings: Conduct progress meetings at a minimum of biweekly intervals or as directed by the Scope of Work.

1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

1) Review schedule for next period.
2) Provide and review a 2-week look-ahead schedule.

b. Review present and future needs, including the following:

1) Interface requirements.
2) Sequence of operations.
3) Resolution of BIM component conflicts.
4) Status of submittals.
5) Deliveries.
6) Off-site fabrication.
7) Access.
8) Site utilization.

9) Temporary facilities and controls.
10) Progress cleaning.
11) Quality and work standards.
12) Status of correction of deficient items.
13) Field observations.
14) Status of RFIs.
15) Status of proposal requests.
16) Pending changes.
17) Status of Change Orders.
18) Pending claims and disputes.
19) Documentation of information for payment requests.

4. Minutes: Contractor to record and distribute the meeting minutes to each party present and to parties requiring information.

    a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

F. Coordination Meetings: Conduct Project coordination meetings as directed by owner or as needed. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and pre-installation conferences.

1. Attendees: In addition to representatives of Owner and Architect, each contractor, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

    a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
    b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
    c. Review present and future needs of project, including the following:

        1) Interface requirements.
        2) Sequence of operations.
        3) Resolution of BIM component conflicts.
        4) Status of submittals.
        5) Deliveries.
        6) Off-site fabrication.
        7) Access.

8) Site utilization.
9) Temporary facilities and controls.
10) Work hours.
11) Hazards and risks.
12) Progress cleaning.
13) Quality and work standards.
14) Change Orders.
15) Regulatory Agencies.

3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01310

In the event of a conflict between the terms of the Agreement that governs this Project and the terms of this Section, the terms of the Agreement shall control. The provisions of other Contract Documents may apply to the subject matter of this Section.

SECTION 01320 - CONSTRUCTION PROGRESS DOCUMENTATION

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Startup construction schedule.
2. Contractor's construction schedule.
3. Construction schedule updating reports.
4. Daily construction reports.
5. Material location reports.
6. Site condition reports.
7. Special reports.

B. Related Requirements:

1. Section 01125 "Summary of Multiple Contracts" for preparing a combined Contractor's construction schedule.
2. Section 01330 "Submittal Procedures" for submitting schedules and reports.
3. Section 01400 "Quality Requirements" for submitting a schedule of tests and inspections.

1.3 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.

1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
2. Predecessor Activity: An activity that precedes another activity in the network.
3. Successor Activity: An activity that follows another activity in the network.

B. Cost Loading: The allocation of the schedule of values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum unless otherwise approved by Architect.

C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

E. Event: The starting or ending point of an activity.

F. Float: The measure of leeway in starting and completing an activity.

1. Float time belongs to the Owner.
2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

G. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

1.4 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:

1. Working electronic copy of schedule file, where indicated.
2. PDF electronic file.

B. Startup construction schedule.

1. Approval of cost-loaded, startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.

C. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.

D. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.

E. Construction Schedule Updating Reports: Submit with Applications for Payment.

F. Daily Construction Reports: Submit at monthly intervals or as directed by Owner.

G. Material Location Reports: Submit at monthly intervals or as directed by Owner.

H. Site Condition Reports: Submit at time of discovery of differing conditions.

I. Special Reports: Submit at time of unusual event.

J. Qualification Data: For scheduling consultant.

1.5 QUALITY ASSURANCE

A. Scheduling Consultant Qualifications: If required by the Contract Documents, an experienced specialist in CPM scheduling and reporting, with capability of producing CPM reports and diagrams within 24 hours of Architect's request.

B. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Section 01310 "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's construction schedule, including, but not limited to, the following:

1. Review software limitations and content and format for reports.
2. Verify availability of qualified personnel needed to develop and update schedule.
3. Discuss constraints, including phasing, work stages, area separations, interim milestones and partial Owner occupancy.
4. Review delivery dates for Owner-furnished products.
5. Review schedule for work of Owner's separate contracts.
6. Review submittal requirements and procedures.
7. Review time required for review of submittals and resubmittals.
8. Review requirements for tests and inspections by independent testing and inspecting agencies.
9. Review time required for Project closeout and Owner startup procedures**,** including commissioning activities if required.
10. Review and finalize list of construction activities to be included in schedule.
11. Review procedures for updating schedule.

1.6 COORDINATION

A. Coordinate Contractor's construction schedule with the schedule of values, submittal schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from entities involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Substantial Completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than 10 working days, unless specifically allowed by Owner.
2. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than 60 calendar days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
3. Submittal Review Time: Include review and resubmittal times indicated in Section 01330 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
4. Startup and Testing Time: Include no fewer than 5 working days for startup and testing.
5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's and Construction Manager's administrative procedures necessary for certification of Substantial Completion.
6. Punch List and Final Completion: Include not more than 10 working days for completion of punch list items and final completion.

C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

1. Phasing: Arrange list of activities on schedule by phase.
2. Work under More Than One Contract: Include a separate activity for each contract.
3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
4. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Section 01100 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
5. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 01100 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
6. Work Restrictions: Show the effect of the following items on the schedule:

a. Coordination with existing construction.
b. Limitations of continued occupancies.
c. Uninterruptible services.
d. Partial occupancy before Substantial Completion.
e. Use of premises restrictions.

f. Provisions for future construction.
g. Seasonal variations.
h. Environmental control.

7. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

a. Subcontract awards.
b. Submittals.
c. Purchases.
d. Mockups.
e. Fabrication.
f. Sample testing.
g. Deliveries.
h. Installation.
i. Tests and inspections.
j. Adjusting.
k. Curing.
l. Building flush-out.
m. Startup and placement into final use and operation.

8. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:

a. Structural completion.
b. Temporary enclosure and space conditioning.
c. Permanent space enclosure.
d. Completion of mechanical installation.
e. Completion of electrical installation.
f. Substantial Completion.

9. Other Constraints as described in the Scope of Work and not included elsewhere.

D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, final completion and any interim milestones as described in the Scope of Work and not included elsewhere.

E. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.

1. See Section 01290 "Payment Procedures" for cost reporting and payment procedures.

F. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:

1. Unresolved issues.
2. Unanswered Requests for Information.
3. Rejected or unreturned submittals.

4. Notations on returned submittals.
5. Pending modifications affecting the Work and Contract Time.

G. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.

H. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

1. Use Microsoft Project compatible with Owner's operating system.

2.2 STARTUP CONSTRUCTION SCHEDULE

A. Bar-Chart Schedule: Submit startup, horizontal, bar-chart-type construction schedule within 7 calendar days of date established for the Notice to Proceed.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's construction schedule within 14 calendar days of date established for the Notice to Proceed. Base schedule on the startup construction schedule and additional information received since the start of Project. Schedule shall indicate the critical path of the project.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.

1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

2.4 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.

6. High and low temperatures and general weather conditions, including presence of rain or snow.
7. Accidents.
8. Meetings and significant decisions.
9. Unusual events (see special reports).
10. Stoppages, delays, shortages, and losses.
11. Meter readings and similar recordings.
12. Emergency procedures.
13. Orders and requests of authorities having jurisdiction.
14. Change Orders received and implemented.
15. Work Change Directives received and implemented.
16. Services connected and disconnected.
17. Equipment or system tests and startups.
18. Partial completions and occupancies.
19. Substantial Completions authorized.

B. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:

1. Material stored prior to previous report and remaining in storage.
2. Material stored prior to previous report and since removed from storage and installed.
3. Material stored following previous report and remaining in storage.

C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.5 SPECIAL REPORTS

A. General: Submit special reports directly to Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At bi-weekly intervals, update schedule to reflect actual construction progress and activities. Issue schedule at each progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate final completion percentage for each activity.

B. Distribution: Distribute copies of approved schedule to Architect**,** Construction Manager, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 01320

In the event of a conflict between the terms of the Agreement that governs this Project and the terms of this Section, the terms of the Agreement shall control. The provisions of other Contract Documents may apply to the subject matter of this Section.

SECTION 01322 - PHOTOGRAPHIC DOCUMENTATION

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Preconstruction photographs.
2. Periodic construction photographs.
3. Final completion construction photographs.
4. Preconstruction video recordings.
5. Periodic construction video recordings.
6. Web-based construction photographic documentation.

B. Related Requirements:

1. Section 01270 "Unit Prices" for procedures for unit prices for extra photographs.
2. Section 01330 "Submittal Procedures" for submitting photographic documentation.
3. Section 01732 "Selective Demolition" for photographic documentation before selective demolition operations commence.
4. Section 01770 "Closeout Procedures" for submitting photographic documentation as project record documents at Project closeout.
5. Section 01820 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For photographer if required.

B. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph and video recording if required by Owner. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.

C. Digital Photographs: Submit image files within 3 business days of taking photographs.

1. Digital Camera: Minimum sensor resolution of 8 megapixels.
2. Format: Minimum 3200 by 2400 pixels, in unaltered original files, with same aspect ratio as the sensor, uncropped, date and time stamped, in folder named by date of photograph, accompanied by key plan file.
3. Identification: Provide the following information with each image description in file metadata tag:

    a. Name of Project.
    b. Name and contact information for photographer.
    c. Name of Owner and Construction Manager.
    d. Name of Contractor.
    e. Date photograph was taken.
    f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
    g. Unique sequential identifier keyed to accompanying key plan.

D. Video Recordings: Submit video recordings within seven business days of recording.

1. Submit video recordings in digital video format acceptable to Owner.
2. Identification: With each submittal, provide the following information:

    a. Name of Project.
    b. Name and address of photographer.
    c. Name of Owner and Construction Manager.
    d. Name of Contractor.
    e. Date video recording was recorded.
    f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
    g. Weather conditions at time of recording.

1.4 QUALITY ASSURANCE

A. Photographer Qualifications: An individual who has been regularly engaged as a professional photographer of construction projects for not less than three years.

B. Web-Based Photographic Documentation Service Provider: A firm specializing in providing photographic equipment, Web-based software, and related services for construction projects, with record of providing satisfactory services similar to those required for Project.

1.5 USAGE RIGHTS

A. Obtain and transfer copyright usage rights from photographer to Owner for unlimited reproduction of photographic documentation.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

A. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of 8 megapixels, and at an image resolution of not less than 3200 by 2400 pixels.

B. Digital Video Recordings: Provide high-resolution, digital video in format acceptable to Owner.

PART 3 - EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

A. Photographer: Engage a qualified photographer to take construction photographs.

B. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.

1. Maintain key plan with each set of construction photographs that identifies each photographic location.

C. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

1. Date and Time: Include date and time in file name for each image.
2. Field Office Images: Maintain one set of images accessible in the field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Owner and Construction Manager.

D. Preconstruction Photographs: Before starting construction, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Owner and Construction Manager.

E. Periodic Construction Photographs: Take a minimum of 20 photographs monthly with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

F. Owner and Construction Manager-Directed Construction Photographs: From time to time, Owner and Construction Manager will instruct photographer about number and frequency of photographs and general directions on vantage points. Select actual vantage points and take photographs to show the status of construction and progress since last photographs were taken.

G. Final Completion Construction Photographs: Take 20 color photographs after date of Substantial Completion for submission as project record documents. Owner and Construction Manager will inform photographer of desired vantage points.

1. Do not include date stamp.

H. Additional Photographs: Owner or Construction Manager may request photographs in addition to periodic photographs specified.

1. Three business days' notice will be given, where feasible.
2. In emergency situations, take additional photographs within 24 hours of request.
3. Circumstances that could require additional photographs include, but are not limited to, the following:

a. Special events planned at Project site.
b. Immediate follow-up when on-site events result in construction damage or losses.
c. Photographs to be taken at fabrication locations away from Project site. These photographs are not subject to unit prices or unit-cost allowances.
d. Substantial Completion of a major phase or component of the Work.
e. Extra record photographs at time of final acceptance.
f. Owner's request for special publicity photographs.

3.2 CONSTRUCTION VIDEO RECORDINGS

A. Video Recording Photographer: Engage a qualified videographer to record construction video recordings.

B. Recording: Mount camera on tripod before starting recording unless otherwise necessary to show area of construction. Display continuous running time and date. At start of each video recording, record weather conditions from local newspaper or television and the actual temperature reading at Project site.

C. Preconstruction Video Recording: Before starting construction, record video recording of Project site and surrounding properties from different vantage points, as directed by Owner and Construction Manager.

END OF SECTION 01322

In the event of a conflict between the terms of the Agreement that governs this Project and the terms of this Section, the terms of the Agreement shall control. The provisions of other Contract Documents may apply to the subject matter of this Section.

SECTION 01330 - SUBMITTAL PROCEDURES

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Requirements:

1. Section 01290 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
2. Section 01320 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
3. Section 01781 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
4. Section 01782 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
5. Section 01820 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect’s and Construction Manager’s responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect’s and Construction Manager’s responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet

protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.

D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.4 ACTION SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and Construction Manager and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 calendar days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.

    a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.

4. Format: Arrange the following information in a tabular format:

    a. Scheduled date for first submittal.
    b. Specification Section number and title.
    c. Submittal category: Action; informational.
    d. Name of subcontractor.
    e. Description of the Work covered.
    f. Scheduled date for Architect’s and Construction Manager’s final release or approval.
    g. Scheduled date of fabrication.
    h. Scheduled dates for purchasing.
    i. Scheduled dates for installation.
    j. Activity or event number.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings may be provided by Architect for Contractor's use in preparing submittals.

1. Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings and Project record drawings at no cost to the contractor or owner.

a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
b. Digital Drawing Software Program: The Contract Drawings are available in AutoCAD.
c. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to Owner and Architect.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

    a. Architect and Construction Manager reserve the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Construction Manager's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow [10] business days for initial review of each submittal. This includes [2] business days on the receipt and [1] business day on return for the Construction Manager’s review and [7] working days for Architect/Engineer review. Allow additional time if coordination with subsequent submittals is required. Architect or Construction Manager will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow [10] business days for review of each resubmittal.
4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow [15] business days for initial review of each submittal.
5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow[10] business days for review of each submittal. Submittal will be returned to Construction Manager, through Architect before being returned to Contractor.

D. Paper Submittals: Shall be provided only at the request of the owner with the exception of samples, color charts, and other items related to the visible selection of materials. Refer to section 2.1D.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect and Construction Manager.
3. Include the following information for processing and recording action taken:

    a. Project name.
    b. Date.
    c. Name of Architect.
    d. Name of Construction Manager.
    e. Name of Contractor.
    f. Name of subcontractor.
    g. Name of supplier.
    h. Name of manufacturer.
    i. Submittal number or other unique identifier, including revision identifier.

        1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 06100.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 06100.01.A).

    j. Number and title of appropriate Specification Section.
    k. Drawing number and detail references, as appropriate.
    l. Location(s) where product is to be installed, as appropriate.
    m. Other necessary identification.

4. Additional Paper Copies: Unless additional copies are required for final submittal, and unless Architect and Construction Manager observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

    a. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect and Construction Manager.

5. Transmittal for Paper Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect and Construction Manager will return without review submittals received from sources other than Contractor.

    a. Transmittal Form for Paper Submittals: Provide locations on form for the following information:

        1) Project name.
        2) Date.
        3) Destination (To:).
        4) Source (From:).
        5) Name and address of Architect.
        6) Name of Construction Manager.
        7) Name of Contractor.
        8) Name of firm or entity that prepared submittal.
        9) Names of subcontractor, manufacturer, and supplier.

10) Category and type of submittal.
11) Submittal purpose and description.
12) Specification Section number and title.
13) Specification paragraph number or drawing designation and generic name for each of multiple items.
14) Drawing number and detail references, as appropriate.
15) Indication of full or partial submittal.
16) Transmittal number.
17) Submittal and transmittal distribution record.
18) Remarks.
19) Signature of transmitter.

E. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:

1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.

    a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-06100.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-06100.01.A).

3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect and Construction Manager.
4. Transmittal Form for Electronic Submittals: Use form acceptable to Owner**,** containing the following information:

    a. Project name.
    b. Date.
    c. Name and address of Architect.
    d. Name of Construction Manager.
    e. Name of Contractor.
    f. Name of firm or entity that prepared submittal.
    g. Names of subcontractor, manufacturer, and supplier.
    h. Category and type of submittal.
    i. Submittal purpose and description.
    j. Specification Section number and title.
    k. Specification paragraph number or drawing designation and generic name for each of multiple items.
    l. Drawing number and detail references, as appropriate.
    m. Location(s) where product is to be installed, as appropriate.
    n. Related physical samples submitted directly.
    o. Indication of full or partial submittal.
    p. Transmittal number.
    q. Submittal and transmittal distribution record.
    r. Other necessary identification.
    s. Remarks.

F. Options: Identify options requiring selection by Architect.

G. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect and Construction Manager on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

H. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Architect's and Construction Manager's action stamp.

I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

J. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's and Construction Manager's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Submit electronic submittals via email as PDF electronic files or if directed by Owner through post electronic submittals as PDF electronic files directly to an FTP site as directed by the Owner.

    a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

2. Action Submittals and Informational Submittals: Submit 3 paper copies of each submittal if requested by Owner.
3. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

    a. Provide a digital signature with digital certificate in a form acceptable to the Owner on electronically submitted certificates and certifications where indicated.

b. Provide a notarized statement on original paper copy certificates and certifications where indicated.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

a. Manufacturer's catalog cuts.
b. Manufacturer's product specifications.
c. Standard color charts.
d. Statement of compliance with specified referenced standards.
e. Testing by recognized testing agency.
f. Application of testing agency labels and seals.
g. Notation of coordination requirements.
h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:

a. Wiring diagrams showing factory-installed wiring.
b. Printed performance curves.
c. Operational range diagrams.
d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before or concurrent with Samples.
6. Submit Product Data in the following format:

a. PDF electronic file.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

a. Identification of products.
b. Schedules.
c. Compliance with specified standards.
d. Notation of coordination requirements.
e. Notation of dimensions established by field measurement.
f. Relationship and attachment to adjoining construction clearly indicated.
g. Seal and signature of professional engineer if specified.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 36 by 48 inches**.**
3. Submit Shop Drawings in the following format:

a. PDF electronic file.
b. Three paper copies of each submittal if requested by Owner. Architect and Construction Manager will retain two copies; remainder will be returned.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Attach label on unexposed side of Samples that includes the following:

a. Generic description of Sample.
b. Product name and name of manufacturer.
c. Sample source.
d. Number and title of applicable Specification Section.
e. Specification paragraph number and generic name of each item.

3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

a. Number of Samples: Submit three sets of Samples. Architect and Construction Manager will retain two Sample sets; remainder will be returned.

1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

E. Coordination Drawing Submittals: Comply with requirements specified in Section 01310 "Project Management and Coordination."

F. Contractor's Construction Schedule: Comply with requirements specified in Section 01320 "Construction Progress Documentation."

G. Application for Payment and Schedule of Values: Comply with requirements specified in Section 01290 "Payment Procedures."

H. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 01400 "Quality Requirements."

I. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 01770 "Closeout Procedures."

J. Maintenance Data: Comply with requirements specified in Section 01782 "Operation and Maintenance Data."

K. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

L. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

M. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

N. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

O. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

P. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

Q. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

R. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

S. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

1. Name of evaluation organization.
2. Date of evaluation.
3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

T. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

U. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

V. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

W. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect and Construction Manager.

B. Project Closeout and Maintenance Material Submittals: See requirements in Section 01770 "Closeout Procedures."

C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S AND CONSTRUCTION MANAGER'S ACTION

A. Action Submittals: Architect and Construction Manager will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect and Construction Manager will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

B. Informational Submittals: Architect and Construction Manager will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect and Construction Manager will forward each submittal to appropriate party.

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect and Construction Manager.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Submittals not required by the Contract Documents may be returned by the Architect without action.

END OF SECTION 01330

In the event of a conflict between the terms of the Agreement that governs this Project and the terms of this Section, the terms of the Agreement shall control. The provisions of other Contract Documents may apply to the subject matter of this Section.

SECTION 01400 - QUALITY REQUIREMENTS

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, Commissioning Authority, Construction Manager, or authorities having jurisdiction are not limited by provisions of this Section.
4. Specific test and inspection requirements are not specified in this Section.

C. Related Requirements:

1. Refer to Scope of Work or contract documents for allowances, if required.

1.3 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect or Construction Manager.

C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

1. Laboratory Mockups: Full-size physical assemblies constructed at testing facility to verify performance characteristics.
2. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.
3. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.

D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.

E. Product Testing: Tests and inspections that are performed by a Nationally Recognized Testing Laboratory (NRTL), a National Voluntary Laboratory Accreditation Program (NVLAP), or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.

G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of 5 previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 ACTION SUBMITTALS

A. Shop Drawings: For integrated exterior or laboratory mockups, provide plans, sections, and elevations, indicating materials and size of mockup construction.

1. Indicate manufacturer and model number of individual components.
2. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.6 INFORMATIONAL SUBMITTALS

A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

B. Qualification Data: For Contractor's quality-control personnel.

C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:

1. Seismic-force-resisting system, designated seismic system, or component listed in the designated seismic system quality-assurance plan prepared by Architect.
2. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan prepared by Architect.

D. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

E. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Entity responsible for performing tests and inspections.
3. Description of test and inspection.
4. Identification of applicable standards.
5. Identification of test and inspection methods.
6. Number of tests and inspections required.

7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

1.7 CONTRACTOR'S QUALITY-CONTROL PLAN

A. Quality-Control Plan, General: Submit quality-control plan within 10 business days of Notice to Proceed, and not less than 5 business days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.

B. Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.

1. Project quality-control manager may also serve as Project superintendent.

C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.

D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:

1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.
2. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."
3. Owner-performed tests and inspections indicated in the Contract Documents.

E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.

F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.8 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.
2. Project title and number.

3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and re-inspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.9 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. 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 installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.

F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

1. Contractor responsibilities include the following:

a. Provide test specimens representative of proposed products and construction.

b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
f. When testing is complete, remove test specimens, assemblies, and mockups; do not reuse products on Project.

2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, and Commissioning Authority if applicable, through Construction Manager, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

K. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect or Construction Manager.
2. Notify Architect and Construction Manager five (5) business days in advance of dates and times when mockups will be constructed.
3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at Project.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Obtain Architect's and Construction Manager's approval of mockups before starting work, fabrication, or construction.

a. Allow 5 business days for initial review and each re-review of each mockup.

6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Demolish and remove mockups when directed unless otherwise indicated.

L. Integrated Exterior Mockups: Construct integrated exterior mockup according to approved Shop Drawings. Coordinate installation of exterior envelope materials and products for which mockups are required in individual Specification Sections, along with supporting materials.

M. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Specification Sections.

1.10 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
2. Payment for these services will be made from testing and inspecting allowances, as authorized by Change Orders.
3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.

1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

    a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 01330 "Submittal Procedures."

D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

E. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

F. Testing Agency Responsibilities: Cooperate with Architect, Commissioning Authority, if applicable, Construction Manager, and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect, Commissioning Authority, if applicable, Construction Manager, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform any duties of Contractor.

G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.

1. Distribution: Distribute schedule to Owner, Architect, Commissioning Authority, if applicable, Construction Manager, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.11 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Unless otherwise noted in the Scope of Work, Owner will engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:

B. Special Tests and Inspections: Conducted by a qualified testing agency as required by authorities having jurisdiction, as indicated in individual Specification Sections, and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect, Commissioning Authority, if applicable, Construction Manager, and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect and Commissioning Authority, through Construction Manager, with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected work. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's, Commissioning Authority, if applicable, and Construction Manager's reference during normal working hours.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01700 "Execution Requirements."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01400

In the event of a conflict between the terms of the Agreement that governs this Project and the terms of this Section, the terms of the Agreement shall control. The provisions of other Contract Documents may apply to the subject matter of this Section.

SECTION 01420 - REFERENCES

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations" or “Codes”: Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.3 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.4 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."

B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

AABC	Associated Air Balance Council www.aabc.com	(202) 737-0202
AAMA	American Architectural Manufacturers Association www.aamanet.org	(847) 303-5664
AASHTO	American Association of State Highway and Transportation Officials www.transportation.org	(202) 624-5800
AATCC	American Association of Textile Chemists and Colorists www.aatcc.org	(919) 549-8141
ABMA	American Bearing Manufacturers Association www.americanbearings.org	(202) 367-1155
ACI	American Concrete Institute (Formerly: ACI International) www.concrete.org	(248) 848-3700

ACPA	American Concrete Pipe Association www.concrete-pipe.org	(972) 506-7216
AEIC	Association of Edison Illuminating Companies, Inc. (The) www.aeic.org	(205) 257-2530
AF&PA	American Forest & Paper Association www.afandpa.org	(800) 878-8878 (202) 463-2700
AGA	American Gas Association www.aga.org	(202) 824-7000
AHAM	Association of Home Appliance Manufacturers www.aham.org	(202) 872-5955
AHRI	Air-Conditioning, Heating, and Refrigeration Institute (The) www.ahrinet.org	(703) 524-8800
AI	Asphalt Institute www.asphaltinstitute.org	(859) 288-4960
AIA	American Institute of Architects (The) www.aia.org	(800) 242-3837 (202) 626-7300
AISC	American Institute of Steel Construction www.aisc.org	(800) 644-2400 (312) 670-2400
AISI	American Iron and Steel Institute www.steel.org	(202) 452-7100
AITC	American Institute of Timber Construction www.aitc-glulam.org	(303) 792-9559
AMCA	Air Movement and Control Association International, Inc. www.amca.org	(847) 394-0150
ANSI	American National Standards Institute www.ansi.org	(202) 293-8020
AOSA	Association of Official Seed Analysts, Inc. www.aosaseed.com	(607) 256-3313
APA	APA - The Engineered Wood Association www.apawood.org	(253) 565-6600
APA	Architectural Precast Association www.archprecast.org	(239) 454-6989
API	American Petroleum Institute www.api.org	(202) 682-8000

ARI	Air-Conditioning & Refrigeration Institute (See AHRI)	
ARI	American Refrigeration Institute (See AHRI)	
ARMA	Asphalt Roofing Manufacturers Association www.asphaltroofing.org	(202) 207-0917
ASCE	American Society of Civil Engineers www.asce.org	(800) 548-2723 (703) 295-6300
ASCE/SEI	American Society of Civil Engineers/Structural Engineering Institute (See ASCE)	
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers www.ashrae.org	(800) 527-4723 (404) 636-8400
ASME	ASME International (American Society of Mechanical Engineers) www.asme.org	(800) 843-2763 (973) 882-1170
ASSE	American Society of Safety Engineers (The) www.asse.org	(847) 699-2929
ASSE	American Society of Sanitary Engineering www.asse-plumbing.org	(440) 835-3040
ASTM	ASTM International (American Society for Testing and Materials International) www.astm.org	(610) 832-9500
ATIS	Alliance for Telecommunications Industry Solutions www.atis.org	(202) 628-6380
AWEA	American Wind Energy Association www.awea.org	(202) 383-2500
AWI	Architectural Woodwork Institute www.awinet.org	(571) 323-3636
AWMAC	Architectural Woodwork Manufacturers Association of Canada www.awmac.com	(403) 453-7387
AWPA	American Wood Protection Association (Formerly: American Wood-Preservers' Association) www.awpa.com	(205) 733-4077

AWS	American Welding Society www.aws.org	(800) 443-9353 (305) 443-9353
AWWA	American Water Works Association www.awwa.org	(800) 926-7337 (303) 794-7711
BHMA	Builders Hardware Manufacturers Association www.buildershardware.com	(212) 297-2122
BIA	Brick Industry Association (The) www.gobrick.com	(703) 620-0010
BICSI	BICSI, Inc. www.bicsi.org	(800) 242-7405 (813) 979-1991
BIFMA	BIFMA International (Business and Institutional Furniture Manufacturer's Association) www.bifma.com	(616) 285-3963
BISSC	Baking Industry Sanitation Standards Committee www.bissc.org	(866) 342-4772
BOCA	BOCA (Building Officials and Code Administrators International Inc.) (See ICC)	
BWF	Badminton World Federation (Formerly: International Badminton Federation) www.bwfbadminton.org	60 3 9283 7155
CDA	Copper Development Association www.copper.org	(800) 232-3282 (212) 251-7200
CEA	Canadian Electricity Association www.electricity.ca	(613) 230-9263
CEA	Consumer Electronics Association www.ce.org	(866) 858-1555 (703) 907-7600
CFFA	Chemical Fabrics & Film Association, Inc. www.chemicalfabricsandfilm.com	(216) 241-7333
CFSEI	Cold-Formed Steel Engineers Institute www.cfsei.org	(866) 465-4732 (202) 263-4488
CGA	Compressed Gas Association www.cganet.com	(703) 788-2700
CIMA	Cellulose Insulation Manufacturers Association	(888) 881-2462

	www.cellulose.org	(937) 222-2462
CISCA	Ceilings & Interior Systems Construction Association www.cisca.org	(630) 584-1919
CISPI	Cast Iron Soil Pipe Institute www.cispi.org	(404) 622-0073
CLFMI	Chain Link Fence Manufacturers Institute www.chainlinkinfo.org	(301) 596-2583
CPA	Composite Panel Association www.pbmdf.com	(703) 724-1128
CRI	Carpet and Rug Institute (The) www.carpet-rug.org	(706) 278-3176
CRRC	Cool Roof Rating Council www.coolroofs.org	(866) 465-2523 (510) 485-7175
CRSI	Concrete Reinforcing Steel Institute www.crsi.org	(800) 328-6306 (847) 517-1200
CSA	Canadian Standards Association www.csa.ca	(800) 463-6727 (416) 747-4000
CSA	CSA International (Formerly: IAS - International Approval Services) www.csa-international.org	(866) 797-4272 (416) 747-4000
CSI	Construction Specifications Institute (The) www.csinet.org	(800) 689-2900 (703) 684-0300
CSSB	Cedar Shake & Shingle Bureau www.cedarbureau.org	(604) 820-7700
CTI	Cooling Technology Institute (Formerly: Cooling Tower Institute) www.cti.org	(281) 583-4087
CWC	Composite Wood Council (See CPA)	
DASMA	Door and Access Systems Manufacturers Association www.dasma.com	(216) 241-7333
DHI	Door and Hardware Institute www.dhi.org	(703) 222-2010
ECA	Electronic Components Association www.ec-central.org	(703) 907-8024

ECAMA	Electronic Components Assemblies & Materials Association (See ECA)	
EIA	Electronic Industries Alliance (See TIA)	
EIMA	EIFS Industry Members Association www.eima.com	(800) 294-3462 (703) 538-1616
EJMA	Expansion Joint Manufacturers Association, Inc. www.ejma.org	(914) 332-0040
ESD	ESD Association (Electrostatic Discharge Association) www.esda.org	(315) 339-6937
ESTA	Entertainment Services and Technology Association (See PLASA)	
EVO	Efficiency Valuation Organization www.evo-world.org	(415) 367-3643 44 20 88 167 857
FIBA	Fédération Internationale de Basketball (The International Basketball Federation) www.fiba.com	41 22 545 00 00
FIVB	Fédération Internationale de Volleyball (The International Volleyball Federation) www.fivb.org	41 21 345 35 45
FM Approvals	FM Approvals LLC www.fmglobal.com	(781) 762-4300
FM Global	FM Global (Formerly: FMG - FM Global) www.fmglobal.com	(401) 275-3000
FRSA	Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc. www.floridaroof.com	(407) 671-3772
FSA	Fluid Sealing Association www.fluidsealing.com	(610) 971-4850
FSC	Forest Stewardship Council U.S. www.fscus.org	(612) 353-4511
GA	Gypsum Association www.gypsum.org	(301) 277-8686

GANA	Glass Association of North America www.glasswebsite.com	(785) 271-0208
GS	Green Seal www.greenseal.org	(202) 872-6400
HI	Hydraulic Institute www.pumps.org	(973) 267-9700
HI/GAMA	Hydronics Institute/Gas Appliance Manufacturers Association (See AHRI)	
HMMA	Hollow Metal Manufacturers Association (See NAAMM)	
HPVA	Hardwood Plywood & Veneer Association www.hpva.org	(703) 435-2900
HPW	H. P. White Laboratory, Inc. www.hpwhite.com	(410) 838-6550
IAPSC	International Association of Professional Security Consultants www.iapsc.org	(415) 536-0288
IAS	International Approval Services (See CSA)	
ICBO	International Conference of Building Officials (See ICC)	
ICC	International Code Council www.iccsafe.org	(888) 422-7233 (202) 370-1800
ICEA	Insulated Cable Engineers Association, Inc. www.icea.net	(770) 830-0369
ICPA	International Cast Polymer Alliance www.icpa-hq.org	(703) 525-0511
ICRI	International Concrete Repair Institute, Inc. www.icri.org	(847) 827-0830
IEC	International Electrotechnical Commission www.iec.ch	41 22 919 02 11
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The) www.ieee.org	(212) 419-7900
IES	Illuminating Engineering Society (Formerly: Illuminating Engineering Society of North	(212) 248-5000

	America) www.ies.org	
IESNA	Illuminating Engineering Society of North America (See IES)	
IEST	Institute of Environmental Sciences and Technology www.iest.org	(847) 981-0100
IGMA	Insulating Glass Manufacturers Alliance www.igmaonline.org	(613) 233-1510
IGSHPA	International Ground Source Heat Pump Association www.igshpa.okstate.edu	(405) 744-5175
ILI	Indiana Limestone Institute of America, Inc. www.iliai.com	(812) 275-4426
Intertek	Intertek Group (Formerly: ETL SEMCO; Intertek Testing Service NA) www.intertek.com	(800) 967-5352
ISA	International Society of Automation (The) (Formerly: Instrumentation, Systems, and Automation Society) www.isa.org	(919) 549-8411
ISAS	Instrumentation, Systems, and Automation Society (The) (See ISA)	
ISFA	International Surface Fabricators Association (Formerly: International Solid Surface Fabricators Association) www.isfanow.org	(877) 464-7732 (801) 341-7360
ISO	International Organization for Standardization www.iso.org	41 22 749 01 11
ISSFA	International Solid Surface Fabricators Association (See ISFA)	
ITU	International Telecommunication Union www.itu.int/home	41 22 730 51 11
KCMA	Kitchen Cabinet Manufacturers Association www.kcma.org	(703) 264-1690
LMA	Laminating Materials Association (See CPA)	
LPI	Lightning Protection Institute	(800) 488-6864

	www.lightning.org	
MBMA	Metal Building Manufacturers Association www.mbma.com	(216) 241-7333
MCA	Metal Construction Association www.metalconstruction.org	(847) 375-4718
MFMA	Maple Flooring Manufacturers Association, Inc. www.maplefloor.org	(888) 480-9138
MFMA	Metal Framing Manufacturers Association, Inc. www.metalframingmfg.org	(312) 644-6610
MHIA	Material Handling Industry of America www.mhia.org	(800) 345-1815 (704) 676-1190
MIA	Marble Institute of America www.marble-institute.com	(440) 250-9222
MMPA	Moulding & Millwork Producers Association (Formerly: Wood Moulding & Millwork Producers Association) www.wmmpa.com	(800) 550-7889 (530) 661-9591
MPI	Master Painters Institute www.paintinfo.com	(888) 674-8937 (604) 298-7578
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry Inc. www.mss-hq.org	(703) 281-6613
NAAMM	National Association of Architectural Metal Manufacturers www.naamm.org	(630) 942-6591
NACE	NACE International (National Association of Corrosion Engineers International) www.nace.org	(800) 797-6223 (281) 228-6200
NADCA	National Air Duct Cleaners Association www.nadca.com	(202) 737-2926
NAIMA	North American Insulation Manufacturers Association www.naima.org	(703) 684-0084
NBGQA	National Building Granite Quarries Association, Inc. www.nbgqa.com	(800) 557-2848
NCAA	National Collegiate Athletic Association (The) www.ncaa.org	(317) 917-6222

NCMA	National Concrete Masonry Association www.ncma.org	(703) 713-1900
NEBB	National Environmental Balancing Bureau www.nebb.org	(301) 977-3698
NECA	National Electrical Contractors Association www.necanet.org	(301) 657-3110
NeLMA	Northeastern Lumber Manufacturers Association www.nelma.org	(207) 829-6901
NEMA	National Electrical Manufacturers Association www.nema.org	(703) 841-3200
NETA	InterNational Electrical Testing Association www.netaworld.org	(888) 300-6382 (269) 488-6382
NFHS	National Federation of State High School Associations www.nfhs.org	(317) 972-6900
NFPA	NFPA (National Fire Protection Association) www.nfpa.org	(800) 344-3555 (617) 770-3000
NFPA	NFPA International (See NFPA)	
NFRC	National Fenestration Rating Council www.nfrc.org	(301) 589-1776
NHLA	National Hardwood Lumber Association www.nhla.com	(800) 933-0318 (901) 377-1818
NLGA	National Lumber Grades Authority www.nlga.org	(604) 524-2393
NOFMA	National Oak Flooring Manufacturers Association (See NWFA)	
NOMMA	National Ornamental & Miscellaneous Metals Association www.nomma.org	(888) 516-8585
NRCA	National Roofing Contractors Association www.nrca.net	(800) 323-9545 (847) 299-9070
NRMCA	National Ready Mixed Concrete Association www.nrmca.org	(888) 846-7622 (301) 587-1400
NSF	NSF International (National Sanitation Foundation International)	(800) 673-6275 (734) 769-8010

	www.nsf.org	
NSPE	National Society of Professional Engineers www.nspe.org	(703) 684-2800
NSSGA	National Stone, Sand & Gravel Association www.nssga.org	(800) 342-1415 (703) 525-8788
NTMA	National Terrazzo & Mosaic Association, Inc. (The) www.ntma.com	(800) 323-9736
NWFA	National Wood Flooring Association www.nwfa.org	(800) 422-4556 (636) 519-9663
PCI	Precast/Prestressed Concrete Institute www.pci.org	(312) 786-0300
PDI	Plumbing & Drainage Institute www.pdionline.org	(800) 589-8956 (978) 557-0720
PLASA	PLASA (Formerly: ESTA - Entertainment Services and Technology Association) www.plasa.org	(212) 244-1505
RCSC	Research Council on Structural Connections www.boltcouncil.org	
RFCI	Resilient Floor Covering Institute www.rfci.com	(706) 882-3833
RIS	Redwood Inspection Service www.redwoodinspection.com	(925) 935-1499
SAE	SAE International (Society of Automotive Engineers) www.sae.org	(877) 606-7323 (724) 776-4841
SBCCI	Southern Building Code Congress International, Inc. (See ICC)	
SCTE	Society of Cable Telecommunications Engineers www.scte.org	(800) 542-5040 (610) 363-6888
SDI	Steel Deck Institute www.sdi.org	(847) 458-4647
SDI	Steel Door Institute www.steeldoor.org	(440) 899-0010
SEFA	Scientific Equipment and Furniture Association	(877) 294-5424

	www.sefalabs.com	(516) 294-5424
SEI/ASCE	Structural Engineering Institute/American Society of Civil Engineers (See ASCE)	
SIA	Security Industry Association www.siaonline.org	(866) 817-8888 (703) 683-2075
SJI	Steel Joist Institute www.steeljoist.org	(843) 293-1995
SMA	Screen Manufacturers Association www.smainfo.org	(773) 636-0672
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association www.smacna.org	(703) 803-2980
SMPTE	Society of Motion Picture and Television Engineers www.smpte.org	(914) 761-1100
SPFA	Spray Polyurethane Foam Alliance www.sprayfoam.org	(800) 523-6154
SPIB	Southern Pine Inspection Bureau www.spib.org	(850) 434-2611
SPRI	Single Ply Roofing Industry www.spri.org	(781) 647-7026
SRCC	Solar Rating and Certification Corporation www.solar-rating.org	(321) 638-1537
SSINA	Specialty Steel Industry of North America www.ssina.com	(800) 982-0355 (202) 342-8630
SSPC	SSPC: The Society for Protective Coatings www.sspc.org	(877) 281-7772 (412) 281-2331
STI	Steel Tank Institute www.steeltank.com	(847) 438-8265
SWI	Steel Window Institute www.steelwindows.com	(216) 241-7333
SWPA	Submersible Wastewater Pump Association www.swpa.org	(847) 681-1868
TCA	Tilt-Up Concrete Association www.tilt-up.org	(319) 895-6911

TCNA	Tile Council of North America, Inc. (Formerly: Tile Council of America) www.tileusa.com	(864) 646-8453
TEMA	Tubular Exchanger Manufacturers Association, Inc. www.tema.org	(914) 332-0040
TIA	Telecommunications Industry Association (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance) www.tiaonline.org	(703) 907-7700
TIA/EIA	Telecommunications Industry Association/Electronic Industries Alliance (See TIA)	
TMS	The Masonry Society www.masonrysociety.org	(303) 939-9700
TPI	Truss Plate Institute www.tpinst.org	(703) 683-1010
TPI	Turfgrass Producers International www.turfgrasssod.org	(800) 405-8873 (847) 649-5555
TRI	Tile Roofing Institute www.tileroofing.org	(312) 670-4177
UBC	Uniform Building Code (See ICC)	
UL	Underwriters Laboratories Inc. www.ul.com	(877) 854-3577
UNI	Uni-Bell PVC Pipe Association www.uni-bell.org	(972) 243-3902
USAV	USA Volleyball www.usavolleyball.org	(888) 786-5539 (719) 228-6800
USGBC	U.S. Green Building Council www.usgbc.org	(800) 795-1747
USITT	United States Institute for Theatre Technology, Inc. www.usitt.org	(800) 938-7488 (315) 463-6463
WASTEC	Waste Equipment Technology Association www.wastec.org	(800) 424-2869 (202) 244-4700
WCLIB	West Coast Lumber Inspection Bureau	(800) 283-1486

	www.wclib.org	(503) 639-0651
WCMA	Window Covering Manufacturers Association www.wcmanet.org	(212) 297-2122
WDMA	Window & Door Manufacturers Association www.wdma.com	(800) 223-2301 (312) 321-6802
WI	Woodwork Institute (Formerly: WIC - Woodwork Institute of California) www.wicnet.org	(916) 372-9943
WMMPA	Wood Moulding & Millwork Producers Association (See MMPA)	
WSRCA	Western States Roofing Contractors Association www.wsrca.com	(800) 725-0333 (650) 938-5441
WWPA	Western Wood Products Association www.wwpa.org	(503) 224-3930

C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

DIN	Deutsches Institut für Normung e.V. www.din.de	49 30 2601-0
IAPMO	International Association of Plumbing and Mechanical Officials www.iapmo.org	(909) 472-4100
ICC	International Code Council www.iccsafe.org	(888) 422-7233
ICC-ES	ICC Evaluation Service, LLC www.icc-es.org	(800) 423-6587 (562) 699-0543

D. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

COE	Army Corps of Engineers www.usace.army.mil	(202) 761-0011
CPSC	Consumer Product Safety Commission www.cpsc.gov	(800) 638-2772 (301) 504-7923

DOC	Department of Commerce National Institute of Standards and Technology www.nist.gov	(301) 975-4040
DOD	Department of Defense http://dodssp.daps.dla.mil	(215) 697-2664
DOE	Department of Energy www.energy.gov	(202) 586-9220
EPA	Environmental Protection Agency www.epa.gov	(202) 272-0167
FAA	Federal Aviation Administration www.faa.gov	(866) 835-5322
FG	Federal Government Publications www.gpo.gov	(202) 512-1800
GSA	General Services Administration www.gsa.gov	(800) 488-3111 (202) 619-8925
HUD	Department of Housing and Urban Development www.hud.gov	(202) 708-1112
LBL	Lawrence Berkeley National Laboratory Environmental Energy Technologies Division http://eetd.lbl.gov	(510) 486-4000
OSHA	Occupational Safety & Health Administration www.osha.gov	(800) 321-6742
SD	Department of State www.state.gov	(202) 647-4000
TRB	Transportation Research Board National Cooperative Highway Research Program www.trb.org	(202) 334-2934
USDA	Department of Agriculture Agriculture Research Service U.S. Salinity Laboratory www.ars.usda.gov	(202) 720-3656
USDA	Department of Agriculture Rural Utilities Service www.usda.gov	(202) 720-2791
USDJ	Department of Justice Office of Justice Programs National Institute of Justice	(202) 307-0703

	www.ojp.usdoj.gov	
USP	U.S. Pharmacopeia www.usp.org	(800) 227-8772 (301) 881-0666
USPS	United States Postal Service www.usps.com	(202) 268-2000

E. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CFR	Code of Federal Regulations Available from Government Printing Office www.gpo.gov/fdsys	(866) 512-1800 (202) 512-1800
DOD	Department of Defense Military Specifications and Standards Available from Department of Defense Single Stock Point http://dodssp.daps.dla.mil	(215) 697-2664
DSCC	Defense Supply Center Columbus (See FS)	
FED-STD	Federal Standard (See FS)	
FS	Federal Specification Available from Department of Defense Single Stock Point http://dodssp.daps.dla.mil	(215) 697-2664
	Available from Defense Standardization Program www.dsp.dla.mil	
	Available from General Services Administration www.gsa.gov	(800) 488-3111 (202) 619-8925
	Available from National Institute of Building Sciences/Whole Building Design Guide www.wbdg.org/ccb	(202) 289-7800
MILSPEC	Military Specification and Standards (See DOD)	
USAB	United States Access Board www.access-board.gov	(800) 872-2253 (202) 272-0080
USATBCB	U.S. Architectural & Transportation Barriers Compliance Board (See USAB)	

F. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CBHF	State of California Department of Consumer Affairs Bureau of Electronic Appliance and Repair, Home Furnishings and Thermal Insulation www.bearhfti.ca.gov	(800) 952-5210 (916) 574-2041
CCR	California Code of Regulations Office of Administrative Law California Title 24 Energy Code www.calregs.com	(916) 323-6225
CDHS	California Department of Health Care Services (Formerly: California Department of Health Services) (See CCR)	
CDPH	California Department of Public Health Indoor Air Quality Program www.cal-iaq.org	
CPUC	California Public Utilities Commission www.cpuc.ca.gov	(800) 848-5580 (415) 703-2782
SCAQMD	South Coast Air Quality Management District www.aqmd.gov	(909) 396-2000
TFS	Texas Forest Service Forest Resource Development and Sustainable Forestry http://txforestservice.tamu.edu	 (979) 458-6606

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01420

In the event of a conflict between the terms of the Agreement that governs this Project and the terms of this Section, the terms of the Agreement shall control. The provisions of other Contract Documents may apply to the subject matter of this Section.

SECTION 01500 - TEMPORARY FACILITIES AND CONTROLS

<BACK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Related Requirements:

1. Refer to the Scope of Work for limitations on work restrictions and utility interruptions.

1.3 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.

B. Sewer Service: Pay sewer-service use charges for sewer usage by all entities for construction operations.

C. Water Service: Pay water-service use charges for water used by all entities for construction operations.

D. Electric Power Service: Pay electric-power-service use charges for electricity used by all entities for construction operations.

1.4 INFORMATIONAL SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA, PADEP, PWD, Construction General Permit or authorities having jurisdiction, whichever is more stringent.

C. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

D. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.

1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
3. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

E. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:

1. Locations of dust-control partitions at each phase of work.
2. HVAC system isolation schematic drawing.
3. Location of proposed air-filtration system discharge.
4. Waste handling procedures.
5. Other dust-control measures.

1.5 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

C. Accessible Temporary Egress: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.

1.6 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch-OD line posts and 2-7/8-inch-OD corner and pull posts.

B. Portable Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch-OD corner and pull posts, with 1-5/8-inch- OD top and bottom rails. Provide concrete bases for supporting posts.

C. Wood Enclosure Fence: Plywood, 6 feet high, framed with four 2-by-4-inch rails, with preservative-treated wood posts spaced not more than 8 feet apart.

D. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.

E. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches.

F. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

2.2 TEMPORARY FACILITIES

A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:

1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot-square tack and marker boards.
3. Drinking water and private toilet.
4. Coffee machine and supplies.
5. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
6. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.

C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

1. Store combustible materials apart from building.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. HVAC Equipment: Provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.

C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

1. Locate facilities to limit site disturbance as specified in Section 01100 "Summary."

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.

C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction. If connection to Owner’s existing water service facilities is approved, clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

1. Toilets: Use of Owner's existing toilet facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

E. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

F. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.

1. Prior to commencing work, isolate the HVAC system in area where work is to be performed according to coordination drawings.

a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
b. Maintain negative air pressure within work area using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.

2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

G. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.

H. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

1. Install electric power service overhead unless otherwise indicated.
2. Connect temporary service to Owner's existing power source, as directed by Owner.

I. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
2. Install lighting for Project identification sign, if required.

J. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one <1> telephone line for each field office.

1. Provide additional telephone lines for the following:

a. Provide a dedicated telephone line for each facsimile machine in each field office.

2. At each telephone, post a list of important telephone numbers.

a. Police and fire departments.
b. Ambulance service.
c. Contractor's home office.
d. Contractor's emergency after-hours telephone number.
e. Architect's office.
f. Engineers' offices.
g. Owner's office.
h. Principal subcontractors' field and home offices.

3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.

1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

C. Temporary Use of Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.

1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
2. Prepare subgrade and install subbase and base for temporary roads and paved areas according to Section 02300 "Earthwork."
3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.
4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course according to Section 02741 "Asphalt Paving."

D. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

E. Parking: Construction personnel are responsible for their own parking and are not to park in any loading docks or adjacent to buildings where public parking is otherwise not permitted.

F. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.

G. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.

1. Identification Signs: Provide Project identification signs as indicated on Drawings.
2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.

    a. Provide temporary, directional signs for construction personnel and visitors.

3. Maintain and touchup signs so they are legible at all times.

H. Waste Disposal Facilities: Comply with requirements specified in Section 01524 "Construction Waste Management."

I. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 01700 "Execution Requirements."

J. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

K. Existing Elevator Use: Use of Owner's existing elevators will be permitted, provided elevators are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore elevators to condition existing before initial use, including replacing worn cables, guide shoes, and similar items of limited life.

1. Do not load elevators beyond their rated weight capacity.
2. Provide protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. If, despite such protection, elevators become damaged, engage elevator Installer to restore damaged work so no evidence remains of correction work. Return items that cannot be refinished in field to the shop, make required repairs and refinish entire unit, or provide new units as required.

L. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.

M. Existing Stair Usage: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.

1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.

N. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

1. Comply with work restrictions specified in Section 01100 "Summary."

C. Temporary Erosion and Sedimentation Control: Comply with the requirements of authorities having jurisdiction.

D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

E. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

F. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.

G. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.

1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
2. Maintain security by limiting number of keys and restricting distribution to authorized personnel.

H. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.

I. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

J. Temporary Egress: Provide and/or Maintain temporary egress from existing occupied facilities as indicated and as required by project phasing and/or authorities having jurisdiction.

K. Covered Walkway: Erect protective, covered walkway for passage of individuals through or adjacent to Project site. Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction.

1. Construct covered walkways using scaffold or shoring framing.
2. Provide overhead decking, protective enclosure walls, handrails, barricades, warning signs, exit signs, lights, safe and well-drained walkways, and similar provisions for protection and safe passage.
3. Paint and maintain appearance of walkway for duration of the Work.

L. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

M. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner from fumes and noise.

1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant-treated plywood on construction operations side.
2. Construct dustproof partitions with two layers of 6-mil polyethylene sheet on each side. Cover floor with two layers of 6-mil polyethylene sheet, extending sheets 18 inches up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant-treated plywood.

a. Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches between doors. Maintain water-dampened foot mats in vestibule.

3. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
4. Insulate partitions to control noise transmission to occupied areas.
5. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
6. Protect air-handling equipment.
7. Provide walk-off mats at each entrance through temporary partition.

N. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program, Temple University's Fire Marshal, and/or the authorities having jurisdiction.

1. Prohibit smoking in construction areas.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.5 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.

B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:

1. Protect porous materials from water damage.
2. Protect stored and installed material from flowing or standing water.
3. Keep porous and organic materials from coming into prolonged contact with concrete.
4. Remove standing water from decks.
5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Periodically collect and remove waste containing cellulose or other organic matter.

4. Discard or replace water-damaged material.
5. Do not install material that is wet.
6. Discard, replace, or clean stored or installed material that begins to grow mold.
7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:

1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Use permanent HVAC system to control humidity.
3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.

    a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.
    b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
    c. Remove materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.6 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Operate Project-identification-sign lighting daily from dusk until 12:00 midnight.

D. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

E. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.

2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01770 "Closeout Procedures."

END OF SECTION 01500

In the event of a conflict between the terms of the Agreement that governs this Project and the terms of this Section, the terms of the Agreement shall control. The provisions of other Contract Documents may apply to the subject matter of this Section.

SECTION 01524 - CONSTRUCTION WASTE MANAGEMENT

<BACK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Salvaging nonhazardous demolition and construction waste.
2. Recycling nonhazardous demolition and construction waste.
3. Disposing of nonhazardous demolition and construction waste.

B. Related Requirements:

1. Section 01125 "Summary of Multiple Contracts" for coordination of responsibilities for waste management.
2. Section 01732 "Selective Demolition" for disposition of waste resulting from partial demolition of buildings, structures, and site improvements.

1.3 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.4 PERFORMANCE REQUIREMENTS

A. General: Achieve end-of-Project rates for salvage/recycling of 75 percent by weight of total non-hazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials, including the following:

1. Demolition Waste:

a. Asphalt paving.
b. Concrete.
c. Concrete reinforcing steel.
d. Brick.
e. Concrete masonry units.
f. Wood studs.
g. Wood joists.
h. Plywood and oriented strand board.
i. Wood paneling.
j. Wood trim.
k. Structural and miscellaneous steel.
l. Rough hardware.
m. Roofing.
n. Insulation.
o. Doors and frames.
p. Door hardware.
q. Windows.
r. Glazing.
s. Metal studs.
t. Gypsum board.
u. Acoustical tile and panels.
v. Carpet.
w. Carpet pad.
x. Demountable partitions.
y. Equipment.
z. Cabinets.
aa. Plumbing fixtures.
bb. Piping.
cc. Supports and hangers.
dd. Valves.
ee. Sprinklers.
ff. Mechanical equipment.
gg. Refrigerants.

hh. Electrical conduit.
ii. Copper wiring.
jj. Lighting fixtures.
kk. Lamps.
ll. Ballasts.
mm. Electrical devices.
nn. Switchgear and panelboards.
oo. Transformers.

2. Construction Waste:

a. Site clearing waste
b. Masonry and CMU.
c. Lumber.
d. Wood sheet materials.
e. Wood trim.
f. Metals.
g. Roofing.
h. Insulation.
i. Carpet and pad.
j. Gypsum board.
k. Piping.
l. Electrical conduit.
m. Packaging: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:

1) Paper.
2) Cardboard.
3) Boxes.
4) Plastic sheet and film.
5) Polystyrene packaging.
6) Wood crates.
7) Plastic pails.

1.5 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within 7 calendar days of date established for the Notice to Proceed.

1.6 INFORMATIONAL SUBMITTALS

A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Use attached Temple University Waste Reduction Report Form. Submit an electronic (.pdf) copy to the Owner with a separate copy sent directly to Temple University's Office of Sustainability. Include the following information:
1. Type of waste: Demolition or Construction
2. Total quantity of waste in tons.

3. Quantity of waste salvaged, both estimated and actual in tons.
4. Quantity of waste recycled, both estimated and actual in tons.
5. Total quantity of waste recovered (salvaged plus recycled) in tons.
6. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.

C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.

D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.

E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

G. Qualification Data: For refrigerant recovery technician, if applicable.

H. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.7 QUALITY ASSURANCE

A. Waste Management Coordinator Qualifications: Experienced firm, with a record of successful waste management coordination of projects with similar requirements, that employs a LEED-Accredited Professional, certified by the USGBC, as waste management coordinator.

B. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.

C. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

D. Waste Management Conference: Conduct conference at Project site to comply with requirements in Section 01310 "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:

1. Review and discuss waste management plan including responsibilities of waste management coordinator.
2. Review requirements for documenting quantities of each type of waste and its disposition.

3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
5. Review waste management requirements for each trade.

1.8 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according to ASTM E 1609 and requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis.

B. Distinguish between demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures. Submit an electronic (.pdf) copy to the Owner with a separate copy sent directly to Temple University's Office of Sustainability.

1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

1. Comply with operation, termination, and removal requirements in Section 01500 "Temporary Facilities and Controls."

B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan.

C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.

1. Distribute waste management plan to everyone concerned within 3 working days of submittal return.
2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
2. Comply with Section 01500 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 SALVAGING DEMOLITION WASTE

A. Salvaged Items for Reuse in the Work: Salvage items for reuse and handle as follows:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
3. Store items in a secure area until installation.
4. Protect items from damage during transport and storage.
5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

B. Salvaged Items for Sale and Donation: Not Permitted on Project site.

C. Salvaged Items for Owner's Use: Salvage items for Owner's use and handle as follows:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

D. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.

E. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.

F. Plumbing Fixtures: Separate by type and size.

G. Lighting Fixtures: Separate lamps by type and protect from breakage.

H. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Receivers and Processors: List below is provided for information only; available recycling receivers and processors include, but are not limited to, the following:

1. Revolution Recovery

2. Richard S. Burns & Company, Inc.

C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.

1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.

    a. Inspect containers and bins for contamination and remove contaminated materials if found.

2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

3.4 RECYCLING DEMOLITION WASTE

A. Asphalt Paving: Grind asphalt to maximum 1-1/2-inch size.

1. Crush asphaltic concrete paving and screen to comply with requirements in Section 02300 "Earthwork" for use as general fill.

B. Asphalt Paving: Break up and transport paving to asphalt-recycling facility.

C. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.

1. Pulverize concrete to maximum 1-1/2-inch size.
2. Crush concrete and screen to comply with requirements in Section 02300 "Earthwork" for use as satisfactory soil for fill or subbase.

D. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.

1. Pulverize masonry to maximum 1-inch size.

2. Clean and stack undamaged, whole masonry units on wood pallets.

E. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.

F. Metals: Separate metals by type.

1. Structural Steel: Stack members according to size, type of member, and length.
2. Remove and dispose of bolts, nuts, washers, and other rough hardware.

G. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.

H. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.

I. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.

J. Metal Suspension System: Separate metal members including trim, and other metals from acoustical panels and tile and sort with other metals.

K. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.

1. Store clean, dry carpet and Pad in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.

L. Carpet Tile: Remove debris, trash, and adhesive.

1. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.

M. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.

N. Conduit: Reduce conduit to straight lengths and store by type and size.

3.5 RECYCLING CONSTRUCTION WASTE

A. Packaging:

1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
2. Polystyrene Packaging: Separate and bag materials.
3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Wood Materials:

1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

    a. Comply with requirements in Section 02930 "Exterior Plants" for use of clean sawdust as organic mulch.

C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.

1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

    a. Comply with requirements in Section 02930 "Exterior Plants" for use of clean ground gypsum board as inorganic soil amendment.

3.6 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Disposal: Remove waste materials from Owner's property and legally dispose of them.

3.7 ATTACHMENTS

A. Temple University Waste Reduction Report Form Sample. Request Microsoft Excel file form from the Temple University Construction Manager.

B. Note: If this project is intended to be LEED Certified, Contractor shall refer to the LEED specifications for the applicable forms.

END OF SECTION 01524

TEMPLE UNIVERSITY
Office of Facilities Management

WASTE REDUCTION REPORT

A. Company Name: _____

B. Project Name: _____

C. Project Location: _____

D. Summary

SAMPLE

E. Project Statistics

1. Demolition Waste

Date	Total Collected (tons)	Weight of Recycled or (tons)	Weight of [illegible] Landfill (tons)	Diversion Rate
Total				

2. Construction Waste

Date	Total Weight Collected (tons)	Weight of Recycled or Salvaged Materials (tons)	Weight of Materials sent to Landfill (tons)	Landfill Diversion Rate
Total				

In the event of a conflict between the terms of the Agreement that governs this Project and the terms of this Section, the terms of the Agreement shall control. The provisions of other Contract Documents may apply to the subject matter of this Section.

SECTION 01600 - PRODUCT REQUIREMENTS

<BACK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

B. Related Requirements:

1. Section 01210 "Allowances" for products selected under an allowance.
2. Section 01230 "Alternates" for products selected under an alternate.
3. Section 01635 "Substitution Procedures" for requests for substitutions.
4. Section 01420 "References" for applicable industry standards for products specified.

1.3 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type,

function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.4 ACTION SUBMITTALS

A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 business days of receipt of request, or 7 business days of receipt of additional information or documentation, whichever is later.

    a. Form of Approval: As specified in Section 01330 "Submittal Procedures."
    b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 01330 "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.
3. In no case shall the coordination and selection of compatible products result in an additional cost to the Owner.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.

2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.
7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 01770 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:

1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
3. Products:

    a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirement**s. Comparable products or substitutions for Contractor's convenience will not be considered.**
    b. Nonrestricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.

4. Manufacturers:

    a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

b. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.

5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 01635 "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01600

In the event of a conflict between the terms of the Agreement that governs this Project and the terms of this Section, the terms of the Agreement shall control. The provisions of other Contract Documents may apply to the subject matter of this Section.

SECTION 01635 - SUBSTITUTION PROCEDURES

<BACK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:

1. Section 01210 "Allowances" for products selected under an allowance.
2. Section 01230 "Alternates" for products selected under an alternate.
3. Section 01600 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.3 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use CSI Form 13.1A.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. Certificates and qualification data, where applicable or requested.
g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
i. Research reports evidencing compliance with building code in effect for Project.
j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
k. Cost information, including a proposal of change, if any, in the Contract Sum.
l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven (7) calendar days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within fifteen (15) calendar days of receipt of request, or seven (7) calendar days of receipt of additional information or documentation, whichever is later.

a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than fifteen (15) calendar days prior to time required for preparation and review of related submittals.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
b. Requested substitution provides sustainable design characteristics that specified product provided.
c. Substitution request is fully documented and properly submitted.
d. Requested substitution will not adversely affect Contractor's construction schedule.
e. Requested substitution has received necessary approvals of authorities having jurisdiction.
f. Requested substitution is compatible with other portions of the Work.
g. Requested substitution has been coordinated with other portions of the Work.
h. Requested substitution provides specified warranty.
i. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Not allowed.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01635

In the event of a conflict between the terms of the Agreement that governs this Project and the terms of this Section, the terms of the Agreement shall control. The provisions of other Contract Documents may apply to the subject matter of this Section.

SECTION 01700 - EXECUTION REQUIREMENTS

<BACK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. Installation of the Work.
4. Cutting and patching.
5. Coordination of Owner-installed products.
6. Progress cleaning.
7. Starting and adjusting.
8. Protection of installed construction.
9. Correction of the Work.

B. Related Requirements:

1. Section 01100 "Summary" for limits on use of Project site.
2. Section 01330 "Submittal Procedures" for submitting surveys.
3. Section 01732 "Selective Demolition" for demolition and removal of selected portions of the building.
4. Section 01770 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
5. Section 07841 "Through-Penetration Firestop Systems" for patching penetrations in fire-rated construction.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For land surveyor.

B. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.

C. Cutting and Patching Plan: Submit plan describing procedures at least 10 business days prior to the time cutting and patching will be performed. Include the following information:

1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
3. Products: List products to be used for patching and firms or entities that will perform patching work.
4. Dates: Indicate when cutting and patching will be performed.
5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.

    a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.

D. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

E. Certified Surveys: Submit 3 paper copies and one electronic copy signed and sealed by land surveyor.

F. Final Property Survey: Submit 3 paper copies and one electronic copy signed and sealed by land surveyor showing the Work performed and record survey data.

1.5 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and

patch structural elements in a manner that could change their load-carrying capacity or increase deflection.

2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:

    a. Primary operational systems and equipment.
    b. Fire separation assemblies.
    c. Air or smoke barriers.
    d. Fire-suppression systems.
    e. Mechanical systems piping and ducts.
    f. Control systems.
    g. Communication systems.
    h. Fire-detection and -alarm systems.
    i. Conveying systems.
    j. Electrical wiring systems.
    k. Operating systems of special construction.

3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:

    a. Water, moisture, or vapor barriers.
    b. Membranes and flashings.
    c. Exterior curtain-wall construction.
    d. Sprayed fire-resistive material.
    e. Equipment supports.
    f. Piping, ductwork, vessels, and equipment.
    g. Noise- and vibration-control elements and systems.

4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

C. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

D. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

1. Description of the Work.
2. List of detrimental conditions, including substrates.
3. List of unacceptable installation tolerances.
4. Recommended corrections.

D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 01310 "Project Management and Coordination."

E. Surface and Substrate Preparation: Comply with manufacturer's written recommendations for preparation of substrates to receive subsequent work.

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect and Construction Manager promptly.

B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish limits on use of Project site.
3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
4. Inform installers of lines and levels to which they must comply.
5. Check the location, level and plumb, of every major element as the Work progresses.
6. Notify Architect and Construction Manager when deviations from required lines and levels exceed allowable tolerances.
7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect and Construction Manager.

3.4 FIELD ENGINEERING

A. Identification: Owner will identify existing benchmarks, control points, and property corners.

B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect or Construction Manager. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect and Construction Manager before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

C. Benchmarks: Establish and maintain a minimum of 2 permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

E. Final Property Survey: Engage a land surveyor to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.

1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 01100 "Summary."

F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.

G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.

    a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

    a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 OWNER-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for Owner's construction personnel.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.

1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.8 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven calendar days during normal weather or three calendar days if the temperature is expected to rise above 80 deg F.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

    a. Use containers intended for holding waste materials of type to be stored.

4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 01500 "Temporary Facilities and Controls." and Section 01524 "Construction Waste Management."

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.9 STARTING AND ADJUSTING

A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 01810 "General Commissioning Requirements."

B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Manufacturer's Field Service: Comply with qualification requirements in Section 01400 "Quality Requirements."

3.10 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 01700

In the event of a conflict between the terms of the Agreement that governs this Project and the terms of this Section, the terms of the Agreement shall control. The provisions of other Contract Documents may apply to the subject matter of this Section.

SECTION 01732 - SELECTIVE DEMOLITION

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.
3. Salvage of existing items to be reused or recycled.

B. Related Requirements:

1. Section 01100 "Summary" for restrictions on the use of the premises, Owner-occupancy requirements, and phasing requirements.
2. Section 01351 "Special Procedures for Historic Treatment" for historic removal and dismantling.
3. Section 01700 "Execution Requirements" for cutting and patching procedures.
4. Section 02230 "Site Clearing" for site clearing and removal of above- and below-grade improvements.
5. Section 02231 "Tree Protection and Trimming" for temporary protection of existing trees and plants that are affected by selective demolition.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.

C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 PRE-INSTALLATION MEETINGS

A. Pre-demolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For refrigerant recovery technician.

B. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting individuals and property for environmental protection, for dust control, and for noise control. Indicate proposed locations and construction of barriers.

C. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs.
5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

D. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.

E. Pre-demolition Photographs or Video: Submit before Work begins.

F. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

G. Warranties: Documentation indicated that existing warranties are still in effect after completion of selective demolition.

1.7 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

B. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.8 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.9 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

1. Before selective demolition, Owner will remove the following items:

a. Refer to scope of work

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. Hazardous materials will be removed by Owner before start of the Work.
2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

1.10 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties. Notify warrantor before proceeding.

B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.

C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

E. Engage a professional engineer to perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.

1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.
2. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.

F. Survey of Existing Conditions: Record existing conditions by use of measured drawings and preconstruction photographs.

1. Comply with requirements specified in Section 01322 "Photographic Documentation."
2. Inventory and record the condition of items to be removed and salvaged. Provide photographs of conditions that might be misconstrued as damage caused by salvage operations.
3. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

1. Comply with requirements for existing services/systems interruptions specified in Section 01100 "Summary."

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
2. Arrange to shut off indicated utilities with utility companies.
3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated to be removed.

    a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
    c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
    d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
    e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
    f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.

g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.

C. Refrigerant: Remove refrigerant from mechanical equipment to be selectively demolished according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Comply with requirements for access and protection specified in Section 01500 "Temporary Facilities and Controls."

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.
5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 01500 "Temporary Facilities and Controls."

C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and

chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.

3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
9. Dispose of demolished items and materials promptly.
10. Comply with requirements in Section 01524 "Construction Waste Management."

B. Reuse of Building Elements: Do not demolish building elements beyond what is indicated on Drawings without Architect's approval.

C. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner
5. Protect items from damage during transport and storage.

D. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.

B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, then remove concrete between saw cuts.

C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.

D. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

E. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings."[

F. Roofing: Remove no more existing roofing than what can be covered in one working day by new roofing and so that building interior remains watertight and weathertight.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
4. Comply with requirements specified in Section 01524 "Construction Waste Management."

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.7 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

3.8 SELECTIVE DEMOLITION SCHEDULE

A. Refer to contract documents

END OF SECTION 01732

In the event of a conflict between the terms of the Agreement that governs this Project and the terms of this Section, the terms of the Agreement shall control. The provisions of other Contract Documents may apply to the subject matter of this Section.

SECTION 01770 - CLOSEOUT PROCEDURES

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final completion procedures.
3. Warranties.
4. Final cleaning.
5. Repair of the Work.

B. Related Requirements:

1. Section 01322 "Photographic Documentation" for submitting final completion construction photographic documentation.
2. Section 01700 "Execution Requirements" for progress cleaning of Project site.
3. Section 01781 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
4. Section 01782 "Operation and Maintenance Data" for operation and maintenance manual requirements.
5. Section 01820 "Demonstration and Training" for requirements for instructing Owner's personnel.

1.3 ACTION SUBMITTALS

A. Product Data: For cleaning agents.

B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.4 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest control inspection.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.6 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of ten [10] working days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Owner. Label with manufacturer's name and model number where applicable.

    a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Owner's signature for receipt of submittals.

5. Submit test/adjust/balance records.
6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of ten [10] working days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Coordinate final changeover of permanent locks with Temple University's Locksmith. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 01820 "Demonstration and Training."
6. Advise Owner of changeover in heat and other utilities.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements, including touchup painting.
10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of ten [10] working days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for final completion.

1.7 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:

1. Submit a final Application for Payment according to Section 01290 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 working days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after

inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.8 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order starting with exterior areas first and proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:

    a. Project name.
    b. Date.
    c. Name of Architect.
    d. Name of Contractor.
    e. Page number.

4. Submit list of incomplete items in the following format:

    a. MS Excel electronic file. Architect will return annotated file.

1.9 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Partial Occupancy: Submit properly executed warranties within fifteen [15] working days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.

3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Remove snow and ice to provide safe access to building.

f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
h. Sweep concrete floors broom clean in unoccupied spaces.
i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
k. Remove labels that are not permanent.
l. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.

    1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning.

p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
q. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Section 01500 "Temporary Facilities and Controls." Prepare written report.

D. Construction Waste Disposal: Comply with waste disposal requirements in Section 01500 "Temporary Facilities and Controls." And Section 01524 "Construction Waste Management."

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.

2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.

    a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.

3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 01770

In the event of a conflict between the terms of the Agreement that governs this Project and the terms of this Section, the terms of the Agreement shall control. The provisions of other Contract Documents may apply to the subject matter of this Section.

SECTION 01781 - PROJECT RECORD DOCUMENTS

<BACK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.
4. Miscellaneous record submittals.

B. Related Requirements:

1. Section 01125 "Summary of Multiple Contracts" for coordinating project record documents covering the Work of multiple contracts.
2. Section 01700 "Execution Requirements" for final property survey.
3. Section 01770 "Closeout Procedures" for general closeout procedures.
4. Section 01782 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit one [1] set of marked-up record prints.
2. Number of Copies: Submit copies of record Drawings as follows:

a. Initial Submittal:
   1) Submit PDF electronic files of scanned record prints and [1] paper-copy set of file prints.
   2) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.

b. Final Submittal:
   1) Submit PDF electronic files of scanned record prints and [3] paper-copy sets of file prints.
   2) Print each drawing, whether or not changes and additional information were recorded.

B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.

1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.

E. Reports: Submit written report weekly indicating items incorporated into project record documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

   a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
   b. Accurately record information in an acceptable drawing technique.
   c. Record data as soon as possible after obtaining it.
   d. Record and check the markup before enclosing concealed installations.
   e. Cross-reference record prints to corresponding archive photographic documentation.

2. Content: Types of items requiring marking include, but are not limited to, the following:

   a. Dimensional changes to Drawings.
   b. Revisions to details shown on Drawings.
   c. Depths of foundations below first floor.
   d. Locations and depths of underground utilities.
   e. Revisions to routing of piping and conduits.

f. Revisions to electrical circuitry.
g. Actual equipment locations.
h. Duct size and routing.
i. Locations of concealed internal utilities.
j. Changes made by Change Order or Work Change Directive.
k. Changes made following Architect's written orders.
l. Details not on the original Contract Drawings.
m. Field records for variable and concealed conditions.
n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:

1. Format: Same digital data software program, version, and operating system as the original Contract Drawings. AutoCAD version (as specified by Owner), Microsoft Word, Excel, and Project.
2. Format: Annotated PDF electronic file.
3. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
4. Refer instances of uncertainty to Architect for resolution.
5. Architect will furnish Contractor one set of digital data files of the Contract Drawings at no cost to the contractor or owner for use in recording information.

a. See Section 01330 "Submittal Procedures" for requirements related to use of Architect's digital data files.
b. Architect will provide data file layer information. Record markups in separate layers.

C. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing record Drawings where Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.

1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.
2. Consult Architect for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared record Drawings into record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.

D. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file.
3. Record Digital Data Files:
    a. Format: AutoCAD version (as specified by Owner), Microsoft Word, Excel, and Project.
    b. Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
    c. Identification: As follows:
        1) Project name.
        2) Date.
        3) Designation "PROJECT RECORD DRAWINGS."
        4) Name of Architect.
        5) Name of Contractor.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
5. Note related Change Orders and record Drawings where applicable.

B. Format: Submit record Specifications as annotated PDF electronic file and editable Microsoft Word files.

2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders and record Drawings where applicable.

B. Format: Submit record Product Data as annotated PDF electronic file.

1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

2.4 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Format: Submit miscellaneous record submittals as PDF electronic file.

1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION 01781

In the event of a conflict between the terms of the Agreement that governs this Project and the terms of this Section, the terms of the Agreement shall control. The provisions of other Contract Documents may apply to the subject matter of this Section.

SECTION 01782 - OPERATION AND MAINTENANCE DATA

<BACK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory.
2. Emergency manuals.
3. Operation manuals for systems, subsystems, and equipment.
4. Product maintenance manuals.
5. Systems and equipment maintenance manuals.

B. Related Requirements:
1. Section 01330 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Architect will comment on whether content of operations and maintenance submittals are acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operations and maintenance manuals in the following format:

1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.

   a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
   b. Enable inserted reviewer comments on draft submittals.

2. Three [3] paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Architect will return one [1] copy.

C. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least [10] business days before commencing demonstration and training. Architect will return copy with comments.

1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within [10] business days of receipt of Architect's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:

1. List of documents.
2. List of systems.
3. List of equipment.
4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Construction Manager.
7. Name and contact information for Architect.
8. Name and contact information for Commissioning Authority.
9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
10. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

F. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

    a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
    b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

    a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
    b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor has delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.

7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUALS

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of operation and maintenance manuals.
2. Comply with requirements of newly prepared record Drawings in Section 01781 "Project Record Documents."

G. Comply with Section 01770 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 01782

In the event of a conflict between the terms of the Agreement that governs this Project and the terms of this Section, the terms of the Agreement shall control. The provisions of other Contract Documents may apply to the subject matter of this Section.

SECTION 01820 - DEMONSTRATION AND TRAINING

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Demonstration of operation of systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment.
3. Demonstration and training video recordings.

1.3 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

B. Qualification Data: For instructor.

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4 CLOSEOUT SUBMITTALS

A. At completion of training, submit complete training manual(s) for Owner's use in PDF electronic file format.

1.5 QUALITY ASSURANCE

A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 01400 "Quality Requirements," experienced in operation and maintenance procedures and training.

B. Pre-instruction Conference: Conduct conference at Project site to comply with requirements in Section 01310 "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:

1. Inspect and discuss locations and other facilities required for instruction.
2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
3. Review required content of instruction.
4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.6 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

a. System, subsystem, and equipment descriptions.
b. Performance and design criteria if Contractor is delegated design responsibility.
c. Operating standards.
d. Regulatory requirements.

e. Equipment function.
f. Operating characteristics.
g. Limiting conditions.
h. Performance curves.

2. Documentation: Review the following items in detail:

a. Emergency manuals.
b. Operations manuals.
c. Maintenance manuals.
d. Project record documents.
e. Identification systems.
f. Warranties and bonds.
g. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

a. Instructions on meaning of warnings, trouble indications, and error messages.
b. Instructions on stopping.
c. Shutdown instructions for each type of emergency.
d. Operating instructions for conditions outside of normal operating limits.
e. Sequences for electric or electronic systems.
f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:

a. Startup procedures.
b. Equipment or system break-in procedures.
c. Routine and normal operating instructions.
d. Regulation and control procedures.
e. Control sequences.
f. Safety procedures.
g. Instructions on stopping.
h. Normal shutdown instructions.
i. Operating procedures for emergencies.
j. Operating procedures for system, subsystem, or equipment failure.
k. Seasonal and weekend operating instructions.
l. Required sequences for electric or electronic systems.
m. Special operating instructions and procedures.

5. Adjustments: Include the following:

a. Alignments.
b. Checking adjustments.
c. Noise and vibration adjustments.
d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:

a. Diagnostic instructions.

b. Test and inspection procedures.

7. Maintenance: Include the following:

a. Inspection procedures.
b. Types of cleaning agents to be used and methods of cleaning.
c. List of cleaning agents and methods of cleaning detrimental to product.
d. Procedures for routine cleaning
e. Procedures for preventive maintenance.
f. Procedures for routine maintenance.
g. Instruction on use of special tools.

8. Repairs: Include the following:

a. Diagnosis instructions.
b. Repair instructions.
c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
d. Instructions for identifying parts and components.
e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 01782 "Operation and Maintenance Data."

B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
2. Owner will furnish an instructor to describe Owner's operational philosophy.
3. Owner will furnish Contractor with names and positions of participants.

B. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner with at least ten (10) business days' advance notice.

C. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

D. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

END OF SECTION 01820

02050 SELECTIVE DEMOLITION

I. GENERAL:

A. Demolition: All existing work designated for removal, including but not limited to walls, floors, ceilings, mechanical equipment, etc., shall be disposed of by the Contractor. "Remove" shall mean completely and entirely from Temple premises. All equipment removed shall be returned to Temple University at their request.

B. Terminating Utilities: The Contractor shall be responsible for terminating plumbing and electrical where items are removed, by dead-ending piping and wires in a safe, Code conforming and permanent manner.

C. Utility Shutdowns: Temple University must receive a minimum of 48 hours for all utility shutdowns and the shutdown must be approved by Temple University. Shutdowns should be scheduled for "off" hours or weekends.

D. Temporary Protection: During any required demolition of designated areas, Contractors shall provide adequate temporary protection and shall secure adjacent areas from dust and debris. All temporary partitions shall maintain existing fire ratings and required fire egress paths and exits. All emergency exit signs shall be fully operational during construction.

E. Patching and Repair: Where partitions or other work is noted to be removed, adjacent walls, ceiling, floors and finishes shall be replaced, patched and/or leveled, as required, to blend together and match existing.

F. Phasing: If work is to be phased it shall be done in segments as noted on the drawings or as designated by Temple University.

G. Signage: Contractor shall provide directional signage as required by Temple. Signage plans must be submitted for approval by Temple University 48 hours prior to the start of any demolition or construction. All signs shall be laminated. Minimal size for exterior signage shall be 24" x 36". Minimal size for interior signage shall be 18" x 24".

02513A NEW ASPHALT CONCRETE PAVING(TENNIS COURT/BASKETBALL COURT)

I. GENERAL:

A. Summary

1. Provide asphalt concrete (bituminous) paving for new Tennis Court/Basketball Court including color coating and stripping.

B. Submittals

1. Material Certificates: Provide copies of materials certificates, signed by material producer and the Contractor, certifying that each material item complies with, or exceeds, specified requirements.

C. Quality Assurance

1. Codes and Standards: Comply with following:

a. Commonwealth of Pennsylvania Department of Transportation Specifications - Pub. 408 (Referred to herein as "PennDOT").

D. Job Conditions

1. Weather limitations: Apply surface and tack coats when ambient temperature is above 50øF (10 deg C), and when temperature has not been below 35øF (1 deg. C) for 12 hours immediately prior to application. Do not apply when base is wet or contains an excess of moisture.

2. Construct asphalt concrete surface course only when atmospheric temperature is 40øF (4 deg. C), and when base is dry. Base may be placed when air temperature is above 30øF (-1 deg. C) and rising.

E. Grade Control: Establish and maintain required lines and elevations.

II. PRODUCTS

A. Materials

1. Base Course: PennDot Section 350, Type C or better, No. 2A and No. OGS aggregate.

2. Bituminous Concrete Base Course: PennDot Section 305.

3. Bituminous Binder Course: PennDot Section 421, 1D-2.

4. Bituminous Wearing Course: PennDot Section 420, 1D-2.

5. Bituminous Tack Coat: PennDot Section 460.

6. Bituminous Prime Coat: PennDot Section 461.

III. EXECUTION

A. Preparation of Subgrade

1. Prepare, shape and compact subgrade in accordance with applicable portions of PennDot Section 210.

B. Base Course

1. Subbase shall be constructed in conference with PennDot Section 350, to a thickness 6".

2. Set base course at grades to allow specified wearing course to finish at grades indicated on the Drawings.

C. Binder Course

1. Bituminous concrete base course shall be constructed in accordance with PennDot Section 305, to a thickness of 2".

D. Wearing Course

1. Wearing course shall be constructed in accordance with PennDot Section 401.3, to a thickness of 1".

2. Finish surface course to grades indicated on the Drawings.

E. Tack Coat

1. Apply to contact surfaces of previously constructed bituminous or portland cement concrete pavement.

2. Allow to dry until at proper condition to receive paving.

3. Exercise care in applying bituminous materials to avoid smearing of adjoining surfaces. Remove and clean damages surfaces.

F. Joints - New and Existing Paving

1. Where construction of new bituminous pavement abuts existing bituminous pavement the existing pavement shall be removed to form a straight, firm edge.

2. The new pavement edges abutting existing pavements and curbs shall be sealed with tack coat for a width of 4 inches.

G. Field Quality Control

1. General: Owner may engage an independent testing agency to test in-place asphalt concrete courses for compliance with requirements for thickness and surface smoothness. Repair or remove and replace unacceptable paving as directed by the Engineer.

2. Thickness: In-place compacted thickness will not be acceptable if exceeding following allowable variation from required thickness:

   a. Base Course: 1/2", plus or minus.

   b. Wearing Course: 1/2", plus or minus.

3. Surface Smoothness: Test will be conducted for finished surface of each asphalt concrete course for smoothness, using 10' straight edge applied parallel with, and at right angles to centerline of paved area. Surfaces will not be acceptable if exceeding the following tolerances for smoothness.

   a. Base Course Surface: 1/2".

   b. Wearing Course Surface: 3/16".

02513B REPAIR & RECONFIGURATION OF EXISTING ASPHALT CONCRETE PAVING (TENNIS COURT/BASKETBALL

I. GENERAL:

A. Survey & Layout - Survey court areas and surrounding ground to provide a basis for establishing grades for drainage improvements and new court elevations.

B. Construction Entrance - Stakeout proposed access area from courts to parking lot #2. Have area approved by Temple personnel. Excavate to a depth of at least 8 inches. Install PennDot Class 4 Geotextile and install PennDot #4 ballast. Upon completion of construction, remove construction entrance and restore area to original condition.

C. Fencing - Remove fencing as needed to complete court repairs. Adjust of all gates to conform to new surface elevation. Reinstall removed fencing and gates to original design. Fence posts shall be welded to original stubs.

D. Backboard Pole Removal as Directed on Drawings - Remove poles as directed. Cut poles as flush as possible with existing surface. Fill with non-shrink grout or 3,000 psi concrete. Return backboards to Temple. Dispose of poles off-site.

II. PRODUCTS

A. Install Tennis Net Posts - Install net post foundations (allow 1 c.y. of 3,000 psi concrete for each) as directed. Provide aluminum net posts, and J.A. Cissel Royal tennis nets complete with center anchor and center strap.

B. 6" Perforated Underdrain as Required by Geo Tech Report - Materials in accordance with PennDot publication 408. Excavate trench 18" wide by 24" deep. Install PennDot Class 1 Geotextile, using a fabric width to permit a minimum trench-width overlap across the backfill at the trench top. Lay fabric in the prepared trench without stretching. Lay the top of the fabric back on the sides to allow for the placement of the aggregate backfill and pipe. Backfill with clean PennDot 2B crushed stone to a depth of 6 inches. Install underdrain. Cap upgrade end of pipe. Backfill with stone to a depth 6 inches above the top of the pipe. Lay fabric overtop of the stone ensuring trench-width overlap. Complete final 6 inches of backfill with topsoil.

C. Swale Grading - Install a 4' wide swale from the asphalt path leading into the court area to a point where the natural fall of the land will allow the water to run. this swale will be graded with a minimum slope of 1%.

D. 24" PetroTac - Material manufactured by Phillips. Install in accordance with manufacturers recommendations.

E. 1 1/2" ID-2 Bituminous Binder - Materials from a PennDot Bulletin 15 approved source and manufactured in accordance with publication 408. Ensure court area is swept clean and bituminous tack coat is applied in accordance with section 460 of publication 408. Due to the tight tolerances required in this work, air temperature must be at least 45 degrees and rigging for asphalt laydown. Install binder to required thickness and sloped to provide positive drainage off of the courts.

F. 1 1/2" ID-2 Bituminous Wearing Course - Materials from a PennDot Bulletin 15 approved source and manufactured in accordance with publication 408. Due to the tight tolerances required in this work, air temperature must be at least 45 degrees and rising for asphalt laydown. Install wearing course to required thickness and sloped to provide positive drainage off of the courts.

G. Color Coating & Striping - Apply color coating system in accordance with the attached specifications. Color coating has a total of five (5) applications of material. The first two applications are acrylic resurfacer, two applications of colorized acrylic filler coats, and one coat of colorized finish coat. Line stripe to owners multi-purpose configuration for four (4) basketball courts and four (4) tennis courts.

H. Landscape Restoration - Restore all disturbed areas to original condition. Install topsoil as needed, seed using an approved mixture, and apply straw mulching. Areas include but are limited to the underdrain trench areas, the drainage swale, and the construction entrance.

02513C COATING SYSTEM NEW/EXISTING ASPHALT CONCRETE PAVING (TENNIS COURT/BASKETBALL COURT)

I. Substrate Repair and Preparation for Coating:

A. Materials: All material to be used must be manufactured by California Products. No approved equals will be permitted.

1. Patching Mix (Court Patch Binder) - for use in cracks, holes, depressions (bird baths) and other imperfections in the surface. This material will be used in accordance with manufacturer's specifications with regard to sand sizes, prime coats and depth of depression, hole or crack.

2. Crack Filler - for use in the cracks and for minor cosmetic this repairs and fills prior to filler course.

3. 100% Acrylic Filler Course (Acrylic Resurfacer) Description: The filler course (Acrylic Resurfacer) shall be California Acrylic Resurfacer and consist of a 100% acrylic emulsion binder containing no vinyl copolymerization constituent and no asbestos fillers. The product shall contain no less than 4% attapulgite and have a pigment-volume concentration not to exceed 9.5%.

B. Material Specifications:

1. Acrylic Resurfacer (California Products)

a. percent solids by weight (minimum) 26.70%
b. percent solids by volume (minimum) 22.90%
c. weight per gallon (minimum) 8.7-8.9 lbs

2. Court Patch Binder

a. percent solids by weight (minimum) 46.50%
b. percent solids by volume (minimum) 44.0%
c. weight per gallon (minimum) 8.7-8.9 lbs

3. Crack Filler

a. percent solids by weight (minimum) 85.605
b. percent solids by volume (minimum) 73.60%
c. weight per gallon (minimum) 15 lbs

C. Construction Methods: The courts shall be surfaced as specified below and/or as directed by the Owner, after consultation with the surfacing material manufacturer or his representative.

D. Surface Preparation: The surface to be coated must be sound, smooth and free from loose dirt or oil materials. All courts must be power washed before any material may be applied to court surface.

E. Holes and Cracks: Cracks and holes shall be cleaned and a suitable soil sterilant as approved by the Owner, shall be applied to kill all vegetation prior to use of Court Patch Binder according to manufacturer's specifications.

F. Depression: Depressions holding enough water to cover a five cent piece shall e filled with Court Patching Mix. This step shall be accomplished prior to the squeegee application of Acrylic Resurfacer. The Contractor shall flood all the courts, then allow to drain. The drainage shall continue until there are no obvious avenues of escape for the water. (i.e. up to 2 hours after flooding). Define and mark all ares holding enough water to cover a nickel. Once depressions have been located, measured and marked, an on-site meeting with the Owner or representative will be required before any work may begin. After defined areas are dry, prime with tack coat mixture of 2 parts water/1 part Court Patch Binder. Allow tack coat to dry completely. Spread Court Patch Binder mix true to grade, using a straight edge (never a squeegee) for strike off. Steel trowel or wood float the patch so that the texture matches the surrounding area. NEVER ADD WATER TO MIX. light misting on surface and edges to feather in is allowed as needed to maintain workability. Allow to dry thoroughly and cure.

G. Filler Course (Acrylic Resurfacer): Filler course shall e applied to the clean underlying surface in one application to obtain a total quantity of not less than 15/20 yards per gallon based on the material prior to any dilution. Acrylic Resurfacer may be used to pre-coat depression and crack/hole repairs to achieve better planarity prior to filler course application.

1. Over a properly repaired surface of asphalt on new or existing courts, apply two or more coats of Acrylic Resurfacer according to the following mix:

Acrylic Resurfacer	55 gallons
Water	20-40 gallons
Sand (30-80 mesh, dry)	600-900 pounds
Liquid Yield	112-138 gallons

Use clean, dry sand and clean, potable water to make mixers. The quantity of sand and water in the above mix may be adjusted to complement the roughness and temperature of the surface.

2. Mix the ingredients thoroughly using accepted mixing devices and use a 70 Durometer rubber bladed squeegee to apply each coat of Acrylic Resurfacer as required.

3. Allow the application of Acrylic Resurfacer to dry thoroughly. Scrape off all ridges and rough spots prior to any subsequent application of Acrylic Resurfacer or subsequent cushion or color surface system.

II. Acrylic Color Playing Surface

A. The Contractor shall apply three (3) coats of Factory Fortified Plexipave.

B. Materials:

1. Description: Job Mixed Fortified Plexipave is a field Mixed combination of California Corporations' Plexichrome and Plexipave Color Base blended in accordance with the manufacturer's Specification Number 10.12 and shall consist of lightfast mineral oxide pigments and fillers, uniformly dispersed in a non-oxidizing 100% acrylic base.

2. Material Specifications:

a. Storage Stability - After 30 days storage in a sealed container at normal temperatures (50 degrees F to degrees F) the product shall not become hard-packed nor show signs of mold growth or spoilage.

b. Weathering - After 1,000 hour accelerated weathering, the product shall not develop checks, cracks, or blisters and shall not excessively fade when compared with a standard.

c. Water Resistance - After 24 hours soaking in distilled water (70 degrees F - 80 degrees F) the film shall not blister or show signs of re-emulsification.

d. Application Properties - The product, when diluted to proper consistency, shall be capable of being applied with 50 Durometer squeegees over clean, dry surfaces, at temperatures between 50 degrees F and 100 degrees F.

3. Application:

a. All areas to be color coated shall be clean, free from sand, clay, grease, dust, salt or other foreign matters. The

Contractor shall obtain the Owner's approval prior to applying any surface treatment. The storage of materials, mixing and surface preparation shall be in accordance with the manufacturer's instructions.

III. Playing Lines

A. The Contractor shall paint lines to define game location sin accordance with the plans, specifications and directions of the Owner. All basketball courts shall have collegiate all Tennis Courts shall be striped for both singles and doubles play three (3) point lines.

B. Materials:

1. The line part shall be California Textured Plexicolor Line Paint and shall conform to the following characteristics and performance.

2. The paint shall be 100$ acrylic emulsion type containing no alkyds, buladiene styrene or vinyl, and shall be thinned with water only. The paint shall also be suitable for the addition of reflectance-type glass spheres at the time of application.

3. All materials used in the manufacture of the paint shall be of good commercial quality, entirely suitable for the purpose intended under normal conditions of use. For white line paint, the opaque portion of the pigment shall be rutile titanium dioxide and vehicle shall consist of 100% acrylic polymer dispersed in water together with the minimum amounts of necessary additives, such as pigment, dispersant, antifoaming agents and preservatives, but no drier shall be used.

4. The paint shall meet a minimum requirement of total solids (percent by weight of paint) of 52.5% and a maximum pigment content (percent by weight of paint) of 39.4%. The white paint shall contain not less than 26% per gallon Type 1 rutile titanium dioxide. Pigment volume concentration not to exceed 39.5%, a minimum fineness of grid of 4 and a viscosity (krebs units) of 70 minimum and 85 maximum as required. The paint shall brush easily and have good flowing, leveling and spreading characteristics and, although it shall be suitable for application by spray equipment, shall not be sprayed but applied by brush for this contract.

5. The paint shall meet the following Solvent Resistance est:

Use a sample of unreduced paint for a draw-down of 0,0003 inch wet film thickness on glass and air dry for 24 hours. Remove the dried paint film in sheets from the glass and weigh out one gram. Place one ram of white paint film (or yellow paint film) in a 50 millimeter beaker and add 20 grams of Toluol (TT-T- 548A. The beaker shall be rotated periodically during test period. The paint film shall not crumple, cloud the liquid or otherwise disintegrate in the liquid within 48 hours and the Toluol shall remain clear and colorless throughout the test. Failure of the film to pass this test shall disqualify the product. Procedures for all other tests shall be as described in TT-P-0019A.

6. The paint shall be suitable for use over all types of asphaltic surfaces, and when applied over emulsified asphalt surface. It shall not cause lifting, crazing, peeling or other damage to the base.

C. Construction Details:

1. All lines shall be carefully laid out, and defined on the surface by chalk markings and tape before being painted, and shall be accurately painted within the limits shown on the plans. All surfaces shall be thoroughly cleaned before the lines are painted thereon. All lines shall be double coated, clear and distinct with sharply defined edges. Use of spraying equipment is not allowed. At least 1/2 hour shall elapse between the paintings of the first and second coats.

2. Unless otherwise indicated, the width of all lines on the courts will be painted two (2) inches wide.

3. Contractor must deliver materials to the job site in unopened drums and supply Owner with a list of batch numbers from the manufacturer for the various materials.

4. GUARANTEE: The contractor shall furnish the Owner a two-year guarantee of workmanship and materials such as paint delamination, excess wear and fading, chipping, flaking, etc. dating from time of acceptance of the project and shall make good any defects which may occur during the period. If any special guarantees in excess of the two-year period are specified by the manufacturer, these guarantees should also be included.

02515 UNIT PAVERS

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. Section Includes:

1. Concrete pavers set in bituminous setting bed.
2. Asphalt-block pavers set in bituminous setting bed.

B. Related Sections:

1. Division 3 –Concrete‖ for concrete base course under unit pavers.

C. References:

1. ASTM C33-93: Specifications for Concrete Aggregates
2. ASTM C136-93: Method for Sieve Analysis of Fine and Coarse Aggregates
3. ASTM C150-94: Specifications for Portland Cement
4. ASTM D36-84: Test Method for Softening Point of Bitumen (Ring-and-Ball Apparatus)
5. ASTM D113-85: Test Method for Ductility of Bituminous Materials
6. ASTM D312-84: Specification for Asphalt Used in Roofing
7. ASTM D33810-83: Specification for Viscosity-Graded Asphalt Cement for use in Pavement Construction
8. ASTM E303-83: Method of Measuring Surface Frictional Properties using the British Pendulum Tester

1.3 SUBMITTALS

A. Product data for the following:

1. Concrete pavers, five (5) samples of each.
2. Asphalt pavers, five (5) samples of each.
3. Bituminous setting materials.
4. Edge restraints and miscellaneous materials.

B. Shop Drawings:

1. Paving Layout: Indicate types, patterns, layout base lines, and work phasing.

2. Curb Layout: Indicate types, length of pieces and work phasing.

C. Samples for verification in full-size units of each type of unit paver indicated; in sets for each color, texture, and pattern specified, showing the full range of variations expected in these characteristics.

D. 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.

1.4 QUALITY ASSURANCE

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

B. Single-Source Responsibility: Obtain each color, type, and variety of unit pavers, joint materials, and setting materials from a single source with resources to provide products and materials of consistent quality in appearance and physical properties without delaying the Work.

C. Mockup: Prior to installing unit pavers, construct mockups for each form and pattern of unit pavers required to verify selections made under sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for final unit of Work, including same base construction, special features for expansion joints, and contiguous work as indicated.

1. Locate mockups of 100 s.f. minimum on-site in the location directed by Architect.
2. Notify Architect ten working days in advance of the dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Architect's acceptance of mockups before start of final unit of Work.
5. Retain and maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
    a. When directed, demolish and remove mockups from Project site.
    b. Accepted mockups in an undisturbed condition at the time of Substantial Completion may become part of the completed Work.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect unit pavers and aggregate during storage and construction against soilage, contamination from earth and other materials, or discoloration from packaging materials.

1. Wrap pavers in plastic or use other packaging materials that will prevent rust marks from steel strapping.

B. Protect asphalt cement and other bituminous materials from moisture and heat. Keep containers tightly closed and away from open flames.

1.6 PROJECT CONDITIONS

A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.

B. Weather Limitations for Bituminous Setting Bed: Comply with the following requirements:

1. Apply asphalt primer coat when ambient temperature is above 50°F (10°F) and when temperature has not been below 35°F (2°C) for 12 hours immediately prior to application. Do not apply when base is wet or contains an excess of moisture.
2. Install bituminous setting bed only when atmospheric temperature is above 40°F (4°c) and when base is dry.

1.7 MAINTENANCE SUPPLY

A. At a location directed by the Owner, provide 30 pieces of each paver type and color as stock for repairs.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Concrete Pavers:

a. Hanover Architectural Products, Inc.

2. Asphalt-Block Pavers:

a. Hanover Architectural Products, Inc.

2.2 COLORS AND TEXTURES

A. Provide materials and products that result in colors and textures of exposed unit paver surfaces and joints complying with the following requirements:

1. Match Architect's samples.
2. Match color and texture indicated by referencing manufacturer's standard designations for these characteristics.

3. Provide Architect's selections from manufacturer's full range of colors and textures for materials and products of type indicated.

2.3 UNIT PAVERS

A. Concrete Pavers: Solid, interlocking paving units, ASTM C 936, made from normal-weight aggregates in sizes and shapes indicated.
Concrete pavers shall be 4‖ X 8‖ X 3‖Prest Paver by Hanover Architectural Products or equal. Color to be by Owner with natural finish.

B. Asphalt-Block Pavers: Manufacturer's standard solid units consisting of coarse aggregate, inorganic dust as filler, and asphalt cement, in sizes and shapes indicated.

1. Coarse Aggregate: Clean, hard, unweathered stone crushed into angular particles varying in size up to 3/8 inch (9.5 mm).
2. Filler: Dust produced from limestone or other material as standard with manufacturer.
3. Asphalt Cement: ASTM D 312, Type III.
4. Dimensional Tolerances: Manufacture unit to standard dimensions indicated with deviations in any dimension not exceeding plus or minus 1/16 inch (1.6 mm).
5. Asphalt pavers shall be 8‖ X 8‖ X 3‖ Hex Asphalt Block by Hanover Architectural Products. Color to be by Owner with ground tudor finish.

2.4 ACCESSORIES

A. Steel Edge Restraints: Painted commercial steel edging with loops pressed from or welded to face of sections at 36 inches (900 mm) o.c. to receive stakes, and steel stakes 15 inches (380 mm) long for each loop. Size of edging as follows:

1. $^{3}/_{16}$ inch (4.8 mm) thick by 4 inches (100 mm) high.
2. 1/4‖ inch (6.4 mm) thick by 5 inches (125 mm) high.

B. Concrete for Job-Built Edge Restraints: Comply with requirements of Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with minimum 28-day compressive strength of 3000 psi (20 MPa).

2.5 BITUMINOUS SETTING-BED MATERIALS

A. Primer for Base: ASTM D 2028, cutback asphalt, grade as recommended by unit paver manufacturer.

B. Fine Aggregate for Setting Bed: ASTM D 1073, Grading No. 2 or No. 3.

C. Asphalt Cement: ASTM D 3381, Viscosity Grade AC-10 or AC-20.

D. Neoprene-Modified Asphalt Adhesive: Paving manufacturer's standard adhesive consisting of oxidized asphalt combined with 2 percent neoprene and 10 percent long-fibered mineral fibers containing no asbestos.

E. Joint Filler Materials: Portland cement, ASTM C 150, Type I; and sand, ASTM C 144.

2.6 BITUMINOUS SETTING-BED MIX

A. Mix bituminous setting-bed materials at an asphalt plant in approximate proportion, by weight, of 7 percent asphalt cement to 93 percent fine aggregate, unless otherwise indicated. Heat mixture to 300□F (149□C).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces indicated to receive paving, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of unit pavers. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean concrete substrates to remove dirt, dust, debris, and loose particles.

B. Remove substances from concrete substrates that could impair setting bed bond, including curing and sealing compounds, form oil, etc.

3.3 INSTALLATION, GENERAL

A. Do not use unit pavers with chips, cracks, voids, discolorations, and other defects which are visible to the eye 6 feet away from the surface or could cause staining in finished work.

B. Mix pavers from several pallets or cubes as they are placed to produce uniform blend of colors and textures.

C. Cut unit pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable. Cut pavers are to be no smaller than 3 inches in any dimension where field cutting would result in pavers below these minimum sizes, use larger pavers adjacent to fill space.

D. Joint Pattern: Match field-constructed mockup.

1. Concrete: 1/8 inch max. joint.
2. Asphalt: 1/8 inch max. joint.

E. Joint Pattern: As indicated on drawings.

F. Tolerances: Do not exceed $^{1}/_{32}$-inch (0.8mm) unit-to-unit offset from flush (lippage) nor 1/8 inch in 10 feet (3 mm in 3 m) from level, or indicated slope, for finished surface of paving.

G. Tolerances: Do not exceed $^{1}/_{16}$-inch (1.5-mm) unit-to-unit offset from flush (lippage) nor 1/8 inch in 24 inches (3 mm in 600 mm) and 1/4 inch in 10 feet (6 mm in 3 m) from level, or indicated slope, for finished surface of paving.

H. Provide edge restraints as indicated. Install edge restraints prior to placing unit pavers.

1. Install job-built concrete edge restraints to comply with requirements of Division 3 Section "Cast-in-Place Concrete."

2. Edge Restraint: Edge restraint shall be in place at commencement of each days work, prior to any compacting, prior to operating vehicles on finish pavements and as otherwise necessary to ensure the integrity of the finished work. Edge restraint shall be vertical to facilitate paver abutment, and shall extend at least to depth of setting bed.

a. Permanent edge restraint includes: The abutting of paver units against vertical elements of curbs, steps, building faces, and pavement as indicated in the drawings. Plan work to lay pavers from permanent edge restraints on 3 sides whenever possible.

b. Temporary edge restraint: Where edge restraints are needed but permanent restraints are not possible, provide means of temporary confinement of pavers and setting material during and after installation to maintain joint pattern and width, and setting bed compaction. Temporary edge restraint shall be used as necessary until permanent edge restraint shall be used as necessary or directed to facilitate construction. Remove and relay 3 feet of pavers abutting temporary restraint when restraint is removed, before proceeding with further paver placement. Recompact all temporarily restrained areas together with entire completed area to distribute lateral forces evenly over entire permanently restrained area.

3.4 BITUMINOUS (IMPERVIOUS) SETTING-BED APPLICATIONS

A. Apply primer to concrete slab or binder course.

B. Prepare for setting-bed placement by locating 1/4 inch (19mm) deep control bars approximately 11 feet (3.3 m) apart and parallel to one another, to serve as guides for striking board. Adjust bars to subgrades required for accurate setting of paving units to finished grades indicated.

C. Place bituminous setting bed where indicated, in panels, by spreading bituminous material between control bars. Strike setting bed smooth, firm, even, and not less than 3/4 inch (19 mm) thick using a 12 foot(3.7m) long, 1 1/2 by 5 1/2 inch (38 by 140mm) board. Add fresh bituminous material to low, porous spots after each pass of striking board. After each panel is completed, advance first control bar to next position in readiness for striking adjacent panels. Carefully fill depressions that remain after removing depth control bars.

1. Roll setting bed with power roller to a nominal depth of 3/4 inch (19 mm) while still hot. Adjust thickness as necessary to allow accurate setting of unit pavers to finished grades indicated.

2. Apply neoprene-modified asphalt adhesive to cold setting bed by squeegeeing or troweling. If troweled on, use trowel with serrations not exceeding $^{1}/_{16}$ inch (1.6 mm). Do not proceed with setting of paving units until adhesive is dry to the touch.

D. Place pavers carefully by hand in straight courses, maintaining accurate alignment and uniform top surface. Protect newly laid pavers with plywood panels on which workers stand. Advance protective panels as work progresses but maintain protection in areas subject to continued movement of materials and equipment to avoid creating depressions or disrupting alignment of pavers. If additional leveling of paving is required, and before treating joints, roll with power roller after sufficient heat has built up in the surface from several days of hot weather.

E. Joint Treatment: Place unit pavers with hand-tight joints. Fill hand-tight joints with a dry mixture of 1 part portland cement and 3 parts sand by sweeping mixture over paved surface until joints are filled. Follow by fogging lightly with water.

3.5 INTERLOCKING PAVERS

A. Hand place in pattern shown on drawings.

B. Place in such a manner that the pattern is maintained and the pavers are laid together as closely as possible to provide a joint approximately 1/8 inch wide.

C. Use string lines to hold all patterns true.

D. The gaps at the edge of the paver surface shall be filled with standard pavers or with pavers cut to fit.

E. Cutting pavers, using a diamond bladed, wet cut masonry saw shall be used.

F. Pavers to be alternately selected from at least three (3) pallets, working from top to bottom in each pallet stack.

G. Pavers shall be rolled into the bituminous setting bed to a nominal depth of 3/4 inch while still hot.

H. Surplus joint filling material shall be swept from the surface (or left on the surface during construction to ensure complete filling of the joints during initial use. This filler may also provide surface protection from construction debris).

3.6 PROTECTION

A. Provide final protection and maintain conditions in a manner acceptable to Installer that ensures that unit paver work is without damage or deterioration at the time of Substantial Completion.

END OF SECTION 02515

02830 FENCES AND GATES

I. GENERAL:

A. Steel Picket Fencing: All steel picket fencing to be either 4'-0" or 6'-0" high as stated on drawings. Main supports to be 1 1/2" x 2 1/2" solid bars at 5'-0" O.C. with angled top and to extend 18" below grade in a concrete footing 24" deep by 12" in diameter. Horizontal members to be 2" by 1/2" solid bars and pickets to be 1" x 1/2" at 5" O.C. All steel picket fencing to be painted Black. Sections not intended to be removable are to be welded and not bolted.

B. Chain Link Fencing:

1. Descripton

This work shall include the installation of Galvanized Chain Link Fence, fittings and gate in accordance with Section 1110 of PennDOT Publication 408, 2000 Edition at amended and supplemented.

2. Material

Section 1110.01, 1110.02 and 1110.04 of PennDOT 408 Specifications.

a. Wire Fabric – Galvanized, (No 11 – gauge, min) Steel Wire
b. Corner and End Posts, with Caps – Galvanzied, 2‖ O D Round, 10’-0‖ O.C., 30‖ min below grade.
c. Top Rails – Galvanized, 1 5/8‖ O.D. round.
d. Gate – Galvanized, 30‖ wide, single, or as noted on plan.

3 Construction

The Contractor shall provide all tools, equipment and labor

necessary

for the completion of this work. All work shall be performed in a safe and workmanlike manner.

4. Measurement and Payment

The price shall be full compensation for furnishing all materials,

for

all preparation and installation of these materials, and for all labor, equipment, tools and incidentals necessary to complete the item.

Payments will be made under:

Chain Link Fence with Gate(s) or Openings) – Linear Foot or Item
A – Base Items – Lump Sum

02842 BICYCLE RACKS

I. PRODUCTS:

A. All bicycle racks where called for on Drawings shall be Ribbon Rack by Brandir International, Inc. (212) 505-6500.

All racks shall be for 5,7,9 or 11 units as indicated on drawings and shall be Inground Anchor Mount in Stainless Steel.

II. INSTALLATION

A. Contractor will have Temple University field verify the exact location of the bicycle rack in the field.

02870 SITE FURNISHING

I. PRODUCT:

A. Outdoor Wood Benches can be obtained from Recreational Resources (800) 220-4402, and the order information is:

Manufacturer: Victor Stanley, Inc., Brickhouse Road, Dunkirk, MD 20754

Bench Description:

UB314, 8'-0", Redwood, Surface Mounted, including assembly hardware.

B. Outdoor Metal Benches can be obtained from Wabash Valley (800) 253-8619, and the order information is:

Manufacturer: Wabash Valley Manufacturing, Inc., P.O. Box 5, 505E. Main, Silver Lake, IN 46982

Bench Description: Model CL7017, 2 Seat w/o back – Inground, Model CL7027, 3-Seat w/o back-Inground.

02980 LANDSCAPE ACCESSORIES

I. PRODUCT:

A. All tree grates to be 5'x 5', Model No. R8712 by Neenah Foundry Co. with cast iron type "U" angle frame set in concrete with #3 re-bar

02990 LANDSCAPING

I. GENERAL:

A. The designing exterior, stairways, ramps, etc. are to be designed and constructed to accommodate riding type snow removal machinery/equipment.

B. Temple University's Grounds Department is to be consulted and involved during the design and selection of planting materials and their approval is required PRIOR to the release of any submittals.

END OF DIVISION

DIVISION 03.00.00 - CONCRETE

03.00.00 **CONCRETE**

03.**30**.00 CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 Basis of Design

A. All exterior poured-in place concrete to be designed and specified by Design Consultant.

B. All concrete associated with new buildings or building renovations and additions to be designed and specified by Design Consultant.

Part 2 – Materials

A. Minimum requirements for walkways: Concrete to be 4,000 psi, 6" thickness where truck traffic is possible and 4" thick elsewhere.

B. Finishes:

1. Broom finish: walking surfaces.
2. Smooth steel trowel finish: floor and pad areas.
3. Smooth rubbed finish: formed concrete surfaces to be left exposed.

Part 3 – Execution

Concrete shall be poured on 4" crushed stone on firm, undisturbed, virgin soil or 95%-98% compacted subbase.

END OF SECTION 03.30.0

DIVISION 5 - METALS

BACK

05120 STRUCTURAL STEEL

I. GENERAL:

A. Code and Standards: AISC "Code of Standard Practice for Steel Buildings and Bridges"; AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings" including "Commentary", AWS "Structural Welding Code - Steel"; comply with applicable provisions excepts as otherwise indicated.

B. Shop Drawings: Show complete details and schedules (if required) for fabrication, assembly and erection. Furnish anchor bolts required for installation in other work; furnish templates for bolt installation.

C. Steel Plates, Shapes, Bars: ASTM A 36.

D. Cold-Formed Steel Tubing: ASTM A 500, Grade B.

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

F. Fasteners: High-strength bolts and nuts, ASTM A 325 or A 490; unfinished bolts and nuts, ASTM A 307, Grade A.

G. Shop Paint: FS TT-P-86, Type II; or, SSPC-Paint 2.

H. Fabrication: Comply with AISC "Specification" and final shop drawings. Mark and match-mark units for field assembly.

I. Connection: As shown on final shop drawings. Use high-strength bolts for field connections, except as otherwise indicated.

a. Comply with AWS: Code for procedures, appearance, and quality of welds.

J. Provisions for Other Work: Fabricate structural steel members to provide holes for securing other work and for passage of other work through steel framing as indicated.

K. Shop Painting: Paint structural steel work, except members or portions of member embedded in concrete or mortar, and contact areas to be welded or riveted. Clean steel free of loose mill scale, rust, oil and grease. Apply prime paint to provide a minimum dry film thickness of 2.0 mils.

II. ERECTION:

A. Comply with AISC Code and Specifications, and maintain work insafe and stable condition during erection. Provide temporary bracing and shoring as required; remove when final connections placed.

B. Set Base Plates: On cleaned bearing surfaces, using wedges or other adjustments as required. Solidly pack open spaces with bedding mortar, consisting of 1 part portland cement to 3 parts sand and only enough water for packing and hydration, or use commercial non-shrink grout material at Erector's option.

C. Splice Members: Only where shown on final shop drawings.

D. Touch-up Prime: Paint after erection. Clean field welds, bolted connections and abraded areas, and apply same type paint as used in shop.

05210 STEEL JOISTS AND JOIST GIRDERS

I. GENERAL:

A. Code and Standards: SJI "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders" for types of joists indicated; comply with applicable provisions except as otherwise indicated.

B. Shop Drawings and Data: Show complete details and schedules (if required) for fabrication and erection, including layout, special connections, jointing and accessories. Locate anchor bolts for installation in other work; furnish templates for bolt installation by others.

II. PRODUCTS:

A. Steel: ASTM A 36, or other per SJI "Specification".

B. Fasteners: High-strength bolts and nuts, ASTM A 325 or A 490; unfinished bolts and nuts, ASTM A 307, Grade A.

C. Shop Paint: Comply with SJI "Specifications" for materials and application.

D. Fabrication: Comply with SJI "Specifications" and final shop drawings.

E. Provisions for Other Work: Provide holes to accommodate other work to be secured to joists as indicated on final shop drawings.

F. Extended and Special Ends: Provide where indicated, complying with SJI "Specifications".

G. Ceiling Extensions: Provide at locations having ceilings attached directly to joist bottom chord. Extend ends to with 1/2" of finished wall surface.

H. Header Units: Provide header units to support tail joists at openings in floor or roof system not framed with steel shapes.

I. Bridging: Comply with SJI "Specifications" for type of joists and installation requirements. Provide bridging anchors for ends of bridging lines terminating at walls or beams.

J. End Anchorage: Comply with SJI "Specifications" unless otherwise indicated.

III. ERECTION:

A. Comply with SJI "Specifications", and maintain work in safe and stable condition during erection. Do not apply construction loads until bridging and anchorages are completed.

05300 METAL DECKING

I. GENERAL:

A. Shop Drawings and Data: Show complete details and schedules (if required) for layout and types of deck panels, anchorage, supplementary framing, cut openings, and accessories.

B. Codes and Standards: AISI "Specification for the Design of Cold-Formed Steel Structural Members"; AWS "Structural Welding Code", SDI "Design manual for Floor Decks and Roof Decks"; comply with applicable provisions except as otherwise indicated.

Provide metal deck units listed in UL "Fire Resistance Directory", bearing UL label and marking for the system detailed.

C. FM Listing: Provide metal roof deck units which have been evaluated by Factory Mutual System and are listed in "Factory Mutual Approval Guide" for "Class I" fire-rated construction.

II. PRODUCTS:

A. Steel for Painted Units: ASTM A 611, Grade C.

B. Steel for Galvanized Units: ASTM A 446, Grade A.

C. Steel Shapes: ASTM A 36.

D. Sheet Metal Accessories: ASTM A 526, galvanized.

E. Galvanizing: ASTM A 525, G60.

F. Galvanizing Repair Paint: MIL-P-21035 (Ships).

G. Shop Paint: Manufacturer's standard baked-on rust-inhibitive paint.

H. Fabrication: Form deck units in lengths to span at least 3 supports; flush, telescoped, or nested 2" end laps; nested or interlocked side laps, unless otherwise indicated.

I. Roof Deck: Comply with SDI "Roof Deck Specifications", of metal thickness, width, and depth indicated.

J. Acoustic Metal Roof Deck Units: Single-pan fluted units with vertical webs perforated with 5/32" diameter holes staggered 3/8" o.c., metal thickness, depth and width as indicated. Provide mineral fiber acoustical insulation strips of profile to fit void space between vertical ribs.

K. Composite Metal Floor Deck: Fluted sections, of metal thickness, width and depth indicated.

L. Cellular Metal Floor Deck: Top fluted sections with flat plate closure; metal thickness, depth, width of unit, number of cells per unit, and width of cells as indicated.

Epic Metals Corp.
Mac-Fab Products, Inc.
H.H. Robertson Co. Roll
Form Products, Inc. United
Steel Deck, Inc.

M. Cellular Composite Metal Floor Deck: Matching top and bottom fluted sections; metal thickness, depth, width of unit, number of cells per unit, and width of cells as indicated.

Manufacturers:

Epic Metals Corp.
Mac-Fab Products, Inc.
H.H. Robertson Co. Roll
Form Products, Inc. United
Steel Deck, Inc.

N. Accessories: Provide cover plates, closure strips, roof sump pans, cant strips, as required, use deck manufacturer's standard unless otherwise shown.

II. INSTALLATION:

A. Place deck units and secure to adjacent framing by fusion welding 12" o.c. to supports, with a minimum of 2 welds at each support, unless otherwise indicated.

B. Secure roof deck units at ends and side laps at spacings recommended by deck manufacturer to provide resistance for gross uplift of 45 psf at eave overhang and 30 psf for other roof areas.

C. Place accessory units in accordance with manufacturer's recommendations unless otherwise shown.

Touch-up Shop Paint: After installation. Clean field welds and abraded ares, and apply same type paint as used in shop. Use galvanizing repair paint to correct damaged galvanized surfaces.

05310 STEEL DECK

II. GENERAL:

A. Shop Drawings and Data: Show complete details and schedules (if required) for layout and types of deck panels, anchorage supplementary framing, cut openings, and accessories.

B. Codes and Standards: American Iron and Steel Institute (AISI) "Specification for the Design of Cold-Formed Steel Structural Members"; American Welding Society (AWS) "Structural Welding code", Steel Deck Institute (SDI) "Design Manual for Composite Decks, Form Decks and Roof Decks" comply with applicable provisions except as otherwise indicated.

Provide metal deck units listed in UL "Fire Resistance Directory", bearing UL label and marking for the system detailed.

Provide cellular floor deck units listed in UL "Electrical Construction Materials List".

C. FM Listing: Provide metal roof deck units which have been evaluated by Factory Mutual System and are listed in "Factory Mutual Approval Guide" for "Class I" fire-rated construction.

II. PRODUCTS:

A. Manufacturers: Provide steel deck as fabricated by one of the following:

Bowman Metal Deck
Consolidated Systems, Inc.
Epic Metals Corp.
Marlyn Steel Products, Inc.
Roll Form Products, Inc.
Roof Deck, Inc. United
Steel Deck, Inc.
Vulcraft/Div. Nucor Corp. Wheeling
Corrugating Co.

B. Steel for Painted Units: ASTM A 611, Grade C.

C. Steel for Galvanized Units: ASTM A 446, Grade A.

D. Steel Shapes: ASTM A 36.

E. Sheet Metal Accessories: ASTM A 526, Galvanized.

F. Galvanizing: ASTM A 525, G60.

G. Galvanizing Repair: ASTM A780.

H. Shop Paint: Manufacturer's standard baked-on rust-inhibitive paint.

III. FABRICATION:

A. Form deck units in lengths to span at least 3 supports; flush, telescoped, or nested 2-inch end laps; nested or interlocked side laps, unless otherwise indicated.

B. Deck Units: Comply with SDI requirements for type of sections, of metal thickness, width, and depth indicated.

C. Accessories: Provide cover plates, closure strips, roof sump pans, cant strips, as required; use deck manufacturer's standard unless otherwise shown.

IV. EXECUTION:

A. Installation: Place deck units and secure to adjacent framing by fusion welding 12 inches o.c. to supports, with a minimum of 2 welds at each support.

B. Mechanical Fasteners: Either powder-actuated or pneumatically driven, may be used in lieu of welding. Locate mechanical fasteners and install in accordance with deck manufacturers' instructions.

Secure roof deck units at ends and side laps at spacings recommended by deck manufacturer to provide resistance for gross uplift of 45 psf at eave overhand and 30 psf for other roof areas.

Place accessory units in accordance with manufacturer's recommendations unless otherwise shown.

C. Touch-up Shop Paint: After installation. Clean field welds and abraded areas, and apply same type paint as used in shop. Use galvanizing repair materials to correct damaged galvanized surfaces.

05400 COLD-FORMED METAL FRAMING

I. GENERAL:

A. Types: Of cold-formed metal framing units for project include the following:

Load-bearing punched channel studs. C-shaped steel studs.
C-shaped steel joists.

B. Shop Drawings and Data: Submit shop drawings for special components and installations not fully dimensioned or detailed in manufacturer's products data.

C. Component Design: Calculated structural properties of studs and joists in accordance with AISI "Specification for the Design of Cold-Formed Steel Structural Members".

D. Fire-Rated Assemblies: Where framing units are components of assemblies indicated for a fire-resistance rating, provide units approved by governing authorities having jurisdiction.

II. PRODUCTS:

A. Manufacturers: Provide cold-formed metal framing produced by one of the following:

Alabama Metal Industries Corp. Dale Industries, Inc.
- Dietrich Industries, Inc.
Marino Industries Corp.
Superior Steel Studs, Inc.
USG Industries
United States Steel Wheeling Corrugating Co.

B. System Components: Manufacturer's standard load-bearing steel studs and joists of type, size, shape, and gage as indicated. With each type of metal framing required, provide manufacturer's standard steel runners (tracks), blocking, lintels, clip angles, shoes, reinforcements, fasteners, and accessories as recommended by manufacturer for application indicated as needed to provide a complete metal framing system.

III. MATERIALS AND FINISHES:

A. For 16-Gage and Heavier Units: Fabricate metal framing components of structural quality steel sheet with a minimum yield point of 40,000 psi; ASTM A 446, A 570, or A 611.

B. For 18-Gage and Lighter Units: Fabricate metal framing components of commercial quality steel sheet with a minimum yield point of 33,000 psi, ASTM A 446, A 570, or A 611.

C. Provide Galvanized Finish: To metal framing components that comply with ASTM A 525 for minimum G 60 coating.

D. Provide Prime-Coated Finish: With one coat of shop-applied red-oxide, zinc-chromate, or other similar rust-inhibitive primer.

E. Electrodes for Welding: Comply with AWS Code and recommendations of framing manufacturer.

F. Galvanizing Repair: Use materials and methods for repair of galvanized surfaces damaged by welding, complying with ASTM A780.

G. Prefabrication: Structural framing components may be prefabricated into panels prior to erection. Fabricate panels plumb, square, true to line and braced against racking with joints welded. Perform lifting of prefabricated panels to prevent damage or distortion.

Fabricated panels in jig templates to hold members in proper alignment and position and to assure consistent component placement.

H. Fastenings: Attach similar components by welding. Attach dissimilar components by welding, bolting, or screw fasteners, as standard with manufacturer.

Wire tying of framing components is not permitted.

I. Fabrication Tolerances: Fabricate panels to a maximum allowable tolerance variation from plumb, level, and true to line of 1/8 inch in 10 feet.

III. EXECUTION:

A. Installation: Install metal framing systems in accordance with manufacturer's printed or written instructions and recommendations unless otherwise indicated.

Install continuous tracks sized to match studs. Secure tracks as recommended by stud manufacturer for type of construction involved.

B. Set Studs Plumb: Except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

C. Install Supplementary Framing: Blocking and bracing in metal framing system wherever walls or partitions are indicated to support fixtures, equipment, services, casework, heavy trim and furnishings, and similar work.

D. Secure Studs: To top and bottom runner tracks by either welding or screw fastening at both inside and outside flanges.

E. Install Horizontal: Stiffeners in stud system, spaces (vertical distance) at not more than 54 inches o.c. Weld at each intersection.

F. Installation of Joists: Install level and plumb, complete with bracing and reinforcing as indicated. Provide not less than 1-1/2-inches end bearing.

Reinforce ends with end clips steel hangers, steel angle clips steel stud section, or as otherwise recommended by joist manufacturer.

05500 METAL FABRICATIONS

I. GENERAL:

A. Definitions: In ASTM E 985 for railing-related terms apply to this section.

B. Structural Performance of Handrails and Railing Systems: Provide handrails and railing systems capable of withstanding the following structural loads without exceeding the allowable design working stress of materials involved. All handrails to be hot dipped galvanized steel.

1. Top Rails of Guardrail Systems: Concentrated load of 300 lbf applied at any point and a uniform load of 100 lbf per linear ft. with each load applied nonconcurrently with respect to direction and each other, vertically downward or horizontally.

2. Handrails Not Serving as Top Rails: Concentrated load of 200 lbf applied at any point and a uniform load of 50 lbf per linear ft. with each load applied nonconcurrently with respect to direction and each other, vertically downward or horizontally.

3. Infill Area of Guardrail Systems: Horizontal concentrated load of 200 lbf applied to one sq. ft. at any point in the system including panels, intermediate rails balusters, or other elements composing the infill area.

4. Treads of Steel Stairs: Uniform load of 100 lbf per sq. ft. or a concentrated load of 300 lbf on a area of 4 sq. inches located in the center of the tread, whichever produces the greater stress.

5. Platforms of Steel Stairs: Capable of withstanding a uniform load of 100 lbf per sq. ft.

C. Submittals: In addition to product data, submit the following:

1. Shop Drawings: Showing details of fabrication, assembly and installation including templates for anchor bolt placement.

2. Samples: Of materials and finished products as may be requested by Architect.

II. PRODUCTS:

A. General: For work exposed to view use materials selected for their smoothness and freedom from surface blemishes.

1. Steel Plates, Shapes, and Bars: ASTM A 36.

2. Rolled Steel Floor Plates: ASTM A 786.

3. Steel Bars for Grating: ASTM A 569 or A 36.

4. Wire Rod for Grating Cross Bars: ASTM A 510.

5. Cold-Formed Steed Tubing: ASTM A 500, grade as indicated below:

   Grade A: Unless otherwise indicated or required for design loading.

   Grade B: Unless otherwise indicated or required for design loading.

6. Hot-Formed Steel Tubing: ASTM A 501.

   For exterior installations and where indicated, provide tubing with hot-dip galvanized coating per ASTM A 53.

7. Uncoated Cold-Rolled Structural Steel Sheet: ASTM A 611, Grade A, unless otherwise indicated or required by design loading.

8. Uncoated Hot-Rolled Structural Steel Sheet: ASTM A 570, Grade 30, unless otherwise indicated or required by design loading.

9. Uncoated Cold-Rolled Commercial Quality Steel Sheet: ASTM A 366.

10. Uncoated Hot-Rolled Commercial Quality Steel Sheet: ASTM A 569.

11. Galvanized Structural Quality Steel Sheet: ASTM A 446; Grade A, unless another grade required for design loading, and G90 coating designation unless otherwise indicated.

12. Galvanized Commercial Quality Steel Sheet: ASTM A 536, G90 coating designation unless otherwise indicated.

13. Steel Pipe: ASTM A 53; finish, type, and weight class as follows:

    a. Black Finish: Unless otherwise indicated.
    b. Galvanized Finish: For exterior installations and where indicated.

c. Type F, Standard Weight: (Schedule 40) unless another weight, type, and grade required by structural loads.
d. Type S, Grade A, Standard Weight: (Schedule 40) unless another grade or weight or both required by structural loads.
e. Type S, Grade B, Standard Weight: (Schedule 40) unless another weight required by structural loads.

14. Gray Iron Castings: ASTM A 48, Class 30.

15. Malleable Iron Castings: ASTM A 47, grade 32510.

16. Brackets, Flanges and Anchors: Cast or formed metal of the same type material and finish as supported rails.

17. Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either malleable iron, ASTM A 47, or cast steel, ASTM A 27. Provide bolts, washers, and shims as required, hot-dip galvanized per ASTM A 153.

18. Extruded Aluminum Bars and Shapes: ASTM B 221, alloys as follows:

    6061-T6 or 6063-T6 for bearing bars of gratings and shapes.

    6061-T1 for grating cross bars.

19. Aluminum-Alloy Rolled Tread Plate: ASTM B 632, alloys as follows:

    6061-T6 for platforms.
    6061-T4 for treads.

20. Aluminum Rivets: ASTM B 316, alloy 6053-T4 or 6061-T6.

21. Aluminum Sheet for Expanded Aluminum Grating: ASTM B 209, alloy 5052-H32.

22. Fasteners for Aluminum Gratings: Same basic metal as fastened metal except use galvanized fasteners complying with ASTM A 153 for exterior aluminum units, unless otherwise indicated. Do not use metals which are corrosive or incompatible with metals joined.

23. Nonshrink Metallic Grout: Premixed, factory-packaged, ferrous aggregate grout complying with CE CRD-C 621.

24. Nonshrink Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with CE CRD-C 621.

25. Interior Anchoring Cement: Factory-prepackaged nonshrink, nonstaining, hydraulic controlled expansion cement formulation for mixing with water at Project site. Use for interior applications only.

26. Fasteners: Provide bolts, nuts, lag bolts, machine screws, wood screws, toggle bolts, masonry anchorage devices, lock washers as required for application indicated and complying with applicable Federal standards. Hot-dip galvanize fasteners for exterior applications to comply with ASTM A 153.

27. Shop Primer for Ferrous Metal: Manufacturer's or fabricator's standard, fast-curing, lead-free, universal modified alkyd primer; resistant to normal atmospheric corrosion, compatible with finish paint systems indicated. capable of providing a sound foundation for field-applied topcoats despite prolonged exposure; complying with performance requirements of FS TT-P-645.

28. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12 except containing no asbestos fibers.

29. Zinc Chromate Primer: FS TT-P-645.

30. Shop Painting: Apply shop primer to surface of metal fabrications except those embedded in concrete or galvanized; comply with SSPC-PA1 and requirements indicated below:

    a. Surface Preparation: Comply with SSPC-SP6 "Commercial Blast Cleaning" for exterior work, and with SSPC-SP3 "Power Tool Cleaning" for interior work.

    b. Stripe Paint: Edges, corners, crevices, bolts, welds and sharp edges.

31. Galvanizing: ASTM A 123 for fabricated and unfabricated steel products made of uncoated rolled, pressed and forged steel shapes, plates, bars and strip 0.0229 inch and thicker.

32. Galvanizing Repair Paint: High zinc dust content paint with dry film containing not less than 94 percent zinc dust by weight, complying with DOD-P-21035 or SSPC-Paint-20.

33. Fabrication, General: Use materials of size and thickness shown, or, if not shown, of required size, grade and thickness to produce strength and durability in finished product. Shop-paint all items not specified to be galvanized after fabrication.

    a. Weld Corners and Seams: Continuously to comply with AWS recommendations. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. Obtain fusion without undercut or overlap. Remove welding flux immediately. Finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.

    b. Form Exposed Connections: With hairline joints, flush and smooth, using concealed fasteners where possible. Locate joints where least conspicuous.

34. Rough Hardware: Furnish custom-fabricated bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes for framing and supporting and anchoring woodwork.

    a. Galvanize, unless otherwise indicated.

35. Ladders: Fabricate ladders for locations shown, with dimensions, spacings, and anchorages as indicated. Comply with the requirements of ANSI A14.3, unless otherwise indicated.

    a. Provide Sloping Ladders: (Ship's ladders) where indicated. Fabricate or open type construction with structural steel channel of plate stringers, pipe handrails, and open steel grating treads, unless otherwise indicated. Provide all necessary brackets, fittings, and anchorages for installation.

    b. Provide ladder Safety Cages: Where indicated. Fabricated of structural steel flat bars, assembled by welding or riveting.

    c. Galvanize after fabrication.

36. Loose Bearing and Leveling Plates: Provide for steel items bearing on masonry or concrete, as indicated. Drill plates to receive anchor bolts.

37. Loose Steel Lintels: Fabricate from shapes and to sizes indicated.

    1. Galvanize after fabrication.

38. Miscellaneous Framing and Supports: Provide as required to complete work and not included with structural steel framework. Fabricate of welded construction in as large units as possible; drill and tap as required to receive hardware and similar items. Include required anchors for building into other work; spaced not more than 24 inches o.c.

39. Miscellaneous Steel Trim: Fabricate to shapes and sizes as required for profiles shown; continuous welded joints and smooth exposed edges. Use concealed field splices wherever possible. Provide cutouts, fittings, and anchorages; coordinate assembly and installation with other work.

40. Prefabricated Building Columns: Assemblies composed of load-bearing steel structural member protected by manufacturer's standard insulating concrete fireproofing encased in outer non-loadbearing steel shell and bearing UL Classification Marking or fire-resistance rating indicated; of size, shape and column configuration indicated.

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        Bridgeport Column Co., Inc.
        George A. Dean Inc.
        Lally Tubular Div., LB Industries, Inc.

41. Nosings: Fabricate of shapes as indicated; miter corners and weld joints. Provide anchors 6 inches from ends of corners and 24 inches o.c.

    Galvanize after fabrication.

42. Shelf and Relieving Angles: Fabricate to sizes indicated for attachment to support framing. Provide slotted holes to receive anchor bolts, spaced not more than 6 inches from ends and 24 inches o.c.

a. Furnish wedge-type concrete inserts complete with fasteners for securing shelf angles to cast-in-place concrete.
b. Galvanize shelf angles to be installed on exterior concrete.

43. Steel Door Frames: Fabricate from structural shapes and bars of size and to dimensions indicated, fully welded together. Secure removable stops to frame with countersunk machine screws. Reinforce frames and drill and tap as required to accept finish hardware.

    a. Provide Steel Strap Anchors: Of size indicated for securing door frames into adjoining concrete or masonry for a minimum 8 inches embedment. Weld anchors to frames.

    b. Extend Bottom of Frames: To Floor elevation indicated with steel angle clips welded to frames for anchoring to floor with expansion shields and bolts.

    c. Galvanize: Frames and anchors where indicated.

44. Metal Bar Gratings: Produce metal bar gratings indicated per NAAMM marking system that comply with the following:

    a. Metal Bar Grating Standard: "Standard Specifications for Metal Bar Grating and Metal Bar Grating Treads" published in ANSI/NAAMM A202.1 "Metal Bar Grating Manual".

45. Heavy Duty Metal Bar Grating Standard: "Guide Specifications for Heavy Duty Metal Bar Grating" published in NAAMM "Heavy Duty Metal Bar Grating Manual".

46. Welded Steel Gratings: W-15-4 (welded with bearing bars 15/16 inch o.c. and cross bars 4 inches o.c.)/bearing bar sizes as indicated.

47. Pressure-Locked Steel Gratings: P-15-4 (pressure-locked with bearing bars 15/16 inch o.c. and cross bars 4 inches o.c.)/bearing bar sizes as indicated.

48. Riveted Steel Gratings: R-12-7 (riveted with 3/4 inch space between bearing bars and cross bars 7 inches o.c.)/bearing bar sizes as indicated.

49. Pressure-Locked Rectangular Bar Aluminum Gratings: P-7-4 (pressure-locked with bearing bars 7/16 inch o.c. and cross bars 4 inches o.c.)/rectangular bearing bar sizes as indicated.

50. Pressure-Locked I-bar Aluminum Gratings: P-16-2 (pressure-locked with bearing bars on inch o.c. and cross bars 2 inches o.c.)/I-shaped bearing bar sizes as indicated.

51. Welded Heavy Duty Steel Gratings: W-19-4 (welded with bearing bars 1-3/16 inch o.c. and cross bars 4 inches o.c.)/bearing bar sizes as indicated.

52. Riveted Heavy Duty Steel Gratings: R-19-3-1/2 (riveted with 1-3/16 inch space between bearing bars and cross bars 3-1/2 inches o.c.)/bearing bar sizes as indicated.

53. Traffic Surface For Steel Bar Gratings: As follows: Serrated

54. Traffic Surface for Aluminum Bar Gratings: As follows:Grooved

55. Steel Finish: As follows:

    a. Shop prime paint applied in accordance with manufacturer's standard practice.

    b. Hot-dip galvanized with a coating weight of not less than 1.8 oz. per sq. ft. of coated surface.

56. Aluminum Finish: As follows:

    Class I clear anodized finish.

57. Fabricate Removable Grating Sections: With banding bars attached by welding to entire perimeter of each section. Include anchors and fasteners of type indicated for attachment to supports.

    a. Provide not less than 4 anchor blocks for each section.

    b. Provide not less than 4 saddle clips for each grating section.

    c. Provide not less than 4 flange blocks for each section of aluminum I-bar grating.

    d. Furnish threaded bolts with nuts and washers for each clip required.

e. Furnish self-drilling fasteners with washers for each clip required.

58. Attach Toe Plates: To grating by welding unless otherwise indicated.

59. Furnish Toe Plates: For attachment in field.

60. Fabricate Cutouts: In grating sections for penetration as indicated. Arrange layout of cutouts to permit grating removal without disturbing items penetrating gratings.

a. Edge band openings in grating which interrupt 4 or more bearing bars with bars of same size and material as bearing bars.

61. Expanded Metal Gratings: Provide style and type indicated in material and finish indicated below:

Material: Steel

Steel Finish: Shop prime paint.

62. Floor Plate: Fabricate raised pattern floor plate from rolled steel floor plate of thickness and pattern indicated.

a. Provide 2 Steel Bar Drop Handles: For lifting plates, one at each end of each removable section.

63. Abrasive Surface Floor Plate: With manufacturer's standard abrasive granules rolled into surface.

a. Provide 2 Steel Bar Drop Handles: For lifting plates, one at each end of each removable section.

64. Fabricate Raised Pattern Tread Plates: From aluminum-alloy rolled tread plate in pattern 1 of thickness indicated.

65. Steel Pipe Railings: Fabricate to dimensions shown, with smooth bends and welded joints using steel pipe of diameter and finish indicated. Secure posts and rail ends to building construction as indicated.

a. Galvanize exterior and interior steel railings, including pipe, fittings, brackets, fasteners and other ferrous metal components.

66. Cast Treads and Threshold: Cast-iron units with integral abrasive finish, of size and configuration indicated; with manufacturer's standard anchors for type of application indicated.

67. Steel Framed Stairs: Complete stair assemblies of type indicated and including metal framing, hangers, columns, railings, newels, balusters, struts, clips, brackets, bearing plates and other components required for support of stairs and platforms.

    a. Stair Framing: Fabricate stringers of structural steel channels or plates or a combination thereof, and platforms of structural steel channel headers and miscellaneous framing members, of size indicated or required to support design loadings.

68. Metal Pan Risers, Subtreads, and Subplatforms: Form metal pans to configuration indicated from hot-rolled or cold-rolled steel. Weld risers and subtreads to stringers, and subplatform to platform framing members.

69. Steel Floor Plate Treads and Platforms: Fabricate treads and platforms from raised pattern steel floor plate of pattern indicated or selected from manufacturer's standards. Form treads of 1/4 inch thick plate with integral nosing and back edge stiffener. Weld treads and platforms to supporting framing.

70. Floor Grating Treads and Platforms: Fabricate treads and platforms from steel bar gratings of type, size, and traffic surface indicated and complying with NAAMM "Metal Bar Grating Manual". Secure treads to framing with bolts and platform by welding.

71. Wheel Guards: Hollow core, gray-iron castings, filled with 3000 psi concrete after installation.

72. Pipe Bollards: Fabricate pipe bollards from Schedule 80 steel pipe. Cap bollards with 1/4 inch minimum thickness steel base plate.

    a. Fabricate Sleeves: For bollard anchorage from steel pipe with 1/4 inch thick steel plate welded to bottom of sleeve.

II. EXECUTION:

A. Installation: Perform cutting, drilling and fitting required for installation, set work accurately in location, alignment and elevation, measured from

established lines and levels. Provide anchorage devices and fasteners where necessary for installation to other work.

1. Set loose items on cleaned bearing surfaces, using wedges or other adjustments as required. Solidly pack open spaces with bedding mortar, consisting of 1-part portland cement to 3-parts sand and only enough water for packing and hydration, or use commercial non-shrink grout material.

2. Touch-Up Shop Paint: After installation. Clean field welds, bolted connections and abraded areas, and apply same type paint as used in shop. Use galvanizing repair paint on damaged galvanized surfaces.

05521 PIPE AND TUBE MATERIALS

I. GENERAL:

A: Structural Performance of Handrails and Railing Systems: Comply with ASTM E 985 based on testing per ASTM E 894 and E 935. Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

II. PRODUCTS:

A. Aluminum: Alloy and temper recommended by aluminum producer or finisher for use and finish indicated, with not less than the strength and durability of alloy and temper designated below:

a. Extruded Bar and Tube: ASTM B 221, 6063-T5/T52.

b. Extruded Structural Pipe and Tube: ASTM B 429, 6063-T5/T52.

c. Drawn Seamless Tube: ASTM B 483, 6063-T832.

d. Plate and Sheet: ASTM B 209, 6061-T6.

e. Die and Hand Forgings: ASTM B 247, 6061-T6.

f. Castings: ASTM B 26, 356-T6.

B. Stainless Steel: Austenitic stainless steel in form indicted complying with the following requirements:

a. Tubing: ASTM A 554, Grade MT 304.

b. Pipe: ASTM A 312, Grade TP 304.

c. Castings: ASTM A 743, Grade CF 8 or CF 20.

d. Plate: ASTM A 167, type 304.

C. Steel Pipe: ASTM A 53; finish, type, and weight class a follows:

a. Black finish, unless otherwise indicated.

b. Galvanized finish for exterior installations and where indicated.

c. Type F, standard weight (schedule 40), unless another weight, type, and grade required by structural loads.

d. Type S. Grade A, standard weight (schedule 40), unless another grade, weight, or both required by structural loads.

e. Type S. Grade B, standard weight (schedule 40), unless another weight required by structural loads.

D. Steel Tubing: Product type (manufacturing method) and other requirements as follows:

a. Cold-Formed Round Steel Tubing: ASTM A 500, grade as required by structural loads.

b. Hot-Formed Round Steel Tubing: ASTM A 501.

c. For exterior installations and where indicated, provide tubing with hot-dip galvanized coating per ASTM A 53.

E. Steel Plates, Shapes, and Bars: ASTM A 36.

F. Brackets, Flanges, and Anchors: Cast or formed metal of the same type material and finish as supported rails.

G. Grout/Anchoring Cement: Nonshrink nonmetallic grout; CE CRD-C621 or erosion-resistant anchoring cement; nonstaining, noncorrosive, nongaseous; recommended by manufacturer for types of applications indicated.

H. Fasteners: Same material as fastened metal; concealed unless otherwise indicated or unavoidable and standard with systems indicated.

I. Anchors and Inserts: As required for secure anchorage of handrails and railings to concrete, masonry, and other adjoining work; noncorrosive to materials joined.

III. FABRICATIONS:

A. Fabricate handrails and railings to design, dimensions, and details indicated and as required to support structural loads.

B. Nonwelded Connections: Fabricate railing systems and handrails for connection of members by means of concealed mechanical fasteners and fittings.

Fabricate splice joints for field connection using epoxy structural adhesive.

C. Welded Connections: Use fully welded joints for permanently connecting railing components by welding. Cope or butt components to provide 100 percent contact or use manufacturer's standard fittings designed for this purpose.

D. Welded Connections for Aluminum Pipe: Fabricate railing members for connection by concealed internal welds, using manufacturer's standard system of sleeve and socket fittings.

E. Expansion Joints: Install expansion joints at locations indicated but not further apart than required to accommodate thermal movement.

F. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required without deforming exposed surfaces.

G. Provide Toeboards, wall returns, closed ends, brackets, flanges, fittings, and sleeves as required for type of installation indicated.

IV. FINISHES:

A. Aluminum Class I Clear Anodized Finish: AA-M12C22A41 complying with AAMA 607.1.

B. Aluminum Class I Color Anodized Finish: AA-M12C22A42/44 complying with AAMA 606.1/AAMA 608.1.

C. Stainless Steel Finish: 180-grit polished finish.

D. Stainless Steel Finish: AISI No. 4 finish.

E. Ferrous Metal Finish: Shop-prime with lead-free "universal" primer selected for compatibility with substrate and field-applied finish paint.

V. EXECUTION:

A. Set work accurately in location, alignment, and elevation and free from rack.

B. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns unless clearance between end of the railing and wall is 1/4 inch or less.

C. Comply with manufacturer's recommendation for field connections of handrail and railing members.

D. Anchor posts in concrete by inserting into preset sleeves and grouting of annular space between sleeve and post.

E. Anchor posts to metal surfaces with fittings designed for this purpose.

F. Anchor rail ends to masonry and concrete with round flanges connected to rail ends and fastened to wall with post-installed anchors and bolts.

G. Attach handrails to wall with wall brackets and end fittings.

a. Use brackets with predrilled hole for exposed bolt anchorage.

END OF DIVISION

DIVISION 6 - WOOD AND PLASTICS

BACK

06200 FINISH CARPENTRY

I. GENERAL:

A. Provide all labor, material and services to perform all operations required for and incidental to the complete installation of all shelving and wood trim.

II. PRODUCTS:

A. Shelving: All shelving will be limited to 4 types.

1. Type "A" shelving will be 3/4" thick high density particle board 11 1/2" deep with 3/4"x1/2" hardwood edge band on exposed edge with primer and 2 finish coats of paint. Location: all fixed shelving in closets at 24", 36", 48", 60" and 72" A.F.F. and 2" above coat rod in all coat closets. Shelving to be supported by 1 x 2 wood pin rails painted as per shelves where fixed and brackets and standards where adjustable. Paint with primer and 2 finish coats of paint.

2. Type "B" shelving to be 3/4" thick birch veneer plywood 11 1/2" deep with birch veneer edge band typical on 4 sides. Finish to be either 2 coats of satin polyurethane varnish.

3. Type "C" shelving to be 3/4" thick M.D.F. with all edges and surfaces finished with plastic laminate as selected by the Architect with a radius edge. Comply with AWI premium grade specifications, flush overlay design.

4. Type "D" shelving to be 1" x 12" epoxy resin.

5. Type –E‖ shelving to be ¾‖ solid red oak shelving stained or polyurathaned as per drawings.

B. Brackets and Standards: Shelving brackets and standards to be KV82.182, white finish. Heavy duty brackets and standards to be KV85-185, white finish. All standards to be on 16" centers and heavy duty standards should be on 12" centers. All standards to be attached to studs in drywall partitions and recessed into 1" x 1 1/2" red oak wood strips on C.M.U. partitions. Wood strip to be stained or painted as noted.

06400 ARCHITECTURAL WOODWORK

I. GENERAL:

A. Specifications: Millwork to be constructed using AWI premium grade specifications, flush overlay design by American Metal Mouldings, Corp, 1801 N. American Street, Philadelphia, PA 19133, (215) 634-3100.

B. Finished Millwork: To be shop-finished and will only require field touch-up.
North Pointe Villager Series, Manhattan Square Raised Penel in Oak.

II. PRODUCTS:

A. Millwork Hardware: Is provided by the Millwork Contractor and shall be as follows: All brushed aluminum finish, unless noted otherwise.

1.	Flush Door/Drawer Pulls:	EPCO #DP-46
2.	Wire Pulls:	Stanley 4"x5/16" diameter brushed aluminum finish.
3.	Cabinets Hinges:	Grass, Atlas 961, Institutional Hinge
4.	Piano Hinges:	STANLEY SC 311 1/4
5.	itchen Drawer Slides:	Grass 6650, Bottom Mounted Drawer Slide
6.	Cabinet Shelf Supports:	KV225AL/256AL, standard finish
7.	Magnetic Catches:	STANLEY SP45/SP46, standard finish
8.	Touch Latches:	IVES 820, standard finish
9.	File Hangers:	PENDAFLEX, legal size, in all file drawers
10.	Cam Locks:	Provide National

Cabinet Lock C8053

on

each drawer and door unit.

B. Finishes: Millwork to be finished as follows:

1. Exterior Surfaces: (countertops, cabinet fronts, doors - all surfaces, exposed end panels) Nevamar high-pressure plastic laminate or wood veneer as indicated. All countertop edges to receive red oak bullnose. Substrate to be 3/4" M.D.F. Board.

2. Interior Surfaces, Shelving: - melamine coated panels MCP

3. Natural Finish:

1st coat	Oil Stain
2nd & 3rd coat	Lacquer Based Sanding Sealer, sanded between coats.
4th & 5th coat	"Lac-Thane", Polish with extra fine steel wool and lemon oil.

4. Avonite: Avonite solid surfacing material where called for on drawings. Countertops to be constructed of one-piece, monolithic design including integral sink bowl, size as noted, one-piece integral cove backsplash and integral no-drip edge on counters. Provide Avonite scribe strips to walls and seam with Avonite approved adhesive.

5. Window Stools

a. Panel Products: Particleboard.
   1) Panel Thickness: As indicated Drawings, but not less than that required by referenced woodworking standard.
b. Finish: Solid Surfacing Material
c. Exposed Edges: Base Bid: Solid Surfacing Material
d. Conceal all fasteners.

III. EXECUTION:

A. Coordination Inspection: Millwork Contractor shall inspect areas to receive work and shall not begin installation until areas have been satisfactorily prepared. Starting work shall indicate acceptance of site conditions. Millwork Contractor to coordinate with General in order to assure that the necessary blocking is installed during framing. All

millwork to have 1/2" plywood blocking unless otherwise noted on drawings. Millwork shall be scribed to wall, ceiling or floor.

B. Field Dimensions: Millwork Contractor shall field check all critical dimensions prior to fabrication and generally coordinate with other trades as required.

C. Cutouts, Grommets: Millwork Contractor to provide cutouts for electrical, telephone and signal outlets where they occur behind millwork and he shall provide grommets in countertops to allow telephone and electrical cord access to the respective outlets. Grommets to be King Kong style by Doug Mocket.

D. Electrical within Millwork: Lighting and electrical work shown attached to Millwork to be provided by the Electrical Contractor, unless noted. MC cable to be used in all Millwork.

IV. QUALITY ASSURANCE

A. Fabricator Qualifications: Firm experienced in producing architectural woodwork similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units without delaying the Work.

B. Installer Qualifications: Arrange for interior architectural woodwork installation by a firm that can demonstrate successful experience in installing architectural woodwork items similar in type and quality to those required for this Project.

C. Single-Source Responsibility for Fabrication and Installation: Engage a qualified woodworking firm to assume undivided responsibility for fabricating, finishing, and installing woodwork specified in this Section.

D. Quality Standard: Except as otherwise indicated, comply with the following standard:

1. AWI Quality Standard: −Architectural Woodwork Quality Standards‖ of the Architectural Woodwork Institute for grades of interior architectural woodwork, construction, finishes, and other requirements.
   a. Provide AWI Certification Labels or or Certificates of Compliance indicating that woodwork meets requirements of grades specified.

2. The Contract Documents contain selections

chosen from options in the Quality Standard as well as additional requirements beyond those of the Quality Standard. Comply with such selections and requirements in addition to the Quality Standard.

E. Fire Test Response Characteristics: Provide materials with the following fire-test-response characteristics as determined by testing identical products per ASTM test method indicated below by UL, Warnock Hersey, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify fire-retardant-treated material with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.

1. Surface-Burning Characteristics: Not exceeding values indicated below, tested per ASTM E 84 for standard time period (10 minutes).
   a. Flame Spread: 75.
   b. Smoke Developed: 450.

2. Surface-Burning Characteristics: Not exceeding values indicated below, tested per ASTM E 84 for 30 minutes with no evidence of significant combustion. In addition, the flame front shall not progress more than 10-1/2 feet (3.2 m) beyond the center line of the burner at any time during the test.
   a. Flame Spread: 25.
   b. Smoke Developed: 450.

F. Pre-installation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section ‖Project Meeting‖.

V. DELIVERY, STORAGE, AND HANDLING

A. Protect woodwork during transit, delivery, storage, and handling to present damage, soilage, and deterioration.

B. Do not deliver woodwork until painting and similar operations that could damage, soil, or deteriorate woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas whose environmental conditions meet requirements specified in ―Project Conditions‖.

VI. PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet-work is completed, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Environmental Limitations: Obtain and comply with woodwork fabricator's and installer's coordinated advice for optimum temperature and humidity conditions for woodwork during its storage and installation. Do not install woodwork until these condition have been attained and stabilized so that woodwork will be within plus or minus 1.0 percent of optimum moisture content from date of installation through remainder of construction period.

C. Field Measurements: Where woodwork is indicated to be fitted to other construction, check actual dimensions of other construction by accurate field measurements before fabrication, and show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Verify locations of concealed framing, blocking, reinforcements, and furring that support woodwork by accurate field measurements before being enclosed. Record measurements on final shop drawings.

2. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site and coordinate construction to ensure that actual dimensions correspond to guaranteed dimensions.

VII. COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

END OF DIVISION

DIVISION 7 - THERMAL AND MOISTURE PROTECTION

BACK

07530 SINGLE PLY MEMBRANE ROOFING

I. GENERAL:

A. Roof: Unless previously authorized by Temple, roofs are to be Carlisle membrane roofs, 60 mil thickness membrane material 20 feet wide rolls, Carlisle walking pads installed per Carlisle method (unless other pavers are specified) pavers to be arranged to allow convenient access to significant features on roof, 20 year warrantee, ballasted, where possible, and mechanically fastened otherwise, and the warrantee to be issued by the manufacturer, not the installer.

07600 FLASHING AND SHEET METAL

I. PRODUCTS:

A. Flashing: All flashing, unless authorized by Temple, is to be stainless steel and all laps and penetrations are to be properly sealed to prevent admission of water and moisture to the building structure.

The rubber roofing material is to rise a minimum of 6" above the top of the roof drain dome, 6" above an unscuppered parapet or 6" above a gravel stop, before any counterflashings begin.

On parapets or rising perimeters the roofing material is to continue over the top of the rise or parapet and terminate in a reglet on the face of the building and covered by architectural sheetmetal.

All flexible flashings (plastic) or flashings other than stainless steel, are to be authorized by Temple before considered for design.

07720 ROOF ACCESSORIES

I. GENERAL:

A. Access to roof to be via stairway or opposed tread stairway but not via vertical ladder, unless authorized by Temple. Roof hatch is to be "coffin" style rather than square and the operating and locking mechanisms are to be at the same end as the head of the stairway.

B. Locking shall be by padlock.

C. Skylights are prohibited.

II. MANUFACTURER:

A. Bilco Company

07920 JOINT SEALERS

I. GENERAL:

A. Related Documents:

1. Stipulations: The specifications section "General Conditions" and "Special Requirements" form a part of this section by this reference thereto and shall have the same force and effect as if printed herewith in full.

B. Summary:

1. This Section includes sealers for the following locations:

a. Exterior joints in vertical surface and non-traffic horizontal surfaces as indicated below.

Control and expansion joints in unit masonry.

Joints between different materials. Perimeter joints between materials and frames of doors and windows. Other joints as indicated and or required.

C. System Performances:

1. Provide joint sealers that have been produced and installed to establish and maintain watertight and airtight continuous seals.

D. Submittals:

1. Product Data from manufacturers for each joint sealer product required, including instructions for joint preparation and joint sealer application.

E. Quality Assurance:

1. Installer Qualifications: Installer who has successfully completed within the last 3 years at least 3 joint sealer applications similar in type and size to that of this project.

2. Single Source Responsibility for Joint Sealer Materials: Obtain joint sealer materials from a single manufacturer for each different product required.

F. Delivery, Storage, and Handling:

1. Deliver materials to project site in original unopened containers with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.

2. Store and handle material in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminates, or other causes.

G. Project Conditions:

1. Environmental Conditions: Do not proceed with installation of joint sealers under the following conditions:

a. When ambient and substrate temperature conditions are outside the limits permitted by joint major sealer manufacturers.

b. When ambient and substrate temperature conditions are outside the limits permitted by joint sealer manufacturer or below 40øF (4.4 deg C).

c. When joint substrates are wet due to rain, frost, condensation, or other causes.

2. Joint Width Conditions: do not proceed with installation of joint sealers where joint widths are less than allowed by joint sealer manufacturer for application indicated.

3. Joint Substrate Conditions: Do not proceed with installation of joint sealers until contaminates capable of interfering with their adhesion are removed from joint substrates.

II. PRODUCTS:

A. Materials, General:

1. Compatibility: Provide joint sealers, joint fillers and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

2. Colors: Provide colors exposed joint sealers to match adjacent surfaces. This requires multiple custom colors.

B. Silicone Joint Sealants:

1. Silicone Sealant Standard: Provide manufacturer's standard atmospheric moisture curing, sealant of silicone indicated which complies with ASTM C 920 requirements, for Type "S", Grade NS, Class 25 and uses NT, M, G, and A.

2. Available Products: Subject to compliance with requirements, silicone sealants which may be incorporated in the work include, but are not limited to, the following:

"Silpruf"; General Electric Co. "Dow Corning 795"
"Omni Seal"; Sonneborn
"Spectrum 2", Tremco, Inc.

C. Joint Sealant Backing:

1. General: Provide sealant backings of material and type which are non-staining; are compatible with joint substrates, sealants, primers and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

2. Plastic Foam Joint Fillers: Preformed, compressible, resilient, non-waxing, non-extruding strips of flexible, non-gassing plastic foam of material indicated below; non-absorbent to water and gas; and of size, shape and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

a. Foam Backer rod - SOF ROD - manufactured by Applied Extrusion Technologies, Inc. or approved equal.

3. Bond-Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

D. Miscellaneous Material:

1. Primer: Provide type recommended by joint sealer manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from pre-construction joint sealer-substrate tests and field tests.

2. Cleaners for Nonporous Surfaces: Provide nonstaining, chemical cleaners of type which are acceptable to manufacturers of sealants and sealant backing materials, which are harmful to substrates and adjacent nonporous materials, and which do not leave oily residues or otherwise have a detrimental effect on sealant adhesion or in-service performance.

3. Masking Tape: Provide nonstaining, nonabsorbent type compatible with joint sealants and to surfaces adjacent to joints.

III. EXECUTION

A. Examination:

1. Examine joints indicated to receive joint sealers, for compliance with requirements for compliance with requirements for joint configuration, installation to tolerances and other conditions affecting joint sealer performance. Do not proceed with installation of joint sealers until unsatisfactory conditions have been corrected.

B. Preparation:

1. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealers to comply with recommendations of joint sealer manufacturers and the following requirements:

a. Remove all foreign material from joint substrates which could interfere with adhesion of joint sealer, including dust; paints, except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer, old joint sealers; oil, grease; waterproofing; water repellents; water; surface dirt; and frost.

b. Clean concrete, masonry, and similar porous joint substrate surfaces, by brushing, grinding, blast cleaning, mechanical abrading, or a combination of there methods to produce a clean, sound substrate capable of developing optimum bond with joint sealers. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.

c. Clean metal, glass, and other nonporous surfaces by chemical cleaners or other means which are not harmful to

substrates or leave residues capable of interfering with adhesion of joint sealers.

2. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealer manufacturer based on preconstruction joint sealer-substrate tests or prior experience. Apply primer to comply with joint sealer manufacturer's recommendations. confine primers to areas of joint sealer bond, do not allow spillage or migration onto adjoining surfaces.

3. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces which otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.

C. Installation of Joint Sealers:

1. General: Comply with joint sealer manufacturers; printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

2. Silicone Sealant Installation Standard: Comply with recommendations of ASTM C 962 for use of joint sealants as applicable to materials, applications and conditions indicated.

3. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:

a. Install joint fillers of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths which allow optimum sealant movement capability.

1) Do not leave gaps between ends of joint fillers.

2) Do not stretch, twist, puncture, or tear joint fillers.

3) Remove absorbent joint fillers which have become wet prior to sealant application and replace with dry material.

b. Install bond breaker tape between sealants and joint fillers, compression seals, or back of joints where adhesion of

sealant to surfaces at back of joints would result in sealant failure.

c. Install compressible seals serving as sealant backings to comply with requirements indicated above for joint fillers.

4. Installation of Sealants: Install sealants by proves techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths which allow optimum sealant movement capability.

5. Tooling of Nonsag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents which discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

a. Provide concave joint configuration per Figure 6A in ASTM C 962, unless otherwise indicated.

D. Cleaning:

1. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealers and of products in which joints occur.

E. Protection:

1. Protect joint sealers during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealers immediately and reseal joints with new materials to produce joint sealer installations with repaired areas indistinguishable from original work.

END OF DIVISION

BACK

DIVISION 08.00.00 - OPENINGS

08.71.00 - DOOR HARDWARE

Image	Part 1 - General	
		Heavy Duty Geared Continuous Hinge Concealed. Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Select Products - 3258 Stadium Park Way, Kalamazoo, Michigan 49009 (800)-585-1019
	Model/Series/Size	BHMA CERTIFIED SL11HD/Standard Sizes; 83, 85, 95, and 120 in
	Material/Finish	Extruded 6063 T6 Aluminum Alloy/Clear, Dark Bronze and Black anodized aluminum
	Part 3 - Execution	Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

08.71.00 - DOOR HARDWARE

Image	Part 1 - General	
		'Heavy Duty Concealed Leaf Hinge.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Hager - 139 Victor Street, Saint Louis, MO 63104 (800-)325-9995
	Model/Series/Size	780-110HD/Length: 79, 83, 85, 95, and 119 inch; Hole Count (Door and Jamb): 16, 18, 20, 26
	Material/Finish	Aluminum 6063-T6
	Part 3 - Execution	For use on door 1" (25mm) to 1-3/8" (35mm) thick. Frame and door leaf alignment ribs for proper hinge and door location. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

08.71.00 - DOOR HARDWARE

Image	Part 1 - General	Product Link (Reference Only)
		'Stanley FBB199.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Stanley - 65 Scott Swamp Rd, Farmington, Connecticut 06032, US (877) 266-0096
	Model/Series/Size	FBB199; Size: 4.5"X4.5", 5"X4.5", 5"X5", 6"X4.5", 6"X5", 6"X6", 8"X6", 8"X8"; Metal Gaugel: 0.18", 0.19", 0.203"
	Material/Finish	Satin Chrome, (Base Brass/Bronze)
	Part 3 - Execution	Five knuckle full mortise with heavy weight ball baring and non-removable pins (NRP). Use FBB191 for standard weight doors. Provide tamper-resistant Torx screws where required. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

08.71.00 - DOOR HARDWARE

Image	Part 1 - General	Product Link (Reference Only)
		'Stanley FBB168.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Stanley - 65 Scott Swamp Rd, Farmington, Connecticut 06032, US (877) 266-0096
	Model/Series/Size	FBB168; Size: 4.5"X4.5", 5"X4.5", 5"X5", 6"X4.5", 6"X5", 6"X6", 8"X6", 8"X8"; Metal Gaugel: 0.18", 0.19", 0.203"
	Material/Finish	Bright Chrome, (Base Steel)
	Part 3 - Execution	Five knuckle full mortise with heavy weight ball baring and non-removable pins (NRP). Use FBB179 for standard weight doors. Provide tamper-resistant Torx screws where required. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

08.71.00 - DOOR HARDWARE		
Image	**Part 1 - General**	
		'Classroom Cylindrical Lever Lockset.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Best - 6161 East 75th Street, Indianapolis, IN 46250 USA (855) 365-2407
	Model/Series/Size	93K 15D; Backset: 2-3/4"; Rose Style Cylinder: 3.5"
	Material/Finish	Satin Chromium Plated; Other Options: Oil Rubbed Bronze, Bright Chromium Plated, Satin Bronze, Satin Brass, Bright Brass
	Part 3 - Execution	Specify cylindrical function based on room type. See PDG Typical Door Hardware Breakdown. Coordinate #626 (satin chromium plated) or #613 (oxidized satin bronze, oil rubbed) if approved with owner. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

08.71.00 - DOOR HARDWARE		
Image	**Part 1 - General**	
		'Electrified Lever Lock.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Best - 6161 East 75th Street, Indianapolis, IN 46250 USA (855) 365-2407
	Model/Series/Size	93KW 15D; Backset: 2-3/4"; Rose Style Cylinder: 3.5"
	Material/Finish	Satin Chromium Plated; Other Options: Oil Rubbed Bronze, Bright Chromium Plated, Satin Bronze, Satin Brass, Bright Brass
	Part 3 - Execution	Specify cylindrical function based on room type. See PDG Typical Door Hardware Breakdown. Coordinate #626 (satin chromium plated) or #613 (oxidized satin bronze, oil rubbed) if approved with owner. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

08.71.00 - DOOR HARDWARE		
Image	**Part 1 - General**	
		'Digital Commercial Keypad Lock.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Napco Security Technologies, Inc. 333 Bayview Ave., Amityville, NY 11701 800-645-9440
	Model/Series/Size	DL2700; Ext. Dim: 8" (H) x 3 1/4" (W) x 1 7/8" (D); Door Thickness: 1-5/8" - 1-7/8"
	Material/Finish	Satin Chrome; Other Options: Duronodic, Polished Brass
	Part 3 - Execution	Push/pull action, non-handed. UL listed for all single labeled metal or wood doors. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

08.71.00 - DOOR HARDWARE		
Image	**Part 1 - General**	
		'Hospital Push-Pull Latch.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Schlage - 11819 N Pennsylvania Ave, Carmel, Indiana 46032, US (888) 805-9837
	Model/Series/Size	HL6; Backset: 2-3/4" or 5"; Latch: 1/2" Throw, 1-1/8"x2-1/4" Face; Strike: 4-7/8"X1-1/4"
	Material/Finish	Satin Chrome (626)
	Part 3 - Execution	Push/pull action, non-handed. UL listed for all single labeled metal or wood doors. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

08.71.00 - DOOR HARDWARE		
Image	**Part 1 - General**	
		'Hospital Push Pull Latch.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	ABH - 1222 Ardmore Avenue, Itasca, IL 60143 (630) 875-9900
	Model/Series/Size	6100; Latch Bolt Throw: 1/2"; Width: 2-11/16"; Height: 6-7/16"; Depth: 2-7/8"
	Material/Finish	Satin Chrome
	Part 3 - Execution	Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

08.71.00 - DOOR HARDWARE		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Double Acting Pivot Set.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Stanley - 65 Scott Swamp Rd, Farmington, Connecticut 06032, US (877) 266-0096
	Model/Series/Size	DAP-3 (ANSI A2742); Pivot Point: 1-1/4" (from jamb); Header Plater: 4-7/8"X7/8"X1/4"; Top Door Plate: 4-3/8"X1"X1/4"; Bottom Jamb Bracket: 3"X1-1/4"X1/4"; Bottom Door Plate: 4-3/8"X1"X1/4"
	Material/Finish	Bright Brass, (Base Steel-US26D)
	Part 3 - Execution	Heavy duty double acting pivot. Complete hardware set includes ES-1 emergency door stop and DLS-1 or DSL-2 double lip strike. Also, HB-1 holdback for ES-1. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

08.71.00 - DOOR HARDWARE		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Emergency Door Stop.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Stanley - 65 Scott Swamp Rd, Farmington, Connecticut 06032, US (877) 266-0096
	Model/Series/Size	ES-1 (ANSI A1882); Surface Plate: 4-1/2"X1-5/8" ; Case:2-1/8"X1-5/16"
	Material/Finish	Bright Brass, (Base Brass-US26D)
	Part 3 - Execution	See item #B1g. HB-1 holdback allows ES-1 to become double acting by holding emergency stop in depressed position. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

08.71.00 - DOOR HARDWARE		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Double Lipped Strike For 1/8" Inset Hung Doors.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Stanley - 65 Scott Swamp Rd, Farmington, Connecticut 06032, US (877) 266-0096
	Model/Series/Size	DLS-1; Latch Bolt Cut-Out: 1-1/4"X11/16"; Material Thickness: 0.093"
	Material/Finish	Satin Bronze, (Base Bronze-US26D)
	Part 3 - Execution	See item #B1g. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

08.71.00 - DOOR HARDWARE		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Double Lipped Strike For Center Hung Doors.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Stanley - 65 Scott Swamp Rd, Farmington, Connecticut 06032, US (877) 266-0096
	Model/Series/Size	DLS-2; Latch Bolt Cut-Out: 1-1/4"X11/16"; Material Thickness: 0.093"
	Material/Finish	Satin Chrome (US26D); Other Options: Satin Bronze, Bright Brass
	Part 3 - Execution	See item #B1g. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

08.71.00 - DOOR HARDWARE		
Image	**Part 1 - General**	
		'MagForce 390+ Series Electromagnetic Lock.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Locknetics - 11819 North Pennsylvania Street Carmel, IN 46032
	Model/Series/Size	Mag Force 390+*; Height: 2-3/4"; Length: 10-1/2"; Width: 1-11/16";
	Material/Finish	Satin Aluminum-Anodized (Standard); Other Options: Satin Black-Anodized, Satin Bronze, Satin Bronze-SF, Dark Satin, Bronze-Anodized, Satin Aluminum-w/ Black, Bright Brass, Bright Brass-SF, Bright Chrome, Bright Chrome-SF
	Part 3 - Execution	DSM (Door Status Monitor) and MBS (Magnetic Bond Sensor) options. Input 12 or 24 VCD, coordinate with owner. Provides 1,650 lbs of holding force. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

08.71.00 - DOOR HARDWARE		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Electromagnetic Door Holder.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	ABH - 1222 Ardmore Avenue, Itasca, IL 60143 (630) 875-9900
	Model/Series/Size	2000; Projection from Wall: 2-5/8" or 3-5/8" (is using complementary 1" extension)
	Material/Finish	Satin Chrome Plated Brass (US26D); Other Options: Satin Aluminum (628-US28), Painted Aluminum (689-S1), Painted Brass (S2; to match US4), Painted Bronze (S3; to match US10). Painted Black (S4), Painted Dark Bronze (S5; to match US10B), Satin Stainless Steel (630-US32D), Bright Stainless Steel, Bright Stainless Steel (629-US32)
	Part 3 - Execution	Recess wall mount. 35 lb holding force, 12V DC, 24V ac/DC or 120V AC – Coordinate with owner. UL listed for smoke barrier or labeled fire doors. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

08.71.00 - DOOR HARDWARE		
Image	**Part 1 - General**	
		'Double Cylinder Mortise Deadlock.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Best - 6161 East 75th Street, Indianapolis, IN 46250 USA (855) 365-2407
	Model/Series/Size	48H; Backset: 2-3/4"; Case: 0.095" cold rolled steel, 3-3/8"X4-3/16"X1"; Faceplate: 5-3/8"X1-3/16"X7/32"
	Material/Finish	Satin Chrome (US26D); Other Options: Bright Chrome, Bright Nickel, Satin Nickel, Oil Rubbed Bronze, Satin Bronze, Bright Brass, Satin Brass
	Part 3 - Execution	Double cylinder mortise deadbolt. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

08.71.00 - DOOR HARDWARE		
Image	**Part 1 - General**	Product Link (Reference Only)
		'T-Series Tubular Deadbolt.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Best - 6161 East 75th Street, Indianapolis, IN 46250 USA (855) 365-2407
	Model/Series/Size	8T3; Faceplate: 1-1/8"X2-1/4"; Strikes: ANSI rectangular 1-1/8"X2-3/4", ANSI curved lip 1-1/4"X4-7/8" or 1-1/8"X2 3/4", ANSI high security rectangular 1-1/4"X4-7/8"; Trim: 2-3/4" (diameter); Backset: 2-3/4"; Deadbolt: 1" throw, 5/8"X7/8"
	Material/Finish	Satin Chrome (US26D); Other Options: Bright Brass, Satin Brass, Bright Bronze, Satin Bronze, Oil-Rubbed Bronze, Bright Chrome
	Part 3 - Execution	Tubular deadbolt. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

08.00.00 - OPENINGS		
Image	**Part 1 - General**	Product Link (Reference Only)
		'B-Series Padlock.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Best - 6161 East 75th Street, Indianapolis, IN 46250 USA (855) 365-2407
	Model/Series/Size	21B722; Case: 1-25/32"X2-1/16"X13/16"; Shackle: 3/4", 1", 1-1/2", 2", 4"; Diameter: 5/16"; Width of opening: 7/8"
	Material/Finish	Satin Chrome (626); Other Options: Satin Brass (606)
	Part 3 - Execution	Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

08.00.00 - OPENINGS		
Image	**Part 1 - General**	Product Link (Reference Only)
		'L-Series Cabinet Lock.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Best - 6161 East 75th Street, Indianapolis, IN 46250 USA (855) 365-2407
	Model/Series/Size	5L; Backset: 7/8"; Thickness: 1/2"; Case: 2-1/8"X2-19/32"X21/32", hole spacing 2-3/16"; Backset – 7/8"; Cylinder diameter: 1-1/8"; Cylinder length: 1-1/16"; Deadbolt: 3/4"X25/64" – 1/2" throw; Face: 1-7/8"X2-1/32"; Latchbolt: 3/4"X25/64" – 9/32" throw; Strike plate: 3/64"X11/16"X1-7/8", hole spacing 1-7/16", 1-1/4" wide lip
	Material/Finish	Satin Aluminum; Other Options: 606, 612, 626
	Part 3 - Execution	Deadbolt function - Lock and unlock by key. Latchbolt function – Retracted by key to unlock. Key withdrawn only in locked position. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

08.00.00 - OPENINGS		
Image	**Part 1 - General**	Product Link (Reference Only)
		'E-Series Mortise and Rim Cylinders.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Best - 6161 East 75th Street, Indianapolis, IN 46250 USA (855) 365-2407
	Model/Series/Size	1E-74/1E-72; Length: 1-1/4"; Diameter: 1-5/32"
	Material/Finish	626 (US26D); Other Options: 605, 606, 611, 612, 613, 619, 625, 690
	Part 3 - Execution	Provide 7 pin interchangeable core(IC). Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

08.00.00 - OPENINGS		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Electric Strike.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Von Duprin - 2720 Tobey Dr, Indianapolis, Indiana 46219-1428, US
	Model/Series/Size	6000;
	Material/Finish	Bright Stainless Steel (629), Satin Stainless Steel (630); Other Options: Polished Brass, Clear-Coated (605), Satin Brass, Clear-Coated (606), Stain Bronze, Clear-Coated (612), Dark Bronze, Oil-Rubbed (613)
	Part 3 - Execution	Fail secure. 24V DC standard.Where surface mounting is required use HES, Inc. 9500 Series, fail secure. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

08.00.00 - OPENINGS		
Image	**Part 1 - General**	Product Link (Reference Only)
		'98/99 Rim Exit Device.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Von Duprin - 2720 Tobey Dr, Indianapolis, Indiana 46219-1428, US
	Model/Series/Size	98/99; Length: 3' or 4'; Center Case: 8"X2-3/4"X2-3/8"; Mechanism Case: 2-1/4"X2-1/4"
	Material/Finish	Satin Chrome (626-US26D); Other Options: Bright Brass (605), Satin Brass (606), Bright Bronze (611), Satin Bronze (612), Satin Bronze, Oil-Rubbed (613), Satin Nickel (619), Polished Chrome (625), Satin Chrome, Antimicrobial (626-AM), Anodized Aluminum (628), Satin Stainless Steel (630), Satin Stainless Steel, Antimicrobial (630-AM), Aged Bronze (643E), Duranodic Dark Bronze (710), Black (711)
	Part 3 - Execution	Use NL/DT at single exterior door. Use EO/NL/DT/KR49549 at exterior door pairs. HDSI and SNB with all devices. Use Detex Advantex 10 series exit device only. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

08.00.00 - OPENINGS		
Image	**Part 1 - General**	Product Link (Reference Only)
		'98/99 Rim Exit Device.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Von Duprin - 2720 Tobey Dr, Indianapolis, Indiana 46219-1428, US
	Model/Series/Size	98/99; Length: 3' or 4'; Center Case: 8"X2-3/4"X2-3/8"; Mechanism Case: 2-1/4"X2-1/4"
	Material/Finish	Satin Chrome (626-US26D); Other Options: Bright Brass (605), Satin Brass (606), Bright Bronze (611), Satin Bronze (612), Satin Bronze, Oil-Rubbed (613), Satin Nickel (619), Polished Chrome (625), Satin Chrome, Antimicrobial (626-AM), Anodized aluminum (628), Satin Stainless Steel (630), Satin Stainless Steel, Antimicrobial (630-AM), Aged Bronze (643E), Duranodic Dark Bronze (710), Black (711)
	Part 3 - Execution	Use EO/NL/DT/LBR at pairs. HDSI and SNB with all devices. 9927L trim where required, CD on entry doors, F on fire rated doors, EL on auto operated doors w/ dummy trim. PS873 Power Supply as required. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

08.00.00 - OPENINGS		
Image	**Part 1 - General**	Product Link (Reference Only)
		'CHEXIT Delayed Egress System.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Von Duprin - 2720 Tobey Dr, Indianapolis, Indiana 46219-1428, US
	Model/Series/Size	CHEXIT 98/99;
	Material/Finish	Satin Chrome (626-US26D)
	Part 3 - Execution	Use where outside access is required. Input current only 1.25 amps. UL294 and NFPA 7.2.16. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

08.00.00 - OPENINGS		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Surface Closer.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	LCN - 121 West Railroad Avenue PO Box 100 Princeton, IL 61356 United States
	Model/Series/Size	4040XP;
	Material/Finish	Satin Aluminum; Other Options: Aluminum (689), Statuary Bronze (690), Light Bronze (691), Black (693), Dark Bronze (695), Brass (696)
	Part 3 - Execution	EDA mount is 5 ½" from door face typical. CUSH mount is 6" from door face typical. All door frames to be reinforced and thru bolted SNB with all devices. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

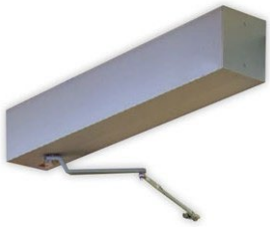
08.00.00 - OPENINGS		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Hold-Open Closer.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	LCN - 121 West Railroad Avenue PO Box 100 Princeton, IL 61356 United States
	Model/Series/Size	4040SE;
	Material/Finish	Satin Aluminum
	Part 3 - Execution	Single point hold open. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

08.00.00 - OPENINGS		
Image	**Part 1 - General**	P
		'Automatic Flush Bolt.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Ives - 601 Croton Road King of Prussia, PA 19406
	Model/Series/Size	FB31; Body Size: 1"X6-3/4"X2"; Guide Size: 1"X1-27/32"X27/32"X3/32"; Strike Size: 15/16"X2-1/4"X1/16"; Rub Plate Size: 1-1/4"X1-11/16"X364"
	Material/Finish	Satin Chrome (626-US26D); Other Options: Bright Brass (605-US3), Satin Brass (606-US4), Satin Bronze (612-US10), Oil-Rubbed Bronze (613-US10B), Matte Black, Bright Stainless Steel (629-US32), Satin Stainless Steel (630-US32D)
	Part 3 - Execution	Metal Doors. Meets ANSI A156.3 Type 25. UL 3 hour fire doors up to 8'-0" X 10'-0". Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

08.00.00 - OPENINGS		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Automatic Flush Bolt.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Ives - 601 Croton Road King of Prussia, PA 19406
	Model/Series/Size	FB41; Body Size: 1"X8-1/2"X2"; Guide Size: 1"X6"X1/8"; Strike Size: 15/16"X2-1/4"X1/16"; Rub Plate Size: 1-1/4"X1-11/16"X3/64"
	Material/Finish	Satin Chrome (626-US26D); Other Options: Bright Brass (605-US3), Satin Brass (606-US4), Satin Bronze (612-US10), Oil-Rubbed Bronze (613-US10B), Matte Black, Bright Stainless Steel (629-US32), Satin Stainless Steel (630-US32D)
	Part 3 - Execution	Wood Doors. Meets ANSI A156.3 Type25. UL 90 Min fire doors up to 8'-0" X 8'-0". Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

08.00.00 - OPENINGS		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Manual Flash Bolt.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Ives - 601 Croton Road King of Prussia, PA 19406
	Model/Series/Size	FB458; Body Size: 1"X6-3/4"X1-1/8"; Guide Size: 1"X2"X5/64"; Strike Size: 15/16"X-1/4"X5/64"
	Material/Finish	Satin Chrome (626-US26D); Other Options: Bright Brass (605-US3), Satin Brass (606-US4), Blackened Brass (609-US5), Satin Bronze (612-US10), Oil-Rubbed Bronze (613-US10B), Satin Nickel (619-US15), Matte Black (622), Bright Chrome (625-US26), Aged Bronze (643e/716)
	Part 3 - Execution	Wood Doors. Meets ANSI/BHMA A156.16 UL 90 Min fire doors up to 8'-0" X 10'-0". Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

08.00.00 - OPENINGS		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Manual Flush Bolt.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Ives - 601 Croton Road King of Prussia, PA 19406
	Model/Series/Size	FB358; Body Size: 1"X6-3/4"X1-3/8"; Guide Size: 1"X 2-1/2"X5/64"; Strike Size: 15/16"X2-1/2"X5/64"
	Material/Finish	Satin Chrome (626-US26D); Other Options: Bright Brass (605-US3), Satin Brass (606-US4), Satin Bronze (612-US10), Oil-Rubbed Bronze (613-US10B), Satin Nickel (619-US15), Matte Black (622), Bright Chrome (625-US26), Aged Bronze (643e/716)
	Part 3 - Execution	Metal Doors. Meets ANSI/BHMA A156.16 UL 90 Min fire doors up to 8'-0" X 10'-0". Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

08.00.00 - OPENINGS		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Auto Operator.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Horton - 4242 Baldwin Blvd., Corpus Christi, TX 78405 (1-800) 531-3111
	Model/Series/Size	4100LE;
	Material/Finish	Clear (204-R1), Dark Bronze (313-R1), Light Bronze (312-R1), Black (315-R1)
	Part 3 - Execution	Power – 120 VAC, 60 HZ 15 AMP in conduit. Push plate or Push button operation. Provide electronic lock kit. ADA compliant. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

08.00.00 - OPENINGS		
Image	**Part 1 - General**	Product Link (Reference Only)
		'M-Force Automatic Swing Door Opener.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Stanley - 65 Scott Swamp Rd, Farmington, Connecticut 06032, US (877) 266-0096
	Model/Series/Size	Magic Force; Header Height: 6"; Header Depth: 5.5";
	Material/Finish	Custom
	Part 3 - Execution	Power – 120 VAC, 50/60 HZ, 5 AMP minimum in conduit. Door panels up to 48" wide. Provide electronic lock kit. ADA compliant. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

08.00.00 - OPENINGS		
Image	**Part 1 - General**	
		'Concave Wrought Wall Stop.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Rockwood - 300 Main St, Rockwood, PA 15557
	Model/Series/Size	409; Fastener: 1-1/14"; Diameter: 2-1/2"; Projection 1"
	Material/Finish	Bright Brass, Clear-Coated (605-US3). Satin Brass, Clear-Coated (606-US4), Satin Bronze, Clear-Coated (612-US10), Sark Oxidized Satin Bronze, Equivalent (613E-US10BE), Bright Chrome Plated (625-US26), Satin Chrome Plated (626-US26D), Satin Stainless Steel (630-US32D), Black Suede Powder Coat
	Part 3 - Execution	For interior. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

08.00.00 - OPENINGS		
Image	**Part 1 - General**	
		'Low Dome Stop.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Rockwood - 300 Main St, Rockwood, PA 15557
	Model/Series/Size	440; Base: 1-7/8"X1/4"; Height: 1-1/8"
	Material/Finish	Solid Cast Brass with Rubber Bumper; Bright Brass, Clear-Coated (605-US3), Satin Brass, Clear-Coated (606-US4), Satin Bronze, Clear-Coated (612-US10), Dark Oxidized Satin Bronze, Oil-Rubbed (613-US10B), Dark Oxiized Satin Bronze, Equivalent (613E-10BE), Black Suede Powder Coat, White Suede Powder Coat, Satin Nickel Plated Brass, Clear-Coated (619-US15), Bright Chrpme PLated (625-US26), Satin Chrome Plated (626-US26D)
	Part 3 - Execution	For interior. For doors without thresholds (not undercut). Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

08.00.00 - OPENINGS		
Image	**Part 1 - General**	
		'Dome top Combination Unit.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Rockwood - 300 Main St, Rockwood, PA 15557
	Model/Series/Size	441 CU; Dome Base: 1-7/8"X1/4"; Height: 1-1/8" or 1-1/2"; Riser Base: 2"X3/8"
	Material/Finish	Solid Cast Brass with Rubber Bumper; Bright Brass, Clear-Coated (605-US3), Satin Brass, Clear-Coated (606-US4), Satin Bronze, Clear-Coated (612-US10), Dark Oxidized Satin Bronze, Oil-Rubbed (613-US10B), Dark Oxiized Satin Bronze, Equivalent (613E-10BE), Black Suede Powder Coat, White Suede Powder Coat, Satin Nickel Plated Brass, Clear-Coated (619-US15), Bright Chrpme PLated (625-US26), Satin Chrome Plated (626-US26D)
	Part 3 - Execution	For interior. Combination Unit for undercut and non-undercut doors. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

08.00.00 - OPENINGS		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Door Silencer.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Rockwood - 300 Main St, Rockwood, PA 15557
	Model/Series/Size	608; Size: 1/2" (Diameter)X5/8"
	Material/Finish	Gray Rubber
	Part 3 - Execution	For Interior. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

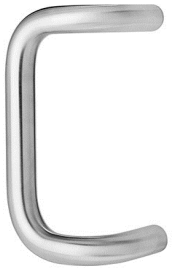
08.00.00 - OPENINGS		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Automatic Door Holder & Stop.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Rockwood - 300 Main St, Rockwood, PA 15557
	Model/Series/Size	491; SIZE: Holder: 3"X3-3/8", Strike: 4"X2"; PROJECTION: Holder: 2-1/8", Strike: 1-1/4"
	Material/Finish	Cast Brass; Bright Brass, Clear-Coated (605-US3), Satin Brass, Clear-Coated (606-US4), Satin Nickel Plated Brass, Clear-Coated (619-US15); Other Options: Satin Bronze, Clear-Coated (612-US10), Dark Oxidized Satin Bronze, Oil-Rubbed (613-US10B), Dark Oxiized Satin Bronze, Equivalent (613E-10BE), Black Suede Powder Coat, White Suede Powder Coat, Bright Chrpme PLated (625-US26), Satin Chrome Plated (626-US26D)
	Part 3 - Execution	For interior. Secure with Trox fasteners. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

08.00.00 - OPENINGS		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Automatic Door Holder & Stop/Foot Pull.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Rockwood - 300 Main St, Rockwood, PA 15557
	Model/Series/Size	494; SIZE: Holder: 3"X3-3/8", Strike: 2"X3"; PROJECTION: Holder: 2-1/8", Strike: 3-1/4"
	Material/Finish	Cast Brass; Bright Brass, Clear-Coated (605-US3), Satin Brass, Clear-Coated (606-US4), Satin Nickel Plated Brass, Clear-Coated (619-US15); Other Options: Satin Bronze, Clear-Coated (612-US10), Dark Oxidized Satin Bronze, Oil-Rubbed (613-US10B), Dark Oxiized Satin Bronze, Equivalent (613E-10BE), Black Suede Powder Coat, White Suede Powder Coat, Bright Chrpme PLated (625-US26), Satin Chrome Plated (626-US26D)
	Part 3 - Execution	For interior. Secure with Trox fasteners. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

08.00.00 - OPENINGS		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Overhead Door Holder/Stop.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Schlage - 11819 N Pennsylvania Ave, Carmel, Indiana 46032, US (888) 805-9837
	Model/Series/Size	450; Size: Varies
	Material/Finish	Chrome-Like Coating (652); Other Options: Polished Brass (US3), Satin Brass (US4), Satin Bronze (US10); Oil-Rubbed Bronze (US10B), Polished Stainless Steel (US32), Satin Stainless Steel (US32D), Powder Coat Brass (SP4), Powder Coat Bronze (SP10); Powder Coat Aluminum (SP28), Powder Coat Dark Bronze (SP313), Powder Coat Black (SPBLK)
	Part 3 - Execution	Order type: Series – 45, Size – 5, Function - H. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

08.00.00 - OPENINGS		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Metal Kick Plate-Standard Duty.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Rockwood - 300 Main St, Rockwood, PA 15557
	Model/Series/Size	K1050; Kick plate – 10" X 1 ½" LDW X .050 X CSK (single door), ½" LDW (double door); Mop Plate – 4" X 1 ½"; LDW X .050 X CSK (single door), ½" LDW (double doors); Armor Plate – 32" X 1 ½" LDW X .050 CSK (single door), ½" LDW (double doors
	Material/Finish	Satin Stainless Steel (630-US32D); Other Options: Polished Brass, Clear-Coated (605-US3), Satin Brass, Clear-Cpated (606-US4), Polished Bronze, Clear-Coated (611-US9), Satin Bronze, Clear-Coated (612-US10), Satin Oxidized Bronze, Oil-Rubbed (613-US10B), Dark Oxidized Satin Bronze, Equivalent (613E-US10BE), Black Suede Powder Coat, White Suede Powder Coat, Polished Chrome Plated Brass (625-US26), Satin Chrome Plated Brass (626-US26D), Clear Anodized Aluminium (628-US28), Polished Stainless Steel (629-US32), Satin 316 Alloy Stainless Steel (US32D316), Satin MicroShield Coated Stainless Steel (US32DMS), Black Powder Coat, White Powder Coat, Flat Black Powder Coat, Red Powder Coat
	Part 3 - Execution	Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

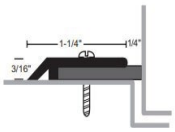
08.00.00 - OPENINGS		
Image	**Part 1 - General**	
		'Push Plate.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Rockwood - 300 Main St, Rockwood, PA 15557
	Model/Series/Size	70C; 4"X16"X0.05"
	Material/Finish	Stainless Steel (US32D-630), Oil-Rubbed Bronze (US10B-613), Bright Brass (US3-605), Black Suede Powder Coat
	Part 3 - Execution	Push plate – 70C x 4" X 16" (CFC where required). Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

08.00.00 - OPENINGS		
Image	**Part 1 - General**	Product Link (Reference Only)
		'90˚ Offset Door Pulls.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Rockwood - 300 Main St, Rockwood, PA 15557
	Model/Series/Size	BF158; Material Size: 1" Diameter; CTC: 12"; Overall: 13"; Base: 1"; Projection: 3-1/2"; Clearance: 2-1/2"; Offset: 4"
	Material/Finish	Satin Chrome Plated Brass (626-US26D); Other Options: Polished Brass, Clear-Coated (605-US3), Satin Brass, Clear-Cpated (606-US4), Polished Bronze, Clear-Coated (611-US9), Satin Bronze, Clear-Coated (612-US10), Satin Oxidized Bronze, Oil-Rubbed (613-US10B), Dark Oxidized Satin Bronze, Equivalent (613E-US10BE), Black Suede Powder Coat, White Suede Powder Coat, Polished Chrome Plated Brass (625-US26), Satin Chrome Plated Brass (626-US26D), Clear Anodized Aluminium (628-US28), Polished Stainless Steel (629-US32), Satin 316 Alloy Stainless Steel (US32D316), Satin MicroShield Coated Stainless Steel (US32DMS), Black Powder Coat, White Powder Coat, Flat Black Powder Coat, Red Powder Coat, Powder Coat
	Part 3 - Execution	Pull plate – 90 deg Offset Door Pull 12" CTC. Use Heavy Duty fastener type BF158BTB16HD. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

08.00.00 - OPENINGS		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Saddle Threshold.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	National Guard - 4985 East Raines Rd, Memphis, TN 38118 or 4584 Calimesa Street, Las Vegas, NV 89115 (800) 647-7874
	Model/Series/Size	425; Width: 5"; Height: 1/2"; Typical Wall Thickness: 0.162"
	Material/Finish	Aluminum; Other Options: Mill Finish, Dark Bronze Finish
	Part 3 - Execution	ADA compliant extra heavy duty. BHMA/ANSI A156.21. 10,000 lb load tested. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

08.00.00 - OPENINGS		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Silicone Bulb Fire and Smoke Seal.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	National Guard - 4985 East Raines Rd, Memphis, TN 38118 or 4584 Calimesa Street, Las Vegas, NV 89115 (800) 647-7874
	Model/Series/Size	5050B; Width: 1/2"; Height: 1/4"
	Material/Finish	Self-Adhesive Synthetic Rubber Polymer: Siloxane
	Part 3 - Execution	Provide NGP 9800C – Intumescent Fire Seal at rated perimeter doors. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

08.00.00 - OPENINGS		
Image	**Part 1 - General**	Product Link (Reference Only)
		'NGP-TPV Overlapping Astragal.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	National Guard - 4985 East Raines Rd, Memphis, TN 38118 or 4584 Calimesa Street, Las Vegas, NV 89115 (800) 647-7874
	Model/Series/Size	158NA; Length: 1-3/8"; Height: 5/16"
	Material/Finish	Aluminum Alloy 6063, T5 Temper
	Part 3 - Execution	BHMA/ANSI A156.22 for heat, cold and air infiltration. Maximum height 120". Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

08.00.00 - OPENINGS		
Image	**Part 1 - General**	Product Link (Reference Only)
 		'Neoprene Closed Cell Sponge Seal.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	National Guard - 4985 East Raines Rd, Memphis, TN 38118 or 4584 Calimesa Street, Las Vegas, NV 89115 (800) 647-7874
	Model/Series/Size	130NA; Length: 1-1/4"; Height: 3/16"
	Material/Finish	Aluminum Alloy 6063, T5 Temper
	Part 3 - Execution	BHMA/ANSI A156.22 for heat, cold, air infiltration and smoke infiltration. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

08.00.00 - OPENINGS		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Adhesive-Backed Fire/Smoke Silicone Seal Perimeter Gasketing.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Pemko - 5535 Distribution Dr, Memphis, TN 38141
	Model/Series/Size	HSS2000; Width: 1/2"; Height: 1/4"
	Material/Finish	Black Silicone (S88BL); Clear Silicone (S88C); Dark Brown Silicone (S88D); Gray Silicone (S88GR); Tan Silicone (S88TAN); White Silicone (S88W)
	Part 3 - Execution	Fire Glazing tape, intumescent seal. Combine with Pemko – S88C, Adhesive-Backed Fire/Smoke Gasketing(image). Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

08.00.00 - OPENINGS		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Rain Drip Guard.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	National Guard - 4985 East Raines Rd, Memphis, TN 38118 or 4584 Calimesa Street, Las Vegas, NV 89115 (800) 647-7874
	Model/Series/Size	16A; Width: 2-1/2"; Height: 1-1/2"
	Material/Finish	Aluminum Alloy 6063, T5 Temper
	Part 3 - Execution	
		BHMA/ANSI A156.22 for heat and cold. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

DIVISION 09.00.00 - FINISHES

09.51.00 - ACOUSTICAL CEILINGS		
Image	**Part 1 - General**	
		'Fine Fissured ACT.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty. Layin tiles only.
	Part 2 - Product/Materials	
	Manufacturer	AHF - 2500 Columbia Ave, Lancaster, PA 17603 (1-877) 276-7876
	Model/Series/Size	Ultima (Fine Fissured); 24"X24" or 24"X48"; 15/16" Lay-In Grid.
	Material/Finish	746 in White (WH), Edge profile: Square
	Part 3 - Execution	Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

09.00.00 - PAINT		
Image	**Part 1 - T.U. Brand**	
		'T.U. Branding (Temple Cherry Red).'
	Part 2 - Product/Materials	
	Manufacturer	Sherwin Williams - 1501 N Broad St Ste 15, Philadelphia, PA 19122 (215) 765-7018
	Model/Series/Size	See "Temple Paint Standards" Document at end of section.
	Material/Finish	Ceiling and Soffits: Flat, Walls: Satin, Trim: Semi-gloss.
	Part 3 - Execution	Install according to Temple University PDG Specifications.

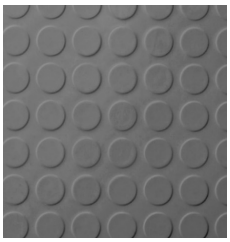
09.00.00 - PAINT		
Image	**Part 1 - General**	
		Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Sherwin Williams - 1501 N Broad St Ste 15, Philadelphia, PA 19122 (215) 765-7018
	Model/Series/Size	See "Temple Paint Standards" Document at end of section.
	Material/Finish	Ceiling and Soffits: Flat, Walls: Satin, Trim: Semi-gloss.
	Part 3 - Execution	Install according to Temple University PDG Specifications.

09.00.00 - CARPET TILE		
Image	**Part 1 - General**	
		Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Interface, Shaw, Mannington and Mohawk. TBD Based on Building, PDG Standards and project specifications
	Model/Series/Size	Based on project specifications.
	Material/Finish	Based on project specifications.
	Part 3 - Execution	Carpet tiles only unless noted otherwise. Install according to manufacturer and Temple University PDG Specifications and established Accessibility policies.

09.00.00 - LVT		
Image	**Part 1 - General**	
		Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Interface, Mohawk, Traverse, Patcraft and Parterre. TBD Based on Building and PDG Standards and project specifications
	Model/Series/Size	3mm & 5mm preferred, others based on project specifications.
	Material/Finish	Based on project specifications.
	Part 3 - Execution	Install according to manufacturer and Temple University PDG Specifications and established Accessibility policies.

09.00.00 - VCT		
Image	**Part 1 - General**	
		'Standard Imperial Texture & Raffia.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	AHF - 3840 Hempland Road P.O. Box 566 Mountville , PA 17554
	Model/Series/Size	12"x12" for "Back of House" spaces only & 12"x24"
	Material/Finish	Based on project specifications.
	Part 3 - Execution	Install according to manufacturer and Temple University PDG Specifications and established Accessibility policies.

09.00.00 - TRHOUGH OR COLOR BODY PORCELAIN TILE		
Image	**Part 1 - General**	
		Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Daltile - 2300 Chestnut St Suite 150 Philadelphia, PA 19103; (215) 977-2871
	Model/Series/Size	Based on project specifications.
	Material/Finish	3"x6", 4"x8", 12x24 tiles on the floor. Walls; Semi-gloss, Daltile or Matte or Gloss color wheel. Collection to be verified by PDG
	Part 3 - Execution	Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

09.00.00 - WALLBASE		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Rubber (TS).' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Roppe - 1602 North Union Street, Fostoria, Ohio 44830-1158 1.800.537.9527 - 419.435.8546
	Model/Series/Size	Based on project specifications.
	Material/Finish	Based on project specifications.
	Part 3 - Execution	Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

TEMPLE PAINT STANDARDS (SHERWIN WILLIAMS)

Project Delivery Group

Cool Colors

Bright Blue

- SW 7613 Aqua-Sphere
- SW 6775 Briny
- SW 6502 Loch Blue

Blue Gray

- SW 9135 Whirlpool
- SW 6249 Storm Cloud
- SW 9141 Waterloo

Green

- SW 6178 Clary Sage
- SW 2811 Rookwood Blue Green
- SW 6474 Raging Sea
- SW 0042 Ruskin Room Green
- SW 6712 Luau Green

Warm Colors

Orange

- SW 6359 Sociable
- SW 6628 Robust Orange
- SW 6341 Red Cent

Yellow

- SW 6682 June Day
- SW 6669 Yarrow
- SW 6698 Kingdom Gold

Purple

- SW 2818 Renwick Heather
- SW 6263 Exclusive Plum
- SW 6286 Mature Grape

Red

- SW 6573 Juneberry
- SW 0072 Deep Maroon
- SW 6594 Poinsettia

Neutral Colors

Beige

- SW 7037 Balanced Beige
- SW 7038 Tony Taupe
- SW 7016 Mindful Gray
- SW 7017 Dorian Gray

White

- SW 7015 Repose Gray
- SW 7029 Agreeable Gray
- SW 7011 Natural Choice
- SW 7009 Pearly White
- SW 7006 Extra White (Ceilings)

Gray

- SW 7072 Online
- SW 7073 Network Gray
- SW 7074 Software
- SW 7066 Gray Matters
- SW 0077 Classic French Gray

Notes:
*Finish Information:
- Ceilings and Soffits: Flat
- Walls: Satin
- Trim: Semi-gloss

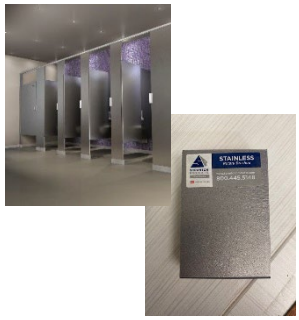
*Colors for public spaces to be reviewed by PDG.
*Neutral colors are preferred for general wall and trim colors.
*Cool and warm colors preferred for accent walls.

***Use PDF as reference only, prints & computer screens may not portray color accuracy.**

DATE: 08/10/18

BACK

DIVISION 10.00.00 - SPECIALTIES

10.21.00 - TOILET COMPARTMENTS		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Hiny Hiders Partitions.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Scranton Products - 801 East Corey Street, Scranton, PA, USA, 18505; 1 (800) 445-5148
	Model/Series/Size	Hiny Hiders OP; Door and Panel Height: 55", 66", 72"
	Material/Finish	Stainless Steel, Rotary Brushed.
	Part 3 - Execution	Continuous SS spring load hinge, ceiling hung, SS emergency Access Strike. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

10.21.00 - TOILET COMPARTMENTS		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Urinal Partitions & Privacy Screens.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Scranton Products - 801 East Corey Street, Scranton, PA, USA, 18505; 1 (800) 445-5148
	Model/Series/Size	Urinal Screens; Width: 18", 24"; Height: 42", 55"
	Material/Finish	Plastic Panels: High Density Polyethylene (HDPE); Zinc Aluminum Magnesium and Copper Alloy (Zamac): ASTM B 86; Stainless Steel Castings: ASTM A167, Type 304; Aluminum: ASTM 6463-T5 alloy.
	Part 3 - Execution	Wall hung. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

10.28.00 - TOILET, BATH, & LAUNDRY ACCESSORIES		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Straight Grab Bar.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Bobrick - 6901 Tujunga Avenue, North Hollywood, CA, USA, 91605-6213; (818) 764-1000 or (818) 982-9600
	Model/Series/Size	6806X18; Length: 18"; Diameter: 1-1/2"
	Material/Finish	Satin-Finish, Slip-Resistant Surface
	Part 3 - Execution	Installation: ANSI a117.1-2009 604.5.1. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

10.28.00 - TOILET, BATH, & LAUNDRY ACCESSORIES		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Straight Grab Bar.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Bobrick - 6901 Tujunga Avenue, North Hollywood, CA, USA, 91605-6213; (818) 764-1000 or (818) 982-9600
	Model/Series/Size	6806X36; Length: 36"; Diameter: 1-1/2"
	Material/Finish	Satin-Finish, Slip-Resistant Surface
	Part 3 - Execution	Installation: ANSI a117.1-2009 604.5.2. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

10.28.00 - TOILET, BATH, & LAUNDRY ACCESSORIES		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Straight Grab Bar.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Bobrick - 6901 Tujunga Avenue, North Hollywood, CA, USA, 91605-6213; (818) 764-1000 or (818) 982-9600
	Model/Series/Size	6806X42; Length: 42"; Diameter: 1-1/2"
	Material/Finish	Satin-Finish, Slip-Resistant Surface
	Part 3 - Execution	Installation: ANSI a117.1-2009 604.5.1. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

10.28.00 - TOILET, BATH, & LAUNDRY ACCESSORIES		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Recessed Baby Changing Station.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	American Specialties, INC - 441 Saw Mill River Road, Yonkers, NY, USA, 10701; (914) 476-9000
	Model/Series/Size	9013; Open: 37X25 1⁄2"X17-3⁄4"; Closed: 37"X25-1⁄2"X3⁄8"; Wall Opening: 34-1⁄4"X22-3⁄4"X3-3⁄4"
	Material/Finish	Stainless Steel
	Part 3 - Execution	ANSI A117.1-2009 603.5, 309, 902. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

10.28.00 - TOILET, BATH, & LAUNDRY ACCESSORIES		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Surface Mounted Baby Changing Station.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	American Specialties, INC - 441 Saw Mill River Road, Yonkers, NY, USA, 10701; (914) 476-9000
	Model/Series/Size	9013-9; Open: 37"X25-1/2"X21-3/4"; Closed: 37"X25-1/2"X4-3/8"
	Material/Finish	Stainless Steel
	Part 3 - Execution	ANSI A117.1-2009 603.5, 309, 902. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

10.28.00 - TOILET, BATH, & LAUNDRY ACCESSORIES		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Surface Mounted Baby Changing Station.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	American Specialties, INC - 441 Saw Mill River Road, Yonkers, NY, USA, 10701; (914) 476-9000
	Model/Series/Size	9014; Open: 35-5/32"X24-1/4"X22-1/32"; Closed: 35-5⁄32"X24-1/4"X3-7⁄8"
	Material/Finish	Plastic
	Part 3 - Execution	ANSI A117.1-2009 603.5, 309, 902. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

10.28.00 - TOILET, BATH, & LAUNDRY ACCESSORIES		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Rovall Surface Mounted Sanitary Waste Receptacle.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	American Specialties, INC - 441 Saw Mill River Road, Yonkers, NY, USA, 10701; (914) 476-9000
	Model/Series/Size	20852; Width: 7-1/4"; Height: 10"; Depth: 3-1/2"
	Material/Finish	Stainless Steel
	Part 3 - Execution	Wall mounted, ASNI A117.1-2009 604.7 Figure 604.7 (A), Rounded edges for user & service safety. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

10.28.00 - TOILET, BATH, & LAUNDRY ACCESSORIES		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Hard Roll Towel Dispenser.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Kimberly-Clark - 1400 Holcomb Bridge Road, Roswell, GA, USA, 30076; 1 (800) 241-3146
	Model/Series/Size	9765; 13.3"X13.5"X9.8"
	Material/Finish	Smoke
	Part 3 - Execution	Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

10.28.00 - TOILET, BATH, & LAUNDRY ACCESSORIES		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Twin Jumbo Roll Tissue Dispenser.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	von Drehle - 612 Third Avenue Northeast, Hickory, NC, USA, 28601; (800) 438-3631 or (828) 322-1805
	Model/Series/Size	3253; Height: 11-1/2"; Width: 20-1/2"; Depth: 4.825"
	Material/Finish	Cover: Polycarbonate Smoke; Base: Polystyrene Black
	Part 3 - Execution	ASNI A117.1-2009 604.7 Figure 604.7 (A). Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

10.28.00 - TOILET, BATH, & LAUNDRY ACCESSORIES		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Single Jumbo Roll Tissue Dispenser.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	von Drehle - 612 Third Avenue Northeast, Hickory, NC, USA, 28601; (800) 438-3631 or (828) 322-1805
	Model/Series/Size	AE42N; Height: 12"; Width: 10-1/2"; Depth: 4-3/4"
	Material/Finish	Cover: Polycarbonate Smoke; Base: Polystyrene Black
	Part 3 - Execution	ASNI A117.1-2009 604.7 Figure 604.7 (A). Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

10.28.00 - TOILET, BATH, & LAUNDRY ACCESSORIES		
Image	**Part 1 - General**	
		'Sanitary Bin.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Rubbermaid - 3980 Broadway Suite 103-118, Boulder, CO, USA, 80304; (866) 727-6243
	Model/Series/Size	750243; Height 19.3"; Length 16.5"; Width 6.1"
	Material/Finish	White
	Part 3 - Execution	Floor standing. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

10.28.00 - TOILET, BATH, & LAUNDRY ACCESSORIES		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Push-Style Dispenser for GOJO Foam Soap.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	GOJO - One GOJO Plaza, Suite 500, Akron, OH, USA, 44309-0991; 1 (800) 321-9647
	Model/Series/Size	ADX-12; Height: 11.89"; Width: 4.64"; Length: 3.98"
	Material/Finish	Chrome; Other Options: Grey, Black, White
	Part 3 - Execution	Installation: ANSI a117.1-2009 308.2.2. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

10.28.00 - TOILET, BATH, & LAUNDRY ACCESSORIES		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Hair and Body Shampoo Dispenser.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Kutol (Dura View) - 100 Partnership Way, Sharonville, OH, USA, 45241; (513) 527-5500
	Model/Series/Size	7567; Capacity: 2,000mL
	Material/Finish	Waterproof
	Part 3 - Execution	Installation: ANSI a117.1-2009 308.2.2. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

10.28.13 - HEALTHCARE TOILET ACCESSORIES		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Chrome-Plated Hook and Bumper.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	BRADLEY - W142N9101 Fountain Boulevard, Menomonee Falls, WI, USA, 53051; 1 (800) 272-3539 or 1 (262) 251-6000
	Model/Series/Size	915; Size: Per Manufacterur
	Material/Finish	Chrome-Plated Brass
	Part 3 - Execution	Hook and bumper, projects 3". Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

10.28.00 - MARKER BOARD		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Marker (Whiteboard).' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Bangor Cork - 316 N Broadway, Wind Gap PA 18091 610-759-0320
	Model/Series/Size	Varies in size based on project location. TBD by Temple University PDG. 48"-60" in HT, length TBD.
	Material/Finish	White Dry Erase, Heavy Aluminum, Magnetic.
	Part 3 - Execution	Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies - 60" to centerline of boards A.F.F.; 48" H boards to be installed @ 36" A.F.F.; 60" H boards to be installed @ 30" A.F.F.

10.28.00 - MARKER BOARD		
Image	**Part 1 - General**	
		'Vinyl Marker Board Wallcovering.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Koroseal - 3875 Embassy Parkway, Suite 110 Fairlawn, Ohio 44333; 855-753-5474, Wolf Gordon - 333 Seventh Avenue New York, NY 10001; 212 255 3300
	Model/Series/Size	Based on project specifications.
	Material/Finish	Walltalkers, Wink.
	Part 3 - Execution	Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

10.28.00 - MARKER BOARD		
Image	**Part 1 - General**	
		'Tackable Rolled Good (Wall).' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Koroseal - 3875 Embassy Parkway, Suite 110 Fairlawn, Ohio 44333, 855-753-5475
	Model/Series/Size	Tacwall (or equal)
	Material/Finish	Aluminum trim
	Part 3 - Execution	Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies. (Aluminum trim may be mechanically fastened with self-tapping drywall screws or bonded with L910 adhesive or construction adhesive.)

10.00.00 - TRASHCANS		
Image	**Part 1 - Interior Public Areas**	Product Link (Reference Only)
		'RS20 Resort waste (silver lid).' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Peter Pepper - 17929 So. Susana Road PO Box 5769 Compton, CA 90224, 800 496 0204
	Model/Series/Size	20"w x 38"h x 20"d, includes waste decal with appropriate top opening name.
	Material/Finish	TOP + BODY FINISH: Graphite, Aluminum Metallic, Taupe Metallic, DOOR FINISH: Bright White, Soft White, Graphite, Aluminum Metallic, Taupe Metallic
	Part 3 - Execution	Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

10.00.00 - TRASHCANS		
Image	**Part 1 - Interior Public Areas**	Product Link (Reference Only)
		'RS14 Resort recycling (blue lid).' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Peter Pepper - 17929 So. Susana Road PO Box 5769 Compton, CA 90224, 800 496 0205
	Model/Series/Size	14"w x 38"h x 20"d, includes custom decal with appropriate top opening name.
	Material/Finish	TOP + BODY FINISH: Graphite, Aluminum Metallic, Taupe Metallic, DOOR FINISH: Bright White, Soft White, Graphite, Aluminum Metallic, Taupe Metallic
	Part 3 - Execution	Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

10.00.00 - TRASHCANS		
Image	**Part 1 - Restrooms**	Product Link (Reference Only)
		'Silhouettes Square Open Top 22.5 Gallon.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Rubbermaid - 8900 Northpointe Executive Drive Huntersville, NC 28078, 800-347-9800
	Model/Series/Size	SKU: FGSR18SSPL, 24" x 12" x 30.30"
	Material/Finish	Stainless steel, Silver metalic.
	Part 3 - Execution	Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

10.00.00 - TRASHCANS		
Image	**Part 1 - Conference Room**	
		'_____.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Uline - Uline 12575 Uline Drive Pleasant Prairie, WI 53158 Locations & Directions, 1-800-295-5510
	Model/Series/Size	
	Material/Finish	
	Part 3 - Execution	Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

BACK

DIVISION 12.00.00 - FURNISHINGS

12.93.13 - BICYCLE RACKS		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Bola Bike Rack.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Landscape Forms, Inc., 7800 E Michigan Ave, Kalamazoo, MI, 49048 (800) 521-2546; Other Vendors: Rodes, Bola
	Model/Series/Size	Depth: 1-1/2"; Width: 28-1/4"; Height: 32"
	Material/Finish	Stainless Steel, Galvanized (316)
	Part 3 - Execution	Impervious conditions only, permeable conditions will require foundation with channel. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

12.93.13 - BICYCLE RACKS		
Image	**Part 1 - General**	
		'Air Kit 3.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	DERO - 5522 Lakeland Avenue North Minneapolis, MN, USA, 55429; 1 (888) 337-6729
	Model/Series/Size	Air Kit 3; Height: 29-1/2"; Diameter: 6"
	Material/Finish	Powdercoated, Deep Red (RAL3003) and Galvanized Parts; Other Options: White, Black, Light Gray (RAL 7042), Yellow (RAL 1023), CNH Bright Yellow, Orange (RAL 2004), Beige (RAL 1001), Iron Gray (7011), Hunter Green (RAL 6005), Light Green (RAL 6018), Green (RAL 6016), Sepia Brown (RAL 8014), Bronze, Silver (9007), Dark Purple, Flat Black, Wine Red (RAL 3005); with Stainless Parts
	Part 3 - Execution	Surfaces mounted wuth standard wedge anchors. Should be installed at least 36" away from obstructions. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

12.93.13 - BICYCLE RACKS		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Fixit Today's Service Station.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	DERO - 5522 Lakeland Avenue North Minneapolis, MN, USA, 55429; 1 (888) 337-6729
	Model/Series/Size	Main Body: 3" x 11g Tube; Foot: ¼" Steel; Top: 1/8" Aluminum.
	Material/Finish	Powdercoated, Deep Red (RAL3003) with Galvanized Parts: Other Options: Black, White, Light Gray, Deep Red, Yellow, Bright Yellow, Orange, Hunter Green, Light Green, Green, Sepia Brown, Bronze, Silver. Dark Purple, Flat Black, Wine Red, Beige, Iron Gray
	Part 3 - Execution	Solid concrete is prefered base material for install. Nothing underneath base material should be susptable to drilling. See pad recommendations for pouring in specs. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

12.93.43 - SITE SEATING AND TABLES		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Hudson Bench.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Forms+Surfaces - 30 Pine Street, Pittsburgh, PA, USA, 15223; (800) 451-0410
	Model/Series/Size	Length: 6' or 8'
	Material/Finish	Solid FSC 100% Ipé Hardwood Slats, Penetrating "Transparent Natural" Oil Finish
	Part 3 - Execution	Surface Mounted with anchor bolts not supplied by manufacturer. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

12.93.43 - SITE SEATING AND TABLES		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Column Table.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Forms+Surfaces - 30 Pine Street, Pittsburgh, PA, USA, 15223; (800) 451-0410
	Model/Series/Size	Base: 30" Diameter; Top: 36" Round Diameter; Height: 28.3", 28.6", 41.8"
	Material/Finish	Stainless Steel, Satin finish
	Part 3 - Execution	Free standing, with or without center umbrella hole. Options for Standard Round Table Top or Concentric Patter of 1/4" Round Perforations Table Top. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

12.93.43 - SITE SEATING AND TABLES		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Vista Chair.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Forms+Surfaces - 30 Pine Street, Pittsburgh, PA, USA, 15223; (800) 451-0410
	Model/Series/Size	Width: 24", 19.8"; Depth: 22.5"; Height: 32.4"
	Material/Finish	Stainless Steel, Powdercoat - Bright Silver Gloss
	Part 3 - Execution	Free standing, with or without arms. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

12.93.43 - SITE SEATING AND TABLES		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Trio Table Ensemble.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Forms+Surfaces - 30 Pine Street, Pittsburgh, PA, USA, 15223; (800) 451-0410
	Model/Series/Size	Overall Length: Nominal 6'; Table Depth: 29.4"; Bench Depth 16.5"; Bench Height: 18"; Overall Height: 29.7"
	Material/Finish	Cast Aluminum Frames with FSC 100% Ipé Hardwood Slats, Powdercoat with Aluminum Texture
	Part 3 - Execution	Surface Mounted with anchor bolts not supplied by manufacturer. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

12.93.43 - SITE SEATING AND TABLES		
Image	**Part 1 - General**	Product Link (Reference Only)
		'4 Seat Backed Carousel Tables with Seating.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Landscape Forms, Inc., 7800 East Michigan Avenue, Kalamazoo, MI, USA, 49048; (800) 521-2546
	Model/Series/Size	Diameter (of Footprint): 94", 86", 76"; Height (to Top of Seat): 33", 44"; Catena Top: 42" Round Diameter
	Material/Finish	Catena Stainless Steel, Type 304, 16 Fauge/Steel Wire Grid/Tubular Steel, Powdercoated Metal (Metallic) Silver Finish
	Part 3 - Execution	Surface mounted with anchor bolts not supplied by manufacturer. Perforated seats, with or without umbrella hole. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

12.93.43 - SITE SEATING AND TABLES		
Image	**Part 1 - General**	Product Link (Reference Only)
		'ADA 3 Seat Backed Carousel Tables with Seating.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Landscape Forms, Inc., 7800 East Michigan Avenue, Kalamazoo, MI, USA, 49048; (800) 521-2546
	Model/Series/Size	Diameter (of Footprint): 94", 86"; Height (to Top of Seat): 33"; Catena Top: 42" Round Diameter
	Material/Finish	Catena Stainless Steel, Type 304, 16 Fauge/Steel Wire Grid/Tubular Steel, Powdercoated Metal (Metallic) Silver Finish
	Part 3 - Execution	Surface Mounted with anchor bolts not supplied by manufacturer. Can be freestanding or surface mounted. 3 seater is ADA complaint, umbrellas available. Perforated seats, with or without umbrella hole. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

12.93.43 - SITE SEATING AND TABLES		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Parc Centre Tables.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Landscape Forms, Inc., 7800 East Michigan Avenue, Kalamazoo, MI, USA, 49048; (800) 521-2546
	Model/Series/Size	Table Top: 30" Round Diameter; Height: 30"
	Material/Finish	Solid Steel Plate, Powdercoated Metal (Metallic) Silver Finish
	Part 3 - Execution	Free standing. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

12.93.43 - SITE SEATING AND TABLES		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Parc Centre Chairs.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Landscape Forms, Inc., 7800 East Michigan Avenue, Kalamazoo, MI, USA, 49048; (800) 521-2546
	Model/Series/Size	With Arms: Depth: 22", Width: 21", Height: 33"; Without Arms: Depth: 22", Width: 19", Height: 33"
	Material/Finish	Cold Drawn Steel, Powdercoated Silver Finish
	Part 3 - Execution	Free standing. With or without arms Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

12.93.43 - SITE SEATING AND TABLES		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Lounge Chair.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Equiparc - 1001 James-Brodie Street, Saint-Jean-sur-Richelieu QC J2X 0C1 CA; 1 (800) 363-9264
	Model/Series/Size	EP 1974; Depth: 29-1/2"; Length: 64"; Height: 40-1/4"
	Material/Finish	Metallic Silver Powdercoat; Other Options: Navy, Chili, Olive, Bronze, Black, Silver, White Meteor Gray, Gal Coverings: Wood: DFP, IPE, AT, HWA; Recylced Plastic: CRPU, ORPU, SRPU, WRPU, YRPU
	Part 3 - Execution	Installation can be surfaced mounted or freestanding. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

12.93.43 - SITE SEATING AND TABLES		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Luxembourg.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Fermob - 1610 Redi Road, Cumming, GA, USA, 30040; (678) 343-9021
	Model/Series/Size	Length: 57cm; Width: 49 cm; Height: 88cm
	Material/Finish	Finish: Powdercoat; Colors: Nutmeg, Russet, Black Cherry, Red Ochre, Chili, Poppy, Pink Praline, Capucine, Honey, Willow Green, Cactus, Rosemary, Cedar Green, Acapulco Blue, Deep Blue, Liquorice, Antracite, Storm Grey, Clay Grey, Ice Mint, Frosted Lemon, Opaline Green, Cotton White
	Part 3 - Execution	Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

12.00.00 - SECTION NAME		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Smoker's Outpost Smoke Stand.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Commercial Zone Products - 2727 West Good Hope Road, Milwaukee WI, USA, 53209; 1 (800) 782-7273
	Model/Series/Size	710607; Height: 41"; Diameter: 14"
	Material/Finish	Silver Powdercoat; Other Options: Black, Nuthatch
	Part 3 - Execution	Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

12.00.00 - SECTION NAME		
Image	**Part 1 - General**	
		'Handrails.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Custom Fabrication - 2903 NY Route 7, Harpursville, NY, USA, 13787; (607) 693-3223
	Model/Series/Size	
	Material/Finish	316 Grade Stainless Steel with Fully Welded Minter Joints With #6 Finish
	Part 3 - Execution	Imbed mount. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

12.00.00 - ROLLER SHADES		
Image	**Part 1 - General**	
		'Clutch Solarshade/Mecho Shades.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	SWF Contract - c/o Springs Window Fashions 7549 Graber Rd Middleton, WI 53562; 1-800-327-9798, Mecho - 42-03 35TH STREET Long Island City, NY 11101; 718-729-2020.
	Model/Series/Size	TBD - Based on project specifications.
	Material/Finish	Oyster, Fascia color to be white or to match window frame color.
	Part 3 - Execution	Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

12.00.00 - PLASTIC LAMINATE		
Image	**Part 1 - Millwork, cabinets & walls**	
		'_____.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Wilsonart - 2501 Wilsonart Drive P.O. Box 6110 Temple, Texas 76503-6110; (800) 433-3222
	Model/Series/Size	TBD - Based on Building and PDG Standards.
	Material/Finish	Based on project specifications.
	Part 3 - Execution	Typical for millwork, cabinets, & walls, final color to be approved by Temple PDG. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

12.00.00 - PLASTIC LAMINATE		
Image	**Part 1 - Millwork, cabinets & walls**	
		'_____.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Formica - 10155 Reading Road Cincinnati, OH 45241; 1-800-367-6422.
	Model/Series/Size	TBD - Based on Building and PDG Standards.
	Material/Finish	Based on project specifications.
	Part 3 - Execution	Typical for millwork, cabinets, & walls, final color to be approved by Temple PDG. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

12.00.00 - PLASTIC LAMINATE		
Image	**Part 1 - Millwork, cabinets & walls**	
		'_____.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Pionite - 2 Corporate Drive, Suite 946 Shelton, CT 06484; 877.726.6526
	Model/Series/Size	TBD - Based on Building and PDG Standards.
	Material/Finish	Based on project specifications.
	Part 3 - Execution	Typical for millwork, cabinets, & walls, final color to be approved by Temple PDG. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

12.00.00 - SOLID SURFACE		
Image	**Part 1 - General**	
		'_____.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Wilsonart - 2501 Wilsonart Drive P.O. Box 6110 Temple, Texas 76503-6110; (800) 433-3222
	Model/Series/Size	TBD - Based on Building and PDG Standards.
	Material/Finish	Based on project specifications.
	Part 3 - Execution	Use strategically in specialty areas and/or wet areas i.e restrooms and reception desks. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

12.00.00 - SOLID SURFACE		
Image	**Part 1 - General**	
		'_____.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	HI-Mac -
	Model/Series/Size	TBD - Based on Building and PDG Standards.
	Material/Finish	Based on project specifications.
	Part 3 - Execution	Use strategically in specialty areas and/or wet areas i.e restrooms and reception desks. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

12.00.00 - STONE SURFACE		
Image	**Part 1 - General**	
		'Quartz.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Cambria - Le Sueur, Minnesota · USA; 1-866-226-2742, Wilsonart - 2501 Wilsonart Drive P.O. Box 6110 Temple, Texas 76503-6110; (800) 433-3222
	Model/Series/Size	TBD - Based on Building and PDG Standards.
	Material/Finish	Based on project specifications.
	Part 3 - Execution	Use strategically in specialty areas only. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

12.00.00 - STONE SURFACE		
Image	**Part 1 - General**	
		'Zodiaq.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Dupont-
	Model/Series/Size	TBD - Based on Building and PDG Standards.
	Material/Finish	Based on project specifications.
	Part 3 - Execution	Use strategically in specialty areas only. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

12.00.00 - WALK-OFF MATS		
Image	**Part 1 - General**	
		'Power Bond Abrasive Action.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Tandus -
	Model/Series/Size	TBD - Based on Building and PDG Standards.
	Material/Finish	Based on project specifications.
	Part 3 - Execution	Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

BACK

DIVISION 14.00.00 - ELEVATORS

14.00.00 - ELEVATORS		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Interior Cab Finishes.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Otis - 30 Twosome Dr Ste 4, Moorestown, NJ 08057, (856) 235-5200, SnapCab - 175 Titus Ave, Warrington, PA 18976, (888) 766-7834.
	Model/Series/Size	TBD - Based on project specifications.
	Material/Finish	Walls: Plam upper with 5. WL metal panel below, Floor: Altro – Quartz tile 24”x24”, Ceiling: Island Downlight Ceiling, Protection Guards: 3/8” x 2” stainless steel handrail AND ¼” x 6” stainless steel bumper
	Part 3 - Execution	Install according to the manufacturer’s installation instructions and Temple Universities established Accessibility policies.

14.00.00 - ELEVATORS		
Image	**Part 1 - General**	
	Part 2 - Product/Materials	
	Manufacturer	
	Model/Series/Size	
	Material/Finish	
	Part 3 - Execution	

14.00.00 - ELEVATORS		
Image	**Part 1 - General**	
	Part 2 - Product/Materials	
	Manufacturer	
	Model/Series/Size	
	Material/Finish	
	Part 3 - Execution	

14.00.00 - ELEVATORS		
Image	**Part 1 - General**	
	Part 2 - Product/Materials	
	Manufacturer	
	Model/Series/Size	
	Material/Finish	
	Part 3 - Execution	

BACK

DIVISION 22.00.00 - PLUMBING

22.40.00 - PLUMBING		
Image	**Part 1 - General**	DISCONTINUED
		'Ellington Drop-In Bathroom Sink with 4" Centerset Faucet Holes.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Kohler - 444 Highland Drive, Kohler, WI, USA, 53044; 1 (800) 456-4537
	Model/Series/Size	K-2906-4; Depth: 19-1/4"; Height: 8-7/16"; Width: 16-1/4"
	Material/Finish	White Vitreous China (0)
	Part 3 - Execution	With required support, or integral counter and lavatory, mount at handicap height. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

22.40.00 - PLUMBING		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Kingston Wall-Mount/Concealed Arm Carrier Bathroom Sink with Widespread Faucet Holes.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Kohler - 444 Highland Drive, Kohler, WI, USA, 53044; 1 (800) 456-4537
	Model/Series/Size	K-2006; Width: 21-1/4"; Height: 12-1/4"; Depth: 18-1/4"
	Material/Finish	White Vitreous China (0); Other Options: Almond (47) Biscuit (96), Black Black (7)
	Part 3 - Execution	With carrier, wall mounted, LAV-3 mounted at ADA height. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

22.40.00 - PLUMBING		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Morningside Wall-Mount Whellchair Bathroom Sink.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Kohler - 444 Highland Drive, Kohler, WI, USA, 53044; 1 (800) 456-4537
	Model/Series/Size	K-12634; Length: 20"; Width: 27"
	Material/Finish	White Vitreous China (0)
	Part 3 - Execution	With carrier and extend depth, mount at handicap height. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

22.40.00 - PLUMBING		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Optima Hardwired-Powered Deck-Mounted Mid Body Faucet.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Sloan - 0500 Seymour Avenue, Franklin Park, IL, USA, 60131; (847) 671-4300 or (800) 982-5839
	Model/Series/Size	EAF200 (Hardwired); Flow Rates: 0.5 gpm, 0.35 gpm, 1.0 gpm
	Material/Finish	Polished Chrome (CP)
	Part 3 - Execution	Sloan BDT Thermostatic mixing valve, grid drain & valve, lead free lavatory supply kit. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

22.40.00 - PLUMBING		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Optima Hardwired-Powered Deck-Mounted Low Integrated Base Body Faucet.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Sloan - 0500 Seymour Avenue, Franklin Park, IL, USA, 60131; (847) 671-4300 or (800) 982-5839
	Model/Series/Size	ETF-600-B-BDT (Hardwired); Flow Rate: 0.5 gpm, 0.35 gpm (1 Lpm) (0.35GPM); Trim Plate: 8"
	Material/Finish	Polished Chrome (CP), Brushed Nickel (BN), Brushed Stainless (SF), Graphite (GR), Polished Brass (PB)
	Part 3 - Execution	4" Center Set, Sloan BDT Thermostatic mixing valve, grid drain & valve, lead free lavatory supply kit. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

22.40.00 - PLUMBING		
Image	**Part 1 - General**	
		'Optima.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Sloan - 0500 Seymour Avenue, Franklin Park, IL, USA, 60131; (847) 671-4300 or (800) 982-5839
	Model/Series/Size	ETF-600-LT-BDT (Hardwired); Flow Rate: 0.5 gpm, 0.35 gpm; Trim Plate: 8"
	Material/Finish	Polished Chrome (CP), Brushed Nickel (BN), Brushed Stainless (SF), Graphite (GR), Polished Brass (PB)
	Part 3 - Execution	4" Center Set, Sloan BDT Thermostatic mixing valve, grid drain & valve, lead free lavatory supply kit. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

22.40.00 - PLUMBING		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Optima Hardwired-Powered Deck-Mounted Gooseneck Body Faucet.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Sloan - 0500 Seymour Avenue, Franklin Park, IL, USA, 60131; (847) 671-4300 or (800) 982-5839
	Model/Series/Size	ETF-700 (Hardwired, IRTU Standard); Flow Rate: 2.2 gpm, 1.5 gpm, 0.5 gpm, 1.0 gpm; Trim Plate: 8", 4"
	Material/Finish	Polished Chrome (CP)
	Part 3 - Execution	0.5 flow rate, Sloan BDT Thermostatic mixing valve, grid drain & valve, lead free lavatory supply kit. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

22.40.00 - PLUMBING		
Image	**Part 1 - General**	Product Link (Reference Only)
		'AquaSpec Service Sink Faucet.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Zurn Service - 2110 West County Road 42, Burnsville, MN, USA, 55337; 1 (800) 518-5388
	Model/Series/Size	Z842M4-XL; Wrist Blade Handles: 4"; Spout with Vacuum Breaker: 6"; Threaded Outlet: 3/4"
	Material/Finish	Polished Chrome
	Part 3 - Execution	With 6" centerline cast brass vacuum breaker spout, lead free, 4" vandal resistant color coded wrist blade handles. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

22.40.00 - PLUMBING		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Kingston Wall-Mount Top Spud Flushometer Bowl.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Kohler - 444 Highland Drive, Kohler, WI, USA, 53044; 1 (800) 456-4537
	Model/Series/Size	K-4325-0; 1.28gpf or 1.6gpf; Top Spud: 1-1/2"; Water Area: 10-1/2"X9"; Length: 26-1/2"; Width: 16-1/2"; Height: 13-1/4"
	Material/Finish	White (0), Biscuit (96), Black Black (7)
	Part 3 - Execution	With carrier, WC-2, ADA option: mount at ADA height. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

22.40.00 - PLUMBING		
Image	**Part 1 - General**	
		'Wellcomme Ultra Floor-Mount Top Spud Flushometer Bowl.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Kohler - 444 Highland Drive, Kohler, WI, USA, 53044; 1 (800) 456-4537
	Model/Series/Size	K-96053-0; 1.28gpf or 1.6gpf; Top Spud: 1-1/2"; Water Surface: 10"X7"; Trapway: 2-1/8"; Rough-In: 10" or 12"
	Material/Finish	White (0), Biscuit (96), Black Black (7)
	Part 3 - Execution	With floor outlet. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

22.40.00 - PLUMBING		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Highcliff Ultra Floor-Mount Top Spud Flushometer Bowl.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Kohler - 444 Highland Drive, Kohler, WI, USA, 53044; 1 (800) 456-4537
	Model/Series/Size	K-96057-0; 1.28gpf or 1.6gpf; Top Spud: 1-1/2"; Trapway: 2-1/8"; Water Surface: 10"X7"; Rough-In: 10" or 12"; Length: 26-1/8"; Width: 14-5/8"; Height: 16-5/8"
	Material/Finish	White (0), Biscuit (96), Black Black (7)
	Part 3 - Execution	With floor outlet, mount at ADA height. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

22.40.00 - PLUMBING		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Royal Exposed Sensor Hardwired Water Closet Flushometer.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Sloan - 0500 Seymour Avenue, Franklin Park, IL, USA, 60131; (847) 671-4300 or (800) 982-5839
	Model/Series/Size	Royal 111 ESS; Flush Volume: 1.28gpf, Other Options: 1.6gpf, 1.1gpf, 2.4gpf; Offset: 2"
	Material/Finish	Polished Chrome, Brushed Nickel, Polished Brass, Brushed Stainless, Graphite
	Part 3 - Execution	Install with all WC, ADA- (1) Water supply rough-in 1-" above top of water closet and (2) adjust vacuum breaker tube height to allow for grab bar installation above flushometer. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

22.40.00 - PLUMBING		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Royal Exposed Sensor Hardwired Urinal Flushometer.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Sloan - 0500 Seymour Avenue, Franklin Park, IL, USA, 60131; (847) 671-4300 or (800) 982-5839
	Model/Series/Size	Royal 186 ESS; Flush Volume: 0.125gpf, Other Options: 0.5gpf, 0.25gpf, 1.0gpf, 1.5gpf; Length: 2" to 10-3/4"
	Material/Finish	Polished Chrome, Brushed Nickel, Polished Brass, Brushed Stainless, Graphite
	Part 3 - Execution	Install with all urinals. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

22.40.00 - PLUMBING		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Bardon High-Efficiency Urinal.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Kohler - 444 Highland Drive, Kohler, WI, USA, 53044; 1 (800) 456-4537
	Model/Series/Size	K-4991-ET; 0.125gpf; Top Spud: 3/4"; Extended Rim: 14"
	Material/Finish	White (0), Biscuit (96), Almond (47), Black Black (7)
	Part 3 - Execution	With carrier, UR-2, ADA option: mount at ADA height. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

22.40.00 - PLUMBING		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Dexter Washdown Wall-Mount 1-Pint Urinal.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Kohler - 444 Highland Drive, Kohler, WI, USA, 53044; 1 (800) 456-4537
	Model/Series/Size	K-5452-ET; 0.125 GPF; Top Spud: 3/4"; Extended Rim: 14-3/4"
	Material/Finish	White (0), Biscuit (96), Almond (47), Black Black (7)
	Part 3 - Execution	With carrier, mount at ADA height. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

22.40.00 - PLUMBING		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Wall Mount ADA Cooler.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Halsey Taylor - 1333 Butterfield Road, Suite 200, Downers Grove, IL, USA, 60515; (800) 476-4106 or (800) 260-6640
	Model/Series/Size	HAC8PV-WF; Length: 20-3/8"; Width: 20-3/16"; Height: 26-5/16"
	Material/Finish	Platinum Vinyl
	Part 3 - Execution	Wall mounted. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

22.40.00 - PLUMBING		
Image	**Part 1 - General**	
		'OVL-II Hands-Free Fountain.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Halsey Taylor - 1333 Butterfield Road, Suite 200, Downers Grove, IL, USA, 60515; (800) 476-4106 or (800) 260-6640
	Model/Series/Size	OVLERGRN-VRWF; Length: 19-3/4"; Width: 18"; Height: 40-13/16"
	Material/Finish	Stainless Steel
	Part 3 - Execution	Recessed mounted. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

22.40.00 - PLUMBING		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Wall Mount Bi-Level ADA Cooler.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Halsey Taylor - 1333 Butterfield Road, Suite 200, Downers Grove, IL, USA, 60515; (800) 476-4106 or (800) 260-6640
	Model/Series/Size	HAC8BLPV-WF; Length: 21"; Width: 21"; Height: 38"
	Material/Finish	Platinum Vinyl
	Part 3 - Execution	Wall mounted. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

22.40.00 - PLUMBING		
Image	**Part 1 - General**	Product Link (Reference Only)
		'OVL-II Bi-Level GreenSpec Fountain.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Halsey Taylor - 1333 Butterfield Road, Suite 200, Downers Grove, IL, USA, 60515; (800) 476-4106 or (800) 260-6640
	Model/Series/Size	OVLSERGRN-VRWF; Length: 38-1/2"; Width: 18-3/8"; Height: 40-13/16"
	Material/Finish	Stainless Steel
	Part 3 - Execution	Recessed mounted. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

22.40.00 - PLUMBING		
Image	**Part 1 - General**	Product Link (Reference Only)
		'HydroBoost Bottle Filling Station & Single ADA Cooler.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Halsey Taylor - 1333 Butterfield Road, Suite 200, Downers Grove, IL, USA, 60515; (800) 476-4106 or (800) 260-6640
	Model/Series/Size	HTHB-HACG8PV-WF; Length: 18"; Width: 18-1/2"; Height: 39-9/16"
	Material/Finish	Platinum Vinyl
	Part 3 - Execution	Wall mounted. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

22.40.00 - PLUMBING		
Image	**Part 1 - General**	Product Link (Reference Only)
		'HydroBoost Bottle Filling Station & Integral OVL-II Fountain.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Halsey Taylor - 1333 Butterfield Road, Suite 200, Downers Grove, IL, USA, 60515; (800) 476-4106 or (800) 260-6640
	Model/Series/Size	HTHBWF-OVLER-I; Length: 19-3/4"; Width: 19"; Height: 55-1/8"
	Material/Finish	Stainless Steel
	Part 3 - Execution	Recessed mounted. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

22.40.00 - PLUMBING		
Image	**Part 1 - General**	Product Link (Reference Only)
		'HydroBoost Bottle Filling Station & Bi-Level ADA Cooler.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Halsey Taylor - 1333 Butterfield Road, Suite 200, Downers Grove, IL, USA, 60515; (800) 476-4106 or (800) 260-6640
	Model/Series/Size	HTHB-HACG8BLPV-WF; Length: 36"; Width: 18-5/8"; Height: 46-1/16"
	Material/Finish	Platinum Vinyl
	Part 3 - Execution	Wall mounted. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

22.40.00 - PLUMBING		
Image	**Part 1 - General**	Product Link (Reference Only)
		'HydroBoost Bottle Filling Station & Bi-Level Integral OVL-II Fountain.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Halsey Taylor - 1333 Butterfield Road, Suite 200, Downers Grove, IL, USA, 60515; (800) 476-4106 or (800) 260-6640
	Model/Series/Size	HTHBWF-OVLSER-I; Length: 38-1/2"; Width: 19"; Height: 55-1/16"
	Material/Finish	Stainless Steel
	Part 3 - Execution	Recessed mounted. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

22.40.00 - PLUMBING		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Safety Station with Eye Wash Station.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Guardian - 1140 North North Branch Street, Chicago, IL, USA, 60642; (312) 447-8100
	Model/Series/Size	G1902; Shower Head: 10" Diameter; Shower Valve: 1"' Eyewash Bowl: 11-1/8"; Eyewash Valve: 1/2"
	Material/Finish	Powder Coated (on Galvanized Pipe and Fittings) in Orange, Yellow, Red, and Green; Stainless Steel Bowl
	Part 3 - Execution	Combination eyewash and safety shower. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

22.40.00 - PLUMBING		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Eyewash/Drench Hose Unit.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Guardian - 1140 North North Branch Street, Chicago, IL, USA, 60642; (312) 447-8100
	Model/Series/Size	G5026; Hose Length: 8'
	Material/Finish	Varies
	Part 3 - Execution	Meets ANSI Z358.1-2004. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

22.40.00 - PLUMBING		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Eyewash/Drench Hose Unit.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Guardian - 1140 North North Branch Street, Chicago, IL, USA, 60642; (312) 447-8100
	Model/Series/Size	G5022; Hose: 8'
	Material/Finish	Varies
	Part 3 - Execution	Meets ANSI Z358.1-2004. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

1. The entire plumbing and drainage system must comply with the International Plumbing Code, latest adopted edition, and this standard.
2. Each system shall be designed and installed in accordance with the latest edition of the applicable Standards, including, but not limited to:
   A. NFPA Standards;
   B. Americans with Disabilities Act Accessibility Guidelines (ADAAG);
   C. Underwriters Laboratory, Inc. (UL);
   D. Factory Mutual System (FM);
   E. American National Standards Institute (ANSI);
   F. American Society for Testing and Materials (ASTM);
   G. American Welding Society (AWS);
   H. American Water Works Association (AWWA);
   I. Manufacturers Standardization Society of Valve and Fitting Industry (MSS);
   J. American Society of Mechanical Engineers (ASME);
   K. International Code Council (ICC).
   L. Temple University Toilet Room Standards Drawing A001
3. All equipment is to be individually scheduled.
4. All new equipment is to be provided with software and hardware necessary for Temple University Facilities & Operations to have the ability to troubleshoot and/or configure any field equipment. Equipment manufacturer is to provide software and hardware as part of closeout package.
5. All devices, piping, valves, relays, control components, power wiring, control wiring and interlock wiring shall be provided as required to accomplish the sequence of operation for the various pieces of equipment to provide a fully operational system.
6. All branch mains shall be provided with shutoff valves to permit servicing of systems without affecting other areas of the building. All loops shall be segmented with isolation and bypass valves. For toilet rooms, as a minimum, each toilet area (men's or women's) shall be provided with isolation valves located outside of the room.
7. All plumbing equipment (heat exchangers, water heaters, etc.) isolation valves are to be upstream of valve assembly sets on supply and downstream of valve assembly sets on return. Valve assembly sets consists of unions, strainers, thermostats, P/T wells, etc.
8. Low-point drains and high-point vents shall be provided on all plumbing piping systems. Drain and vent valves shall be a minimum of 1 in. NPS and shall be installed in accessible locations. The discharge of the drain and vent valves shall be routed to a sanitary sewer or other disposal location. Where it is not practical to route the discharge to a sanitary sewer or disposal location, the drain and vent valves shall be of the “hose connection” type as specified herein.
9. Where isolation valves (2-1/ in. NPS and small) cannot be located for operation without a ladder, each valve shall be provided with a reach rod for operation of the valve from the operating floor. Where isolation valves (3 in. NPS and larger) cannot be located for operation without a ladder,

each valve shall be equipped with a chain wheel operator with sufficient chain for operation of the valve from the operating floor.

10. All domestic water systems must be cleaned and disinfected in accordance with AWWA Standards. Bacteriological test shall be performed by a state-certified laboratory and certified analysis and delivered to owner.

11. Domestic Cold Water System

    A. Domestic cold water service shall be provided from a connection to the existing city water system. Triplex constant pressure booster pumps (if required) shall be provided with each pump sized at 40% of the estimated requirements. Variable speed drive similar to the Delta Pak system from Delta P Systems shall be provided for all systems.

    B. Piping shall be sized to maintain a minimum pressure of 35 psig at the farthest flush valve and 30 psig at the hydraulically most remote safety shower. Water velocity in the distribution piping system will not exceed 6 feet per second and provisions shall be made to reduce any water hammer with water hammer arrestors. All of the piping in the domestic water system will be insulated. All branches off the domestic cold water distribution main providing service to mechanical shall be provided with backflow preventers.

12. Domestic Hot Water System

    A. Heating sources for domestic hot water heaters will depend on location and application but, generally, gas-fired devices are preferred.

    B. The maximum hot-water temperature produced will be 140 degrees F with service to laboratory sinks, lavatories, showers, washdown stations, general purpose sinks, service sinks, and other specific equipment mixed to 120° F as required. All hot water heating sources shall generate a minimum of 130° F supply water.

    C. A temperature controlled mixing valve shall be installed in hot water systems requiring supply water temperature below 160°F.

    D. All central domestic hot water systems which serve fixture(s) located more than 50 feet from the hot water source shall be provided with a properly sized hot water return system complete with all appurtenances. Temperatures should be maintained at 120° F at the faucet.

    E. For kitchen equipment, dishwashers, cage, rack and glassware washers and hose station requirements, 140° F water shall be provided. Any requirements for higher temperature water shall be provided by local water booster heaters provided with the equipment.

    F. Domestic hot water shall be produced by duplex domestic hot water generators. Where steam is available provide instantaneous water heaters. Additionally, where steam is available, the steam condensate should be used to preheat the incoming cold water to the hot water generators. The generators shall be sized to satisfy the domestic fixture and equipment demands. Hot water generators shall be designed, with each generator capable of satisfying a minimum of 75% of system demand upon the failure of any single hot water generator.

    G. Special consideration must be taken into account for the large stop / start water demands of washers. Systems serving these must be designed so that the controls response time is

rapid so as not to over shoot or under shoot the set-point by more than ± 5° F. A buffer or reservoir tank may be needed to satisfy this requirement.

H. Systems shall be carefully designed to provide design temperature hot water within 5 seconds at any system outlet.

I. Laboratory safety equipment (eyewashes and emergency showers) shall be supplied with TEPID water, 60-100° F.

J. Isolation valves shall be installed on all utilities at each lab or room, each branch from mains, and at each floor to maximize system isolation.

13. Sanitary Drainage System

A. Sanitary drainage, waste and vent system shall be provided including waste and vent systems from all toilets, lavatories, service sinks, non-process floor drainage, etc. Sanitary drainage will be connected directly into the site sanitary sewer system without treatment.

B. New toilet rooms shall be provided with one 4-inch floor drain approximately centered in the room to facilitate cleaning. Trap primers shall be installed in accordance with Section P-1204.3 of the City of Philadelphia Plumbing Code. All floor drains shall be provided with trap primers. Rubber boot type seals are unacceptable. Non-electronic trap primers shall be provided – See 22 13 19.

14. Laboratory/Process Waste and Vent System

A. Laboratory/process waste and vent system shall be provided for all lab fixtures, equipment and floor drains located in lab and process areas. Laboratory/process waste shall be a dedicated system within the building and be connected to the site sanitary system. Sampling capability for effluent testing shall be provided prior to connecting to the site sanitary system. On a project by project basis, the need for a chemical neutralization system before connection into the site sanitary sewer system shall be evaluated.

B. Waste systems shall not be required to filter, distill, incinerate or otherwise remove any toxins, particulate, solid, radioactivity, or heavy metals. Only pH neutralization and/or dilution will be considered.

C. Treatment of biological waste shall be via dedicated treatment systems before discharging into the site sanitary system.

D. Toxic, radioactive, solvent or high concentration wastes will be disposed through local, “in-lab” safety containers, without use of piped waste systems.

15. Storm Water Drainage System

A. Storm water drainage system shall be provided for all roof and area drains and be connected into the site storm system.

B. Parking area drains shall connect into the storm drainage system.

C. Storm water drainage overflow system shall be provided for all roofs which cannot support the buildup of rainwater caused by an obstructed primary roof drain and where scuppers are not provided.

D. If required, sanitary, laboratory/process or storm drainage from lower building levels shall be lifted to the main sanitary line and draining by gravity to the site sewer system. A duplex

sewage ejector pumping system shall be used for this purpose. Each pump shall be sized for a capacity of 100 percent of the load.

E. Sump pumps shall be provided at the bottom of elevator shafts where floor drains cannot be installed. Sump pumps will be supplied with an oil shut-off switch or an oil interceptor shall be installed in the pump discharge pipe if the elevator is hydraulic. Discharge shall connect to the sanitary system.

16. Vivarium Systems

A. Vivarium water system shall be supplied from the laboratory water system or have a dedicated system supplied from the domestic water service. The system shall be equipped with a reduced type (RPZ) backflow preventer.

B. Hose stations shall be provided - see section 22 11 19.

C. Electric Flush Valves and Control Panels for Flushing Drains and Large Animal Room Trenches

D. Provide concealed flush valve, rough brass, 1 inch IPS wheel handle back check angle stop, adjustable tailpiece, vacuum breaker, 1 inch female IPS union outlet (no flush connection), with 24 V ac solenoid operator and electric pushbutton (remotely located). Exposed parts shall be chrome-plated.

E. Electric pushbutton for each room shall be grouped together in a stainless steel control panel. Panel shall be furnished with prewired momentary contacts and 120 V/24 V ac transformers as required. Transformers shall be sized for simultaneous solenoid operation plus 20 percent spare capacity. Panels shall be NEMA 4 and UL rated.

F. Large animal room trenches shall either have a drain provided in the center of the trench and flushing nozzles at each end or on smaller trenches, the drain provided at one end and the flushing nozzle at the opposite end. The flushing nozzle shall be a "Barco" stainless steel nozzle or equal.

G. Vivaria shall be located on the buildings upper floors where possible to avoid the need for sewage ejector lift stations. If lift stations are required, provide stainless steel cutter pumps with turbulence flush valves and basin wash down devices.

H. Methods and materials for wet taps, where permitted by the Temple University Facilities & Operations, shall be submitted for approval by the Design Professional. Submittals shall include documentation on the products to be used with complete instructions and procedures to ensure successful wet taps.

END OF SECTION

1. All motors shall conform to the latest IEEE or NEMA standards relating to characteristics, dimensions, tolerances, temperature rise, insulation, and ratings for noise and vibration.
2. Use NEMA Class B insulation with motor frame amply sized to provide a 1.15 service factor and an ambient of 40°C maximum.
3. To maintain the University's Green Initiative, and to optimize motor system efficiency, reduce electrical power consumption and costs, and improve system reliability, NEMA Premium® labeled electric motors shall be specified for all motors. Each motor shall achieve the NEMA Premium™ efficiency levels contained in NEMA Standards Publication MG 1-2011 as follows:

Nominal Efficiencies For "NEMA Premium™" Induction Motors Rated 600 Volts Or Less (Random Wound)						
Motor HP	Open Drip-Proof			Totally Enclosed Fan-Cooled		
	6-pole	4-pole	2-pole	6-pole	4-pole	2-pole
1	82.5	85.5	77.0*	82.5	85.5	77.0
1.5	86.5	86.5	84.0	87.5	86.5	84.0
2	87.5	86.5	85.5	88.5	86.5	85.5
3	88.5	89.5	85.5	89.5	89.5	86.5
5	89.5	89.5	86.5	89.5	89.5	88.5
7.5	90.2	91.0	88.5	91.0	91.7	89.5
10	91.7	91.7	89.5	91.0	91.7	90.2
15	91.7	93.0	90.2	91.7	92.4	91.0
20	92.4	93.0	91.0	91.7	93.0	91.0
25	93.0	93.6	91.7	93.0	93.6	91.7
30	93.6	94.1	91.7	93.0	93.6	91.7
40	94.1	94.1	92.4	94.1	94.1	92.4
50	94.1	94.5	93.0	94.1	94.5	93.0
60	94.5	95.0	93.6	94.5	95.0	93.6
75	94.5	95.0	93.6	94.5	95.4	93.6
100	95.0	95.4	93.6	95.0	95.4	94.1
125	95.0	95.4	94.1	95.0	95.4	95.0
150	95.4	95.8	94.1	95.8	95.8	95.0

4. Provide shaft grounding kit for field installation:
   A. All motors controlled by Variable Frequency Drives shall be equipped with AEGIS Shaft Grounding Ring kit to be installed by motor or equipment manufacturer or installed in the field by contractor.
5. Motors:
   A. Wire shaft ground kit on motors for use with variable frequency drives:
      I. Ensure AEGIS Shaft Grounding Kit is installed on motor in accordance with manufacturer's recommendation.

II. AEGIS Shaft Grounding Ring (SGR) is bolted directly to the motor end bracket or installed with conductive epoxy to ensure ground connection from the AEGIS SGR to motor frame.

END OF SECTION

1. All devices, piping, valves, relays, end switches, control components, power wiring, control wiring and interlock wiring shall be provided as required to accomplish the sequence of operation for the various pieces of equipment to provide a fully operational system.

2. Pressure and Temperature Ratings:

   A. Each meter and gauge shall be rated and suitable for the piping system that it is being installed in.

   B. Minimum upstream and downstream straight pipe diameters for meters shall be provided per manufacturer's published recommendations.

3. Pressure Gauges – Provide and install all gauges in such a manner as to be easily read from normal observation positions. Gauges shall be as follows:

   A. Dial Size: 4-1/2 inch.

   B. Accuracy: 1/2% of Full Scale, Grade 2A, ASME B40.100.

   C. Case: Black Phenoilc, Solid Front.

   D. Ring: Threaded Reinforced Black Polypropylene.

   E. Window: Glass.

   F. Pointer: Micrometer Adjustable.

   G. Movement: Rotary, Type 400 SS, Teflon-Coated Pinion Gear & Segment.

   H. Bourdon Tube & Socket: Type 316L Stainless Steel.

   I. Optional Features: PLUS! Performance.

   J. Manufacturer: Ashcroft.

   K. Model: 45-1279-SS-(Connection Size & Type)-XLL-(Pressure Range).

   L. *Alternate Manufacturer: Treice.

   M. *Alternate Model: 450SS-45-(Connection Size)-(Connection Location)-A-(Pressure Range Code)-SS(code for fluid selection for snubber screw).

   N. *Each gauge must be supplied with a Treice Model 870-13 or 870-16 impulse dampener.

   NOTE: All pressure gauges utilized for steam service must be equipped with a coil syphon constructed of 316 stainless steel or seamless Schedule 80 carbon steel.

   O. Select range in such a manner that the operating pressures is at the mid-point of the scale. Pressure ranges shall be as follows:

      I. Fluids, Suction Side of Pump, Open Systems: 30 in. to 0 PSI to 150 PSI.

      II. Fluids, Suction and Discharge Side of Pump, Closed Systems: 0 PSI to 100 PSI.

4. Thermometers – Provide and install all thermometers in such a manner as to be easily read from normal observation positions. Thermometer shall be as follows:

   A. Dial Size: 5 inch.

   B. Accuracy: 1% of Full Scale, Grade A, ASME B40.3.

   C. Stem & Case: Type 304 Stainless Steel Hermetically Sealed.

   D. Stem Diameter: 0.250 inch.

E. Window: Polycarbonate.

F. Connection: 1/2 inch NPT Union.

G. Location: Everyangle®.

H. Manufacturer: Ashcroft.

I. Model: 50-EL-42-E-(Stem Length Code)-(Range Code).

J. Alternate Manufacturer: Treice.

K. Alternate Model: B856-(Stem Length Code)-(Range Code)-SWV.

NOTE: All thermometers installed in piping or pipelines shall be supplied with threaded, stepped shank, Type 316 stainless steel thermowells of suitable dimensions for the thermometer being supplied.

L. Select range in such manner that the operating temperature is at the mid-point of the scale. Thermometer ranges shall be as follows:

I. Cold water: 40°F to 160°F.

II. Hot water: 50°F to 300°F.

5. Water Meters – Provide hot and/or cold water meters as required by the project. Install meters in locations that will be accessible, without ladders or other equipment, for manual readings and service after construction is complete.

6. Domestic Hot & Cold Water Meter Sizing, Selection, and Installation Design:

A. Water meters shall be utilized to measure consumption of domestic hot & cold water.

B. Water meter sizing shall be performed prior to meter selection.

C. In order to correctly select the water meters, the maximum and normal flow rates, temperatures, and pressures shall first be determined by the design engineer.

D. Using the maximum and normal flow rates, temperatures, and pressures, as determined by the design engineer, the water meter vendor, in coordination with the design engineer, shall select the water meter size so that the maximum allowable water meter flow rate is not exceeded and to obtain acceptable pressure drop under normal operating conditions.

E. After meter selection, the design engineer shall design the physical installation per the water meter manufacturer's installation instructions, standard drawings, the International Plumbing Code, and the Plumbing Code section of the Philadelphia Building Construction and Occupancy Code.

F. Meter run piping shall be the same pipe size as the nominal meter size. The meter run shall be complete with (at least) the minimum required straight runs of upstream and downstream piping, as indicated on the standard drawings and manufacturer's installation instructions. Reductions and/or enlargements of the piping shall occur before and/or after the meter run.

G. A fully isolating bypass piping arrangement shall be included on all water meter installations.

H. Water Metering Equipment (All information shall be verified with manufacturer prior to equipment procurement):

I. Hot & Cold Water Meters, 1.5-in. nominal size and smaller – Hot & cold water meters shall utilize the following components:

(a) Badger RCDL Industrial Nutating Disk Meter with bronze body, 250°F. option, and equipped with a Badger RTR Transmitter/Register.

(b) Register scale & transmitter units of measure shall be in cubic feet or fractions/multiples thereof (one per service required).

I. Hot & Cold Water Meters, 2-in. through 6-in. nominal size– Hot & cold water meters shall utilize the following components:

(a) Badger RCDL Industrial Turbo Turbine Meter with bronze body, equipped with a Badger RTR Transmitter/Register.

(b) Register scale & transmitter units of measure shall be in cubic feet or fractions/multiples thereof (one per service required).

(c) Badger Bronze Plate Strainer sized to match the water meter (one required for each water meter).

END OF SECTION

1. Isolation Valves

   A. Up to Two and One-half (2-1/2) inches: Full port, 2-piece, bronze body ball valves conforming to ASTM B-61 or B-62. Ball valves shall be as follows;

      I. Solder-End and Threaded-End Ball Valves:

         (a) Rating: 600 PSI CWP, 150 PSI Steam.

         (b) Body: Two-Piece, Bronze. Lead-Free Bronze

         (c) Ball & Stem: 316 Stainless Steel.

         (d) Seat & Packing: MPTFE.

         (e) Latch-Lock Lever & Nut: Stainless Steel.

         (f) Brand: Apollo Valves.

         (g) Model: 77CLF - (1 or 2) 4 (Size Designation) – 10 – 27 – A

         (h) Alternate Manufacturers: Crane, Jamesbury, or Nibco. Must be equal to specified valve.

      II. Three (3) inches and above: Epoxy-coated ductile iron ball valve.

         (a) Rating: ANSI Class 125.

         (b) Body: Ductile Iron, ASTM A536 Grade 65-45-12.

         (c) Ball & Stem: 304 Stainless Steel.

         (d) Seat & Packing: PTFE.

         (e) Brand: Apollo 6Q.

         (f) Model: 6Q20(Size Designation)(1 for lever through 4 in., G for gear operator 6 in. and above).

         (g) Alternate Manufacturers: Bray, DeZurik, or Jamesbury. Must be equal to specified valve.

2. Check Valves

   A. Up to Two and One-half (2-1/2) inches: Threaded or Solder-End Swing Check Valve, Threaded Cap:

      I. Rating: 200 CWP.

      II. Body: AB1953 Brass 0T60

      III. Retaining Disc: AB1953 Brass 0T57

      IV. Cap: AB1953 Brass 0T57

      V. Gasket: PTFE AE/2

      VI. Brand: Crane Energy Flow Solutions.

      VII. Model: LF37 or LF1340.

      VIII. Alternate Manufacturers: Apollo, Jamesbury, or Nibco. Must be equal to specified valve.

B. Three (3) inches and above: High performance check valve:

I. Rating: ANSI Class 150.

II. Body: Wafer Style, ASTM A351 Gr. CF-8M Stainless Steel.

III. Seal: EPDM.

IV. Disc, Arm & Pin: 316 Stainless Steel.

V. Brand: Crane Energy Flow Solutions – Uni Check.

VI. Model: (Size Designation)-15-A-2-3-4-1-3-0.

VII. Alternate Manufacturers: Bray, DeZurik, or Jamesbury. Must be equal to specified valve.

3. Drain & Vent Valves

A. Up to One (1) inch: Full port, 2-piece, bronze body ball valves conforming to ASTM B-61 or B-62 with hose cap. Ball valves shall be as follows:

I. Solder-End and Threaded-End Ball Valves:

II. Rating: 600 PSI CWP, 150 PSI Steam.

III. Body: Two-Piece, Lead-Free Bronze.

IV. Ball & Stem: 316 Stainless Steel.

V. Seat & Packing: MPTFE.

VI. Latch-Lock Lever & Nut: Stainless Steel.

VII. Hose Cap: Brass, ASTM B16

VIII. Ball Chain: Stainless Steel

IX. Brand: Apollo Valves.

X. Model: 70LF HC - (1 or 2) 4 (Size Designation) – 10 – 27 – A

XI. Alternate Manufacturers: Crane, Jamesbury, or Nibco. Must be equal to specified valve.

END OF SECTION

1. Hangers shall be spaced to prevent sag and permit proper drainage of piping. A hanger shall be placed within 1 ft. of each horizontal elbow or valve.
2. Vertical runs of pipe and conduit less than 10 ft. long shall be supported by hangers placed one (1) foot or less from the elbows on the connecting horizontal runs. Vertical runs of pipe and conduit over 10 ft. long, but not over 30 ft. long, and not over 6 inches in size, shall be supported by heavy metal clamps. Clamps shall be bolted tightly around the pipes and conduits and shall rest securely on the building structure without blocking. When run in a shaft, support riser clamps on both sides of clamp. For pipes over 30 feet long or over 6 inches in size, support base of all vertical pipe stacks (except soil pipe stacks, generator exhaust stacks and copper water pipe risers) with a base leg. Cut top of base leg to shape and completely weld to heel of base elbow. Weld leg support to a bearing plate and bolt to floor. Locate base leg on vertical pipe centerline. All vent stack piping shall be supported from below roof. Provide springs for vibration isolation where piping system movement, expansion, or noise criteria dictate. Clamps may be welded to the pipes and placed below couplings.
3. In lieu of individual hangers, multiple (trapeze) hangers should be considered for water pipes having the same elevation and slope. Each multiple hanger shall be designed to support a load equal to the sum of the weights of the pipes, water, and the weight of the hanger itself, plus 200 lbs. The size of the hanger rods shall be such that the stress at the root of the thread will not be over 10,000 PSI at the design load. No rod shall be smaller than 3/8 inches. The size of the horizontal members shall be such that the maximum stress will not be over 15,000 PSI design load. A structural engineer shall review all loads imposed upon the structure.
4. Roller-type pipe supports shall be specified where significant horizontal pipe movement will occur due to thermal expansion, and spring-type supports shall be specified where significant vertical movement will occur and where vibration isolation is needed due to building usage and program requirements.
5. The following hanger types shall be specified for the support of piping with buildings;
    A. All pipe hangers shall be sized to fit over insulated piping. Provide the following insulation protection devices:
        I. Up to and including 6" - Insulation shield equal to Anvil Fig. 167.
        II. 6" and above - Pipe insulation protection saddle equal to Anvil Fig. 160.
        III. Alternate: Insulated piping above 2" - Rigid hydrous calcium silicate insulation having a compressive strength of 200 PSI may be used at hanger locations on piping above 2". Insulation shields equal to Anvil Fig. 167 must be used in conjunction with the insulation.
    B. All hangers and supports directly in contact with the piping must be of compatible materials.
    C. Horizontal piping up to and including 6" nominal pipe diameter:
        I. Ceiling Hung - Adjustable clevis hangers equal to Anvil Fig. 260.
        II. Floor, wall or rack supported - offset pipe clamp equal to Anvil Fig. 103.
    D. Horizontal piping 8" through 12":
        I. Ceiling Hung - Adjustable steel yoke pipe roll equal to Anvil Fig. 181.

II. Floor or rack supported - Adjustable pipe roll stand with steel base plate equal to Anvil Fig. 274P.

E. Horizontal Piping above 12":

I. Ceiling Hung – Adjustable steel yoke pipe roll equal to Anvil Fig. 181.

II. Floor or rack supported - Adjustable pipe roll with base equal to Anvil Fig. 274P.

F. Spring hangers shall be used within mechanical rooms to support piping connected to rotating equipment as follows:

I. Up to and including 6" nominal pipe size: Ceiling mounted, pre-engineered spring pipe hanger equal to Anvil Fig. B-268 Type A.

II. Above 6" manual pipe size: Piping cushion for pipe rolls equal to Anvil Fig. 178.

6. Hanger Spacing: Piping shall be supported at distances not exceeding the spacing specified in Table 305.4 of the currently-adopted edition of the International Mechanical Code.

7. All hub or joint pipe shall be supported within the above recommendations for steel and at each joint.

8. Polyvinyl chloride pipe (PVC) shall be supported at intervals recommended by the manufacturer for a 120°F fluid temperature.

9. All piping which must pass to within six (6) feet, measured horizontally, from all switchboards, panels, metering assemblies, buss ducts, etc., shall be provided with watertight sheet-metal enclosures to completely protect such equipment in the event of leakage. Provide a drain tapping at the low point of the enclosure and pipe such to the nearest drain.

END OF SECTION

1. All domestic water piping and equipment shall be labeled to comply with OSHA regulations and the current edition of the ANSI/ASME A13.1 standard for the identification of systems.
2. The marking system shall identify the contents, size, direction of flow, and operating characteristics (i.e. pressure and/or temperature).
3. All valves and controls shall be labeled using plastic I.D. tags securely connected to the specific item using brass chain or "S" hooks. The contractor shall provide a list of each tagged item and its function and a valve chart in the main Mechanical Room.
4. All equipment must be identified using phenolic nameplates and labeled in accordance with the nomenclature used on the drawings.
5. Underground piping installations shall be provided with acid and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep.

END OF SECTION

1. All domestic cold and hot water and hot water return piping must be insulated with 1 lb. density fiberglass insulation having an outer jacket of Kraft paper bonded to aluminum foil reinforced with fiberglass yarn. The longitudinal seams of the jacket shall overlap and be sealed using the factory applied pressure sensitive adhesive. Staples are prohibited. Insulation thickness shall not be less than those recommended in the currently-adopted edition of the International Energy Conservation Code for the intended service or that required to present the formation of condensation or that required to assure a maximum surface temperature of 80°F, whichever is the most stringent. The insulation shall have a maximum thermal conductivity of 0.23 BTU-IN./HR.-FT^2-°F at a mean temperature of 75°F.
2. All domestic cold and hot water and hot water return pipe risers exposed to view in occupied spaces are to be insulated and have a PVC cover. The minimum thickness of the cover will be 30 mil.
3. All non-service/maintenance related fittings (i.e. elbows, tees, etc.) shall be insulated with pre-molded, light impact, UV resistant PVC covers. The minimum thickness of the cover will be 30 mil. Fiberglass insulation thickness shall be equal to the required thickness of the adjoining piping. Foam filled fittings and covers are **prohibited**.
4. Fittings requiring service/maintenance access (i.e. flanges, unions, shut-off valves, check valves, balancing valves, PRV's, etc.) shall be insulated with removable, reusable covers which use straps and buckles to secure the cover in place. The drawings shall detail the interface between the removable cover and the adjacent piping insulation to assure a tight interface which prevents heat loss and the formation of condensation. Covers shall consist of inner and outer walls of 304 SS 0.11" thick mesh, nylon coated 304SS 0.15" threaded seams, 304SS 1/8" thick x 1-1/2" buckles, PTFE/Teflon belting and 304SS I.D. tags.
5. All pre-fabricated underground piping systems shall be designed to meet the above insulation thickness requirements. All piping within manholes and removable covers for valves etc. shall meet the above insulation thickness requirements, and shall be considered an exterior application and therefore be covered with the aluminum jacket.
6. All insulation provided shall conform to all pertinent codes including ASTM E-84, UL 73 and NFPA 255, and shall not exceed a flame spread of 25, fuel contributed 50 and smoke developed 50.
7. Rigid hydrous calcium silicate insulation having a compressive strength of 200 PSI may be used at hanger locations on piping above 2". Insulation shields equal to Anvil Fig. 167 must be used in conjunction with the insulation.
8. Refer to Pipe Insulation Schedule below for minimum insulation size based on pipe size:

Piping System Types	Fluid Temp. Range (deg. F)	Insulation Thickness (Inches) for Pipe Sizes				
		Less than 1	1 to less than 1.5	1.5 to less than 4	4 to less than 8	8 and larger
PLUMBING SYSTEMS						
Domestic, Softened, Lab & Lab Special Cold Water:	Any	1.0	1.0	1.0	1.0	1.0
Domestic, Softened, Lab & Lab Special Hot Water and Recirculating:	130 & below	1.0	1.0	1.0	1.5	2.0
	131-160	1.0	1.0	1.5	1.5	2.0
	above 160	1.0	1.5	2.0	2.0	2.0
Horizontal Rain Water Conductors	Any	1.0	1.0	1.0	1.0	1.0
Above Grade Horizontal Sanitary Piping from Mech. Equipment Area Floor Drains	Any	1.0	1.0	1.0	1.0	1.0

END OF SECTION

1. The purpose of the commissioning process is to provide the Owner with a high level of assurance that the plumbing systems have been installed in the prescribed manner, and operate within the required performance guidelines. This process is not intended to take away or reduce the responsibility of the design team or installing contractors to provide a finished product. Commissioning is intended to enhance the quality of system start-up and aid in the orderly transfer of systems for beneficial use by the Owner.
2. The commissioning responsibilities of the Installing Contractor shall include the following:
   A. Review design for provision of power to appropriate plumbing equipment.
   B. Prior to completion of installation, submit “System Verification Checklists” to Engineer of Record and Owner for review.
   C. Certify that plumbing systems, subsystems, and equipment have been installed, calibrated, and started and are operating in accordance with the Contract Documents.
   D. Certify that plumbing instrumentation and control systems have been completed and calibrated, that they are operating in accordance with the Contract Documents, and that pretest set points have been recorded.
   E. Certify that the testing and adjusting procedures have been completed and that testing, adjusting, and balancing reports have been submitted, discrepancies corrected, and corrective work approved.
   F. Complete System Verification Checklists and manufacturer’s pre-start checklists prior to scheduling acceptance and operating tests.
   G. Provide a plumbing system technician to assist during functional performance testing.
   H. Participate in the functional performance tests as required to achieve design intent.
   I. Where necessary, provide dates when governing authorities testing will be conducted
   J. Participate in O&M Training as required by project specifications.
   K. Obtain O&M data on all equipment and assemble in binders as required by the project specifications.
   L. Conduct a maintenance demonstration with hands-on training. Submit record drawings as required by the project specifications prior to the training. Demonstrate proper use, operations and routine maintenance of the elevators and components.
   M. Submit completed System Verification Checklists documenting that the work has been completed in accordance with the plans and specifications and that they are functioning as designed.
   N. Provide written certification documenting that the following work has been completed in accordance with the plans and specifications and that they are functioning as designed. This certification must be submitted prior to the final verification.
   O. Provide set of record as-built drawings to the Engineer of Record for inclusion into record documents.

3. Start-Up:

   A. The installing contractor shall perform start-up of the appropriate plumbing systems. The appropriate contractors and/or manufacturer's representative shall be on-site to perform start-up. No system will be started until the manufacturer's checklists have been completed. Start-up will be performed according to the manufacturer's recommended procedures. The Owner will visit the site to review completeness of installation in conjunction with progress meetings prior to starting equipment.

   B. Contractors involved in installation, fabrication, manufacturer, control, or designs of equipment shall be present at the time of start-up. A factory-authorized technician shall be on site to start equipment when required by the specifications. This will minimize delays in bringing equipment on line and expedite acceptable functional performance.

4. Functional Performance Tests:

   A. Scope of plumbing testing shall include entire plumbing installation, from central equipment for hot water generation through distribution systems to each fixture and appliance. Testing shall include measuring capacities and pressures of operational and control functions.

   B. Each major system will be tested. This will be coordinated and witnessed by the Owner. Witnessing the functional performance tests will serve as a compliment to the O&M Training. No tests will be performed until the system and related subsystems have been started and documented through point-to-point checklists and other documentation.

   C. The Functional Performance Tests shall include the following, with the Commissioning Agent (if applicable) and Owner:

      I. Water Heating Systems.

      II. Pipe system cleaning, flushing, hydrostatic tests, and chemical treatment.

      III. Energy Supply System (heating hot water).

      IV. Plumbing Distribution Systems.

      V. Owner Orientation and Training

      VI. The installing contractor shall provide the Owner comprehensive training in the understanding of the systems and operation and maintenance of each major piece of equipment.

      VII. The installing contractor or manufacturer's representative will provide the training. This training should include hands-on operational training. The Owner may choose to videotape this training for future use.

      VIII. The training shall include start-up, operation in all modes possible, shut-down and any emergency procedures.

      IX. The training shall include a review of all systems using simplified system schematics including riser diagrams, valve locations, and equipment locations.

      X. The installing contractor shall provide the Owner with copies of all inspections and acceptance.

XI. The manufacturer's representative shall provide the instructions on each major piece of equipment. These sessions shall use the printed installation, operation and maintenance instruction material included in the O&M manuals and shall include a review of the written O&M installations emphasize safe and proper operating requirements and preventative maintenance. Qualified service engineers employed by the manufacturers or their qualified sales representatives shall do equipment training. The operation and function of the equipment in the system shall be discussed. The start-up and shut-down modes of operation shall be demonstrated. Emergency operations shall be demonstrated.

XII. The Contractor shall attend all sessions and shall add to each session any special information relating to the details of installation of the equipment as it might impact the operation and maintenance.

XIII. The installing contractor shall assist in the coordination of yearly testing, calibrating, and servicing as specified in the contract documents.

END OF SECTION

1. All instrumentation and control systems and devices for plumbing systems shall be integrated into, and meet all requirements of, the building automation system and the campus SCADA system specifications, as described in Instrumentation and Control for HVAC (23 09 00) and Integrated Automation (25 00 00).

END OF SECTION

1. This section is intended to define the general installation requirements for the numerous plumbing piping systems installed at Temple University. Codes which govern the actual sizing and installation of piping should be used during the design process. Welding shall conform to current standards and recommendations of the National Certified Pipe Welding Bureau and all OSHA, State and City fire protection, NFPA Standard 241, American Welding Society, ASTM, and the University's Office of Fire and Safety requirements.
2. Pipe and fittings shall be specified to meet one of the numerous industry standards such as ANSI, ASTM, AWWA, etc. and shall be suitable for the operating temperatures and pressures to be encountered on the project. Pipe stress analysis shall be provided when deemed necessary by the University Representative or the Project Engineer.
3. Piping and conduits shall be designed to run parallel with the lines of the building. Electrical conduits shall not be hung on hangers with any other service pipes. The different service pipes, valves, and fittings shall be installed so that after the covering is applied, there will not be less than 4 inches clear space between the finished covering and other work and between the finished covering or parallel adjacent pipes. Hangers on different service lines, running parallel with each other and nearly together shall be in line with each other and parallel to the lines of the building.
4. The minimum pipe shall be ¾ inch for plumbing systems. Size reductions may only occur immediately adjacent to equipment connections. Valves and specialties serving equipment shall be full pipe size, not the reduced equipment connection size.
5. Piping shall be designed and installed without undue stress or strain and run parallel to the lines of the building, except to grade them as specified in a neat and workmanlike manner using a minimum of fittings. Fittings, valves, and accessories shall be designed as may be required to meet the conditions of installation and accommodate service. Piping shall be designed to suit the necessities of clearance with ducts, conduits, and other work and so as not to interfere with any passages or doorways and allow sufficient headroom at all places. Install piping in a manner that will preserve access to valves and accessories.
6. Gas-piping systems and other hazardous services shall be designed in strict compliance with all applicable codes and NFPA requirements.
7. Plumbing system vents, relief valves, rupture disc, etc., shall be piped safely outdoors. Overflow pipes, system drains, and relief devices shall be piped to suitable drainage facilities facility locations and indirectly connected. Certain pieces of equipment may have high discharge rates that can quickly result in flooding; drains, sumps, or other receiving devices must be sized sufficiently and have the storage volume required.
8. Unions and flanges on each side of all pieces of equipment and other similar items shall be designed in such a manner that they can be readily disconnected. Unions and flanges shall not be placed in a location which will be inaccessible after completion of the project.
9. The project engineer shall specify testing, and flushing, disinfection, balancing and purging procedures for each piping service installed on the project. Test procedures shall include all items required by code and be sufficient to prove all systems tight at conditions which exceed the maximum design conditions. Water sampling to establish a treatment plan, pipeline sterilization, positive pressure, and vacuum testing must be included as part of the procedures.
10. All piping systems shall be designed to meet seismic codes.

11. All piping and drain lines are to be installed to avoid tripping hazards in public or work areas.
12. Underground piping shall comply with the following:
    A. All underground utility work on Temple University property must be approved by the Director of Utilities & Energy Management.
    B. Laboratory waste within buildings shall be a separate system through the building wall.
    C. The Design Professional shall coordinate the termination of services with the Utility Companies and project the costs of extending services to any new buildings or projects.
    D. Critical Utilities: On a project by project basis, the Design Professional and the University shall determine which utilities are critical to support the project during a utility failure. Consideration shall be given to multiple sources or utility connections to critical functions.
    E. Provide isolation valves outside buildings in non-traffic areas, pedestrian or vehicle, as near to the main utility connection and inside buildings before any branch connections or devices.
13. Plumbing pipe and fittings for all buildings shall be as defined as follows:
    A. Hot & Cold Domestic Water Service - (includes domestic cold water, domestic hot water, domestic hot water recirculation, tempered water, laboratory hot water, laboratory cold water, laboratory hot water recirculation, drinking water, and animal drinking water);
        I. Aboveground;
            (a) Pipe: Seamless hard copper water tube, ASTM B88, Type L.
            (b) Fittings: Wrought copper solder joint fittings, ASME/ANSI B16.22, ASTM B-4 for threaded-end copper pipe nipples.
            (c) Joints: Soldered, lead-free, ASTM B32, 95% tin, 5% antimony
        II. Underground (2-1/2 in. and smaller);
            (a) Pipe: Seamless hard copper water tube, ASTM B88, Type K.
            (b) Fittings: Wrought copper solder joint fittings, ASME/ANSI B16.22, ASTM B4 for threaded-end copper pipe nipples.
            (c) Joints: Soldered, lead-free, ASTM B32, 95% tin, 5% antimony
        III. Underground (3 in. and larger);
            (a) Pipe: Ductile iron pressure pipe, outside-coated, cement mortar-lined, AWWA C104/A 21.4.
            (b) Fittings: Ductile iron pressure fittings, AWWA C110/A 21.10.
            (c) Joints: Mechanical joint, rubber gasket, for ductile iron pressure pipe, AWWA C110/A 21.11.
    B. Laboratory Water - (Includes softened, distilled. deionized, and reverse-osmosis supply & return water)
        I. Pipe, Fittings, and Joints: As required by water quality and program requirements.

C. Sanitary Drainage - (Includes domestic sanitary drainage & venting, storm water/clear water drainage and venting, water fountain drains, and equipment condensate drains);

I. Underground:

(a) Pipe: Cast iron soil pipe, hub & spigot, ASTM A74.

(b) Fittings: Cast iron hub & spigot fittings, ASTM A74.

(c) Joints: Packing (oakum) with molten lead filled hub.

II. Aboveground:

(a) Pipe: Seamless hard copper water tube, ASTM B88, Type L (**Preferred**).

(b) Pipe, (Urinal Drains): Seamless hard copper water tube, ASTM B88, Type K or 2 in. cast iron soil pipe, ASTM A888, with no-hub joints (utilizing extra-heavy clamps), ASTM C564.

(c) Pipe: Seamless hard copper drainage tube, ASTM B306, Type DWV.

(d) Fittings: Wrought copper solder joint fittings, ASME/ANSI B16.22, ASTM B-4 for threaded-end copper pipe nipples (**Preferred**).

(e) Fittings: Cast and wrought copper drainage fittings ANSI/ASME B16.23, ANSI/ASME B16.29 or ANSI/ASME B16.32

(f) Joints: Soldered, ASTM B32, 95% tin, 5% antimony

D. Laboratory Drainage - (Includes laboratory, photo processing, and biohazard drainage and venting);

I. Underground;

(a) Pipe: Corrosion-resistant high silicone iron, hub & spigot, ASTM A518.

(b) Fittings: Corrosion-resistant high silicone iron hub & spigot fittings, ASTM A518, Grade 1.

(c) Joints: Acid-resistant packing (white oakum) with molten lead filled hub.

II. Aboveground;

(a) Pipe: Flame-retardant polypropylene, Schedule 40, ASTM D4101.

(b) Fittings: Electrofusion or socket-fusion joint, fire-retardant polypropylene acid-resistant drainage fittings, ASTM D4101. All joints are to be made with heat tools that will produce a hermetically sealed joint. The joints will conform to ASTM 1290, Technique I.

(c) Joints: All joints are to be made with heat tools that will produce a hermetically sealed joint. Joints and joining procedures will conform to ASTM 2657, Technique I.

(d) Manufacturer: Watts ORION Rionfuse.

E. Laboratory Gasses & Vacuum - (Includes Oxygen [O], Nitrogen [N], Nitrous Oxide [NO], Carbon Dioxide [CO], Helium [H], compressed air, natural gas in laboratories, gas evacuation, and vacuum);

I. Pipe: Seamless hard copper water tube, ASTM B88, Type K.

II. Fittings: Wrought copper solder joint fittings, ASME/ANSI B16.22, ASTM B687 for threaded-end copper pipe nipples.

III. Joints: Brazed, AWS A5.8 BcuP (brazing-copper-phosphorus) series greater than 538°C melting temperature, cadmium-free filler, flux prohibited.

END OF SECTION

1. Water-hammer arrestors shall be provided to control and absorb hydrostatic shock pressure of the piping system. Arrestors shall conform to American Society of Sanitary Engineers (ASSE) 1010 and be sized in accordance with Plumbing and Drainage Institute (PDI) WH-201. Field-manufactured water hammer arrestors or air chambers are not acceptable. Water-hammer arrestors shall be equal to Jay R. Smith Series 5000.
2. Provide hose bibs on the exterior of all buildings. A minimum of one (1) bib shall be installed on each building face and the maximum distance between bibs shall not exceed 100 ft. The hose bibs shall be of the non-freeze type housed in a lockable wall box.
3. Washing machine connections shall be wall box assembly containing water supply and drain connections. Include water supply line and single control valve with lever handle.
4. Vending machine and mechanical equipment connections shall be provided with cold water supply piping equipped with isolation valves and reduced pressure-type backflow preventers.
5. Dielectric unions are **prohibited**. On the larger carbon steel (3 in.) to copper connections use grooved-end dielectric waterways. In the smaller applications, use threaded by grooved-end dielectric waterways.
6. Thermostatic Mixing (Temperature Control) Valves:
    A. Provide for the Domestic Hot Water System, and any Tempered Water Systems, and for domestic water supply to the Laboratory Purified Water Systems. Manufacturer shall be Leonard.
    B. Provide valve with swivel-action check stops, removable cartridge with strainer, wall-mounted type dial thermometer, and standard rough chrome finish.
    C. Provide check valve on cold water inlet to mixing valve when mixing valve is not furnished with integral check valve.
7. Wall Hydrants
    A. Provide wall hydrants with built-in vacuum breaker on the exterior of all buildings. A minimum of one (1) hydrant shall be installed on each building face and the maximum distance between hydrants shall not exceed 100 feet. The wall hydrants shall be non-freeze type housed in a lockable wall box, Zurn Model Z1305-VB, or approved equal.
8. Wall-Mounted Hose Station for Domestic Hot and Cold Water Service
    A. Unit shall be supplied with a domestic hot and cold water thermostatic mixing valve, bimetal thermostat, temperature-adjusting handle, and color-coded heat- resistant handles. Inlets shall be provided with unions. Outlet shall be provided with dial thermometer having a range of 20 to 180 degrees F, vacuum breaker, and hose connection. Degrees in Celsius and Fahrenheit shall be shown on thermometer. Hose rack shall be stainless steel.
    B. Unit shall have concealed cabinet for recessed installation, body of No. 16 gauge stainless steel, door and flange of No. 12 gauge stainless steel, No. 4 finish. Door shall be provided with piano hinge on left side of door, cylinder lock and top inlets. Cabinet shall be factory assembled as a unit.

C. Hose shall be 3/4 inch 2-braid heavy-duty hose, SBR high-temperature resistant (290 degrees F at 50 psig) with Nitrile-PVC cover. Length determined on a project by project basis.

D. Hose nozzles shall be adjustable spray, with self-closing automatic shut-off, and heavy-duty rubber cover.

E. Where required, retractable hose reel and spray shall be supplied with a heavy-duty, 35 foot hose of 3/8 inch I.D., with adjustable hose bumper, open reel, and no cover, and spray nozzle with heat-resistant handle.

9. Backflow Preventers

A. All domestic water services must be provided with a backflow prevention device of a type and in a location in accordance with the currently-adopted edition of the International Plumbing Code.

B. The basis of design manufacturer shall be Watts or Conbraco.

C. The basis of design configuration shall include two full-size backflow preventers installed in parallel to permit continuous, uninterrupted water service during testing and maintenance.

D. Each assembly shall be provided with FM-approved epoxy-coated flanged OS&Y gate valves.

E. A sanitary drain shall be provided directly below the assemblies for relief valve discharge.

F. Backflow Preventers (Reduced-Pressure Zone and Double Check Valve Types) shall have iron body, stainless steel internal parts, and double-seated first check valve. Backflow preventer shall conform to ASSE 1013 for reduced-pressure zone principle. For sizes up to 2 inches, provide union connections. For sizes 2 1/2 to 6 inches, provide flanged connections. Backflow preventers shall be provided with test cocks. Provisions must be made to accept full drain discharge. If at all possible locate backflow preventer above grade to allow discharge above ground.

G. Double Check Valve Type shall be used in minimum hazard fire protection applications and shall have bronze body, stainless steel internal parts, and double check valve assembly. Backflow preventer shall conform to ASSE 1015. For sizes up to 2 inches, pro- vide union connections. Furnish backflow preventers with test cocks.

H. Backflow Preventers (Atmospheric Type) shall have brass body and a rubber-to-rubber seating design with male threads at one end and female threads on opposite end. Backflow preventers shall be suitable for hose bibbs and wall hydrants, and shall conform to ANSI/ASSE 1011.

10. Relief Valves

A. Pressure-relief valves shall have bronze body, carbon steel spring, and shall be set at a maxi- mum of 90 psig and be installed on all equipment for heating or storage of hot water.

B. Vacuum-Relief Valves shall be installed on all equipment used for storage and shall have brass body with heating-resisting disc and male inlet connection. Unless otherwise required by the specific application, valves shall have a maximum water working pressure of 200 psi and a maximum operating temperature of 250 degrees F. Approved manufactures are Sarco or approved equal.

11. Pressure Reducing Valves

    A. Water Pressure-Reducing Valves shall be installed when street main pressure exceeds 80 pounds per square inch and shall conform to ASSE 1003.

    B. For pipe sizes 1/2 to 6 inches use a diaphragm-actuated valve with bonze or stainless steel body, stainless steel spring, rubber disc, renewable stainless steel seat, and threaded ends.

    C. For pipe sizes 3 to 4 inches use a diaphragm-actuated valve with iron body, stainless steel spring, stainless steel stem, rubber disc, renewable stainless steel seat, and flanged ends.

    D. For pipe sizes 6 inches and larger use a diaphragm-actuated, pilot-controlled modulating globe valve with stainless steel body and bonnet, stainless steel stem, cast bronze seat ring, cast bronze pilot body, and flanged ends. Valve and pilot shall be factory assembled, including all control line tubing.

    E. Manufacturer: Watts or Cla-Val.

12. Drain Pans

    A. Drain pans shall be continuous watertight galvanized steel construction and installed under piping for the protection of computers, computer components and other electrical equipment. Pans shall be located directly below drainage piping, below hot and cold water supply piping and other piping. The minimum dimensions of the pan shall be 1 foot 6 inches wide with a 6 inch high wall. A drain connection shall be provided and shall be piped to the equipment room floor or to a floor drain.

END OF SECTION

1. All soil and waste piping belowground shall be service weight cast iron conforming to ASTM A74. Joints shall be lead and oakum type.
2. All soil and waste piping aboveground shall be service weight cast iron conforming to ASTM A-888. Joints shall be no-hub type.
3. Individual lavatory and indirect waste piping may be Type DWV copper between the fixture and horizontal branch main when such piping is located above grade; however, Type L copper tubing with wrought copper pressure fittings are preferred. Shower piping should be not less than 2-inch from drain to riser.
4. Urinal drains shall be 2-inch, Type K copper tubing with wrought copper pressure fittings or cast iron soil pipe with No-Hub fittings separately connected to the stack.
5. All systems shall be provided with cleanouts where the sanitary or waste main change direction and in all straight mains on a maximum spacing of 75 ft. Provide access covers in finished areas.
6. The Design Professional, Construction Manager, and all Contractors involved in the work affecting floor and area drains shall ensure that the floors are properly slopped towards the floor and area drains in mechanical rooms, restrooms, areaways, etc. Floors found to be insufficiently sloped will be required to be replaced with no expense, project delay, or program disruptions to Temple University.
7. The Design Professional shall design the sanitary system with wall cleanouts in restroom areas. Floor cleanouts are **prohibited**.

END OF SECTION

1. Drain Traps

   A. Provide separate traps for drains not equipped with integral traps

2. Trap Primers

   A. Provide trap primers conforming to ANSI/ASSE 1018.

   B. Single Trap Primers: Cast bronze with 1/2 inch NPT female connections.

   C. Multiple Trap Primers: With distribution units.

   D. When required provide trap primers with time clock equipped with 24-hour dial with replaceable trippers suitable for 120 V, 60 Hz operation. Interval timer shall be base-mounted. Solenoid valve shall be all-bronze with threaded connections suitable for 120V, 60 Hz operation.

3. Interceptors

   A. Interceptors shall be used when waste discharged into a drainage system containing substances which hinder sewage disposal, such as non-soluble, flammable, or hazardous substances.

   B. Solids interceptors shall have cast iron body, including bolted and gasketed watertight cover, removable inlet baffle, removable sediment basket with bronze screens, and 2 inch IPS threaded female inlet and outlet connections.

   C. Oil interceptors shall have steel body with acid-resistant rubber base coating applied in-side and outside including baffle plates, draw-off connections, double wall trap seal, air relief bypass, countersunk clean-out plug, sediment basket, scoriated non-skid neoprene gasketed cover, IPS threaded female inlet and outlet connections, two IPS vent connections and lift rings.

4. Grease Interceptors

   A. Grease interceptors shall be floor-mounted, semi-recessed or flush-to-finished floor having cast iron body with anchor flange, and acid-resistant rubber base coating or porcelain enamel applied inside and outside.

   B. Inceptors shall be installed with monitoring equipment that notifies occupants when the inceptor needs servicing.

   C. Inceptors shall be located as close as possible to the source.

   D. Serviceability and access by a vacuum truck to the unit shall be considered a top priority by the AE team.

   E. A placard in the area must describe the service requirements of the unit.

5. Test Tees

   A. Test tees shall be provided with screwed plug at the base of each soil, waste and vent stack, including interior rainwater conductors, and on every third floor in multi-storied buildings in accordance with the requirements of the currently-adopted edition of the International Plumbing Code.

6. Backwater Valves

   A. Backwater valves shall be installed where plumbing fixtures are subject to backflow from public sewers and shall have a cast iron body with hub and spigot connections, bronze flapper-type backwater valve, and ferrule and plug threaded access cover.

7. Electric Flush Valves and Control Panels for Flushing Drains and Large Animal Room Trenches

   A. Provide concealed flush valve, rough brass, 1 inch IPS wheel handle back check angle stop, adjustable tailpiece, vacuum breaker, 1 inch female IPS union outlet (no flush connection), with 24 V ac solenoid operator and electric pushbutton (remotely located). Ex- posed parts shall be chrome-plated.

   B. Electric pushbuttons for each room shall be grouped together in a stainless steel control panel. Panel shall be furnished with prewired momentary contacts and 120 V/24 V AC.

END OF SECTION

1. Air compressors are to be a reciprocating compressor type with oil less airside.
2. Provide air dryers, air filters and coalescing filters as required per project.
3. Approved manufacturer are Atlas Copco, Gardner Denver, Ingersoll Rand, and Quincy.

END OF SECTION

1. Electric type water heaters are to be used when natural gas is not available or as point of use, i.e. Kitchenette. Approved manufacturer are Bradford White Corporation, AO Smith Corporation and Rheem Manufacturing Company.
2. Storage tank construction to be glass lined steel tank, electric storage type, less than 120 gallon capacity.
3. Heater components to be included but not limited to the following:
   A. Extruded magnesium anode.
   B. ASME-rated, bronze temperature and pressure relief valve.
   C. Drain valve.
   D. Inlet and outlet piping connections.
   E. High density glass fiber insulation meeting criteria for heat loss efficiency.
   F. Steel jacket with baked enamel finish.
   G. Fused on alkaline borosilicate composition glass lining.
   H. Temperature Control Limit Switch with manual reset if temperature reaches 190°F.
   I. Hinged compartment housing.
   J. Control circuit transformer.
   K. Transformer fusing.
   L. Magnetic contactors.
   M. Immersion style operating thermostat.
   N. Element fusing.
   O. Medium watt density, commercial grade, Incoloy sheathed flange mounted elements with pre-wired terminal leads.

END OF SECTION

1. The Design Professional is responsible for identifying and documenting what natural gas pressure and pipe main is locally available at the building with PGW. This information shall be used for determining overall equipment load and pipe sizing. No equipment is to be selected below 4.5 in. w.g., which is PGW's minimum guaranteed system supply.
2. Storage water heaters and instantaneous water heaters if all the following are not exceeded:
    A. A heat input of 200,000 BTU/HR (58.6 kW).
    B. A water temperature of 210°F (99ºC).
    C. A nominal water-containing capacity of 120 gallons (454 L).
    D. Approved manufacturers are Bradford White Corporation, A.O. Smith Corporation, and Rheem Manufacturing Company.
3. Storage water heaters and instantaneous water heaters that exceed the design criteria listed Paragraph 2 above:
    A. Approved manufacturers are Bradford White Corporation, Lochinvar LLC, A.O. Smith Corporation, Rheem Manufacturing Company, and RBI.
4. All heaters, and installation thereof, falling under Paragraph 2, shall be equipped with ANSI/ASME CSD-1 controls and comply with the Pennsylvania Department of Labor & Industry Boiler and Unfired Pressure Vessel Regulations, Title 34, Part I, Chapter 3a.
5. Storage tank construction to be gas fired, glass lined steel tank, storage type, less than 120 gallon capacity.
6. Heater components to be included but not limited to the following:
    A. Gas fired burner:
        I. Automatic gas pilot assembly, pilot valve and gas pilot pressure reducing valve.
        II. Manual gas cock.
        III. Hydraulic motorized gas valve.
        IV. Gas pressure reducing valve.
        V. Flame safeguard
    B. Fused-on alkaline borosilicate composition glass lining.
    C. ASME-rated steel tank on channel steel skid.
    D. High density glass fiber insulation meeting criteria for heat loss efficiency.
    E. Steel jacket with baked enamel finish.
    F. Extruded magnesium anodes.
    G. Flame inspection port.
    H. Handhold cleanouts.
    I. Inlet and outlet piping connections.
    J. Drain valve.

K. ASME-rated, bronze temperature and pressure relief valve.

L. Hinged control compartment housing.

M. High temperature limit control with manual reset.

N. Upper and lower thermostats.

O. Combination temperature and pressure gauge.

P. Low water cutoff.

Q. Draft regulator.

7. Contractor is responsible for requiring a variance from the Commonwealth of Pennsylvania along with any other requirements for Unfired Pressure vessels installations. Unfired pressure vessels will not satisfy the code clearance requirements (minimum of 18 inches in front, at rear and on both sides, and 30 inch in front of manhole cover. FM Global will inspect the vessel installation upon completion.

END OF SECTION

1. U-tube, heating-fluid-in-coil, heat exchangers shall be used in all steam to domestic hot water applications.
2. All heat exchangers shall be constructed in accordance with the ASME Boiler & Pressure Vessel Code, bear the ASME "U" Stamp and be registered with the National Board of Boiler and Pressure Vessel Inspectors.
3. All heat exchangers shall be rated for 150 PSIG operating pressure at 300°F or 300 PSIG if operating steam pressure is greater than 15 PSIG.
4. Steam heat exchangers are to be fitted with a vacuum breaker.
5. Automatic control valves for heat exchangers are to be normally closed.
6. All nozzles shall be ANSI Class 150 or ANSI Class 300 if the operating steam pressure is greater than 15 PSIG.
7. U-tube heat exchangers shall be constructed as follows:
    A. Shell: 316 stainless steel.
    B. Tubes: ¾ in. O.D., 316 stainless steel or cupronickel (Cu-Ni), with a maximum tube velocity of 7.5 feet per second.
    C. Heads: 316 stainless steel or cupronickel (Cu-Ni).
    D. Tube sheets: 316 stainless steel or cupronickel (Cu-Ni).
    E. Tube supports: 316 stainless steel or cupronickel (Cu-Ni).
    F. Tappings: Factory-fabricated of materials compatible with the heat exchanger shell. Attach tappings to shell before testing and labeling.
        I. 2 in. NPS and Smaller: Threaded ends according to ASME B1.20.1.
        II. 2-1/2 in. NPS and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.
    G. Relief Valves: ASME-rated and stamped for combination temperature-and-pressure relief valves. Include one or more relief valves with total relieving capacity in compliance with the ASME Boiler & Pressure Vessel Code.
    H. Minimum scale factor - 0.002 ft^2-hr-°F/BTU.
    I. Maximum water side pressure drop - 12 feet of water.
    J. Temperature Controls: Automatic control valves for heat exchangers are to be normally closed. See 23 09 00 for controls.
    K. All systems shall be designed to assure adequate service and maintenance clearances for tube bundle removal/installation.

END OF SECTION

1. Commercial plumbing fixtures shall comply with Temple University Toilet Room Standards Drawing A001.
2. The number and types of plumbing fixtures shall be based on the minimum Code requirements. The breakdown of male and female population is generally assumed to be a 50/50 percent split.
3. Similar plumbing fixtures installed within a building shall be of one (1) manufacturer to reduce stocking costs of replacement parts.
4. Selection of fixtures, trim, and hardware shall be approved by the Temple University Facilities & Operations Department. See Temple University Toilet Room Standards Drawing A001.
5. Control-stop valves shall be provided in each supply to each fixture. The finish of fittings, accessories, and supplies exposed to view shall be chromium-plated.
6. All piping serving ADA sinks/lavatories are to be fitted with antimicrobial molded under-sink safety covers. The covers shall be Trubro, model Lav Guard 2 Model 103 E-Z.

END OF SECTION

1. Water closets and urinals shall comply with Temple University Toilet Room Standards Drawing A001.
2. Basis of Design:
   A. Wall-Mounted Water Closet Fixture (ADA and non-ADA): Kohler Kingston Model K-4325-0
   B. Floor-Mounted Water Closet (non-ADA): Kohler Wellcomme K-96053-0
   C. Floor-Mounted Water Closet (ADA): Kohler Highcliff K-96057-0
   D. Wall-Mounted Urinal Fixture (ADA and non-ADA): Kohler Bardon Model K-4991-ET
   E. Limited-Space Urinal Fixture: Kohler Dexter Model K-5452-ET
3. Water closets shall be provided with Bemis Model B1655SSCT000 elongated, open-front, seat with stainless steel self-sustaining check hinge.

END OF SECTION

1. Lavatories shall comply with Temple University Toilet Room Standards Drawing A001.
2. Basis of Design:
   A. Wall-Mounted Lavatory (ADA and non-ADA): Kohler Kingston Model K-2006
   B. Wall-Mounted ADA Lavatory: Kohler Morningside Model K-12634
   C. Counter-Mounted Drop-In Lavatory: Kohler Ellington Model K-2906-4
   D. Mop Sink: Zurn Model Z1996-36-AW
   E. Service Sink: Zurn Model 5880
3. University does have existing floor mounted water closets in various facilities. Replacement water closets are to be Kohler-brand and style is to match existing.
4. Accessible piping within base cabinets shall be chrome-plated and equipped with metal stop valves having waste cups.
5. Approved manufacturer for plumbing fixture carriers are Jay R. Smith and Zurn.

END OF SECTION

1. Plastic bathtubs units shall be white with slip-resistant bathing surfaces and three walls integrally molded in one piece or made in sections. Provided with brass body drains with nickel bronze perforated grid strainers and 2 inch adjustable P-trap and pressure balance mixing valve with single handle, volume control showerhead, adjustable high temperature limit stop, and diverter tub spout.

END OF SECTION

1. Shower heads shall be water conserving type (1.5 GPM), Zurn Model Z7000-S9.
2. Shower Valves: MOEN Commercial Bath Mixing Valve, pressure-balancing valve with 1/4 turn stops, Posi-Temp #62370 (CC), Single handle pressure balance monitor with scald- guard valve; ADA shower with trim kit - Moen Chateau Posi-Temp model #TL182.

END OF SECTION

1. Basis of Design:
   A. Lavatories, Single-Hole: Sloan EAF200-P-ISM CP
   B. Lavatories, 4 in. Center-Set: Sloan ETF600-B-BDT CP, Sloan ETF600-B-LT-BDT
   C. Lavatories, Gooseneck: Sloan Optima Model ETF700-LT CP
   D. Service & Mop Sink, Wall-Mounted: Zurn Model Z843M4-XL
2. Electronic faucets shall be supplied with Sloan Model EL-248-40 box-mount transformers. Limit (2) faucets per transformer. Transformers shall be enclosed in a UL-listed NEMA 4 enclosure.
3. Where hands-free lavatory faucets are specified, fixtures shall be centrally wired automatic faucets. At least one lavatory in all public restrooms shall be equipped with a manual faucet by Sloan.
4. All faucets for laboratories and miscellaneous locations shall be manufactured by Sloan.

END OF SECTION

1. Basis of Design:
   A. Water Closet Flush Valve: Sloan Royal Optima Model ROYAL 111-1.28 ES-S TMO
   B. Urinal Flush Valve: Sloan Royal Optima Model ROYAL 186-0.125 ES-S TMO HEU
2. Electronic flushometers shall be supplied with Sloan Model EL-154 box-mount transformers. Limit (2) flushometers per transformer. Transformers shall be enclosed in a UL-listed NEMA 4 enclosure.

END OF SECTION

1. Scope:

   A. This section presents the minimum performance requirements for eyewash and shower equipment for the emergency treatment of the eyes or body of a person exposed to injurious materials. It covers the following types of equipment: emergency showers, eyewash equipment, and combination shower and eyewash or eye/face wash.

   B. All eyewash and deluge showers must comply with ANSI Z 358.1.

   C. A plumbed eyewash shall be provided for all work areas where, during normal operations or foreseeable emergencies, the eyes of an employee may come into contact with a substance which can cause corrosion, severe irritation, or is toxic by skin absorption. Drench hoses, sink faucets, or showers are not acceptable eyewash facilities.

   D. A plumbed eyewash shall be provided at all work areas where formaldehyde solutions in concentrations greater than or equal to 0.1% are handled.

   E. An emergency shower shall be provided for all work areas where, during normal operations or foreseeable emergencies, areas of the body may come into contact with a substance which is corrosive, severely irritating to the skin or is toxic by skin absorption.

   F. A deluge shower shall be provided at all work areas where formaldehyde solutions in concentrations greater than or equal to 1% are handled.

   G. Laboratory safety equipment (eyewashes and emergency showers) shall be supplied with TEPID water, 60-100 ° F.

2. General Location:

   A. Emergency eyewash facilities and deluge showers shall be in unobstructed and accessible locations that require no more than 10 seconds or 25 feet for the injured person to reach along an unobstructed pathway (i.e., no doors without panic bars or which don't swing open when pushed). If both eyewash and shower are needed, they shall be located so that both can be used at the same time by one person.

   B. American with Disabilities Act (ADA) Emergency Eyewash/Showers: Install an emergency eyewash/shower so that a disabled person can access it within 10 seconds of an ADA fume hood (minimally one ADA hood per laboratory floor). These emergency eyewash/showers must provide appropriate accessibility (e.g., activation of controls and height of eyecups) to individuals in wheelchairs.

3. Signage:

   A. Emergency eyewash and shower locations shall be identified with a highly visible sign. The areas around the eyewash or shower shall be well lighted and highly visible.

   B. Whenever possible, the floor immediately beneath the eyewash and emergency shower, and to a radius of between about 12-30 inches, shall be a distinctive pattern and color to facilitate promoting a clear path of access.

4. Prohibitions Around Equipment:

   A. No obstructions, protrusions, or sharp objects shall be located within 16 inches from the center of the spray pattern of the emergency shower facility.

B. Electrical apparatus, telephones, thermostats, or power outlets should not be located within 18 inches of either side of the emergency shower or emergency eyewash facility (i.e., a 36-inch clearance zone).

END OF SECTION

1. Deluge Shower Positioning:
   A. The emergency shower location must have a level surface beneath the shower head.
   B. Emergency shower heads shall be designed so that a flushing fluid column is provided that is not less than 82 inches and not more than 96 inches in height from the surface on which the user stands.
   C. The shower head should not be mounted flush or recessed within any constructed surfaces or partitions and the center of the spray pattern shall be located at least 16 inches from any obstruction.
   D. The spray pattern shall have a minimum diameter of 20 inches at 60 inches above the surface on which the user stands
2. Flushing Rates:
   A. Emergency shower heads shall be capable of delivering a minimum of 75.7 liters per minute (20 GPM) of flushing fluid.
   B. The shower should be attached to a flushing fluid supply from a 1-inch minimum iron pipe size (IPS).
3. Equipment Activation:
   A. The valve shall be designed so that the flushing fluid remains on without requiring the use of the operator's hands. The valve shall be designed to remain activated until intentionally shut off.
   B. The manual actuator, triangle pull, shall be located not more than 69 inches above the surface on which the user stands. The manual actuator shall be free from obstruction for 18 to 24 inches in all directions. The actuator shall not be mounted flush or recessed within any constructed surfaces or partitions.
4. Design for Maintenance/Use:
   A. The water supply to showers and/or shower/eyewash combination units should be controlled by a ball-type shutoff valve which is visible and accessible to shower testing personnel in the event of leaking or failed shower head valves.
   B. Any floor drain which may be in service during safety shower use shall be installed with a temporary plug which remains closed except when the shower is in use, or if protected from spills by a covered sump or berm system.
5. Testing:
   A. Proper operation of the equipment must be demonstrated by the contractor installing the emergency eyewash or shower equipment prior to project closeout and facility occupation. Tags to allow monthly testing records to be kept shall be affixed to the showers and eyewash fountains.
6. Approved Equipment:
   A. All emergency showers and eyewash facilities shall meet the requirements of ANSI Z358.1 and shall be installed in accordance with ANSI Z358.1.

END OF SECTION

1. Flushing Rates

   A. A means shall be provided to ensure that a controlled flow of flushing fluid is provided to both eyes simultaneously.

   B. Eyewash equipment shall be capable of delivering to the eyes not less than 0.4 gallons per minute of flushing fluid for 15 minutes.

2. Eyewash Positioning

   A. The eyewash unit shall be positioned with the water nozzles 33-45 inches from the floor and 6 inches minimum from the wall or nearest obstruction. The unit must be located at an operable sink.

3. Equipment Activation

   A. The valve shall be designed so that the flushing fluid remains on without requiring the use of the operator's hands. The valve shall be designed to remain activated until intentionally shut off.

4. Eyewash Equipment Protection

   A. Nozzles shall be protected from airborne contaminants. The removal of the nozzle protection shall not require a separate motion by the operator when activating the unit.

END OF SECTION

1. Water coolers to be a combination bottle fill and bubbler type;
    A. Wall-Mounted;
        I. Single: Halsey Taylor Model HTHB-HACG8PV-WF
        II. Double: Halsey Taylor Model HTHB-HACG8BLPV-WF
    B. Recessed-Mounted:
        I. Single: Halsey Taylor Model HTHBWF-OVLER-I
        II. Double: Halsey Taylor Model HTHBWF-OVLSER-I
2. Where water coolers are required without bottle-filling stations;
    A. Wall-Mounted;
        I. Single: Halsey Taylor Model HACG8PV-WF
        II. Double: Halsey Taylor Model HACG8BLPV-WF
    B. Recessed-Mounted:
        I. Single: Halsey Taylor Model OVLERGRN-VRWF
        II. Double: Halsey Taylor Model OVLSERGRN-VRWF

END OF SECTION

1. All new and renovated laboratory compressed-air systems shall be designed, installed, tested/certified in strict accordance with the currently-adopted edition(s) of the International Building Codes. Coordinate project specification with Temple University Facilities & Operations and Environmental Health and Radiation Safety Departments in regards to project requirements.

2. A compressed air system shall be provided to supply laboratory outlets, outlets in mechanical equipment rooms and equipment requiring this service. Oil-free Grade D compressed air shall be distributed throughout the facility at 100 psig. Branches to equipment will be provided with pressure regulators to reduce system pressure as required for specific equipment. A maximum pressure of 35 psig will be supplied to laboratory outlets.

3. Compressed air shall be dried to 35 degrees F or minus 40 degrees C dew-point prior to distribution. The distribution system shall be designed based on one (1) SCFM per outlet, with diversity (based on intended use) factors applied based on the number of outlets, plus actual demands of equipment requiring this service. Diversity factors are as follows:

COMPRESSED AIR SYSTEM DIVERSITY FACTORS		
Number of Outlets	Use Factor - Percent	Minimum Outlets
1-2	100	---
3-12	80	3
13-38	60	10
39-115	40	25
116-316	30	50
317-700	20	95

4. Installed equipment shall provide for a minimum of 67 percent system capacity upon the failure of any single compressor or drier.

5. Air compressors shall be oil free air cooled.

6. Air shall be filtered centrally to 5 microns with additional branch or point of use filtration where necessary. Redundant filtration devices shall be provided for on-line maintenance.

7. All compressed-air piping shall be labeled in accordance with OSHA and ASME A13.1.

8. System shall be tested and certified in accordance with International, National, and local code requirements.

END OF SECTION

1. All new and renovated laboratory vacuum systems shall be designed, installed, tested/certified in strict accordance with the currently-adopted edition(s) of the International Building Codes. Coordinate project specification with Temple University Facilities & Operations and Environmental Health and Radiation Safety Departments in regards to project requirements.

2. Vacuum shall be provided at a minimum of 25 in Hg at the furthest inlet (to be confirmed with users group). System shall be designed based on one (1) SCFM per inlet. Diversity factors shall be applied based on the maximum number of inlets. Diversity factors are as follows:

LABORATORY VACUUM SYSTEM DIVERSITY FACTORS		
Number of Inlets	Use Factor - Percent	Minimum Inlets
1-5	100	---
6-12	80	5
13-33	60	10
34-80	50	21
81-150	40	40
151-315	35	61
316-565	30	111

3. Installed equipment shall provide 67 percent standby capacity upon the failure of any single vacuum pump.

4. Vacuum pumps are to be located below the area they serve, preferably in the lowest level of the building.

5. All piping shall be labeled in accordance with OSHA and ASME A13.1.

6. System shall be tested and certified in accordance with International, National, and local code requirements.

7. Approved vacuum pump manufacturers:

   A. Busch. Gardner Denver, Nash.

END OF SECTION

1. All new and renovated laboratory gas systems shall be designed, installed, tested/certified in strict accordance with the currently-adopted edition(s) of the International Building Codes. Coordinate project specification with Temple University Facilities & Operations and Environmental Health and Radiation Safety Departments in regards to project requirements.

2. All piping shall be labeled in accordance with OSHA and ASME A13.1.

3. Tubing: Seamless, Type K (ASTM B819) hard drawn copper tubing, factory oxygen cleaned, nitrogenized, capped and bagged. Where material compatibility issues between the piping and gas, suitable materials must be utilized.

4. Joints to be brazed with alloy classification BCuP5 (15 percent silver, 5 percent phosphorous, 80 percent copper), with continuous nitrogen gas purge in accordance with ASTM B32, ANSI/AWS A5.8 and Federal Specification QQ-B-654A Grade III.

5. Fittings to be wrought copper, solder cup ends, factory oxygen cleaned, nitrogenized, capped and bagged, in accordance with ANSI B16.22.

6. All gas systems shall be tested and certified in accordance with International, National, local code, and PGW requirements.

END OF SECTION

1. The Design Professional shall determine the laboratory water requirements and consult with the Temple University Facilities & Operations department prior to designing the laboratory water systems. Point-of-Use laboratory water systems are preferred.

2. Laboratory grade water conforming to ASTM standards for Type II reagent grade water shall be provided for general laboratory use.

3. Pending the review of a water sample analysis, a system utilizing pretreatment by sediment and carbon filtration, water softening (and brine tank), distillation, ion, exchange, re- verse osmosis, continuous deionization unit (CDI), or a combination thereof, followed by polishing and .45 micron membrane filters shall be provided as required to produce 1.0 meg-ohm-cm quality water as a minimum.

4. The water distribution loops shall have continuous flow. Dead legs of more than 6 pipe diameters are not permitted. Pumps shall be redundant. System shall also incorporate a storage tank and a UV light sterilizer. Resistivity shall be monitored in the return line to the storage tank. A method for system sanitization shall be provided with sample points as required to permit testing of the water. All of the water system equipment shall be located in a mechanical room. Local point-of-use laboratory polishing units shall be pro- vided if required to produce water of higher quality.

5. The piping capacity shall be based on an instantaneous demand of 0.5 GPM per lab outlet (with applied diversity factor) plus equipment demands. Pretreatment equipment capacity shall be based on 2 GPH per lab plus equipment demands.

6. Serious consideration should be given to the use of local pure water generators only with no central system.

END OF SECTION

1. General HVAC Design Considerations

<BACK

A. Types of Systems:

I. HVAC systems are highly diverse and must satisfy a large variety of program requirements. The challenge to the HVAC designer is to accurately define system operating parameters, control strategies, heat load data, utility requirements, and program equipment needs. The Design Professional must take a proactive role in the early design stages so that operating requirements and space needs are defined clearly and concisely. HVAC systems must fully support the program of requirements, utilize state-of-the-art efficient technology, and promote the health and safety of building occupants.

II. Proposed system alternatives must be evaluated fairly with consideration given to operating and maintenance costs, reliability, serviceability, flexibility, durability, redundancy, and the value of lost research in the event of system failures. The health and safety of building occupants drive the need for good indoor air quality, and all system alternatives must fully comply with the requirements of these guidelines.

III. Temple University Facilities Operations & Maintenance prefers an HVAC system design that utilizes conventional VAV boxes with terminal reheat and perimeter radiation with central station air handlers under static pressure and airflow tracking DDC control via the BAS. The air handlers shall be equipped with conventional centrifugal supply and return fans with backward-inclined airfoil blades and have their housing outlets directed at the path of air airflow. If equipped, preheat coils shall utilize propylene glycol. **Steam or hot water preheat coils are prohibited.**

IV. All HVAC equipment shall be connected to, and controlled by, the building automation system. **Pneumatic and stand-alone controls are prohibited.**

V. The building automation system (BAS) shall be integrated into the Temple University Integrated Facilities Management System (TU-IFMS). See Temple University Design Standards - Section 23 09 00 Instrumentation and Control for HVAC and Section 25 00 00 Integrated Automation for details and requirements.

VI. In addition to the requirements contained in this section, refer to the other Division 23 sections for specific equipment requirements such as acceptable manufacturers and performance criteria.

B. All-Air Systems:

I. The fan energy required for the distribution of the air can be quite significant and is dependent upon the quantity of the air, pressure drops in the conditioning equipment and ductwork, fan and drive efficiencies, and hours of operation. Although ventilation for reduction of contaminants may govern in labs, animal spaces, and special spaces, the quantity of air is usually determined by the space-sensible cooling or heating load. Consequently, reduction in the space cooling load through prudent design of the building envelope and lighting will produce a reduction in air volume and hence a reduction of the required energy consumption by the variable speed supply and return fans.

II. Air handling equipment including intake and exhaust louvers, filters, and heating and cooling coils can be optimized by selection at a conservative face velocity. Lower face velocities can be justified by life cycle cost analysis. Filter life may be improved by

reducing face velocity, permitting an economically justifiable lower final pressure drop (before replacement).

III. **Rooftop air handlers and packaged rooftop units are prohibited.** When renovation of existing buildings requires rooftop-mounted air handling equipment and there is no alternative, the air handlers shall be custom-built with access corridors (e.g.: Haakon) and be approved by Temple University Facilities Operations & Maintenance.

IV. Simpler, shorter duct systems designed with conservatively low duct velocities are consistent with energy efficiency objectives and offer acoustical benefits. High-loss fittings, such as mitered elbows, abrupt transitions, and takeoffs and internal obstructions shall be avoided. Long duct runs, if necessary, shall be designed with special consideration of pressure loss since the maximum loss for any run shall be imposed upon the entire fan system. Duct systems shall be designed at the lowest pressure possible given the physical restrictions within buildings and shall not exceed SMACMA standards.

V. The duct pressure classification to be utilized for duct construction, per SMACNA standards, shall be specified by the design professional and shall be at least equal to the total static pressure capabilities of the connected fan at its maximum operating speed and at the maximum available horsepower of the supplied motor.

VI. Ducted return air ductwork (including drops) shall be extended (at a minimum) from the return air duct shaft to approximately 2/3 of the distance to the farthest extremity of the space.

VII. **Air systems shall serve spaces having similar operating characteristics. Spaces with different periods of occupancy or substantially different ventilation requirements shall not be combined on the same system.** Dedicating air systems to specific departments provides proper grouping of spaces with similar occupancy characteristics and environmental performance requirements and simplifies the duct distribution systems.

VIII. VAV terminals or HVAC zones shall serve no more than three spaces per terminal or zone. Each space combined on a VAV terminal or HVAC zone shall have the same occupancy and (if an exterior zone) exterior exposure. Spaces with multiple exposures (i.e. – a corner office) shall not be combined on the same VAV terminal or HVAC zone with core or single-exposure spaces.

IX. Areas or spaces that require 24-hour operation, such as communications rooms, electrical rooms, data centers and other process areas, shall be provided with dedicated systems.

X. The usage of cold (ultra-low temperature) air distribution may not be considered for an energy conservation or cost saving method due to the supply temperature of the central chilled water system.

XI. The chilled water supply temperature varies based on outdoor conditions; therefore, for systems with winter loads such as data centers and telecom rooms utilizing chilled water service to provide cooling, equipment shall be sized based on a winter chilled water supply temperature of 55°F. The summer chilled water supply temperature can vary from 42°F to 45°F.

XII. A high chilled water temperature rise in the coil is required to reduce pumping horsepower and to increase the efficiency of refrigeration equipment. A minimum 15°F rise is required.

XIII. **Water coil face velocity shall not be more than 400 FPM on new installations and 450 FPM for replacement coils (maximum 8 rows). The maximum tube velocity shall not exceed 8 FPS.**

XIV. The aspect ratio (ratio of width to height) of rectangular ducts shall be minimized to reduce pressure losses and initial costs. Duct aspect ratios shall not exceed 4:1.

C. Air and Water Systems:

I. Air and water systems, when permitted, but not preferred, by the Temple University Facilities Operations & Maintenance department, are generally composed of a central ventilation system and either active chilled beams or four-pipe fan coil units. Fan coil systems shall utilize both chilled water and hot water piping to each terminal fan coil unit.

II. Controls for these systems shall be sequenced to avoid simultaneous heating and cooling with provisions for an adjustable dead band between cooling and heating modes, unless relative humidity control is essential, in which case simultaneous cooling and heating may be considered.

III. Two pipe fan coil units may be utilized to provide year-round supplemental cooling for equipment areas or other spaces with large internal heat gains and limited ventilation requirements. These fan coil units shall be sized for a 55°F entering water temperature.

IV. The central air systems will be utilized in conjunction with the fan coil units and/or chilled beams to maintain minimum ventilation rates.

V. Secondary pumps designed for the heating or cooling piping loops shall be automatically controlled to shut off when their function is unnecessary.

VI. Variable Frequency Drives (VFDs) shall be utilized on applicable fan and pumping systems with motors greater than 5 horsepower.

D. Unitary Equipment:

I. The use of unitary equipment shall be restricted to serve unique areas, such as computer rooms and support facilities, retail facilities, or as required to maintain specific environmental conditions.

E. HVAC System Noise Criteria:

I. **Duct lining is prohibited for use in supply or return duct systems.** Omission of duct lining usually requires sound attenuators in order to meet the specified Room Criteria (RC) levels shown below. The Design Professional shall confirm that any breakout noise from ductwork passing through a space does not violate the specified RC criteria. A sound analysis shall be performed to ascertain the need of terminal sound attenuators.

II. Maximum noise criteria levels to be used in the HVAC equipment and distribution design are outlined below. These noise criteria levels are based upon an unoccupied space with only the mechanical systems operating, and do not take into account any noise generated by users, animals or equipment. Readings are assumed to be taken

in the center of the room, nominally five (5) feet above the floor, unless noted otherwise.

III. Sound attenuators shall be selected for low velocities and low-pressure losses. High-velocity selection shall be avoided due to the pressure loss and internally generated noise. Sound attenuators shall be fabricated to match the construction and pressure classification of adjoining duct or casing and be constructed of incombustible materials.

IV. Filler materials used in sound attenuators on clean systems shall be inert, vermin, and moisture-proof and shall have an approved moisture and particulate lining material between perforated metal panels and sound-attenuating filler material to prevent insulation fibers from becoming airborne.

V. ANSI/ASA Standard S12.60-2010/Part 1 American National Standard Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools, Part 1: Permanent Schools" shall be used as the basis for defining goals for appropriate reverberation times and acoustical isolation of various types of spaces, such as:

(a) The following maximum reverberation times for sound pressure levels in octave bands with mid-band frequencies of 500, 1000, and 2000 Hz for core learning spaces:

(i) Enclosed volumes less than 10,000 cubic feet: 0.6 seconds.

(ii) Enclosed volumes between 10,000 and 20,000 cubic feet: 0.7 seconds.

(iii) Enclosed volumes greater than 20,000 cubic feet: no requirement.

(b) The following minimum sound transmission class (STC) ratings required for single or composite wall, floor-ceiling, and roof-ceiling assemblies that separate the core learning spaces from the following spaces:

(i) Corridor, staircase, office, or conference room: STC-45.

(ii) Other enclosed or open plan core learning space, speech clinic, health care room, and outdoors: STC-50.

(iii) Common use and public use toilet rooms: STC-53.

(iv) Music room, mechanical/electrical equipment rooms: STC-60.

VI. The current edition of the ASHRAE HVAC Applications Handbook shall be used as the basis for defining appropriate HVAC-related background sound pressure levels for various types of spaces.

(a) Sound pressure level design goals shall be defined utilizing the Room Criteria (RC) Method, which includes a quantitative value and a qualitative suffix. The "N" suffix, indicating a desired neutral quality sound, shall be the design intent. Where system installations or modifications result in an RC rating that exceeds the desired quantitative value or does not achieve a neutral quality sound, it is the responsibility of the Design Professional to revise the design or incorporate sound attenuating measures to achieve the desired goal.

(b) The following ranges of limits shall be used as the basis of design for all projects, regardless of whether the Program fails to mention acoustical

considerations (All levels are measured in the center of the room unless noted otherwise):

(i) Animal Holding Room: RC50 (N)

(ii) Animal Procedure Room: RC50 (N)

(iii) Auditorium: RC35 (N)

(iv) Classroom: RC35 (N)

(v) Conference Room: RC35 (N)

(vi) Corridors and Lobbies: RC45 (N)

(vii) Executive Dining Rooms: RC35 (N)

(viii) Gymnasiums and Natatoriums: RC50 (N)

(ix) Laboratories: RC45 (N) maximum allowable HVAC noise level as measured nominally three (3) feet from fume hoods.

(x) Laboratory Equipment Support Rooms: RC50 (N)

(xi) Libraries: RC40 (N)

(xii) Open Office: RC40 (N)

(xiii) Private Office: RC35 (N)

(xiv) Public Dining Areas: RC40 (N)

(xv) Residential Sleeping Area: RC35 (N)

(xvi) Video Teleconferencing Room: RC25 (N) (Max)

(xvii) Vivarium Support Rooms (Cagewash/Glasswash Rooms): RC65 (N)

(c) Mechanical Rooms: 80 dB(a) maximum allowable HVAC system noise level as measured from the center of the room. These criteria may not be able to be achieved in all mechanical rooms (such as chiller rooms). A program of hearing protection will need to be considered in some mechanical spaces.

F. Exterior Sound and Vibration Transmission:

I. The operation of any equipment installed on the exterior of a building or installed on inside of a building that results in the discharge of sound outside of a building shall comply with maximum permissible levels stipulated in Chapter 10-400 of the Philadelphia Code, entitled “Noise and Excessive Vibration.”

II. §10-403-(3) limits sound from non-residential properties to 5 dB above background sound level measured at the property boundary of the nearest occupied residential property and to 10 dB above background sound level measured at the property boundary of the nearest occupied non-residential property.

III. §10-403-(11) limits vibration levels to 0.15 inches per second beyond any property boundary or 30 yards from any moving source.

IV. Control of mechanical, plumbing, fire protection and electrical equipment shall be enhanced by giving attention to the proximity of the noise and vibration generating equipment to areas requiring low sound levels.

V. A post construction sound and vibration test shall be specified to prove the integrity of sound and vibration control where this is critical, and on a random sampling basis in other areas if deemed necessary. Specifications shall require that testing equipment meet the latest ASA/ANSI Standards for sound level meters. The Design Professional shall review the need for this requirement and make his/her recommendation in the Design Development phase report.

VI. An acoustical analysis shall be submitted for all major or critical equipment. The Design Professional shall define the major and critical pieces of equipment within the documents. A copy of the list shall be submitted to the University Project Manager for review. The Design Professional shall review the need for this requirement and make his/her recommendations in the Design Development phase report.

G. Plenums:

I. The use of air shafts for air distribution (supply, return, or exhaust) is not permitted. Corridors, exit passageways, stairways, and other similar spaces shall not be used as plenums or transfer air paths as defined by NFPA and the International Building Code.

II. The use of building structures as plenums shall be limited to outside air intakes. The use of return air plenum ceilings is strongly discouraged.

H. Indoor Air Quality:

I. Providing acceptable indoor air quality (IAQ) is the responsibility of the Design Professional. Typical contaminant control measures include elimination of contaminant sources, dilution ventilation, local exhaust ventilation, and air cleaning.

II. The mechanical ventilation system shall be designed to maintain relatively comfortable and odor-free indoor spaces.

III. The Design Professional shall consider the various sources of air contamination that would contribute to poor indoor air quality conditions. These sources may occur from building materials and systems, originate in outside air, and/or be from building operating and maintenance programs and procedures that may foster growth of biological organisms. These sources would include, but not be limited to, the following:

(a) Non-biological particles such as synthetic vitreous fibers, combustion nuclei, nuisance dust, etc.

(b) Bioaerosol particles including airborne viruses, bacteria, pollen, and fungus spores.

(c) Gases and Vapors that may be generated by industrial process, by emissions from building materials, furnishings, and equipment, by occupants and their activities in a space, brought in from the outdoors (e.g.: smoking and food trucks), or by entry from surrounding soil (e.g.: radon gas). Volatile Organic Compounds (VOCs) are generated by emissions from new construction materials (furniture, furnishings, wall and floor finishes, paint and adhesives).

IV. The Design Professional shall consider the following strategies (or combination thereof) that may be used to improve the indoor air quality:

(a) Elimination and control of sources: Many sources can be eliminated or minimized by substitution of materials and control measures that include careful planning; specifications; and selection, modification, and treatment of products, as well as special installation procedures. Another example of source control would be limiting or prohibiting vehicular traffic or parking in the vicinity of building outdoor air intakes and avoiding intakes that are located too low. Designated smoking areas in the vicinity of outside air intakes and cooking odors from food trucks are common problems.

(b) Ventilation: Dilution ventilation is an effective way to control normal constant-emission sources present in buildings. Compliance with ASHRAE Standard 62 shall satisfy indoor dilution ventilation requirements.

(c) Local Exhaust: Local exhaust ventilation is effective for controlling known, unavoidable point emissions sources such as office machines, food service equipment, and specialized work areas (printing rooms, photo labs, etc.).

(d) Ventilation Air Cleaning: Gas Phase Air Filtration shall be considered to control gaseous contaminants to provide ventilation without the need of additional outdoor air, or to clean poor quality outdoor air. Particle Filtration shall be used to reduce the level of airborne particles that may be harmful to humans, such as airborne microorganisms and respirable particles. It is also effective to lower the particular matter in the ventilation system components where wet surfaces are present. Dirt accumulation on wet surfaces provides a substrate that may lead to microbial growth which in turn causes the ventilation system to become a source of contaminants.

V. System operation with 100% outdoor air shall be considered for use at the completion of construction or during and at the finish of remodeling or renovation activities. Operation with 100% outside air would continue until enough time has passed to lower emitted contamination concentrations to near background levels.

VI. To confirm that gaseous contaminants are not present in spaces, as well as to save energy, a system that continually senses gaseous contaminants and regulates air flow based on actual air quality, such as the Aircuity system, may be considered.

VII. Where significant variations in occupancy patterns occur, the Design Professional shall incorporate a ventilation control system that sequences, as close as possible, the quantity of outdoor air based on actual building occupancy and any thermal load conditions. The latest version of ASHRAE Standard 62 "Indoor Air Quality Procedure" permits the use of innovative, energy conserving practices, utilizing whatever amount of outdoor air quantity necessary to maintain levels of indoor air contaminants below recommend levels. This procedure shall be used whenever credit is taken for controls that remove contaminants or for other design techniques that can be reliably demonstrated to result in indoor contaminant concentrations equal to or lower than those achieved using the Standard's "Ventilation Rate Procedure".

VIII. The ASHRAE Standard 62 Ventilation Rate Procedure is a prescriptive approach in which outdoor air intake rates are determined based on space type/application, occupancy level and floor area. This procedure may be utilized where occupancy rates are known to be constant, or in systems that would not otherwise result in the economic benefits of using outdoor intake controls to track space occupancy.

IX. The Design Professional shall identify and respond to air contaminants impacting outdoor air intakes or other infiltration sites.

X. Outdoor air contamination from, but not limited to, the following sources of contamination shall be considered:

(a) Motor vehicle exhaust from garages, parking lots, roadways, loading docks and emergency/standby power generators.

(b) Cooling Towers.

(c) Localized exhaust and relief air systems from adjacent openings or other nearby buildings.

(d) Sewer vents.

(e) Kitchen Exhaust fans and food trucks.

XI. Where the possibility exists that flow patterns and turbulence of wind passing over a building can cause recirculation of exhaust gases to air intakes, an evaluation shall be performed by the Design Professional to determine the effects of wind on intakes and exhausts. On small projects, or less critical applications, accepted ASHRAE methodology may be used to evaluate these effects. On larger projects or any critical application, such as where health and safety are of concern, physical modeling (wind tunnel exhaust dispersion study) shall be used. The possibility of snow infiltration at intakes shall also be evaluated.

2. General HVAC Requirements

A. All HVAC systems or units serving common or public spaces (corridors, lounges, lobbies, multipurpose rooms, laundry rooms, exercise rooms, etc.) shall be installed in secure locations that are inaccessible to the occupants or to the public.

B. The secure locations required above shall be mechanical rooms or closets designed specifically and exclusively for HVAC equipment installations. HVAC systems or units shall not be installed on roofs or in custodial, telecommunications, or other closets unless the system or unit being installed serves only that closet.

C. All HVAC systems or units serving common or public spaces shall be controlled by one of the Temple University standard Building Automation Systems (see Section 23 09 00 for acceptable manufacturers) and space temperature shall be monitored by vandal-proof, flush-mount, stainless steel wall plate sensors. Under no circumstances shall a conventional thermostat be utilized in common or public spaces.

D. Temperature of all rooms or zones shall be monitored and controlled through the Building Automation System.

E. If a Building Automation System is not otherwise part of the mechanical system design, a Building Automation System shall be provided and installed exclusively for HVAC control in all common or public spaces. All instrumentation and control systems and devices shall be integrated into, and meet all requirements of, the Building Automation System and the campus SCADA system specifications, as described in Instrumentation and Control for HVAC (23 09 00) and Integrated Automation (25 00 00).

F. All equipment installed in the University shall be controlled from centrally located Building Automation Systems. The Instrumentation and Control for HVAC Section, contained herein as Section 23 09 00, describes the specific minimum control requirements associated with

the central control system. Temple University has multiple Building Automation System suppliers (See 23 09 00 for acceptable manufacturers).

G. **For renovation projects, the Design Professional shall coordinate with Temple University Facilities Operations & Maintenance to determine the specific requirements for building automation on a case-by-case basis. Depending on the scope of the renovation project and the age and condition of the existing BAS, Facilities Operations & Maintenance may require expansion of the existing BAS utilizing sole-source equipment from the currently installed manufacturer or require replacement of the entire BAS via competitive bidding. Where the building is to be partially renovated and there is an existing Building Automation System, the Design Professional shall consult with Temple University Facilities Operations & Maintenance to determine the project-specific building automation requirements.**

H. All billed electrical, water, steam, and fuel services shall be metered into the Building Automation System. Design Professional is to coordinate with Temple University Facilities Operations & Maintenance department in regard to specifying either direct hardwired connections or integration to the BAS system, i.e. Modbus. **Coordinate all utilities metering interfaces with Temple University's Energy Office.**

I. The assigning of responsibility for the cutting and patching of all work must be coordinated by the entire design team and be thoroughly and succinctly detailed in the contract documents.

J. Coordination of the design for the location of all floor and wall openings, lintels, equipment pads, etc. is the responsibility of the Design Professional engaged to design the system which penetrates the floor, wall or roof.

K. Exterior HVAC installations must consider the aesthetics of the building, noise pollution, accessibility, maintainability, safety regulations and health effects.

L. All new equipment is to be provided with the software and hardware necessary for the Temple University Facilities Operations & Maintenance department to have the ability to troubleshoot and/or configure any field equipment. Equipment manufacturer is to provide and transfer ownership of all software and hardware as part of closeout package without any recurring license or other fees. All materials developed, generated or produced (including, but not limited to, software, firmware, program code, software/firmware settings and/or configurations, reports, plans, assessments, recommendations, drawings, designs and/or surveys) by the building automation system provider shall be owned by and shall be the exclusive property of Temple University and considered a "WORK MADE FOR HIRE," as that term is defined for copyright and other purposes. The building automation system provider shall be required to assign all rights to the materials developed as part of the project finally and irrevocably to Temple University. The building automation system provider shall promptly execute any and all documents and take any additional actions that Temple University may reasonably request in order to affect this assignment.

M. The following is a list of **prohibited** installations and require Temple University Facilities Operations & Maintenance department approval for their installation:

I. Plug valves (except as specified herein for natural gas service);

II. Triple-duty (combination) valves used for shutoff service – only single devices are permitted;

III. Groove-end valves, pipe, or fittings (except for use in fire protection systems);

IV. Press-end valves;

V. Cast press fittings;

VI. Press-end fittings;

VII. Cast iron fittings (use malleable iron or forged steel fittings);

VIII. HVAC paddle-type flow switches (use differential pressure or electronic flow switches);

IX. Dielectric unions (use dielectric waterways);

X. Gate valves (except as specified herein for steam service);

XI. Balancing valves used for shutoff service;

XII. Schedule 10 pipe (use Schedule 40 as a minimum);

XIII. Butt-welded seam steel pipe (use electric resistance welded or seamless pipe);

XIV. Bullhead piping connections;

XV. Insertion flow meters (use inline meters only);

XVI. Paddle-wheel (turbine) flow meters;

XVII. Internally-lined duct systems;

XVIII. Fiberglass duct systems (except for transfer ducts);

XIX. Dual temperature systems;

XX. Dual duct systems;

XXI. High static pressure systems;

XXII. Steam or water-based preheat coils (with or without face/bypass dampers). Use glycol only;

XXIII. DX cooling systems where chilled water is available;

XXIV. Pneumatic controls and end devices;

XXV. Air flow measuring devices other than multi-point thermal dispersion or Pitot traverse stations that are selected and installed in compliance with AMCA Standard 203 and reviewed and approved by Temple University Facilities Operations & Maintenance;

XXVI. Wireless control elements; i.e. valves, dampers, relays, etc.;

XXVII. Fan coil and through-wall unit systems;

XXVIII. Induction units;

XXIX. Multi-zone units;

XXX. Fan-powered terminal units;

XXXI. Unit ventilators;

XXXII. Trane® or Carrier® water-source heat pumps;

XXXIII. Air-cooled glycol or water chillers for low-ambient service;

XXXIV. Natural gas-fired commercial boilers or emergency power generators requiring a natural gas booster pump to operate with natural gas supply pressures down to 4 inches of water column;

XXXV. Fuel oil-fired commercial boilers where natural gas is available;

XXXVI. Chilled beams;

XXXVII. Energy recovery wheels without bypass dampers;

XXXVIII. Enthalpy wheels utilizing silica;

XXXIX. Dependence on energy recovery for required capacity;

XL. The installation of equipment, ductwork, piping, pumps, etc. on roofs;

XLI. Rooftop air handlers and packaged rooftop units;

XLII. Electric heat in air handlers;

XLIII. Equipment exposed to weather, except exhaust fans from toilets, fume hoods, and general exhausts;

XLIV. Vertical pumps;

XLV. Underground storage tanks;

XLVI. Emergency power generators equal to, or larger than, 1,000 HP;

XLVII. Diesel engine-driven emergency power generators or fire pumps;

XLVIII. Atriums that necessitate the use of smoke control systems for building code compliance;

XLIX. Ethylene glycol;

L. Fanwalls or plug fans;

LI. Radiant heat panels;

LII. Fans or motors with integral variable frequency drives or electronically commutated motors (**use stand-alone ABB ACH580 VFDs with eClipse bypasses only**) except for fractional horsepower motors.

3. Accessibility

A. All devices shall be within reach for operation without dismantling equipment except access doors.

B. Equipment and devices located six feet or more above the floor shall be accessible through platforms protected by guard rails.

C. All valves, balancing dampers, and miscellaneous materials located above ceilings must be made accessible by installing access doors. Equipment and devices above ceilings may not be located above counters, cabinets, or stationary room furnishing. Materials above accessible lay-in ceilings must be located from below the ceilings through the installation of ceiling markers applied to the underside of the ceilings. The ceiling marker shall be a red adhesive circle applied to the ceiling and shall have a diameter of 3/8-inch.

D. Design shall not install rotating equipment above ceiling and shall provide for an equipment room (non-fan powered VAV and CAV terminal units are an exception). During the Schematic Design Phase, the Design Professional shall indicate if an exception is required. Equipment approved for above ceiling location shall be serviceable directly from ladder or a service platform shall be provided.

E. Pipe and duct spaces shall be designed to adequately house the intended quantity of materials and to allow for a minimum future expansion of 25%. The shaft space shall have minimum interior dimensions of 2 ft. – 0 in. square. Hinged and locked access door shall be installed and provide access to the shaft on alternate levels.

F. Make provisions for chain hoist above all motors and pumps weighing over 75 lbs.

G. All mechanical rooms and electrical substations shall be provided with emergency lighting and electrical outlets.

H. All mechanical rooms shall be provided with minimum 6-inch floor drains near equipment containing water, strainers and blowdowns. Specialized equipment may require larger drain. Trap primers shall be installed in accordance with the currently adopted edition of the International Plumbing Code. Non-electronic trap primers are preferred. Approved manufacturers are Jay R. Smith and Precision Plumbing Product Company.

I. Floors in mechanical rooms shall be sloped toward floor drains providing positive unrestricted flow without puddling. Trench drains, curbs, floor penetrations, floor to wall connection details must be included to prevent flooding to floors below during routine maintenance or pipe breaks.

J. Floors in mechanical rooms that are located above other spaces (not on-grade) shall be sealed with Dex-O-Tex to prevent water leaks.

K. Consideration must be given to the proximity of outdoor air intakes to relief outlets, exhaust outlets, streets, and loading docks. Outdoor air intakes located below grade are prohibited. If outdoor air intake is relocated to be located below grade due to renovation, Contractor shall dig a well that is 12 inches below the louver, 6 inches wider than the louver and 24 inches from the louver face with a grate and CMU well walls.

L. Strainers and blowdowns shall be installed away from electrical equipment.

M. All equipment must be installed on raised concrete pads. Pads shall be a minimum of 4-inches high.

N. All equipment is to be individually scheduled.

O. All new buildings and major renovations are to be designed to include baseboard heat at the exterior wall.

4. Temperature Control Requirements

A. The program developed for each project will generally list specific temperature and/or humidity requirements for the facility, which are necessary for the execution of the space function. In the event that no temperature and/or humidity requirements are indicated in the program, the Design Professional shall utilize the design temperature and humidity requirements specified herein.

B. Space temperature & humidity controls and other equipment controls are to be incorporated into Building Automation Systems (BAS) where they are present in existing buildings. All new construction controls are to be part of an approved BAS system.

C. In general, all non-critical temperature/humidity areas shall be designed to maintain the following conditions and in accordance with the currently adopted edition of the International Energy Conservation Code and ANSI/ASHRAE/IESNA Standard 90.1;

I. Summer periods: maximum 74°F ± 2°F; 50% RH ± 5% RH in occupied areas.

II. Winter periods: minimum 72°F ± 2°F; 30% RH ± 10% RH in occupied areas.

D. The summer period requirements listed above shall be maintained with an outdoor air dry bulb temperature of 95°F concurrent with a wet bulb temperature of 78°F.

E. The summer dehumidification load shall be determined utilizing an outside air condition of 134.6 grains of moisture per pound of dry air.

F. The winter period requirements listed above shall be maintained with an outdoor air dry bulb temperature of 0°F. The 0°F temperature provides a built-in safety factor.

G. Mechanical Equipment Rooms and Penthouse temperature shall be designed to maintain the following conditions:

I. Summer (cooling): Ventilated 10-15 air changes per hour maximum based on gross volume with a 10-foot maximum height (thermostatically controlled to 85°F DB).

II. Winter (heating): Ventilated 10-15 air changes per hour maximum based on gross volume with a 10-foot maximum height (thermostatically controlled to 65°F DB).

H. Electrical Closet temperature shall be designed to maintain the following conditions:

I. Summer (cooling): 86°F DB average, 104°F DB maximum.

II. Winter (heating): 65°F DB, minimum.

I. Telecommunication and Data Room temperature/humidity shall be designed to maintain the following condition:

I. Setpoint: 75°F DB, range 64°F-75°F DB; 30-55% RH.

5. Energy Conservation Requirements

A. All HVAC system designs and specifications shall meet and incorporate the requirements of the currently adopted editions of ANSI/ASHRAE/IESNA Standard 90.1 and the International Energy Conservation Code (IECC), or more restrictive standards, as required by law.

B. All prescriptive provisions of ANSI/ASHRAE/IESNA Standard 90.1and the IECC shall be met, except as provided by the Energy Cost Budget Method.

C. Energy Cost Budget Method

I. The energy cost budget method described in ANSI/ASHRAE/IESNA Standard 90.1 shall be performed for all designs with the following additional requirements:

(a) Calculations shall be performed for all 8,760 hours of the year.

(b) Software used for simulation shall meet the requirements of ANSI/ASHRAE/IESNA Standard 90.1 shall be approved by the Temple University Facilities Energy Office.

(c) Climatic data shall be based on ASHRAE Weather Year for Energy Calculations Version 2 (WYCE2) dataset or the US Department of Energy, National Renewable Energy Laboratory's Typical Meteorological Year Version

2 (TMY2) dataset and shall utilize National Weather Service Station data for Philadelphia, PA (WBAN ID 13739).

(d) Unless otherwise prescribed by law, current purchased energy rates shall be obtained from the Temple University Energy Office.

(e) The purchased energy rates shall not be utilized for actual fiscal energy budgeting purposes.

D. Efficiency Standards Compliance Documentation

I. Efficiency standards compliance documentation shall be prepared by the design professional.

II. All efficiency standards compliance documentation shall be submitted for review to the Temple University Energy Office prior to final preparation of project bid documents (or earlier, if practicable).

III. The following compliance documents (per the examples shown in the User's Manual for ANSI/ASHRAE/IESNA Standard 90.1-2001) shall be prepared and submitted for review:

(a) Building Envelope Compliance Document Part I & II

(b) HVAC Mandatory Provisions Part II

(c) HVAC Prescriptive Provisions Part III

(d) Service Water Heating Compliance Documentation

(e) Lighting Compliance Documentation (Space-by-Space Method)

(f) Energy Cost Budget Compliance Report

E. Energy Consumption & Demand Data

I. Energy consumption data shall be prepared by the design professional.

II. Energy Consumption data shall be supplied for the typical meteorological year (as described in the Energy Cost Budget Method above) and for design conditions.

III. Energy consumption data shall be submitted for review to the Temple University Energy Office prior to final preparation of project bid documents (or earlier, if practicable).

IV. Energy consumption data shall be submitted in a Microsoft Excel spreadsheet file (worksheet, workbook, or comma-separated variable file) showing data for each of the 8,760 hours in the year.

V. Energy consumption may be indicated by thousands or millions of units but must be clearly labeled. (**K**WH, **mm**Btu, etc.)

VI. The file shall contain the following data:

(a) Hourly electricity consumption in watt-hours.

(b) Electricity demand data, in watts, based on a 30-minute fixed demand window. The maximum of the two 30-minute demand windows shall be the maximum demand for the reported hour.

(c) Hourly saturated steam consumption (for buildings served by central plants) in British Thermal Units or pounds of steam at a specified pressure.

(d) Hourly chilled water consumption (for buildings served by central plants) in British Thermal Units or ton-hours.

(e) Space heating system fuel consumption as follows:

(i) Natural gas consumption in British Thermal Units or cubic feet at a specified higher heating value per cubic foot for single (natural gas) fuel equipment.

(ii) Fuel oil consumption in British Thermal Units or gallons at a specified higher heating value per gallon for single (fuel oil) fuel equipment.

(iii) Total fuel input in British Thermal Units for dual fuel (natural gas & fuel oil) equipment.

(f) Process (domestic hot water, kitchens, labs, etc.) heating system fuel consumption as follows:

(i) Natural gas consumption in British Thermal Units or cubic feet at a specified higher heating value per cubic foot for single (natural gas) fuel equipment.

(ii) Fuel oil consumption in British Thermal Units or gallons at a specified higher heating value per gallon for single (fuel oil) fuel equipment

(iii) Total fuel input in British Thermal Units for dual fuel (natural gas & fuel oil) equipment.

(g) Water consumption in gallons or cubic feet.

VII. In addition, the simulation software files used to prepare the energy analysis of the building design shall be submitted to the Temple University Energy Office for performance monitoring and benchmarking purposes.

END OF SECTION

1. All devices, piping, valves, relays, end switches, control components, power wiring, control wiring and interlock wiring shall be provided as required to accomplish the sequence of operation for the various pieces of equipment to provide a fully operational system.
2. Pressure and Temperature Ratings:
   A. Each meter and gauge shall be rated and suitable for the piping system that it is being installed in.
   B. Minimum upstream and downstream straight pipe diameters for meters shall be provided per manufacturer's published recommendations.
3. Pressure Gauges – Provide and install all gauges in such a manner as to be easily read from normal observation positions. Gauges shall be as follows:
   A. Dial Size: 4-1/2 inch.
   B. Accuracy: 1/2% of Full Scale, Grade 2A, ASME B40.100.
   C. Case: Black Phenoilc, Solid Front.
   D. Ring: Threaded Reinforced Black Polypropylene.
   E. Window: Glass.
   F. Pointer: Micrometer Adjustable.
   G. Movement: Rotary, Type 400 SS, Teflon-Coated Pinion Gear & Segment.
   H. Bourdon Tube & Socket: Type 316L Stainless Steel.
   I. Optional Features: PLUS! Performance.
   J. Manufacturer: Ashcroft.
   K. Model: 45-1279-SS-(Connection Size & Type)-XLL-(Pressure Range).
   L. *Alternate Manufacturer: Treice.
   M. *Alternate Model: 450SS-45-(Connection Size)-(Connection Location)-A-(Pressure Range Code)-SS(code for fluid selection for snubber screw).
   N. *Each gauge must be supplied with a Treice Model 870-13 or 870-16 impulse dampener.

      NOTE: All pressure gauges utilized for steam service must be equipped with a coil syphon constructed of 316 stainless steel or seamless Schedule 80 carbon steel.

   O. Select range in such a manner that the operating pressures is at the mid-point of the scale. Pressure ranges shall be as follows:
      I. Steam, 0 to 20 PSI: 0 PSI to 30 PSI
      II. Steam, 21 to 60 PSI: 0 PSI to 100 PSI
      III. Steam, 61 to 150 PSI: 0 PSI to 200 PSI
      IV. Fluids, Suction Side of Pump, Open Systems: 30 in. to 0 PSI to 150 PSI.
      V. Fluids, Suction and Discharge Side of Pump, Closed Systems: 0 PSI to 100 PSI.

4. Gauge Pressure Transmitters – Provide and install gauge pressure transmitters where indicated on the drawings in accordance with the manufacturer's installation requirements. Gauge pressure transmitters shall be as follows;

   A. Type: High Performance Gauge Pressure Transmitter.

   B. Accuracy: ±0. 055% of Span.

   C. Stability: ±0.1% of URL for 10 Years.

   D. Output: Two wire 4 to 20 mA DC.

   E. Integrated Indicator (LCD display): Full dot-matrix LCD.

   F. Body: Stainless Steel, ASTM CF8M.

   G. Flange & Process Connector: Stainless Steel, ASTM CF8M.

   H. Field Connection: Provide 2-Valve Stainless Steel Transmitter Manifold

   I. Diaphragm: Hastelloy C-276.

   J. Capsule Gasket: Stainless steel, Teflon-coated 316L.

   K. Manufacturer: Yokogawa.

   L. Model: EJA430E-D(measurement span code)S4G-(installation code)32D(mounting bracket code)N/FF1/D1.

   M. Two-Valve Manifold for Pressure Transmitter:

   N. Type: Two-Valve Block & Bleed.

   O. Body: Stainless Steel, ASTM A479 Type 316/316L.

   P. Seat: Integral, metal-to-metal seated. Back-seat: Metal-to-metal secondary needle seal.

   Q. Stem Seal: Teflon Pressure-Core.

   R. Manufacturer: Yokogawa.

   S. Model: C13ST-2TSA1-S2-NNPS1-NNNN with C13SA-MUPS0 mounting bracket.

5. Differential Pressure Transmitters – Provide and install differential pressure transmitters where indicated on the drawings in accordance with the manufacturer's installation requirements. Gauge pressure transmitters shall be as follows;

   A. Type: High Performance Differential Pressure Transmitter.

   B. Reference Accuracy: ±0.04% of Span.

   C. Stability: ±0.1% of URL per 15 years.

   D. Power Supply Effects: ±0.005% per Volt (from 21.6 to 32 V DC, 350 Ω).

   E. Output: Two wire 4 to 20 mA DC.

   F. Integrated Indicator (LCD display): 5-digit numeric, 6-digit unit display and bar graph.

   G. Cover Flange & Process Connector: ASTM A351-CF8M.

   H. Capsule: Hastelloy C-276 Diaphragm, 316L Stainless Steel.

   I. Capsule Gasket: 316L Stainless Steel, Teflon-Coated.

J. Drain/Vent Plug: 316L Stainless Steel.

K. Bolting: 316L Stainless Steel.

L. Housing: Cast Aluminum.

M. Cover O-Ring: Buna-N.

N. Fill fluid: Silicone.

O. Field Connection: Provide 3-Valve Stainless Steel Transmitter Manifold.

P. Manufacturer: Yokogawa.

Q. Model: EJX110A-D(measurement span code)S4G(installation code)17E(mounting bracket code)/FF1/D1/C1.

R. Two-Valve Manifold for Pressure Transmitter:

S. Type: Three-Valve Block & Bleed.

T. Body: Stainless Steel, ASTM A479 Type 316/316L.

U. Seat: Integral, metal-to-metal seated. Back-seat: Metal-to-metal secondary needle seal.

V. Stem Seal: Teflon Pressure-Core.

W. Manufacturer: Yokogawa.

X. Model: C13ST-3TSA0-S4-NNNN-NNNN with C13SA-MUPS0 mounting bracket..

6. Thermometers – Provide and install all thermometers in such a manner as to be easily read from normal observation positions. Thermometer shall be as follows:

A. Dial Size: 5 inch.

B. Accuracy: 1% of Full Scale, Grade A, ASME B40.3.

C. Stem & Case: Type 304 Stainless Steel Hermetically Sealed.

D. Stem Diameter: 0.250 inch.

E. Window: Polycarbonate.

F. Connection: 1/2 inch NPT Union.

G. Location: Everyangle®.

H. Manufacturer: Ashcroft.

I. Model: 50-EL-42-E-(Stem Length Code)-(Range Code).

J. Alternate Manufacturer: Treice.

K. Alternate Model: B856-(Stem Length Code)-(Range Code)-SWV.

NOTE: All thermometers installed in piping or pipelines shall be supplied with threaded, stepped shank, Type 316 stainless steel thermowells of suitable dimensions for the thermometer being supplied.

L. Select range in such manner that the operating temperature is at the mid-point of the scale. Thermometer ranges shall be as follows:

I. Steam, 0 to 20 psi: 50˚F to 300˚F.

II. Steam, 21 to 150 psi: 50°F to 400°F.

III. Condenser water: 50°F to 120°F.

IV. Chilled water: 30°F to 100°F.

V. Heating water:50°F to 250°F.

VI. Closed Circuit Cooler: 60°F to 120°F.

VII. Ice Storage Water: 0°F to 90°F.

7. Temperature Transmitters – Provide and install temperature transmitters where indicated on the drawings in accordance with the manufacturer's installation requirements. Temperature transmitters shall be as follows;

   A. Type: High Accuracy Temperature Transmitter.

   B. Accuracy: ±0.1°C.

   C. Stability: RTD: ±0.1% of reading or ±0.1°C per 2 years, RTD: ±0.2% of reading or ±0.2°C. per 5 years.

   D. Output: Two wire 4 to 20 mA DC.

   E. Integrated Indicator (LCD display): Full dot-matrix LCD.

   F. Sensor: 100 Ohm Pt RTD.

   G. Sensor Style: Spring Loaded Sensor with Thermowell.

   H. RTD Accuracy: ±0.10% of resistance a 0°C.

   I. Element Lead Configuration: Three Wire Single.

   J. Connection Head: Aluminum, Epoxy Coated.

   K. Extension Type: Nipple-Union-Nipple, 316 Stainless Steel.

   L. Immersion Length: Shall be determined by pipe size.

   M. Thermowell Type: Reduced Tip, Threaded, ¾ in. NPT Process Connection.

   N. Thermowell Material: 316 Stainless Steel.

   O. Manufacturer: Yokogawa/Burns Engineering.

   P. Model: Yokogawa YTA710-DA1A2DN/N4/FU1 with Burns Engineering Model No. TSE-200C-10A2E3B(Immersion Length) RT3/03.

8. Meters - Provide HVAC meters as required by the project. Install meters in locations that will be accessible, without ladders or other equipment, for manual readings and service after construction is complete.

   A. General Requirements for Meters:

      I. Meter Sizing, Selection, and Installation Design:

         (a) Meter sizing shall be performed prior to meter selection.

         (b) The Design Professional shall consider the installation requirements (straight runs of pipe/duct required and minimum/maximum meter

velocities, etc.) during the design development process to ensure that adequate space is provided for meter installation.

(c) In order to correctly size the meter, the minimum, maximum, and normal operating flow rates and pressures shall first be determined by the Design Professional.

(d) Using the minimum, maximum, and normal operating flow rates and pressures, as determined by the Design Professional, the meter vendor shall size the flow metering system for maximum turndown, accuracy, and repeatability.

(e) The results of the metering system vendor's sizing shall be utilized by the Design Professional to design the physical installation per the meter manufacturer's installation instructions, standard drawings, AMCA Standard 203 for air and ANSI/ASME B31.1 Code for Pressure Piping for fluids.

(f) Meter run piping/ductwork shall be the same pipe/duct size as the nominal meter size. The meter run shall be complete with (at least) the minimum required straight runs of upstream and downstream piping/ductwork, as indicated on the design drawings and manufacturer's installation instructions. Reductions and/or enlargements of the piping/ductwork shall occur before and/or after the meter run.

(g) For steam meters, metering shall only be performed at locations where the normal steam operating pressure is greater than 50 PSIG. Metering of low pressure steam is **prohibited**. Coordinate mechanical systems design and layout to facilitate the metering plan.

(h) Coordinate connection of steam and BTU metering system flow computers to the Building Automation System (23 09 00) and Temple University's Energy Office monitoring systems.

(i) All saturated steam meters shall be pressure compensated. Where superheat is expected (downstream of PRV stations, etc.), steam meters shall be pressure and temperature compensated.

(j) Shedder bars on vortex flowmeters used for steam service shall be installed in the horizontal position when installed in horizontal pipe runs.

(k) For steam and BTU metering systems, unless an alternate is specifically listed, the components and manufacturers specified herein shall not be substituted.

B. Steam Metering System:

I. Pipeline Element:

(a) Type: ANSI-Flanged Vortex Flowmeter.

(b) Accuracy: ±1. 00% of Rate.

(c) Repeatability: ±0.2% of Rate.

(d) Output: Two wire 4 to 20 mA DC.

(e) Integrated Indicator (LCD display): Full dot-matrix LCD.

(f) Body: Stainless Steel, ASTM CF8M.

(g) Flanges: Stainless Steel, ASTM CF8M.

(h) Shedder Bar: Stainless Steel.

(i) Manufacturer: Yokogawa.

(j) Model: DY(size code) -DBLBA2-2D /SCT.

II. Pressure Transmitter:

(a) Type: High Performance Gauge Pressure Transmitter.

(b) Accuracy: ±0. 055% of Span.

(c) Stability: ±0.1% of URL for 10 Years.

(d) Output: Two wire 4 to 20 mA DC.

(e) Integrated Indicator (LCD display): Full dot-matrix LCD.

(f) Body: Stainless Steel, ASTM CF8M.

(g) Flange & Process Connector: Stainless Steel, ASTM CF8M.

(h) Diaphragm: Hastelloy C-276.

(i) Capsule Gasket: Stainless steel, Teflon-coated 316L.

(j) Manufacturer: Yokogawa.

(k) Model: EJA430E-DAS4G-U32DN/FF1/D1.

III. Two-Valve Manifold for Pressure Transmitter:

(a) Type: Two-Valve Block & Bleed.

(b) Body: Stainless Steel, ASTM A479 Type 316/316L.

(c) Seat: Integral, metal-to-metal seated. Back-seat: Metal-to-metal secondary needle seal.

(d) Stem Seal: Teflon Pressure-Core.

(e) Flange Seal Standard: Taylor Mount Flange Seals.

(f) Manufacturer: Yokogawa.

(g) Model: C13ST-2TSA1-S2-NNPS1-NNNN with C13SA-MUPS0 mounting bracket.

IV. Temperature Sensor & Transmitter (Superheat Applications Only):

(a) Type: High Accuracy Temperature Transmitter.

(b) Accuracy: ±0.1°C.

(c) Stability: RTD: ±0.1% of reading or ±0.1°C per 2 years, RTD: ±0.2% of reading or ±0.2°C. per 5 years.

(d) Output: Two wire 4 to 20 mA DC.

(e) Integrated Indicator (LCD display): Full dot-matrix LCD.

(f) Sensor: 100 Ohm Pt RTD.

(g) Sensor Style: Spring Loaded Sensor with Thermowell.

(h) RTD Accuracy: ±0.10% of resistance a 0°C.

(i) Element Lead Configuration: Three Wire Single.

(j) Connection Head: Aluminum, Epoxy Coated.

(k) Extension Type: Nipple-Union-Nipple, 316 Stainless Steel.

(l) Immersion Length: Shall be determined by pipe size.

(m) Thermowell Type: Reduced Tip, Threaded, ¾ in. NPT Process Connection.

(n) Thermowell Material: 316 Stainless Steel.

(o) Manufacturer: Yokogawa/Burns Engineering.

(p) Model: Yokogawa YTA710-DA1A2DN/N4/FU1 with Burns Engineering Model No. TSE-200C-10A2E3B(Immersion Length) RT3/03.

V. Flow Conditioner (For Vortex Flowmeters, 2 inch NPS and larger):

(a) Type: Flanged, Meter Run, 7D.

(b) Body: 316 Stainless Steel.

(c) Flanges: Carbon Steel, ANSI Class 300.

(d) Manufacturer: Vortab Company.

(e) Model: VMR-(pipe size)-3-6 (one required for each steam flowmeter, 2 inch and larger).

VI. Flow Computer:

(a) Type: Multi-Function, Field Mount.

(b) Display Type: LCD.

(c) Input Voltage: 85 to 276 VAC.

(d) Manufacturer: Kessler-Ellis Products.

(e) Model: MS-748-L-1-0-V-MB.

C. BTU Metering System:

I. Pipeline Element:

(a) Type: ANSI-Flanged Magnetic Flowmeter with Integral Sensor.

(b) Accuracy: ±0.35% of Rate.

(c) Repeatability: ±0.1% of Rate.

(d) Output: Two wire 4 to 20 mA DC.

(e) Integrated Indicator (LCD display): Full dot-matrix LCD.

(f) Lining: PFA.

(g) Body: Stainless Steel.

(h) Flanges: Stainless Steel.

(i) Electrodes: Stainless Steel.

(j) Grounding Ring: Stainless Steel.

(k) Manufacturer: Yokogawa.

(l) Model: AXF (size code) G-D2AL1S-(ANSI Flange Code)1-21B.

II. Temperature Sensor & Transmitter (two required):

(a) Type: High Accuracy Temperature Transmitter.

(b) Accuracy: ±0.1°C.

(c) Stability: RTD: ±0.1% of reading or ±0.1°C per 2 years, RTD: ±0.2% of reading or ±0.2°C. per 5 years.

(d) Output: Two wire 4 to 20 mA DC.

(e) Integrated Indicator (LCD display): Full dot-matrix LCD.

(f) Sensor: 100 Ohm Pt RTD.

(g) Sensor Style: Spring Loaded Sensor with Thermowell.

(h) RTD Accuracy: ±0.10% of resistance a 0°C.

(i) Element Lead Configuration: Three Wire Single.

(j) Connection Head: Aluminum, Epoxy Coated.

(k) Extension Type: Nipple-Union-Nipple, 316 Stainless Steel.

(l) Immersion Length: Shall be determined by pipe size.

(m) Thermowell Type: Reduced Tip, Threaded, ¾ in. NPT Process Connection.

(n) Thermowell Material: 316 Stainless Steel.

(o) Manufacturer: Yokogawa/Burns Engineering.

(p) Model: Yokogawa YTA710-DA1A2DN/N4/FU1 with Burns Engineering Model No. TSE-200C-10A2E3B(Immersion Length) RT3/03.

III. Flow Computer:

(a) Type: Multi-Function, Field Mount.

(b) Display Type: LCD.

(c) Input Voltage: 85 to 276 VAC.

(d) Manufacturer: Kessler-Ellis Products.

(e) Model: MS-748-L-1-0-V-MB.

D. Airflow Measurement Systems:

I. Airflow measurement systems (AFMS) shall be manufactured by either Ebtron or Air Monitor Corporation.

II. All airflow measurement systems (AFMS) shall be selected for a minimum measurement velocity of 400 FPM and a maximum velocity of 4,000 FPM.

III. The Design Professional shall ensure that appropriate geometry and adequate space is provided in the design of the air handling and distribution system to meet the velocity limits and the AFMS manufacturer's installation requirements.

IV. The Design Professional and the installing contractor shall ensure that field-installed probe-type airflow measurement devices have adequate clearance for removal/installation for future service without disturbing any other permanently installed equipment or building features.

V. Where practical, a complete, factory pre-fabricated, airflow measurement station equipped with an Integral corrosion resistant, aluminum honeycomb air straightener, is preferred over field-installed probes.

VI. The Design Professional shall ensure that installations for outside air intakes are designed to prevent infiltration of moisture/rain into the airflow measurement device(s).

VII. Thermal dispersion-type airflow measurement systems shall meet the following requirements:

(a) The AFMS design sensor density shall be the highest available for the measurement location dimensions and shall comply with the requirements of AMCA Standard 203, Appendix H for the minimum number and distribution of traverse points.

(b) The **minimum** sensor or point density shall be as follows (**no exceptions**):

Measurement Area in Square Feet	Minimum number of sensors or traverse points
Less than one square feet	2
One square foot but less than four square feet	4
Four square feet but less than eight square feet	6
Eight square feet but less than twelve square feet	8
Twelve square feet but less than sixteen square feet	12
Greater than sixteen square feet	16

(c) Each sensor assembly shall independently determine the airflow rate and temperature at each a measurement point.

(d) AFMS installed accuracy shall be ±2% of reading to NIST-traceable airflow standards **without adjustment to factory calibrations.**

(e) Temperature accuracy shall be ±0.15°F over the entire operating temperature range of -20°F to 140°F.

(f) The operating humidity range for each sensor probe shall be 0-99% RH.

(g) Each sensor probe shall have an integral, U.L. listed, plenum rated cable and terminal plug for connection to the remotely mounted transmitter. All terminal plug interconnecting pins shall be gold plated.

(h) Each sensor assembly shall not require matching to the transmitter in the field.

(i) A single manufacture shall provide both the airflow/temperature measuring device(s) and transmitter for each measurement location.

(j) Basis of Design (Ducts):

(i) Ebtron Advantage Gold Series – GP1/GTx116

(ii) Air Monitor Coropration ELECTRA-flo/CM.

(k) Basis of Dersign (OA Intakes):

(i) Ebtron AIR-IQ2.

(l) Basis of Design (Fan Arrays):

(i) Measure in supply duct.

END OF SECTION

1. Valves for water service shall be utilized for chilled water, glycol heating or cooling water, heating hot water, condenser water, and non-potable domestic water for HVAC service.
2. Valves for water service shall not be utilized for steam condensate service. Valves for steam condensate service and steam service are specified separately.
3. Isolation valves for water service shall be provided at each piping connection to boilers, chillers, heat exchangers, pumps, coils (in mechanical rooms and in terminal equipment), and all other HVAC equipment.
4. Isolation ball valves, as specified herein, shall be provided at the supply and return connections of each water coil with piping up to 2-1/2 inches, separately from, and in addition to, any valves supplied with packaged hose kits.
5. Isolation valves for water service, 3 in. and larger, at connections to building "central plant" equipment (boilers, chillers, heat exchangers, pumps, segmental riser isolation, etc.) shall be high performance butterfly valves as specified herein.
6. Isolation valves for water service, 3 in. and larger, at other connections (air handler and terminal equipment coils, cooling towers, branch connections from risers, etc.) may be resilient-seated butterfly valves as specified herein.
7. Isolation valves for steam with operating pressures greater than 15 PSIG shall be cast, forged, or stainless steel gate valves rated for a minimum of 300 PSI (ANSI Class 300) as specified herein.
8. High performance, triple-offset, metal-seated, lug-style, butterfly valves may be permitted for steam isolation valve service where space is at a premium. Consult Temple University Facilities Operations & Maintenance department for the specific application.
9. Bypass valves for steam with operating pressures greater than 15 PSIG shall be cast, forged, or stainless steel globe valves rated for a minimum of 300 PSI (ANSI Class 300). The valve shall be selected to provide the same flow coefficient as the control valve(s) that it will be utilized to bypass.
10. Isolation valves for steam with operating pressures of 15 PSIG or less shall be cast, forged, or stainless steel gate valves rated for a minimum of 150 PSI (ANSI Class 150). High performance, triple-offset, metal-seated, lug-style, butterfly valves may be permitted where space is at a premium.
11. Bypass valves for steam with operating pressures of 15 PSIG or less shall be cast, forged, or stainless steel globe valves rated for a minimum of 150 PSI (ANSI Class 150). The valve shall be selected to provide the same flow coefficient as the control valve(s) that it will be utilized to bypass.
12. Isolation valves shall be provided at all branch connections from risers.
13. Triple-duty valves are **prohibited**. Provide independent isolation, check, and balancing valves at each pump.
14. Isolation Valves for Water:
    A. Up to two and one-half (2-1/2) inches;
        I. Solder-End and Threaded-End Ball Valves:
            (a) Rating: 600 PSI CWP, 150 PSI Steam.
            (b) Body: Two-Piece, B584 Bronze.

(c) **Ball & Stem: 316 Stainless Steel.**

(d) Seat & Packing: RPTFE.

(e) **Latch-Lock Lever & Nut: Stainless Steel.**

(f) Brand: Apollo Valves.

(g) Model: 77C – (1 or 2) 4 (Size Designation) – 10 – 27 – A

(h) Alternate Manufacturers: Crane, Jamesbury, or Nibco. Must be equal to specified valve.

B. Three (3) inches and above;

I. High performance butterfly valve:

(a) Rating: ANSI Class 150.

(b) Body: ASTM A216 Grade WCC Carbon Steel, Lug Style, Bolted Seat Retainer.

(c) Stem: ASTM A564 Type 630 Stainless Steel.

(d) Disc: ASTM A351 CF8M Stainless Steel.

(e) Seat: TFM.

(f) Packing: TFE Vee.

(g) Brand: Cameron WKM MB-1 Dynacentric.

(h) Model: (Size Designation)-B5-113-02-S02-11-WG.

(i) Alternate Manufacturers: Bray, DeZurik, or Jamesbury. Must be equal to specified valve.

C. Three (3) inches and above;

I. Resilient-seated butterfly valve (where permitted):

(a) Rating: 285 PSI.

(b) Body: Ductile Iron, Lug Style, ANSI Class 150 Flange.

(c) Stem: Type 416 Stainless Steel.

(d) Disc: Aluminum Bronze.

(e) Seat: Peroxide-Cured, EPDM.

(f) Actuator;

(i) Four (4) inch and under: 10-position lever.

(ii) Six (6) inch and larger: Handwheel gear.

(g) Manufacturer: Cameron DEMCO Series NE-C.

(h) 222 (Size Designation) – 511435(1 or A)

(i) Alternate Manufacturers: Bray 31H, Chrispin K-Flow 507. Must be equal to specified valve.

15. Check Valves for Water:
    A. Up to two (2) inches:;
        I. Threaded-end swing check valve, threaded cap:
            (a) Rating: ANSI Class 150.
            (b) Body & Cover: Bronze ASTM B-62/B-61.
            (c) Disc Holder: Bronze ASTM B-62 or Bronze ASTM B-16.
            (d) Disc: PTFE (15% Glass Filled).
            (e) Brand: Crane Energy Flow Solutions.
            (f) Model: Figure 141TF.
            (g) Alternate Manufacturers: Equivalent products from Apollo, Jamesbury, or Nibco (all alternates must equal to the specified valve and be approved by Temple University Facilities Operations & Maintenance).
    B. Two and one-half (2-1/2) inches and above;
        I. High performance check valve:
            (a) Rating: ANSI Class 150.
            (b) Body: Wafer Style, ASTM A351 Gr. CF-8M Stainless Steel.
            (c) Seal: EPDM.
            (d) Disc, Arm & Pin: 316 Stainless Steel.
            (e) Brand: Crane Energy Flow Solutions – Uni Chek.
            (f) Model: (Size Designation)-15-A-2-3-4-1-3-0.
            (g) Alternate Manufacturers: Bray, DeZurik, or Keckley. Must be equal to specified valve.
16. Drain & Vent Valves for Water:
    A. Up to one (1) inch;
        I. Solder-End and Threaded-End Ball Valves:
            (a) Rating: 600 PSI CWP, 150 PSI Steam.
            (b) Body: Two-Piece, B584 Bronze.
            (c) Ball & Stem: 316 Stainless Steel.
            (d) Seat & Packing: MPTFE.
            (e) Latch-Lock Lever & Nut: Stainless Steel.
            (f) Hose Cap: Brass, ASTM B16
            (g) Ball Chain: Stainless Steel
            (h) Brand: Apollo Valves.
            (i) Model: 70 - (1 or 2) 4 (Size Designation) – HC – 10 – 27 – A
            (j) Alternate Manufacturers: Crane, Jamesbury, or Nibco Must be equal to specified valve.

17. Isolation Valves for Steam (operating pressures greater than 15 PSIG):

    A. Up to two (2) inches;

        I. Threaded-End and Socket-Weld Gate Valves:

            (a) Rating: ANSI Class 800.

            (b) Body & Bonnet: Forged carbon steel.

            (c) Bonnet Gasket: Metallic, sprial-wound.

            (d) Stem: OS&Y

            (e) Packing Gland: Self aligning, two piece.

            (f) Brand: Bonney Forge

            (g) Model: Figure H-10

            (h) Alternate Manufacturers: Apollo, Crane, Jamesbury, or Nibco. Must be equal to specified valve.

    B. Two and one-half (2-1/2) inches and above;

        I. Flanged-End and Butt-Welding End Gate Valves:

            (a) Rating: ANSI Class 300.

            (b) Body & Bonnet: WCB cast carbon steel.

            (c) Seat Rings: Hardfaced.

            (d) Back Seat: 410 stainless steel.

            (e) Disc: CA-15 or 13% CR overlay.

            (f) Stem: OS&Y, 410 stainless steel.

            (g) Packing: Graphite.

            (h) Bonnet Gasket: Stainless steel, spiral-wound, graphite.

            (i) Yoke Sleeve: D2 Ni-Resist.

            (j) Retaining Nut: Malleable iron or steel.

            (k) Gland: Steel.

            (l) Gland Flange: Steel.

            (m) Eye Bolt: Steel.

            (n) Eye Bolt Nuts: Steel.

            (o) Pins: Steel.

            (p) Bonnet Studs: Steel, A193 Gr. B7

            (q) Bonnet Nuts: Steel, A194 Gr. 2H.

            (r) Handwheel: Malleable iron, ductile iron, or steel.

            (s) Handwheel Nut: Ductile iron or steel.

            (t) Brand: Crane or Velan.

(u) Model: Flanged – Figure 33, Butt-Welded – Figure 33-1/2.

18. Bypass Valves for Steam (operating pressures greater than 15 PSIG):

A. Up to two (2) inches;

I. Threaded-End and Socket-Weld Globe Valves:

(a) Rating: ANSI Class 800.

(b) Body & Bonnet: Forged carbon steel.

(c) Bonnet Gasket: Metallic, sprial-wound.

(d) Stem: OS&Y

(e) Disc: Loose solid disc.

(f) Packing Gland: Self aligning, two piece.

(g) Brand: Bonney Forge

(h) Model: Figure H-30 or HL-30.

(i) Alternate Manufacturers: Apollo, Crane, Jamesbury, or Nibco. Must be equal to specified valve.

B. Two and one-half (2-1/2) inches and above;

I. Flanged-End and Butt-Welding End Globe Valves:

(a) Rating: ANSI Class 300.

(b) Body & Bonnet: WCB cast carbon steel.

(c) Seat Rings: Hardfaced.

(d) Back Seat: 410 stainless steel.

(e) Disc: 13% CR overlay.

(f) Stem: 410 stainless steel.

(g) Packing: Graphite.

(h) Bonnet Gasket: Stainless steel, spiral-wound, graphite.

(i) Disc Stem Nut: 410 stainless steel.

(j) Disc Washer: Carbon steel.

(k) Retaining Nut: Malleable iron or steel.

(l) Gland: 410 stainless steel.

(m) Gland Flange: WCB cast carbon steel.

(n) Eye Bolt: Steel.

(o) Eye Bolt Nuts: Steel, A563 Gr. A or O.

(p) Bonnet Studs: Steel, A193 Gr. B7.

(q) Bonnet Nuts: Steel, A194 Gr. 2H.

(r) Handwheel: WCB cast carbon steel.

(s) Handwheel Nut: Steel, A194 Gr. 2H

(t) Brand: Crane or Velan.

(u) Model: Flanged – Figure 151, Butt-Welded – Figure 151-1/2.

19. Isolation Valves for Steam (operating pressures 15 PSIG or less):

A. Up to two (2) inches;

I. Threaded-End and Socket-Weld Gate Valves:

(a) Rating: ANSI Class 800.

(b) Body & Bonnet: Forged carbon steel.

(c) Bonnet Gasket: Metallic, sprial-wound.

(d) Stem: OS&Y

(e) Packing Gland: Self aligning, two piece.

(f) Brand: Bonney Forge

(g) Model: Figure H-10

(h) Alternate Manufacturers: Apollo, Crane, Jamesbury, or Nibco. Must be equal to specified valve.

B. Two and one-half (2-1/2) inches and above;

I. Flanged-End and Butt-Welding End Gate Valves:

(a) Rating: ANSI Class 300.

(b) Body & Bonnet: WCB cast carbon steel.

(c) Seat Rings: Hardfaced.

(d) Back Seat: 410 stainless steel.

(e) Disc: CA-15 or 13% CR overlay.

(f) Stem: OS&Y, 410 stainless steel.

(g) Packing: Graphite.

(h) Bonnet Gasket: Stainless steel, spiral-wound, graphite.

(i) Yoke Sleeve: D2 Ni-Resist.

(j) Retaining Nut: Malleable iron or steel.

(k) Gland: Steel.

(l) Gland Flange: Steel.

(m) Eye Bolt: Steel.

(n) Eye Bolt Nuts: Steel.

(o) Pins: Steel.

(p) Bonnet Studs: Steel, A193 Gr. B7

(q) Bonnet Nuts: Steel, A194 Gr. 2H.

(r) Handwheel: Malleable iron, ductile iron, or steel.

(s) Handwheel Nut: Ductile iron or steel.

(t) Brand: Crane or Velan.

(u) Model: Flanged – Figure 33, Butt-Welded – Figure 33-1/2.

20. Bypass Valves for Steam (operating pressures 15 PSIG or less):

A. Up to two (2) inches;

I. Threaded-End and Socket-Weld Globe Valves:

(a) Rating: ANSI Class 800.

(b) Body & Bonnet: Forged carbon steel.

(c) Bonnet Gasket: Metallic, sprial-wound.

(d) Stem: OS&Y

(e) Disc: Loose solid disc.

(f) Packing Gland: Self aligning, two piece.

(g) Brand: Bonney Forge

(h) Model: Figure H-30 or HL-30.

(i) Alternate Manufacturers: Apollo, Crane, Jamesbury, or Nibco. Must be equal to specified valve.

B. Two and one-half (2-1/2) inches and above;

I. Flanged-End and Butt-Welding End Globe Valves:

(a) Rating: ANSI Class 300.

(b) Body & Bonnet: WCB cast carbon steel.

(c) Seat Rings: Hardfaced.

(d) Back Seat: 410 stainless steel.

(e) Disc: 13% CR overlay.

(f) Stem: 410 stainless steel.

(g) Packing: Graphite.

(h) Bonnet Gasket: Stainless steel, spiral-wound, graphite.

(i) Disc Stem Nut: 410 stainless steel.

(j) Disc Washer: Carbon steel.

(k) Retaining Nut: Malleable iron or steel.

(l) Gland: 410 stainless steel.

(m) Gland Flange: WCB cast carbon steel.

(n) Eye Bolt: Steel.

(o) Eye Bolt Nuts: Steel, A563 Gr. A or O.

(p) Bonnet Studs: Steel, A193 Gr. B7.

(q) Bonnet Nuts: Steel, A194 Gr. 2H.

(r) Handwheel: WCB cast carbon steel.

(s) Handwheel Nut: Steel, A194 Gr. 2H

(t) Brand: Crane or Velan.

C. Model: Flanged – Figure 151, Butt-Welded – Figure 151-1/2.

END OF SECTION

1. All building mechanical systems shall be controlled via an electronic Building Automation System (BAS) with local and remote access. All building automation systems shall be integrated into the Temple University Integrated Facilities Management System (TU-IFMS, a.k.a. – SCADA) which is built on the Microsoft Azure and TwinWorX platform. See Temple University Design Standards Section 25 00 00 Integrated Automation for detailed requirements.
2. All commercial grade electronic controllers shall be fully compliant with the current edition of ANSI/ASHRAE 135 and carry the BACnet Testing Laboratories (BTL) seal. All process control / PLC controllers shall be Object Linking and Embedding for Process Control (OPC) compliant.
3. All Building Automation Systems shall provide full BACnet-compliant interoperability via the Temple University Integrated Facilities Management System, including the following BACnet Interoperability Building Blocks (BIBBs):
    A. Data Sharing
    B. Point Commanding
    C. Change of Value
    D. Trending
    E. Scheduling
    F. Alarm & Event Management
    G. Device & Network Management
4. The BAS shall have the ability to provide BACnet Data Sharing for all physical and virtual point values with the TU-IFMS.
5. The BAS shall have the ability to provide BACnet point commanding for all hardware points, setpoints, and operator-adjustable variables and these shall be adjustable/commandable from the TU-IFMS.
6. The BAS shall have the ability to provide BACnet COV/Trending for all physical and virtual point values with the TU-IFMS.
7. The BAS shall have the ability to provide BACnet Scheduling, including special events scheduling, and shall be implemented to allow centralized hierarchical scheduling via the TU-IFMS for all HVAC equipment.
8. The BAS shall have the ability to provide BACnet Alarm & Event Management and these shall be available and configurable via the TU-IFMS for all physical and virtual points.
9. The BAS contractor shall provide the IP infrastructure within the building, as described herein, for all building automation equipment including, but not limited to, HVAC controls, lighting controls, shading controls, and any other automation equipment that are operated and maintained by the Temple University Facilities Operations & Maintenance Department and are required for building automation integration. The BAS contractor shall coordinate the IP communications requirements for those systems with the appropriate contractors.
10. All BAS networks and BAS communications within each building shall be BACnet/IP and all required communication wiring, network switches, controllers, etc. necessary for a complete building automation system shall be the responsibility of the BAS contractor as a sole point of responsibility for the complete BAS within the building. With prior written approval of the Temple University

Facilities Operation & Maintenance Department, floor-level networks may be BACnet MS/TP, BACnet over ARCNET, or other BTL Listed configurations.

11. BACnet/SC is permitted and requires a physical BACnet/SC hub and physical failover BACnet/SC hub within each building where BACnet/SC is utilized. In addition, a BACnet/SC license manager software package shall be provided. Exact system architecture shall be proposed by the BAS vendor and approved by the Temple University Facilities Operations & Maintenance and Temple University Information Technology Services Departments prior to installation.

12. **Individual Campus Ethernet-based interfaces to field equipment are prohibited. Only one connection per building between the BAS and Campus Ethernet shall be permitted. Network switches or bridging devices, other than those listed below, are PROHIBITED.** The Temple University ITS-approved IP switches are as follows:

    A. Extreme Networks VSP 8404 Compact Modular 10/40/100 Gigabit Aggregation Switch (a minimum of one of these switches shall be provided by the BAS contractor for each building).

    B. Extreme Networks 5520-12MW-36W Edge and Aggregation Switch, 48 Port, for individual floor networks.

    C. Extreme Networks 5420M-48W-4YE Universal Edge Switch, 48 Port, for expansion of individual floor networks.

    D. Extreme Networks 5420M-24W-4YE Universal Edge Switch, 24 Port, for additional expansion, as needed.

13. Each IP switch shall be located in the main mechanical room or other location as specified by Temple University Facilities Operations & Maintenance. Each IP switch shall be installed in a location that is secure and free from damage from overheating, freezing temperatures, and water damage.

14. The BAS contractor shall provide any network wiring required to interconnect the IP switches and this wiring shall be Category 6 (or better) Industrial Ethernet Cable or fiber optic cable (preferred) enclosed in conduit.

15. **The BAS contractor shall provide the system integration services necessary to integrate the BAS into the TU-IFMS. See Temple University Design Standards Section 25 00 00 Integrated Automation for detailed requirements.**

16. All BAS vendors / contractors are responsible for system tie-in and graphics to their manufacturer specific front-end / HMI / Server system. If the manufacturer-specific front-end / HMI /Server system does not currently exist on Temple's network, one shall be provided as part of the project. In addition, the BAS contractor shall be responsible for integration of the BAS into the TU-IFMS.

17. The BAS contractor shall provide an operator workstation/HMI, to be located in the main mechanical room or other location as specified by Temple University Facilities Operations & Maintenance and this operator workstation/HMI shall be connected to a port on one of the IP switches identified above.

18. The BAS shall be provided by one of the following preapproved automation equipment and system vendors **ONLY**: Allen-Bradley (industrial PLC-based systems only), Automated Logic WebCTRL, Delta Controls, Johnson Controls (JCI) Metasys, or Siemens Apogee for the Main Campus. The HSC campus shall remain a JCI-only campus. For new construction and entire building renovations, all

of the control companies identified below are to be considered approved vendors for bid purposes on any controls project unless otherwise directed by the Temple University Facilities Operations & Maintenance Department:

A. Allen-Bradley, Thermo Systems, LLC. West Point, PA, (industrial PLC-based systems only)

B. Automated Logic Corporation, Radius Systems, LLC, Chadds Ford, PA

C. Delta Controls Inc., Intellimation LLC, Norristown, PA

D. Johnson Controls Incorporated, Plymouth Meeting, PA Branch Office

E. Siemens Industry, Blue Bell, PA Branch Office

19. **For renovation projects, the Design Professional shall coordinate with Temple University Facilities Operations & Maintenance to determine the specific requirements for building automation on a case-by-case basis.** Depending on the scope of the renovation project and the age and condition of the existing BAS, Facilities Operations & Maintenance may require expansion of the existing BAS utilizing sole-source equipment from the currently installed manufacturer or require replacement of the entire BAS via competitive bidding.

20. For airflow control equipment and controls in wet labs, the equipment and controls shall be provided by Phoenix Controls, via The Kirkman Oliver Company, Newtown Square, PA. Control of wet lab airflow equipment shall be provided by Phoenix Controls and interfaced to the building automation system utilizing BACnet.

21. The Design Professional shall coordinate with Temple University Facilities Operations & Maintenance during design phases to provide a complete Building Automation System (BAS) points list for each piece of equipment, VFD, etc. on the project.

22. The Design Professional shall coordinate with BAS Contractor during all design phases to ensure a complete design and compliance with this Guide.

23. In general, for each project a BAS contractor shall furnish, install, wire, and guarantee the entire BAS, including all BAS communication wiring and IP switches utilized for BAS service within the building.

24. Prime Contractor is required to contract with the BAS Contractor directly. Contracting the BAS Contractor under Division 23 is prohibited.

25. Prime Contractor is to award the BAS contract in the same timeframe as the award of contracts to Divisions 22, 23 and 26, etc.

26. The University requires electric/electronic end devices, **no pneumatic devices shall be specified or installed in new work.** Electronic motors used as control valve and control damper actuators shall meet the torque requirements for closing / opening against system pressure and the response time of said actuators shall be adequate to maintain desired conditions of the process variable.

27. Unless otherwise specified elsewhere in these Design Standards, all control valves (chilled water, condenser water, hot water, and steam) shall be of the throttling plug (water service), V-port (chilled water choke valve service) repacking type, or globe valves (steam service). Valves 2” and smaller shall have threaded brass bodies and unions installed before and after for service. Valves larger than 2” shall be flanged and have cast iron bodies. All valves shall be provided with stainless steel stems and trims, seats, plugs, etc. Plug types shall be:

A. Steam – Linear characteristic – 1/3-2/3 for capacities 1,200 lbs/hr or greater. [Consider the use of V-port ball valves, configured with fail-safe closed, for steam service with no 1/3-2/3 arrangement (300:1 rangeability)]

B. Modulating chilled water service for hydronic coils – equal percentage plug.

C. Modulating hot water service for hydronic coils – equal percentage plug.

D. Mixed water application service (non-coils) – linear characteristic.

E. Two position – flat seat/quick opening.

28. Each project shall provide control panels in the quantities and locations necessary to properly access and house all control equipment. Panels shall be provided with hinged covers and key operated locks. **Top conduit access to any panel(s) is prohibited.** Panels shall be located in a dry location and accessible from floor level. All control panel locations shall be indicated on the project coordination drawings. The control panel power requirements shall be documented on the contract drawings. All control panels shall be fed from a dedicated power source (emergency/UPS if applicable), have an electrical breaker and available duplex outlet. All control panels shall have the appropriate primary and secondary circuit protection.

29. A full and complete drawings and specifications submittal package shall be sent to the University for review by the Temple University Facilities Operations & Maintenance Department and shall, at a minimum, include the following requirements:

A. General system description, system architecture, including sequence of operations, point listing, description and type, engineering units, device range, point alarm parameters, control panel locations, sensor locations, etc.

B. Shop drawing submittal requirements include the following:

I. Individual drawing for each system.

II. Drawings shall depict all system hardware, control panels, field devices, electrical work as well as all BAS work with each drawing containing the following information:

(a) Wiring type and method of installation.

(b) Control tubing information.

(c) Point names and termination numbering for each control panel.

(d) Detailed Bill of Material with appropriate reference to section where product data is presented.

(e) Sequence of operation, including P&ID (control) diagrams.

(f) Hardwired, calculated, and logic point database listing, software addresses following nomenclature in appendix, wiring numbering, control/alarm, setpoints, and termination locations.

C. Hardware product data:

I. The BAS contractor shall furnish complete documentation pertaining to hardware and all other equipment supplied including power requirements per control panel and end devices.

II. The BAS contractor shall document all point connections at the control panels. Include all pertinent wiring, field device, hardware, termination modules, and software data. Control panels are to be located by the Design Professional with final approval coordinated with the University.

III. The BAS contractor shall document all I/O modules and communications cards installed in control panels. Include all pertinent data, including firmware/software versions, switch settings, and calibration data.

D. Software; provide the following information pertaining to BAS software:

I. All programs pertinent to project and backup format with software used to create backup.

II. Operating system software on acceptable digital media.

III. **All software, hardware, and licenses required to operate, maintain, program, configure, and modify the building automation system shall be provided with the building automation system and Temple University shall, upon completion of the project, become the owner, for the sole purpose of operating and maintaining the building automation system, of such software without recurring licensing or other fees.**

IV. A list of system graphics, to include a design depiction or rendering of each display.

V. Table of Contents of routines that the contractor shall use to implement the sequence of operations specified.

VI. A written narrative shall be detailed and include definitions of each variable and instruction contained in the control panel's code.

VII. A list of software points to be used to implement each and control PID tuning parameters and any other software points used.

VIII. A list of the active control programs resident in each panel and their memory footprint with respect to total available memory in the device. Control programs and point database shall not consume more than 50% of available device memory.

IX. Energy management routines implemented, if using manufacturer firmware specific features, requires a full description and sequence of operation for the feature to be included.

X. Wireless System Requirements (use of which is generally **prohibited** and shall be pre-approved by Temple University Facilities Operations & Maintenance Department on a case-by-case basis).

E. Description of Points:

I. Provide tables listing all points to include:

(a) Point name.

(b) BACnet point type and instance number (e.g. AI:9, BO:2, AV:7).

(c) Functional description (e.g. Chilled Water Return Temperature).

(d) Device termination address (if physical point).

(e) Control drawing callout reference (e.g. TT-1, ES-4, SD-2).

(f) Alarm Limits.

(g) Engineering units.

(h) Device range in Engineering Units.

(i) Device range in physical units (e.g. 4-20 mA, 0-10 VDC, 1000 Ω@72 DEG F).

II. See Temple University Design Standards Section 25 00 00 Integrated Automation for point naming requirements and integration to the TU-IFMS.

F. Field Devices:

I. Specification data sheets to include accuracy, calibration, and servicing information and quantities for all field devices.

II. Tabulated information showing point name, field device, and data sheets reference for all points.

III. Drawings of all local control panels including installed modules and wiring terminations.

G. Electrical Work:

I. Submit data sheet on each type of wire to be used and its specific job application (e.g. Signal Wiring, Communication, Data Communication, etc.).

H. Electrical Work Requirements:

I. General:

(a) Wiring of all field devices and electrical devices to control panels. **Panels shall not have top penetrations.**

(b) All communications wiring (MS/TP, ARCNET156) between BACnet routers, control panels, or sub-devices.

(c) All wiring of control panels including, but not limited to, EP's, I/P's, pilot lights, relays, transformers, and other miscellaneous devices as shown and specified.

(d) All power wiring of field devices as required.

(e) All end device control wiring as required.

(f) All field devices with potential for liquid exposure, indoor and outdoor, shall have conduit connections made to them from junction boxes, with a minimum of 18 inches and a maximum of 36 inches of flexible metallic conduit ("Greenfield", liquid tight) with sufficient slack to allow for removal and/or servicing.

II. Signal Wiring:

(a) All signal wiring shall be point to point. **No splices between the control panel enclosure and the field device are ever permitted.** Terminal strips or terminal blocks are permitted within the confines of a control panel enclosure if the use thereof facilitates fabrication or post installation

service. In such circumstances each wire leading into and out of the termination strip or block shall be imprinted with the signal name using polyolefin heat shrink labeling sleeves spaced not less than ½ inch from the cut end of the wire insulation.

(b) Signal wiring to all analog field devices, including but not limited to temperature transmitters (TT), resistance temperature detectors (RTD), humidity transmitters (HT), current to pneumatic (I/P) transducers, shall be run in conduit. Conduits shall be marked "BAS" at regular intervals not exceeding 4 feet. If the field device has an enclosure, said enclosure shall be marked with an imprinted label indicating the device control drawing callout (e.g. TT-3, ES-7, SD-1). The control panel termination of the signal wire shall be imprinted with the signal name using polyolefin heat shrink labeling sleeves spaced not less than ½ inch from the cut end of the wire insulation.

(c) Signal wiring to binary field devices (for circuits of 30 VAC or less) shall be as specified herein for Low Voltage Control Wiring and shall be run in conduit. Conduits shall be marked "BAS" at regular intervals not exceeding 4 feet. If the field device has an enclosure, said enclosure shall be marked with an imprinted label indicating the device control drawing callout (e.g. TT-3, ES-7, SD-1). The control panel termination of the signal wire shall be imprinted with the signal name using polyolefin heat shrink labeling sleeves spaced not less than ½ inch from the cut end of the wire insulation.

(d) Signal wiring shields shall be grounded at the control panel end only.

(e) Room Temperature Transmitters connected to terminal device controllers (VAV, fan coil, unit conditioner) shall have their enclosure marked with an imprinted label indicating the control drawing callout of the associated terminal device (e.g. VAV2-1, FCU-4, UC-3).

(f) Occupied space CO2 sensors shall have their enclosure marked with an imprinted label indicating the control drawing callout of the associated unit (e.g. AHU-2, RTU-6).

III. Communications Wiring:

(a) All communications wiring shall be run in conduit with no splices and separate from all wiring over 30 volts. Shield shall be terminated as recommended by the control panel manufacturer. Conduits shall be marked "BAS" at regular intervals not exceeding 4 feet.

(b) All IP switches shall be installed in locked enclosures or located in a space secured from unauthorized physical access.

(c) All LAN (IP) cabling shall be Category 6 (or better) Industrial Ethernet Cable enclosed in conduit.

(d) Communications drops and controller locations shall be marked on the system architecture or riser diagram such that the installed wire path from controller to controller can be determined.

IV. Low Voltage Control Wiring (30 VAC or Less):

(a) Low voltage control wiring shall be run in conduit with no splices, separate from any wiring above 30 volts. The wire terminations shall be imprinted with the signal name using polyolefin heat shrink labeling sleeves spaced not less than ½ inch from the cut end of the wire insulation.

I. Field Devices:

I. Temperature Transmitters (TT)

(a) All temperature transmitters shall be resistance temperature detectors (RTD), 4-20 mA, with two or three wire connections, with the exception of room temperature sensors, which may be RTD or thermistor. Room temperature sensors shall have their cable entrance sealed, insulated and mounted away from direct sunlight or drafts.

(b) Flexible averaging type RTDs shall be used in any application where there is potential for air stratification, and shall include the sensing probe, mounting clips, utility box and gasket (to prevent air leakage and vibration noise). **The length of the averaging bulb shall be sufficient to cover the free area from top to bottom. Each pass of the bulb shall not exceed 12 inches from the previous pass.**

(c) **Duct mounted rigid insertion type RTDs shall span at least 33% of the duct** and include the sensing probe, mounting clips, utility box and gasket (to prevent air leakage and vibration noise).

(d) Immersion type RTDs shall be used in all fluid applications and shall include stainless steel thermowells, **strap-on type pipe sensors are never permitted.** The connection head and sensor probe shall be removable without breaking fluid seal or removal of any equipment or piping. **The thermowell shall penetrate 1/2 of the pipe diameter and the associated sensor shall match the thermowell size**.

(e) All control sensing devices shall be installed as to be accessible from the outside of the airstream served. Accessibility of all devices shall be verified during the shop drawing review.

(f) Temperature transmitters shall have to following ranges:

(i)	AHU (air only)	20°F to 120°F.
(ii)	Chilled Water	30°F to 80°F.
(iii)	Condenser Water	20°F to 120°F.
(iv)	Hot Water Systems	50°F to 250°F.
(v)	Steam Systems	100°F to 500°F.

(g) Mount RTDs per manufacturer's requirements with insulated mounting brackets. **Mounting RTDs with cable ties is strictly prohibited**.

(h) Provide NEMA 4 enclosures for devices mounted outdoors.

II. Humidity Transmitters (HT)

(a) Units shall be suitable for duct or wall (room) or outdoor mounting. Unit shall be 2-wire transmitter with humidity sensor and shall operate on power requirements of 24V DC nominally unregulated. Unit shall produce linear continuous output of 4 to 20 mA for percent relative humidity (% RH). Sensors shall have the following performance and application criteria:

(i) Input Range: 0 to 100% RH

(ii) Output Range: 4 to 20 mA

(iii) Accuracy (% RH): ± 2% between 0 & 95% RH at 25°C.

(iv) Sensor Operating Range: -58°F to 185°F; (Maximum operating temperature for wall mounted unit: 150°F).

(v) Minimum zero and span adjustments of ± 15% of full scale.

(vi) Provide radiation shield for outdoor mounting applications.

III. Current Transmitters (Status Inputs for Electric Motors): Comply with ISA 50.00.01, current sensing fixed or split-core transformers with self-powered transmitter, adjustable and suitable for 175 percent of rated motor current.

IV. Current Switches: Self powered, solid state with adjustable trip current, selected to match current and system output requirements.

V. Flow Switch (Hydronic): Mount per manufacturer's requirements including upstream and downstream diameters required.

VI. Electrical Interface Devices:

(a) Control Relays:

(i) All control relays shall be UL listed with contacts rated for the application and mounted in minimum NEMA I enclosure.

(ii) Relays used for across the line control (start/stop) of 120V motors, 1/4 HP and 1/3 HP shall be rated to break a minimum 10 amp inductive load.

(iii) Control relays for use on electrical systems greater than 120 volts shall be rated for 600 volts and shall be Allen Bradley Bulletin 70, Type N or approved equivalent by Temple University Facilities Operations & Maintenance Department.

(iv) No relays mounted inside the motor control center.

(b) Control Transformers:

(i) Furnish and install control transformers as required.

(ii) **Transformer loading shall not exceed 60% of capacity.** All control transformers shall include primary and secondary circuit protection.

(iii) Maintain enclosure environmental temperature within transformer operating range as recommended by transformer manufacturer.

30. Project Closeout Requirements

A. Before control or Building Automation Systems are closed out a point-to-point verification, from the field devices to EBI shall take place. The system controls shall be tested at each unit level, AHUs, VAV/CAV terminal units, hydronic systems, etc. Components failed and replaced during the warranty period shall repeat point-to-point check out.

B. The contractor shall submit three binders and electronic copies for each project including the following:

I. P&ID diagram for each system.

II. Point listing, by system, with variable acronym or point name, software address, point type, and engineering units.

III. Wiring diagrams by system including termination nomenclature, location and wiring identification.

IV. Calibration sheet (minimum 3-point calibration) for each device identified in the design as requiring calibration certificate, indicating calibration date and model number. Include equipment calibration certifications for calibration standards.

V. Final tune-up list of parameters for each PID loop.

VI. **All software, hardware and licenses necessary to operate, maintain, update modify the system, including a final version of the software operating the installed system.**

VII. A statement indicating all systems graphics are complete and accurate.

C. The contractor shall provide the following training:

I. The BAS contractor shall provide factory-trained instructor(s) to give full instruction to designated personnel in the operation of the system installed. Instructors shall be thoroughly familiar with all aspects of the subject matter they are to teach.

II. The BAS Contractor shall provide all students with a student binder containing product specific training modules for the system installed. All training shall be held during normal working hours of 7:00 AM to 3:30 PM weekdays.

III. Provide 40 hours of training for Temple University's designated operating personnel.

IV. Training shall include:

(a) Explanation of drawings, operations and maintenance manuals.

(b) Walk-through of the job to locate control components and to explain system operation.

(c) Operator workstation and peripherals.

(d) Network and controller operation/function.

(e) Operator control functions including graphic generation and system/field panel programming.

(f) Operation of portable operator's terminal.

(g) Explanation of adjustment, calibration and replacement procedures.

(h) Student binder with training modules.

V. Since the Temple University Facilities Operations & Maintenance may require personnel to have more comprehensive understanding of the hardware and software, additional training shall be available from the Manufacturer. If such training is required by the Temple University Facilities Operations & Maintenance, it will be contracted at a later date.

D. Confirmation in writing by the controls contractor that:

I. All construction Requests for Information (RFIs) are resolved.

II. All shop drawings, as-builts, and submittals are completed.

III. All required training is completed.

IV. All Testing, Adjusting and Balancing, and commissioning activities are completed.

END OF SECTION

1. Ductwork

A. All ductwork shall be designed, constructed, supported, and sealed in accordance with SMACNA HVAC Duct Construction Standards and pressure classifications. When the ductwork pressure classification of these standards is exceeded, construct ductwork in accordance with SMACNA Round and Rectangular Industrial Duct Construction Standards. The following modifications to the Standards shall be specified:

I. Where possible, radius elbows with a construction radius of 1.5 of the duct width shall be utilized instead of square elbows.

II. All square elbows must be constructed with single thickness turning vanes, Runner Type 2 as shown in Figures 4-3 and 4-4 of SMACNA Duct Construction Standards - Metal and Flexible. Where a rectangular duct changes in size at a square-throat elbow fitting, use single thickness turning vanes with trailing edge extensions aligned with the sides of the duct.

III. Air extractors and splitter dampers are **PROHIBITED**.

IV. Transitions and offsets shall follow Figure 4-7 of SMACNA HVAC Duct Construction Standards - Metal and Flexible, except that sides of transitions shall slope a maximum of 15°.

V. Minimum duct gauge shall be 22 gauge for ducts up through 43 in., 20 gauge up through 60 in. and 18 gauge above 60 in.

VI. Transverse/Longitudinal Joints:

(a) Transverse joints for all supply, return, make-up air and outside air ducts serving an application that requires ductwork to be inspected and cleaned periodically shall be gasketed flanged Vanstone joints with minimum 1.5 in. flanges fastened 6 in. on center or “Ductmate” transverse sheet metal duct connection system with manufacturer-furnished gasketing system. Gasket shall be "440 Gasket Tape" by Ductmate Industries, Inc. or approved equal.

(b) Duct transverse and longitudinal joints (except for the above requirements) shall be selected and used consistent with the static pressure class, applicable sealing requirements, materials involved, duct support intervals and other provisions for proper assembly of ductwork outlined in the SMACNA HVAC Duct Construction Standards - Metal and Flexible. Transverse joints T-15 through T-24, shown in Figure 2-1 are acceptable construction. Type L-2 (button punch snap lock) or Type L-3 (grooved seam) longitudinal seams, shown in Figure 2-2, are **PROHIBITED**.

B. The design SMACNA Pressure Classification for all ductwork shall be the next highest pressure classification that is greater than the maximum total static pressure that can be exerted by the fan(s) connected to the duct system. The design pressure classification for each duct system shall be noted on the project drawings and listed in the project specifications.

C. Maximum design velocities for ductwork shall be as follows:

I. Medium pressure ductwork in mechanical rooms and shaft ways: 2000 FPM

II. Medium pressure ductwork in or above occupied spaces: 1750 FPM

III. Low pressure ductwork in mechanical rooms and shaft ways: 1500 FPM

IV. Low pressure ductwork in or above occupied spaces: 1200 FPM

V. Terminal outlets: 500 FPM

VI. Outdoor and relief air ductwork: 1500 FPM

D. Acoustical duct lining in any part of the duct system is **PROHIBITED**. All ductwork requiring insulation shall be externally insulated. Double-wall ducts consisting of an outer wall of galvanized sheet metal and an inner wall of perforated galvanized sheet metal with insulation between the layers is permitted. Ducts shall be externally insulated as follows:

I. Rectangular supply and return ductwork in mechanical rooms, all exposed areas, and duct shafts:

(a) Indoor: Rigid mineral fiberboard, 1.5 in. thick, 3 PCF, with “all-service” jacket.

(b) Outdoor: Rigid mineral fiberboard, 2 in. thick, 6 PCF, with 3M™ VentureClad™ Insulation Jacketing System.

II. Rectangular supply ductwork in concealed spaces and return ductwork in unconditioned spaces:

(a) Indoor: Rigid mineral fiberboard, 1.5 in. thick, 3 PCF, with “all-service” jacket or mineral fiber Ductwrap, 2 in. thick, 1 PCF, with “all-service” jacket.

(b) Outdoor: Rigid mineral fiberboard, 2 in. thick, 6 PCF, with 3M™ VentureClad™ Insulation Jacketing System.

III. Outside air intake, relief, and exhaust plenums:

(a) Indoor: Rigid mineral fiberboard, 2 in. thick, 6 PCF, with “all-service” jacket.

(b) Outdoor: Rigid mineral fiberboard, 2 in. thick, 6 PCF, with 3M™ VentureClad™ Insulation Jacketing System.

IV. Louver blank-off panels:

(a) Rigid mineral fiberboard, 2 in. thick, 6 PCF, with galvanized sheet metal on both sides.

V. Round and flat-oval supply, return, and outside air ductwork in mechanical rooms:

(a) Indoor: Mineral fiber Ductwrap, 2 in. thick, 1 PCF, with “all-service” jacket.

E. Insulation specifications are as follows:

I. Rigid mineral fiberboard: ASTM C612, k = 0.23 BTU · IN/HR · FT^2 · at 75°F.

II. Mineral fiber Ductwrap: ASTM C553, k = 0.27 BTU · IN/HR · FT2 · at 75°F.

F. Seal all ductwork seams, joints, fastener penetrations and fitting connections with sealants in accordance with SMACNA Seal Classification as required by the design SMACNA Duct Pressure Classification. Specify that all ductwork, regardless of pressure classification, shall have a minimum Seal Class B. Where ducts are not continuously welded, provide liquid, mastic, and embedded fabric tape type sealants or combination, and gaskets as required to meet the specified duct leakage allowance.

G. Sealant composite fire and smoke rating, when tested in accordance with ASTM E 84, NFPA 255 or UL 723, shall not exceed Flame Spread of 25 and Smoke Developed of 50.

H. The aspect ratio (ratio of width to height) of rectangular ducts should be minimized to reduce pressure losses and initial costs. Duct aspect ratios should not exceed 4:1.

I. To minimize fan energy, consideration must be given to the lowest practical velocity and pressure criteria which will provide adequate service. In general, size ductwork to maintain a maximum pressure drop of 0.08 feet per 100 lineal feet of ductwork.

J. Industrial Duct Construction:

   I. Prior approval must be attained from the Associate Vice President of Facilities Operations & Maintenance for the use of systems requiring industrial duct construction.

   II. Follow SMACNA Round and Rectangular Industrial Duct Construction Standards.

   III. Specify sealing requirements in terms of percent leakage appropriate for the application.

   IV. To minimize fan energy, consideration must be given to the lowest practical velocity and pressure criteria which will provide adequate service.

K. All duct systems must be designed to meet the sound level requirements listed in Section 23 00 00 - Heating, Ventilating, and Air Conditioning. The specification shall state that the Contractor is responsible for all duct generated noises which will result in noise levels greater than those stated in Section 23 00 00 - Heating, Ventilating, and Air Conditioning, and for all discrete frequency noises generated by the ductwork, such as oil canning, banging, clicking, hissing or rattling. All such deficiencies shall be corrected by the Contractor as directed by the Design Professional.

L. Contract drawings must have adequate notation which correlates each duct and diffuser with the central air handling unit from which it is served. The notation must be completed in such a manner as to clearly identify each system and its components without tracing systems between drawings.

M. Shop drawings of all sheet metal ductwork and related equipment must be furnished in a minimum scale of 3/8 inch to the foot or shall be submitted electronically. The Design Professional shall carefully review all contractor-generated sheet metal submittals and mark appropriately.

N. All materials for all duct systems shall be specified as follows:

   I. General Ductwork - Galvanized sheet steel meeting ASTM A 653 and ASTM A 924 with G60 coating designation. G90 shall be required in specific applications such as general laboratory exhaust.

   II. Stainless Steel - Specify type as dictated by the application. Specify finish for exposed ductwork.

   III. Aluminum Duct - ASTM B-209, Alloy Number 3003, H-14. Specify finish for exposed ductwork.

O. All rectangular panels above 10 inches in width must be cross broken on all four sides.

P. All ductwork and accessories must be supported from the structure only using trapeze, strap, or angle iron hangers conforming to SMACNA HVAC Duct Construction Standards - Metal and Flexible.

Q. Provide supplemental structural steel to span joists where required. Deflection of supplemental structural steel shall be limited to length/180 of the span.

R. Do not support ductwork from furring, hung ceilings, metal floor deck, metal roof deck or from another duct or pipe.

S. Do not hang lighting fixtures or piping from ductwork.

T. Do not use perforated band iron for duct support.

U. Support ductwork at each change in direction.

V. Where vertical ducts penetrate floor openings, and require support, provide two horizontal galvanized steel angle supports attached to the long side of the duct and anchored to the floor with expansion bolts. Extend angles 3 inches beyond edge of opening. Provide the following angle sizes:

Duct Size	Angle Size
Thru 36 in.	1-1/4 in. by 1-1/4 in. by 1/8 in.
37 in. thru 59 in.	2 in. by 2 in. by 3/16 in.
60 in. and larger	3 in. by 3 in. by 3/8 in.

W. Where ducts penetrate mechanical room floors, provide 4 in. high concrete curbs similar to piping penetrations.

X. Where duct connects to or terminates at masonry openings or at floors where concrete curbs are not used, provide a continuous 1-1/2 in. by 1-1/2 in. by 3/16 in. galvanized steel angle support around the ductwork. Bolt and seal the supports to the building construction using expansion bolts and caulking compound. Seal shall be watertight at floor or wall and duct such that a spill will not pass down through the opening.

Y. All exterior duct work shall be double wall insulated construction. Exterior ductwork shall be round or sloped (rectangular) to avoid standing water on top. Any exterior ductwork with standing water will be replaced at the Contractor's expense. Service stairs up and over the ductwork may be required to maintain access to the roof.

Z. For insulated ductwork, install hangers on the outside of the insulation. To maintain the insulation value, inset a piece of 1-inch thick, 6 PCF fiberglass board with a foil/scrim/kraft (FSK) jacket at these supports.

AA. Plenum chambers shall be constructed of minimum 18-gauge metal with ½ in. x ½ in. x 3/16 in. galvanized angles up to 10 ft. in height. Above 10 ft., angles of 2 in. x 2 in. x 1/4 in. must be used. Angles must be installed on all vertical and longitudinal seams and on a maximum center of 4 ft.

BB. Low pressure (class 2 or lower) round ductwork shall be specified as follows:

I. Lock-type spiral seam or lock-type longitudinal seam duct construction.

II. Round galvanized gauge selection shall be in accordance with Table 3-5 of the SMACNA Duct Construction Standards - Metal and Flexible, except that the following minimum gauges are required:

(a) Longitudinal lock - 22 gauge

(b) Spiral lock - 24 gauge

III. Fittings shall have a construction radius of 1-1/2" times the diameter.

IV. All branch connections from duct headers shall be made using tee (90 degrees), lateral (45 degrees), tee cross, lateral cross or "Y" branch fittings of the conical type. All fittings fabricated as separate fittings shall have continuous welds along all seams and joints.

V. All seams shall be sealed.

CC. Flexible Ductwork:

I. Flexible ducting constructed of wire frames and fiberglass or plastic film is **PROHIBITED**.

II. Ducts shall be aluminum with spiral fabricated triple lock construction. Pressure drop shall not exceed 0.23 inches of water column per 100 ft. of duct for 300 CFM in an 8 in. duct.

III. Duct shall conform to NFPA 90A and shall be UL listed, Specification 181, Class 1, including insulation.

IV. Insulation where required, shall be on the exterior of the duct.

V. Maximum flexible ductwork length shall be 6 ft. or less. The remainder of the branch ductwork shall be sheet metal. Provide flexible duct runs as short and straight as possible.

VI. Flexible ductwork shall be limited to low pressure connections to diffusers and registers. Use of flexible ductwork on the high pressure (upstream) side of air terminals and VAV boxes is **PROHIBITED**.

DD. Ducts penetrating through masonry walls, floors, and roofs shall be clearly detailed on the drawings. The details shall, as a minimum, indicate curbs, flashing, counterflashing, fire dampers, sealing, and weatherproofing.

EE. Horizontal exterior rectangular ducts shall be fabricated with all seams at the bottom and installed with a top surface slope of ¼ in. per ft., side to side. Supports shall be detailed on the drawings.

FF. Specify special duct sealing and weatherproofing requirements for all exterior duct applications.

GG. Dishwasher, sterilizer, autoclave, cage washer, etc. exhaust hoods and ductwork shall be constructed of welded stainless steel. Ductwork shall be sloped and provided with drain connections at low points. Ducts to be installed with all longitudinal seams at the top of the duct. Kitchen exhaust ductwork shall be provided with adequate access doors to facilitate cleaning.

HH. Kitchen exhaust hoods and exposed range hood exhaust duct shall be constructed of No. 18 gauge welded stainless steel. Concealed range hood exhaust ductwork shall be constructed and supported by of minimum No. 12 gauge black iron or No. 18 gauge stainless steel with no turning vanes. All joints shall be welded liquid tight. As an alternative, pre-manufactured grease duct may be used when installed strictly in accordance with the manufacturer's instructions. Slope ductwork to hood or to the base of vertical risers and provide an accessible collection point for grease and residue at base of vertical risers. Provide approved access panels for cleaning at minimum 20-foot centers on horizontal duct and on each floor on vertical risers where personnel entry is not possible from the top of the riser. Hard connections to fans shall be utilized in lieu of flexible fabric connections. The

construction and installation of all kitchen range hoods and grease duct shall comply with applicable codes.

II. Shower exhaust systems shall be constructed of aluminum and sloped to drain provisions. After the shower exhaust is mixed with a volume of general exhaust air equal to 200% of the shower exhaust rate, standard galvanized construction may be used.

JJ. Laboratory exhaust duct material must be reviewed and approved by the Facilities Operations & Maintenance Department. All laboratory exhaust ductwork that is undiluted (fume hood branch ductwork, dedicated fume hood exhaust, etc.) shall be stainless steel. Acceptable duct materials for other lab exhaust applications are as follows:

I. Galvanized (minimum G-90)

II. Stainless Steel

III. PVC-coated (pre-baked) steel, or epoxy-phenolic-coated (air dried) steel. Coatings for exhaust duct shall be evaluated on a case-by-case basis.

IV. Plastic ducts such as Dynel reinforced polyester. When using plastic ductwork, all fire code and sprinkler code requirements must be addressed.

KK. To reduce operating system pressure drop, manifold laboratory fume hoods to a common exhaust where possible.

LL. All duct systems shall be field leak tested at 100% of the duct construction rating. Leak testing shall follow general procedures (Chapter 3) and use apparatus (Chapter 5) as outlined in the SMACNA HVAC Air Duct Leakage Test Manual, Latest Edition. The Design Professional shall specify the allowable leakage in terms of percent of total rated airflow capacity for each duct system based on leakage allowances accounted for in airflow rate and fan selection calculations. The Design Professional shall specify that the allowable leakage rates for each duct section tested shall be determined by the use of Appendix C in the SMACNA HVAC Air Duct Leakage Test Manual. Ductwork to be leak tested after all branch connections are installed. All leak testing shall be witnessed by a representative from the Facilities Operation and Maintenance Department.

MM. All Phoenix valves shall be provided with manufacturer's transition collar such that sheet metal screws into the Phoenix valve are not required.

NN. For all ductwork types, the screw type shall match the duct construction type.

2. Ductwork Accessories

A. Each branch duct to individual diffusers and registers shall have a balancing damper, located as far away from the air terminal as possible. Dampers shall be located as close as possible to the location where the duct branches off of the main. Dampers in diffusers and registers shall be used for fine tuning the airflow only. Dampers supported by cantilevered shafts are **PROHIBITED**. All shafts shall extend through the duct and be supported at both ends. Dampers 11 in. high and smaller shall be single-blade type. Dampers 12 in. high and larger shall be multi-blade, opposed-blade type. On insulated ductwork, control shaft shall be extended and provided with mounting bracket so that damper regulator can be installed at the surface of the insulation. Excessive, un- necessary balancing dampers upstream of VAV boxes shall be avoided.

B. Specify flexible connections not less than 3 in. wide at the inlet and outlet of all rotating equipment and at all building expansion joints. The clear space between connected parts

shall be a minimum 3 in., and the connection shall have minimum additional 1.5 in. slack material. The connector fabric shall be fire retardant and asbestos free. All connectors shall be UL listed. The Design Professional shall include special requirements for flexible connections where airstream contaminants, temperature, or pressure may necessitate the use of heavy duty or corrosive resistant materials. Outdoor connectors shall be ozone and UV resistant and shall be rated for constant maximum temperature of 250° F.

C. Access doors must be installed both upstream and downstream of all duct-mounted equipment including but not limited to:

   I. Coils (including VAV box mounted reheat coils)

   II. Fire and smoke dampers

   III. Automatic dampers

   IV. Filters

   V. Controls

   VI. Humidifiers

   VII. Airflow measuring devices

   VIII. In-line fans

D. All access doors shall be hinged and be constructed of a minimum No. 22 gauge materials or as required by duct construction. The doors shall be installed with stiffening frames constructed from angle supports and provided with continuous hinges. Doors shall be fabricated of the same material as the ductwork with closed cell full sealing gaskets and quick fastening locking devices. For insulated ductwork, fabricate double wall door with internal insulation not less than the thickness of the adjacent ductwork or casing. Minimum door size shall be 18 in. x 18 in. Make as large as possible where the size of the duct will not support this size.

E. Sound attenuators shall be installed on all systems as required to meet the specified noise criteria levels in Section 23 00 00 - Heating, Ventilating, and Air Conditioning. Use of sound attenuators shall be based on an analysis by a qualified acoustics consultant. Sound attenuators shall have internal baffles filled with inorganic incombustible glass fiber acoustic material. Exposed filler material in contact with the airstream is **PROHIBITED**. Interior liner shall be perforated with a tedlar sheet and acoustic stand-off between the perforated interior liner and filler material.

F. Where multiple sound attenuators are grouped together in-parallel within a duct system or air handling unit, sound attenuators shall be sealed tight with sealant.

G. Provide gradual transition duct fittings between attenuators and connecting ductwork where attenuators are of a different size than the ductwork.

H. Fire dampers shall be of the out-of-air stream design (i.e., Type B: hi-hat profile, 90 percent free area, average 0.053 in. w.g. loss at 2000 FPM). Frames shall be minimum No. 20 gage galvanized steel channel. Blades shall be minimum No. 24 gage galvanized steel curtain type. Closure springs shall be Type 301 stainless steel. All fire dampers shall be rated as dynamic type. All system designs will conform with the following:

   I. The locations of all fire dampers must be indicated on the drawings as required to meet applicable codes.

II. Both NFPA and SMACNA design standards must be referenced as a standard for the installation of the dampers.

III. Each fire damper shall be field tested to ascertain proper operation.

IV. The supplier of the fire dampers must provide two (2) additional fusible links for each fire damper installed.

I. Registers and diffusers shall be of the hinged type (where applicable), shall be steel (except as noted below) with factory baked enamel finish of color selected by architect, and shall be designed as follows:

I. Air outlets shall be selected to result in a maximum occupied space velocity of 35 FPM at normally occupied locations and 3 feet below the ceiling.

II. Throws based upon a terminal velocity of 50 FPM, shall not exceed 1/2 the distance between adjacent diffusers or 67% of the distance between the outlet and the wall.

III. In addition to balancing dampers furnished at branch take-offs from mains, all units shall be provided with opposed blade dampers.

IV. Aluminum units shall be installed in wet areas or areas with high moisture content.

V. Non-dumping type supply outlets shall be specified for use in VAV systems. Analyze the outlet's performance at minimum airflow conditions.

VI. All supply and return units shall have a maximum neck velocity of 500 FPM.

VII. "Lay-in" type units are preferred.

VIII. The design of the outlet locations should consider accessibility requirements for the use of airflow balancing hoods (consider clearance space from furniture below and the location of walls and demountable partitions, etc.).

J. Intake and exhaust louvers shall be fixed and drainable, and designed within the following parameters:

I. Intake:

(a) Maximum free area velocity: 750 FPM

(b) Maximum water penetration: Less than 0.14 ounces/sq.ft. for a 15 Minute duration.

(c) Maximum pressure drop: Less than 0.15 in. w.g.

(d) Minimum free area: 45% of face area

(e) Bird screen

II. Exhaust:

(a) Maximum free area velocity: 1000 FPM

(b) Minimum free area: 45% of face area

(c) Maximum pressure drop: 0.25 in. w.g.

(d) Bird screen.

K. All unused portions of supply air and exhaust louvers shall be blanked off with an insulated No. 18 gauge galvanized steel sheet metal sandwich panel.

L. The Design Professional shall analyze the selection and location of louvers to account for snow infiltration and contaminants.

M. Duct coils shall be supported independently of the connected ductwork.

N. Single duct, shut-off, air volume control (VAV) boxes shall be DDC-powered, system static pressure independent throughout their operating range, equipped with multi-point center-averaging & amplified velocity pressure sensor, gasketed control damper, bottom access door, 1 in. fiberglass board with reinforced aluminum foil faced liner, hanger brackets and dust tight sealed control enclosure. Fan-powered VAV boxes are **PROHIBITED**.

I. Provide native BAS controller and accessories for each VAV box.

II. Provide hot water, or electric, heating coils where indicated.

III. Provide integral sound attenuators where indicated.

IV. Provide casings constructed of No. 20-gauge galvanized steel, where boxes are to be installed within 50 feet of the supply fan outlet.

V. Design shall ensure that controls section of each VAV box is easily accessible for service. Maintain 2 ft. free and clear space in front of access door.

VI. Static pressure sensor connections (tee) at VAV boxes shall be brass with brass plugs.

VII. Provide a minimum of three duct diameters of straight run of duct that is the same size as the VAV box inlet upstream of each VAV box.

O. Modulating dampers shall be sized for linear airflow control within the angle of rotation with mini- mum pressure drop. The units shall be constructed of minimum No. 16 gauge galvanized steel frames and blades having a maximum width of 6 in. Each blade shall be constructed with edge seals and shall be sealed to minimum 1/2 in. steel angles. End bearings shall be of the self-lubricating type. Maximum damper leakage shall be 2% when closed across a 4" static pressure differential.

P. Backdraft dampers shall be industrial, low-leakage, parallel-blade type, with double-thickness airfoil blades and blade seals, complete with adjustable counterweights and linkage for the duty.

Q. Bubble-tight dampers shall utilize heavy duty fast-acting 120V electric actuators. Dampers shall be bubble tight at 10 in. w.c. Dampers shall be constructed of Type 316 stainless steel with silicone gaskets and stainless-steel shafts. Bubble-tight dampers shall be installed where indicated on plans.

R. Airflow measuring stations shall be provided for VAV systems on the discharge of air handling units, inlets of return, outdoor air and exhaust systems and other locations as required for system control. Airflow measuring stations shall be duct mounted. Refer to Section 23 05 19 Meters and Gages for HVAC additional requirements.

S. Provide turning vanes installed on runners in all square throat rectangular duct elbows. Install single-thickness vanes up to a length of 36 in.; double thickness vanes in greater lengths. Provide 4 in. radius vanes wherever possible; 2 in. radius only where 4 in. vanes cannot be installed. Modify vane shape or angle of entry/exit for unequal entry/exit elbows.

END OF SECTION

1. General Requirements

   A. Modular Indoor Central Station Air Handler Applications:

      I. Modular indoor central station air handlers shall only be utilized for indoor units with a maximum airflow rate of less than 40,000 CFM that utilize return air and are not serving critical program functions. All air handlers with a maximum airflow rate of 40,000 CFM or greater and all 100% outdoor air units, regardless of size, and those serving critical program functions shall be custom-designed central station air handlers. For requirements, see Section 23 73 23 – Custom Indoor Central Station Air Handlers.

      II. Outdoor installation of air handlers is **PROHIBITED**. In specific instances where replacement of an existing outdoor air handler is required or where the Associate Vice President of Facilities Operations & Maintenance has specifically waived this prohibition in writing, the requirements of Section 23 75 13 – Custom Packaged Outdoor Central Station Air Handlers shall apply.

2. Modular Indoor Central Station Air Handler Requirements

   A. General:

      I. Air handlers shall be floor mounted within mechanical Rooms. Ceiling mounted air handlers are **PROHIBITED.** Deviation from this prohibition requires prior written authorization from the Associate Vice President of Facilities Operations & Maintenance.

      II. Draw-through arrangements are preferred. Blow-through arrangements are acceptable when necessary for replacement units.

      III. Each air handling unit shall be provided with a filter section(s) capable of housing the air filters and a mixing box designed to prevent stratification. If mixing of air cannot be assured due to unit configuration, the use of an air blender section shall be included.

      IV. Factory filter/mixing boxes shall only be utilized for air handlers with low outdoor air volume to total air volume ratios and where filtration is limited to 30% prefilters. Built-up filter/mixing sections utilizing high-quality low-leakage dampers and filter frames installed within insulated metal casings are required for all other units.

      V. The design of mixing sections shall consider proper mixing of outside air and return air airstreams. Outside air intake location is critical. Where proper mixing may be difficult, air blenders shall be considered.

      VI. All dampers and actuators shall be fully accessible for lubrication and shall be located outside of the unit casing and be fully accessible for removal and repair. Damper linkages shall be fully accessible (not enclosed).

      VII. Adequate service space shall be provided for the removal of coils, fans, fan shafts etc. without disturbing surrounding equipment. Piping drops to air handler coils shall be arranged to facilitate coil removal without removing large sections of pipe.

      VIII. Coil sections shall be provided with tracks, extended the full length of the unit to provide for the removal of the coil or an individual coil in a bank of coils.

IX. For recirculation systems, consider eliminating the preheat coil where reheat coils can pick up the load and there is no building warm-up or outside air purge required.

X. Variable temperature glycol systems are preferred for preheating to control to 0° F. A separate in-line pump shall be utilized to maintain a constant flow through the preheat coil. Control shall be performed via a mixing valve based on mixed air temperature if multiple systems are connected.

XI. Isolation equipment, as required to meet the sound and vibration limitations specified in Section 23 00 00 - Heating, Ventilating, and Air Conditioning shall be provided. Sound attenuators shall be provided where fan noise will be transmitted to interior spaces or exterior areas in excess of the levels permitted in Section 23 00 00 for interior spaces.

XII. Safety control components such as smoke detectors and/or smoke dampers shall be provided per code requirements. Smoke dampers at air handling units that are connected to emergency power shall be provided with uninterruptable power supplies to avoid the fan shutting down on high pressure after a power loss.

XIII. Provide a local keyed test switch within sight of fan with “Test- Reset” option for all duct smoke detectors.

XIV. Acceptable manufacturers are Carrier, Daikin, JCI, and Trane.

B. Casings:

I. Units shall be of a modular design and have double-wall casing for all component sections.

II. All sections shall be foam filled double-wall construction and insulated with a minimum of 2 in., 1-1/2 lb. insulation. The use of single-wall construction is **PROHIBITED**.

III. Casings shall have a solid exterior shell construction, minimum No. 14 gauge galvanized steel and an interior shell of No. 20 gauge galvanized steel or aluminum.

IV. All unit components shall have large access doors to permit inspection, routine service, and cleaning. To minimize leakage, the quantity of access doors should be limited to those locations requiring access for routine maintenance. These locations include access to fans, coils, temperature sensing devices, and filters. Clearly identified removable panels shall be provided at other locations (e.g., at coils for coil cleaning purposes, at damper locations, etc.). Access doors shall be a minimum 20 inches wide by the full height of casing or a maximum of 60 inches, whichever is smaller. Doors shall swing against the air pressure.

V. Unit casings shall be pressure rated for the total system design operating pressure plus 25%.

VI. Each unit shall have adequate space to house, service, and maintain all ancillary equipment, controls, valves, instruments, etc.

C. Fans:

I. The design of fan inlet and outlet conditions shall consider the impact of system effects on the fan performance. The recommendations shown in the SMACNA Duct Design Manual for fan inlet and outlet arrangements shall be utilized.

II. All units in excess of 2,000 CFM must be provided with a return air fan. The return air fan can be a single width single inlet centrifugal fan set, integral or independent cabinet fan, or in-line centrifugal type fan and must be mounted to permit servicing without the use of a ladder.

III. Fans for new air handlers shall provide a minimum of 25% reserve capacity over and above the design maximum flow rate at the design total static pressure and shall be provided with motors and variable speed drives capable of providing that capacity.

IV. Fans for replacement air handlers shall provide a minimum of 15% reserve capacity over and above the design maximum flow rate at the design total static pressure and shall be provided with motors and variable speed drives capable of providing that capacity.

V. Fan selections shall be based on the lowest reasonable speed while optimizing efficiency. Fan selections shall consider longevity of components, especially bearing life at maximum design conditions.

VI. Fans shall be double width, double inlet (DWDI) centrifugal type fans. The selected fan blades shall be the most efficient fan available (i.e. - forward curved, backward inclined). Airfoil fans are **PROHIBITED**.

VII. Fan sections shall employ fans with a minimum ACMA Construction Class of II. Use Class III fan construction if the fan characteristic curve extends to within 10% of the fan's Class II selection zone.

VIII. Fan sections shall be isolated from the remaining unit and the connecting duct system to control vibration.

IX. Use only solid fan shafts.

X. Fan bearings shall be self-aligning, pillow block, regreaseable ball bearings rated for an average life of a minimum of L-10, 200,000 Hrs.

XI. Fan shafts and fans shall be rated for continuous operation and shall be statically and dynamically balanced in all planes. Fan drives shall be selected for a service factor of 1.5.

XII. All fans must be fully accessible for service and routine maintenance. Fan motors and drives shall not be located within hazardous or contaminated exhaust air streams. All drives shall be exterior to air handling units. Fan bearings where possible shall be serviceable outside of hazardous or contaminated exhaust air streams. Inline fans with motors or drive exposed to exhaust air streams are not permitted.

XIII. Fan systems designed for parallel or manifold operation shall be protected against backward rotation of fan wheels. Anti-rotation devices, motor brakes, or other approved methods shall be provided.

XIV. Fans shall be certified sound and air rating based on tests performed in accordance with AMCA Bulletins 210, 211A, and 300. The arrangement, size, class, and capacity of all fans shall be scheduled on the contract drawings for permanent records.

XV. All fans shall be statically and dynamically balanced by the manufacturer and shall be provided with vibration isolation. Fans shall not transmit vibration to the duct system or building structure. All fans shall also be dynamically balanced in the field by the manufacturer after the installation is complete.

XVI. Inlets and outlets of fans that are not duct-connected, including fans in plenum chambers or open to the weather, shall have heavy OSHA-approved guard screens to protect personnel. Guard screens shall not impair fan performance and, when bolted to equipment, will permit their removal for fan service and cleaning.

XVII. Complete fan lubrication facilities shall be provided, such as oil reservoirs, sight glasses, grease and relief fittings, fill and drain plugs, pipe connections, etc. The facility shall be placed in a readily and safely accessible location so that after installation they will perform the required function without requiring the dismantling of any parts or stopping equipment. For fans located within contaminated air streams, lubrication facilities shall be piped to the exterior casing wall.

XVIII. Certified performance data including acoustical data shall be submitted for each fan at maximum design conditions. Data shall include published sound power levels based on actual tests on the fan sizes being furnished and conducted in accordance with current AMCA standards. Such data are to define sound power levels (PWL) (10 -12 W for each of the eight frequency bands). The acoustical design of the fan system must conform to the space noise criteria. Fan curves shall be submitted which will depict static pressure, total pressure, brake horsepower, and mechanical efficiency plotted against air volume. Fan curves shall include estimated losses for field installation conditions, system effect, and actual installed drive components. All included losses shall be defined on the fan curves. Data may also be submitted in tabular form, but tables are not a substitute for actual performance curves.

XIX. Direct drive fans are preferred to reduce maintenance costs and improve reliability. Where factory-designed and assembled belt drives are proposed to be furnished, OSHA-approved mesh-type guards shall be provided for all belt drives, and the drives shall comply with the following:

(a) Each drive shall be selected according to the rating and recommendations of the manufacturer for the service with which used, giving proper allowance for sheave diameter, center distance, and arc of contact less than 180 degrees. The motor shall have a name- plate rating of not less than 5% above the total of actual fan brake horsepower and drive loss at specified capacity.

(b) Belts shall be constructed of endless reinforced cords of long staple cotton, nylon, rayon, or other suitable textile fibers imbedded in rubber. The belt shall have the correct cross section to fit the sheave grooves properly. Belts shall be matched carefully for each drive. Extended-horsepower belts are not acceptable.

(c) Motor sheaves shall be adjustable pitch type for fans under 25 HP, selected so that the required fan rotational speed will be obtained with the motor sheave set approximately in mid-position and have the specified pitch diameter in that position. Fixed pitch "initial" sheaves shall be installed on fans 25 HP and larger. All multiplex belt drive assemblies regardless of horsepower shall be fixed-pitch type. When correct “final” sheave size has been determined by Testing and Balancing Agency, furnish and install a permanent fixed- pitch sheave for motor to replace variable-pitch and “initial” motor sheaves. Turn over variable-pitch and “initial” motor sheaves to Temple University.

(d) Fan motors shall have the capacity needed to operate the equipment at the specified mid-position operating condition. Where non-overloading motors are specified, the motor capacity rating at the most closed position of the motor sheave shall be selected. In no case shall motors be a smaller size than that required to operate without overload. Motors shall be NEMA Premium Efficiency with Aegis grounding rings.

(e) Fan sheaves shall not be smaller in diameter than 30% of the fan wheel diameter.

(f) Sheaves shall be constructed of cast iron or steel, bored to fit properly on the shafts, and secured with keyways of proper size (no set screws). Keyways may be omitted for sheaves having ½ inch or smaller bores, where set screws may be used.

(g) Fans shall be furnished complete as a package with motors, drives, curbs, bases, and inlet and outlet fittings. Detached vibration isolation devices may be provided separately.

XX. Fan volume shall be controlled utilizing ABB ACH580 variable frequency drives equipped with ABB eClipse bypasses. Inlet vanes and discharge dampers are **PROHIBITED**.

D. Steam Coils:

I. Steam preheat coils are **PROHIBITED**. In specific instances where replacement of an existing air handler necessitates the use of a steam preheat coil due to lack of space for the installation of a glycol preheat system AND the Associate Vice President of Facilities Operations & Maintenance has specifically waived this prohibition in writing, the steam preheat coil shall be the integral face and bypass (IFB) type with dampers arranged so as to completely enclose and isolate the heating coil passes when no temperature rise is required. Each coil shall be capable of maintaining a constant discharge air temperature regardless of variations in entering air temperatures under full (uncontrolled) flow conditions. Provide linkage and DDC damper actuators with positioners. Provide 2-position, sprig-return open, fail-open, steam control valve to eliminate steam flow when there is no call for heat. Casing shall be 14-gauge stainless steel with rigid framework.

II. One-third and two-thirds steam control valve arrangements with a manual bypass valve shall be provided for large steam coils to improve control and operating efficiency. Steam mains shall be dripped prior to control valves. Steam control valves used on integral face and bypass coils shall be controlled to the fully open position when the inlet air temperature is 32°F or less, and to modulate in response to the setpoint temperature when the inlet air is above 32°F.

III. Float traps shall be used on steam coils. Trap bypass lines shall not be used; dual traps may be considered.

IV. Steam coils must be piped for complete gravity drainage and fitted with vacuum breakers. Vacuum breakers shall be located external to the air-handling casing. Condensate shall not be lifted downstream of modulating valves for steam coils. Condensate lines shall not be designed to discharge under pressure. There shall be a hydraulic head between the coil and steam trap of 18 inches minimum.

E. Water Coils (chilled water, heating hot water, glycol, etc.):

I. The air handler's coil capacities must be able to handle up to 100% outdoor air (at 95°F DB, 78°F WB, and 134.6 grains of moisture for summer and 0°F for winter without moisture carryover or insufficient capacity.

II. Design water temperature rise shall be 15°F (45°F to 60°F) for chilled water coils, 30°F for glycol preheat coils, and 20°F maximum (160°F to 180°F) for heating hot water coils.

III. Coil vent and drain piping shall extend to outside the unit casing to vent and drain valves. The vent and drain valve piping shall be all brass construction.

IV. Individual coils must be fully accessible on both the upstream and downstream sides to permit inspection and cleaning.

V. Preheat coils, if used, shall be of the glycol type in all applications and are mandatory in all applications resulting in a mixed air temperature below 50°F. Glycol preheat coils shall be a minimum 2 rows, fully circuited, with supply and return headers.

VI. Coil drain pans shall be stainless steel and have a positive slope-to-drain connection. Drain connections shall be from the bottom of the coil rather than the side. Drain pans shall be double-wall and constructed of welded stainless steel with 1 in., ¾ lb. insulation sandwiched between the pans. Drain pans shall be sloped to drain connections per the currently adopted ASHRAE Standard 62 (and all approved addenda thereto). Intermediate drain pans shall be used for stacked coils. Each pan shall be independently drained.

VII. All coils shall be installed in a counter flow arrangement and shall be ARI Standard 410 certified, factory tested with air at 250 PSIG under water and rated for a 150 PSIG operating pressure at 300°F. Staggered coil arrangements are PROHIBITED. Utilize V-type arrangement if required.

VIII. Thermal breaks shall be provided downstream of cooling coils.

IX. Where multiple coils are required to provide the total capacity of individual unit, the maximum coil depth shall be 8 rows with no more than two coils in series. Coils shall be a maximum of 10 feet long by 3 1/2 feet high and be capable of replacement without major rigging. Individual coils within a coil bank must be removable without disturbing pipe headers or other coils.

X. Multiple coils shall be valved separately so that, if any individual coil fails, it can be isolated and drained while the remaining coils stay in operation. Return headers for multiple-stacked coils shall be piped reverse return to assist a balanced water flow at all load conditions. Staggered coil arrangements and V-coil arrangements are prohibited. Piping within the airstream shall be minimized.

XI. All coils shall have integral vent and drainage ports. Steam coils shall be non-freeze vertical tube and provided with steam vacuum breakers (not check valves) located outside of the air stream.

XII. Even and consistent airflow across the entire coil surface is required. Upstream mixing and the use of air blenders shall be provided where necessary.

XIII. Coil bank supply and return mains or steam and condensate mains shall have manual isolation valves so that the entire unit can be drained.

XIV. Control and balancing valves shall be installed on the return line for water coils. Balancing valves shall be specifically designed for balancing and have integral memory stops. Combination balancing, shutoff, and flow meter devices are not acceptable.

XV. Glycol preheat coils shall be designed for parallel flow-circuiting. Glycol flow shall be maintained through the unit by a run around loop with mixing valve pump system.

XVI. Water coils shall meet the following requirements:

(a) Maximum coil face velocity shall not exceed 400 feet per minute for new units, or 450 feet per minute for replacement units, at the air handler's maximum airflow rate (no diversity).

(b) Pressure drop shall not exceed 0.50 in. w.c. for hot water heating coils, 0.60 in. w.c. for glycol heating coils and recirculating system cooling coils (wet), and 1.00 in. w.c. for 100% outside air cooling coils (wet).

(c) Maximum tube velocity at maximum design flow shall not exceed 8 feet per or be less than 3 feet per second.

(d) Maximum water side pressure drop shall not exceed 20 feet w.c.

XVII. Water coils shall be constructed of the following materials:

(a) Primary Surface (Tubes) – minimum of 5/8 in. OD by 0.035 in. wall thickness seamless copper with die formed return bends silver soldered to the tubes. Tubes shall be expanded to form a mechanical bond with the secondary surface fins. Depth of coils shall not exceed 8 rows.

(b) Secondary Surface (Fins) – Die formed aluminum fins, minimum .010 in. thick designed to minimize carryover. Copper fins shall be utilized in environments that are corrosive to aluminum fins. Fin density shall not exceed 10 fins/inch maximum.

(c) Headers - Seamless copper tubing silver soldered to tubes. Connections shall be of red brass with male pipe threads, silver soldered to the headers. Each header shall contain a ¼ in. FPT vent and a ¼ in. FP drain tapping. Connection to headers shall be arranged for counter-flow operation with supply connections on the bottom and return connections at the top. Provide all water and glycol coils with two (2) headers ("Contractor's Coil"). Headers shall be constructed for 250 PSIG operating pressure.

(d) Casing - Structural strength of casing material shall be suitable for stacking of coils with end tube sheets to support tubes. All coils with finned lengths 60 in. or greater shall be provided with intermediate tube supports. Casing channels shall be free draining without depressions which may collect water or contaminants. Material used for casing, tube sheets and tube supports shall be galvanized steel for heating coils and stainless steel for cooling coils. Provide stainless steel drain pans where applicable.

(e) For laboratory exhaust air heat recovery coils, tube, fin, casing and header surfaces shall be coated with a phenolic resin.

(f) The use of special coil materials mandated by a particular application which may cause corrosion shall be reviewed and approved by Temple University Facilities Operations & Maintenance.

XVIII. Coil capacity schedules shall be included in the drawings and list the following:

(a) Number of rows and fin spacing.

(b) Entering and leaving air conditions (DB & WB in cooling applications).

(c) Air side pressure drop.

(d) Entering and leaving water temperatures.

(e) Water pressure drops.

(f) Airflow in CFM and face velocity.

(g) Water flow rate in GPM.

(h) Water velocity in tubes in FPS.

F. Humidifiers:

I. Humidifiers for central station air handlers shall be of the dry-steam, manifold-jacketed type and be located in the air handler up-stream of the chilled Water coil. Ductwork within the absorption range of the humidifier shall be fully welded stainless steel and pitched to drain. Smoke detectors and airflow measurement stations installed at air handling units shall take the absorption distance into consideration. Steam lines serving humidifiers shall have an automatic isolation valve and be dripped to remove condensate prior to manifold. The isolation valve shall be closed during cooling mode to prevent additional heat gain in the duct system. A high-limit humidity controller must be provided for each humidifier.

G. Airflow Measurement Systems for Air Handlers:

I. Airflow Measurement Systems (AFMS) shall be provided where required for airflow tracking VAV control or for control of ventilation.

II. Airflow measurement systems (AFMS) shall be manufactured by either Ebtron or Air Monitor Corporation and shall be duct mounted.

III. All airflow measurement systems (AFMS) shall be selected for a minimum measurement velocity of 400 FPM and a maximum velocity of 4,000 FPM.

IV. The Design Professional shall ensure that appropriate geometry and adequate space is provided in the design of the air handling system to meet the velocity limits and the AFMS manufacturer's installation requirements.

V. The Design Professional and the installing contractor shall ensure that field-installed probe-type airflow measurement devices have adequate clearance for removal/installation for future service without disturbing any other permanently installed equipment or building features.

VI. Where practical, a complete, factory prefabricated, airflow measurement station equipped with an Integral corrosion resistant, aluminum honeycomb air straightener, is preferred over field-installed probes.

VII. The Design Professional shall ensure that installations for outside air intakes are designed to prevent infiltration of moisture/rain into the airflow measurement device(s).

VIII. Thermal dispersion-type airflow measurement systems shall meet the following requirements:

(a) The AFMS design sensor density shall be the highest available for the measurement location dimensions and shall comply with the requirements of AMCA Standard 203, Appendix H for the minimum number and distribution of traverse points.

(b) The **minimum** sensor or point density shall be as follows (**no exceptions**):

Measurement Area in Square Feet	Minimum number of sensors or traverse points
Less than one square foot	2
One square foot but less than four square feet	4
Four square feet but less than eight square feet	8
Eight square feet but less than twelve square feet	12
Twelve square feet but less than sixteen square feet	16
Greater than sixteen square feet	24

(c) Each sensor assembly shall independently determine the airflow rate and temperature at each a measurement point.

(d) AFMS installed accuracy shall be ±2% of reading to NIST-traceable airflow standards without adjustment to factory calibrations. **Under no circumstances shall the AFMS be field calibrated to correct for installation deficiencies.**

(e) Temperature accuracy shall be ±0.15°F over the entire operating temperature range of -20°F to 140°F.

(f) The operating humidity range for each sensor probe shall be 0-99% RH.

(g) Each sensor probe shall have an integral, U.L. listed, plenum rated cable and terminal plug for connection to the remotely mounted transmitter. All terminal plug interconnecting pins shall be gold plated.

(h) Each sensor assembly shall not require matching to the transmitter in the field.

(i) A single manufacture shall provide both the airflow/temperature measuring device(s) and transmitter for each measurement location.

END OF SECTION

1. General Requirements

   A. Custom Indoor Central Station Air Handler Applications:

      I. All air handlers with a maximum airflow rate of 40,000 CFM or greater and all 100% outdoor air units, regardless of size, and those serving critical program functions shall be custom-designed central station air handlers. Modular indoor central station air handlers shall only be utilized for indoor units with a maximum airflow rate of less than 40,000 CFM that utilize return air and are not serving critical program functions. For requirements, see Section 23 73 33 – Modular Indoor Central Station Air Handlers.

      II. Outdoor installation of air handlers is **PROHIBITED**. In specific instances where replacement of an existing outdoor air handler is required or where the Associate Vice President of Facilities Operations & Maintenance has specifically waived this prohibition in writing, the requirements of this section and Section 23 75 13 – Custom Packaged Outdoor Central Station Air Handlers shall apply.

2. Custom Indoor Central Station Air Handler Requirements

   A. General:

      I. Custom-designed, factory-fabricated air handling units shall be based on the Design Professional's Contract documents and built to specific dimensions indicated thereon. The Design Professional shall lay out, in sufficient detail, the desired arrangement of each complete unit showing all required components, access doors, casing openings, service clearances, and overall dimensions. Layouts shall include sections to define the overall height and vertical location of duct connections, dampers, louvers, etc. The factory-fabricated unit shall be capacity and pressure tested as a completed unit at the factory before shipment.

      II. Custom-designed, field-erected, air handling units shall be similar in many respects to those which are factory fabricated. These units basically arrive at the job site as individual components that must be assembled on concrete pads or curbs to form the unit. Casing construction quality and erection procedures are extremely important on these units. Poor quality casings result in excessive air handling unit leakage and poor system performance. Contractor-shop-fabricated casings are prohibited. The Design Professional shall individually review the design parameters for each field erected unit with the Associate Vice President of Facilities Operations & Maintenance.

      III. Air handlers shall be floor mounted within mechanical Rooms. Ceiling mounted air handlers are **PROHIBITED.** Deviation from this prohibition requires prior written authorization from the Associate Vice President of Facilities Operations & Maintenance.

      IV. Draw-through arrangements are preferred. Blow-through arrangements are acceptable when necessary for replacement units.

      V. Adequate service space shall be provided for the removal of coils, fans, fan shafts etc. without disturbing surrounding equipment. Piping drops to air handler coils shall be arranged to facilitate coil removal without removing large sections of pipe.

VI. Each unit shall have adequate space to house, service, and maintain all ancillary equipment, controls, valves, instruments, etc.

VII. Custom units must be designed to be totally isolated from other adjacent units so that routine maintenance can occur with the unit off and other units operational. Ultra-low leakage, industrial-quality isolation dampers shall be installed at the discharge of manifold units.

VIII. Each air handling unit section shall be provided with drainage facilities that permit the washdown of units and contain leaks resulting from coil failures.

IX. For Air handling units serving contaminated systems, all piping and appurtenances shall be outside of the air stream.

X. The Design Professional will review the noise and vibration levels of the units and provide isolation equipment as required to meet acceptable levels. Sound attenuators shall be provided where fan noise will be transmitted to interior spaces or exterior areas in excess of the levels permitted in Section 23 00 00 for interior spaces. On a project-by-project basis, exterior installations of fans shall be evaluated against local site noise level goals and criteria.

XI. Field-erected air handling units must meet all requirements herein and shall be constructed in accordance with SMACNA standards. Integral unit fans or independent fan sets may be used.

XII. Acceptable manufacturers are Carrier, Daikin, JCI, and Trane.

B. Accessories:

I. Each air handling unit component section shall be supplied with suitable vapor-tight lighting to permit maintenance functions. Lights are typically controlled from a pilot switch located adjacent to the access door. Lights shall be LED type with minimum life of 20,000 hours and minimum light output of 3,200 lumens. Lights shall be provided with 2-hour timers (push-button type). Provide a duplex GFCI electrical outlet inside each motor section. Outlet shall be controlled from the outside by a separate switch. All wiring shall be provided by the unit manufacturer.

II. Unit louvers shall be ACMA rated and selected for low-pressure drop with less than 0.14 oz./Ft^2 penetration at 750 FPM free-area velocity. Areaways for louvers shall have a minimum of two drainage points sized for full capacity. Areaway floors shall be sloped a minimum of 8% to drain.

III. Where required, sound attenuators shall be integrated as a part of the air handling unit. The large cross-sectional area of most units results in low attenuator velocity and a corresponding pressure drop while maximizing attenuator performance. The silencer rating shall be determined in a duct-to-reverberant room test facility which provides airflow in both directions through the test silencer in accordance with ASTM Specification E477.

IV. Safety control components such as smoke detectors and/or smoke dampers shall be provided per code requirements. Smoke dampers at air handling units on emergency power shall be on UPS power or powered pneumatically to avoid the fan shutting down on high pressure after a power loss.

V. Duct Smoke Detectors shall be provided with a local keyed test switch within sight of Fan with "Test- Reset" option.

C. Air Filters:

I. Each air handling unit shall be provided with a filter section(s) capable of housing the filters and a mixing box designed to prevent stratification. The design of mixing sections must consider proper mixing of outside air and return air airstreams. Outside air intake location is critical. Where proper mixing may be difficult, air blenders shall be provided.

II. Air filters may consist of bag or cartridge-type elements; roll filters are **PROHIBITED**. Filter design face velocity shall not exceed 500 FPM nor shall manufacturers' standard nominal ratings be exceeded. The preferred filter face section dimensions are 24 in. by 24 in. Outdoor air and return air, as applicable, shall pass through prefilters. Large filter banks shall have intermediate supports to prevent bank deflection at maximum design pressure differentials.

III. Filters shall be installed in the exhaust air path upstream of any heat recovery device and shall have a minimum rating of MERV 11. Filters shall be installed in the outside air path upstream of any energy recovery device and shall have a minimum rating of MERV 13.

D. Airflow Measurement Systems for Air Handlers:

I. Airflow Measurement Systems (AFMS) shall be provided where required for airflow tracking VAV control or for control of ventilation.

II. Airflow measurement systems (AFMS) shall be manufactured by either Ebtron or Air Monitor Corporation and shall be duct mounted.

III. All airflow measurement systems (AFMS) shall be selected for a minimum measurement velocity of 400 FPM and a maximum velocity of 4,000 FPM.

IV. The Design Professional shall ensure that appropriate geometry and adequate space is provided in the design of the air handling system to meet the velocity limits and the AFMS manufacturer's installation requirements.

V. The Design Professional and the installing contractor shall ensure that field-installed probe-type airflow measurement devices have adequate clearance for removal/installation for future service without disturbing any other permanently installed equipment or building features.

VI. Where practical, a complete, factory prefabricated, airflow measurement station equipped with an Integral corrosion resistant, aluminum honeycomb air straightener, is preferred over field-installed probes.

VII. The Design Professional shall ensure that installations for outside air intakes are designed to prevent infiltration of moisture/rain into the airflow measurement device(s).

VIII. Thermal dispersion-type airflow measurement systems shall meet the following requirements:

(a) The AFMS design sensor density shall be the highest available for the measurement location dimensions and shall comply with the requirements

of AMCA Standard 203, Appendix H for the minimum number and distribution of traverse points.

(b) The **minimum** sensor or point density shall be as follows (**no exceptions**):

Measurement Area in Square Feet	Minimum number of sensors or traverse points
Less than one square foot	2
One square foot but less than four square feet	4
Four square feet but less than eight square feet	8
Eight square feet but less than twelve square feet	12
Twelve square feet but less than sixteen square feet	16
Greater than sixteen square feet	24

(c) Each sensor assembly shall independently determine the airflow rate and temperature at each a measurement point.

(d) AFMS installed accuracy shall be ±2% of reading to NIST-traceable airflow standards without adjustment to factory calibrations. **Under no circumstances shall the AFMS be field calibrated to correct for installation deficiencies.**

(e) Temperature accuracy shall be ±0.15°F over the entire operating temperature range of -20°F to 140°F.

(f) The operating humidity range for each sensor probe shall be 0-99% RH.

(g) Each sensor probe shall have an integral, U.L. listed, plenum rated cable and terminal plug for connection to the remotely mounted transmitter. All terminal plug interconnecting pins shall be gold plated.

(h) Each sensor assembly shall not require matching to the transmitter in the field.

(i) A single manufacture shall provide both the airflow/temperature measuring device(s) and transmitter for each measurement location.

E. Casings:

I. Units shall be custom engineered and preassembled at the factory on a structural steel base. The units shall be shipped as one piece if possible or in as few sections as possible. The number of field-casing joints shall be reduced at all reasonable cost.

II. Casings shall be factory fabricated and double walled with structural, acoustical, and thermal performance certified by testing data. Casings shall have a solid exterior shell construction, minimum No. 14 gauge galvanized steel and an interior shell of No. 20 gauge galvanized steel or aluminum. A solid interior shell shall be provided upstream of prefilters and downstream of final filters and cooling coils. Remaining sections can have perforated interior shell as long as a Tedlar® or mylar insulation liner is used.

III. Casing access doors shall be provided for both sides of each coil, fan, filter, damper, sound attenuator, heat recovery device, humidifier, and any other component

requiring routine service. Access doors shall be a minimum of 24 in. by 72 in., have vision panels, and seal with the air pressure. Access doors shall open fully after the unit is completely piped and insulated. Filter section access doors shall be piano hinged.

IV. Casings shall be constructed in a water and air-tight manner. The manufacturer's standard cabinet construction shall result in an ASHRAE/ ANSI Standard 111 (current edition) leakage class of less than 9 for demount units as measured in accordance with AMCA Standard Z10 (current edition). The fully assembled unit shall have a maximum air leakage rate of 0.5 percent of the supply air volume. Unit casings shall be pressure rated for the total system design operating pressure plus 25%.

F. Coils:

I. Coils installed in either factory-packaged or custom-designed units, if not properly engineered, will not be serviced and will eventually fail to perform. The Design Professional shall ascertain that all components are serviceable.

II. The following issues shall be specifically addressed for all coil installations:

(a) Size all air handling unit system components and duct mains to allow for future expansion and renovations in accordance with specific criteria furnished by the Associate Vice President of Facilities Operations & Maintenance.

(b) Individual coils must be fully accessible on both the upstream and downstream sides to permit inspection and cleaning.

(c) Coil sections shall be provided with tracks, extended the full length of the unit to provide for the removal of the coil or an individual coil in a bank of coils.

(d) The cooling-coil face velocity must be limited to 400 FPM across the entire face area to prevent carryover at maximum future and present design conditions. Air distribution plates should be considered for use upstream of coils, but plates must not induce a high pressure drop.

(e) Moisture eliminators may be considered where carryover presents a problem; however, eliminators must not impede service access to the coil surface for cleaning.

III. The air handler’s coil capacities must be able to handle up to 100% outdoor air at 95°F DB, 78°F WB, and 134.6 grains of moisture for summer and 0°F for winter without moisture carryover or insufficient capacity.

IV. Steam Coils:

(a) Steam preheat coils are **PROHIBITED**. In specific instances where replacement of an existing air handler necessitates the use of a steam preheat coil due to lack of space for the installation of a glycol preheat system AND the Associate Vice President of Facilities Operations & Maintenance has specifically waived this prohibition in writing, the steam preheat coil shall be the integral face and bypass (IFB) type with dampers arranged so as to completely enclose and isolate the heating coil passes when no temperature rise is required. Each coil shall be capable of maintaining a constant discharge air temperature regardless of variations in

entering air temperatures under full (uncontrolled) flow conditions. Provide linkage and DDC damper actuators with positioners. Provide 2-position, sprig-return open, fail-open, steam control valve to eliminate steam flow when there is no call for heat. Casing shall be 14-gauge stainless steel with rigid framework.

(b) One-third and two-thirds steam control valve arrangements with a manual bypass valve shall be provided for large steam coils to improve control and operating efficiency. Steam mains shall be dripped prior to control valves. Steam control valves used on integral face and bypass coils shall be controlled to the fully open position when the inlet air temperature is 32°F or less, and to modulate in response to the setpoint temperature when the inlet air is above 32°F.

(c) Float traps shall be used on steam coils. Trap bypass lines shall not be used; dual traps may be considered.

(d) Steam coils shall be non-freeze vertical tube and shall be piped for complete gravity drainage and fitted steam vacuum breakers (not check valves) located outside of the air stream and be located external to the air handling unit casing. Condensate shall not be lifted downstream of modulating valves for steam coils. Condensate lines shall not be designed to discharge under pressure. There shall be a hydraulic head between the coil and steam trap of 18 in. minimum.

(e) Coil bank steam and condensate mains shall have manual isolation valves so that the entire unit can be drained.

V. Water Coils (chilled water, heating hot water, glycol, etc.):

(a) Design water temperature rise shall be 15°F (45°F to 60°F) for chilled water coils, 30°F for glycol preheat coils, and 20°F maximum (160°F to 180°F) for heating hot water coils.

(b) Coil vent and drain piping shall extend to outside the unit casing to vent and drain valves. The vent and drain valve piping shall be all brass construction.

(c) Individual coils must be fully accessible on both the upstream and downstream sides to permit inspection and cleaning.

(d) Preheat coils, if used, shall be of the glycol type in all applications and are mandatory in all applications resulting in a mixed air temperature below 50°F. Glycol preheat coils shall be a minimum 2 rows, fully circuited, with supply and return headers.

(e) Coil drain pans shall be stainless steel and have a positive slope-to-drain connection. Drain connections shall be from the bottom of the coil rather than the side. Drain pans shall be double-wall and constructed of welded stainless steel with 1 in., ¾ lb. insulation sandwiched between the pans. Drain pans shall be sloped to drain connections per the currently adopted ASHRAE Standard 62 (and all approved addenda thereto). Intermediate drain pans shall be used for stacked coils. Each pan shall be independently drained.

(f) All coils shall be installed in a counter flow arrangement and shall be ARI Standard 410 certified, factory tested with air at 250 PSIG under water and

rated for a 150 PSIG operating pressure at 300°F. Staggered coil arrangements are **PROHIBITED**. Utilize V-type arrangement if required.

(g) Thermal breaks shall be provided downstream of cooling coils.

(h) Where multiple coils are required to provide the total capacity of individual unit, the maximum coil depth shall be 8 rows with no more than two coils in series. Coils shall be a maximum of 10 ft. long by 3.5 ft. high and be capable of replacement without major rigging. Individual coils within a coil bank must be removable without disturbing pipe headers or other coils.

(i) Multiple coils shall be valved separately so that, if any individual coil fails, it can be isolated and drained while the remaining coils stay in operation. Return headers for multiple-stacked coils shall be piped reverse return to assist a balanced water flow at all load conditions. Piping within the airstream shall be minimized.

(j) All coils shall have integral vent and drainage ports.

(k) Even and consistent airflow across the entire coil surface is required. Upstream mixing and the use of air blenders shall be provided where necessary.

(l) Coil bank supply and return mains shall have manual isolation valves so that the entire unit can be drained.

(m) Control and balancing valves shall be installed on the return line for water coils. Balancing valves shall be specifically designed for balancing and have integral memory stops. Combination balancing, shutoff, and flow meter devices are **PROHIBITED**.

(n) Glycol preheat coils shall be designed for parallel flow-circuiting. Glycol flow shall be maintained through the unit by a run around loop with mixing valve pump system.

(o) Water coils shall meet the following requirements:

(i) Maximum coil face velocity shall not exceed 400 feet per minute for new units, or 450 feet per minute for replacement units, at the air handler's maximum airflow rate (no diversity).

(ii) Airside pressure drop shall not exceed 0.50 in. w.c. for hot water heating coils, 0.60 in. w.c. for glycol heating coils and recirculating system cooling coils (wet), and 1.00 in. w.c. for 100% outside air cooling coils (wet).

(iii) Maximum tube velocity at maximum design flow shall not exceed 8 feet per second or be less than 3 feet per second.

(iv) Maximum water side pressure drop shall not exceed 20 feet w.c.

(p) Water coils shall be constructed of the following materials:

(i) Primary Surface (Tubes) – minimum of 5/8 in. OD by 0.035 in. wall thickness seamless copper with die formed return bends silver soldered to the tubes. Tubes shall be expanded to form a mechanical

bond with the secondary surface fins. Depth of coils shall not exceed 8 rows.

(ii) Secondary Surface (Fins) – Die formed aluminum fins, minimum .010 in. thick designed to minimize carryover. Copper fins shall be utilized in environments that are corrosive to aluminum fins. Fin density shall not exceed 10 fins/inch maximum.

(iii) Headers - Seamless copper tubing silver soldered to tubes. Connections shall be of red brass with male pipe threads, silver soldered to the headers. Each header shall contain a ¼ in. FPT vent and a ¼ in. FP drain tapping. Connection to headers shall be arranged for counter-flow operation with supply connections on the bottom and return connections at the top. Provide all water and glycol coils with two (2) headers ("Contractor's Coil"). Headers shall be constructed for 250 PSIG operating pressure.

(iv) Casing - Structural strength of casing material shall be suitable for stacking of coils with end tube sheets to support tubes. All coils with finned lengths 60 in. or greater shall be provided with intermediate tube supports. Casing channels shall be free draining without depressions which may collect water or contaminants. Material used for casing, tube sheets and tube supports shall be galvanized steel for heating coils and stainless steel for cooling coils. Provide stainless steel drain pans where applicable.

(q) For laboratory exhaust air heat recovery coils, tube, fin, casing and header surfaces shall be coated with a phenolic resin.

(r) The use of special coil materials mandated by a particular application which may cause corrosion shall be reviewed and approved by Temple University Facilities Operations & Maintenance.

(s) Coil capacity schedules shall be included in the drawings and list the following:

(i) Number of rows and fin spacing.

(ii) Entering and leaving air conditions (DB & WB in cooling applications).

(iii) Air side pressure drop.

(iv) Entering and leaving water temperatures.

(v) Water pressure drops.

(vi) Airflow in CFM and face velocity.

(vii) Water flow rate in GPM.

(viii) Water velocity in tubes in FPS.

G. Dampers:

I. Dampers shall be low leakage and opposed or parallel blade as required to accommodate mixing of air stream. Insulated-blade dampers as manufactured by Tamco are preferred. Opposed blade dampers are preferred and required for mixing applications. Particular attention shall be given to achieve good mixing of outdoor

and return air to minimize stratification and freezing of water coils. Air blenders shall be considered for use when airflow arrangements do not support the effective mixing of different air streams.

II. All dampers and actuators shall be fully accessible for lubrication.

H. Electrical Provisions:

I. The unit manufacturer shall furnish and install a complete factory wired electrical system for each unit, so as to allow single-source responsibility and to ensure proper selection and installation of all electrical components.

II. Provide factory-installed and sealed wiring sleeves for all control and power wiring that penetrate the unit casing. All power wiring shall be factory installed to a single point for power source connection on the exterior of the unit. All wiring within unit shall be enclosed in sealed moisture resistant EMT.

III. The unit manufacturer shall provide prewired and switched non-corroding vapor-tight LED lights in each compartment with an access door and in the service corridors as follow:

(a) Lights shall be suitable for use in wet and damp locations.

(b) Lighting, internal wiring, switching mounted in bell boxes, and all other electrical wiring associated with the lighting shall be provided by the unit manufacturer at the factory.

(c) Lighting shall be 120-volt and suitable for cold weather (-20 F) and shall comply with UL 1570 and shall carry the UL label.

IV. Unit manufacturer shall provide (2) 120-volt, single-phase electric connections for the lights and receptacles, via junction boxes with circuit breakers for connection in the field by the Electrical Contractor (20 amperes power supply).

I. Energy Recovery:

I. When energy recovery equipment is used, the heating and cooling coils shall be designed to function at full load with and without energy recovery. All coil schedules shall show both entering air conditions. Units with energy recovery systems shall be designed such that devices could be out of commission without any interruption to air handling unit system operation. Provide isolation and bypass dampers around both sides of energy recovery wheels and modulating bypass dampers for mixed air temperature control on the supply side. The modulating bypass and full bypass damper may be a single damper serving both functions.

II. Enthalpy wheels utilizing silica are **PROHIBITED**.

J. Fans:

I. Air handling unit fans may be centrifugal (double width) or plenum fans as justified by life cycle costing. Use of plenum fans is strongly discouraged. Fans shall have a minimum ACMA Construction Class of II. Fan blades shall be continuously welded to wheels. Fans shall be totally isolated from the unit using inertia base and spring isolation. Fan volume control shall be achieved using VFDs on centrifugal and plenum fans. Discharge dampers are not suitable for volume control. Fans may be arranged in either the blow-through or draw-through position. Redundant or parallel fans shall be installed in separate compartments and be capable of complete isolation.

II. Fans shall be individually selected for their specific application. Many different fan types and arrangements exist in the marketplace from a large variety of manufacturers. The Design Professional has the responsibility to select the fan and specify its requirements to meet the functional needs of the system while providing stable, efficient, and quiet operation. Fan selections shall be based on the lowest reasonable speed while optimizing efficiency. Fan selections shall consider longevity of components, especially bearing life at maximum design conditions.

III. Specify fans having a certified sound and air rating based on tests performed in accordance with AMCA Bulletins 210, 211A, and 300. See AMCA Standard 99, Standard Handbook, for definitions of fan terminology. If specific sound data for the selected fan is not available, certified testing for fan sound data shall be required. The arrangement, size, class, and capacity of all fans shall be scheduled on the contract drawings for permanent records.

IV. The Design Professional shall give careful consideration to the location of the supply air fan with respect to coil banks. Excessive air velocity stratification across the face of a coil may affect the capacity, pressure drop, and water carryover characteristics. Thus, the location of the fan with respect to the coil bank is very important. Generally, if the air velocity across the coil does not vary by more than +/- 10% of nominal, essentially full capacity will be achieved, and water carryover will not be a problem. However, if the air velocity stratification is greater than this, capacity reduction, carryover, and freeze-up problems could occur. When space limitations dictate that the fans be placed in close proximity to the heating or cooling coils, the following criteria should be used to determine the minimum distance between fan and coil for field built-up systems:

(a) Draw-through System: For single-width fans, the distance between the fan intake and coil should be a minimum of one wheel diameter. For double-width fans, the distance between the fan intake and coil should be a minimum of 1/2 wheel diameter.

(b) Blow-through System: Most problems occur in this type of system. To minimize space requirements, it is desirable to place the coil as close to the fan as possible without causing excessive air velocity stratification across the face of the coil. The minimum distance for satisfactory operation is a function of the dimensional relationship of fan to coil, the fan outlet velocity, coil face velocity, and coil pressure drop. Where extreme limited physical space conditions exist, the use of a carefully designed baffle plate between the fan discharge and the coil may be considered. The Contract documents should specifically address the placement of the fan with respect to the coil.

V. The design of fan inlet and outlet conditions shall consider the impact of system effects on the fan performance. The recommendations shown in the SMACNA Duct Design Manual for fan inlet and outlet arrangements shall be utilized.

VI. Multiple fans provided in air handling units and exhaust fans for redundancy purposes shall be provided in separate compartments with inlet isolation dampers to facilitate maintenance without taking the unit out of service.

VII. All units in excess of 2,000 CFM must be provided with a return air fan. The return air fan can be a single width single inlet centrifugal fan set, integral or independent cabinet fan, or in-line centrifugal type fan and must be mounted to permit servicing

without the use of a ladder. Units which are not floor mounted and are mounted in excess of 6 ft. - 0 in. above the floor must be provided with stable catwalks constructed of structural grade steel and steel grating. Access ladders shall be integral with the catwalk.

VIII. Fans for new air handlers shall provide a minimum of 25% reserve capacity over and above the design maximum flow rate at the design total static pressure and shall be provided with motors and variable speed drives capable of providing that capacity.

IX. Fans for replacement air handlers shall provide a minimum of 15% reserve capacity over and above the design maximum flow rate at the design total static pressure and shall be provided with motors and variable speed drives capable of providing that capacity.

X. Fan selections shall be based on the lowest reasonable speed while optimizing efficiency. Fan selections shall consider longevity of components, especially bearing life at maximum design conditions.

XI. Fans shall be double width, double inlet (DWDI) centrifugal type fans. The selected fan blades shall be the most efficient fan available (i.e. - forward curved, backward inclined). Airfoil fans are **PROHIBITED**.

XII. Fan sections shall employ fans with a minimum ACMA Construction Class of II. Use Class III fan construction if the fan characteristic curve extends to within 10% of the fan's Class II selection zone.

XIII. Fan sections shall be isolated from the remaining unit and the connecting duct system to control vibration.

XIV. An integral all welded steel vibration isolation base shall be provided for the fan and motor.

(a) Isolators shall be free standing with sound deadening pads and leveling bolts.

(b) The spring diameter to compressed operating height ratio shall be 1 to 1.

(c) The spring deflection shall be 2 in.

(d) Isolators shall have earthquake restraints.

XV. Fan shafts shall be solid and shall be of AISI C-1018, 1040 or 1045 hot rolled steel accurately turned, ground, polished, and ring gauged for accuracy.

XVI. Fan bearings shall be self-aligning, pillow block, regreaseable ball bearings rated for an average life of a minimum of L-10, 200,000 Hrs.

XVII. Fan shafts and fans shall be rated for continuous operation and shall be statically and dynamically balanced in all planes. Fan drives shall be selected for a service factor of 1.5.

XVIII. All fans must be fully accessible for service and routine maintenance. Fan motors and drives shall not be located within hazardous or contaminated exhaust air streams. All drives shall be exterior to air handling units. Fan bearings where possible shall be serviceable outside of hazardous or contaminated exhaust air streams. Inline fans with motors or drive exposed to exhaust air streams are not permitted.

XIX. Fan systems designed for parallel or manifold operation shall be protected against backward rotation of fan wheels. Anti-rotation devices, motor brakes, or other approved methods shall be provided.

XX. Fans shall be certified sound and air rating based on tests performed in accordance with AMCA Bulletins 210, 211A, and 300. The arrangement, size, class, and capacity of all fans shall be scheduled on the contract drawings for permanent records.

XXI. All fans shall be statically and dynamically balanced by the manufacturer and shall be provided with vibration isolation. Fans shall not transmit vibration to the duct system or building structure. All fans shall also be dynamically balanced in the field by the manufacturer after the installation is complete.

XXII. Diffuser cones and inlet bells are not permitted in rating a fan unless they are an integral part of the fan design.

XXIII. Inlets and outlets of fans that are not duct-connected, including fans in plenum chambers or open to the weather, shall have heavy OSHA-approved guard screens to protect personnel. Guard screens shall not impair fan performance and, when bolted to equipment, will permit their removal for fan service and cleaning.

XXIV. Complete fan lubrication facilities shall be provided, such as oil reservoirs, sight glasses, grease and relief fittings, fill and drain plugs, pipe connections, etc. The facility shall be placed in a readily and safely accessible location so that after installation they will perform the required function without requiring the dismantling of any parts or stopping equipment. For fans located within contaminated air streams, lubrication facilities shall be piped to the exterior casing wall.

XXV. Fans shall be specifically addressed, as the air stream may contain excessive moisture, fumes, corrosive vapors, or contaminated or hazardous particles. Special consideration shall be given to those fans handling explosive vapors or radioactive material.

XXVI. Certified performance data including acoustical data shall be submitted for each fan at maximum design conditions. Data shall include published sound power levels based on actual tests on the fan sizes being furnished and conducted in accordance with current AMCA standards. Such data are to define sound power levels (PWL) (10 -12 W for each of the eight frequency bands). The acoustical design of the fan system must conform to the space noise criteria. Fan curves shall be submitted which will depict static pressure, total pressure, brake horsepower, and mechanical efficiency plotted against air volume. Fan curves shall include estimated losses for field installation conditions, system effect, and actual installed drive components. All included losses shall be defined on the fan curves. Data may also be submitted in tabular form, but tables are not a substitute for actual performance curves.

XXVII. Direct drive fans are preferred to reduce maintenance costs and improve reliability. Where factory-designed and assembled belt drives are proposed to be furnished, OSHA-approved mesh-type guards shall be provided for all belt drives, and the drives shall comply with the following:

(a) Each drive shall be selected according to the rating and recommendations of the manufacturer for the service with which used, giving proper allowance for sheave diameter, center distance, and arc of contact less than 180

degrees. The motor shall have a nameplate rating of not less than 5% above the total of actual fan brake horsepower and drive loss at specified capacity.

(b) Belts shall be constructed of endless reinforced cords of long staple cotton, nylon, rayon, or other suitable textile fibers imbedded in rubber. The belt shall have the correct cross section to fit the sheave grooves properly. Belts shall be matched carefully for each drive. Extended-horsepower belts are not acceptable.

(c) Motor sheaves shall be adjustable pitch type for fans under 25 HP, selected so that the required fan rotational speed will be obtained with the motor sheave set approximately in mid-position and have the specified pitch diameter in that position. Fixed pitch "initial" sheaves shall be installed on fans 25 HP and larger. All multiplex belt drive assemblies regardless of horsepower shall be fixed-pitch type. When correct “final” sheave size has been determined by Testing and Balancing Agency, furnish and install a permanent fixed- pitch sheave for motor to replace variable-pitch and “initial” motor sheaves. Turn over variable-pitch and “initial” motor sheaves to Temple University.

(d) Fan motors shall have the capacity needed to operate the equipment at the specified mid-position operating condition. Where non-overloading motors are specified, the motor capacity rating at the most closed position of the motor sheave shall be selected. In no case shall motors be a smaller size than that required to operate without overload. Motors shall be NEMA Premium Efficiency with Aegis grounding rings.

(e) Fan sheaves shall not be smaller in diameter than 30% of the fan wheel diameter.

(f) Sheaves shall be constructed of cast iron or steel, bored to fit properly on the shafts, and secured with keyways of proper size (no set screws). Keyways may be omitted for sheaves having ½ inch or smaller bores, where set screws may be used.

(g) Fans shall be furnished complete as a package with motors, drives, curbs, bases, and inlet and outlet fittings. Detached vibration isolation devices may be provided separately.

XXVIII. Fan volume shall be controlled utilizing ABB ACH580 variable frequency drives equipped with ABB eClipse bypasses. Inlet vanes and discharge dampers are **PROHIBITED**.

K. Humidifiers:

I. Humidifiers for central station air handlers shall be of the dry-steam, manifold-jacketed type and be located in the air handler up-stream of the chilled Water coil. Ductwork within the absorption range of the humidifier shall be fully welded stainless steel and pitched to drain. Smoke detectors and airflow measurement stations installed at air handling units shall take the absorption distance into consideration. Steam lines serving humidifiers shall have an automatic isolation valve and be dripped to remove condensate prior to manifold. The isolation valve shall be closed during cooling mode to prevent additional heat gain in the duct system. A high-limit humidity controller must be provided for each humidifier.

L. Testing:

I. Each custom designed unit shall be tested at the **factory** by the unit manufacturer prior to shipping, as follows:

(a) Air volume and discharge static test shall verify that the air volume is within the range of 100% to 110% of scheduled nominal CFM requirements when operating at design total static pressure. The test for airflow and static capability shall include airflow measuring devices installed in all ducts returning to or leaving the unit. These devices shall be installed in accordance with the measuring device manufacturer's recommendations. Pressures external to the unit shall be simulated using a combination of ducts and dampers. The tests shall prove design airflow and static capability of the assembled unit.

(b) Casing leakage tests shall be run to prove that unit casing leakage is less than 0.5% of design flow at 1.5 x operating pressure. The duct openings in the pressure section shall be sealed and this section shall be tested at 12.0" w.c. The CFM of this fan shall be read using an approved airflow measuring device. When the static pressure developed by the test fan reaches 1.5 times the unit design static pressure, the fan CFM shall be read and this CFM will be considered the casing leakage. The casing leakage must be less than 0.5% of the design CFM. Factory casing leakage test for fully welded units may be deleted. However, leakage test must be performed at the site after joining and sealing of sections for all unit construction types.

(c) The duct openings in the suction side of the unit shall be sealed and this section shall be connected to a test fan capable of developing a suction that is numerically equal to 1.5 times the design static pressure. The CFM of this test fan shall be read using an approved airflow measuring device. When the suction developed by the test fan is numerically equal to 1.5 times the unit design total static pressure, the fan CFM shall be read and this CFM will be considered the casing leakage. The casing leakage must be less than 0.5% of the section's design CFM (supply/return). Leakage across the septum wall located the discharge end of the fan shall be 0 CFM (no leakage).

(d) Both the casing leakage test and the airflow and static capability test, as defined above, shall meet the required acceptance criterion without the use of any temporary caulking at any permanent panel joints. Temporary test caulking shall be utilized at the unit shipping splits to simulate "as installed" conditions.

(e) System sound levels shall be measured in all nine (9)-octave bands (31.25 Hz through 8000 Hz) at system design operating conditions. Airborne sound levels at all openings shall be read in the test ductwork 5'-0" from the openings. Transmitted sound levels shall be read 5'-0" from the outside of the fan section.

(f) Sound tests shall be conducted while the unit is running at design conditions. An octave band sound pressure level reading shall be taken at outside louver, exhaust louver, supply discharge opening, return air opening, economizer opening and adjacent to each fan section outside of the unit casing.

(g) Each individual fan shall be tested for vibration in X-Y-Z directions at the fan manufacturer's facility before shipment to the unit manufacturer to assure that specified fan balancing criteria is adhered to.

II. Pressurized leak testing shall be performed in the **field** after assembly of the unit sections by the HVAC Contractor, under the direction of the unit manufacturer, by running the fans and soap bubble testing all field joints and penetrations to ensure unit tightness. The unit manufacturer shall correct and pay for the repair of all deficiencies found during testing, except for the repair of all deficiencies found during testing, except for unit section joints leaks, which shall be the responsibility of the HVAC Contractor. The HVAC Contractor shall provide all field labor necessary to join the unit sections, including all electric and drain splits after they are delivered to the site and set in place. All fieldwork shall be provided under the direct supervision of a qualified Design Professional employed by the unit manufacturer. Rigging for unit sections shall be provided by the HVAC Contractor.

III. Test Procedures:

(a) A complete test procedure shall be submitted to the Architect for approval detailing the methods, equipment, and techniques to be employed for each specific test. Equipment will not be considered approved until written approval of testing procedures is attained.

(b) As hereinbefore specified, the preceding airflow/static, sound and vibration tests shall be required for all Air handling units specified in this Section and shall be witnessed by designated representatives of the Design Professional and Owner (total [3] people). All unit sections shall be leak tested at the field after installation. The unit manufacturer shall notify the University project manager for their approval. The unit manufacturer shall pay for all air and ground transportation, lodging, and meals for the designated witnesses to attend the testing. If multiple trips are re- quired, they shall all be paid for by the unit manufacturer.

(c) Any deficiencies in unit performance must be corrected by the unit manufacturer in the manufacturing plant prior to shipping.

END OF SECTION

1. General Requirements

   A. Custom Outdoor Central Station Air Handler Applications:

      I. Outdoor installation of air handlers is **PROHIBITED**. In specific instances where replacement of an existing outdoor air handler is required or where the Associate Vice President of Facilities Operations & Maintenance has specifically waived this prohibition in writing, the requirements of this section a shall apply.

2. Custom Outdoor Central Station Air Handler Requirements

   A. General:

      I. Custom-designed, factory-fabricated air handling units shall be based on the Design Professional's Contract documents and built to specific dimensions indicated thereon. The Design Professional shall lay out, in sufficient detail, the desired arrangement of each complete unit showing all required components, access doors, casing openings, service clearances, and overall dimensions. Layouts shall include sections to define the overall height and vertical location of duct connections, dampers, louvers, etc. The factory-fabricated unit shall be capacity and pressure tested as a completed unit at the factory before shipment.

      II. Custom-designed, field-erected, air handling units shall be similar in many respects to those which are factory fabricated. These units basically arrive at the job site as individual components that must be assembled on concrete pads or curbs to form the unit. Casing construction quality and erection procedures are extremely important on these units. Poor quality casings result in excessive air handling unit leakage and poor system performance. Contractor-shop-fabricated casings are prohibited. The Design Professional shall individually review the design parameters for each field erected unit with the Associate Vice President of Facilities Operations & Maintenance.

      III. Draw-through arrangements are preferred. Blow-through arrangements are acceptable when necessary for replacement units.

      IV. Adequate service space shall be provided for the removal of coils, fans, fan shafts etc. without disturbing surrounding equipment. Piping drops to air handler coils shall be arranged to facilitate coil removal without removing large sections of pipe.

      V. Each unit shall have adequate space to house, service, and maintain all ancillary equipment, controls, valves, instruments, etc.

      VI. Custom units must be designed to be totally isolated from other adjacent units so that routine maintenance can occur with the unit off and other units operational. Ultra-low leakage, industrial-quality isolation dampers shall be installed at the discharge of manifold units.

      VII. Each air handling unit section shall be provided with drainage facilities that permit the washdown of units and contain leaks resulting from coil failures.

      VIII. For air handling units serving contaminated systems, all piping and appurtenances shall be outside of the air stream.

      IX. The Design Professional will review the noise and vibration levels of the units and provide isolation equipment as required to meet acceptable levels. Sound

attenuators shall be provided where fan noise will be transmitted to interior spaces or exterior areas in excess of the levels permitted in Section 23 00 00 for interior spaces. On a project-by-project basis, exterior installations of fans shall be evaluated against local site noise level goals and criteria.

X. Field-erected air handling units must meet all requirements herein and shall be constructed in accordance with SMACNA standards. Integral unit fans or independent fan sets may be used.

XI. Air handling units shall be provided with all controls, control devices, variable speed drives, accessories, and appurtenances factory pre-wired, piped, and tested with field termination points provided for ease of installation.

XII. Acceptable manufacturers are Buffalo, Haakon Industries, and JCI-York Custom.

B. Accessories:

I. Each air handling unit component section shall be supplied with suitable vapor-tight lighting to permit maintenance functions. Lights are typically controlled from a pilot switch located adjacent to the access door. Lights shall be LED type with minimum life of 20,000 hours and minimum light output of 3,200 lumens. Lights shall be provided with 2-hour timers (push-button type). Provide a duplex GFCI electrical outlet inside each motor section. Outlet shall be controlled from the outside by a separate switch. All wiring shall be provided by the unit manufacturer.

II. Unit louvers shall be ACMA rated and selected for low-pressure drop with less than 0.14 oz./Ft^2 penetration at 750 FPM free-area velocity. Areaways for louvers shall have a minimum of two drainage points sized for full capacity. Areaway floors shall be sloped a minimum of 8% to drain.

III. Where required, sound attenuators shall be integrated as a part of the air handling unit. The large cross-sectional area of most units results in low attenuator velocity and a corresponding pressure drop while maximizing attenuator performance. The silencer rating shall be determined in a duct-to-reverberant room test facility which provides airflow in both directions through the test silencer in accordance with ASTM Specification E477.

IV. Safety control components such as smoke detectors and/or smoke dampers shall be provided per code requirements. Smoke dampers at air handling units on emergency power shall be on UPS power or powered pneumatically to avoid the fan shutting down on high pressure after a power loss.

V. Duct Smoke Detectors shall be provided with a local keyed test switch within sight of Fan with “Test- Reset” option.

C. Air Filters:

I. Each air handling unit shall be provided with a filter section(s) capable of housing the filters and a mixing box designed to prevent stratification. The design of mixing sections must consider proper mixing of outside air and return air airstreams. Outside air intake location is critical. Where proper mixing may be difficult, air blenders shall be provided.

II. Air filters may consist of bag or cartridge-type elements; roll filters are PROHIBITED. Filter design face velocity shall not exceed 500 FPM nor shall manufacturers’

standard nominal ratings be exceeded. The preferred filter face section dimensions are 24 in. by 24 in. Outdoor air and return air, as applicable, shall pass through prefilters. Large filter banks shall have intermediate supports to prevent bank deflection at maximum design pressure differentials.

III. Filters shall be installed in the exhaust air path upstream of any heat recovery device and shall have a minimum rating of MERV 11. Filters shall be installed in the outside air path upstream of any energy recovery device and shall have a minimum rating of MERV 13.

D. Airflow Measurement Systems for Air Handlers:

I. Airflow measurement systems (AFMS) shall be provided where required for airflow tracking VAV control or for control of ventilation.

II. Airflow measurement systems (AFMS) shall be manufactured by either Ebtron or Air Monitor Corporation and shall be duct mounted.

III. All airflow measurement systems (AFMS) shall be selected for a minimum measurement velocity of 400 FPM and a maximum velocity of 4,000 FPM.

IV. The Design Professional shall ensure that appropriate geometry and adequate space is provided in the design of the air handling system to meet the velocity limits and the AFMS manufacturer's installation requirements.

V. The Design Professional and the installing contractor shall ensure that field-installed probe-type airflow measurement devices have adequate clearance for removal/installation for future service without disturbing any other permanently installed equipment or building features.

VI. Where practical, a complete, factory prefabricated, airflow measurement station equipped with an Integral corrosion resistant, aluminum honeycomb air straightener, is preferred over field-installed probes.

VII. The Design Professional shall ensure that installations for outside air intakes are designed to prevent infiltration of moisture/rain into the airflow measurement device(s).

VIII. Thermal dispersion-type airflow measurement systems shall meet the following requirements:

(a) The AFMS design sensor density shall be the highest available for the measurement location dimensions and shall comply with the requirements of AMCA Standard 203, Appendix H for the minimum number and distribution of traverse points.

(b) The **minimum** sensor or point density shall be as follows (**no exceptions**):

Measurement Area in Square Feet	Minimum number of sensors or traverse points
Less than one square foot	2
One square foot but less than four square feet	4
Four square feet but less than eight square feet	8

Eight square feet but less than twelve square feet	12
Twelve square feet but less than sixteen square feet	16
Greater than sixteen square feet	24

(c) Each sensor assembly shall independently determine the airflow rate and temperature at each a measurement point.

(d) AFMS installed accuracy shall be ±2% of reading to NIST-traceable airflow standards without adjustment to factory calibrations. **Under no circumstances shall the AFMS be field calibrated to correct for installation deficiencies.**

(e) Temperature accuracy shall be ±0.15°F over the entire operating temperature range of -20°F to 140°F.

(f) The operating humidity range for each sensor probe shall be 0-99% RH.

(g) Each sensor probe shall have an integral, U.L. listed, plenum rated cable and terminal plug for connection to the remotely mounted transmitter. All terminal plug interconnecting pins shall be gold plated.

(h) Each sensor assembly shall not require matching to the transmitter in the field.

(i) A single manufacture shall provide both the airflow/temperature measuring device(s) and transmitter for each measurement location.

E. Bases:

I. Provide a structural base rail under the full perimeter of the unit, formed from a minimum of No. 12 gauge G-90 mill galvanized steel.

II. Provide sufficient clearance to achieve proper external trapping of drain pans for coils and humidifiers. Provide a base rail with a minimum height of 6 in.

III. Provide base rail and lifting lug system that does not require additional support for rigging, including lifting lugs on the base rail at each side of each shipping split and at unit corners.

IV. A minimum 0.125” thick aluminum checker plate floor shall be installed on the base. The floor shall be flat, reinforced from below, with all seams continuously welded. Drive screw attachment and caulking are not acceptable. The base shall be provided with lifting lugs, a minimum of four [4] per unit section. The base shall be insulated with 2 in. fiberglass insulation and sheeted with a No. 20 gauge galvanized steel liner. Floors that “oil can” are not acceptable.

V. A 1.5 in. perimeter collar around the entire unit and around each floor opening to ensure the unit is internally watertight shall be provided. The entire base shall act as an auxiliary drain pan and hold up to 1.5 in. of water.

VI. Auxiliary drains in fan sections downstream of cooling coils and in mixing sections shall be provided.

VII. Maximum base deflection shall be ¼ in. on 240 in. unsupported span.

F. Casings:

I. Units shall be custom engineered and preassembled at the factory on a structural steel base. The units shall be shipped as one piece if possible or in as few sections as possible. The number of field-casing joints shall be reduced at all reasonable cost.

II. Casings shall be constructed in a water and air-tight manner. The fully assembled unit shall have a maximum air leakage rate of 0.5 percent of the supply air volume. Unit casings shall be pressure rated for the total system design operating pressure plus 25%.

III. Casings shall be factory fabricated with 2 in. thick, double-walled panels with structural, acoustical, and thermal performance certified by testing data. Casings shall have a solid exterior shell construction, minimum No. 14 gauge washdown galvanized steel and a solid interior shell of minimum No. 20 gauge washdown galvanized steel with thermal break. Insulation shall be a minimum of 2 in. thick 4.5 lb./cu ft. density fiberglass with a mylar liner to seal the insulation. All permanently joined flanged panel surfaces shall be sealed with an individual strip of 1/8 in. x 3/8 in. tape sealer. Wall seams shall be turned inward to provide a clean flush exterior finish. All panel seams shall be sealed during assembly to produce an airtight unit.

IV. The internal liner shall be suitable for washing with a pressure washer or steam cleaner without risk of wetting the insulation. The liner shall be installed over top of the panel flanges and each liner seam shall be sealed with a lap joint. The wall liner shall be installed over top of the base water dam such that any water run-off from the liner will drip into the watertight base rather than into the wall panel. The roof liner shall be installed over top of the roof support so that water cannot enter the roof insulation.

V. Roof panels shall be broken outward to provide a lapped joint watertight seal. Outdoor roofs shall be sloped a minimum of 5/8 in. away from the access side.

VI. All panels shall be joined on 8 in. centers using stainless steel fasteners.

VII. All insulation edges shall be protected with metal lagging. Insulation systems using stickpins or adhesives are not acceptable.

VIII. Stiffeners of angle steel shall be supplied as required to maintain casing deflection criteria of 1/200 at 1.5 times the working pressure. If panels cannot meet this deflection, an additional internal reinforcing shall be added.

IX. A minimum 72 in. wide service corridor shall be provided and shall be equal in length to the entire length of the unit with casing construction of the same material as the rest of the air handler.

X. Electric unit and/or baseboard heaters and controlling thermostats shall be provided and factory-prewired to provide 65°F service corridor temperature at 0°F outdoor temperature.

XI. Access doors shall be provided for both sides of each coil, fan, filter, damper, sound attenuator, heat recovery device, humidifier, and any other component requiring routine service. In addition, access entry doors shall be provided, as a minimum, at the two ends of the service corridor. Access doors shall be a minimum of 24 in. by 72 in., have vision panels, and seal with the air pressure. Access doors shall open fully after the unit is completely piped and insulated. Access doors shall be manufactured

from No. 14 gauge galvanized steel. The doors shall be double wall construction with No. 20 gauge solid metal liner on the inside. Corners of the doors shall be continuously welded for rigidity. 2 in. - 4.5 lb./cu ft. density insulation shall be sandwiched between the No. 14 gauge outer layer and the No. 20 gauge inner layer. Doors shall be the same thickness as the unit casing to maximize thermal and acoustical resistance. A 12 in. round hermetically sealed double glazed laminated glass window shall be provided in each door. Hinges shall be continuous piano type stainless steel. Two [2] "Ventlok" Model No. 310 high pressure latches operable from either side of the door shall be provided. The door opening shall be fully gasketed with continuous ½ in. closed cell hollow round black gasketing and a metal encapsulated reinforcing backing that mechanically fastens to the door frame. Door frames shall be made from No. 14 gauge galvanized steel with the outside of the door flush with the access corridor. Fan compartment access doors must have a minimum width as required to remove the motor.

XII. The unit shall be finish painted with two components, etch bond primer and alkyd enamel. All uncoated steel shall be painted with grey enamel. All metal surfaces shall be pre-painted with vinyl wash primer to ensure paint bonds to metal. The unit exterior shall be finish coated with polyurethane paint.

XIII. Rain hoods shall be provided complete with 0.5" x 0.5" bird screen and finished to match the color of the unit. Rain hoods shall be of No. 14 gauge galvanized steel construction. Continuous rain gutters with drain connections around the perimeter of the rain hood shall be provided.

G. Coils:

I. Coils installed in either factory-packaged or custom-designed units, if not properly engineered, will not be serviced and will eventually fail to perform. The Design Professional shall ascertain that all components are serviceable.

II. The following issues shall be specifically addressed for all coil installations:

(a) Size all air handling unit system components and duct mains to allow for future expansion and renovations in accordance with specific criteria furnished by the Associate Vice President of Facilities Operations & Maintenance.

(b) Individual coils must be fully accessible on both the upstream and downstream sides to permit inspection and cleaning.

(c) Coil sections shall be provided with tracks, extended the full length of the unit to provide for the removal of the coil or an individual coil in a bank of coils.

(d) The cooling-coil face velocity must be limited to 400 FPM across the entire face area to prevent carryover at maximum future and present design conditions. Air distribution plates should be considered for use upstream of coils, but plates must not induce a high pressure drop.

(e) Moisture eliminators may be considered where carryover presents a problem; however, eliminators must not impede service access to the coil surface for cleaning.

III. The air handler's coil capacities must be able to handle up to 100% outdoor air at 95°F DB, 78°F WB, and 134.6 grains of moisture for summer and 0°F for winter without moisture carryover or insufficient capacity.

IV. Steam Coils:

(a) Steam preheat coils are **PROHIBITED**. In specific instances where replacement of an existing air handler necessitates the use of a steam preheat coil due to lack of space for the installation of a glycol preheat system AND the Associate Vice President of Facilities Operations & Maintenance has specifically waived this prohibition in writing, the steam preheat coil shall be the integral face and bypass (IFB) type with dampers arranged so as to completely enclose and isolate the heating coil passes when no temperature rise is required. Each coil shall be capable of maintaining a constant discharge air temperature regardless of variations in entering air temperatures under full (uncontrolled) flow conditions. Provide linkage and DDC damper actuators with positioners. Provide 2-position, sprig-return open, fail-open, steam control valve to eliminate steam flow when there is no call for heat. Casing shall be 14-gauge stainless steel with rigid framework.

(b) One-third and two-thirds steam control valve arrangements with a manual bypass valve shall be provided for large steam coils to improve control and operating efficiency. Steam mains shall be dripped prior to control valves. Steam control valves used on integral face and bypass coils shall be controlled to the fully open position when the inlet air temperature is 32°F or less, and to modulate in response to the setpoint temperature when the inlet air is above 32°F.

(c) Float traps shall be used on steam coils. Trap bypass lines shall not be used; dual traps may be considered.

(d) Steam coils shall be non-freeze vertical tube and shall be piped for complete gravity drainage and fitted steam vacuum breakers (not check valves) located outside of the air stream and be located external to the air handling unit casing. Condensate shall not be lifted downstream of modulating valves for steam coils. Condensate lines shall not be designed to discharge under pressure. There shall be a hydraulic head between the coil and steam trap of 18 in. minimum.

(e) Coil bank steam and condensate mains shall have manual isolation valves so that the entire unit can be drained.

V. Water Coils (chilled water, heating hot water, glycol, etc.):

(a) Design water temperature rise shall be 15°F (45°F to 60°F) for chilled water coils, 30°F for glycol preheat coils, and 20°F maximum (160°F to 180°F) for heating hot water coils.

(b) Coil vent and drain piping shall extend to outside the unit casing to vent and drain valves. The vent and drain valve piping shall be all brass construction.

(c) Individual coils must be fully accessible on both the upstream and downstream sides to permit inspection and cleaning.

(d) Preheat coils, if used, shall be of the glycol type in all applications and are mandatory in all applications resulting in a mixed air temperature below 50°F. Glycol preheat coils shall be a minimum 2 rows, fully circuited, with supply and return headers.

(e) Coil drain pans shall be stainless steel and have a positive slope-to-drain connection. Drain connections shall be from the bottom of the coil rather than the side. Drain pans shall be double-wall and constructed of welded stainless steel with 1 in., ¾ lb. insulation sandwiched between the pans. Drain pans shall be sloped to drain connections per the currently adopted ASHRAE Standard 62 (and all approved addenda thereto). Intermediate drain pans shall be used for stacked coils. Each pan shall be independently drained.

(f) All coils shall be installed in a counter flow arrangement and shall be ARI Standard 410 certified, factory tested with air at 250 PSIG under water and rated for a 150 PSIG operating pressure at 300°F. Staggered coil arrangements are **PROHIBITED**. Utilize V-type arrangement if required.

(g) Thermal breaks shall be provided downstream of cooling coils.

(h) Where multiple coils are required to provide the total capacity of individual unit, the maximum coil depth shall be 8 rows with no more than two coils in series. Coils shall be a maximum of 10 ft. long by 3.5 ft. high and be capable of replacement without major rigging. Individual coils within a coil bank must be removable without disturbing pipe headers or other coils.

(i) Multiple coils shall be valved separately so that, if any individual coil fails, it can be isolated and drained while the remaining coils stay in operation. Return headers for multiple-stacked coils shall be piped reverse return to assist a balanced water flow at all load conditions. Piping within the airstream shall be minimized.

(j) All coils shall have integral vent and drainage ports.

(k) Even and consistent airflow across the entire coil surface is required. Upstream mixing and the use of air blenders shall be provided where necessary.

(l) Coil bank supply and return mains shall have manual isolation valves so that the entire unit can be drained.

(m) Control and balancing valves shall be installed on the return line for water coils. Balancing valves shall be specifically designed for balancing and have integral memory stops. Combination balancing, shutoff, and flow meter devices are **PROHIBITED**.

(n) Glycol preheat coils shall be designed for parallel flow-circuiting. Glycol flow shall be maintained through the unit by a run around loop with mixing valve pump system.

(o) Water coils shall meet the following requirements:

(i) Maximum coil face velocity shall not exceed 400 feet per minute for new units, or 450 feet per minute for replacement units, at the air handler's maximum airflow rate (no diversity).

(ii) Airside pressure drop shall not exceed 0.50 in. w.c. for hot water heating coils, 0.60 in. w.c. for glycol heating coils and recirculating system cooling coils (wet), and 1.00 in. w.c. for 100% outside air cooling coils (wet).

(iii) Maximum tube velocity at maximum design flow shall not exceed 8 feet per second or be less than 3 feet per second.

(iv) Maximum water side pressure drop shall not exceed 20 feet w.c.

(p) Water coils shall be constructed of the following materials:

(i) Primary Surface (Tubes) – minimum of 5/8 in. OD by 0.035 in. wall thickness seamless copper with die formed return bends silver soldered to the tubes. Tubes shall be expanded to form a mechanical bond with the secondary surface fins. Depth of coils shall not exceed 8 rows.

(ii) Secondary Surface (Fins) – Die formed aluminum fins, minimum .010 in. thick designed to minimize carryover. Copper fins shall be utilized in environments that are corrosive to aluminum fins. Fin density shall not exceed 10 fins/inch maximum.

(iii) Headers - Seamless copper tubing silver soldered to tubes. Connections shall be of red brass with male pipe threads, silver soldered to the headers. Each header shall contain a ¼ in. FPT vent and a ¼ in. FP drain tapping. Connection to headers shall be arranged for counter-flow operation with supply connections on the bottom and return connections at the top. Provide all water and glycol coils with two (2) headers ("Contractor's Coil"). Headers shall be constructed for 250 PSIG operating pressure.

(iv) Casing - Structural strength of casing material shall be suitable for stacking of coils with end tube sheets to support tubes. All coils with finned lengths 60 in. or greater shall be provided with intermediate tube supports. Casing channels shall be free draining without depressions which may collect water or contaminants. Material used for casing, tube sheets and tube supports shall be galvanized steel for heating coils and stainless steel for cooling coils. Provide stainless steel drain pans where applicable.

(q) For laboratory exhaust air heat recovery coils, tube, fin, casing and header surfaces shall be coated with a phenolic resin.

(r) The use of special coil materials mandated by a particular application which may cause corrosion shall be reviewed and approved by Temple University Facilities Operations & Maintenance.

(s) Coil capacity schedules shall be included in the drawings and list the following:

(i) Number of rows and fin spacing.

(ii) Entering and leaving air conditions (DB & WB in cooling applications).

(iii) Air side pressure drop.

(iv) Entering and leaving water temperatures.

(v) Water pressure drops.

(vi) Airflow in CFM and face velocity.

(vii) Water flow rate in GPM.

(viii) Water velocity in tubes in FPS.

H. Dampers:

I. Dampers shall be low leakage and opposed or parallel blade as required to accommodate mixing of air stream. Insulated-blade dampers as manufactured by Tamco are preferred. Opposed blade dampers are preferred and required for mixing applications. Particular attention shall be given to achieve good mixing of outdoor and return air to minimize stratification and freezing of water coils. Air blenders shall be considered for use when airflow arrangements do not support the effective mixing of different air streams.

II. All dampers and actuators shall be fully accessible for lubrication.

I. Electrical Provisions:

I. The unit manufacturer shall furnish and install a complete factory wired electrical system for each unit, so as to allow single-source responsibility and to ensure proper selection and installation of all electrical components.

II. Provide factory-installed and sealed wiring sleeves for all control and power wiring that penetrate the unit casing. All power wiring shall be factory installed to a single point for power source connection on the exterior of the unit. All wiring within unit shall be enclosed in sealed moisture resistant EMT.

III. The unit manufacturer shall provide prewired and switched non-corroding vapor-tight LED lights in each compartment with an access door and in the service corridors as follow:

(a) Lights shall be suitable for use in wet and damp locations.

(b) Lighting, internal wiring, switching mounted in bell boxes, and all other electrical wiring associated with the lighting shall be provided by the unit manufacturer at the factory.

(c) Lighting shall be 120-volt and suitable for cold weather (-20 F) and shall comply with UL 1570 and shall carry the UL label.

IV. Unit manufacturer shall provide (2) 120-volt, single-phase electric connections for the lights and receptacles, via junction boxes with circuit breakers for connection in the field by the Electrical Contractor (20 amperes power supply).

J. Energy Recovery:

I. When energy recovery equipment is used, the heating and cooling coils shall be designed to function at full load with and without energy recovery. All coil schedules shall show both entering air conditions. Units with energy recovery systems shall be designed such that devices could be out of commission without any interruption to air handling unit system operation. Provide isolation and bypass dampers around both sides of energy recovery wheels or heat exchangers and modulating bypass

dampers for mixed air temperature control on the supply side. The modulating bypass and full bypass damper may be a single damper serving both functions.

II. Enthalpy wheels utilizing silica are **PROHIBITED**.

K. Fans:

I. Air handling unit fans may be centrifugal (double width) or plenum fans as justified by life cycle costing. Use of plenum fans is strongly discouraged. Fans shall have a minimum ACMA Construction Class of II. Fan blades shall be continuously welded to wheels. Fans shall be totally isolated from the unit using inertia base and spring isolation. Fan volume control shall be achieved using VFDs on centrifugal and plenum fans. Discharge dampers are not suitable for volume control. Fans may be arranged in either the blow-through or draw-through position. Redundant or parallel fans shall be installed in separate compartments and be capable of complete isolation.

II. Fans shall be individually selected for their specific application. Many different fan types and arrangements exist in the marketplace from a large variety of manufacturers. The Design Professional has the responsibility to select the fan and specify its requirements to meet the functional needs of the system while providing stable, efficient, and quiet operation. Fan selections shall be based on the lowest reasonable speed while optimizing efficiency. Fan selections shall consider longevity of components, especially bearing life at maximum design conditions.

III. Specify fans having a certified sound and air rating based on tests performed in accordance with AMCA Bulletins 210, 211A, and 300. See AMCA Standard 99, Standard Handbook, for definitions of fan terminology. If specific sound data for the selected fan is not available, certified testing for fan sound data shall be required. The arrangement, size, class, and capacity of all fans shall be scheduled on the contract drawings for permanent records.

IV. The Design Professional shall give careful consideration to the location of the supply air fan with respect to coil banks. Excessive air velocity stratification across the face of a coil may affect the capacity, pressure drop, and water carryover characteristics. Thus, the location of the fan with respect to the coil bank is very important. Generally, if the air velocity across the coil does not vary by more than +/- 10% of nominal, essentially full capacity will be achieved, and water carryover will not be a problem. However, if the air velocity stratification is greater than this, capacity reduction, carryover, and freeze-up problems could occur. When space limitations dictate that the fans be placed in close proximity to the heating or cooling coils, the following criteria should be used to determine the minimum distance between fan and coil for field built-up systems:

(a) Draw-through System: For single-width fans, the distance between the fan intake and coil should be a minimum of one wheel diameter. For double-width fans, the distance between the fan intake and coil should be a minimum of 1/2 wheel diameter.

(b) Blow-through System: Most problems occur in this type of system. To minimize space requirements, it is desirable to place the coil as close to the fan as possible without causing excessive air velocity stratification across the face of the coil. The minimum distance for satisfactory operation is a function of the dimensional relationship of fan to coil, the fan outlet velocity,

coil face velocity, and coil pressure drop. Where extreme limited physical space conditions exist, the use of a carefully designed baffle plate between the fan discharge and the coil may be considered. The Contract documents should specifically address the placement of the fan with respect to the coil.

V. The design of fan inlet and outlet conditions shall consider the impact of system effects on the fan performance. The recommendations shown in the SMACNA Duct Design Manual for fan inlet and outlet arrangements shall be utilized.

VI. Multiple fans provided in air handling units and exhaust fans for redundancy purposes shall be provided in separate compartments with inlet isolation dampers to facilitate maintenance without taking the unit out of service.

VII. All units in excess of 2,000 CFM must be provided with a return air fan. The return air fan can be a single width single inlet centrifugal fan set, integral or independent cabinet fan, or in-line centrifugal type fan and must be mounted to permit servicing without the use of a ladder. Units which are not floor mounted and are mounted in excess of 6 ft. - 0 in. above the floor must be provided with stable catwalks constructed of structural grade steel and steel grating. Access ladders shall be integral with the catwalk.

VIII. Fans for new air handlers shall provide a minimum of 25% reserve capacity over and above the design maximum flow rate at the design total static pressure and shall be provided with motors and variable speed drives capable of providing that capacity.

IX. Fans for replacement air handlers shall provide a minimum of 15% reserve capacity over and above the design maximum flow rate at the design total static pressure and shall be provided with motors and variable speed drives capable of providing that capacity.

X. Fan selections shall be based on the lowest reasonable speed while optimizing efficiency. Fan selections shall consider longevity of components, especially bearing life at maximum design conditions.

XI. Fans shall be double width, double inlet (DWDI) centrifugal type fans. The selected fan blades shall be the most efficient fan available (i.e. - forward curved, backward inclined). Airfoil fans are **PROHIBITED**.

XII. Fan sections shall employ fans with a minimum ACMA Construction Class of II. Use Class III fan construction if the fan characteristic curve extends to within 10% of the fan's Class II selection zone.

XIII. Fan sections shall be isolated from the remaining unit and the connecting duct system to control vibration.

XIV. An integral all welded steel vibration isolation base shall be provided for the fan and motor.

(a) Isolators shall be free standing with sound deadening pads and leveling bolts.

(b) The spring diameter to compressed operating height ratio shall be 1 to 1.

(c) The spring deflection shall be 2 in.

(d) Isolators shall have earthquake restraints.

XV. Fan shafts shall be solid and shall be of AISI C-1018, 1040 or 1045 hot rolled steel accurately turned, ground, polished, and ring gauged for accuracy.

XVI. Fan bearings shall be self-aligning, pillow block, regreaseable ball bearings rated for an average life of a minimum of L-10, 200,000 Hrs.

XVII. Fan shafts and fans shall be rated for continuous operation and shall be statically and dynamically balanced in all planes. Fan drives shall be selected for a service factor of 1.5.

XVIII. All fans must be fully accessible for service and routine maintenance. Fan motors and drives shall not be located within hazardous or contaminated exhaust air streams. All drives shall be exterior to air handling units. Fan bearings where possible shall be serviceable outside of hazardous or contaminated exhaust air streams. Inline fans with motors or drive exposed to exhaust air streams are not permitted.

XIX. Fan systems designed for parallel or manifold operation shall be protected against backward rotation of fan wheels. Anti-rotation devices, motor brakes, or other approved methods shall be provided.

XX. Fans shall be certified sound and air rating based on tests performed in accordance with AMCA Bulletins 210, 211A, and 300. The arrangement, size, class, and capacity of all fans shall be scheduled on the contract drawings for permanent records.

XXI. All fans shall be statically and dynamically balanced by the manufacturer and shall be provided with vibration isolation. Fans shall not transmit vibration to the duct system or building structure. All fans shall also be dynamically balanced in the field by the manufacturer after the installation is complete.

XXII. Diffuser cones and inlet bells are not permitted in rating a fan unless they are an integral part of the fan design.

XXIII. Inlets and outlets of fans that are not duct-connected, including fans in plenum chambers or open to the weather, shall have heavy OSHA-approved guard screens to protect personnel. Guard screens shall not impair fan performance and, when bolted to equipment, will permit their removal for fan service and cleaning.

XXIV. Complete fan lubrication facilities shall be provided, such as oil reservoirs, sight glasses, grease and relief fittings, fill and drain plugs, pipe connections, etc. The facility shall be placed in a readily and safely accessible location so that after installation they will perform the required function without requiring the dismantling of any parts or stopping equipment. For fans located within contaminated air streams, lubrication facilities shall be piped to the service corridor.

XXV. Fans shall be specifically addressed, as the air stream may contain excessive moisture, fumes, corrosive vapors, or contaminated or hazardous particles. Special consideration shall be given to those fans handling explosive vapors or radioactive material.

XXVI. Certified performance data including acoustical data shall be submitted for each fan at maximum design conditions. Data shall include published sound power levels based on actual tests on the fan sizes being furnished and conducted in accordance with current AMCA standards. Such data are to define sound power levels (PWL) (10 -12 W for each of the eight frequency bands). The acoustical design of the fan system must conform to the space noise criteria. Fan curves shall be submitted which will

depict static pressure, total pressure, brake horsepower, and mechanical efficiency plotted against air volume. Fan curves shall include estimated losses for field installation conditions, system effect, and actual installed drive components. All included losses shall be defined on the fan curves. Data may also be submitted in tabular form, but tables are not a substitute for actual performance curves.

XXVII. Direct drive fans are preferred to reduce maintenance costs and improve reliability. Where factory-designed and assembled belt drives are proposed to be furnished, OSHA-approved mesh-type guards shall be provided for all belt drives, and the drives shall comply with the following:

(a) Each drive shall be selected according to the rating and recommendations of the manufacturer for the service with which used, giving proper allowance for sheave diameter, center distance, and arc of contact less than 180 degrees. The motor shall have a nameplate rating of not less than 5% above the total of actual fan brake horsepower and drive loss at specified capacity.

(b) Belts shall be constructed of endless reinforced cords of long staple cotton, nylon, rayon, or other suitable textile fibers imbedded in rubber. The belt shall have the correct cross section to fit the sheave grooves properly. Belts shall be matched carefully for each drive. Extended-horsepower belts are not acceptable.

(c) Motor sheaves shall be adjustable pitch type for fans under 25 HP, selected so that the required fan rotational speed will be obtained with the motor sheave set approximately in mid-position and have the specified pitch diameter in that position. Fixed pitch "initial" sheaves shall be installed on fans 25 HP and larger. All multiplex belt drive assemblies regardless of horsepower shall be fixed-pitch type. When correct “final” sheave size has been determined by Testing and Balancing Agency, furnish and install a permanent fixed- pitch sheave for motor to replace variable-pitch and “initial” motor sheaves. Turn over variable-pitch and “initial” motor sheaves to Temple University.

(d) Fan motors shall have the capacity needed to operate the equipment at the specified mid-position operating condition. Where non-overloading motors are specified, the motor capacity rating at the most closed position of the motor sheave shall be selected. In no case shall motors be a smaller size than that required to operate without overload. Motors shall be NEMA Premium Efficiency with Aegis grounding rings.

(e) Fan sheaves shall not be smaller in diameter than 30% of the fan wheel diameter.

(f) Sheaves shall be constructed of cast iron or steel, bored to fit properly on the shafts, and secured with keyways of proper size (no set screws). Keyways may be omitted for sheaves having ½ inch or smaller bores, where set screws may be used.

(g) Fans shall be furnished complete as a package with motors, drives, curbs, bases, and inlet and outlet fittings. Detached vibration isolation devices may be provided separately.

XXVIII. Fan volume shall be controlled utilizing ABB ACH580 variable frequency drives equipped with ABB eClipse bypasses. Inlet vanes and discharge dampers are **PROHIBITED**.

L. Humidifiers:

I. Humidifiers for central station air handlers shall be of the dry-steam, manifold-jacketed type and be located in the air handler up-stream of the chilled Water coil. Ductwork within the absorption range of the humidifier shall be fully welded stainless steel and pitched to drain. Smoke detectors and airflow measurement stations installed at air handling units shall take the absorption distance into consideration. Steam lines serving humidifiers shall have an automatic isolation valve and be dripped to remove condensate prior to manifold. The isolation valve shall be closed during cooling mode to prevent additional heat gain in the duct system. A high-limit humidity controller must be provided for each humidifier.

M. Testing:

I. Each custom designed unit shall be tested at the **factory** by the unit manufacturer prior to shipping, as follows:

(a) Air volume and discharge static test shall verify that the air volume is within the range of 100% to 110% of scheduled nominal CFM requirements when operating at design total static pressure. The test for airflow and static capability shall include airflow measuring devices installed in all ducts returning to or leaving the unit. These devices shall be installed in accordance with the measuring device manufacturer's recommendations. Pressures external to the unit shall be simulated using a combination of ducts and dampers. The tests shall prove design airflow and static capability of the assembled unit.

(b) Casing leakage tests shall be run to prove that unit casing leakage is less than 0.5% of design flow at 1.5 x operating pressure. The duct openings in the pressure section shall be sealed and this section shall be tested at 12.0" w.c. The CFM of this fan shall be read using an approved airflow measuring device. When the static pressure developed by the test fan reaches 1.5 times the unit design static pressure, the fan CFM shall be read and this CFM will be considered the casing leakage. The casing leakage must be less than 0.5% of the design CFM. Factory casing leakage test for fully welded units may be deleted. However, leakage test must be performed at the site after joining and sealing of sections for all unit construction types. Leakage test shall be performed with all control, VFD, and humidifier panels installed.

(c) The duct openings in the suction side of the unit shall be sealed and this section shall be connected to a test fan capable of developing a suction that is numerically equal to 1.5 times the design static pressure. The CFM of this test fan shall be read using an approved airflow measuring device. When the suction developed by the test fan is numerically equal to 1.5 times the unit design total static pressure, the fan CFM shall be read and this CFM will be considered the casing leakage. The casing leakage must be less than 0.5% of the section's design CFM (supply/return). Leakage across the septum wall located the discharge end of the fan shall be 0 CFM (no leakage).

(d) Both the casing leakage test and the airflow and static capability test, as defined above, shall meet the required acceptance criterion without the use of any temporary caulking at any permanent panel joints. Temporary test caulking shall be utilized at the unit shipping splits to simulate "as installed" conditions.

(e) All unit bases shall be flooded to a level of 1.5" after manufacturing to assure there is no leakage through the floor and the perimeter water barrier. The results of the flood test shall be certified by the manufacturer.

(f) System sound levels shall be measured in all nine (9)-octave bands (31.25 Hz through 8000 Hz) at system design operating conditions. Airborne sound levels at all openings shall be read in the test ductwork 5ft.-0 in. from the openings. Transmitted sound levels shall be read 5 ft.-0 in. from the outside of the fan section.

(g) Sound tests shall be conducted while the unit is running at design conditions. An octave band sound pressure level reading shall be taken at outside louver, exhaust louver, supply discharge opening, return air opening, economizer opening and adjacent to each fan section outside of the unit casing.

(h) Each individual fan shall be tested for vibration in X-Y-Z directions at the fan manufacturer's facility before shipment to the unit manufacturer to assure that specified fan balancing criteria is adhered to.

II. Pressurized leak testing shall be performed in the **field** after assembly of the unit sections by the HVAC Contractor, under the direction of the unit manufacturer, by running the fans and soap bubble testing all field joints and penetrations to ensure unit tightness. The unit manufacturer shall correct and pay for the repair of all deficiencies found during testing, except for the repair of all deficiencies found during testing, except for unit section joints leaks, which shall be the responsibility of the HVAC Contractor. The HVAC Contractor shall provide all field labor necessary to join the unit sections, including all electric and drain splits after they are delivered to the site and set in place. All fieldwork shall be provided under the direct supervision of a qualified Design Professional employed by the unit manufacturer. Rigging for unit sections shall be provided by the HVAC Contractor.

III. Test Procedures:

(a) A complete test procedure shall be submitted to the Architect for approval detailing the methods, equipment, and techniques to be employed for each specific test. Equipment will not be considered approved until written approval of testing procedures is attained.

(b) As hereinbefore specified, the preceding airflow/static, sound and vibration tests shall be required for all Air handling units specified in this Section and shall be witnessed by designated representatives of the Design Professional and Owner (total [3] people). All unit sections shall be leak tested at the field after installation. The unit manufacturer shall notify the University project manager for their approval. The unit manufacturer shall pay for all air and ground transportation, lodging, and meals for the designated witnesses to

attend the testing. If multiple trips are re- quired, they shall all be paid for by the unit manufacturer.

(c) Any deficiencies in unit performance must be corrected by the unit manufacturer in the manufacturing plant prior to shipping.

END OF SECTION

<BACK

1. This Design Standard is defines the requirements for integration of Building Automation Systems (BAS), Advanced Lighting Control Systems (ALCS), and other building systems into the Temple University Integrated Facilities Management System (TU-IFMS, a.k.a. – SCADA**).**
2. For detailed requirements for Building Automation Systems (BAS) see Temple University Design Standards - Section 23 09 00 Instrumentation and Control for HVAC. For detailed requirements for Advanced Lighting Control Systems (ALCS) see Temple University Design Standards - Section 26 09 00 Instrumentation and Control for Electrical Systems.
3. All BAS and ALCS shall be integrated into the Temple University Integrated Facilities Management System (TU-IFMS, a.k.a. – SCADA) which is built on the Microsoft Azure and TwinWorX platform. Communications between these systems and the TU-IFMS is via BACnet/IP over Campus Ethernet.
4. The TU-IFMS translates BACnet data to Microsoft Azure and TwinWorx via a virtual Edge Server running Kepserver ES and Cogent DataHub.
5. It shall be the BAS and/or ALCS contractor(s) responsibility to provide the system integration services required to integrate the BAS and/or ALCS systems being provided into the TU-IFMS.
6. All BAS and ALCS shall provide full BACnet-compliant interoperability via the Temple University Integrated Facilities Management System, including the following BACnet Interoperability Building Blocks (BIBBs):
    A. Data Sharing
    B. Point Commanding
    C. Change of Value
    D. Trending
    E. Scheduling
    F. Alarm & Event Management
    G. Device & Network Management
7. The BAS and ALCS shall have the ability to provide BACnet Data Sharing for all physical and virtual point values with the TU-IFMS.
8. The BAS and ALCS shall have the ability to provide BACnet point commanding for all hardware points, setpoints, and operator-adjustable variables and these shall be adjustable/commandable from the TU-IFMS.
9. The BAS and ALCS shall have the ability to provide BACnet COV/Trending for all physical and virtual point values with the TU-IFMS.
10. The BAS and ALCS shall have the ability to provide BACnet Scheduling, including special events scheduling, and shall be implemented to allow centralized hierarchical scheduling via the TU-IFMS for all HVAC equipment.
11. The BAS and ALCS shall have the ability to provide BACnet Alarm & Event Management and these shall be available and configurable via the TU-IFMS for all physical and virtual points.
12. The following documents, incorporated herein, provide detailed information regarding the TU-IFMS, its scope and purpose, and the technical requirements for integration:

A. Temple University – IFMS Objectives

B. Temple University – IFMS Standard Handbook

C. Temple University – IFMS Integration

D. Temple University – IFMS Point Naming Conventions

IFMS OBJECTIVES

A Complete vision for a University Wide IFMS Platform for the Present and Future

Presented by:

e-Magic Inc.

April 13, 2022

Contents

Executive Summary 3
1.0 Economic Benefits of IFMS Platform 4
1.1 Economic Impact 4
1.2 Operational Capabilities and Benefits 5
2.0 Data Logging 6
3.0 Troubleshooting 7
3.1 Alarming 7
3.2 Fault Detection and Diagnostics 7
4.0 IFMS Functionality and Responsibility 8
4.1 Alarms 8
4.2 Scheduling 9
4.3 Analytics and Reporting. 9
5.0 System Redundancy and/or Redundant I/O for critical areas 11
6.0 IFMS Platform and Temple University Network 13
6.1 IFMS Requirements 13
6.2 Integrations & Sub-System Data Connections (Layer 1) 14
6.3 Sub-Systems 16
6.3.1 Mechanical BAS 16
6.3.1.1 HVAC Integration Data Parameters 16
6.3.2 Electrical 17
6.3.2.1 Electrical Integration Data Parameters 18
6.3.2.2 Lighting 18
6.3.2.2.1 Lighting Integration Data Parameters 19
6.3.2.3 Fire 19
6.3.2.3.1 Fire Integration Data Parameters 19
6.3.2.4 Metering 20
6.3.2.4.1 Metering Integration Data Parameters 20
6.3.2.5 Security 20
6.3.2.5.1 Security Integration Data Parameters 21
6.3.2.6 Elevators / Vertical Transportation (VT) 21

6.3.2.7 Elevator / VT Integration Data Parameters 21
6.4 Single Pane of Glass (SPoG) 22
6.5 Converged Building Network (CBN) & Network Security 22
7.0 Open System Standards Utilization 24
7.1 OPC Device Configuration 25
8.0 Impact of Microsoft Technologies on IFMS 26
8.1 Facilities Management Challenges 26
8.2 Microsoft Technologies in Facility Management 26
8.2.1 Microsoft Digital Twins 27
9.0 Security Requirements for IFMS Platform 29
9.1 Microsoft Zero Trust 30
9.1.1 Azure IoT Security 30
9.1.2 Azure Defender 31
9.2 Microsoft Impact on Cybersecurity 32
9.2.1 Zero Trust for IoT 33

Executive Summary

Temple University Facilities & Operations have developed a digital transformation and smart building strategy that provides the foundation for optimizing building operations, reducing costs, and improving building services for the university's many schools, businesses, employees and students.

As a global provider with more than 35 years of experience in building systems, e-Magic is proud to have worked with the Temple team to produce critical project deliverables that will support the ongoing development and execution of building intelligence strategies across the university. This document outlines the numerous benefits of the proposed IFMS platform architecture and pilot solutions that will be delivered.

Notably, the project will yield:

- Positive economic impact and cost savings
- New and improved operational capabilities and benefits
- Reference architecture for a campus-wide IFMS platform
- A data strategy aligned to the University's strategic priorities and interests
- A strategy that reduces vendor risk for Temple University
- A platform designed for future growth, further enablement and enriched capability

In this Objectives of IFMS document, we have:

- Outlined the criteria for selection of the IFMS platform
- Discussed the use of Microsoft technologies to further enhance IFMS platform functionalities
- Recommended standard cybersecurity requirements for the IFMS platform
- Detailed requirements & functionalities of the IFMS platform
- Evaluate Temple University's existing control and provide reports

1.0 Economic Benefits of IFMS Platform

The IFMS project has yielded significant outcomes and provided numerous benefits for Temple to date. Additionally, there are many potential opportunities for Temple to increase value through the expansion of the IFMS platform across campus.

1.1 Economic Impact

The IFMS implementation project has delivered cost savings through:

1. Reduced hardware and software costs will be realized campus wide or per building across various sub-systems such as HVAC, elevator, lighting, and metering for the following:
    - Delta Controls
    - Johnson Controls
    - Lutron
    - Otis
    - Siemens
    - Trane
    - Yokogawa
2. Reduced ongoing IT services costs by using Azure Cloud storage, services, and security
3. Open Bid Selection:
    - Temple has the freedom to select subcontractors and not be held hostage to a single solution provider for hardware, software and/or services
    - New BAS installations can be opened to multiple vendors - it is expected that competition will drive the prices down 30-40% from single source pricing
4. Additional expected cost savings – projections based on industry benchmarks:
    - Save on Energy costs and improve energy utilization by optimization (+20%)
    - Reduce operating costs through the introduction of Single Pane of Glass (+15%)
    - Early implementation cost saving by reducing interfaces and server dependencies
    - Mitigate downtime from unplanned maintenance
    - Reduce operational maintenance costs (+15%)
    - Improve process efficiencies and automate workflows

1.2 Operational Capabilities and Benefits

1. Aligned vision and strategy between Facilities Management and IT departments by leveraging Microsoft Azure as a platform for IFMS that meets objectives and goals of both departments
2. Improved productivity and usability by centralizing information to one screen with a Single Pane of Glass:
    - Users do not have to log into multiple systems to find and access information, insights or alerts
    - The operations team has a convenient, centralized overview of all connected buildings and control of sub-system data points
    - Decision-makers can quickly access meaningful information and actionable insight into sub-system performance
    - FM staff have real-time information and visibility into equipment and any immediate problems or locations
3. Streamlined, context-based, and centralized Command & Control ensures the right settings adjustments can be made remotely at the right time and place
4. Improved Customer Service with faster response times enabled through central alerts, notifications and monitoring:
    - Faster response times reduces impact and damages caused by emergency issues such as water leaks or power outages
5. Equipment and occupant experience optimization according to occupancy and usage through Scheduling capabilities – Charles building
6. Fault detection and diagnosis leverages hundreds of human-informed rulesets to analyze streaming data and advise on faults
7. Energy insights into reduction and efficiency improvements
8. Remote monitoring and graphical representations of sub-system data
9. Floor plans overlaid with system real-time, live information

2.0 Data Logging

Data logging or historization is at the center of every successful IFMS. It is the foundation upon which the IFMS can recognize changes to normal operation, produce insights and reports, provide actionable recommendations to reduce inefficiencies, and short-track outages increasing productivity at the facility. While the method to acquire data from each system varies, a well-designed IFMS will normalize the data to a consistent ontology and process that data on the fly into a well-designed, high-performance historian.

Historian at the fundamental level, is a simple datalogger that writes all datapoint changes to a database. Historization is not a new concept; there are many standalone historians available that can produce this basic functionality. In designing a historian, maximizing performance, scalability, and accessibility to data are paramount.

One-hundred devices logging data every second would create 8,640,000 records each day. In the longer term, performance degradation negatively impacts any application parsing through that data to produce any kind of insight. Facilities commonly contain many thousands if not millions of data points. With this in mind, a Historian needs to be strategically designed at the outset as changes to large datasets introduces challenges at a later date.

An optimized historian design should include configurable options on a point-by-point basis. While voluminous telemetry data flows into the system at a high rate, creating a record for every data change is not necessarily beneficial. If a sensor measures the supply air temperature of a room every second, it would be prudent to log the average temperature at 15-minute increments to decrease data hosting costs and maximize application query times.

A high-performing historian for an IFMS will leverage cloud-based architecture built for high-frequency big data. Tools like Azure IoT Hub, Kafka, and Microsoft Stream Analytics are designed to ingest and apply real-time processing on the incoming dataflow. Stream processing allows the IFMS to optimize, organize, and query both hot-path and cold-path datastores. The IFMS should segment and organize the data based on the probability a datapoint is to be queried in the near future. It should routinely perform operations on previously stored data using parameters, age of the data as an example.

Microsoft Azure provides access to leading time-series databases such as Influx DB, PostgreSQL, and Timescale DB. Designed for timestamped data, these databases scale to growing workloads by using high-compression, cloud-driven storage algorithms combined with table indexing. This decreases query times providing the IFMS application with the foundation it needs to operate efficiently.

3.0 Troubleshooting

The purpose of an IFMS is to assist the facilities team in resolving issues and maintaining normal operation of all systems. A historian and live telemetry will only prove useful if the IFMS is able to sort the most important information and provide it to the operator. To assist in troubleshooting and maintenance, the IFMS should provide Alarming for real-time observation, and Fault Detection and Diagnostics for the purpose of predictive maintenance.

3.1 Alarming

Each system in the IFMS will have normal operating thresholds for which alarm triggers should be defined and configured. An alarm module within the IFMS should provide flexible options to address the various alarming requirements and configurations of different vendor systems. The alarm module in an IFMS should be filterable by device, area, or alarm name. A properly designed alarm module should include the following capabilities:

- Generate alerts based on static and dynamic thresholds
- Correlate data to detect event anomalies and missing events
- Support scheduling, digest, and auto-retry of notifications
- Publish alerts via various event sinks such as email and MQs
- Portal: acknowledge, annotate, and assign issues for corrective action
- Support integration to work order systems / CMMS

3.2 Fault Detection and Diagnostics

Process controllers are designed to maintain satisfactory operations by compensating for the effects of disturbances and changes occurring in the process. While they can compensate for various types of disturbances, there are changes in the process which the controller cannot handle adequately. These changes are called faults. More precisely, a fault is defined as an unpermitted deviation of at least one characteristic property or variable of the system.

A well designed IFMS should have a system in place that provides fault detection and diagnostics (FDD). Fault detection and diagnosis capabilities contribute significantly to reducing building operation costs, as well as providing occupants with an optimal level of comfort and service. For many companies, fault detection requires making judgment calls based on incomplete data, often piecing together spreadsheets, maintenance logs, and utility bills and other data from equipment level sources and site observations. Fault detection and diagnostics should combine human expertise, complex rules, Machine Learning (ML) models and AI-based analytics to monitor assets in order to detect, diagnose, predict, advise, and optimize performance.

Fault detection and diagnostics should include the following features:

- Prioritize faults based on projected costs
- Provide contextualized fault causes

- Increase building and maintenance safety
- Reduce energy consumption and reduce operational costs
- Minimize equipment downtime and provide responsive service
- Improve occupant experience, comfort, and services
- Digital Twin integration for continuous commissioning of new devices and rules
- Ability to disable fault

4.0 IFMS Functionality and Responsibility

The IFMS platform provides analytics functionality facilitating data mining, data visualizations, and interactive dashboards.

The IFMS platform should connect to 3rd party artificial intelligence (AI) and machine learning (ML) algorithms to analyze data sets, generate predictive faults, enable system optimizations, and provide key insights.

The IFMS should provide the integration to the CAFM platform via a suitable documented protocol such as JSON, API or MQTT.

The IFMS platform should have integration connection to a 3rd party solution or provide as part of the core solution offering 'drag and drop' configurable and customizable dashboards.

All dashboards shall be interactive, displaying:

- Graphs
- Key performance indicators (KPIs)
- Priority alarms – easily visible and accessible on the home page
- System information displayed in a hierarchy / system interdependency enabling drill down capability to discover more granular information

4.1 Alarms

All sub-system alarms shall be prioritized into the following:

- Priority
- General
- Notification

All alarms shall be ordered by prioritization and by date and time raised.

Additional functionality should be implemented whereby the user can search and filter the list of alarms to locate a specific alarm they are searching for.

Alarms should have an additional drop-down field when selected to allow responses, closing of alarms, and also a text input field to add notes. This allows FM operators to assign alarms to FM staff via email or work order raising with full alarm details and associated metadata included.

Any actions taken on the alarms shall also update any integrated work order management platforms where this alarm is raised for attention.

When an alarm is raised, linking to supporting data sources increases value add through increased usability and efficiencies. Some examples are as follows:

- Floor plan drawings / BIM model
- System interdependencies
- Past alarm history related to the current alarm
- Asset metadata
- System performance status
- System performance data

4.2 Scheduling

The IFMS platform can be configured to maintain or alter control values at specific times, over specific intervals. Scheduling can be used to grant temporary access to shared or restricted resources like meeting rooms or labs. A robust scheduling system would allow for one-time or recurring scheduled changes with date/time-based or duration-based event options and a high degree of granularity in interval settings. For example, HVAC schedules can be developed and automatically adjusted according to time of day, seasonal/atmospheric conditions, and level of occupant activity. This automation ensures that the HVAC subsystems are only operating when required significantly reducing energy usage.

4.3 Analytics and Reporting

All sub-systems, applications, technology deployments, and analytic data alongside system control functionality and software data points should be accessible within the IFMS.

As part of the IFMS package delivery or via integration to a third-party ML / AI analytic platform, the ability to run algorithms on data sets across integrated data points to understand the following:

- Trends
- Cause and effect scenarios
- Predicted fault causes
- Pre-empt faults (FDD)
- Frequency of failures
- Cost implications of system performance and faults / repairs

Statistical comparisons of building and equipment performance data, in both real time and over historical data sets, can allow the ability to detect faults. With sufficient levels of data to begin inferring insights, the approach can predefine faults with statistical confidence without human interaction.

Statistical comparisons to enable fault detection and diagnosis shall only be deployed and implemented after commissioning acceptance to ensure algorithms measure performance against commissioned status. The IBMP analytic functionality can provide full capability for statistical comparison modelling and data analysis, natively as part of the IBMP solution offering or via a third-party integration for integrated building systems.

The IBMP should surface this data for visualisation and actioning within a single pane of glass (SPoG) view.

Examples of how analytics can be utilised include:

Example 1:

- Understand occupancy within a space
- Understand occupancy variations within the space
- Utilize HVAC system data to understand ventilation strategy
- Utilize occupancy data to inform HVAC operation of optimal start up time and air flow parameters for maximum user comfort and energy efficiency
- Inform system operation based on building data versus 'rule of thumb' parameters

Example 2:

- Analyze performance data sets from sub-system equipment
- Recognize abnormal performance when compared to performance data
- Log when system fault occurs including behavioral patterns resulting in fault
- Proactively alert operational staff to order equipment parts and / or investigate equipment
- Leverage the preventative maintenance function to reduce down time maintaining tenant satisfaction

5.0 System Redundancy and/or Redundant I/O for critical areas

With the continuous growth of broadband connectivity and technology, cloud computing has become a viable option for many businesses. Cloud computing drives the new breed of applications that harness the cloud services hosted by companies like Amazon, Google, and Microsoft. With cloud computing comes greater accessibility, lower capital expenses, faster deployment, scalability, reliability and maintainability, high recovery, and improved security.

A cloud computing based IFMS solution will inherit these benefits. The system can be easily accessed from everywhere and anywhere. It can expand and scale as required without the need for upfront capital expenditure. Time to deploy new cloud resources for the IFMS is reduced. All the hardware and software updates are managed by the cloud service providers.

IFMS should have a redundancy strategy to minimize any disruption for the monitoring and control operations when the connection between cloud and on-premise assets are broken.

Redundancy for IFMS can be breakdown into:

- IFMS system redundancy
- Network and Data Path redundancy

IFMS system redundancy relates to the availability of the IFMS to the operation in the cloud.

Network and Data Path redundancy relates to the networking and data path connectivity between on-premise assets and the IFMS in the cloud.

While redundancy is an important backup for IFMS to provide continuous service with minimal disruption, the degree of redundancy requirement varies depending on the facilities.

At Temple University, the following facts are observed:

- Environmental Network uptime for the Facilities Management is 99.9%
- Facilities assets operate autonomously; they run independently without any operational intervention
- Building with critical facilities assets requires close monitoring and control
- Most Microsoft Azure Cloud Services guarantees the apps running in the cloud available 99.95%

The use of Azure cloud services as the backbone reduces the criticality of IFMS redundancy requirement. IFMS should have one or more systems configured to run in parallel. Operations should be able to switch seamlessly among primary and secondary systems for monitoring and control.

Network and Data Path redundancy requires multiple paths for on-premise assets to reach the IFMS.

In a case where the connection to the IFMS is interrupted, an alternative network and data path should be available that allows data flow into IFMS.

The following alternatives can be considered:

- **Parallel LAN setup –** a physical network with duplicate switches provides alternative path for the data to flow to IFMS in the cloud. The advantage is that this provides a seamless transition to an alternative path when the primary path is blocked. However, the disadvantage will be the capital cost that is associated with the secondary path layout and the maintenance cost attributed to maintaining the health of the secondary path.
- **Portable network and data path setup –** mobile datahub availability that can be placed in buildings when primary data connections are lost. With an alternate internet connection and ability to temporarily store data then send once internet connectivity is restored, Operations can continue to monitor and control buildings when the primary connection is lost. The advantage is that this provides an economical secondary path. However, the disadvantage is the secondary path is not permanent meaning the logistics of mobile datahub deployment during primary data connection loss will need to be thoroughly planned and tested in advance.

6.0 IFMS Platform and Temple University Network

The Master Systems Integrator (MSI) contractor will provide an Integrated Facilities Management System (IFMS) as part of the overall smart building strategy.

The MSI contractor shall be responsible for the design, deployment, testing and commissioning of the integration platform as detailed and in accordance with an agreed upon specification. The MSI contractor shall be responsible for coordination with key stakeholders to achieve outcomes as detailed within that specification.

The IFMS shall be a software stack that features:

- Edge computing deployments for localized control
- Cloud computing deployments for virtualized environments
- Scalability to negate data bottlenecking maximizing operations
- Sufficient cyber security considerations to prevent unauthorized access
- A design that addresses latency and / or routing issues due to network segregations or protocol conversions

The software stack shall be a combination of component parts which constitute the complete IFMS.

The IFMS shall not be considered a single deployment but comprising multiple elements each contributing to different aspects of the data routing, processing, and visualizations.

6.1 IFMS Requirements

The IFMS shall be capable of the following minimum requirements:

- Data exchange between building sub-systems and third-party cloud services
- Advanced system control via bidirectional communication where required
- Single Pane of Glass (SPoG) visualizations
- Central alarm management
- Data normalization
- Data integration
- Remote visibility

The IFMS shall provide the communication protocol integration to cloud services and on-premises building subsystems via documented open APIs and / or open IP protocol communications.

The IFMS shall be a well architected middleware layer allowing seamless integration, scalability, and flexibility.

To enable data exchange between the IFMS and the building sub-systems, a suitable gateway device(s) will be required, capable of exchanging data via the appropriate drivers and protocols as necessary for each of the subsystems located on site.

The gateway device shall be able to expose the required building data. For any system points which are not named by the sub-system contractor, the gateway shall be able to take this data and convert it to the project nomenclature when routing this data to the IFMS.

Digital enablement of the various on-site building systems has already begun with the nomenclature being enforced by the Smart Building Consultant. As such, system points are expected to be correctly named prior to integration. For those not named correctly, a look-up table will be provided by the sub-system vendor allowing the MSI contractor to convert to the project nomenclature.

The core building systems for integration are listed as follows:

- BAS
- Fire
- HVAC
- Security
- Elevator
- Lighting
- Electrical
- Metering
- Parking management

Third party cloud management platforms, collating data from the various technology deployments on site, will integrate to the IFMS via a secure and documented API communication.

These technology deployments include:

- IoT occupancy sensing
- IoT environmental sensing
- Bluetooth low energy (BLE) beacon cloud management
- Cloud based content management systems for signage and mobile apps

6.2 Integrations & Sub-System Data Connections (Layer 1)

The sub-system integrations will be designed to allow the IFMS connection to the sub-system at a point in time leveraging known integration methods and data structures.

The MSI contractor shall provide the necessary coordination with all sub-system sub-trades and contractors to ensure:

- Availability
- Authentications
- Correct data formats are observed

Layer 1 integrations and data connections shall provide the physical integration to each sub-system via open IP protocols, complete with the correct nomenclature and metadata submittals.

All data structures shall be normalized into an agreed format, complete with the associated metadata for relational associations. The data structures shall be offered up for integration to the IFMS by the sub-trade in the correct format, however additional work may be required to ensure the system points are integrated correctly.

The data flow into layers 2 and 3 shall be provided and implemented here, with data flow either read-only or read-write, to fulfil the requirements outlined within this specification.

The integration shall carry any necessary authentications and subscriptions required to maintain API integration or database queries to all sub-systems and sources.

The MSI contractor shall deliver the functionality of this layer, including full coordination with the subsystem contractors and / or suppliers of the sub-systems, technology deployments, and data sources to ensure the agreed upon outcomes are met. This includes the guidance of sub-systems or source data, structures or any reprogramming required, where necessary, to fulfil all smart building requirements.

The MSI contractor shall be responsible for spatial coordination of all equipment with the architects and ICT consultant / contractor.

The MSI contractor shall ensure all systems, technology deployments and their associated devices display a general status (live health / fault status) where available via the integration, to allow the IFMS to monitor the general sub-system devices and sub-system network remotely – i.e., 'Device Online' and 'Device Healthy'.

Integration to the sub-systems shall enable:

- Analytics
- Fault analytics
- Performance analytics
- Control functionality – where required
- Floor plans overlaid with system real time information
- Energy insights into reduction and efficiency improvements
- Integration between other sub-systems also integrated to the IFMS
- Remote monitoring and graphical representations of sub-system data
- Consolidated SPoG view with all building sub-systems and technology deployments

All systems shall be integrated as necessary to achieve the requirements of the overarching smart building goals.

To enable the integration and data exchange between the IFMS and the building sub-systems, a suitable gateway device(s) will be required, capable of exchanging data via the appropriate drivers, protocols, and gateways as necessary for each of the sub-systems located on site.

The on-site gateway shall be capable of exchanging data with the IFMS via a secure and documented open protocol communication, such as JSON API or MQTT, as examples.

6.3 Sub-Systems

6.3.1 Mechanical BAS

The mechanical HVAC system is designed and will be deployed to provide HVAC control and monitoring for the building.

The system will communicate via BACnet IP to all main BAS controllers, while some select equipment will operate via BACnet IP to the edge. Where the sub-system equipment was deemed as not requiring direct IP connectivity, the equipment operates over BACnet MSTP; with the immediate BAS controller upstream surfacing this BACnet MSTP data to BACnet IP.

The MSI contractor will be responsible for integration of the BAS to the IFMS.

The BAS integration will provide both real-time read-write capability, while also read-only data exchange, with the software parameters of the overarching BAS strategy. All sub-system basic functionality and control will be within the BAS sub-system, with the IFMS having no influence over the system operation.

The MSI contractor shall provide the necessary design input and coordination to ensure the smart building functionality is achieved in relation to the BAS solution.

The data shall be integrated to allow for an operational overview of data, hence not every parameter throughout the entire BAS system will be required. The mechanical system will be digitally enabled and exposed for integration and data exchange with all system physical input / output statuses, as well as programmed software parameters. The final list of integrated data points will be developed through collaboration between the BAS contractor and the MSI contractor.

6.3.1.1 HVAC Integration Data Parameters

The following is a non-exhaustive and high-level list of example integration data parameters, which will be made available as a result of collaboration between the BAS contractor and the MSI contractor.

General Controls	• Controls system operation status • Controls system operation calendar • Control system set points Control system set points
Variable Frequency Drives	• VFD alarm • VFD motor • VFD speed • Motor power • Motor current • Motor voltage • Motor run time • Supply fan VFD frequency • Supply fan run-time status

Alarms	• Alarms list • Alarm status
Air Handling Units	• AHU supply temperature • AHU return air temperature
Sensors	• Sensor measurement period • Sensor measurement value • Sensor measurement unit
Fan Coil Units	• FCU fan speed • FCU zone temperature • FCU supply air temperature • FCU return air temperature • Temperature set point • Space temperature • Actuator position
Dampers	• Damper position • Damper status
Variable Air Volumes	• Zone temperature • Supply air set point • Occupied cooling set point

6.3.2 Electrical

The electrical system is designed and will be deployed to provide power to the building and various systems, devices, and technology contained within.

The electrical system will communicate its data via an industry standard open IP protocol, with the point of integration being either:

- Electrical system edge devices (IP to the edge) – where feasible
- Strategic electrical system head-end / gateway devices

The electrical integration will provide read-only data exchange with the software parameters of the overarching electrical strategy, with possible read-write data exchange at day two for certain parameters.

All sub-system basic functionality and control will be within the electrical sub-system with the IFMS having no influence over the system operation.

The MSI contractor will be responsible for integration of the electrical system to the IFMS.

The MSI contractor shall provide the necessary design input and coordination to ensure the smart building functionality is achieved in relation to the electrical package.

The data shall be integrated to allow for an operational overview of data, hence not every parameter throughout the whole electrical system will be required. The electrical system will be digitally enabled and

offered up for integration and data exchange with all system physical input / output statuses, as well as programmed software parameters. The final list of data points, while also data to be exchanged, will be developed as a result of collaboration between the electrical contractor and the MSI contractor.

6.3.2.1 Electrical Integration Data Parameters

The following is a non-exhaustive and high-level list of example integration data parameters, which will be made available as a result of collaboration between the electrical contractor, designer, facilities and the MSI contractor.

General	• Surge • Transients • Harmonics • Power factor • AC frequency • Breaker status • Power readings • Current readings • Voltage readings • Operating status • Device / system alarms • Apparent power readings
Emergency Generators	• Fuel level • Run parameters • Operating status
Uninterrupted Power Supply	• Capacity • Operating status

6.3.2.2 Lighting

The lighting system is designed and will be deployed to provide lighting control and monitoring for the building.

The lighting system will communicate data via an industry standard open IP protocol with the point of integration being either:

- IP to lighting gateways
- IP to local edge device, such as Lighting Control Module (LCM) or local sub-system controller

The lighting integration will provide both real-time read-write capability and read-only data exchange with the software parameters of the overarching lighting strategy. All sub-system basic functionality and control will be within the lighting sub-system. The IFMS shall have a read / write integration allowing the

lighting to be controlled remotely, adjust schedules, and eliminate the requirement to use the native platform for largely high-level tasks, as examples.

6.3.2.2.1 Lighting Integration Data Parameters

The following is a non-exhaustive and high-level list of example integration data parameters, which will be made available as a result of collaboration between the lighting contractor and the MSI contractor.

- Time scheduling
- Lux sensor light levels
- Luminaire scene status
- Luminaire health status
- Emergency lighting status
- Luminaire operational status
- Scene plate control settings
- Scene plate control functions
- Occupancy and absence detection PIR status

6.3.2.3 Fire

The fire system is designed and will be deployed to provide fire monitoring for the building. The fire system will communicate its data via an industry standard open IP protocol. with the point of integration being either:

- IP connectivity to fire servers / fire alarm panels (FAPs)
- IP connectivity to fire alarm repeater panels (FARPs)
- Non-IP protocol to FARPs with all data points exposed to an IP protocol for integration
    - Main FAPs providing aggregation
- IP gateway device exposing all fire system data in an open IP protocol
    - This is not best practice and shall not be deemed a priority over the above two options

The fire integration will provide read-only data exchange with the software parameters of the overarching fire strategy. All sub-system basic functionality and control will be within the fire sub-system – the IFMS will have no influence over the system operation.

6.3.2.3.1 Fire Integration Data Parameters

The following is a non-exhaustive and high-level list of example integration data parameters, which will be made available as a result of collaboration between the fire contractor and the MSI contractor.

- Elevator status
- Door holder status
- Fan / damper status
- PAVA system alarms

- PAVA system activities
- Device / system alarms
- Break glass fault status
- Strobe activation status
- Break glass activation status
- Fire curtain activation status
- Heat / thermal / photodetector alarm status
- Heal / thermal / photodetector fault status
- Heat / thermal / photodetector pre-alarm status

6.3.2.4 Metering

The metering system is designed and will be deployed to provide energy monitoring for the building.

The metering system will communicate its data via an industry standard open IP protocol with the point of integration being either:

- IP connectivity to each metering edge device
- IP connectivity to an integration gateway device

The metering integration will provide read-only data exchange with the software parameters of the overarching metering strategy. All sub-system basic functionality and control will be within the metering sub-system, with the IFMS having no influence over the system operation.

6.3.2.4.1 Metering Integration Data Parameters

The following is a non-exhaustive and high-level list of example integration data parameters, which will be made available as a result of collaboration between the metering contractor and the MSI contractor.

- Gas metering
- Hot water metering
- Cold water metering
- House equipment metering
- Retail tenant electrical metering
- Corporate tenant electrical metering

6.3.2.5 Security

The security system is designed and will be deployed to provide security monitoring and control for the building.

The security system will communicate its data via an industry standard open IP protocol with the point of integration being either:

- IP connectivity to each security edge device
- IP connectivity to an intermediate integration device only where the above option is unachievable

The security integration will provide both real-time read-write capability, while also read-only data exchange with the software parameters of the overarching security strategy. All sub-system basic functionality and control will be within the security sub-system, with the IFMS having no influence over the system operation.

6.3.2.5.1 Security Integration Data Parameters

The following is a non-exhaustive and high-level list of example integration data parameters which will be made available as a result of collaboration between the security contractor and the MSI contractor.

Access Control	• Time scheduling • Controller status • Device fault status • Device health status • Device operating status • Access credentials presented
CCTV	• Camera feed • Time scheduling • Controller status • Pan status / angle • Device fault status • Device operating status

6.3.2.6 Elevators / Vertical Transportation (VT)

The VT system is designed and will be deployed to provide VT monitoring for the building.

The VT system will communicate its data via an industry standard open IP protocol with the point of integration being IP connectivity to a gateway integration device, exposing all data in an open IP format for integration, e.g., BACnet IP.

The VT integration will provide read-only data exchange with the software parameters of the overarching VT strategy. All sub-system basic functionality and control will be within the VT sub-system with the IFMS having no influence over the system operation.

6.3.2.7 Elevator / VT Integration Data Parameters

The following is a non-exhaustive and high-level list of example integration data parameters which will be made available as a result of collaboration between the VT contractor and the MSI contractor.

- Load of car
- Waiting time
- Time scheduling
- Speed / velocity
- Lift failure alarms

- Destination control
- Floor of pick-up / drop off
- Ride time / journey duration
- Elevator car calling / request
- Emergency alarm test failure alarm

6.4 Single Pane of Glass (SPoG)

With system interoperability and data routing defined, the IFMS shall provide a consolidated view of all building sub-systems into one single interface eliminating the requirement for multiple, disparate head-end displays per sub-system and allowing access to a holistic set of building information.

The IFMS shall provide the ability to allow for a SPoG environment either as part of the IFMS package delivery or via a third-party connection. The SPoG shall allow simultaneous viewing of key information, provide 'easy to read' metrics, graphs and statistics, while allowing ease of identifying interrelationships via KPI dashboards.

All visualizations will be based on user requirements with user profile sign-in authentication required. Dashboards will be utilized for:

- Operational staff
    - FM staff
    - Prioritizing function, clarity, and efficiency when surfacing data for operational outcomes
- Management staff
    - High-level stakeholders
    - Easily accessible data-to-hand dashboards clear formats and readable information

6.5 Converged Building Network (CBN) & Network Security

Any new network provisions required as part of the IFMS delivery shall be defined and clearly detailed in all document responses. The MSI contractor will ensure any network switches used as part of the IFMS are managed network switches – unmanaged network switches introduce risk and, as such, are deemed unacceptable to the project. Any additional hardware that may be required shall be raised for attention and full coordination with the appropriate stakeholders.

All IFMS integrations to IP enabled sub-systems residing on the converged building network (CBN) will require the MSI contractor to coordinate with Temple University's OT Network Services Team.

The MSI contractor will ensure all relevant security provisions such as firewalls and VLANs are implemented upon Temple University's OT Network Services Team review and acceptance. All cyber security deployments shall ensure the required bandwidth and latency is observed in all scenarios to ensure unimpeded data exchange and transfer reducing the risk of data bottlenecking.

With each sub-system integrated to the IFMS via IP communications, each sub-system will reside on its own VLAN network segregation including suitable firewalls to ensure sufficient security on all networked devices.

The IFMS platform shall provide cyber security levels that meet industry best practices ensuring sufficient measures are taken to the prevent cyber-attacks from any route of connectivity to the IFMS platform or associated systems and connections. The IFMS shall utilize encrypted data packets when communicating / transferring / exchanging data.

The MSI contractor shall employ best practices to minimize unauthorized users gaining access to data such as:

- Firmware updates
- Connection to the CBN
- Sub-system segregation via VLANs
- Securing access between gateways
- Deploying appropriately placed firewalls
- IFMS functionality validation when CBN equipment is updated to the latest firmware
- Implementation and management of Network Access Control (NAC) for the full list of IT devices

Ensuring any use of the Wi-Fi network as part of the IFMS deployment is appropriately secured and coordinated between the Temple University IT Department and Facilities Management.

7.0 Open System Standards Utilization

The proposed IFMS Platform should be able to integrate data with protocols such as BACnet, Modbus, M-Bus, oBIX, OPC (UA), TCP/IP, SNMP, LonWorks, KNX/EIB, HTTP (HTML5/XML Mark-up Languages), SQL, APIs, MQTT, REST API, Sedona and others.

An “open system” is defined by a true ‘standard’ that provides universal accessibility to any person or entity, to make data available without restriction, license, or limitation of use. The Internet Protocol (IP) is the only truly open global protocol standard. This protocol, coupled with the worldwide IT standards of HTTP, XML, SMTP, HTML, RSS, and FTP connect and communicate with technologies around the world.

The key data acquisition component of an enterprise energy management system is an intelligent middleware platform with its primary purpose to provide a common presentation and management interface for all of the devices and systems within a facility, regardless of manufacturer or protocol. The OPC server should:

- Enable devices, equipment, and systems of virtually any manufacturers, using virtually any communications protocols, to intercommunicate seamlessly in a single, integrated system
- Allow all of the facility systems – metering, HVAC, lighting, security, existing Building Management Systems – to be monitored and controlled via a centralized interface
- Receive data from other devices such as generators, uninterruptible power supplies and power distribution units providing the additional value of measuring discrete power use and maintenance efficiencies of equipment critical to the core operations
- Enable two-way communication over a TCP/IP network between all of the sensors, devices, and systems within a facility by interfacing to all of the different communications protocols those devices and systems use
- Collect data from numerous sources that use disparate protocols and are otherwise unable to intercommunicate, normalizes the data into a single, widely used format such as XML, and provides this information to numerous client views and enterprise applications and services
- Receive inputs through user applications and convert into commands and data that conform to the protocols required by the facility’s sensors, devices and systems
- Run multiple services and protocols concurrently providing the capability to respond immediately to events, such as alarms, generated in the network environment
- Highly scalable to allow the seamless integration of new equipment, systems, and whole into an existing installation or network as the enterprise grows
- Allow for integration or re-integration of brown-field equipment, thus maximizing ROI on existing equipment
- Designed to support numerous building systems protocols which promote the convergence of buildings systems and IP, specifically enabling a deeper convergence amongst traditionally isolated building silos

The majority of the industry uses proprietary implementations of these standards to aggregate information from multiple buildings and sites into a central client-server architecture with a single point of failure where management and data visualization occurs.

The IFMS solution should provide capabilities for database integration allowing shared data between third party systems. The IFMS platform should have an open system architecture that enables the development of applications that are built by combining loosely coupled and interoperable services.

Services such as advanced building systems analytics, energy management, Fault Detection and Diagnostics (FDD), Computerized Maintenance Management Systems (CMMS), work order systems, tenant billing, database management and global schedules are integrated with the building management systems.

7.1 OPC Device Configuration

Steps Involved in configuring OPC Devices includes:

- Add Devices to the Configuration
- Create New Channel
- Required Inputs
- Name of Channel (Building, System)
- Type (BACnet, Modbus)
- IP Address of BBMD
- Control Drawings (if available)
- Device Names and Descriptions (if available)
- Manuals, Floor Plans, etc.
- Access to DCS, Vendor Application
- Configure Channel
- Configure parameters
- Device Discovery
- Generate Tags, Rename Tags, Test Connections
- Create OPC Tag List for HMI Connections and Configuration.

8.0 Impact of Microsoft Technologies on IFMS

IFMS plays a pivotal role in building services management, ensuring buildings are operating, maintained, and compliant. With technology continuing to transform the commercial real estate industry, the role of facilities management is evolving. With developments in the Internet of Things (IoT) space driving smart building adoption, real assets and even cities are becoming intelligent and highly automated, comprising of multiple, versatile control systems. These advances are being developed to help facilities managers operate their assets more effectively. Previously, some have viewed field facilities management as a more hands-on role with fewer requirements to be tech-savvy. However, with the rise of technology, and with tenants and occupants expecting more building capabilities, that role is evolving into a multi-channel position, encompassing aspects of IT and HR. As a result, facilities managers will require systems that enable them to manage multiple, disparate data sets into one source of truth and use that data to drive decision making.

8.1 Facilities Management Challenges

The major challenges faced in Facilities management are envisaged as below:

- **Fragmented and siloed data**
  - IoT devices and equipment components controlled by proprietary software packages provided are siloed information
  - Differing digital languages and proprietary schema make it inefficient to connect assets and devices and gain a larger picture of aggregate data
  - This situation is exacerbated further by varying protocols from asset to asset across different locations
- **A lack of real-time data**
  - Real-time data is essential to realize a complete understanding of building systems such as plumbing, fire protection, energy use, air quality, equipment functions
  - Maintenance service levels are limited to static systems like paper drawings or PDF files rather than dynamic, live representations of what is happening
  - These results prompt reactive solutions of the analyzed data
- **Cybersecurity management**
  - Cybersecurity is critical and posing a great challenge for all companies in the 21st century
  - A secure and integrated approach to IoT building technologies is paramount to mitigate risk of systems disruption

8.2 Microsoft Technologies in Facility Management

Microsoft smart building systems can process 500 million data transactions collected from some two million data points strategically located in its 125 buildings every 24 hours spread over nearly 15 million square feet of office space. 48% of the issues Microsoft's smart building system detect are corrected within 60 seconds. The Microsoft products like Excel and Word are utilized on a daily basis to track facility

management functions and are an integral component of day-to-day operations. This approach of data-driven solutions coined as 'Internet of Things meets Big Data' approach.

The platform-based approach by Microsoft and its partners enables emissions reductions and carbon risk management through smart real estate portfolio analytics. Decarbonization and digitization of smart buildings is evolving focusing on safety and service. Microsoft technologies like Dynamics 365, Digital Twins, and Big Data support sustainability, smart building management, resource consumption, CO2 targets, tenant satisfaction, and profitability KPIs.

8.2.1 Microsoft Digital Twins

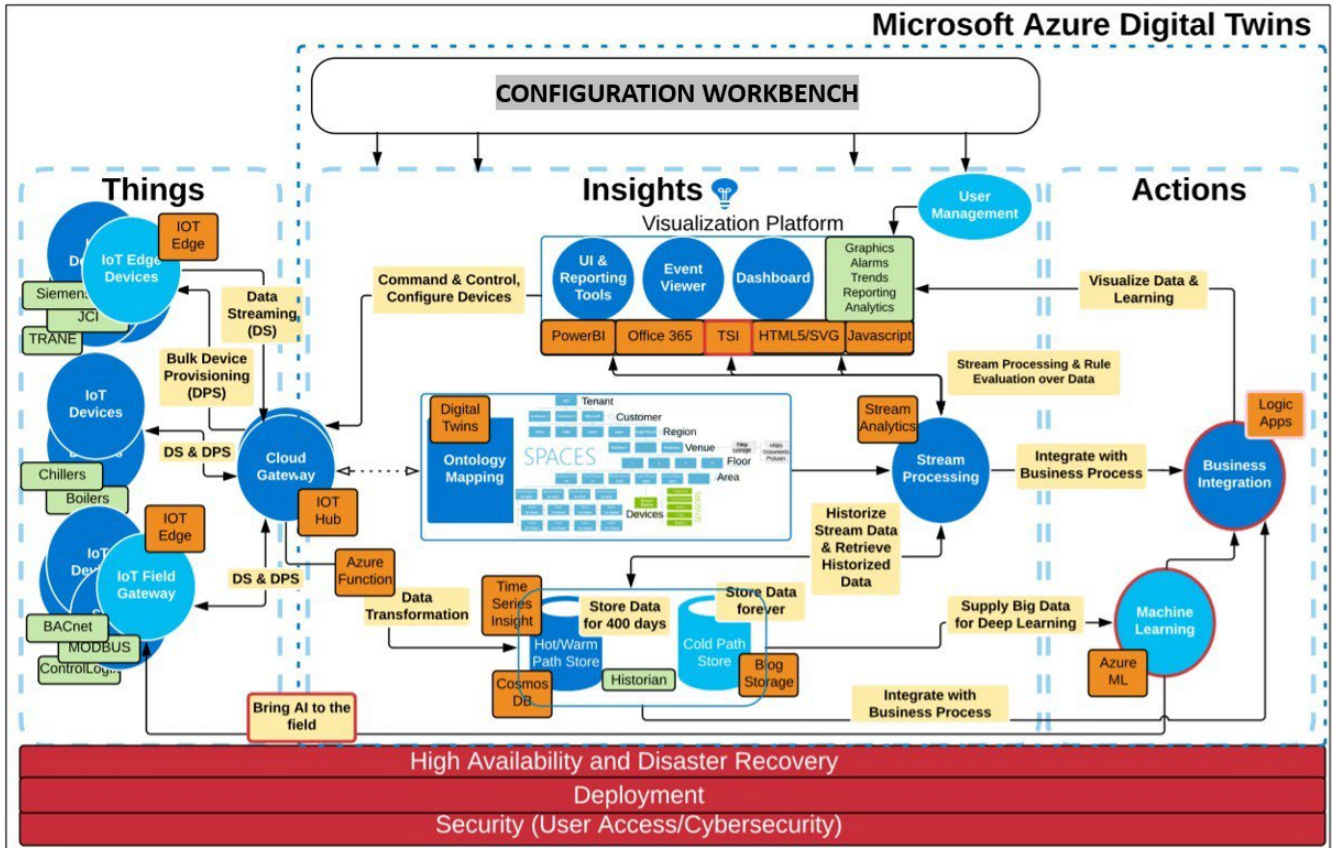


Figure 1: Microsoft Azure Digital Twins

Digital Twins are a popular technology across multiple sectors such as manufacturing, logistics, automotive, and construction. Twining solves the data challenges for facilities management by bringing disparate information silos together enabling operators to visualize and analyze everything happening with across building systems.

The application of virtual modelling in Digital Twin facility management solutions add an extra dimension to more traditional 3D Building Information Modelling (BIM) through their ability to combine real-time data, physical dependency models and intelligence from different platforms to simulate, predict and improve assets and end-to-end (E2E) processes. Digital representation of the asset simulates identification

of faults, anticipation of future risks, and facilitates predictive maintenance scheduling. The ability to compare real-time records against historical readings makes it possible to determine maintenance needs with greater accuracy. This avoids potential failures and downtime reducing costs.

Digital Twins simulate when assets require attention and can flag the need for maintenance through problem prediction resulting in increased life cycle of an asset. Through twining, all assets and related information are readily available improving efficiency, reducing training costs, and improving ROI. Intelligent buildings outfitted with linked sensors learn the behavioral patterns of tenants. As a result, lighting, heat, and temperature levels can be automated to improve power usage decreasing a buildings carbon footprint.

Azure Digital Twins is an Internet of Things (IoT) platform that enables you to create a digital representation of real-world things, places, business processes, and people. Gain insights that help you drive better products, optimize operations and costs, and create breakthrough customer experiences. Open modeling language to create custom domain models of any connected environment using Digital Twins Definition Language. It enables Live execution environment to bring your digital twins to life in a live graph representation

Microsoft Azure Digital Twins enables ease of modelling to create digital representations of connected environments with an open modeling language. Model buildings, factories, farms, energy networks, railways, stadiums, campuses — even entire cities. Bring these digital twins to life with a live execution environment, building dynamic business logic and data processing on a robust event system. Unlock actionable insights with powerful query APIs, and seamlessly integrate with Azure data, analytics, and AI services. Any physical environment can be modelled thereby connecting inputs from IoT devices that are using Azure IoT Hub or from any business system to establish a single live integration layer that delivers insights from across the entire environment.

9.0 Security Requirements for IFMS Platform

Temple University embraces the Zero Trust security model which is a model that assumes breach and treats every access attempt as though it originates from an open network.

Securing IoT solutions with a Zero Trust security model starts with non-IoT specific requirements—specifically ensuring you have implemented the basics to securing identities, their devices, and limit their access. These include explicitly verifying users, having visibility into the devices they're bringing on to the network, and being able to make dynamic access decisions using real-time risk detections.

Once the non-IoT specific requirements are met, the focus will be on the Zero Trust requirements for IoT solutions:

- **Strong identity to authenticate devices**
  - Register devices, issue renewable credentials, employ passwordless authentication, and use a hardware root of trust to ensure you can trust its identity before making decisions
- **Least privileged access to mitigate blast radius**
  - Implement device and workload access control to limit any potential blast radius from authenticated identities that may have been compromised or running unapproved workloads
- **Device health to gate access or flag devices for remediation**
  - Check security configuration, assess for vulnerabilities and insecure passwords, and monitor for active threats and anomalous behavioral alerts to build ongoing risk profiles
- **Continual updates to keep devices healthy**
  - Utilize a centralized configuration and compliance management solution and a robust update mechanism to ensure devices are up to date and in a healthy state
- **Security monitoring and response to detect and respond to emerging threats**
  - Employ proactive monitoring to rapidly identify unauthorized or compromised devices

9.1 Microsoft Zero Trust

9.1.1 Azure IoT Security



Azure IoT helps mitigate risk with secure, reliable, end-to-end IoT/OT solutions that protect your people, operations, and data from ever evolving real-world cyber threats. Solutions built using Microsoft IoT provide secure-by-design deployments — from the edge to the cloud — that reduce complexity and ensure resilience.

With a secure-by-design approach to devices and services, build reliable and manageable IoT solutions that help protect vital green and brownfield equipment, connected products, and data against evolving real-world threats. This protection is achieved with reliable integrations and services meant to reduce risk caused by complexity to maximize operational up-time. Security posture management and analytics using Azure Defender for IoT and Azure Sentinel, highly secure operating systems like Azure Sphere and IoT Edge, and lightweight agents for IoT operating systems are key in maximizing network and infrastructure security.

IoT Services:

- Azure IoT Hub
- Azure Defender for IoT
- Azure Device Update for IoT Hub
- Azure IoT Hub Device Provisioning Service (DPS)
- Azure IoT Central for infrastructure components

IoT Devices:

- Azure Sphere and Azure Percept Zero Trust

- Azure IoT Edge and Azure IoT platform SDKs
- Azure RTOS and Windows 10 IoT for Enterprise
- Lightweight endpoint security agents that interoperate with Azure IoT Hub and Azure Defender for IoT

9.1.2 Azure Defender



Azure Defender for IoT is an agentless solution using Passive monitoring meaning ease of deployment for operation at the network layer with zero production impact. Deployment can be completed in less than one day including integration with the Security Operation Centre (SOC).

Azure Defender encompasses the following core functions:

- **Unmanaged device detection**
  - Many organizations do not have full visibility on what devices are connected to the network and how those devices are communicating
- **Vulnerability Mitigation**
  - Vulnerabilities of connected devices are identified including risk mitigation recommendations
- **Threat Monitoring**
  - Continuous monitoring for threats including threat intelligence tracking IoT and OT vulnerabilities, malware campaigns and adversaries providing a unified view across IT and OT through the integration with Azure Sentinel or other third-party tools

9.2 Microsoft Impact on Cybersecurity

Microsoft has invested in security across certain areas including identity and access management, data and network security, threat protection, and security management. It is recommended the proposed IFMS platform leverages Microsoft Zero Trust technologies to achieve and ensure a secure network.



Azure Built-in Controls

Identity & access	Apps & data security	Network security	Threat protection	Security management
Role based access	Encryption	DDoS Protection	Antimalware	Log Management
Multi-Factor Authentication	Confidential Computing	NG Firewall	AI Based Detection and Response	Security Posture Assessment
Central Identity Management	Key Management	Web App Firewall	Cloud Workload Protection	Policy and governance
Identity Protection	Certificate Management	Private Connections	SQL Threat Protection	Regulatory Compliance
Privileged Identity Management	Information Protection	Network Segmentation	IoT Security	SIEM

Defense in Depth

- **Identity and Access Management**
  - Tools that utilize an identity-based approach to security and establish truly conditional access policies
  - Capabilities like Role based access control, MFA, or Identity Protection ensure the right users are getting the appropriate level of access minimizing risks associated with identity thefts or misuse of admin privileges
- **Application and Data Security**
  - Ensure confidentiality and integrity of data by leveraging multiple encryption options for data-at-rest in virtual machines, databases, and storage
  - Data encryption controls are built-in to services from virtual machines to storage, SQL, Cosmos DB, and Azure Data Lake
  - Azure Key Vault enables the safeguard and control of cryptographic keys and other encrypted elements used by cloud apps and services
- **Network Security**
  - **E**stablish secure connections to and within Azure using virtual networks, network security groups, VPN, and ExpressRoute

- Protect against network layer threats and ensure availability of applications with services like Web Application Firewall, Azure Firewall, and Azure DDoS Protection

- **Threat Protection and Security Management**
  - It is equally important to assess security state continuously, especially as cloud workloads change dynamically
  - Azure Security Center will help monitor security state of Azure resources and hybrid workloads
  - Provide a dynamic security score card and recommendations to improve security in a centralized console, making security management easier across different resources
  - Advanced threat protection can be provided across many services like virtual machines, servers, apps, Azure SQL, Storage, containers on VMs – backed by Microsoft Intelligent Graph
  - Azure offers a robust log management system and provides more insights from Log Analytics

9.2.1 Zero Trust for IoT



To adapt to this new reality, a new set of principles area required:

- Move from assumption to explicit verification
- Adopt a policy-based, least-privileged access model
- Design with the assumption that every element of the system can be breached

These are the key principles of Zero Trust. Zero Trust provides a modern security framework to manage the complexity of today's organization. A holistic approach to Zero Trust should extend throughout the entire digital estate, serving as an integrated security philosophy and an end-to-end strategy. This can be achieved by implementing Zero Trust controls and technologies across six foundational elements.

- **Identities**
  - For people, services, and IOT devices, define the Zero Trust control plane
  - When an identity attempts to access a resource, verify that identity with authentication to ensure access compliancy for that identity adhering to least-privilege access principles
- **Devices**
  - Once an identity has been granted access to a resource, data can flow to a variety of different devices—from IoT devices to smartphones, BYOD to partner-managed devices, and on-premises workloads to cloud-hosted servers
  - This diversity creates attack surface areas requiring the monitoring and enforcement of device health and compliance for secure access
- **Data**
  - Ultimately, security teams are focused on protecting data
  - Where possible, data should remain safe even if it leaves the devices, apps, infrastructure, and networks the organization controls
  - Data should be classified, labeled, and encrypted with access rules designed and enforced based on those attributes
- **Applications**
  - Applications and APIs provide the interface by which data is consumed
  - They may be legacy on-premises apps, apps that have been lifted and shifted to cloud workloads, or modern SaaS applications
  - Controls and technologies should be applied to discover shadow IT, ensure appropriate in-app permissions, regulate access based on real-time analytics, monitor for abnormal behavior, control user actions, and validate secure configuration options
- **Infrastructure**
  - Whether on-premises servers, cloud-based VMs, containers, or microservices, infrastructure represents a critical threat vector
  - Assess for version, configuration, and JIT access to strengthen defense
  - Use telemetry to detect attacks and anomalies
  - Automatically block and flag risky behavior and take protective actions
- **Networks**
  - All data is ultimately accessed over network infrastructure
  - Networking controls can provide critical ‘in-pipe’ controls to enhance visibility and help prevent attackers from moving laterally across the network
  - Networks should be segmented including deeper in network micro segmentation and employ real-time threat protection, end-to-end encryption, monitoring, and analytics

Once in place, use key tools to tie Zero Trust security together:

- **Policy-driven access**
  - Modern micro-segmentation means more than networks
  - It requires we also regulate access based on role, location, behavior patterns, data sensitivity, client application, and device security
  - It's important to ensure all policies are automatically enforced at the time of access and continuously throughout the session where possible
- **Visibility, Analytics, and Automation**
  - Telemetry from the systems above must be processed and acted on automatically
  - Attacks happen at cloud speed – security defense systems must act at cloud speed as well
  - Integrate intelligence with policy-based response for real-time automated threat protection

IFMS STANDARD HANDBOOK

A detailed integration handbook for Temple University IFMS built on Microsoft Azure and TwinWorX®

Presented by:

e-Magic Inc.

April 13, 2022

Contents

TwinWorX® (TWX) Software Executive Summary 2
1.0 Naming Convention 3
1.1 Anatomy of the TwinWorX® (TWX) Variables 3
1.1.1 Creating Building Names 4
1.1.2 Creating Entity Names 4
1.1.3 Creating Properties Names 4
1.2 Tagging of the TwinWorX® (TWX) Variable 5
2.0 Integration Process 7
2.1 OPC Device Configuration 7
2.2 Edge Server Integration 7
2.2.1 Communication Between BAS and the Edge Server 7
2.2.2 Edge Server Limitations 8
2.2.3 Adding Points in the Edge Server and MS Azure 8
2.2.4 Edge Server Optimization 8
2.3 Cloud/Front-end Virtual Machine (VM) Configuration 8
2.3.1 Mapping Points & Creating TwinWorX Variables 8
2.3.2 Configuration of TwinWorX® Modules 9
3.0 Graphics 10
3.1 Graphic Standards 11
4.0 Conclusion 12

TwinWorX® (TWX) Software Executive Summary

TwinWorX® software is built on Microsoft Azure Digital Twins and other Azure native services.

TwinWorX® is a scalable, secure and high availability platform that integrates and normalizes all telemetry data into a Single Pane of Glass (SPoG), resulting in increased operational visibility while providing real-time and historical data for visualization, command and control, alarming, trending, reporting, analytics, optimization, ML and AI, integration with work order and other business systems.

TwinWorX® runs on-premise as well as in the Microsoft Azure Cloud and supports international standards for asset tagging, data acquisition and normalization.

TwinWorX® integrates data with protocols such as BACnet, Modbus, M-Bus, oBIX, OPC (UA), TCP/IP, SNMP, LonWorks, KNX/EIB, HTTP (HTML5/XML Mark-up Languages), SQL, APIs, MQTT, REST API, Sedona and many others.

TwinWorX® Explore provides 3D graphic visualization and data modeling to effectively construct compatible views of the built world and could be created from construction models. It also applies augmented and virtual reality for operation insights.

TwinWorX® Insights uses human expertise, ML and AI to watch over your process in order to detect, diagnose, predict, advise and optimize its performance.

TwinWorX® Insights:

- Detects and diagnoses process faults
- Predicts process states
- Advises on how to improve process performance
- Optimizes process performance autonomously

1.0 Naming Convention

The amount of data generated from a wide range of sources such as sensors, smart meters and IoT devices within buildings are at an all-time high and continually increasing. As the data increases, making sense of the data becomes challenging, hence the need for a data strategy. The purpose of a data strategy is to provide a consistent method within and across building subsystems; for data and metadata identification and, naming and structuring for IFMS integration. Microsoft has partnered with the RealEstateCore Consortium to provide an open-source DTDL-based ontology called RealEstateCore (REC), which is a common language used to model and control buildings.

Naming convention makes it easier to easily identify, analyze and categorize data. When standardizing naming conventions, it is important to ensure that the proposed convention aligns on a framework and a process is in place. Perfecting these two items will bring consistency, convenience and clarity.

1.1 Anatomy of the TwinWorX® (TWX) Variables

This section describes the naming convention RealEstateCore (REC) that should be adopted by the Master System Integrator (MSI) for any IFMS integration as well as provide readily available information to the university for subsequent maintenance. Any deviation from this standard for any IFMS integration shall be required to be documented and incorporated as a revision of this document.

TwinWorX® variables are made up of three parts separated with a period:

Building.Entity.RECProperty

The components are the building name or number, an entity within that building, and the properties of that entity respectively.

An entity can be a physical asset, a person, or a space. Every entity is unique and has a unique name within the context of a building.

There are a set of rules that should be followed when naming a data point. These rules are:

- All TWX variables comprise three components - Building, Entity, and Properties
- Entities have unique names and can be a sub-entity of another entity
- Entities are contained within another entity by combining the entity names with an underscore. This allows for compound entities to form
- Compound entities follow a hierarchical structure as properties always relate to the last entity/sub entity of the compound entity

- Parent_Child_Grandchild/Entiy_sub-entity_sub-sub-entity
- Attributes are named using the REC ontology, natively supported by Microsoft

Examples below illustrates the use of naming convention:

Example 1:

Temperature of Area Within a Room, within a Zone
Building 1 – Floor 1 – Washroom 1 – Stall 1 – Temperature Setpoint
BLDG001.FL1_WR1_STL1.ZoneAirTemperatureSensor

Example 2:

Speed of a Supply Fan in an Air Handler Unit
Building 1 – Air Handler Unit 1 – Supply Fan 2 – Speed
BLDG001.AHU1_SF2.SupplyFanSpeedCommand

Example 3: Mixed Air Temperature inside an Air Handler Unit
Building 1 – Air Handler Unit 1 – Mixed Air Temp
BLDG001.AHU1.MixedAirTemperatureSensor

1.1.1 Creating Building Names

When representing a building in TWX variable, the building number which is the building's unique identifier is used in place of the building name. As shown in the examples 1, 2 & 3; BLDG1 describes building 1, where 1 is the building's unique identifier.

1.1.2 Creating Entity Names

Entities are typically named using the convention specified by the client. This is to keep names in line with what is specified in the shop drawings for a particular building. Optionally a client may choose to genericize all names, using identifiers like AHU## and FCU## for example. Which ever convention is selected by the client must be used throughout an entire project portfolio.

1.1.3 Creating Properties Names

REC specifies a method of generating attribute names by defining four parts that are optionally included. These parts are the Placement, the Phenomenon, the Model, and the Capability concatenated in the same order to form an attribute.

The *Placement* references the phenomenon's positioning. For example, if you have "Air" as a phenomenon, placement could be Discharge or Mixed. If you have "Data" as a phenomenon, the placement may be Upload or Download.

The *Phenomenon* is the material or media that the entity deals with which can vary widely. Examples being WifiData, Water, Condensate, Air, Fuel, Light, and Wind.

The *Model* can be further broken down into two of three parts – Component and Quantity or State.

- *Component* is the name of the physical asset
  - Damper, Fan, Motor, Compressor, VFD
- *Quantity* refers to quantity kind as a type of measurement using a numeric schema (double)
- *State* refers to condition of the asset classified by possible schemas
  - StartStop, OnOff
  - binary, percent unity (double between 0-1), and multi-state (enum)

The *Capability* is always appended to the end of the attribute name representing some form of Actuator, Parameter, Sensor, or State. These four Capability classes can contain sub-classes. "Setpoint" for example is a sub-class of "Parameter" and can be appended instead of the word parameter.

The following are examples of some applicable attribute names for an air handler unit.

REC Placement	REC Phenom	REC Com	REC Quantity	REC State	REC Capability	REC Property
	ChilledWater	Valve		Position	Command	ChilledWaterValvePositionCommand
Discharge	Air		Temperature		Sensor	DischargeAirTemperatureSensor
Discharge	Air		Temperature		Setpoint	DischargeAirTemperatureSetpoint
Dehumidification	Air			StartStop	Command	DehumidificationAirStartStopCommand
Dehumidification	Air		Humidity		Setpoint	DehumidificationAirHumiditySetpoint
Zone	Air		Temperature		Sensor	ZoneAirTemperatureSensor
Outside	Air		Damper	Position	Command	OutsideAirDamperPositionCommand
Outside	Air		Temperature		Sensor	OutsideAirTemperatureSensor
Preheat	HeatedWater	Valve		Position	Command	PreheatHeatedWaterValvePositionCommand
Preheat	Air		Temperature		Sensor	PreheatAirTemperatureSensor
Reheat	Air	Valve		Position	Command	ReheatAirValvePositionCommand
Reheat	Air		Temperature		Sensor	ReheatAirTemperatureSensor
Reheat	Air		Temperature		Setpoint	ReheatAirTemperatureSetpoint
Discharge	Fan		StartStop		Command	DischargeFanStartStopCommand
Discharge	Fan		StartStop		Status	DischargeFanStartStopStatus
Discharge	Air		Temperature		EffectiveSetpoint	DischargeAirTemperatureEffectiveSetpoint
Preheat	Air		Temperature		EffectiveSetpoint	PreheatAirTemperatureEffectiveSetpoint
Zone	Air		Humidity		Sensor	ZoneAirHumiditySensor
Supply	Fan			Off	Parameter	SupplyFanOffParameter
Supply	Fan			Off	Setpoint	SupplyFanOffSetpoint

1.2 Tagging of the TwinWorX® (TWX) Variable

Both Entities and Properties are assigned tags that are used to help index and understand what the TwinWorX Variable is used for.

Below are some sample tags that may be applied to various components:

Entity/Properties	Name	Tags
Entity	BLDG1	Building
Entity	AHU1	Equipment, AirHandlerUnit, HVAC
Entity	SF2	Supply, Air, Fan, HVAC
Properties	RunCommand	Run, Command

If we take the TWX variable BLDG1.AHU1_SF2.Command, the tags for this variable would be Building, Equipment, AirHandlerUnit, HVAC, Supply, Air, Fan, Run, Command.

- Our main source of tags is derived from REC naming convention
- All applicable tags from this ontology must be applied to each TWX attribute
- REC generates a base set of tags from the attribute name which are always included out of the box
- Additional lists of Tags are built to supplement the REC tags
    - These tags can be appended to further aid in classifying variables
- Tags for common entity types are defined
    - Tags will be automatically assigned to an entity when its type is defined

Following are sample entities mapped to an entity type:

Entity	Entity Description	Entity Type	Type Description
AHU1	Air Handler Unit 1	AHU	Air Handler Unit
AHU2	Air Handler Unit 2	AHU	Air Handler Unit
SF2	Supply Fan 2	SF	Supply Fan

Following are the associated tags for two defined entity types:

Entity Type	Tags
AHU	Equipment, AirHandlerUnit, HVAC
SF	Supply, Air, Fan

As presented, three entities can be tagged successfully with two entity types.

2.0 Integration Process

2.1 OPC Device Configuration

Steps Involved in configuring OPC Devices includes:

- **Add Devices to the Configuration**
  - Create New Channel
  - Required Inputs
    - IP Address of BBMD
    - Type (BACnet, Modbus)
    - Name of Channel (Building, System)
    - Control Drawings (where available)
    - Device Names and Descriptions (where available)
    - Access to DCS, Vendor Application
    - Manuals, Floor Plans, etc.
- **Configure Channel**
  - Configure parameters
  - Test Connections
  - Device Discovery
  - Generate Tags
  - Rename Tags
- **Create OPC Tag list for HMI Connections and Configuration**

2.2 Edge Server Integration

Edge Server can be a physical computer or a Virtual Machine (VM). VM is recommended. Both the Edge Server and the Building Automation System will reside in the Environmental Network.

2.2.1 Communication Between BAS and the Edge Server

- The BAS must provide a BACnet Protocol Implementation Conformance Statement for its BACnet conformance
- The BAS must facilitate BACnet devices discovery and BACnet points communication
- Any BACnet Communication OPC Server running on the Edge Server can be used to initiate communication with the BAS to read/write BAS data points
  - Kepserver BACnet Communication Driver is recommended
- BACnet Communication OPC Server will be configured on a communication channel for each BACnet IP and port of the BAS

- Communication parameters such as timeout, scan time can be configured
    - Typically, the default settings are adequate
    - In some cases, different BAS may require different settings
- BACnet Communication OPC Server will be used to discover the BACnet devices for the BAS
- BACnet Communication OPC Server will be used to generate BACnet points for each device
- BAS data points are now available via any OPC Client compliant application

2.2.2 Edge Server Limitations

The software and Edge Server are designed to be scalable. Memory and processing power can be increased to load additional points if necessary. Limitations such as the on-site network may expose bottle necks. Possible remedies include adding more bandwidth or modifying the polling rate for each point.

2.2.3 Adding Points in the Edge Server and MS Azure

Points can be added any time after the initial setup as long as they are exposed to the network. In case of a new system that is proprietary and needs a custom driver, time is needed to understand the device and develop a solution. Note that drivers cannot be written for every case.

2.2.4 Edge Server Optimization

Edge server optimization is more related to being able to load more points from the BAS network, things like more ram, a better CPU and a higher bandwidth network allow for more points to be loaded in at the edge. More points at the Edge doesn't mean more points uploaded to the cloud.

To get points from the Edge to the Cloud, the integrator decides which points are uploaded. The Integrator can modify whether to wait for COV (change of value), or to upload a point at a specific rate. Adjusting these parameters can lessen the load going into Azure. For example, a room temperature doesn't change often and therefore not required to be uploaded every second.

2.3 Cloud/Front-end Virtual Machine (VM) Configuration

The TwinWorX application runs on a VM in Azure, and it's configured similarly to how an application runs in windows. Most of the configuration is done in this TwinWorX VM environment.

2.3.1 Mapping Points & Creating TwinWorX Variables

Data is pulled from the cloud (IOT hub) into TwinWorX via mapping files. Mapping files are csv files that map the original OPC data point name to the TwinWorX variable name.

All data points are mapped to TwinWorX variables. TwinWorX variable names are normalized to Real Estate Core ontology a Microsoft endorsed Smart Building Ontology.

Full naming convention used by the vendor should be provided in order to accurately map BAS data points to TwinWorX variables.

A separate document is provided to the vendors to define the Metadata for each variable. This document is to be completed by the subsystems vendors and submitted to the Integrator (*Reference e-Magic Integration Checklist)*

2.3.2 Configuration of TwinWorX® Modules

In TwinWorX each of these "features" are replicated using various modules. In general, each module accepts its own type of configuration files. Multiple configuration files can be created for each module, for example multiple Alarm configurations, one for each device. The module then reads all the configuration files together to create the alarming system.

TwinWorX Historical Analytics (THA) is a trending model in TwinWorX that allows for the creation and saving of charts from any historized point. There is a configuration file that defines which points are to be historized, what the frequency should be, and how long each point should be stored. The saved charts are embeddable anywhere on the TwinWorX platform.

Point commanding is done by via the control module which is accessed by clicking a controllable point from an HMI screen.

The Schedular module builds on the control module to offer a way to automate the changing of controls via predetermined calendars.

3.0 Graphics

This document makes extensive use of illustrations to enable integrators to meet the established look and feel of the University's IFMS platform. This is not intended to stifle the creativity of the integrator. This enables reusability of HMI templates for specific equipment in a copy and paste fashion increasing efficiencies and uniformity.

Graphics in TwinWorX are created in SVG format using Inkscape, an open source SVG editor available on all desktop operating systems. SVG is the chosen graphics format as it allows for graphic manipulation through JavaScript and scales infinitely without loss of image quality. TwinWorX has pre-built templates created for many devices that can be reused or modified to add new systems to the solution quickly.

Within a particular graphic, label boxes with text elements are positioned over assets where live data is to be displayed. These text elements are given an element ID. The terms 'anchor ID' or 'label anchor' are used to refer to these element IDs with which to target in TwinWorX and always begin with "**TWXLbl**" which is how the application recognizes them. These element IDs from Inkscape to TwinWorX datapoints can be mapped allowing the text throughout the graphics to display corresponding real-time TwinWorX data. Similarly, the ability to show or hide graphical elements based off a TwinWorX datapoint value compared to a configurable threshold.

When creating anchor IDs, aim to create a label as generic as possible while remaining only unique to the type of asset, and the property of that asset we wish to tie the element to.

For example:

TWXLblAHU2ReturnAirFanSpeedSensor = ✗

TWXLblAHUReturnAirFanSpeedSensor = ✓

The latter is correct because it is not specific to a particular entity, but only the type of entity.

With this naming technique, the drawing can be used for any air handler from any project. Only the graphics needs to be modified to match the layout of the new air handler, thereafter, the existing label anchors can be automatically mapped to a chosen entity. The property portion of the anchor label is based off the REC property model to ensure consistent properties between similar entities.

Each SVG file in TwinWorX is accompanied with a template HTML file, that serves as a container used to house the graphic on the portal. It is also accompanied with a configuration file that has all of the datapoint mappings for the graphics element IDs. This configuration file is tied to the HTML file and graphic which is how TwinWorX understands how to manipulate the graphic.

3.1 Graphic Standards

In the portal, certain conventions and color schemes are used across all HMI to indicate status. See table below.

Color Standards	
	Status = OFF / Stopped
	Status = ON / Running
	There was an error receiving data, or the value of the associated datapoint is “null”

Text Standards
Labels displaying ‘N/A’ are indicative values from the datapoint are not updating. Causes can be the page is still querying data or there is a problem with that elements mapping.
Labels displaying ‘NaN’ or ‘null’ are indicative values from the datapoint are updating, however, there is no data in the specified TwinWorX datapoint. Causes can be faulty sensors or change in datapoint name requiring updates to mappings.

4.0 Conclusion

This is the first version of the IFMS handbook. The upcoming versions will include screenshots of the HMI graphics and the navigation of the IFMS platform.

TEMPLE UNIVERSITY-IFMS INTEGRATION

An overview of the steps involved in Integrating into a SPoG

Presented by:

e-Magic Inc.

August 9th, 2021

Table of Contents

1.0 OPC Device Configuration 2

2.0 Edge Server Integration 2

2.1 Communication Between BAS and the Edge Server. 2

2.2 Edge Server Limitations (if any) 2

2.3 Adding Points in the Edge Server and MS Azure 3

2.4 Edge Server Optimization 3

3.0 MS Azure Integration. 3

3.1 Mapping Points & Creating TwinWorX Variables 3

3.2 Building Graphics & Point Mapping in TwinWorX 4

3.3 Configuration of TwinWorX Modules 4

3.4 Continuous Commissioning 4

1.0 OPC Device Configuration

Steps Involved in configuring OPC Devices includes:

- **Add Devices to the Configuration**
  - Create New Channel
  - Required Inputs
    - Name of Channel (Building, System)
    - Type (BACnet, Modbus)
    - IP Address of BBMD
    - Control Drawings (if available)
    - Device Names and Descriptions (if available)
    - Manuals, Floor Plans, etc
    - Access to DCS, Vendor Application
- **Configure Channel**
  - Configure parameters
  - Device Discovery
  - Generate Tags
  - Rename Tags
  - Test Connections
- **Create OPC Tag List for HMI Connections and Configuration**

2.0 Edge Server Integration

Edge Server can be a physical computer or a VM. VM is recommended. Both the Edge Server and the BAS System will reside in the Environmental Network.

2.1 Communication Between BAS and the Edge Server

- The BAS System must provide a BACnet Protocol Implementation Conformance Statement for its BACnet conformance.
- The BAS System must facilitate BACnet devices discovery and BACnet points communication
- Any BACnet Communication OPC Server running on the Edge Server can be used to initiate communication with the BAS System to read/write BAS data points. Kepserver BACnet Communication Driver is recommended.
- BACnet Communication OPC Server will be configured a communication channel for each BACnet IP and port of the BAS System. Communication parameters such as timeout, scan time can be configured. Normally, the default settings are adequate. Sometimes, different BAS system might need different settings.
- BACnet Communication OPC Server will be used to discover the BACnet devices for the BAS System
- BACnet Communication OPC Server will be used to generate BACnet points for each device
- BAS System data points are now available via any OPC Client compliant application

2.2 Edge Server Limitations (if any)

Since the Edge Server can be a VM, it can be easily scaled as the system grows. It can be scaled by running multiples or running it with a higher performance CPU, more network interfaces and more memories.

Pricing and Limitation for OPC Server for BACnet Communication varies. Kepware BACnet/IP Communication Driver costs $2,192. It can have maximum 128 channels. Each channel can communicate up to 128 devices. There is no limit to the number of points (tags) per channel. The number of BACnet devices in a building will determine the number of building an Edge Server can support, assuming one BAS system per building. Normally, we limit 100 channels.

2.3 Adding Points in the Edge Server and MS Azure

Additional BAS points will be required to be added to the BACnet Communication OPC Server configuration. These points can be added manually or via BACnet Points Discovery process and will be configured to exchange between Edge Server and MS Azure.

2.4 Edge Server Optimization

Edge Server can be configured to limit the points to MS Azure. Communication parameters for the BACnet Communication OPC Server can be configured to optimize the polling rate of data traveling to MS Azure.

Edge server optimization is more related to being able to load more points from the BAS network, things like more ram, a better CPU and a higher bandwidth network allow for more points to be loaded in at the edge. More points at the Edge doesn't mean more points uploaded to the cloud.

To get points from the Edge to the Cloud, the integrator decides which points are uploaded. The Integrator can modify weather to wait for COV (change of value), or whether to upload a point at a specific rate. Adjusting these parameters can lessen the load going into Azure. For example, a room temperature doesn't change often and therefore not required to be uploaded every second.

3.0 MS Azure Integration

TwinWorX runs on Azure infrastructure, similar to how an application runs in windows. Most of the configuration is done in the TwinWorX environment.

The BACnet Communication OPC Server will be configured to exchange BAS points data from the BAS System.

An IoTGateway is required to move data from OPC server to MS Azure. This application will run with Kepware on the Edge Server in the VM. Cogent IoT Gateway is recommended.

The IoT Gateway will be configured for the connection to MS Azure IoTHub and the BAS points to be exchanged with MS Azure IoTHub.

3.1 Mapping Points & Creating TwinWorX Variables

Data is pulled from the cloud (IOT hub) into TwinWorX via mapping files. Mapping files are csv files that map the original data point (OPC) name to the TwinWorX variable name.

All the BAS data points are mapped into TwinWorX Variables. TwinWorX Variables name are normalized with the Microsoft Endorsed Smart Building Ontology: RealEstateCore. (*Reference Naming Convention document).*

Full naming convention used by the BAS should be provided in order to accurately map BAS data points to TwinWorX variable.

A separate document is provided to the vendors to define the Metadata for each variable. This document is to be completed by the subsystems vendors and submitted to the Integrator (*Reference e-Magic Integration Checklist)*

3.2 Building Graphics & Point Mapping in TwinWorX

A predefined Smart Buildings portal framework is available with TwinWorX Explore that supports portfolio of buildings. The framework provides portfolio maps page, portfolio overview page, building overview page, building assets pages, alarming page, scheduling page, trending page, reporting page, FDD page and etc. All pages are in HTML5 format. It is highly customizable.

HTML5 graphics editor will be used to create customized HTML5 pages for the Smart Building portal, 2D/3D graphics and 3D Model Graphics can be inserted into the pages. Library of HVAC equipment/devices and charts are ready to be used and to be adapt for any HMI graphics page. Custom graphics template for equipment/system can be created. Graphics templates allow high reusability.

Points in the page will be mapped into graphics template either during graphics configuration or during runtime with a point mapping file that is generated during configuration. All pages are put in a predefined repository for the Smart Buildings Portal.

3.3 Configuration of TwinWorX Modules

BACnet services such as alarm and event notification, scheduling, trending and point commanding are available in TwinWorX.

BACnet services configuration for alarm and event notification, scheduling, and trending will be pulled from the BAS system to generate the same configuration within the TwinWorX environment.

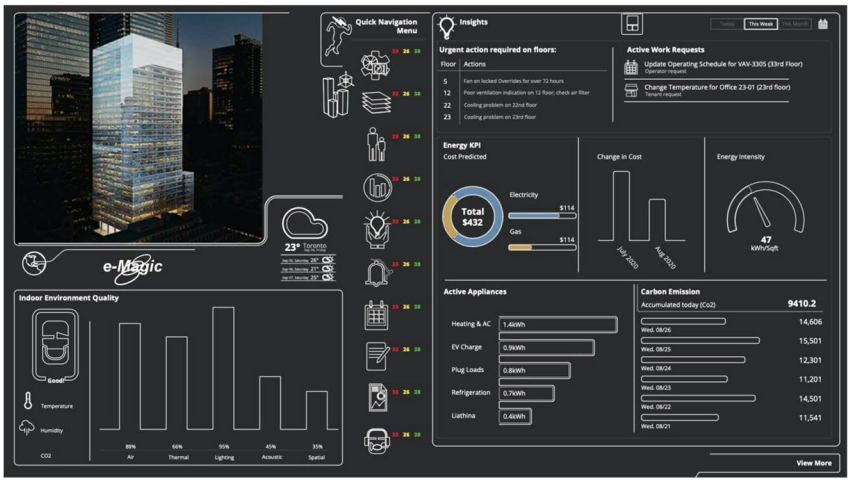
3.4 Continuous Commissioning

TwinWorX FDD will be used for continuous commissioning. FDD rules are required to be configured for continuous commissioning. TwinWorX FDD comes with a set of FDD rules templates that are ready to be used or to be modified. TwinWorX FDD will be automatically run by default. *(Reference e-Magic FDD Rules)*

Temple University

Integrated Facilities Management System(IFMS)

VARIABLE NAMING CONVENTION



This document provides information and standard conventions used in the naming of variables to configure any Integrated Facilities Management System(IFMS) related project at Temple University.

Temple University
Operations and Maintenance

e-Magic

Table of Contents

1.0 Introduction 2

2.0 Naming Convention 2

2.1 Anatomy of the TwinWorX (TWX) Variables 2

2.1.1 Creating Building Names 3

2.1.2 Creating Entity Names 3

2.1.3 Creating Properties Names 3

3.0 Tagging of the TWX Variable 4

4.0 References 6

1.0 Introduction

The amount of data generated from a wide range of sources such as sensors, smart meters and IoT devices within buildings are at an all-time high and continually increasing. As the data increases, making sense of the data becomes challenging, hence the need for a data strategy. The purpose of the data strategy is to provide a consistent method within and across building subsystems for data and metadata identification, naming and structuring for IFMS integration. Microsoft has partnered with the RealEstateCore Consortium to provide an open-source DTDL-based ontology called RealEstateCore (REC), which is a common language used to model and control buildings.

The intent of this document is to explain the naming convention (REC) that should be adopted by MSI for any IFMS integration as well as provide readily available information to the university for subsequent maintenance. Any deviation from this standard for any IFMS integration will be required to be documented and incorporated as a revision of this document.

2.0 Naming Convention

Naming convention makes it easier to easily identify, analyze and categorize data. When standardizing naming conventions, it is important to ensure that the proposed convention aligns on a framework and a process is in place, perfecting these two items will bring consistency, convenience and clarity.

2.1 Anatomy of the TwinWorX (TWX) Variables

TwinWorX® is a digital twins platform built on Microsoft Azure Digital Twins that integrates and normalizes all telemetry data from IoT devices into a single pane of glass. TwinWorX variables are made up of three parts separated with a period as shown below.

Building.Entity.Properties

They represent the building, entity and properties respectively. Entity can be a physical asset or entity like zone. Every entity is unique and has a unique name within the context of a building. Below describes the naming convention that should be followed when naming variable. Below are examples to illustrated the use of the naming convention prior to describe the rules in naming the variable.

Below are some of the naming convention rules that are used to make up the variable name

- All TWX Variables are made up of three parts… Building, Entity, and Properties.
- Entities have unique names and can be a sub-entity of another entity.
- Entities are contained within another entity by combining the entity names with an underscore. This allows for compound entities to form.

- Compound entities follow a hierarchical structure (Parent_Child_Grandchild/Entiy_sub-entity_sub-sub-entity)
  The reason is that the properties are related to the last entity/sub entity of the entity
- Attributes are named using the Real Estate Core ontology, which is natively supported by Microsoft.

Example 1: Temperature of Area Within a Room, within a Zone. All three are entities.
Building 1 - Floor 1 – Washroom 1 – Stall 1 – Temperature Setpoint
BLDG1.FL1_WR1_STL1.ZoneAirTemperatureSensor

Example 2: Speed of a Supply Fan in an Air Handler Unit
Building 1 – Air Handler Unit 1 – Supply Fan 2 – Speed
BLDG1.AHU1_SF2.SupplyFanSpeedCommand

Example 3: Mixed Air Temperature inside an Air Handler Unit
Building 1 – Air Handler Unit 1 – Mixed Air Temp
BLDG1.AHU1.MixedAirTemperatureSensor

2.1.1 Creating Building Names

When representing a building in TWX variable, the building number which is the building's unique identifier is used in place of the building name. As shown in the examples 1, 2 & 3; BLDG1 describes building 1, where 1 is the building's unique identifier.

2.1.2 Creating Entity Names

Entities are typically named using the convention specified by the client. This is to keep names in line with what is specified in the shop drawings for a particular building. Optionally a client may choose to genericize all names, using terms like AHU##, and FCU## for example. This is okay too, however which ever method is preferred by the client should be used throughout an entire project portfolio.

2.1.3 Creating Properties Names

RealEstateCore specifies a method of generating Attribute names by defining four parts that are optionally included. These parts are the Placement, the Phenomenon, the Model, and the Capability, and are strung together in the same order to form an Attribute.

The *Placement* is in reference to the phenomenon's positioning that describes below. For example, if you have "Air" as a phenomenon, its placement might be Discharge, or Mixed. If you have "Data" as your phenomenon, the placement may be upload or download.

The *Phenomenon* is the material or media that the entity deals with, this can vary widely. (e.g. WifiData, Water, Condensate, Air, Fuel, Light, Wind)

The *Model* can be further broken down into two of three parts, Component, and Quantity or State.

- *Component* is the name of the physical asset. (e.g. Damper, Fan, Motor, Compressor, VFD.)

- *Quantity refers to quantity kind, is a type of measurement. It has a* numeric schema (double)
- *State* refers to condition of the asset (e.g. StartStop, OnOff) it is classified by its possible schemas (binary, percent unity (double between 0-1), and multi-state (enum))

The *Capability* is always appended to the end. It will be some kind of Actuator, Parameter, Sensor, or State. These four Capability classes can have sub-classes. "Setpoint" for example is a sub-class of "Parameter" and it can be appended instead of the word parameter.

The following are examples of some applicable attribute names for an air handler unit.

Placement	Phenomenon	Model	Capability	Result Attribute
Discharge	Air	Temperature	Sensor	DischargeAirTemperatureSensor
Discharge	Air	Temperature	Setpoint	DischargeAirTemperatureSetpoint
Zone	Air	Temperature	Sensor	ZoneAirTemperatureSensor
Outside	Air	Damper	Command	OutsideAirDamperCommand
Outside	Air	Temperature	Sensor	OutsideAirTemperatureSensor
Preheat	Air	Temperature	Sensor	PreheatAirTemperatureSensor
Reheat	Air	Valve	Actuator	ReheatAirValveActuator
Reheat	Air	Temperature	Sensor	ReheatAirTemperatureSensor
Reheat	Air	Temperature	Setpoint	ReheatAirTemperatureSetpoint
Discharge	Fan	StartStop	Command	DischargeFanStartStopCommand
Discharge	Fan	StartStop	Status	DischargeFanStartStopStatus
AverageZone	Air	Temperature	Sensor	AverageZoneAirTemperatureSensor
AverageZone	Air	Temperature	Setpoint	AverageZoneAirTemperatureSetpoint
Preheat	Air	Temperature	Setpoint	PreheatAirTemperatureSetpoint
Zone	Air	Humidity	Sensor	ZoneAirHumiditySensor

3.0 Tagging of the TWX Variable

- Both Entities and Properties are assigned tags that are used to help index and understand what exactly what the TwinWorX Variable is used for.
  Here are some sample tags that may be applied to various components:

Entity/Properties	Name	Tags
Entity	BLDG1	Building
Entity	AHU1	Equipment, AirHandlerUnit, HVAC
Entity	SF2	Supply, Air, Fan, HVAC
Properties	RunCommand	Run, Command

If we take the TWX Variable BLDG1.AHU1_SF2.Command, the tags for this variable would be Building, Equipment, AirHandlerUnit, HVAC, Supply, Air, Fan, Run, Command.

- Our main source of tags is derived from Real Estate Core Naming Convention. All applicable tags from this ontology must be applied to each TWX Attribute.
- Real Estate Core generates a base set of tags from the Attribute name, these tags will always be included out of the box. Additional lists of Tags are built to supplement the Real Estate Core Tags. These tags can be optionally appended to further aid in classifying variables.
- Tags for common entities type are defined. Tags will be automatically assigned to an entity when its type is defined.

Here are some sample entities being mapped to an entity type.

Entity	Entity Description	Entity Type	Type Description
AHU1	Air Handler Unit 1	AHU	Air Handler Unit
AHU2	Air Handler Unit 2	AHU	Air Handler Unit
SF2	Supply Fan 2	SF	Supply Fan

Here are the tags for two defined entity types.

Entity Type	Tags
AHU	Equipment, AirHandlerUnit, HVAC
SF	Supply, Air, Fan

As presented, three entities can be tagged successfully with two entity type.

4.0 References

Digital Twins Definition Language-based RealEstateCore ontology for smart buildings: https://github.com/Azure/opendigitaltwins-building/

RealEstateCore. (2018). *realestatecore.io*. Retrieved from https://www.realestatecore.io/ https://www.realestatecore.io/download

END OF SECTION

1. This Design Standard is primarily for lighting control systems and their integration into building automation systems and the Temple University Integrated Facilities Management System (TU-IFMS, a.k.a. – SCADA).
2. Unless otherwise required by the Authority Having Jurisdiction, **Temple University Facilities Operations & Maintenance Department prefers simple, local, lighting controls with individual room occupancy sensors and switches/dimming controls such as those offered by Wattstopper or Aquity.** If advanced lighting controls (combinations of dimming, color temperature control, daylight harvesting, shading control, etc.) are required by code or by the specific application, the requirements contained herein shall apply.
3. All advanced lighting control systems (ALCS) shall be controlled via an electronic lighting control system with local and remote access. All ALCS shall be integrated into the Temple University Integrated Facilities Management System (TU-IFMS, a.k.a. – SCADA) which is built on the Microsoft Azure and TwinWorX platform. See Temple University Design Standards Section 25 00 00 Integrated Automation for detailed requirements.
4. The ALCS shall not require a server computer or other network-based proprietary software for configuration, operation, maintenance, troubleshooting, or repair and shall be fully compliant with the current edition of ANSI/ASHRAE 135 and carry the BACnet Testing Laboratories (BTL) seal.
5. All ALCS shall provide full BACnet-compliant interoperability via the Temple University Integrated Facilities Management System, including the following BACnet Interoperability Building Blocks (BIBBs):
    A. Data Sharing
    B. Point Commanding
    C. Change of Value
    D. Trending
    E. Scheduling
    F. Alarm & Event Management
    G. Device & Network Management
6. The ALCS shall have the ability to provide BACnet Data Sharing for all physical and virtual point values with the TU-IFMS.
7. The ALCS shall have the ability to provide BACnet point commanding for all hardware points, setpoints, and operator-adjustable variables and these shall be adjustable/commandable from the TU-IFMS.
8. The ALCS shall have the ability to provide BACnet COV/Trending for all physical and virtual point values with the TU-IFMS.
9. The ALCS shall have the ability to provide BACnet Scheduling, including special events scheduling, and shall be implemented to allow centralized hierarchical scheduling via the TU-IFMS for all HVAC equipment.
10. The ALCS shall have the ability to provide BACnet Alarm & Event Management and these shall be available and configurable via the TU-IFMS for all physical and virtual points.

11. Unless the project does not include a Building Automation System (BAS), the BAS contractor shall provide the IP infrastructure within the building, as described herein, for all building automation equipment including, but not limited to, HVAC controls, lighting controls, shading controls, and any other automation equipment that are operated and maintained by the Temple University Facilities Operations & Maintenance Department and are required for building automation integration. Under this standard, the ALCS contractor shall coordinate the IP communications requirements for those systems with the BAS contractor.

12. In the event that the project is **advanced lighting controls only** and does not include a building automation system, the following applies to the ALCS:

    A. All ALCS networks and ALCS communications within each building shall be BACnet/IP and all required communication wiring, network switches, controllers, etc. necessary for a complete advanced lighting control system shall be the responsibility of the ALCS contractor as a sole point of responsibility for the complete ALCS within the building. With prior written approval of the Temple University Facilities Operation & Maintenance Department, floor-level lighting control networks may utilize other communications protocols or configurations, but the wiring requirements contained herein shall apply to the alternate protocol or configuration.

    B. BACnet/SC is permitted and requires a physical BACnet/SC hub and physical failover BACnet/SC hub within each building where BACnet/SC is utilized. In addition, a BACnet/SC license manager software package shall be provided. Exact system architecture shall be determined between the ALCS vendor, Temple University Facilities Operations & Maintenance and Information Technology Services Departments.

    C. **Individual Campus Ethernet-based interfaces to field equipment are prohibited. Only one connection per building between the ALCS and Campus Ethernet shall be permitted. Network switches or bridging devices, other than those listed below, are PROHIBITED.** The Temple University ITS-approved IP switches are as follows:

        I. Extreme Networks VSP 8404 Compact Modular 10/40/100 Gigabit Aggregation Switch (a minimum of one of these switches shall be provided by the BAS contractor for each building).

        II. Extreme Networks 5520-12MW-36W Edge and Aggregation Switch, 48 Port, for individual floor networks.

        III. Extreme Networks 5420M-48W-4YE Universal Edge Switch, 48 Port, for expansion of individual floor networks.

        IV. Extreme Networks 5420M-24W-4YE Universal Edge Switch, 24 Port, for additional expansion, as needed.

    D. Each IP switch shall be located in the main mechanical or electrical room, or other location as specified by Temple University Facilities Operations & Maintenance. Each IP switch shall be installed in a location that is secure and free from damage from overheating, freezing temperatures, and water damage.

    E. The ALCS contractor shall provide any network wiring required to interconnect the IP switches and this wiring shall be Category 6 (or better) Industrial Ethernet Cable or fiber optic cable (preferred) enclosed in conduit.

13. The ALCS contractor shall provide the system integration services necessary to integrate the ALCS into the TU-IFMS. See Temple University Design Standards Section 25 00 00 Integrated Automation for detailed requirements.

14. If required for local configuration, operation, maintenance, troubleshooting, or repair, The ALCS contractor shall provide an operator workstation/HMI with any software and hardware required to perform these functions. The operator workstation/HMI shall be located in the main mechanical or electrical room, or other location as specified by Temple University Facilities Operations & Maintenance and this operator workstation/HMI shall be connected to a port on one of the IP switches identified above.

15. The Design Professional shall coordinate with Temple University Facilities Operations & Maintenance during design phases to provide a complete Advanced Lighting Control System points list for each point in the project.

16. The Design Professional shall coordinate with ALCS contractor during all design phases to ensure a complete design and compliance with this Standard.

17. In general, for each project a ALCS contractor shall furnish, install, wire, and guarantee the entire BAS, including all BAS communication wiring and IP switches utilized for ALCS service within the building.

18. Each project shall provide control panels in the quantities and locations necessary to properly access and house all control equipment. Panels shall be provided with hinged covers and key operated locks. **Top conduit access to any panel(s) is prohibited.** Panels shall be located in a dry location and accessible from floor level. All control panel locations shall be indicated on the project coordination drawings. The control panel power requirements shall be documented on the contract drawings. All control panels shall be fed from a dedicated power source (emergency/UPS if applicable), have an electrical breaker and available duplex outlet. All control panels shall have the appropriate primary and secondary circuit protection.

19. A full and complete drawings and specifications submittal package shall be sent to the University for review by the Temple University Facilities Operations & Maintenance department and shall, at a minimum, include the following requirements:

    A. General system description, system architecture, including sequence of operations, point listing, description and type, engineering units, device range, point alarm parameters, control panel locations, sensor locations, etc.

    B. Shop drawing submittal requirements include the following:

        I. Individual drawing for each system.

        II. Drawings shall depict all system hardware, control panels, field devices, electrical work as well as all ALCS work with each drawing containing the following information:

            (a) Wiring type and method of installation.

            (b) Point names and termination numbering for each control panel.

            (c) Detailed Bill of Material with appropriate reference to section where product data is presented.

            (d) Sequence of operation, including controls diagrams.

(e) Hardwired, calculated, and logic point database listing, software addresses following nomenclature in appendix, wiring numbering, control/alarm, setpoints, and termination locations.

C. Hardware product data:

I. The ALCS contractor shall furnish complete documentation pertaining to hardware and all other equipment supplied including power requirements per control panel and end devices.

II. The ALCS contractor shall document all point connections at the control panels. Include all pertinent wiring, field device, hardware, termination modules, and software data. Control panels are to be located by the Design Professional with final approval coordinated with the University.

III. The ALCS contractor shall document all I/O modules and communications cards installed in control panels. Include all pertinent data, including firmware/software versions, switch settings, and calibration data.

D. Software; provide the following information pertaining to ALCS software:

I. All programs pertinent to project and backup format with software used to create backup.

II. Operating system software on acceptable digital media.

III. **All software, hardware, and licenses required to operate, maintain, program, configure, and modify the ALCS shall be provided with the ALCS, and Temple University shall, upon completion of the project, become the owner, for the sole purpose of operating and maintaining the ALCS, of such software without recurring licensing or other fees.**

IV. A list of system graphics, to include a design depiction or rendering of each display.

V. Table of Contents of routines that the contractor shall use to implement the sequence of operations specified.

VI. A written narrative shall be detailed and include definitions of each variable and instruction contained in the control panel's code.

VII. A list of software points to be used to implement each and parameters and any other software points used.

VIII. A list of the active control programs resident in each panel and their memory footprint with respect to total available memory in the device. Control programs and point database shall not consume more than 50% of available device memory.

IX. Energy management routines implemented, if using manufacturer firmware specific features, requires a full description and sequence of operation for the feature to be included.

X. Wireless System Requirements (use of which is generally **prohibited** and shall be pre-approved by Temple University Facilities Operations & Maintenance department on a case-by-case basis).

E. Description of Points:

I. Provide tables listing all points to include:

(a) Point name.

(b) BACnet point type and instance number (e.g. AI:9, BO:2, AV:7).

(c) Functional description (e.g. Room 100 Color Temperature).

(d) Device termination address (if physical point).

(e) Control drawing callout reference (e.g. TT-1, ES-4, SD-2).

(f) Alarm Limits.

(g) Engineering units.

(h) Device range in Engineering Units.

(i) Device range in physical units (e.g. 4-20 mA, 0-10 VDC, 0 to 5000K).

II. See Temple University Design Standards Section 25 00 00 Integrated Automation for point naming requirements and integration to the TU-IFMS.

F. Field Devices:

I. Specification data sheets to include accuracy, calibration, and servicing information and quantities for all field devices.

II. Tabulated information showing point name, field device, and data sheets reference for all points.

III. Drawings of all local control panels including installed modules and wiring terminations.

G. Electrical Work:

I. Submit data sheet on each type of wire to be used and its specific job application (e.g. Signal Wiring, Communication, Data Communication, etc.).

H. Electrical Work Requirements:

I. General:

(a) Wiring of all field devices and electrical devices to control panels. **Panels shall not have top penetrations.**

(b) All communications wiring between IP switches, control panels, or sub-devices.

(c) All wiring of control panels including, but not limited to, occupancy sensors, dimming controls, color temperature controls, shading controls, daylight sensors, relays, transformers, and other miscellaneous devices as shown and specified.

(d) All power wiring of field devices as required.

(e) All end device control wiring as required.

(f) All field devices with potential for liquid exposure, indoor and outdoor, shall have conduit connections made to them from junction boxes, with a minimum of 18 inches and a maximum of 36 inches of flexible metallic conduit ("Greenfield", liquid tight) with sufficient slack to allow for removal and/or servicing.

II. Signal Wiring:

(a) All signal wiring shall be point to point. **No splices between the control panel enclosure and the field device are ever permitted.** Terminal strips or terminal blocks are permitted within the confines of a control panel enclosure if the use thereof facilitates fabrication or post installation service. In such circumstances each wire leading into and out of the termination strip or block shall be imprinted with the signal name using polyolefin heat shrink labeling sleeves spaced not less than ½ inch from the cut end of the wire insulation.

(b) Signal wiring to all analog field devices, including but not limited to dimming controls, color temperature controls, shading controls, daylight sensors, etc. shall be run in conduit. Conduits shall be marked "ALCS" at regular intervals not exceeding 4 feet. If the field device has an enclosure, said enclosure shall be marked with an imprinted label indicating the device control drawing callout (e.g. TT-3, ES-7, SD-1). The control panel termination of the signal wire shall be imprinted with the signal name using polyolefin heat shrink labeling sleeves spaced not less than ½ inch from the cut end of the wire insulation.

(c) Signal wiring to binary field devices (for circuits of 30 VAC or less) shall be as specified herein for Low Voltage Control Wiring and shall be run in conduit. Conduits shall be marked "ALCS" at regular intervals not exceeding 4 feet. If the field device has an enclosure, said enclosure shall be marked with an imprinted label indicating the device control drawing callout (e.g. TT-3, ES-7, SD-1). The control panel termination of the signal wire shall be imprinted with the signal name using polyolefin heat shrink labeling sleeves spaced not less than ½ inch from the cut end of the wire insulation.

(d) Signal wiring shields shall be grounded at the control panel end only.

III. Communications Wiring:

(a) All communications wiring shall be run in conduit with no splices and separate from all wiring over 30 volts. Shield shall be terminated as recommended by the control panel manufacturer. Conduits shall be marked "ALCS" at regular intervals not exceeding 4 feet.

(b) All IP switches shall be installed in locked enclosures or located in a space secured from unauthorized physical access.

(c) All LAN (IP) cabling shall be Category 6 (or better) Industrial Ethernet Cable enclosed in conduit.

(d) Communications drops and controller locations shall be marked on the system architecture or riser diagram such that the installed wire path from controller to controller can be determined.

IV. Low Voltage Control Wiring (30 VAC or Less):

(a) Low voltage control wiring shall be run in conduit with no splices, separate from any wiring above 30 volts. The wire terminations shall be imprinted with the signal name using polyolefin heat shrink labeling sleeves spaced not less than ½ inch from the cut end of the wire insulation.

I. Field Devices:

I. Electrical Interface Devices:

(a) Control Relays:

(i) All control relays shall be UL listed with contacts rated for the application and mounted in minimum NEMA I enclosure.

(ii) Control relays for use on electrical systems greater than 120 volts shall be rated for 600 volts and shall be Allen Bradley Bulletin 70, Type N or approved equivalent by Temple University Facilities Operations & Maintenance department.

(iii) No relays shall be mounted inside the motor control center.

(b) Control Transformers:

(i) Furnish and install control transformers as required.

(ii) **Transformer loading shall not exceed 60% of capacity.** All control transformers shall include primary and secondary circuit protection.

(iii) Maintain enclosure environmental temperature within transformer operating range as recommended by transformer manufacturer.

20. Project Closeout Requirements

A. Before Advanced Lighting Control Systems Systems are closed out a point-to-point verification, from the field devices to EBI shall take place. The system controls shall be tested at each room level. Components failed and replaced during the warranty period shall repeat point-to-point check out.

B. The contractor shall submit three binders and electronic copies for each project including the following:

I. Point listing, by system, with variable acronym or point name, software address, point type, and engineering units.

II. Wiring diagrams by system including termination nomenclature, location and wiring identification.

III. Calibration sheet (minimum 3-point calibration) for each device identified in the design as requiring calibration certificate, indicating calibration date and model number. Include equipment calibration certifications for calibration standards.

IV. **All software, hardware and licenses necessary to operate, maintain, update modify the system, including a final version of the software operating the installed system.**

V. A statement indicating all systems configurations, programming, and graphics are complete and accurate.

C. The contractor shall provide the following training:

I. The ALCS contractor shall provide factory-trained instructor(s) to give full instruction to designated personnel in the operation of the system installed. Instructors shall be thoroughly familiar with all aspects of the subject matter they are to teach.

II. The ALCS Contractor shall provide all students with a student binder containing product specific training modules for the system installed. All training shall be held during normal working hours of 7:00 AM to 3:30 PM weekdays.

III. Provide 40 hours of training for Temple University's designated operating personnel.

IV. Training shall include:

(a) Explanation of drawings, operations and maintenance manuals.

(b) Walk-through of the job to locate control components and to explain system operation.

(c) Operator workstation and peripherals.

(d) Network and controller operation/function.

(e) Operator control functions including graphic generation and system/field panel programming.

(f) Operation of portable operator's terminal.

(g) Explanation of adjustment, calibration and replacement procedures.

(h) Student binder with training modules.

V. Since the Temple University Facilities Operations & Maintenance may require personnel to have more comprehensive understanding of the hardware and software, additional training shall be available from the Manufacturer. If such training is required by the Temple University Facilities Operations & Maintenance, it will be contracted at a later date.

D. Confirmation in writing by the ALCS contractor that:

I. All construction Requests for Information (RFIs) are resolved.

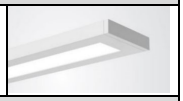
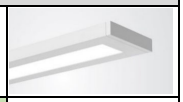
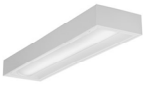
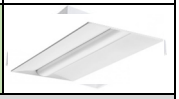
II. All shop drawings, as-builts, and submittals are completed.

III. All required training is completed.

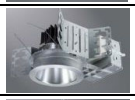
IV. All testing and commissioning activities are completed.

END OF SECTION

TEMPLE UNIVERSITY LIGHTING STANDARDS

SPEC	LIGHT TYPE	CATALOG #	MANUFACTURER	VENDOR	
SURFACE MOUNT LINEAR:					
BASE	ABL-Peerless	BRM9L S 4FT 80CRI 650LMF MIN1 ZT 120 SCT C210	Bruno	Illuminations Inc.	
SUSPENDED LINEAR:					
BASE	ABL-Peerless	BRM9L QS LLP 4FT MSL4 80CRI 40K ID1000LMF 70/30 MIN1 ZT 120 SCT F1/24A C210	Bruno	Illuminations Inc.	
ALT	ABL-Lithonia Lighting	GRD LLP 4FT MSL4 80CRI 40K ID1000LMF 20/80 MIN1 ZT 120 SCT F1/24A C210	Lithonia	Illuminations Inc.	
SURFACE MOUNT 1X4 VOLUMETRIC:					
BASE	ABL-Lithonia Lighting	RTLX4 40L EZ1 LP840 N80EMG	Lithonia	Illuminations Inc.	
BASE	ABL-Lithonia Lighting	RTLX4 40L EZ1 LP840	Lithonia	Illuminations Inc.	
BASE	ABL-Lithonia Lighting	BLTX4 40L ADP EZ1 EL14L LP840	Lithonia	Illuminations Inc.	
ALT	ABL-Lithonia Lighting	BLTX4 40L ADP EZ1 LP840	Lithonia	Illuminations Inc.	
RECESSED 2X2 VOLUMETRIC:					
BASE	ABL-Lithonia Lighting	2RTL2 20L EZ1 LP840	Lithonia	Illuminations Inc.	
ALT	Williams	HET6 S22 L50/835	Williams	Diversified	
2X2 HET STYLE					
BASE	ABL-Lithonia Lighting	2GTL 2 33L EZ1 LP840	Lithonia	Illuminations Inc.	
BASE	ABL-Lithonia Lighting	2GTL2 3300LM LP840	Lithonia	Illuminations Inc.	
RECESSED 2X4 VOLUMETRIC:					
BASE	ABL-Lithonia Lighting	2RTL4 40L EZ1 LP840	Lithonia	Illuminations Inc.	
ALT	Williams	HET6 S24 L50/835	Williams	Diversified	
GIMBAL STYLE DOWNLIGHT					
BASE	ABL-Lithonia Lighting	6G1MW L7XLED LED 40K T24 90 CRI	Lithonia	Illuminations Inc.	

FLAT PANEL					
ALT	1X4FP	14FP4235C	METALUX	Lighting Solutions Inc.	

ALT	1X4FPSMK	FPSURF14	METALUX	Lighting Solutions Inc.	
ALT	2X2FP	22FP4235C	METALUX	Lighting Solutions Inc.	
ALT	2X2FPSMK	FPSURF22	METALUX	Lighting Solutions Inc.	
ALT	2X4FP	24FP4735C	METALUX	Lighting Solutions Inc.	
ALT	2X4FPSMK	FPSURF24	METALUX	Lighting Solutions Inc.	
SURFACE FLAT PANEL					
ALT	1X4SP	14SP420RT	METALUX	Lighting Solutions Inc.	
ALT	2X2SP	22SP3435	METALUX	Lighting Solutions Inc.	
LED BASKET					
BASE	1X4BASKET	14AC-LD5-35-UNV-L835-CD1-U	METALUX	Lighting Solutions Inc.	
BASE	2X4BASKET	24AC-LD5-44-UNV-L835-CD1-U	METALUX	Lighting Solutions Inc.	
ALT	2X2BASKET	22AC-LD5-38-UNV-L835-CD1-U	METALUX	Lighting Solutions Inc.	
LED DOWNLIGHT 4" AND 6" WITH COMPANION WALLWASH					
BASE	6DL	LD6B15D010 EU6B10208035 6LBM1H HB26	PORTFOLIO	Lighting Solutions Inc.	
ALT	4DL	LD4B15D010 EU4B10208035 4LBM1LI HB26	PORTFOLIO	Lighting Solutions Inc.	
ALT	4WW	LD4B15D010 EU4B10208035 4LBSW1H HB26	PORTFOLIO	Lighting Solutions Inc.	
ALT	6WW	LD6B15D010 EU6B10208035 4LBSW1H HB26	PORTFOLIO	Lighting Solutions Inc.	
EXIT LIGHTS:					
BASE	ABL-Lithonia Lighting	EDG - Surface Mtd. EDGR - Recessed Mtd.	Lithonia	Illuminations Inc.	
BASE	Lamar Lighting	VO-LED Voyager Gen 5 - Vol24 or 48	Voyager	Lamar	

TEMPLE UNIVERSITY DEPARTMENT OF TELECOMMUNICATIONS

TECHNICAL SPECIFICATIONS FOR

THE

TELECOMMUNICATIONS DISTRIBUTION SYSTEM

TELECOMMUNICATIONS DISTRIBUTION SYSTEM

1 GENERAL

Section Includes: Equipment, materials, labor, and services to provide telephone and data distribution system including, but not limited to:

1) Raceway, boxes, and cable tray.
2) Telephone and data cabling terminations.
3) Optical fiber and terminations.
4) Telecommunications outlets.
5) Terminal blocks/cross-connect systems.
6) Equipment racks and cabinets.
7) System testing.
8) Documentation and submissions.

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

1.1 Work not included:

The following work will be done by others:

Underground conduit and manholes.

Installation of network switches

Patch cables

Phones

CATV taps

Ground bars

Plywood backboards

1.2 DEMOLITION

All cable removal shall be performed prior to new cable installation ONLY by a Temple approved Telecommunications (low Voltage) contractor. When demolition drawings are provided, they should be followed closely to determine which cables are to be removed and which are to stay in place. All previous active recently decommissioned cables shall be logged during removal with cable number, switch ID and port number. All legacy and previously decommissioned cabling (old cabling) shall be removed at this time as well, logging is not required for these cables. Cables should be removed in their entirety unless deemed not necessary by the telecommunications dept personal.

1.3 REFERENCES

Design, manufacture, test, and install telecommunications cabling networks per manufacturer's requirements and in accordance with the current adopted edition of NFPA-70 (*National Electrical Code*®), state codes, local codes, requirements of authorities having jurisdiction, and particularly the following standards including all addenda:

1.3.1 ANSI/TIA/EIA/NECA/BICSI Standards

1.3.1.1 ANSI/NECA/BICSI-568-2006 -- *Standard for Installing Commercial Building Telecommunications Cabling*

1.3.1.2 ANSI/TIA/EIA-568-B.1 -- *Commercial Building Telecommunications Cabling Standard, Part 1: General Requirements*

1.3.1.3 ANSI/TIA/EIA-568-B.2 -- *Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted Pair Cabling Components*

1.3.1.4 ANSI/TIA/EIA-568-B.2-1 -- *Part 2: Balanced Twisted Pair Components - Addendum 1 - Transmission Performance Specifications for 4-Pair 100 Ohm Category 6 Cabling*

1.3.1.5 ANSI/TIA/EIA-568-B.3 -- *Optical Fiber Cabling Components Standard*

1.3.1.6 ANSI/TIA/EIA-569-B -- *Commercial Building Standard for Telecommunications Pathways and Spaces*

1.3.1.7 ANSI/TIA/EIA-606-A -- *The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings*

1.3.1.8 ANSI/TIA/607-B -- *Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications*

1.3.1.9 TIA/526-7 OFSTP-7-- *Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant*

1.3.1.10 TIA/526-14B -- *Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant*

1.3.1.11 ANSI/TIA/758-B -- *Customer-Owned Outside Plant Telecommunications Cabling Standard*

1.3.2 Install cabling in accordance with the most recent edition of BICSI® publications:

a. BICSI—*Telecommunications Distribution Methods Manual*

b. BICSI—*Information Technology Systems Installation Methods Manual*

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 Temple University 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.

1.4 PERMITS, FEES, AND CERTIFICATES OF APPROVAL

The cabling contractor shall prepare all necessary and required applications and procure required permits at the contractor's expense.

1.5 SYSTEM DESCRIPTION

All cable placed in 4" duct will be Superior Essex jelly filled 24 gauge underground sheath. All cable placed in the vertical riser will be plenum rated. All splice cases will be 3M. All fiber cable placed in 4" duct will be in Maxcell innerduct and be Superior Essex Freedom Riser cable with Corning glass. All other fiber cables placed in the vertical riser will be Superior Essex interlock armored plenum rated 50 micron multi mode OM4 with Corning glass. All splice cases will be 3M.

The intra-building backbone fiber optic cables will terminate in a Corning Closet Connector Housing Fiber Enclosure (CCH) e/w two 12 port single mode and one 12 port multi mode adapter panel in each of the floor serving telecommunications closets (IDF). The fiber enclosures for the IDFs will be supplied by the contractor and installed at the top of a 19-inch communications rack, which will be supplied and installed by the telecommunications contractor. All racks will have vertical wire managers by Master Cabling Sections part # 30094-503. The racks must also be grounded with a #6 AWG insulated copper grounding conductor with crimp style connectors. All single mode and multi mode fibers will terminate on "SC" connectors.

All copper cables will terminate on 66M1-50 punch down blocks in all telecommunications closets. Copper Riser cables will be terminated on blue backboards in the BDF and green backboards in the IDF closets. Copper Station cables will be terminated on blue backboards in the IDF closet. Blue backboards signify outbound (exit) cables and green backboards signify inbound (feed) cables. Backboards must be metallic and light in color.

The vertical coax will be CommScope plenum rated 500.

The typical work area consists of a single-gang faceplate. One outlet (dark red in color) for Voice (VOIP) and data terminated with Berk-Tek plenum-rated, color blue, Category 6e, 4-PR cable (Trade name Lanmark-1000) using the 568A wiring scheme.

The Data cables will be terminated in the IDF closets on Leviton eXtreme® 6+ QuickPort® 48-port Patch Panels (Leviton PN 69586-C48) using the 568A wiring scheme.

The coax cables will terminate in the IDF closets on Leviton "F" connectors PN 41084-FWF in Leviton wall mounted patch panel PN 49255-H48 e/w Leviton hinged wall mounting bracket PN 49251-W62.

1.6 SUBMITTALS

Submit to Temple University Department of Telecommunications, product data (including cut sheets and catalog information) and samples (samples are only required if there is to be product substitution). Submit product data and samples with such promptness and in such sequence as to cause no delay in the work or in the activities of separate contractors. The Temple Rep will indicate approval of product data and samples submitted indicating in writing such submittals as approved.

Shop drawings are not required for this project prior to starting the job. Proper final documentation in AutoCAD DWG format is required.

If submitted, shop drawings shall be initialed or signed by the contractor showing the date and the contractor's legitimate firm name.

Submit product data and samples as a complete set within thirty (30) days of award of contract.

General: Submit the following:

1) Bill of materials, noting lead-time items.

2) Optical loss calculations for each optical fiber run, if applicable.

3) Project schedule timeline - include all work components/phases that affect any other work on the project.

4) Costs of adds and deletes for each type of cable run.

5) Shop drawings indicating pathways and penetrations (Not applicable prior to project start only for project documentation).

6) Shop drawings or written details indicating site issues due to materials already installed by other trades that may impede the installation of the telecommunications materials (not applicable prior to project start, only for project documentation).

7) Backbone (riser) diagram.

8) Fabrication drawings for custom-built equipment.

9) Technician certification of level and training.

Product Data: Provide catalog cut sheets and information for the following:

1. Wire, cable, and optical fiber.

   a. Voice and Data Cable – Berk-Tek Enhanced Cat 6e, color blue, plenum-rated 4-pair (PN 100324)

   b Outdoor Rated Voice and Data Cable – Berk-Tek LANmark-6 1000 305m CAT6, UTP, color black, 4-Pair Man. Part# 60-4P24-BK-R-BER-NR

   c Fiber Optic Plenum Distribution – SUPERIOR ESSEX, Tight Buffer Premises Distribution plenum-rated , 50 µm OM4 TeraGain® optical fiber, 6 through 72 fibers.

2. Outlets, jacks, faceplates, and connectors.

   a. Voice Jack – Leviton QuickPort® Snap-in Connector, 8-conductor eXtreme 6+ channel-rated connector (LEVITON PN 5G110-RW5, White)

   b. Data Jack – Leviton QuickPort® Snap-in Connector, 8-conductor eXtreme 6+ connector (LEVITON PN 61110-RR6, Dark Red)

   c. Wall Phone Jack – Stainless Steel Wall Phone Jack, 6-position, 4-conductor (Leviton PN CO256-0SS)

   d. Wall Faceplate - QuickPort® Single-Gang Wallplates (Leviton PN 41080-*WP, the * is replaced with the port configuration, e.g., 1, 2, 3, 4, 6) for use with voice, data

and catv jacks installed in a single-gang backbox or box eliminator

e. Furniture Faceplate - QuickPort® Modular Furniture Extended Faceplate (Leviton PN 49910-E*4, the * is replaced with the color designator, e.g., “G” for grey, “I” for ivory, “E” for black and “”W” for white) for use with all modular furniture with openings of approximately 1.38” x 2.63” and where additional depth is required

f. Furniture Faceplate - QuickPort® Modular Furniture Standard Faceplate (Leviton PN 49910-S*2 and 49910-S*4, the * is replaced with the color designator, e.g., “G” for grey, “I” for ivory, “E” for black and “”W” for white and the 2 and 4 stand for port count) for use with standard modular furniture with openings of approximately 1.38” x 2.63”

g. Furniture Faceplate - QuickPort® Modular Furniture Herman Miller Faceplate (Leviton PN 49910-H*2 and 49910-H*4, the * is replaced with the color designator, e.g., “G” for grey, “I” for ivory, “E” for black and “”W” for white and the 2 and 4 stand for port count) for use with Herman Miller modular furniture with openings of approximately 1.88” x 2.98”

h. Surface Mount Housing – QuickPort® 1-port Surface Mount Housing (Leviton PN 41089-1*P, the * is replaced with the color designator, e.g., “I” for ivory and “W” for white) for use with voice and data jacks installed in ceilings and enclosed panels

i. Surface Mount Housing – QuickPort® 2-port Surface Mount Housing (Leviton PN 41089-2*P, the * is replaced with the color designator, e.g., “I” for ivory and “W” for white) for use with voice and data jacks installed in ceilings and enclosed panels

j. Fiber Optic Connectors – Corning Unicam SC Style

3. All metallic and nonmetallic raceways, including surface raceways, outlet boxes, and fittings.

4. Terminal blocks and patch panels.

   a. Split M Block – 50-pair 66M1-50 Block (Leviton PN 40066-M50)

   b. M-Block Bracket – 89-D M-Block Standoff Bracket for use with M-Blocks (Leviton PN 40089-00D)

   c. Patch Panel – Leviton eXtreme® 6+ QuickPort® Patch Panels (Leviton PN 69586-C48)

   d. Hinged Wall-Mount Bracket – 2RU (Leviton PN 49251-W62), 3RU (Leviton PN 49251-W63), 4RU (Leviton PN 49251-W64)

   e. Terminal Blocks/Cross-Connects – Leviton GigaMax 110-style Blocks and Kits (See catalog and product specification sheets for ordering information)

5. Enclosures, racks, and equipment housings.

   a. Fiber Optic Enclosures (Empty) – Corning Closet Connector Housing CCH-04U rack-mounted enclosure in BDF. Corning Closet Connector Housing CCH-02U rack mounted in IDF’s.

b. Fiber Optic Adapter Panels– Corning CCH-CP12-G6 (Multi mode) with “SC” connectors and Corning CCH-CP12-3C (Single mode) with “SC” connectors.

c. Equipment Rack – Chatsworth 2-Post Open Frame Rack, Aluminum, 7 feet, 19” Rack Mount (Chatsworth PN 55053-503)

d. Vertical Wire Managers-Acceptable product Chatsworth Products Inc, Master Cable Section PN 30094-503

6. Firestop

e. Hilti FS1

f. STI EZ Path series 33 (for entering IDF closets and passing thru fire rated walls)

7.Manholes

a. All manholes and conduit on this project are Temple owned.

b. All manholes on this project are in high foot traffic areas.

Safety of the walking public is imperative.

c. At no time will an open manhole be left unattended.

d. Supply all necessary tools and equipment for proper manhole opening and safety including ventilation, manhole gates, gas testing, cones, pump and caution tape.

Project record drawings:

Submit project record drawings at conclusion of the project and include:

1) Approved shop drawings (As-built drawings) in AutoCad dwg format. Drawings and all electronic documentation will be submitted to Temple University on a CD.

2) Plan drawings indicating locations and identification of work area outlets, nodes, telecommunications closets (BDFs and IDFs), and backbone (House and Riser) cable runs.

3) Telecommunications closets (TCs) and equipment room (ER and/or MDF) termination detail sheets.

4) Labeling and administration documentation.

5) Warranty documents for equipment.

6) Copper certification test result printouts and diskettes.

7) Optical fiber power meter/light source test results.

Provide three (3) copies of operations and maintenance manuals. As a minimum, manuals should include:

1) Complete schematics of each system component.

2) Troubleshooting procedures.

Factory-authorized support information.

1.7 QUALITY ASSURANCE

1.7.1 The following manufacturer's cabling systems are approved for the work of this section:

1.7.1.1 Leviton for station outlets and patch panels

1.7.1.2 Berk-Tek for all horizontal voice and data station cables

1.7.1.3 Superior Essex w/Corning glass for all intra-building riser cables

1.7.1.4 Superior Essex w/Corning glass for all optical fiber cables for OSP underground cables

1.7.1.5 Corning for all optical fiber enclosures and connectors

1.7.2 The contractor shall have worked satisfactorily for a minimum of five (5) years on systems of this type and size.

1.7.3 Upon request by the Temple University Department of Telecommunications, furnish a list of references with specific information regarding type of project and involvement in providing of equipment and systems.

1.7.4 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.

1.7.5 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.

1.7.6 All 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.

1.7.7 Subcontractors shall assume all rights and obligations toward the contractor that the contractor assumes toward the Temple University Department of Telecommunications.

1.8 WARRANTY

1.8.1 Unless otherwise specified, unconditionally guarantee in writing the materials, equipment, and workmanship for a period of not less than one (1) year from date of acceptance by the Temple University Department of Telecommunications. Acceptance shall be deemed as beneficial use by the Temple University Department of Telecommunications.

1.8.2 Transfer manufacturer's warranties to the Temple University Department of Telecommunications in addition to the General System Guarantee. Submit these warranties on each item in list form with shop drawings. Detail specific parts within equipment that are subject to separate conditional warranty. Warranty proprietary equipment and systems involved in this contract during the guarantee period. Final payment shall not relieve you of these obligations.

1.9 DELIVERY, STORAGE, AND HANDLING

1.9.1 Protect equipment during transit, storage, and handling to prevent damage, theft, soiling, and misalignment. Coordinate with the Turner Construction for secure storage of equipment and materials. Do not store equipment where conditions fall outside manufacturer's recommendations for environmental conditions. Do not install damaged equipment; remove from site and replace damaged equipment with new equipment.

1.10 SEQUENCE AND SCHEDULING

Submit schedule for installation of equipment and cabling. Indicate delivery, installation, and testing for conformance to specific job completion dates. As a minimum, dates are to be provided for bid award, installation start date, completion of station cabling, completion of riser cabling, completion of testing and labeling, cutover, completion of the final punch list, start of demolition, Temple University Department of Telecommunications acceptance, and completion.

Prior to installation, it is the responsibility of the cabling contractor to verify all dimensions on site and to verify all quantities before ordering materials.

1.11 USE OF THE SITE

Access to building wherein the work is performed shall be in accordance with Division 1 specifications.

2 PRODUCTS

2.1 MANUFACTURERS

Provide products of manufacturers as named in individual articles.

Wire, cable, and optical fiber.

a.. Voice and Data Cable – Berk-Tek Landmark 1000 Enhanced Category 6e, color blue, plenum-rated 4- pair. PN 100324

b Outdoor Rated Voice and Data Cable – Berk-Tek LANmark-6 1000 305m CAT6, UTP, color black, 4-Pair Man. Part# 60-4P24-BK-R-BER-NR

c. Fiber Optic Plenum Distribution – SUPERIOR ESSEX, Tight Buffer Premises Distribution plenum-rated (OFNP), 50 micron OM4 optical fiber, 6 through 72 fibers.

d Copper Plenum Distribution-SUPERIOR ESSEX, Cat 3 plenum rated .

e Coax Distribution-CommScope RG6 quad shield plenum rated coax cable 75 ohm. Catalog #229V.

f. Coax Plenum Riser Cable-CommScope 500 JCAP.

2.2 FABRICATION

Fabricate custom-made equipment with careful consideration given to aesthetic, technical, and

functional aspects of equipment and its installation. All fabricated components must be approved by the Temple University Department of Communications.

2.3 SUITABILITY

Provide products that are suitable for intended use, including, but not limited to environmental, regulatory, and electrical.

All materials to be installed must bear the label or listing of a nationally recognized independent testing laboratory, such as UL.

2.4 RACEWAY AND CONDUIT PATHWAYS

All Surface mounted raceway shall be metal and of a color to match the final finish in the area it is to be installed. Expect to provide faceplates for all surface mounted raceway. Installation of Raceway must be approved by the Department of Telecommunications

2.5 VOICE/DATA TELECOMMUNICATIONS SERVICE BACKBONE CABLE (Reference Section 1.5 for additional part number information)

SUPERIOR ESSEX Category 3, solid copper, 24 AWG, 100 Ω balanced twisted-pair (UTP) backbone cable, in sizes as indicated on the drawings, with mechanical and transmission performance specifications that meet or exceed ANSI/TIA/EIA-568-B.2

Listed Type CMP.

Acceptable Products: SUPERIOR ESSEX Category 3

SUPERIOR ESSEX TeraGain singlemode, 50/125µm OM4 multimode tight-buffered optical fiber, with fiber counts as indicated on drawings, with mechanical and transmission performance specifications that meet or exceed ANSI/TIA/EIA-568-B.3

Listed type OFNP (Meets or exceeds EIA/TIA standards)

Acceptable Products: SUPERIOR ESSEX Optical Fiber Cable with Corning glass.

2.6 VOICE AND DATA STATION CABLE (Reference Section 1.5 for additional part number information)

Voice and Data Cable – Berk-tek Landmark-1000 solid copper, 23 AWG, 100 Ω balanced twisted-pair (UTP), Enhanced Category 6e 4-PR cables, which meet or exceed the mechanical and transmission performance specifications in ANSI/TIA/EIA-568-B.2-1.

Listed type CMP

Color: Blue for Data and Voice

Acceptable Products: Berk-Tek

Part Number: Berk-Tek Landmark -1000 Enhanced CAT 6e (PN 100324)

2.7 WORK AREA OPTICAL FIBER CABLE (Reference Section 1.5 for additional part number information)

Note: Optical Fiber Station cable is not part of the installation.

Multimode 50 µm diameter tight-buffered optical fiber, with mechanical and transmission performance specifications that meet or exceed ANSI/TIA/EIA-568-B.3

Listed type OFNP.Meets or exceeds EIA/TIA standards.

Acceptable Products: SUPERIOR ESSEX Premises Distribution Cables

2.8 VOICE/DATA WORK AREA OUTLETS (Reference Section 1.5 for additional part number information)

Typical: Single-gang mounting plate with two (2) openings containing the following devices:

Voice Outlet - 8-pin modular, Category 6e, unkeyed, WHITE in color, pinned to ANSI/TIA/EIA 568A standards.

Data Outlet - 8-pin modular, Category 6e, unkeyed, DARK RED in color, pinned to ANSI/TIA/EIA 568A standards.

Faceplate configurations may vary. Install as indicated by the symbol(s) on the project drawings.

Color is white unless another color is specified.

Acceptable Products: Leviton PN 41080-*WP *= port count 1-6

2.9 WALL TELEPHONE OUTLETS (Reference Section 1.5 for additional part number information)

Stainless Steel Wall Phone Jack, 6-position, 4-conductor

Acceptable Products: Leviton PN CO256-0SS

2.10 DATA ONLY WORK AREA OUTLET (Reference Section 1.5 for additional part number information)

Data Outlet - 8-pin modular, category 6, unkeyed, DARK RED in color, pinned to ANSI/TIA/EIA 568A standards.

Acceptable Products: Leviton QuickPort® eXtreme 6 Outlets

2.11 VOICE ONLY WORK AREA OUTLET (Reference Section 1.5 for additional part number information)

Voice Outlet - 8-pin modular, category 6, unkeyed, WHITE in color, pinned to ANSI/TIA/EIA 568A standards.

Acceptable Products: Leviton QuickPort® eXtreme 6 outlets

2.12 TERMINATION BLOCKS/BACKBOARDS (Reference Section 1.5 for additional part number information)

66M1-50 Blocks shall be CAT 3 compliant.

Blocks to be mounted on preassembled metal backboards that are fully loaded with 89-D brackets and 66M1-50 blocks.

Backboards shall be color-coded to identify block usage. Typically color blue for cable(s) going out of the telecommunication closet and color green for cable(s) coming into the telecommunications closet (feed). Backboards shall be light in color.

Acceptable Products: 183B1 blue, 183B2 green (Marconi)

2.13 WALL MOUNTED WIRE MANAGEMENT FOR 66 BLOCKS

Wire management to be placed below each backboard panel installed. Management to have a (6) inch area to house cross-connect cables and looms to be plastic.

Acceptable Products: Suttle '187B1'

2.14 PATCH PANELS (Reference Section 1.5 for additional part number information)

UTP patch panels shall be rated for Enhanced Category 6 performance in accordance with NextLAN Systems performance requirements (LEVITON/SUPERIOR ESSEX Enhanced link and channel system)

Patch panels shall incorporate 110 style IDC terminations mounted to a PC board on the rear of the panel.

Patch panels shall have 8-position, 8-wire jacks wired in accordance with the T568A cable termination scheme.

Patch panels shall have or be installed with rear strain relief bars or brackets to facilitate the installation of the UTP cables.

Patch panels shall accommodate front and rear labeling for each discrete 4-pair circuit.

Patch panels shall not occupy more than one EIA rack space (1.75") for every 24 port positions.

Modular outlets shall be compliant with FCC CFR 47 part 68 and subpart F and IEC 603.7.

Patch panels shall be 48 port units

Acceptable Products: Leviton eXtreme QuickPort® Patch Panels (PN 69586-C48)

2.15 RACK MOUNTED OPTICAL FIBER TERMINATION PANEL

Fiber termination panels shall be sized to handle the appropriate number of SC-style fiber optic connectors and organized fiber slack for the area served.

Provide separate enclosures for backbone cable and station cable.

Fiber termination panels shall be 19" rack mountable.

Fiber termination panels shall provide complete access to connectors and slack storage via enclosed doors.

Fiber termination panels shall be complete with the required quantity of SC-style interconnect couplers for the backbone cable.

Fiber termination panels shall be equipped with cable strain relief brackets.

Fiber termination panels shall provide ample storage and handling for up to 36" of cable slack per fiber.

Fiber termination panels shall fully enclose the installed cable and patch cord cable interface when the enclosures doors are in the closed position.

Acceptable Products: Corning Closet Connector Housing, CCH-02 for IDF spaces and Corning CCH-04 for BDF space.

2.16 OPTICAL FIBER CONNECTORS

Ceramic tipped field installed SC connectors meeting the following minimum requirements:

Meets ANSI/TIA/EIA 568-A specifications

0.3 dB typical insertion loss

Acceptable Product: Corning adapter panels CCH-CP12-G6 multi mode with “SC” connectors and CCH-CP12-3C single mode, with “SC” connectors.

2.17 OPEN FRAME EQUIPMENT RACK

Equipment racks shall meet or exceed the following specifications:

Floor mount racks shall be supplied and installed with two floor mount base angles and two top angles.

Floor mount racks shall have both front and rear rails tapped with #12-24 mounting holes.

Floor mount racks shall be tapped (#12-24) at 5/8” - *5/8”* - ½” universal hole spacing.

Floor mount racks shall be 7 foot in overall height and supply 45 EIA rack mount spaces.

Floor mount racks shall have a maximum footprint size of 15” X 20.25”.

Each rack shall be supplied with 100 #12-24 mounting screws.

Securely anchor each rack to the floor as required.

Racks shall be UL listed.

Racks shall be provided with copper ground bar with (6) each #12-24 tapped mounting holes.

Acceptable Products:

CPI (Chatsworth) PN 55053-503

Hoffman PN EVR19FM45U

Vertical Wire Manager. Acceptable product Chatsworth Master Cabling Section

PN 30094-503

2.18 OVER HEAD CABLE RACKS

Cable pathways outside of the communications closets-Not Applicable

Above the voice details in the IDF closets, use 6-inch wide “Finger Rack” on three walls to be specified by Temple Rep. Acceptable Products: B-Line half rack.

In the BDF use solid bar 12” rack with 1 1/2” stringer. Hollow tube rack is not acceptable.

Acceptable product Homaco Solid Runway PN 2-E1-12WS.

2.19 CABLE SUPPORTS

All cable supports will be rated as Category 6 compliant, plenum rated and attached to permanent building structure. Attachment to ceiling grid support wires is not acceptable.

Acceptable Products: Caddy, Hilti and B-Line

Note: Any substitutions must be approved by Temple Telecommunications Department

2.20 CABLE TYES

All Cable Tyes used in the telecommunication closets will be Velcro, Black in color.

Plastic tye-wraps may be used in the ceiling areas as long as they are plenum rated.

Spiral wrap is to be used at station/user furniture locations that have cables exiting the wall and not immediately entering the furniture.

2.21 SPARES

Do not furnish spares

3 EXECUTION

3.1 PRE-INSTALLATION SITE SURVEY

Prior to start of systems installation, meet at the project site with the Temple University Department of Telecommunication’s representative and representatives of trades performing related work, to coordinate efforts.

It is the Contractor’s responsibility to review areas of potential interference with other trades/installations and resolve the conflicts before proceeding with the work. Facilitation with the General Contractor will be necessary to plan the crucial scheduled completions of the equipment room and telecommunications closets.

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

Refer to the ’Temple University Department of Telecommunications General Specifications’ document for basic construction materials and methods.

3.2 CHANGES

The Temple university Department of Telecommunications must be notified of all changes to the installation in writing. A change to the original job or other approved changes cannot be implemented without the following:

1) Written approval from the Temple University Telecommunications Department

2) A documented and accepted cost for the work to be done or materials to be installed.

Deletions and additions will be handled in the same manner.

3.3 HANDLING AND PROTECTION OF EQUIPMENT AND MATERIALS

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

3.4 PROTECTION OF TEMPLE UNIVERSITY DEPARTMENT OF TELECOMMUNICATIONS'S FACILITIES

Effectively protect the Temple University Department of Telecommunication's facilities, equipment, and materials from dust, dirt, and damage during construction.

Remove protection at completion of the work.

3.5 INSTALLATION

1) 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 Temple University Department of Telecommunication'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.

2) 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.

3) Adhere to manufacturer's published specifications for pulling tension, minimum bend radii, and sidewall pressure when installing cables.

4) 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 Temple University Department of Telecommunications.

5) Penetrations thru IDF closets and fire-rated walls shall utilize STI EZ-Path series 33. Sleeves passing thru floor shall utilize Hilti FS1. All sleeves in IDF closets will be fire stopped in use or not by the contractor.

6) All cores and penetrations made to facilitate this installation will be fire stopped to meet or exceed the specified fire rating of the penetrated barrier. A single vendor of fire stop should be used. Consult with the Architect or project Manager for type of firestop to be used by all other trades for this project. Temple Telecommunications uses the Hilti System with the following exception: the STI System is used for horizontal station cabling entering/exiting an IDF closet or passing through a fire rated wall in a corridor ceiling.

7) All station cables on each floor will terminate in the telecommunications closet on the same floor. No station cables will run between floors. (Exception will be the dining facility only).

8) Use approved wire, cable, and wiring devices.

9) Install blank covers over all unused telecommunication outlet boxes. Finish to match what is specified for the area.

10) Neat and uncluttered wire termination.

11) Attach cables to permanent structure with suitable attachments at intervals of 48 to 60 inches. Support cables installed above removable ceilings. Category 6 type 'J' hooks are approved for this site. Limit the cable bundles in a 'J' hook to 50 cables.

12) Install adequate support structures for 10-foot cable service loops at each Telecommunications closet for Copper cable.

13) Optical fiber cable passing thru sleeves from floor to floor will be supported on 6.6M strand on every floor. The fiber cable for each closet will have a 15' service coil supported above the plywood backboard.

14) Racks shall be installed in the following manner: Floor mount racks shall be securely attached to the concrete floor using minimum 3/8" hardware. Rack mount screws (#12-24) not used for installing hardware shall be bagged and left with the rack upon completion of the installation. Inter-bay and end-cap managers shall be installed to the rear-mounting rail of the rack using all available mounting holes. Cables shall be securely fastened to the cable managers. Cable feeds shall alternate left and right to minimize congestion at the top of the rack. All racks shall be grounded to the appropriate grounding system

15) Support copper and fiber riser cables every three (3) floors and at top of run with cable grips and 6.6M strand.

16) Install cables in one continuous piece. **Splices shall not be allowed**.

17) In the closet use Velcro wraps to manage the cable bundles. Velcro wraps shall be black in color and sized to allow a minimum of 20% additional cables to be added to the bundle.

18) Many of the classrooms will have "University Seating". This is fixed seating that has the data jacks located in a panel mounted in the desktop surface. Consideration should be given to how the cables are to be routed into these units and if there are special inserts/hardware required to complete the installation. The furniture has a covered cable tray that can accommodate a surface mount box. Install all of the work station outlets in a surface mount box that will sit in the furniture tray.

19) At locations with "University Seating" or similar furniture that have cables exiting the wall and not immediately entering the furniture, use spiral wrap to manage the cables. The cables will exit the wall via a grommeted wall plate. This grommet will be rounded over as to prevent the cable from becoming cut or otherwise damaged. The spiral wrap shall be appropriately sized to the cable bundle. The spiral wrap shall be secured in the wall and in the furniture to prevent accidental removal.

20) All fiber optic Backbone cabling in the riser shall be installed in inner duct (sized to maintain a 40% fill for each particular segment). Unprotected fiber optic cabling shall not

be acceptable. All backbone fiber optic cables shall pass though a junction box in each telecommunications closet. This junction box serves to protect slack, which cannot fit into the fiber optic rack enclosure, and to act as a break out point to continue other fiber optic cable runs to other telecommunications closets.

21) Copper backbone cabling (Riser) shall be placed per Temple work print M00064.

22) All riser cable will be identified with a permanent label that lists the cable destination. All riser cable will be properly supported in each telecommunications closet. Each type of riser cable will be place in separate riser cores.

3.6 GROUNDING

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.

Bond and Ground equipment racks, housings, messenger cables, and raceways.

Connect cabinets, racks, and frames to single-point ground which is connected to building ground system via #6 AWG green insulated copper grounding conductor. All grounds must be terminated using a crimp style connector. No mechanical connections are acceptable.

Provide closet ground connections as required.

3.7 LABELING

Labeling shall conform to ANSI/TIA/EIA-606 standards. Temple University utilizes the Brady system for telecommunications labeling. Refer to drawing LBL-1.

In addition, provide the following:

1) Label each outlet with permanent self-adhesive label with minimum 3/16 in. high characters.

2) Label each cable with permanent self-adhesive label with minimum, 1/8 in. high characters, in the following locations:

    a. Inside receptacle box at the work area.

    b. Behind the communication closet patch panel or punch block.

3) Use labels on face of data patch panels. Provide facility assignment records in a protective cover at each telecommunications closet location that is specific to the facilities terminated therein.

4) Mount termination blocks on color-coded backboards.

    a. Green for cables coming in to the closet.

    b. Blue for cables going out of the closet.

5) Labels shall be machine-printed. Hand-lettered labels shall not be acceptable. The Brady system is the standard for labels for the department of Telecommunications.

6) Label cables, outlets and patch panels with a unique cable number to the floor the cable is terminated on. Numbering on all floors will start at 001. A finalized labeling scheme will be provided before the start of the installation. Typically each outlet faceplate will have a single label identifying the building and telecommunication closet it is associated with. Then each outlet on the faceplate will have unique numerical identifiers for voice and data.

7) Mark up floor plans showing outlet locations, type, and cable marking of cables. Turn these drawings over to the Temple University Department of Telecommunications upon completion to allow the Temple University Department of Telecommunications personnel to connect and test Temple University Department of Telecommunications-provided equipment in a timely fashion.

8) Three (3) sets of as-built drawing shall be delivered to the Temple University Department of Telecommunications within two (2) weeks of acceptance of project by the Temple University Department of Telecommunications. A set of as-built drawings shall be provided to the Temple University Department of Telecommunications on 3.5” CD media form and utilizing CAD software that is acceptable to the Temple University Department of Telecommunications (AutoCAD 2009 or newer). The documentation media shall be delivered to the Temple University Department of Telecommunications within two (2) weeks of acceptance of project by Temple University Department of Telecommunications.

3.8 TESTING

1) Test documentation shall be provided in a three-ring binder(s) within three weeks after the completion of the project. The binder(s) shall be clearly marked on the outside front cover and spine with the words “Test Results”, the project name, and the date of completion (month and year). Major heading tabs shall divide the binder. Each major heading shall be further sectioned by test type. Within the sections, scanner test results (Category 6), OTDR traces, and power meter test results shall be segregated by tab. Test data within each section shall be presented in the sequence listed in the administration records. The test equipment by name, manufacturer, model number and last calibration date will also be provided at the end of the document. Unless a more frequent calibration cycle is specified by the manufacturer, an annual calibration cycle is anticipated on all test equipment used for this installation. The test document shall detail the test method used and the specific settings of the equipment during the test.

2) Scanner tests shall be printed on 8 ½ x 11. Attenuation and power meter result reports shall be machine generated. OTDR test results shall be printed or attached and copied on 8 ½ x 11 paper for inclusion in the test documentation binder. Hand written reports are unacceptable.

3) When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be collocated in the binder.

4) Upon receipt of the test documentation, Temple University reserves the right to perform spot testing of a representative sample of the cabling system to validate test results provided in the test document. Temple University testing will use the same method employed by the Contractor, and minor variations will be allowed to account for differences in test equipment. If significant discrepancies are found, the Contractor will be notified for resolution.

5) Testing shall conform to ANSI/TIA/EIA-568-B.1 standards. Testing shall be accomplished using level IIe or higher field testers.

6) Test each pair and shield of each cable for opens, shorts, grounds, and pair reversal. Correct grounded and reversed pairs. Examine open and shorted pairs to determine if problem is caused by improper termination. If termination is proper, tag bad pairs at both ends and note on termination sheets.

7) Perform testing of copper cables with tester meeting ANSI/TIA/EIA-568-B.1 requirements.

8) If copper backbone cable contains more than one (1) percent bad pairs, remove and replace entire cable at no charge to the Temple University Department of Telecommunications.

9) If horizontal cable contains bad conductors or shield, remove and replace cable at no charge to the Temple University Department of Telecommunications.

10) Initially test optical fiber cable with a light source and power meter utilizing procedures as stated in ANSI/TIA/EIA-526-14A: *OFSTP-14A Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant* and ANSI/TIA/EIA-526-7 (currently Standard Proposal Number 2974-B). Measured results shall be plus/minus 1 dB of submitted loss budget calculations. If loss figures are outside this range, test cable with optical time domain reflectometer to determine cause of variation. Correct improper splices and replace damaged cables at no charge to the Temple University Department of Telecommunications.

11) Cables shall be tested at 850 nm and 1300 nm for multimode optical fiber cables. Cables shall be tested at 1310 nm and 1550 nm for single mode optical fibers.

12) Testing procedures shall utilize “Method B” – One jumper reference.

13) Bidirectional testing of optical fibers is required.

14) Perform optical time domain reflectometer (OTDR) testing on each fiber optic conductor. Measured results shall be plus/minus 1 dB of submitted loss budget calculations.

15) Submit printout for each cable tested.

16) Submit 3.5 in. CD with test results and program to view results.

17) Where any portion of system does not meet the specifications, correct deviation and repeat applicable testing at no additional cost to the Temple University Department of Telecommunications.

3.8.1 FIELD QUALITY CONTROL

Employ job superintendent or project manager (PM) during the course of the installation to provide coordination of work of this specification and of other trades, and provide technical information when requested by other trades. This person shall maintain current RCDD® (Registered Communications Distribution Designer) registration and shall be responsible for quality control during installation, equipment set-up, and testing. This person shall attend all required job site meetings and immediately report any situations that may impede or adversely affect the quality of the installation to the Temple University Department of Telecommunications contact. The PM must be available to meet with the Temple University SPOC if an unscheduled meeting is required.

For jobs that have duration of less than one week: The PM must come to the site daily and provide Temple University with a daily progress/status report.

For jobs that have a duration (this being at least four consecutive days) of more than one week: The PM must come to the site a minimum of three days a week and provide Temple University with a progress/status report on Monday, Wednesday and Friday.

Installation personnel shall meet manufacturer's training and education requirements for implementation of warranty program.

It is preferred that key installation personnel be BICSI registered telecommunications installers at the Technician level. It is preferred that the installation personnel be BICSI registered telecommunications installers at the Installer level and/or be registered at the Apprentice level.

The type of labor on site shall conform to these guidelines. All labor shall be IBEW affiliated unless otherwise noted.

Technicians assigned to the project must stay on the job until completion.

All Technicians must be trained and certified in telecommunication systems installation. Technician certification must be submitted to Temple University prior to the technician starting work on the job site.

Temple University Office of Telecommunications
Approved Contractor Bid List

Atlantic Coast Communications
Address: 7112 Airport Highway
Pennsauken, New Jersey 08109
Telephone: 856 488-8889
Fax: 856 488-0002
www.accnjinc.com
Attention: Rich Bainger: baingerr@ACCNJINC.COM

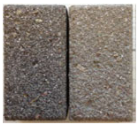
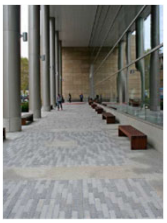
LanConnect, Inc
Address: 623 W. Washington Street
Norristown, PA 19401
Telephone: 610 272-2044
Fax: 610-272-3411
www.lanconnectinc.com
Attention: Dave Stubblebine: dstubblebine@lanconnectinc.com

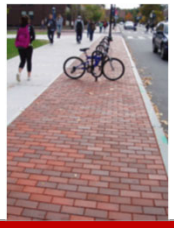
Bluestone Communications, Inc
Address: 780C Primos Ave.
Folcroft, PA 19032
Telephone: 484 574-5227
Fax: 610 237-8801
www.bluestonecomm.com
Attention: Jim Gallagher: j.gallagher@bluestonecomm.com

Battaglia Integrated Technologies
Address: 11Industrial Blvd.
New Castle, DE 19720
Telephone: 302 325-6100
Fax: 302 325-6108
www.battag.com
Attention: Roy Dowell: rdowell@battag.com

LCN Communications
Address: 102 Erickson Ave
Essington, PA 19029
Office: 610 915-4055
Fax: 215 279-7891
Direct: 610 915-4050
www.lcncom.com
Attention: Joseph Robbins: jrobbins@lcncom.com

DIVISION 32.00.00 - EXTERIOR IMPROVEMENTS

32.00.00 - EXTERIOR IMPROVEMENTS		
Image	**Part 1 - General**	Product Link (Reference Only)
 		'Planstone Prest Brick.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Hanover Architectural Products - 5000 Hanover Road, Hanover, PA, USA, 17331; (800) 426-4242
	Model/Series/Size	Face Size: 4"X8"; Thickness: 3"
	Material/Finish	Tuder Finish, Multi-Colors Used Across Campus
	Part 3 - Execution	Please note that permiable or impermiable pavers will vary based on location. Please confirm with member of Temple PDG before ordering. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

32.00.00 - EXTERIOR IMPROVEMENTS		
Image	**Part 1 - General**	Product Link (Reference Only)
 		'Heavy Vehicular Paving Brick.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Whitacre Greer - 1400 South Mahoning Avenue Alliance, OH, USA, 44601; (330) 823-1610
	Model/Series/Size	ASTM C 1272, Type F; Face Size: 4"X8"; Thickness: 3"; Chamfered Edge on One Side Only
	Material/Finish	Equal Blend #32 Antique, #33 Dark Antique, #43 Tangerine
	Part 3 - Execution	Currently utilized, but not limited to tree trenches, crosswalks, and intersections. Please note that permiable or impermiable pavers will vary based on location. Please confirm with member of Temple PDG before ordering. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

32.00.00 - EXXTERIOR IMPROVEMENTS		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Prest Pavers.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	Hanover Architectural Products - 5000 Hanover Road, Hanover, PA, USA, 17331; (800) 426-4242
	Model/Series/Size	18"X36"X3"; 18"X18"X3"; 18"X12"X3"
	Material/Finish	Tudor Style. Colors Blend Matrix #B93217 and Matrix #B93218. 18" x 36" x3" / 18" x 18" x 3" / 18" x 12" x 3"
	Part 3 - Execution	Typically used, but not limited to sidewalks and walkways. Please note that permiable or impermiable pavers will vary based on location. Please confirm with member of Temple PDG before ordering. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

32.00.00 - EXTERIOR IMPROVEMENTS		
Image	**Part 1 - General**	Product Link (Reference Only)
		'Georgia Grey Granite.' Delivered in manufacturers original packaging and installed per manufacturer installation instructions with manufacturers standard warranty.
	Part 2 - Product/Materials	
	Manufacturer	North Carolina Granite - 151 Granite Quarry Trail Mount Airy, NC, USA, 27030; (336) 786-5141
	Model/Series/Size	N/A
	Material/Finish	Dimensional Curbing, Split Face, Sawn Top and Sides
	Part 3 - Execution	Edge restraint for all unit pavers to define plant beds and lawn area. Please note that permiable or impermiable pavers will vary based on location. Please confirm with member of Temple PDG before ordering. Install according to the manufacturer's installation instructions and Temple Universities established Accessibility policies.

Temple University
Project Delivery Group

Standard Signage Specifications

Introduction

Temple University uses several different styles of signs on its campuses. This has evolved over a period of years as new styles have been adopted. The current Standard Style was first employed in the New Medical School Building on the Health Sciences Center Campus. It has since been used on the Business School in Alter and Speakman Halls, the Tyler School of Art, SERC, the Charles Library, and several other buildings. This style will be used on all new construction and also during extensive renovations to existing buildings where much of the old signage will have to be replaced. The remainder of Temple Buildings use the older style signs. Temple wishes to have a uniform appearance of the signs in a particular building, so these older style signs will continue to be used when minor changes are needed rather than replace individual signs with the new style.

These specifications provide the information necessary to fabricate the New Style signs.

It should be noted that these specifications only deal with the standard types of signs most commonly used. There is also a constant need for special signs that fall outside these specifications. These are handled on a case by case basis.

All Temple signage is to be managed and/or procured through Project Delivery Group through the TU Requisition process. Special and/or Donor signage may require input from Strategic Marketing and Communications, working closely with Project Delivery Group. Exterior signage is required to follow Temple's Standard as referenced in these Signage Standards as well as the "Verdant Temple" Landscape Master Plan document.

Project Delivery Group

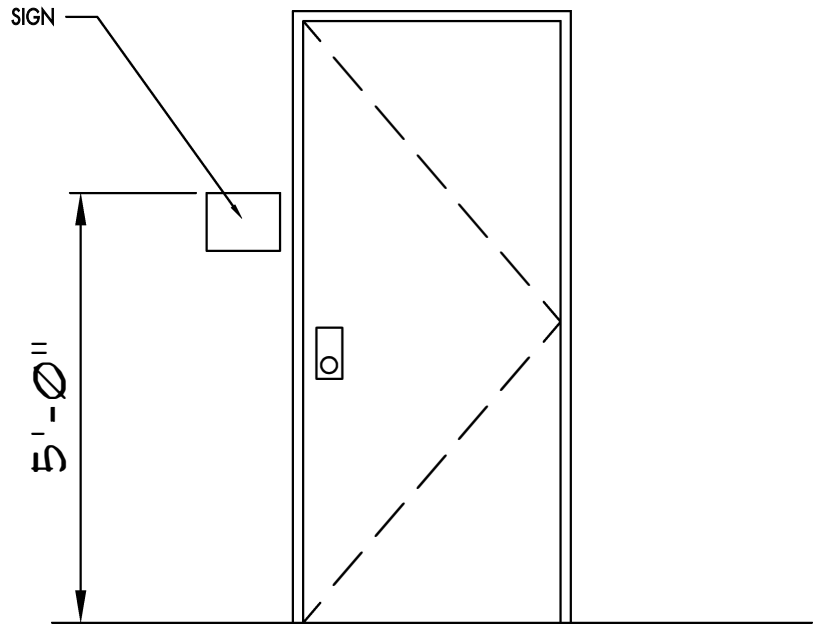
January 2023

Temple University Standard Sign Types

Type	Description	Size
N2	Large Room Identification Sign w/ Insert	8 1/2" x 6"
N2a	Insert Holder with no Room Number	8 1/2" x 4"
N3	Large Room Identification Sign - 3 Lines Permanent Text	8 1/2" x 6"
N3a	Large Room Identification Sign - 3 Lines Permanent Text, 2 Lines of Braille	8 1/2" x 6 1/2"
N4	Large Room Identification Sign - 2 Lines Permanent Text	8 1/2" x 6"
N5	Room Identification Sign - 1 Line Permanent Text	8 1/2" x 4"
N5a	Room Identification Sign - 1 Line Permanent Text with Occupied/Unoccupied Slider	8 1/2" x 5"
N6	Wall Mounted Directory Sign	Variable
N7, 7a	Wall Mounted Information Sign	Variable
N8a,b,c	Wall Mounted Single Sheet Holder (With and Without Header)	Variable
N9a,b,c	Wall Mounted Double Sheet holder	Variable
R1	Restroom Sign	6" x 9"
R2	All Gender Restroom Sign	6" x 9"
R3	Restroom Directional Signs	Variable
S1	Interior Stairway Sign	2'-0" x 2'-0"
S2	Stairway Identification Sign	6" x 9"
S3	Exit Sign	8" x 8"
S3a	Exit Emergency Exit Only Sign	8" x 8"
S4	Floor Identification Sign	4" x 6"
S5	Area of Refuge Sign	6" x 9"
EMH	Evacuation Map Holder	12 1/2" x 15 3/4"
ROSH	Room Occupancy Sign Holder	10" x 11 3/4"
P1	Wall-Mounted Solid Pin Letters	Variable
P2	Wall-Mounted Fabricated Pin Letters	Variable
P3	Acrylic panel & Puck Sign	Variable

MOUNTING INSTRUCTIONS

Signs will be mounted in compliance with Section 703 of the ICC/ANSI Al 17.1-2009 Accessible and Usable Buildings and Facilities Code. Room identification signs will generally be mounted with the top of the sign at 60" above the floor and 2" away from the door frame. This may vary from location to location but must still comply with the ICC/ANSI Code noted above.



Signs will be attached using foam tape. for large signs or mounting on irregular surfaces, the tape will be supplemented with a silicone adhesive.

When the sign is to be mounted on glass, first a piece of silver vinyl (2 mil high performance Arlon Silver Metallic) of the same size as the sign will be applied to the front face of the glass where the sign will be mounted. Then the sign will be mounted directly on the vinyl. Silicone adhesive MUST be used in this case as the plasticizers in the vinyl will interfere with the foam tape over time.

Sign Types

	COLOR DESIGNATION	COLOR	COLOR REFERENCE	EXTERIOR/ INTERIOR	APPLICATION DESCRIPTION	APPLICATION PROCESS	FABRICATOR'S SPECIFICATION
	COLOR 1	TEMPLE GREY	MATTHEWS MP50244 BRASS ALLOY	INTERIOR	PRIMARY BACKGROUND	SUBSURFACE PAINTED	
	COLOR 2	TEMPLE CHERRY RED	PMS 201	INTERIOR	PRIMARY BACKGROUND	SUBSURFACE PAINTED	

Planning and Design
1101 W. Montgomery Ave
Philadelphia, PA 19122
Tel. (215) 204-1406
Fax (215) 204-1700

TEMPLE
A Commonwealth University
Office of Facilities Management

PROJECT NO.: GENERAL SIGNAGE
DATE: 11-21-16
SCALE: NTS
DRAWN BY: SW
CHECKED BY:

TEMPLE UNIVERSITY SIGNAGE
NEW SIGNAGE STANDARD

STANDARD COLORS

DRAWING NO. NS-1

OF

ABCDEFGHIJKLMNOPQRSTUVWXYZ

abcdefghijklmnopqrstuvwxyz

1234567890

Typeface: Futura Book

Planning and Design
1101 W. Montgomery Ave
Philadelphia, PA 19122
Tel. (215) 204-1406
Fax (215) 204-1700

TEMPLE
A Commonwealth University
Office of Facilities Management

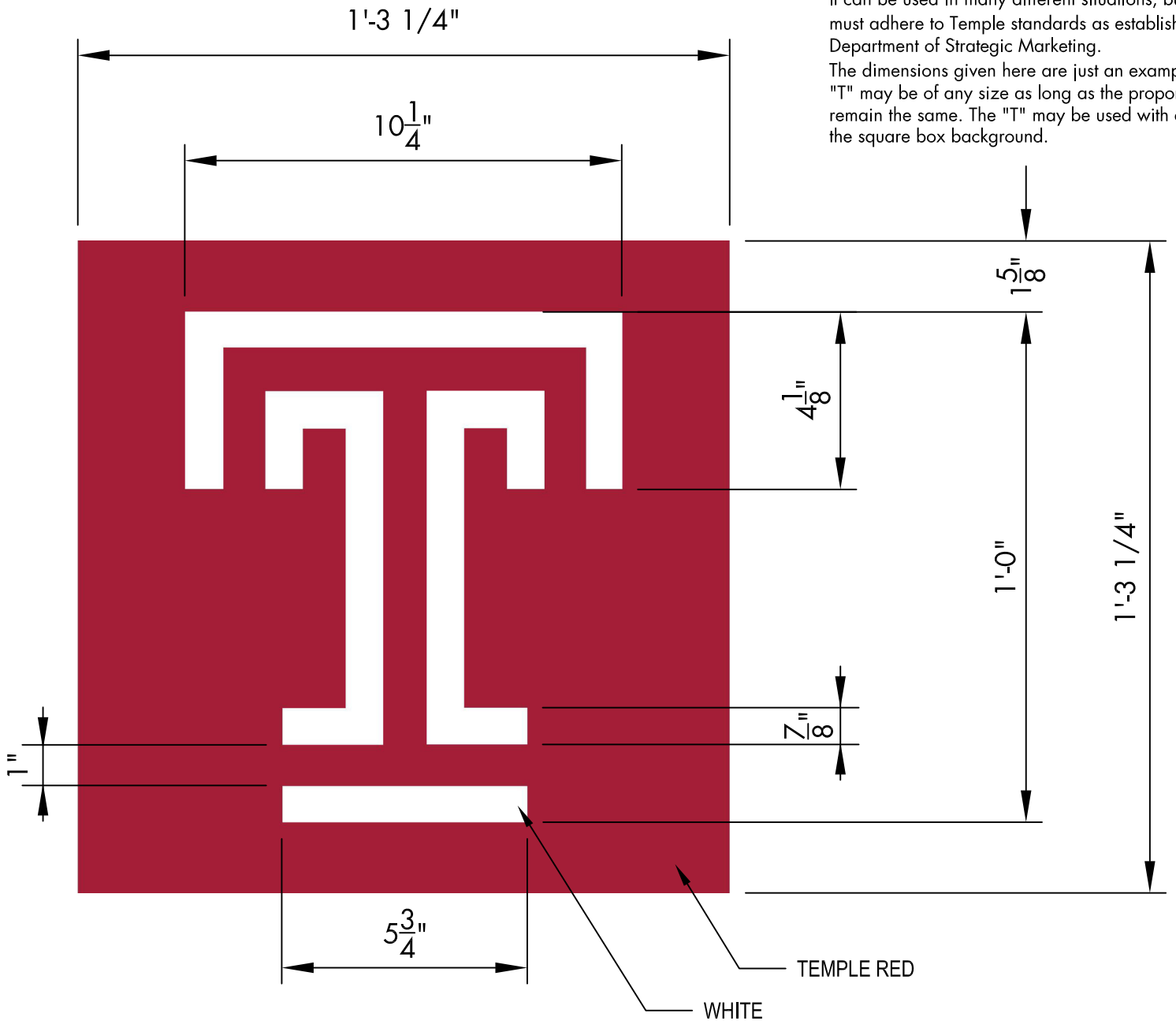
PROJECT NO.: GENERAL SIGNAGE
DATE: 11-21-16
SCALE: NTS
DRAWN BY: SW
CHECKED BY:

TEMPLE UNIVERSITY SIGNAGE
NEW SIGNAGE STANDARD

STANDARD TYPEFACE

DRAWING NO.
NS-2
OF

The Temple "T" logo appears frequently on signs.
It can be used in many different situations, but any usage must adhere to Temple standards as established by the Department of Strategic Marketing.
The dimensions given here are just an example and the "T" may be of any size as long as the proportions remain the same. The "T" may be used with or without the square box background.



DRAWING NO. NS-3 OF

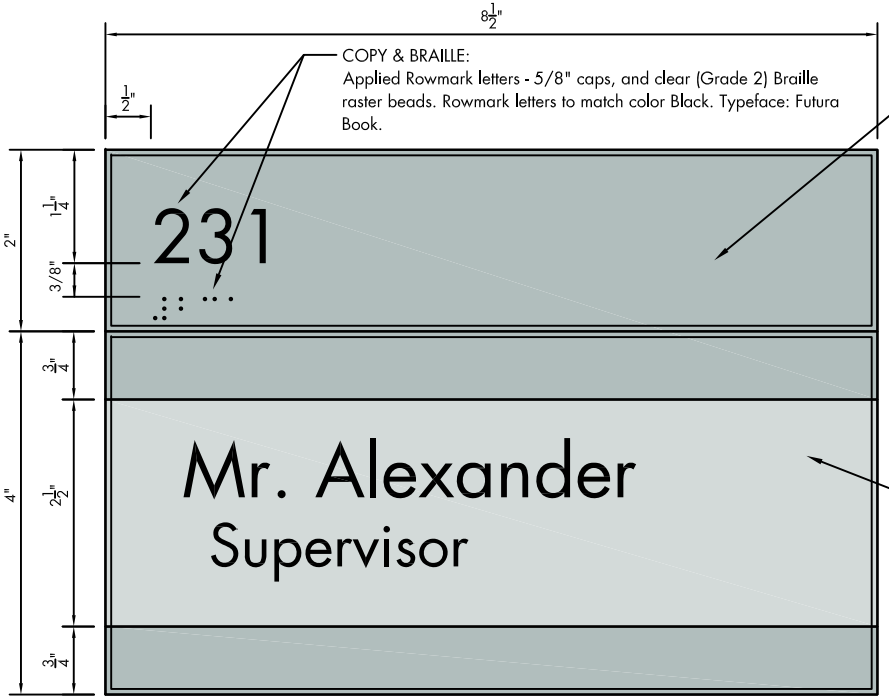
TEMPLE UNIVERSITY SIGNAGE
NEW SIGNAGE STANDARD

TEMPLE LOGO

PROJECT NO.: GENERAL SIGNAGE
DATE: 3-6-2020
SCALE: NTS
DRAWN BY: SW
CHECKED BY:

TEMPLE
A Commonwealth University
Office of Facilities Management

Planning and Design
1101 W. Montgomery Ave
Philadelphia, PA 19122
Tel. (215) 204-1406
Fax (215) 204-1700

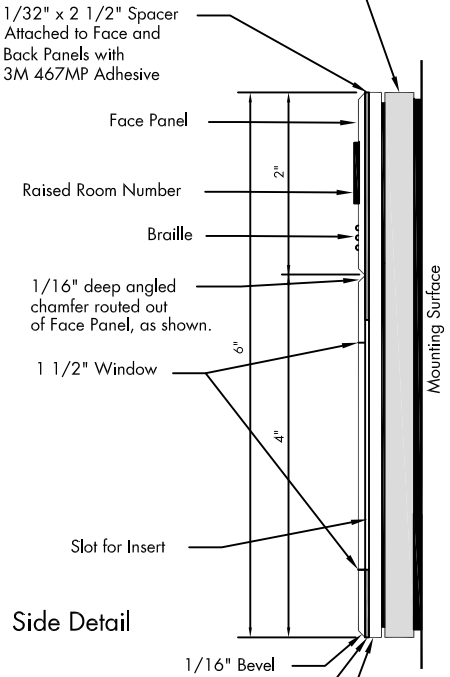


COPY & BRAILLE:
Applied Rowmark letters - 5/8" caps, and clear (Grade 2) Braille raster beads. Rowmark letters to match color Black. Typeface: Futura Book.

FACE PANEL:
6"H x 8 1/2"W x 1/16" thk face plate with 1/8" thk back panel separated by 1/32" thk. spacer to create slot for insert. Attach using 3M 467MP adhesive. Face plate with 1/16" chamfered edges. Rear Plate and Spacer painted Color 1. Mask and subsurface spray Front Plate leaving 1 1/2" H clear window for insert. Mount Face Panel to Rear Panel with 1/16" foam tape to create reveal.

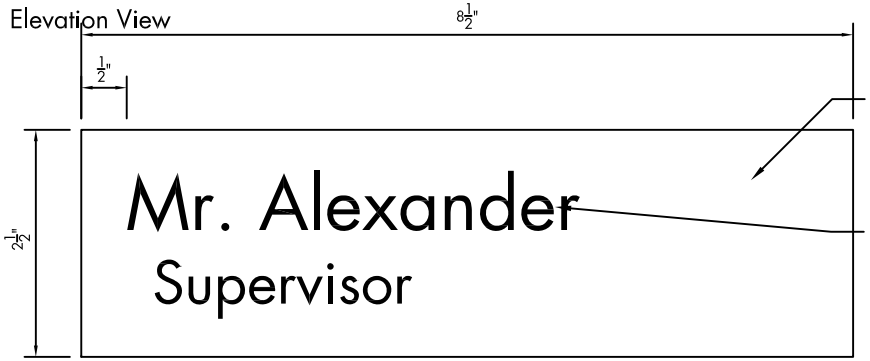
Window for Insert

Rear Panel:
6"H x 8 1/2" W x 1/4" thk, clear acylic panel, with front and side edges painted to match Color 1. Mount to mounting surface with 1/16" thk. black DF foam tape.



Side Detail

Elevation View



Name Insert:
2 1/2" H x 8 1/2" W x .025 thk. clear polycarbonate panel.

Copy:
Surface applied digitally printed copy to match color Black. Cap height is either 5/8"H or 1/2" H, depending on length of text. Copy to be centered vertically within insert window. Typeface: Futura Book

Insert Detail

NOTE: For sign locations where the sign is to be mounted on glass, apply a piece of 2 mil high performance Arlon Silver Metallic Vinyl to the front of the glass first. The vinyl should be the same size as the sign. Then mount the sign to the vinyl using foam tape and a silicone adhesive.

SIGN TYPE N2

DRAWING NO. NS-4 OF

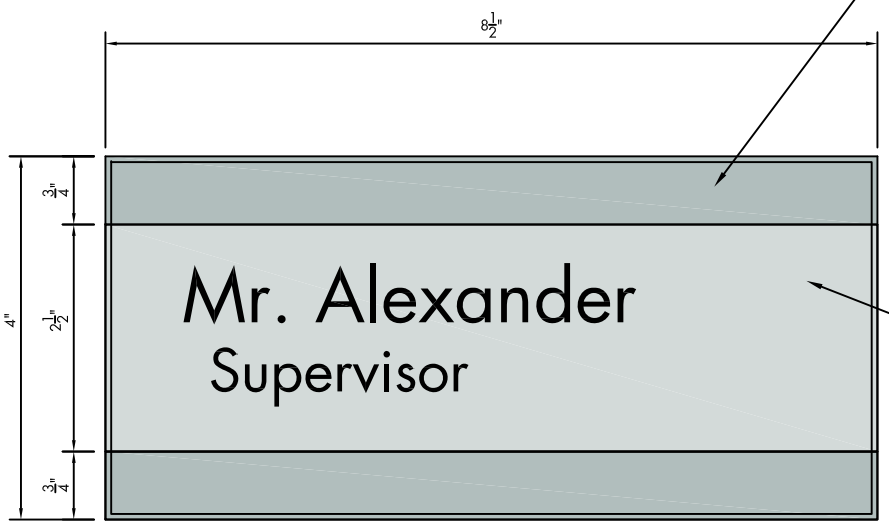
TEMPLE UNIVERSITY SIGNAGE
NEW SIGNAGE STANDARD

TYPE - N2 OFFICE SIGN
WITH NAME INSERT

PROJECT NO.: GENERAL SIGNAGE
DATE: 11-21-16
SCALE: NTS
DRAWN BY: SW
CHECKED BY:

TEMPLE
A Commonwealth University
Office of Facilities Management

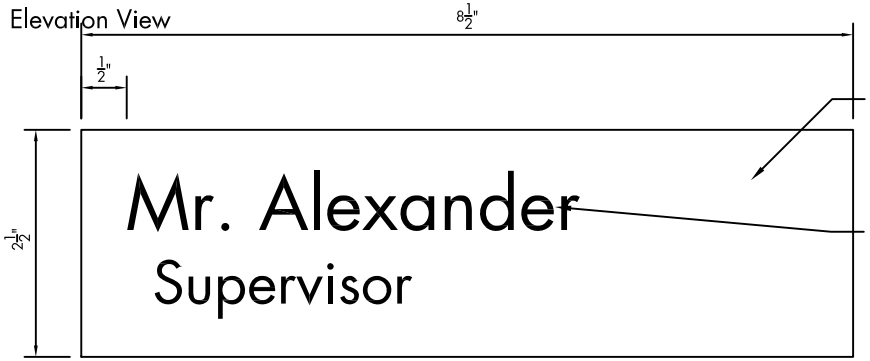
Planning and Design
1101 W. Montgomery Ave
Philadelphia, PA 19122
Tel. (215) 204-1406
Fax (215) 204-1700



FACE PANEL:
4"H x 8 1/2"W x 1/16" thk face plate with 1/8" thk back panel separated by 1/32" thk. spacer to create slot for insert. Attach using 3M 467MP adhesive. Face plate with 1/16" chamfered edges. Rear Plate and Spacer painted Color 1. Mask and subsurface spray Front Plate leaving 1 1/2" H clear window for insert. Mount Face Panel to Rear Panel with 1/16" foam tape to create reveal.

Window for Insert

Elevation View

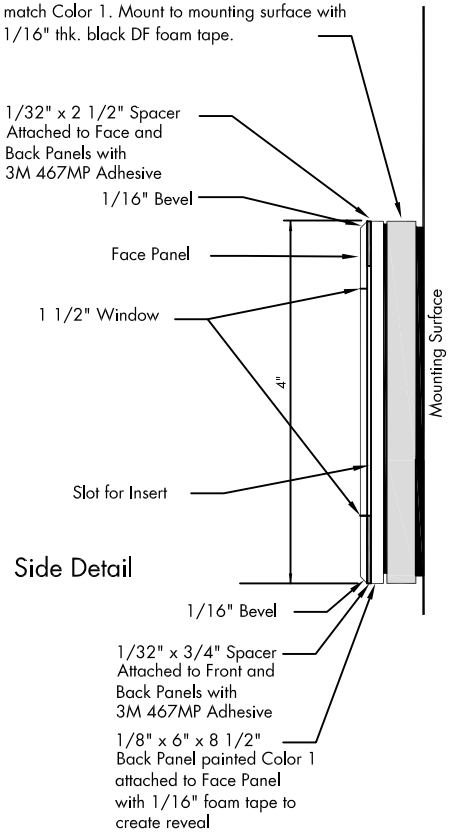


Name Insert:
2 1/2" H x 8 1/2" W x .025 thk. clear polycarbonate panel.

Copy:
Surface applied digitally printed copy to match color Black. Cap height is either 5/8"H or 1/2" H, depending on length of text. Copy to be centered vertically within insert window. Typeface: Futura Book

Insert Detail

Rear Panel:
6"H x 8 1/2" W x 1/4" thk, clear acylic panel, with front and side edges painted to match Color 1. Mount to mounting surface with 1/16" thk. black DF foam tape.



Side Detail

SIGN TYPE N2a

NOTE: For sign locations where the sign is to be mounted on glass, apply a piece of 2 mil high performance Arlon Silver Metallic Vinyl to the front of the glass first. The vinyl should be the same size as the sign. Then mount the sign to the vinyl using foam tape and a silicone adhesive.

DRAWING NO. NS-5 OF

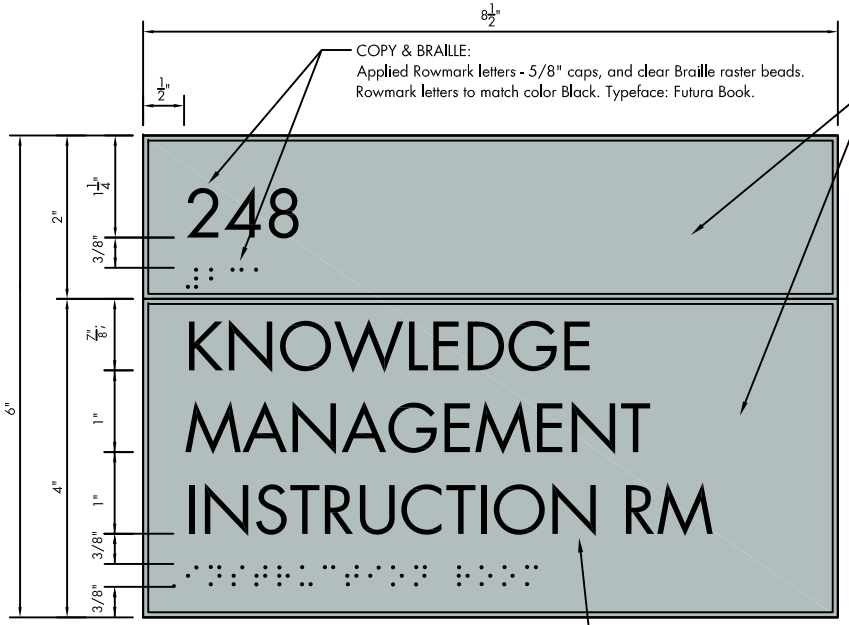
TEMPLE UNIVERSITY SIGNAGE
NEW SIGNAGE STANDARD

TYPE - N2a INSERT HOLDER

PROJECT NO.: GENERAL SIGNAGE
DATE: 4-25-18
SCALE: NTS
DRAWN BY: SW
CHECKED BY:

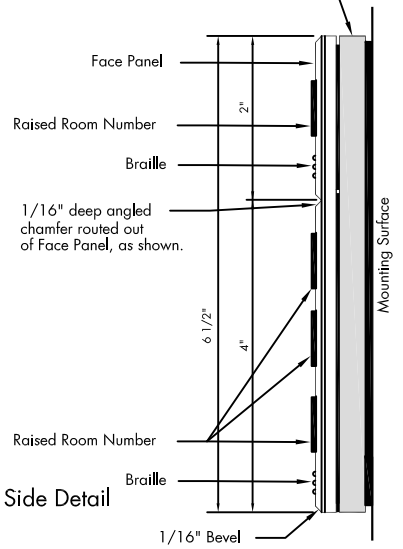
TEMPLE
A Commonwealth University
Office of Facilities Management

Planning and Design
1101 W. Montgomery Ave
Philadelphia, PA 19122
Tel. (215) 204-1406
Fax (215) 204-1700



Elevation View

Rear Panel:
6"H x 8 1/2" W x 1/4" thk, clear acrylic panel, with front and side edges painted to match Color 1. Mount to mounting surface with 1/16" thk. black DF foam tape.



Side Detail

NOTE: For sign locations where the sign is to be mounted on glass, apply a piece of 2 mil high performance Arlon Silver Metallic Vinyl to the front of the glass first. The vinyl should be the same size as the sign. Then mount the sign to the vinyl using foam tape and a silicone adhesive.

SIGN TYPE N3

DRAWING NO. NS-6 OF

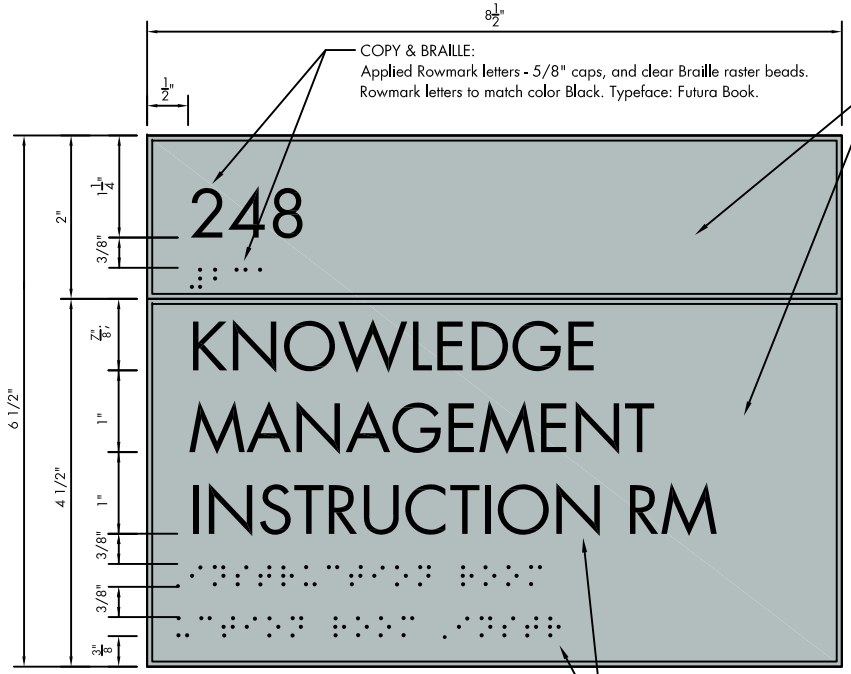
TEMPLE UNIVERSITY SIGNAGE
NEW SIGNAGE STANDARD

TYPE - N3 OFFICE SIGN
THREE LINES OF PERMANENT TEXT

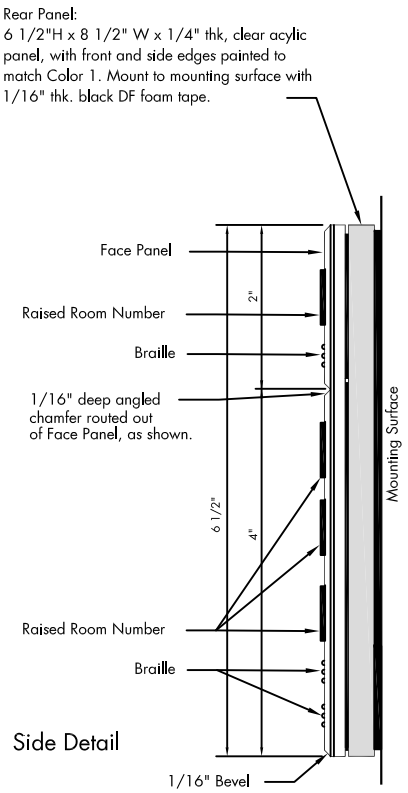
PROJECT NO.: GENERAL SIGNAGE
DATE: 11-21-16
SCALE: NTS
DRAWN BY: SW
CHECKED BY:

TEMPLE
A Commonwealth University
Office of Facilities Management

Planning and Design
1101 W. Montgomery Ave
Philadelphia, PA 19122
Tel. (215) 204-1406
Fax (215) 204-1700



Elevation View



Side Detail

NOTE: For sign locations where the sign is to be mounted on glass, apply a piece of 2 mil high performance Arlon Silver Metallic Vinyl to the front of the glass first. The vinyl should be the same size as the sign. Then mount the sign to the vinyl using foam tape and a silicone adhesive.

SIGN TYPE N3a

NOTE: The Type N-3a sign should be used if two lines of Braille text are required. Otherwise the Type N-3 sign should be used.

DRAWING NO. NS-7 OF

TEMPLE UNIVERSITY SIGNAGE
NEW SIGNAGE STANDARD

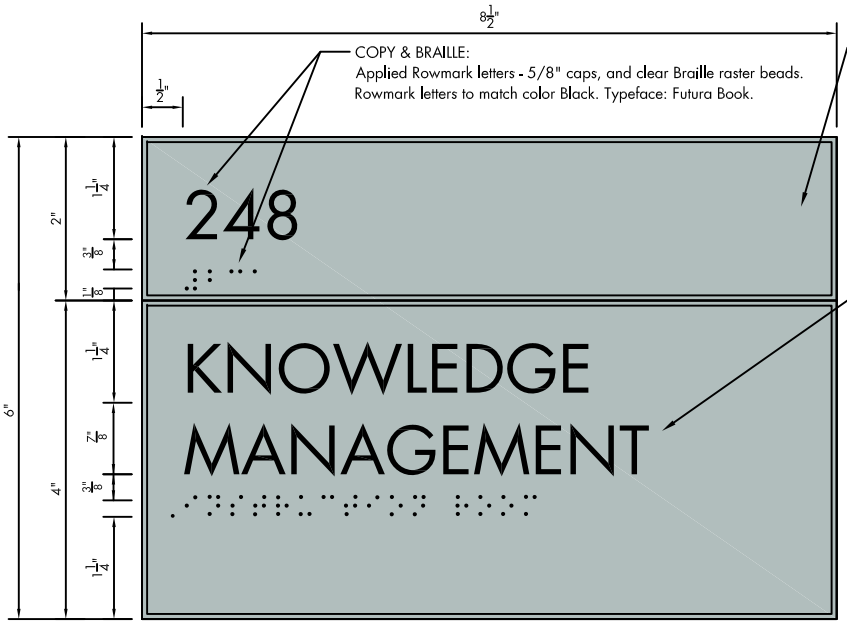
TYPE - N3a OFFICE SIGN
THREE LINES OF PERMANENT TEXT
AND TWO LINES OF BRAILLE

PROJECT NO.: GENERAL SIGNAGE
DATE: 11-21-16
SCALE: NTS
DRAWN BY: SW
CHECKED BY:

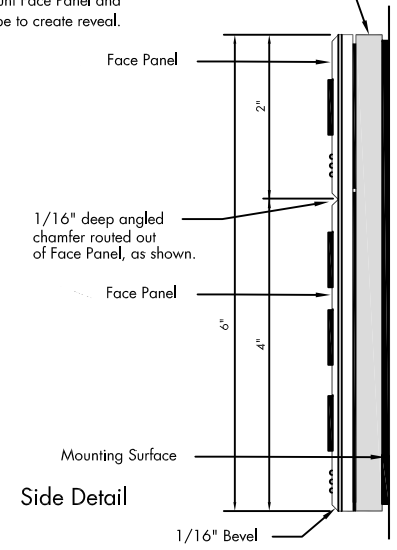
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Tel. (215) 204-1406
Fax (215) 204-1700

NOTE: For sign locations where the sign is to be mounted on glass, apply a piece of 2 mil high performance Arlon Silver Metallic Vinyl to the front of the glass first. The vinyl should be the same size as the sign. Then mount the sign to the vinyl using foam tape and a silicone adhesive.



Elevation Detail



Side Detail

SIGN TYPE N4

DRAWING NO.	NS-8
	DF

TEMPLE UNIVERSITY SIGNAGE
NEW SIGNAGE STANDARD

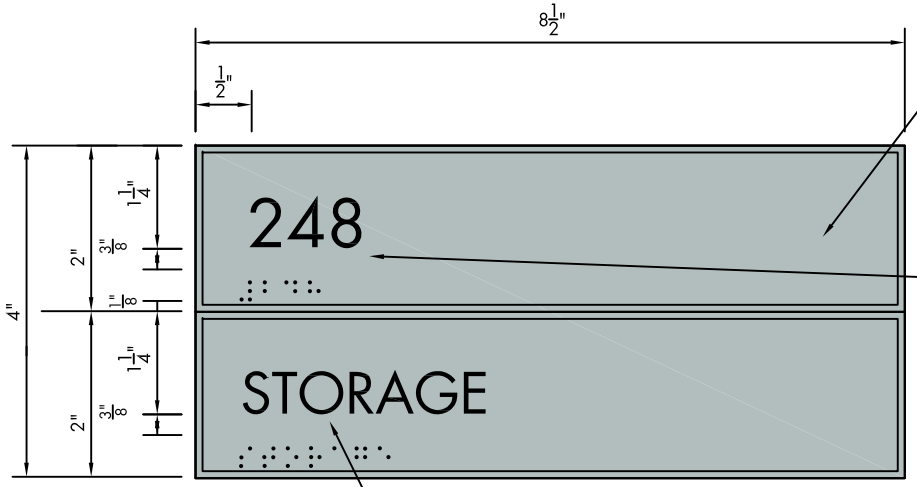
TYPE - N4 OFFICE SIGN
TWO LINES OF PERMANENT TEXT

PROJECT NO.:	GENERAL SIGNAGE
DATE:	11-21-10
SCALE:	NTS
DRAWN BY:	SW
CHECKED BY:	

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SIGN TYPE N5



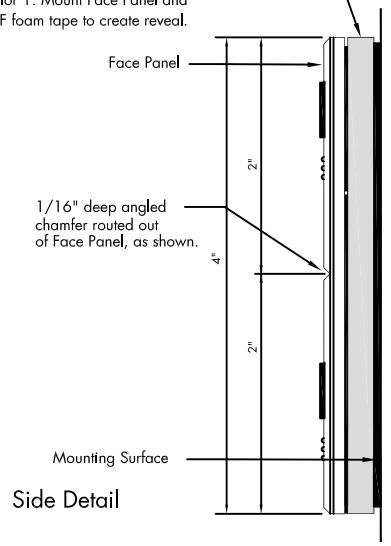
Elevation Detail

FACE PANEL:
2"H x 8 1/2"W x 1/16" thk Face Plate with 1/8" thk Back Panel. Face Plate with 1/16" chamfered edges. Attach Face Plate to Back Panel using 3M 467MP adhesive. Back Panel painted Color 1. Mount Face Panel and Back Panel to Rear Panel with 1/32" black DF foam tape to create reveal.

Room Numbers & Braille:
Applied Romark - 5/8" H caps, and clear Braille raster beads. Romark Letters to match color Black. Typeface: Futura Book.

Room ID Copy & Braille:
Applied Romark letters - 5/8" H caps, and clear Braille raster beads.
Color Black.
Typeface: Futura Book

Rear Panel:
4"H x 8 1/2" W x 1/4" thk, clear acrylic panel, with front and side edges painted to match Color 1. Mount to mounting surface with 1/16" thk. black DF foam tape.



Side Detail

NOTE: For sign locations where the sign is to be mounted on glass, apply a piece of 2 mil high performance Arlon Silver Metallic Vinyl to the front of the glass first. The vinyl should be the same size as the sign. Then mount the sign to the vinyl using foam tape and a silicone adhesive.

DRAWING NO. NS-9 OF

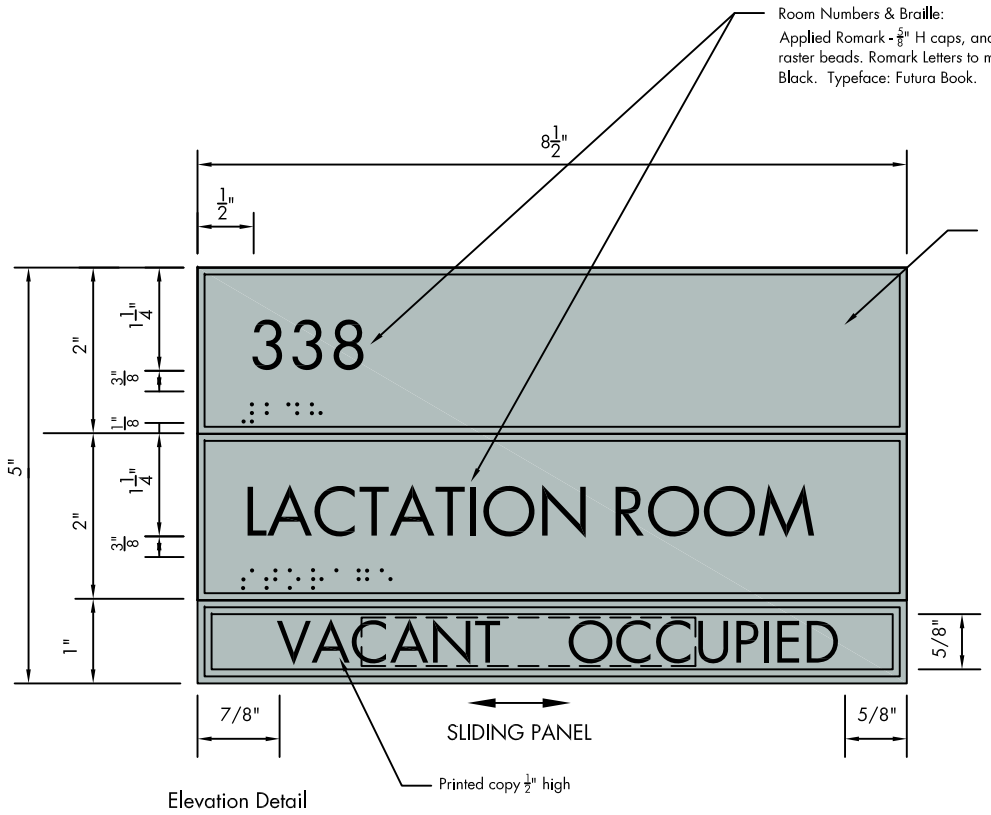
TEMPLE UNIVERSITY SIGNAGE
NEW SIGNAGE STANDARD

TYPE - N5 OFFICE SIGN
ONE LINE OF PERMANENT TEXT

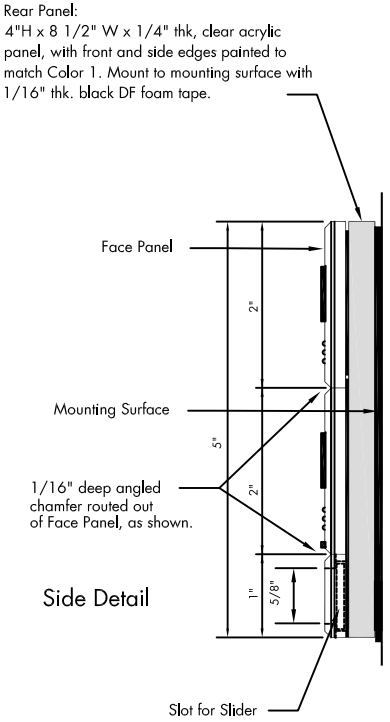
PROJECT NO.: GENERAL SIGNAGE
DATE: 11-21-10
SCALE: NTS
DRAWN BY: SW
CHECKED BY:

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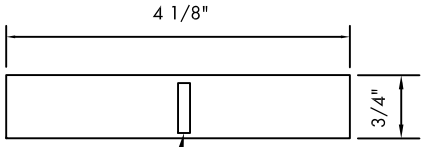


Elevation Detail



Side Detail

NOTE: For sign locations where the sign is to be mounted on glass, apply a piece of 2 mil high performance Arlon Silver Metallic Vinyl to the front of the glass first. The vinyl should be the same size as the sign. Then mount the sign to the vinyl using foam tape and a silicone adhesive.



Slider Detail

1/16" thk matte acrylic piece painted Color 1

Pull:
1/2"H x 1/4"W x 1/8" thk. matte acrylic piece painted Color 1, attached to slide with 3M 467MP adhesive

SIGN TYPE N5a

DRAWING NO. NS-10 DF

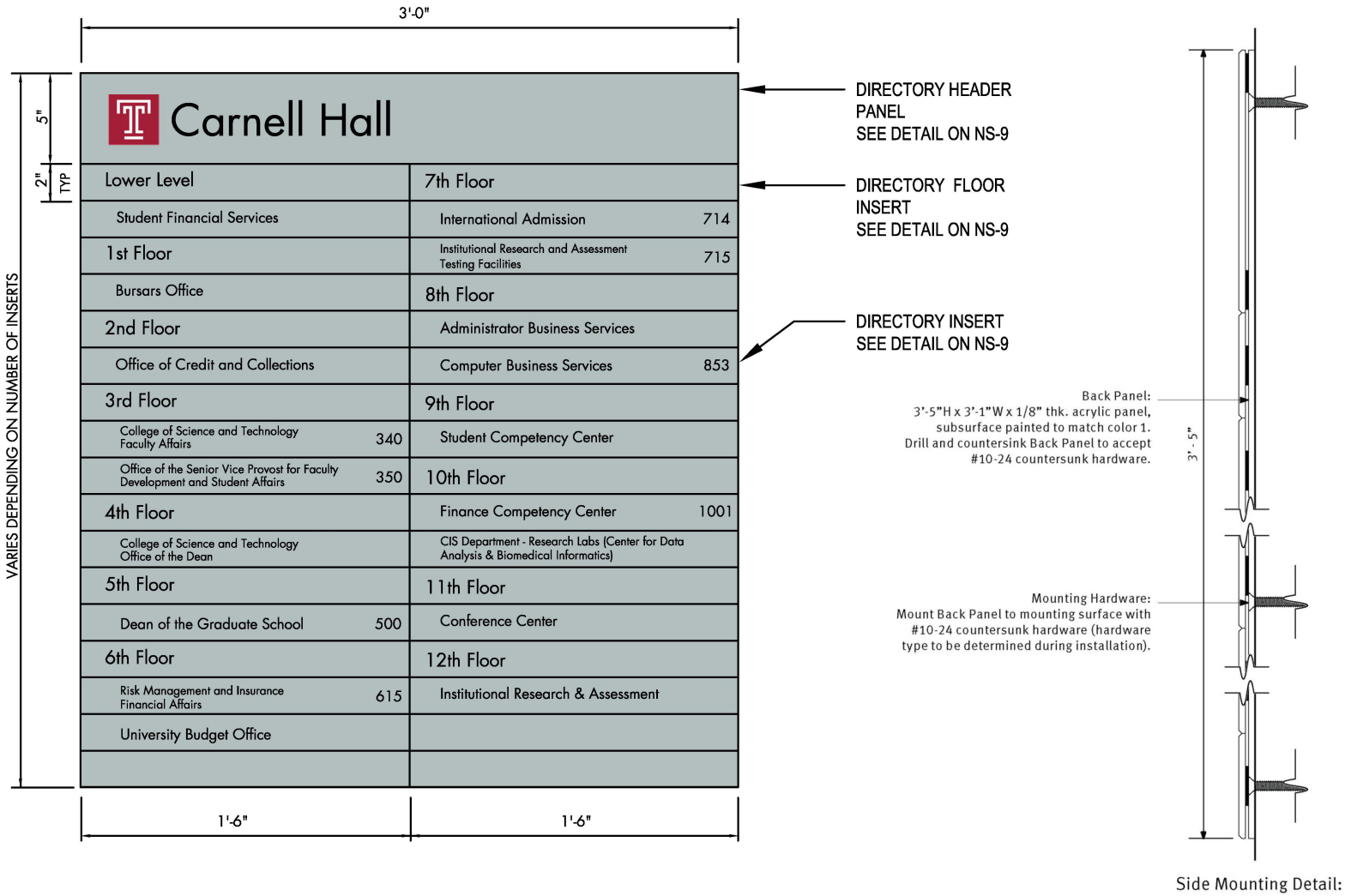
TEMPLE UNIVERSITY SIGNAGE
NEW SIGNAGE STANDARD

TYPE - N5a OFFICE SIGN
ONE LINE OF PERMANENT TEXT
VACANT/OCCUPIED SLIDER

PROJECT NO.: GENERAL SIGNAGE
DATE: 6-4-2019
SCALE: NTS
DRAWN BY: SW
CHECKED BY:

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WALL MOUNTED DIRECTORY SIGN
BUILDING DIRECTORIES AND FLOOR DIRECTORIES

NOTE: FOR DIRECTORIES WHERE FEWER INSERTS ARE NEEDED A DIRECTORY WITH A SINGLE COLUMN OF INSERTS CAN BE MADE WHICH REDUCES THE WIDTH OF THE DIRECTORY AND THE TOP PANEL TO 1'-6"

THE OVERALL VERTICAL DIMENSION CAN VARY DEPENDING ON THE NUMBER OF INSERTS DESIRED.

SIGN TYPE N6

DRAWING NO. NS-11 OF

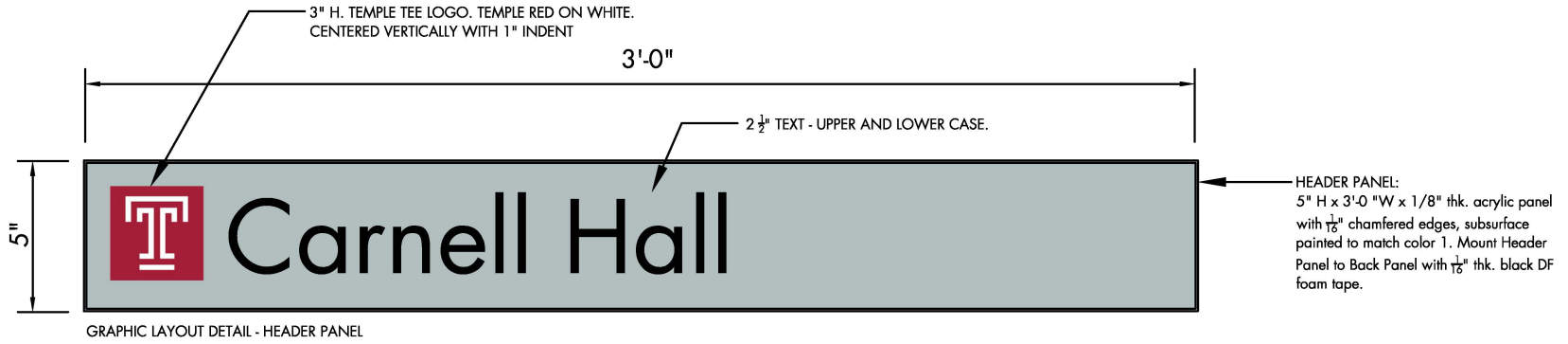
TEMPLE UNIVERSITY SIGNAGE
NEW SIGNAGE STANDARD

SIGN TYPE N6
WALL MOUNTED DIRECTORY SIGN

PROJECT NO.: GENERAL SIGNAGE
DATE: 11-21-10
SCALE: NTS
DRAWN BY: SW
CHECKED BY:

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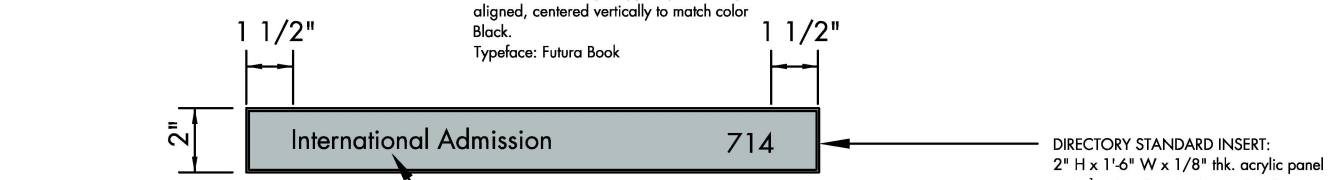


GRAPHIC LAYOUT DETAIL - HEADER PANEL



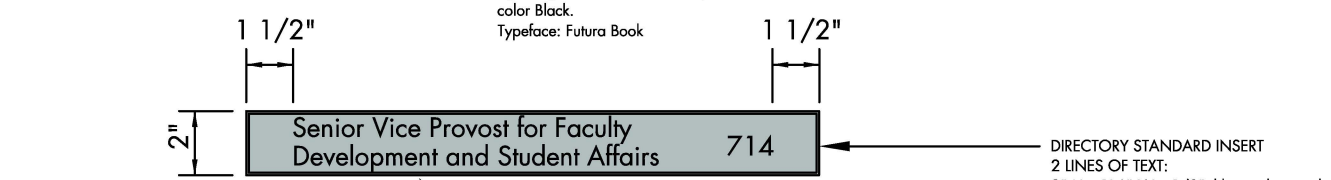
GRAPHIC LAYOUT DETAIL - HEADER INSERT

COPY:
5/8" H. caps copy digitally printed on first surface of Directory Copy Strip, left & right aligned, centered vertically to match color Black.
Typeface: Futura Book



GRAPHIC LAYOUT DETAIL - STANDARD INSERT

COPY:
5/8" H. caps copy digitally printed on first surface of Directory Standard Insert, left & right aligned, centered vertically to match color Black.
Typeface: Futura Book



GRAPHIC LAYOUT DETAIL - STANDARD INSERT WITH 2 LINES OF TEXT

COPY:
5/8" H. caps copy digitally printed on first surface of Directory Standard Insert, left & right aligned, centered vertically to match color Black.
Typeface: Futura Book

WALL MOUNTED DIRECTORY INSERT DETAILS

DRAWING NO. NS-12 OF

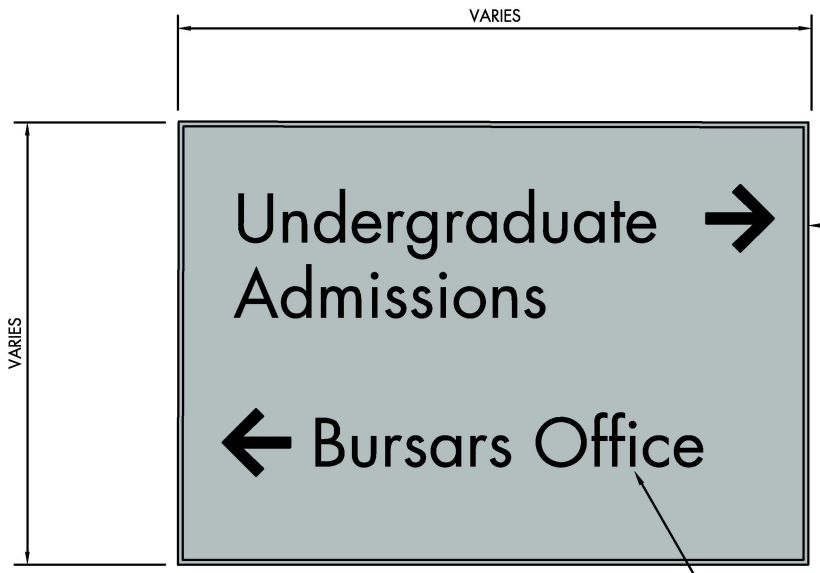
TEMPLE UNIVERSITY SIGNAGE
NEW SIGNAGE STANDARD

SIGN TYPE N6
WALL MOUNTED DIRECTORY
INSERT DETAILS

PROJECT NO.: GENERAL SIGNAGE
DATE: 11-21-10
SCALE: NTS
DRAWN BY: SW
CHECKED BY:

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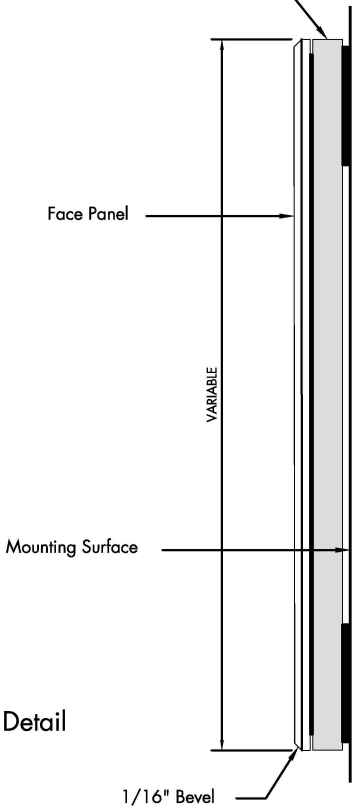


Elevation Detail

Face Panel:
Variable Height and Width x 1/8" thk. matte acrylic panel with 1/16" chamfered edges. Apply subsurface graphics and then spray to match Color 1.
Mount Face Panel to Back Panel with 1/32" thk. black DF foam tape. Do not put tape to edge of panel-create reveal on edges.

Back Panel:
Variable Height and Width x 1/4" thk, clear acylic panel, with front and side edges painted to match Color 1. Mount to mounting surface with 1/16" thk. black DF foam tape.

Text:
Typeface: Futura Book
Size: Will vary from sign to sign per application.



Side Detail

NOTE: For sign locations where the sign is to be mounted on glass, apply a piece of 2 mil high performance Arlon Silver Metallic Vinyl to the front of the glass first. The vinyl should be the same size as the sign. Then mount the sign to the vinyl using foam tape and a silicone adhesive.

WALL MOUNTED INFORMATION SIGN

NOTE: THIS SIGN CAN BE USED FOR A VARIETY OF PURPOSES INCLUDING INFORMATION AND WAYFINDING.

SIGN TYPE N7

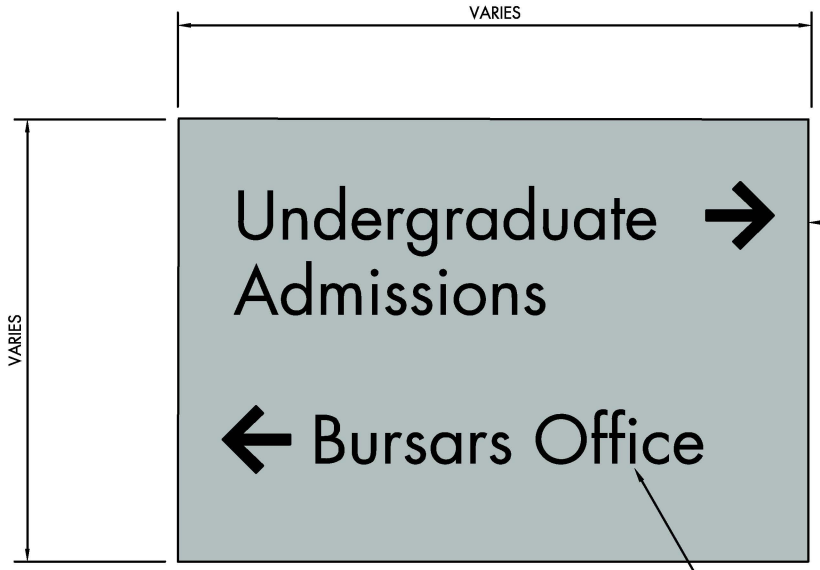
DRAWING NO. NS-13 OF

TEMPLE UNIVERSITY SIGNAGE
NEW SIGNAGE STANDARD
SIGN TYPE N7
WALL MOUNTED INFORMATION SIGN

PROJECT NO.: GENERAL SIGNAGE
DATE: 3-22-11
SCALE: NTS
DRAWN BY: SW
CHECKED BY:

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Tel. (215) 204-1406
Fax (215) 204-1700

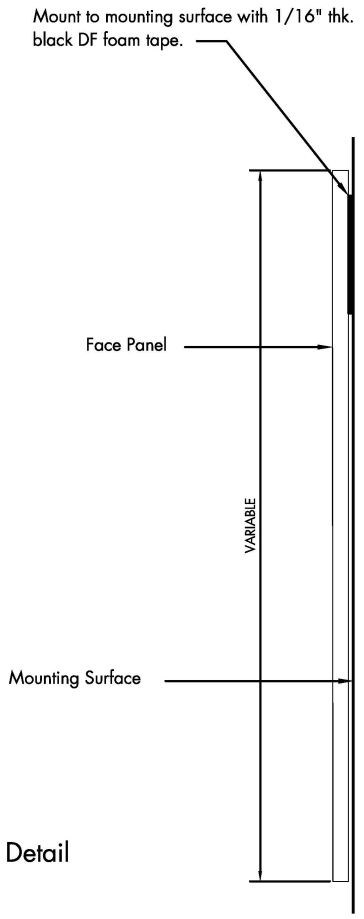


Elevation Detail

Face Panel:
Variable Height and Width x 1/8" thk. matte acrylic panel with. Apply subsurface graphics and then spray to match Color 1.

Text:
Typeface: Futura Book
Size: Will vary from sign to sign per application.

NOTE: For sign locations where the sign is to be mounted on glass, apply a piece of 2 mil high performance Arlon Silver Metallic Vinyl to the front of the glass first. The vinyl should be the same size as the sign. Then mount the sign to the vinyl using foam tape and a silicone adhesive.



Side Detail

WALL MOUNTED INFORMATION SIGN

NOTE: THIS SIGN CAN BE USED FOR A VARIETY OF PURPOSES INCLUDING INFORMATION AND WAYFINDING.

SIGN TYPE N7a (No Back Panel)

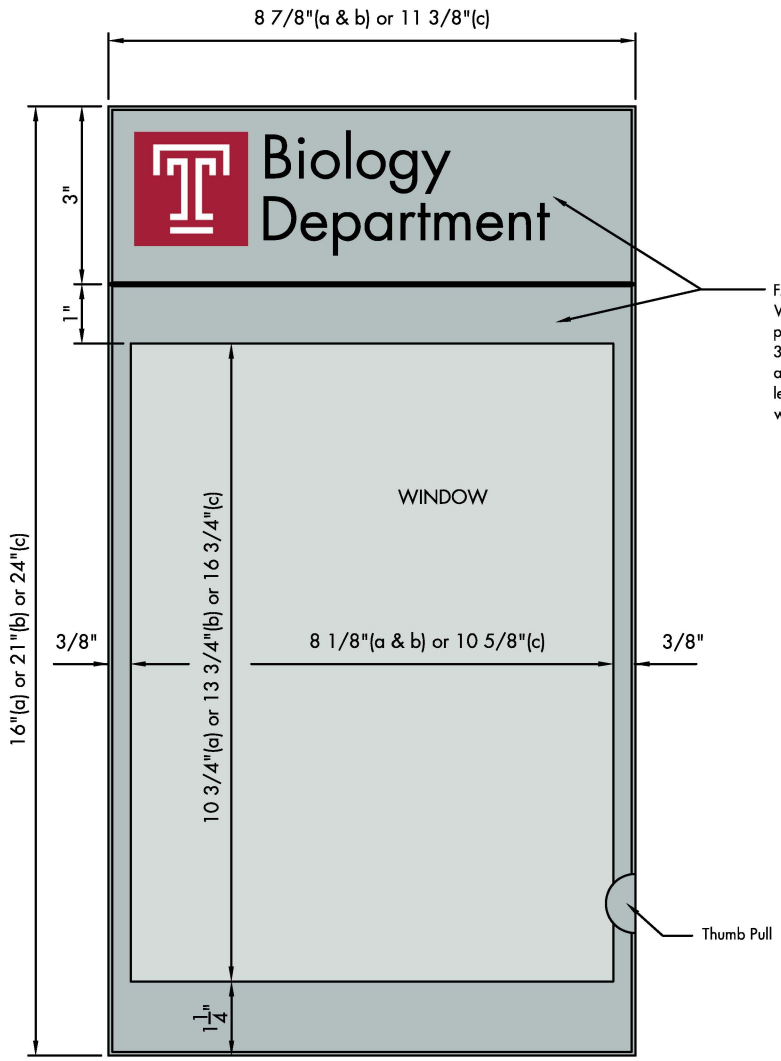
DRAWING NO. NS-14 OF

TEMPLE UNIVERSITY SIGNAGE
NEW SIGNAGE STANDARD
SIGN TYPE N7
WALL MOUNTED INFORMATION SIGN

PROJECT NO.: GENERAL SIGNAGE
DATE: 3-22-11
SCALE: NTS
DRAWN BY: SW
CHECKED BY:

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Office of Facilities Management

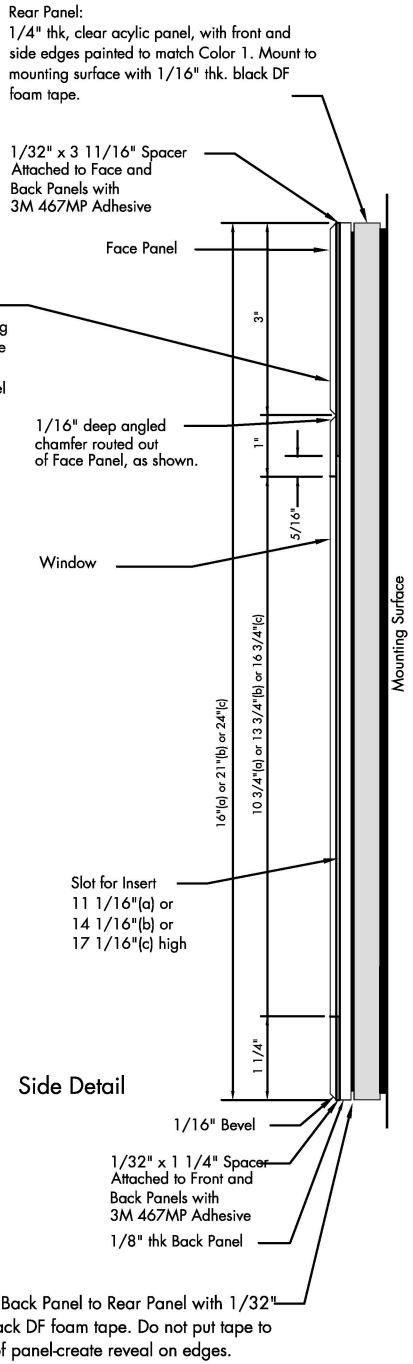
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FACE PANEL:
Variable height and width x 1/16" thk face plate with 1/8" thk back panel separated by 1/32" thk. spacer to create slot for insert. Attach using 3M 467MP adhesive. Face plate with 1/16" chamfered edges. Rear Plate and Spacer painted Color 1. Mask and subsurface spray Front Plate leaving 1 1/2" H clear window for insert. Mount Face Panel to Rear Panel with 1/16" foam tape to create reveal.

NOTE: For sign locations where the sign is to be mounted on glass, apply a piece of 2 mil high performance Arlon Silver Metallic Vinyl to the front of the glass first. The vinyl should be the same size as the sign. Then mount the sign to the vinyl using foam tape and a silicone adhesive.

Text:
Typeface: Futura Book
Size: Will vary from sign to sign per application.



DEPARTMENTAL DIRECTORIES

WALL MOUNTED INFORMATION SIGN - SINGLE SHEET HOLDER

NOTE: THIS SIGN IS USED TO HOLD A SINGLE 8 1/2" X 11"(a), 8 1/2" X 14"(b) OR 11" X 17"(c) SHEET OF PAPER.

SIGN TYPE N8a, b & c (With Header)

DRAWING NO. NS-15 DF

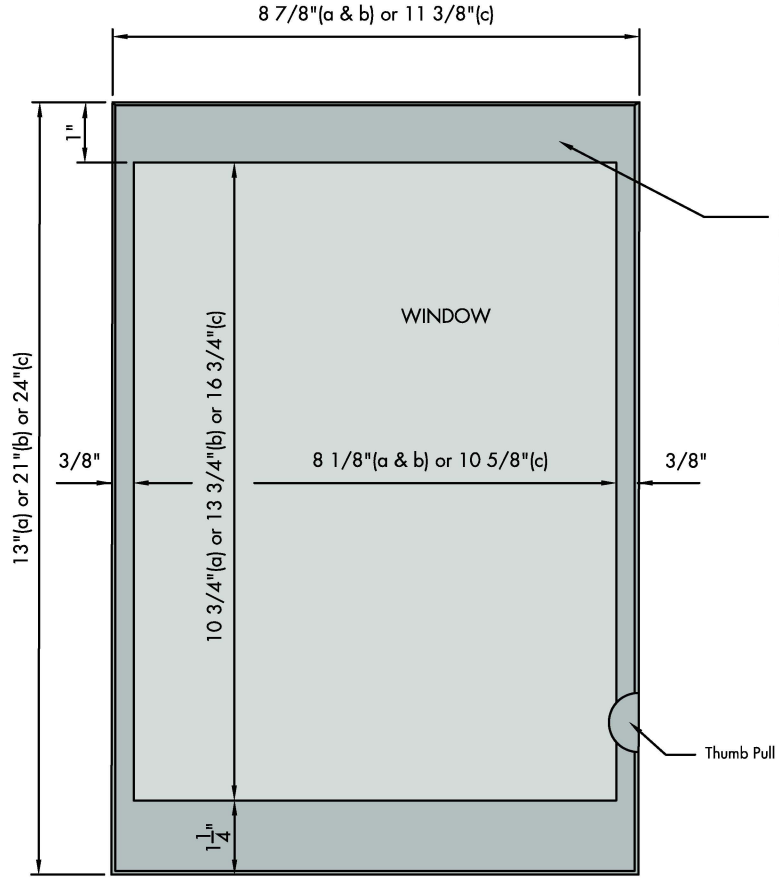
TEMPLE UNIVERSITY SIGNAGE
NEW SIGNAGE STANDARD

SIGN TYPE N8A, B, & C
WALL MOUNTED SHEET HOLDER

PROJECT NO.: GENERAL SIGNAGE
DATE: 11-10-11
SCALE: NTS
DRAWN BY: SW
CHECKED BY:

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1101 W. Montgomery Ave
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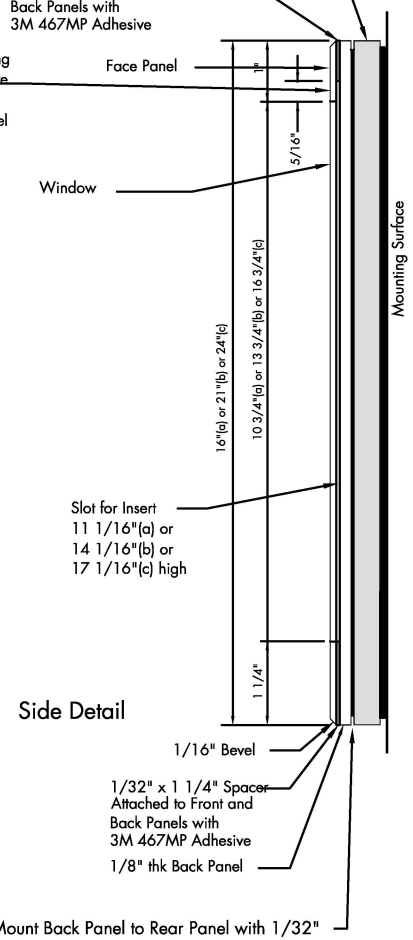


FACE PANEL:
Variable height and width x 1/16" thk face plate with 1/8" thk back panel separated by 1/32" thk. spacer to create slot for insert. Attach using 3M 467MP adhesive. Face plate with 1/16" chamfered edges. Rear Plate and Spacer painted Color 1. Mask and subsurface spray Front Plate leaving 1 1/2" H clear window for insert. Mount Face Panel to Rear Panel with 1/16" foam tape to create reveal.

NOTE: For sign locations where the sign is to be mounted on glass, apply a piece of 2 mil high performance Arlon Silver Metallic Vinyl to the front of the glass first. The vinyl should be the same size as the sign. Then mount the sign to the vinyl using foam tape and a silicone adhesive.

Text:
Typeface: Futura Book
Size: Will vary from sign to sign per application.

Rear Panel:
1/4" thk, clear acylic panel, with front and side edges painted to match Color 1. Mount to mounting surface with 1/16" thk. black DF foam tape.



Side Detail

Mount Back Panel to Rear Panel with 1/32" thk. black DF foam tape. Do not put tape to edge of panel-create reveal on edges.

DEPARTMENTAL DIRECTORIES

WALL MOUNTED INFORMATION SIGN - SINGLE SHEET HOLDER

NOTE: THIS SIGN IS USED TO HOLD A SINGLE 8 1/2" X 11"(a), 8 1/2" X 14"(b) OR 11" X 17"(c) SHEET OF PAPER.

SIGN TYPE N8a, b & c (Without Header)

DRAWING NO. NS-16 OF

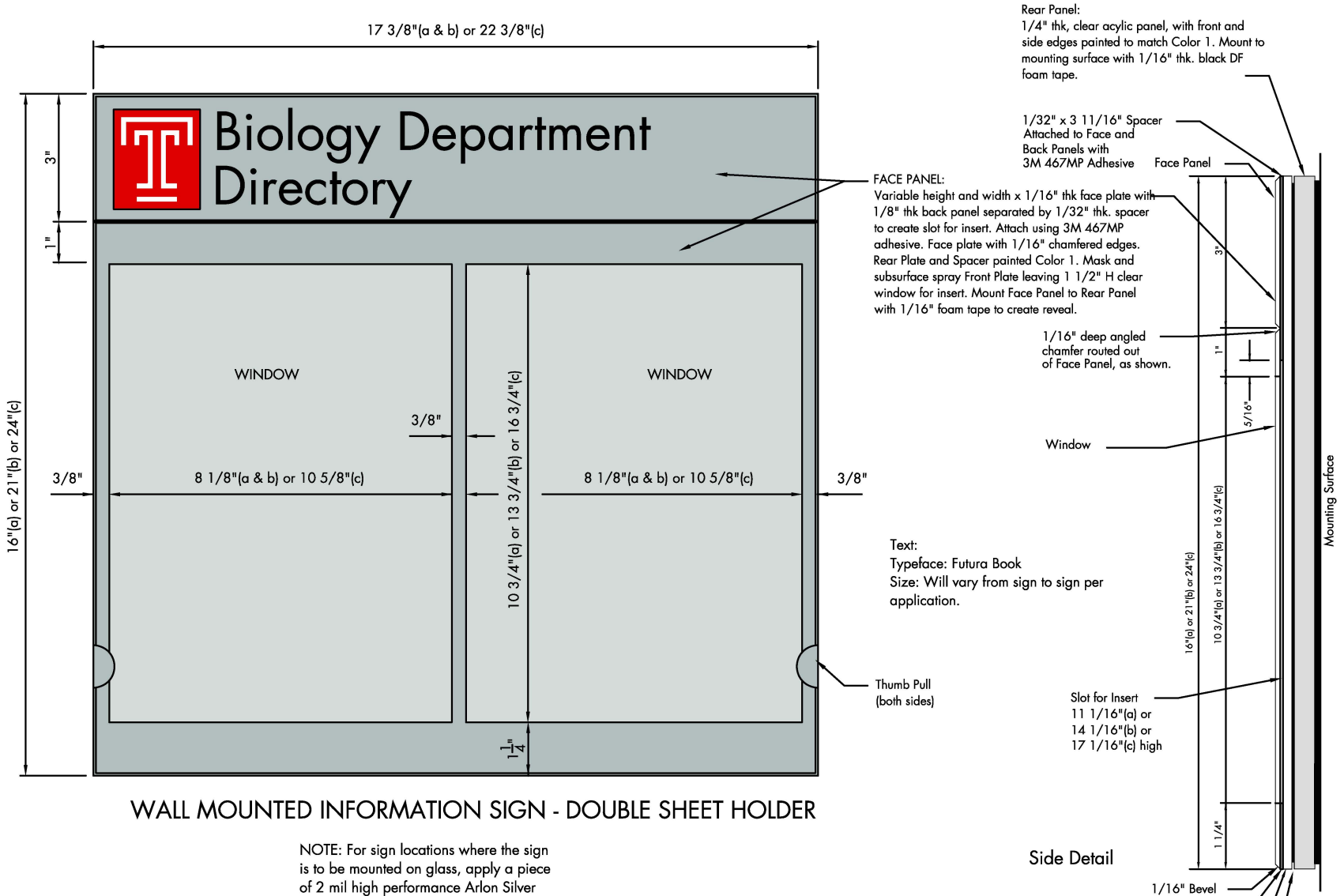
TEMPLE UNIVERSITY SIGNAGE
NEW SIGNAGE STANDARD

SIGN TYPE N8A, B, & C
WALL MOUNTED SHEET HOLDER

PROJECT NO.: GENERAL SIGNAGE
DATE: 11-10-11
SCALE: NTS
DRAWN BY: SW
CHECKED BY:

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WALL MOUNTED INFORMATION SIGN - DOUBLE SHEET HOLDER

NOTE: For sign locations where the sign is to be mounted on glass, apply a piece of 2 mil high performance Arlon Silver Metallic Vinyl to the front of the glass first. The vinyl should be the same size as the sign. Then mount the sign to the vinyl using foam tape and a silicone adhesive.

DEPARTMENTAL DIRECTORIES

NOTE: THIS SIGN IS USED TO HOLD TWO 8 1/2" X 11"(a), 8 1/2" X 14"(b) OR 11" X 17"(c) SHEETS OF PAPER.

SIGN TYPE N9a, b & c

DRAWING NO. NS-17 OF

TEMPLE UNIVERSITY SIGNAGE
NEW SIGNAGE STANDARD

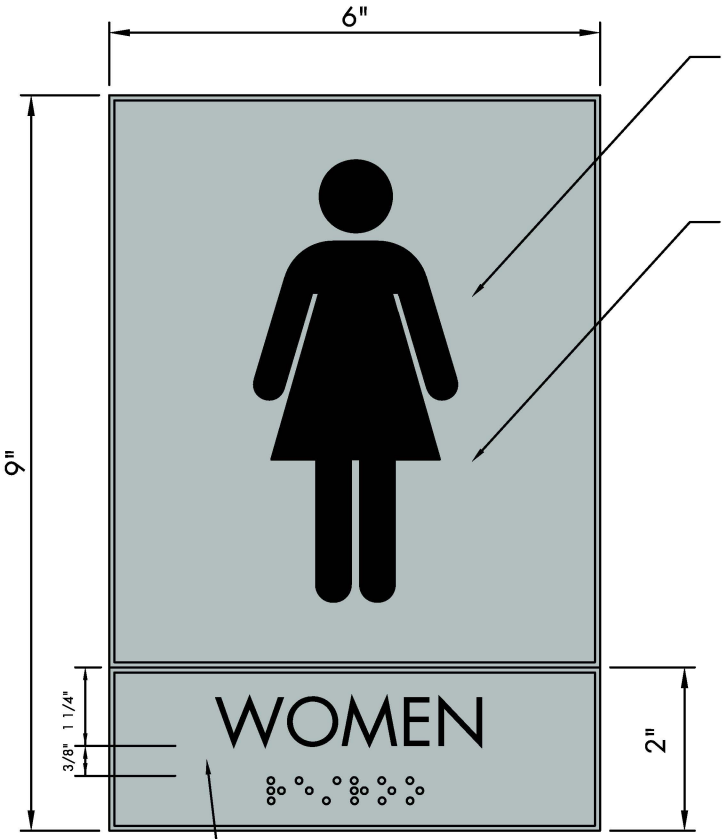
SIGN TYPE N9A, B, & C
WALL MOUNTED SHEET HOLDER

PROJECT NO.: GENERAL SIGNAGE
DATE: 11-10-16
SCALE: NTS
DRAWN BY: SW
CHECKED BY:

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SIGN TYPE R1



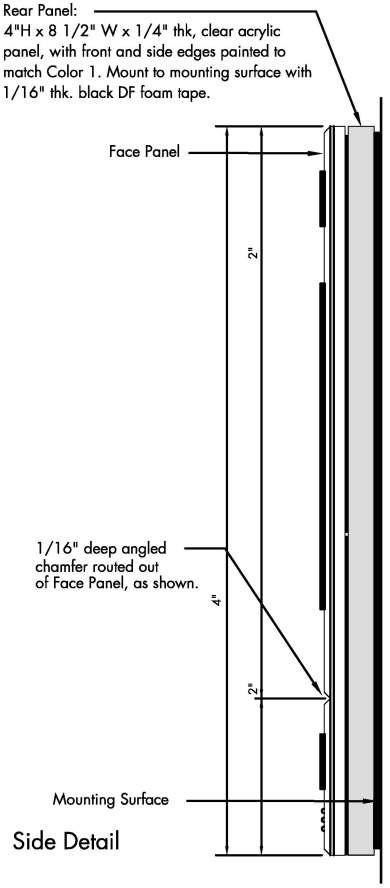
Elevation Detail

FACE PANEL:
9"H x 6"W x 1/16" thk Face Plate with 1/8" thk Back Panel. Face Plate with 1/16" chamfered edges. Attach Face Plate to Back Panel using 3M 467MP adhesive. Back Panel painted Color 1. Mount Face Panel and Back Panel to Rear Panel with 1/32" black DF foam tape to create reveal.

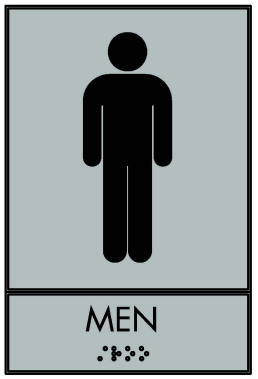
Symbol:
Applied 5" H Romark symbol, to match color Black. Center on top panel vertically and horizontally.

COPY & BRAILLE:
Applied Rowmark letters - 5/8" caps, and clear (Grade 2) Braille raster beads. Rowmark letters to match color Black. Typeface: Futura Book.

NOTE: For sign locations where the sign is to be mounted on glass, apply a piece of 2 mil high performance Arlon Silver Metallic Vinyl to the front of the glass first. The vinyl should be the same size as the sign. Then mount the sign to the vinyl using foam tape and a silicone adhesive.



Side Detail



Alternate Copy Layout:



ACCESSIBILITY SYMBOL TO COMPLY WITH 1SO 7001 DOT PICTOGRAM STANDARDS

Alternate ADA Layout:

DRAWING NO. NS-18 OF

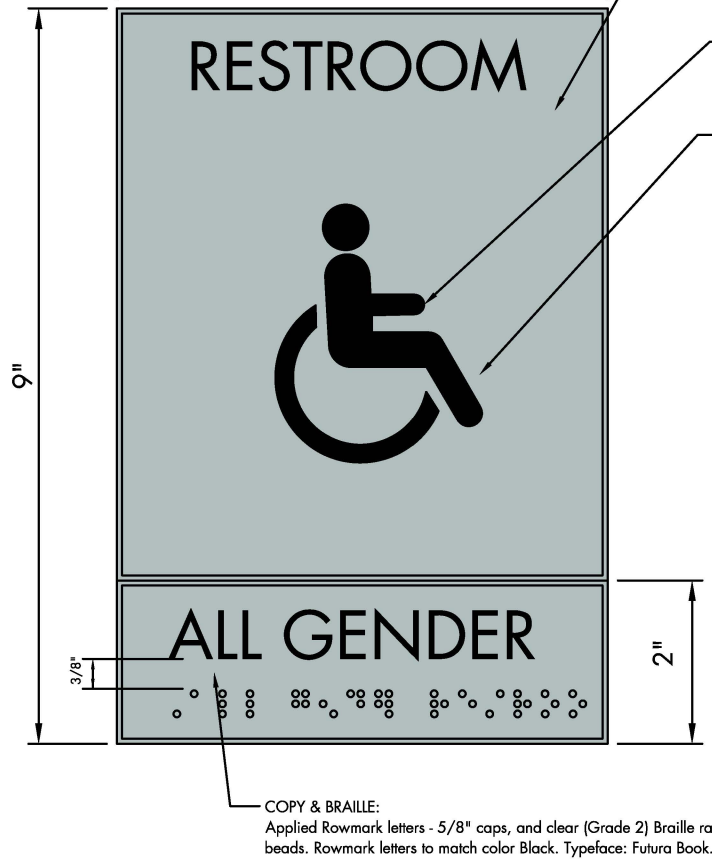
TEMPLE UNIVERSITY SIGNAGE
NEW SIGNAGE STANDARD

TYPE - R1 RESTROOM SIGN

PROJECT NO.: GENERAL SIGNAGE
DATE: 11-21-16
SCALE: NTS
DRAWN BY: SW
CHECKED BY:

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Office of Facilities Management

Planning and Design
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Philadelphia, PA 19122
Tel. (215) 204-1406
Fax (215) 204-1700



FACE PANEL:
9"H x 6"W x 1/16" thk Face Plate with 1/8" thk Back Panel. Face Plate with 1/16" chamfered edges. Attach Face Plate to Back Panel using 3M 467MP adhesive. Back Panel painted Color 1. Mount Face Panel and Back Panel to Rear Panel with 1/32" black DF foam tape to create reveal.

3" ACCESSIBILITY SYMBOL TO COMPLY WITH 1SO 7001 DOT PICTOGRAM STANDARDS

Symbol:
Applied Romark symbol, to match color Black.

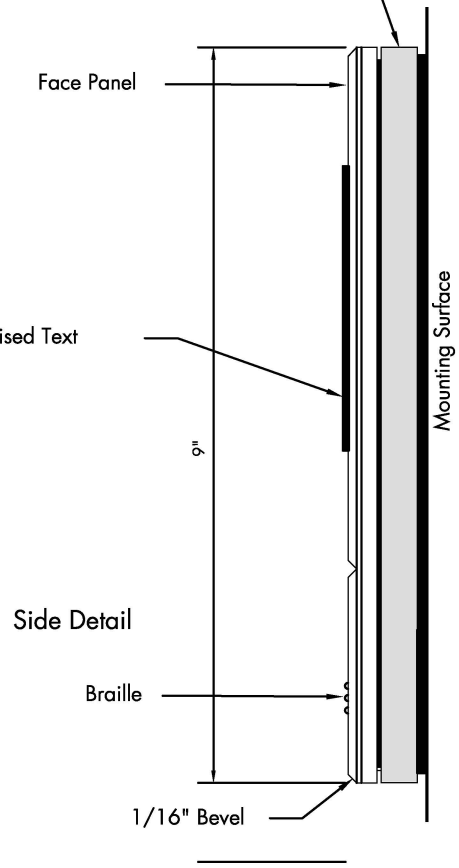
COPY & BRAILLE:
Applied Rowmark letters - 5/8" caps, and clear (Grade 2) Braille raster beads. Rowmark letters to match color Black. Typeface: Futura Book.

SIGN TYPE R2



SIGN TYPE R2a

Rear Panel:
8"H x 8" W x 1/4" thk, clear acylic panel, with front and side edges painted to match Color 1. Mount to mounting surface with 1/16" thk. black DF foam tape.



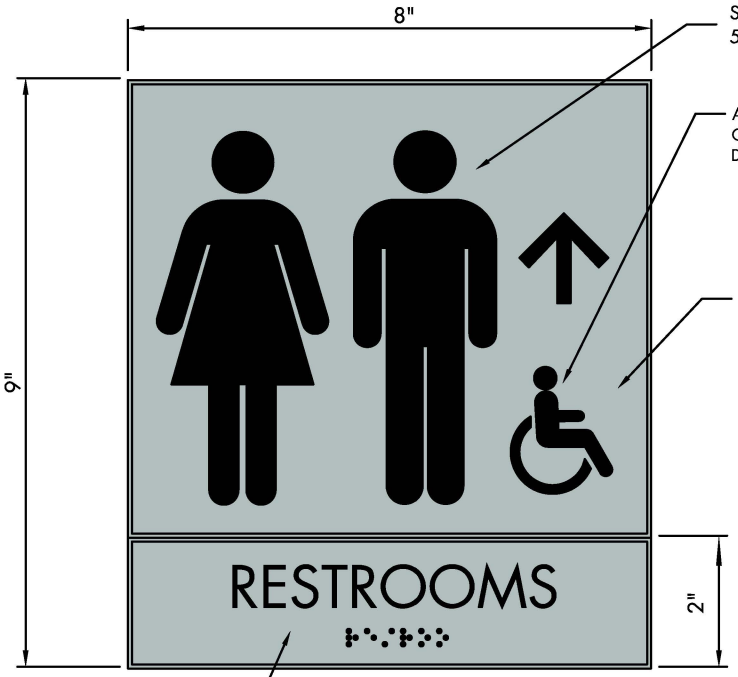
DRAWING NO. NS-19 OF

TEMPLE UNIVERSITY SIGNAGE
NEW SIGNAGE STANDARD
TYPE - R2 & 2a
ALL GENDER RESTROOM SIGN

PROJECT NO.: GENERAL SIGNAGE
DATE: 11-21-16
SCALE: NTS
DRAWN BY: SW
CHECKED BY:

TEMPLE
A Commonwealth University
Office of Facilities Management

Planning and Design
1101 W. Montgomery Ave
Philadelphia, PA 19122
Tel. (215) 204-1406
Fax (215) 204-1700



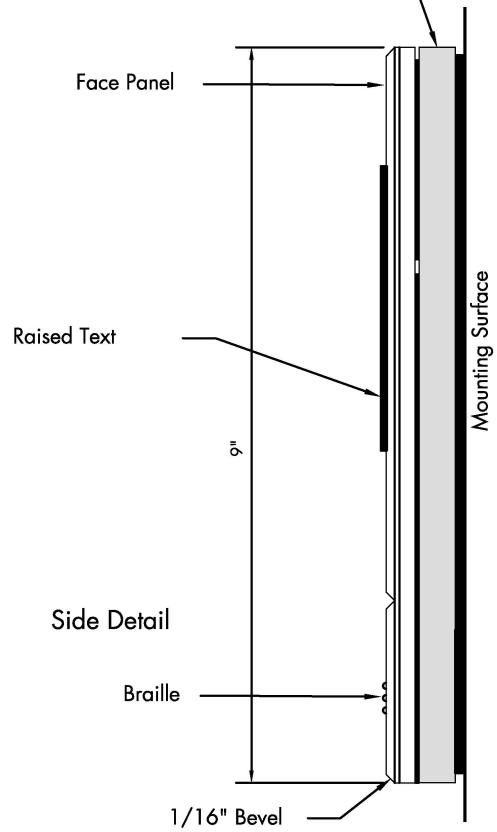
Symbol:
5" H. applied Romark symbol, to match color Black.

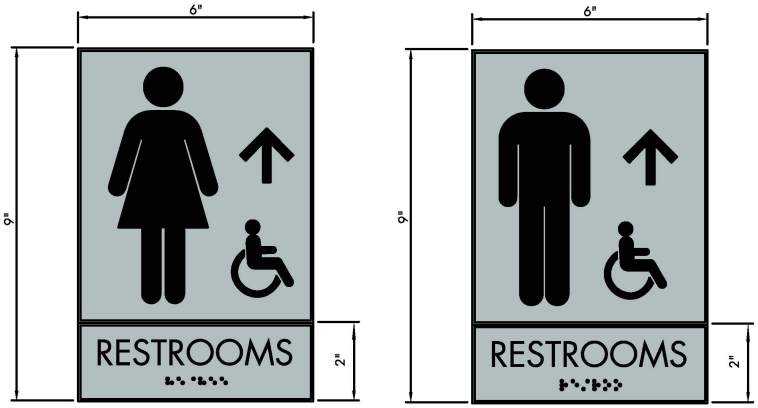
ACCESSIBILITY SYMBOL TO
COMPLY WITH 1SO 7001
DOT PICTOGRAM STANDARDS

FACE PANEL:
9"H x 6"W x 1/16" thk Face Plate with 1/8" thk Back Panel. Face Plate with 1/16" chamfered edges. Attach Face Plate to Back Panel using 3M 467MP adhesive. Back Panel painted Color 1. Mount Face Panel and Back Panel to Rear Panel with 1/32" black DF foam tape to create reveal.

COPY & BRAILLE:
Applied Rowmark letters - 5/8" caps, and clear (Grade 2) Braille raster beads. Rowmark letters to match color Black. Typeface: Futura Book.

Rear Panel:
8"H x 8" W x 1/4" thk, clear acylic panel, with front and side edges painted to match Color 1. Mount to mounting surface with 1/16" thk. black DF foam tape.





Alternate Copy Layout:

SIGN TYPE R3

DRAWING NO. NS-20 OF

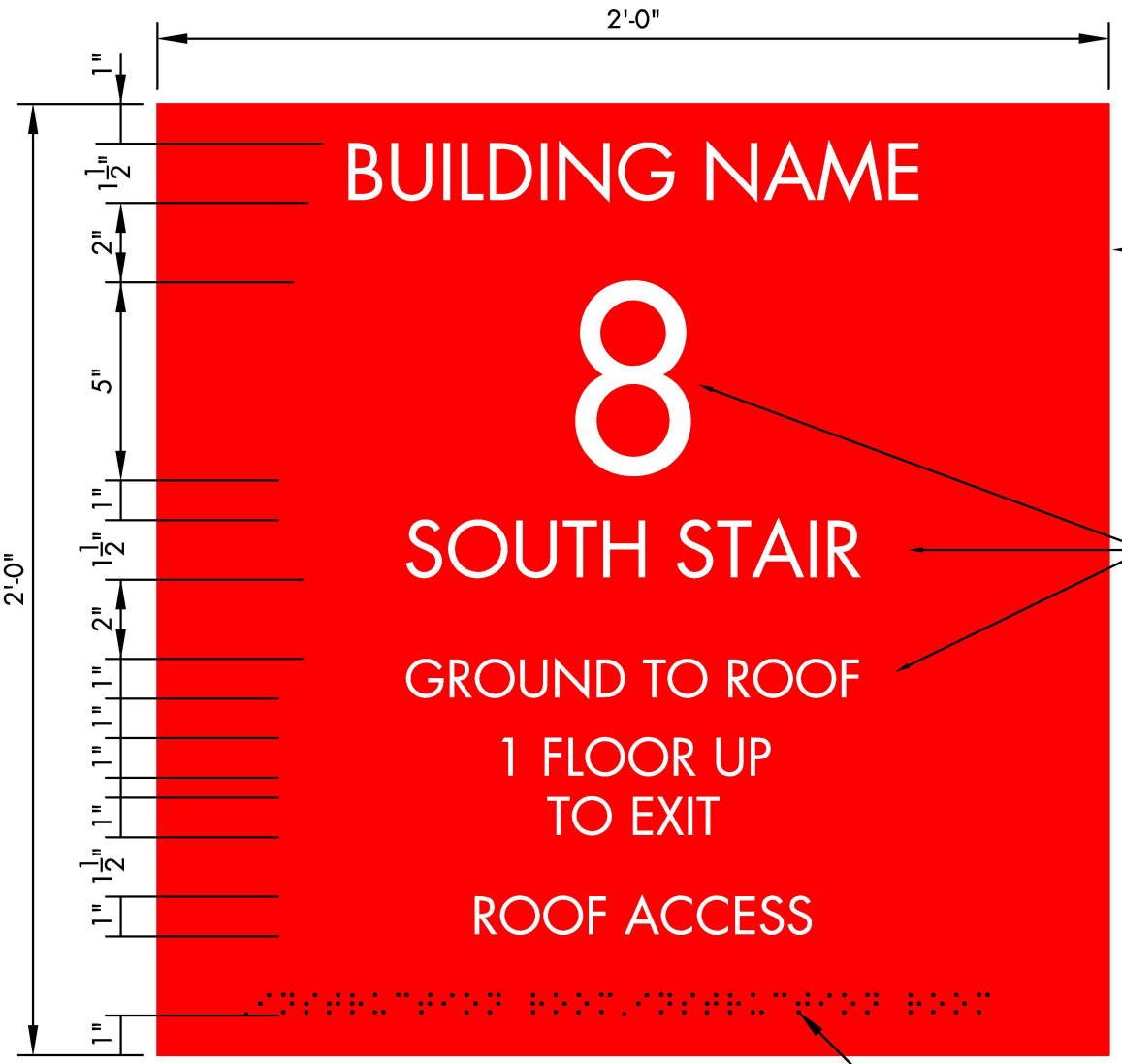
TEMPLE UNIVERSITY SIGNAGE
NEW SIGNAGE STANDARD

TYPE - R4 RESTROOM
DIRECTIONAL SIGNS

PROJECT NO.: GENERAL SIGNAGE
DATE: 11-21-16
SCALE: NTS
DRAWN BY: SW
CHECKED BY:

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Office of Facilities Management

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Philadelphia, PA 19122
Tel. (215) 204-1406
Fax (215) 204-1700



Sign Panel:
2'-0"H x 2'-0"W x 1/8" thk. acrylic panel.
Mount to wall with 1/16" thk. DF foam tape and clear silicone.

Text:
Typeface: Futura Book
Size: As noted. Photoluminescent graphics as per IFC-1024.4. Direct Print Color #2 background on photoluminescent sheeting, leaving graphics "open".

Clear Braille raster beads.
Include Floor #, Stair ID, and Number of floors to exit

SIGN TYPE S1

DRAWING NO. NS-21 OF

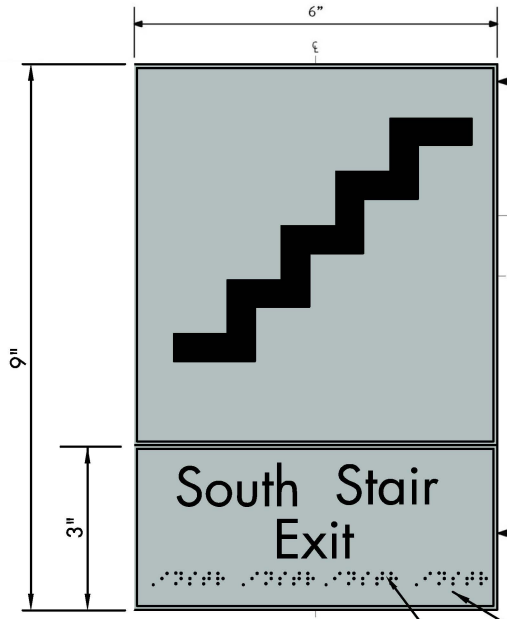
TEMPLE UNIVERSITY SIGNAGE
NEW SIGNAGE STANDARD

S1 STAIRWELL INTERIOR SIGN

PROJECT NO.: GENERAL SIGNAGE
DATE: 11-21-16
SCALE: NTS
DRAWN BY: SW
CHECKED BY:

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Office of Facilities Management

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Detail:

Top Face Panel:
7"H x 6"W x 1/8" thk. matte acrylic panel with 1/16" chamfered edges, subsurface painted to match color 1. Mount Face Panel to Back Panel with 1/32" thk. black DF foam tape.

Symbol:
4"H applied Romark symbol, to match color Black. Center Symbol vertically and horizontally on Top Face Panel.

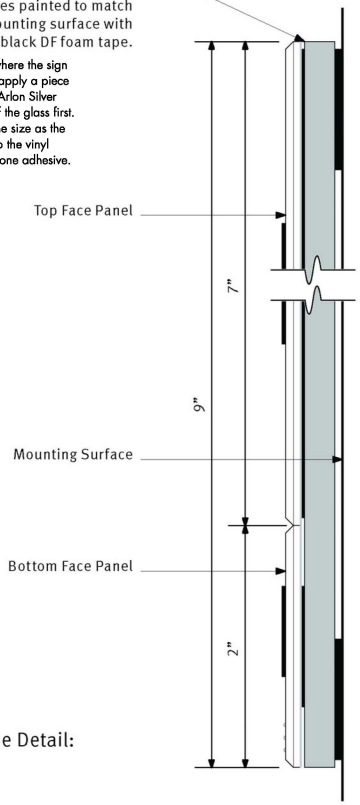
Bottom Face Panel:
2"H x 6"W x 1/8" thk. matte acrylic panel with 1/16" chamfered edges, subsurface painted to match color 1. Mount Face Panel to Back Panel with 1/32" thk. black DF foam tape.

Copy & Braille:
Applied Romark letters - 3/4"H caps, and clear Braille raster beads. Romark letters to match color Black. Typeface: Futura Book

IN NEW CONSTRUCTION, EXIT STAIRS ARE GIVEN DESCRIPTIVE NAMES SUCH AS "NORTH STAIR", "WEST STAIR", ETC. THE WORD "EXIT" MUST ALSO BE INVLUDED. IF THE STAIR NAME REQUIRES THE BOTTOM FACE PANEL TO BE ENLARGED, THIS IS PERMITTED.

Back Panel:
9"H x 6"W x 1/4" thk. clear acrylic panel, with front & side edges painted to match color 1. Mount to mounting surface with 1/16" thk. black DF foam tape.

NOTE: For sign locations where the sign is to be mounted on glass, apply a piece of 2 mil high performance Arlon Silver Metallic Vinyl to the front of the glass first. The vinyl should be the same size as the sign. Then mount the sign to the vinyl using foam tape and a silicone adhesive.



Side Detail:

SIGN TYPE S2

DRAWING NO. NS-22 OF

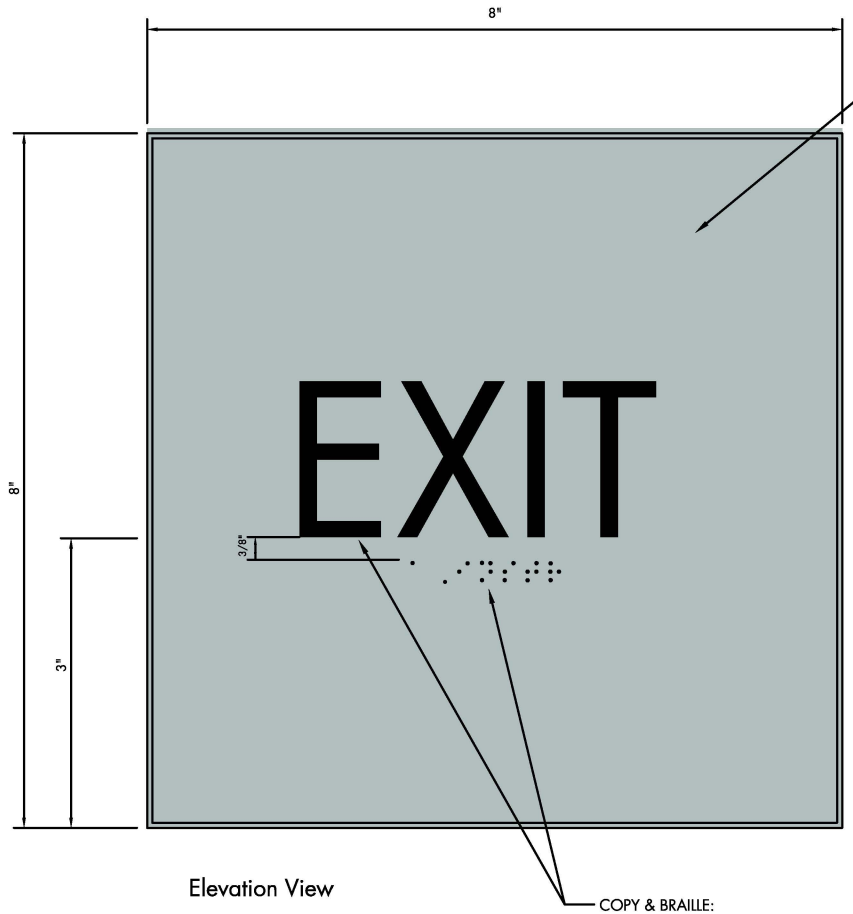
TEMPLE UNIVERSITY SIGNAGE
NEW SIGNAGE STANDARD

TYPE - S2 STAIRWAY
IDENTIFICATION SIGN

PROJECT NO.: GENERAL SIGNAGE
DATE: 11-21-16
SCALE: NTS
DRAWN BY: SW
CHECKED BY:

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Office of Facilities Management

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Fax (215) 204-1700



Elevation View

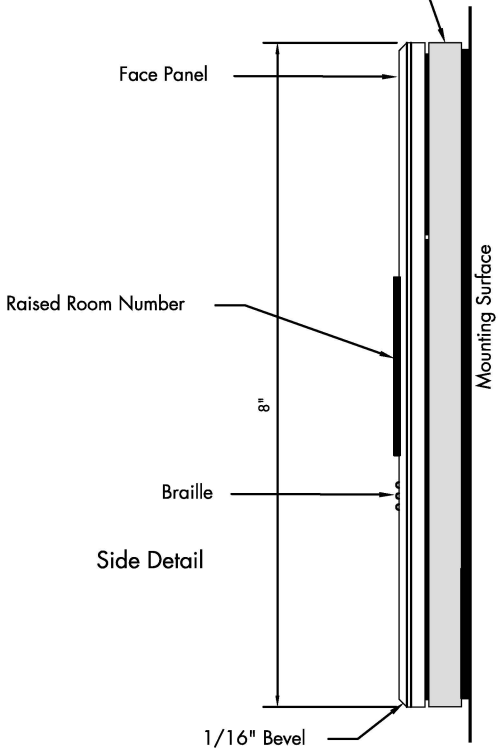
FACE PANEL:
8"H x 8"W x 1/8" thk. matte acrylic panel with 1/16" chamfered edges, subsurface painted to match Color 1. Mount Face Panel to Rear Panel with 1/32" thk. black DF foam tape to create reveal.

COPY & BRAILLE:
Applied Rowmark letters - 2" caps, and clear Braille raster beads. Rowmark letters to match color Black. Typeface: Futura Book.

NOTE: For sign locations where the sign is to be mounted to glass, apply 6 1/2"H x 8 1/2" W vinyl rectangle to opposite side of glass to hide mounting tape. Vinyl to match sign paint color.

NOTE: For sign locations where the sign is to be mounted on glass, apply a piece of 2 mil high performance Arlon Silver Metallic Vinyl to the front of the glass first. The vinyl should be the same size as the sign. Then mount the sign to the vinyl using foam tape and a silicone adhesive.

Rear Panel:
8"H x 8" W x 1/4" thk, clear acylic panel, with front and side edges painted to match Color 1. Mount to mounting surface with 1/16" thk. black DF foam tape.



Side Detail

NOTE: The Type S3 SIGN SHOULD BE USED WHERE REQUIRED BY THE IBC CODE SECTION 1011.3.

SIGN TYPE S3

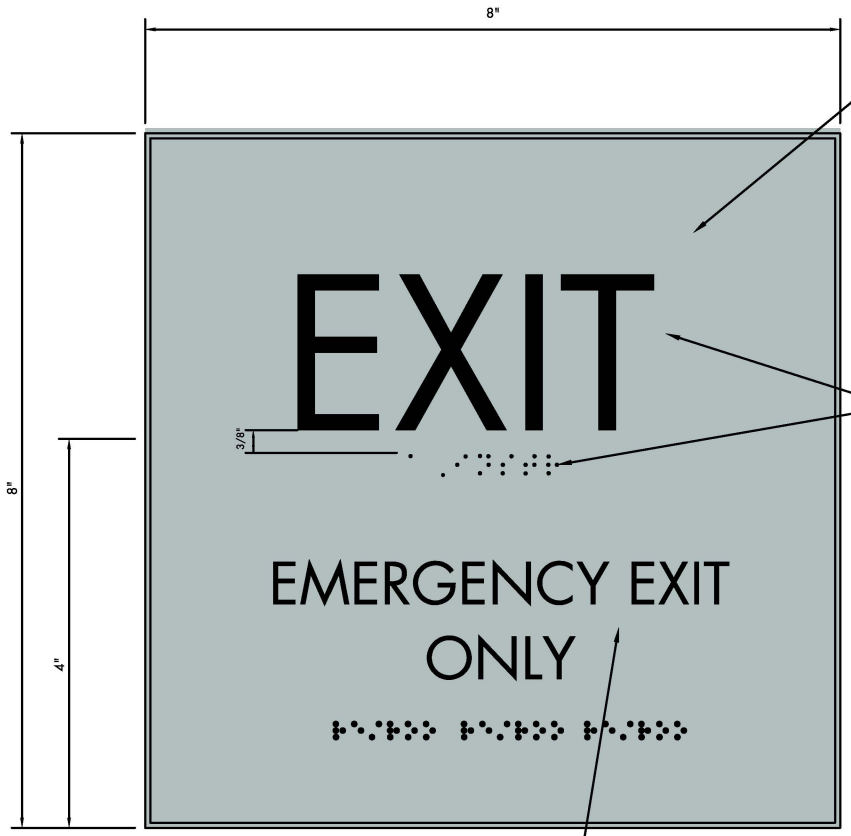
DRAWING NO. NS-23 OF

TEMPLE UNIVERSITY SIGNAGE
NEW SIGNAGE STANDARD
TYPE - S3 EXIT SIGN
TACTILE EXIT SIGN

PROJECT NO.: GENERAL SIGNAGE
DATE: 11-21-16
SCALE: NTS
DRAWN BY: SW
CHECKED BY:

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A Commonwealth University
Office of Facilities Management

Planning and Design
1101 W. Montgomery Ave
Philadelphia, PA 19122
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Fax (215) 204-1700



Elevation View

FACE PANEL:
8"H x 8"W x 1/8" thk. matte acrylic panel with 1/16" chamfered edges, subsurface painted to match Color 1. Mount Face Panel to Rear Panel with 1/32" thk. black DF foam tape to create reveal.

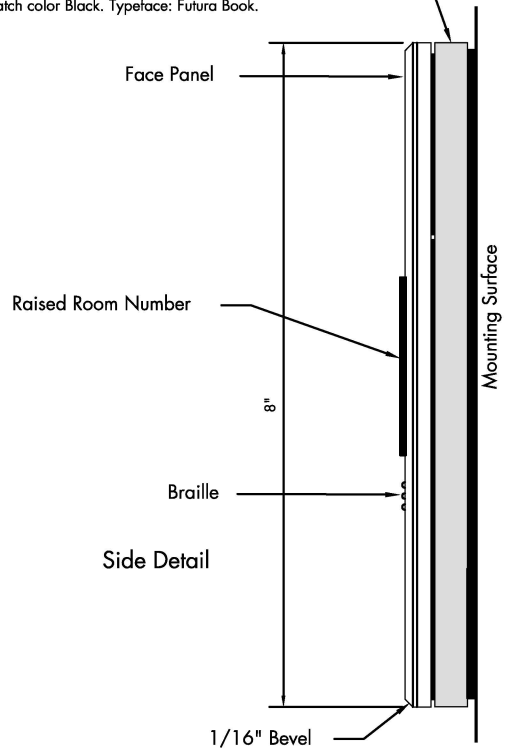
COPY & BRAILLE:
Applied Rowmark letters - 2" caps, and clear Braille raster beads. Rowmark letters to match color Black. Typeface: Futura Book.

COPY & BRAILLE:
Applied Rowmark letters - 5/8" caps, and clear (Grade 2) Braille raster beads. Rowmark letters to match color Black. Typeface: Futura Book.

NOTE: For sign locations where the sign is to be mounted to glass, apply 6 1/2"H x 8 1/2" W vinyl rectangle to opposite side of glass to hide mounting tape. Vinyl to match sign paint color.

NOTE: For sign locations where the sign is to be mounted on glass, apply a piece of 2 mil high performance Arlon Silver Metallic Vinyl to the front of the glass first. The vinyl should be the same size as the sign. Then mount the sign to the vinyl using foam tape and a silicone adhesive.

Rear Panel:
8"H x 8" W x 1/4" thk, clear acylic panel, with front and side edges painted to match Color 1. Mount to mounting surface with 1/16" thk. black DF foam tape.



Side Detail

NOTE: The Type S3a SIGN SHOULD BE USED WHERE REQUIRED BY THE IBC CODE SECTION 1011.3.

SIGN TYPE S3a

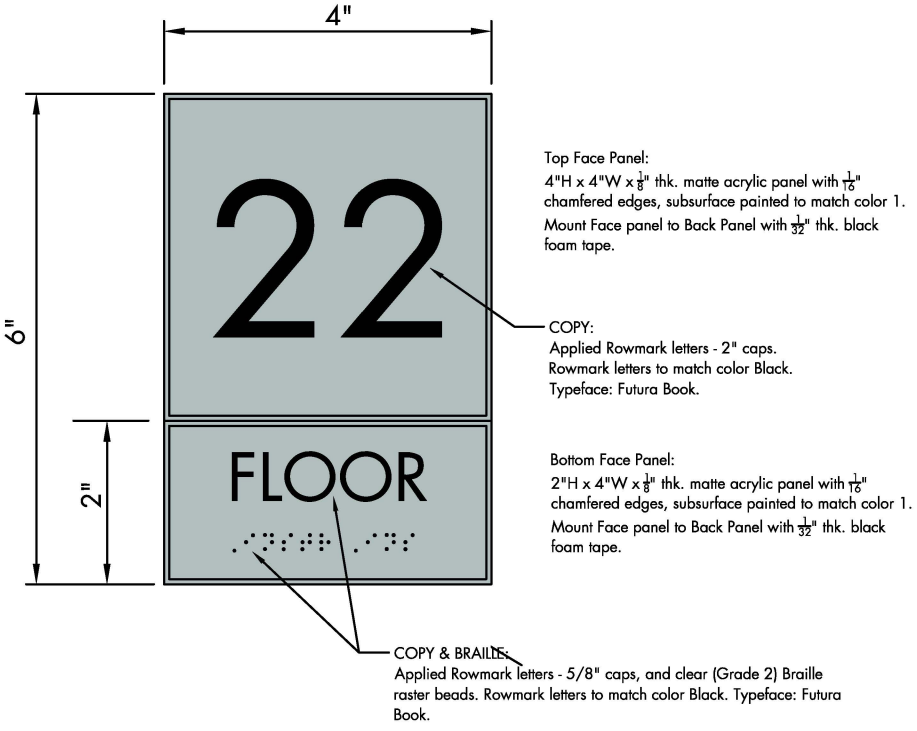
DRAWING NO. NS-24 OF

TEMPLE UNIVERSITY SIGNAGE
NEW SIGNAGE STANDARD
TYPE - S3a EXIT SIGN
TACTILE EXIT/EMERGENCY EXIT ONLY SIGN

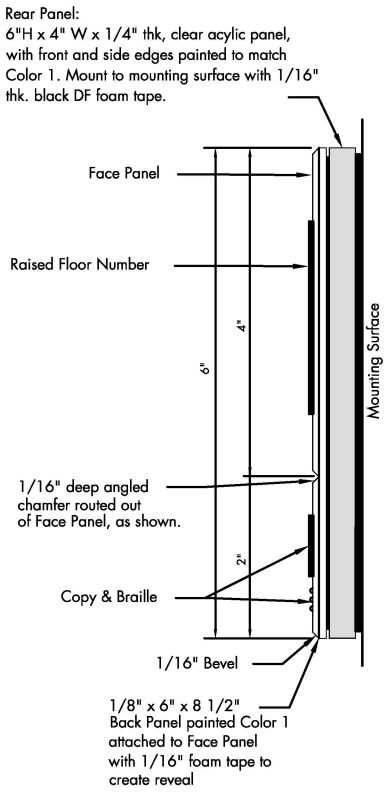
PROJECT NO.: GENERAL SIGNAGE
DATE: 11-21-16
SCALE: NTS
DRAWN BY: SW
CHECKED BY:

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Office of Facilities Management

Planning and Design
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Fax (215) 204-1700



Elevation Detail



Side Detail

SIGN TYPE S4

DRAWING NO.	NS-25
	DF

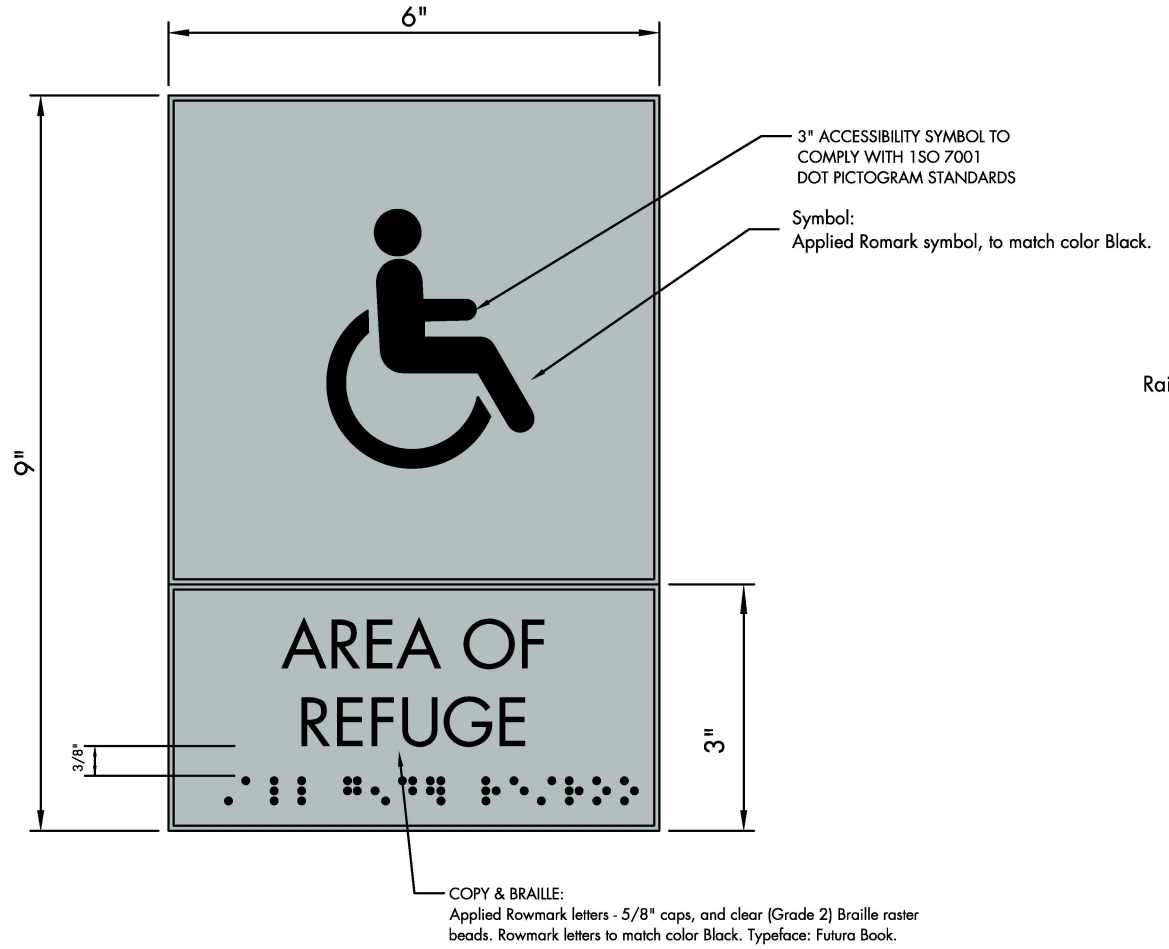
TEMPLE UNIVERSITY SIGNAGE
NEW SIGNAGE STANDARD

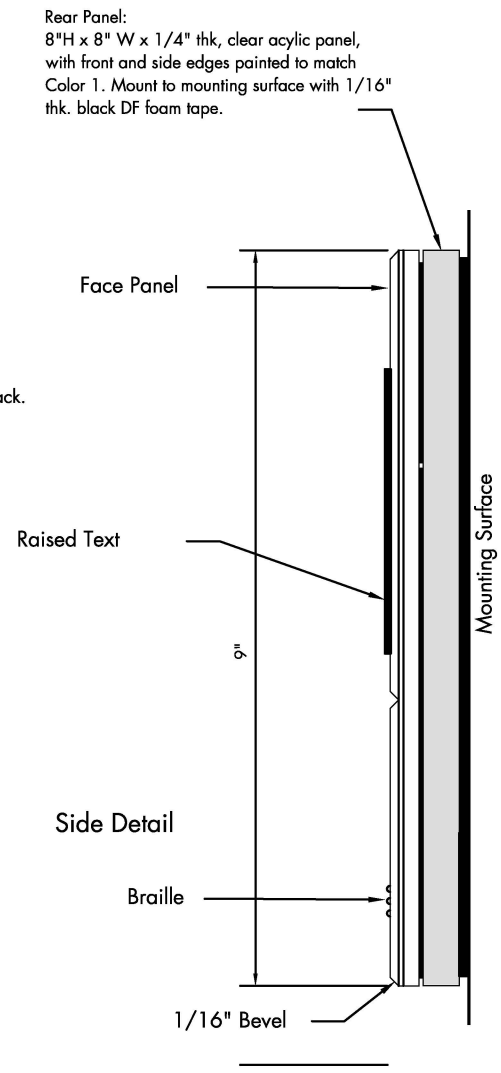
TYPE - S4 STAIRWAY
FLOOR IDENTIFICATION SIGN

PROJECT NO.:	GENERAL SIGNAGE
DATE:	1-8-2020
SCALE:	NTS
DRAWN BY:	SW
CHECKED BY:	

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SIGN TYPE S5

DRAWING NO. NS-26 OF

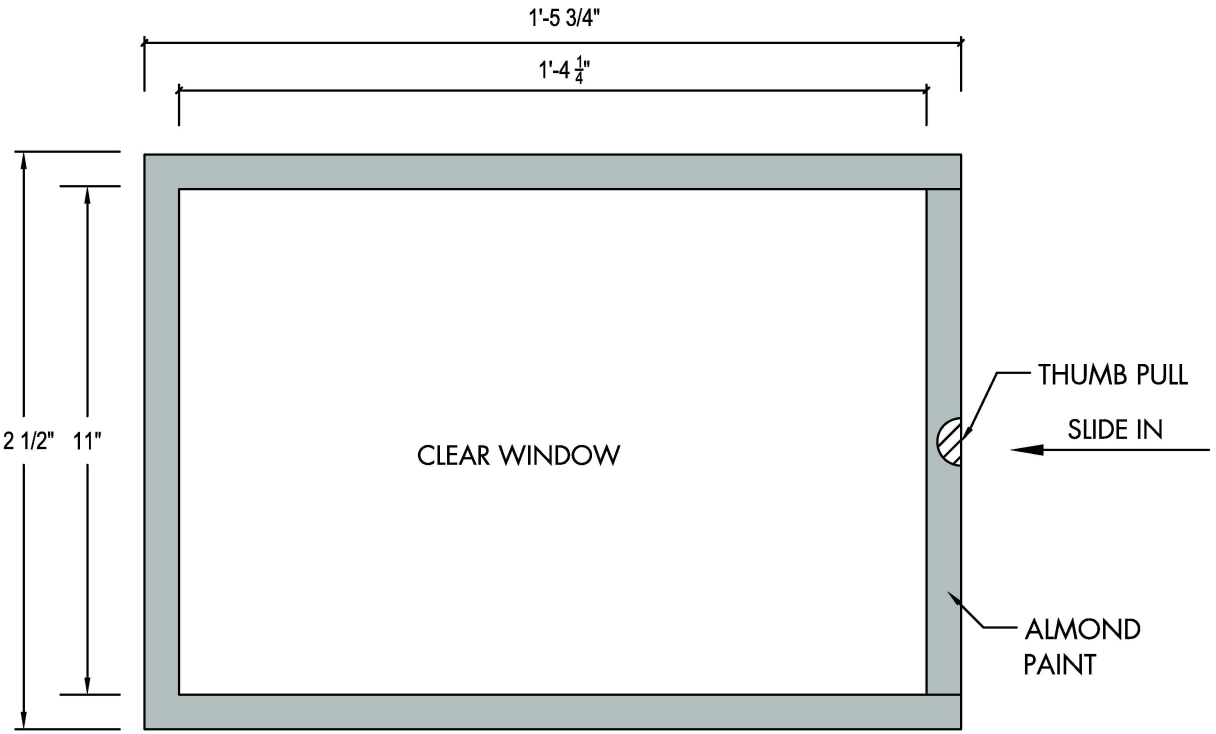
TEMPLE UNIVERSITY SIGNAGE
NEW SIGNAGE STANDARD

TYPE - S5
AREA OF REFUGE SIGN

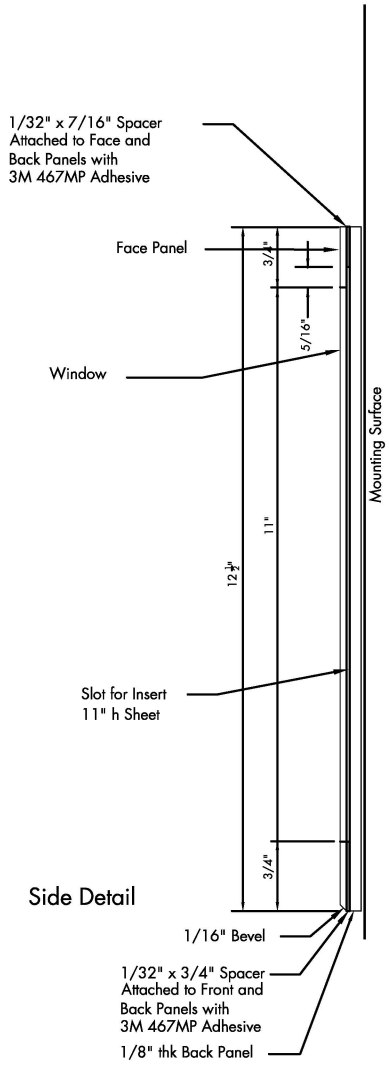
PROJECT NO.: GENERAL SIGNAGE
DATE: 9-12-18
SCALE: NTS
DRAWN BY: SW
CHECKED BY:

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EVACUATION MAP HOLDER
(EMH)



Side Detail

DRAWING NO. NS-27 OF

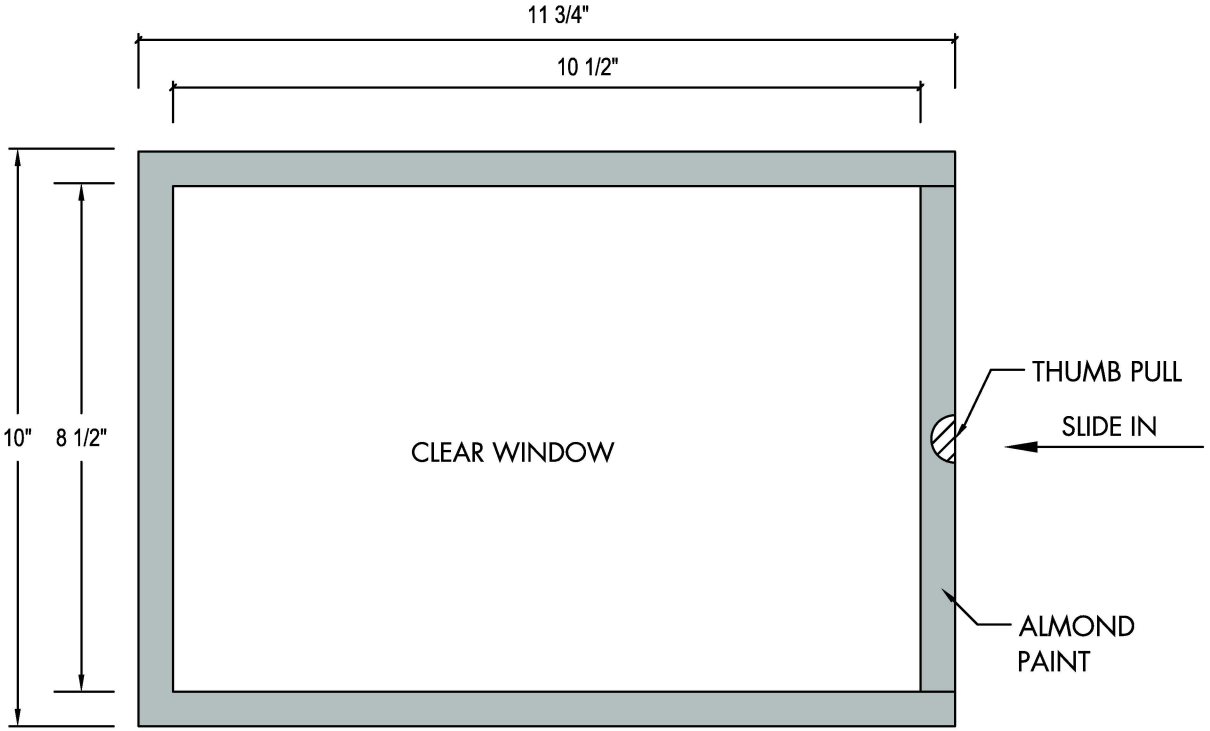
TEMPLE UNIVERSITY SIGNAGE
NEW SIGNAGE STANDARD

TYPE - EMH
EVACUATION MAP HOLDER

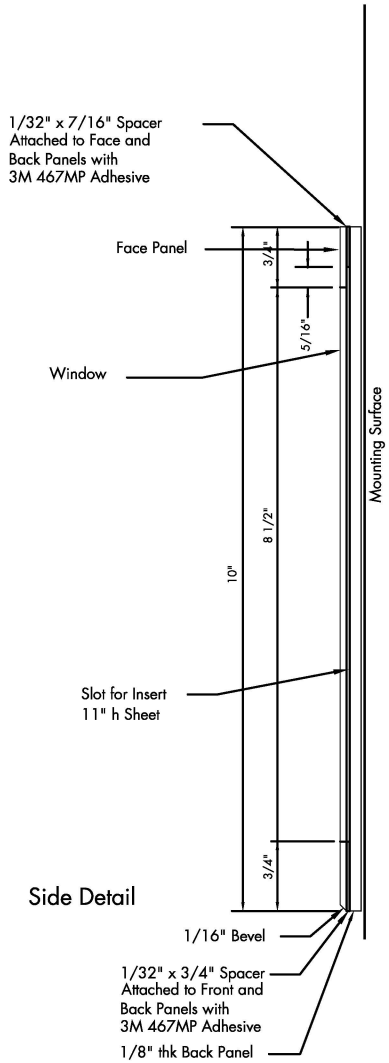
PROJECT NO.: GENERAL SIGNAGE
DATE: 11-21-16
SCALE: NTS
DRAWN BY: SW
CHECKED BY:

TEMPLE
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Office of Facilities Management

Planning and Design
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ROOM OCCUPANCY SIGN HOLDER
(ROSH)



Side Detail

DRAWING NO. NS-28 OF

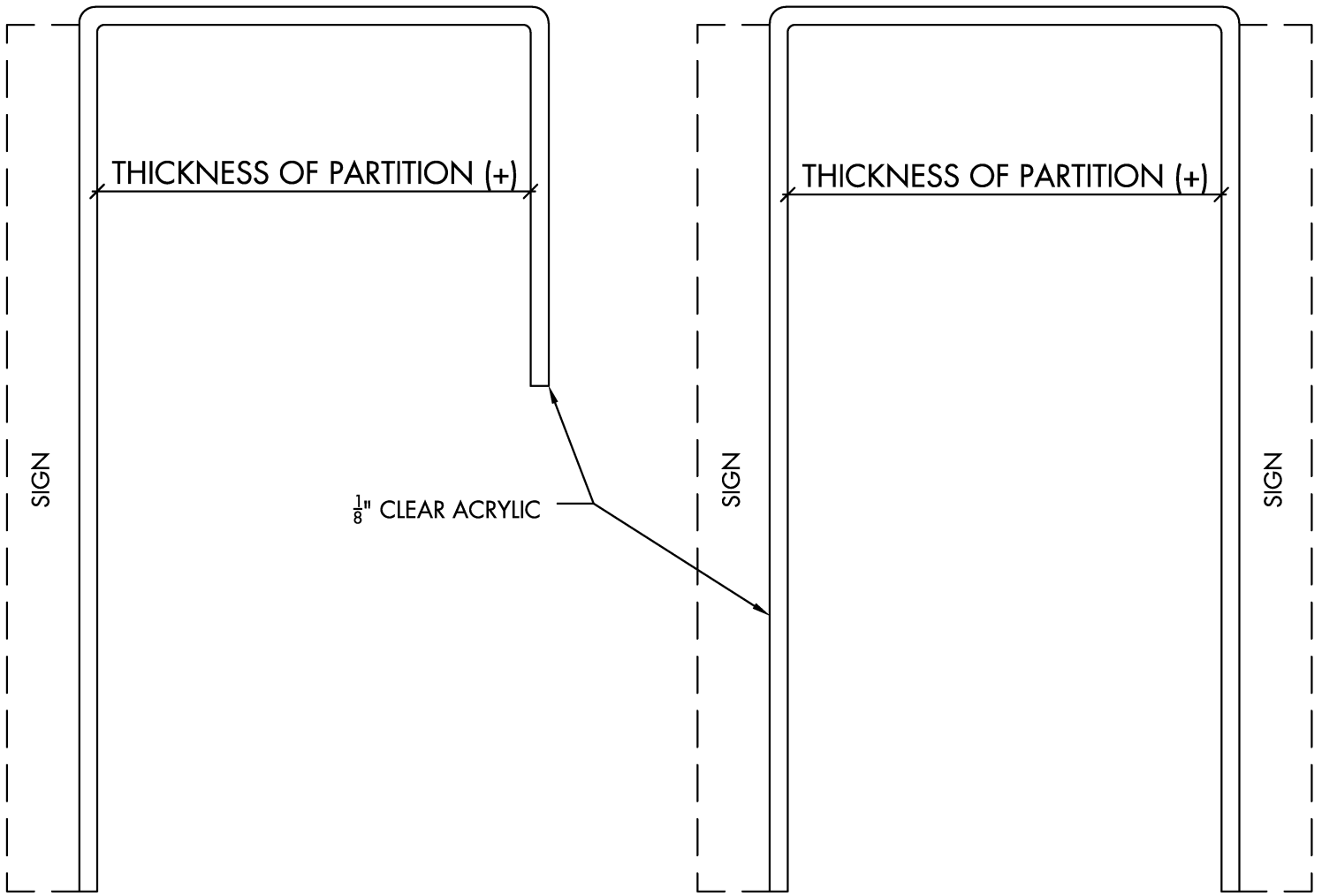
TEMPLE UNIVERSITY SIGNAGE
NEW SIGNAGE STANDARD

TYPE - ROSH
ROOM OCCUPANCY SIGN HOLDER

PROJECT NO.: GENERAL SIGNAGE
DATE: 11-21-16
SCALE: NTS
DRAWN BY: SW
CHECKED BY:

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Philadelphia, PA 19122
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SINGLE PARTITION BRACKET

DOUBLE PARTITION BRACKET

WHEN SIGNS NEED TO BE MOUNTED ON CUBICLE PARTITION, THESE BRACKETS SHOULD BE USED.

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PROJECT NO.: GENERAL SIGNAGE
DATE: 1-17-2020
SCALE: NTS
DRAWN BY: SW
CHECKED BY:

TEMPLE UNIVERSITY SIGNAGE
NEW SIGNAGE STANDARD
PARTITION MOUNTING BRACKETS

DRAWING NO. NS-29
OF

Interior College, School, and Departmental Signs

Large interior signs denoting Colleges, Schools, and Departments can be done in a number of different ways. The exact design of the sign will depend on the location, the function, and the intended audience. The Temple Standards can only provide guidelines for this sort of sign and each instance will have to be evaluated based upon the specific circumstances.

Materials: These will usually be pin letter signs made of solid brushed aluminum. Occasionally, letters will be fabricated, typically of stainless steel. Less commonly, they may fabricated with acrylic plastic.

Standard Components:

COLLEGE NAME: i.e. COLLEGE OF ENGINEERING This is typically done in all capitals. Font: Gotham Medium.

Department Name: i.e. Accounting Department This is typically done in upper and lower case. Font: Gotham Medium.

TEMPLE UNIVERSITY Including Temple University will be relatively rare since it is assumed that anyone reading the sign will already know they are at Temple university. However, if the location is one of unusual prominence where the outside public will be a frequent visitor then using Temple University may be appropriate. Normally in all capitals. Font: Swift Bold.

TEMPLE LOGO: The Temple Logo is a combination of the Temple "T" and the name Temple University. It can also sometimes include the name of a college. The use of the Temple Logo is strictly regulated and defined by the Department of Strategic Marketing. Any usage of the Logo or any use of the elements making up the Logo in combination must be approved by Strategic Marketing.

TEMPLE "T": The Temple "T" can be used alone or in combination with college or department names as long as it does not approximate the Temple Logo as mentioned above. The "T" can be made of brushed aluminum or acrylic plastic. Usage of the "T" must follow the guidelines defined by Strategic Marketing.

BRUSHED ALUMINUM PIN LETTER
FONT: SWIFT BOLD
SIZE & THICKNESS WILL VARY BY
LOCATION. ALL CAPS

TEMPLE UNIVERSITY

COLLEGE NAME
Department Name

BRUSHED ALUMINUM PIN LETTERS
FONT: GOTHAM MEDIUM
SIZE WILL VARY BY LOCATION
ALL CAPS

BRUSHED ALUMINUM PIN LETTERS
FONT: GOTHAM MEDIUM
SIZE WILL VARY BY LOCATION
UPPER & LOWER

P-1d UNIVERSITY NAME WITH COLLEGE AND DEPARTMENT
CENTER JUSTIFIED (LEFT JUSTIFIED IS ALSO PERMITTED)

COLLEGE NAME
Department Name

BRUSHED ALUMINUM PIN LETTERS
FONT: GOTHAM MEDIUM
SIZE WILL VARY BY LOCATION
ALL CAPS

BRUSHED ALUMINUM PIN LETTERS
FONT: GOTHAM MEDIUM
SIZE WILL VARY BY LOCATION
UPPER & LOWER

P-1e COLLEGE AND DEPARTMENT NAMES
CENTER JUSTIFIED (LEFT JUSTIFIED IS ALSO PERMITTED)

Department Name

BRUSHED ALUMINUM PIN LETTERS
FONT: GOTHAM MEDIUM
SIZE WILL VARY BY LOCATION
UPPER & LOWER

P-1f DEPARTMENT NAME

SIGN TYPE P1

DRAWING NO. NS-30 OF

TEMPLE UNIVERSITY SIGNAGE
NEW SIGNAGE STANDARD
P1 PIN LETTERS

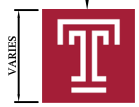
PROJECT NO.: GENERAL SIGNAGE
DATE: 3-30-2020
SCALE: NTS
DRAWN BY: SW
CHECKED BY:

TEMPLE
A Commonwealth University
Office of Facilities Management

Planning and Design
1101 W. Montgomery Ave
Philadelphia, PA 19122
Tel. (215) 204-1406
Fax (215) 204-1700

1/8" THK. ALUMINUM BACKER
PLATE PAINTED TEMPLE RED.
BRUSHED ALUMINUM TEE ATTACHED
TO FRONT. THICKNESS TO MATCH LETTERS

BRUSHED ALUMINUM PIN LETTERS
FONT: SWIFT BOLD
SIZE & THICKNESS WILL VARY BY
LOCATION. ALL CAPS



TEMPLE UNIVERSITY
COLLEGE NAME

P-1g UNIVERSITY LOGO WITH COLLEGE OR DEPARTMENT

BRUSHED ALUMINUM PIN LETTERS
FONT: GOTHAM MEDIUM
SIZE WILL VARY BY LOCATION
ALL CAPS

SIGN TYPE P1

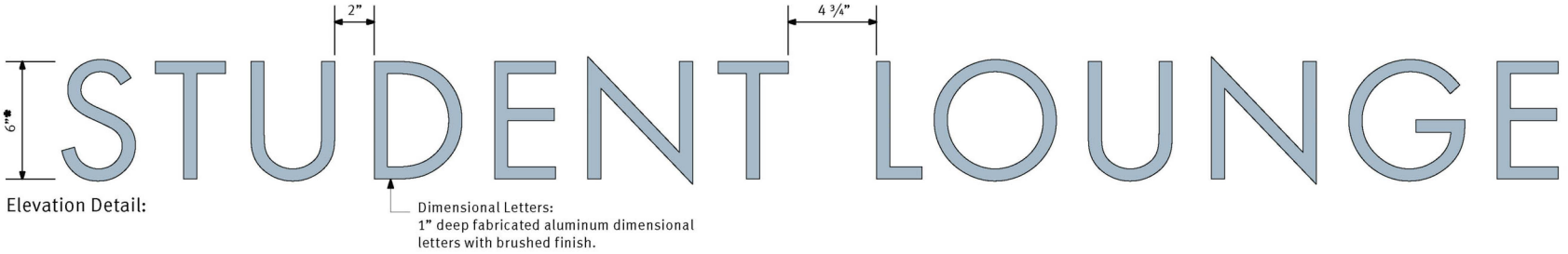
DRAWING NO. NS-31 OF

TEMPLE UNIVERSITY SIGNAGE
NEW SIGNAGE STANDARD
P1 PIN LETTERS

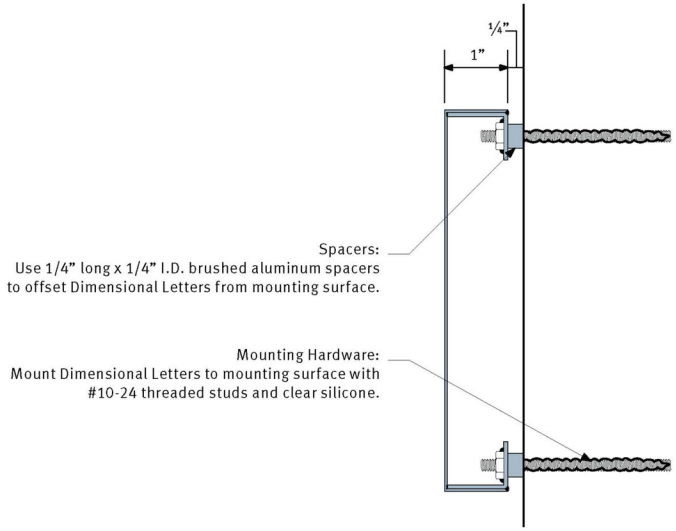
PROJECT NO.: GENERAL SIGNAGE
DATE: 3-30-2020
SCALE: NTS
DRAWN BY: SW
CHECKED BY:

TEMPLE
A Commonwealth University
Office of Facilities Management

Planning and Design
1101 W. Montgomery Ave
Philadelphia, PA 19122
Tel. (215) 204-1406
Fax (215) 204-1700



* Note: Letter size and spacing can vary for each application.
FONT: Fonts will be the standard Gotham as used
in other dimensional signs



Side Mounting Detail:

SIGN TYPE P2

FABRICATED LETTERS

For some applications, especially outdoors, it may be desirable to use fabricated dimensional which can economically have a much greater depth than cast aluminum. These can be made of either aluminum or stainless steel

DRAWING NO. NS-32 OF

TEMPLE UNIVERSITY SIGNAGE
NEW SIGNAGE STANDARD
P2 - PIN LETTERS

PROJECT NO.: GENERAL SIGNAGE
DATE: 11-21-16
SCALE: NTS
DRAWN BY: SW
CHECKED BY:

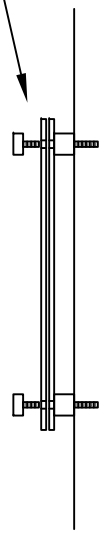
TEMPLE
A Commonwealth University
Office of Facilities Management

Planning and Design
1101 W. Montgomery Ave
Philadelphia, PA 19122
Tel. (215) 204-1406
Fax (215) 204-1700

DIGITAL PRINTED GRAPHICS ON
CLEAR PLASTIC SANDWICHED
BETWEEN TWO SHEETS OF $\frac{1}{8}$" ACRYLIC

MOUNT TO WALL
WITH ALUMINUM
PUCKS





P-3 DEPARTMENT SIGN

CLEAR ACRYLIC SIGN FOR COLLEGE, CENTER & DEPARTMENT IDENTIFICATION

This type of sign is usually used at college main offices, centers, or at department entrances. There are a variety of types and arrangements for these signs and the size will vary depending on the space in which they are located. The design should not vary from those shown here without permission.

SIGN TYPE P3

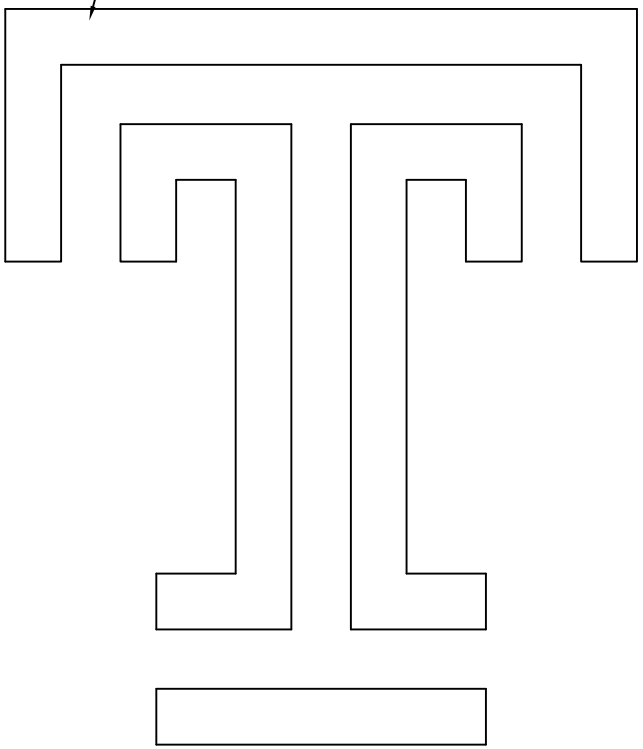
DRAWING NO. NS-33 OF

TEMPLE UNIVERSITY SIGNAGE
NEW SIGNAGE STANDARD
P3 - ACRYLIC SIGN

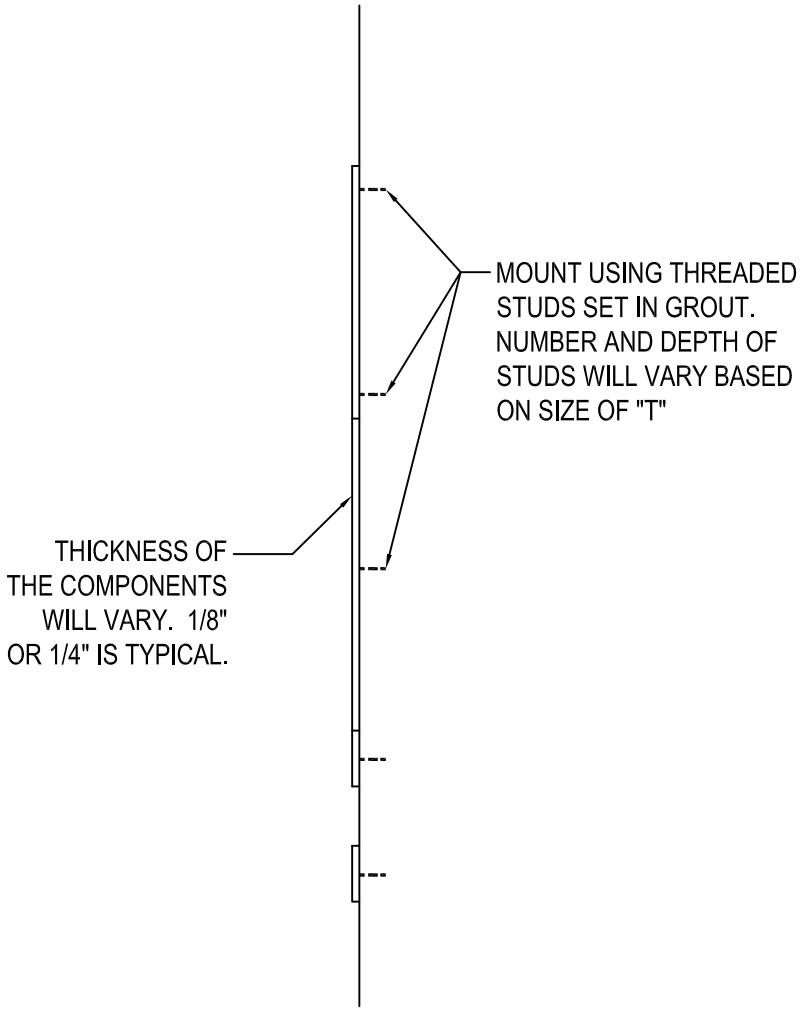
PROJECT NO.: GENERAL SIGNAGE
DATE: 11-21-16
SCALE: NTS
DRAWN BY: SW
CHECKED BY:

TEMPLE
A Commonwealth University
Office of Facilities Management

Planning and Design
1101 W. Montgomery Ave
Philadelphia, PA 19122
Tel. (215) 204-1406
Fax (215) 204-1700



Elevation View



Side Detail

TEMPLE 'T'

See the instructions on the size and arrangement of the "T" given earlier in this document.

DRAWING NO. NS-34 OF

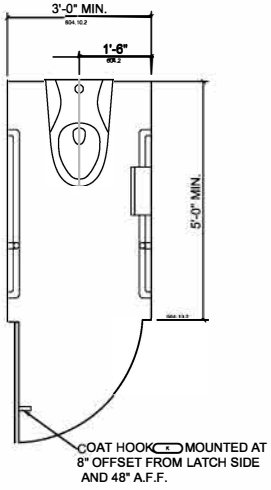
TEMPLE UNIVERSITY SIGNAGE
NEW SIGNAGE STANDARD

FABRICATED TEMPLE 'T'

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SCALE: NTS
DRAWN BY: SW
CHECKED BY:

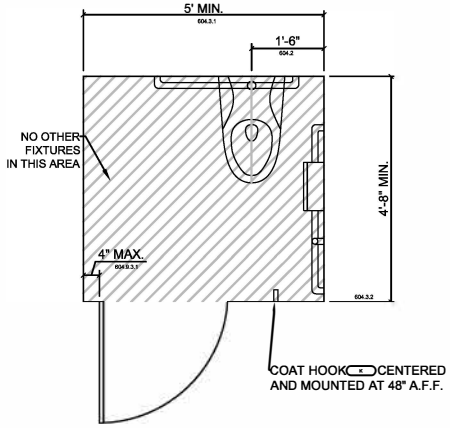
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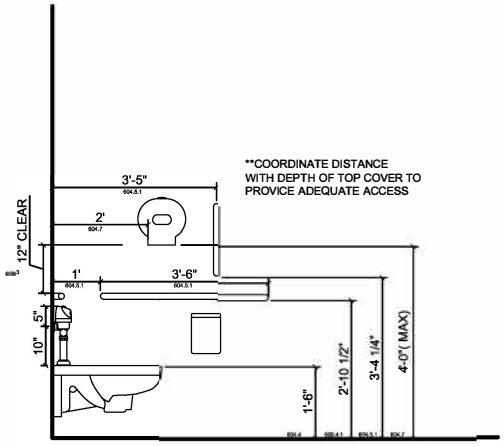
NOTE: SEE 3/A-1 FOR GRAB BAR DIMENSIONS

1 A-1 AMBULATORY TOILET STALL PLAN
SCALE: 1/4" = 1'-0"

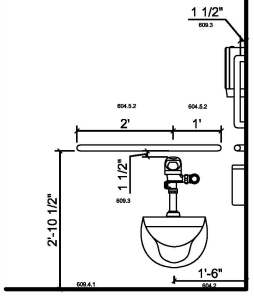


NOTE: SEE 3/A-1 & 4/A-1 FOR GRAB BAR DIMENSIONS

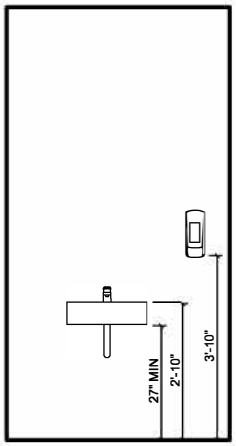
2 A-1 ACCESSIBLE TOILET STALL PLAN
SCALE: 1/4" = 1'-0"



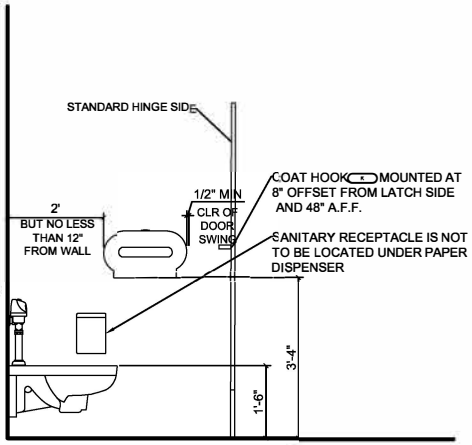
3 A-1 ACCESSIBLE TOILET STALL (SIDE WALL)
SCALE: 1/4" = 1'-0"



4 A-1 ACCESSIBLE TOILET STALL (BACK WALL)
SCALE: 1/4" = 1'-0"

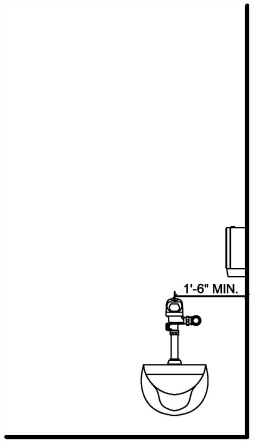


5 A-1 LAVATORY ADA
SCALE: 1/4" = 1'-0"



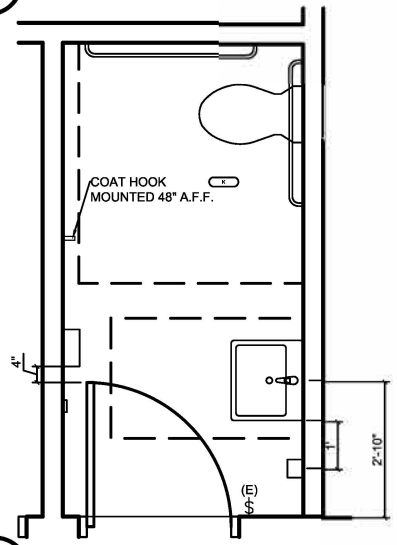
NOTE: TAKE INTO CONSIDERATION LOCATION OF HINGES AND DOOR SWING CLEARANCE WHEN LOCATING TOILET TISSUE DISPENSER

6 A-1 TYPICAL TOILET STALL (SIDE WALL)
SCALE: 1/4" = 1'-0"



NOTE: STANDARD STALL WIDTH MINIMUM OF 3'

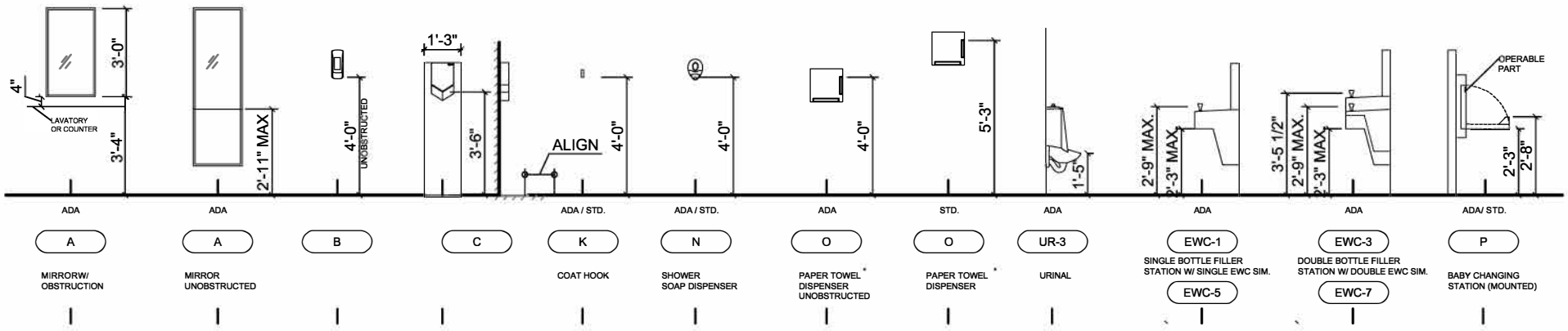
7 A-1 TYPICAL TOILET STALL (BACK WALL)
SCALE: 1/4" = 1'-0"



8 A-1 ALL GENDER BATHROOM
SCALE: 1/4" = 1'-0"

A001a	**BUILDING NAME, FLOOR LEVEL, ROOM NAME PROJECT ADDRESS, PHILADELPHIA, PA 19122**	PROJECT NO.: BXXXXXX	TEMPLE UNIVERSITY	ISSUE / DATE
	ADA TOILET ROOM STANDARDS	DATE: 4/11/19		
		SCALE: AS NOTED		
		DRAWN BY: XX	PROJECT DELIVERY GROUP PLANNING & DESIGN	1009 W. MONTGOMERY AVE PHILADELPHIA, PA 19122 T. 215-204-1406 F. 215-204-1700
		CHECKED BY: XX		

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1 / A-2 STANDARD MOUNTING HEIGHT AND EQUIPMENT LIST
SCALE: 3/16" = 1'-0"

A001b

BUILDING NAME, FLOOR LEVEL,
ROOM NAME
PROJECT ADDRESS,
PHILADELPHIA, PA 19122

STANDARD MOUNTING HEIGHT AND EQUIPMENT LIST

PROJECT NO.:	BXXXXXX
DATE:	4/11/19
SCALE:	3/16" = 1' - 0"
DRAWN BY:	XX
CHECKED BY:	XX

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PROJECT DELIVERY GROUP
PLANNING & DESIGN
1009 W. MONTGOMERY AVE
PHILADELPHIA, PA 19122
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ISSUE	DATE

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PLUMBING FIXTURE SCHEDULE				
NO	FIXTURES	MANUFACTURER	MODEL NO	NOTES
WATER CLOSET				
WC-1	WALL MOUNTED	KOHLER KINGSTON	K-4325-0 1.28/1.6 *1	- W/ CARRIER
WC-2	WALL MOUNTED ADA	KOHLER KINGSTON	K-4325-0 1.28/1.6 *1	- MOUNT AT HANDICAPPED HEIGHT - W/ CARRIER
WC-3	FLOOR MOUNTED	KOHLER WELLCOMME	K-96053-0 1.28/1.6 *1	- W/ FLOOR OUTLET
WC-4	FLOOR MOUNTED ADA	KOHLER HIGHCLIFF	K-96057-0 1.28/1.6 *1	- W/ FLOOR OUTLET
FV-1	FLUSHOMETER	SLOAN ROYAL OPTIMA FLUSH VALVE	ROYAL 111-1.28 ES-S TMO *1	- INSTALL WITH ALL WC - ADA - (1) WATER SUPPLY ROUGH-IN 10" ABOVE TOP OF WATER CLOSET AND (2) ADJUST VACUUM BREAKER TUBE HEIGHT TO ALLOW FOR GRAB BAR INSTALLATION ABOVE FLUSHOMETER
SC-1		BEMIS WHITE ELONGATED OPEN FRONT SEAT LESS COVER	B1655SSCT000	- WITH STAINLESS STEEL SELF SUSTAINING CHECK HINGE - INSTALL WITH ALL WC
URINAL				
UR-1	WALL MOUNTED	KOHLER BARDON HEU 0.125-1 GPF	K-4991-ET	- W/ CARRIER
UR-2	WALL MOUNTED ADA	KOHLER BARDON HEU 0.125-1 GPF	K-4991-ET	- MOUNT AT HANDICAPPED HEIGHT - W/ CARRIER
UR-3	WALL MOUNTED NARROW	KOHLER DEXTER 0.125 GPF	K-5452-ET	- MOUNT AT HANDICAPPED HEIGHT - W/ CARRIER
FV-2		SLOAN ROYAL OPTIMA FLUSH VALVE	ROYAL 186-0.125 ES-S TMO HEU *1	- INSTALL WITH ALL URINALS
LAVATORY				
LAV-1	COUNTER MOUNTED DROP-IN	KOHLER ELLINGTON	K-2906-4	- W/ REQUIRED SUPPORT - OR INTEGRAL COUNTER AND LAV - MOUNT AT HANDICAPPED HEIGHT
LAV-2	WALL MOUNTED	KOHLER KINGSTON (21-1/4"Lx18-1/4"D)	K-2006	- W/ CARRIER
LAV-3	WALL MOUNTED ADA	KOHLER KINGSTON (21-1/4"Lx18-1/4"D)	K-2006	- MOUNT AT HANDICAPPED HEIGHT - W/ CARRIER
LAV-4	WALL MOUNTED ADA	KOHLER MORNINGSIDE (20"Lx27"D)	K-12634	- MOUNT AT HANDICAPPED HEIGHT - W/ CARRIER AND EXTENDED DEPTH
FAU-1		SLOAN OPTIMA FAUCET SINGLE HOLE	EAF200 (HARDWIRED) *1	-POLISHED CHROME, W/ELECTRICAL WIRING, SLOAN BDT THERMOSTATIC MIXING VALVE, GRID DRAIN & VALVE, LEAD FREE LAVATORY SUPPLYKIT"
FAU-2		SLOAN OPTIMA FAUCET 4" CENTER SET	ETF-600-B-BDT (HARDWIRED) *1	-SLOAN BDT THERMOSTATIC MIXING VALVE, GRID DRAIN & VALVE, LEAD FREE LAVATORY SUPPLY KIT
FAU-3		SLOAN OPTIMA FAUCET 4" CENTER SET	ETF-600-LT-BDT (HARDWIRED) *1	- W/ SLOAN BDT THERMOSTATIC MIXING VALVE, GRID DRAIN & VALVE, LEAD FREE LAVATORY SUPPLY KIT
FAU-4		SLOAN GOOSENECK FAUCET	ETF700 (HARDWIRED,IR TU STANDARD) *1	- CHROME FINISH .5 FLOW RATE
CVR-1		TRUEBRO LAV GUARD 2 UNDERSINK PIPING COVERS	103 E-Z	- ADJUSTABLE TUBULAR P-TRAP, OFF SET, AND TWO ANGLE VALVE COVERS - INSTALL WITH ALL LAVATORIES
ELECTRIC WATER COOLER				
EWC-1	WALL MOUNTED	HALSEY TAYLOR	HTHB-HACG8PV-WF	- SINGLE BOTTLE FILLING W/WATER FILTER
EWC-2	RECESSED MOUNTED	HALSEY TAYLOR	HTHBWF-OVLER-I	- SINGLE BOTTLE FILLING W/WATER FILTER
EWC-3	WALL MOUNTED	HALSEY TAYLOR	HTHB-HACG8BLPV-WF	- DOUBLE BOTTLE FILLING W/WATER FILTER
EWC-4	RECESSED MOUNTED	HALSEY TAYLOR	HTHBWF-OVLSER-I	- DOUBLE BOTTLE FILLING W/WATER FILTER
EWC-5	WALL MOUNTED	HALSEY TAYLOR	HACG8PV-WF	- SINGLE W/ WATER FILTER
EWC-6	RECESSED MOUNTED	HALSEY TAYLOR OVL-11	OVLERGRN-VRWF	- SINGLE W/ WATER FILTER
EWC-7	WALL MOUNTED	HALSEY TAYLOR	HACG8BLPV-WF	- DOUBLE W/ WATER FILTER
EWC-8	RECESSED MOUNTED	HALSEY TAYLOR OVL-II	OVLSERGRN-VRWF	- DOUBLE W/ WATER FILTER
SERVICE				
SB-1	FLOOR MOUNTED	ZURN MOP SERVICE BASIN		
SB-1	FLOOR MOUNTED	ZURN MOP SERVICE BASIN		
SS-1	WALL MOUNTED			
SS-1	WALL MOUNTED			
FAU-5	WALL MOUNTED	ZURN SERVICE SINK FAUCET	"MODEL:Z842M4-XL PART:164106"	-W/6" CENTERLINE CAST BRASS VACUM BREAKER SPOUT, LEAD FREE, PAIL HOOK, WALL BRACE, 4" VANDAL RESISTANT COLOR CODED WRIST BLADE HANDLES

NOTE:
1. FOR ALL PROJECTS APPLYING FOR SUSTAINABLE PROGRAMS LEED, WELL, ETC FLOW RATES ARE TO BE ADJUSTED ACCORDINGLY IN COMPLIANCE WITH THE APPLICABLE PROGRAM.

TEMPLE UNIVERSITY
PROJECT DELIVERY GROUP
PLANNING & DESIGN
1009 W. MONTGOMERY AVE
PHILADELPHIA, PA 19122
T. 215-204-1406 F. 215-204-1700

ISSUE | DATE

PROJECT NO.: BXXXXXX
DATE: 4/11/19
SCALE: AS NOTED
DRAWN BY: XX
CHECKED BY: XX

BUILDING NAME, FLOOR LEVEL, ROOM NAME
PROJECT ADDRESS, PHILADELPHIA, PA 19122

STANDARD PLUMBING FIXTURE SCHEDULE

A001c

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ACCESSORY SCHEDULE						
TAG	ITEM	MANUFACTURER	MODEL	COLOR	INSTALLATION	NOTES
A	MIRROR	-	-	-	ANSI A117.1-2009 603.3	00"X00" FRAMELESS
B	SOAP DISPENSER	GOJO	ADX-12	CHROME	ANSI A117.1-2009 308.2.2	3.94" D x 4.64" W x 11.89" H
C	HAND DRYER	DYSON	AIRBLADE V -HU02	SPRAYED NICKEL	ANSI A117.1-2009 308.2.1	-LOW VOLTAGE 110V -PROVIDE 2 PER BATHROOM –1 STANDARD HEIGHT –1 ADA HEIGHT - 4" D x 9.21" W x 15.5" H -INSTALL W/ SS BACK PLATE EXTEND VERTICALLY TO FLOOR AND TURN HORIZONTALLY MIN 10" FLUSH WITH FLOOR SURFACE
D	18" VERTICAL GRAB BAR	BOBRICK	6806X18	SATIN FINISH	ANSI A117.1-2009 604.5.1	1-1/2 DIA
E	36" HORIZONTAL GRAB BAR	BOBRICK	6806X36	SATIN FINISH	ANSI A117.1-2009 604.5.2	1-1/2 DIA
F	42" HORIZONTAL GRAB BAR	BOBRICK	6806X42	SATIN FINISH	ANSI A117.1-2009 604.5.1	1-1/2 DIA
G	TOILET PAPER DISPENSER	VONDREHLE	3253	COVER-SMOKE BASE - BLACK	ANSI A117.1-2009 604.7 Figure 604.7 (A)	DOUBLE
H	TOILET PAPER DISPENSER	VONDREHLE	AE42N	COVER-SMOKE BASE - BLACK	ANSI A117.1-2009 604.7 Figure 604.7 (A)	SINGLE
I	WASTE RECEPTACLES	RUBBERMAID	-	-	-	-
J1	SANITARY RECEPTACLE, FLOOR STANDING	RUBBERMAID	750243	WHITE	-	3 GALLON SANITARY BIN WHITE
J2	SANITARY RECEPTACLE, SURFACE MOUNTED	AMERICAN SPECIALTIES, INC	20852	STAINLESS STEEL	ANSI A117.1-2009 604.7 Figure 604.7 (A)	- SATIN FINISH -ROUNDED EDGES FOR USER AND SERVICE SAFETY
K	COAT HOOK	BRADLEY	915	-		- HOOK AND BUMPER
L	TOILET PARTITION	SCRANTON PRODUCTS	HINY HIDERS OP	-	-	- ORANGE PEEL TEXTURE (OP), CONTINUOUS SS SPRING LOAD HINGE, CEILING HUNG, SS EMERGENCY ACCESS STRIKE
M	URINAL SCREEN	SCRANTON PRODUCTS	URINAL SCREENS	-	-	-ORANGE PEEL TEXTURE (OP), WALL HUNG
N	SHOWER SOAP DISPENSER	KUTOL (DURA VIEW)	7567	CLEAR BLUE	ANSI A117.1-2009 308.2.2	LARGE CAPACITY 2L/4.5L WITH 9908 ZPL
O	PAPER TOWEL DISPENSER	KIMBERLY-CLARK	9765	SMOKE	-	9.8" D x 13.5" W x 13.3" H
P1	BABY CHANGING STATION (ADA ACCESSIBLE)	ASI	9013	STAINLESS STEEL (RECESSED)	ANSI A117.1-2009 603.5, 309, 902	17.75" D x 37" W x 25.5" H
P2	BABY CHANGING STATION (ADA ACCESSIBLE)	ASI	9013-9	STAINLESS STEEL (MOUNTED)	ANSI A117.1-2009 603.5, 309, 902	17.75" + 4" D x 37" W x 25.5" H
P3	BABY CHANGING STATION (ADA ACCESSIBLE) | ALTERNATIVE IF SPACE IS LIMITED	ASI	9014	PLASTIC (RECESSED/ MOUNTED)	ANSI A117.1-2009 603.5, 309, 902	3..875" + 18.125" D x 35.16" W x 24.25" H

NOTE:
1. CONTRACTOR TO PROVIDE AND INSTALL WOOD BLOCKING FOR ALL RESTROOM ACCESSORIES
2. SEE ACCESSIBILITY GUIDELINES FOR ACCESSIBLE MOUNTING HEIGHTS
3. PAPER TOWEL DISPENSERS MUST NOT BE MOUNTED IN THE CIRCULATION PATH, REF ANSI 117.1 SECTION 307 PROTRUDING OBJECTS

A001d

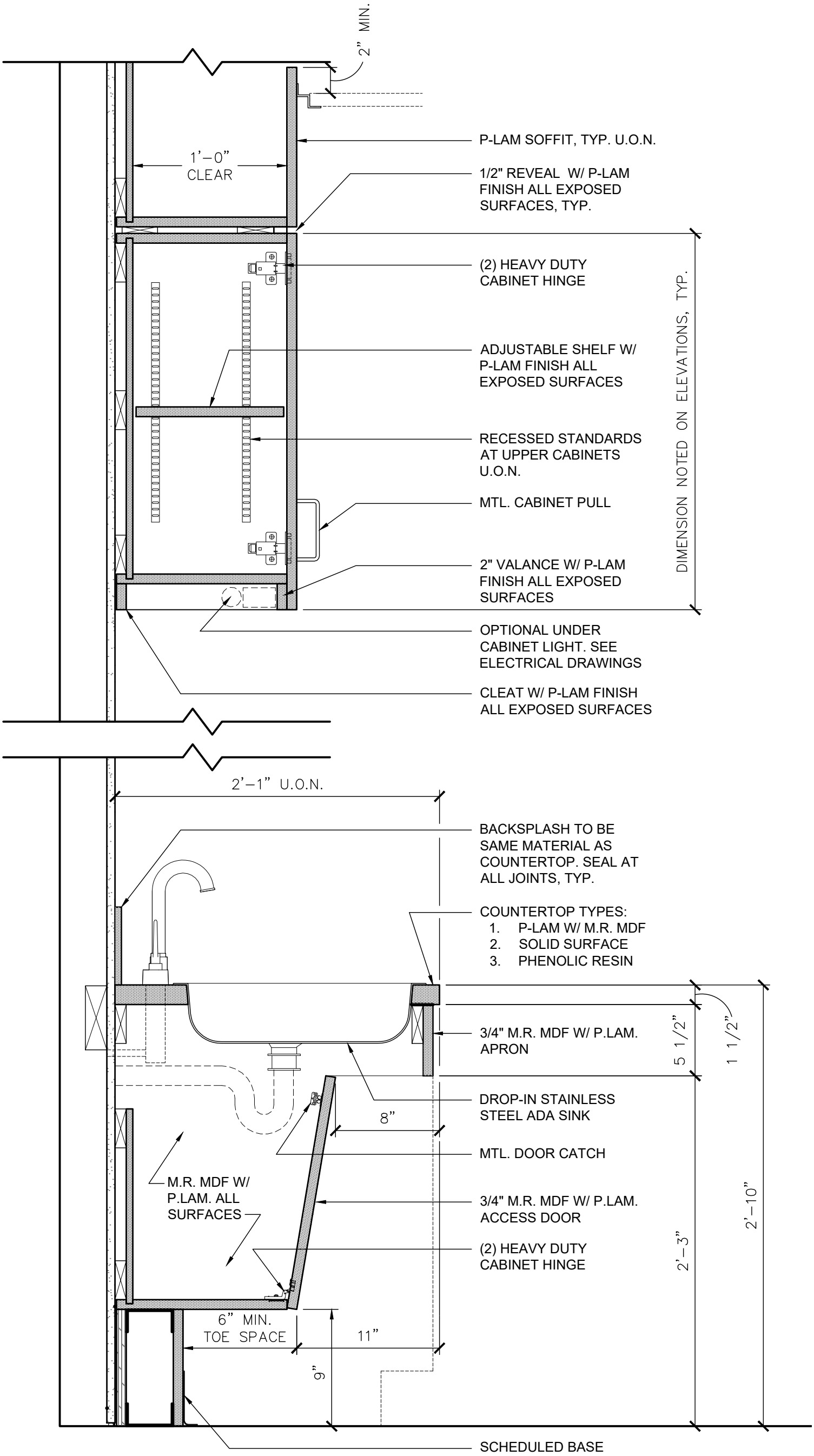
BUILDING NAME, FLOOR LEVEL, ROOM NAME
PROJECT ADDRESS, PHILADELPHIA, PA 19122

STANDARD TOILET ACCESSORY SCHEDULE

PROJECT NO.: BXXXXXX
DATE: 4/11/19
SCALE: AS NOTED
DRAWN BY: XX
CHECKED BY: XX

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ISSUE	DATE



2 / A001E CASEWORK DETAIL AT BARRIER FREE SINK
SCALE: NTS

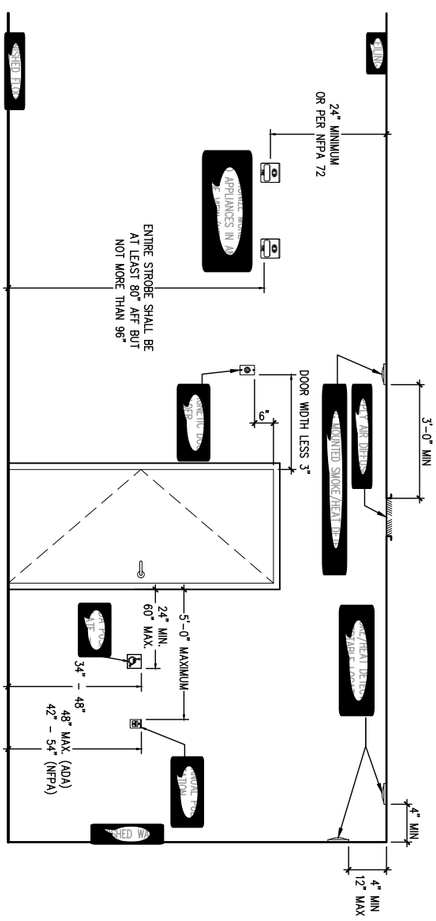
A001 E	**BUILDING NAME, FLOOR LEVEL, ROOM NAME PROJECT ADDRESS, PHILADELPHIA, PA 19122**	PROJECT NO.: BXXXXXX	TEMPLE UNIVERSITY	ISSUE	DATE
	BARRIER FREE CASEWORK DETAIL	DATE: 12/11/19			
		SCALE: AS NOTED			
		DRAWN BY: XX			
		CHECKED BY: XX			

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1 A001F

NFPA 72 DEVICE MOUNTING HEIGHTS

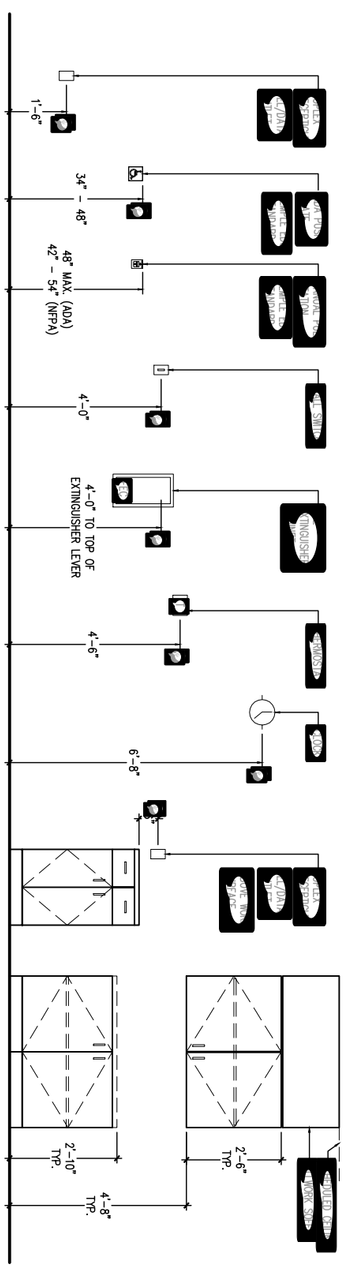
SCALE: NTS



2 A001F

STANDARD MOUNTING HEIGHTS FOR DEVICES

SCALE: NTS

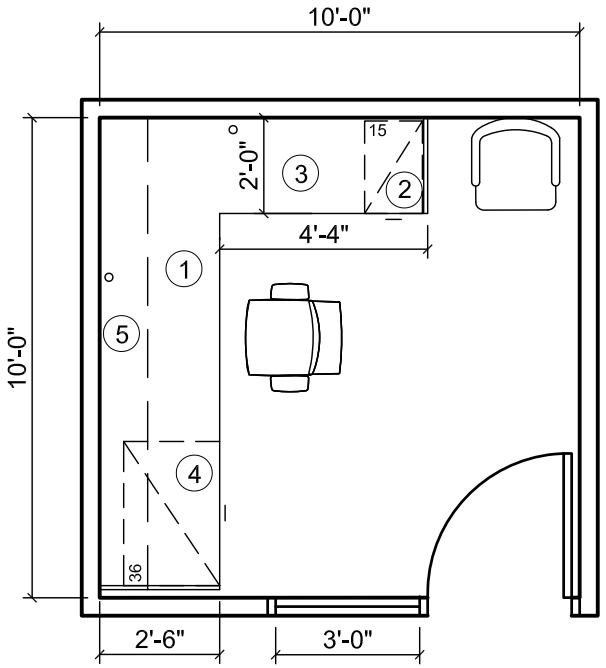


A001 F	**BUILDING NAME, FLOOR LEVEL, ROOM NAME PROJECT ADDRESS, PHILADELPHIA, PA 19122**	PROJECT NO.: BXXXXXX	TEMPLE UNIVERSITY	ISSUE	DATE
	MOUNTING HEIGHTS FOR DEVICES	DATE: 12/11/19			
		SCALE: AS NOTED			
		DRAWN BY: XX	**PROJECT DELIVERY GROUP PLANNING & DESIGN**	**1009 W. MONTGOMERY AVE PHILADELPHIA, PA 19122 T. 215-204-1406 F. 215-204-1700**	
		CHECKED BY: XX			

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100 SF. OFFICE



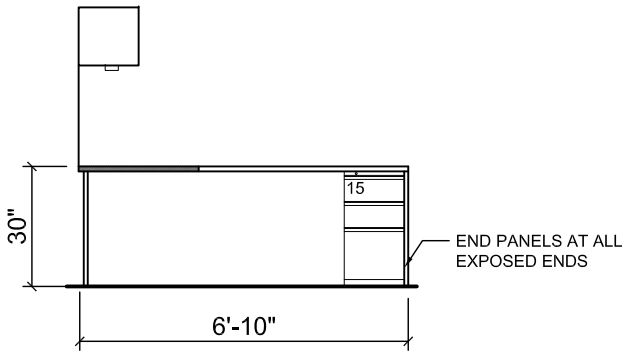
100 SQ. FT. OFFICE FLOOR PLAN
SCALE: 1/4" =1'-0"

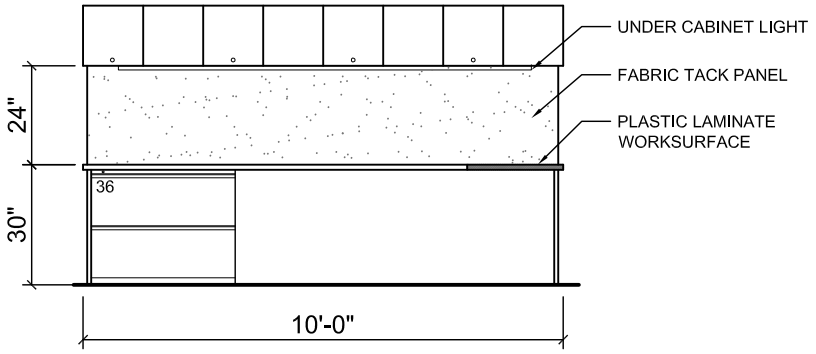
LEGEND

1. DESK: 30" D. FINISH & EDGE: PLASTIC LAMINATE. SQUARE EDGE WITH MATCHING PVC EDGE BAND ON ALL SIDES
2. STORAGE: FULL HEIGHT BOX/BOX/FILE PEDESTAL. FINISH: METAL HARDWARE PULL & FINISH: INTEGRAL TO MATCH SURROUNDING FINISH
3. RECTANGULAR DESK SHELL: 24" D.; FINISH: PLASTIC LAMINATE WITH MATCHING PVC EDGE BAND ON ALL SIDES
4. FILE CABINET: TWO DRAWER LATERAL FILE 36" W. FRONT & CASE FINISH: METAL HARDWARE PULL & FINISH; INTEGRAL TO MATCH SURROUND FINISH
5. OVERHEAD CABINET WITH UNDER CABINET LIGHT.

NOTES:

1. ALL STORAGE CABINETS TO BE KEYED LOCKED. KEYED ALIKE PER OFFICE.
2. VERTICAL & HORIZONTAL WORKSURFACE FINISH: PLASTIC LAMINATE EDGE: SQUARE EDGE WITH MATCHING PVC EDGE BAND ON ALL SIDES

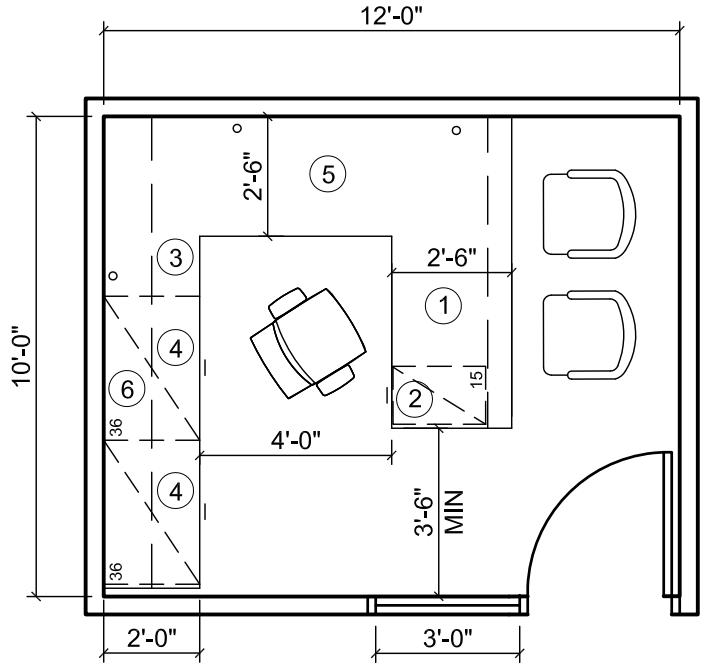




ELEVATIONS
SCALE: 1/4" =1'-0"

120 SF. OFFICE

TEMPLE UNIVERSITY



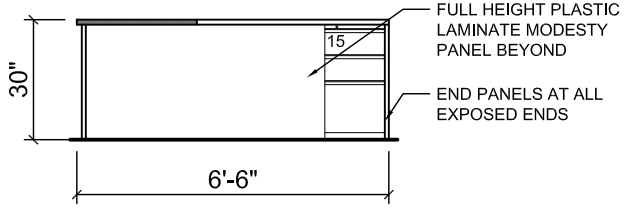
120 SQ. FT. OFFICE FLOOR PLAN
SCALE: 1/4" =1'-0"

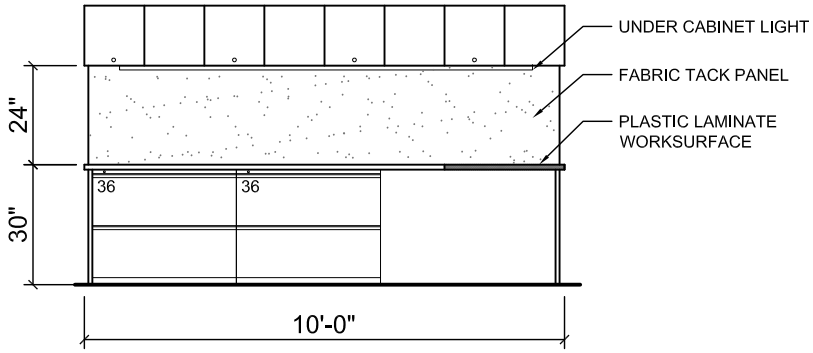
LEGEND

1. DESK: 30" D. FULL HEIGHT MODESTY PANEL, RECESSED 6" FROM FRONT. FINISH & EDGE: PLASTIC LAMINATE. SQUARE EDGE WITH MATCHING PVC EDGE BAND ON ALL SIDES
2. STORAGE: FULL HEIGHT BOX/BOX/FILE PEDESTAL. FINISH: METAL HARDWARE PULL & FINISH: INTEGRAL TO MATCH SURROUNDING FINISH
3. RECTANGULAR DESK SHELL: 24" D.; FINISH: PLASTIC LAMINATE WITH MATCHING PVC EDGE BAND ON ALL SIDES
4. FILE CABINET: TWO DRAWER LATERAL FILE 36" W. FRONT & CASE FINISH: METAL HARDWARE PULL & FINISH; INTEGRAL TO MATCH SURROUND FINISH
5. BRIDGE WORKSURFACE: 24" D.; FINISH: PLASTIC LAMINATE, SQUARE EDGE WITH MATCHING PVC EDGE BAND ON ALL SIDES
6. OVERHEAD CABINET WITH UNDER CABINET LIGHT.

NOTES:

1. ALL STORAGE CABINETS TO BE KEYED LOCKED. KEYED ALIKE PER OFFICE.
2. VERTICAL & HORIZONTAL WORKSURFACE FINISH: PLASTIC LAMINATE EDGE: SQUARE EDGE WITH MATCHING PVC EDGE BAND ON ALL SIDES

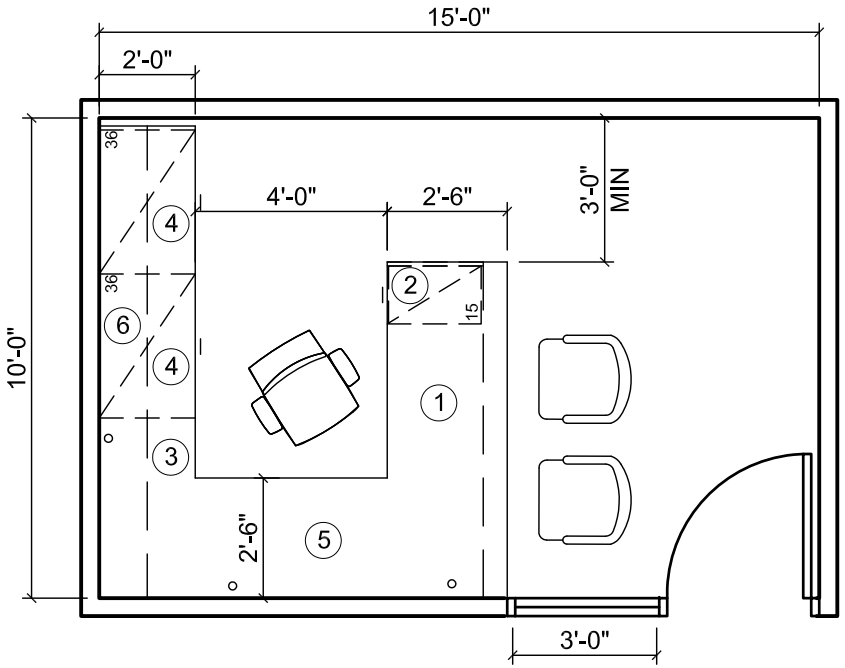




ELEVATIONS
SCALE: 1/4" =1'-0"

150 SF. OFFICE

TEMPLE UNIVERSITY



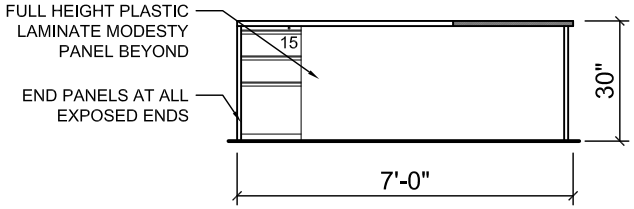
150 SQ. FT. OFFICE FLOOR PLAN
SCALE: 1/4" =1'-0"

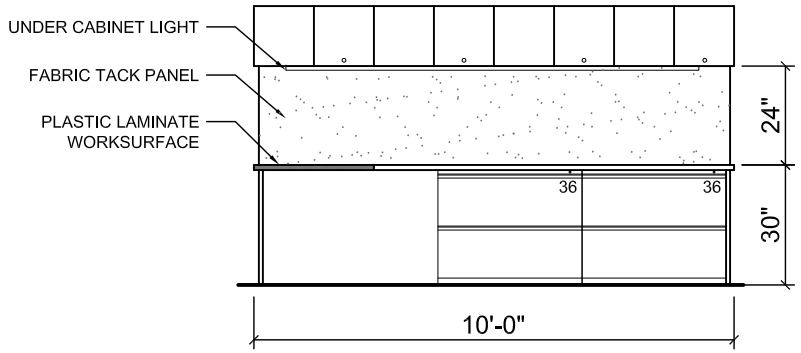
LEGEND

1. DESK: 30" D. FULL HEIGHT MODESTY PANEL, RECESSED 6" FROM FRONT. FINISH & EDGE: PLASTIC LAMINATE. SQUARE EDGE WITH MATCHING PVC EDGE BAND ON ALL SIDES
2. STORAGE: FULL HEIGHT BOX/BOX/FILE PEDESTAL. FINISH: METAL HARDWARE PULL & FINISH: INTEGRAL TO MATCH SURROUNDING FINISH
3. RECTANGULAR DESK SHELL: 24" D.; FINISH: PLASTIC LAMINATE WITH MATCHING PVC EDGE BAND ON ALL SIDES
4. FILE CABINET: TWO DRAWER LATERAL FILE 36" W. FRONT & CASE FINISH: METAL HARDWARE PULL & FINISH; INTEGRAL TO MATCH SURROUND FINISH
5. BRIDGE WORKSURFACE: 24" D.; FINISH: PLASTIC LAMINATE, SQUARE EDGE WITH MATCHING PVC EDGE BAND ON ALL SIDES
6. OVERHEAD CABINET WITH UNDER CABINET LIGHT.

NOTES:

1. ALL STORAGE CABINETS TO BE KEYED LOCKED. KEYED ALIKE PER OFFICE.
2. VERTICAL & HORIZONTAL WORKSURFACE FINISH: PLASTIC LAMINATE EDGE: SQUARE EDGE WITH MATCHING PVC EDGE BAND ON ALL SIDES

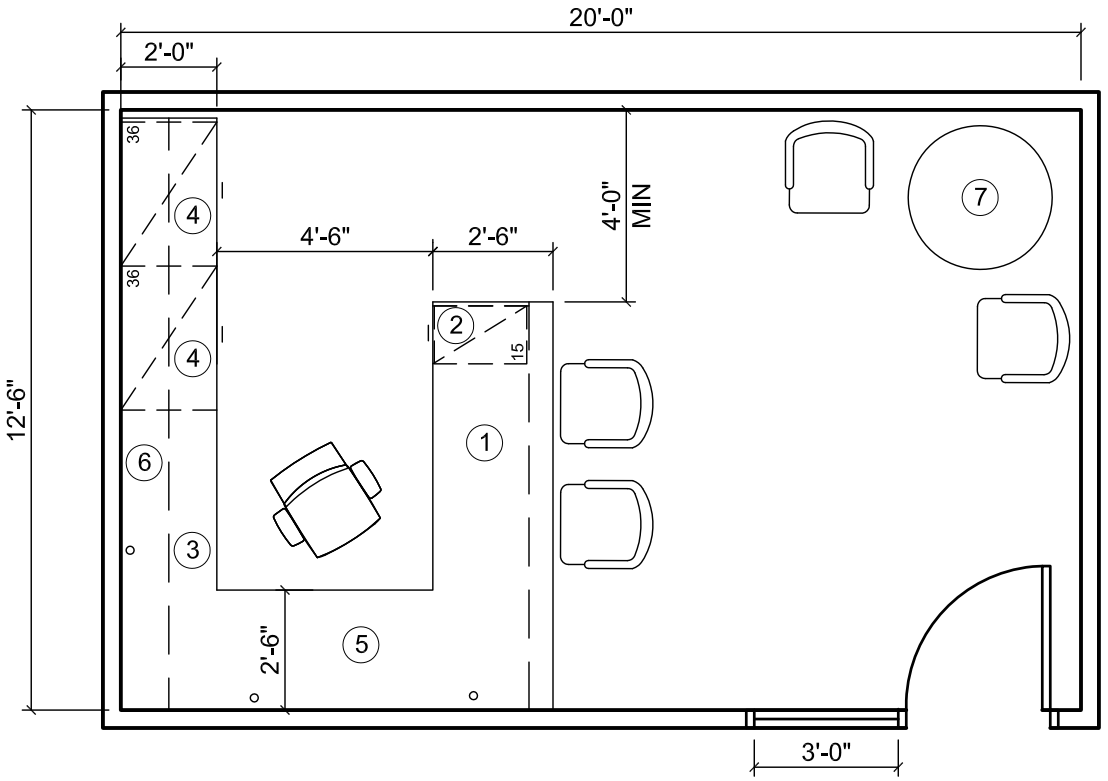




ELEVATIONS
SCALE: 1/4" =1'-0"

250 SF. OFFICE

TEMPLE UNIVERSITY



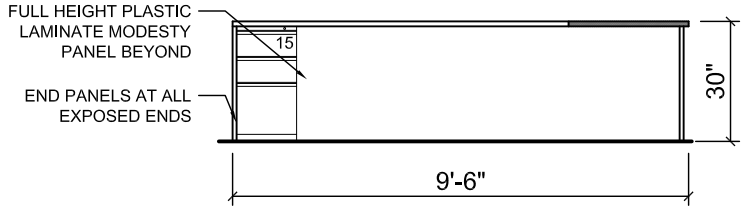
250 SQ. FT. OFFICE FLOOR PLAN
SCALE: 1/4" =1'-0"

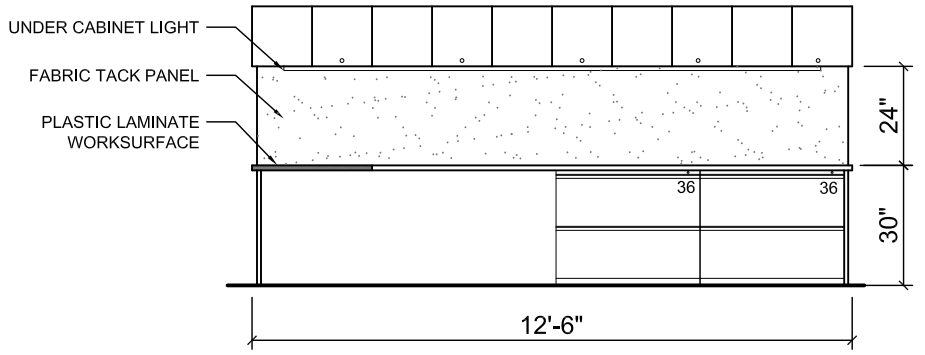
LEGEND

1. DESK: 30" D. FULL HEIGHT MODESTY PANEL, RECESSED 6" FROM FRONT. FINISH & EDGE: PLASTIC LAMINATE. SQUARE EDGE WITH MATCHING PVC EDGE BAND ON ALL SIDES
2. STORAGE: FULL HEIGHT BOX/BOX/FILE PEDESTAL. FINISH: METAL HARDWARE PULL & FINISH: INTEGRAL TO MATCH SURROUNDING FINISH
3. RECTANGULAR DESK SHELL: 24" D.; FINISH: PLASTIC LAMINATE WITH MATCHING PVC EDGE BAND ON ALL SIDES
4. FILE CABINET: TWO DRAWER LATERAL FILE 36" W. FRONT & CASE FINISH: METAL HARDWARE PULL & FINISH; INTEGRAL TO MATCH SURROUND FINISH
5. BRIDGE WORKSURFACE: 24" D.; FINISH: PLASTIC LAMINATE, SQUARE EDGE WITH MATCHING PVC EDGE BAND ON ALL SIDES
6. OVERHEAD CABINET WITH UNDER CABINET LIGHT.
7. ROUND 36" D. TABLE WITH 2 SIDE CHAIRS.

NOTES:

1. ALL STORAGE CABINETS TO BE KEYED LOCKED. KEYED ALIKE PER OFFICE.
2. VERTICAL & HORIZONTAL WORKSURFACE FINISH: PLASTIC LAMINATE EDGE: SQUARE EDGE WITH MATCHING PVC EDGE BAND ON ALL SIDES

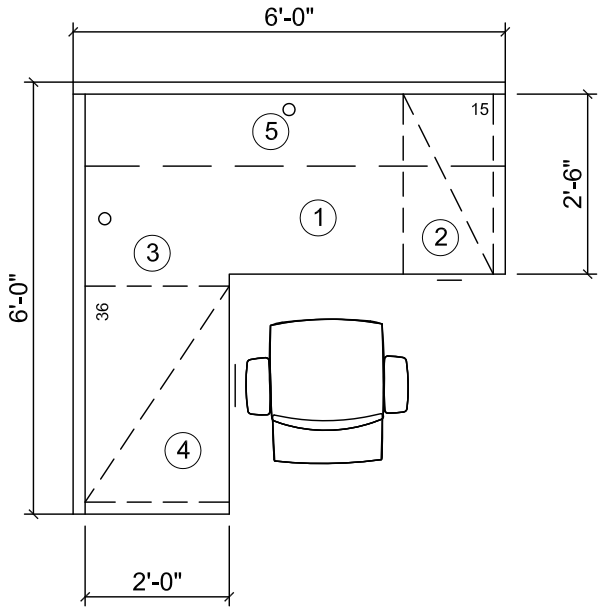




ELEVATIONS
SCALE: 1/4" =1'-0"

6 X 6 WORKSTATION

TEMPLE UNIVERSITY



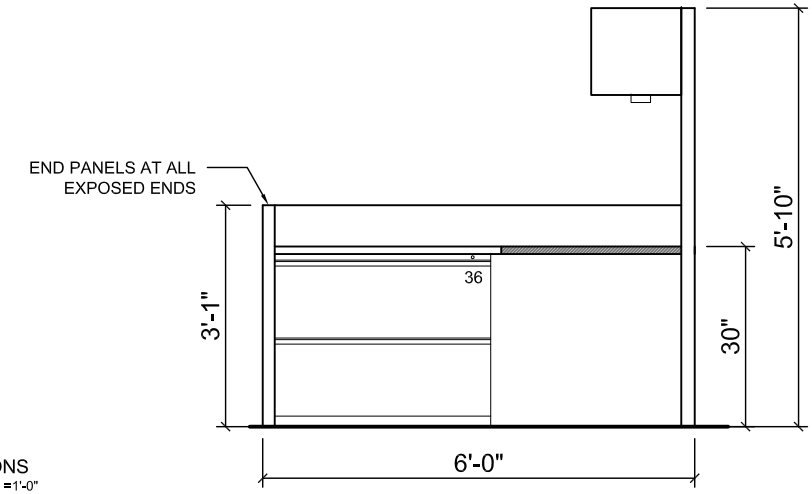
6 x 6 WORKSTATION PLAN
SCALE: 3/8" =1'-0"

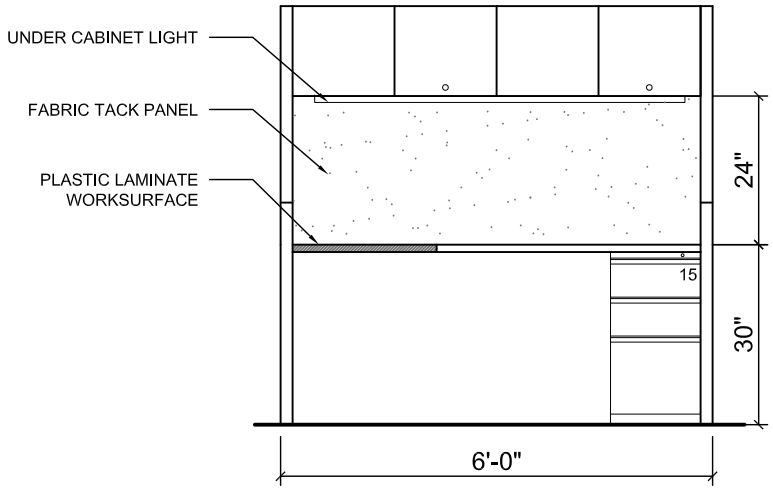
LEGEND

1. DESK: 30" D. FINISH & EDGE: PLASTIC LAMINATE. SQUARE EDGE WITH MATCHING PVC EDGE BAND.
2. STORAGE: FULL HEIGHT BOX/BOX/FILE PEDESTAL. FINISH: METAL HARDWARE PULL & FINISH: INTEGRAL TO MATCH SURROUNDING FINISH
3. RECTANGULAR DESK SHELL: 24" D.; FINISH: PLASTIC LAMINATE WITH MATCHING PVC EDGE BAND ON ALL SIDES
4. FILE CABINET: TWO DRAWER LATERAL FILE 36" W. FRONT & CASE FINISH: METAL HARDWARE PULL & FINISH; INTEGRAL TO MATCH SURROUND FINISH
5. OVERHEAD CABINET WITH UNDER CABINET LIGHT.

NOTES:

1. ALL STORAGE CABINETS TO BE KEYED LOCKED. KEYED ALIKE PER OFFICE.

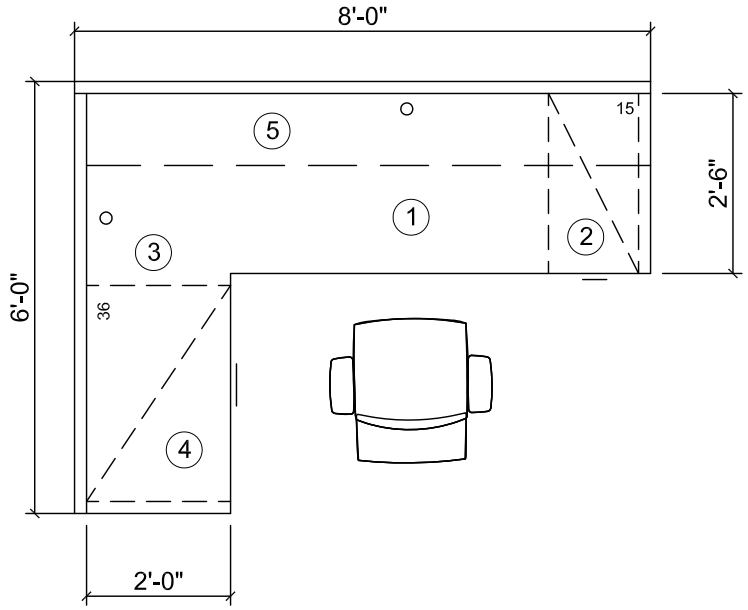




ELEVATIONS
SCALE: 3/8" =1'-0"

6 X 8 WORKSTATION

TEMPLE UNIVERSITY



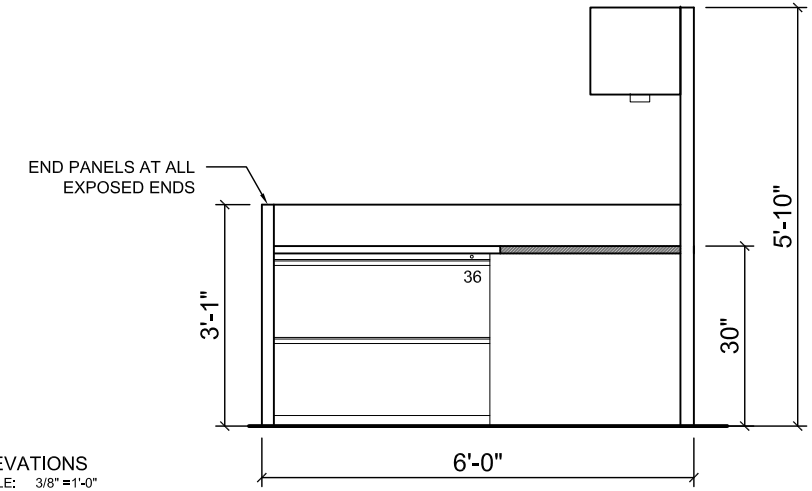
6 X 8 WORKSTATION PLAN
SCALE: 3/8" =1'-0"

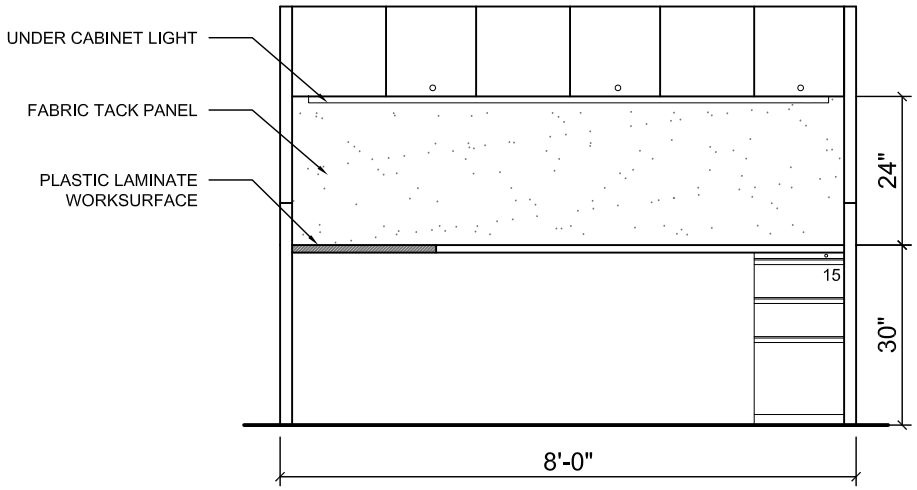
LEGEND

1. DESK: 30" D. FINISH & EDGE: PLASTIC LAMINATE. SQUARE EDGE WITH MATCHING PVC EDGE BAND.
2. STORAGE: FULL HEIGHT BOX/BOX/FILE PEDESTAL. FINISH: METAL HARDWARE PULL & FINISH: INTEGRAL TO MATCH SURROUNDING FINISH
3. RECTANGULAR DESK SHELL: 24" D.; FINISH: PLASTIC LAMINATE WITH MATCHING PVC EDGE BAND ON ALL SIDES
4. FILE CABINET: TWO DRAWER LATERAL FILE 36" W. FRONT & CASE FINISH: METAL HARDWARE PULL & FINISH; INTEGRAL TO MATCH SURROUND FINISH
5. OVERHEAD CABINET WITH UNDER CABINET LIGHT.

NOTES:

1. ALL STORAGE CABINETS TO BE KEYED LOCKED. KEYED ALIKE PER OFFICE.

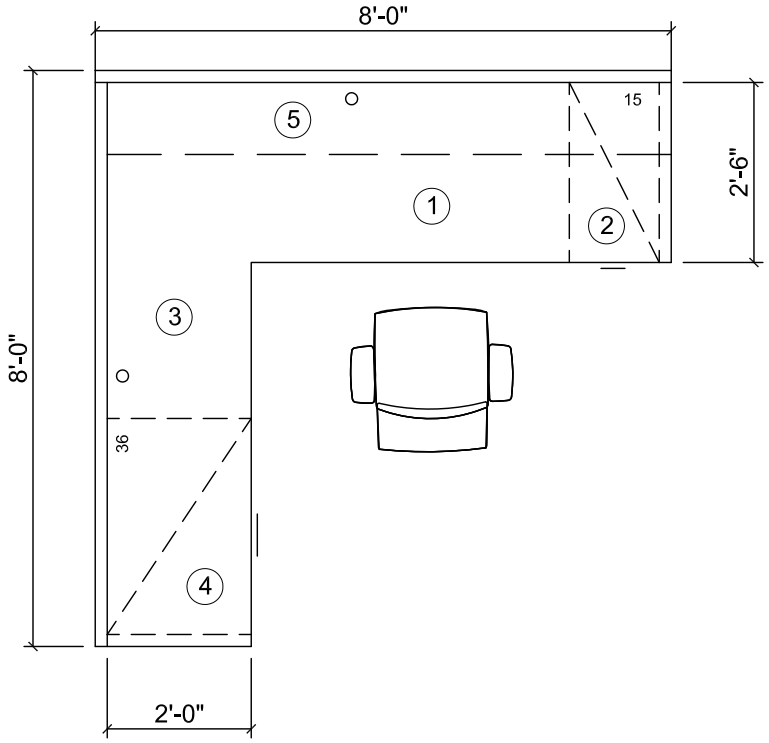




ELEVATIONS
SCALE: 3/8" =1'-0"

TEMPLE UNIVERSITY

8 X 8 WORKSTATION



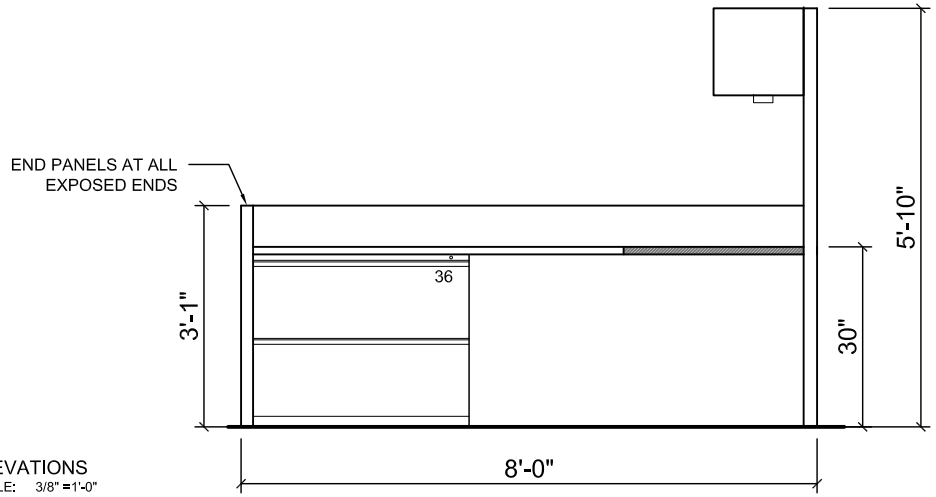
8 X 8 WORKSTATION PLAN
SCALE: 3/8" =1'-0"

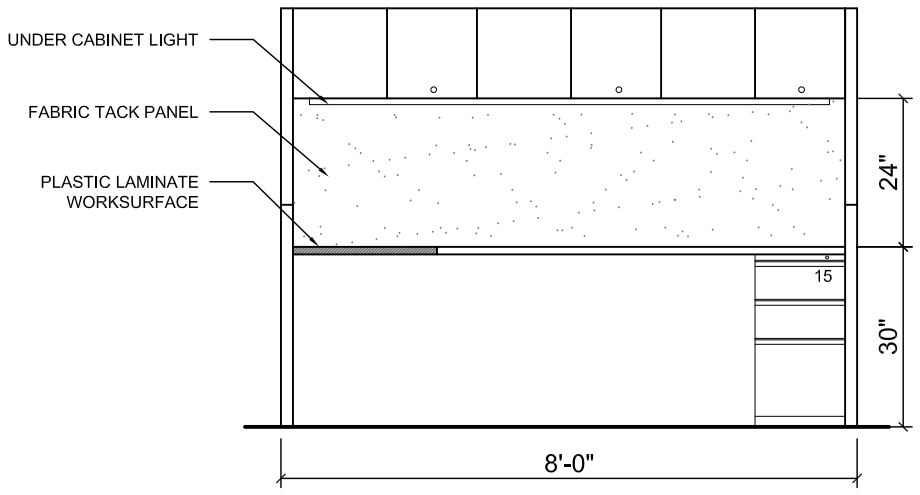
LEGEND

1. DESK: 30" D. FINISH & EDGE: PLASTIC LAMINATE. SQUARE EDGE WITH MATCHING PVC EDGE BAND.
2. STORAGE: FULL HEIGHT BOX/BOX/FILE PEDESTAL. FINISH: METAL HARDWARE PULL & FINISH: INTEGRAL TO MATCH SURROUNDING FINISH
3. RECTANGULAR DESK SHELL: 24" D.; FINISH: PLASTIC LAMINATE WITH MATCHING PVC EDGE BAND ON ALL SIDES
4. FILE CABINET: TWO DRAWER LATERAL FILE 36" W. FRONT & CASE FINISH: METAL HARDWARE PULL & FINISH; INTEGRAL TO MATCH SURROUND FINISH
5. OVERHEAD CABINET WITH UNDER CABINET LIGHT.

NOTES:

1. ALL STORAGE CABINETS TO BE KEYED LOCKED. KEYED ALIKE PER OFFICE.





ELEVATIONS
SCALE: 3/8" =1'-0"